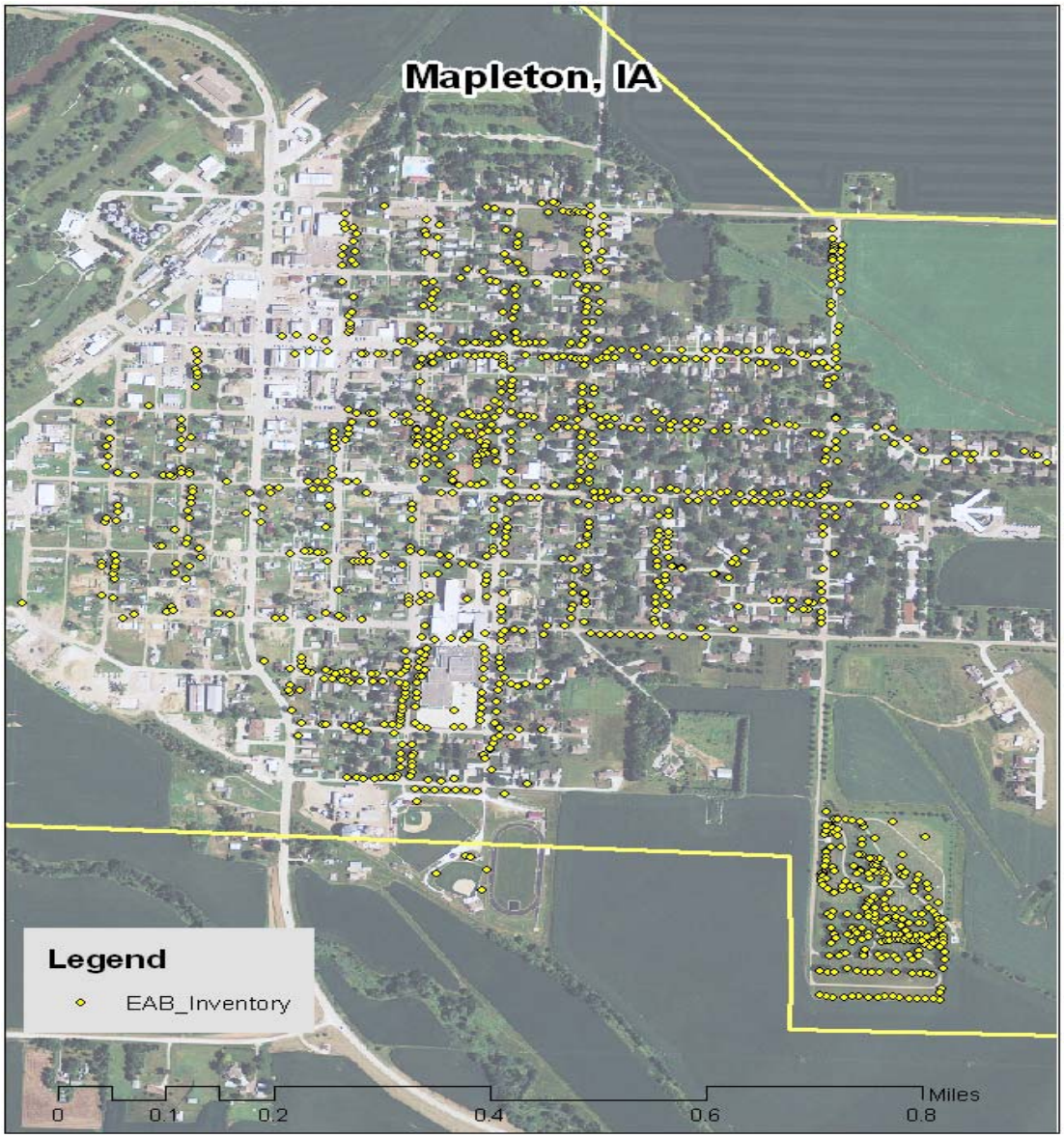
Mapleton, IA



2012 Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Mapleton with managing its urban forest. Trees can provide a multitude of benefits to the community, and sound management allows a community 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 (this does not include mountain ash). There is a strong possibility that 24% of Mapleton'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 and Results

In 2011, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 1,144 trees inventoried.

- Mapleton's trees provide $188,459 of benefits annually, an average of $165 a tree
- There are over 52 species of trees
- The top three genus are: Maple 31%, Ash 21%, and Spruce 13%
- 19% of trees are in need of some type of management
- 63 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 63 trees needing removal, 27 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 12 of the 240 ash trees are in need of follow up 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

Introduction

This plan was developed to assist Mapleton with the management and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Mapleton, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Mapleton's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of Mapleton and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Mapleton's urban forestry goals.

Inventory

In 2011, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. 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. Because the inventory is a digital document the data can be updated with new information and become a working document.

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. The i-Tree suite is a public domain which can be accessed for free.

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 wood pecker damage.

Inventory Results

The data collected for the 1,144 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

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Mapleton's trees reduce energy related costs by approximately $46,948 annually (Appendix A, Table 1). These savings are both in Electricity (225.2 MWh) and in Natural Gas (30,462 Therms).

Annual Stormwater Benefits

Mapleton's trees intercept about 2,744,149 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $74,372 of benefits to the city.

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 mater (ozone). In Mapleton, it is estimated that trees remove 2,662 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 $7,240 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Mapleton, trees sequester about 898,509 lbs of carbon a year with an associated value of $6,739 (Appendix A, Table 5). In addition, the trees store 9,012,765 lbs of carbon, with a yearly benefit of $67,596 (Appendix A, Table 4).

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. Mapleton receives $53,161 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Mapleton's trees provide $188,459 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,144 trees in Mapleton provide approximately $165 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Mapleton has over 52 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	350	31%
Ash	240	21%
Spruce	148	13%
Pear	69	6%
Pine	64	6%
Oak	53	5%
Linden/Basswood	50	4%
Apple (Crab)	46	4%
Hackberry	26	2%
Juniper	18	2%
Catalpa	9	<1%
Locust	9	<1%
Walnut	9	<1%
Plum	8	<1%
Elm	4	<1%
Hemlock	4	<1%
White Cedar	4	<1%
Birch	3	<1%
Coffeetree	3	<1%
Cottonwood	2	<1%
Mountain Ash	1	<1%
Poplar	1	<1%
Redbud	1	<1%
Sycamore	1	<1%
Other Evergreen	18	2%

Age Class

Most of Mapleton's trees (36%) are between 6 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 18 inches in diameter at 4.5 ft. Mapleton's size curve is on the smaller side, indicating a younger than average stand.

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 Mapleton indicate that 77% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 &

Appendix B, Figure 3). Also, 38% of Mapleton's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). 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.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	130	11%
Tree Removal	63	6%
Crown Raising	3	<1%
Crown Reduction	1	<1%
Tree Staking	1	<1%

Canopy Cover

The canopy cover of Mapleton is approximately 25 acres (Appendix A, Figure 4). According to the 2010 census, Mapleton occupies 1,024 acres. Thus the canopy cover on city land is about 2.4%.

Land Use and Location

The majority of Mapleton's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

Land Use	
Single family residential	67%
Park/vacant/other	30%
Small commercial	2%
Industrial/Large commercial	<1%

Location	
Planting strip	49%
Other maintained locations	28%
Front yard	23%
Cutout (surrounded by pavement)	<1%
Median	<1%

Recommendations

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.

Hazardous trees

Mapleton has 6 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. After the critical concern there are 22 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. In addition there are 35 other trees marked for removal, for a total of 63 trees. 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 such as cleaning immediately. There are a total of 55 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 63 removals, 3 are ash trees. There are a total of 240 ash trees, and 12 of those have signs and symptoms that have been associated with EAB. In addition, there are 25 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

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.

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%. Please refer to the six year maintenance plan at the end of this section. 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 Mapleton.

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 (31%) (Appendix A, Figure 1). 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. Please contact the Iowa DNR Forestry Bureau for the most recent suggested planting list.

Due to the threat of EAB, it is important to continuously check the health of ash trees. 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 dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan

Year 1

Removal: 6 critical concern trees and 20 immediate removal trees
Planting and Replacement: 31 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 26 immediate removal trees
Planting and Replacement: 31 trees in open locations from year one removals
Routine trimming: Contract to trim 1/3 of the city trees –starting with side of town most heavily hit by the tornado
Visual Survey for signs and symptoms of EAB

Year 3

Removal: Removal of 11 trees marked for routine removal
Planting and Replacement: 13 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4

Removal: Removal of any new critical concern trees and ash in poor health
Planting and Replacement: Trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: Removal of any new critical concern trees and ash in poor health
Planting and Replacement: Trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: Removal of any new critical concern trees and ash in poor health

Planting and Replacement: Trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

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.

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. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed ash trees will be replaced. Please contact Iowa DNR Forestry for the most up to date suggested planting list.

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.

Monitoring

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 dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if they do not choose treatment.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

1/21/2012

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	44.7	3,393	5,958.6	5,839	9,232	(N/A)	17.8	19.7	45.26
Silver maple	55.1	4,180	7,180.5	7,037	11,217	(N/A)	14.3	23.9	68.82
Sugar maple	23.5	1,786	3,193.0	3,129	4,915	(N/A)	7.0	10.5	61.44
Norway spruce	10.8	822	1,416.1	1,388	2,210	(N/A)	6.6	4.7	29.47
Norway maple	11.6	880	1,685.9	1,652	2,532	(N/A)	5.5	5.4	40.20
Apple	2.3	178	380.8	373	551	(N/A)	4.0	1.2	11.98
Austrian pine	6.7	508	884.7	867	1,375	(N/A)	3.6	2.9	33.54
Pear	1.6	119	257.5	252	372	(N/A)	3.4	0.8	9.53
Spruce	4.3	330	549.6	539	869	(N/A)	3.2	1.9	23.47
White ash	3.7	280	470.2	461	741	(N/A)	3.0	1.6	21.80
Blue spruce	2.4	185	331.5	325	510	(N/A)	3.0	1.1	14.99
Callery pear	1.3	99	207.6	203	302	(N/A)	2.6	0.6	10.07
American basswood	8.9	676	1,290.0	1,264	1,940	(N/A)	2.6	4.1	64.68
Northern hackberry	8.3	629	1,169.9	1,147	1,776	(N/A)	2.3	3.8	68.29
Northern red oak	3.3	251	468.4	459	710	(N/A)	2.0	1.5	30.86
Littleleaf linden	3.4	261	478.1	469	730	(N/A)	1.8	1.6	36.48
Eastern red cedar	1.9	147	287.5	282	429	(N/A)	1.6	0.9	23.84
Pin oak	5.4	412	726.0	712	1,124	(N/A)	1.6	2.4	62.43
Maple	0.6	44	85.4	84	128	(N/A)	1.5	0.3	7.53
Conifer Evergreen Large	1.7	131	222.3	218	349	(N/A)	1.5	0.7	20.52
Black maple	4.0	302	558.6	547	850	(N/A)	1.2	1.8	60.68
Other street trees	19.5	1,482	2,659.7	2,606	4,088	(N/A)	10.1	8.7	35.55
Citywide total	225.2	17,096	30,462.0	29,853	46,948	(N/A)	100.0	100.0	41.04

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

1/21/2012

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	426,596	11,562	(N/A)	17.8	15.6	56.67
Silver maple	806,091	21,847	(N/A)	14.3	29.4	134.03
Sugar maple	268,876	7,287	(N/A)	7.0	9.8	91.09
Norway spruce	218,597	5,924	(N/A)	6.6	8.0	78.99
Norway maple	104,279	2,826	(N/A)	5.5	3.8	44.86
Apple	10,914	296	(N/A)	4.0	0.4	6.43
Austrian pine	150,508	4,079	(N/A)	3.6	5.5	99.49
Pear	5,415	147	(N/A)	3.4	0.2	3.76
Spruce	66,883	1,813	(N/A)	3.2	2.4	48.99
White ash	23,468	636	(N/A)	3.0	0.9	18.71
Blue spruce	28,507	773	(N/A)	3.0	1.0	22.72
Callery pear	7,507	203	(N/A)	2.6	0.3	6.78
American basswood	102,225	2,770	(N/A)	2.6	3.7	92.35
Northern hackberry	74,215	2,011	(N/A)	2.3	2.7	77.36
Northern red oak	31,881	864	(N/A)	2.0	1.2	37.57
Littleleaf linden	31,959	866	(N/A)	1.8	1.2	43.31
Eastern red cedar	28,444	771	(N/A)	1.6	1.0	42.83
Pin oak	60,224	1,632	(N/A)	1.6	2.2	90.68
Maple	4,169	113	(N/A)	1.5	0.2	6.65
Conifer Evergreen Large	23,667	641	(N/A)	1.5	0.9	37.73
Black maple	40,135	1,088	(N/A)	1.2	1.5	77.70
Other street trees	229,588	6,222	(N/A)	10.1	8.4	54.11
Citywide total	2,744,149	74,372	(N/A)	100.0	100.0	65.01

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

1/21/2012

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Green ash	46.8	7.5	23.5	2.1	252	212.0	31.0	29.6	202.6	1,324	0.0	0	554.9	1,576	(N/A)	17.8	7.73
Silver maple	142.0	24.1	69.4	6.3	765	259.0	38.0	36.3	249.1	1,622	-73.7	-277	750.4	2,110	(N/A)	14.2	12.95
Sugar maple	36.2	6.2	18.0	1.6	196	112.0	16.3	15.6	106.6	698	-28.3	-106	284.1	788	(N/A)	7.0	9.85
Norway spruce	26.0	5.1	21.0	3.2	170	51.0	7.5	7.1	49.1	319	-117.7	-442	52.2	48	(N/A)	6.6	0.64
Norway maple	20.7	3.6	10.3	0.9	112	56.3	8.1	7.7	52.6	349	-4.9	-18	155.4	443	(N/A)	5.5	7.02
Apple	3.2	0.5	1.5	0.1	17	11.7	1.7	1.6	10.6	72	0.0	0	31.0	89	(N/A)	4.0	1.93
Austrian pine	18.2	3.6	14.5	2.2	119	31.6	4.6	4.4	30.3	198	-86.4	-324	23.1	-8	(N/A)	3.6	-0.19
Pear	1.0	0.2	0.6	0.0	5	7.9	1.1	1.1	7.1	48	0.0	0	18.9	54	(N/A)	3.4	1.37
Spruce	7.5	1.5	6.3	0.9	50	20.3	3.0	2.9	19.7	128	-29.3	-110	32.8	68	(N/A)	3.2	1.83
White ash	1.1	0.2	0.8	0.0	7	17.3	2.5	2.4	16.7	109	0.0	0	41.1	115	(N/A)	3.0	3.39
Blue spruce	3.1	0.6	2.8	0.4	21	11.6	1.7	1.6	11.0	72	-9.6	-36	23.2	57	(N/A)	3.0	1.69
Callery pear	0.9	0.1	0.5	0.0	5	6.5	0.9	0.9	5.9	40	-0.3	-1	15.5	44	(N/A)	2.6	1.46
American basswood	14.1	2.4	6.9	0.6	76	43.2	6.2	5.9	40.4	268	-12.0	-45	107.9	299	(N/A)	2.6	9.96
Northern hackberry	11.0	1.9	5.7	0.5	60	40.0	5.8	5.5	37.6	248	0.0	0	107.9	308	(N/A)	2.3	11.85
Northern red oak	6.5	1.1	3.2	0.3	35	15.9	2.3	2.2	15.0	99	-9.4	-35	37.1	99	(N/A)	2.0	4.29
Littleleaf linden	5.2	0.9	2.6	0.2	28	16.5	2.4	2.3	15.6	103	-2.6	-10	43.2	121	(N/A)	1.7	6.07
Eastern red cedar	5.9	1.2	4.7	0.7	38	9.4	1.4	1.3	8.8	58	-15.7	-59	17.6	38	(N/A)	1.6	2.10
Pin oak	10.6	1.9	5.4	0.5	58	25.7	3.8	3.6	24.6	161	-19.7	-74	56.4	145	(N/A)	1.6	8.06
Maple	0.9	0.1	0.4	0.0	5	2.8	0.4	0.4	2.6	18	-0.3	-1	7.5	21	(N/A)	1.5	1.24
Conifer Evergreen Large	2.6	0.5	2.2	0.3	17	8.1	1.2	1.1	7.8	51	-9.7	-36	14.2	32	(N/A)	1.5	1.87
Black maple	10.5	1.8	4.8	0.5	56	19.1	2.8	2.6	18.0	119	-3.4	-13	56.7	162	(N/A)	1.2	11.54
Other street trees	32.7	5.6	18.1	2.0	184	93.0	13.6	12.9	88.5	580	-35.2	-132	231.2	632	(N/A)	10.1	5.49
Citywide total	406.7	70.6	223.3	23.6	2,277	1,070.9	156.2	149.0	1,020.3	6,681	-458.2	-1,718	2,662.4	7,240	(N/A)	100.0	6.33

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

1/21/2012

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,533,631	11,502	(N/A)	17.8	17.0	56.38
Silver maple	3,266,513	24,499	(N/A)	14.3	36.2	150.30
Sugar maple	1,039,188	7,794	(N/A)	7.0	11.5	97.42
Norway spruce	296,653	2,225	(N/A)	6.6	3.3	29.67
Norway maple	343,419	2,576	(N/A)	5.5	3.8	40.88
Apple	53,480	401	(N/A)	4.0	0.6	8.72
Austrian pine	221,732	1,663	(N/A)	3.6	2.5	40.56
Pear	19,044	143	(N/A)	3.4	0.2	3.66
Spruce	68,807	516	(N/A)	3.2	0.8	13.95
White ash	44,361	333	(N/A)	3.0	0.5	9.79
Blue spruce	16,653	125	(N/A)	3.0	0.2	3.67
Callery pear	16,272	122	(N/A)	2.6	0.2	4.07
American	523,005	3,923	(N/A)	2.6	5.8	130.75
Northern	160,782	1,206	(N/A)	2.3	1.8	46.38
Northern red oak	141,668	1,063	(N/A)	2.0	1.6	46.20
Littleleaf linden	113,342	850	(N/A)	1.8	1.3	42.50
Eastern red cedar	19,012	143	(N/A)	1.6	0.2	7.92
Pin oak	278,039	2,085	(N/A)	1.6	3.1	115.85
Maple	10,105	76	(N/A)	1.5	0.1	4.46
Conifer Evergreen	21,773	163	(N/A)	1.5	0.2	9.61
Black maple	111,234	834	(N/A)	1.2	1.2	59.59
Other street trees	323,888	5,355	(N/A)	10.1	7.9	46.57
Citywide total	9,012,765	67,596	(N/A)	100.0	100.0	59.09

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

1/21/2012

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	101,933	764	-7,361	-40	-56	74,978	562	169,510	1,271	(N/A)	17.8	18.9	6.23
Silver maple	235,619	1,767	-15,679	-32	-118	92,377	693	312,286	2,342	(N/A)	14.3	34.8	14.37
Sugar maple	53,844	404	-4,988	-16	-38	39,477	296	88,317	662	(N/A)	7.0	9.8	8.28
Norway spruce	11,765	88	-1,424	-15	-11	18,172	136	28,499	214	(N/A)	6.6	3.2	2.85
Norway maple	16,961	127	-1,648	-12	-12	19,453	146	34,754	261	(N/A)	5.5	3.9	4.14
Apple	2,814	21	-257	-9	-2	3,926	29	6,475	49	(N/A)	4.0	0.7	1.06
Austrian pine	6,981	52	-1,064	-8	-8	11,228	84	17,137	129	(N/A)	3.6	1.9	3.13
Pear	2,482	19	-91	-8	-1	2,634	20	5,017	38	(N/A)	3.4	0.6	0.96
Spruce	4,308	32	-330	-7	-3	7,291	55	11,261	84	(N/A)	3.2	1.3	2.28
White ash	7,005	53	-213	-7	-2	6,192	46	12,978	97	(N/A)	3.0	1.4	2.86
Blue spruce	1,588	12	-80	-7	-1	4,083	31	5,584	42	(N/A)	3.0	0.6	1.23
Callery pear	2,802	21	-78	-6	-1	2,180	16	4,898	37	(N/A)	2.6	0.6	1.22
American basswood	30,097	226	-2,510	-6	-19	14,940	112	42,521	319	(N/A)	2.6	4.7	10.63
Northern hackberry	9,953	75	-772	-5	-6	13,902	104	23,078	173	(N/A)	2.3	2.6	6.66
Northern red oak	3,774	28	-680	-4	-5	5,545	42	8,635	65	(N/A)	2.0	1.0	2.82
Littleleaf linden	6,616	50	-544	-4	-4	5,769	43	11,836	89	(N/A)	1.8	1.3	4.44
Eastern red cedar	126	1	-91	-4	-1	3,258	24	3,289	25	(N/A)	1.6	0.4	1.37
Pin oak	25,693	193	-1,335	-4	-10	9,110	68	33,465	251	(N/A)	1.6	3.7	13.94
Maple	1,275	10	-49	-3	0	979	7	2,201	17	(N/A)	1.5	0.3	0.97
Conifer Evergreen	1,702	13	-105	-3	-1	2,894	22	4,487	34	(N/A)	1.5	0.5	1.98
Black maple	1,847	14	-534	-3	-4	6,677	50	7,988	60	(N/A)	1.2	0.9	4.28
Other street trees	35,000	263	-3,427	-22	-26	32,744	246	64,294	482	(N/A)	10.1	7.2	4.19
Citywide total	564,185	4,231	-43,261	-223	-326	377,808	2,834	898,509	6,739	(N/A)	100.0	100.0	5.89

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

1/21/2012

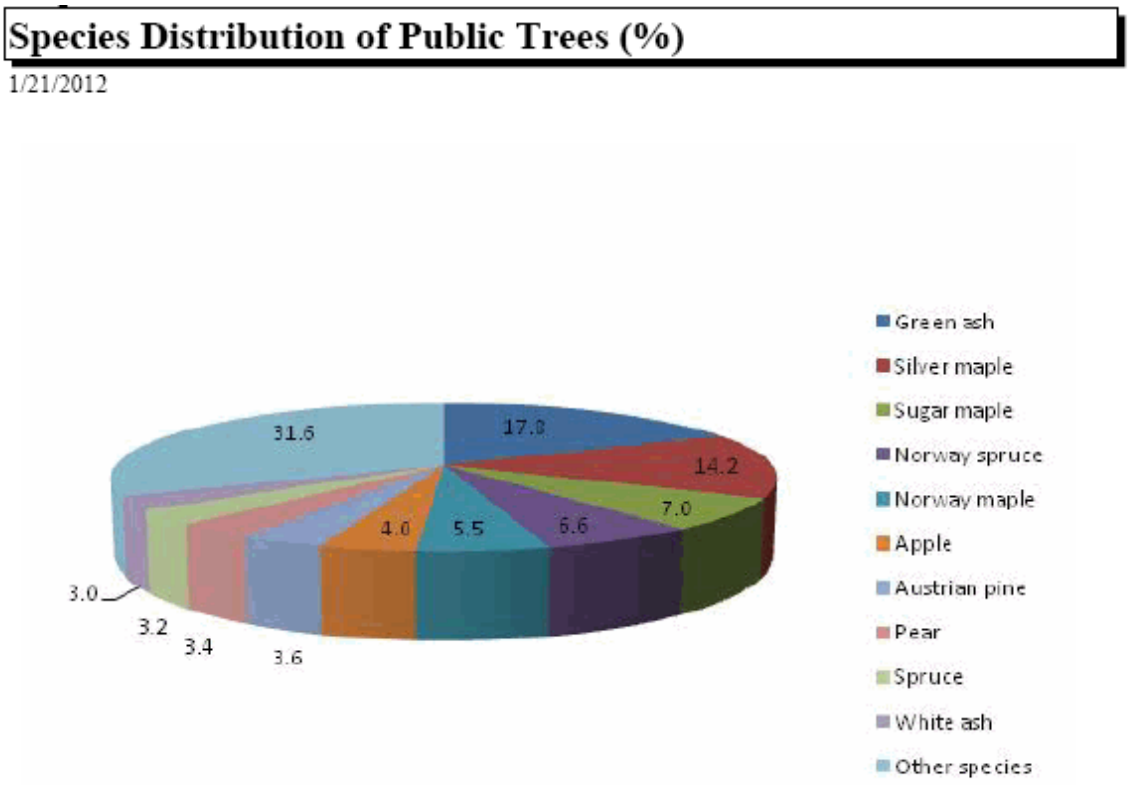
Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	9,332	(N/A)	17.8	17.6	45.75
Silver maple	17,950	(N/A)	14.3	33.8	110.12
Sugar maple	5,562	(N/A)	7.0	10.5	69.52
Norway spruce	2,199	(N/A)	6.6	4.1	29.33
Norway maple	1,684	(N/A)	5.5	3.2	26.72
Apple	154	(N/A)	4.0	0.3	3.34
Austrian pine	1,124	(N/A)	3.6	2.1	27.42
Pear	135	(N/A)	3.4	0.3	3.45
Spruce	1,085	(N/A)	3.2	2.0	29.34
White ash	1,129	(N/A)	3.0	2.1	33.20
Blue spruce	639	(N/A)	3.0	1.2	18.81
Callery pear	362	(N/A)	2.6	0.7	12.05
American basswood	2,142	(N/A)	2.6	4.0	71.40
Northern hackberry	1,385	(N/A)	2.3	2.6	53.27
Northern red oak	316	(N/A)	2.0	0.6	13.76
Littleleaf linden	747	(N/A)	1.8	1.4	37.35
Eastern red cedar	49	(N/A)	1.6	0.1	2.71
Pin oak	1,947	(N/A)	1.6	3.7	108.16
Maple	168	(N/A)	1.5	0.3	9.91
Conifer Evergreen Large	431	(N/A)	1.5	0.8	25.37
Black maple	218	(N/A)	1.2	0.4	15.58
Other street trees	4,402	(N/A)	10.1	8.3	38.28
Citywide total	53,161	(N/A)	100.0	100.0	46.47

Table 7: Summary of Benefits in Dollars

Total Annual Benefits of Public Trees by Species ($)

1/21/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	9,232	1,271	1,576	11,562	9,332	32,973	(±0)	17.5
Silver maple	11,217	2,342	2,110	21,847	17,950	55,466	(±0)	29.4
Sugar maple	4,915	662	788	7,287	5,562	19,215	(±0)	10.2
Norway spruce	2,210	214	48	5,924	2,199	10,596	(±0)	5.6
Norway maple	2,532	261	443	2,826	1,684	7,745	(±0)	4.1
Apple	551	49	89	296	154	1,138	(±0)	0.6
Austrian pine	1,375	129	-8	4,079	1,124	6,699	(±0)	3.6
Pear	371	38	54	147	135	744	(±0)	0.4
Spruce	869	84	68	1,813	1,085	3,919	(±0)	2.1
White ash	741	97	115	636	1,129	2,718	(±0)	1.4
Blue spruce	510	42	57	773	639	2,021	(±0)	1.1
Callery pear	302	37	44	203	362	948	(±0)	0.5
American basswood	1,940	319	299	2,770	2,142	7,471	(±0)	4.0
Northern hackberry	1,776	173	308	2,011	1,385	5,653	(±0)	3.0
Northern red oak	710	65	99	864	316	2,054	(±0)	1.1
Littleleaf linden	730	89	121	866	747	2,553	(±0)	1.4
Eastern red cedar	429	25	38	771	49	1,311	(±0)	0.7
Pin oak	1,124	251	145	1,632	1,947	5,099	(±0)	2.7
Maple	128	17	21	113	168	447	(±0)	0.2
Conifer Evergreen	349	34	32	641	431	1,487	(±0)	0.8
Black maple	850	60	162	1,088	218	2,377	(±0)	1.3
Other street trees	4,088	482	632	6,222	4,402	15,826	(±0)	8.4
Citywide Total	46,948	6,739	7,240	74,372	53,161	188,459	(±0)	100.0

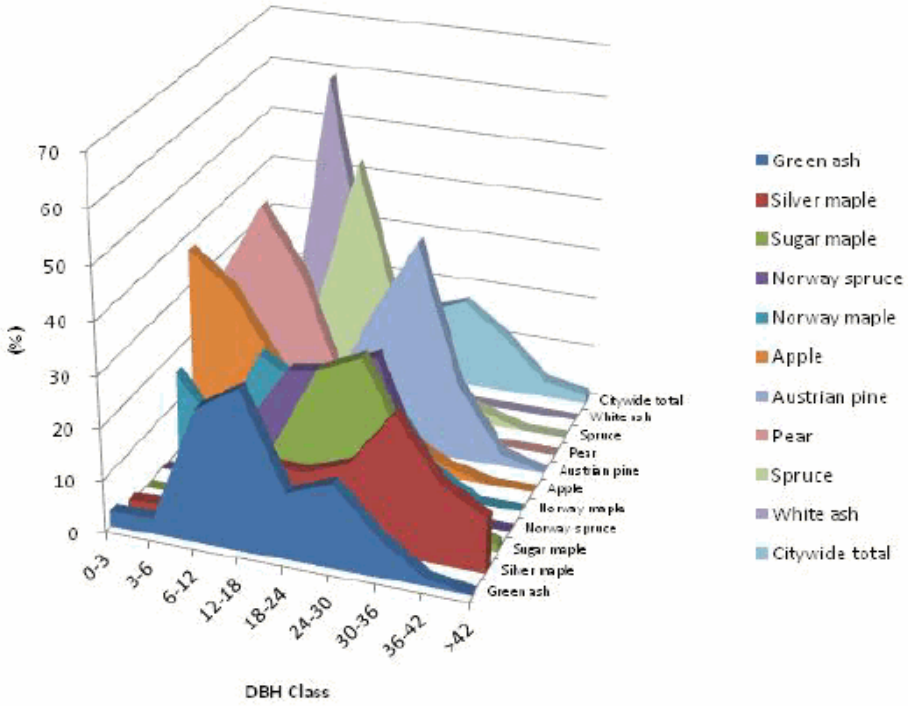


Species	Percent
Green ash	17.8
Silver maple	14.2
Sugar maple	7.0
Norway spruce	6.6
Norway maple	5.5
Apple	4.0
Austrian pine	3.6
Pear	3.4
Spruce	3.2
White ash	3.0
Other species	31.6
Total	100.0

Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)

1/21/2012



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Green ash	2.9	2.9	25.5	30.9	12.7	16.2	7.4	1.5	0.0
Silver maple	1.2	1.8	1.8	13.5	12.9	16.0	27.0	15.3	10.4
Sugar maple	0.0	0.0	5.0	12.5	28.8	32.5	16.3	3.8	1.3
Norway spruce	0.0	1.3	12.0	24.0	25.3	29.3	8.0	0.0	0.0
Norway maple	15.9	4.8	22.2	17.5	17.5	17.5	4.8	0.0	0.0
Apple	37.0	30.4	17.4	2.2	4.3	6.5	2.2	0.0	0.0
Austrian pine	0.0	0.0	4.9	9.8	26.8	41.5	14.6	2.4	0.0
Pear	25.6	41.0	28.2	5.1	0.0	0.0	0.0	0.0	0.0
Spruce	0.0	5.4	18.9	48.6	18.9	5.4	2.7	0.0	0.0
White ash	11.8	8.8	61.8	17.6	0.0	0.0	0.0	0.0	0.0
Citywide total	8.0	8.1	17.1	18.9	14.1	17.3	11.4	3.3	1.8

Figure 2: Relative Age Class

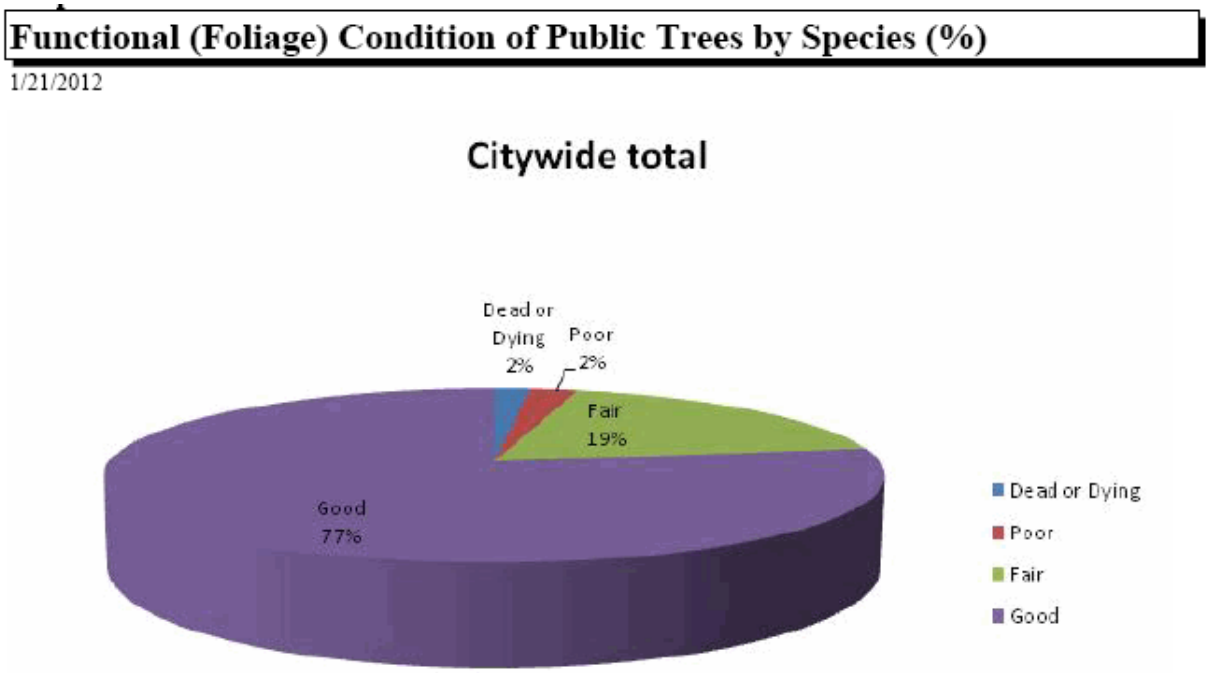


Figure 3: Foliage Condition

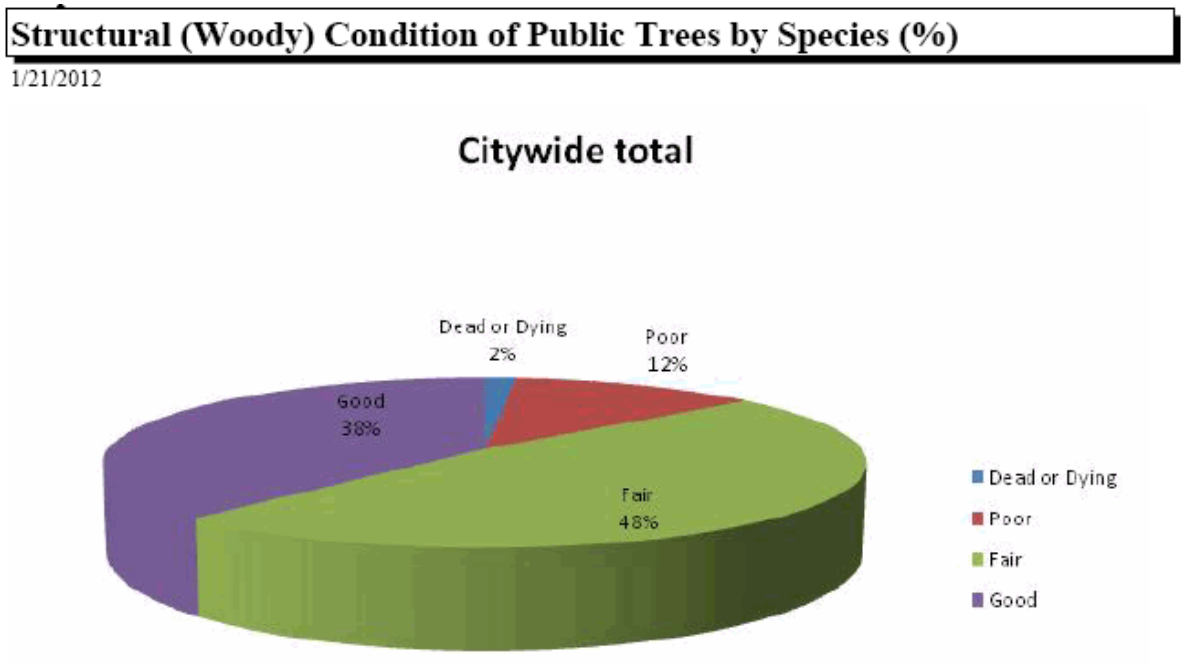
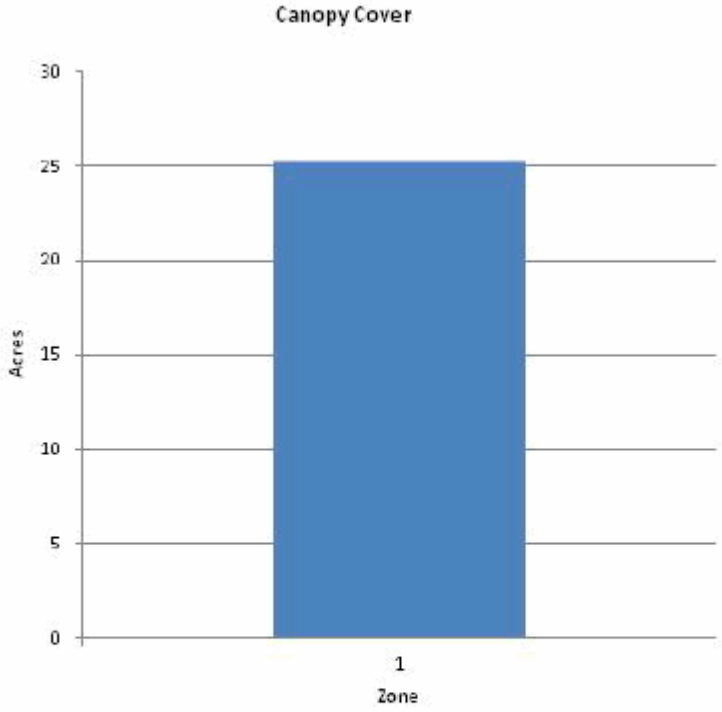


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

1/21/2012



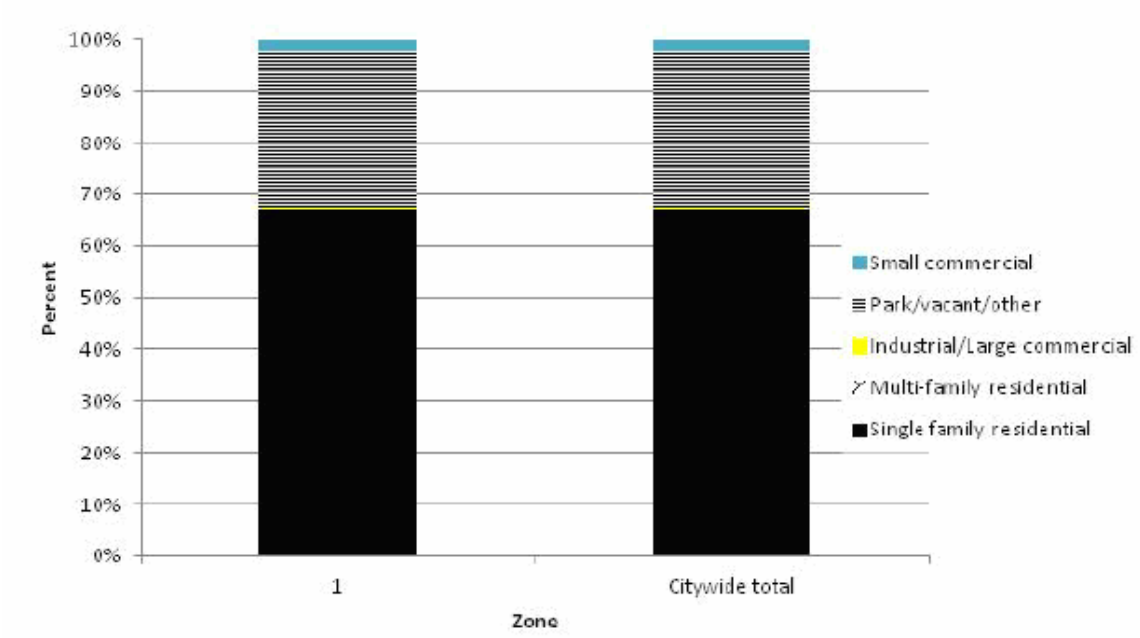
Zone	Acres	% of Total Canopy Cover
1	25	100.0
Citywide total	25	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	25		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

1/21/2012

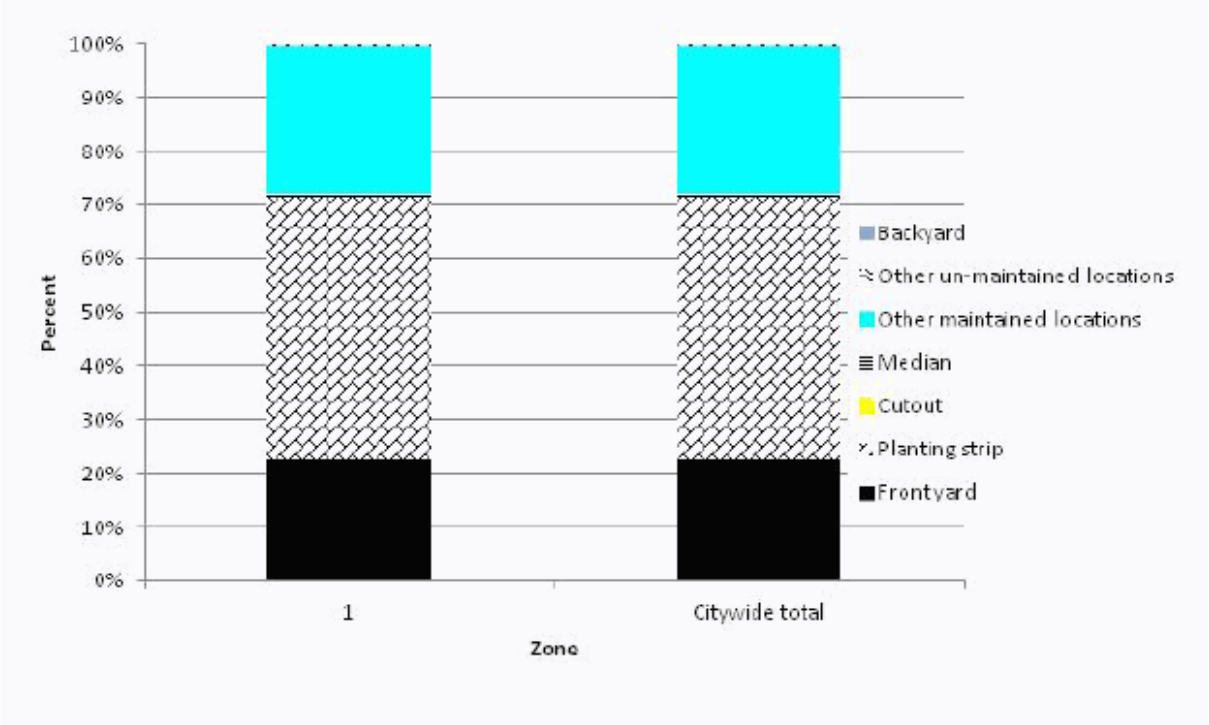


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	67.1	0.0	0.3	30.2	2.3
Citywide total	67.1	0.0	0.3	30.2	2.3

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

1/21/2012



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	22.7	48.8	0.2	0.3	27.7	0.3	0.0
Citywide total	22.7	48.8	0.2	0.3	27.7	0.3	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

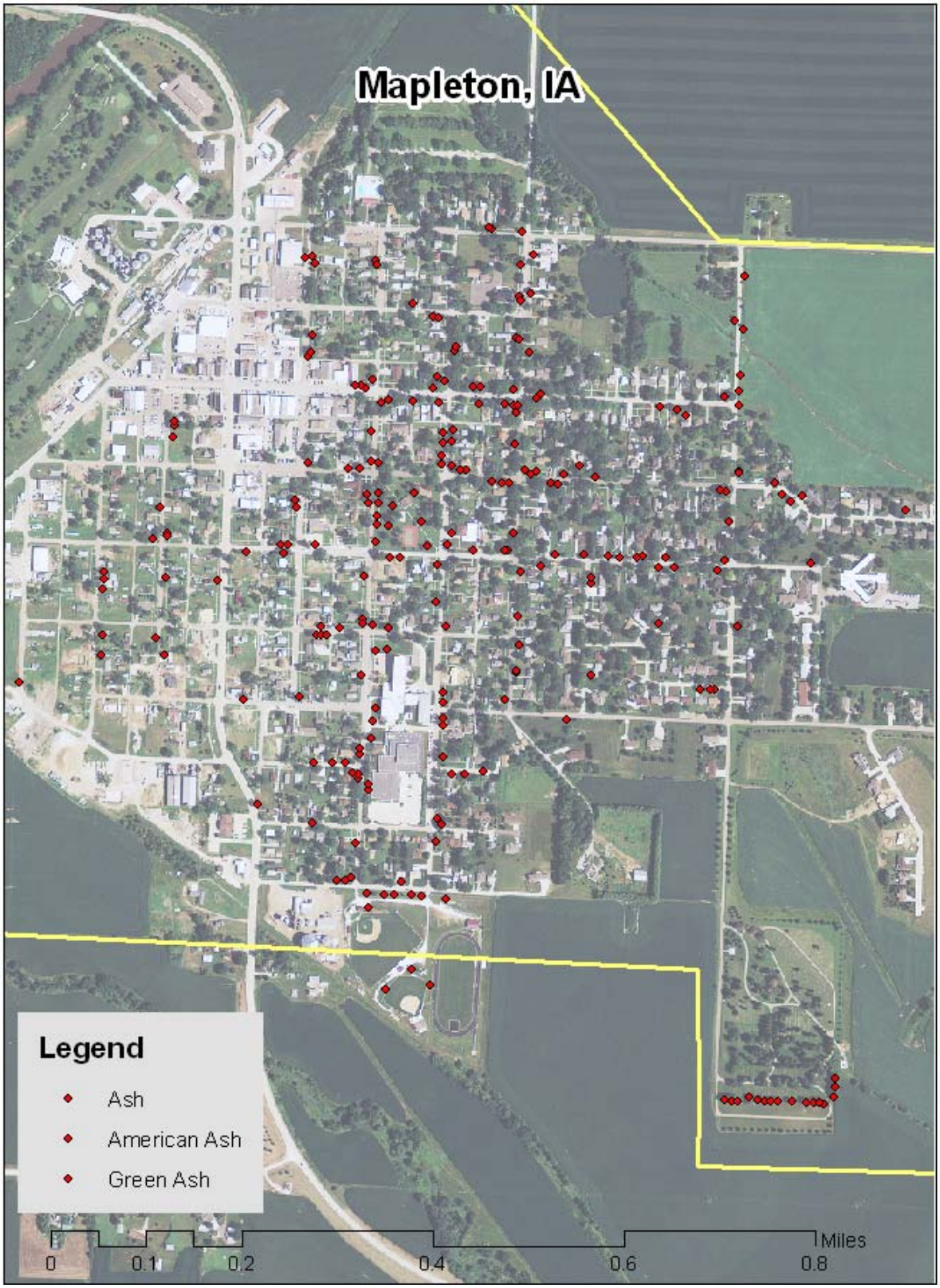


Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

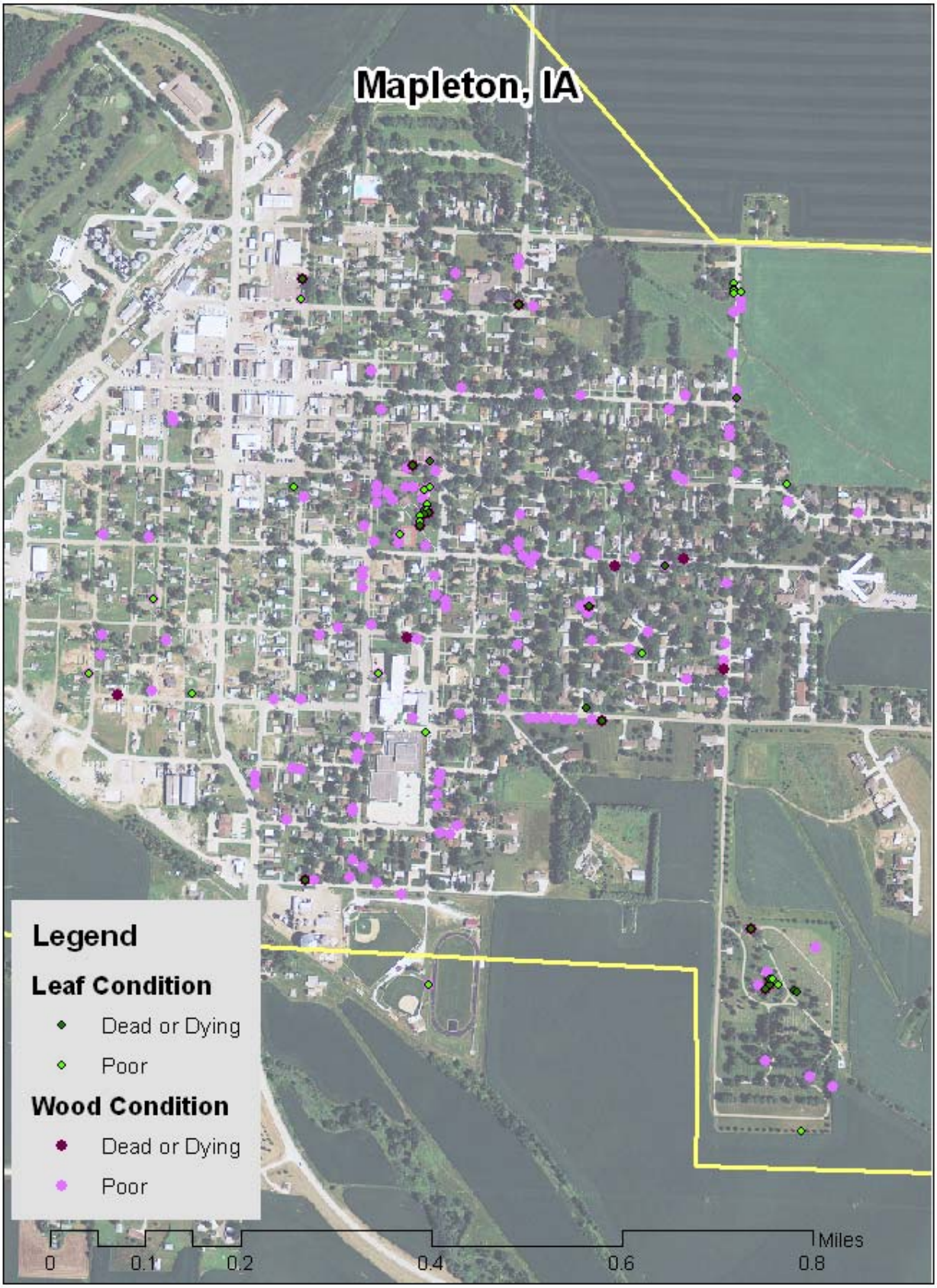


Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

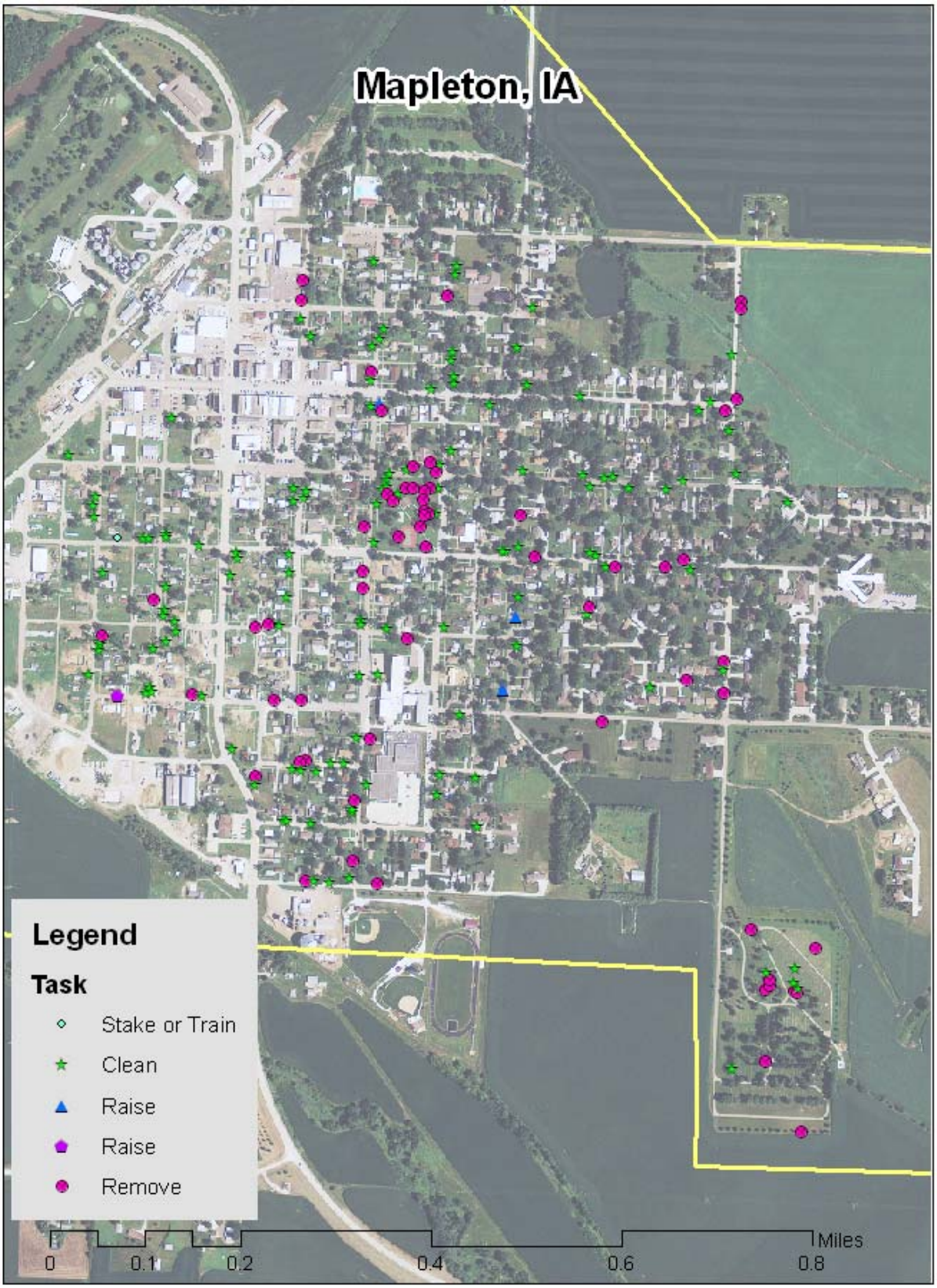


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Mapleton Tree Ordinances

The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 9th St., Des Moines, IA 50319.

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-281-5918.