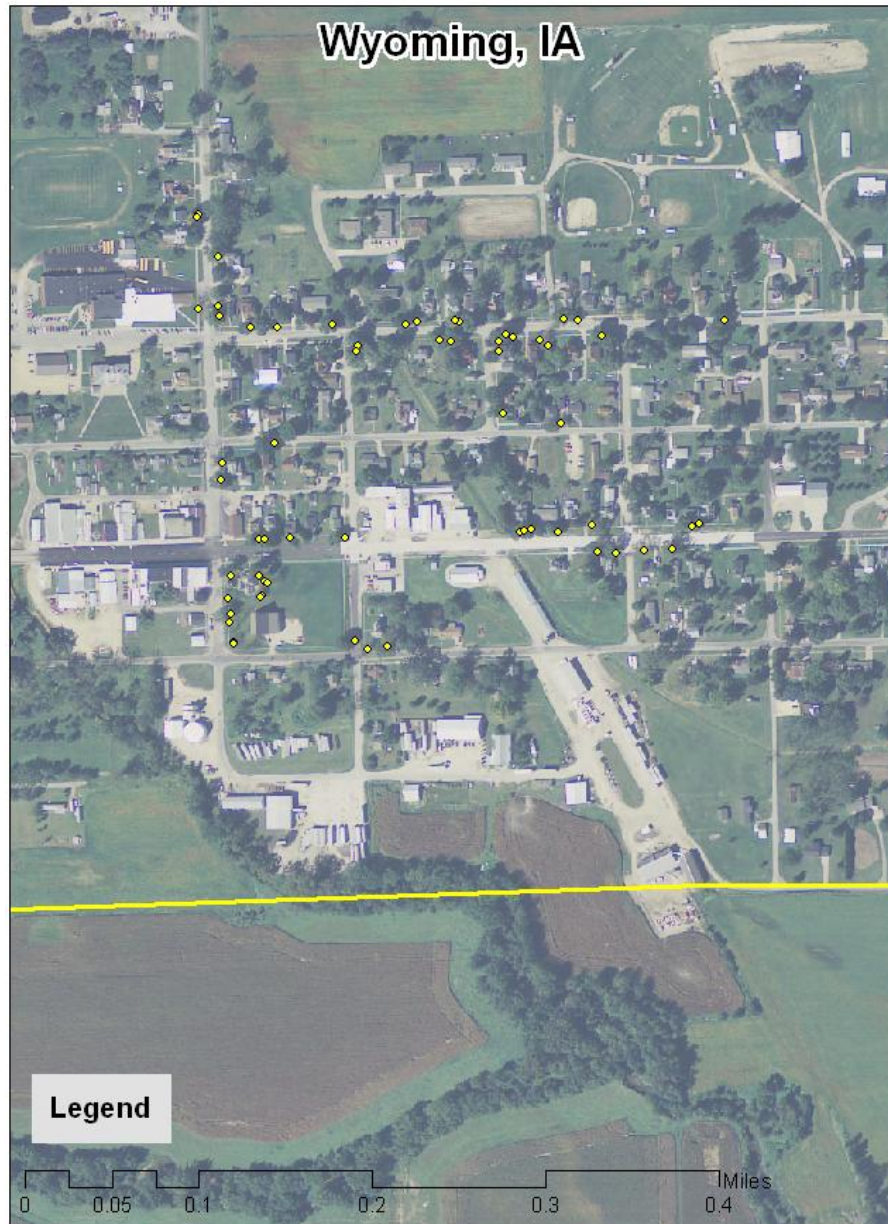


WYOMING, IA



2011 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Wyoming with managing its urban forest, including budgeting and future planning. 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 28% of Wyoming'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 61 trees inventoried.

- Wyoming's trees provide \$13,829 of benefits annually, an average of \$227 a tree
- There are over 15 species of trees
- The top three genus are: Maple 43%, Ash 28%, and Walnut 11%
- 11% of trees are in need of some type of management
- No 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.

- No trees need removal **City ownership of the trees recommended for removal should be verified prior to any removal**
- 11 of the 17 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 half of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Siberian elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly

Introduction

This plan was developed to assist Wyoming with the management, budgeting 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 tree canopy in Wyoming, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Wyoming'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 Wyoming 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 Wyoming'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 61 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. Wyoming's trees reduce energy related costs by approximately \$1,680 annually (Appendix A, Table 1). These savings are both in Electricity (18.3 MWh) and in Natural Gas (2,516.9 Therms).

Annual Stormwater Benefits

Wyoming's trees intercept about 205,465 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$5,568 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 Wyoming, it is estimated that trees remove 242.4 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$685 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Wyoming, trees sequester about 61,285 lbs of carbon a year with an associated value of \$460 (Appendix A, Table 4). In addition, the trees store 800,764 lbs of carbon, with a yearly benefit of \$6,006 (Appendix A, Table 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. Wyoming receives \$3,264 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, Wyoming's trees provide \$13,829 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 61 trees in Wyoming provide approximately \$227 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Wyoming has over 11 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genus is as follows:

Maple(Sugar, Norway,Black,Silver)	26	43%
Ash	17	28%
Black Walnut	7	11%
Ginkgo	2	3%
Hackberry	2	3%
Elm(American,Siberian)	2	3%
Norway Spruce	1	2%
Honeylocust	1	2%
Birch	1	2%
Sycamore	1	2%
Hemlock	1	1%

Size Class

Most of Wyoming's trees (54%) are between 18 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For size, a Bell Curve is preferred and shows the highest amount of trees around 18 inches in diameter at 4.5 ft. Wyoming's size curve is on the average side, indicating an average stand. Generally with trees size does not indicate age.

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 Wyoming indicate that 93% of the trees are in good health, with none of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 52% of Wyoming'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 0% of the population. There is 11% 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).

Cleaning	5	8%
Raise	1	2%
Reduce	1	2%

Canopy Cover

The canopy cover of Wyoming is 2 acre (Appendix A, Figure 4). According to the 2000 census, Wyoming occupies 218 acres. Thus the canopy cover on city land is about 1%.

Land Use and Location

The majority of Wyoming's city and park trees are planted on the city parking. (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	87%
Park/vacant/other	13%

Location

Planting strip	100%
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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

Wyoming has no critical concern trees. There are 5 tree that needs to be cleaned, 1 tree needs to be raised, and 1 tree needs to be reduced. Please refer to the six year maintenance plan at the end of this section.

Poor tree species

There are a total of 17 ash trees, and 11 of those have signs and symptoms that have been associated with EAB. *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 Wyoming.

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 (43%) (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, Siberian elm, evergreen, willow or black walnut. All trees planted must meet the restrictions in city ordinance.

Continual Monitoring

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 with No Additional Funding

Year 1

- Clean, Reduce & Raise 7 trees
- Visual Survey for signs and symptoms of EAB

Year 2

- Routine trimming: Contract to trim 1/2 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 3

- Visual Survey for signs and symptoms of EAB

Year 4

- Routine trimming: Contract to trim 1/2 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 5

- Visual Survey for signs and symptoms of EAB

Year 6

- Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: EAB could potentially start killing ash within 6 years of its arrival. This should leave adequate time for a strategy, the tree removals will increase once it arrives, but if they are kept up, the EAB population will be reduced decreasing their impact.

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. All trees will meet the restrictions in 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.

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.

Budget

Current Budget

Total \$1,350 over 6 years (\$225/year)

FY 2012 Budget

Clean, Reduce & Raise: \$150

FY 2013 Budget

Routine trimming: \$600

FY 2014 Budget

FY 2015 Budget

Routine trimming: \$600

FY 2016 Budget

FY 2017 Budget

*Reduction of ash over 6 years: EAB could potentially start killing ash within 6 years of its arrival. This should leave adequate time for a strategy, the tree removals will increase once it arrives, but if they are kept up the EAB population will be reduced decreasing their impact.

Purposed Budget Increase

EAB could potentially kill all ash trees in Wyoming within 10-12 years of its arrival. To remove all ash trees within 10-12 years after the discovery of EAB the budget would need to be increased to \$1,400 a year. If the budget were increased to \$8,500 a year all ash could be removed within 1 year. Additionally, it is recommended that Wyoming apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

10/15/2011

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	5.1	383	738.8	724	1,108	(N/A)	27.9	28.7	65.15
Sugar maple	3.8	287	520.5	510	797	(N/A)	19.7	20.7	66.45
Norway maple	1.8	137	266.9	262	399	(N/A)	11.5	10.4	56.98
Black walnut	2.0	153	256.0	251	404	(N/A)	11.5	10.5	57.68
Silver maple	2.1	159	273.7	268	427	(N/A)	9.8	11.1	71.23
Northern hackberry	0.8	61	103.1	101	162	(N/A)	3.3	4.2	80.79
Ginkgo	0.5	36	64.0	63	99	(N/A)	3.3	2.6	49.28
Black maple	0.3	22	39.9	39	61	(N/A)	1.6	1.6	60.68
Birch	0.2	18	29.5	29	47	(N/A)	1.6	1.2	46.78
Honeylocust	0.3	23	42.3	41	65	(N/A)	1.6	1.7	64.79
Norway spruce	0.2	14	24.6	24	38	(N/A)	1.6	1.0	38.17
American sycamore	0.5	37	63.1	62	99	(N/A)	1.6	2.6	98.63
Eastern hemlock	0.1	10	14.6	14	24	(N/A)	1.6	0.6	24.14
American elm	0.4	29	52.8	52	80	(N/A)	1.6	2.1	80.37
Siberian elm	0.2	18	26.8	26	44	(N/A)	1.6	1.2	44.29
Other street trees	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	18.3	1,386	2,516.9	2,467	3,853	(N/A)	100.0	100.0	63.16

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

10/15/2011

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	54,139	1,467	(N/A)	27.9	26.4	86.31
Sugar maple	46,788	1,268	(N/A)	19.7	22.8	105.67
Norway maple	16,284	441	(N/A)	11.5	7.9	63.05
Black walnut	19,633	532	(N/A)	11.5	9.6	76.01
Silver maple	30,504	827	(N/A)	9.8	14.9	137.78
Northern hackberry	7,919	215	(N/A)	3.3	3.9	107.31
Ginkgo	3,714	101	(N/A)	3.3	1.8	50.33
Black maple	2,867	78	(N/A)	1.6	1.4	77.70
Birch	1,409	38	(N/A)	1.6	0.7	38.19
Honeylocust	2,905	79	(N/A)	1.6	1.4	78.73
Norway spruce	4,604	125	(N/A)	1.6	2.2	124.79
American sycamore	7,238	196	(N/A)	1.6	3.5	196.17
Eastern hemlock	1,539	42	(N/A)	1.6	0.8	41.70
American elm	4,551	123	(N/A)	1.6	2.2	123.34
Siberian elm	1,370	37	(N/A)	1.6	0.7	37.14
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	205,465	5,568	(N/A)	100.0	100.0	91.29

Table 3: Annual Air Quality Benefits**Annual Air Quality Benefits of Public Trees by Species**

10/15/2011

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total (\$)	Standard Error	% of Total Trees	Avg. \$/tree
	O ₃	NO ₂	PM ₁₀	SO ₂		NO ₂	PM ₁₀	VOC	SO ₂								
Ash	11.9	2.1	5.7	0.5	64	24.6	3.5	3.4	22.9	152	-2.7	-10	71.9	206 (N/A)		27.9	12.11
Sugar maple	6.4	1.1	3.1	0.3	35	18.1	2.6	2.5	17.1	113	-5.0	-19	46.3	128 (N/A)		19.7	10.70
Norway maple	3.2	0.5	1.6	0.1	17	8.8	1.3	1.2	8.2	55	-0.8	-3	24.2	69 (N/A)		11.5	9.84
Black walnut	2.8	0.4	1.3	0.1	15	9.4	1.4	1.3	9.1	59	0.0	0	26.0	74 (N/A)		11.5	10.58
Silver maple	5.4	0.9	2.7	0.2	29	9.9	1.4	1.4	9.5	62	-2.9	-11	28.6	80 (N/A)		9.8	13.37
Northern hackberry	1.8	0.3	0.9	0.1	10	3.8	0.6	0.5	3.6	24	0.0	0	11.5	33 (N/A)		3.3	16.60
Ginkgo	1.1	0.2	0.5	0.0	6	2.2	0.3	0.3	2.1	14	-0.3	-1	6.5	19 (N/A)		3.3	9.29
Black maple	0.7	0.1	0.3	0.0	4	1.4	0.2	0.2	1.3	8	-0.2	-1	4.0	12 (N/A)		1.6	11.54
Birch	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8 (N/A)		1.6	7.92
Honeylocust	0.5	0.1	0.3	0.0	3	1.5	0.2	0.2	1.4	9	-0.4	-1	3.8	11 (N/A)		1.6	10.61
Norway spruce	0.6	0.1	0.4	0.1	4	0.9	0.1	0.1	0.8	5	-2.9	-11	0.3	-2 (N/A)		1.6	-1.58
American sycamore	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23 (N/A)		1.6	22.55
Eastern hemlock	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)		1.6	2.82
American elm	0.5	0.1	0.3	0.0	3	1.8	0.3	0.3	1.7	11	0.0	0	4.9	14 (N/A)		1.6	14.10
Siberian elm	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.7	7 (N/A)		1.6	7.49
Other street trees	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)		0.0	0.00
Citywide total	37.1	6.3	18.2	1.7	200	87.4	12.7	12.1	82.8	544	-15.8	-59	242.4	685 (N/A)		100.0	11.22

Table 4: Annual Carbon Stored**Stored CO2 Benefits of Public Trees by Species**

10/15/2011

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	196,111	1,471	(N/A)	27.9	24.5	86.52
Sugar maple	184,659	1,385	(N/A)	19.7	23.1	115.41
Norway maple	51,296	385	(N/A)	11.5	6.4	54.96
Black walnut	94,900	712	(N/A)	11.5	11.9	101.68
Silver maple	129,350	970	(N/A)	9.8	16.2	161.69
Northern	30,611	230	(N/A)	3.3	3.8	114.79
Ginkgo	15,601	117	(N/A)	3.3	2.0	58.50
Black maple	7,945	60	(N/A)	1.6	1.0	59.59
Birch	3,624	27	(N/A)	1.6	0.5	27.18
Honeylocust	6,743	51	(N/A)	1.6	0.8	50.57
Norway spruce	7,490	56	(N/A)	1.6	0.9	56.18
American	55,982	420	(N/A)	1.6	7.0	419.86
Eastern hemlock	1,170	9	(N/A)	1.6	0.2	8.78
American elm	12,245	92	(N/A)	1.6	1.5	91.84
Siberian elm	3,037	23	(N/A)	1.6	0.4	22.78
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	800,764	6,006	(N/A)	100.0	100.0	98.45

Table 5: Annual Carbon Sequestered**Annual CO₂ Benefits of Public Trees by Species**

10/15/2011

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	5,612	42	-941	-3	-7	8,475	64	13,142	99 (N/A)	27.9	21.4	5.80
Sugar maple	9,151	69	-886	-2	-7	6,349	48	14,612	110 (N/A)	19.7	23.8	9.13
Norway maple	3,205	24	-246	-1	-2	3,035	23	5,993	45 (N/A)	11.5	9.8	6.42
Black walnut	3,777	28	-456	-1	-3	3,378	25	6,698	50 (N/A)	11.5	10.9	7.18
Silver maple	9,126	68	-621	-1	-5	3,516	26	12,020	90 (N/A)	9.8	19.6	15.03
Northern hackberry	945	7	-147	0	-1	1,337	10	2,134	16 (N/A)	3.3	3.5	8.00
Ginkgo	0	0	-75	0	-1	792	6	717	5 (N/A)	3.3	1.2	2.69
Black maple	0	0	-38	0	0	477	4	439	3 (N/A)	1.6	0.7	3.29
Birch	386	3	-17	0	0	395	3	763	6 (N/A)	1.6	1.3	5.73
Honeylocust	936	7	-32	0	0	515	4	1,419	11 (N/A)	1.6	2.3	10.64
Norway spruce	0	0	-36	0	0	311	2	275	2 (N/A)	1.6	0.5	2.06
American sycamore	479	4	-269	0	-2	813	6	1,023	8 (N/A)	1.6	1.7	7.67
Eastern hemlock	116	1	-6	0	0	216	2	326	2 (N/A)	1.6	0.5	2.45
American elm	454	3	-59	0	0	632	5	1,027	8 (N/A)	1.6	1.7	7.70
Siberian elm	314	2	-15	0	0	397	3	697	5 (N/A)	1.6	1.1	5.23
Other street trees	0	0	0	0	0	0	0	0	0 (N/A)	0.0	0.0	0.00
Citywide total	34,501	259	-3,844	-12	-29	30,639	230	61,285	460 (N/A)	100.0	100.0	7.54

Table 6: Annual Social and Aesthetic Benefits**Annual Aesthetic/Other Benefits of Public Trees by Species**

10/15/2011

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	502	(N/A)	27.9	15.4	29.54
Sugar maple	930	(N/A)	19.7	28.5	77.47
Norway maple	297	(N/A)	11.5	9.1	42.50
Black walnut	335	(N/A)	11.5	10.3	47.90
Silver maple	687	(N/A)	9.8	21.1	114.54
Northern hackberry	121	(N/A)	3.3	3.7	60.41
Ginkgo	0	(N/A)	3.3	0.0	0.00
Black maple	0	(N/A)	1.6	0.0	0.00
Birch	39	(N/A)	1.6	1.2	39.16
Honeylocust	195	(N/A)	1.6	6.0	194.60
Norway spruce	0	(N/A)	1.6	0.0	0.00
American sycamore	29	(N/A)	1.6	0.9	28.57
Eastern hemlock	32	(N/A)	1.6	1.0	32.32
American elm	64	(N/A)	1.6	2.0	64.36
Siberian elm	32	(N/A)	1.6	1.0	32.00
Other street trees	0	(±NaN)	0.0	0.0	0.00
Citywide total	3,264	(N/A)	100.0	100.0	53.50

Table 7: Summary of Benefits in Dollars

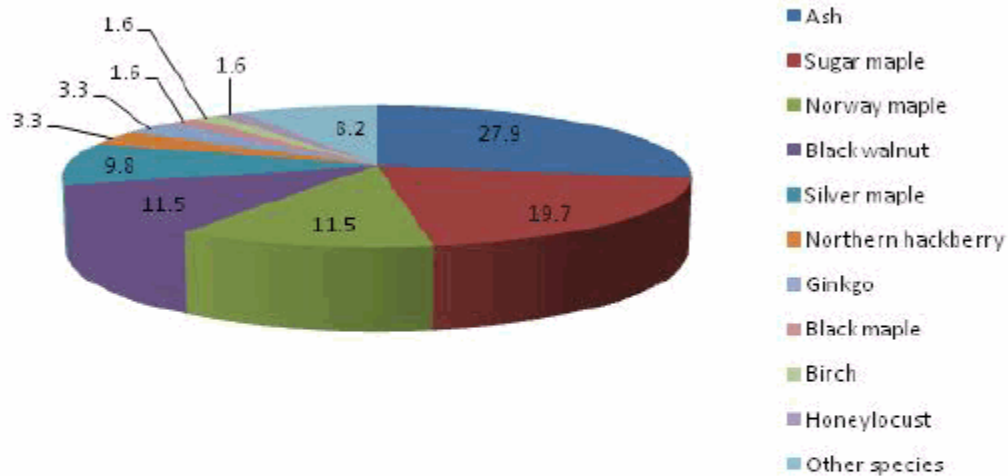
Total Annual Benefits of Public Trees by Species (\$)

10/15/20

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Ash	1,108	99	206	1,467	502	3,381	(±0)	24.5
Sugar maple	797	110	128	1,268	930	3,233	(±0)	23.4
Norway maple	399	45	69	441	297	1,251	(±0)	9.0
Black walnut	404	50	74	532	335	1,395	(±0)	10.1
Silver maple	427	90	80	827	687	2,112	(±0)	15.3
Northern hackberry	162	16	33	215	121	546	(±0)	3.9
Ginkgo	99	5	19	101	0	223	(±0)	1.6
Black maple	61	3	12	78	0	153	(±0)	1.1
Birch	47	6	8	38	39	138	(±0)	1.0
Honeylocust	65	11	11	79	195	359	(±0)	2.6
Norway spruce	38	2	-2	125	0	163	(±0)	1.2
American sycamore	99	8	23	196	29	354	(±0)	2.6
Eastern hemlock	24	2	3	42	32	103	(±0)	0.7
American elm	80	8	14	123	64	290	(±0)	2.1
Siberian elm	44	5	7	37	32	126	(±0)	0.9
Other street trees	0	0	0	0	0	0	(±0)	0.0
Citywide Total	3,853	460	685	5,568	3,264	13,829	(±0)	100.0

Species Distribution of Public Trees (%)

10/15/2011

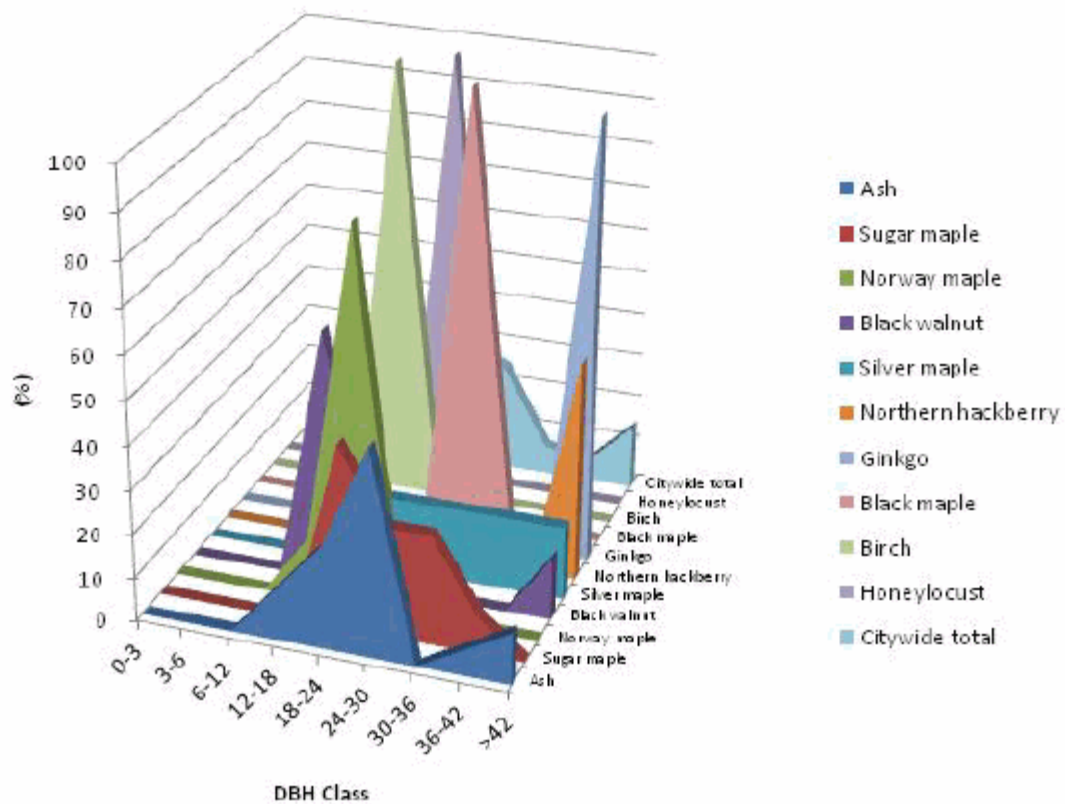


Species	Percent
Ash	27.9
Sugar maple	19.7
Norway maple	11.5
Black walnut	11.5
Silver maple	9.8
Northern hackberry	3.3
Ginkgo	3.3
Black maple	1.6
Birch	1.6
Honeylocust	1.6
Other species	8.2
Total	100.0

Figure 1: Species Distribution

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

10/15/2011



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Ash	0.0	0.0	0.0	11.8	23.5	47.1	0.0	5.9	11.8
Sugar maple	0.0	0.0	0.0	0.0	41.7	25.0	25.0	8.3	0.0
Norway maple	0.0	0.0	0.0	14.3	85.7	0.0	0.0	0.0	0.0
Black walnut	0.0	0.0	0.0	57.1	14.3	14.3	0.0	0.0	14.3
Silver maple	0.0	0.0	0.0	16.7	16.7	16.7	16.7	16.7	16.7
Northern hackberry	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	50.0
Ginkgo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Black maple	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Birch	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Honeylocust	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Citywide total	0.0	0.0	0.0	19.7	29.5	24.6	6.6	4.9	14.8

Figure 2: Relative Age Class

Functional (Foliage) Condition of Public Trees by Species (%)

10/15/2011

Citywide total

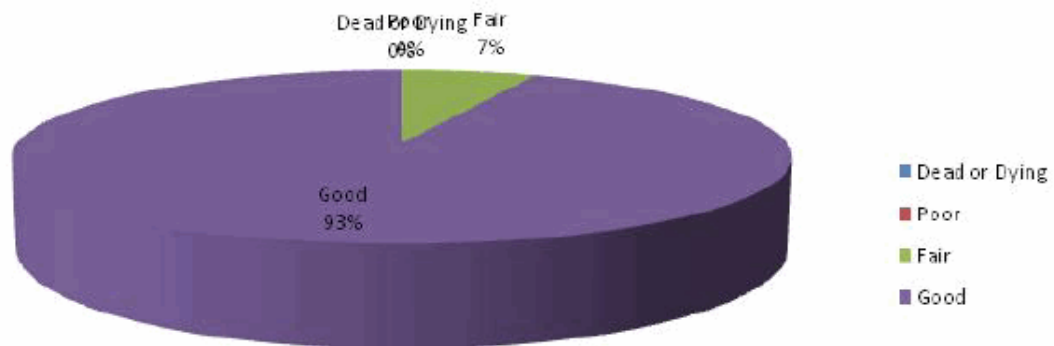


Figure 3: Foliage Condition

Structural (Woody) Condition of Public Trees by Species (%)

10/15/2011

Citywide total

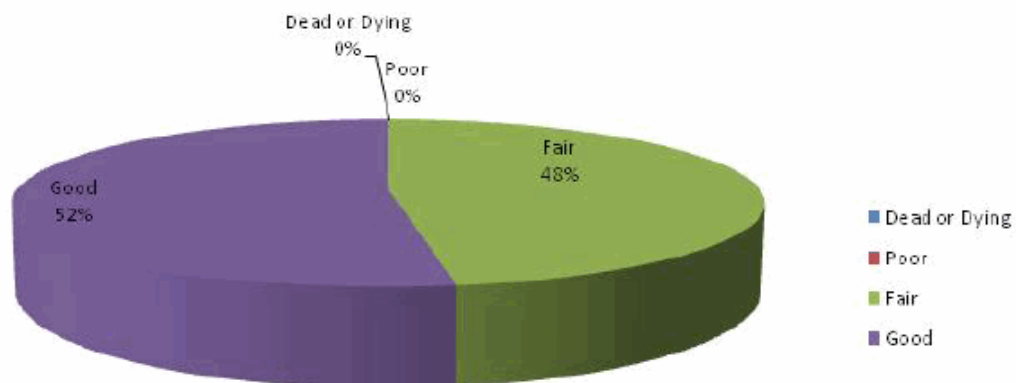
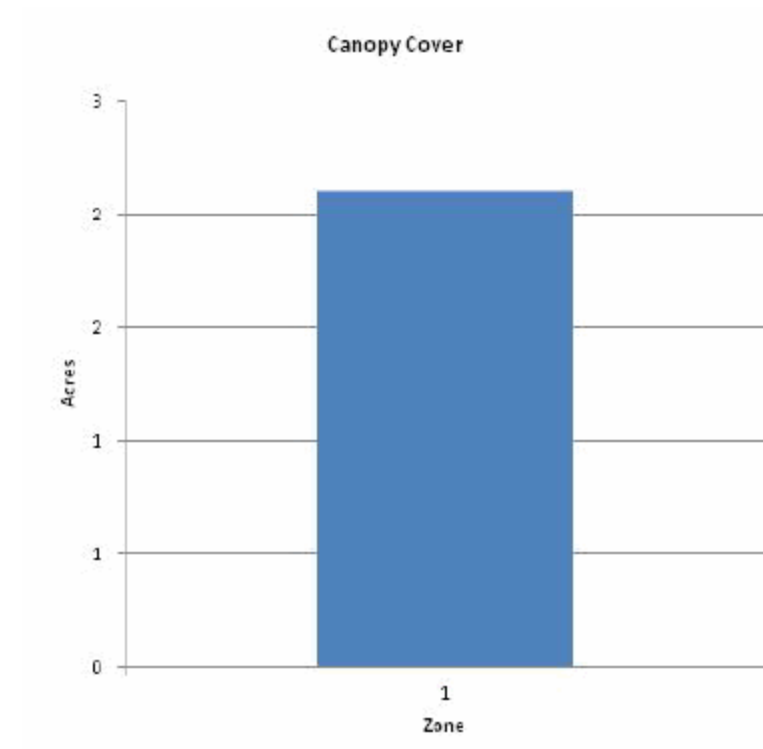


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

10/15/2011



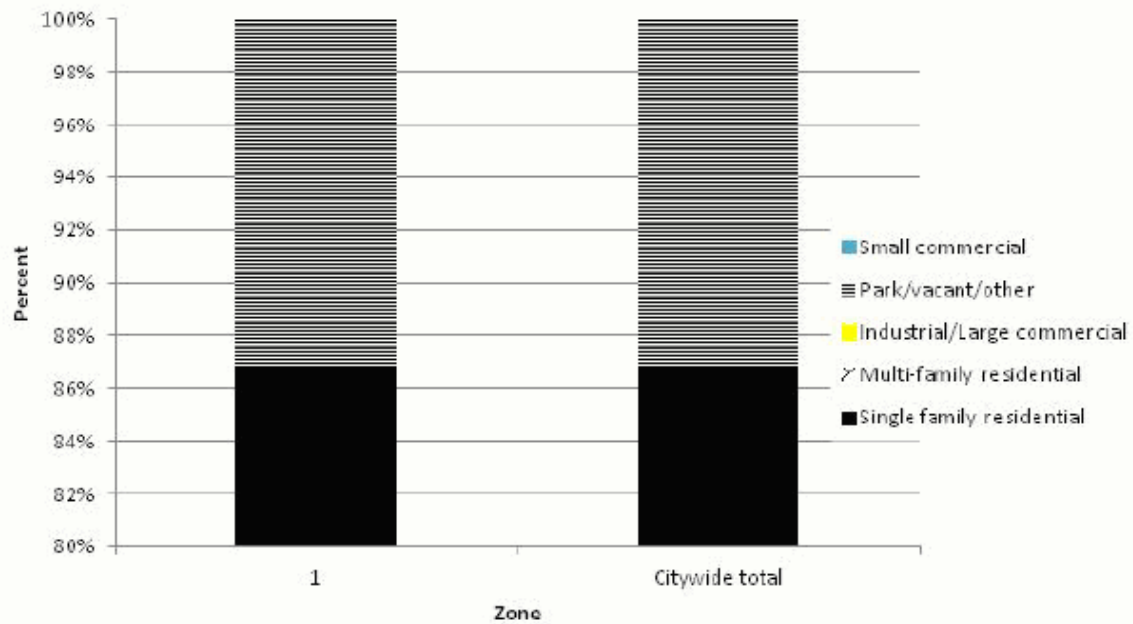
Zone	Acres	% of Total Canopy Cover
1	2	100.0
Citywide total	2	100.0

	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	2		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

10/15/2011



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	86.9	0.0	0.0	13.1	0.0
Citywide total	86.9	0.0	0.0	13.1	0.0

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

10/15/2011

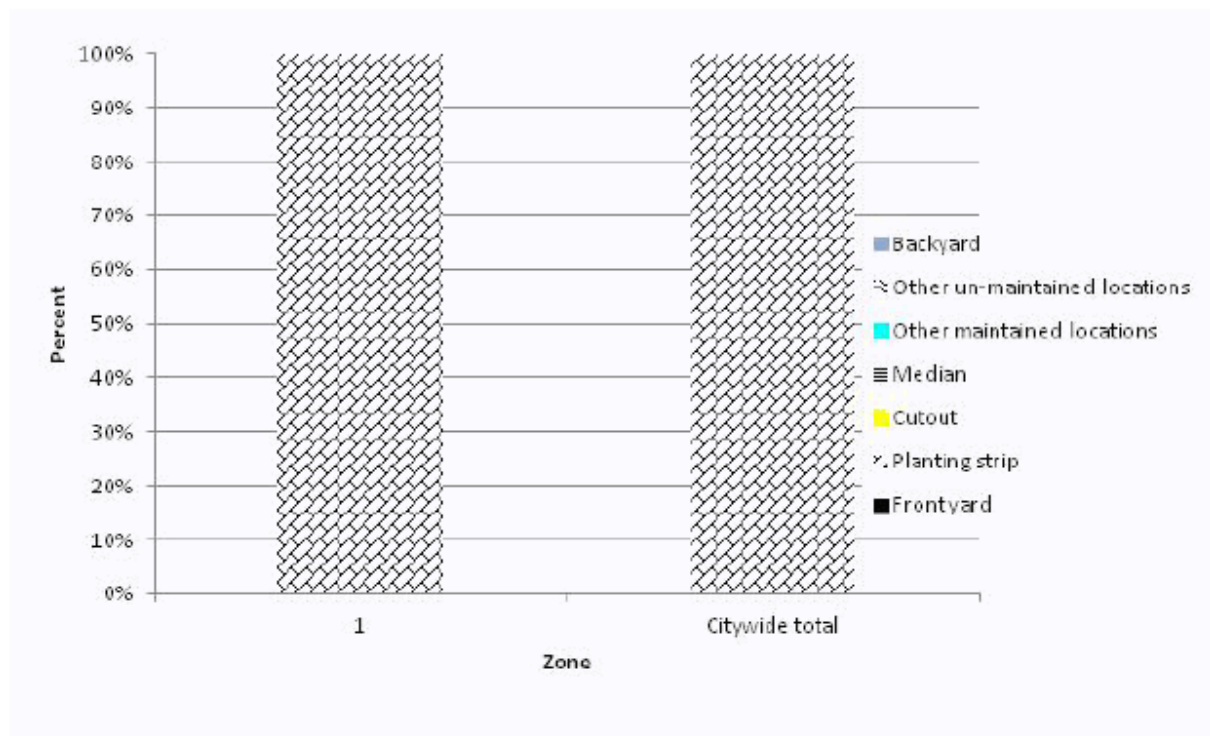


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

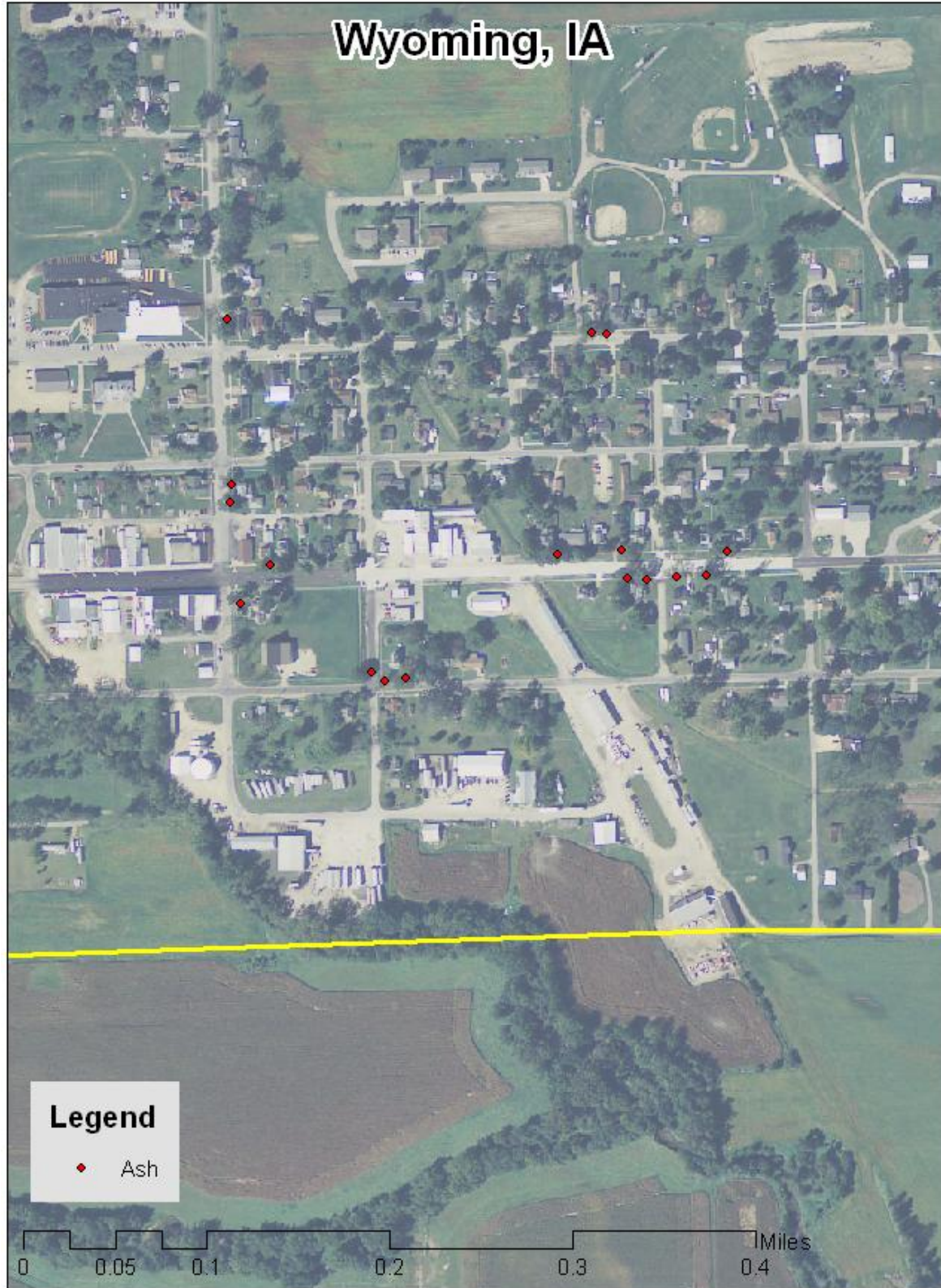


Figure 1: Location of Ash Trees



Figure 2: Location of EAB symptoms

NO SIGNS OF POOR CONDITION TREES

Figure 3: Location of Poor Condition Trees

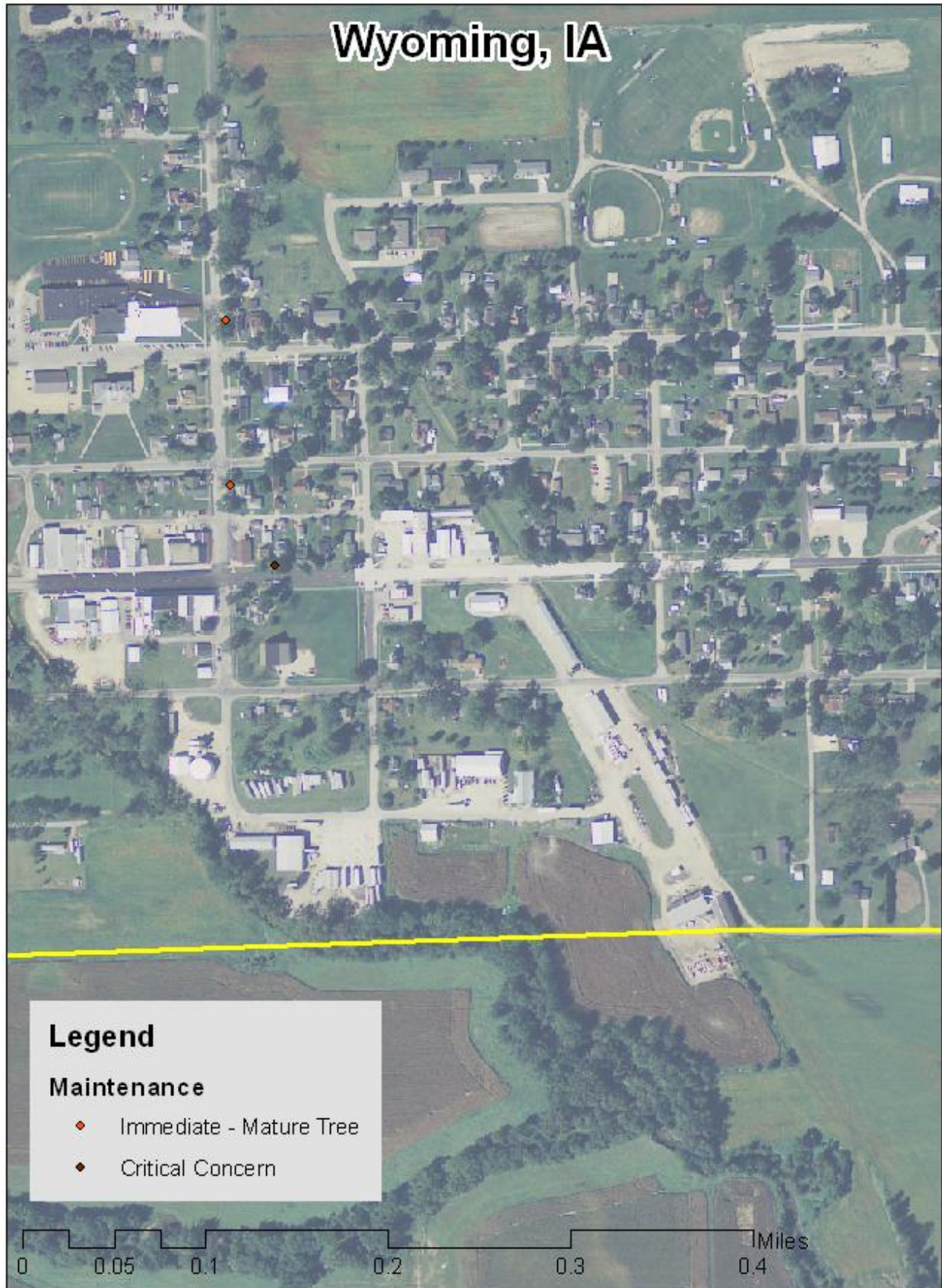


Figure 4: Location of Trees with Recommended Maintenance

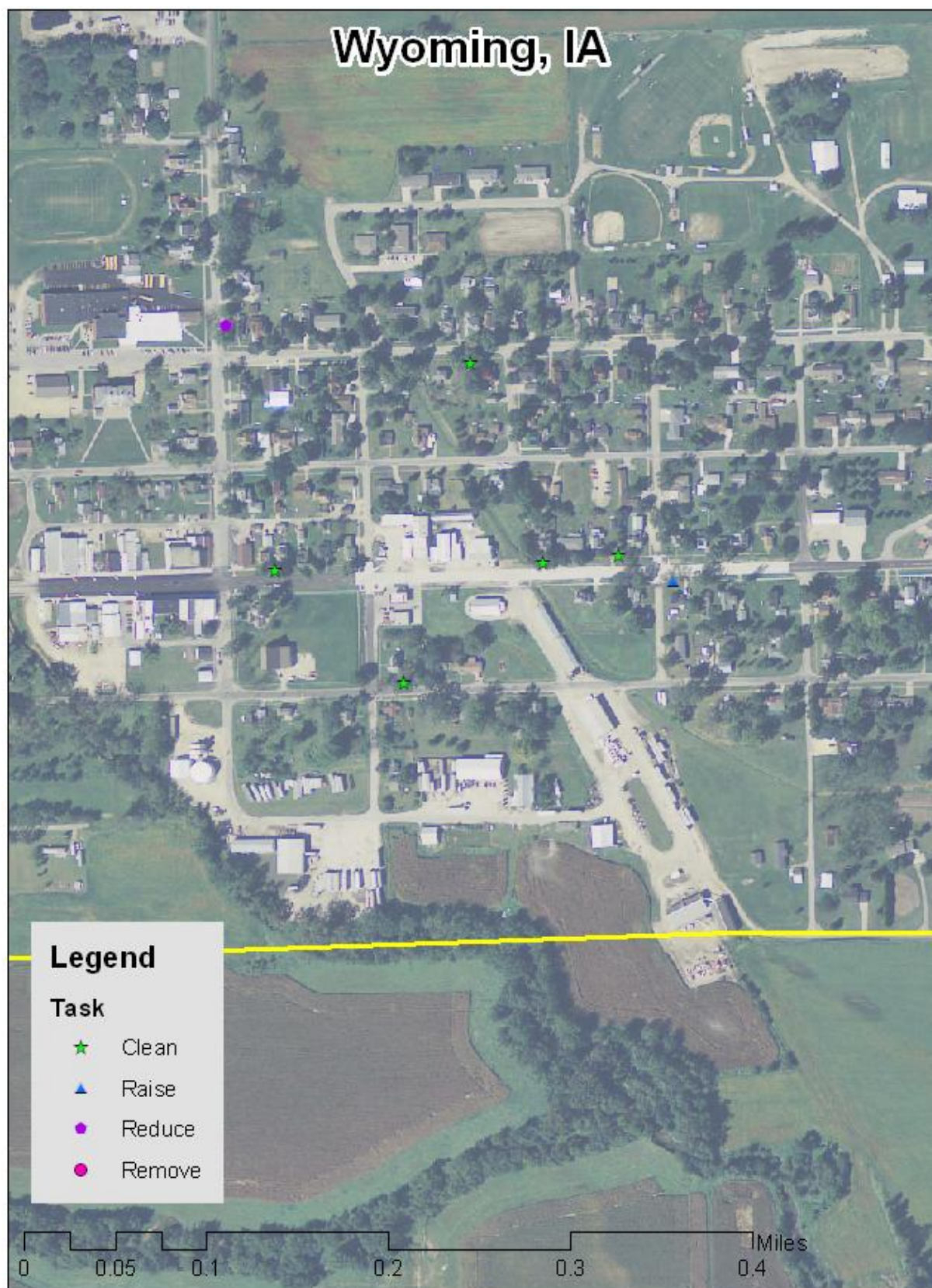


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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