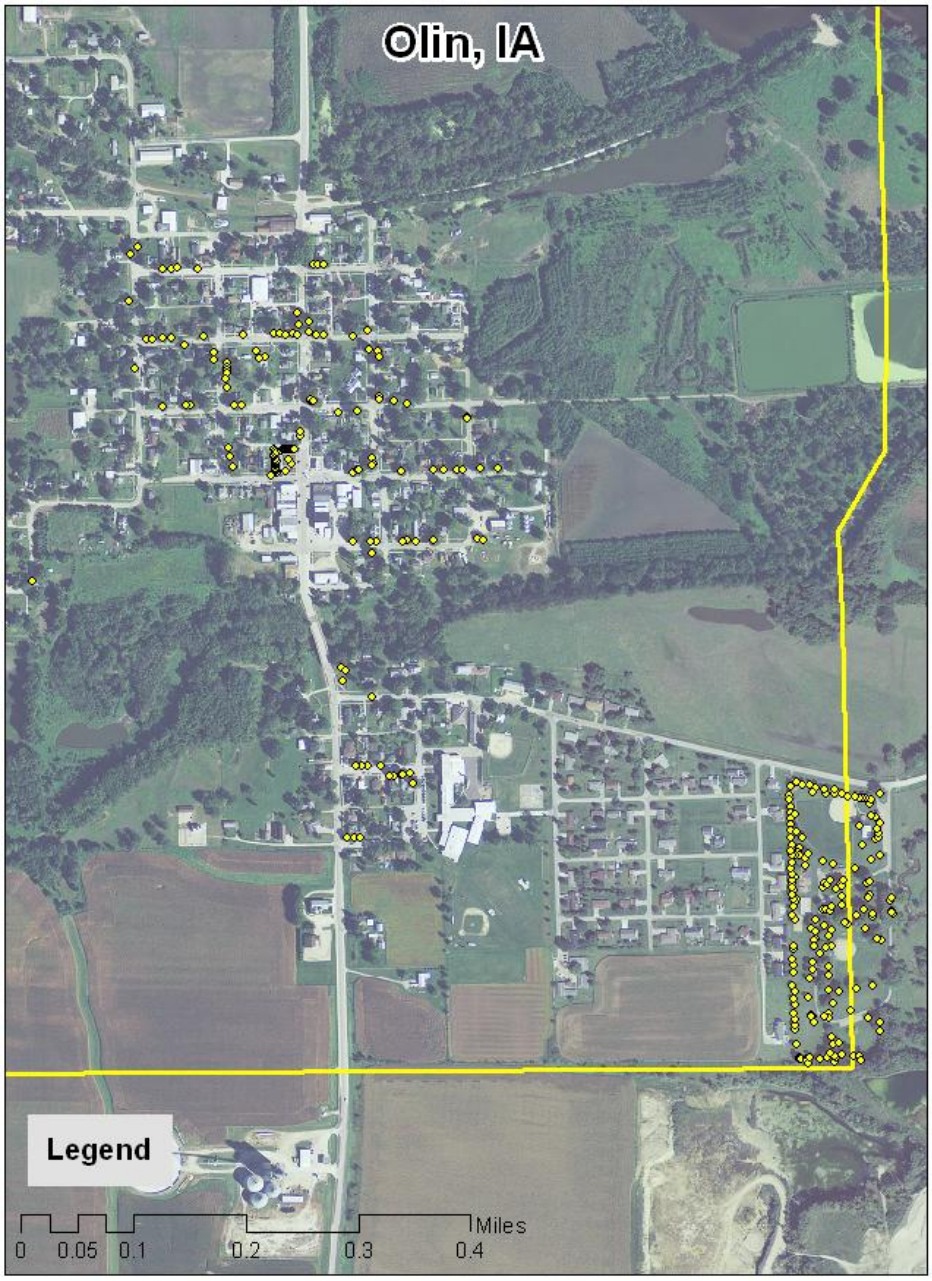
OLIN, IA



2011 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Olin 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 12% of Olin'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 312 trees inventoried.

- Olin's trees provide $48,636 of benefits annually, an average of $156 a tree
- There are over 32 species of trees
- The top three genus are: Maple 38%, Ash 12%, and White Cedar 9%
- 10% of trees are in need of some type of management
- 10 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.

- 10 trees need removal *City ownership of the trees recommended for removal should be verified prior to any removal*
- 4 of the 38 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 quart 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 Olin 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 Olin, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Olin'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 Olin 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 Olin'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 312 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. Olin's trees reduce energy related costs by approximately $13,361 annually (Appendix A, Table 1). These savings are both in Electricity (62.7 MWh) and in Natural Gas (8,775.7 Therms).

Annual Stormwater Benefits

Olin's trees intercept about 656,770 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $17,800 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 Olin, it is estimated that trees remove 808.3 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 $2,278 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Olin, trees sequester about 234,118 lbs of carbon a year with an associated value of $1,756 (Appendix A, Table 4). In addition, the trees store 2,366,340 lbs of carbon, with a yearly benefit of $17,748 (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. Olin receives $13,441 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, Olin's trees provide $48,636 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 312 trees in Olin provide approximately $156 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Olin has over 31 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple(Sugar, Norway,Red,Amur,Silver)	119	38%
Ash	38	12%
White Cedar	28	9%
Hackberry	27	9%
Spruce(Blue,Black Hills)	26	8%
Oak(Bur,Red)	20	6%
Crab Apple	11	4%
Cottonwood	7	2%
Walnut	6	2%
Elm(American,Siberian)	5	2%
Black Cherry	5	2%
Plum	4	1%
Honeylocust	3	1%
Birch	2	<1%
Pine(Red,Austrian)	2	<1%
Concolor	2	<1%
Buckeye	1	<1%
Catalpa	1	<1%
Tulip Poplar	1	<1%
Mulberry	1	<1%
Willow	1	<1%
Mountain Ash	1	<1%
Little Leaf Linden	1	<1%

Size Class

Most of Olin's trees (62%) are between 6 and 24 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 16 inches in diameter at 4.5 ft. Olin'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 Olin indicate that 95% of the trees are in good health, with 1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 73% of Olin'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 5% 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	14	4%
Raise	4	1%
Reduce	3	1%
Removal	10	3%

Canopy Cover

The canopy cover of Olin is 7 acre (Appendix A, Figure 4). According to the 2000 census, Olin occupies 194 acres. Thus the canopy cover on city land is about 4%.

Land Use and Location

The majority of Olin's city and park trees are growing on the city parks. (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	32%
Park/vacant/other	68%

Location	
Planting strip	100%

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

Olin are 5 critical concern trees. Of these critical concern trees 4 trees need to be removed and 1 tree that needs to have its crown reduced. In addition there is 1 immediate tree that needs to be removed, 2 immediate trees need to be cleaned and 1 that needs crown reduction. There are also 23 trees that are routine trees that need maintenance. 5 of these need to be removed, 13 need to be cleaned, 5 need their crowns raised or reduced. Please refer to the six year maintenance plan at the end of this section.

Poor tree species

There are a total of 38 ash trees, and 8 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 Olin.

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 (38%) (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

Removal: 4 Critical trees
Clean, Reduce & Raise: 2 critical trees
Visual Survey for signs and symptoms of EAB
Plant 5 Trees

Year 2

Removal: 1 immediate tree
Reduce & Clean: 3 immediate trees
Routine trimming: Contract to trim 1/4 of the city trees
Visual Survey for signs and symptoms of EAB
Plant 2 trees

Year 3

Removal: 3 routine removals
Clean, Raise & Reduce: 9 trees
Plant 3 trees
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 2 routine trees
Clean, Raise & Reduce: 9 trees
Routine trimming: Contract to trim 1/4 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Visual Survey for signs and symptoms of EAB
Plant 3 trees

Year 6

Routine trimming: Contract to trim 1/4 of the city trees
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 $13,200 over 6 years ($2,200/year)

FY 2012 Budget
Removals: $2,000
Clean, Reduce & Raise: $200
Tree Planting: $500
FY 2013 Budget
Removals: $500
Routine trimming: $1,600
Clean, Reduce & Raise: $300
FY 2014 Budget
Removal: $1,500
Clean, Reduce & Raise: $900
Tree Planting: $300
FY 2015 Budget
Removals: $1,000
Routine trimming: $1,600
Clean, Reduce & Raise: $900
FY 2016 Budget
Tree Planting: $300
FY 2017 Budget
Routine trimming: $1,600

*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 keep up the EAB population will be reduced decreasing there impact.

Purposed Budget Increase

EAB could potentially kill all ash trees in Olin 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 $4,100 a year. If the budget were increased to $19,000 a year all ash could be removed within 1 year. Additionally, it is recommended that Olin 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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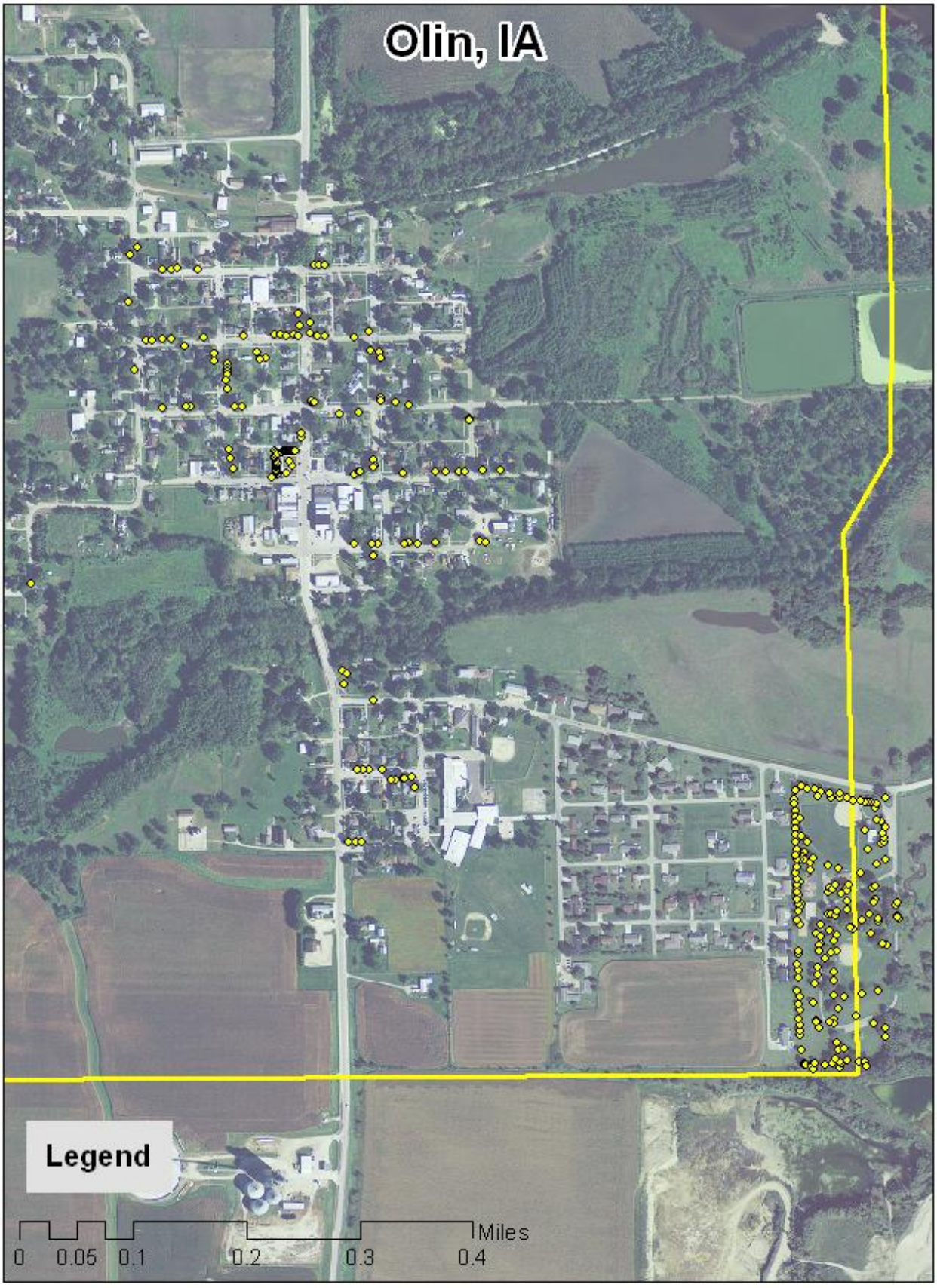
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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

10/14/2011

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	7.8	596	1,146.7	1,124	1,719	(N/A)	17.7	12.9	31.26
Silver maple	13.9	1,058	1,845.9	1,809	2,867	(N/A)	13.5	21.5	68.25
Ash	9.5	724	1,403.2	1,375	2,099	(N/A)	12.2	15.7	55.23
Northern white cedar	0.6	48	111.3	109	157	(N/A)	9.0	1.2	5.61
Northern hackberry	8.8	670	1,274.6	1,249	1,919	(N/A)	8.7	14.4	71.08
Blue spruce	2.9	218	359.0	352	569	(N/A)	8.0	4.3	22.77
Bur oak	5.6	423	757.1	742	1,164	(N/A)	5.5	8.7	68.50
Sugar maple	3.5	262	462.1	453	715	(N/A)	4.2	5.4	54.99
Apple	0.4	30	68.9	67	98	(N/A)	3.5	0.7	8.89
Red maple	0.4	30	59.1	58	88	(N/A)	2.3	0.7	12.63
Cottonwood	2.7	206	370.7	363	569	(N/A)	2.3	4.3	81.35
Black walnut	1.4	105	188.4	185	290	(N/A)	1.9	2.2	48.32
Black cherry	1.0	72	137.2	135	207	(N/A)	1.6	1.6	41.33
Plum	0.1	7	15.2	15	22	(N/A)	1.3	0.2	5.40
Siberian elm	0.9	68	113.9	112	180	(N/A)	1.3	1.4	45.02
Other street trees	3.2	244	462.3	453	697	(N/A)	7.1	5.2	31.69
Citywide total	62.7	4,761	8,775.7	8,600	13,361	(N/A)	100.0	100.0	42.96

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

10/14/2011

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	50,737	1,375	(N/A)	17.7	7.7	25.00
Silver maple	194,130	5,261	(N/A)	13.5	29.6	125.27
Ash	91,631	2,483	(N/A)	12.2	14.0	65.35
Northern white cedar	5,957	161	(N/A)	9.0	0.9	5.77
Northern hackberry	76,373	2,070	(N/A)	8.7	11.6	76.66
Blue spruce	35,429	960	(N/A)	8.0	5.4	38.41
Bur oak	72,070	1,953	(N/A)	5.5	11.0	114.90
Sugar maple	34,118	925	(N/A)	4.2	5.2	71.13
Apple	1,343	36	(N/A)	3.5	0.2	3.31
Red maple	1,937	52	(N/A)	2.3	0.3	7.50
Cottonwood	37,681	1,021	(N/A)	2.3	5.7	145.89
Black walnut	16,016	434	(N/A)	1.9	2.4	72.35
Black cherry	4,347	118	(N/A)	1.6	0.7	23.56
Plum	275	7	(N/A)	1.3	0.0	1.86
Siberian elm	6,720	182	(N/A)	1.3	1.0	45.53
Other street trees	28,005	759	(N/A)	7.1	4.3	34.50
Citywide total	656,770	17,800	(N/A)	100.0	100.0	57.23

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

10/14/2011

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
Norway maple	7.3	1.3	4.1	0.3	41	38.2	5.5	5.2	35.6	236	-2.0	-8	95.6	270	(N/A)	17.7	4.90
Silver maple	34.2	5.8	16.8	1.5	184	65.8	9.6	9.2	63.0	412	-18.7	-70	187.3	526	(N/A)	13.5	12.52
Ash	18.8	3.2	9.2	0.8	101	46.5	6.7	6.4	43.3	287	-4.4	-16	130.5	372	(N/A)	12.2	9.80
Northern white cedar	0.2	0.0	0.4	0.0	2	3.2	0.5	0.4	2.9	20	-1.6	-6	6.0	16	(N/A)	9.0	0.56
Northern hackberry	11.2	1.9	5.9	0.5	62	42.8	6.2	5.9	40.0	265	0.0	0	114.5	327	(N/A)	8.7	12.10
Blue spruce	4.3	0.9	3.7	0.5	29	13.3	2.0	1.9	13.0	84	-12.6	-47	27.0	66	(N/A)	8.0	2.63
Bur oak	10.9	1.8	5.0	0.5	58	26.5	3.9	3.7	25.2	165	0.0	0	77.5	223	(N/A)	5.5	13.12
Sugar maple	4.6	0.8	2.4	0.2	25	16.4	2.4	2.3	15.6	102	-3.7	-14	41.0	114	(N/A)	4.2	8.74
Apple	0.2	0.0	0.1	0.0	1	2.0	0.3	0.3	1.8	12	0.0	0	4.7	13	(N/A)	3.5	1.21
Red maple	0.2	0.0	0.1	0.0	1	1.9	0.3	0.3	1.8	12	-0.1	0	4.6	13	(N/A)	2.3	1.84
Cottonwood	6.4	1.0	2.8	0.3	33	13.0	1.9	1.8	12.3	81	0.0	0	39.5	114	(N/A)	2.3	16.31
Black walnut	2.1	0.3	1.0	0.1	11	6.6	1.0	0.9	6.3	41	0.0	0	18.2	52	(N/A)	1.9	8.69
Black cherry	1.5	0.2	0.7	0.1	8	4.6	0.7	0.6	4.3	29	0.0	0	12.7	36	(N/A)	1.6	7.27
Plum	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	0.0	0	1.0	3	(N/A)	1.3	0.71
Siberian elm	0.8	0.1	0.4	0.0	4	4.2	0.6	0.6	4.1	27	0.0	0	10.8	31	(N/A)	1.3	7.67
Other street trees	4.0	0.7	2.3	0.2	22	15.5	2.2	2.1	14.6	96	-4.2	-16	37.5	103	(N/A)	7.1	4.69
Citywide total	106.7	18.1	54.8	5.2	583	301.2	43.7	41.7	284.3	1,872	-47.3	-177	808.3	2,278	(N/A)	100.0	7.32

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

10/14/2011

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	126,966	952	(N/A)	17.7	5.4	17.31
Silver maple	838,111	6,286	(N/A)	13.5	35.4	149.66
Ash	308,931	2,317	(N/A)	12.2	13.1	60.97
Northern white	1,069	8	(N/A)	9.0	0.1	0.29
Northern	162,035	1,215	(N/A)	8.7	6.9	45.01
Blue spruce	25,329	190	(N/A)	8.0	1.1	7.60
Bur oak	367,900	2,759	(N/A)	5.5	15.6	162.31
Sugar maple	135,225	1,014	(N/A)	4.2	5.7	78.01
Apple	4,146	31	(N/A)	3.5	0.2	2.83
Red maple	3,294	25	(N/A)	2.3	0.1	3.53
Cottonwood	217,169	1,629	(N/A)	2.3	9.2	232.68
Black walnut	68,381	513	(N/A)	1.9	2.9	85.48
Black cherry	22,597	169	(N/A)	1.6	1.0	33.90
Plum	711	5	(N/A)	1.3	0.0	1.33
Siberian elm	19,227	144	(N/A)	1.3	0.8	36.05
Other street trees	29,597	489	(N/A)	7.1	2.8	22.24
Citywide total	2,366,340	17,748	(N/A)	100.0	100.0	57.07

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

10/14/2011

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
Norway maple	14,749	111	-609	-11	-5	13,165	99	27,294	205	(N/A)	17.7	11.7	3.72
Silver maple	59,991	450	-4,023	-8	-30	23,371	175	79,331	595	(N/A)	13.5	33.9	14.17
Ash	13,752	103	-1,483	-7	-11	15,995	120	28,257	212	(N/A)	12.2	12.1	5.58
Northern white cedar	504	4	-5	-5	0	1,059	8	1,552	12	(N/A)	9.0	0.7	0.42
Northern hackberry	10,623	80	-778	-5	-6	14,810	111	24,650	185	(N/A)	8.7	10.5	6.85
Blue spruce	2,064	15	-122	-5	-1	4,808	36	6,745	51	(N/A)	8.0	2.9	2.02
Bur oak	11,819	89	-1,766	-3	-13	9,337	70	19,387	145	(N/A)	5.5	8.3	8.55
Sugar maple	7,325	55	-649	-3	-5	5,791	43	12,464	93	(N/A)	4.2	5.3	7.19
Apple	645	5	-20	-2	0	670	5	1,293	10	(N/A)	3.5	0.6	0.88
Red maple	524	4	-16	-1	0	673	5	1,180	9	(N/A)	2.3	0.5	1.26
Cottonwood	5,203	39	-1,042	-1	-8	4,556	34	8,715	65	(N/A)	2.3	3.7	9.34
Black walnut	3,157	24	-328	-1	-2	2,328	17	5,156	39	(N/A)	1.9	2.2	6.44
Black cherry	1,760	13	-108	-1	-1	1,595	12	3,245	24	(N/A)	1.6	1.4	4.87
Plum	152	1	-3	-1	0	149	1	296	2	(N/A)	1.3	0.1	0.56
Siberian elm	1,429	11	-92	-1	-1	1,514	11	2,850	21	(N/A)	1.3	1.2	5.34
Other street trees	6,625	50	-313	-4	-2	5,396	40	11,703	88	(N/A)	7.1	5.0	3.99
Citywide total	140,321	1,052	-11,358	-61	-86	105,216	789	234,118	1,756	(N/A)	100.0	100.0	5.65

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

10/14/2011

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,603	(N/A)	17.7	11.9	29.15
Silver maple	4,561	(N/A)	13.5	33.9	108.58
Ash	1,294	(N/A)	12.2	9.6	34.04
Northern white cedar	191	(N/A)	9.0	1.4	6.83
Northern hackberry	1,490	(N/A)	8.7	11.1	55.19
Blue spruce	605	(N/A)	8.0	4.5	24.19
Bur oak	901	(N/A)	5.5	6.7	53.01
Sugar maple	781	(N/A)	4.2	5.8	60.04
Apple	36	(N/A)	3.5	0.3	3.24
Red maple	96	(N/A)	2.3	0.7	13.73
Cottonwood	371	(N/A)	2.3	2.8	52.99
Black walnut	271	(N/A)	1.9	2.0	45.13
Black cherry	104	(N/A)	1.6	0.8	20.81
Plum	8	(N/A)	1.3	0.1	2.06
Siberian elm	132	(N/A)	1.3	1.0	33.01
Other street trees	998	(N/A)	7.1	7.4	45.36
Citywide total	13,441	(N/A)	100.0	100.0	43.22

Table 7: Summary of Benefits in Dollars

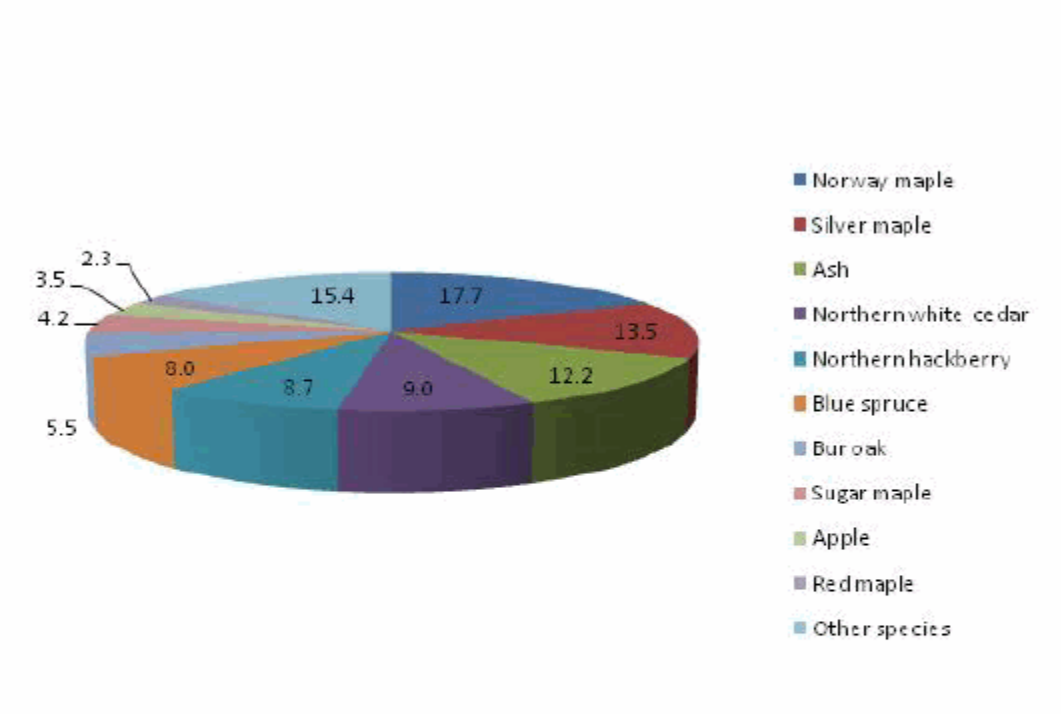
Total Annual Benefits of Public Trees by Species ($)

10/15/20

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	1,719	205	270	1,375	1,603	5,172	(±0)	10.6
Silver maple	2,867	595	526	5,261	4,561	13,809	(±0)	28.4
Ash	2,099	212	372	2,483	1,294	6,460	(±0)	13.3
Northern white cedar	157	12	16	161	191	537	(±0)	1.1
Northern hackberry	1,919	185	327	2,070	1,490	5,991	(±0)	12.3
Blue spruce	569	51	66	960	605	2,251	(±0)	4.6
Bur oak	1,164	145	223	1,953	901	4,387	(±0)	9.0
Sugar maple	715	93	114	925	781	2,627	(±0)	5.4
Apple	98	10	13	36	36	193	(±0)	0.4
Red maple	88	9	13	52	96	259	(±0)	0.5
Cottonwood	569	65	114	1,021	371	2,141	(±0)	4.4
Black walnut	290	39	52	434	271	1,086	(±0)	2.2
Black cherry	207	24	36	118	104	489	(±0)	1.0
Plum	22	2	3	7	8	42	(±0)	0.1
Siberian elm	180	21	31	182	132	546	(±0)	1.1
Other street trees	697	88	103	759	998	2,645	(±0)	5.4
Citywide Total	13,361	1,756	2,278	17,800	13,441	48,636	(±0)	100.0

Species Distribution of Public Trees (%)

10/14/2011

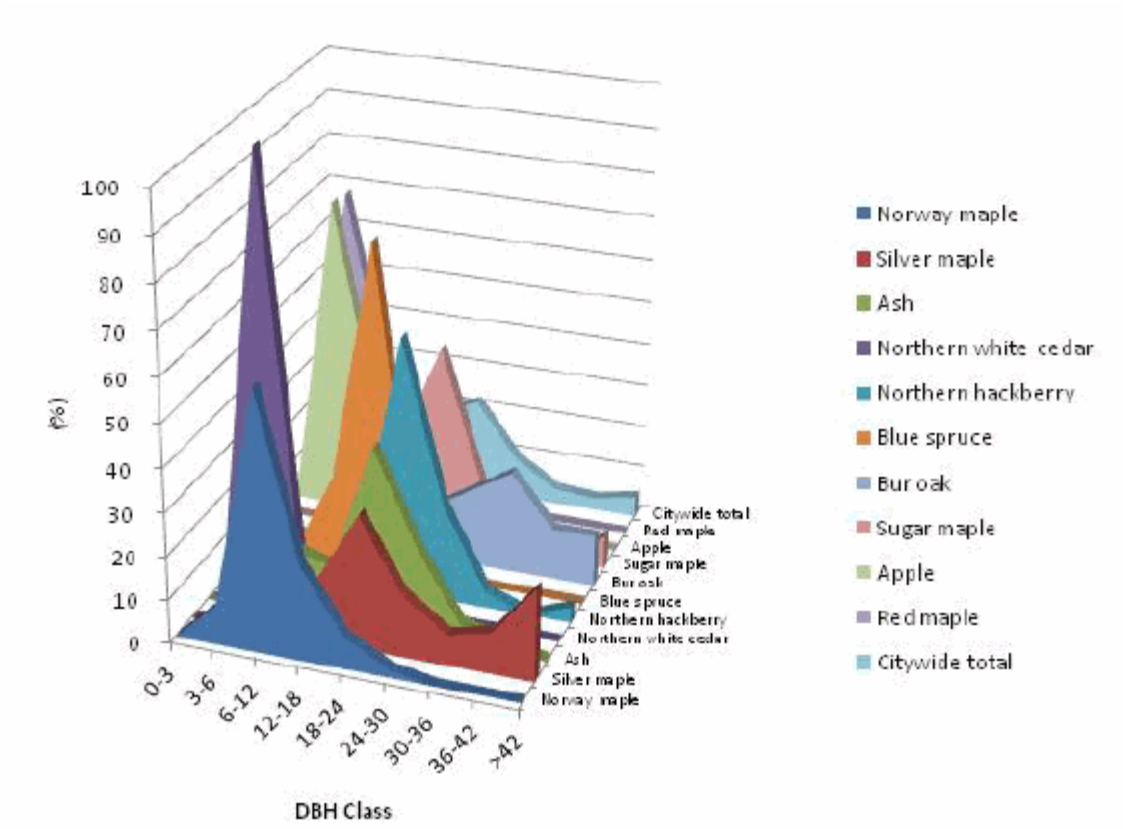


Species	Percent
Norway maple	17.7
Silver maple	13.5
Ash	12.2
Northern white cedar	9.0
Northern hackberry	8.7
Blue spruce	8.0
Bur oak	5.5
Sugar maple	4.2
Apple	3.5
Red maple	2.3
Other species	15.4
Total	100.0

Figure 1: Species Distribution

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

10/14/2011



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	0.0	9.1	60.0	21.8	7.3	1.8	0.0	0.0	0.0
Silver maple	0.0	0.0	2.4	14.3	31.0	14.3	7.1	9.5	21.4
Ash	0.0	0.0	15.8	13.2	42.1	21.1	5.3	2.6	0.0
Northern white cedar	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	11.1	59.3	22.2	3.7	0.0	3.7
Blue spruce	0.0	0.0	20.0	76.0	4.0	0.0	0.0	0.0	0.0
Bur oak	0.0	0.0	11.8	11.8	11.8	17.6	23.5	11.8	11.8
Sugar maple	0.0	0.0	7.7	23.1	46.2	15.4	0.0	0.0	7.7
Apple	0.0	72.7	27.3	0.0	0.0	0.0	0.0	0.0	0.0
Red maple	0.0	71.4	28.6	0.0	0.0	0.0	0.0	0.0	0.0
Citywide total	0.0	17.0	21.2	18.6	22.2	9.6	3.5	2.9	4.8

Figure 2: Relative Age Class

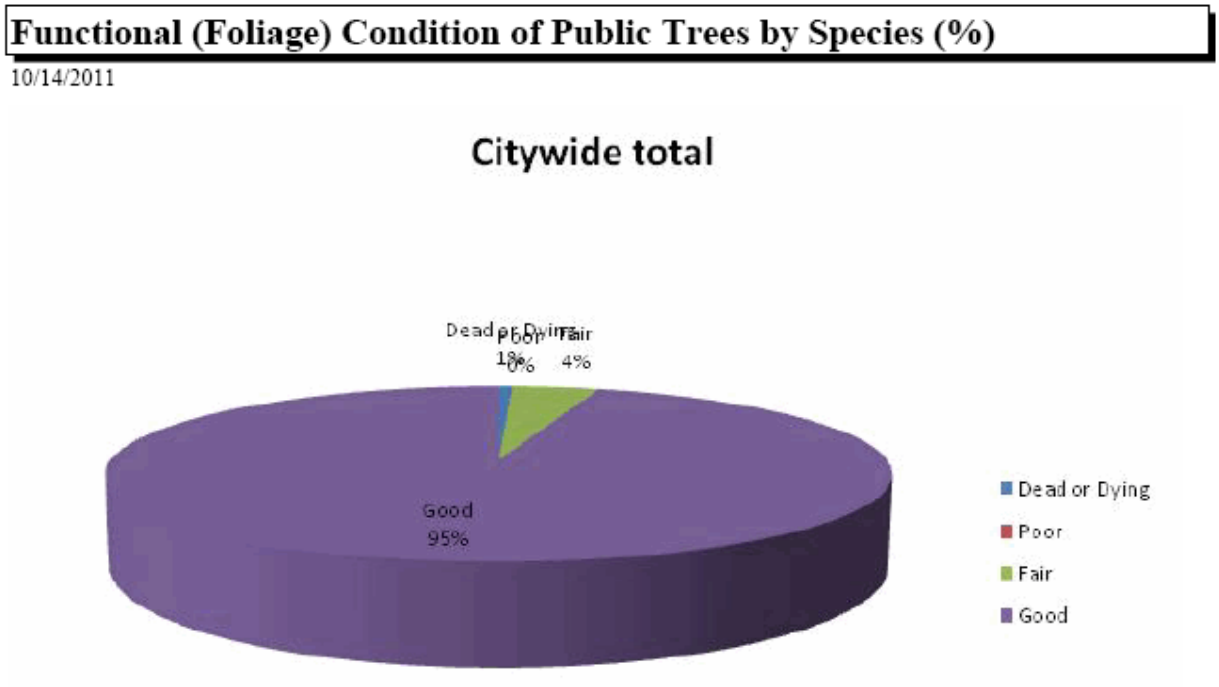


Figure 3: Foliage Condition

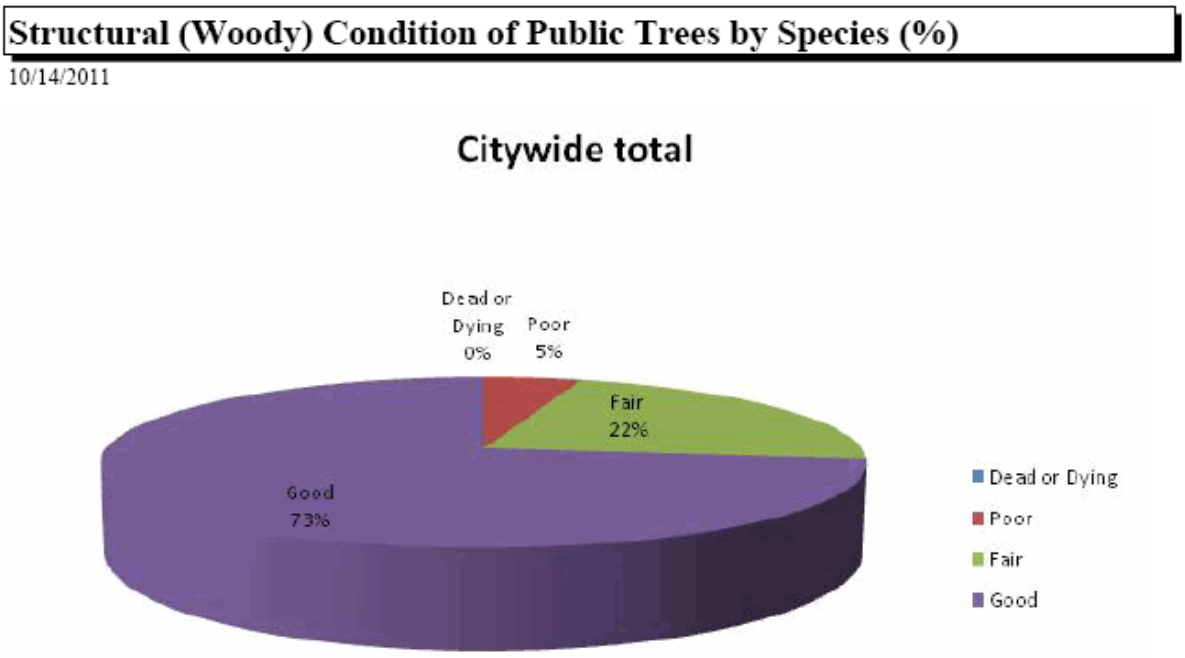
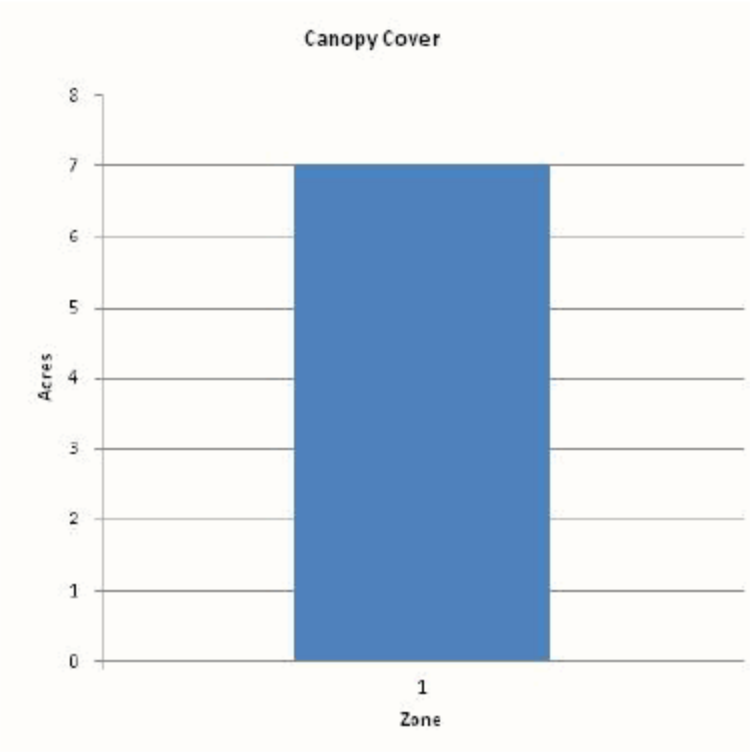


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

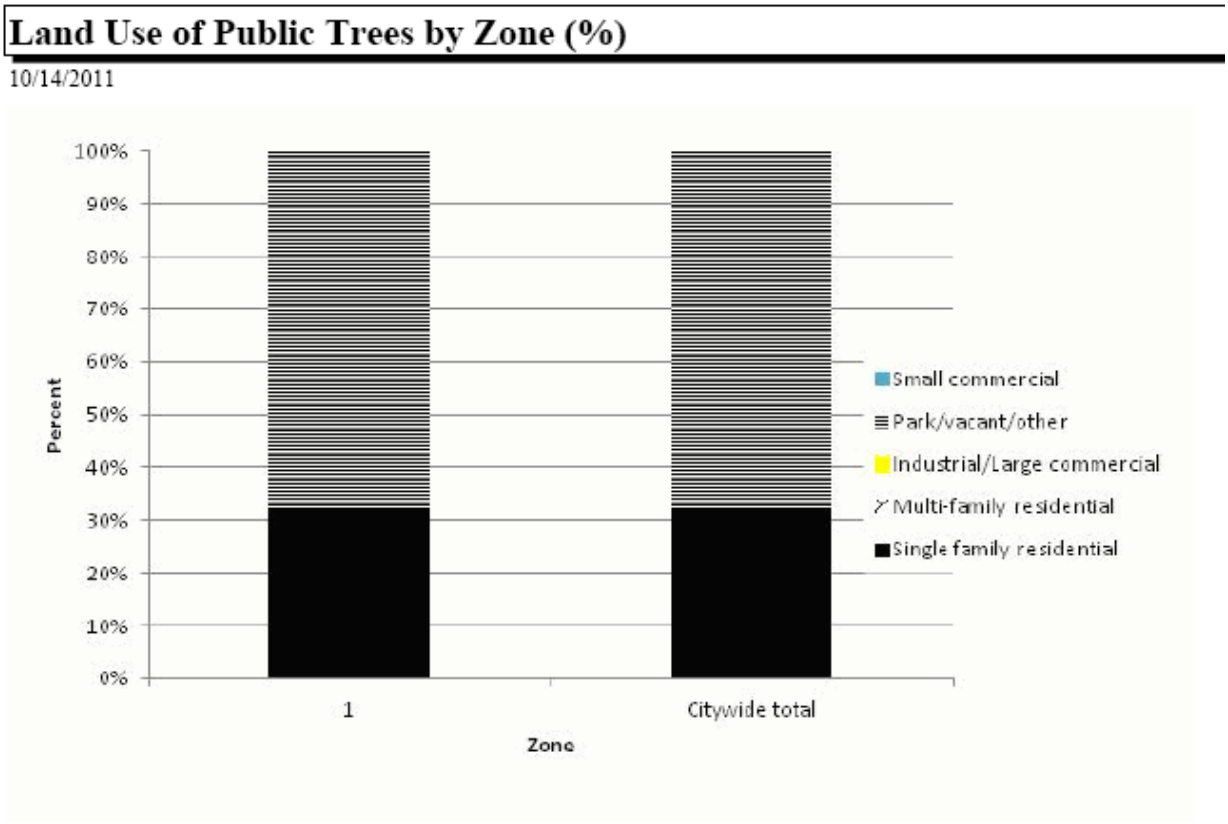
10/14/2011



Zone	Acres	% of Total Canopy Cover
1	7	100.0
Citywide total	7	100.0

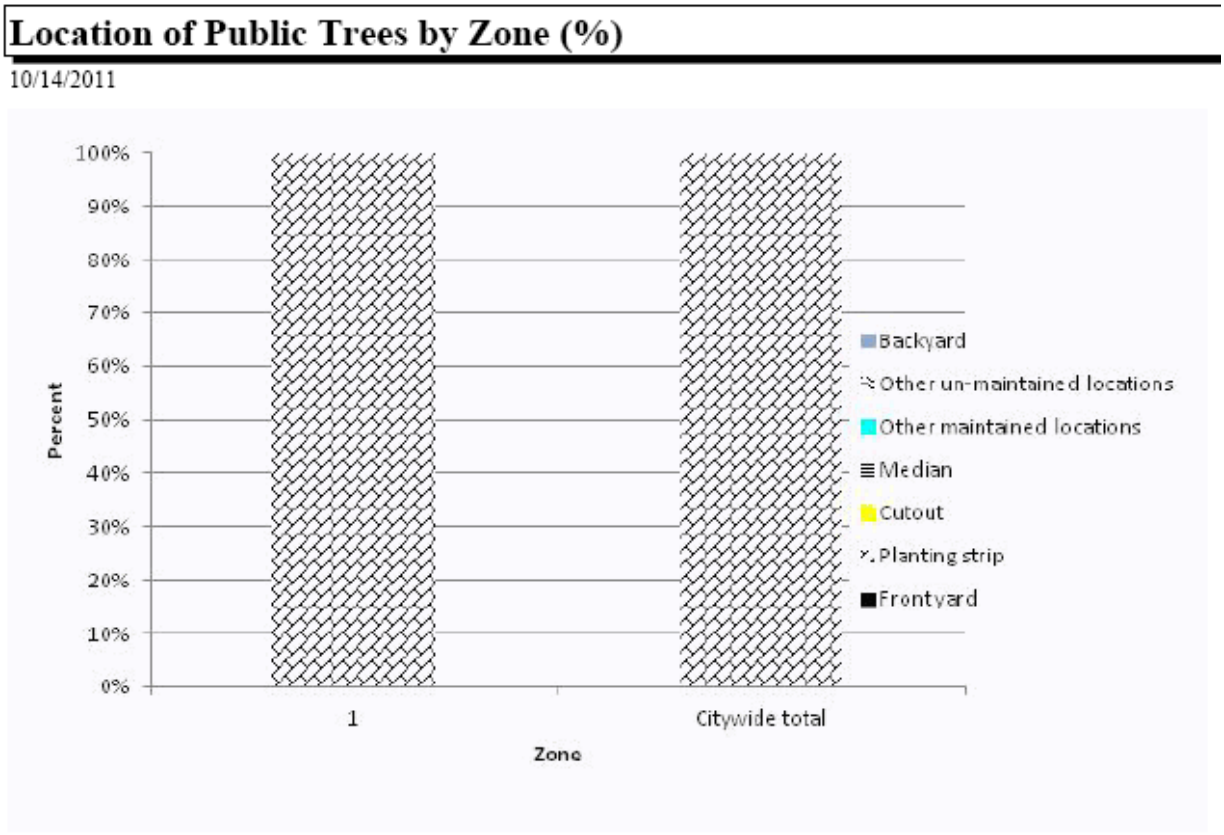
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	7		

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	32.4	0.0	0.0	67.6	0.0
Citywide total	32.4	0.0	0.0	67.6	0.0

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Citywide total	0.0	100.0	0.0	0.0	0.0	0.0	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

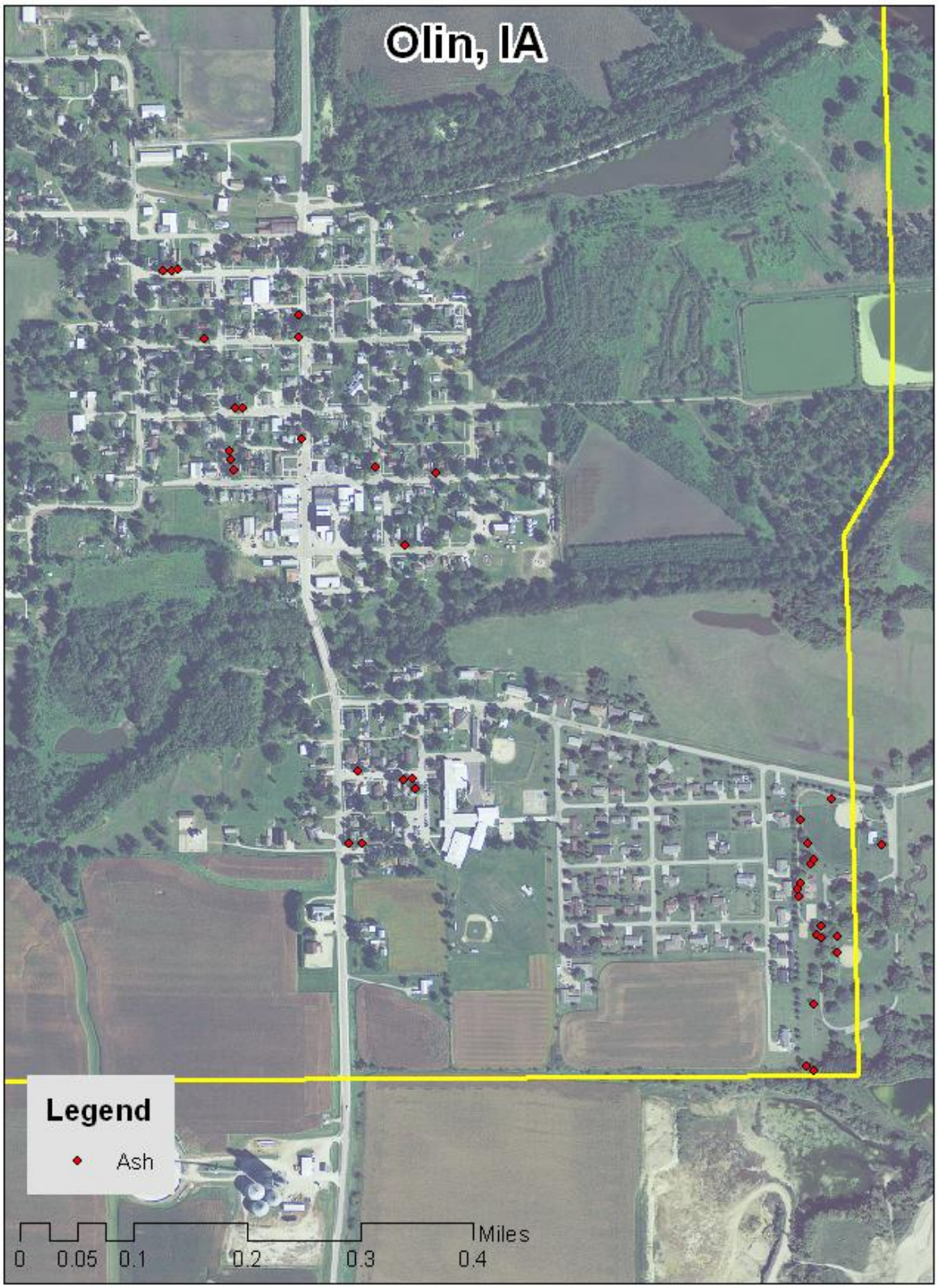


Figure 1: Location of Ash Trees

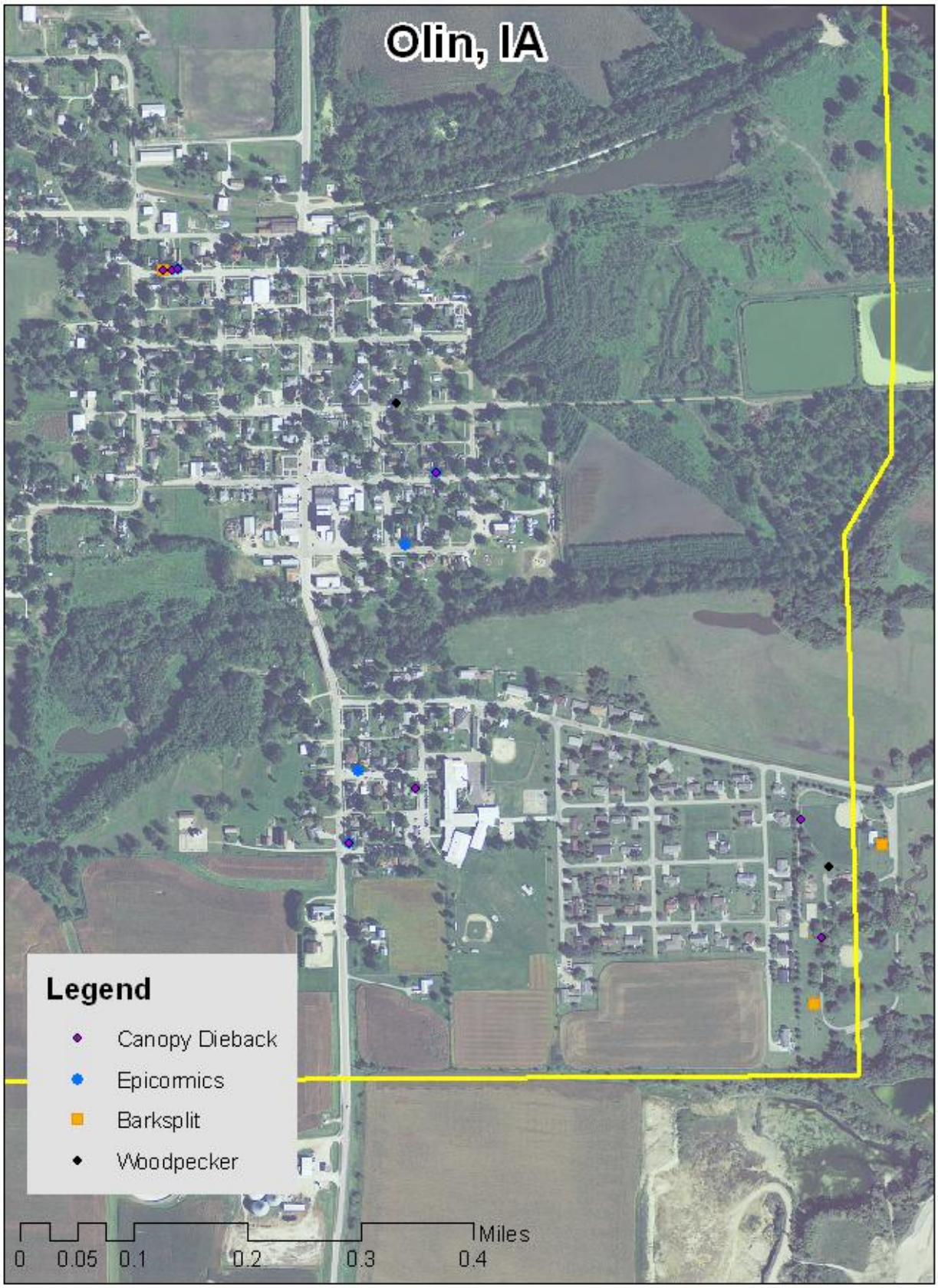


Figure 2: Location of EAB symptoms

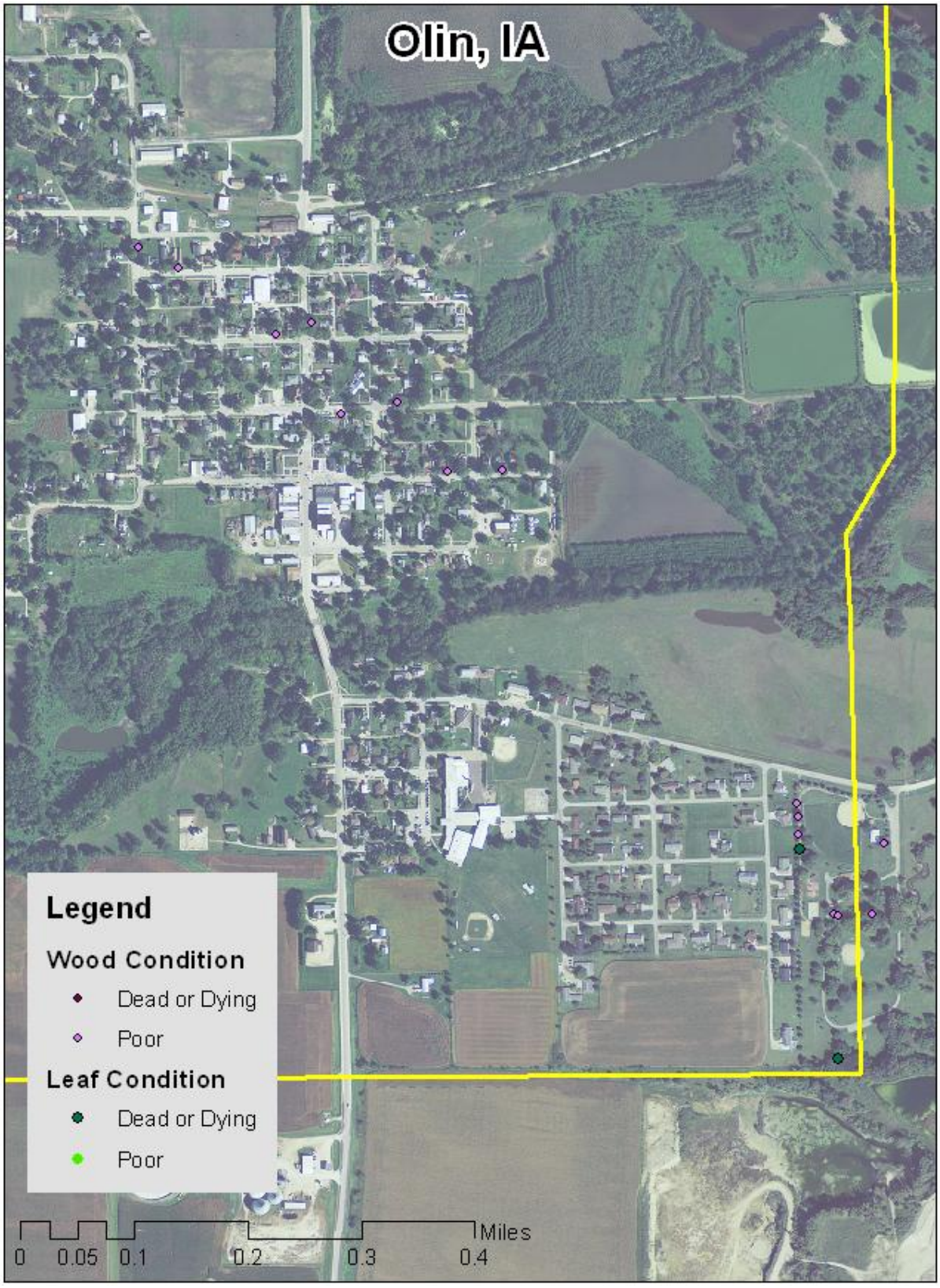


Figure 3: Location of Poor Condition Trees

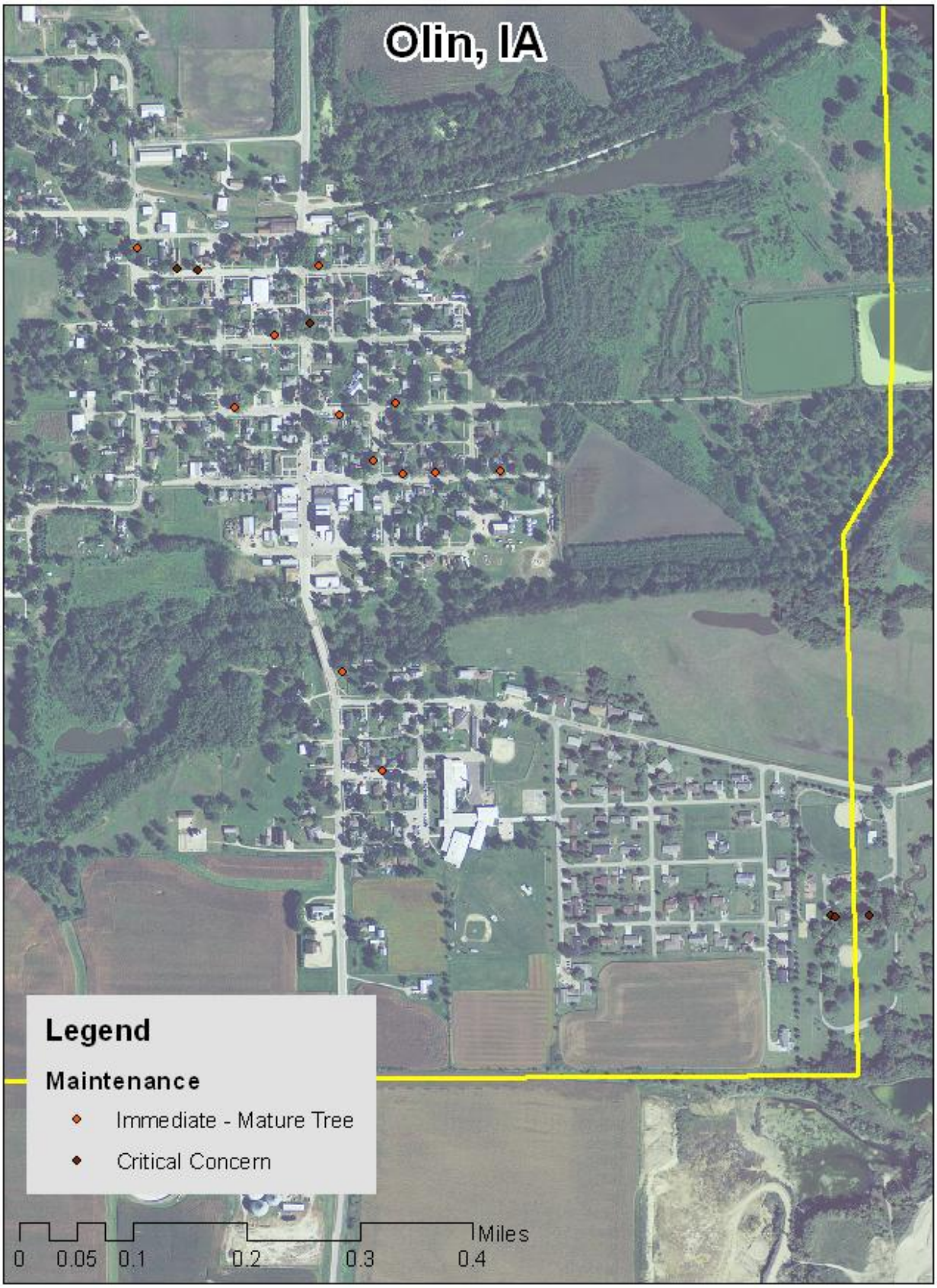


Figure 4: Location of Trees with Recommended Maintenance

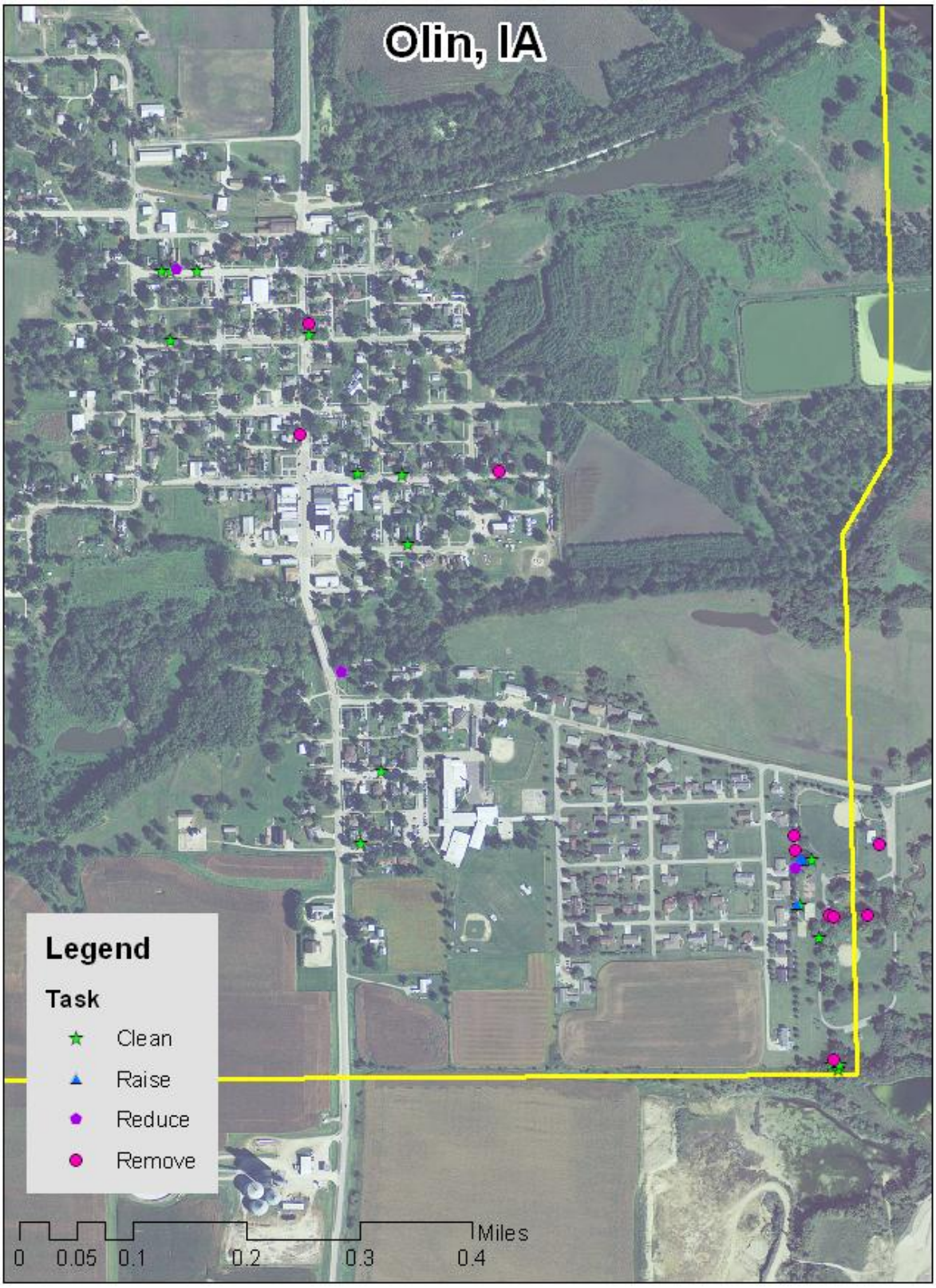


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

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