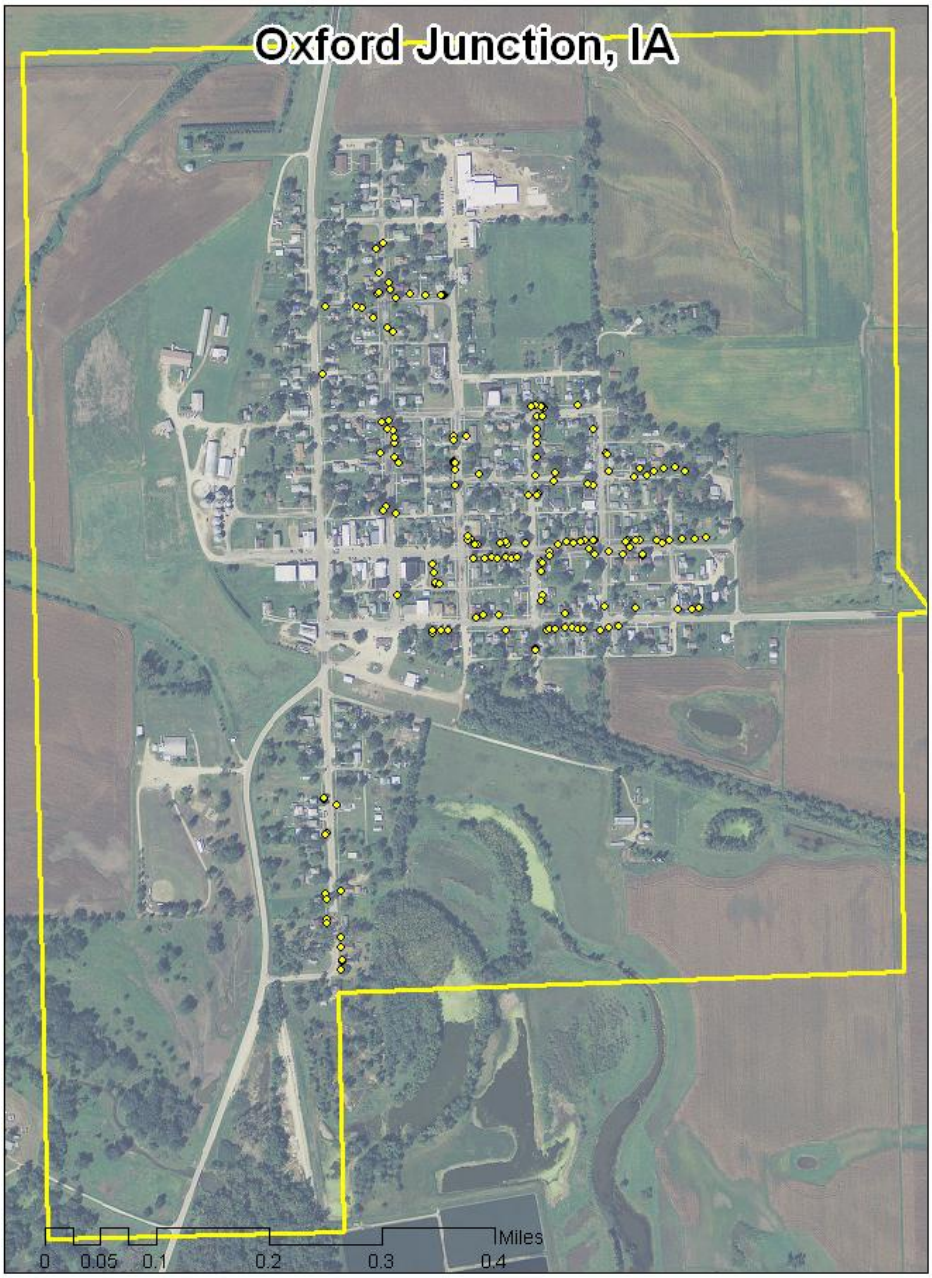
OXFORD JUNCTION, IA



2011 Management Plan

Prepared by Steven Swinconos
Bureau of Forestry, Iowa DNR

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Executive Summary

Overview

This plan was developed to assist the City of Oxford Junction 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 33% of Oxford Junction'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 166 trees inventoried.

- Oxford Junction's trees provide $27,316 of benefits annually, an average of $165 a tree
- There are over 24 species of trees
- The top three genus are: Maple 34%, Ash 33%, and Crab Apple 5%
- 6% of trees are in need of some type of management
- 3 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.

- 3 trees need removal *City ownership of the trees recommended for removal should be verified prior to any removal*
- 16 of the 55 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 Oxford Junction 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 Oxford Junction, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Oxford Junction'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 Oxford Junction 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 Oxford Junction'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 166 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. Oxford Junction's trees reduce energy related costs by approximately $8,208 annually (Appendix A, Table 1). These savings are both in Electricity (38.7 MWh) and in Natural Gas (5,374.9 Therms).

Annual Stormwater Benefits

Oxford Junction's trees intercept about 374,371 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $10,146 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 Oxford Junction, it is estimated that trees remove 495.7 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 $1,393 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Oxford Junction, trees sequester about 125,927 lbs of carbon a year with an associated value of $944 (Appendix A, Table 4). In addition, the trees store 1,304,433 lbs of carbon, with a yearly benefit of $9,783 (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. Oxford Junction receives $6,625 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, Oxford Junction's trees provide $27,316 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 166 trees in Oxford Junction provide approximately $165 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Oxford Junction has over 24 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, Silver)	56	34%
Ash	55	33%
Apple(Crab, Apple)	8	5%
Linden(American)	6	4%
Redcedar	6	4%
Hackberry	5	3%
Other Trees*	30	17%

*other trees include the following: catalpa, concolor fir, magnolia, white pine, black cherry, American & Siberian elm, blue spruce, Walnut, Pear, birch, honey locust, black locust, plum & cherry plum.

Size Class

Most of Oxford Junction's trees (57%) are between 12 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 18 inches in diameter at 4.5 ft. Oxford Junction'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 Oxford Junction indicate that 97% of the trees are in good health, with 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 75% of Oxford Junction'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 4% of the population. There is 6% 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	6	4%
Raise	1	<1%
Removal	3	2%

Canopy Cover

The canopy cover of Oxford Junction is 4 acre (Appendix A, Figure 4). According to the 2000 census, Oxford Junction occupies 108 acres. Thus the canopy cover on city land is about 4%.

Land Use and Location

The majority of Oxford Junction's city and park trees are growing on the city parkings. (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	98%
Park/vacant/other	2%

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

Oxford Junction has no critical concern trees. In addition there are 3 immediate tree that needs to be removed, 1 immediate trees need to be cleaned. There are also 6 trees that are routine trees that need maintenance. 5 need to be cleaned and 1 needs to be raised. Please refer to the six year maintenance plan at the end of this section.

Poor tree species

There are a total of 55 ash trees, and 16 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 Oxford Junction.

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 (34%) (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

Year 1

Removal: 3 immediate trees
Clean, Reduce & Raise: 7 immediate trees
Visual Survey for signs and symptoms of EAB
Plant 4 Trees

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

Visual Survey for signs and symptoms of EAB

Year 5

Visual Survey for signs and symptoms of EAB

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 $6,000 over 6 years ($1,000/year)

FY 2012 Budget
Removals: $1,500
Clean, Reduce & Raise: $700
Tree Planting: $400
FY 2013 Budget
Routine trimming: $1,700
FY 2014 Budget
FY 2015 Budget
FY 2016 Budget
FY 2017 Budget
Routine trimming: $1,700

*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 Oxford Junction 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 $3,750 a year. If the budget were increased to $27,500 a year all ash could be removed within 1 year. Additionally, it is recommended that Oxford Junction 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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Oxford Junction, IA
0
0.05
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Miles

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

11/18/2011

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	13.5	1,028	1,854.6	1,817	2,845	(N/A)	33.1	34.7	51.73
Norway maple	8.2	619	1,184.4	1,161	1,779	(N/A)	19.9	21.7	53.92
Sugar maple	3.5	269	472.2	463	732	(N/A)	7.2	8.9	60.96
Silver maple	3.0	231	405.4	397	628	(N/A)	5.4	7.7	69.78
Apple	0.9	72	138.9	136	208	(N/A)	4.8	2.5	25.97
Eastern red cedar	0.7	51	98.7	97	147	(N/A)	3.6	1.8	24.57
American basswood	1.2	94	179.6	176	270	(N/A)	3.6	3.3	44.97
Northern hackberry	1.6	122	229.2	225	346	(N/A)	3.0	4.2	69.28
Northern catalpa	1.7	130	227.4	223	353	(N/A)	2.4	4.3	88.30
Honeylocust	1.3	96	165.4	162	258	(N/A)	2.4	3.1	64.41
Black walnut	0.3	25	47.8	47	72	(N/A)	1.8	0.9	24.07
Blue spruce	0.2	17	30.2	30	46	(N/A)	1.8	0.6	15.42
Eastern white pine	0.5	39	68.9	68	107	(N/A)	1.8	1.3	35.61
Red maple	0.1	9	17.2	17	26	(N/A)	1.2	0.3	12.80
Southern magnolia	0.2	13	25.4	25	38	(N/A)	1.2	0.5	18.82
Swamp white oak	0.4	32	64.3	63	95	(N/A)	1.2	1.2	47.66
Siberian elm	0.5	38	64.8	63	102	(N/A)	1.2	1.2	50.85
Other street trees	0.8	57	100.6	99	156	(N/A)	4.2	1.9	22.28
Citywide total	38.7	2,941	5,374.9	5,267	8,208	(N/A)	100.0	100.0	49.45

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

11/18/2011

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	110,201	2,987	(N/A)	33.1	29.4	54.30
Norway maple	75,134	2,036	(N/A)	19.9	20.1	61.71
Sugar maple	39,094	1,060	(N/A)	7.2	10.4	88.29
Silver maple	42,516	1,152	(N/A)	5.4	11.4	128.03
Apple	3,840	104	(N/A)	4.8	1.0	13.01
Eastern red cedar	9,807	266	(N/A)	3.6	2.6	44.30
American basswood	10,837	294	(N/A)	3.6	2.9	48.95
Northern hackberry	13,705	371	(N/A)	3.0	3.7	74.28
Northern catalpa	24,306	659	(N/A)	2.4	6.5	164.68
Honeylocust	12,051	327	(N/A)	2.4	3.2	81.65
Black walnut	3,978	108	(N/A)	1.8	1.1	35.94
Blue spruce	2,556	69	(N/A)	1.8	0.7	23.09
Eastern white pine	12,178	330	(N/A)	1.8	3.3	110.01
Red maple	637	17	(N/A)	1.2	0.2	8.63
Southern magnolia	1,354	37	(N/A)	1.2	0.4	18.34
Swamp white oak	4,350	118	(N/A)	1.2	1.2	58.95
Siberian elm	3,661	99	(N/A)	1.2	1.0	49.60
Other street trees	4,168	113	(N/A)	4.2	1.1	16.14
Citywide total	374,371	10,146	(N/A)	100.0	100.0	61.12

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

11/18/2011

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	21.1	3.6	10.6	0.9	115	64.8	9.4	9.0	61.4	403	-5.1	-19	175.9	499	(N/A)	33.1	9.08
Norway maple	15.1	2.6	7.5	0.7	82	39.6	5.7	5.4	37.0	245	-3.6	-13	110.0	313	(N/A)	19.9	9.50
Sugar maple	5.2	0.9	2.6	0.2	28	16.8	2.5	2.3	16.0	105	-4.1	-15	42.4	118	(N/A)	7.2	9.80
Silver maple	7.5	1.3	3.7	0.3	40	14.4	2.1	2.0	13.8	90	-4.1	-15	40.9	115	(N/A)	5.4	12.76
Apple	1.2	0.2	0.5	0.1	6	4.6	0.7	0.6	4.3	28	0.0	0	12.1	35	(N/A)	4.8	4.32
Eastern red cedar	2.1	0.4	1.6	0.3	13	3.2	0.5	0.4	3.0	20	-5.4	-20	6.1	13	(N/A)	3.6	2.19
American basswood	1.2	0.2	0.6	0.1	7	6.0	0.9	0.8	5.6	37	-1.1	-4	14.3	40	(N/A)	3.6	6.62
Northern hackberry	1.9	0.3	1.0	0.1	11	7.8	1.1	1.1	7.3	48	0.0	0	20.6	59	(N/A)	3.0	11.75
Northern catalpa	5.0	0.8	2.2	0.2	26	8.1	1.2	1.1	7.8	51	0.0	0	26.5	77	(N/A)	2.4	19.25
Honeylocust	2.3	0.4	1.1	0.1	12	5.9	0.9	0.8	5.7	37	-1.7	-6	15.5	43	(N/A)	2.4	10.75
Black walnut	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	13	(N/A)	1.8	4.21
Blue spruce	0.3	0.1	0.2	0.0	2	1.0	0.2	0.1	1.0	7	-0.9	-3	2.1	5	(N/A)	1.8	1.73
Eastern white pine	1.5	0.3	1.2	0.2	10	2.4	0.4	0.3	2.3	15	-7.1	-27	1.5	-2	(N/A)	1.8	-0.57
Red maple	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	1.2	1.88
Southern magnolia	0.0	0.0	0.1	0.0	0	0.8	0.1	0.1	0.8	5	-0.3	-1	1.6	4	(N/A)	1.2	2.10
Swamp white oak	0.9	0.2	0.5	0.0	5	2.1	0.3	0.3	1.9	13	-0.2	-1	6.0	17	(N/A)	1.2	8.52
Siberian elm	0.4	0.1	0.2	0.0	2	2.4	0.3	0.3	2.3	15	0.0	0	6.0	17	(N/A)	1.2	8.48
Other street trees	0.5	0.1	0.3	0.0	3	3.6	0.5	0.5	3.4	22	-0.4	-1	8.5	24	(N/A)	4.2	3.37
Citywide total	66.7	11.5	34.1	3.3	365	185.7	27.0	25.7	175.7	1,155	-34.0	-127	495.7	1,393	(N/A)	100.0	8.39

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

11/18/2011

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	349,152	2,619	(N/A)	33.1	26.8	47.61
Norway maple	248,402	1,863	(N/A)	19.9	19.0	56.46
Sugar maple	148,309	1,112	(N/A)	7.2	11.4	92.69
Silver maple	183,735	1,378	(N/A)	5.4	14.1	153.11
Apple	18,026	135	(N/A)	4.8	1.4	16.90
Eastern red cedar	6,612	50	(N/A)	3.6	0.5	8.27
American	44,340	333	(N/A)	3.6	3.4	55.43
Northern	27,613	207	(N/A)	3.0	2.1	41.42
Northern catalpa	176,404	1,323	(N/A)	2.4	13.5	330.76
Honeylocust	28,767	216	(N/A)	2.4	2.2	53.94
Black walnut	15,797	118	(N/A)	1.8	1.2	39.49
Blue spruce	1,445	11	(N/A)	1.8	0.1	3.61
Eastern white pine	18,323	137	(N/A)	1.8	1.4	45.81
Red maple	1,118	8	(N/A)	1.2	0.1	4.19
Southern magnolia	968	7	(N/A)	1.2	0.1	3.63
Swamp white oak	15,381	115	(N/A)	1.2	1.2	57.68
Siberian elm	9,780	73	(N/A)	1.2	0.8	36.67
Other street trees	4,654	77	(N/A)	4.2	0.8	10.99
Citywide total	1,304,433	9,783	(N/A)	100.0	100.0	58.94

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

11/18/2011

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
Ash	18,678	140	-1,676	-11	-13	22,713	170	39,704	298	(N/A)	33.1	31.5	5.41
Norway maple	12,151	91	-1,192	-6	-9	13,673	103	24,625	185	(N/A)	19.9	19.6	5.60
Sugar maple	7,832	59	-712	-2	-5	5,941	45	13,059	98	(N/A)	7.2	10.4	8.16
Silver maple	13,121	98	-882	-2	-7	5,100	38	17,338	130	(N/A)	5.4	13.8	14.45
Apple	1,585	12	-87	-2	-1	1,583	12	3,080	23	(N/A)	4.8	2.5	2.89
Eastern red cedar	86	1	-32	-1	0	1,121	8	1,174	9	(N/A)	3.6	0.9	1.47
American basswood	3,002	23	-213	-1	-2	2,072	16	4,860	36	(N/A)	3.6	3.9	6.08
Northern hackberry	1,879	14	-133	-1	-1	2,691	20	4,437	33	(N/A)	3.0	3.5	6.65
Northern catalpa	2,096	16	-847	-1	-6	2,880	22	4,129	31	(N/A)	2.4	3.3	7.74
Honeylocust	2,347	18	-138	-1	-1	2,111	16	4,319	32	(N/A)	2.4	3.4	8.10
Black walnut	862	6	-76	-1	-1	561	4	1,347	10	(N/A)	1.8	1.1	3.37
Blue spruce	141	1	-7	-1	0	367	3	501	4	(N/A)	1.8	0.4	1.25
Eastern white pine	443	3	-88	-1	-1	868	7	1,223	9	(N/A)	1.8	1.0	3.06
Red maple	168	1	-5	0	0	192	1	355	3	(N/A)	1.2	0.3	1.33
Southern magnolia	113	1	-5	0	0	282	2	389	3	(N/A)	1.2	0.3	1.46
Swamp white oak	594	4	-74	0	-1	714	5	1,234	9	(N/A)	1.2	1.0	4.63
Siberian elm	799	6	-47	0	0	845	6	1,596	12	(N/A)	1.2	1.3	5.99
Other street trees	1,339	10	-49	-1	0	1,269	10	2,557	19	(N/A)	4.2	2.0	2.74
Citywide total	67,236	504	-6,261	-32	-47	64,985	487	125,927	944	(N/A)	100.0	100.0	5.69

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

11/18/2011

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	1,839	(N/A)	33.1	27.8	33.44
Norway maple	1,154	(N/A)	19.9	17.4	34.96
Sugar maple	813	(N/A)	7.2	12.3	67.79
Silver maple	998	(N/A)	5.4	15.1	110.90
Apple	92	(N/A)	4.8	1.4	11.52
Eastern red cedar	27	(N/A)	3.6	0.4	4.56
American basswood	242	(N/A)	3.6	3.7	40.31
Northern hackberry	269	(N/A)	3.0	4.1	53.80
Northern catalpa	143	(N/A)	2.4	2.2	35.85
Honeylocust	492	(N/A)	2.4	7.4	122.98
Black walnut	76	(N/A)	1.8	1.2	25.37
Blue spruce	59	(N/A)	1.8	0.9	19.54
Eastern white pine	73	(N/A)	1.8	1.1	24.45
Red maple	30	(N/A)	1.2	0.5	14.94
Southern magnolia	44	(N/A)	1.2	0.7	21.93
Swamp white oak	58	(N/A)	1.2	0.9	28.84
Siberian elm	72	(N/A)	1.2	1.1	35.97
Other street trees	144	(N/A)	4.2	2.2	20.52
Citywide total	6,625	(N/A)	100.0	100.0	39.91

Table 7: Summary of Benefits in Dollars

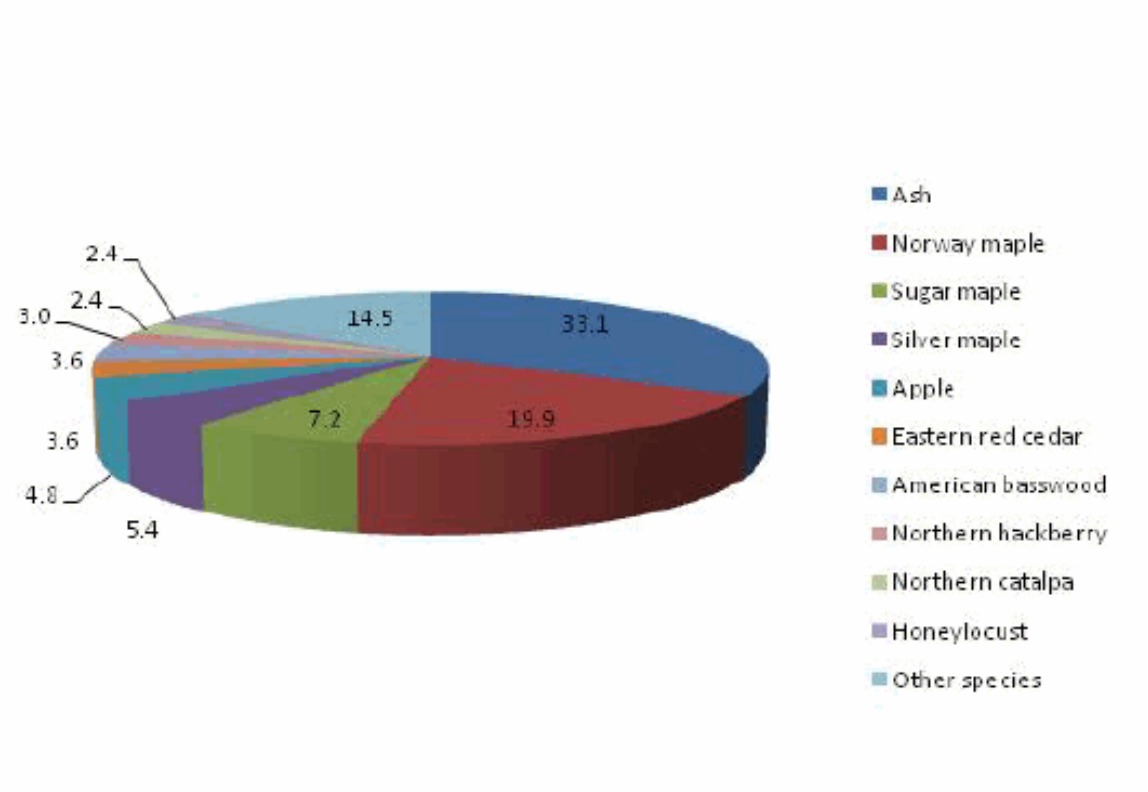
Total Annual Benefits of Public Trees by Species ($)

11/18/20

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Ash	2,845	298	499	2,987	1,839	8,468	(±0)	31.0
Norway maple	1,779	185	313	2,036	1,154	5,468	(±0)	20.0
Sugar maple	732	98	118	1,060	813	2,820	(±0)	10.3
Silver maple	628	130	115	1,152	998	3,023	(±0)	11.1
Apple	208	23	35	104	92	462	(±0)	1.7
Eastern red cedar	147	9	13	266	27	462	(±0)	1.7
American basswood	270	36	40	294	242	882	(±0)	3.2
Northern hackberry	346	33	59	371	269	1,079	(±0)	3.9
Northern catalpa	353	31	77	659	143	1,263	(±0)	4.6
Honeylocust	258	32	43	327	492	1,152	(±0)	4.2
Black walnut	72	10	13	108	76	279	(±0)	1.0
Blue spruce	46	4	5	69	59	183	(±0)	0.7
Eastern white pine	107	9	-2	330	73	518	(±0)	1.9
Red maple	26	3	4	17	30	79	(±0)	0.3
Southern magnolia	38	3	4	37	44	125	(±0)	0.5
Swamp white oak	95	9	17	118	58	297	(±0)	1.1
Siberian elm	102	12	17	99	72	302	(±0)	1.1
Other street trees	156	19	24	113	144	455	(±0)	1.7
Citywide Total	8,208	944	1,393	10,146	6,625	27,316	(±0)	100.0

Species Distribution of Public Trees (%)

11/18/2011

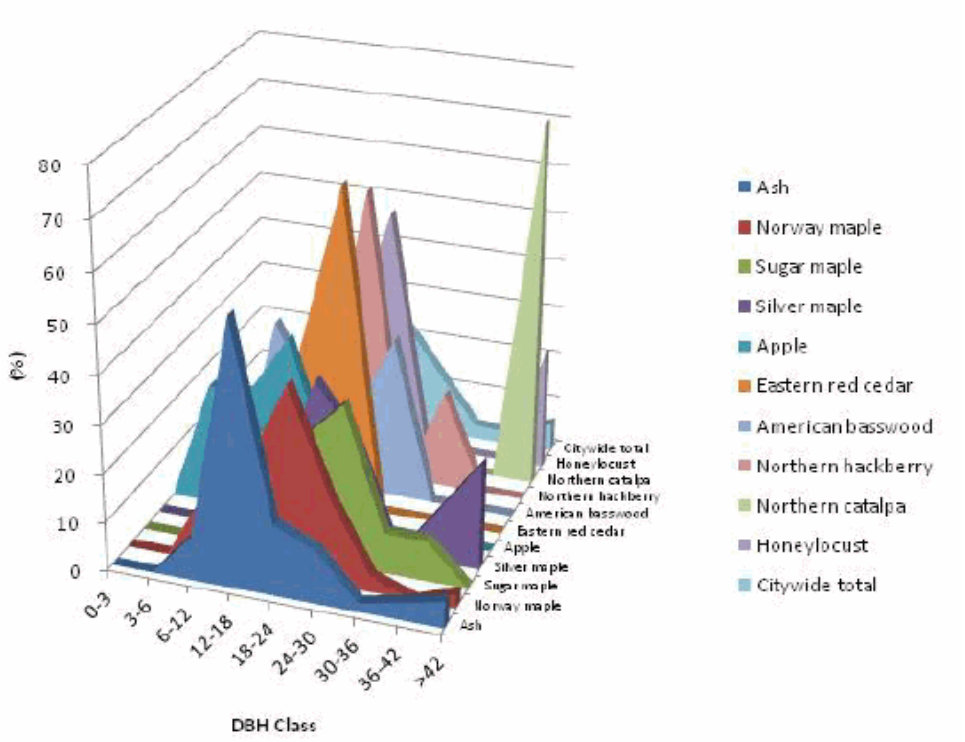


Species	Percent
Ash	33.1
Norway maple	19.9
Sugar maple	7.2
Silver maple	5.4
Apple	4.8
Eastern red cedar	3.6
American basswood	3.6
Northern hackberry	3.0
Northern catalpa	2.4
Honeylocust	2.4
Other species	14.5
Total	100.0

Figure 1: Species Distribution

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

11/18/2011



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Ash	0.0	0.0	9.1	54.5	14.5	10.9	1.8	3.6	5.5
Norway maple	0.0	0.0	15.2	21.2	39.4	18.2	3.0	0.0	3.0
Sugar maple	0.0	0.0	0.0	25.0	25.0	33.3	8.3	8.3	0.0
Silver maple	0.0	0.0	0.0	11.1	33.3	22.2	0.0	11.1	22.2
Apple	0.0	25.0	25.0	37.5	12.5	0.0	0.0	0.0	0.0
Eastern red cedar	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0
American basswood	0.0	0.0	33.3	16.7	16.7	33.3	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	20.0	60.0	0.0	20.0	0.0	0.0
Northern catalpa	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	75.0
Honeylocust	0.0	0.0	0.0	25.0	50.0	0.0	0.0	0.0	25.0
Citywide total	2.4	2.4	13.3	31.9	24.7	13.9	3.0	2.4	6.0

Figure 2: Relative Age Class

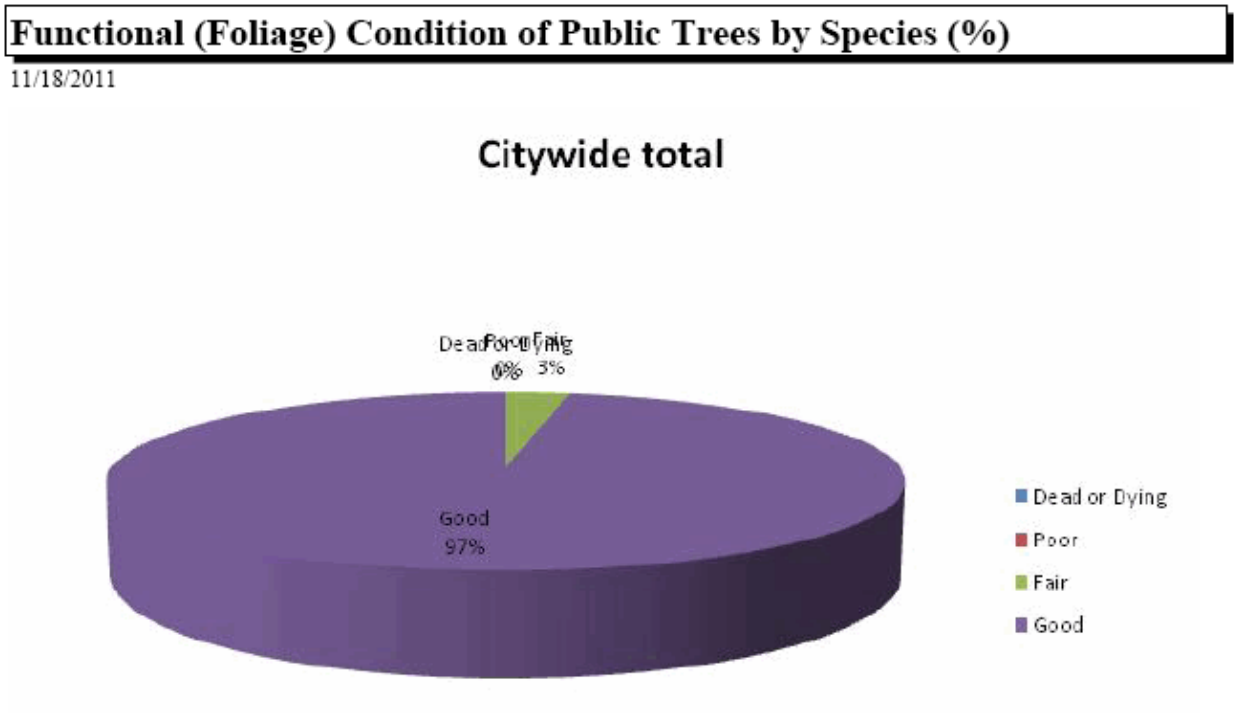


Figure 3: Foliage Condition

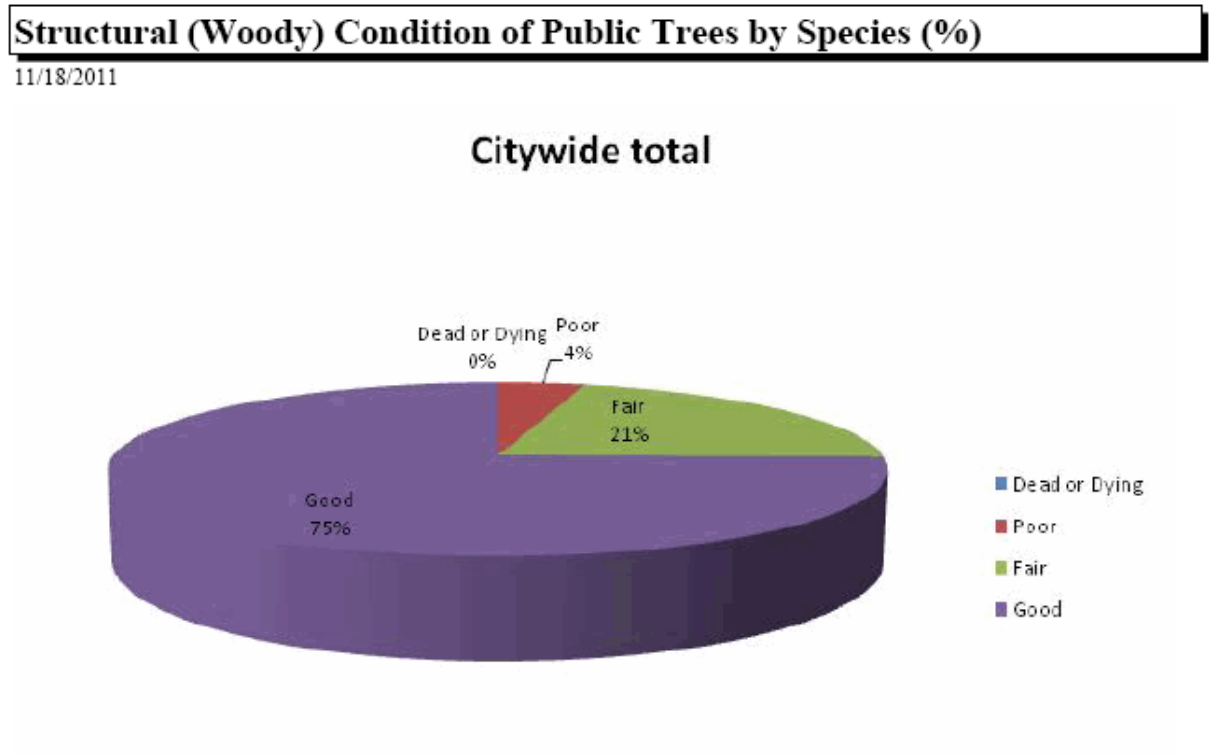
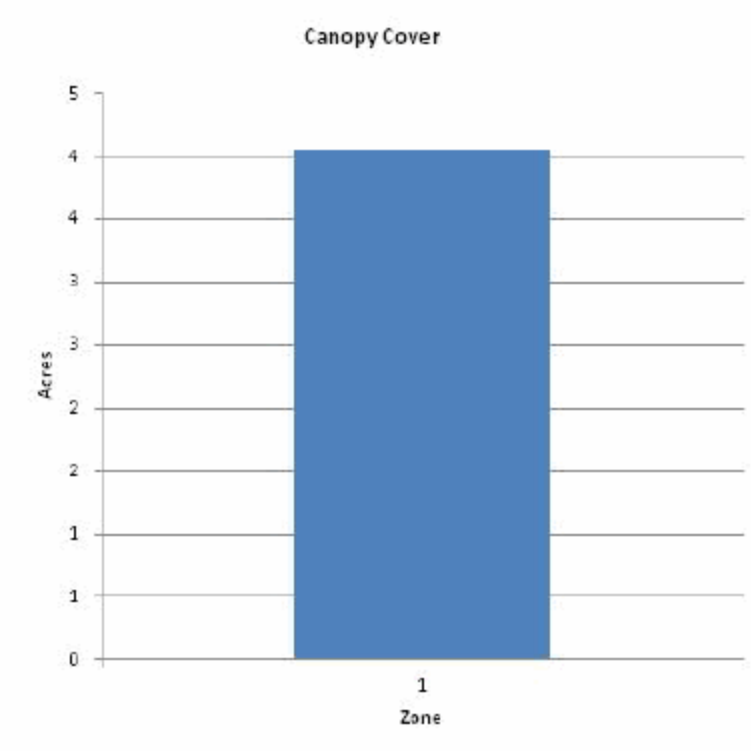


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

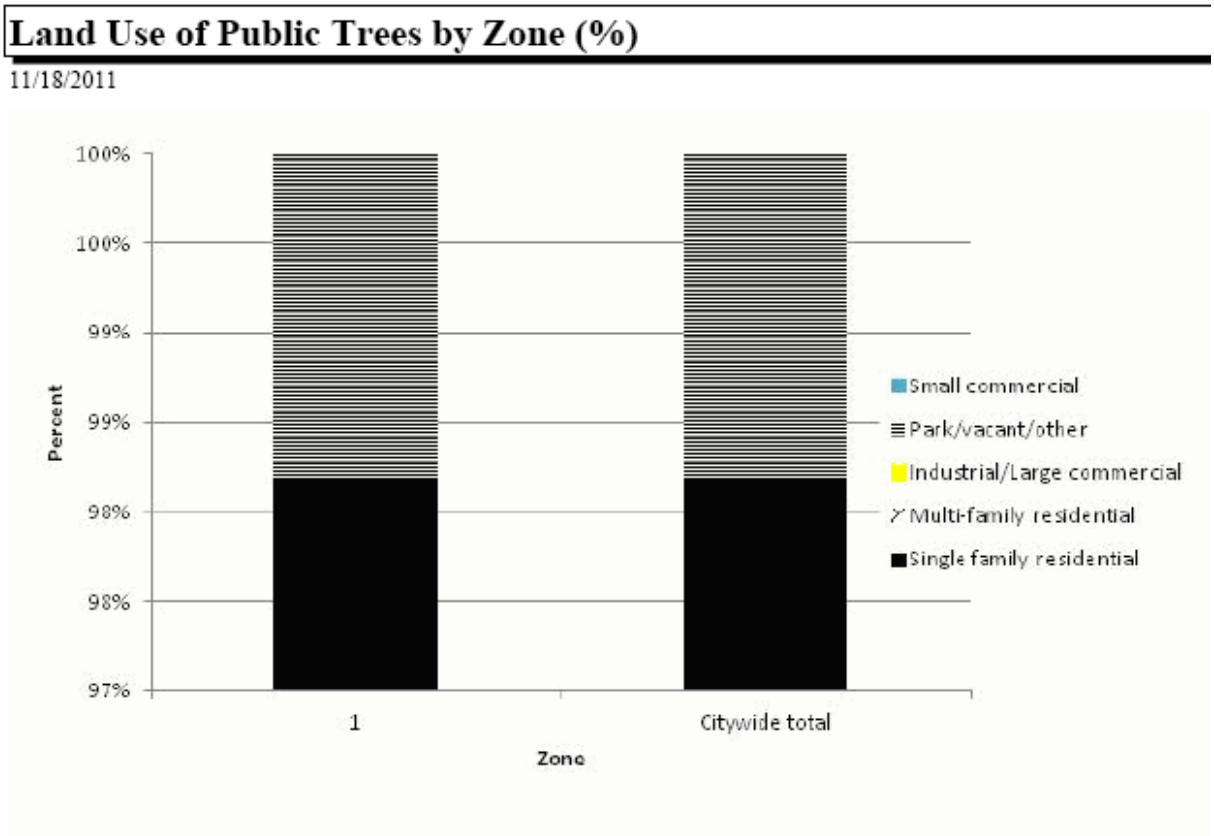
11/18/2011



Zone	Acres	% of Total Canopy Cover
1	4	100.0
Citywide total	4	100.0

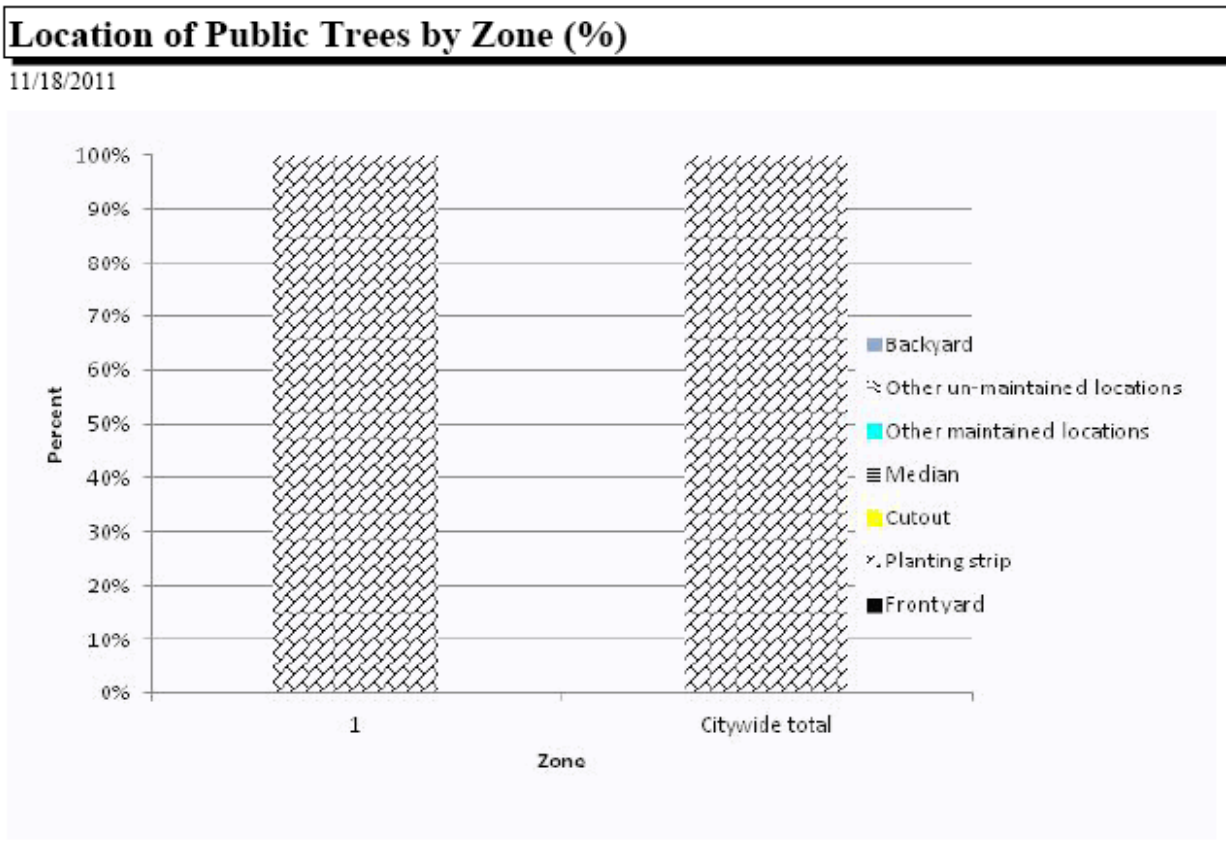
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	4		

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	98.2	0.0	0.0	1.8	0.0
Citywide total	98.2	0.0	0.0	1.8	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

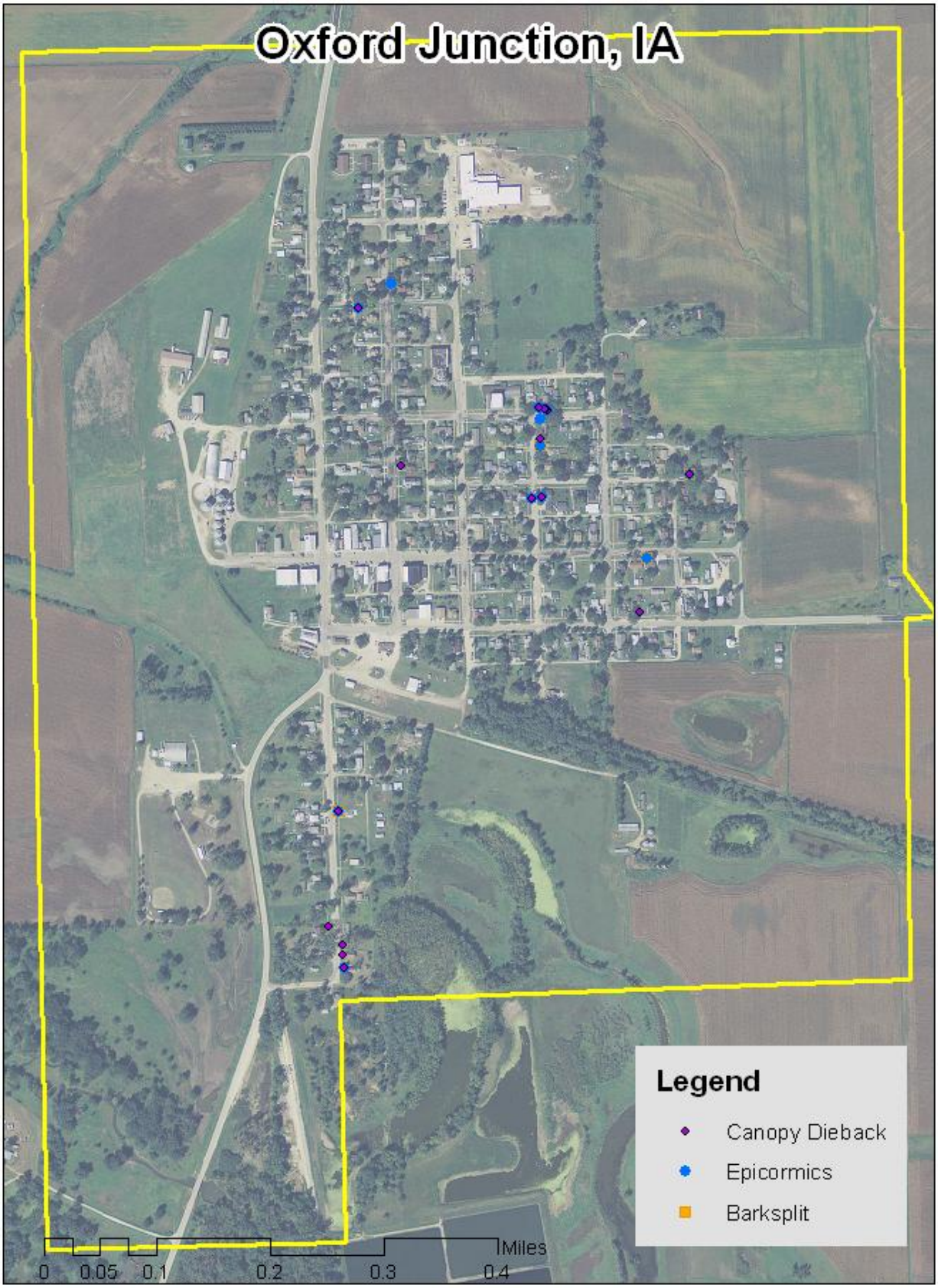


Figure 2: Location of EAB symptoms

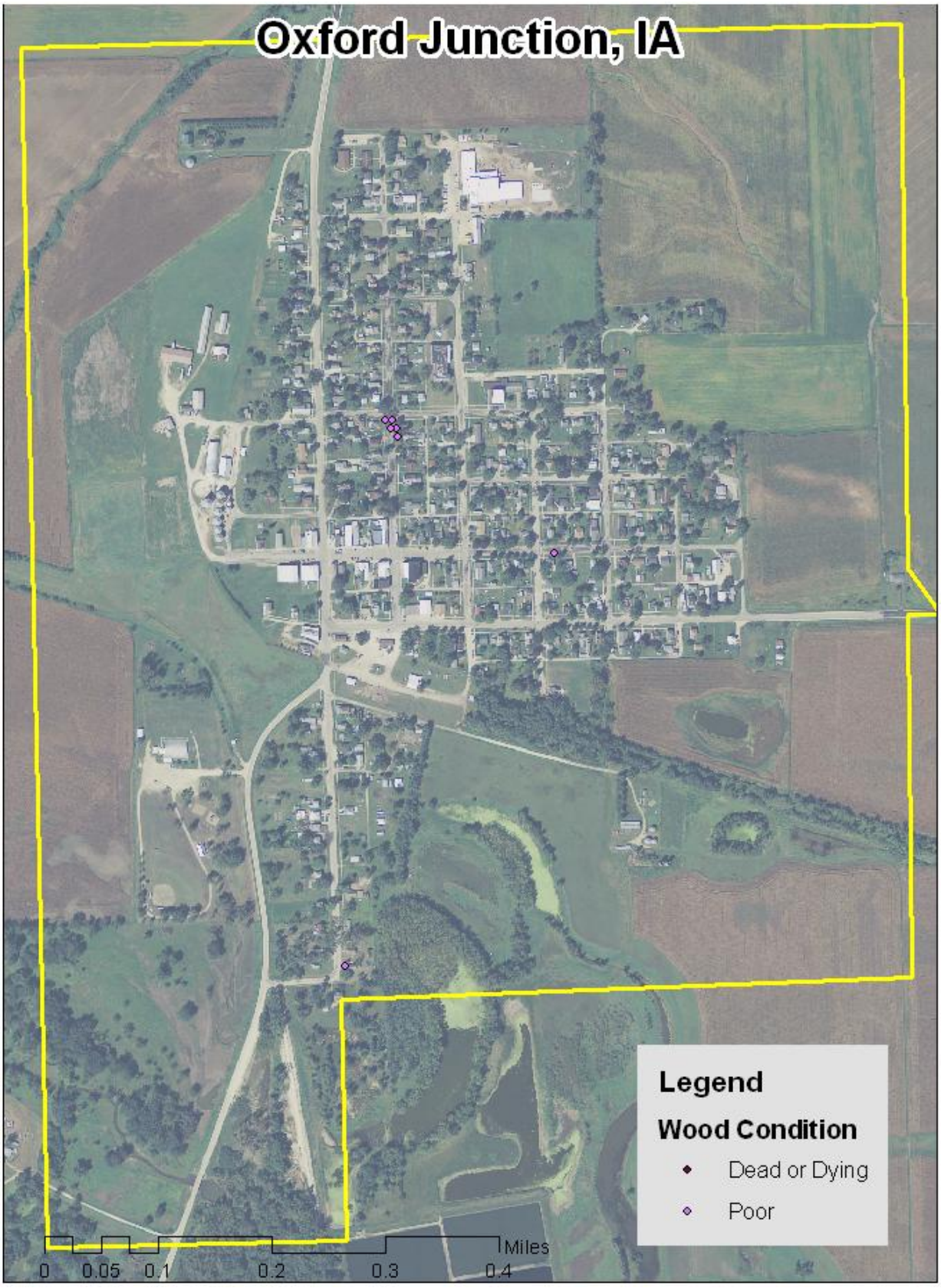


Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

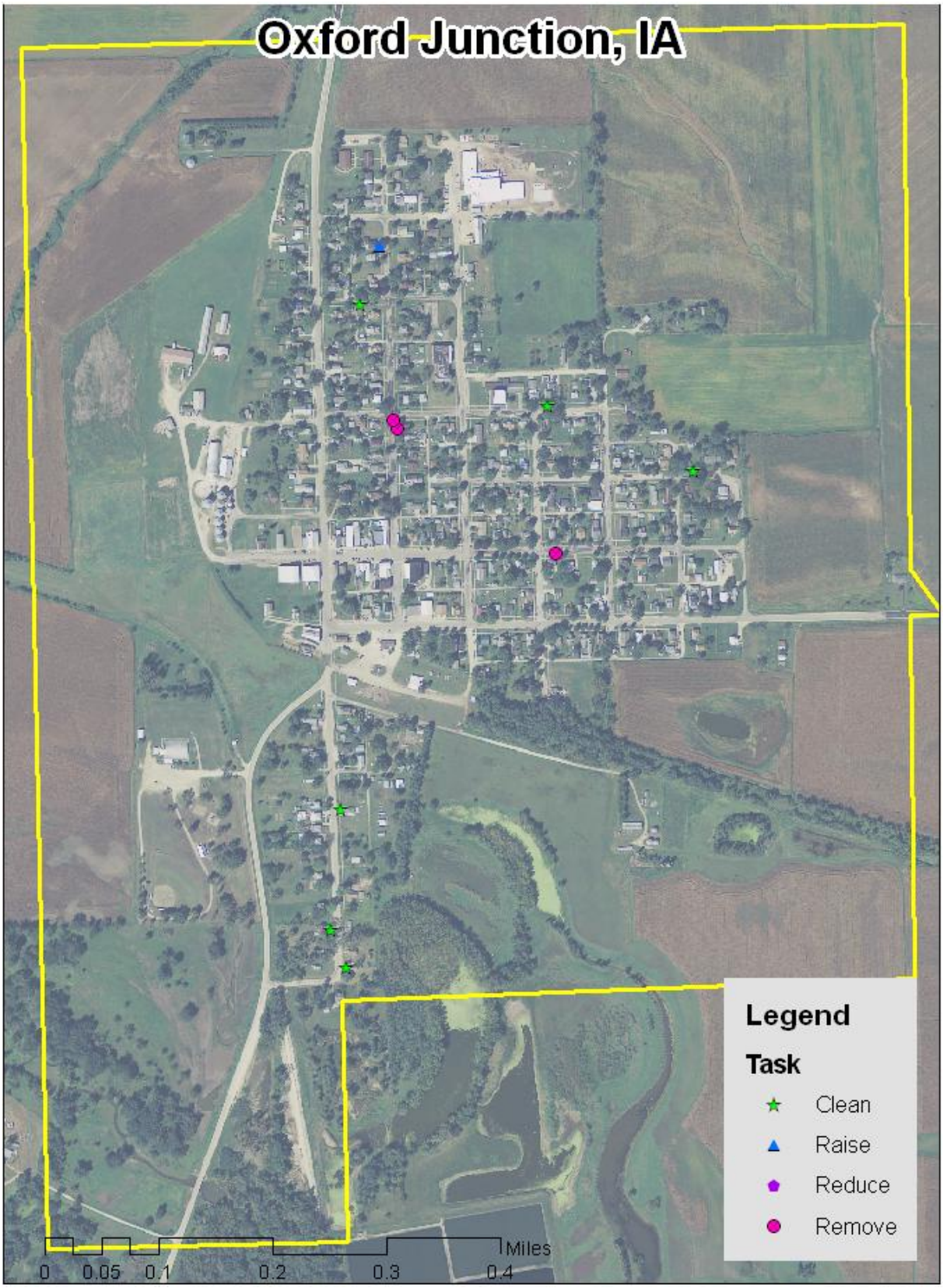


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

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