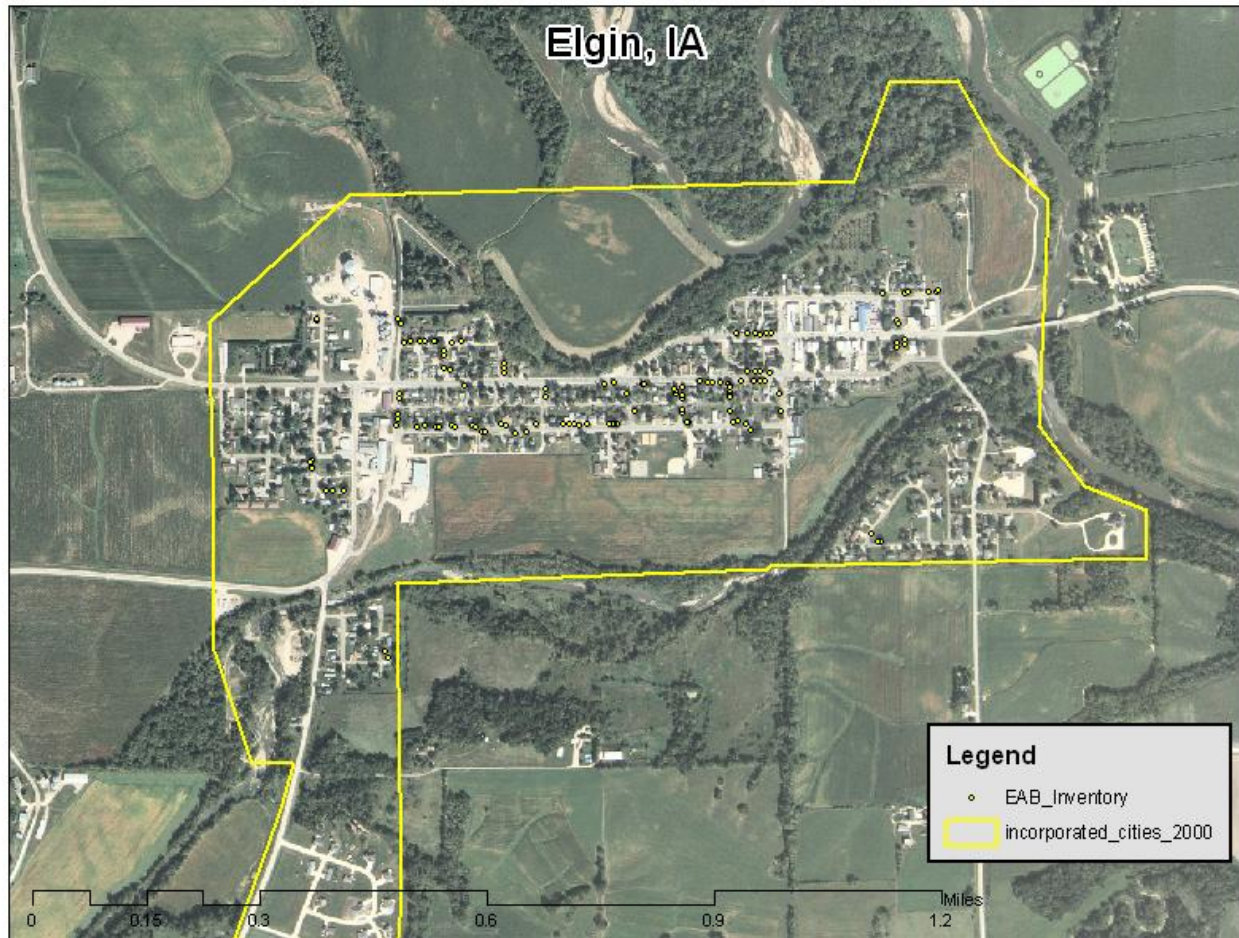


# ELGIN, IA



## 2011 Management Plan

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# Executive Summary

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## Overview

This plan was developed to assist the City of Elgin 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 19.7% of Elgin'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 2010, 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 122 trees inventoried.

- Elgin's trees provide \$24,473 of benefits annually, an average of \$200 a tree
- There are over 18 species of trees
- The top three genus are: Sugar Maple 25%, Silver Maple 17%, and Green Ash 17%
- 39% 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.

- Of the 10 trees needing removal, 4 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately [\\*City ownership of the trees recommended for removal should be verified prior to any removal\\*](#)
- 8 of the 24 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
- Plant a diverse mix of trees that do not include: ash, maple, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven or willow.
- Check ash trees with a visual survey yearly

## Introduction

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This plan was developed to assist Elgin 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 canopy in Elgin, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Elgin'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 Elgin 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 Elgin's urban forestry goals.

## Inventory

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In 2010, a tree inventory was conducted that included 100% of the city owned trees along the streets. 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

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The data collected for the 122 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. Elgin's trees reduce energy related costs by approximately \$6,482 annually (Appendix A, Table 1). These savings are both in Electricity (31.0 MWh) and in Natural Gas (4,211.2 Therms).

#### **Annual Stormwater Benefits**

Elgin's trees intercept about 317,004 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$8591 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 matter (ozone). In Elgin, it is estimated that trees remove 386.9 lbs. of air pollution (ozone (O<sub>3</sub>), particulate matter less than 10 microns (PM<sub>10</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>)) per year with a net value of \$1,087 (Appendix A, Table 3).

#### **Annual Carbon Benefits**

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Elgin, trees sequester about 72,457 lbs of carbon a year with an associated value of \$543 (Appendix A, Table 5). In addition, the trees store 1,045,722 lbs of carbon, with a yearly benefit of \$7843 (Appendix A, Table 4).

#### **Annual Aesthetics Benefits**

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Elgin receives \$7,497 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, Elgin's trees provide \$24,473 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 122 trees in Elgin provide approximately \$200 annually (Appendix A, Table 7).

## **Forest Structure**

### **Species Distribution**

Elgin has over 18 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

<b><u>Species</u></b>	<b><u># of Trees</u></b>	<b><u>% of Total</u></b>
Maple	74	60.7
Ash	24	19.7
Hackberry	4	3.3
Honeylocust	4	3.3
Black Walnut	3	2.5
Other	13	10.7

### **Age Class**

Most of Elgin's trees are between 24 and 30" in diameter (31%) and between 12 and 18 inches in diameter (23%) at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 26 inches in diameter at 4.5 ft. Elgin's size curve is on the larger side, indicating an older than average stand. Only about 8% are 1" to 6" in diameter suggesting some new plantings will be needed in the near future to replace to older trees.

### **Condition: Wood and Foliage**

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage that was present on trees appeared quite healthy (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 70% of Elgin's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 10% of the population. This 10% is an estimate of trees that need management follow up.

## Management Needs

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

Crown Raising	31	25%
Tree Removal	10	9%
Crown cleaning	6	5%

## Canopy Cover

The canopy cover of Elgin is approximately 3 acres (Appendix A, Figure 4).

## Recommendations

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### 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

Elgin has 4 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately for removal. After those trees are addressed, there are 6 trees under 24 inches that should be addressed for removal. After the removals, other trees in town are in need of various work to eliminate possible hazards (Appendix B, Figure 3 & Appendix B, Figure 4).

### Ash trees

After the hazardous tree work is complete, ash trees in poor health should be assessed for removal. Of the 10 removals, 2 of these are ash trees. There are a total of 24 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 6 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 Elgin.

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 (60%) (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: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

## **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.



# Emerald Ash Borer Plan

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## 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](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 the city ordinance. The new plantings will be a diverse mix and will not include ash, maple, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

## **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 as trees are infested with Emerald Ash Borer. Trees that are on private property are part of Elgin's urban forest. Private property owners should be given direction to the proper species to plant, spacing, and location.

## Six Year Work Plan and Estimated Costs

### Year 1:

Remove 5 hazard trees	\$2500
Plant 5 trees in open locations	\$500
Visual survey of signs and symptoms of Emerald Ash Borer	

### Year 2:

Remove 5 hazard trees	\$2500
Plant 5 trees in open locations	\$500
Maintenance of newly planted trees in city	\$250
Visual survey of signs and symptoms of Emerald Ash Borer	

### Year 3:

Appendix B, Figure 3 & Appendix B, Figure 4 tree work	\$????
Remove 2 ash trees	\$1,000
Plant 2 trees in open locations	\$200
Maintenance of newly planted trees in city	\$500
Prune 1/4 of city trees	
Visual survey of signs and symptoms of Emerald Ash Borer	

### Year 4:

Remove 2 ash trees	\$1,000
Plant 2 trees in open locations	\$200
Maintenance of newly planted trees in city	\$500
Prune 1/4 of city trees	
Visual survey of signs and symptoms of Emerald Ash Borer	

### Year 5:

Remove 2 ash trees	\$1,000
Plant 2 trees in open locations	\$200
Maintenance of newly planted trees in city	\$500
Prune 1/4 of city trees	
Visual survey of signs and symptoms of Emerald Ash Borer	

## Year 6:

Remove 2 ash trees	\$1,000
Plant 2 trees in open locations	\$200
Maintenance of newly planted trees in city	\$500
Prune 1/4 of city trees	
Visual survey of signs and symptoms of Emerald Ash Borer	

\*\* The ash removed in this six year plan is 25% of the total ash in Elgin.

## Funding

Elgin can 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

<b>Annual Energy Benefits of Public Trees by Species</b>									
7/9/2010									
Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Sugar maple	8.1	614	1,086.1	1,064	1,679	(N/A)	24.6	25.9	55.95
Silver maple	6.0	458	793.4	778	1,236	(N/A)	17.2	19.1	58.85
Green ash	5.3	405	740.8	726	1,131	(N/A)	17.2	17.5	53.86
Norway maple	3.6	276	510.0	500	776	(N/A)	12.3	12.0	51.70
Maple	0.3	26	42.0	41	67	(N/A)	4.1	1.0	13.34
Northern hackberry	1.5	116	220.6	216	333	(N/A)	3.3	5.1	83.15
Honeylocust	1.3	98	161.5	158	256	(N/A)	3.3	4.0	64.02
Red maple	0.4	28	47.3	46	75	(N/A)	2.5	1.2	24.85
White ash	0.3	25	36.8	36	61	(N/A)	2.5	1.0	20.47
Black walnut	0.9	70	131.8	129	199	(N/A)	2.5	3.1	66.38
American basswood	0.9	72	139.2	136	209	(N/A)	2.5	3.2	69.51
Boxelder	0.3	23	38.8	38	61	(N/A)	1.6	0.9	30.54
Spruce	0.3	20	29.3	29	48	(N/A)	1.6	0.7	24.14
Willow	0.6	49	94.8	93	142	(N/A)	1.6	2.2	70.84
Siberian elm	0.7	50	91.1	89	140	(N/A)	1.6	2.2	69.75
Other street trees	0.3	24	47.6	47	71	(N/A)	1.6	1.1	35.45
Citywide total	31.0	2,355	4,211.2	4,127	6,482	(N/A)	100.0	100.0	53.13

Table 2: Annual Stormwater Benefits

<b>Annual Stormwater Benefits of Public Trees by Species</b>						
7/9/2010						
Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Sugar maple	84,130	2,280	(N/A)	24.6	26.5	76.00
Silver maple	70,463	1,910	(N/A)	17.2	22.2	90.94
Green ash	52,260	1,416	(N/A)	17.2	16.5	67.44
Norway maple	30,869	837	(N/A)	12.3	9.7	55.77
Maple	1,902	52	(N/A)	4.1	0.6	10.31
Northern hackberry	16,019	434	(N/A)	3.3	5.1	108.54
Honeylocust	12,482	338	(N/A)	3.3	3.9	84.57
Red maple	2,241	61	(N/A)	2.5	0.7	20.24
White ash	1,989	54	(N/A)	2.5	0.6	17.97
Black walnut	10,476	284	(N/A)	2.5	3.3	94.64
American basswood	11,350	308	(N/A)	2.5	3.6	102.53
Boxelder	2,176	59	(N/A)	1.6	0.7	29.48
Spruce	3,077	83	(N/A)	1.6	1.0	41.70
Willow	7,528	204	(N/A)	1.6	2.4	102.01
Siberian elm	6,857	186	(N/A)	1.6	2.2	92.92
Other street trees	3,186	86	(N/A)	1.6	1.0	43.17
Citywide total	317,004	8,591	(N/A)	100.0	100.0	70.42

**Table 3: Annual Air Quality Benefits**

**Annual Air Quality Benefits of Public Trees by Species**

7/9/2010

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 <sub>3</sub>	NO <sub>2</sub>	PM <sub>10</sub>	SO <sub>2</sub>		NO <sub>2</sub>	PM <sub>10</sub>	VOC	SO <sub>2</sub>								
Sugar maple	10.7	1.8	5.4	0.5	58	38.4	5.6	5.3	36.7	240	-8.5	-32	96.0	266 (N/A)	24.6	8.88	
Silver maple	10.3	1.7	5.3	0.5	56	28.5	4.2	4.0	27.3	178	-5.6	-21	76.0	213 (N/A)	17.2	10.14	
Green ash	5.6	0.9	2.8	0.3	30	25.6	3.7	3.5	24.2	159	0.0	0	66.6	189 (N/A)	17.2	9.02	
Norway maple	6.0	1.0	3.0	0.3	32	17.5	2.5	2.4	16.5	109	-1.4	-5	47.8	136 (N/A)	12.3	9.05	
Maple	0.3	0.1	0.2	0.0	2	1.6	0.2	0.2	1.5	10	-0.1	0	4.0	11 (N/A)	4.1	2.25	
Northern hackberry	2.6	0.4	1.3	0.1	14	7.4	1.1	1.0	7.0	46	0.0	0	20.9	60 (N/A)	3.3	15.04	
Honeylocust	2.4	0.4	1.1	0.1	13	6.0	0.9	0.8	5.8	38	-1.8	-7	15.7	44 (N/A)	3.3	10.89	
Red maple	0.4	0.1	0.2	0.0	2	1.7	0.3	0.2	1.7	11	-0.2	-1	4.5	13 (N/A)	2.5	4.17	
White ash	0.1	0.0	0.1	0.0	1	1.5	0.2	0.2	1.5	10	0.0	0	3.7	10 (N/A)	2.5	3.43	
Black walnut	1.3	0.2	0.6	0.1	7	4.5	0.6	0.6	4.2	28	0.0	0	12.0	34 (N/A)	2.5	11.43	
American basswood	1.6	0.3	0.8	0.1	9	4.6	0.7	0.6	4.3	29	-1.3	-5	11.6	32 (N/A)	2.5	10.71	
Boxelder	0.2	0.0	0.1	0.0	1	1.4	0.2	0.2	1.4	9	-0.1	0	3.5	10 (N/A)	1.6	4.82	
Spruce	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.2	7	-1.1	-4	2.3	6 (N/A)	1.6	2.82	
Willow	1.7	0.3	0.8	0.1	9	3.1	0.5	0.4	2.9	19	-0.4	-1	9.5	27 (N/A)	1.6	13.58	
Siberian elm	1.1	0.2	0.5	0.0	6	3.2	0.5	0.4	3.0	20	0.0	0	8.9	26 (N/A)	1.6	12.79	
Other street trees	0.3	0.1	0.2	0.0	2	1.6	0.2	0.2	1.4	10	-0.2	-1	3.9	11 (N/A)	1.6	5.41	
Citywide total	44.9	7.6	22.7	2.0	244	147.7	21.5	20.5	140.6	921	-20.7	-78	386.9	1,087 (N/A)	100.0	8.91	

**Table 4: Annual Carbon Stored**

**Stored CO2 Benefits of Public Trees by Species**

7/9/2010

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Sugar maple	302,711	2,270	(N/A)	24.6	29.0	75.68
Silver maple	214,086	1,606	(N/A)	17.2	20.5	76.46
Green ash	179,348	1,345	(N/A)	17.2	17.2	64.05
Norway maple	97,994	735	(N/A)	12.3	9.4	49.00
Maple	4,095	31	(N/A)	4.1	0.4	6.14
Northern	39,204	294	(N/A)	3.3	3.8	73.51
Honeylocust	30,564	229	(N/A)	3.3	2.9	57.31
Red maple	4,742	36	(N/A)	2.5	0.5	11.85
White ash	4,043	30	(N/A)	2.5	0.4	10.11
Black walnut	40,003	300	(N/A)	2.5	3.8	100.01
American	58,121	436	(N/A)	2.5	5.6	145.30
Boxelder	4,725	35	(N/A)	1.6	0.5	17.72
Spruce	2,340	18	(N/A)	1.6	0.2	8.78
Willow	28,560	214	(N/A)	1.6	2.7	107.10
Siberian elm	26,471	199	(N/A)	1.6	2.5	99.27
Other street trees	3,953	65	(N/A)	1.6	0.8	32.68
Citywide total	1,045,722	7,843	(N/A)	100.0	100.0	64.29

**Table 5: Annual Carbon Sequestered**

**Annual CO<sub>2</sub> Benefits of Public Trees by Species**

7/9/2010

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	Standard % of Total Trees	% of Total \$	Avg. \$/tree
Sugar maple	17,231	129	-1,453	-6	-11	13,575	102	29,347	220 (N/A)	24.6	24.6	7.34
Silver maple	20,027	150	-1,028	-4	-8	10,128	76	29,124	218 (N/A)	17.2	24.4	10.40
Green ash	12,946	97	-861	-4	-6	8,954	67	21,035	158 (N/A)	17.2	17.6	7.51
Norway maple	5,881	44	-470	-3	-4	6,095	46	11,502	86 (N/A)	12.3	9.6	5.75
Maple	566	4	-20	-1	0	565	4	1,111	8 (N/A)	4.1	0.9	1.67
Northern hackberry	2,086	16	-188	-1	-1	2,573	19	4,471	34 (N/A)	3.3	3.7	8.38
Honeylocust	3,920	29	-147	-1	-1	2,161	16	5,934	45 (N/A)	3.3	5.0	11.13
Red maple	651	5	-23	-1	0	623	5	1,251	9 (N/A)	2.5	1.1	3.13
White ash	624	5	-19	-1	0	559	4	1,164	9 (N/A)	2.5	1.0	2.91
Black walnut	2,373	18	-192	-1	-1	1,546	12	3,727	28 (N/A)	2.5	3.1	9.32
American basswood	3,327	25	-279	-1	-2	1,593	12	4,641	35 (N/A)	2.5	3.9	11.60
Boxelder	599	4	-23	0	0	509	4	1,085	8 (N/A)	1.6	0.9	4.07
Spruce	231	2	-11	0	0	433	3	652	5 (N/A)	1.6	0.6	2.45
Willow	0	0	-137	0	-1	1,077	8	940	7 (N/A)	1.6	0.8	3.52
Siberian elm	1,281	10	-127	0	-1	1,109	8	2,263	17 (N/A)	1.6	1.9	8.49
Other street trees	712	5	-42	0	0	536	4	1,206	9 (N/A)	1.6	1.0	4.52
Citywide total	72,457	543	-5,019	-24	-38	52,038	390	119,452	896 (N/A)	100.0	100.0	7.34

**Table 6: Annual Social and Aesthetic Benefits**

**Annual Aesthetic/Other Benefits of Public Trees by Species**

7/9/2010

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Sugar maple	1,815	(N/A)	24.6	24.2	60.52
Silver maple	1,761	(N/A)	17.2	23.5	83.87
Green ash	1,132	(N/A)	17.2	15.1	53.88
Norway maple	559	(N/A)	12.3	7.5	37.26
Maple	81	(N/A)	4.1	1.1	16.11
Northern hackberry	261	(N/A)	3.3	3.5	65.29
Honeylocust	983	(N/A)	3.3	13.1	245.80
Red maple	96	(N/A)	2.5	1.3	31.92
White ash	89	(N/A)	2.5	1.2	29.76
Black walnut	189	(N/A)	2.5	2.5	62.96
American basswood	236	(N/A)	2.5	3.2	78.60
Boxelder	66	(N/A)	1.6	0.9	33.23
Spruce	65	(N/A)	1.6	0.9	32.32
Willow	0	(N/A)	1.6	0.0	0.00
Siberian elm	91	(N/A)	1.6	1.2	45.31
Other street trees	73	(N/A)	1.6	1.0	36.55
Citywide total	7,497	(N/A)	100.0	100.0	61.45



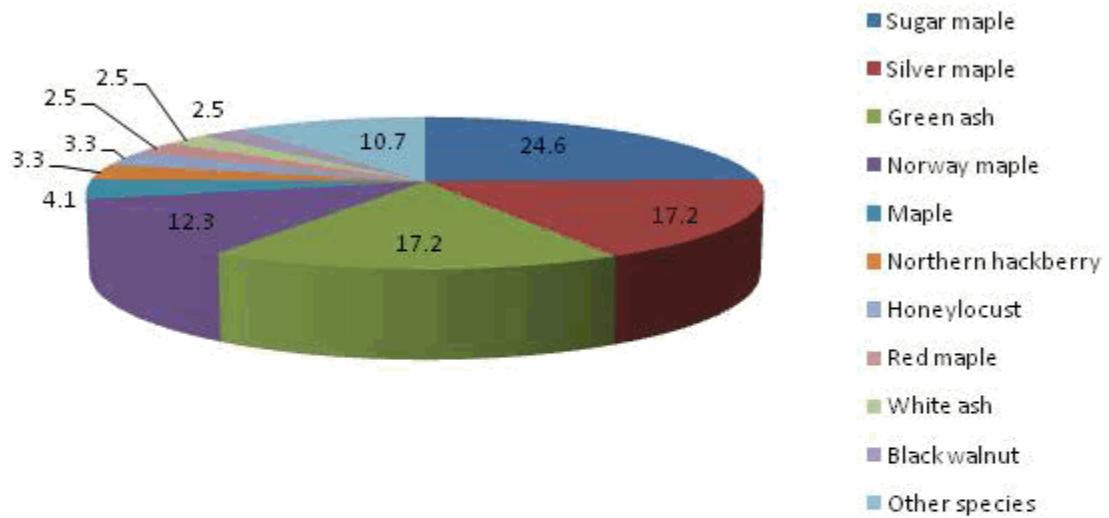
**Table 7: Summary of Benefits in Dollars**

<b>Annual Benefits of Public Trees by Species (\$/tree)</b>							
7/9/2010							
Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error
Sugar maple	55.95	7.34	8.88	76.00	60.52	208.69	(N/A)
Silver maple	58.85	10.40	10.14	90.94	83.87	254.20	(N/A)
Green ash	53.86	7.51	9.02	67.44	53.88	191.72	(N/A)
Norway maple	51.70	5.75	9.05	55.77	37.26	159.54	(N/A)
Maple	13.34	1.67	2.25	10.31	16.11	43.67	(N/A)
Northern hackberry	83.15	8.38	15.04	108.54	65.29	280.39	(N/A)
Honeylocust	64.02	11.13	10.89	84.57	245.80	416.41	(N/A)
Red maple	24.85	3.13	4.17	20.24	31.92	84.32	(N/A)
White ash	20.47	2.91	3.43	17.97	29.76	74.54	(N/A)
Black walnut	66.38	9.32	11.43	94.64	62.96	244.72	(N/A)
American basswood	69.51	11.60	10.71	102.53	78.60	272.95	(N/A)
Boxelder	30.54	4.07	4.82	29.48	33.23	102.14	(N/A)
Spruce	24.14	2.45	2.82	41.70	32.32	103.42	(N/A)
Willow	70.84	3.52	13.58	102.01	0.00	189.96	(N/A)
Siberian elm	69.75	8.49	12.79	92.92	45.31	229.26	(N/A)
Other street trees	35.45	4.52	5.41	43.17	36.55	125.11	(N/A)

Figure 1: Species Distribution

## Species Distribution of Public Trees (%)

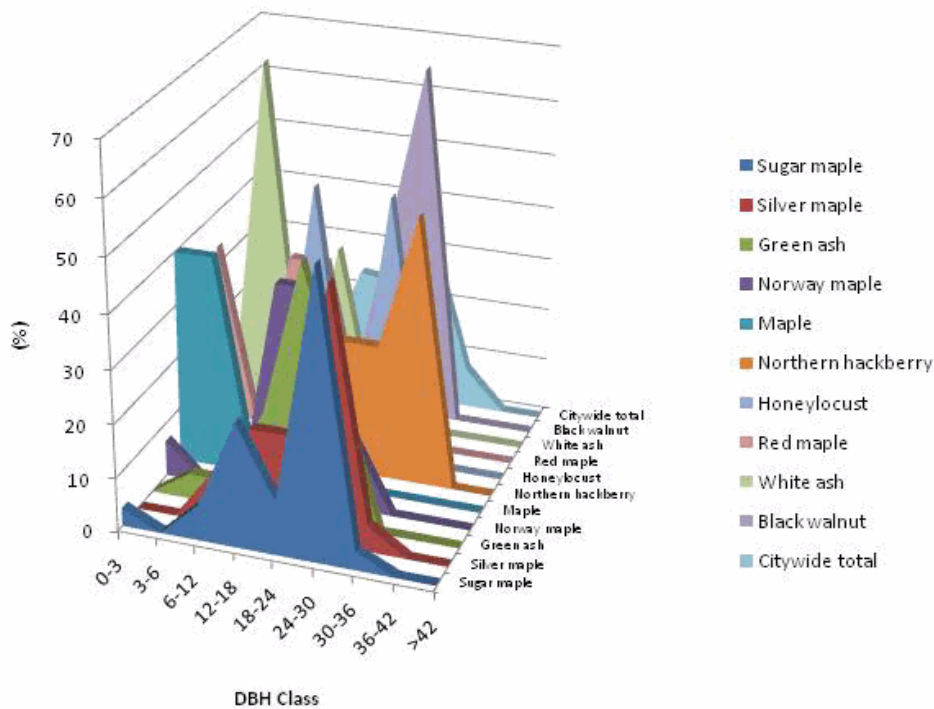
7/9/2010



Species	Percent
Sugar maple	24.6
Silver maple	17.2
Green ash	17.2
Norway maple	12.3
Maple	4.1
Northern hackberry	3.3
Honeylocust	3.3
Red maple	2.5
White ash	2.5
Black walnut	2.5
Other species	10.7
Total	100.0

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

7/9/2010



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Sugar maple	3.3	0.0	6.7	23.3	10.0	53.3	3.3	0.0	0.0
Silver maple	0.0	0.0	9.5	19.0	19.0	47.6	4.8	0.0	0.0
Green ash	0.0	4.8	4.8	19.0	47.6	23.8	0.0	0.0	0.0
Norway maple	6.7	0.0	0.0	40.0	40.0	13.3	0.0	0.0	0.0
Maple	40.0	40.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	0.0	25.0	25.0	50.0	0.0	0.0
Honeylocust	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0
Red maple	33.3	0.0	33.3	33.3	0.0	0.0	0.0	0.0	0.0
White ash	0.0	66.7	0.0	33.3	0.0	0.0	0.0	0.0	0.0
Black walnut	0.0	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0
Citywide total	4.1	4.1	6.6	23.8	23.0	31.1	7.4	0.0	0.0

Figure 2: Relative Age Class

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

7/19/2010

## Citywide total

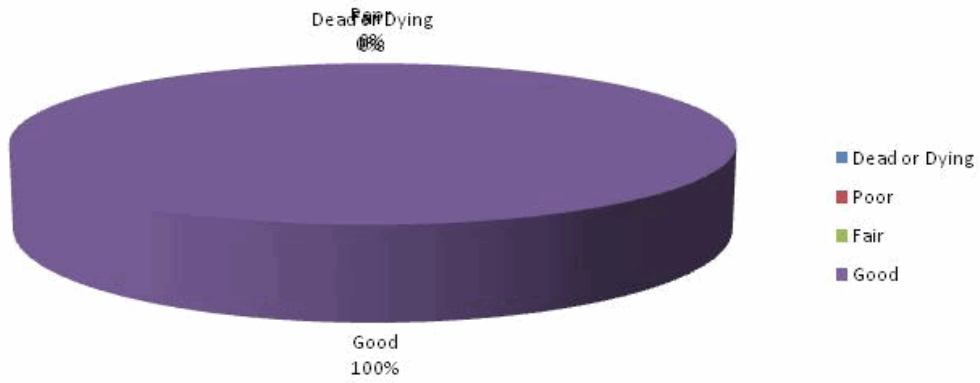


Figure 3: Foliage Condition

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

7/19/2010

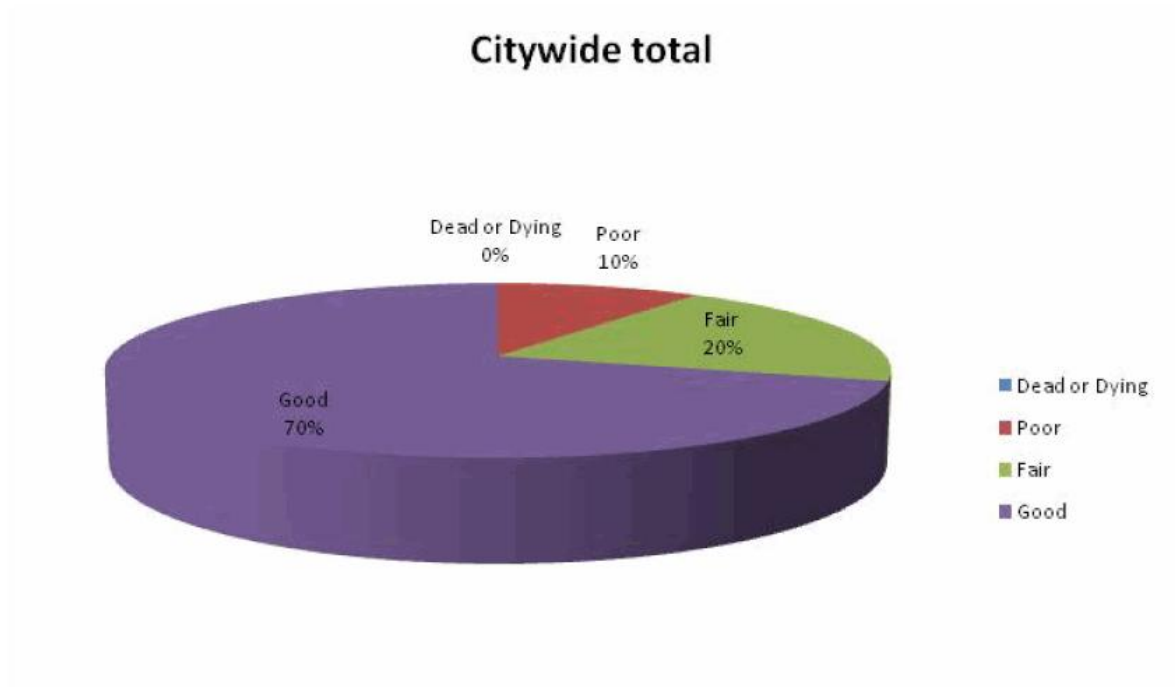
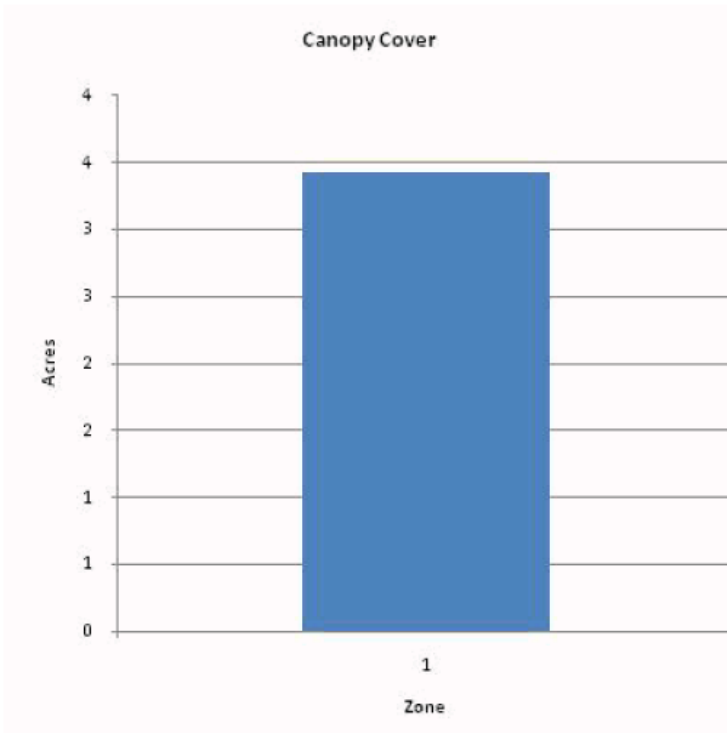


Figure 4: Wood Condition

## Canopy Cover of Public Trees (Acres)

7/9/2010



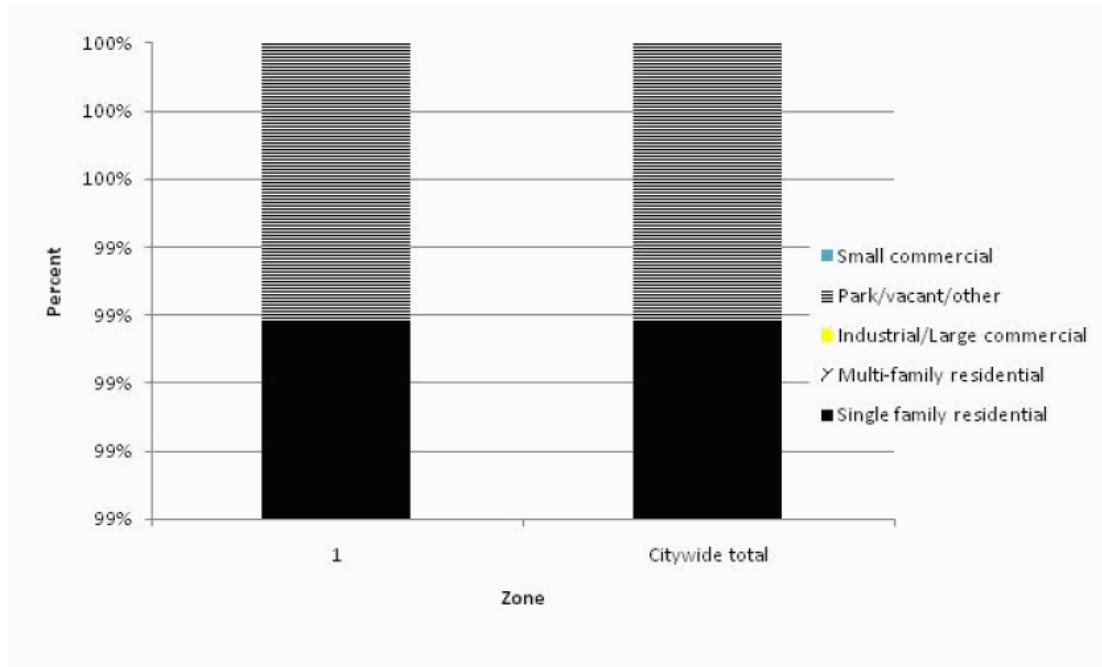
Zone	Acres	% of Total Canopy Cover
1	3	100.0
Citywide total	3	100.0

	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	3		

**Figure 5: Canopy Cover in Acres**

## Land Use of Public Trees by Zone (%)

7/9/2010

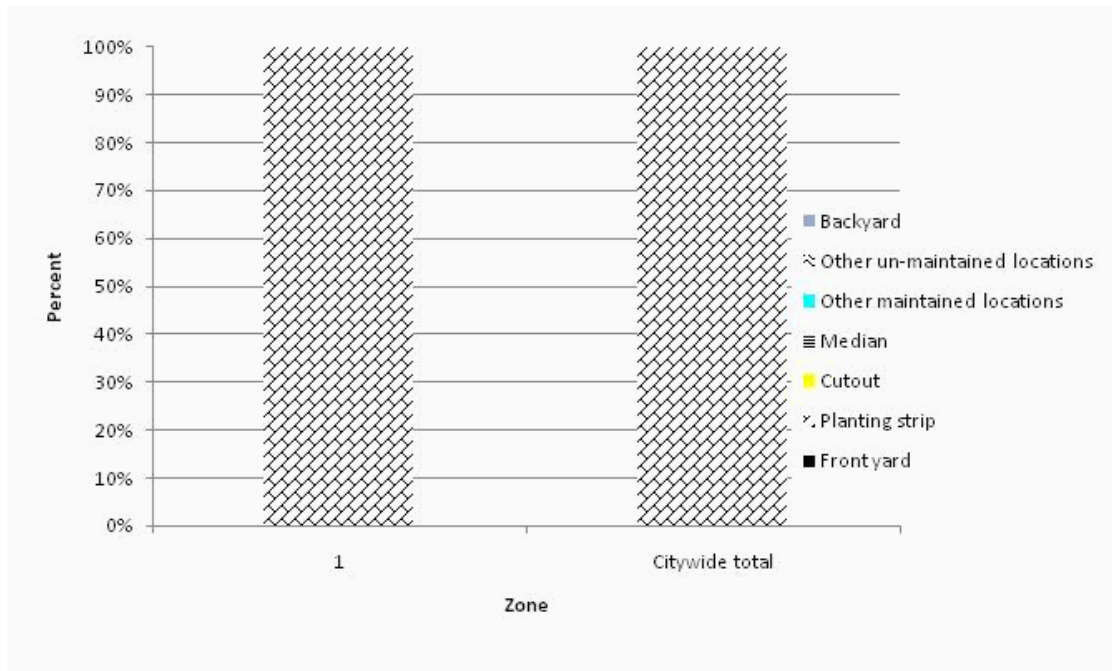


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	99.2	0.0	0.0	0.8	0.0
Citywide total	99.2	0.0	0.0	0.8	0.0

**Figure 6: Land Use of city/park trees**

## Location of Public Trees by Zone (%)

7/9/2010



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

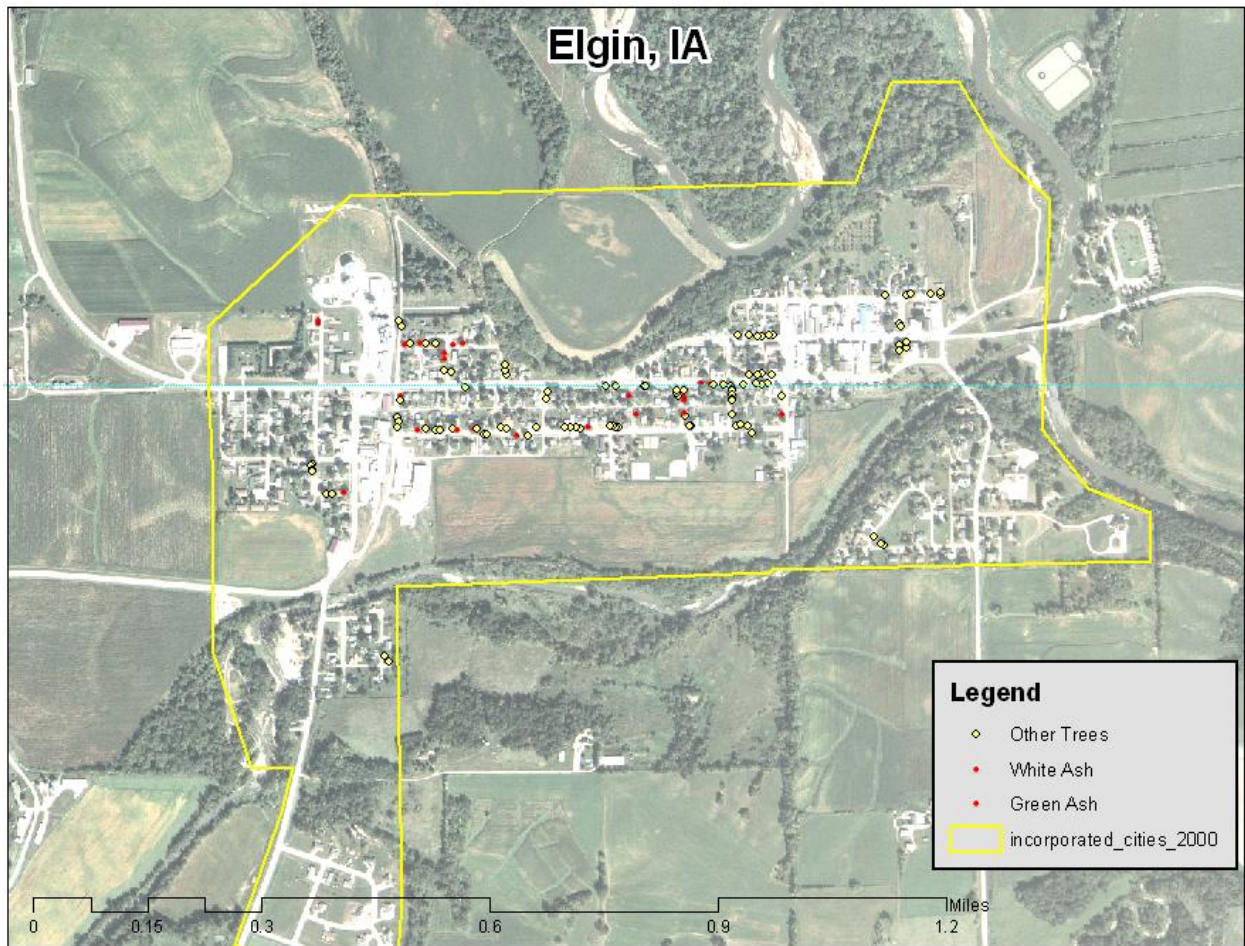


Figure 1: Location of Ash Trees

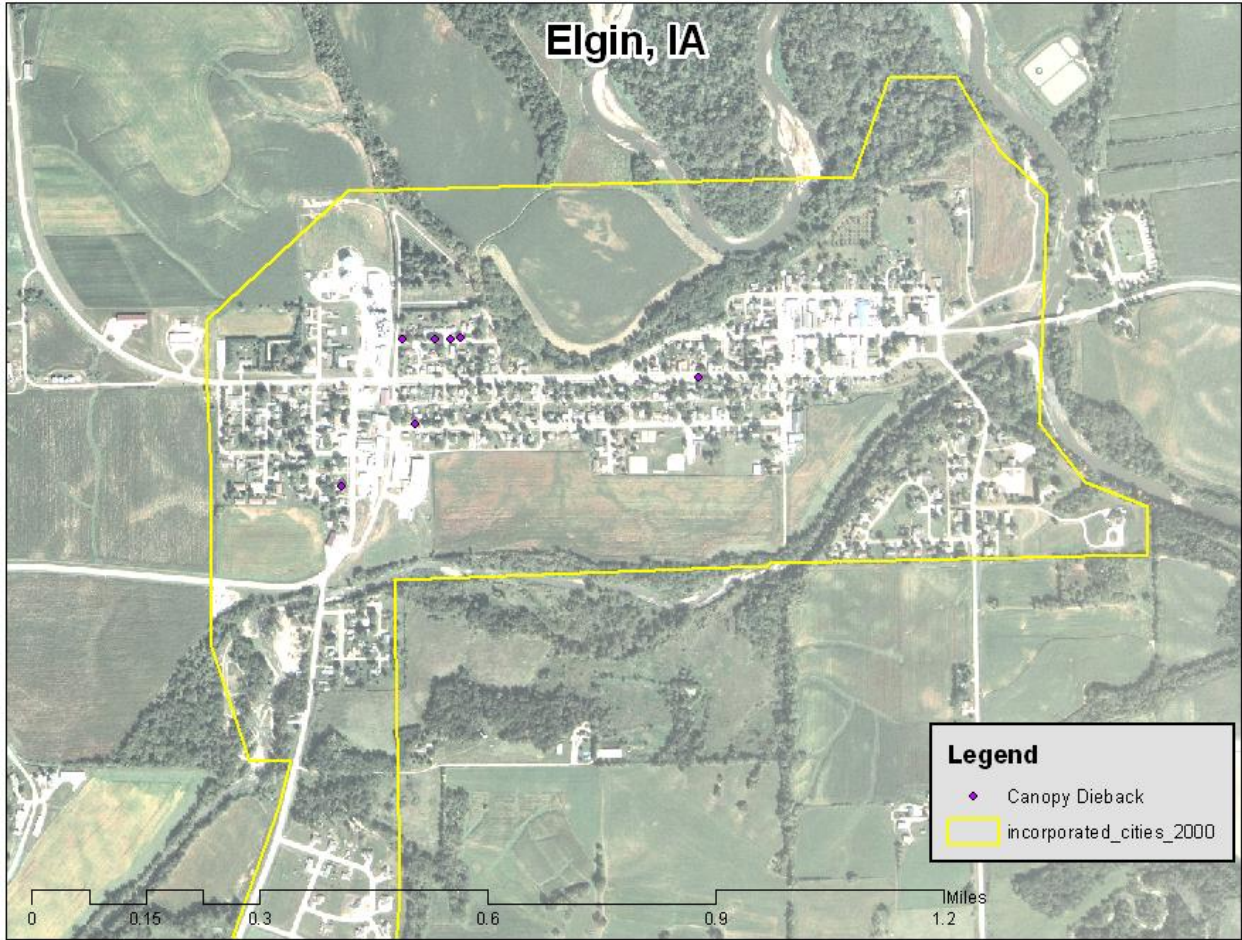
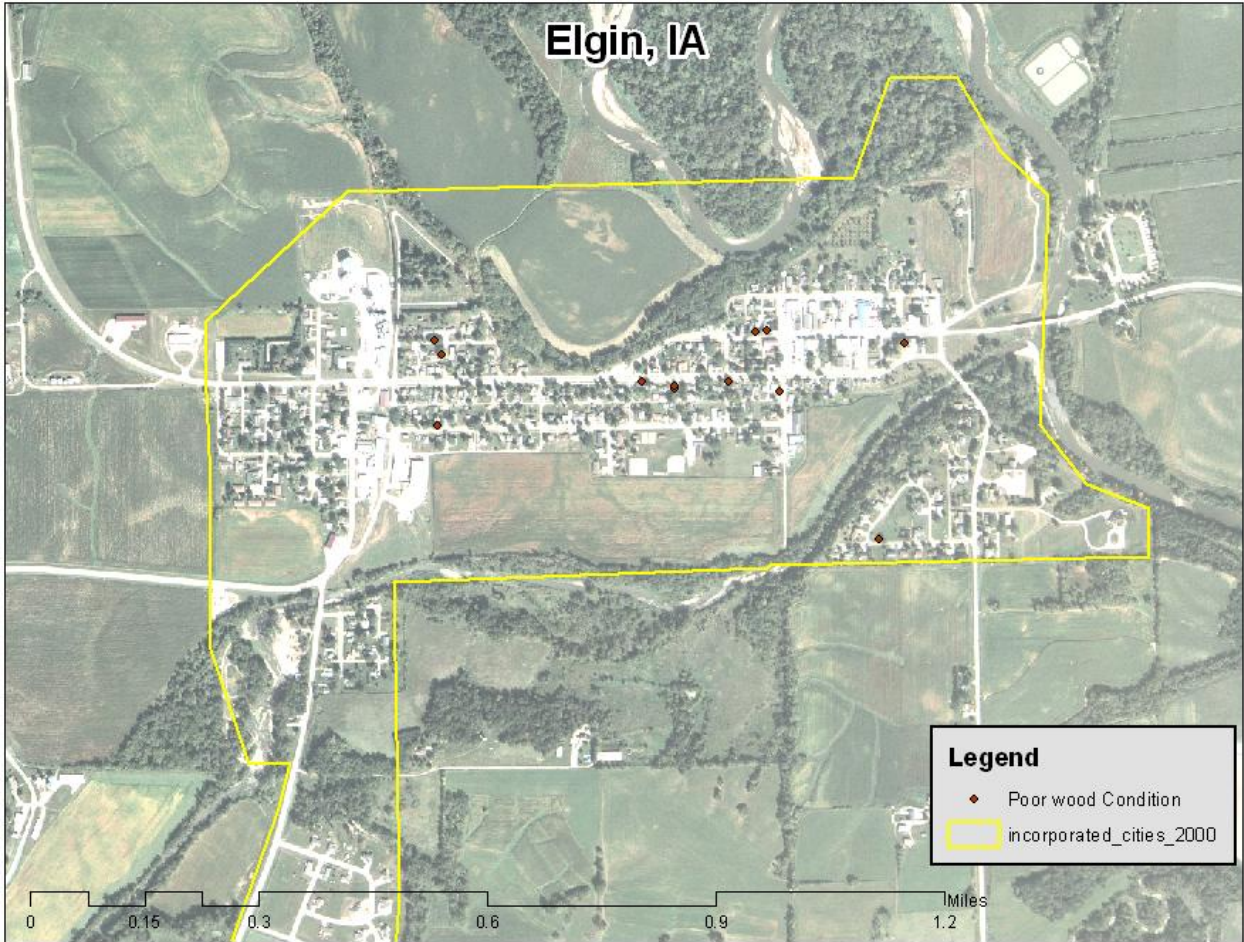
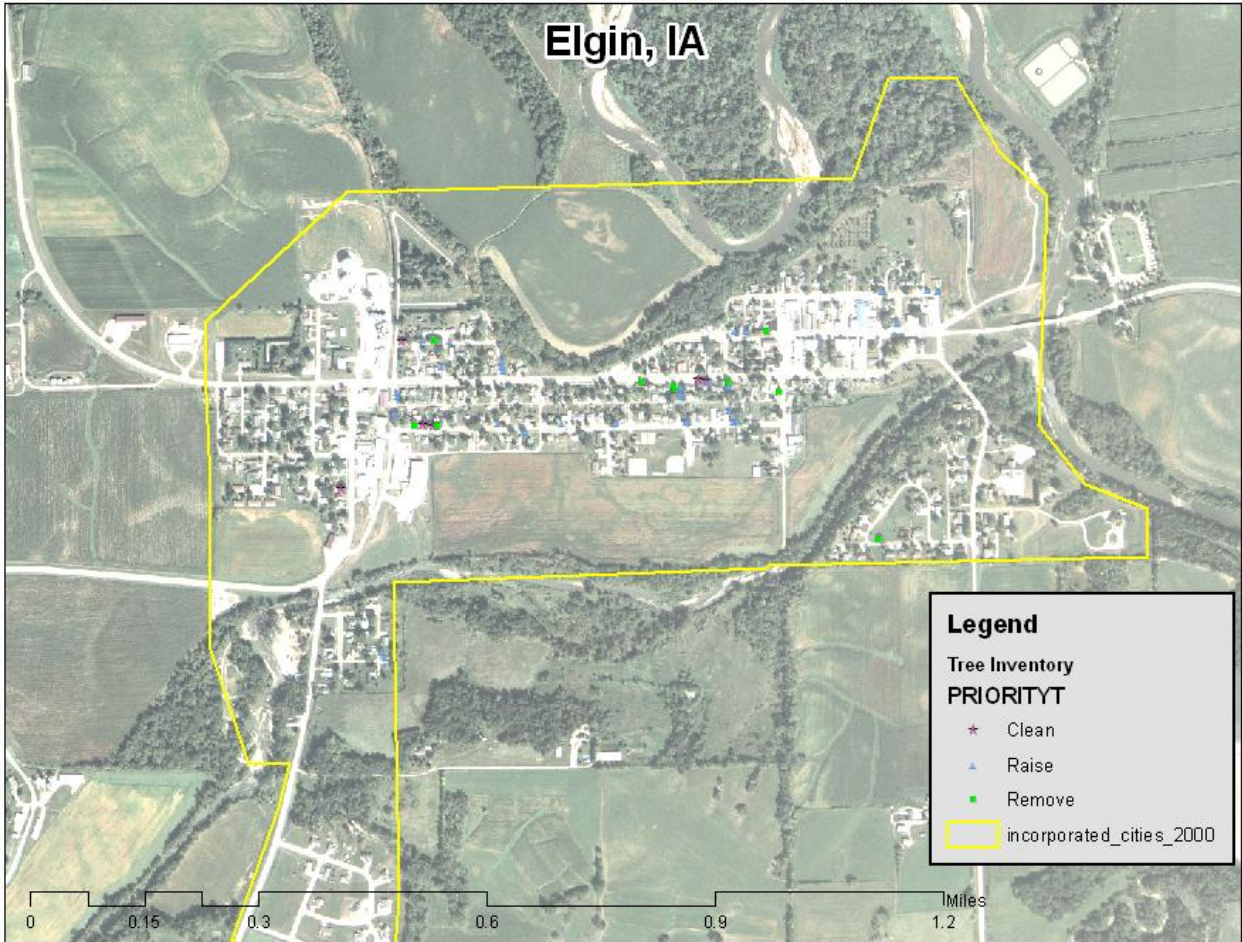


Figure 2: Location of EAB symptoms





**Figure 3: Location of Poor Condition Trees**



**Figure 4: Location of Trees with Recommended Maintenance\*City ownership of the trees recommended for removal should be verified prior to any removal\***

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