

# MONMOUTH, IA



2011 Management Plan  
Prepared by Steven Swinonos  
Bureau of Forestry, Iowa DNR



# Table of Contents

<b>Executive Summary</b> .....	<b>4</b>
Overview.....	4
Inventory and Results.....	4
Recommendations.....	4
<b>Introduction</b> .....	<b>5</b>
<b>Inventory</b> .....	<b>6</b>
<b>Inventory Results</b> .....	<b>7</b>
<i>Annual Benefits</i> .....	6
Annual Energy Benefits .....	6
Annual Stormwater Benefits .....	6
Annual Air Quality Benefits .....	6
Annual Carbon Benefits.....	6
Annual Aesthetics Benefits .....	6
Financial Summary of all Benefits.....	6
<i>Forest Structure</i> .....	7
Species Distribution .....	7
Age Class .....	7
Condition: Wood and Foliage .....	7
Management Needs.....	7
Canopy Cover .....	7
Land Use and Location .....	7
<b>Recommendations</b> .....	<b>8</b>
Risk Management .....	8
Pruning Cycle.....	8
Planting .....	8
Continual Monitoring.....	9
Six Year Maintenance Plan with No Additional Funding .....	9
<b>Emerald Ash Borer</b> .....	<b>9</b>
Ash Tree Removal .....	10
EAB Quarantines .....	10
Wood Disposal.....	10
Canopy Replacement .....	11
Postponed Work .....	11
Monitoring .....	11
Private Ash Trees.....	11
<b>Budget</b> .....	<b>10</b>
<b>Works Cited</b> .....	<b>11</b>
<b>Appendix A: i-Tree Data</b> .....	<b>12</b>
<b>Appendix B: ArcGIS Mapping</b> .....	<b>13</b>

# Executive Summary

---

## Overview

This plan was developed to assist the City of Monmouth with managing its park trees, 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 20% of Monmouth's city park 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 20 trees inventoried.

- Monmouth's trees provide \$4,240 of benefits annually, an average of \$212 a tree
- There are 8 species of trees
- The top three genus are: Maple 45%, ash 20%, and Crab apple 10%
- 10% of trees are in need of some type of management
- 1 tree is 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 1 tree needing removal, the 1 tree is 12 - 18 inches in diameter at 4.5 ft and must be addressed in the near future. [\\*City ownership of the trees recommended for removal should be verified prior to any removal\\*](#)
- None of the 4 ash trees are in need of follow up because they are not displaying signs and symptoms associated with EAB
- All trees should be pruned on a routine schedule- one half of the park trees every other year, then wait 3 years.
- 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 Monmouth with the management, budgeting and future planning of their park trees. 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 Monmouth, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

## Inventory

---

In 2011, a tree inventory was conducted that included 100% of the city owned trees in the park. 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 20 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. Monmouth's trees reduce energy related costs by approximately \$1,138 annually (Appendix A, Table 1). These savings are both in Electricity (5.5 MWh) and in Natural Gas (735.7 Therms).

#### Annual Stormwater Benefits

Monmouth's trees intercept about 58,460 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$1,584 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 Monmouth, it is estimated that trees remove 69 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 \$193 (Appendix A, Table 3).

#### Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Monmouth, trees sequester about 21,334 lbs of carbon a year with an associated value of \$160 (Appendix A, Table 4). In addition, the trees store 216,027 lbs of carbon, with a yearly benefit of \$1,620 (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. Monmouth receives \$1,164 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, Monmouth's trees provide \$4,240 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 20 trees in Monmouth provide approximately \$212 annually (Appendix A, Table 7).

## **Forest Structure**

### Species Distribution

Monmouth has 8 different tree species in its park (Appendix A, Figure 1).

The distribution of trees by genus is as follows:

Maple(Silver,Sugar)	9	45%
Ash	4	20%
Crab Apple	2	10%

### Size Class

Most of Monmouth's trees (60%) 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. Monmouth'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 Monmouth indicate that 95% of the trees are in good health, with 5% foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 75% of Monmouth'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 1% 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 Cleaning	1	5%
Tree Removal	1	5%

### Canopy Cover

The canopy cover of Monmouth is approximately 1 acre (Appendix A, Figure 4). According to the 2000 census, Monmouth occupies 38 acres. Thus the canopy cover on city land is about 2%.

### Land Use and Location

The all of Monmouth's city trees are in the city park (Appendix A, Figure 6 & Appendix A, Figure 7). The following describes the land use and locations for the street and park trees.

### Land Use

Park/vacant/other	100%
-------------------	------

## Location

Park

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

Springbrook has 1 immediate tree that needs removal. This trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). The removal is not critical concerns but should be address as soon as possible. Please refer to the six year maintenance plan at the end of this section. After the immediate concern tree is addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming.

### Poor tree species

Ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). There are a total of 4 ash trees, and none 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 trees in the park in Monmouth.

It is important to plant a diverse mix of species in the park 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 park trees. Presently, the forest is moderately planted with Maple (45%) (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: 1 intermediate concern Siberian elm tree
- Visual Survey for signs and symptoms of EAB
- Replant 1 tree

#### Year 2

- Removal: none needed
- Routine trimming: Contract to trim ½ of the city trees
- Visual Survey for signs and symptoms of EAB

#### Year 3

- Visual Survey for signs and symptoms of EAB

#### Year 4

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

#### Year 5

- Visual Survey for signs and symptoms of EAB

#### Year 6

- Visual Survey for signs and symptoms of EAB

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



# Emerald Ash Borer Plan

---

## Ash Tree Removal

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

## EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

## Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website [http://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/emerald\\_ash\\_b/regulatory.shtml](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, Siberian/Chinese elm, evergreen, willow or black walnut.

### Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genus other than ash will be prioritized by hazardous or emergency situations only.

### Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

### Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB.

# Budget

---

## **Current Budget**

**Total \$1,000 over 6 years (\$167/year)**

### **FY 2012 Budget**

Removal: \$500

Replanting 1 tree: \$100

### **FY 2013 Budget**

Routine trimming: \$200

### **FY 2014 Budget**

### **FY 2015 Budget**

Routine trimming: \$200

### **FY 2016 Budget**

### **FY 2017 Budget**

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

## **Purposed Budget Increase**

EAB could potentially kill all ash trees in Monmouth's city park 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 \$200 a year. If the budget were increased to \$2,000 a year all ash could be removed within 1 year. Additionally, it is recommended that Monmouth 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.

## **Works Cited**

Census Bureau. 2000. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2010)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, D.J. and J.F. Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J.; McPherson, E. Gregory; Simpson, James R.; Vargas, Kelaine E.; Xiao, Qingfu  
2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen.  
Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific  
Southwest Research Station. p.115

# Monmouth, IA



# 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
Silver maple	1.5	113	187.8	184	297	(N/A)	25.0	26.1	59.35
Sugar maple	1.4	107	188.9	185	292	(N/A)	20.0	25.7	72.96
Ash	1.0	76	138.1	135	211	(N/A)	20.0	18.5	52.73
Apple	0.4	28	49.3	48	76	(N/A)	10.0	6.7	38.13
Siberian elm	0.7	51	93.1	91	142	(N/A)	10.0	12.5	71.03
Eastern red cedar	0.1	8	16.4	16	25	(N/A)	5.0	2.2	24.57
Blue spruce	0.1	10	15.2	15	25	(N/A)	5.0	2.2	24.51
White oak	0.3	25	46.9	46	71	(N/A)	5.0	6.2	70.91
Other street trees	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	5.5	417	735.7	721	1,138	(N/A)	100.0	100.0	56.89

**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
Silver maple	16,839	456	(N/A)	25.0	28.8	91.27
Sugar maple	18,674	506	(N/A)	20.0	31.9	126.52
Ash	7,776	211	(N/A)	20.0	13.3	52.69
Apple	1,333	36	(N/A)	10.0	2.3	18.06
Siberian elm	6,717	182	(N/A)	10.0	11.5	91.03
Eastern red cedar	1,634	44	(N/A)	5.0	2.8	44.30
Blue spruce	1,544	42	(N/A)	5.0	2.6	41.85
White oak	3,943	107	(N/A)	5.0	6.7	106.85
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	58,460	1,584	(N/A)	100.0	100.0	79.22

**Table 3: Annual Air Quality Benefits**

## Annual Air Quality Benefits of Public Trees by Species

10/14/2011

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 <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>								
Silver maple	2.5	0.4	1.3	0.1	13	6.9	1.0	1.0	6.7	44	-1.4	-5	18.5	52	(N/A)	25.0	10.38
Sugar maple	3.1	0.5	1.5	0.1	16	6.7	1.0	0.9	6.4	42	-2.4	-9	17.8	49	(N/A)	20.0	12.29
Ash	1.4	0.2	0.7	0.1	8	4.8	0.7	0.7	4.5	30	-0.3	-1	12.8	36	(N/A)	20.0	9.04
Apple	0.4	0.1	0.2	0.0	2	1.7	0.3	0.2	1.7	11	0.0	0	4.6	13	(N/A)	10.0	6.56
Siberian elm	1.0	0.2	0.5	0.0	6	3.2	0.5	0.4	3.0	20	0.0	0	8.9	25	(N/A)	10.0	12.72
Eastern red cedar	0.3	0.1	0.3	0.0	2	0.5	0.1	0.1	0.5	3	-0.9	-3	1.0	2	(N/A)	5.0	2.19
Blue spruce	0.2	0.0	0.2	0.0	1	0.6	0.1	0.1	0.6	4	-0.6	-2	1.2	3	(N/A)	5.0	2.89
White oak	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	5.0	12.48
Other street trees	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.0	0.00
Citywide total	9.4	1.6	4.8	0.5	51	26.1	3.8	3.6	24.9	163	-5.5	-21	69.1	193	(N/A)	100.0	9.66

**Table 4: Annual Carbon Stored**

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

10/14/2011

Species	Total Stored CO <sub>2</sub> (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	52,280	392	(N/A)	25.0	24.2	78.42
Sugar maple	92,051	690	(N/A)	20.0	42.6	172.60
Ash	23,139	174	(N/A)	20.0	10.7	43.39
Apple	6,074	46	(N/A)	10.0	2.8	22.78
Siberian elm	24,490	184	(N/A)	10.0	11.3	91.84
Eastern red cedar	1,102	8	(N/A)	5.0	0.5	8.27
Blue spruce	1,118	8	(N/A)	5.0	0.5	8.39
White oak	15,773	118	(N/A)	5.0	7.3	118.30
Other street trees	0	0	(N/A)	0.0	0.0	0.00
<b>Citywide total</b>	<b>216,027</b>	<b>1,620</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>81.01</b>

**Table 5: Annual Carbon Sequestered**

**Annual CO<sub>2</sub> 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 Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	4,848	36	-251	-1	-2	2,492	19	7,087	53 (N/A)	25.0	33.2	10.63
Sugar maple	3,843	29	-442	-1	-3	2,358	18	5,758	43 (N/A)	20.0	27.0	10.80
Ash	1,712	13	-111	-1	-1	1,670	13	3,270	25 (N/A)	20.0	15.3	6.13
Apple	535	4	-29	0	0	617	5	1,123	8 (N/A)	10.0	5.3	4.21
Siberian elm	1,279	10	-118	0	-1	1,122	8	2,284	17 (N/A)	10.0	10.7	8.56
Eastern red cedar	0	0	-5	0	0	187	1	181	1 (N/A)	5.0	0.9	1.36
Blue spruce	91	1	-5	0	0	213	2	298	2 (N/A)	5.0	1.4	2.23
White oak	857	6	-76	0	-1	552	4	1,333	10 (N/A)	5.0	6.3	10.00
Other street trees	0	0	0	0	0	0	0	0	0 (N/A)	0.0	0.0	0.00
<b>Citywide total</b>	<b>13,164</b>	<b>99</b>	<b>-1,037</b>	<b>-4</b>	<b>-8</b>	<b>9,211</b>	<b>69</b>	<b>21,334</b>	<b>160 (N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>8.00</b>

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

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

10/14/2011

Species	Total Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	418 (N/A)	25.0	35.9	83.57
Sugar maple	368 (N/A)	20.0	31.6	92.08
Ash	164 (N/A)	20.0	14.1	41.11
Apple	31 (N/A)	10.0	2.7	15.48
Siberian elm	92 (N/A)	10.0	7.9	46.00
Eastern red cedar	0 (N/A)	5.0	0.0	0.00
Blue spruce	25 (N/A)	5.0	2.2	25.23
White oak	66 (N/A)	5.0	5.6	65.59
Other street trees	0 (±NaN)	0.0	0.0	0.00
<b>Citywide total</b>	<b>1,164 (N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>58.22</b>

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

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

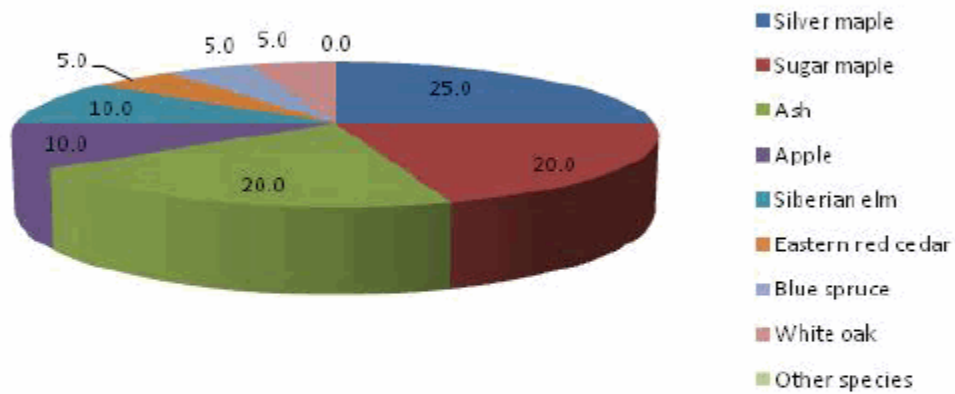
10/14/20

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Silver maple	297	53	52	456	418	1,276	(±0)	30.1
Sugar maple	292	43	49	506	368	1,259	(±0)	29.7
Ash	211	25	36	211	164	647	(±0)	15.3
Apple	76	8	13	36	31	165	(±0)	3.9
Siberian elm	142	17	25	182	92	459	(±0)	10.8
Eastern red cedar	25	1	2	44	0	72	(±0)	1.7
Blue spruce	25	2	3	42	25	97	(±0)	2.3
White oak	71	10	12	107	66	266	(±0)	6.3
Other street trees	0	0	0	0	0	0	(±0)	0.0
<b>Citywide Total</b>	<b>1,138</b>	<b>160</b>	<b>193</b>	<b>1,584</b>	<b>1,164</b>	<b>4,240</b>	<b>(±0)</b>	<b>100.0</b>



## Species Distribution of Public Trees (%)

10/14/2011

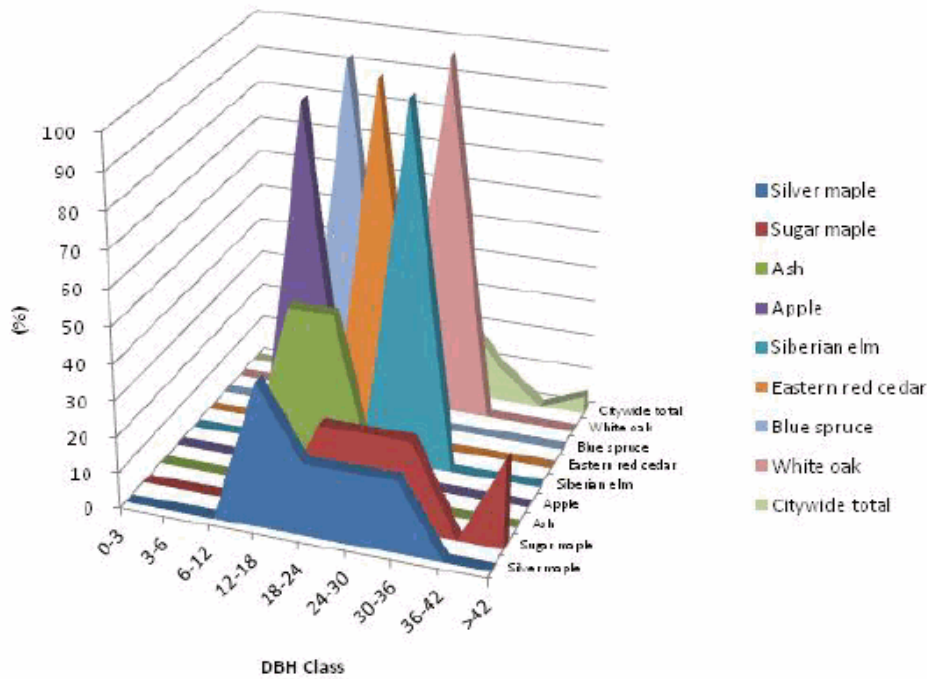


Species	Percent
Silver maple	25.0
Sugar maple	20.0
Ash	20.0
Apple	10.0
Siberian elm	10.0
Eastern red cedar	5.0
Blue spruce	5.0
White oak	5.0
Other species	0.0
Total	100.0

**Figure 1: Species Distribution**

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

10/14/2011



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Silver maple	0.0	0.0	0.0	40.0	20.0	20.0	20.0	0.0	0.0
Sugar maple	0.0	0.0	0.0	0.0	25.0	25.0	25.0	0.0	25.0
Ash	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Apple	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Siberian elm	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Eastern red cedar	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Blue spruce	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
White oak	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Citywide total	0.0	0.0	0.0	35.0	25.0	25.0	10.0	0.0	5.0

Figure 2: Relative Age Class

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

10/14/2011

## Citywide total

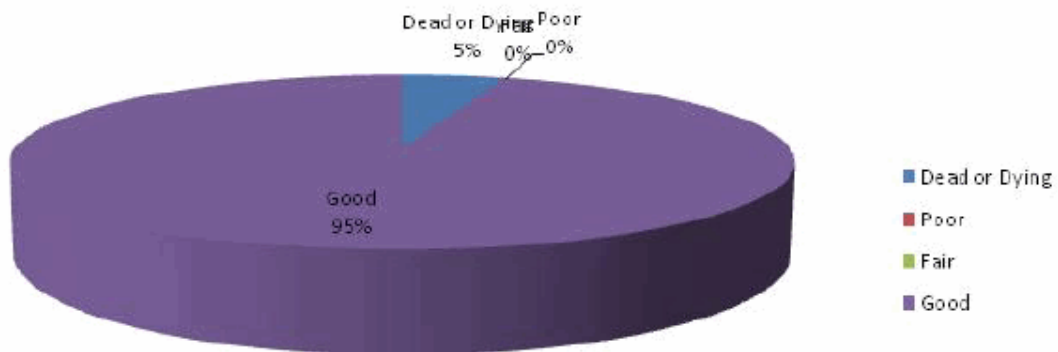


Figure 3: Foliage Condition

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

10/14/2011

## Citywide total

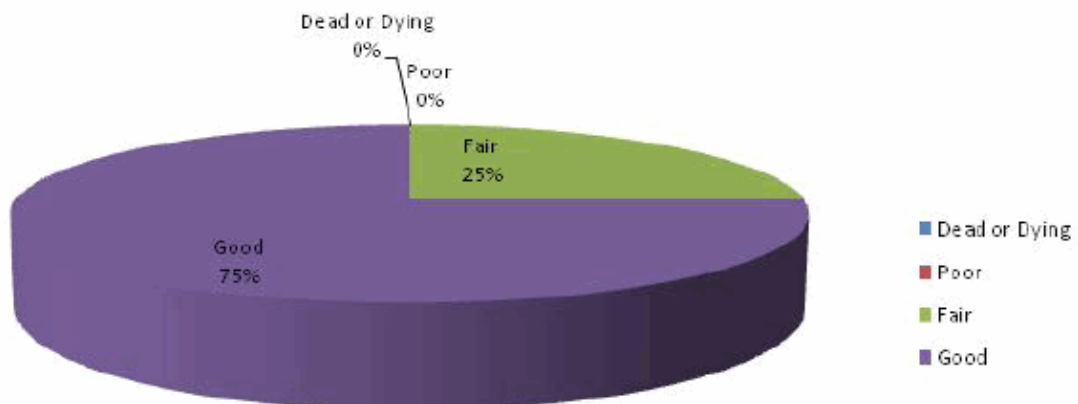
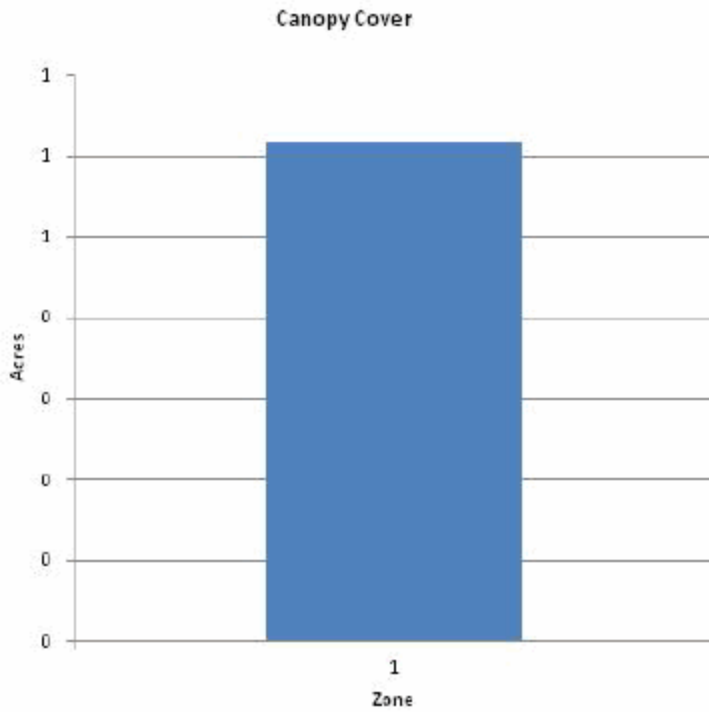


Figure 4: Wood Condition

# Canopy Cover of Public Trees (Acres)

10/15/2011



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

Figure 5: Canopy Cover in Acres

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

10/14/2011

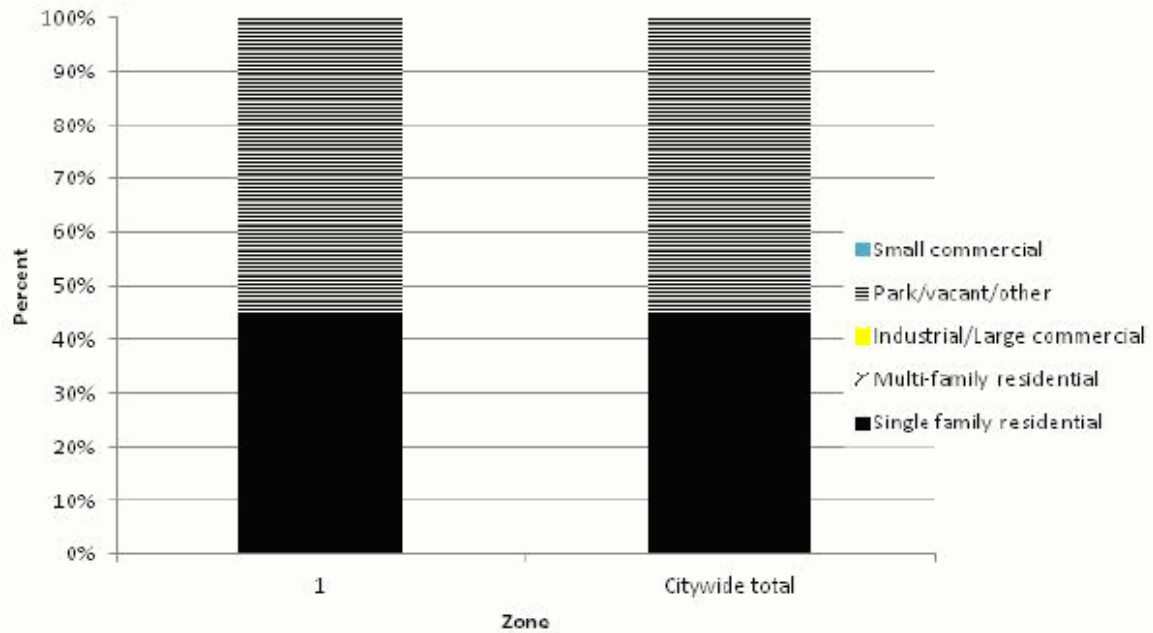
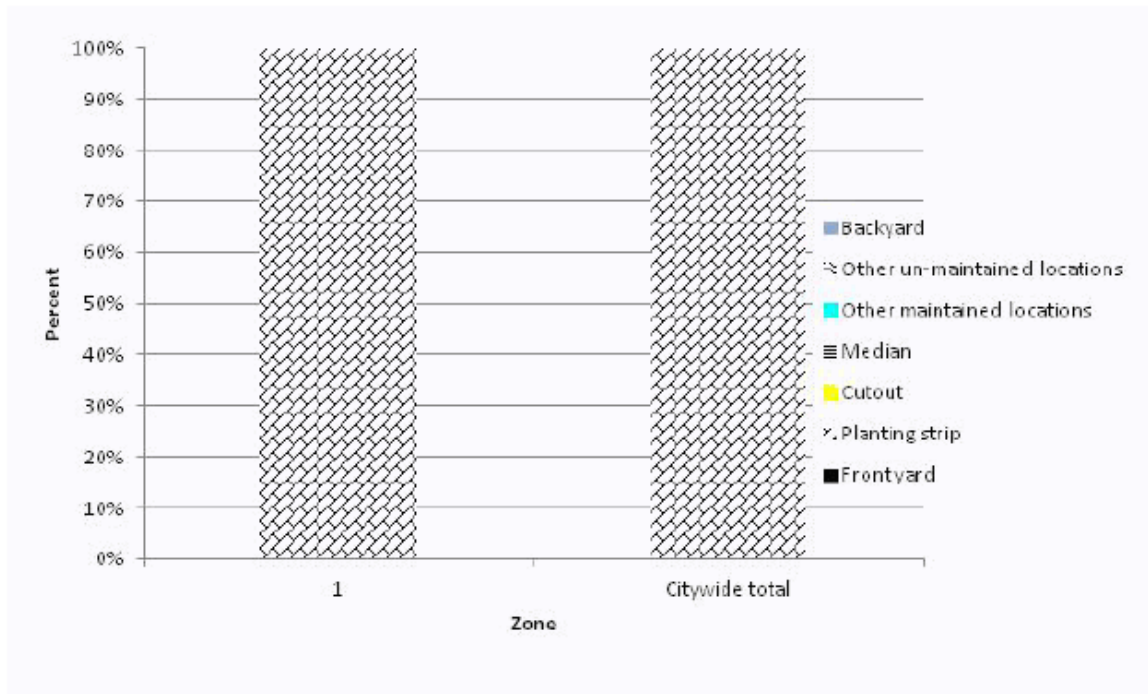


Figure 6: Land Use of city/park trees

## Location of Public Trees by Zone (%)

10/14/2011



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

**NO SIGNS OR SYMPTOMS**

Figure 2: Location of EAB symptoms



Figure 3: Location of Poor Condition Trees



**NO TASK ORDER**

**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\*

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

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

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