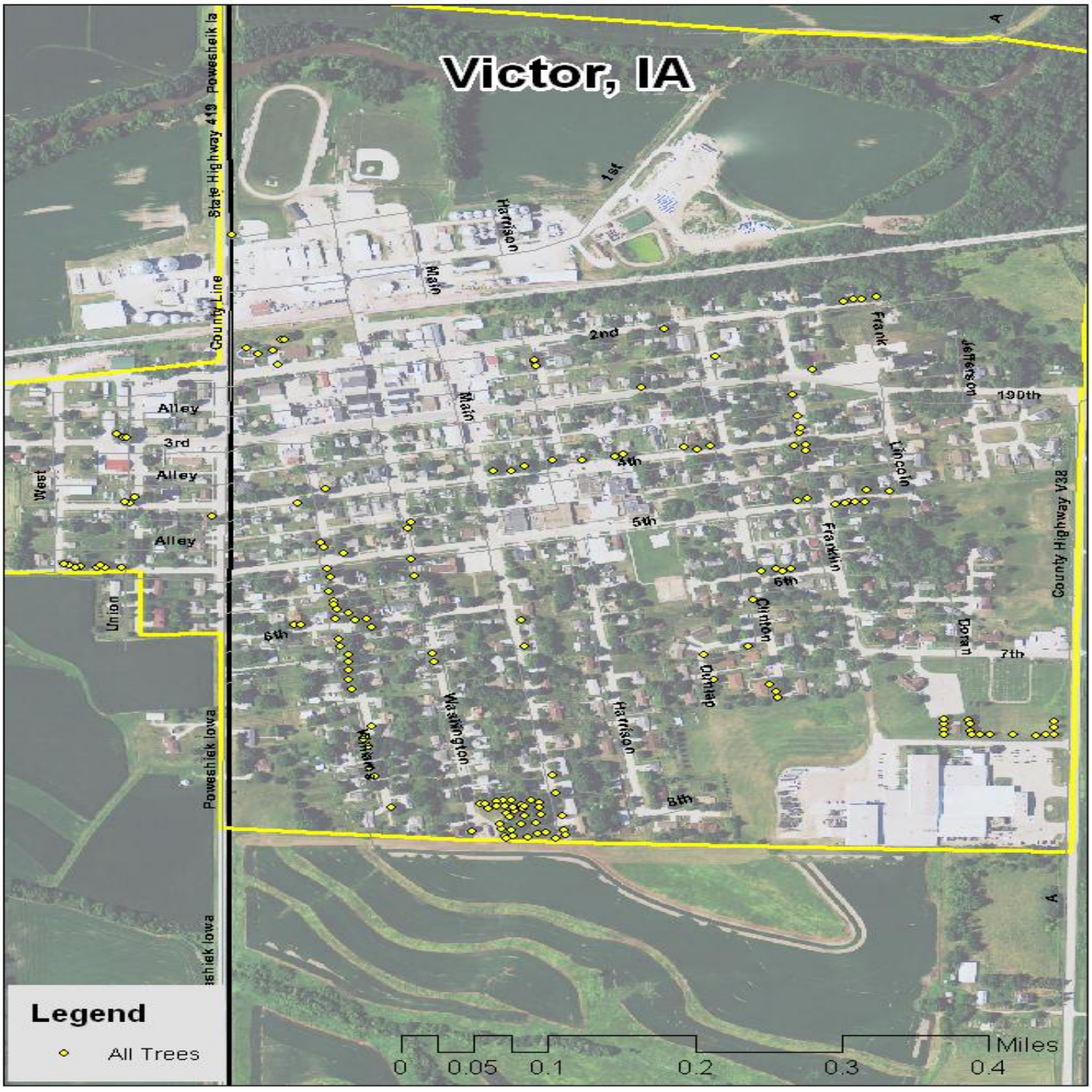
Victor, IA



2012 Management Plan

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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Victor 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 29% of Victor'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 2012, 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 165 trees inventoried.

- Victor's trees provide $34,174. of benefits annually, an average of $207 a tree
- There are over 17 species of trees
- The top three genus are: Maple 32%, Ash 29%, and Hackberry 9%
- 89% of trees are in need of some type of management
- 4 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 4 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*
- 9 of the 48 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 third of the city every other year
- Plant a diverse mix of trees that do not include: ash and maple
- Check ash trees with a visual survey yearly
- With the current budget it could take 24 years to remove ash – Suggestion: request a budget increase to $10,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2012, 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 165 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. Findings

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Victor's trees reduce energy related costs by approximately $9,592 annually (Appendix A, Table 1). These savings are both in Electricity (45.6 MWh) and in Natural Gas (3,460 Therms).

Annual Stormwater Benefits

Victor's trees intercept about 469,512 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $12,725 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 Victor it is estimated that trees remove 586 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 $1,659. (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Victor, trees sequester about 1,656,365 lbs of carbon a year with an associated value of $12,423 (Appendix A, Table 4). In addition, the trees store 161,930 lbs of carbon, with a yearly benefit of $1,214 (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. Victor receives $8,983 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, Victor's trees provide $34,174. of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 165 trees in Victor provide approximately $207 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Victor has over 17 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Green Ash	41	25%
Sugar Maple	23	14%
Norway Maple	14	9%
Northern Hackberry	14	9%
Silver Maple	9	6%
Black Walnut	8	5%
Northern Pin Oak	8	5%
Ash	7	4%
Bur Oak	7	4%
Maple	3	2%
Other species	26	16%

Age Class

Most of Victor's trees (35%) are between 12 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 18 inches in diameter at 4.5 ft. Victor's size curve is on the smaller side, indicating a younger than average stand.

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 Victor indicate that 6% of the trees are in good health, with only 1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 21% of Victor'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 15% of the population. This 15% 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	146	89%
Crown Raising	11	6%
Tree Staking	3	2%
Tree Removal	8	5%
Crown Reduction	1	1%

Canopy Cover

The canopy cover of Victors is approximately 5 acres (Appendix A, Figure 4). According to the 2010 census, Victor occupies 313.6 acres. Thus the canopy cover on city land is about 2%.

Land Use and Location

The majority of Victor's city and park trees are in planting strips in single family residential neighborhoods (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	65%
Park/vacant/other	34%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

Location	
Planting strip	100%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	0%

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

Victor has 4 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 4 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are a total of 19 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 8 removals, 3 are ash trees. There are a total of 41 ash trees, and 9 of those have signs and symptoms that have been associated with EAB. In addition, there are 15 trees that are in poor health. *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 Victor.

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 (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. All trees planted must meet the restrictions in the 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 <u>No Additional Funding</u>

Year 1

Removal: 4 largest critical concern trees
Planting and Replacement: 4 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 4 critical concern trees and 8 additional ash trees with poor health
Planting and Replacement: 4 trees in open locations from year one removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 4 trees - removal of any new critical concern trees and 8 ash in poor health
Planting and Replacement: 12 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 8 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 12 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 8 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 8 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 9 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 8 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 30 to 38 ash trees removed (approximately 25% of ash). It will take approximately 24 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 years of its arrival.

** To remove all ash trees within 6 years, the budget would need to be increased to $19,500 a year. If the budget were increased to $10,000 a year all ash could be removed in 13 years.

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 the city ordinance. The new plantings will be a diverse mix and will not include ash and maple.

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 $10,692.00 over 6 years ($1,782.00/year)

FY 2012 Budget
Removal: $2000.00 (Additional $218.00 funding needed)
Planting: ($400. Additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

FY 2013 Budget
Removal: $6,000.00 (Additional $4,230.00 funding needed)
Planting: ($400 additional funding needed)
Routine trimming: ($312.00 additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

FY 2014 Budget
Removal: $6,000.00 (Additional $4,230.00 funding needed)
Planting: ($1,200. Additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

FY 2015 Budget
Removal: $4,000.00 (Additional $3,418.00 funding needed)
Planting: ($1,200. additional funding needed)
Routine trimming: ($312.00 additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

FY 2016 Budget
Removal: $4,000.00 (Additional $3,418.00 funding needed)
Planting: ($800 additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

FY 2017 Budget
Removal: $4,500 (Additional $6,718.00 funding needed)
Planting: ($800 additional funding needed)
Routine trimming: ($312.00 additional funding needed)
Watering & Maintenance: ($500 additional funding needed)

*Reduction of ash over 6 years: approximately 30 to 38 ash trees removed (approximately 25% of ash). **It will take approximately 24 years to remove all ash with the current budget.**

Purposed Budget Increase

EAB could potentially kill all ash trees in Victor within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $8,330. a year. If the budget were increased to $10,000 a year all ash could be removed within 13 years. Additionally, it is recommended that Victor 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

Victor

Annual Energy Benefits of Public Trees by Species

1/10/2013

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	11.0	839	1,509.1	1,479	2,317	(N/A)	25.0	24.2	56.52
Sugar maple	6.9	524	917.7	899	1,423	(N/A)	14.0	14.8	61.87
Norway maple	3.6	270	490.2	480	751	(N/A)	9.2	7.8	50.05
Northern hackberry	5.3	404	759.9	745	1,149	(N/A)	9.2	12.0	76.59
Silver maple	3.6	276	487.3	478	753	(N/A)	6.7	7.9	68.46
Black walnut	2.0	151	260.4	255	406	(N/A)	4.9	4.2	50.77
Northern pin oak	2.5	188	361.4	354	543	(N/A)	4.9	5.7	67.83
Ash	2.0	153	288.2	282	436	(N/A)	4.3	4.5	62.23
Bur oak	2.0	153	282.6	277	430	(N/A)	3.7	4.5	71.58
Maple	0.9	69	116.5	114	183	(N/A)	2.4	1.9	45.79
Red maple	0.6	45	79.6	78	123	(N/A)	2.4	1.3	30.67
Northern red oak	0.7	56	104.6	103	158	(N/A)	2.4	1.7	39.60
Ohio buckeye	0.6	49	94.8	93	142	(N/A)	1.2	1.5	70.84
Birch	0.3	26	46.3	45	71	(N/A)	1.2	0.7	35.62
Honeylocust	0.6	47	84.6	83	130	(N/A)	1.2	1.4	64.79
Apple	0.4	28	49.3	48	76	(N/A)	1.2	0.8	38.13
White oak	0.6	43	73.8	72	115	(N/A)	1.2	1.2	57.57
Other street trees	1.9	141	250.5	246	387	(N/A)	4.9	4.0	48.37
Citywide total	45.6	3,460	6,257.0	6,132	9,592	(N/A)	100.0	100.0	58.49

Table 2: Annual Stormwater Benefits

Victor

Annual Stormwater Benefits of Public Trees by Species

1/10/2013

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	114,684	3,108	(N/A)	25.0	24.4	75.81
Sugar maple	76,614	2,076	(N/A)	14.0	16.3	90.28
Norway maple	26,733	725	(N/A)	9.2	5.7	48.30
Northern hackberry	50,611	1,372	(N/A)	9.2	10.8	91.44
Silver maple	49,263	1,335	(N/A)	6.7	10.5	121.37
Black walnut	16,224	440	(N/A)	4.9	3.5	54.96
Northern pin oak	27,758	752	(N/A)	4.9	5.9	94.04
Ash	20,353	552	(N/A)	4.3	4.3	78.80
Bur oak	25,795	699	(N/A)	3.7	5.5	116.52
Maple	6,700	182	(N/A)	2.4	1.4	45.39
Red maple	3,480	94	(N/A)	2.4	0.7	23.58
Northern red oak	8,118	220	(N/A)	2.4	1.7	55.00
Ohio buckeye	7,528	204	(N/A)	1.2	1.6	102.01
Birch	1,995	54	(N/A)	1.2	0.4	27.03
Honeylocust	5,810	157	(N/A)	1.2	1.2	78.73
Apple	1,333	36	(N/A)	1.2	0.3	18.06
White oak	5,408	147	(N/A)	1.2	1.2	73.29
Other street trees	21,107	572	(N/A)	4.9	4.5	71.50
Citywide total	469,512	12,725	(N/A)	100.0	100.0	77.59

Table 3: Annual Air Quality Benefits

Victor

Annual Air Quality Benefits of Public Trees by Species

1/10/2013

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Green ash	13.3	2.1	6.5	0.6	71	52.7	7.7	7.3	50.1	328	0.0	0	140.4	400	(N/A)	25.0	9.75
Sugar maple	10.2	1.7	5.1	0.4	55	32.7	4.8	4.6	31.3	204	-8.0	-30	82.7	229	(N/A)	14.0	9.97
Norway maple	4.8	0.8	2.4	0.2	26	17.1	2.5	2.4	16.2	106	-1.2	-4	45.1	128	(N/A)	9.1	8.52
Northern hackberry	7.7	1.3	4.0	0.3	42	25.7	3.7	3.5	24.2	160	0.0	0	70.6	202	(N/A)	9.1	13.46
Silver maple	7.9	1.3	4.0	0.4	43	17.2	2.5	2.4	16.4	107	-4.1	-15	48.0	135	(N/A)	6.7	12.27
Black walnut	1.5	0.2	0.8	0.1	8	9.4	1.4	1.3	9.0	59	0.0	0	23.7	67	(N/A)	4.9	8.38
Northern pin oak	6.3	1.1	3.0	0.3	34	12.1	1.7	1.7	11.3	75	-1.4	-5	35.9	103	(N/A)	4.9	12.87
Ash	4.4	0.8	2.1	0.2	24	9.8	1.4	1.3	9.2	60	-1.0	-4	28.1	80	(N/A)	4.3	11.47
Bur oak	3.5	0.6	1.6	0.2	18	9.7	1.4	1.3	9.1	60	0.0	0	27.3	78	(N/A)	3.7	13.06
Maple	1.5	0.3	0.7	0.1	8	4.3	0.6	0.6	4.1	27	-0.5	-2	11.6	33	(N/A)	2.4	8.17
Red maple	0.6	0.1	0.3	0.0	3	2.8	0.4	0.4	2.7	17	-0.2	-1	7.0	20	(N/A)	2.4	4.92
Northern red oak	1.8	0.3	0.8	0.1	9	3.5	0.5	0.5	3.3	22	-2.5	-9	8.4	22	(N/A)	2.4	5.50
Ohio buckeye	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)	1.2	13.58
Birch	0.3	0.0	0.2	0.0	2	1.6	0.2	0.2	1.5	10	-0.1	0	4.0	11	(N/A)	1.2	5.69
Honeylocust	1.1	0.2	0.5	0.0	6	2.9	0.4	0.4	2.8	18	-0.8	-3	7.6	21	(N/A)	1.2	10.61
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)	1.2	6.56
White oak	0.6	0.1	0.3	0.0	3	2.7	0.4	0.4	2.6	17	0.0	0	7.0	20	(N/A)	1.2	9.95
Other street trees	3.4	0.6	1.8	0.2	19	8.9	1.3	1.2	8.4	55	-1.3	-5	24.5	69	(N/A)	4.9	8.65
Citywide total	70.9	11.9	35.1	3.2	383	217.8	31.7	30.2	206.6	1,357	-21.5	-81	586.0	1,659	(N/A)	100.0	10.12

Table 4: Annual Carbon Stored

Victor

Stored CO2 Benefits of Public Trees by Species

1/10/2013

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	433,737	3,253	(N/A)	25.0	26.2	79.34
Sugar maple	290,322	2,177	(N/A)	14.0	17.5	94.67
Norway maple	77,766	583	(N/A)	9.2	4.7	38.88
Northern	114,193	856	(N/A)	9.2	6.9	57.10
Silver maple	168,188	1,261	(N/A)	6.7	10.2	114.67
Black walnut	48,518	364	(N/A)	4.9	2.9	45.49
Northern pin oak	103,585	777	(N/A)	4.9	6.3	97.11
Ash	72,314	542	(N/A)	4.3	4.4	77.48
Bur oak	113,663	852	(N/A)	3.7	6.9	142.08
Maple	16,294	122	(N/A)	2.4	1.0	30.55
Red maple	6,926	52	(N/A)	2.4	0.4	12.99
Northern red oak	38,708	290	(N/A)	2.4	2.3	72.58
Ohio buckeye	28,560	214	(N/A)	1.2	1.7	107.10
Birch	4,725	35	(N/A)	1.2	0.3	17.72
Honeylocust	13,485	101	(N/A)	1.2	0.8	50.57
Apple	6,074	46	(N/A)	1.2	0.4	22.78
White oak	19,445	146	(N/A)	1.2	1.2	72.92
Other street trees	45,297	749	(N/A)	4.9	6.0	93.62
Citywide total	1,656,365	12,423	(N/A)	100.0	100.0	75.75

Table 5: Annual Carbon Sequestered

Victor

Annual CO_2 Benefits of Public Trees by Species

1/10/2013

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
Green ash	26,004	195	-2,082	-8	-16	18,531	139	42,445	318	(N/A)	25.0	26.2	7.76
Sugar maple	15,270	115	-1,394	-4	-10	11,575	87	25,447	191	(N/A)	14.0	15.7	8.30
Norway maple	6,131	46	-373	-3	-3	5,976	45	11,731	88	(N/A)	9.2	7.2	5.87
Northern hackberry	6,778	51	-548	-3	-4	8,932	67	15,159	114	(N/A)	9.2	9.4	7.58
Silver maple	13,872	104	-807	-2	-6	6,090	46	19,152	144	(N/A)	6.7	11.8	13.06
Black walnut	4,420	33	-233	-2	-2	3,337	25	7,523	56	(N/A)	4.9	4.7	7.05
Northern pin oak	1,866	14	-497	-2	-4	4,165	31	5,532	41	(N/A)	4.9	3.4	5.19
Ash	2,722	20	-347	-1	-3	3,384	25	5,758	43	(N/A)	4.3	3.6	6.17
Bur oak	4,905	37	-546	-1	-4	3,372	25	7,730	58	(N/A)	3.7	4.8	9.66
Maple	2,055	15	-78	-1	-1	1,524	11	3,500	26	(N/A)	2.4	2.2	6.56
Red maple	979	7	-33	-1	0	988	7	1,933	14	(N/A)	2.4	1.2	3.62
Northern red oak	757	6	-186	-1	-1	1,235	9	1,805	14	(N/A)	2.4	1.1	3.38
Ohio buckeye	0	0	-137	0	-1	1,077	8	940	7	(N/A)	1.2	0.6	3.52
Birch	610	5	-23	0	0	571	4	1,158	9	(N/A)	1.2	0.7	4.34
Honeylocust	1,873	14	-65	0	0	1,030	8	2,838	21	(N/A)	1.2	1.8	10.64
Apple	535	4	-29	0	0	617	5	1,123	8	(N/A)	1.2	0.7	4.21
White oak	1,302	10	-93	0	-1	945	7	2,154	16	(N/A)	1.2	1.3	8.08
Other street trees	3,358	25	-479	-2	-4	3,126	23	6,004	45	(N/A)	4.9	3.7	5.63
Citywide total	93,437	701	-7,951	-32	-60	76,476	574	161,930	1,214	(N/A)	100.0	100.0	7.41

Table 6: Annual Social and Aesthetic Benefits

Victor

Annual Aesthetic/Other Benefits of Public Trees by Species

1/10/2013

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	2,221	(N/A)	25.0	24.7	54.17
Sugar maple	1,589	(N/A)	14.0	17.7	69.08
Norway maple	598	(N/A)	9.2	6.7	39.85
Northern hackberry	897	(N/A)	9.2	10.0	59.78
Silver maple	1,124	(N/A)	6.7	12.5	102.17
Black walnut	414	(N/A)	4.9	4.6	51.77
Northern pin oak	165	(N/A)	4.9	1.8	20.63
Ash	247	(N/A)	4.3	2.8	35.32
Bur oak	372	(N/A)	3.7	4.1	61.92
Maple	271	(N/A)	2.4	3.0	67.67
Red maple	155	(N/A)	2.4	1.7	38.85
Northern red oak	53	(N/A)	2.4	0.6	13.21
Ohio buckeye	0	(N/A)	1.2	0.0	0.00
Birch	65	(N/A)	1.2	0.7	32.69
Honeylocust	389	(N/A)	1.2	4.3	194.60
Apple	31	(N/A)	1.2	0.3	15.48
White oak	111	(N/A)	1.2	1.2	55.72
Other street trees	281	(N/A)	4.9	3.1	35.17
Citywide total	8,983	(N/A)	100.0	100.0	54.78

Table 7: Summary of Benefits in Dollars

Victor

Total Annual Benefits of Public Trees by Species ($)

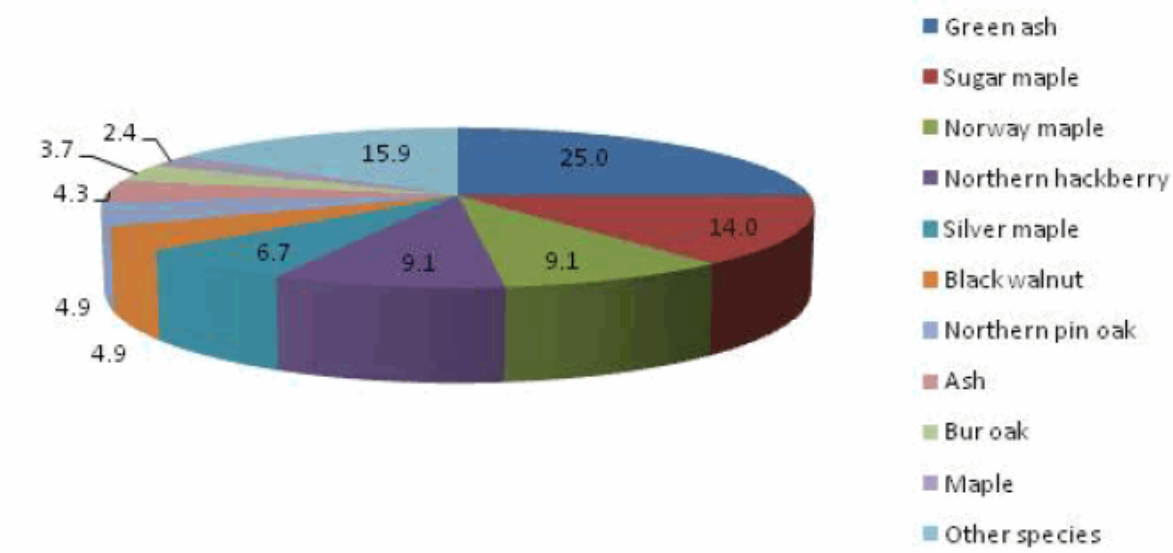
1/10/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	2,317	318	400	3,108	2,221	8,365	(±0)	24.5
Sugar maple	1,423	191	229	2,076	1,589	5,508	(±0)	16.1
Norway maple	751	88	128	725	598	2,289	(±0)	6.7
Northern hackberry	1,149	114	202	1,372	897	3,733	(±0)	10.9
Silver maple	753	144	135	1,335	1,124	3,491	(±0)	10.2
Black walnut	406	56	67	440	414	1,384	(±0)	4.0
Northern pin oak	543	41	103	752	165	1,604	(±0)	4.7
Ash	436	43	80	552	247	1,358	(±0)	4.0
Bur oak	430	58	78	699	371	1,636	(±0)	4.8
Maple	183	26	33	182	271	694	(±0)	2.0
Red maple	123	14	20	94	155	407	(±0)	1.2
Northern red oak	158	14	22	220	53	467	(±0)	1.4
Ohio buckeye	142	7	27	204	0	380	(±0)	1.1
Birch	71	9	11	54	65	211	(±0)	0.6
Honeylocust	130	21	21	157	389	719	(±0)	2.1
Apple	76	8	13	36	31	165	(±0)	0.5
White oak	115	16	20	147	111	409	(±0)	1.2
Other street trees	387	45	69	572	281	1,355	(±0)	4.0
Citywide Total	9,592	1,214	1,659	12,725	8,983	34,174	(±0)	100.0

Victor

Species Distribution of Public Trees (%)

1/10/2013



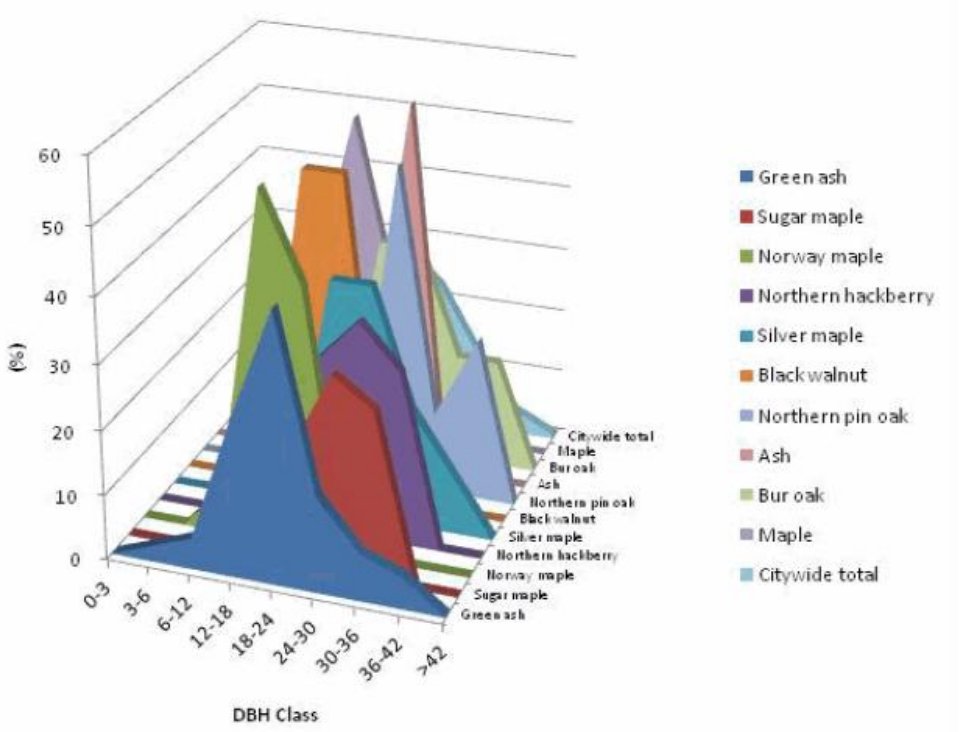
Species	Percent
Green ash	25.0
Sugar maple	14.0
Norway maple	9.1
Northern hackberry	9.1
Silver maple	6.7
Black walnut	4.9
Northern pin oak	4.9
Ash	4.3
Bur oak	3.7
Maple	2.4
Other species	15.9
Total	100.0

Figure 1: Species Distribution

Victor

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

1/10/2013



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Green ash	0.0	2.4	4.9	24.4	41.5	14.6	7.3	4.9	0.0
Sugar maple	0.0	0.0	0.0	26.1	17.4	30.4	26.1	0.0	0.0
Norway maple	0.0	0.0	6.7	53.3	40.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	13.3	26.7	33.3	26.7	0.0	0.0
Silver maple	0.0	0.0	0.0	0.0	36.4	36.4	18.2	9.1	0.0
Black walnut	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Northern pin oak	0.0	0.0	0.0	12.5	0.0	50.0	12.5	25.0	0.0
Ash	0.0	0.0	0.0	28.6	14.3	57.1	0.0	0.0	0.0
Bur oak	0.0	0.0	0.0	0.0	33.3	33.3	16.7	16.7	0.0
Maple	0.0	0.0	25.0	50.0	25.0	0.0	0.0	0.0	0.0
Citywide total	0.6	0.6	6.1	25.6	28.0	22.6	12.2	3.7	0.6

Figure 2: Relative Age Class

Victor

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

1/10/2013

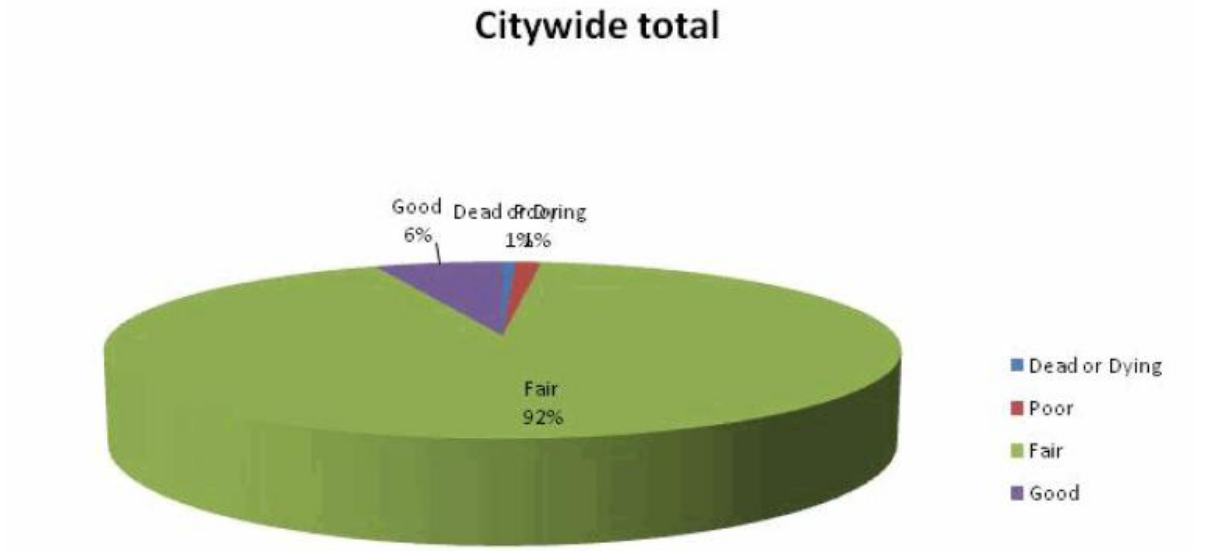


Figure 3: Foliage Condition

Victor

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

1/10/2013

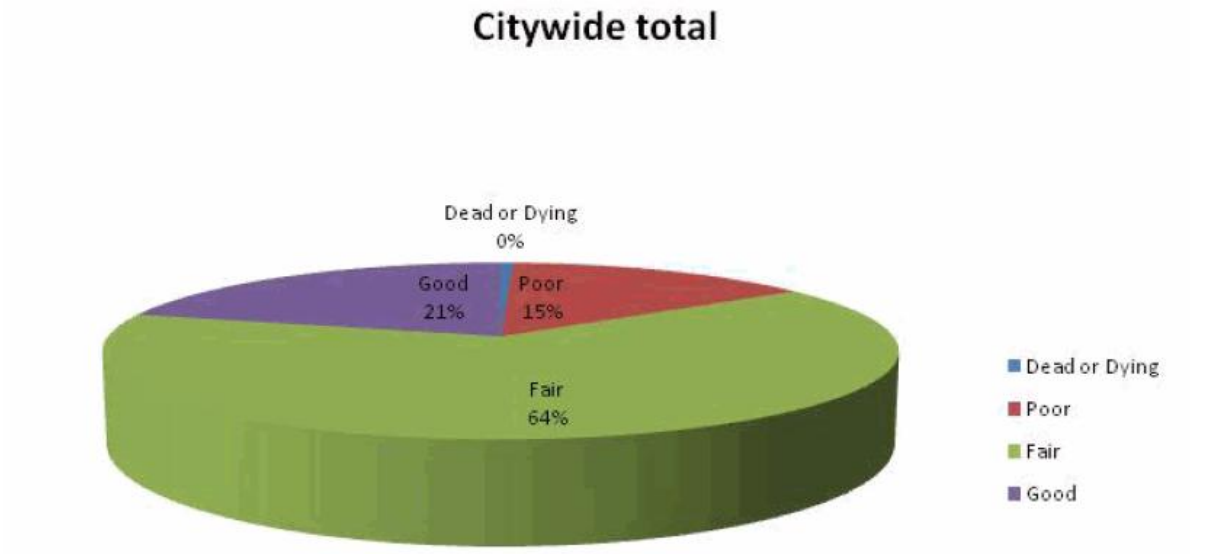
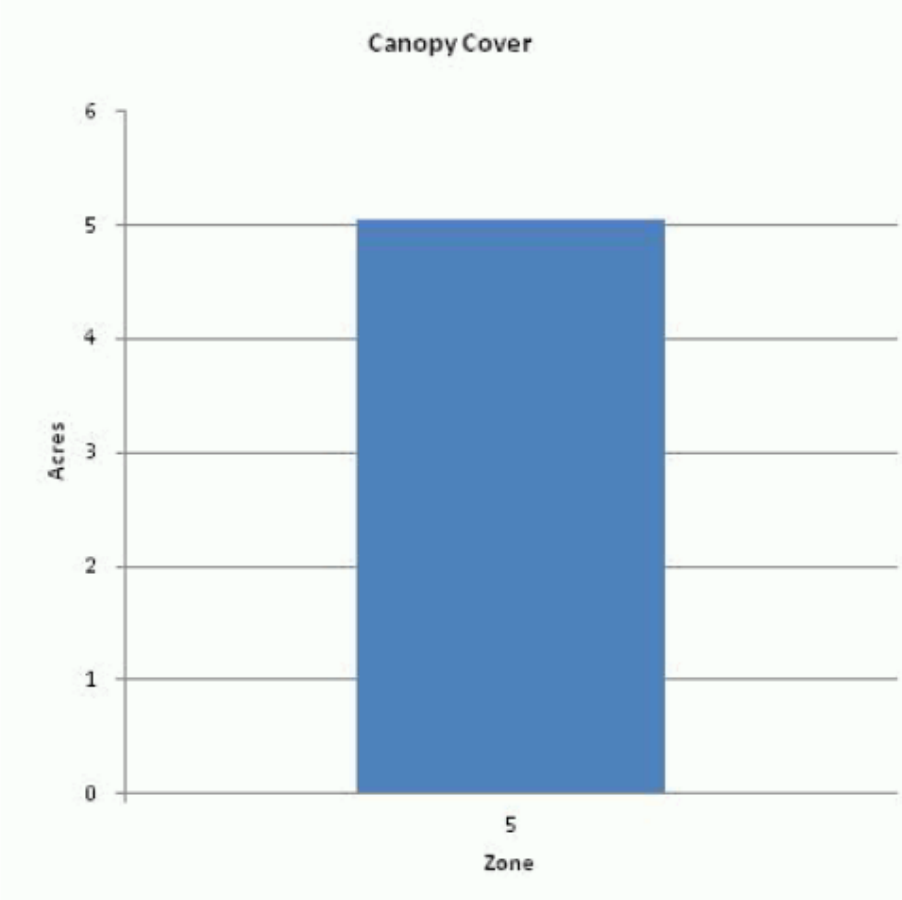


Figure 4: Wood Condition

Victor

Canopy Cover of Public Trees (Acres)

1/10/2013



Zone	Acres	% of Total Canopy Cover
5	5	100.0
Citywide total	5	100.0

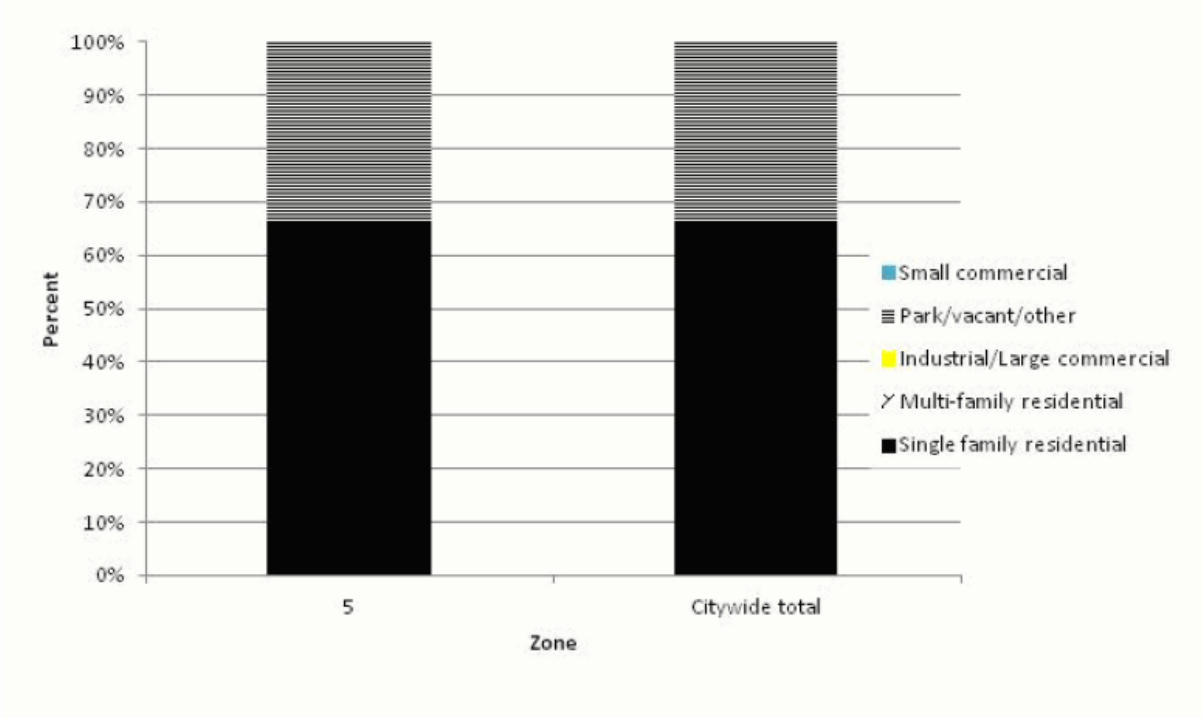
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	5		

Figure 5: Canopy Cover in Acres

Victor

Land Use of Public Trees by Zone (%)

1/10/2013



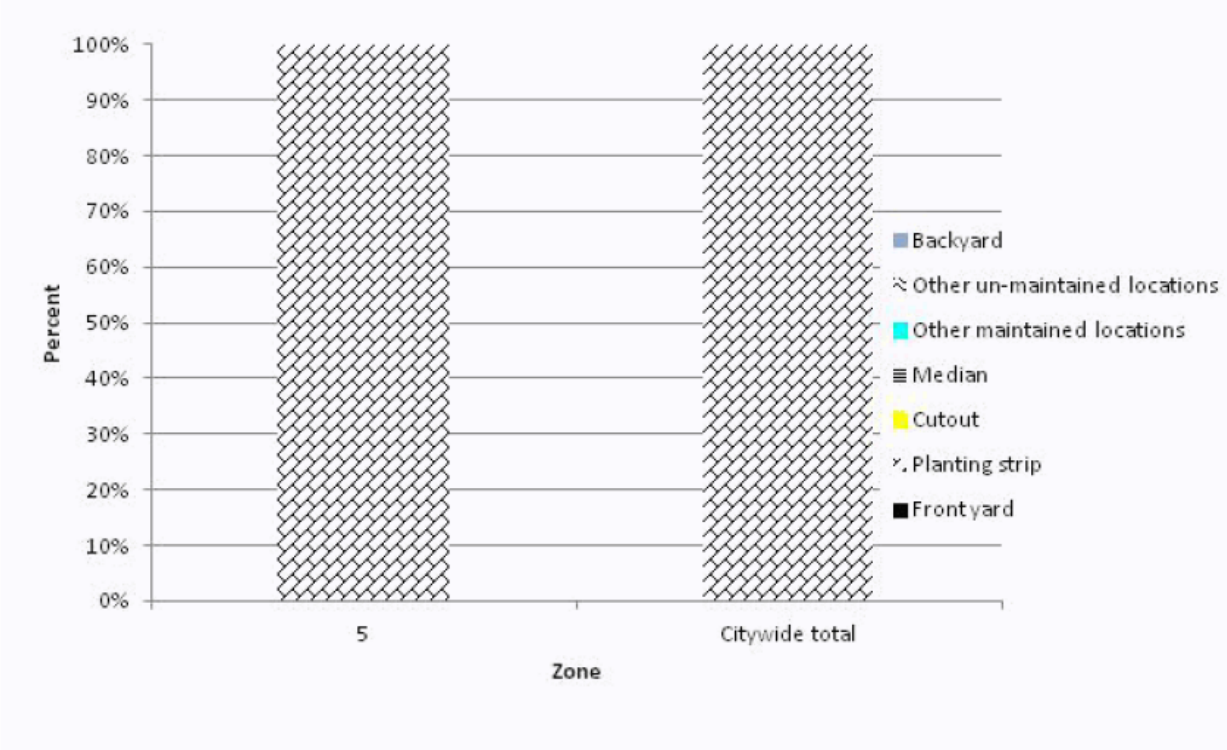
Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
5	66.5	0.0	0.0	33.5	0.0
Citywide total	66.5	0.0	0.0	33.5	0.0

Figure 6: Land Use of city/park trees

Victor

Location of Public Trees by Zone (%)

1/10/2013



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
5	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

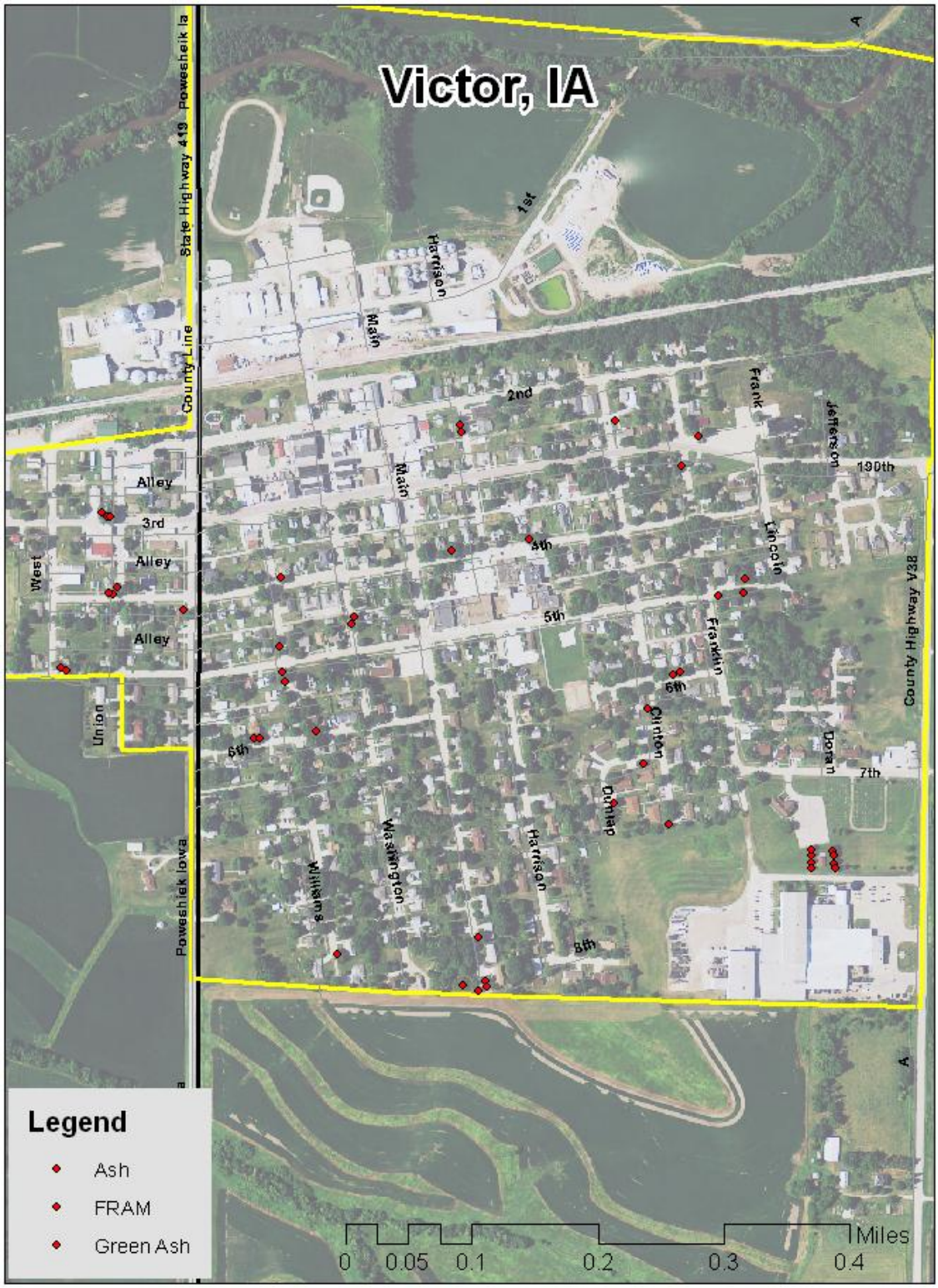


Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

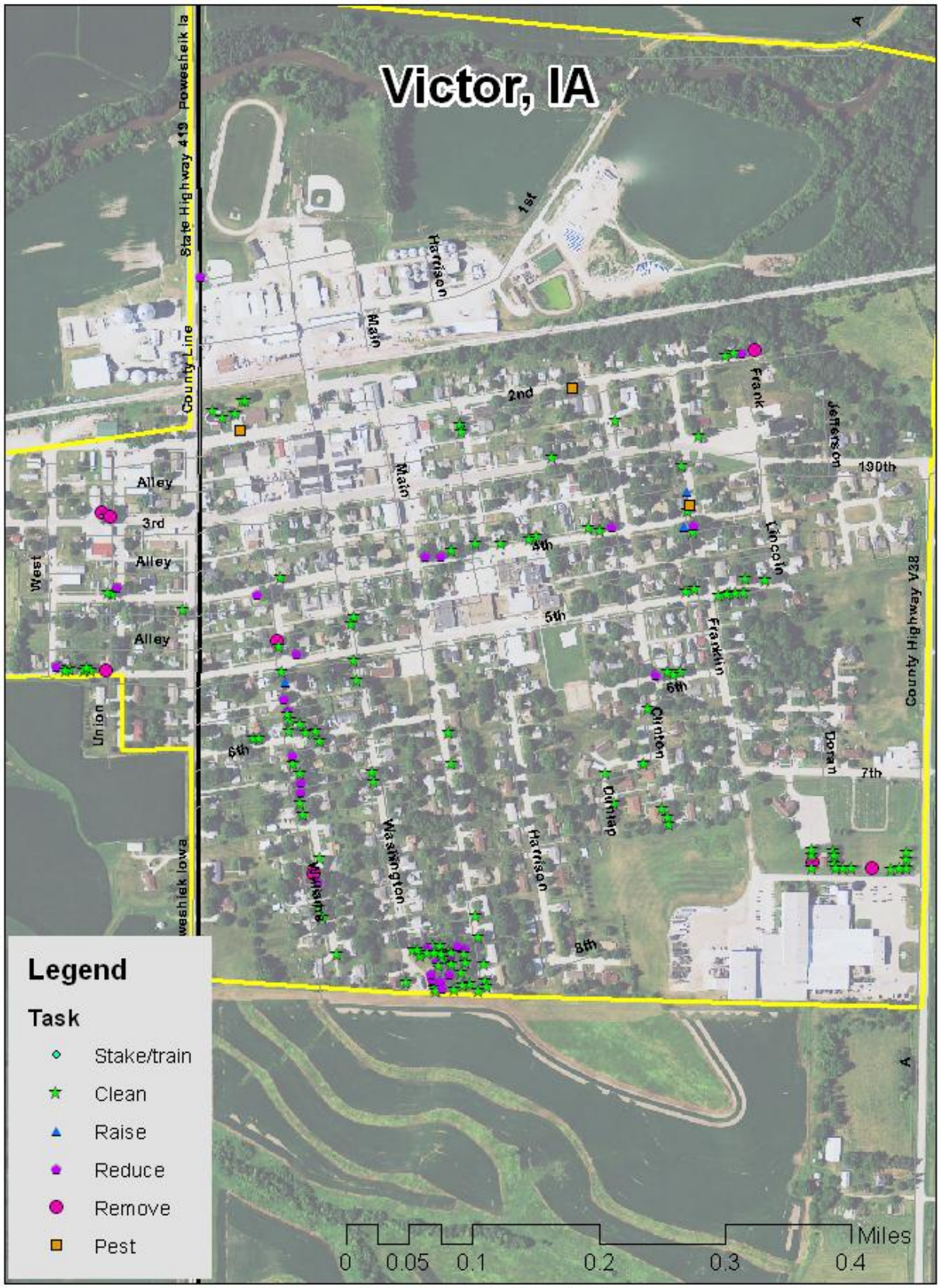


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

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