Tripoli, IA
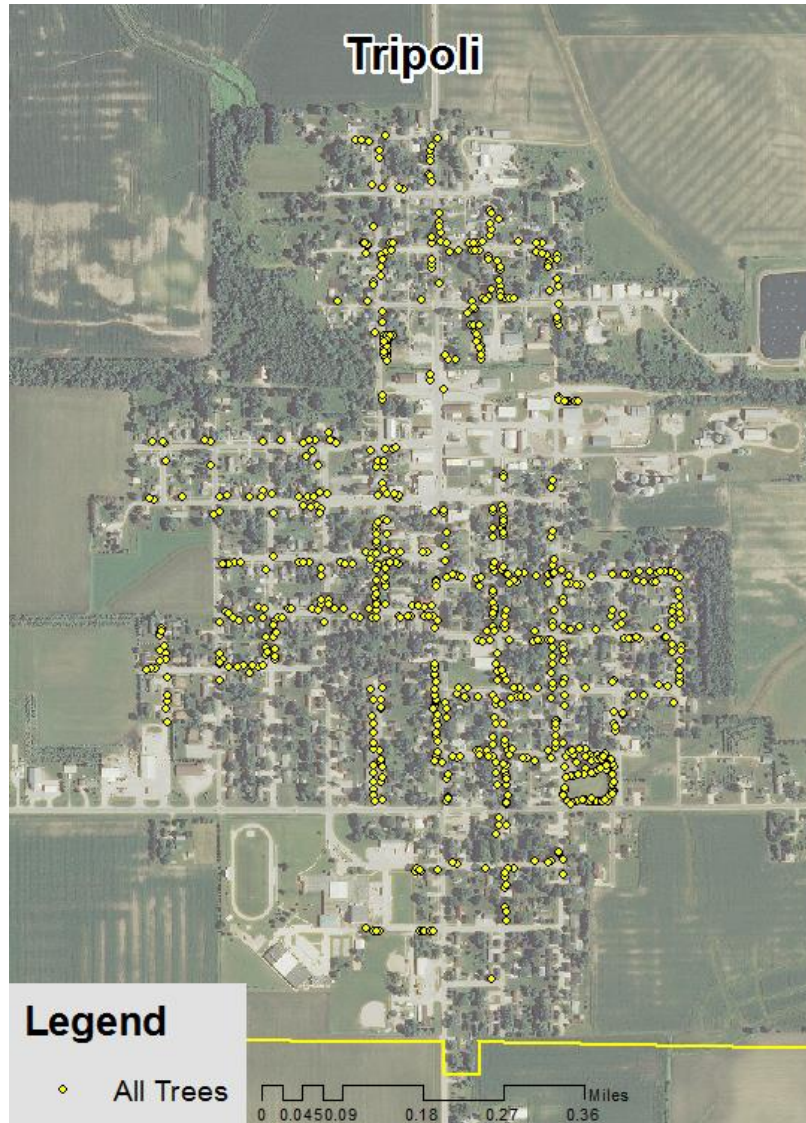

2015 Urban Forest Management Plan
Prepared by Matt Brewer
Bureau of Forestry, Iowa DNR

Table of Contents

Executive Summary_____

Overview

This plan was developed to assist the City of Tripoli 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 22% of Tripoli's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. 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 2014, a tree inventory was conducted by Emma Hanigan, Iowa DNR, 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 746 trees inventoried.
- Tripoli's trees provide $120,925 of benefits annually, an average of $162 a tree
- There are over 43 species of trees
- The top three genera are: Maple 47%, Ash 22%, and Spruce 7%
- 3% of trees are in need of some type of management
- 11 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 11 trees needing removal, 6 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*
- 81 of the 167 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- 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, maple, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current proposed budget it could take 67 years to remove ash – Suggestion: request a budget increase to $11,600 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2014, a tree inventory was conducted by Emma Hanigan, Iowa DNR, 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 associated with 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 746 city trees was entered into the USDA Forest Service program i-Tree Streets, part of the i-Tree suite. The following are results from the i-Tree Streets analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Tripoli's trees reduce energy related costs by approximately $33,156 annually (Appendix A, Table 1). These savings are both in Electricity (158.7 MWh) and in Natural Gas (21,541.6 Therms).

Annual Stormwater Benefits

Tripoli's trees intercept about 1,610,563 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $43,646 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 Tripoli, it is estimated that trees remove 2,004.9 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 $5,646 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Tripoli, trees sequester about 358,027 lbs of carbon a year with an associated value of $2,685 (Appendix A, Table 4). In addition, the trees store 5,610,046 lbs of carbon, with a yearly benefit of $42,075 (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. Tripoli receives $34,009 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree Streets analysis, Tripoli's trees provide $120,925 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 746 trees in Tripoli provide approximately $162 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Tripoli has over 43 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	350	47%
Ash	167	22%
Spruce	49	7%
Apple/Crabapple	43	6%
Oak	32	4%
Black Walnut	18	2%
Birch	13	2%
Hackberry	10	1%
Honeylocust	10	1%
Linden/Basswood	9	1%
Ohio Buckeye	7	1%
Pine	7	1%
Mulberry	5	1%
Northern White Cedar	5	1%
Cherry/Plum	3	<1%
Pear	3	<1%
Elm	3	<1%
Hickory	2	<1%
Mountain Ash	2	<1%
Lilac	2	<1%
Tulip Tree	1	<1%
American Sycamore	1	<1%
Other Small Deciduous	4	1%

Age Class

Most of Tripoli's trees (73%) are between 6 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Tripoli's size curve indicates there are relatively few young trees and relatively few over-mature trees.

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 Tripoli indicate that 92% of the trees are in good health,

with 0% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Additionally, 40% of Tripoli'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 5% of the population. This 5% 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).

Tree Removal	11	1%
Crown Cleaning	9	1%
Crown Reduction	3	<1%

Canopy Cover

The total canopy with both private and public trees is 11%, 100 acres. The canopy cover included in the Tripoli inventory includes approximately 17 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Tripoli'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	82%
Park/vacant/other	15%
Small commercial	2%
Multifamily residential	<1%

Location
Planting strip	62%
Front yard	38%

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

Tripoli has 0 critical concern trees that need immediate removal, but one critical concern tree that needs immediate attention (cleaning). 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 is 1 tree over 36 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. There are a total of 23 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 11 removals, 6 are ash trees. There are a total of 167 ash trees, and 81 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 at least 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 or greater number of trees helps ensure continuation of the benefits of the existing forest in Tripoli.

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 (47%) (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: any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen,

willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring For EAB

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 decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage (See examples below). Once EAB arrives in Tripoli, it could potentially kill all ash within 4 to 10 years of its arrival.

EAB infested tree in Muscatine with top thinning and many new green epicormic sprouts

EAB infested tree in Muscatine with sprouting, wood pecker activity, and D-shaped exit holes

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*

Treatment of Ash Trees
Chemical treatment can be an effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of 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.

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? The entire state of Iowa is under quarantine, so regulated articles may not be moved into non-quarantined states. For more information, please visit http://www.emeraldashborer.info/.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera 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. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property".

Six Year Maintenance Plan and Cost Estimates

Year 1 (FY 2016)

Maintain one critical concern tree that needs immediate attention (cleaning)	$900
Remove 11 trees (marked for removal)	$9,900
Plant and Maintain 14 trees in open locations (pursue grants)	$1,400
Ash tree treatment (if elected), 56 trees in good condition, average 10"	avg. $150/tree
-$15 per inch, treated every two years, see note	
Visual Survey for signs and symptoms of EAB	

Year 2 (FY 2017)

Remove 15 ash trees (or others) with poor health	$13,500
Plant and Maintain 18 trees in open locations (pursue grants)	$1,800
Ash tree treatment (if elected)	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 3 (FY 2018)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 18 trees in open locations (pursue grants)	$1,800
Ash tree treatment (if elected)	
Visual Survey for signs and symptoms of EAB	

Year 4 (FY 2019)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 18 trees in open locations (pursue grants)	$1,800
Ash tree treatment (if elected)	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 5 (FY 2020)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 18 trees in open locations (pursue grants)	$1,800
Ash tree treatment (if elected)	
Visual Survey for signs and symptoms of EAB	

Year 6 (FY 2021)

Remove any new critical concern trees and ash in poor health $900/tree
Plant and Maintain 18 trees in open locations (pursue grants) $1,800
Ash tree treatment (if elected)
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)
Visual Survey for signs and symptoms of EAB

*Reduction of ash in poor health will reduce exposure to Emerald Ash Borer over time. EAB could potentially kill all ash within 4 years of its arrival.
**Assuming a cost of $900 per tree for removal, the budget would need to be increased to $25,050 a year to remove all ash trees within 6 years.
***Suggest a future (post ash removal and replacement) budget of at least $2 per capita (population 1,313). Currently, this amount would cover about 10% of what would be needed to remove EAB infested trees over a six year period. Suggest setting aside additional funds to prepare for the expected arrival of EAB. Planting would be dependent on receiving grant funds annually.

Proposed Budget Increase
EAB could potentially kill all ash trees in Tripoli within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $25,050 a year. If the budget were increased to $11,600 a year all ash could be removed within 13 years. Additionally, it is recommended that Tripoli 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.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For an example, if the average ash diameter is 20 inches and treatment costs $15 per inch, then treating 10 trees would cost about $3,000 (every other year treatment). This would be 10 trees selected for treatment, and Tripoli would still need to find $900 per tree for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 every two years for treatment and leave five less trees for removal (for at least two more years). These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Tripoli. It is suggested to consider increasing the budget to plan for this.

Works Cited

Census Bureau. 2010. http://censtats.census.gov/data/IA/1601964290.pdf (April, 2013)

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

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees

1/27/2015

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	41.9	3,183	5,600.5	5,489	8,672	(N/A)	20.5	26.2	56.68
Norway maple	31.2	2,365	4,407.6	4,319	6,684	(N/A)	20.2	20.2	44.27
Silver maple	30.3	2,298	3,915.8	3,838	6,135	(N/A)	13.1	18.5	62.60
Sugar maple	19.6	1,488	2,614.4	2,562	4,050	(N/A)	9.9	12.2	54.73
Apple	3.9	296	580.7	569	865	(N/A)	5.8	2.6	20.12
Northern red oak	4.7	360	654.0	641	1,001	(N/A)	3.5	3.0	38.49
Norway spruce	0.2	15	27.9	27	43	(N/A)	2.8	0.1	2.03
Black walnut	3.6	275	490.4	481	755	(N/A)	2.4	2.3	41.95
Spruce	1.0	75	124.9	122	198	(N/A)	2.3	0.6	11.63
Red maple	1.1	80	146.3	143	224	(N/A)	1.5	0.7	20.33
Blue spruce	0.8	60	116.8	114	174	(N/A)	1.5	0.5	15.85
White ash	1.0	77	146.7	144	221	(N/A)	1.5	0.7	20.10
Honeylocust	2.6	198	349.2	342	540	(N/A)	1.3	1.6	54.03
Northern hackberry	3.7	277	521.7	511	788	(N/A)	1.3	2.4	78.83
River birch	1.5	114	210.0	206	320	(N/A)	1.1	1.0	39.99
Ohio buckeye	1.4	106	193.1	189	295	(N/A)	0.9	0.9	42.20
American basswood	1.0	79	158.7	156	235	(N/A)	0.9	0.7	33.54
Maple	0.8	61	114.3	112	173	(N/A)	0.8	0.5	28.76
Eastern white pine	0.5	35	64.0	63	97	(N/A)	0.8	0.3	16.23
Black maple	1.1	86	149.5	147	232	(N/A)	0.8	0.7	38.72
Mulberry	0.4	27	54.8	54	81	(N/A)	0.7	0.2	16.16
Northern white cedar	0.2	16	31.2	31	47	(N/A)	0.7	0.1	9.37
Broadleaf Deciduous Small	0.2	15	26.5	26	41	(N/A)	0.5	0.1	10.18
Plum	0.2	17	38.5	38	55	(N/A)	0.4	0.2	18.19
Bur oak	0.2	12	21.1	21	32	(N/A)	0.4	0.1	10.76
Ash	0.4	34	63.2	62	96	(N/A)	0.4	0.3	31.91
Pear	0.1	5	11.4	11	16	(N/A)	0.4	0.0	5.40
Paper birch	0.7	56	92.1	90	146	(N/A)	0.4	0.4	48.59
Boxelder	0.5	40	69.6	68	108	(N/A)	0.4	0.3	35.95
American elm	0.8	63	113.9	112	175	(N/A)	0.3	0.5	87.36
Littleleaf linden	0.2	12	24.9	24	37	(N/A)	0.3	0.1	18.25
Mountain ash	0.2	16	28.5	28	44	(N/A)	0.3	0.1	21.77
Hickory	0.3	25	40.7	40	65	(N/A)	0.3	0.2	32.43
Lilac	0.2	16	28.5	28	44	(N/A)	0.3	0.1	21.77
Birch	0.5	40	79.1	78	117	(N/A)	0.3	0.4	58.69
Elm	0.4	29	53.7	53	82	(N/A)	0.1	0.2	82.02
Amur maple	0.0	2	3.8	4	5	(N/A)	0.1	0.0	5.40
Swamp white oak	0.0	3	6.2	6	9	(N/A)	0.1	0.0	8.99
American sycamore	0.4	29	53.7	53	82	(N/A)	0.1	0.2	82.02
Pin oak	0.3	21	38.4	38	58	(N/A)	0.1	0.2	58.37
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.1	0.1	24.14
White oak	0.1	7	13.7	13	21	(N/A)	0.1	0.1	20.64
Tulip tree	0.3	25	46.9	46	71	(N/A)	0.1	0.2	70.91
Total	158.7	12,045	21,541.6	21,111	33,156	(N/A)	100.0	100.0	44.45

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees

1/27/2015

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	444,276	12,040	(N/A)	20.5	27.6	78.69
Norway maple	266,250	7,215	(N/A)	20.2	16.5	47.78
Silver maple	397,538	10,773	(N/A)	13.1	24.7	109.93
Sugar maple	196,301	5,320	(N/A)	9.9	12.2	71.89
Apple	15,291	414	(N/A)	5.8	0.9	9.64
Northern red oak	44,605	1,209	(N/A)	3.5	2.8	46.49
Norway spruce	2,513	68	(N/A)	2.8	0.2	3.24
Black walnut	35,139	952	(N/A)	2.4	2.2	52.90
Spruce	11,572	314	(N/A)	2.3	0.7	18.45
Red maple	7,045	191	(N/A)	1.5	0.4	17.36
Blue spruce	9,389	254	(N/A)	1.5	0.6	23.13
White ash	6,750	183	(N/A)	1.5	0.4	16.63
Honeylocust	23,081	625	(N/A)	1.3	1.4	62.55
Northern hackberry	35,721	968	(N/A)	1.3	2.2	96.80
River birch	11,655	316	(N/A)	1.1	0.7	39.48
Ohio buckeye	11,069	300	(N/A)	0.9	0.7	42.85
American basswood	8,937	242	(N/A)	0.9	0.6	34.60
Maple	7,008	190	(N/A)	0.8	0.4	31.65
Eastern white pine	10,115	274	(N/A)	0.8	0.6	45.69
Black maple	7,951	215	(N/A)	0.8	0.5	35.91
Mulberry	1,272	34	(N/A)	0.7	0.1	6.89
Northern white cedar	3,711	101	(N/A)	0.7	0.2	20.11
Broadleaf Deciduous Small	689	19	(N/A)	0.5	0.0	4.67
Plum	793	22	(N/A)	0.4	0.0	7.17
Bur oak	951	26	(N/A)	0.4	0.1	8.59
Ash	2,581	70	(N/A)	0.4	0.2	23.32
Pear	206	6	(N/A)	0.4	0.0	1.86
Paper birch	5,522	150	(N/A)	0.4	0.3	49.88
Boxelder	4,409	119	(N/A)	0.4	0.3	39.83
American elm	9,102	247	(N/A)	0.3	0.6	123.33
Littleleaf linden	921	25	(N/A)	0.3	0.1	12.48
Mountain ash	735	20	(N/A)	0.3	0.0	9.96
Hickory	2,073	56	(N/A)	0.3	0.1	28.09
Lilac	735	20	(N/A)	0.3	0.0	9.96
Birch	4,959	134	(N/A)	0.3	0.3	67.19
Elm	5,491	149	(N/A)	0.1	0.3	148.79
Amur maple	69	2	(N/A)	0.1	0.0	1.86
Swamp white oak	163	4	(N/A)	0.1	0.0	4.41
American sycamore	5,491	149	(N/A)	0.1	0.3	148.79
Pin oak	2,397	65	(N/A)	0.1	0.1	64.95
Scotch pine	1,539	42	(N/A)	0.1	0.1	41.70
White oak	608	16	(N/A)	0.1	0.0	16.47
Tulip tree	3,943	107	(N/A)	0.1	0.2	106.85
Citywide total	1,610,563	43,646	(N/A)	100.0	100.0	58.51

Table 3: Annual Air Quality Benefits

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($) Standard Error	% of Total Trees	Avg. $/tree
	O$_3$	NO$_2$	PM$_{10}$	SO$_2$		NO$_2$	PM$_{10}$	VOC	SO$_2$							
Green ash	53.8	8.6	25.9	2.4	287	199.0	29.1	27.7	190.1	1,243	0.0	0	536.6	1,530 (N/A)	20.5	10.00
Norway maple	51.9	8.9	25.8	2.3	281	150.3	21.8	20.7	141.4	933	-12.4	-46	410.8	1,168 (N/A)	20.2	7.73
Silver maple	64.1	10.9	32.0	2.8	347	142.1	20.8	19.9	137.0	891	-33.5	-126	396.1	1,112 (N/A)	13.1	11.35
Sugar maple	24.6	4.2	12.6	1.1	134	92.9	13.6	12.9	88.8	580	-19.6	-73	231.1	641 (N/A)	9.9	8.66
Apple	4.3	0.7	2.1	0.2	23	19.0	2.7	2.6	17.7	118	0.0	0	49.4	141 (N/A)	5.8	3.27
Northern red oak	9.2	1.6	4.5	0.4	50	22.6	3.3	3.1	21.5	141	-13.1	-49	53.2	142 (N/A)	3.5	5.44
Norway spruce	0.2	0.0	0.2	0.0	1	1.0	0.1	0.1	0.9	6	-0.9	-3	1.6	4 (N/A)	2.8	0.18
Black walnut	3.8	0.6	1.9	0.2	21	17.2	2.5	2.4	16.4	107	0.0	0	45.1	128 (N/A)	2.4	7.12
Spruce	1.2	0.2	1.1	0.1	8	4.6	0.7	0.7	4.5	29	-4.0	-15	9.1	22 (N/A)	2.3	1.31
Red maple	1.3	0.2	0.7	0.1	7	5.1	0.7	0.7	4.8	31	-0.5	-2	13.1	37 (N/A)	1.5	3.36
Blue spruce	1.0	0.2	0.9	0.1	7	3.8	0.6	0.5	3.6	24	-3.1	-11	7.6	19 (N/A)	1.5	1.71
White ash	0.2	0.0	0.2	0.0	1	4.9	0.7	0.7	4.6	31	0.0	0	11.4	32 (N/A)	1.5	2.91
Honeylocust	4.2	0.7	2.0	0.2	23	12.4	1.8	1.7	11.8	77	-3.1	-12	31.8	88 (N/A)	1.3	8.82
Northern hackberry	5.6	1.0	2.8	0.2	30	17.7	2.6	2.4	16.6	109	0.0	0	48.8	140 (N/A)	1.3	13.98
River birch	2.1	0.4	1.1	0.1	12	7.2	1.0	1.0	6.8	45	-0.5	-2	19.2	55 (N/A)	1.1	6.82
Ohio buckeye	2.1	0.4	1.0	0.1	11	6.7	1.0	0.9	6.3	42	-0.5	-2	18.0	51 (N/A)	0.9	7.30
American basswood	1.0	0.2	0.5	0.0	5	5.1	0.7	0.7	4.7	32	-0.9	-3	12.1	34 (N/A)	0.9	4.80
Maple	1.7	0.3	0.8	0.1	9	3.8	0.6	0.5	3.6	24	-0.6	-2	10.8	31 (N/A)	0.8	5.10
Eastern white pine	1.2	0.2	1.0	0.1	8	2.2	0.3	0.3	2.1	14	-6.0	-22	1.4	-1 (N/A)	0.8	-0.17
Black maple	1.6	0.3	0.8	0.1	9	5.3	0.8	0.7	5.1	33	-0.6	-2	14.2	40 (N/A)	0.8	6.66
Mulberry	0.3	0.0	0.2	0.0	2	1.8	0.3	0.2	1.6	11	0.0	0	4.4	12 (N/A)	0.7	2.49
Northern white cedar	0.4	0.1	0.3	0.0	3	1.0	0.1	0.1	1.0	6	-1.6	-6	1.6	3 (N/A)	0.7	0.61
Broadleaf Deciduous Small	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.9	6	0.0	0	2.4	7 (N/A)	0.5	1.72
Plum	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.0	7	0.0	0	2.7	8 (N/A)	0.4	2.55
Bur oak	0.0	0.0	0.0	0.0	0	0.7	0.1	0.1	0.7	5	0.0	0	1.7	5 (N/A)	0.4	1.58
Ash	0.3	0.1	0.2	0.0	2	2.2	0.3	0.3	2.0	13	-0.1	0	5.3	15 (N/A)	0.4	4.95
Pear	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.8	2 (N/A)	0.4	0.71
Paper birch	0.5	0.1	0.3	0.0	3	3.4	0.5	0.5	3.3	21	0.0	0	8.6	24 (N/A)	0.4	8.06
Boxelder	0.5	0.1	0.2	0.0	3	2.5	0.4	0.3	2.4	15	-0.2	-1	6.3	17 (N/A)	0.4	5.73
American elm	1.5	0.2	0.7	0.1	8	4.0	0.6	0.6	3.8	25	0.0	0	11.4	33 (N/A)	0.3	16.31
Littleleaf linden	0.1	0.0	0.1	0.0	0	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5 (N/A)	0.3	2.55
Mountain ash	0.2	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.6	7 (N/A)	0.3	3.63
Hickory	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)	0.3	5.21
Lilac	0.2	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.6	7 (N/A)	0.3	3.63
Birch	1.0	0.2	0.5	0.0	5	2.6	0.4	0.4	2.4	16	-0.2	-1	7.1	20 (N/A)	0.3	10.16
Elm	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16 (N/A)	0.1	15.71
Amur maple	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.1	0.71
Swamp white oak	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1 (N/A)	0.1	1.21
American sycamore	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16 (N/A)	0.1	15.71
Pin oak	0.3	0.1	0.2	0.0	2	1.3	0.2	0.2	1.2	8	-0.7	-3	2.9	8 (N/A)	0.1	7.54
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)	0.1	2.82
White oak	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.1	2.99
Tulip tree	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)	0.1	12.48
Citywide total	243.0	40.9	122.2	11.1	1,318	755.8	110.2	105.1	719.1	4,713	-102.6	-385	2,004.9	5,646 (N/A)	100.0	7.57

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees

1/27/2015

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,756,819	13,176	(N/A)	20.5	31.3	86.12
Norway maple	858,189	6,436	(N/A)	20.2	15.3	42.63
Silver maple	1,381,630	10,362	(N/A)	13.1	24.6	105.74
Sugar maple	701,710	5,263	(N/A)	9.9	12.5	71.12
Apple	68,863	516	(N/A)	5.8	1.2	12.01
Northern red oak	194,170	1,456	(N/A)	3.5	3.5	56.01
Norway spruce	1,220	9	(N/A)	2.8	0.0	0.44
Black walnut	124,244	932	(N/A)	2.4	2.2	51.77
Spruce	7,847	59	(N/A)	2.3	0.1	3.46
Red maple	15,981	120	(N/A)	1.5	0.3	10.90
Blue spruce	4,553	34	(N/A)	1.5	0.1	3.10
White ash	11,380	85	(N/A)	1.5	0.2	7.76
Honeylocust	53,516	401	(N/A)	1.3	1.0	40.14
Northern hackberry	82,675	620	(N/A)	1.3	1.5	62.01
River birch	35,316	265	(N/A)	1.1	0.6	33.11
Ohio buckeye	34,215	257	(N/A)	0.9	0.6	36.66
American basswood	35,601	267	(N/A)	0.9	0.6	38.14
Maple	18,126	136	(N/A)	0.8	0.3	22.66
Eastern white pine	15,280	115	(N/A)	0.8	0.3	19.10
Black maple	18,496	139	(N/A)	0.8	0.3	23.12
Mulberry	5,045	38	(N/A)	0.7	0.1	7.57
Northern white cedar	3,607	27	(N/A)	0.7	0.1	5.41
Broadleaf Deciduous	3,079	23	(N/A)	0.5	0.1	5.77
Plum	2,724	20	(N/A)	0.4	0.0	6.81
Bur oak	1,405	11	(N/A)	0.4	0.0	3.51
Ash	5,825	44	(N/A)	0.4	0.1	14.56
Pear	533	4	(N/A)	0.4	0.0	1.33
Paper birch	15,801	119	(N/A)	0.4	0.3	39.50
Boxelder	12,670	95	(N/A)	0.4	0.2	31.68
American elm	31,973	240	(N/A)	0.3	0.6	119.90
Littleleaf linden	2,049	15	(N/A)	0.3	0.0	7.68
Mountain ash	3,215	24	(N/A)	0.3	0.1	12.06
Hickory	4,706	35	(N/A)	0.3	0.1	17.65
Lilac	3,215	24	(N/A)	0.3	0.1	12.06
Birch	15,891	119	(N/A)	0.3	0.3	59.59
Elm	25,943	195	(N/A)	0.1	0.5	194.57
Amur maple	178	1	(N/A)	0.1	0.0	1.33
Swamp white oak	218	2	(N/A)	0.1	0.0	1.64
American sycamore	25,943	195	(N/A)	0.1	0.5	194.57
Pin oak	8,218	62	(N/A)	0.1	0.1	61.63
Scotch pine	1,170	9	(N/A)	0.1	0.0	8.78
White oak	1,035	8	(N/A)	0.1	0.0	7.76
Tulip tree	15,773	118	(N/A)	0.1	0.3	118.30
Citywide total	5,610,046	42,075	(N/A)	100.0	100.0	56.40

Table 5: Annual Carbon Sequestered

Annual CO₂ Benefits of Public Trees

1/27/2015

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	97,001	728	-8,433	-426	-66	70,346	528	158,488	1,189 (N/A)	20.5	26.6	7.77
Norway maple	45,118	338	-4,128	-319	-33	52,259	392	92,930	697 (N/A)	20.2	15.6	4.62
Silver maple	112,717	845	-6,632	-317	-52	50,775	381	156,543	1,174 (N/A)	13.1	26.3	11.98
Sugar maple	40,426	303	-3,369	-203	-27	32,876	247	69,730	523 (N/A)	9.9	11.7	7.07
Apple	6,398	48	-331	-52	-3	6,546	49	12,561	94 (N/A)	5.8	2.1	2.19
Northern red oak	4,938	37	-932	-60	-7	7,952	60	11,898	89 (N/A)	3.5	2.0	3.43
Norway spruce	186	1	-6	-6	0	338	3	512	4 (N/A)	2.8	0.1	0.18
Black walnut	8,521	64	-596	-37	-5	6,067	46	13,955	105 (N/A)	2.4	2.3	5.81
Spruce	894	7	-38	-17	0	1,663	12	2,502	19 (N/A)	2.3	0.4	1.10
Red maple	2,099	16	-77	-11	-1	1,773	13	3,784	28 (N/A)	1.5	0.6	2.58
Blue spruce	502	4	-22	-14	0	1,324	10	1,790	13 (N/A)	1.5	0.3	1.22
White ash	2,003	15	-55	-13	-1	1,711	13	3,646	27 (N/A)	1.5	0.6	2.49
Honeylocust	7,333	55	-257	-21	-2	4,377	33	11,433	86 (N/A)	1.3	1.9	8.57
Northern hackberry	4,754	36	-397	-34	-3	6,123	46	10,446	78 (N/A)	1.3	1.8	7.83
River birch	2,451	18	-170	-15	-1	2,523	19	4,789	36 (N/A)	1.1	0.8	4.49
Ohio buckeye	2,227	17	-164	-13	-1	2,347	18	4,396	33 (N/A)	0.9	0.7	4.71
American basswood	2,449	18	-171	-13	-1	1,751	13	4,016	30 (N/A)	0.9	0.7	4.30
Maple	2,183	16	-87	-8	-1	1,339	10	3,426	26 (N/A)	0.8	0.6	4.28
Eastern white pine	78	1	-73	-11	-1	766	6	760	6 (N/A)	0.8	0.1	0.95
Black maple	2,386	18	-89	-10	-1	1,895	14	4,182	31 (N/A)	0.8	0.7	5.23
Mulberry	542	4	-24	-5	0	600	4	1,112	8 (N/A)	0.7	0.2	1.67
Northern white cedar	251	2	-17	-4	0	359	3	588	4 (N/A)	0.7	0.1	0.88
Broadleaf Deciduous Smal	294	2	-15	-3	0	325	2	602	5 (N/A)	0.5	0.1	1.13
Plum	342	3	-13	-4	0	372	3	697	5 (N/A)	0.4	0.1	1.74
Bur oak	357	3	-7	-2	0	256	2	604	5 (N/A)	0.4	0.1	1.51
Ash	834	6	-28	-4	0	747	6	1,548	12 (N/A)	0.4	0.3	3.87
Pear	114	1	-3	-2	0	112	1	221	2 (N/A)	0.4	0.0	0.55
Paper birch	1,550	12	-76	-7	-1	1,227	9	2,695	20 (N/A)	0.4	0.5	6.74
Boxelder	1,293	10	-61	-6	0	875	7	2,102	16 (N/A)	0.4	0.4	5.26
American elm	1,020	8	-153	-8	-1	1,394	10	2,253	17 (N/A)	0.3	0.4	8.45
Littleleaf linden	447	3	-10	-2	0	267	2	702	5 (N/A)	0.3	0.1	2.63
Mountain ash	306	2	-15	-3	0	346	3	633	5 (N/A)	0.3	0.1	2.37
Hickory	654	5	-23	-3	0	552	4	1,180	9 (N/A)	0.3	0.2	4.43
Lilac	306	2	-15	-3	0	346	3	633	5 (N/A)	0.3	0.1	2.37
Birch	940	7	-76	-5	-1	880	7	1,738	13 (N/A)	0.3	0.3	6.52
Elm	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.1	0.2	11.11
Amur maple	38	0	-1	-1	0	37	0	74	1 (N/A)	0.1	0.0	0.55
Swamp white oak	96	1	-2	-1	0	65	0	158	1 (N/A)	0.1	0.0	1.18
American sycamore	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.1	0.2	11.11
Pin oak	880	7	-39	-3	0	458	3	1,296	10 (N/A)	0.1	0.2	9.72
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	0.1	0.1	2.43
White oak	209	2	-5	-1	0	159	1	361	3 (N/A)	0.1	0.1	2.71
Tulip tree	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.1	0.2	9.97
Citywide total	358,027	2,685	-26,940	-1,680	-215	266,195	1,996	595,603	4,467 (N/A)	100.0	100.0	5.99

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees
1/27/2015

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	8,170	(N/A)	20.5	24.0	53.40
Norway maple	4,464	(N/A)	20.2	13.1	29.57
Silver maple	9,235	(N/A)	13.1	27.2	94.24
Sugar maple	4,344	(N/A)	9.9	12.8	58.71
Apple	367	(N/A)	5.8	1.1	8.55
Northern red oak	402	(N/A)	3.5	1.2	15.48
Norway spruce	148	(N/A)	2.8	0.4	7.02
Black walnut	775	(N/A)	2.4	2.3	43.04
Spruce	287	(N/A)	2.3	0.8	16.90
Red maple	301	(N/A)	1.5	0.9	27.36
Blue spruce	231	(N/A)	1.5	0.7	21.04
White ash	368	(N/A)	1.5	1.1	33.42
Honeylocust	1,661	(N/A)	1.3	4.9	166.15
Northern hackberry	616	(N/A)	1.3	1.8	61.63
River birch	247	(N/A)	1.1	0.7	30.90
Ohio buckeye	221	(N/A)	0.9	0.6	31.56
American basswood	205	(N/A)	0.9	0.6	29.26
Maple	278	(N/A)	0.8	0.8	46.32
Eastern white pine	34	(N/A)	0.8	0.1	5.63
Black maple	330	(N/A)	0.8	1.0	55.06
Mulberry	30	(N/A)	0.7	0.1	6.08
Northern white cedar	80	(N/A)	0.7	0.2	15.96
Broadleaf Deciduous Small	16	(N/A)	0.5	0.0	3.90
Plum	19	(N/A)	0.4	0.1	6.40
Bur oak	58	(N/A)	0.4	0.2	19.34
Ash	92	(N/A)	0.4	0.3	30.53
Pear	6	(N/A)	0.4	0.0	2.06
Paper birch	149	(N/A)	0.4	0.4	49.80
Boxelder	118	(N/A)	0.4	0.3	39.36
American elm	139	(N/A)	0.3	0.4	69.42
Littleleaf linden	62	(N/A)	0.3	0.2	31.20
Mountain ash	18	(N/A)	0.3	0.1	8.77
Hickory	74	(N/A)	0.3	0.2	37.21
Lilac	18	(N/A)	0.3	0.1	8.77
Birch	86	(N/A)	0.3	0.3	43.05
Elm	67	(N/A)	0.1	0.2	66.60
Amur maple	2	(N/A)	0.1	0.0	2.06
Swamp white oak	13	(N/A)	0.1	0.0	12.89
American sycamore	67	(N/A)	0.1	0.2	66.60
Pin oak	83	(N/A)	0.1	0.2	83.10
Scotch pine	32	(N/A)	0.1	0.1	32.32
White oak	29	(N/A)	0.1	0.1	28.56
Tulip tree	66	(N/A)	0.1	0.2	65.59
Citywide total	34,009	(N/A)	100.0	100.0	45.59

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

Total Annual Benefits of Public Trees by Species ($)

1/27/2015

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	8,672	1,189	1,530	12,040	8,170	31,600	(N/A)	26.1
Norway maple	6,684	697	1,168	7,215	4,464	20,229	(N/A)	16.7
Silver maple	6,135	1,174	1,112	10,773	9,235	28,430	(N/A)	23.5
Sugar maple	4,050	523	641	5,320	4,344	14,878	(N/A)	12.3
Apple	865	94	141	414	367	1,882	(N/A)	1.6
Northern red oak	1,001	89	142	1,209	402	2,843	(N/A)	2.4
Norway spruce	43	4	4	68	148	266	(N/A)	0.2
Black walnut	755	105	128	952	775	2,715	(N/A)	2.2
Spruce	198	19	22	314	287	840	(N/A)	0.7
Red maple	224	28	37	191	301	781	(N/A)	0.6
Blue spruce	174	13	19	254	231	692	(N/A)	0.6
White ash	221	27	32	183	368	831	(N/A)	0.7
Honeylocust	540	86	88	625	1,661	3,001	(N/A)	2.5
Northern hackberry	788	78	140	968	616	2,591	(N/A)	2.1
River birch	320	36	55	316	247	973	(N/A)	0.8
Ohio buckeye	295	33	51	300	221	900	(N/A)	0.7
American basswood	235	30	34	242	205	746	(N/A)	0.6
Maple	173	26	31	190	278	697	(N/A)	0.6
Eastern white pine	97	6	-1	274	34	410	(N/A)	0.3
Black maple	232	31	40	215	330	849	(N/A)	0.7
Mulberry	81	8	12	34	30	166	(N/A)	0.1
Northern white cedar	47	4	3	101	80	235	(N/A)	0.2
Broadleaf Deciduous Sn	41	5	7	19	16	86	(N/A)	0.1
Plum	55	5	8	22	19	108	(N/A)	0.1
Bur oak	32	5	5	26	58	125	(N/A)	0.1
Ash	96	12	15	70	92	284	(N/A)	0.2
Pear	16	2	2	6	6	32	(N/A)	0.0
Paper birch	146	20	24	150	149	489	(N/A)	0.4
Boxelder	108	16	17	119	118	378	(N/A)	0.3
American elm	175	17	33	247	139	610	(N/A)	0.5
Littleleaf linden	37	5	5	25	62	134	(N/A)	0.1
Mountain ash	44	5	7	20	18	93	(N/A)	0.1
Hickory	65	9	10	56	74	215	(N/A)	0.2
Lilac	44	5	7	20	18	93	(N/A)	0.1
Birch	117	13	20	134	86	371	(N/A)	0.3
Elm	82	11	16	149	67	324	(N/A)	0.3
Amur maple	5	1	1	2	2	11	(N/A)	0.0
Swamp white oak	9	1	1	4	13	29	(N/A)	0.0
American sycamore	82	11	16	149	67	324	(N/A)	0.3
Pin oak	58	10	8	65	83	224	(N/A)	0.2
Scotch pine	24	2	3	42	32	103	(N/A)	0.1
White oak	21	3	3	16	29	71	(N/A)	0.1
Tulip tree	71	10	12	107	66	266	(N/A)	0.2
Citywide Total	33,156	4,467	5,646	43,646	34,009	120,925	(N/A)	100.0

Species Distribution of Public Trees

1/27/2015
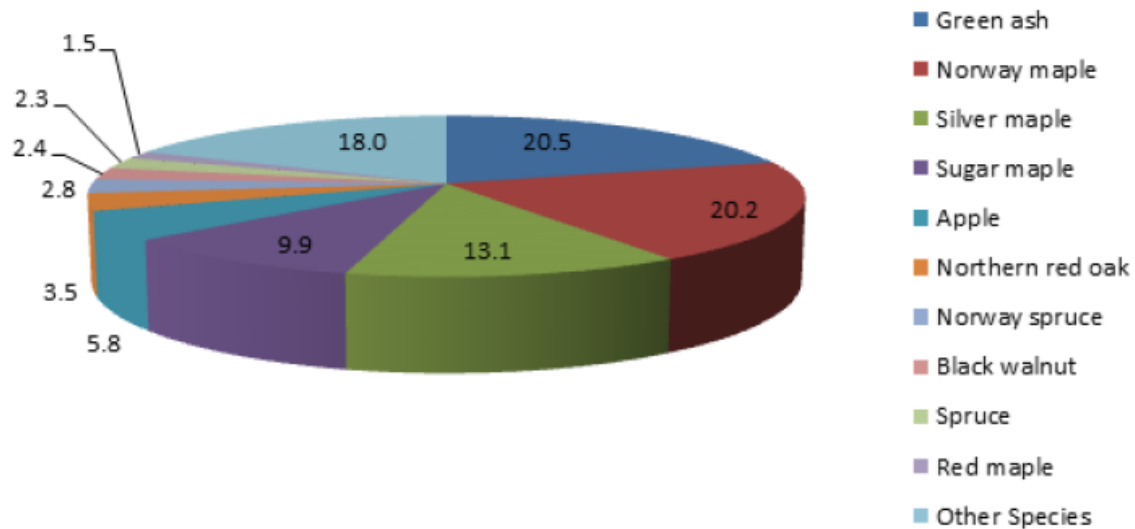
Species	Percent
Green ash	20.5
Norway maple	20.2
Silver maple	13.1
Sugar maple	9.9
Apple	5.8
Northern red oak	3.5
Norway spruce	2.8
Black walnut	2.4
Spruce	2.3
Red maple	1.5
Other Species	18.0
Total	100.0

Figure 1: Species Distribution

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

1/27/2015
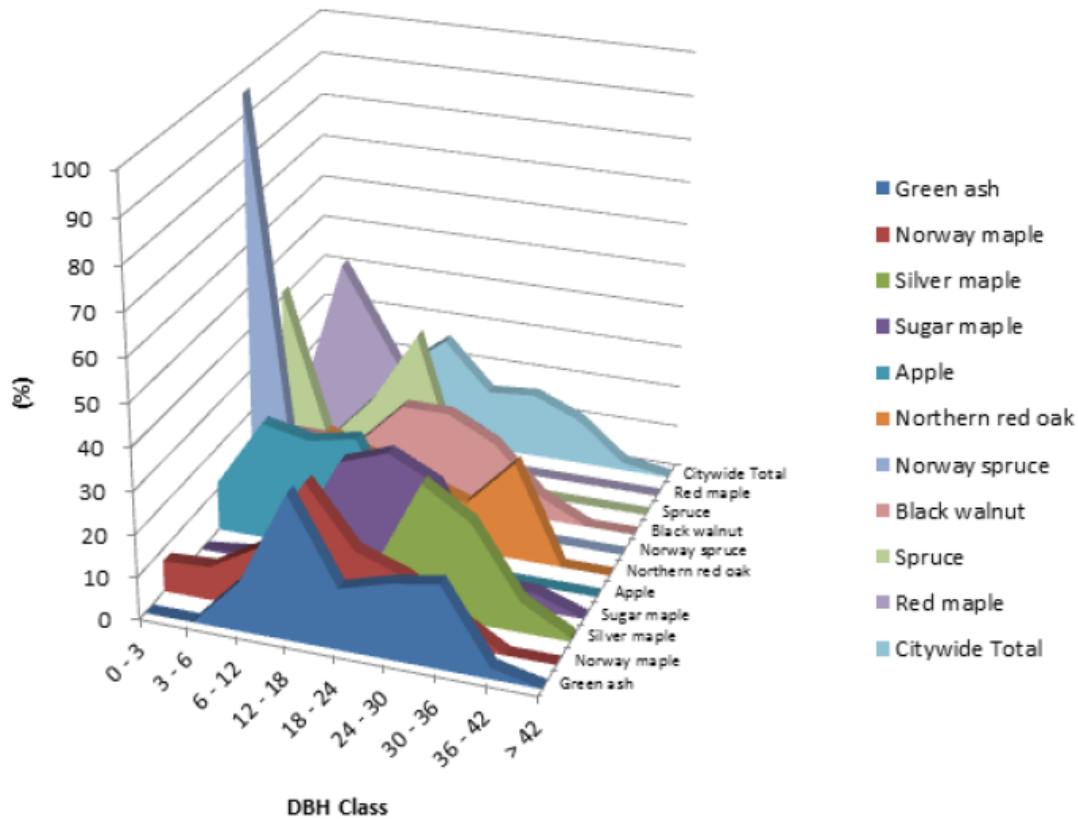
				DBH class	(in)				
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Green ash	0.00	0.00	11.76	33.99	14.38	17.65	19.61	2.61	0.00
Norway maple	7.28	7.95	14.57	31.79	17.88	13.91	6.62	0.00	0.00
Silver maple	0.00	0.00	9.18	20.41	8.16	30.61	23.47	7.14	1.02
Sugar maple	0.00	1.35	6.76	27.03	31.08	25.68	4.05	4.05	0.00
Apple	11.63	27.91	25.58	27.91	6.98	0.00	0.00	0.00	0.00
Northern red oak	7.69	0.00	23.08	19.23	15.38	11.54	23.08	0.00	0.00
Norway spruce	95.24	0.00	0.00	4.76	0.00	0.00	0.00	0.00	0.00
Black walnut	11.11	11.11	11.11	22.22	22.22	16.67	5.56	0.00	0.00
Spruce	41.18	5.88	17.65	35.29	0.00	0.00	0.00	0.00	0.00
Red maple	9.09	45.45	27.27	9.09	9.09	0.00	0.00	0.00	0.00
Citywide Total	8.18	6.03	17.29	25.74	14.48	15.42	10.86	1.88	0.13

Figure 2: Relative Age Class

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

Dead or Dying 0%
Poor 0%
Fair 8%
Good 92%

Legend:
- Dead or Dying
- Poor
- Fair
- Good
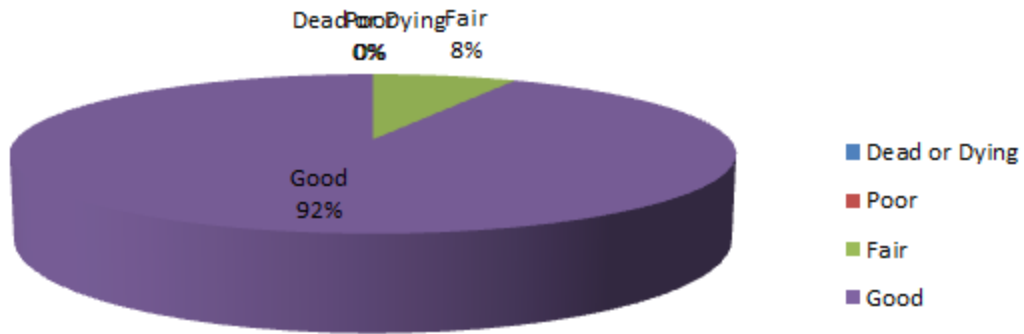
Figure 3: Foliage Condition

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

Dead or Dying 0%
Poor 5%
Good 41%
Fair 54%

Legend:
- Dead or Dying
- Poor
- Fair
- Good
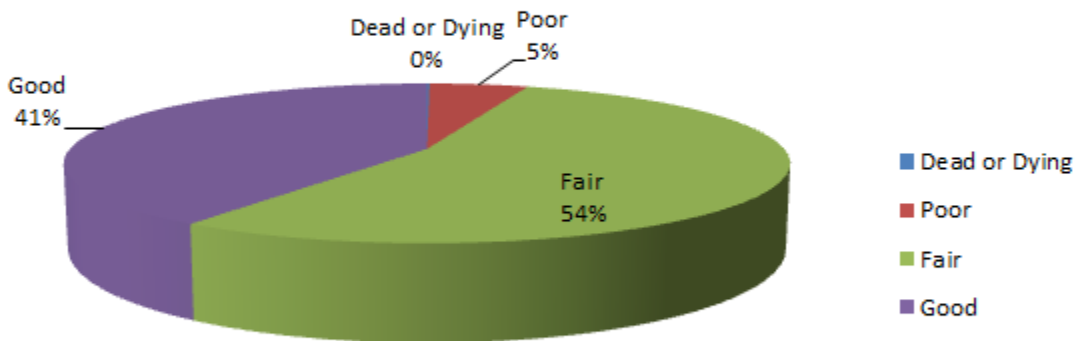
Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

1/27/2015
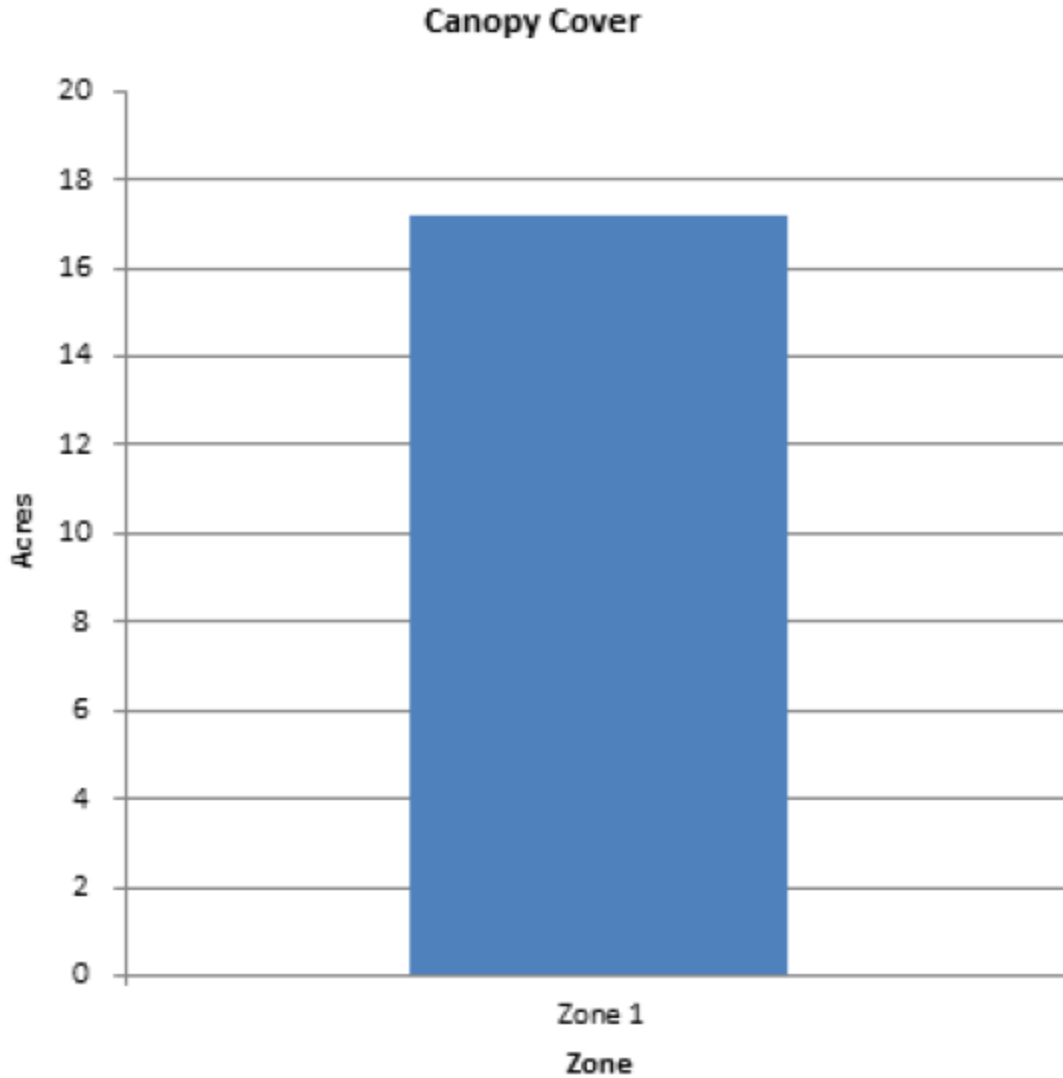
Canopy Cover

Zone	Acres	% of Total Canopy Cover
Zone 1	17	100.0
Citywide total	17	100.0

Figure 5: Canopy Cover in Acres

Land use Public Trees by Zone (%)

Zone	Single family residential	Multi-family residential	Industrial/Large commercial	Park/vacant/other	Small commercial
1	82.31	0.67	0.00	15.42	1.61
Citywide total	82.31	0.67	0.00	15.42	1.61
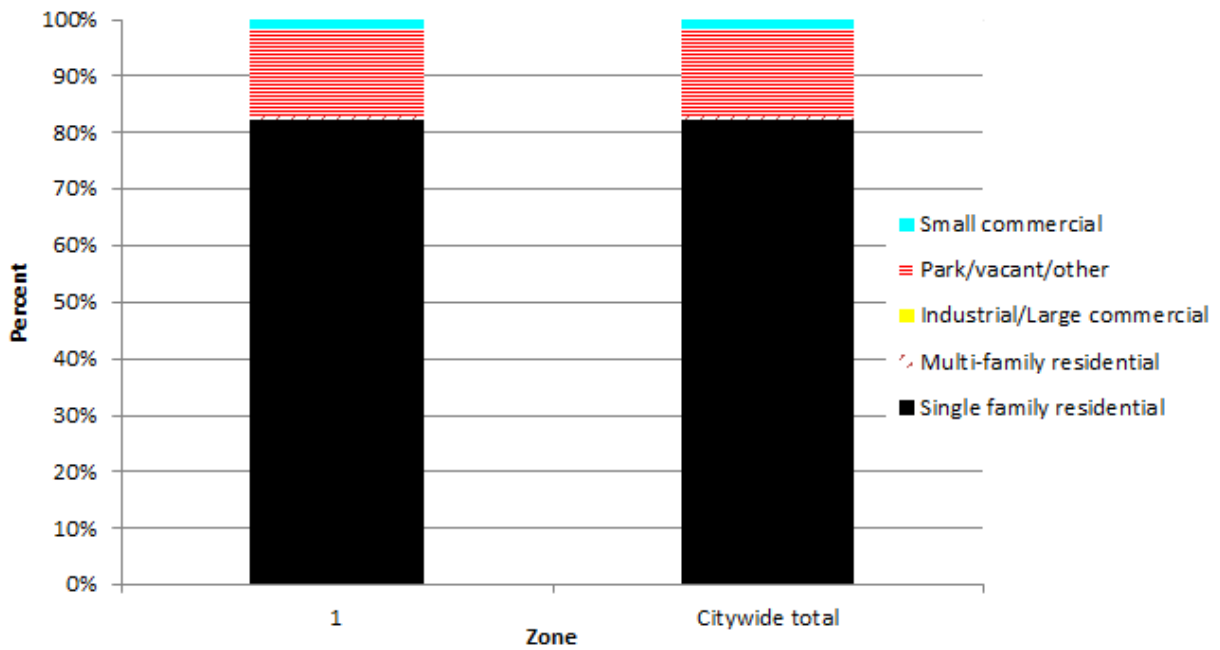
Figure 6: Land Use of city/park trees

Location Public Trees by Zone (%)
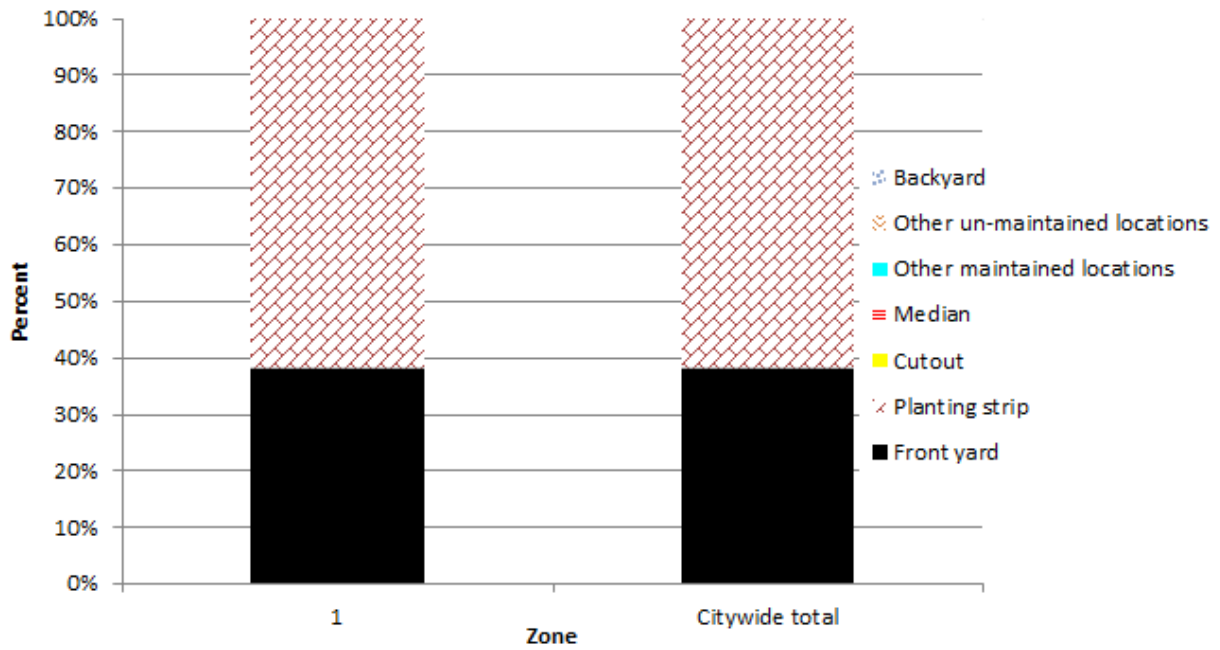
Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	38.07	61.93	0.00	0.00	0.00	0.00	0.00
Citywide total	38.07	61.93	0.00	0.00	0.00	0.00	0.00

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping
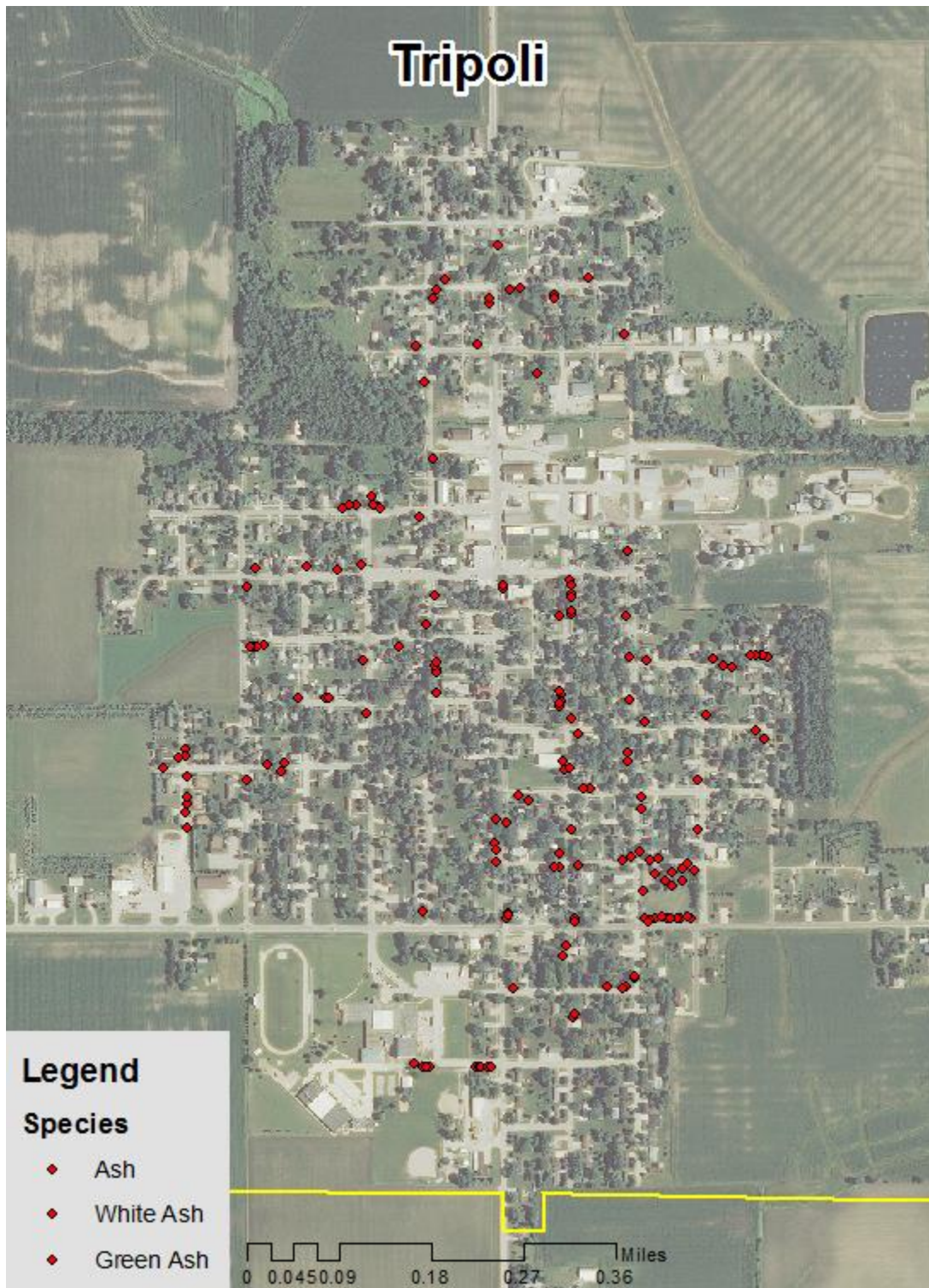
Figure 1: Location of Ash Trees
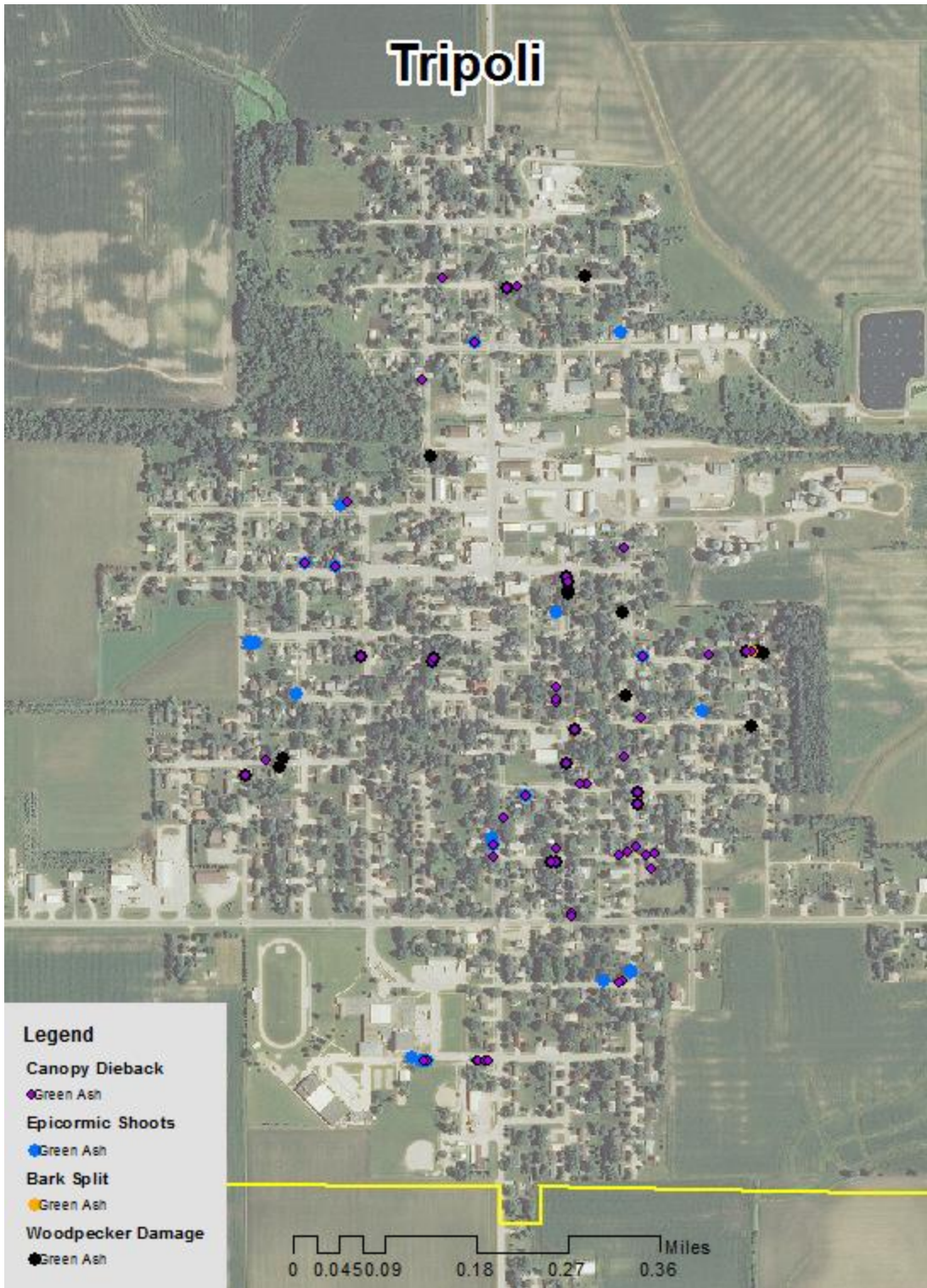
Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance
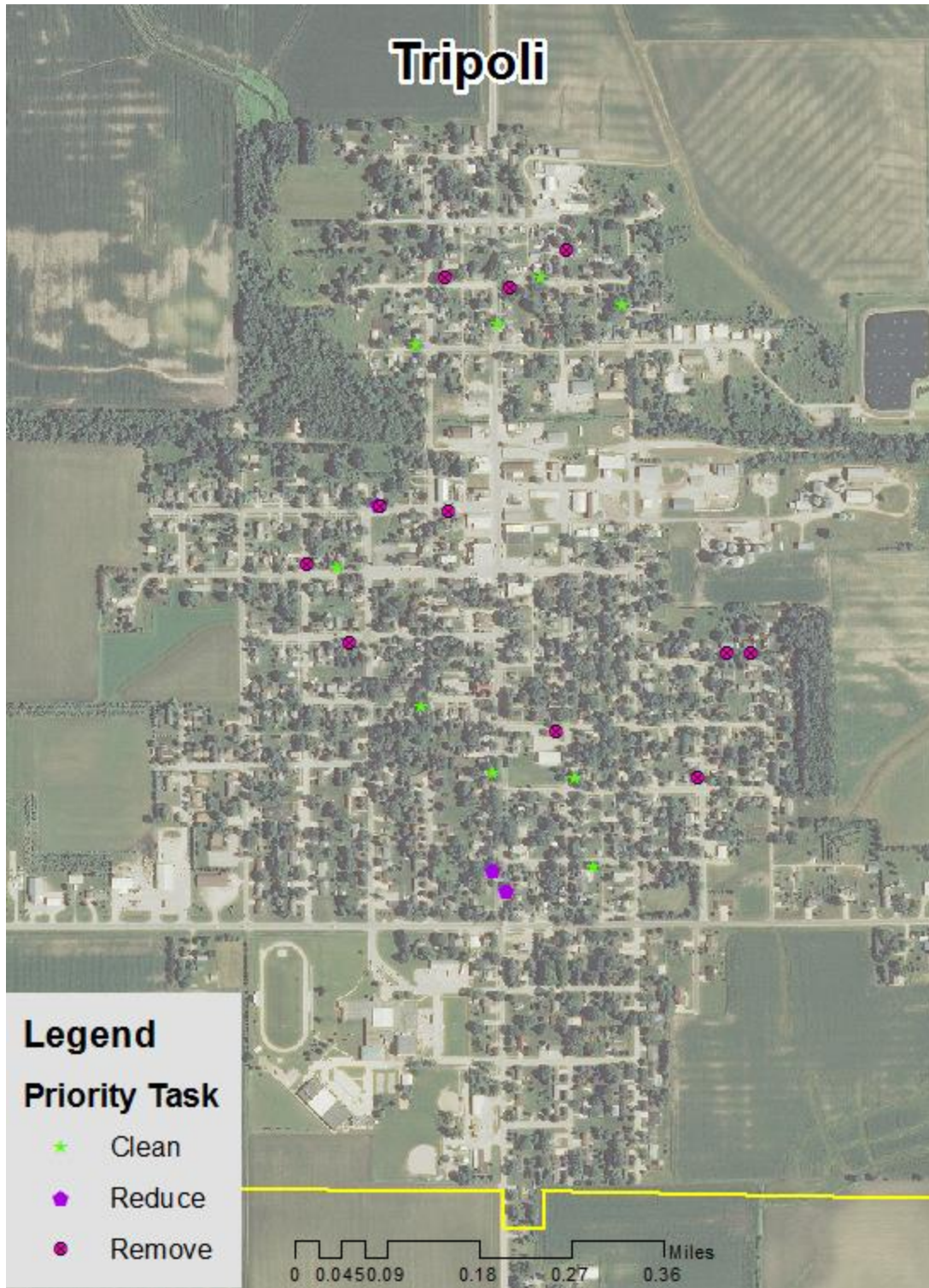
Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Tripoli Tree Ordinances

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.

2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06   INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1.   City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2.   Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

(Code of Iowa, Sec. 364.12[3b & h])

135.10   MAINTENANCE OF PARKING OR TERRACE. It shall be the responsibility of the abutting property owner to maintain all property outside the lot and property lines and inside the curb lines upon the public streets, except that the abutting property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. Maintenance includes timely mowing, trimming trees and shrubs and picking up litter.

(Code of Iowa, Sec. 364.12[2c])

62.06   OBSTRUCTING VIEW AT INTERSECTIONS. It is unlawful to allow any tree, hedge, billboard, or other object to obstruct the view of an intersection by preventing persons from having a clear view of traffic approaching the intersection from cross streets. Any such obstruction is deemed a nuisance and in addition to the standard penalty may be abated in the manner provided by Chapter 50 of this Code of Ordinances.

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. 9th 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.