



2014 Urban Forest Management Plan
 Prepared by Copper Tree Consulting
 In Partnership with the Iowa DNR



Table of Contents

Executive Summary	4
Overview	4
Inventory and Results	4
Recommendations	4
Introduction.....	5
Inventory ____.....	5
Inventory_Results	5
<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>	6
Species Distribution	6
Age Class.....	7
Condition: Wood and Foliage	7
Management Needs	7
Canopy Cover.....	8
Land Use and Location.....	8
Recommendations	8
Risk Management.....	8
Pruning Cycle	9
Planting	9
Continual Monitoring	9
Six Year Maintenance Plan	9
Emerald Ash Borer	10
Ash Tree Removal.....	10
EAB Quarantines.....	10
Wood Disposal	11
Canopy Replacement.....	11
Postponed Work	11
Monitoring.....	11
Private Ash Trees	11
Budget ____	12
Works Cited.....	13
Appendix B: ArcGIS Mapping	25
Appendix C: Marcus Tree Ordinances	29

Executive Summary

Overview

This plan was developed to assist the City of Marcus 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 27.8% of Marcus'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 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 1,027 trees inventoried.

- Marcus's trees provide \$230,074 of benefits annually, an average of \$224 a tree
- There are over 44 species of trees
- The top three genera are: Maple 44.4%, Ash 27.8%, and Spruce 4.1%
- 3% of trees are in need of some type of management
- 12 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 12 trees needing removal, 8 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*
- 103 of the 290 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- 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 \$13,384 annually and apply for grants to plant replacement trees

Introduction

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

Trees are an important component of Marcus'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, storm water 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 Marcus 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 Marcus's urban forestry goals.

Inventory

In 2014, 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 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 1,027 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. Marcus's trees reduce energy related costs by approximately \$20,294 annually (Appendix A, Table 1). These savings are both in Electricity (267.4 MWh) and in Natural Gas (35,967.7 Therms).

Annual Stormwater Benefits

Marcus's trees intercept about 3,202,351 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$86,784 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 Marcus, it is estimated that trees remove 2,853 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$9,820 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Marcus, trees sequester about 807,344 lbs of carbon a year with an associated value of \$6,055 (Appendix A, Table 4). In addition, the trees store 12,769,809 lbs of carbon, with a yearly benefit of \$95,774 (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. Marcus receives \$68,991 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, Marcus's trees provide \$230,074 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,027 trees in Marcus provide approximately \$224 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Marcus has over 44 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees is as follows:

Silver maple	27.85
Green ash	27.85
Norway maple	12.37
Sugar maple	4.19
Spruce	4.09
American basswood	3.12
Honeylocust	2.24
Black walnut	2.24
Littleleaf linden	1.85

Blue spruce	1.75
Northern hackberry	1.36
Red maple	0.97
American elm	0.88
Apple	0.88
Ohio buckeye	0.68
Cherry plum	0.58
Bur oak	0.58
Pin oak	0.49
Conifer Evergreen	0.49
Black maple	0.49
Eastern red cedar	0.49
Maple	0.39
Swamp white oak	0.39
Birch	0.39
Willow	0.39
White ash	0.39
American sycamore	0.29
Chinese elm	0.29
Norway spruce	0.19
Amur corktree	0.19
Scotch pine	0.19
Cottonwood	0.19
Boxelder	0.19
Black poplar	0.10
Mountain ash	0.10
Ginkgo	0.10
Ponderosa pine	0.10
Amur maple	0.10
Bolander beach pine	0.10
Pear	0.10
Northern red oak	0.10
Eastern redbud	0.10
Siberian elm	0.10
Northern white cedar	0.10

Age Class

Most of Marcus’s trees (40.51%) are between 6 and 18 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. Marcus’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 Marcus indicate that 96% of the trees are in good health, with <1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 75% of Marcus’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).

Crown Cleaning	912	92%
----------------	-----	-----

Crown Raising	20	2%
Tree Removal	12	<1%
Crown Reduction	6	<1%

Canopy Cover

The total canopy with both private and public trees is 8% or 82.29 acres. The canopy cover included in the Marcus inventory includes approximately 32 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Marcus’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

See Graph

Location

Planting strip	63%
Front yard	1%

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

Marcus has 12 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 8 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. There are a total of 16 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 12 removals, 5 are ash trees. There are a total of 290 ash trees, and 103 of those have signs and symptoms that have been associated with EAB. In addition, there are 41 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 Marcus.

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 (44.4%) (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, 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

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.

Six Year Maintenance Plan

Year 1

- Removal: 12 largest critical concern trees
- Planting and Replacement: 50 trees to be planted in open locations
- Visual Survey for signs and symptoms of EAB

Year 2

- Removal: 12 trees plus additional ash trees with poor health
- *Or saving for ash tree treatment
- Planting and Replacement: 15 trees in open locations from year one removals
- Routine trimming: Contract to trim city trees
- Visual Survey for signs and symptoms of EAB

Year 3

- Removal: 12 trees - removal of any new critical concern trees and ash in poor health
- *Or saving for ash tree treatment

Planting and Replacement: 15 trees to be planted in open locations and locations from previous removals

Visual Survey for signs and symptoms of EAB

Year 4

Removal: 12 trees - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment

Planting and Replacement: 15 trees in open locations from previous removals

Routine trimming: Contract to trim city trees

Visual Survey for signs and symptoms of EAB

Year 5

Removal: 12 trees - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment

Planting and Replacement: 15 trees to be planted in open locations and locations from previous removals

Visual Survey for signs and symptoms of EAB

Year 6

Removal: 12 trees - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment

Planting and Replacement: 15 trees in open locations from previous removals

Routine trimming: Contract to trim city trees

Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 73 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 \$29,000 a year. If the budget were increased to \$13,384 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*

Treatment of Ash Trees

Chemical treatment can be 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 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 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, 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 (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the 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 14 days

of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Budget

Current Budget

Total \$59,400 over 6 years (\$9,900/year)

FY 2015 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

*Save for routine trimming: \$2000

Watering & Maintenance: \$500

FY 2016 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

Routine trimming: \$4,000

Watering & Maintenance: \$500

FY 2017 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

*Save for routine trimming: \$2000

Watering & Maintenance: \$500

FY 2018 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

Routine trimming: \$4,000

Watering & Maintenance: \$500

FY 2019 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

*Save for routine trimming: \$2000

Watering & Maintenance: \$500

FY 2020 Budget

Removal: \$7200

*Or saving for ash tree treatment

Planting: \$200

Routine trimming: \$4,000

Watering & Maintenance: \$500

***Reduction of ash over 6 years: approximately 73 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 Marcus within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$29,000 a year. If the budget were increased to \$13,384 a year all ash could be removed within 13 years. Additionally, it is recommended that Marcus 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. 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

Annual Energy Benefits of Public Trees

3/1/2015

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	102.9	7,807	13,533.5	13,263	21,070 (N/A)	27.8	37.9	73.67
Green ash	68.4	5,189	9,169.2	8,986	14,175 (N/A)	27.8	25.5	49.56
Norway maple	30.3	2,299	4,344.3	4,257	6,556 (N/A)	12.4	11.8	51.62
Sugar maple	10.2	776	1,365.6	1,338	2,114 (N/A)	4.2	3.8	49.16
Spruce	4.0	307	527.4	517	824 (N/A)	4.1	1.5	19.62
American basswood	8.5	647	1,173.9	1,150	1,798 (N/A)	3.1	3.2	56.17
Honeylocust	7.5	570	985.5	966	1,536 (N/A)	2.2	2.8	66.79
Black walnut	5.8	438	768.3	753	1,191 (N/A)	2.2	2.1	51.77
Littleleaf linden	2.8	211	402.2	394	606 (N/A)	1.9	1.1	31.88
Blue spruce	1.9	147	256.4	251	398 (N/A)	1.8	0.7	22.13
Northern hackberry	4.1	314	563.4	552	866 (N/A)	1.4	1.6	61.86
Red maple	1.1	81	142.6	140	221 (N/A)	1.0	0.4	22.08
American elm	3.3	248	422.8	414	662 (N/A)	0.9	1.2	73.54
Apple	1.2	90	172.6	169	259 (N/A)	0.9	0.5	28.74
Ohio buckeye	1.3	95	168.5	165	261 (N/A)	0.7	0.5	37.22
Cherry plum	0.2	18	40.4	40	57 (N/A)	0.6	0.1	9.53
Bur oak	1.4	104	187.4	184	287 (N/A)	0.6	0.5	47.89
Eastern red cedar	0.5	38	73.7	72	110 (N/A)	0.5	0.2	21.95
Black maple	0.9	66	119.5	117	183 (N/A)	0.5	0.3	36.67
Conifer Evergreen Large	0.6	45	73.1	72	116 (N/A)	0.5	0.2	23.29
Pin oak	1.2	93	164.0	161	254 (N/A)	0.5	0.5	50.72
White ash	0.3	24	44.2	43	67 (N/A)	0.4	0.1	16.74
Maple	0.6	45	79.6	78	123 (N/A)	0.4	0.2	30.67
Willow	1.0	72	143.4	141	213 (N/A)	0.4	0.4	53.17
Swamp white oak	0.4	32	67.4	66	98 (N/A)	0.4	0.2	24.47
Birch	0.3	22	46.1	45	67 (N/A)	0.4	0.1	16.73
American sycamore	1.1	84	154.2	151	235 (N/A)	0.3	0.4	78.32
Chinese elm	1.3	100	176.9	173	273 (N/A)	0.3	0.5	91.02
Cottonwood	0.8	63	112.7	110	173 (N/A)	0.2	0.3	86.52
Bowelder	0.6	44	81.3	80	124 (N/A)	0.2	0.2	62.01
Amur corktree	0.5	36	59.0	58	94 (N/A)	0.2	0.2	46.78
Scotch pine	0.3	21	34.3	34	55 (N/A)	0.2	0.1	27.30
Norway spruce	0.4	28	49.2	48	76 (N/A)	0.2	0.1	38.17
Eastern redbud	0.1	6	12.8	13	18 (N/A)	0.1	0.0	18.19
Northern white cedar	0.1	11	19.7	19	30 (N/A)	0.1	0.1	30.47
Siberian elm	0.4	34	58.3	57	91 (N/A)	0.1	0.2	91.06
Northern red oak	0.1	7	14.2	14	21 (N/A)	0.1	0.0	21.11
Pear	0.1	6	12.8	13	18 (N/A)	0.1	0.0	18.19
Ginkgo	0.2	18	32.0	31	49 (N/A)	0.1	0.1	49.28
Mountain ash	0.1	6	12.8	13	18 (N/A)	0.1	0.0	18.19
Black poplar	0.4	29	53.7	53	82 (N/A)	0.1	0.1	82.02
Bolander beach pine	0.0	1	2.5	2	4 (N/A)	0.1	0.0	3.62
Amur maple	0.2	15	31.6	31	46 (N/A)	0.1	0.1	46.14
Ponderosa pine	0.1	10	14.6	14	24 (N/A)	0.1	0.0	24.14
Total	267.4	20,294	35,967.7	35,248	55,542 (N/A)	100.0	100.0	54.08

Table 1: Annual Energy Benefits

Marcus

Annual Stormwater Benefits of Public Trees

3/1/2015

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	1,588,848	43,058	(N/A)	27.8	49.6	150.55
Green ash	661,847	17,936	(N/A)	27.8	20.7	62.71
Norway maple	279,254	7,568	(N/A)	12.4	8.7	59.59
Sugar maple	95,892	2,599	(N/A)	4.2	3.0	60.43
Spruce	54,179	1,468	(N/A)	4.1	1.7	34.96
American basswood	88,011	2,385	(N/A)	3.1	2.7	74.53
Honeylocust	81,852	2,218	(N/A)	2.2	2.6	96.44
Black walnut	57,158	1,549	(N/A)	2.2	1.8	67.35
Littleleaf linden	24,810	672	(N/A)	1.9	0.8	35.39
Blue spruce	25,369	687	(N/A)	1.8	0.8	38.19
Northern hackberry	31,486	853	(N/A)	1.4	1.0	60.95
Red maple	6,132	166	(N/A)	1.0	0.2	16.62
American elm	29,562	801	(N/A)	0.9	0.9	89.02
Apple	4,702	127	(N/A)	0.9	0.1	14.16
Ohio buckeye	7,394	200	(N/A)	0.7	0.2	28.63
Cherry plum	816	22	(N/A)	0.6	0.0	3.68
Bur oak	19,171	520	(N/A)	0.6	0.6	86.59
Eastern red cedar	7,197	195	(N/A)	0.5	0.2	39.01
Black maple	6,347	172	(N/A)	0.5	0.2	34.40
Conifer Evergreen Large	8,181	222	(N/A)	0.5	0.3	44.34
Pin oak	11,117	301	(N/A)	0.5	0.3	60.26
White ash	2,004	54	(N/A)	0.4	0.1	13.58
Maple	3,480	94	(N/A)	0.4	0.1	23.58
Willow	9,309	252	(N/A)	0.4	0.3	63.07
Swamp white oak	2,344	64	(N/A)	0.4	0.1	15.88
Birch	1,497	41	(N/A)	0.4	0.0	10.14
American sycamore	14,924	404	(N/A)	0.3	0.5	134.81
Chinese elm	21,717	589	(N/A)	0.3	0.7	196.17
Cottonwood	12,729	345	(N/A)	0.2	0.4	172.48
Boxelder	8,047	218	(N/A)	0.2	0.3	109.04
Amur corktree	2,818	76	(N/A)	0.2	0.1	38.19
Scotch pine	4,508	122	(N/A)	0.2	0.1	61.08
Norway spruce	9,209	250	(N/A)	0.2	0.3	124.79
Eastern redbud	264	7	(N/A)	0.1	0.0	7.17
Northern white cedar	2,969	80	(N/A)	0.1	0.1	80.46
Siberian elm	5,904	160	(N/A)	0.1	0.2	159.99
Northern red oak	529	14	(N/A)	0.1	0.0	14.33
Pear	264	7	(N/A)	0.1	0.0	7.17
Ginkgo	1,857	50	(N/A)	0.1	0.1	50.33
Mountain ash	264	7	(N/A)	0.1	0.0	7.17
Black poplar	5,491	149	(N/A)	0.1	0.2	148.79
Bolander beach pine	183	5	(N/A)	0.1	0.0	4.97
Amur maple	1,174	32	(N/A)	0.1	0.0	31.82
Ponderosa pine	1,539	42	(N/A)	0.1	0.0	41.70
Citywide total	3,202,351	86,784	(N/A)	100.0	100.0	84.50

Table 2: Annual Stormwater Benefits

Annual Air Quality Benefits of Public Trees

3/1/2015

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								
Silver maple	296.6	50.3	143.5	13.2	1,593	484.9	71.0	67.8	465.2	3,034	-155.6	-584	1,436.8	4,043	(N/A)	27.8	14.14
Green ash	74.6	11.9	37.2	3.3	401	324.7	47.4	45.2	309.9	2,027	0.0	0	854.3	2,429	(N/A)	27.8	8.49
Norway maple	56.8	9.8	28.0	2.5	307	146.6	21.2	20.2	137.4	909	-13.3	-50	409.2	1,166	(N/A)	12.4	9.18
Sugar maple	11.6	2.0	6.0	0.5	63	48.4	7.1	6.8	46.3	303	-9.3	-35	119.3	331	(N/A)	4.2	7.70
Spruce	5.8	1.2	5.1	0.7	39	19.0	2.8	2.7	18.3	119	-21.0	-79	34.6	80	(N/A)	4.1	1.90
American basswood	11.8	2.0	5.9	0.5	64	40.9	5.9	5.7	38.7	254	-10.2	-38	101.2	280	(N/A)	3.1	8.75
Honeylocust	15.9	2.6	7.3	0.7	84	35.4	5.2	5.0	34.0	222	-12.3	-46	93.8	260	(N/A)	2.2	11.29
Black walnut	6.5	1.0	3.2	0.3	35	27.4	4.0	3.8	26.1	171	0.0	0	72.4	206	(N/A)	2.2	8.95
Littleleaf linden	3.8	0.7	2.0	0.2	21	13.5	2.0	1.9	12.6	84	-1.9	-7	34.7	97	(N/A)	1.9	5.12
Blue spruce	3.2	0.6	2.7	0.4	21	9.1	1.3	1.3	8.8	57	-9.1	-34	18.4	45	(N/A)	1.8	2.47
Northern hackberry	4.2	0.7	2.3	0.2	23	19.8	2.9	2.7	18.8	123	0.0	0	51.5	146	(N/A)	1.4	10.45
Red maple	1.0	0.2	0.5	0.0	5	5.1	0.7	0.7	4.8	32	-0.4	-1	12.7	36	(N/A)	1.0	3.56
American elm	7.3	1.2	3.5	0.3	39	15.4	2.3	2.2	14.8	96	0.0	0	46.9	135	(N/A)	0.9	15.03
Apple	1.4	0.2	0.7	0.1	7	5.7	0.8	0.8	5.3	35	0.0	0	15.1	43	(N/A)	0.9	4.77
Ohio buckeyes	1.0	0.2	0.6	0.0	6	6.0	0.9	0.8	5.7	37	-0.3	-1	15.0	42	(N/A)	0.7	6.01
Cherry plum	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	7	0.0	0	2.8	8	(N/A)	0.6	1.33
Bur oak	2.8	0.4	1.3	0.1	15	6.5	0.9	0.9	6.2	41	0.0	0	19.2	55	(N/A)	0.6	9.20
Eastern red cedar	1.4	0.3	1.1	0.2	9	2.4	0.3	0.3	2.2	15	-4.0	-15	4.4	9	(N/A)	0.5	1.87
Black maple	1.3	0.2	0.6	0.1	7	4.2	0.6	0.6	4.0	26	-0.5	-2	11.1	31	(N/A)	0.5	6.24
Conifer Evergreen Large	0.9	0.2	0.8	0.1	6	2.7	0.4	0.4	2.7	17	-3.2	-12	5.0	11	(N/A)	0.5	2.28
Pin oak	1.7	0.3	0.9	0.1	9	5.8	0.8	0.8	5.5	36	-3.3	-12	12.7	33	(N/A)	0.5	6.68
White ash	0.1	0.0	0.1	0.0	0	1.5	0.2	0.2	1.4	9	0.0	0	3.5	10	(N/A)	0.4	2.43
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)	0.4	4.92
Willow	1.9	0.3	0.9	0.1	10	4.7	0.7	0.6	4.3	29	-0.4	-2	13.1	37	(N/A)	0.4	9.34
Swamp white oak	0.2	0.0	0.2	0.0	1	2.1	0.3	0.3	1.9	13	-0.1	0	4.9	14	(N/A)	0.4	3.47
Birch	0.1	0.0	0.1	0.0	1	1.4	0.2	0.2	1.3	9	0.0	0	3.3	9	(N/A)	0.4	2.34
American sycamore	2.1	0.3	0.9	0.1	11	5.3	0.8	0.7	5.0	33	0.0	0	15.3	44	(N/A)	0.3	14.63
Chinese elm	3.5	0.6	1.5	0.2	18	6.2	0.9	0.9	6.0	39	0.0	0	19.7	57	(N/A)	0.3	19.04
Cottonwood	2.0	0.3	0.9	0.1	10	3.9	0.6	0.5	3.7	25	0.0	0	12.0	35	(N/A)	0.2	17.37
Boxelder	1.2	0.2	0.5	0.1	6	2.8	0.4	0.4	2.6	17	-0.4	-1	7.9	22	(N/A)	0.2	11.20
Ammr corktree	0.4	0.1	0.2	0.0	2	2.2	0.3	0.3	2.1	14	-0.1	0	5.6	16	(N/A)	0.2	7.92
Scotch pine	0.5	0.1	0.4	0.1	3	1.3	0.2	0.2	1.2	8	-1.9	-7	2.1	4	(N/A)	0.2	2.13
Norway spruce	1.1	0.2	0.9	0.1	7	1.8	0.3	0.2	1.7	11	-5.7	-21	0.6	-3	(N/A)	0.2	-1.58
Eastern redbud	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3	(N/A)	0.1	2.55
Northern white cedar	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1	(N/A)	0.1	1.45
Siberian elm	1.2	0.2	0.6	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.8	20	(N/A)	0.1	19.64

Table 3: Annual Air Quality Benefits

Annual CO Benefits of Public Trees

3/1/2015

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 \$
Silver maple	482,285	3,617	-34,412	-1,195	-9	172,538	1,204	619,215	4,644 (N/A)	27.8	52.0
Green ash	155,451	1,166	-11,748	-693	-5	114,682	860	257,691	1,933 (N/A)	27.8	21.6
Norway maple	37,333	280	-4,508	-325	-2	50,800	381	83,300	625 (N/A)	12.4	7.0
Sugar maple	20,120	151	-1,579	-105	-1	17,141	129	35,576	267 (N/A)	4.2	3.0
Spruce	3,967	30	-221	-70	-1	6,786	51	10,462	78 (N/A)	4.1	0.9
American basswood	25,944	195	-2,127	-95	-1	14,303	107	38,026	285 (N/A)	3.1	3.2
Honeylocust	17,094	128	-980	-59	0	12,605	95	28,659	215 (N/A)	2.2	2.4
Black walnut	13,098	98	-1,028	-58	0	9,676	73	21,688	163 (N/A)	2.2	1.8
Littleleaf linden	7,814	59	-404	-35	0	4,673	35	12,048	90 (N/A)	1.9	1.0
Blue spruce	1,489	11	-95	-33	0	3,250	24	4,612	35 (N/A)	1.8	0.4
Northern hackberry	4,270	32	-286	-35	0	6,936	52	10,884	82 (N/A)	1.4	0.9
Red maple	1,746	13	-59	-11	0	1,792	13	3,469	26 (N/A)	1.0	0.3
American elm	3,952	30	-715	-32	0	5,471	41	8,676	65 (N/A)	0.9	0.7
Apple	1,450	11	-105	-15	0	1,978	15	3,308	25 (N/A)	0.9	0.3
Ohio buckeye	2,216	17	-85	-11	0	2,108	16	4,226	32 (N/A)	0.7	0.4
Cherry plum	368	3	-13	-4	0	389	3	739	6 (N/A)	0.6	0.1
Bur oak	3,188	24	-444	-16	0	2,290	17	5,019	38 (N/A)	0.6	0.4
Eastern red cedar	168	1	-22	-9	0	829	6	966	7 (N/A)	0.5	0.1
Black maple	979	7	-71	-8	0	1,465	11	2,364	18 (N/A)	0.5	0.2
Conifer Evergreen Large	587	4	-34	-10	0	990	7	1,533	11 (N/A)	0.5	0.1
Pin oak	4,388	33	-204	-12	0	2,053	15	6,225	47 (N/A)	0.5	0.5
White ash	612	5	-16	-4	0	522	4	1,113	8 (N/A)	0.4	0.1
Maple	979	7	-33	-5	0	988	7	1,928	14 (N/A)	0.4	0.2
Willow	1,534	12	-150	-10	0	1,594	12	2,968	22 (N/A)	0.4	0.2
Swamp white oak	896	7	-21	-5	0	703	5	1,573	12 (N/A)	0.4	0.1
Birch	639	5	-14	-4	0	481	4	1,102	8 (N/A)	0.4	0.1
American sycamore	2,776	21	-325	-12	0	1,852	14	4,292	32 (N/A)	0.3	0.4
Chinese elm	2,736	21	-565	-15	0	2,203	17	4,359	33 (N/A)	0.3	0.4
Cottonwood	1,872	14	-313	-9	0	1,384	10	2,934	22 (N/A)	0.2	0.2
Boselder	2,908	22	-219	-9	0	979	7	3,660	27 (N/A)	0.2	0.3
Amur corktree	772	6	-35	-4	0	790	6	1,523	11 (N/A)	0.2	0.1
Scotch pine	303	2	-22	-5	0	463	3	739	6 (N/A)	0.2	0.1
Norway spruce	256	2	-72	-8	0	622	5	798	6 (N/A)	0.2	0.1

Table 5: Annual Carbon Sequestered

Marcus

Stored CO2 Benefits of Public Trees

3/1/2015

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	7,168,741	53,766	(N/A)	27.8	56.1	187.99
Green ash	2,447,570	18,357	(N/A)	27.8	19.2	64.18
Norway maple	938,407	7,038	(N/A)	12.4	7.3	55.42
Sugar maple	328,710	2,465	(N/A)	4.2	2.6	57.33
Spruce	46,111	346	(N/A)	4.1	0.4	8.23
American basswood	443,140	3,324	(N/A)	3.1	3.5	103.86
Honeylocust	204,156	1,531	(N/A)	2.2	1.6	66.57
Black walnut	214,264	1,607	(N/A)	2.2	1.7	69.87
Littleleaf linden	84,209	632	(N/A)	1.9	0.7	33.24
Blue spruce	19,753	148	(N/A)	1.8	0.2	8.23
Northern hackberry	59,670	448	(N/A)	1.4	0.5	31.97
Red maple	12,323	92	(N/A)	1.0	0.1	9.24
American elm	149,042	1,118	(N/A)	0.9	1.2	124.20
Apple	21,793	163	(N/A)	0.9	0.2	18.16
Ohio buckeye	17,799	133	(N/A)	0.7	0.1	19.07
Cherry plum	2,765	21	(N/A)	0.6	0.0	3.46
Bur oak	92,550	694	(N/A)	0.6	0.7	115.69
Eastern red cedar	4,685	35	(N/A)	0.5	0.0	7.03
Black maple	14,871	112	(N/A)	0.5	0.1	22.31
Conifer Evergreen La	7,110	53	(N/A)	0.5	0.1	10.67
Pin oak	42,477	319	(N/A)	0.5	0.3	63.72
White ash	3,289	25	(N/A)	0.4	0.0	6.17
Maple	6,926	52	(N/A)	0.4	0.1	12.99
Willow	31,271	235	(N/A)	0.4	0.2	58.63
Swamp white oak	4,403	33	(N/A)	0.4	0.0	8.26
Birch	2,638	20	(N/A)	0.4	0.0	4.95
American sycamore	67,659	507	(N/A)	0.3	0.5	169.15
Chinese elm	117,776	883	(N/A)	0.3	0.9	294.44
Cottonwood	65,202	489	(N/A)	0.2	0.5	244.51
Boxelder	45,612	342	(N/A)	0.2	0.4	171.04
Amur corktree	7,248	54	(N/A)	0.2	0.1	27.18
Scotch pine	4,513	34	(N/A)	0.2	0.0	16.92
Norway spruce	14,981	112	(N/A)	0.2	0.1	56.18
Eastern redbud	908	7	(N/A)	0.1	0.0	6.81
Northern white cedar	3,343	25	(N/A)	0.1	0.0	25.07
Siberian elm	29,353	220	(N/A)	0.1	0.2	220.15
Northern red oak	1,025	8	(N/A)	0.1	0.0	7.68
Pear	908	7	(N/A)	0.1	0.0	6.81
Ginkgo	7,800	59	(N/A)	0.1	0.1	58.50
Mountain ash	908	7	(N/A)	0.1	0.0	6.81
Black poplar	25,943	195	(N/A)	0.1	0.2	194.57
Bolander beach pine	43	0	(N/A)	0.1	0.0	0.32
Amur maple	6,743	51	(N/A)	0.1	0.1	50.57
Ponderosa pine	1,170	9	(N/A)	0.1	0.0	8.78
Citywide total	12,769,809	95,774	(N/A)	100.0	100.0	93.26

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

1

Table 4: Annual Carbon Stored

Marcus

Annual Aesthetic/Other Benefits of Public Trees

3/1/2015

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	35,207	(N/A)	27.8	51.0	123.10
Green ash	13,977	(N/A)	27.8	20.3	48.87
Norway maple	3,640	(N/A)	12.4	5.3	28.66
Sugar maple	2,226	(N/A)	4.2	3.2	51.78
Spruce	1,062	(N/A)	4.1	1.5	25.30
American basswood	1,869	(N/A)	3.1	2.7	58.39
Honeylocust	4,035	(N/A)	2.2	5.8	175.44
Black walnut	1,158	(N/A)	2.2	1.7	50.34
Littleleaf linden	883	(N/A)	1.9	1.3	46.50
Blue spruce	413	(N/A)	1.8	0.6	22.97
Northern hackberry	667	(N/A)	1.4	1.0	47.64
Red maple	273	(N/A)	1.0	0.4	27.30
American elm	531	(N/A)	0.9	0.8	59.01
Apple	83	(N/A)	0.9	0.1	9.24
Ohio buckeye	235	(N/A)	0.7	0.3	33.61
Cherry plum	19	(N/A)	0.6	0.0	3.22
Bur oak	250	(N/A)	0.6	0.4	41.59
Eastern red cedar	62	(N/A)	0.5	0.1	12.48
Black maple	155	(N/A)	0.5	0.2	31.08
Conifer Evergreen Large	159	(N/A)	0.5	0.2	31.89
Pin oak	371	(N/A)	0.5	0.5	74.27
White ash	113	(N/A)	0.4	0.2	28.26
Maple	155	(N/A)	0.4	0.2	38.85
Willow	144	(N/A)	0.4	0.2	35.95
Swamp white oak	105	(N/A)	0.4	0.2	26.22
Birch	78	(N/A)	0.4	0.1	19.55
American sycamore	199	(N/A)	0.3	0.3	66.26
Chinese elm	175	(N/A)	0.3	0.3	58.34
Cottonwood	125	(N/A)	0.2	0.2	62.47
Bowelder	157	(N/A)	0.2	0.2	78.52
Amur corktree	78	(N/A)	0.2	0.1	39.16
Scotch pine	79	(N/A)	0.2	0.1	39.70
Norway spruce	26	(N/A)	0.2	0.0	13.13
Eastern redbud	6	(N/A)	0.1	0.0	6.40
Northern white cedar	47	(N/A)	0.1	0.1	47.08
Siberian elm	54	(N/A)	0.1	0.1	53.50
Northern red oak	16	(N/A)	0.1	0.0	16.24
Pear	6	(N/A)	0.1	0.0	6.40
Ginkgo	0	(N/A)	0.1	0.0	0.00
Mountain ash	6	(N/A)	0.1	0.0	6.40
Black poplar	67	(N/A)	0.1	0.1	66.60
Bolander beach pine	13	(N/A)	0.1	0.0	13.37
Amur maple	29	(N/A)	0.1	0.0	28.80
Ponderosa pine	32	(N/A)	0.1	0.0	32.32
Citywide total	68,991	(N/A)	100.0	100.0	67.18

Table 6: Annual Social and Aesthetic Benefits

Marcus

Total Annual Benefits, Net Benefits, and Costs for Public Trees

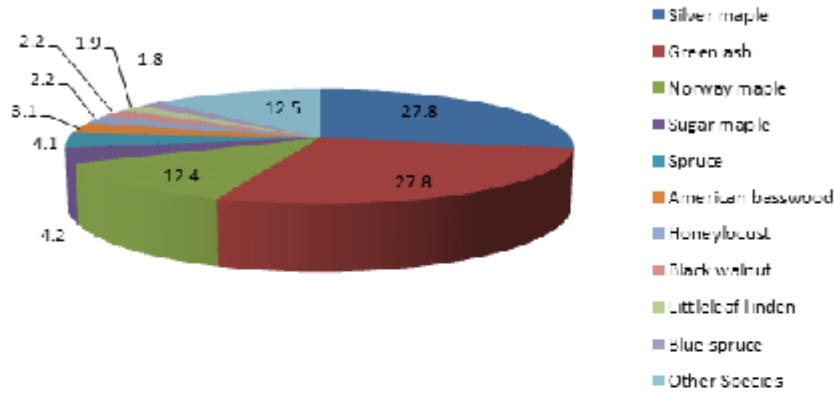
3/1/2015

Benefits	Total (\$)	Standard Error	\$/tree	Standard Error	\$/capita	Standard Error
Energy	55,542	(N/A)	54.08	(N/A)	0.00	(N/A)
CO2	8,937	(N/A)	8.70	(N/A)	0.00	(N/A)
Air Quality	9,820	(N/A)	9.56	(N/A)	0.00	(N/A)
Stormwater	86,784	(N/A)	84.50	(N/A)	0.00	(N/A)
Aesthetic/Other	68,991	(N/A)	67.18	(N/A)	0.00	(N/A)
Total Benefits	230,074	(N/A)	224.02	(N/A)	0.00	(N/A)
Costs						
Planting	0		0.00		0.00	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	0		0.00		0.00	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	0		0.00		0.00	
Total Costs	0		0.00		0.00	
Net Benefits	230,074	(N/A)	224.02	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Table 7: Summary of Benefits in Dollars

Species Distribution of Public Trees

3/1/2015

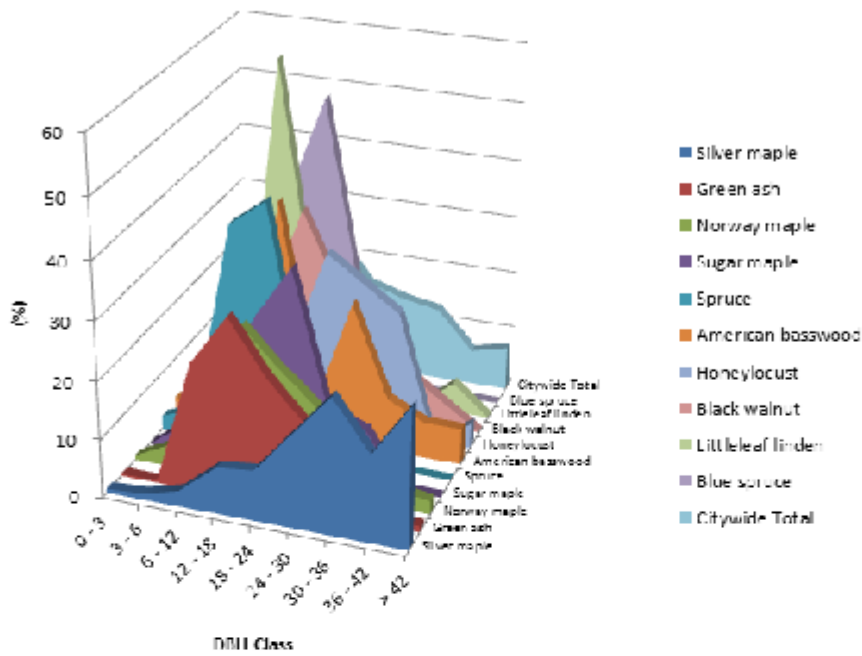


Species	Percent
Silver maple	27.8
Green ash	27.8
Norway maple	12.4
Sugar maple	4.2
Spruce	4.1
American basswood	3.1
Honeylocust	2.2
Black walnut	2.2
Littleleaf linden	1.9
Blue spruce	1.8
Other Species	12.5
Total	100.0

Figure 1: Species Distribution

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

3/1/2015

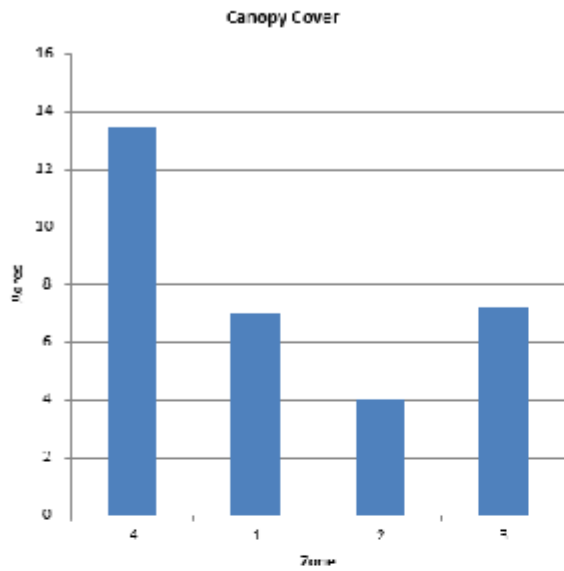


Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Silver maple	0.70	1.05	2.80	8.04	8.74	16.08	23.43	15.03	24.13
Green ash	0.35	0.35	22.03	30.77	21.68	15.03	7.69	1.05	1.05
Norway maple	0.79	3.94	15.75	26.77	20.47	14.96	11.81	3.15	2.36
Sugar maple	0.00	4.65	13.95	25.58	34.88	11.63	9.30	0.00	0.00
Spruce	2.38	4.76	38.10	42.86	9.52	2.38	0.00	0.00	0.00
American basswood	3.13	0.00	3.13	40.63	6.25	25.00	9.38	6.25	6.25
Honeylocust	0.00	0.00	4.35	13.04	30.43	26.09	21.74	0.00	4.35
Black walnut	0.00	0.00	17.39	34.78	21.74	13.04	8.70	4.35	0.00
Littleleaf linden	0.00	0.00	57.89	15.79	10.53	10.53	0.00	5.26	0.00
Blue spruce	0.00	0.00	33.33	50.00	16.67	0.00	0.00	0.00	0.00
Citywide Total	0.97	2.34	17.04	23.47	15.77	13.83	12.76	6.13	7.69

Figure 2: Relative Age Class

Canopy Cover of Public Trees (Acres)

3/1/2015



Zone	Acres	% of Total Canopy Cover
4	13	42.5
1	7	22.1
2	4	12.7
3	7	22.6
Citywide total	32	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 Total	0	0	32	0.00	0.00

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone

3/1/2015

Zone	Land Use	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Single family residential	214	(N/A)	100.00	20.84
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	0	(N/A)	0.00	0.00
	Total		214	(N/A)	100.00
4	Single family residential	419	(N/A)	100.00	40.80
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	0	(N/A)	0.00	0.00
	Total		419	(N/A)	100.00
2	Single family residential	125	(N/A)	100.00	12.17
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	0	(N/A)	0.00	0.00
	Total		125	(N/A)	100.00
3	Single family residential	265	(N/A)	98.51	25.80
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	2	(N/A)	0.74	0.19
	Park/vacant/other	2	(N/A)	0.74	0.19
	Total		269	(N/A)	100.00
Citywide	Single family residential	1,023	(N/A)	99.61	99.61
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	2	(N/A)	0.19	0.19
	Park/vacant/other	2	(N/A)	0.19	0.19
	Total		1,027	(N/A)	100.00

Figure 6: Land Use of city/park 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: Marcus Tree Ordinances

CHAPTER 151 TREES AND GRASS

151.01 Definition 151.05 Disease Control
151.02 Planting Restrictions 151.06 Inspection and Removal
151.03 Duty to Trim Trees 151.07 Cutting or Mowing of Grass
151.04 Trimming Trees to be Supervised

151.01 DEFINITION. For use in this chapter, “boulevard” 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 boulevard or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the boulevard 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 boulevard 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 eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, 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 infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

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 the 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 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])

151.07 CUTTING OR MOWING OF GRASS.

1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.

2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

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.