Mallard, IA

2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Mallard 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 33% of Mallard'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 2018, 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 89 trees inventoried.

- Mallard's trees provide $27,873.91 of benefits annually, an average of $313.19 a tree
- There were 13 species of trees from 11 different genera that were recorded in this inventory.
- The top three genera are: Maple 40%, Ash 33%, and Honeylocust 9%
- None of the trees inventoried recorded management needs other than routine maintenance.
- No data was collected for which trees are recommended for removal or where they are located. Additionally, no data was collected as to the maintenance priority of any given tree.

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.

- EAB was not recorded when the inventory was conducted. There are 29 ash trees within Mallard and it is likely that some are currently displaying symptoms of EAB. It is recommended that a visual inspection of all ash trees be conducted annually.
- All trees should be pruned on a routine schedule- one sixth of the city every year
- 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

Introduction

This plan was developed to assist Mallard 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 or treatment and replacement planting. With proper planning and management of the current canopy in Mallard, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2018, 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 89 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as 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. Mallard's trees reduce energy related costs by approximately $6,216 annually (Appendix A, Table 1). These savings are both in Electricity (30.0 MWh) and in Natural Gas (4,019.0 Therms).

Annual Stormwater Benefits
Mallard's trees intercept about 396,283 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $10,739 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 Mallard, it is estimated that trees remove 414 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $1,174 (Appendix A, Table 3).

Annual Carbon Benefits
Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Mallard, trees sequester about 99,960 lbs of carbon a year with an associated value of $750 (Appendix A, Table 5). In addition, the trees store 1,763,888 lbs of carbon, with a yearly benefit of $13,229 (Appendix A, Table 4).

Annual Aesthetics Benefits
Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Mallard receives $8,683 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, Mallard's trees provide $27,873.91 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 89 trees in Mallard provide approximately $313.19 annually (Appendix A, Table 7).

Forest Structure

Species Distribution
Mallard has at least 13 different tree species of trees from 11 different genera along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Genus	Count	Percent
Maple	36	40%
Ash	29	33%
Honeylocust	8	9%
Elm	4	4%
Walnut	3	3%
Hackberry	2	2%
Oak	2	2%
Spruce	2	2%
Basswood	1	1%
Broadleaf	1	1%

(S/M/L)		
Birch	1	1%

Age Class

Most of Mallard's trees (36%) are between 18 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. Mallard has a positive slope, indicating that there more trees in larger size categories than smaller categories, indicating that Mallard has an older than average tree stand. Additionally, there were no trees surveyed that had a diameter of between 0-3 inches, and only 2% of trees surveyed had a diameter of between 3-6 inches. This indicates that Mallard does not have a very resilient canopy, as there are currently very few young trees on public land to replace old trees as they naturally die.

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 Mallard indicate that 65% of the trees are in good health, with 9% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 65% of Mallard'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 7% of the population. This 7% is an estimate of trees that need management follow up.

Management Needs

There were no specific management needs recorded for Mallard's trees. It is recommended that the trees that were listed as in need of immediate maintenance be prioritized.

Canopy Cover

The total canopy with both private and public trees is 21%, 53.47acres. The canopy cover included in the Mallard inventory includes approximately 3.91 acres, which is 2% of the total land area of Mallard. (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 19 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Mallard'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	**Count**	**Percent**
Park/Vacant/Other	19	21%
Single Family Res.	70	79%

Location	**Count**	**Percent**
Front Yard	5	6%
Other Maintained	19	21%
Planting Strip	65	73%

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

Detailed information was not collected on which trees are potentially hazardous or where they might be located.

Poor tree species

The data collectors did not collect appropriate data on this, however it was noted that 29 trees in Mallard are ash trees, which is 33% of the total trees inventoried. While the collectors did not gather data on EAB, it is common though out the region and very likely affecting many of the ash trees in Mallard. Visual inspections of ash trees should be conducted annually in order track their conditions. Treatment for EAB is an effective preventative measure that can be taken to prevent the death of healthy ash trees. It is not recommended to be used on ash trees already displaying two or more symptoms of EAB. Since data for EAB was not collected, we will present two separate scenarios regarding ash management versus removal. If all 29 ash trees in Mallard are healthy and could be treated, it would cost an estimated $10,485 every two years, which is an average of $361.55 per tree. If all 29 ash trees in Mallard are suffering from EAB, it would cost an estimated $23,200 to remove them, which is an average of $800 per tree. These scenarios represent two different extremes and while it is likely that many ash trees within Mallard are displaying signs of EAB, it is also likely that many are not and would therefore be eligible for treatment. It is recommended that Mallard treat many of its larger, healthier ash trees and begin removing dead or dying ash trees, as well as those found to be displaying 2 or more symptoms of EAB.

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.

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 Mallard.

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 (40%) (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. All trees planted must comply by any/any ordinances that Mallard has for tree plantings and acceptable tree species.

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.

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 must meet Mallard's city ordinances. The new plantings should be a diverse mix and should not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow, black walnut, or any species otherwise prohibited by Mallard city ordinances.

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 if preventative treatments are not being used

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

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Annual Energy Benefits of Public Trees

12/10/2019

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	11.8	898	1,562.1	1,531	2,429	(N/A)	32.6	39.1	83.74
Green ash	8.7	660	1,201.1	1,177	1,838	(N/A)	32.6	29.6	63.36
Honeylocust	2.7	205	346.1	339	544	(N/A)	9.0	8.7	67.96
Norway maple	1.5	111	208.6	204	315	(N/A)	7.9	5.1	45.03
American elm	2.0	153	241.2	236	389	(N/A)	4.5	6.3	97.30
Northern hackberry	1.2	88	164.9	162	249	(N/A)	3.4	4.0	83.12
Black walnut	1.0	73	135.2	132	206	(N/A)	3.4	3.3	68.56
Norway spruce	0.2	14	24.1	24	38	(N/A)	2.2	0.6	18.86
White oak	0.0	2	3.7	4	6	(N/A)	1.1	0.1	5.82
Paper birch	0.2	18	27.0	26	44	(N/A)	1.1	0.7	44.23
Broadleaf Deciduous Large	0.4	29	53.7	53	82	(N/A)	1.1	1.3	82.02
American basswood	0.4	27	51.4	50	77	(N/A)	1.1	1.2	77.27
Total	30.0	2,278	4,019.0	3,939	6,216	(N/A)	100.0	100.0	69.85

Table 2: Annual Stormwater Benefits

Rodman

Annual Stormwater Benefits of Public Trees

12/10/2019

Species	Total rainfall interception (Gal)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	201,631	5,464	(N/A)	32.6	50.9	188.42
Green ash	99,040	2,684	(N/A)	32.6	25.0	92.55
Honeylocust	29,443	798	(N/A)	9.0	7.4	99.74
Norway maple	12,290	333	(N/A)	7.9	3.1	47.58
American elm	15,044	408	(N/A)	4.5	3.8	101.92
Northern hackberry	12,544	340	(N/A)	3.4	3.2	113.31
Black walnut	12,420	337	(N/A)	3.4	3.1	112.20
Norway spruce	2,134	58	(N/A)	2.2	0.5	28.92
White oak	172	5	(N/A)	1.1	0.0	4.65
Paper birch	1,466	40	(N/A)	1.1	0.4	39.72
Broadleaf Deciduous Large	5,491	149	(N/A)	1.1	1.4	148.79
American basswood	4,609	125	(N/A)	1.1	1.2	124.90
Citywide total	396,283	10,739	(N/A)	100.0	100.0	120.67

Table 3: Annual Air Quality Benefits

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Annual Air Quality Benefits of Public Trees

12/10/2019

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	39.5	6.7	18.9	1.8	212	55.8	8.2	7.8	53.5	349	-20.5	-77	171.6	484	(N/A)	32.6	16.68
Green ash	12.3	2.0	5.9	0.6	66	41.6	6.1	5.8	39.4	259	0.0	0	113.6	325	(N/A)	32.6	11.20
Honeylocust	5.8	0.9	2.6	0.3	30	12.6	1.9	1.8	12.2	79	-4.5	-17	33.6	93	(N/A)	9.0	11.60
Norway maple	2.3	0.4	1.2	0.1	13	7.1	1.0	1.0	6.6	44	-0.6	-2	19.1	54	(N/A)	7.9	7.77
American elm	6.7	1.1	3.1	0.3	36	9.3	1.4	1.3	9.1	59	0.0	0	32.4	94	(N/A)	4.5	23.59
Northern hackberry	2.1	0.4	1.0	0.1	11	5.6	0.8	0.8	5.2	35	0.0	0	16.0	46	(N/A)	3.4	15.34
Black walnut	1.7	0.3	0.8	0.1	9	4.6	0.7	0.6	4.4	29	0.0	0	13.1	38	(N/A)	3.4	12.57
Norway spruce	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.7	4	(N/A)	2.2	2.15
White oak	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)	1.1	0.87
Paper birch	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7	(N/A)	1.1	7.42
Broadleaf Deciduous Large	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)	1.1	15.71
American basswood	0.7	0.1	0.3	0.0	4	1.7	0.2	0.2	1.6	11	-0.6	-2	4.4	12	(N/A)	1.1	12.18
Citywide total	72.3	12.1	34.4	3.2	386	142.3	20.8	19.8	135.9	889	-26.8	-101	414.0	1,174	(N/A)	100.0	13.20

Table 4: Annual Carbon Stored

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Stored CO2 Benefits of Public Trees

12/10/2019

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	978,094	7,336	(N/A)	32.6	55.5	252.96
Green ash	401,129	3,008	(N/A)	32.6	22.7	103.74
Honeylocust	74,041	555	(N/A)	9.0	4.2	69.41
Norway maple	38,738	291	(N/A)	7.9	2.2	41.51
American elm	126,831	951	(N/A)	4.5	7.2	237.81
Northern hackberry	32,702	245	(N/A)	3.4	1.9	81.75
Black walnut	56,174	421	(N/A)	3.4	3.2	140.43
Norway spruce	1,427	11	(N/A)	2.2	0.1	5.35
White oak	185	1	(N/A)	1.1	0.0	1.39
Paper birch	3,672	28	(N/A)	1.1	0.2	27.54
Broadleaf Deciduous	25,943	195	(N/A)	1.1	1.5	194.57
American basswood	24,952	187	(N/A)	1.1	1.4	187.14
Citywide total	1,763,888	13,229	(N/A)	100.0	100.0	148.64

Table 5: Annual Carbon Sequestered

Rodman

Annual CO Benefits of Public Trees

12/10/2019

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standar ($) d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	61,401	461	-4,695	-145	-36	19,839	149	76,400	573 (N/A)	32.6	54.0	19.76
Green ash	20,985	157	-1,925	-91	-15	14,596	109	33,564	252 (N/A)	32.6	23.7	8.68
Honeylocust	6,342	48	-355	-20	-3	4,521	34	10,487	79 (N/A)	9.0	7.4	9.83
Norway maple	2,031	15	-187	-15	-2	2,449	18	4,278	32 (N/A)	7.9	3.0	4.58
American elm	2,395	18	-609	-20	-5	3,379	25	5,145	39 (N/A)	4.5	3.6	9.65
Northern hackberry	1,563	12	-157	-11	-1	1,939	15	3,334	25 (N/A)	3.4	2.4	8.33
Black walnut	2,232	17	-270	-11	-2	1,617	12	3,568	27 (N/A)	3.4	2.5	8.92
Norway spruce	168	1	-7	-3	0	311	2	469	4 (N/A)	2.2	0.3	1.76
White oak	74	1	-1	-1	0	49	0	121	1 (N/A)	1.1	0.1	0.91
Paper birch	445	3	-18	-2	0	393	3	819	6 (N/A)	1.1	0.6	6.14
Broadleaf Deciduous Large	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	1.1	1.0	11.11
American basswood	1,365	10	-120	-4	-1	594	4	1,835	14 (N/A)	1.1	1.3	13.76
Citywide total	99,960	750	-8,467	-327	-66	50,336	378	141,502	1,061 (N/A)	100.0	100.0	11.92

Table 6: Annual Social and Aesthetic Benefits

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Annual Aesthetic/Other Benefits of Public Trees

12/10/2019

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	4,287	(N/A)	32.6	49.4	147.83
Green ash	1,692	(N/A)	32.6	19.5	58.34
Honeylocust	1,567	(N/A)	9.0	18.0	195.84
Norway maple	204	(N/A)	7.9	2.3	29.08
American elm	297	(N/A)	4.5	3.4	74.22
Northern hackberry	194	(N/A)	3.4	2.2	64.74
Black walnut	174	(N/A)	3.4	2.0	57.90
Norway spruce	48	(N/A)	2.2	0.5	23.87
White oak	15	(N/A)	1.1	0.2	14.73
Paper birch	46	(N/A)	1.1	0.5	45.86
Broadleaf Deciduous Large	67	(N/A)	1.1	0.8	66.60
American basswood	94	(N/A)	1.1	1.1	94.13
Citywide total	8,683	(N/A)	100.0	100.0	97.56

Table 7: Summary of Benefits in Dollars

Rodman

Annual Benefits of Public Trees by Species ($/tree)

12/10/2019

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Silver maple	83.74	19.76	16.68	188.42	147.83	456.43	(N/A)
Green ash	63.36	8.68	11.20	92.55	58.34	234.13	(N/A)
Honeylocust	67.96	9.83	11.60	99.74	195.84	384.97	(N/A)
Norway maple	45.03	4.58	7.77	47.58	29.08	134.04	(N/A)
American elm	97.30	9.65	23.59	101.92	74.22	306.68	(N/A)
Northern hackberry	83.12	8.33	15.34	113.31	64.74	284.85	(N/A)
Black walnut	68.56	8.92	12.57	112.20	57.90	260.15	(N/A)
Norway spruce	18.86	1.76	2.15	28.92	23.87	75.55	(N/A)
White oak	5.82	0.91	0.87	4.65	14.73	26.98	(N/A)
Paper birch	44.23	6.14	7.42	39.72	45.86	143.36	(N/A)
Broadleaf Deciduous I	82.02	11.11	15.71	148.79	66.60	324.23	(N/A)
American basswood	77.27	13.76	12.18	124.90	94.13	322.23	(N/A)
Citywide Total	69.85	11.92	13.20	120.67	97.56	313.19	(N/A)

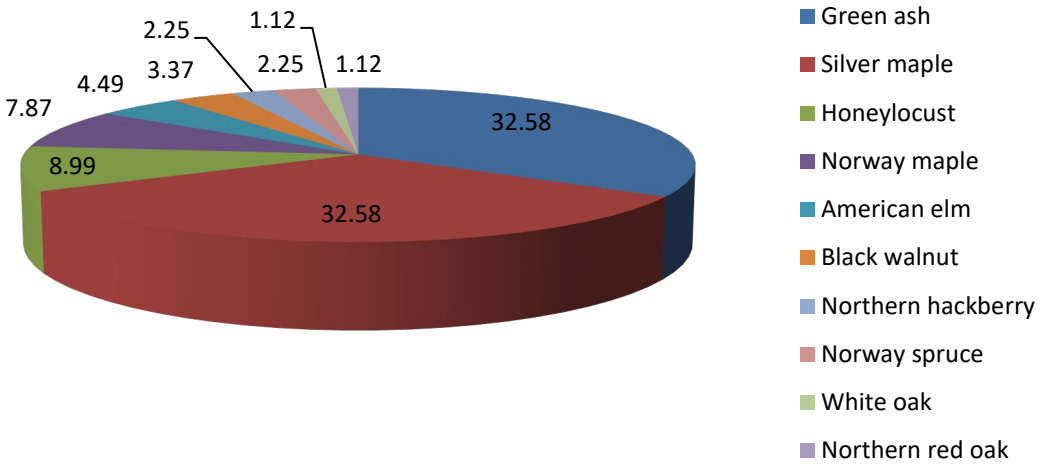

Figure 1: Species Distribution

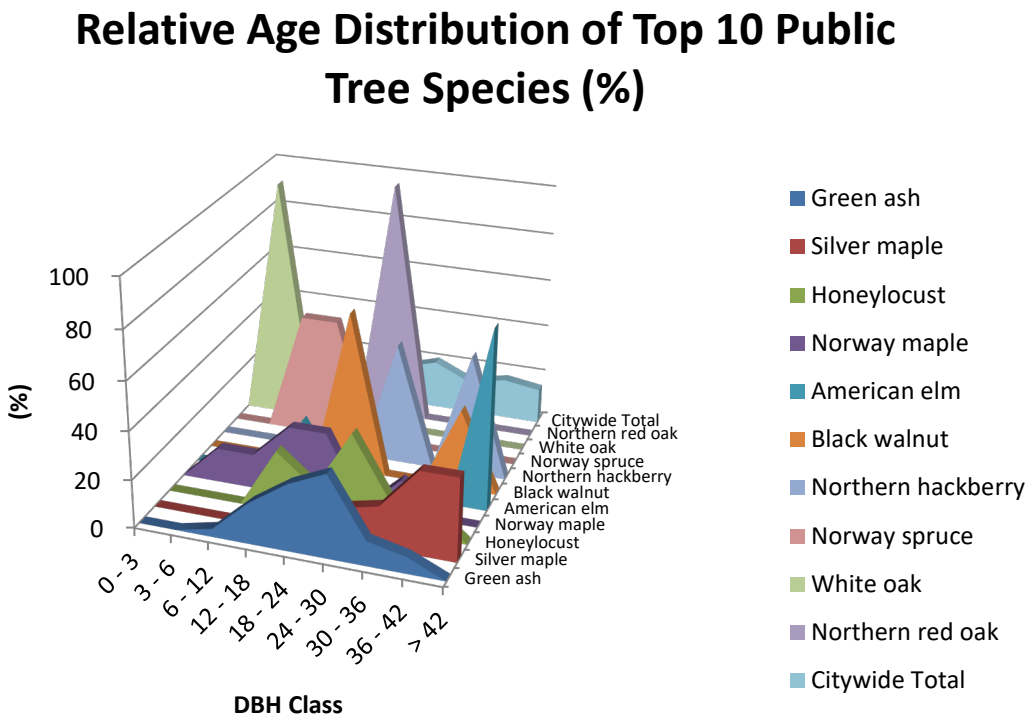

Figure 2: Relative Age Class

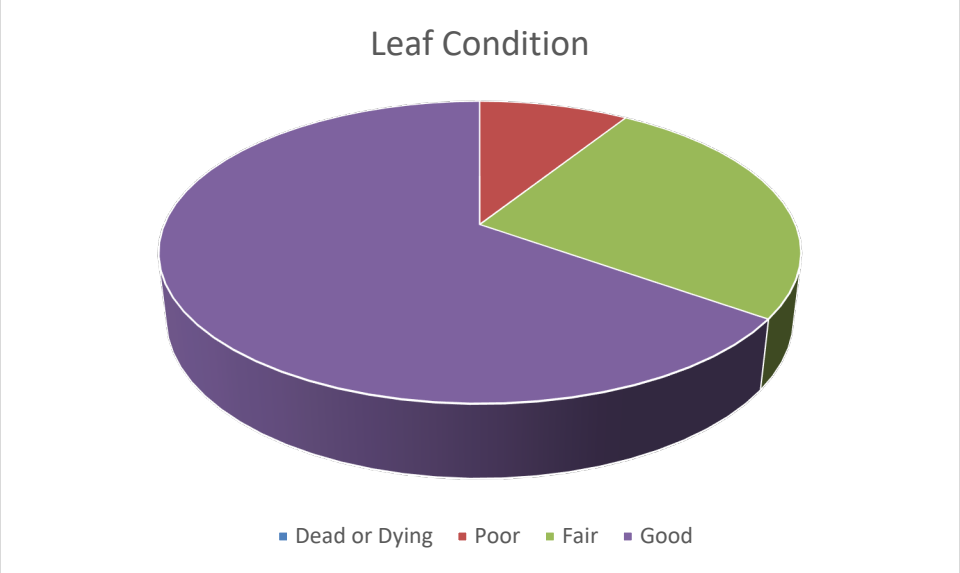

Figure 3: Foliage Condition

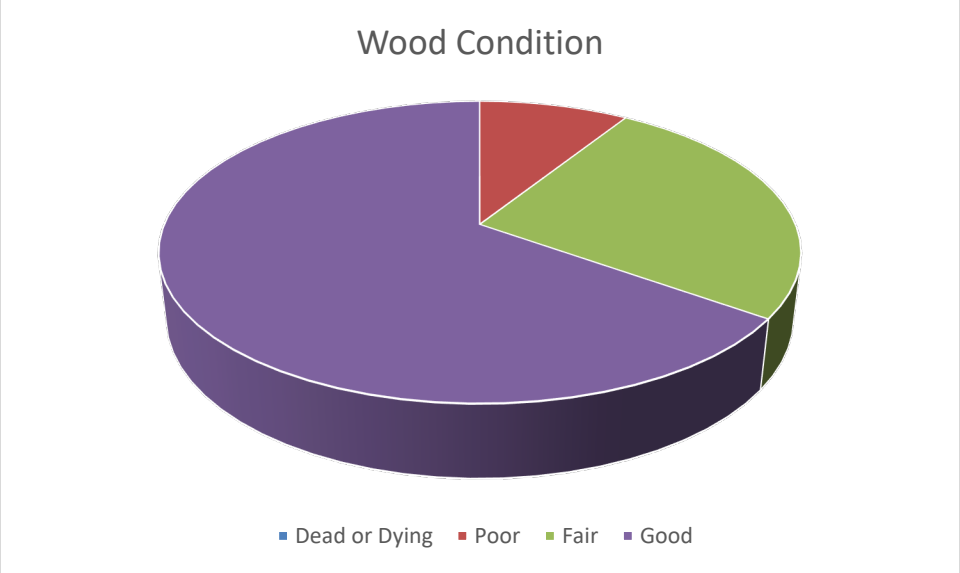

Figure 4: Wood Condition

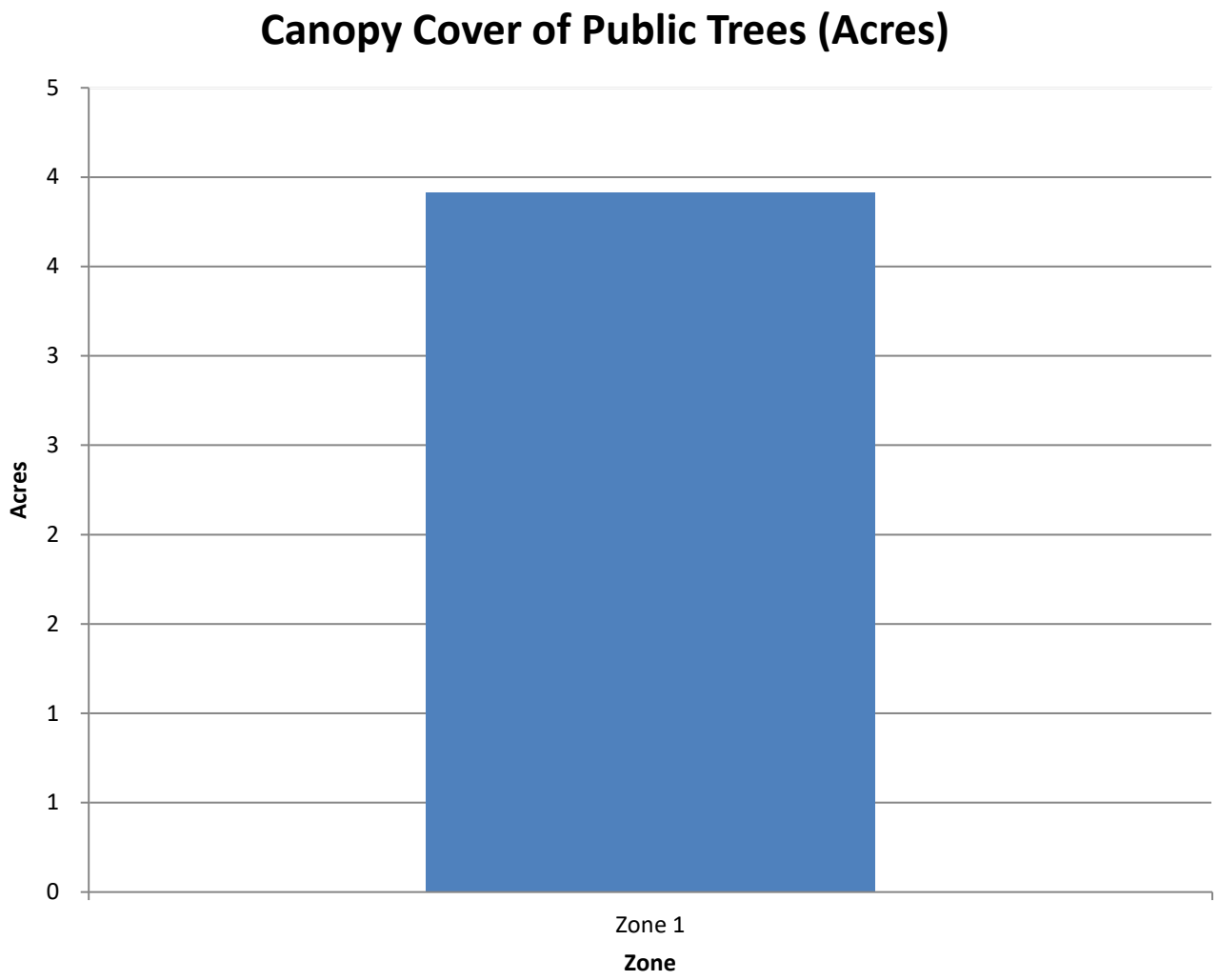

Figure 5: Canopy Cover in Acres

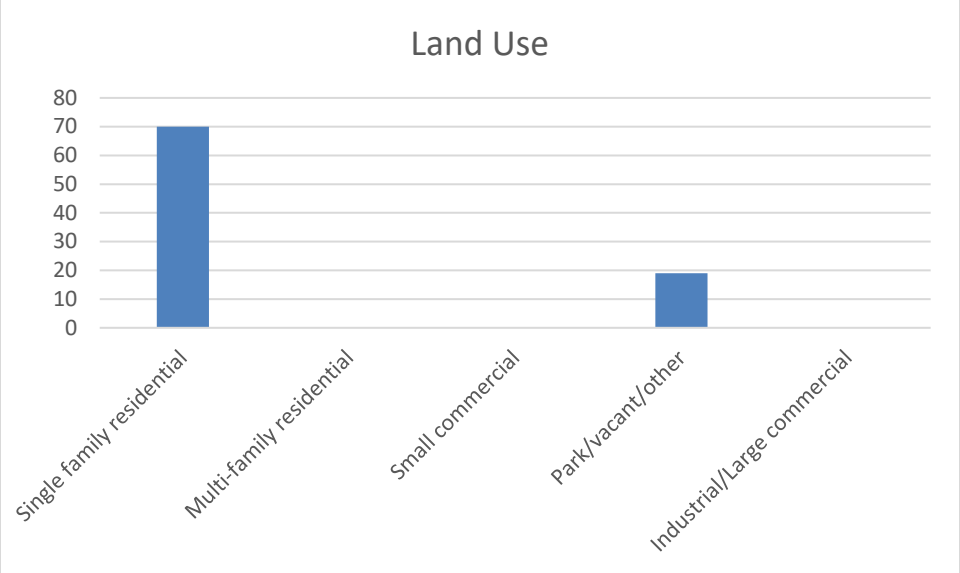

Figure 6: Land Use of city/park trees

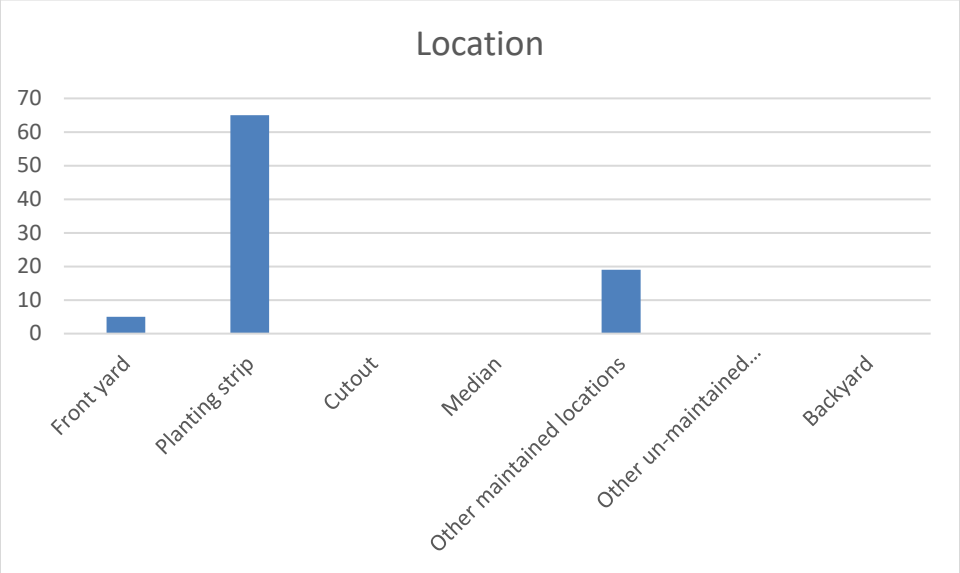

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 3: Location of Poor Condition Trees

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