Readlyn, IA

2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Readlyn 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 23% of Readlyn's city owned trees (ash) will die since EAB has becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2020, 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 529 trees inventoried.

- Readlyn's trees provide $95,031 of benefits annually, an average of $179.61 a tree
- There are over 27 species of trees
- The top three genera are: Maple 43%, Ash 23%, and Oak 5%
- 33% of trees are in need of some type of management
- 13 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 13 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*
- 79 of the 120 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, 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 121 years to remove ash – Suggestion: request a budget increase to $16,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2020, 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 529 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. Fin

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Readlyn's trees reduce energy related costs by approximately $26,384 annually (Appendix A, Table 1). These savings are both in Electricity (124.7 MWh) and in Natural Gas (17,265.8 Therms).

Annual Stormwater Benefits

Readlyn's trees intercept about 1,298,000 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $35,176 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 Readlyn, it is estimated that trees remove 1,625 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 $4,583 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Readlyn, trees sequester about 268,339 lbs of carbon a year with an associated value of $2,013 (Appendix A, Table 5). In addition, the trees store 4,642,639 lbs of carbon, with a yearly benefit of $34,820 (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. Readlyn receives $25,465 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, Readlyn's trees provide $95,031 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 529 trees in Readlyn provide approximately $179.61 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Readlyn has over 27 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	227	43%
Ash	120	23%
Oak	28	5%
Apple (Crab)	20	4%
Hackberry	19	4%
Honey Locust	18	3%
Arborvitae	15	3%
Basswood	12	2%
Callery Pear	11	2%
Spruce	11	2%
Walnut	9	2%
Elm	5	1%
Kentucky Coffee Tree	2	1%
Catalpa	1	<1%
Ginkgo	1	<1%
Redbud	1	<1%
Elm	2	<1%
Other	4	1%

Age Class

Most of Readlyn's trees 54% are 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. Readlyn's size curve is on the larger side, indicating an older 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 Readlyn indicate that 94% of the trees are in good health, with only 6% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 94% of Readlyn'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 6% of the population. This 6% 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	78	15%
Crown Raising	65	12%
Tree Staking	0	0%
Tree Removal	13	2%
Crown Reduction	13	2%

Canopy Cover

The total canopy with both private and public trees is 28%, 58 acres. The canopy cover included in the Readlyn inventory includes approximately 13.75 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 1-3%, in 30 years. To achieve this goal it is estimated that 5 to 15 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Readlyn'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	76%
Park/vacant/other	24%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

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

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

Hazardous trees

Readlyn has 1 critical concern tree that needs immediate removal. This tree can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). 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 12 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, 11 are ash trees. There are a total of 120 ash trees, and 79 of those have signs and symptoms that have been associated with EAB. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Readlyn.

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 (43%) (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 with <u>No Additional Funding</u>

Year 1

Removal: 1 critical concern tree.
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 1 ash tree with poor health
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees (No budget)
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 1 ash tree with poor health
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 1 ash tree with poor health
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees (No budget)
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 1 ash tree with poor health
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 1 ash tree with poor health
Planting and Replacement: Plant 5 new trees (No budget)
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees (No budget)
Visual Survey for signs and symptoms of EAB

Reduction of ash over 6 years: Approximately 5 ash trees removed (approximately 4% of ash). It will take approximately 121 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years.
**To remove all ash trees within 6 years, the budget would need to be increased to $16,000 a year. If the budget were increased to $10,000 a year all ash could be removed in 10 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 if preventative treatments are not being used. 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 $3,000 over 6 years ($500/year)

FY 2020 Budget
Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Watering & Maintenance:

FY 2021 Budget
Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Routine trimming:
Watering & Maintenance:

FY 2022 Budget

Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Watering & Maintenance:

FY 2023 Budget

Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Routine trimming:
Watering & Maintenance:

FY 2024 Budget

Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Watering & Maintenance:

FY 2025 Budget

Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting:
Routine trimming:
Watering & Maintenance:

*Reduction of ash over 6 years: approximately 5 ash trees removed (approximately 4% of ash). **It will take approximately 121 years to remove all ash with the current budget.**

<u>Proposed Budget Increase</u>

EAB could potentially kill all ash trees in Readlyn within 4 years. To remove all ash trees within 6 years the budget would need to be increased to $16,000 a year. If the budget were increased to $10,000 a year all ash could be removed within 10 years. Additionally, it is recommended that Readlyn 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 instance, in this treatment scenario, the average ash diameter is 20 inches and at $15 per inch, about 2 trees could be treated per year (every other year treatment). This would be 4 trees selected for treatment, and Readlyn would still need to find $12,800 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 a year for treatment and leave $4,000 for removal. 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 because EAB is already in Readlyn. It is suggested to consider increasing the budget to deal with the damage from this insect.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Readlyn

Annual Energy Benefits of Public Trees

8/6/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	32.5	2,468	4,704.7	4,611	7,079	(N/A)	22.8	26.8	58.99
Silver maple	28.0	2,127	3,701.9	3,628	5,755	(N/A)	19.9	21.8	54.81
Norway maple	16.5	1,250	2,355.1	2,308	3,558	(N/A)	14.2	13.5	47.43
Sugar maple	14.0	1,060	1,849.9	1,813	2,873	(N/A)	8.9	10.9	61.12
Apple	1.6	118	237.8	233	351	(N/A)	3.8	1.3	17.55
Northern hackberry	6.7	507	952.6	934	1,440	(N/A)	3.6	5.5	75.80
Northern pin oak	5.3	402	754.1	739	1,141	(N/A)	3.6	4.3	60.04
Honeylocust	4.1	309	517.5	507	816	(N/A)	3.4	3.1	45.35
Northern white cedar	1.7	130	204.1	200	330	(N/A)	2.8	1.3	22.02
American basswood	3.9	295	551.7	541	835	(N/A)	2.3	3.2	69.61
Callery pear	0.4	32	68.1	67	99	(N/A)	2.1	0.4	8.99
Broadleaf Deciduous Small	1.2	89	163.8	161	249	(N/A)	1.9	0.9	24.93
Black walnut	2.5	190	331.6	325	515	(N/A)	1.7	2.0	57.27
Red maple	1.0	72	131.4	129	201	(N/A)	1.7	0.8	22.35
Blue spruce	0.8	63	106.5	104	167	(N/A)	1.5	0.6	20.87
Littleleaf linden	0.7	52	98.7	97	148	(N/A)	1.3	0.6	21.18
Northern red oak	1.0	76	137.6	135	211	(N/A)	1.1	0.8	35.16
Spruce	0.1	8	17.4	17	25	(N/A)	0.6	0.1	8.26
Kentucky coffeetree	0.0	0	0.9	1	1	(N/A)	0.4	0.0	0.66
Siberian elm	0.7	54	96.2	94	148	(N/A)	0.4	0.6	74.24
Elm	0.8	58	105.8	104	162	(N/A)	0.4	0.6	80.97
Swamp white oak	0.2	18	30.3	30	48	(N/A)	0.4	0.2	23.94
Catalpa	0.5	37	63.1	62	99	(N/A)	0.2	0.4	98.63
Eastern redbud	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
American elm	0.5	40	67.0	66	106	(N/A)	0.2	0.4	105.59
Maple	0.1	8	16.5	16	25	(N/A)	0.2	0.1	24.58
Paper birch	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Ginkgo	0.0	0	0.4	0	1	(N/A)	0.2	0.0	0.57
Total	124.7	9,464	17,265.8	16,920	26,384	(N/A)	100.0	100.0	50.07

Table 2: Annual Stormwater Benefits

Readlyn

Annual Stormwater Benefits of Public Trees

8/6/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	320,081	8,674	(N/A)	22.8	24.7	72.28
Silver maple	371,281	10,062	(N/A)	19.9	28.6	95.83
Norway maple	139,856	3,790	(N/A)	14.2	10.8	50.53
Sugar maple	158,876	4,306	(N/A)	8.9	12.2	91.61
Apple	5,996	162	(N/A)	3.8	0.5	8.12
Northern hackberry	61,181	1,658	(N/A)	3.6	4.7	87.26
Northern pin oak	50,966	1,381	(N/A)	3.6	3.9	72.69
Honeylocust	25,920	702	(N/A)	3.4	2.0	39.02
Northern white cedar	20,250	549	(N/A)	2.8	1.6	36.58
American basswood	48,141	1,305	(N/A)	2.3	3.7	108.72
Callery pear	1,790	49	(N/A)	2.1	0.1	4.41
Broadleaf Deciduous Small	4,659	126	(N/A)	1.9	0.4	12.63
Black walnut	24,420	662	(N/A)	1.7	1.9	73.53
Red maple	6,645	180	(N/A)	1.7	0.5	20.01
Blue spruce	9,988	271	(N/A)	1.5	0.8	33.83
Littleleaf linden	4,023	109	(N/A)	1.3	0.3	15.58
Northern red oak	9,628	261	(N/A)	1.1	0.7	43.49
Spruce	1,021	28	(N/A)	0.6	0.1	9.22
Kentucky coffeetree	36	1	(N/A)	0.4	0.0	0.48
Siberian elm	8,194	222	(N/A)	0.4	0.6	111.03
Elm	11,182	303	(N/A)	0.4	0.9	151.51
Swamp white oak	1,421	39	(N/A)	0.4	0.1	19.26
Catalpa	7,239	196	(N/A)	0.2	0.6	196.17
Eastern redbud	7	0	(N/A)	0.2	0.0	0.20
American elm	4,551	123	(N/A)	0.2	0.4	123.33
Maple	625	17	(N/A)	0.2	0.0	16.95
Paper birch	18	0	(N/A)	0.2	0.0	0.48
Ginkgo	7	0	(N/A)	0.2	0.0	0.19
Citywide total	1,298,000	35,176	(N/A)	100.0	100.0	66.75

Table 3: Annual Air Quality Benefits

Readlyn

Annual Air Quality Benefits of Public Trees

8/6/2020

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							
Ash	67.4	11.6	32.8	3.0	363	157.8	22.8	21.7	147.5	977	-15.6	-59	449.0	1,282 (N/A)	22.8	10.68
Silver maple	61.1	10.4	30.5	2.7	331	132.3	19.4	18.5	126.8	827	-33.4	-125	368.2	1,033 (N/A)	19.9	9.84
Norway maple	26.8	4.6	13.4	1.2	146	79.7	11.5	11.0	74.7	494	-6.4	-24	216.5	615 (N/A)	14.2	8.20
Sugar maple	21.8	3.7	10.8	1.0	118	66.0	9.7	9.2	63.2	413	-17.1	-64	168.3	467 (N/A)	8.9	9.93
Apple	1.6	0.3	0.8	0.1	9	7.6	1.1	1.0	7.0	47	0.0	0	19.5	56 (N/A)	3.8	2.78
Northern hackberry	9.1	1.6	4.7	0.4	50	32.3	4.7	4.4	30.3	200	0.0	0	87.4	250 (N/A)	3.6	13.15
Northern pin oak	10.7	1.8	5.2	0.5	58	25.6	3.7	3.5	24.0	159	-2.5	-9	72.6	207 (N/A)	3.6	10.89
Honeylocust	4.3	0.7	2.1	0.2	23	19.1	2.8	2.7	18.4	120	-2.8	-10	47.6	133 (N/A)	3.4	7.37
Northern white cedar	2.2	0.4	1.9	0.3	15	7.9	1.2	1.1	7.8	50	-7.0	-26	15.7	38 (N/A)	2.8	2.55
American basswood	7.0	1.2	3.4	0.3	38	18.8	2.7	2.6	17.6	116	-5.8	-22	47.7	132 (N/A)	2.3	11.01
Callery pear	0.1	0.0	0.1	0.0	1	2.1	0.3	0.3	1.9	13	0.0	0	4.8	13 (N/A)	2.1	1.21
Broadleaf Deciduous Small	1.5	0.2	0.7	0.1	8	5.6	0.8	0.8	5.3	35	0.0	0	15.0	43 (N/A)	1.9	4.28
Black walnut	2.8	0.4	1.4	0.1	15	11.9	1.7	1.7	11.4	74	0.0	0	31.3	89 (N/A)	1.7	9.89
Red maple	1.3	0.2	0.7	0.1	7	4.6	0.7	0.6	4.3	28	-0.5	-2	11.9	34 (N/A)	1.7	3.75
Blue spruce	1.2	0.2	1.0	0.1	8	3.9	0.6	0.5	3.7	24	-3.5	-13	7.8	19 (N/A)	1.5	2.38
Littleleaf linden	0.4	0.1	0.2	0.0	2	3.3	0.5	0.5	3.1	20	-0.2	-1	7.8	22 (N/A)	1.3	3.10
Northern red oak	2.0	0.3	1.0	0.1	11	4.8	0.7	0.7	4.5	30	-2.9	-11	11.2	30 (N/A)	1.1	4.98
Spruce	0.1	0.0	0.1	0.0	1	0.5	0.1	0.1	0.5	3	-0.3	-1	1.0	3 (N/A)	0.6	0.86
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.1	0 (N/A)	0.4	0.08
Siberian elm	1.5	0.3	0.7	0.1	8	3.4	0.5	0.5	3.2	21	0.0	0	10.1	29 (N/A)	0.4	14.56
Elm	1.7	0.3	0.7	0.1	9	3.7	0.5	0.5	3.5	23	0.0	0	10.9	32 (N/A)	0.4	15.76
Swamp white oak	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.9	8 (N/A)	0.4	4.03
Catalpa	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23 (N/A)	0.2	22.55
Eastern redbud	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.2	0.11
American elm	1.5	0.3	0.7	0.1	8	2.5	0.4	0.3	2.4	15	0.0	0	8.1	23 (N/A)	0.2	23.47
Maple	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.3	4 (N/A)	0.2	3.64
Paper birch	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.2	0.08
Ginkgo	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.2	0.07
Citywide total	227.8	39.0	113.7	10.4	1,236	597.2	86.8	82.7	565.2	3,716	-98.1	-368	1,624.7	4,583 (N/A)	100.0	8.70

Table 4: Annual Carbon Stored

Readlyn

Stored CO2 Benefits of Public Trees

8/6/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	1,109,406	8,321	(N/A)	22.8	23.9	69.34
Silver maple	1,423,606	10,677	(N/A)	19.9	30.7	101.69
Norway maple	442,870	3,322	(N/A)	14.2	9.5	44.29
Sugar maple	631,720	4,738	(N/A)	8.9	13.6	100.81
Apple	26,013	195	(N/A)	3.8	0.6	9.75
Northern hackberry	131,445	986	(N/A)	3.6	2.8	51.89
Northern pin oak	175,713	1,318	(N/A)	3.6	3.8	69.36
Honeylocust	52,785	396	(N/A)	3.4	1.1	21.99
Northern white cedar	14,813	111	(N/A)	2.8	0.3	7.41
American basswood	264,678	1,985	(N/A)	2.3	5.7	165.42
Callery pear	2,403	18	(N/A)	2.1	0.1	1.64
Broadleaf Deciduous	22,312	167	(N/A)	1.9	0.5	16.73
Black walnut	89,091	668	(N/A)	1.7	1.9	74.24
Red maple	15,342	115	(N/A)	1.7	0.3	12.79
Blue spruce	6,444	48	(N/A)	1.5	0.1	6.04
Littleleaf linden	9,743	73	(N/A)	1.3	0.2	10.44
Northern red oak	42,664	320	(N/A)	1.1	0.9	53.33
Spruce	333	2	(N/A)	0.6	0.0	0.83
Kentucky coffeetree	24	0	(N/A)	0.4	0.0	0.09
Siberian elm	36,096	271	(N/A)	0.4	0.8	135.36
Elm	55,031	413	(N/A)	0.4	1.2	206.37
Swamp white oak	3,641	27	(N/A)	0.4	0.1	13.65
Catalpa	55,982	420	(N/A)	0.2	1.2	419.86
Eastern redbud	14	0	(N/A)	0.2	0.0	0.10
American elm	29,353	220	(N/A)	0.2	0.6	220.15
Maple	1,101	8	(N/A)	0.2	0.0	8.26
Paper birch	12	0	(N/A)	0.2	0.0	0.09
Ginkgo	5	0	(N/A)	0.2	0.0	0.03
Citywide total	4,642,639	34,820	(N/A)	100.0	100.0	66.07

Table 5: Annual Carbon Sequestered

Readlyn

Annual CO Benefits of Public Trees

8/6/2020

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
Ash	41,595	312	-5,325	-346	-43	54,546	409	90,469	679 (N/A)	22.8	19.9	5.65
Silver maple	110,174	826	-6,837	-305	-54	47,015	353	150,047	1,125 (N/A)	19.9	33.1	10.72
Norway maple	25,721	193	-2,127	-167	-17	27,615	207	51,042	383 (N/A)	14.2	11.2	5.10
Sugar maple	31,760	238	-3,032	-149	-24	23,419	176	51,997	390 (N/A)	8.9	11.5	8.30
Apple	2,533	19	-125	-22	-1	2,609	20	4,995	37 (N/A)	3.8	1.1	1.87
Northern hackberry	8,413	63	-631	-61	-5	11,196	84	18,918	142 (N/A)	3.6	4.2	7.47
Northern pin oak	6,145	46	-843	-57	-7	8,879	67	14,124	106 (N/A)	3.6	3.1	5.58
Honeylocust	8,055	60	-255	-31	-2	6,831	51	14,599	109 (N/A)	3.4	3.2	6.08
Northern white cedar	1,544	12	-71	-27	-1	2,881	22	4,328	32 (N/A)	2.8	1.0	2.16
American basswood	14,551	109	-1,270	-46	-10	6,513	49	19,748	148 (N/A)	2.3	4.4	12.34
Callery pear	1,052	8	-19	-6	0	710	5	1,736	13 (N/A)	2.1	0.4	1.18
Broadleaf Deciduous Smal	1,431	11	-107	-15	-1	1,963	15	3,272	25 (N/A)	1.9	0.7	2.45
Black walnut	5,774	43	-428	-25	-3	4,209	32	9,531	71 (N/A)	1.7	2.1	7.94
Red maple	1,062	8	-74	-10	-1	1,599	12	2,577	19 (N/A)	1.7	0.6	2.15
Blue spruce	569	4	-31	-13	0	1,383	10	1,908	14 (N/A)	1.5	0.4	1.79
Littleleaf linden	1,854	14	-47	-9	0	1,139	9	2,937	22 (N/A)	1.3	0.6	3.15
Northern red oak	1,143	9	-205	-13	-2	1,683	13	2,608	20 (N/A)	1.1	0.6	3.26
Spruce	89	1	-2	-2	0	170	1	255	2 (N/A)	0.6	0.1	0.64
Kentucky coffeetree	5	0	0	0	0	9	0	13	0 (N/A)	0.4	0.0	0.05
Siberian elm	1,396	10	-173	-8	-1	1,197	9	2,411	18 (N/A)	0.4	0.5	9.04
Elm	1,769	13	-264	-9	-2	1,287	10	2,783	21 (N/A)	0.4	0.6	10.44
Swamp white oak	391	3	-18	-2	0	402	3	774	6 (N/A)	0.4	0.2	2.90
Catalpa	479	4	-269	-6	-2	813	6	1,017	8 (N/A)	0.2	0.2	7.63
Eastern redbud	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
American elm	655	5	-141	-5	-1	883	7	1,392	10 (N/A)	0.2	0.3	10.44
Maple	165	1	-5	-1	0	186	1	344	3 (N/A)	0.2	0.1	2.58
Paper birch	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Ginkgo	2	0	0	0	0	4	0	6	0 (N/A)	0.2	0.0	0.04
Citywide total	268,339	2,013	-22,300	-1,336	-177	209,148	1,569	453,851	3,404 (N/A)	100.0	100.0	6.46

Table 6: Annual Social and Aesthetic Benefits

Readlyn

Annual Aesthetic/Other Benefits of Public Trees

8/6/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	3,867	(N/A)	22.8	15.2	32.23
Silver maple	9,012	(N/A)	19.9	35.4	85.83
Norway maple	2,516	(N/A)	14.2	9.9	33.55
Sugar maple	3,259	(N/A)	8.9	12.8	69.33
Apple	144	(N/A)	3.8	0.6	7.20
Northern hackberry	1,122	(N/A)	3.6	4.4	59.06
Northern pin oak	576	(N/A)	3.6	2.3	30.32
Honeylocust	1,689	(N/A)	3.4	6.6	93.86
Northern white cedar	434	(N/A)	2.8	1.7	28.94
American basswood	989	(N/A)	2.3	3.9	82.38
Callery pear	142	(N/A)	2.1	0.6	12.89
Broadleaf Deciduous Small	82	(N/A)	1.9	0.3	8.16
Black walnut	497	(N/A)	1.7	2.0	55.18
Red maple	170	(N/A)	1.7	0.7	18.89
Blue spruce	189	(N/A)	1.5	0.7	23.67
Littleleaf linden	242	(N/A)	1.3	1.0	34.61
Northern red oak	90	(N/A)	1.1	0.4	14.97
Spruce	29	(N/A)	0.6	0.1	9.70
Kentucky coffeetree	11	(N/A)	0.4	0.0	5.26
Siberian elm	93	(N/A)	0.4	0.4	46.72
Elm	124	(N/A)	0.4	0.5	61.96
Swamp white oak	42	(N/A)	0.4	0.2	20.95
Catalpa	29	(N/A)	0.2	0.1	28.57
Eastern redbud	0	(N/A)	0.2	0.0	0.03
American elm	82	(N/A)	0.2	0.3	82.32
Maple	30	(N/A)	0.2	0.1	29.84
Paper birch	5	(N/A)	0.2	0.0	5.26
Ginkgo	0	(N/A)	0.2	0.0	0.37
Citywide total	25,465	(N/A)	100.0	100.0	48.32

Table 7: Summary of Benefits in Dollars

Readlyn

Total Annual Benefits of Public Trees by Species ($)

8/6/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Ash	7,079	679	1,282	8,674	3,867	21,581	(N/A)	22.7
Silver maple	5,755	1,125	1,033	10,062	9,012	26,987	(N/A)	28.4
Norway maple	3,558	383	615	3,790	2,516	10,862	(N/A)	11.4
Sugar maple	2,873	390	467	4,306	3,259	11,293	(N/A)	11.9
Apple	351	37	56	162	144	751	(N/A)	0.8
Northern hackberry	1,440	142	250	1,658	1,122	4,612	(N/A)	4.9
Northern pin oak	1,141	106	207	1,381	576	3,411	(N/A)	3.6
Honeylocust	816	109	133	702	1,689	3,450	(N/A)	3.6
Northern white cedar	330	32	38	549	434	1,384	(N/A)	1.5
American basswood	835	148	132	1,305	989	3,409	(N/A)	3.6
Callery pear	99	13	13	49	142	315	(N/A)	0.3
Broadleaf Deciduous Sm	249	25	43	126	82	524	(N/A)	0.6
Black walnut	515	71	89	662	497	1,834	(N/A)	1.9
Red maple	201	19	34	180	170	604	(N/A)	0.6
Blue spruce	167	14	19	271	189	660	(N/A)	0.7
Littleleaf linden	148	22	22	109	242	543	(N/A)	0.6
Northern red oak	211	20	30	261	90	611	(N/A)	0.6
Spruce	25	2	3	28	29	86	(N/A)	0.1
Kentucky coffeetree	1	0	0	1	11	13	(N/A)	0.0
Siberian elm	148	18	29	222	93	511	(N/A)	0.5
Elm	162	21	32	303	124	641	(N/A)	0.7
Swamp white oak	48	6	8	39	42	142	(N/A)	0.1
Catalpa	99	8	23	196	29	354	(N/A)	0.4
Eastern redbud	1	0	0	0	0	1	(N/A)	0.0
American elm	106	10	23	123	82	345	(N/A)	0.4
Maple	25	3	4	17	30	78	(N/A)	0.1
Paper birch	1	0	0	0	5	7	(N/A)	0.0
Ginkgo	1	0	0	0	0	1	(N/A)	0.0
Citywide Total	26,384	3,404	4,583	35,176	25,465	95,013	(N/A)	100.0

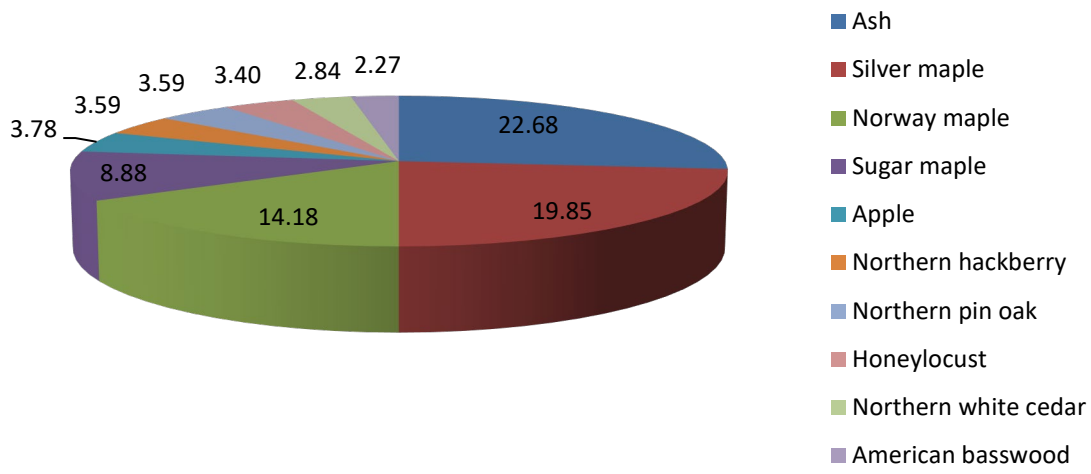

Figure 1: Species Distribution

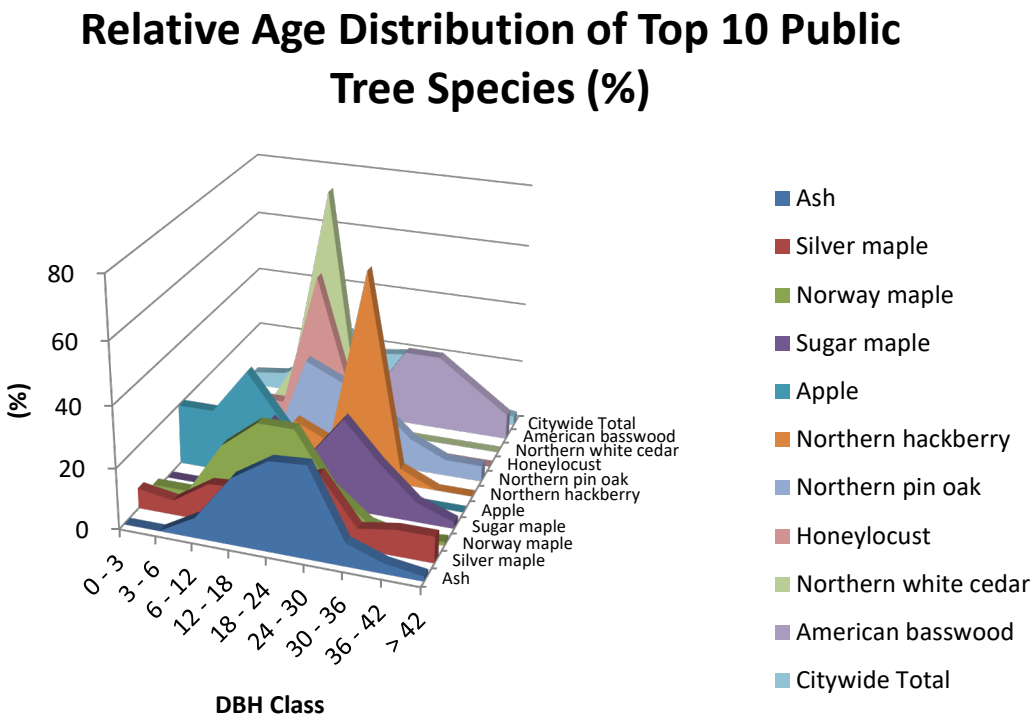

Figure 2: Relative Age Class

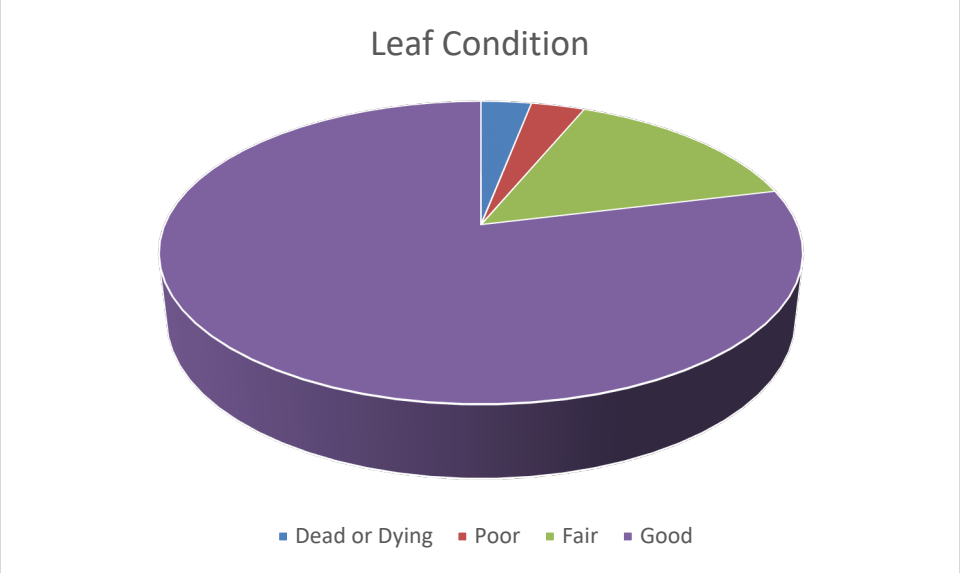

Figure 3: Foliage Condition

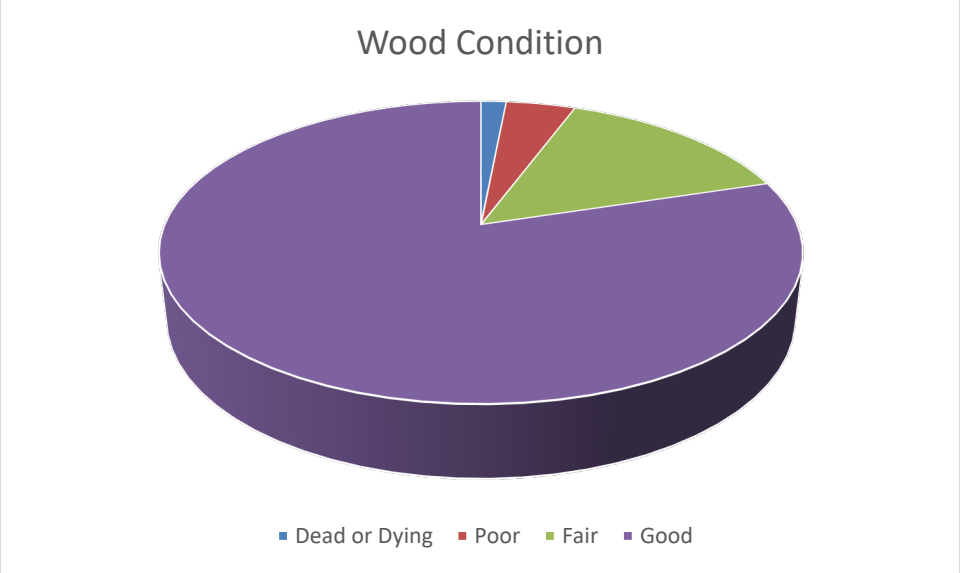

Figure 4: Wood Condition

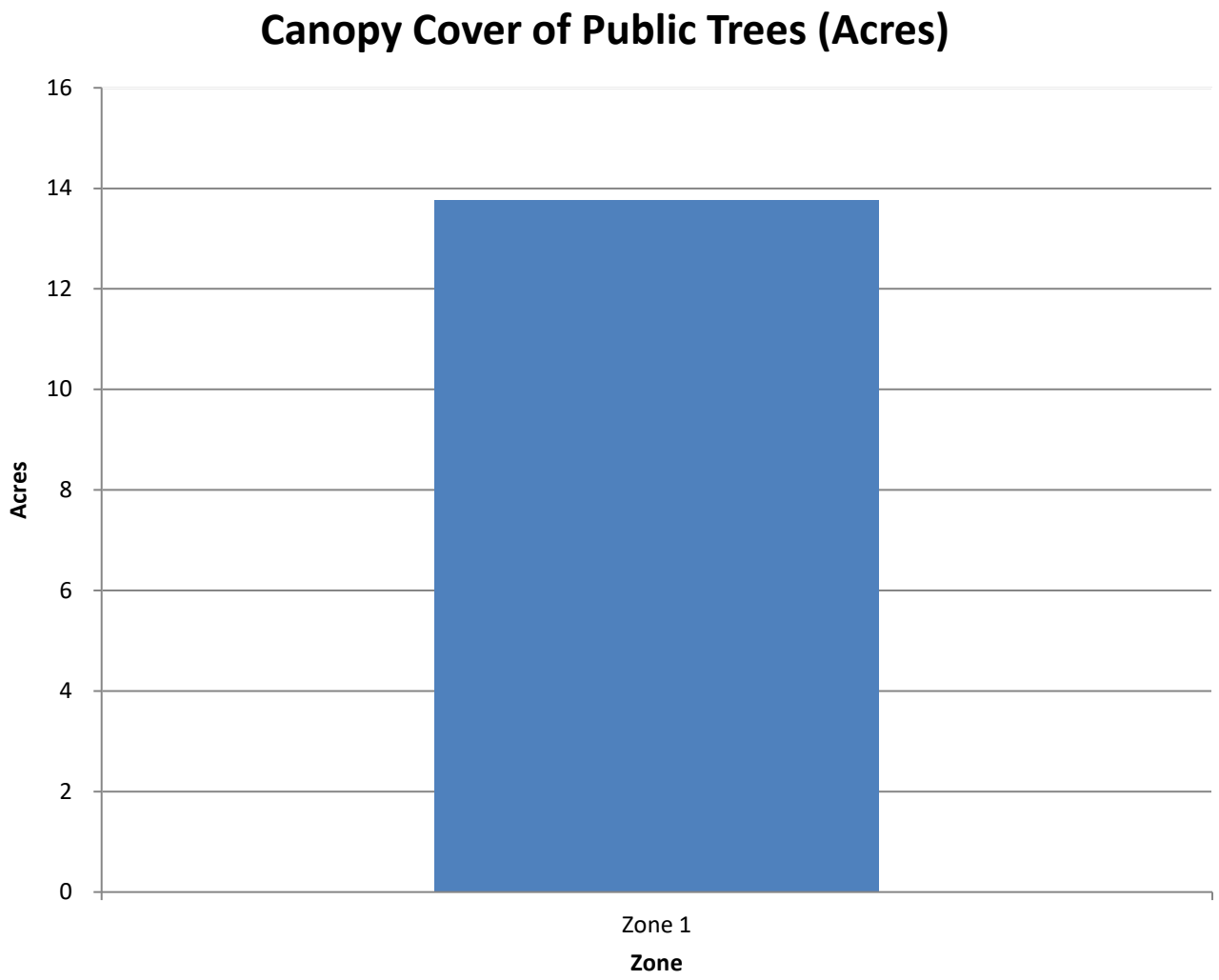

Figure 5: Canopy Cover in Acres

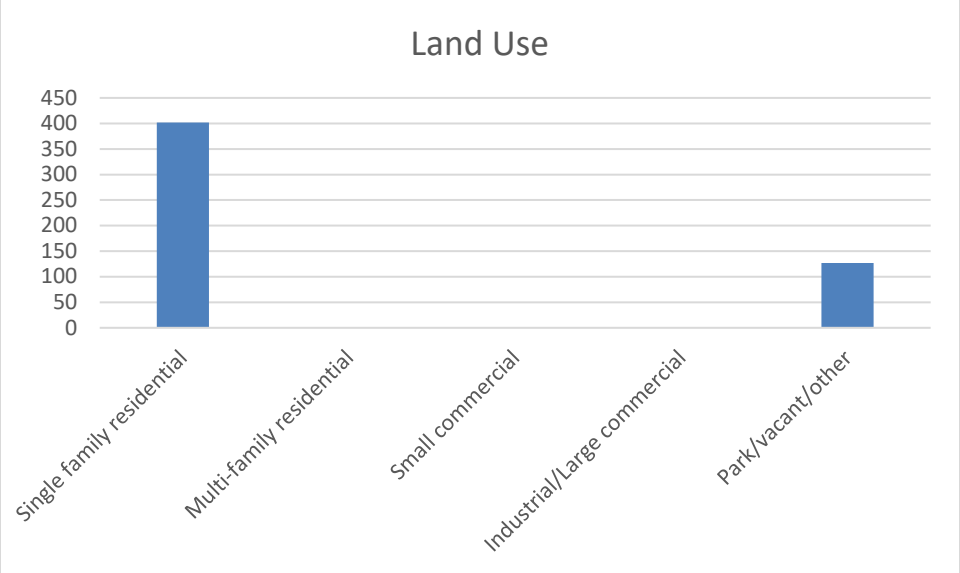

Figure 6: Land Use of city/park trees

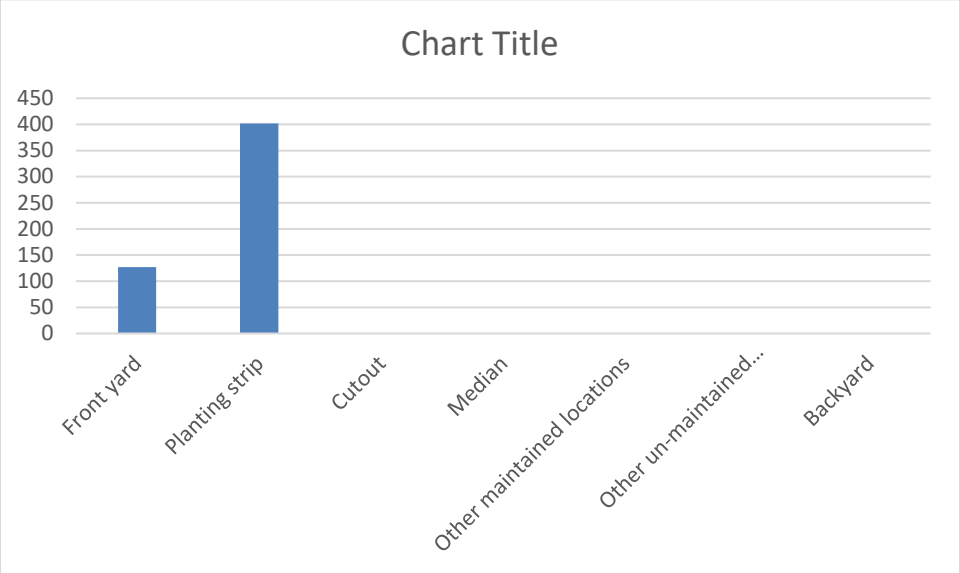

Figure 7: Location of city/park trees

Appndix 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: Readlyn Tree Ordinances

CHAPTER 151

TREES

151.01 Definition
151.02 Planting Restrictions
151.03 Duty to Trim Trees
151.04 Trimming Trees to be Supervised
151.05 Disease Control
151.06 Inspection and Removal

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 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])

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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 515-725-8200.