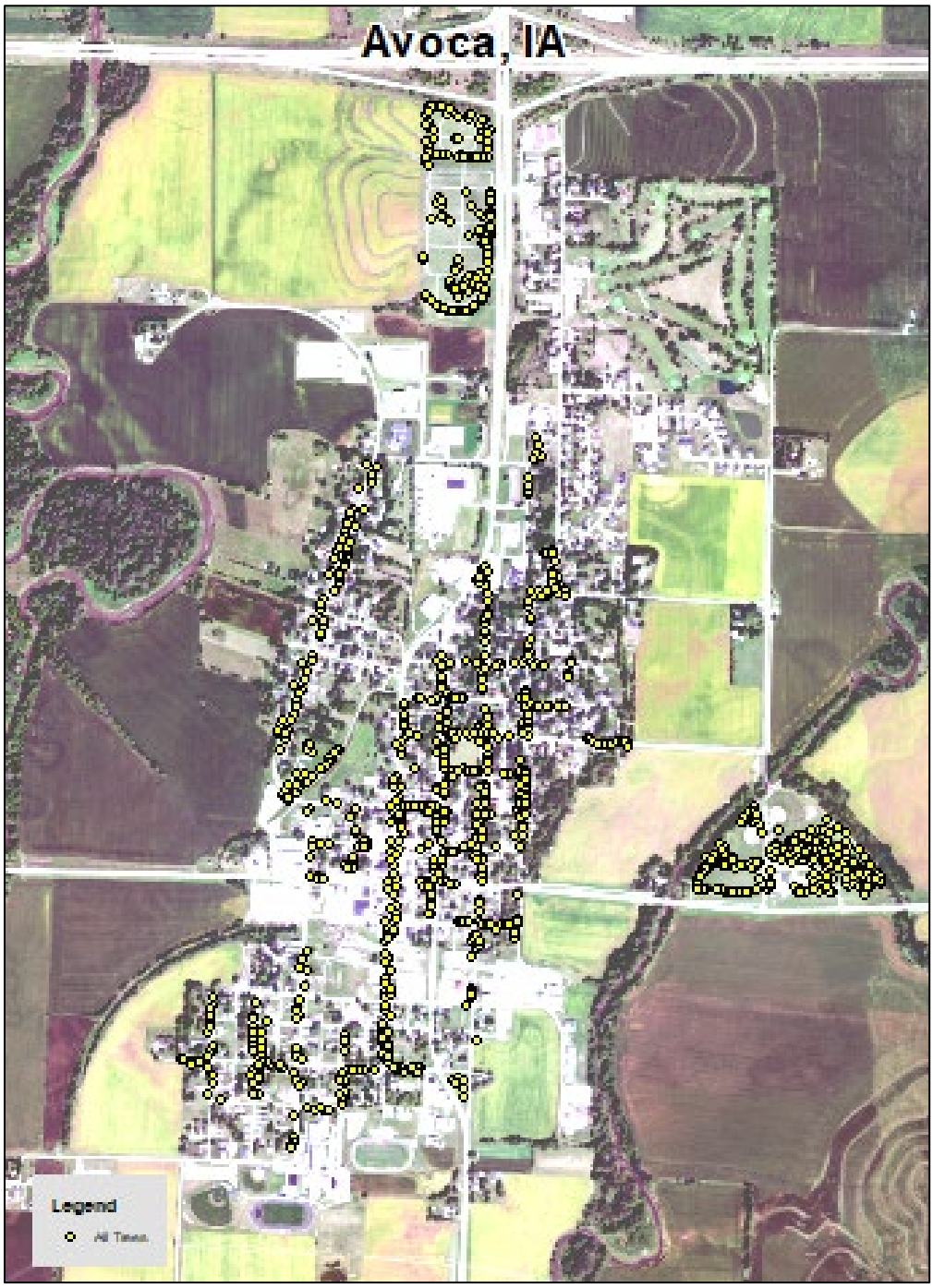
Avoca, IA



2022 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Avoca 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 7.2% of Avoca'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 2021, 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 1,136 trees inventoried.

- Avoca's trees provide $214,461 of benefits annually, an average of $188 a tree
- There are over 47 species of trees
- The top three genera are: Maple 19.1%, Northern Hackberry 18.9%, and Apple 12.2%
- 14% of trees are in need of some type of management
- 25 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 25 trees needing removal, 4 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately
- 50 of the 82 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

Introduction

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

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

Inventory

In 2021, 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 1,136 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. Avoca's trees reduce energy related costs by approximately $57,743 annually (Appendix A, Table 1). These savings are both in Electricity (273.5 MWh) and in Natural Gas (37,737.2 Therms).

Annual Stormwater Benefits

Avoca's trees intercept about 3,195,339 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $86,594 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 Avoca, it is estimated that trees remove 3,509.4 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 $9,780 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Avoca, trees sequester about 552,087 lbs of carbon a year with an associated value of $4,141 (Appendix A, Table 5). In addition, the trees store 11,228,239 lbs of carbon, with a yearly benefit of $84,212 (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. Avoca receives $53,191 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, Avoca's trees provide $214,461 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,136 trees in Avoca provide approximately $188 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Avoca has over 47 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	217	19.1%
Northern Hackberry	215	18.9%
Apple	138	12%
Oak	113	9%
Spruce	89	7%
Ash	82	7%
Conifer Evergreen Large	49	4%
Pine	48	4%
Honeylocust	44	3%
Linden/Basswood	41	3%
Cedar	21	1%
Walnut	18	1%
Sycamore	17	1%
Pear	10	<1%
Cherry	6	<1%
Elm	6	<1%
Dec. Broadleaf Large	4	<1%
Kentucky Coffeetree	3	<1%
Buckeye	3	<1%
Dec. Broadleaf Medium	2	<1%
Willow	2	<1%
Birch	2	<1%
Dogwood	1	<1%
Catalpa	1	<1%
Magnolia	1	<1%
Ginkgo	1	<1%
Cottonwood	1	<1%

Age Class

Most of Avoca's trees (34%) are between 12 and 24 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. Avoca's size curve is on the smaller side, indicating a medium aged 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 Avoca indicate that 87% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 73% of Avoca'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 3% of the population. This 3% 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	103	9%
Tree Removal	25	2%
Crown Reduction	19	1%
Crown Raising	11	<1%
Treat Pest & Disease	3	<1%

Canopy Cover

The total canopy with both private and public trees is 16%, 218.25 acres. The canopy cover on city own properties included in the Avoca inventory includes approximately 32.35 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years on all lands. To achieve this goal it is estimated that 99 trees need to be planted annually on public and/or private lands.

Land Use and Location

The majority of Avoca'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	52%
Park/vacant/other	40%
Small commercial	4%
Industrial/Large commercial	3%

Location	
Front yard	51%
Planting strip	46%
Cutout (surrounded by pavement)	2%

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

Avoca has 1 critical concern trees that need immediate removal and 2 critical concern trees that need immediate cleaning. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 10 trees over 30 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 and immediate concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 141 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 25 removals, 7 are ash trees. There are a total of 82 ash trees, and 50 of those have signs and symptoms that have been associated with EAB. In addition, there are 16 trees that are in poor health, 7 of which are ash.

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 Avoca.

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 (19.1%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been

recommended since 2002, due to the threat of EAB. All trees planted must meet the restrictions in city ordinance 8.11 (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.

Budget and Emerald Ash Borer Plan

Six Year Maintenance Plan with <u>No Additional Funding</u>

Current Budget $2,700 per year, Total $16,400 over 6 years.

FY 2022

Removal: 1 critical concern tree, 2 immediate removal	($2,400)
Planting and Replacement: 3 trees to be planted in open locations,	($300)
Pruning & Maintenance:	
Visual Survey for signs and symptoms of EAB	

FY 2023

Removal: 3 immediate concern trees or ash trees with poor health	($2,400)
Planting and Replacement: 3 trees in open locations from year one removals	($300)
Pruning & Maintenance:	
Visual Survey for signs and symptoms of EAB	

FY 2024

Removal: 3 critical concern trees or ash trees with poor health	($2,400)
Planting and Replacement:	
Pruning & Maintenance:	($300)
Visual Survey for signs and symptoms of EAB	

FY 2025

Removal: 3 critical concern trees or ash trees with poor health	($2,400)
Planting and Replacement: 3 trees in open locations from removals	($300)
Pruning & Maintenance:	
Visual Survey for signs and symptoms of EAB	

FY 2026

Removal: 3 critical concern trees or ash trees with poor health	($2,400)
Planting and Replacement:	
Pruning & Maintenance:	($300)
Visual Survey for signs and symptoms of EAB	

FY 2027

Removal: 3 critical concern trees or ash trees with poor health	($2,400)
Planting and Replacement:	
Pruning & Maintenance:	($300)
Visual Survey for signs and symptoms of EAB	

*Reduction of ash over 6 years: Approximately 20 ash trees removed (approximately 25% of ash). It will take approximately 6 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.
**To remove all ash trees within 6 years, the budget would need to be increased to $13,669 a year. If the budget were increased to $10,000 a year all ash could be removed in 12 years.

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).

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 8.11 (Appendix C).

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.

Proposed Budget Increase

EAB could potentially kill all ash trees in Avoca within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $13,669 a year. Additionally, it is recommended that Avoca 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 4 trees could be treated per year (every other year treatment) would be $1,200. This would be 8 trees selected for treatment, and Avoca would still need to find $9,866 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $2,250 a year for treatment and leave $8,933 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 if EAB is found in Avoca. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Avoca

Annual Energy Benefits of Public Trees

5/6/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	83.0	6,296	11,639.0	11,406	17,702	(N/A)	18.9	30.7	82.34
Apple	13.0	984	1,985.0	1,945	2,929	(N/A)	12.2	5.1	21.23
Silver maple	30.5	2,316	4,047.1	3,966	6,282	(N/A)	7.2	10.9	76.61
Blue spruce	8.2	619	1,116.9	1,095	1,714	(N/A)	6.4	3.0	23.47
Green ash	22.4	1,701	3,024.4	2,964	4,665	(N/A)	6.3	8.1	65.71
Red maple	8.3	632	1,111.7	1,089	1,722	(N/A)	5.6	3.0	26.90
Conifer Evergreen Large	7.6	578	971.9	952	1,530	(N/A)	4.3	2.7	31.23
Honeylocust	8.7	658	1,192.3	1,168	1,826	(N/A)	3.9	3.2	41.50
Northern red oak	5.6	428	764.3	749	1,177	(N/A)	3.6	2.0	28.71
Austrian pine	5.3	405	737.8	723	1,128	(N/A)	3.2	2.0	31.34
Norway maple	9.3	703	1,314.7	1,288	1,991	(N/A)	3.2	3.4	55.30
Bur oak	9.7	739	1,315.0	1,289	2,028	(N/A)	2.8	3.5	63.37
Littleleaf linden	3.9	293	559.7	548	841	(N/A)	2.0	1.5	36.57
Northern white cedar	3.7	281	492.1	482	763	(N/A)	1.9	1.3	36.34
Northern pin oak	6.2	467	917.2	899	1,366	(N/A)	1.9	2.4	65.05
American basswood	6.1	467	873.2	856	1,322	(N/A)	1.6	2.3	73.46
Black walnut	5.4	406	727.2	713	1,119	(N/A)	1.6	1.9	62.17
American sycamore	7.2	549	961.2	942	1,491	(N/A)	1.5	2.6	87.70
Sugar maple	3.8	289	507.2	497	786	(N/A)	1.4	1.4	49.15
Black maple	4.3	326	585.5	574	900	(N/A)	1.4	1.6	56.23
Pin oak	4.4	333	582.4	571	904	(N/A)	1.1	1.6	75.31
Eastern white pine	1.6	120	213.8	209	330	(N/A)	1.1	0.6	27.46
Black spruce	1.2	93	160.1	157	250	(N/A)	1.0	0.4	22.75
White ash	2.5	186	297.6	292	478	(N/A)	0.9	0.8	47.76
Black cherry	1.1	85	155.0	152	237	(N/A)	0.5	0.4	39.47
American elm	2.8	209	360.8	354	563	(N/A)	0.5	1.0	93.84
Callery pear	0.9	72	141.4	139	210	(N/A)	0.4	0.4	42.09
Pear	0.4	28	64.2	63	91	(N/A)	0.4	0.2	18.19
Swamp white oak	0.2	14	30.0	29	44	(N/A)	0.4	0.1	10.89
Norway spruce	0.7	50	88.6	87	137	(N/A)	0.4	0.2	34.32
Broadleaf Deciduous Large	1.5	112	203.7	200	311	(N/A)	0.4	0.5	77.84
Kentucky coffeetree	1.2	91	163.6	160	252	(N/A)	0.3	0.4	83.85
White oak	0.0	1	1.4	1	2	(N/A)	0.3	0.0	0.66
Ohio buckeye	0.8	62	116.5	114	176	(N/A)	0.3	0.3	58.77
Broadleaf Deciduous Mediu	0.3	20	40.4	40	60	(N/A)	0.2	0.1	29.89
Amur maple	0.4	29	56.3	55	84	(N/A)	0.2	0.1	42.14
Willow	0.0	3	7.0	7	10	(N/A)	0.2	0.0	5.04
Japanese maple	0.2	15	31.6	31	46	(N/A)	0.1	0.1	46.14
Dogwood	0.0	0	0.6	1	1	(N/A)	0.1	0.0	0.87
Paper birch	0.1	7	13.7	13	21	(N/A)	0.1	0.0	20.64
Catalpa	0.3	25	46.9	46	71	(N/A)	0.1	0.1	70.91
Southern magnolia	0.1	6	12.7	12	19	(N/A)	0.1	0.0	18.82
Spruce	0.1	4	9.5	9	14	(N/A)	0.1	0.0	13.58
Ginkgo	0.2	13	18.9	19	31	(N/A)	0.1	0.1	31.46
Black ash	0.0	0	0.8	1	1	(N/A)	0.1	0.0	1.10
Eastern cottonwood	0.3	25	46.9	46	71	(N/A)	0.1	0.1	70.91
River birch	0.2	18	29.5	29	47	(N/A)	0.1	0.1	46.78
Total	273.5	20,760	37,737.2	36,982	57,743	(N/A)	100.0	100.0	50.87

Table 2: Annual Stormwater Benefits

Avoca

Annual Stormwater Benefits of Public Trees

5/6/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	879,805	23,843	(N/A)	18.9	27.5	110.90
Apple	55,360	1,500	(N/A)	12.2	1.7	10.87
Silver maple	476,430	12,911	(N/A)	7.2	14.9	157.45
Blue spruce	120,953	3,278	(N/A)	6.4	3.8	44.90
Green ash	264,153	7,159	(N/A)	6.3	8.3	100.82
Red maple	59,333	1,608	(N/A)	5.6	1.9	25.12
Conifer Evergreen Large	153,142	4,150	(N/A)	4.3	4.8	84.70
Honeylocust	67,125	1,819	(N/A)	3.9	2.1	41.34
Northern red oak	43,545	1,180	(N/A)	3.6	1.4	28.78
Austrian pine	88,744	2,405	(N/A)	3.2	2.8	66.80
Norway maple	85,544	2,318	(N/A)	3.2	2.7	64.40
Bur oak	128,195	3,474	(N/A)	2.8	4.0	108.57
Littleleaf linden	37,266	1,010	(N/A)	2.0	1.2	43.91
Northern white cedar	88,520	2,399	(N/A)	1.9	2.8	114.23
Northern pin oak	66,201	1,794	(N/A)	1.9	2.1	85.43
American basswood	87,192	2,363	(N/A)	1.6	2.7	131.27
Black walnut	60,849	1,649	(N/A)	1.6	1.9	91.61
American sycamore	110,595	2,997	(N/A)	1.5	3.5	176.30
Sugar maple	38,079	1,032	(N/A)	1.4	1.2	64.50
Black maple	39,841	1,080	(N/A)	1.4	1.2	67.48
Pin oak	53,395	1,447	(N/A)	1.1	1.7	120.58
Eastern white pine	35,538	963	(N/A)	1.1	1.1	80.26
Black spruce	17,659	479	(N/A)	1.0	0.6	43.51
White ash	19,215	521	(N/A)	0.9	0.6	52.07
Black cherry	4,507	122	(N/A)	0.5	0.1	20.36
American elm	25,535	692	(N/A)	0.5	0.8	115.33
Callery pear	10,183	276	(N/A)	0.4	0.3	55.19
Pear	1,322	36	(N/A)	0.4	0.0	7.17
Swamp white oak	924	25	(N/A)	0.4	0.0	6.26
Norway spruce	15,148	411	(N/A)	0.4	0.5	102.63
Broadleaf Deciduous Large	19,068	517	(N/A)	0.4	0.6	129.18
Kentucky coffeetree	16,672	452	(N/A)	0.3	0.5	150.61
White oak	54	1	(N/A)	0.3	0.0	0.48
Ohio buckeye	7,653	207	(N/A)	0.3	0.2	69.13
Broadleaf Deciduous Medium	2,491	68	(N/A)	0.2	0.1	33.76
Amur maple	1,841	50	(N/A)	0.2	0.1	24.94
Willow	175	5	(N/A)	0.2	0.0	2.37
Japanese maple	1,174	32	(N/A)	0.1	0.0	31.82
Dogwood	7	0	(N/A)	0.1	0.0	0.20
Paper birch	608	16	(N/A)	0.1	0.0	16.47
Catalpa	3,943	107	(N/A)	0.1	0.1	106.85
Southern magnolia	677	18	(N/A)	0.1	0.0	18.34
Spruce	596	16	(N/A)	0.1	0.0	16.14
Ginkgo	718	19	(N/A)	0.1	0.0	19.45
Black ash	12	0	(N/A)	0.1	0.0	0.33
Eastern cottonwood	3,943	107	(N/A)	0.1	0.1	106.85
River birch	1,409	38	(N/A)	0.1	0.0	38.19
Citywide total	3,195,339	86,594	(N/A)	100.0	100.0	76.29

Table 3: Annual Air Quality Benefits

Avoca

Annual Air Quality Benefits of Public Trees

5/6/2022

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Northern hackberry	151.5	26.2	75.2	6.8	821	399.3	57.9	55.2	376.2	2,480	0.0	0	1,148.2	3,301	(N/A)	18.9	15.35
Apple	16.5	2.7	7.8	0.8	88	63.7	9.1	8.7	58.8	392	-0.1	0	168.0	480	(N/A)	12.2	3.48
Silver maple	91.4	15.5	44.1	4.1	490	144.1	21.1	20.1	138.0	901	-48.4	-181	429.9	1,210	(N/A)	7.2	14.75
Blue spruce	18.2	3.6	14.9	2.2	120	38.8	5.7	5.4	36.9	242	-44.9	-168	80.9	194	(N/A)	6.4	2.65
Green ash	37.3	6.0	17.3	1.7	197	106.7	15.6	14.8	101.6	665	0.0	0	301.0	863	(N/A)	6.3	12.15
Red maple	12.4	2.1	6.0	0.5	67	39.4	5.8	5.5	37.7	246	-4.4	-16	105.1	297	(N/A)	5.6	4.63
Conifer Evergreen Large	18.3	3.6	14.7	2.3	120	35.6	5.2	5.0	34.5	224	-83.4	-313	35.9	31	(N/A)	4.3	0.63
Honeylocust	11.5	1.9	5.6	0.5	62	41.4	6.0	5.7	39.2	258	-8.3	-31	103.7	288	(N/A)	3.9	6.56
Northern red oak	8.2	1.4	4.2	0.4	45	26.8	3.9	3.7	25.5	167	-11.5	-43	62.6	169	(N/A)	3.6	4.12
Austrian pine	14.6	2.9	11.6	1.8	95	25.5	3.7	3.5	24.2	159	-34.2	-128	53.6	126	(N/A)	3.2	3.49
Norway maple	17.5	3.0	8.6	0.8	95	44.7	6.5	6.2	42.0	277	-4.1	-15	125.1	357	(N/A)	3.2	9.90
Bur oak	20.9	3.3	9.4	0.9	109	46.3	6.8	6.4	44.1	289	0.0	0	138.2	398	(N/A)	2.8	12.45
Littleleaf linden	6.0	1.0	3.0	0.3	33	18.7	2.7	2.6	17.5	116	-3.0	-11	48.9	137	(N/A)	2.0	5.98
Northern white cedar	10.8	2.1	8.6	1.3	70	17.5	2.6	2.4	16.8	109	-52.7	-198	9.4	-18	(N/A)	1.9	-0.86
Northern pin oak	14.4	2.5	7.0	0.6	78	30.1	4.3	4.1	27.9	186	-3.3	-12	87.7	251	(N/A)	1.9	11.95
American basswood	13.7	2.3	6.4	0.6	73	29.7	4.3	4.1	27.9	184	-11.1	-42	77.8	215	(N/A)	1.6	11.96
Black walnut	8.2	1.3	3.8	0.4	43	25.5	3.7	3.5	24.3	159	0.0	0	70.7	202	(N/A)	1.6	11.24
American sycamore	20.9	3.3	9.1	0.9	109	34.3	5.0	4.8	32.8	214	0.0	0	111.1	323	(N/A)	1.5	18.99
Sugar maple	4.8	0.8	2.4	0.2	26	18.0	2.6	2.5	17.3	113	-3.8	-14	44.9	125	(N/A)	1.4	7.79
Black maple	10.0	1.7	4.6	0.4	53	20.5	3.0	2.8	19.4	127	-3.3	-12	59.2	168	(N/A)	1.4	10.52
Pin oak	9.9	1.7	5.0	0.4	54	20.8	3.0	2.9	19.9	130	-18.3	-69	45.4	115	(N/A)	1.1	9.62
Eastern white pine	4.2	0.8	3.4	0.5	28	7.5	1.1	1.0	7.2	47	-20.0	-75	5.8	0	(N/A)	1.1	-0.03
Black spruce	2.5	0.5	2.1	0.3	17	5.8	0.8	0.8	5.6	36	-6.6	-25	11.9	28	(N/A)	1.0	2.57
White ash	1.7	0.3	0.9	0.1	9	11.4	1.7	1.6	11.1	72	0.0	0	28.7	81	(N/A)	0.9	8.10
Black cherry	1.5	0.2	0.7	0.1	8	5.4	0.8	0.7	5.1	33	0.0	0	14.4	41	(N/A)	0.5	6.85
American elm	6.9	1.2	3.3	0.3	37	13.0	1.9	1.8	12.5	82	0.0	0	40.9	118	(N/A)	0.5	19.74
Callery pear	2.2	0.4	1.1	0.1	12	4.6	0.7	0.6	4.3	29	-0.5	-2	13.5	39	(N/A)	0.4	7.73
Pear	0.2	0.0	0.1	0.0	1	1.9	0.3	0.3	1.7	11	0.0	0	4.5	13	(N/A)	0.4	2.55
Swamp white oak	0.1	0.0	0.1	0.0	0	0.9	0.1	0.1	0.8	6	0.0	0	2.1	6	(N/A)	0.4	1.51
Norway spruce	1.8	0.4	1.5	0.2	12	3.1	0.5	0.4	3.0	20	-8.5	-32	2.4	0	(N/A)	0.4	-0.06
Broadleaf Deciduous Large	3.1	0.5	1.4	0.1	16	7.0	1.0	1.0	6.7	44	0.0	0	20.8	60	(N/A)	0.4	14.99
Kentucky coffeetree	2.9	0.5	1.3	0.1	15	5.7	0.8	0.8	5.4	36	0.0	0	17.5	51	(N/A)	0.3	16.91
White oak	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)	0.3	0.08
Ohio buckeye	1.6	0.3	0.8	0.1	8	4.0	0.6	0.5	3.7	25	-0.4	-1	11.1	32	(N/A)	0.3	10.55
Broadleaf Deciduous Medium	0.5	0.1	0.2	0.0	3	1.3	0.2	0.2	1.2	8	-0.1	0	3.6	10	(N/A)	0.2	5.15
Amur maple	0.6	0.1	0.3	0.0	3	1.9	0.3	0.3	1.7	12	0.0	0	5.2	15	(N/A)	0.2	7.45
Willow	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	0.2	0.67
Japanese maple	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8	(N/A)	0.1	8.35
Dogwood	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)	0.1	0.11
Paper birch	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.1	2.99
Catalpa	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.1	12.48
Southern magnolia	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2	(N/A)	0.1	2.10
Spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	0.1	1.48
Ginkgo	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.8	5	0.0	0	1.9	5	(N/A)	0.1	5.44
Black ash	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)	0.1	0.14
Eastern cottonwood	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.1	12.48
River birch	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8	(N/A)	0.1	7.92
Citywide total	548.6	94.7	287.6	30.0	3,028	1,308.4	190.3	181.4	1,239.5	8,144	-371.2	-1,392	3,509.4	9,780	(N/A)	100.0	8.62

Table 4: Annual Carbon Stored

Avoca

Stored CO2 Benefits of Public Trees

5/6/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	2,373,474	17,801	(N/A)	18.9	21.1	82.80
Apple	262,968	1,972	(N/A)	12.2	2.3	14.29
Silver maple	2,258,719	16,940	(N/A)	7.2	20.1	206.59
Blue spruce	142,272	1,067	(N/A)	6.4	1.3	14.62
Green ash	1,245,216	9,339	(N/A)	6.3	11.1	131.54
Red maple	140,577	1,054	(N/A)	5.6	1.3	16.47
Conifer Evergreen La	210,874	1,582	(N/A)	4.3	1.9	32.28
Honeylocust	146,999	1,102	(N/A)	3.9	1.3	25.06
Northern red oak	159,493	1,196	(N/A)	3.6	1.4	29.18
Austrian pine	120,884	907	(N/A)	3.2	1.1	25.18
Norway maple	289,152	2,169	(N/A)	3.2	2.6	60.24
Bur oak	709,623	5,322	(N/A)	2.8	6.3	166.32
Littleleaf linden	129,617	972	(N/A)	2.0	1.2	42.27
Northern white cedar	136,558	1,024	(N/A)	1.9	1.2	48.77
Northern pin oak	236,534	1,774	(N/A)	1.9	2.1	84.48
American basswood	530,637	3,980	(N/A)	1.6	4.7	221.10
Black walnut	271,083	2,033	(N/A)	1.6	2.4	112.95
American sycamore	721,990	5,415	(N/A)	1.5	6.4	318.53
Sugar maple	136,066	1,020	(N/A)	1.4	1.2	63.78
Black maple	107,317	805	(N/A)	1.4	1.0	50.30
Pin oak	267,493	2,006	(N/A)	1.1	2.4	167.18
Eastern white pine	50,937	382	(N/A)	1.1	0.5	31.84
Black spruce	18,473	139	(N/A)	1.0	0.2	12.60
White ash	45,801	344	(N/A)	0.9	0.4	34.35
Black cherry	21,929	164	(N/A)	0.5	0.2	27.41
American elm	138,686	1,040	(N/A)	0.5	1.2	173.36
Callery pear	36,741	276	(N/A)	0.4	0.3	55.11
Pear	4,540	34	(N/A)	0.4	0.0	6.81
Swamp white oak	1,554	12	(N/A)	0.4	0.0	2.91
Norway spruce	21,666	162	(N/A)	0.4	0.2	40.62
Broadleaf Deciduous	103,300	775	(N/A)	0.4	0.9	193.69
Kentucky coffeetree	97,698	733	(N/A)	0.3	0.9	244.24
White oak	36	0	(N/A)	0.3	0.0	0.09
Ohio buckeye	25,850	194	(N/A)	0.3	0.2	64.62
Broadleaf Deciduous	7,962	60	(N/A)	0.2	0.1	29.86
Amur maple	9,780	73	(N/A)	0.2	0.1	36.67
Willow	235	2	(N/A)	0.2	0.0	0.88
Japanese maple	6,743	51	(N/A)	0.1	0.1	50.57
Dogwood	14	0	(N/A)	0.1	0.0	0.10
Paper birch	1,035	8	(N/A)	0.1	0.0	7.76
Catalpa	15,773	118	(N/A)	0.1	0.1	118.30
Southern magnolia	484	4	(N/A)	0.1	0.0	3.63
Spruce	257	2	(N/A)	0.1	0.0	1.93
Ginkgo	1,787	13	(N/A)	0.1	0.0	13.40
Black ash	17	0	(N/A)	0.1	0.0	0.13
Eastern cottonwood	15,773	118	(N/A)	0.1	0.1	118.30
River birch	3,624	27	(N/A)	0.1	0.0	27.18
Citywide total	11,228,239	84,212	(N/A)	100.0	100.0	74.20

Table 5: Annual Carbon Sequestered

Avoca

Annual CO Benefits of Public Trees

5/6/2022

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
Northern hackberry	110,211	827	-11,393	-804	-91	139,145	1,044	237,159	1,779 (N/A)	18.9	24.9	8.27
Apple	22,656	170	-1,263	-181	-11	21,748	163	42,961	322 (N/A)	12.2	4.5	2.33
Silver maple	148,623	1,115	-10,842	-361	-84	51,172	384	188,592	1,414 (N/A)	7.2	19.8	17.25
Blue spruce	7,029	53	-683	-153	-6	13,681	103	19,874	149 (N/A)	6.4	2.1	2.04
Green ash	48,782	366	-5,977	-237	-47	37,601	282	80,169	601 (N/A)	6.3	8.4	8.47
Red maple	13,358	100	-675	-80	-6	13,968	105	26,571	199 (N/A)	5.6	2.8	3.11
Conifer Evergreen Large	6,451	48	-1,012	-146	-9	12,769	96	18,061	135 (N/A)	4.3	1.9	2.76
Honeylocust	15,310	115	-708	-71	-6	14,535	109	29,066	218 (N/A)	3.9	3.0	4.95
Northern red oak	8,278	62	-766	-68	-6	9,459	71	16,904	127 (N/A)	3.6	1.8	3.09
Austrian pine	5,083	38	-580	-106	-5	8,956	67	13,354	100 (N/A)	3.2	1.4	2.78
Norway maple	12,147	91	-1,388	-96	-11	15,525	116	26,188	196 (N/A)	3.2	2.7	5.46
Bur oak	19,056	143	-3,406	-110	-26	16,332	122	31,872	239 (N/A)	2.8	3.3	7.47
Littleleaf linden	12,852	96	-623	-47	-5	6,466	48	18,648	140 (N/A)	2.0	2.0	6.08
Northern white cedar	2,473	19	-655	-82	-6	6,207	47	7,943	60 (N/A)	1.9	0.8	2.84
Northern pin oak	5,069	38	-1,135	-74	-9	10,325	77	14,185	106 (N/A)	1.9	1.5	5.07
American basswood	27,493	206	-2,547	-76	-20	10,312	77	35,181	264 (N/A)	1.6	3.7	14.66
Black walnut	11,932	89	-1,301	-56	-10	8,980	67	19,555	147 (N/A)	1.6	2.1	8.15
American sycamore	11,273	85	-3,466	-85	-27	12,130	91	19,852	149 (N/A)	1.5	2.1	8.76
Sugar maple	7,851	59	-654	-40	-5	6,393	48	13,550	102 (N/A)	1.4	1.4	6.35
Black maple	7,155	54	-515	-40	-4	7,202	54	13,802	104 (N/A)	1.4	1.4	6.47
Pin oak	23,251	174	-1,284	-48	-10	7,358	55	29,278	220 (N/A)	1.1	3.1	18.30
Eastern white pine	1,316	10	-244	-34	-2	2,654	20	3,691	28 (N/A)	1.1	0.4	2.31
Black spruce	1,087	8	-89	-22	-1	2,063	15	3,039	23 (N/A)	1.0	0.3	2.07
White ash	5,367	40	-220	-20	-2	4,110	31	9,237	69 (N/A)	0.9	1.0	6.93
Black cherry	1,817	14	-105	-12	-1	1,877	14	3,576	27 (N/A)	0.5	0.4	4.47
American elm	3,396	25	-666	-27	-5	4,629	35	7,333	55 (N/A)	0.5	0.8	9.17
Callery pear	1,311	10	-177	-11	-1	1,589	12	2,712	20 (N/A)	0.4	0.3	4.07
Pear	569	4	-22	-6	0	621	5	1,162	9 (N/A)	0.4	0.1	1.74
Swamp white oak	421	3	-9	-3	0	312	2	721	5 (N/A)	0.4	0.1	1.35
Norway spruce	375	3	-104	-15	-1	1,115	8	1,371	10 (N/A)	0.4	0.1	2.57
Broadleaf Deciduous Large	3,049	23	-496	-16	-4	2,470	19	5,007	38 (N/A)	0.4	0.5	9.39
Kentucky coffeetree	2,295	17	-469	-14	-4	2,015	15	3,828	29 (N/A)	0.3	0.4	9.57
White oak	8	0	0	-1	0	13	0	20	0 (N/A)	0.3	0.0	0.05
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
Ohio buckeye	856	6	-124	-9	-1	1,374	10	2,096	16 (N/A)	0.3	0.2	5.24
Broadleaf Deciduous Medi	475	4	-38	-3	0	447	3	881	7 (N/A)	0.2	0.1	3.31
Amur maple	746	6	-47	-5	0	643	5	1,338	10 (N/A)	0.2	0.1	5.02
Willow	101	1	-2	-1	0	72	1	170	1 (N/A)	0.2	0.0	0.64
Japanese maple	0	0	-32	-4	0	335	3	299	2 (N/A)	0.1	0.0	2.24
Dogwood	9	0	0	0	0	6	0	14	0 (N/A)	0.1	0.0	0.10
Paper birch	209	2	-5	-1	0	159	1	361	3 (N/A)	0.1	0.0	2.71
Catalpa	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.1	0.1	9.97
Southern magnolia	56	0	-2	-1	0	141	1	194	1 (N/A)	0.1	0.0	1.45
Spruce	53	0	-1	-1	0	94	1	145	1 (N/A)	0.1	0.0	1.08
Ginkgo	134	1	-9	-2	0	285	2	409	3 (N/A)	0.1	0.0	3.07
Black ash	5	0	0	0	0	7	0	12	0 (N/A)	0.1	0.0	0.09
Eastern cottonwood	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.1	0.1	9.97
River birch	386	3	-17	-2	0	395	3	762	6 (N/A)	0.1	0.1	5.71
Citywide total	552,087	4,141	-53,904	-3,175	-428	458,795	3,441	953,804	7,154 (N/A)	100.0	100.0	6.30

Table 6: Annual Social and Aesthetic Benefits

Avoca

Annual Aesthetic/Other Benefits of Public Trees

5/6/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	13,771	(N/A)	18.9	25.9	64.05
Apple	1,313	(N/A)	12.2	2.5	9.52
Silver maple	10,643	(N/A)	7.2	20.0	129.79
Blue spruce	1,339	(N/A)	6.4	2.5	18.34
Green ash	3,884	(N/A)	6.3	7.3	54.70
Red maple	1,902	(N/A)	5.6	3.6	29.73
Conifer Evergreen Large	1,298	(N/A)	4.3	2.4	26.49
Honeylocust	3,122	(N/A)	3.9	5.9	70.95
Northern red oak	714	(N/A)	3.6	1.3	17.42
Austrian pine	601	(N/A)	3.2	1.1	16.70
Norway maple	1,159	(N/A)	3.2	2.2	32.20
Bur oak	1,461	(N/A)	2.8	2.7	45.66
Littleleaf linden	1,367	(N/A)	2.0	2.6	59.43
Northern white cedar	393	(N/A)	1.9	0.7	18.71
Northern pin oak	462	(N/A)	1.9	0.9	22.00
American basswood	1,764	(N/A)	1.6	3.3	98.03
Black walnut	976	(N/A)	1.6	1.8	54.22
American sycamore	725	(N/A)	1.5	1.4	42.67
Sugar maple	845	(N/A)	1.4	1.6	52.81
Black maple	882	(N/A)	1.4	1.7	55.12
Pin oak	1,718	(N/A)	1.1	3.2	143.14
Eastern white pine	261	(N/A)	1.1	0.5	21.78
Black spruce	209	(N/A)	1.0	0.4	18.99
White ash	690	(N/A)	0.9	1.3	68.96
Black cherry	106	(N/A)	0.5	0.2	17.70
American elm	441	(N/A)	0.5	0.8	73.53
Callery pear	122	(N/A)	0.4	0.2	24.32
Pear	32	(N/A)	0.4	0.1	6.40
Swamp white oak	55	(N/A)	0.4	0.1	13.68
Norway spruce	94	(N/A)	0.4	0.2	23.54
Broadleaf Deciduous Large	225	(N/A)	0.4	0.4	56.34
Kentucky coffeetree	161	(N/A)	0.3	0.3	53.59
White oak	16	(N/A)	0.3	0.0	5.26
Ohio buckeye	82	(N/A)	0.3	0.2	27.40
Broadleaf Deciduous Medium	46	(N/A)	0.2	0.1	22.89
Amur maple	44	(N/A)	0.2	0.1	22.14
Willow	16	(N/A)	0.2	0.0	7.81
Japanese maple	0	(N/A)	0.1	0.0	0.00
Dogwood	0	(N/A)	0.1	0.0	0.03
Paper birch	29	(N/A)	0.1	0.1	28.56
Catalpa	66	(N/A)	0.1	0.1	65.59
Southern magnolia	22	(N/A)	0.1	0.0	21.93
Spruce	15	(N/A)	0.1	0.0	15.42
Ginkgo	12	(N/A)	0.1	0.0	12.07
Black ash	3	(N/A)	0.1	0.0	2.74
Eastern cottonwood	66	(N/A)	0.1	0.1	65.59
River birch	39	(N/A)	0.1	0.1	39.16
Citywide total	53,191	(N/A)	100.0	100.0	46.86

Table 7: Summary of Benefits in Dollars

Avoca

Total Annual Benefits of Public Trees by Species ($)

5/6/2022

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Northern hackberry	17,702	1,779	3,301	23,843	13,771	60,396	(N/A)	28.2
Apple	2,929	322	480	1,500	1,313	6,545	(N/A)	3.1
Silver maple	6,282	1,414	1,210	12,911	10,643	32,460	(N/A)	15.1
Blue spruce	1,714	149	194	3,278	1,339	6,673	(N/A)	3.1
Green ash	4,665	601	863	7,159	3,884	17,172	(N/A)	8.0
Red maple	1,722	199	297	1,608	1,902	5,728	(N/A)	2.7
Conifer Evergreen Large	1,530	135	31	4,150	1,298	7,145	(N/A)	3.3
Honeylocust	1,826	218	288	1,819	3,122	7,273	(N/A)	3.4
Northern red oak	1,177	127	169	1,180	714	3,367	(N/A)	1.6
Austrian pine	1,128	100	126	2,405	601	4,360	(N/A)	2.0
Norway maple	1,991	196	357	2,318	1,159	6,021	(N/A)	2.8
Bur oak	2,028	239	398	3,474	1,461	7,600	(N/A)	3.5
Littleleaf linden	841	140	137	1,010	1,367	3,495	(N/A)	1.6
Northern white cedar	763	60	-18	2,399	393	3,597	(N/A)	1.7
Northern pin oak	1,366	106	251	1,794	462	3,979	(N/A)	1.9
American basswood	1,322	264	215	2,363	1,764	5,929	(N/A)	2.8
Black walnut	1,119	147	202	1,649	976	4,093	(N/A)	1.9
American sycamore	1,491	149	323	2,997	725	5,685	(N/A)	2.7
Sugar maple	786	102	125	1,032	845	2,889	(N/A)	1.3
Black maple	900	104	168	1,080	882	3,133	(N/A)	1.5
Pin oak	904	220	115	1,447	1,718	4,403	(N/A)	2.1
Eastern white pine	330	28	0	963	261	1,581	(N/A)	0.7
Black spruce	250	23	28	479	209	989	(N/A)	0.5
White ash	478	69	81	521	690	1,838	(N/A)	0.9
Black cherry	237	27	41	122	106	533	(N/A)	0.2
American elm	563	55	118	692	441	1,870	(N/A)	0.9
Callery pear	210	20	39	276	122	667	(N/A)	0.3
Pear	91	9	13	36	32	180	(N/A)	0.1
Swamp white oak	44	5	6	25	55	135	(N/A)	0.1
Norway spruce	137	10	0	411	94	652	(N/A)	0.3
Broadleaf Deciduous La	311	38	60	517	225	1,151	(N/A)	0.5
Kentucky coffeetree	252	29	51	452	161	944	(N/A)	0.4
White oak	2	0	0	1	16	20	(N/A)	0.0
Ohio buckeye	176	16	32	207	82	513	(N/A)	0.2
Broadleaf Deciduous M	60	7	10	68	46	190	(N/A)	0.1
Amur maple	84	10	15	50	44	203	(N/A)	0.1
Willow	10	1	1	5	16	33	(N/A)	0.0
Japanese maple	46	2	8	32	0	89	(N/A)	0.0
Dogwood	1	0	0	0	0	1	(N/A)	0.0
Paper birch	21	3	3	16	29	71	(N/A)	0.0
Catalpa	71	10	12	107	66	266	(N/A)	0.1
Southern magnolia	19	1	2	18	22	63	(N/A)	0.0
Spruce	14	1	1	16	15	48	(N/A)	0.0
Ginkgo	31	3	5	19	12	71	(N/A)	0.0
Black ash	1	0	0	0	3	4	(N/A)	0.0
Eastern cottonwood	71	10	12	107	66	266	(N/A)	0.1
River birch	47	6	8	38	39	138	(N/A)	0.1
Citywide Total	57,743	7,154	9,780	86,594	53,191	214,461	(N/A)	100.0

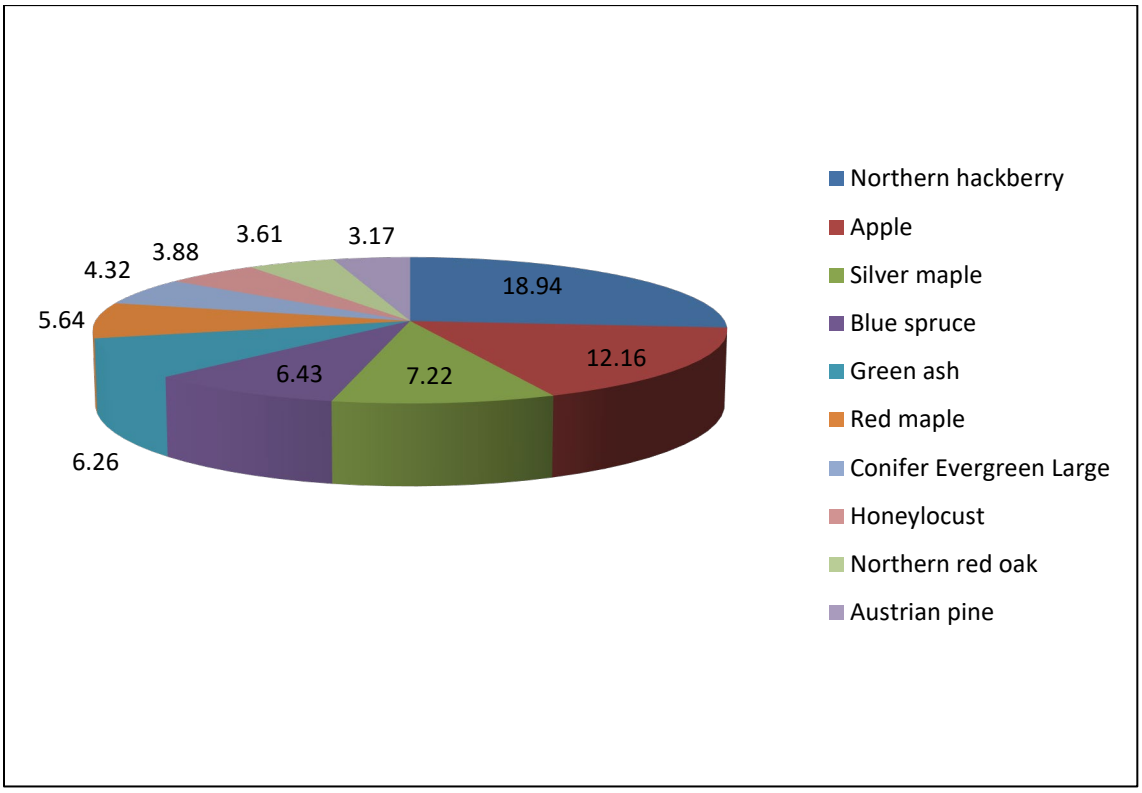

Figure 1: Species Distribution

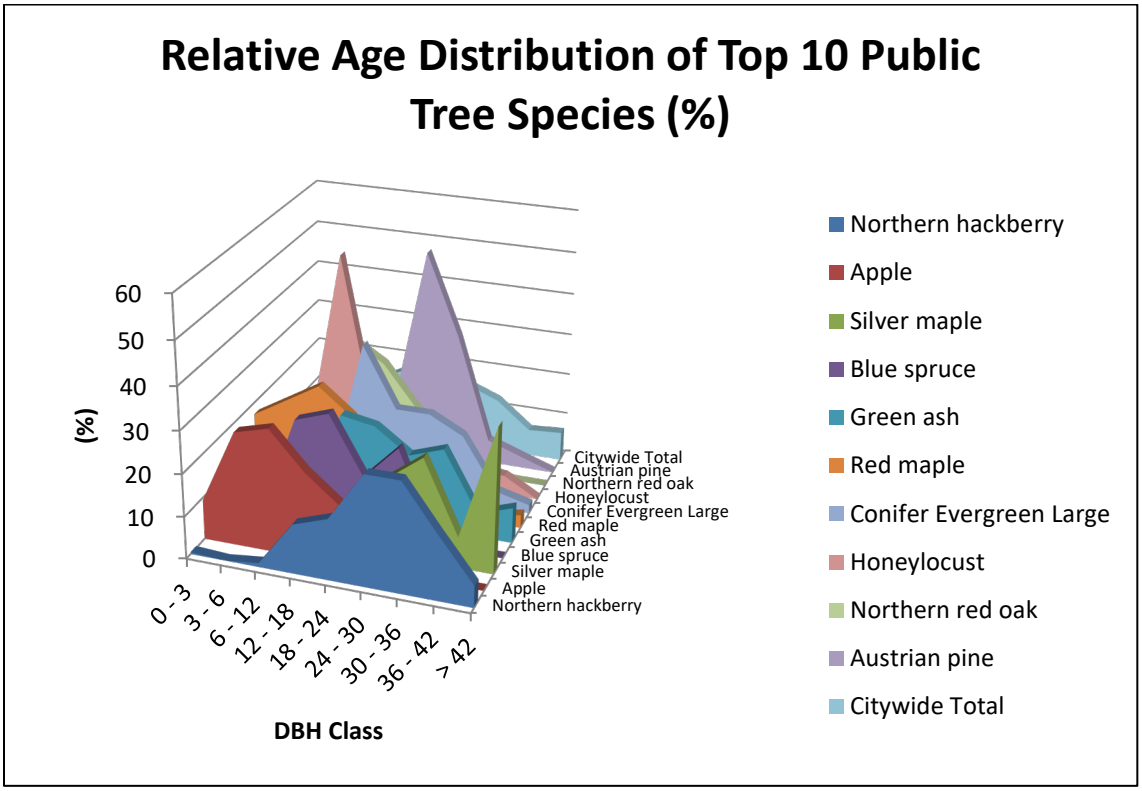

Figure 2: Relative Age Class

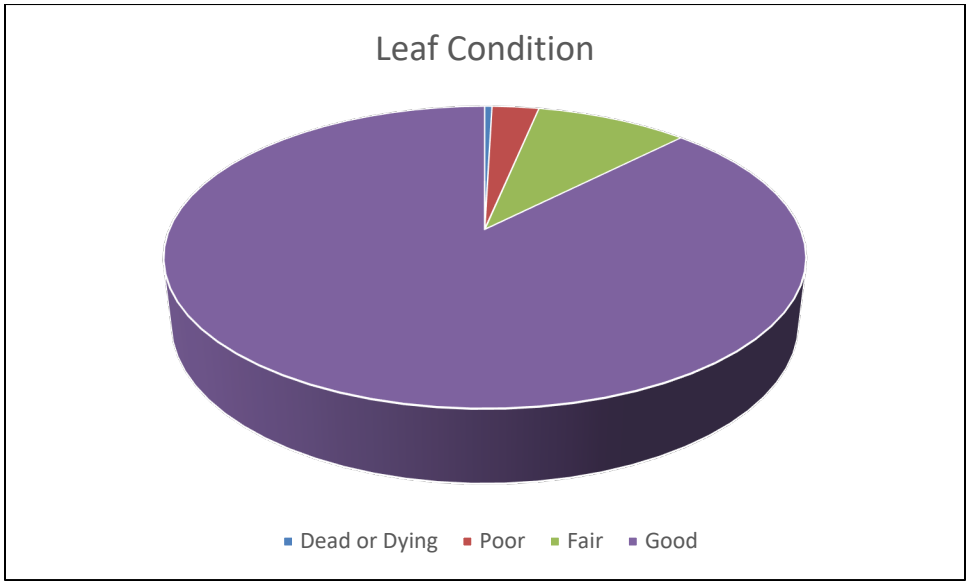

Figure 3: Foliage Condition

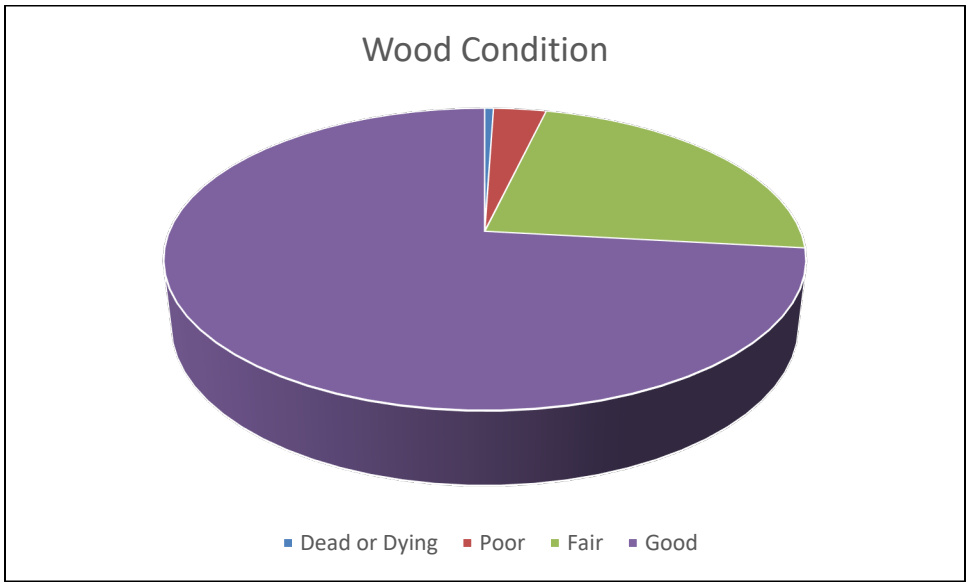

Figure 4: Wood Condition

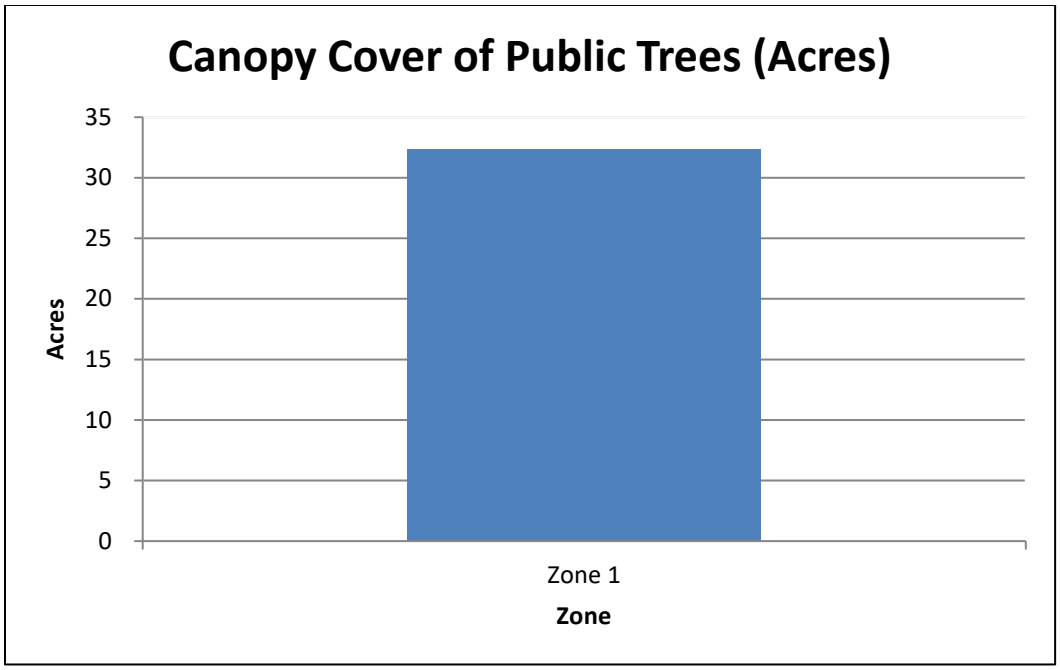

Figure 5: Canopy Cover in Acres

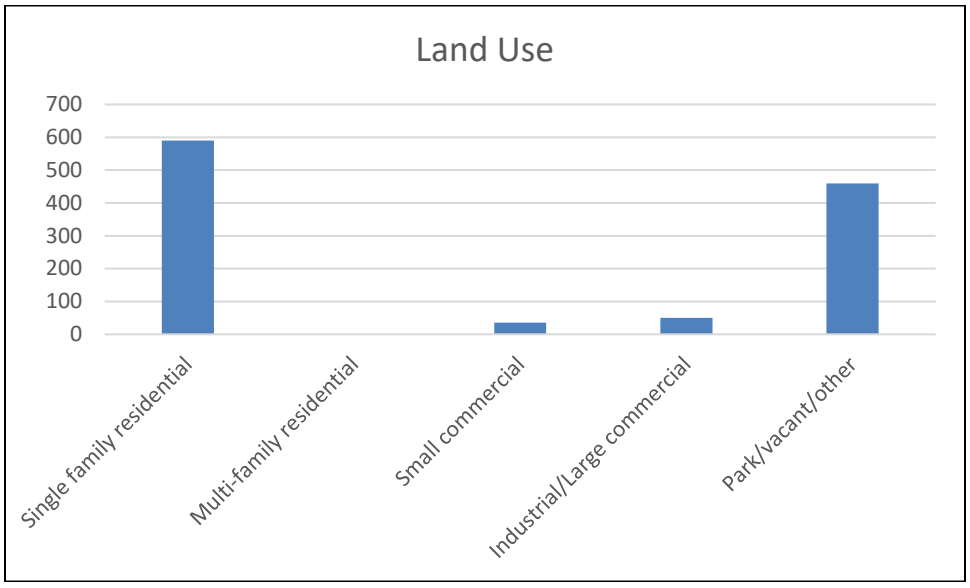

Figure 6: Land Use of city/park trees

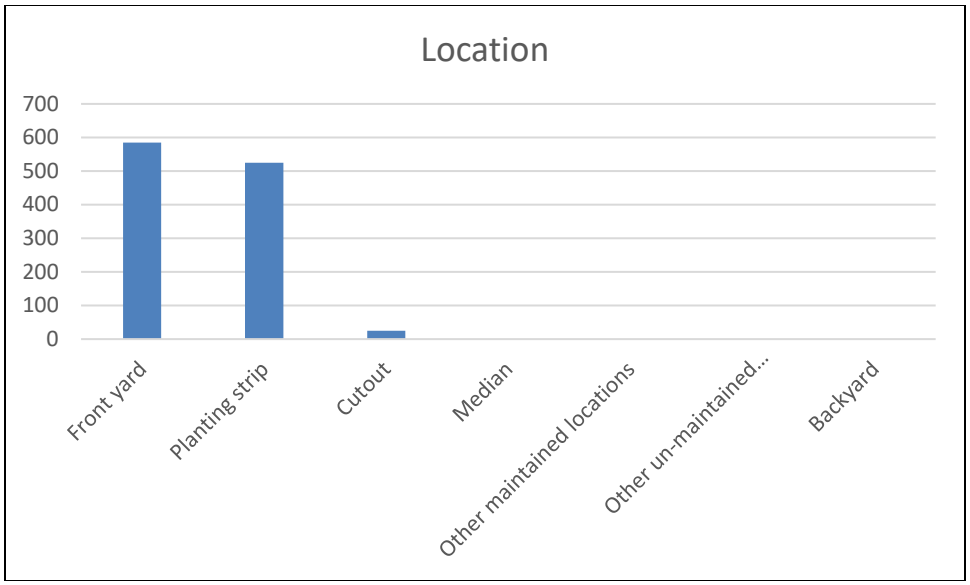

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

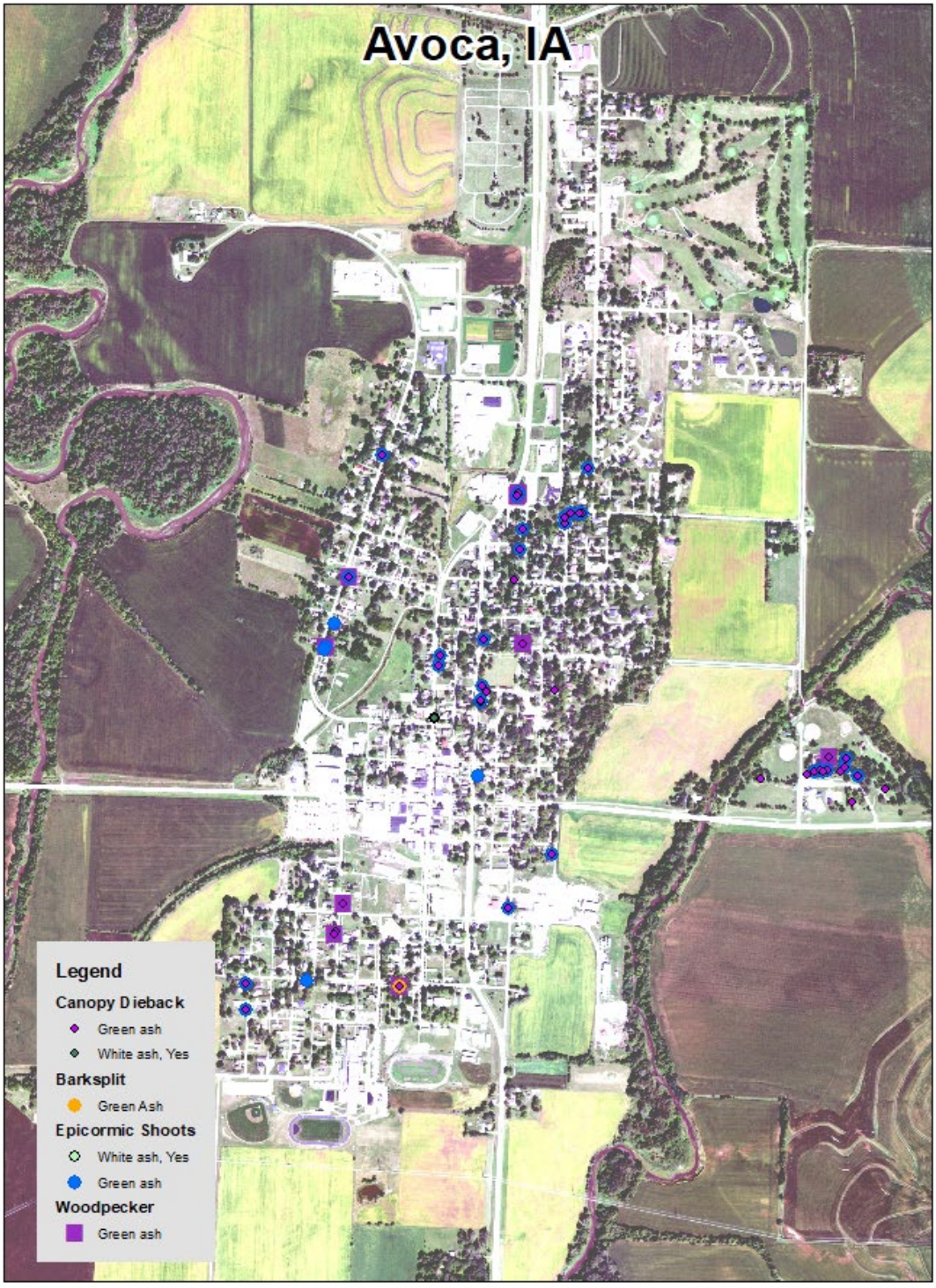

Figure 2: Location of EAB symptoms

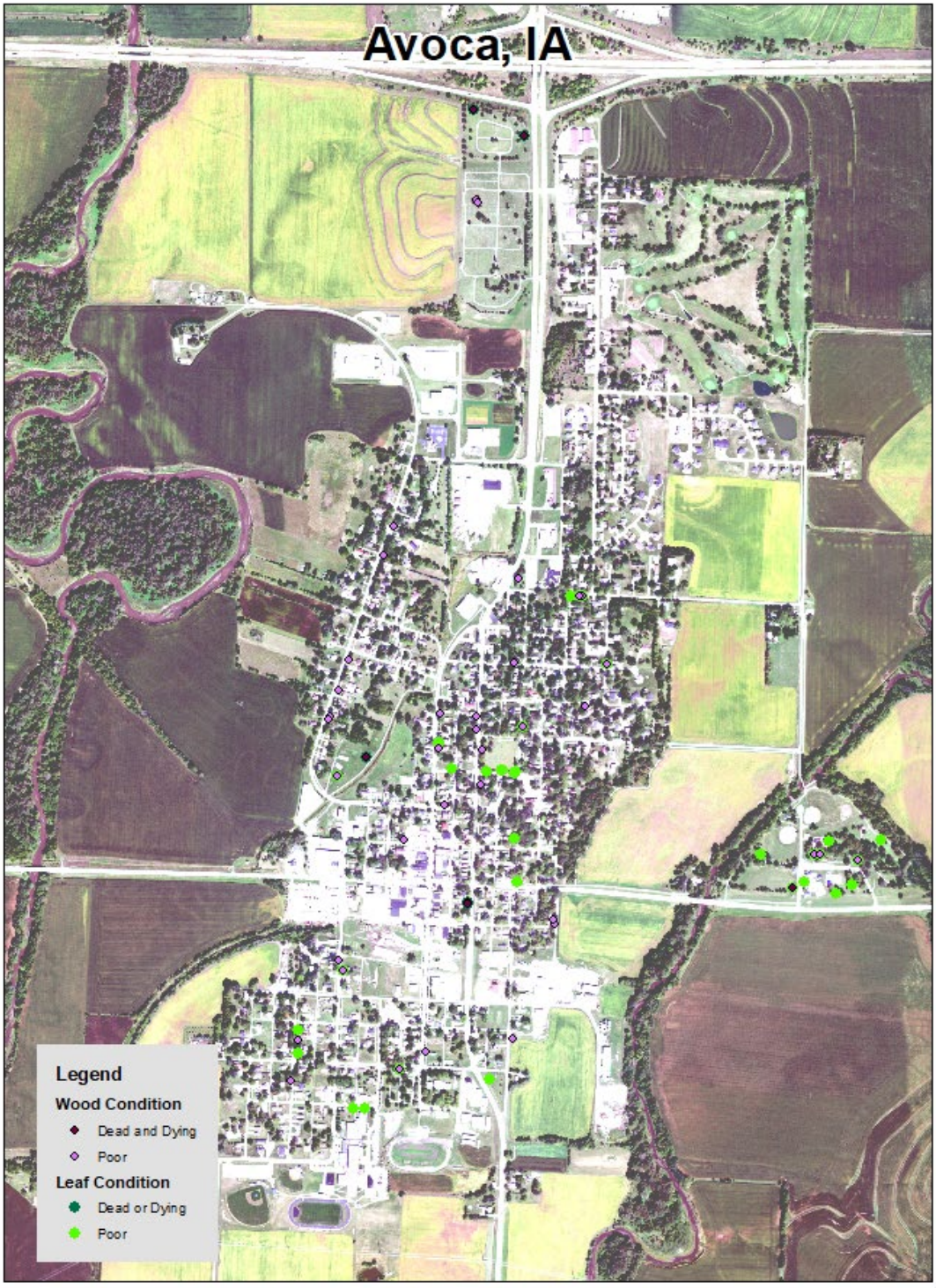

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

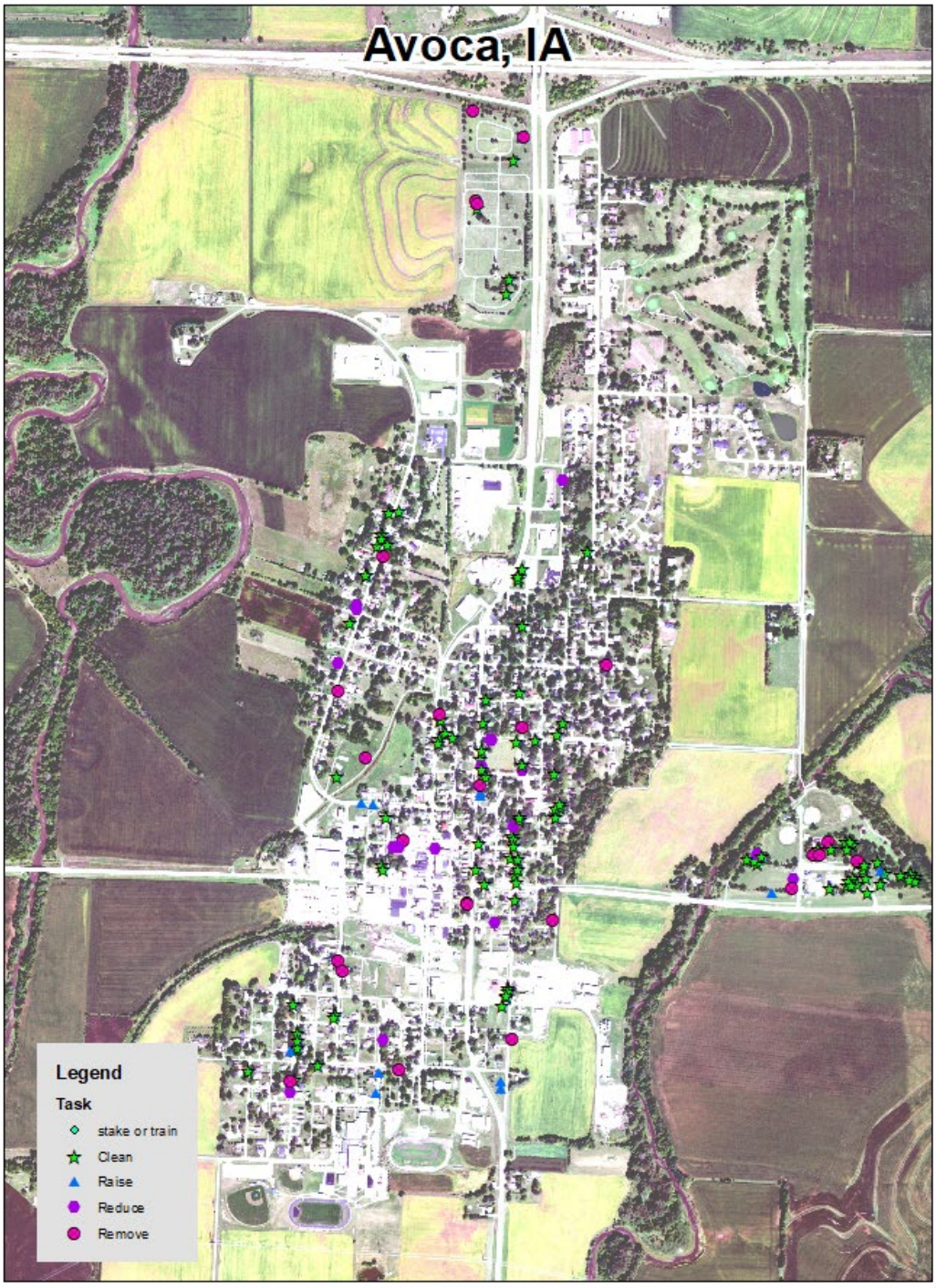

Figure 5: Maintenance Tasks

Appendix C: Avoca Tree Ordinances

8.11 Tree Regulations. The purpose of this section is to regulate the planting and maintenance of trees within the City.

A. Authority of City Generally. The City shall have jurisdiction over all trees and other planting on City property and public right-of-way within the City.

B. Trimming and Removal. The following shall apply

1. City Rights Reserved. The City expressly reserves and asserts its rights to at any time trim or remove, or cause to be trimmed or removed, any tree now or hereafter planted along any publicly owned property or right-of-way whenever the City deems such trimming or removal necessary. An abutting property owner shall not be paid compensation for claimed damages resulting from loss of view, ambiance, shade, or aesthetic appearance which is related to the City tree trimming or removal or trees located along any street or public way.

2. Abutting Owner Responsibilities. The City may require an abutting property owner to maintain and trim trees located along on publicly owned property or right-of-way, but the abutting property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way.

C. Planting Restrictions. No tree shall be planted in any parking or public right-of-way except in accordance with the following:

1. Permit Required. No person shall plant a tree within the parking or public right of-way without first obtaining a permit therefore, which shall show the type of tree to be planted and the placement of the tree. The application for a permit shall not be considered until the applicant has staked the exact location for the proposed street tree and has obtained permission to dig in such exact location from all concerned utilities. The approval of the permit shall be based upon the existing number, location in relation to other trees and utilities, and species of other street trees.

2. Approved Tree and Shrub Species List. The Council shall approve an Approved Trees and Shrub Species List. All plantings must be of a species included on the Approved Trees and Shrub Species List.

D. Trees on Private Property. The property owner is responsible for the maintenance and care of any tree located on private property. Whenever the City is notified or becomes aware of a dead tree or broken or dead branch or limb in any private tree, the Manager or other authorized official may declare the tree, branch or limb a nuisance and order the property owner to remove the hazard in an expedient manner.

1. **Notice.** The notice to remove trees on private property shall contain:

    a. **Description of Nuisance.** A description of the nuisance tree; and
    b. **Location of Nuisance.** The location of the nuisance tree; and

    c. **Acts Necessary to Abate.** A statement of the act or acts necessary to abate the nuisance; and

    d. **Reasonable Time.** A reasonable time within which to complete the removal; and

2. **Right to Hearing.** A statement that the owner has a right to a hearing before the Manager, or his or her designee, by filing a written request therefore with such officer within a reasonable time; and

    a. Assessment of City Costs. A statement that if the tree is not removed as directed and no request for hearing is made within the time prescribed, the City will abate it and assess the costs against such person.

3. **Method of Service.** The notice may be served upon a property owner by any of the following methods:

    a. Personal service of the notice to the property owner by an employee or other contracted agent of the City; or

    b. Certified mail to the property owner. If a certified mailing has not been signed for by the property owner within (ten) 10 days of mailing, reasonable notice will be considered to have been given; or

    c. Posting a sign containing the notice in a conspicuous place on or near the property upon which action is pending. Such posted notice shall be of sufficient size and so placed upon the property that is easily visible from the street. It shall be unlawful for any person to remove, mutilate, destroy or change such posted notice; or

    d. Publication in a newspaper having a general circulation in the City.

4. **Request for Hearing.** Any person ordered to remove a nuisance tree may have a hearing with the Manager, or his or her designee, as to whether a nuisance exists. The following shall apply.

    a. A request for a hearing must be made in writing and delivered to the Clerk, within the reasonable time stated in the notice, or it will be conclusively presumed that a nuisance exists and it must be abated as ordered.

b. The Manager, or his or her designee, shall serve as the hearing officer and the Clerk shall serve as secretary for the hearing.

c. The hearing will be conducted according to the provisions of Chapter 1.8 of this Code.

d. The findings of the hearing officer shall be conclusive and, if a nuisance is found to exist, it shall be ordered abated within a reasonable time under the circumstances. Any person requesting a hearing will have the right to appeal for further review and decision to the Iowa District Court of Pottawattamie County, Iowa within fourteen (14) days of the final orders of the hearing officer.

5. **Emergency Abatement.** If it is determined that an emergency exists by reason of the continuing maintenance of the nuisance tree, the City may perform any action which may be required under this Chapter without prior notice.

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.