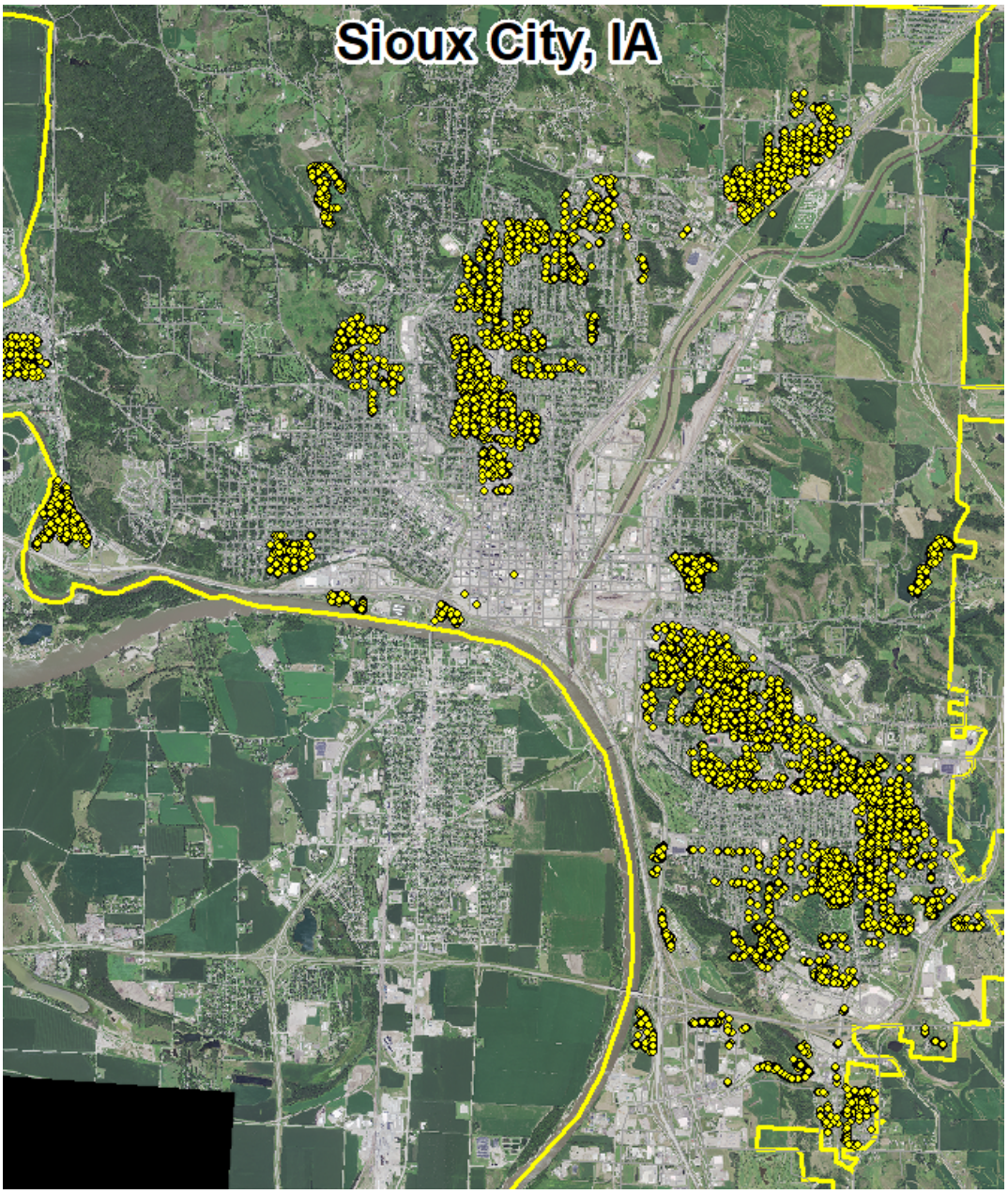
Sioux City, IA



2018 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Sioux City 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 28% of Sioux City's city owned park 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 2016, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of park trees. Below are some key findings of the 9,730 trees inventoried.

- Sioux City's trees provide $2,069,454 of benefits annually, an average of $212 a tree
- There are over 50 species of trees
- The top three genera are: Ash 28%, Maple 24%, and Oak 7%
- 21% of trees are in need of some type of management
- 439 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 439 trees needing removal, 125 are critical concerns and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 2,020 of the 2,760 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 Sioux City with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal or treatment and replacement planting. With proper planning and management of the current canopy in Sioux City, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2016, a tree inventory was conducted that included 100% of the city owned park trees. 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 9,730 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. Sioux City's trees reduce energy related costs by approximately $545,441 annually (Appendix A, Table 1). These savings are both in Electricity (2,583.2 MWh) and in Natural Gas (356,505.7 Therms).

Annual Stormwater Benefits

Sioux City's trees intercept about 30,691,800 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $831,748 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 Sioux City, it is estimated that trees remove 30,220 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 $76,912 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Sioux City, trees sequester about 5,678,266 lbs of carbon a year with an associated value of $70,425 (Appendix A, Table 5). In addition, the trees store 123,378,831 lbs of carbon, with a yearly benefit of $925,341 (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. Sioux City receives $523,706 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, Sioux City's trees provide $2,069,454 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 9,730 trees in Sioux City provide approximately $212 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Sioux City has over 50 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Ash	2760	28%

Maple	2366	24%
Oak	671	7%
Honeylocust	578	6%
Other	558	6%
Hackberry	531	5%
Linden	467	5%
Apple (crabapple)	425	4%
Spruce	330	3%
Pear	169	2%
Elm	135	1%
Walnut	124	1%
Cedar	105	1%
Cottonwood/Poplar	82	1%
Hickory	72	1%
Pine	64	1%
Arborvitae	51	1%
Sycamore	38	<1%
Cherry	36	<1%
Mulberry	34	<1%
Kentucky Coffeetree	30	<1%
Birch	28	<1%
Lilac	21	<1%
Ginkgo	17	<1%
Buckeye	10	<1%
Willow	10	<1%
Sumac/Buckthorn	8	<1%
Alder	3	<1%
Mountain Ash	3	<1%
Redbud	2	<1%
Chestnut	1	<1%
Dogwood	1	<1%

Age Class

Most of Sioux City's trees (35%) are between 18 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Sioux City's size curve peaks in the middle, indicating middle 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 Sioux City indicate that 79% of the trees are in good health, with only 5% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 71% of Sioux City'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 8% of the population. This 8% 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	1,975	20%
Crown Raising	1,434	15%
Tree Staking	2	<1%
Tree Removal	439	5%
Crown Reduction	96	1%

Canopy Cover

The total canopy with both private and public trees is 24%, 9040 acres. The canopy cover included in the Sioux City park inventory includes approximately 309 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 2,736 trees need to be planted annually on all lands.

Land Use and Location

The majority of Sioux City'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	63%
Park/vacant/other	34%
Industrial/Large commercial	1%
Small commercial	<1%
Multifamily residential	<1%

Location	
Planting strip	71%
Median	<1%
Cutout (surrounded by pavement)	<1%
Front yard	28%

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

Sioux City has 125 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 135 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 3,686 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 439 removals, 178 are ash trees. There are a total of 2,760 ash trees, and 2,020 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 Sioux City.

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 (24%) (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.

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: 125 critical concern trees, and 314 marked for removal and 65 new critical concern trees and ash in poor health
Planting and Replacement: 605 trees to be planted in open locations
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 504 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 605 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 504 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 605 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 504 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 605 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 504 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 605 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 504 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 605 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

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. The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work
While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring
It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees
It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 8.56.060 states "If there is a danger that all or a substantial portion of such tree or trees located on private property might fall on any public alley, street or other public property this will be sufficient evidence that such tree or trees constitute a nuisance. When a dangerous tree exists on public property the city manager or his designee shall abate said nuisance. If the declared nuisance exists upon private property, the abutting property owner shall receive notice as provided in Chapter 8.72 of the municipal code of Sioux City, Iowa. If the owner fails to act upon said notice, then the city manager or his designee shall abate said nuisance and the costs incurred will be assessed against the property owner as provided in Chapter 8.72 of the municipal code of Sioux City, Iowa."

Budget

Purposed Ash Treament
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). This would be 500 trees selected for treatment ($75,000), and Sioux City would still need to find $1,808,000 for removal. Alternatively, if there are 1,000 treatable trees, it would cost approximately $150,000 a year for treatment and leave $1,408,000 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 if EAB is found in Sioux City. 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

Sioux City

Annual Energy Benefits of Public Trees

4/8/2018

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	485.6	36,855	70,968.6	69,549	106,404	(N/A)	17.9	19.5	61.08
Silver maple	455.8	34,599	60,414.5	59,206	93,805	(N/A)	12.9	17.2	74.98
Green ash	233.1	17,689	31,453.2	30,824	48,514	(N/A)	9.2	8.9	54.45
Honeylocust	187.1	14,199	24,348.9	23,862	38,061	(N/A)	5.9	7.0	65.85
Northern hackberry	202.5	15,368	28,444.9	27,876	43,244	(N/A)	5.5	7.9	81.44
Apple	54.9	4,168	8,329.1	8,162	12,331	(N/A)	4.4	2.3	29.01
Norway maple	104.1	7,902	14,882.5	14,585	22,487	(N/A)	4.2	4.1	54.85
Maple	59.4	4,509	8,130.1	7,967	12,477	(N/A)	4.0	2.3	31.75
Bur oak	115.6	8,772	15,913.5	15,595	24,367	(N/A)	3.6	4.5	69.42
Oak	71.6	5,436	9,666.1	9,473	14,909	(N/A)	2.8	2.7	54.81
American basswood	76.8	5,832	10,948.8	10,730	16,562	(N/A)	2.6	3.0	64.69
Broadleaf Deciduous Large	65.3	4,958	8,777.3	8,602	13,559	(N/A)	2.1	2.5	65.82
Littleleaf linden	35.9	2,728	5,067.2	4,966	7,694	(N/A)	2.0	1.4	39.86
Spruce	22.1	1,674	2,749.9	2,695	4,369	(N/A)	1.8	0.8	25.40
Pear	16.7	1,271	2,525.9	2,475	3,746	(N/A)	1.6	0.7	23.71
Sugar maple	34.2	2,598	4,601.5	4,509	7,108	(N/A)	1.3	1.3	55.10
Black walnut	38.2	2,902	5,230.1	5,125	8,027	(N/A)	1.3	1.5	64.74
Conifer Evergreen Large	20.6	1,565	2,736.2	2,681	4,246	(N/A)	1.2	0.8	35.38
Blue spruce	9.8	742	1,350.2	1,323	2,065	(N/A)	1.1	0.4	18.77
Red maple	22.2	1,688	3,035.1	2,974	4,662	(N/A)	1.1	0.9	43.98
Eastern red cedar	10.3	785	1,536.9	1,506	2,292	(N/A)	1.1	0.4	21.82
White ash	33.7	2,560	4,082.7	4,001	6,561	(N/A)	1.0	1.2	64.96
Conifer Evergreen Small	1.9	144	305.3	299	443	(N/A)	0.9	0.1	5.34
Catalpa	25.0	1,897	3,395.9	3,328	5,225	(N/A)	0.7	1.0	72.57
Cottonwood	29.2	2,213	3,884.2	3,807	6,019	(N/A)	0.7	1.1	88.52
Amur maple	9.6	729	1,432.6	1,404	2,133	(N/A)	0.7	0.4	32.31
American elm	23.7	1,796	3,050.6	2,990	4,786	(N/A)	0.7	0.9	74.78
Conifer Evergreen Medium	5.0	377	731.4	717	1,094	(N/A)	0.5	0.2	20.64
Northern white cedar	6.4	485	861.3	844	1,329	(N/A)	0.5	0.2	26.06
Siberian elm	17.9	1,357	2,302.0	2,256	3,613	(N/A)	0.5	0.7	75.27
Broadleaf Deciduous Small	2.4	180	387.1	379	560	(N/A)	0.5	0.1	11.91
Swamp white oak	2.7	202	419.4	411	613	(N/A)	0.5	0.1	13.62
American sycamore	14.4	1,096	1,946.5	1,908	3,003	(N/A)	0.4	0.6	79.03
Black spruce	3.8	287	517.2	507	794	(N/A)	0.4	0.1	21.47
Austrian pine	5.0	380	677.4	664	1,044	(N/A)	0.4	0.2	28.20
Broadleaf Deciduous Mediu	7.1	537	995.8	976	1,513	(N/A)	0.3	0.3	44.49
Common chokecherry	3.1	234	473.7	464	698	(N/A)	0.3	0.1	22.51
Kentucky coffeetree	9.6	726	1,322.1	1,296	2,022	(N/A)	0.3	0.4	67.39
Mulberry	3.8	285	586.5	575	860	(N/A)	0.3	0.2	30.71
Black ash	6.0	457	846.7	830	1,287	(N/A)	0.3	0.2	49.48
Lilac	1.8	140	291.3	285	425	(N/A)	0.2	0.1	20.25
Elm	4.9	372	657.1	644	1,016	(N/A)	0.2	0.2	56.45
Basswood	7.1	536	958.3	939	1,475	(N/A)	0.2	0.3	81.97
River birch	4.0	305	605.0	593	898	(N/A)	0.2	0.2	52.84
Ginkgo	1.1	81	148.0	145	226	(N/A)	0.2	0.0	13.28
Black locust	3.9	297	574.9	563	860	(N/A)	0.1	0.2	66.18
Scotch pine	1.6	125	205.6	202	326	(N/A)	0.1	0.1	27.18
Red pine	1.5	117	210.2	206	323	(N/A)	0.1	0.1	26.88
Callery pear	1.3	102	205.1	201	303	(N/A)	0.1	0.1	27.54
Norway spruce	1.4	102	170.4	167	269	(N/A)	0.1	0.0	24.50
Birch	1.3	98	191.7	188	285	(N/A)	0.1	0.1	28.54
Willow	3.1	237	456.2	447	684	(N/A)	0.1	0.1	68.43
Ohio buckeye	2.7	204	378.9	371	576	(N/A)	0.1	0.1	57.57
Eastern cottonwood	3.0	228	396.7	389	616	(N/A)	0.1	0.1	77.06
Boxelder	1.8	135	241.7	237	371	(N/A)	0.1	0.1	53.05
Black poplar	2.9	217	374.5	367	584	(N/A)	0.1	0.1	97.36

White mulberry	0.9	71	145.2	142	213 (N/A)	0.1	0.0	35.49
Chinese elm	1.6	124	230.4	226	350 (N/A)	0.1	0.1	69.92
Buckthorn	1.0	73	144.2	141	215 (N/A)	0.1	0.0	42.94
Black maple	0.7	56	93.1	91	147 (N/A)	0.0	0.0	36.76
Alder	0.4	31	63.9	63	93 (N/A)	0.0	0.0	31.05
Eastern white pine	0.4	33	59.1	58	91 (N/A)	0.0	0.0	30.47
Sumac	0.0	2	5.0	5	7 (N/A)	0.0	0.0	2.38
Plum	0.3	20	38.1	37	57 (N/A)	0.0	0.0	19.06
Mountain ash	0.4	32	67.0	66	98 (N/A)	0.0	0.0	32.56
Eastern redbud	0.2	15	32.2	32	47 (N/A)	0.0	0.0	23.50
Broadleaf Evergreen Small	0.1	9	18.3	18	27 (N/A)	0.0	0.0	13.40
Dogwood	0.0	0	0.6	1	1 (N/A)	0.0	0.0	0.87
American chestnut	0.3	20	38.1	37	57 (N/A)	0.0	0.0	57.32
American holly	0.2	17	28.2	28	44 (N/A)	0.0	0.0	44.11
Northern red oak	0.2	16	30.6	30	46 (N/A)	0.0	0.0	46.28
Black cherry	0.0	0	0.6	1	1 (N/A)	0.0	0.0	0.87
Pin oak	0.2	19	28.4	28	46 (N/A)	0.0	0.0	46.43
Broadleaf Evergreen Mediu	0.2	18	24.2	24	41 (N/A)	0.0	0.0	41.29
Cherry plum	0.0	0	0.6	1	1 (N/A)	0.0	0.0	0.87
White oak	0.5	37	63.1	62	99 (N/A)	0.0	0.0	98.63
Total	2,583.2	196,066	356,505.7	349,376	545,441 (N/A)	100.0	100.0	56.05

Table 2: Annual Stormwater Benefits

Sioux City

Annual Stormwater Benefits of Public Trees

4/8/2018

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	5,151,969	139,618	(N/A)	17.9	16.8	80.15
Silver maple	7,236,004	196,096	(N/A)	12.9	23.6	156.75
Green ash	2,413,218	65,398	(N/A)	9.2	7.9	73.40
Honeylocust	2,107,667	57,118	(N/A)	5.9	6.9	98.82
Northern hackberry	2,149,888	58,262	(N/A)	5.5	7.0	109.72
Apple	252,395	6,840	(N/A)	4.4	0.8	16.09
Norway maple	978,433	26,516	(N/A)	4.2	3.2	64.67
Maple	490,310	13,287	(N/A)	4.0	1.6	33.81
Bur oak	1,475,105	39,975	(N/A)	3.6	4.8	113.89
Oak	880,757	23,869	(N/A)	2.8	2.9	87.75
American basswood	1,027,932	27,857	(N/A)	2.6	3.3	108.82
Broadleaf Deciduous Large	866,402	23,480	(N/A)	2.1	2.8	113.98
Littleleaf linden	359,112	9,732	(N/A)	2.0	1.2	50.42
Spruce	349,663	9,476	(N/A)	1.8	1.1	55.09
Pear	70,798	1,919	(N/A)	1.6	0.2	12.14
Sugar maple	384,407	10,417	(N/A)	1.3	1.3	80.76
Black walnut	464,019	12,575	(N/A)	1.3	1.5	101.41
Conifer Evergreen Large	481,212	13,041	(N/A)	1.2	1.6	108.67
Blue spruce	130,422	3,534	(N/A)	1.1	0.4	32.13
Red maple	194,742	5,278	(N/A)	1.1	0.6	49.79
Eastern red cedar	150,898	4,089	(N/A)	1.1	0.5	38.95
White ash	387,741	10,508	(N/A)	1.0	1.3	104.04
Conifer Evergreen Small	23,943	649	(N/A)	0.9	0.1	7.82
Catalpa	331,286	8,978	(N/A)	0.7	1.1	124.69
Cottonwood	431,960	11,706	(N/A)	0.7	1.4	172.15
Amur maple	44,571	1,208	(N/A)	0.7	0.1	18.30
American elm	209,723	5,683	(N/A)	0.7	0.7	88.80
Conifer Evergreen Medium	72,833	1,974	(N/A)	0.5	0.2	37.24
Northern white cedar	130,373	3,533	(N/A)	0.5	0.4	69.28
Siberian elm	229,592	6,222	(N/A)	0.5	0.7	129.62
Broadleaf Deciduous Small	8,794	238	(N/A)	0.5	0.0	5.07
Swamp white oak	17,036	462	(N/A)	0.5	0.1	10.26
American sycamore	202,836	5,497	(N/A)	0.4	0.7	144.65
Black spruce	51,501	1,396	(N/A)	0.4	0.2	37.72
Austrian pine	78,331	2,123	(N/A)	0.4	0.3	57.37
Broadleaf Deciduous Medium	54,697	1,482	(N/A)	0.3	0.2	43.60
Common chokecherry	12,371	335	(N/A)	0.3	0.0	10.81
Kentucky coffeetree	116,834	3,166	(N/A)	0.3	0.4	105.54
Mulberry	18,961	514	(N/A)	0.3	0.1	18.35
Black ash	51,395	1,393	(N/A)	0.3	0.2	53.57
Lilac	9,741	264	(N/A)	0.2	0.0	12.57
Elm	59,372	1,609	(N/A)	0.2	0.2	89.39
Basswood	101,249	2,744	(N/A)	0.2	0.3	152.44
River birch	40,426	1,096	(N/A)	0.2	0.1	64.44
Ginkgo	7,077	192	(N/A)	0.2	0.0	11.28
Black locust	42,726	1,158	(N/A)	0.1	0.1	89.07
Scotch pine	27,944	757	(N/A)	0.1	0.1	63.11
Red pine	31,247	847	(N/A)	0.1	0.1	70.57
Callery pear	12,278	333	(N/A)	0.1	0.0	30.25

Norway spruce	22,014	597	(N/A)	0.1	0.1	54.23
Birch	10,184	276	(N/A)	0.1	0.0	27.60
Willow	35,288	956	(N/A)	0.1	0.1	95.63
Ohio buckeye	24,367	660	(N/A)	0.1	0.1	66.04
Eastern cottonwood	42,901	1,163	(N/A)	0.1	0.1	145.33
Boxelder	23,728	643	(N/A)	0.1	0.1	91.86
Black poplar	43,434	1,177	(N/A)	0.1	0.1	196.17
White mulberry	4,718	128	(N/A)	0.1	0.0	21.31
Chinese elm	20,105	545	(N/A)	0.1	0.1	108.97
Buckthorn	4,855	132	(N/A)	0.1	0.0	26.31
Black maple	4,458	121	(N/A)	0.0	0.0	30.21
Alder	2,356	64	(N/A)	0.0	0.0	21.28
Eastern white pine	8,908	241	(N/A)	0.0	0.0	80.46
Sumac	84	2	(N/A)	0.0	0.0	0.75
Plum	938	25	(N/A)	0.0	0.0	8.48
Mountain ash	2,417	65	(N/A)	0.0	0.0	21.83
Eastern redbud	1,181	32	(N/A)	0.0	0.0	16.01
Broadleaf Evergreen Small	578	16	(N/A)	0.0	0.0	7.83
Dogwood	7	0	(N/A)	0.0	0.0	0.20
American chestnut	2,591	70	(N/A)	0.0	0.0	70.21
American holly	2,052	56	(N/A)	0.0	0.0	55.60
Northern red oak	2,039	55	(N/A)	0.0	0.0	55.25
Black cherry	7	0	(N/A)	0.0	0.0	0.20
Pin oak	1,378	37	(N/A)	0.0	0.0	37.35
Broadleaf Evergreen Medium	1,775	48	(N/A)	0.0	0.0	48.11
Cherry plum	7	0	(N/A)	0.0	0.0	0.20
White oak	7,239	196	(N/A)	0.0	0.0	196.17
Citywide total	30,691,800	831,748	(N/A)	100.0	100.0	85.47

Table 3: Annual Air Quality Benefits

Sioux City

Annual Air Quality Benefits of Public Trees

4/8/2018

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	1,128.0	194.5	544.5	49.9	6,067	2,362.3	340.9	324.3	2,202.8	14,612	-258.0	-967	6,889.4	19,711 (N/A)	17.9	11.32
Silver maple	1,384.1	234.5	666.9	61.4	7,426	2,153.0	314.9	300.5	2,061.8	13,459	-733.7	-2,751	6,443.4	18,135 (N/A)	12.9	14.50
Green ash	292.5	46.8	142.2	13.1	1,564	1,108.8	161.7	154.3	1,056.3	6,917	0.0	0	2,975.7	8,481 (N/A)	9.2	9.52
Honeylocust	413.1	68.1	187.8	18.8	2,179	879.8	129.0	123.2	846.7	5,511	-324.0	-1,215	2,342.5	6,475 (N/A)	5.9	11.20
Northern hackberry	380.0	65.7	188.3	17.0	2,059	974.8	141.4	134.7	918.2	6,054	0.0	0	2,820.2	8,113 (N/A)	5.5	15.28
Apple	81.7	13.5	38.0	3.7	433	269.3	38.7	36.8	248.8	1,660	-0.4	-2	730.1	2,092 (N/A)	4.4	4.92
Norway maple	201.6	34.8	98.8	8.9	1,089	503.6	72.9	69.4	472.4	3,122	-47.1	-177	1,415.3	4,034 (N/A)	4.2	9.84
Maple	114.4	19.5	54.0	5.1	611	283.1	41.3	39.3	269.1	1,765	-38.4	-144	787.4	2,232 (N/A)	4.0	5.68
Bur oak	218.1	34.9	99.8	9.8	1,148	552.7	80.4	76.6	523.7	3,441	0.0	0	1,596.0	4,589 (N/A)	3.6	13.07
Oak	135.1	21.6	61.8	6.1	712	340.7	49.7	47.4	324.5	2,125	0.0	0	987.0	2,837 (N/A)	2.8	10.43
American basswood	156.5	26.7	74.2	6.9	837	371.3	53.8	51.2	348.5	2,303	-128.6	-482	960.6	2,658 (N/A)	2.6	10.38
Broadleaf Deciduous Large	147.9	23.6	66.3	6.6	775	310.4	45.3	43.2	296.0	1,937	0.0	0	939.4	2,712 (N/A)	2.1	13.17
Littleleaf linden	60.7	10.5	30.1	2.7	329	173.2	25.1	23.9	163.1	1,076	-29.4	-110	459.9	1,294 (N/A)	2.0	6.70
Spruce	39.8	7.9	33.2	4.9	264	102.6	15.1	14.5	99.9	646	-154.9	-581	163.0	328 (N/A)	1.8	1.91
Pear	21.3	3.5	10.1	1.0	114	82.0	11.8	11.2	75.9	506	-0.1	0	216.6	619 (N/A)	1.6	3.92
Sugar maple	52.3	8.9	25.9	2.3	283	162.5	23.7	22.6	155.1	1,014	-41.0	-154	412.3	1,143 (N/A)	1.3	8.86
Black walnut	62.7	10.0	29.2	2.8	331	182.5	26.6	25.3	173.3	1,137	0.0	0	512.4	1,468 (N/A)	1.3	11.84
Conifer Evergreen Large	58.5	11.6	46.4	7.2	381	97.4	14.3	13.6	93.4	609	-280.3	-1,051	62.1	-61 (N/A)	1.2	-0.51
Blue spruce	16.7	3.3	14.3	2.1	112	46.6	6.8	6.5	44.2	290	-46.4	-174	94.1	228 (N/A)	1.1	2.07
Red maple	47.2	8.0	22.0	2.1	251	105.9	15.4	14.7	100.7	660	-15.8	-59	300.3	852 (N/A)	1.1	8.04
Eastern red cedar	30.7	6.1	24.3	3.8	199	50.3	7.3	6.9	46.8	311	-83.2	-312	92.9	199 (N/A)	1.1	1.89
White ash	72.2	11.5	32.8	3.2	380	156.0	23.1	22.1	152.7	984	0.0	0	473.7	1,364 (N/A)	1.0	13.50
Conifer Evergreen Small	1.7	0.3	1.8	0.2	12	9.4	1.3	1.3	8.6	58	-12.2	-46	12.5	24 (N/A)	0.9	0.29
Catalpa	52.3	8.4	23.6	2.3	275	119.1	17.4	16.6	113.3	743	0.0	0	352.9	1,017 (N/A)	0.7	14.13
Cottonwood	80.2	12.8	35.3	3.6	418	138.3	20.2	19.3	132.1	864	0.0	0	441.7	1,282 (N/A)	0.7	18.85
Amur maple	14.8	2.4	6.9	0.7	79	46.9	6.7	6.4	43.5	289	-0.1	0	128.3	368 (N/A)	0.7	5.57
American elm	56.4	9.6	26.8	2.5	302	111.4	16.3	15.6	107.2	698	0.0	0	345.8	999 (N/A)	0.7	15.62
Conifer Evergreen Medium	10.4	2.1	8.8	1.3	69	24.1	3.5	3.3	22.5	149	-26.3	-98	49.7	120 (N/A)	0.5	2.26
Northern white cedar	15.4	3.0	12.5	1.9	101	30.3	4.4	4.2	28.9	189	-70.5	-264	30.1	26 (N/A)	0.5	0.50
Siberian elm	47.1	8.0	22.0	2.1	251	84.0	12.3	11.8	81.0	527	0.0	0	268.2	777 (N/A)	0.5	16.19
Broadleaf Deciduous Small	1.9	0.3	1.0	0.1	11	11.9	1.7	1.6	10.8	73	0.0	0	29.3	83 (N/A)	0.5	1.77
Swamp white oak	2.3	0.4	1.3	0.1	13	13.2	1.9	1.8	12.1	81	-0.7	-2	32.5	92 (N/A)	0.5	2.04
American sycamore	34.0	5.4	15.1	1.5	178	68.7	10.0	9.6	65.4	428	0.0	0	209.7	606 (N/A)	0.4	15.95
Black spruce	6.8	1.4	5.8	0.8	46	18.0	2.6	2.5	17.1	112	-18.5	-69	36.6	89 (N/A)	0.4	2.39
Austrian pine	12.0	2.4	9.7	1.5	79	23.7	3.5	3.3	22.6	148	-29.8	-112	49.0	115 (N/A)	0.4	3.12

Broadleaf Deciduous Medium	9.9	1.7	5.0	0.4	54	34.1	4.9	4.7	32.1	212	-2.4	-9	90.4	256 (N/A)	0.3	7.54
Common chokecherry	3.4	0.6	1.7	0.2	18	15.2	2.2	2.1	13.9	93	0.0	0	39.1	112 (N/A)	0.3	3.60
Kentucky coffeetree	16.3	2.6	7.6	0.7	86	45.8	6.7	6.3	43.3	285	0.0	0	129.3	371 (N/A)	0.3	12.37
Mulberry	6.4	1.1	2.9	0.3	34	18.6	2.7	2.5	17.0	114	0.0	0	51.4	148 (N/A)	0.3	5.28
Black ash	10.0	1.7	5.0	0.4	54	29.0	4.2	4.0	27.3	180	-2.4	-9	79.3	226 (N/A)	0.3	8.67
Lilac	3.4	0.6	1.5	0.2	18	9.1	1.3	1.2	8.3	56	0.0	0	25.6	74 (N/A)	0.2	3.51
Elm	9.4	1.5	4.3	0.4	49	23.3	3.4	3.2	22.2	145	0.0	0	67.7	195 (N/A)	0.2	10.81
Basswood	16.4	2.6	7.3	0.7	86	33.7	4.9	4.7	32.0	210	0.0	0	102.3	296 (N/A)	0.2	16.42
River birch	8.4	1.5	4.1	0.4	45	19.7	2.8	2.7	18.3	122	-2.0	-7	55.9	160 (N/A)	0.2	9.39
Ginkgo	1.7	0.3	0.9	0.1	9	5.1	0.7	0.7	4.8	32	-0.6	-2	13.8	39 (N/A)	0.2	2.30
Black locust	9.5	1.6	4.6	0.4	51	19.1	2.7	2.6	17.7	118	-2.2	-8	56.1	161 (N/A)	0.1	12.36
Scotch pine	3.2	0.6	2.7	0.4	21	7.6	1.1	1.1	7.4	48	-13.3	-50	10.9	20 (N/A)	0.1	1.63
Red pine	3.7	0.7	3.0	0.5	24	7.3	1.1	1.0	7.0	46	-16.8	-63	7.4	7 (N/A)	0.1	0.56
Callery pear	2.4	0.4	1.2	0.1	13	6.6	0.9	0.9	6.1	41	-0.6	-2	18.1	52 (N/A)	0.1	4.69
Norway spruce	2.5	0.5	2.1	0.3	17	6.3	0.9	0.9	6.1	40	-9.9	-37	9.7	19 (N/A)	0.1	1.72
Birch	1.8	0.3	0.9	0.1	10	6.3	0.9	0.9	5.8	39	-0.4	-2	16.6	47 (N/A)	0.1	4.70
Willow	8.0	1.4	3.8	0.4	43	15.2	2.2	2.1	14.2	94	-1.8	-7	45.4	130 (N/A)	0.1	13.02
Ohio buckeye	4.9	0.9	2.4	0.2	27	13.0	1.9	1.8	12.2	81	-1.2	-4	36.1	103 (N/A)	0.1	10.29
Eastern cottonwood	8.8	1.4	3.8	0.4	46	14.2	2.1	2.0	13.6	89	0.0	0	46.3	134 (N/A)	0.1	16.81
Boxelder	3.5	0.6	1.6	0.2	18	8.4	1.2	1.2	8.0	53	-0.9	-3	23.7	67 (N/A)	0.1	9.63
Black poplar	9.1	1.5	3.9	0.4	47	13.5	2.0	1.9	13.0	85	0.0	0	45.2	132 (N/A)	0.1	21.96
White mulberry	1.6	0.3	0.7	0.1	8	4.6	0.7	0.6	4.2	28	0.0	0	12.8	37 (N/A)	0.1	6.11
Chinese elm	2.6	0.4	1.2	0.1	14	7.9	1.1	1.1	7.4	49	0.0	0	21.8	63 (N/A)	0.1	12.52
Buckthorn	1.7	0.3	0.8	0.1	9	4.7	0.7	0.6	4.4	29	0.0	0	13.3	38 (N/A)	0.1	7.63
Black maple	0.8	0.1	0.4	0.0	4	3.4	0.5	0.5	3.3	22	-0.3	-1	8.8	25 (N/A)	0.0	6.20
Alder	0.9	0.1	0.4	0.0	5	2.0	0.3	0.3	1.8	12	0.0	0	5.8	17 (N/A)	0.0	5.60
Eastern white pine	1.0	0.2	0.8	0.1	7	2.1	0.3	0.3	2.0	13	-4.1	-15	2.8	4 (N/A)	0.0	1.45
Sumac	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.31
Plum	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.2	9 (N/A)	0.0	3.07
Mountain ash	0.9	0.1	0.4	0.0	5	2.1	0.3	0.3	1.9	13	0.0	0	6.0	17 (N/A)	0.0	5.80
Eastern redbud	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)	0.0	4.23
Broadleaf Evergreen Small	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	4	0.0	0	1.5	4 (N/A)	0.0	2.06
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)	0.0	0.11
American chestnut	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9 (N/A)	0.0	9.34
American holly	0.7	0.1	0.5	0.1	4	1.0	0.1	0.1	1.0	6	0.0	0	3.7	11 (N/A)	0.0	10.84
Northern red oak	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	1.0	6	-0.6	-2	2.4	7 (N/A)	0.0	6.50
Black cherry	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)	0.0	0.11
Pin oak	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.3	-1	2.5	7 (N/A)	0.0	6.75
Broadleaf Evergreen Medium	0.1	0.0	0.1	0.0	1	1.0	0.2	0.1	1.0	7	-0.5	-2	2.1	5 (N/A)	0.0	5.49
Cherry plum	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)	0.0	0.11
White oak	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)	0.0	22.55
Citywide total	5,606.7	948.4	2,738.7	265.9	30,220	12,356.8	1,797.2	1,713.1	11,704.9	76,912	-2,399.7	-8,999	34,732.1	98,133 (N/A)	100.0	10.08

Table 4: Annual Carbon Stored

Sioux City

Stored CO2 Benefits of Public Trees

4/8/2018

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	18,613,502	139,601	(N/A)	17.9	15.1	80.14
Silver maple	34,428,984	258,217	(N/A)	12.9	27.9	206.41
Green ash	9,625,215	72,189	(N/A)	9.2	7.8	81.02
Honeylocust	5,326,439	39,948	(N/A)	5.9	4.3	69.11
Northern hackberry	6,016,465	45,123	(N/A)	5.5	4.9	84.98
Apple	1,277,237	9,579	(N/A)	4.4	1.0	22.54
Norway maple	3,322,948	24,922	(N/A)	4.2	2.7	60.79
Maple	1,258,552	9,439	(N/A)	4.0	1.0	24.02
Bur oak	7,276,376	54,573	(N/A)	3.6	5.9	155.48
Oak	4,579,665	34,347	(N/A)	2.8	3.7	126.28
American basswood	6,006,479	45,049	(N/A)	2.6	4.9	175.97
Broadleaf Deciduous	5,071,467	38,036	(N/A)	2.1	4.1	184.64
Littleleaf linden	1,302,412	9,768	(N/A)	2.0	1.1	50.61
Spruce	366,552	2,749	(N/A)	1.8	0.3	15.98
Pear	337,048	2,528	(N/A)	1.6	0.3	16.00
Sugar maple	1,512,275	11,342	(N/A)	1.3	1.2	87.92
Black walnut	2,062,532	15,469	(N/A)	1.3	1.7	124.75
Conifer Evergreen La	722,268	5,417	(N/A)	1.2	0.6	45.14
Blue spruce	109,309	820	(N/A)	1.1	0.1	7.45
Red maple	510,693	3,830	(N/A)	1.1	0.4	36.13
Eastern red cedar	99,383	745	(N/A)	1.1	0.1	7.10
White ash	1,151,502	8,636	(N/A)	1.0	0.9	85.51
Conifer Evergreen Sm	8,274	62	(N/A)	0.9	0.0	0.75
Catalpa	1,766,251	13,247	(N/A)	0.7	1.4	183.98
Cottonwood	2,770,595	20,779	(N/A)	0.7	2.2	305.58
Amur maple	229,467	1,721	(N/A)	0.7	0.2	26.08
American elm	1,137,211	8,529	(N/A)	0.7	0.9	133.27
Conifer Evergreen Me	79,628	597	(N/A)	0.5	0.1	11.27
Northern white cedar	177,265	1,329	(N/A)	0.5	0.1	26.07
Siberian elm	1,157,454	8,681	(N/A)	0.5	0.9	180.85
Broadleaf Deciduous	34,345	258	(N/A)	0.5	0.0	5.48
Swamp white oak	43,525	326	(N/A)	0.5	0.0	7.25
American sycamore	1,156,778	8,676	(N/A)	0.4	0.9	228.31
Black spruce	46,588	349	(N/A)	0.4	0.0	9.44
Austrian pine	93,625	702	(N/A)	0.4	0.1	18.98
Broadleaf Deciduous	164,014	1,230	(N/A)	0.3	0.1	36.18
Common chokecherry	55,443	416	(N/A)	0.3	0.0	13.41
Kentucky coffeetree	537,696	4,033	(N/A)	0.3	0.4	134.42
Mulberry	100,544	754	(N/A)	0.3	0.1	26.93
Black ash	166,643	1,250	(N/A)	0.3	0.1	48.07
Lilac	52,860	396	(N/A)	0.2	0.0	18.88
Elm	319,186	2,394	(N/A)	0.2	0.3	132.99
Basswood	553,402	4,151	(N/A)	0.2	0.4	230.58
River birch	138,282	1,037	(N/A)	0.2	0.1	61.01
Ginkgo	25,383	190	(N/A)	0.2	0.0	11.20
Black locust	155,981	1,170	(N/A)	0.1	0.1	89.99
Scotch pine	32,287	242	(N/A)	0.1	0.0	20.18
Red pine	42,186	316	(N/A)	0.1	0.0	26.37
Callery pear	40,497	304	(N/A)	0.1	0.0	27.61
Norway spruce	23,665	177	(N/A)	0.1	0.0	16.13
Birch	30,504	229	(N/A)	0.1	0.0	22.88
Willow	132,145	991	(N/A)	0.1	0.1	99.11
Ohio buckeye	81,173	609	(N/A)	0.1	0.1	60.88
Eastern cottonwood	307,922	2,309	(N/A)	0.1	0.2	288.68
Boxelder	141,319	1,060	(N/A)	0.1	0.1	151.41

Black poplar	319,168	2,394	(N/A)	0.1	0.3	398.96
White mulberry	25,081	188	(N/A)	0.1	0.0	31.35
Chinese elm	84,574	634	(N/A)	0.1	0.1	126.86
Buckthorn	26,302	197	(N/A)	0.1	0.0	39.45
Black maple	9,450	71	(N/A)	0.0	0.0	17.72
Alder	13,499	101	(N/A)	0.0	0.0	33.75
Eastern white pine	10,028	75	(N/A)	0.0	0.0	25.07
Sumac	205	2	(N/A)	0.0	0.0	0.51
Plum	3,959	30	(N/A)	0.0	0.0	9.90
Mountain ash	13,663	102	(N/A)	0.0	0.0	34.16
Eastern redbud	6,756	51	(N/A)	0.0	0.0	25.34
Broadleaf Evergreen S	1,816	14	(N/A)	0.0	0.0	6.81
Dogwood	14	0	(N/A)	0.0	0.0	0.10
American chestnut	8,458	63	(N/A)	0.0	0.0	63.43
American holly	6,743	51	(N/A)	0.0	0.0	50.57
Northern red oak	8,218	62	(N/A)	0.0	0.0	61.63
Black cherry	14	0	(N/A)	0.0	0.0	0.10
Pin oak	3,595	27	(N/A)	0.0	0.0	26.96
Broadleaf Evergreen L	1,851	14	(N/A)	0.0	0.0	13.88
Cherry plum	14	0	(N/A)	0.0	0.0	0.10
White oak	55,982	420	(N/A)	0.0	0.0	419.86
Citywide total	123,378,831	925,341	(N/A)	100.0	100.0	95.09

Table 5: Annual Carbon Sequestered

Sioux City

Annual CO Benefits of Public Trees

4/8/2018

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	399,302	2,995	-89,361	-5,663	-713	814,484	6,109	1,118,763	8,391 (N/A)	17.9	11.9	4.82
Silver maple	2,240,520	16,804	-165,270	-5,431	-1,280	764,620	5,735	2,834,438	21,258 (N/A)	12.9	30.2	16.99
Green ash	529,761	3,973	-46,201	-2,391	-364	390,930	2,932	872,100	6,541 (N/A)	9.2	9.3	7.34
Honeylocust	316,245	2,372	-25,571	-1,433	-203	313,787	2,353	603,027	4,523 (N/A)	5.9	6.4	7.82
Northern hackberry	268,275	2,012	-28,879	-1,981	-231	339,633	2,547	577,048	4,328 (N/A)	5.5	6.1	8.15
Apple	80,796	606	-6,132	-760	-52	92,121	691	166,025	1,245 (N/A)	4.4	1.8	2.93
Norway maple	133,266	999	-15,954	-1,097	-128	174,632	1,310	290,846	2,181 (N/A)	4.2	3.1	5.32
Maple	71,173	534	-6,042	-588	-50	99,656	747	164,200	1,231 (N/A)	4.0	1.7	3.13
Bur oak	255,102	1,913	-34,927	-1,265	-271	193,851	1,454	412,762	3,096 (N/A)	3.6	4.4	8.82
Oak	144,614	1,085	-21,983	-790	-171	120,129	901	241,969	1,815 (N/A)	2.8	2.6	6.67
American basswood	319,093	2,393	-28,832	-944	-223	128,883	967	418,201	3,137 (N/A)	2.6	4.5	12.25
Broadleaf Deciduous Larg	118,499	889	-24,344	-738	-188	109,561	822	202,978	1,522 (N/A)	2.1	2.2	7.39
Littleleaf linden	97,129	728	-6,257	-443	-50	60,285	452	150,714	1,130 (N/A)	2.0	1.6	5.86
Spruce	22,782	171	-1,759	-377	-16	36,992	277	57,638	432 (N/A)	1.8	0.6	2.51
Pear	26,060	195	-1,618	-230	-14	28,081	211	52,292	392 (N/A)	1.6	0.6	2.48
Sugar maple	77,778	583	-7,262	-372	-57	57,425	431	127,569	957 (N/A)	1.3	1.4	7.42
Black walnut	89,169	669	-9,900	-407	-77	64,127	481	142,989	1,072 (N/A)	1.3	1.5	8.65
Conifer Evergreen Large	25,646	192	-3,467	-394	-29	34,578	259	56,363	423 (N/A)	1.2	0.6	3.52
Blue spruce	7,646	57	-525	-174	-5	16,389	123	23,336	175 (N/A)	1.1	0.2	1.59
Red maple	25,314	190	-2,452	-209	-20	37,294	280	59,947	450 (N/A)	1.1	0.6	4.24
Eastern red cedar	1,904	14	-477	-186	-5	17,357	130	18,598	139 (N/A)	1.1	0.2	1.33
White ash	71,920	539	-5,528	-289	-44	56,573	424	122,676	920 (N/A)	1.0	1.3	9.11
Conifer Evergreen Small	1,551	12	-40	-57	-1	3,188	24	4,642	35 (N/A)	0.9	0.0	0.42
Catalpa	51,317	385	-8,478	-277	-66	41,920	314	84,482	634 (N/A)	0.7	0.9	8.80
Cottonwood	46,997	352	-13,299	-339	-102	48,898	367	82,257	617 (N/A)	0.7	0.9	9.07
Amur maple	14,398	108	-1,102	-129	-9	16,103	121	29,271	220 (N/A)	0.7	0.3	3.33
American elm	28,567	214	-5,460	-229	-43	39,693	298	62,570	469 (N/A)	0.7	0.7	7.33
Conifer Evergreen Mediun	4,331	32	-382	-96	-4	8,338	63	12,190	91 (N/A)	0.5	0.1	1.72
Northern white cedar	6,649	50	-851	-126	-7	10,713	80	16,384	123 (N/A)	0.5	0.2	2.41
Siberian elm	34,713	260	-5,556	-202	-43	29,987	225	58,942	442 (N/A)	0.5	0.6	9.21
Broadleaf Deciduous Smal	3,870	29	-165	-39	-2	3,983	30	7,648	57 (N/A)	0.5	0.1	1.22
Swamp white oak	5,109	38	-232	-36	-2	4,459	33	9,300	70 (N/A)	0.5	0.1	1.55

American sycamore	27,687	208	-5,553	-163	-43	24,212	182	46,183	346 (N/A)	0.4	0.5	9.12
Black spruce	3,045	23	-224	-67	-2	6,353	48	9,107	68 (N/A)	0.4	0.1	1.85
Austrian pine	4,725	35	-449	-95	-4	8,391	63	12,572	94 (N/A)	0.4	0.1	2.55
Broadleaf Deciduous Medi	11,040	83	-787	-70	-6	11,864	89	22,047	165 (N/A)	0.3	0.2	4.86
Common chokecherry	4,690	35	-266	-43	-2	5,162	39	9,543	72 (N/A)	0.3	0.1	2.31
Kentucky coffeetree	22,058	165	-2,581	-103	-20	16,043	120	35,417	266 (N/A)	0.3	0.4	8.85
Mulberry	4,438	33	-483	-57	-4	6,299	47	10,197	76 (N/A)	0.3	0.1	2.73
Black ash	7,723	58	-800	-62	-6	10,095	76	16,956	127 (N/A)	0.3	0.2	4.89
Lilac	708	5	-254	-33	-2	3,088	23	3,510	26 (N/A)	0.2	0.0	1.25
Elm	9,506	71	-1,532	-54	-12	8,226	62	16,146	121 (N/A)	0.2	0.2	6.73
Basswood	14,471	109	-2,656	-80	-21	11,852	89	23,587	177 (N/A)	0.2	0.3	9.83
River birch	5,917	44	-664	-44	-5	6,748	51	11,957	90 (N/A)	0.2	0.1	5.28
Ginkgo	295	2	-122	-19	-1	1,784	13	1,938	15 (N/A)	0.2	0.0	0.86
Black locust	3,646	27	-749	-45	-6	6,562	49	9,415	71 (N/A)	0.1	0.1	5.43
Scotch pine	1,564	12	-155	-29	-1	2,754	21	4,135	31 (N/A)	0.1	0.0	2.58
Red pine	1,400	11	-202	-30	-2	2,577	19	3,744	28 (N/A)	0.1	0.0	2.34
Callery pear	1,809	14	-197	-16	-2	2,253	17	3,849	29 (N/A)	0.1	0.0	2.62
Norway spruce	1,467	11	-114	-23	-1	2,265	17	3,595	27 (N/A)	0.1	0.0	2.45
Birch	2,228	17	-147	-14	-1	2,156	16	4,223	32 (N/A)	0.1	0.0	3.17
Willow	756	6	-634	-40	-5	5,242	39	5,324	40 (N/A)	0.1	0.1	3.99
Ohio buckeye	3,324	25	-390	-28	-3	4,516	34	7,422	56 (N/A)	0.1	0.1	5.57
Eastern cottonwood	3,772	28	-1,478	-36	-11	5,032	38	7,290	55 (N/A)	0.1	0.1	6.83
Boxelder	8,428	63	-678	-25	-5	2,973	22	10,697	80 (N/A)	0.1	0.1	11.46
Black poplar	3,306	25	-1,532	-34	-12	4,799	36	6,539	49 (N/A)	0.1	0.1	8.17
White mulberry	495	4	-120	-15	-1	1,561	12	1,921	14 (N/A)	0.1	0.0	2.40
Chinese elm	4,095	31	-406	-18	-3	2,735	21	6,407	48 (N/A)	0.1	0.1	9.61
Buckthorn	1,014	8	-126	-14	-1	1,621	12	2,495	19 (N/A)	0.1	0.0	3.74
Black maple	1,297	10	-45	-6	0	1,233	9	2,478	19 (N/A)	0.0	0.0	4.65
Alder	9	0	-65	-7	-1	675	5	612	5 (N/A)	0.0	0.0	1.53
Eastern white pine	562	4	-48	-8	0	739	6	1,245	9 (N/A)	0.0	0.0	3.11
Sumac	55	0	-1	-1	0	48	0	102	1 (N/A)	0.0	0.0	0.25
Plum	390	3	-19	-3	0	438	3	806	6 (N/A)	0.0	0.0	2.02
Mountain ash	516	4	-66	-7	-1	707	5	1,151	9 (N/A)	0.0	0.0	2.88
Eastern redbud	9	0	-32	-4	0	340	3	313	2 (N/A)	0.0	0.0	1.17
Broadleaf Evergreen Small	163	1	-9	-2	0	195	1	347	3 (N/A)	0.0	0.0	1.30
Dogwood	9	0	0	0	0	6	0	14	0 (N/A)	0.0	0.0	0.10
American chestnut	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.0	0.0	7.93
American holly	0	0	-32	-2	0	365	3	331	2 (N/A)	0.0	0.0	2.48
Northern red oak	382	3	-39	-3	0	360	3	700	5 (N/A)	0.0	0.0	5.25
Black cherry	9	0	0	0	0	6	0	14	0 (N/A)	0.0	0.0	0.10
Pin oak	473	4	-17	-2	0	411	3	865	6 (N/A)	0.0	0.0	6.49
Broadleaf Evergreen Medi	143	1	-9	-2	0	388	3	520	4 (N/A)	0.0	0.0	3.90
Cherry plum	9	0	0	0	0	6	0	14	0 (N/A)	0.0	0.0	0.10
White oak	479	4	-269	-6	-2	813	6	1,017	8 (N/A)	0.0	0.0	7.63
Citywide total	5,678,266	42,587	-592,298	-29,004	-4,660	4,333,004	32,498	9,389,968	70,425 (N/A)	100.0	100.0	7.24

Table 6: Annual Social and Aesthetic Benefits

Sioux City

Annual Aesthetic/Other Benefits of Public Trees

4/8/2018

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	37,121	(N/A)	17.9	7.1	21.31
Silver maple	160,637	(N/A)	12.9	30.7	128.41
Green ash	45,737	(N/A)	9.2	8.7	51.33
Honeylocust	75,775	(N/A)	5.9	14.5	131.10
Northern hackberry	33,598	(N/A)	5.5	6.4	63.27
Apple	4,718	(N/A)	4.4	0.9	11.10
Norway maple	12,669	(N/A)	4.2	2.4	30.90
Maple	9,813	(N/A)	4.0	1.9	24.97
Bur oak	19,423	(N/A)	3.6	3.7	55.33
Oak	11,748	(N/A)	2.8	2.2	43.19
American basswood	20,941	(N/A)	2.6	4.0	81.80
Broadleaf Deciduous Large	9,000	(N/A)	2.1	1.7	43.69
Littleleaf linden	10,193	(N/A)	2.0	1.9	52.81
Spruce	5,653	(N/A)	1.8	1.1	32.87
Pear	1,510	(N/A)	1.6	0.3	9.56
Sugar maple	8,029	(N/A)	1.3	1.5	62.24
Black walnut	6,977	(N/A)	1.3	1.3	56.26
Conifer Evergreen Large	3,750	(N/A)	1.2	0.7	31.25
Blue spruce	2,175	(N/A)	1.1	0.4	19.77
Red maple	3,376	(N/A)	1.1	0.6	31.85
Eastern red cedar	756	(N/A)	1.1	0.1	7.20
White ash	7,891	(N/A)	1.0	1.5	78.13
Conifer Evergreen Small	1,185	(N/A)	0.9	0.2	14.28
Catalpa	3,819	(N/A)	0.7	0.7	53.04
Cottonwood	3,124	(N/A)	0.7	0.6	45.94
Amur maple	844	(N/A)	0.7	0.2	12.79
American elm	3,784	(N/A)	0.7	0.7	59.13
Conifer Evergreen Medium	1,008	(N/A)	0.5	0.2	19.03
Northern white cedar	1,269	(N/A)	0.5	0.2	24.89
Siberian elm	2,189	(N/A)	0.5	0.4	45.61
Broadleaf Deciduous Small	214	(N/A)	0.5	0.0	4.54
Swamp white oak	648	(N/A)	0.5	0.1	14.41
American sycamore	1,964	(N/A)	0.4	0.4	51.68
Black spruce	786	(N/A)	0.4	0.2	21.24
Austrian pine	715	(N/A)	0.4	0.1	19.32
Broadleaf Deciduous Medium	1,119	(N/A)	0.3	0.2	32.90
Common chokecherry	270	(N/A)	0.3	0.1	8.71
Kentucky coffeetree	1,711	(N/A)	0.3	0.3	57.02
Mulberry	259	(N/A)	0.3	0.0	9.26
Black ash	772	(N/A)	0.3	0.1	29.71
Lilac	37	(N/A)	0.2	0.0	1.75
Elm	783	(N/A)	0.2	0.1	43.52
Basswood	1,011	(N/A)	0.2	0.2	56.15
River birch	552	(N/A)	0.2	0.1	32.45
Ginkgo	41	(N/A)	0.2	0.0	2.42
Black locust	326	(N/A)	0.1	0.1	25.05
Scotch pine	377	(N/A)	0.1	0.1	31.40
Red pine	288	(N/A)	0.1	0.1	23.98

Callery pear	197 (N/A)	0.1	0.0	17.94
Norway spruce	351 (N/A)	0.1	0.1	31.94
Birch	237 (N/A)	0.1	0.0	23.69
Willow	71 (N/A)	0.1	0.0	7.06
Ohio buckeye	317 (N/A)	0.1	0.1	31.73
Eastern cottonwood	267 (N/A)	0.1	0.1	33.32
Boxelder	485 (N/A)	0.1	0.1	69.33
Black poplar	201 (N/A)	0.1	0.0	33.53
White mulberry	28 (N/A)	0.1	0.0	4.72
Chinese elm	314 (N/A)	0.1	0.1	62.83
Buckthorn	60 (N/A)	0.1	0.0	11.95
Black maple	191 (N/A)	0.0	0.0	47.86
Alder	0 (N/A)	0.0	0.0	0.01
Eastern white pine	141 (N/A)	0.0	0.0	47.08
Sumac	2 (N/A)	0.0	0.0	0.71
Plum	22 (N/A)	0.0	0.0	7.31
Mountain ash	31 (N/A)	0.0	0.0	10.29
Eastern redbud	0 (N/A)	0.0	0.0	0.02
Broadleaf Evergreen Small	9 (N/A)	0.0	0.0	4.38
Dogwood	0 (N/A)	0.0	0.0	0.03
American chestnut	58 (N/A)	0.0	0.0	57.69
American holly	0 (N/A)	0.0	0.0	0.00
Northern red oak	27 (N/A)	0.0	0.0	27.47
Black cherry	0 (N/A)	0.0	0.0	0.03
Pin oak	48 (N/A)	0.0	0.0	47.55
Broadleaf Evergreen Medium	35 (N/A)	0.0	0.0	34.98
Cherry plum	0 (N/A)	0.0	0.0	0.03
White oak	29 (N/A)	0.0	0.0	28.57
Citywide total	523,706 (N/A)	100.0	100.0	53.82

Table 7: Summary of Benefits in Dollars

Sioux City

Total Annual Benefits of Public Trees by Species ($)

4/8/2018

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Ash	106,404	8,391	19,711	139,618	37,121	311,245	(N/A)	15.0
Silver maple	93,805	21,258	18,135	196,096	160,637	489,931	(N/A)	23.7
Green ash	48,514	6,541	8,481	65,398	45,737	174,671	(N/A)	8.4
Honeylocust	38,061	4,523	6,475	57,118	75,775	181,951	(N/A)	8.8
Northern hackberry	43,244	4,328	8,113	58,262	33,598	147,545	(N/A)	7.1
Apple	12,331	1,245	2,092	6,840	4,718	27,226	(N/A)	1.3
Norway maple	22,487	2,181	4,034	26,516	12,669	67,887	(N/A)	3.3
Maple	12,477	1,231	2,232	13,287	9,813	39,041	(N/A)	1.9
Bur oak	24,367	3,096	4,589	39,975	19,423	91,449	(N/A)	4.4
Oak	14,909	1,815	2,837	23,869	11,748	55,177	(N/A)	2.7
American basswood	16,562	3,137	2,658	27,857	20,941	71,153	(N/A)	3.4
Broadleaf Deciduous La	13,559	1,522	2,712	23,480	9,000	50,273	(N/A)	2.4
Littleleaf linden	7,694	1,130	1,294	9,732	10,193	30,043	(N/A)	1.5
Spruce	4,369	432	328	9,476	5,653	20,259	(N/A)	1.0
Pear	3,746	392	619	1,919	1,510	8,186	(N/A)	0.4
Sugar maple	7,108	957	1,143	10,417	8,029	27,655	(N/A)	1.3
Black walnut	8,027	1,072	1,468	12,575	6,977	30,120	(N/A)	1.5
Conifer Evergreen Large	4,246	423	-61	13,041	3,750	21,399	(N/A)	1.0
Blue spruce	2,065	175	228	3,534	2,175	8,177	(N/A)	0.4
Red maple	4,662	450	852	5,278	3,376	14,618	(N/A)	0.7
Eastern red cedar	2,292	139	199	4,089	756	7,475	(N/A)	0.4
White ash	6,561	920	1,364	10,508	7,891	27,243	(N/A)	1.3
Conifer Evergreen Smal	443	35	24	649	1,185	2,337	(N/A)	0.1
Catalpa	5,225	634	1,017	8,978	3,819	19,672	(N/A)	1.0
Cottonwood	6,019	617	1,282	11,706	3,124	22,748	(N/A)	1.1
Amur maple	2,133	220	368	1,208	844	4,772	(N/A)	0.2
American elm	4,786	469	999	5,683	3,784	15,722	(N/A)	0.8
Conifer Evergreen Medi	1,094	91	120	1,974	1,008	4,288	(N/A)	0.2
Northern white cedar	1,329	123	26	3,533	1,269	6,280	(N/A)	0.3
Siberian elm	3,613	442	777	6,222	2,189	13,243	(N/A)	0.6
Broadleaf Deciduous Sn	560	57	83	238	214	1,152	(N/A)	0.1
Swamp white oak	613	70	92	462	648	1,885	(N/A)	0.1
American sycamore	3,003	346	606	5,497	1,964	11,416	(N/A)	0.6
Black spruce	794	68	89	1,396	786	3,133	(N/A)	0.2
Austrian pine	1,044	94	115	2,123	715	4,091	(N/A)	0.2
Broadleaf Deciduous M	1,513	165	256	1,482	1,119	4,536	(N/A)	0.2
Common chokecherry	698	72	112	335	270	1,486	(N/A)	0.1
Kentucky coffeetree	2,022	266	371	3,166	1,711	7,535	(N/A)	0.4
Mulberry	860	76	148	514	259	1,857	(N/A)	0.1
Black ash	1,287	127	226	1,393	772	3,805	(N/A)	0.2
Lilac	425	26	74	264	37	826	(N/A)	0.0
Elm	1,016	121	195	1,609	783	3,724	(N/A)	0.2
Basswood	1,475	177	296	2,744	1,011	5,702	(N/A)	0.3
River birch	898	90	160	1,096	552	2,795	(N/A)	0.1
Ginkgo	226	15	39	192	41	512	(N/A)	0.0
Black locust	860	71	161	1,158	326	2,575	(N/A)	0.1
Scotch pine	326	31	20	757	377	1,511	(N/A)	0.1
Red pine	323	28	7	847	288	1,492	(N/A)	0.1

Callery pear	303	29	52	333	197	913 (N/A)	0.0
Norway spruce	269	27	19	597	351	1,263 (N/A)	0.1
Birch	285	32	47	276	237	877 (N/A)	0.0
Willow	684	40	130	956	71	1,881 (N/A)	0.1
Ohio buckeye	576	56	103	660	317	1,712 (N/A)	0.1
Eastern cottonwood	616	55	134	1,163	267	2,235 (N/A)	0.1
Boxelder	371	80	67	643	485	1,647 (N/A)	0.1
Black poplar	584	49	132	1,177	201	2,143 (N/A)	0.1
White mulberry	213	14	37	128	28	420 (N/A)	0.0
Chinese elm	350	48	63	545	314	1,319 (N/A)	0.1
Buckthorn	215	19	38	132	60	463 (N/A)	0.0
Black maple	147	19	25	121	191	503 (N/A)	0.0
Alder	93	5	17	64	0	178 (N/A)	0.0
Eastern white pine	91	9	4	241	141	488 (N/A)	0.0
Sumac	7	1	1	2	2	13 (N/A)	0.0
Plum	57	6	9	25	22	120 (N/A)	0.0
Mountain ash	98	9	17	65	31	220 (N/A)	0.0
Eastern redbud	47	2	8	32	0	90 (N/A)	0.0
Broadleaf Evergreen Sm	27	3	4	16	9	58 (N/A)	0.0
Dogwood	1	0	0	0	0	1 (N/A)	0.0
American chestnut	57	8	9	70	58	202 (N/A)	0.0
American holly	44	2	11	56	0	113 (N/A)	0.0
Northern red oak	46	5	7	55	27	141 (N/A)	0.0
Black cherry	1	0	0	0	0	1 (N/A)	0.0
Pin oak	46	6	7	37	48	145 (N/A)	0.0
Broadleaf Evergreen Me	41	4	5	48	35	134 (N/A)	0.0
Cherry plum	1	0	0	0	0	1 (N/A)	0.0
White oak	99	8	23	196	29	354 (N/A)	0.0
Citywide Total	545,441	70,425	98,133	831,748	523,706	2,069,454 (N/A)	100.0

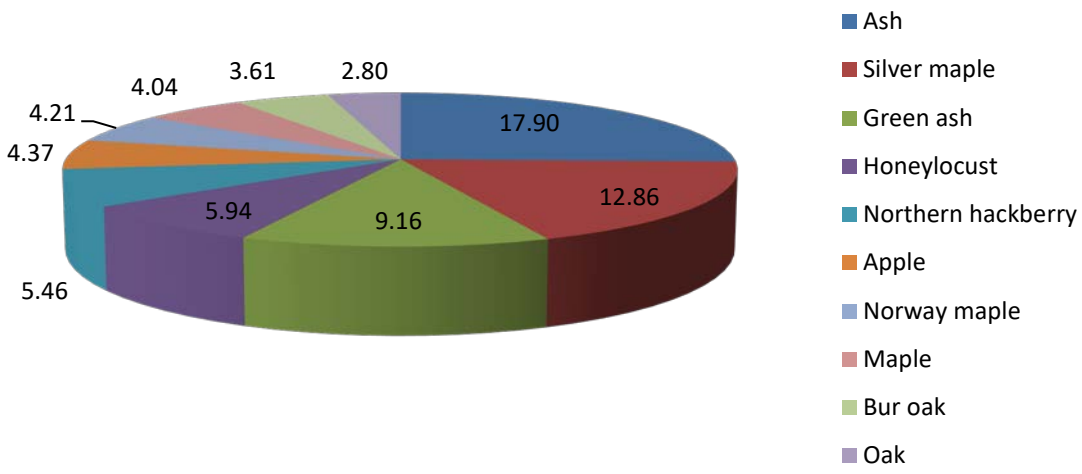

Figure 1: Species Distribution

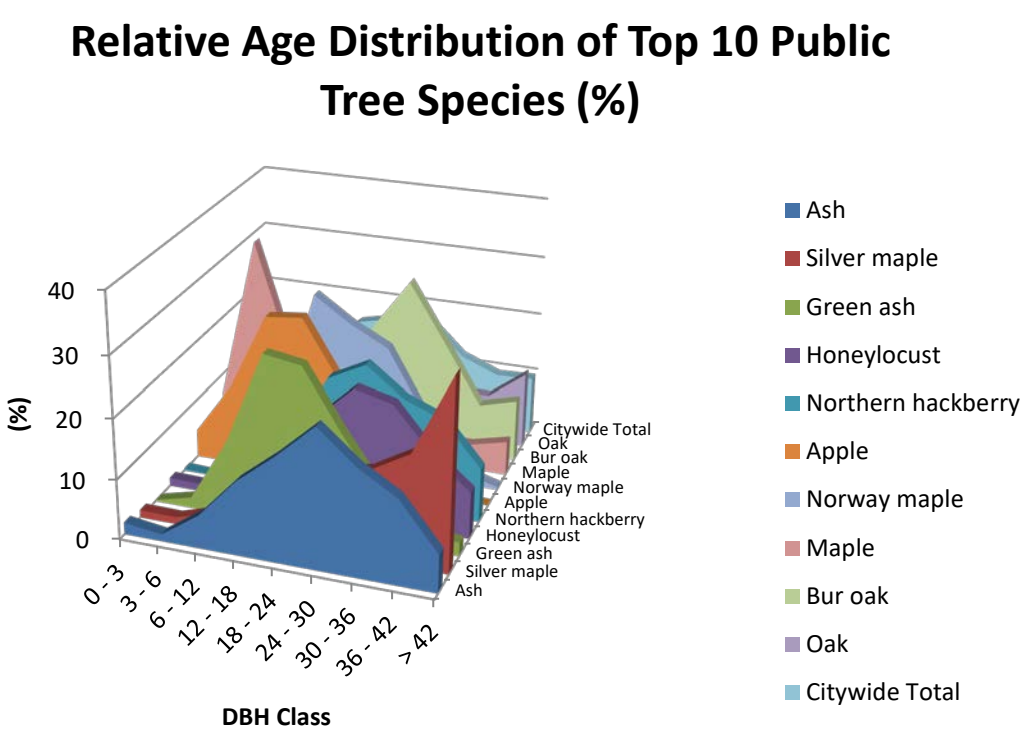

Figure 2: Relative Age Class

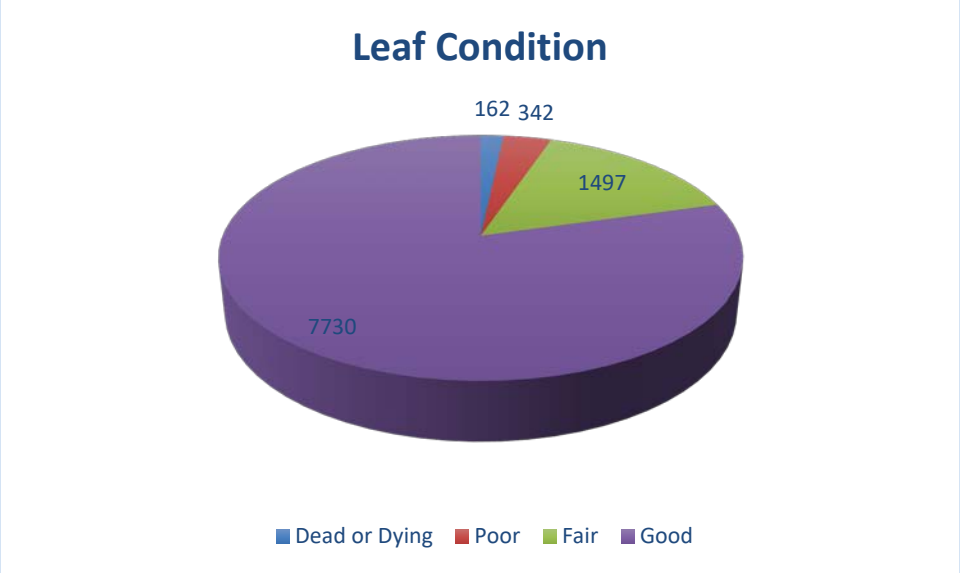

Figure 3: Foliage Condition

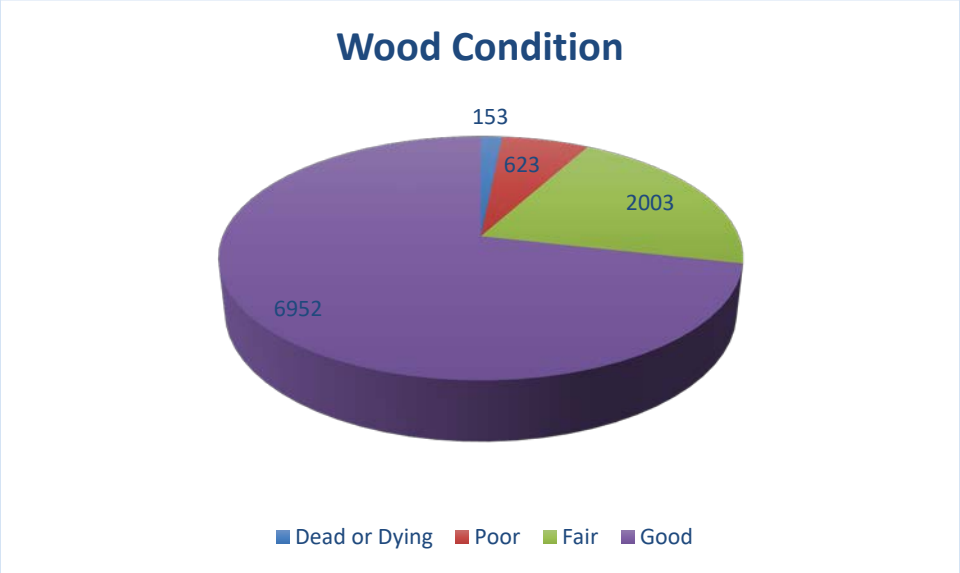

Figure 4: Wood Condition

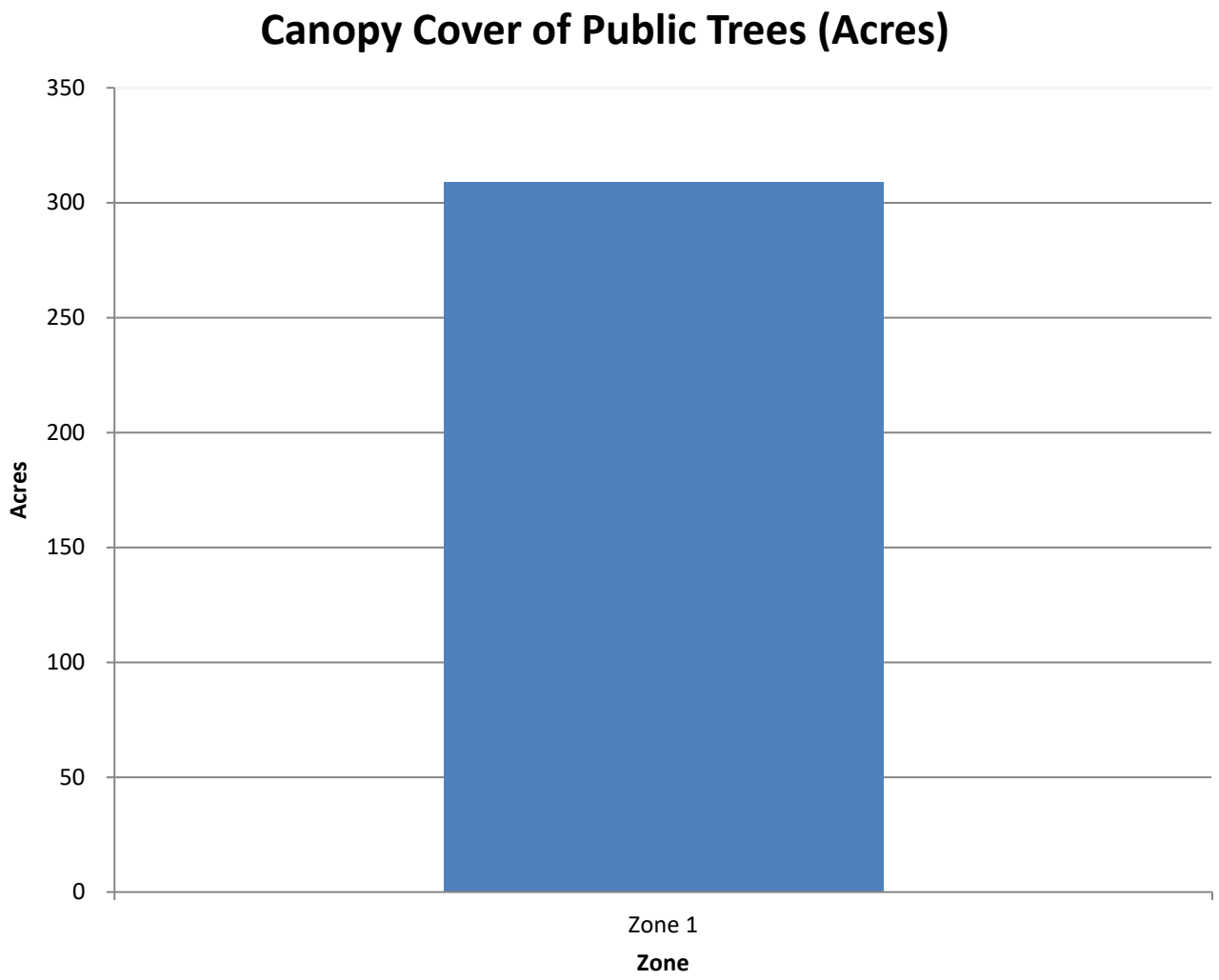

Figure 5: Canopy Cover in Acres

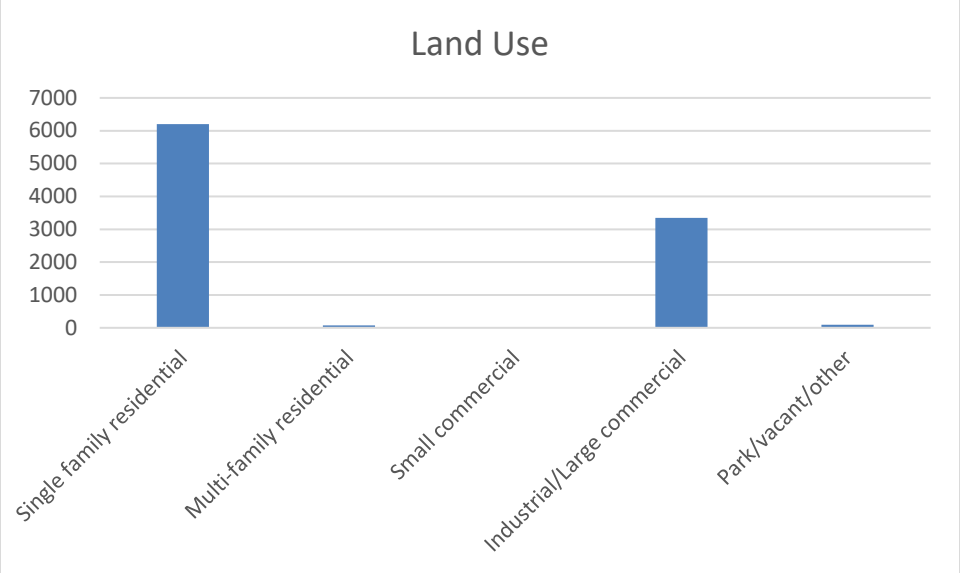

Figure 6: Land Use of city/park trees

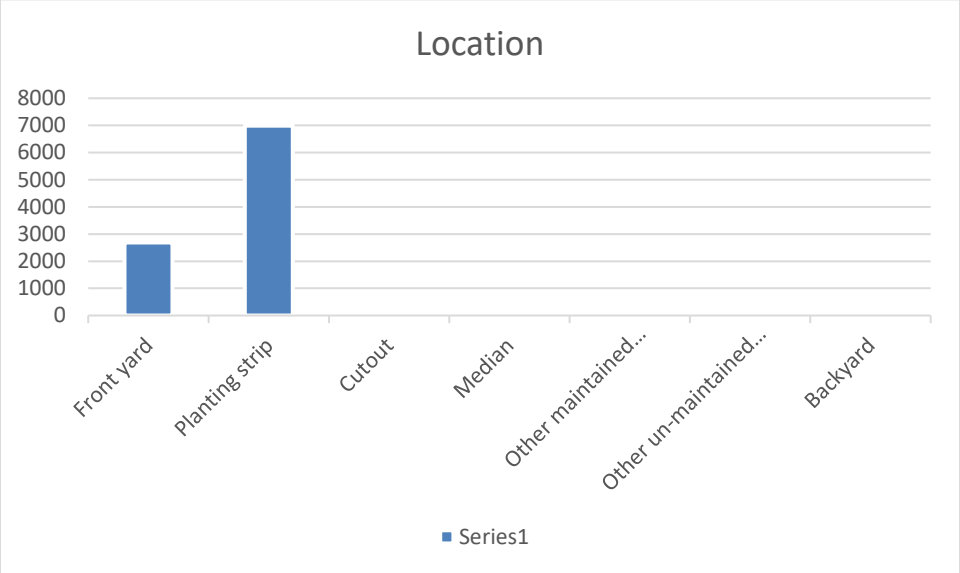

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

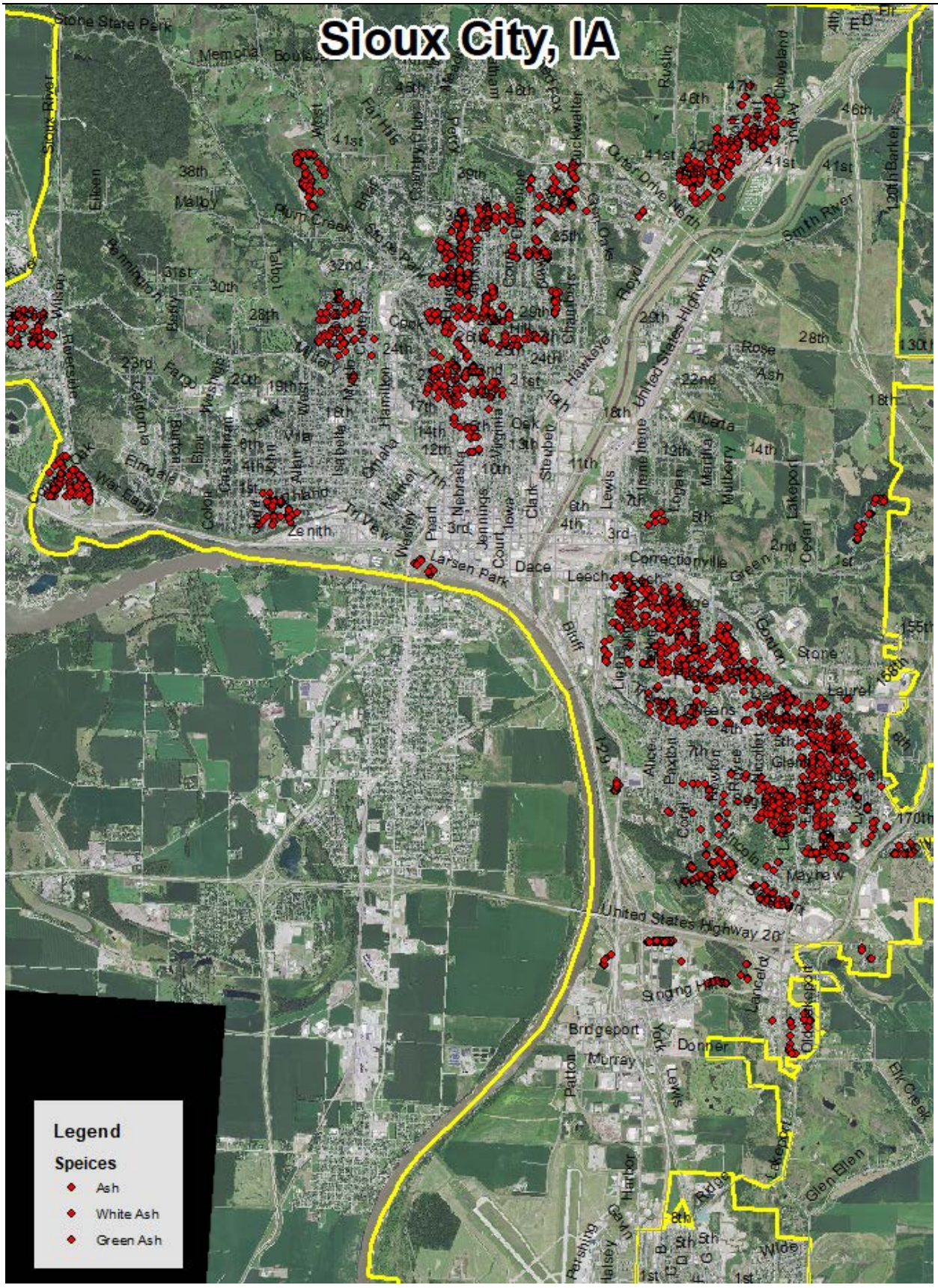

Figure 1: Location of Ash Trees

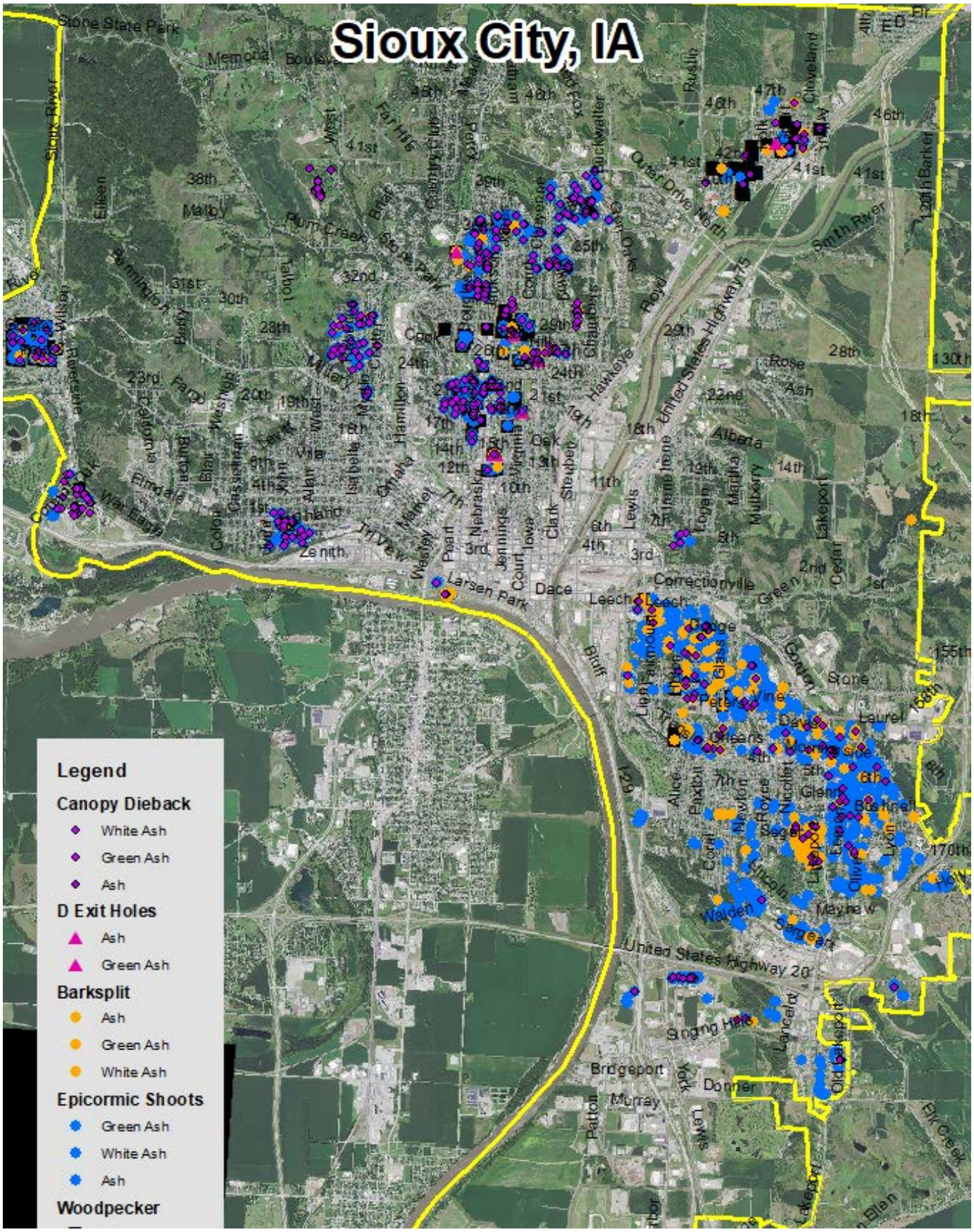

Figure 2: Location of EAB symptoms

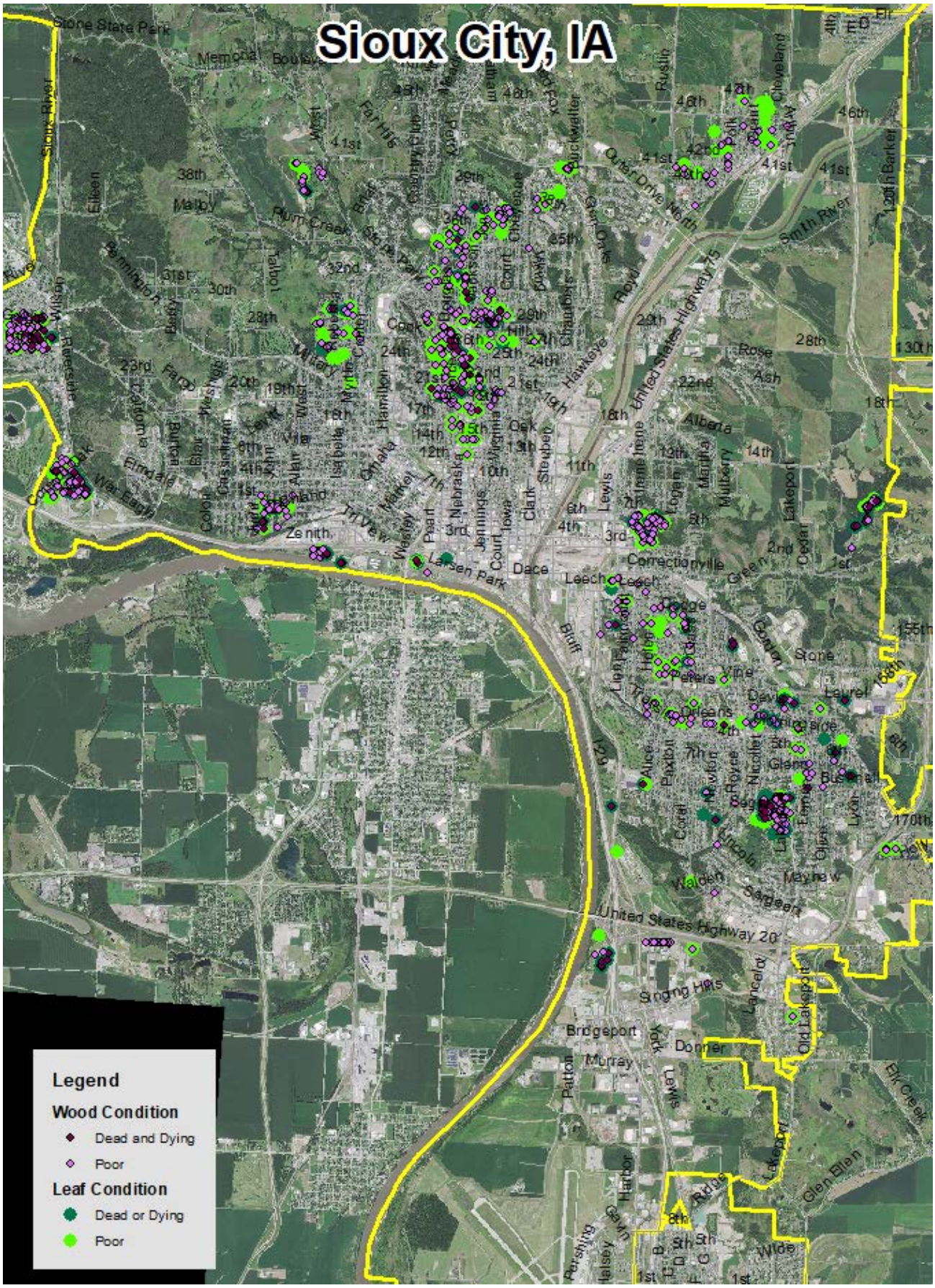

Figure 3: Location of Poor Condition Trees

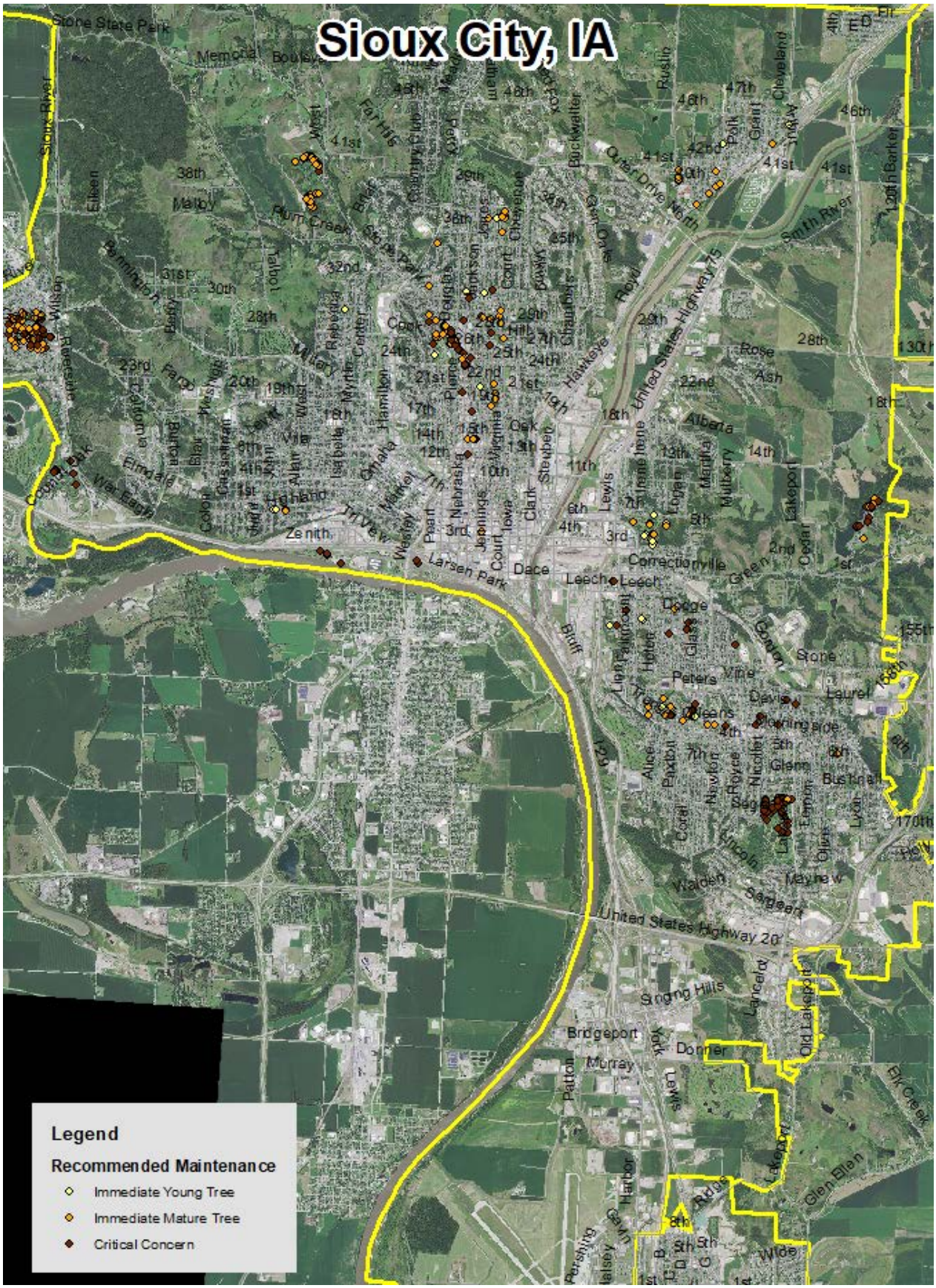
Sioux City, IA
Legend
Recommended Maintenance
Immediate Young Tree
Immediate Mature Tree
Critical Concern

Figure 4: Location of Trees with Recommended Maintenance

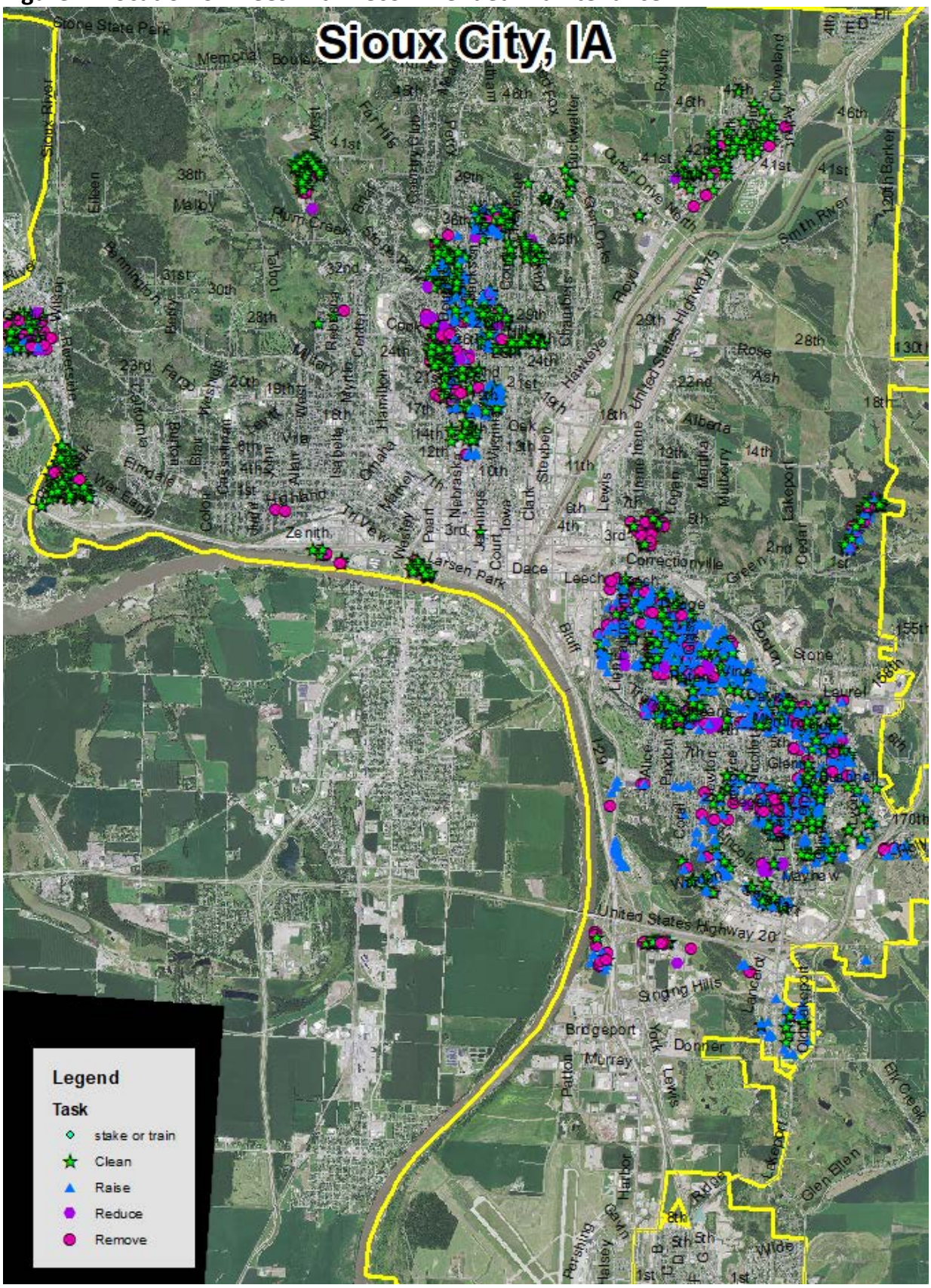

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Sioux City Tree Ordinances

CHAPTER 8.56. TREES

Contents:

8.56.010 Dangerous Trees.

All trees which by reason of their condition or location may endanger public life or safety, or the safety of property, are hereby declared to be dangerous and a nuisance which should be removed and abated.

(Ord. 88/T-6350)

8.56.020 Method of Abatement.

Abatement of nuisances declared herein and the collection of any costs incurred shall be in the manner provided in Chapter 8.72 of the Municipal Code of Sioux City, Iowa.

(Ord. S-20761, 1972)

8.56.030 Multiple Owners.

If such tree is growing upon the property of two different owners, and/or two different occupants, notices shall be served upon both and the expense of removal shall be divided equally between them.

(Ord. S-10508, 1968)

8.56.040 Public Nuisances Declared.

The council having determined that the health of the elm trees within the city is threatened by a fatal disease known as the Dutch elm disease hereby declares the following to be public nuisances:

1. Any living or standing elm tree or part thereof infected with the Dutch elm disease fungus or which harbors any of the elm bark beetles, that is scolytus multistriatus (eichb.), or hylurgopinus rufipes (marsh).
2. Any dead elm tree or part thereof including logs, branches, stumps, firewood or other elm material from which the bark has not been removed and burned or sprayed with an effective elm bark beetle destroying insecticide.

(Ord. S-10508, 1968; S-4536, 1965)

8.56.050 Nuisances Prohibited.

No person, firm or corporation shall permit any public nuisances as defined in Section 8.56.040 to remain on the premises owned, controlled or occupied by him within the city.

(Ord. S-10508, 1968; S-4536, 1965)

8.56.060 Duty to Abate Dangerous Trees.

1. If there is a danger that all or a substantial portion of such tree or trees located on private property might fall on any public alley, street or other public property this will be sufficient evidence that such tree or trees constitute a nuisance.
2. When a dangerous tree exists on public property the city manager or his designee shall abate said nuisance.
3. If the declared nuisance exists upon private property, the abutting property owner shall receive notice as provided in Chapter 8.72 of the municipal code of Sioux City, Iowa. If the owner fails to act upon said notice, then the city manager or his designee shall abate said nuisance and the costs incurred will be assessed against the property owner as provided in Chapter 8.72 of the municipal code of Sioux City, Iowa.

(Ord. 88/T-6350)

8.56.070 Abatement of Nuisances.

1. If the city forester upon inspection or examination, in person or by some qualified person acting for him determines that any public nuisance as defined in Section 8.56.040 exists in or upon any public street, alley, park or any public place, including the strip between the curb and the lot line of public property, within the city, and that the danger to other elm trees within the city, is imminent, he shall immediately cause it to be removed and burned or otherwise abate the same in such manner as to destroy or prevent as fully as possible the spread of Dutch elm disease or the insect pests or vectors known to carry such disease fungus.
2. If the city forester upon inspection or examination, in person or by some qualified person acting for him determines with reasonable certainty that any public nuisance as defined in Section 8.56.040 exists in or upon private premises and that the danger to other elm trees within the city is imminent, he shall cause the same to be abated and the collection of any costs incurred in the manner provided in Chapter 8.72 of the Municipal Code of Sioux City, Iowa.
3. If the city forester is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected with Dutch elm disease, he is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens.

(Ord. S-20761, 1972)

8.56.080 Interference with Removal by City.

It is unlawful for any person, firm or corporation to hinder, obstruct or otherwise interfere with the agents or employees of the city while engaged in carrying out the provisions of this chapter upon order of the council made thereunder.

(Ord. S-10508, 1968)

8.56.090 Penalty for Violations.

Any person who violates the provisions of this chapter or who hinders, obstructs, or otherwise interferes with the agents or employees of the city while carrying out the provisions of this chapter upon order of the

council made thereunder, shall be deemed guilty of a municipal infraction and upon conviction thereof shall be punished according to the provisions of section 1.04.100(1).

(Ord. 2017-1097; 99-8132; S-10508, 1968)

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.