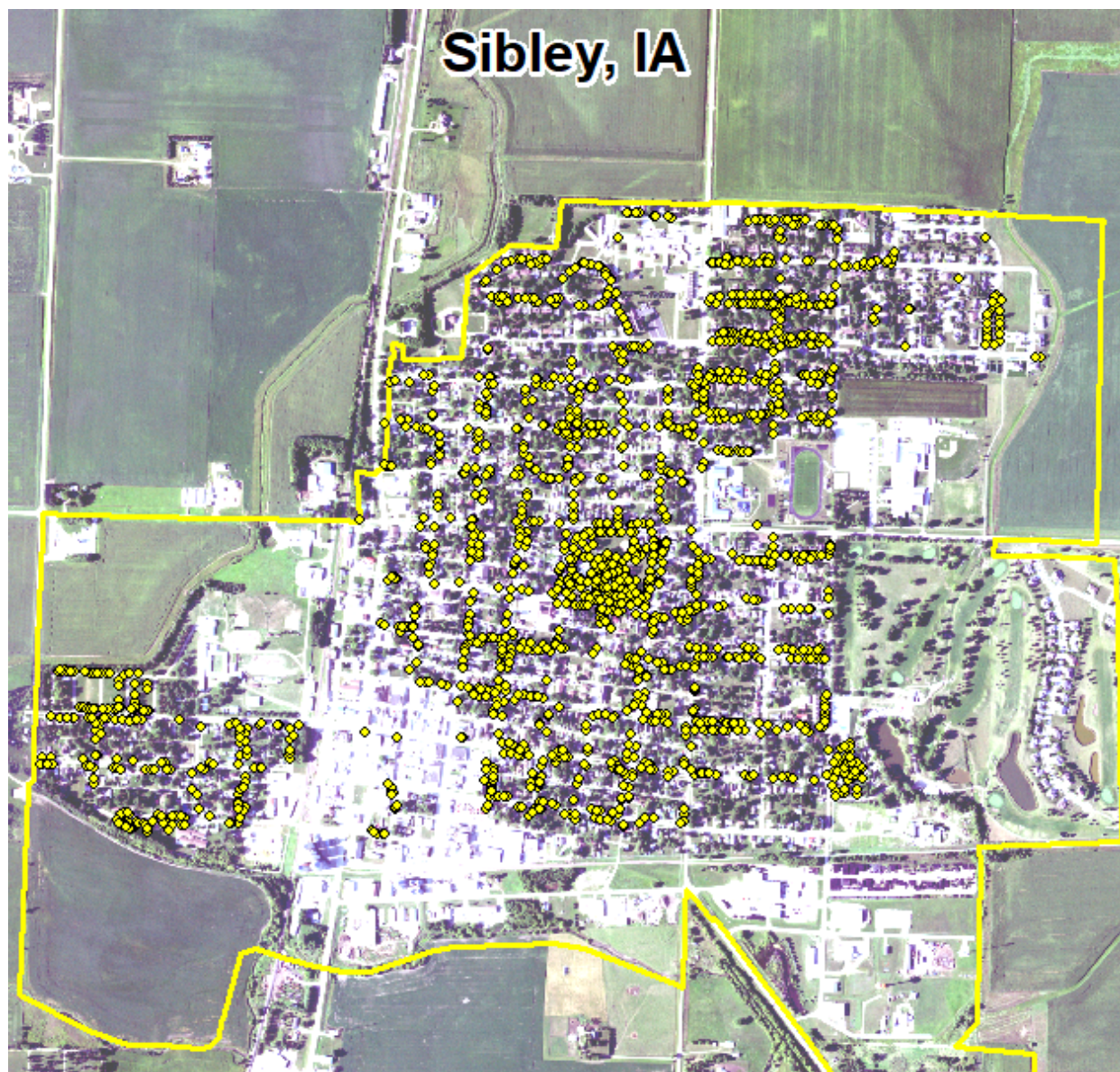


2023 Urban Forest Management Plan



For Sibley, Iowa
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Executive Summary

Overview

This plan was developed to assist the City of Sibley 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 29% of Sibley'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 2022, 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 1,642 trees inventoried.

- Sibley's trees provide \$356,872 of benefits annually, an average of \$217 a tree
- There are over 52 species of trees
- The top three genera are: Maple 43%, Ash 29%, and Basswood/Linden 6%
- 4% of trees are in need of some type of management
- 31 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 31 trees needing removal, 18 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately [*City ownership of the trees recommended for removal should be verified prior to any removal*](#)
- 42 of the 476 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 40 years to remove ash – Suggestion: request a budget increase to \$30,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2022, 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 1642 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. Sibley's trees reduce energy related costs by approximately \$89,349 annually (Appendix A, Table 1). These savings are both in Electricity (429.4 MWh) and in Natural Gas (57,918.5 Therms).

Annual Stormwater Benefits

Sibley's trees intercept about 4,976,273 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$134,857 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 Sibley, it is estimated that trees remove 5,605 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$15,826 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Sibley, trees sequester about 1,767,476 lbs of carbon a year with an associated value of \$13,256 (Appendix A, Table 5). In addition, the trees store 18,873,305 lbs of carbon, with a yearly benefit of \$141,550 (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. Sibley receives \$103,584 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, Sibley's trees provide \$356,872 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1642 trees in Sibley provide approximately \$217 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Sibley has over 52 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Species	Number	% of Total
Maple	702	43
Ash	476	29
Basswood/Linden	97	6
Honeylocust	81	5
Northern hackberry	44	3
Apple	43	3
Spruce	39	2
Oak	25	2
Conifer Evergreen	19	1
Black walnut	18	1
Elm	17	1
Broadleaf Deciduous	11	1
Lilac	10	1
Redbud	7	<1
Birch	6	<1
Pine	6	<1
Cottonwood	5	<1
Catalpa	4	<1
Kwanzan cherry	4	<1
Northern white cedar	4	<1
Poplar	3	<1
Buckeye	3	<1
Aspen	3	<1
Pear	2	<1
Ginkgo	2	<1
Kentucky coffee tree	2	<1
Plum	2	<1
Mulberry	2	<1
Willow	2	<1
Broadleaf Evergreen	1	<1
Dogwood	1	<1
Mountain ash	1	<1

Age Class

Most of Sibley's trees (57%) are between 12 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. Sibley's size curve has two main peaks in the middle, indicating a mostly mature 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 Sibley indicate that 97.5% of the trees are in good health, with only 2.5% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 92% of Sibley'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.

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).

Tree Removal	31	2%
Crown Reduction	13	<1%
Stake/Train	9	<1%
Crown Cleaning	7	<1%
Crown Raising	1	<1%

Canopy Cover

The total canopy with both private and public trees is 9%, or 92 acres. The canopy cover on city owned properties included in the Sibley inventory includes approximately 50 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 79 trees need to be planted annually on public and/or private lands.

Land Use and Location

The majority of Sibley'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.

<u>Land Use</u>	
Single family residential	78%
Park/vacant/other	18%
Multifamily residential	2%
Industrial/Large Commercial	2%
<u>Location</u>	
Planting strip	67%
Front Yard	17%
Other Un-maintained Locations	16%
Median	<1%
Cutout	<1%

Changes in Forest Structure Since 2014 Plan

- 139 more trees inventoried
- \$83,798 more in annual benefits
- 10 fewer trees recommended for removal
- Much higher percentages for good foliage and wood health

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

Sibley has 3 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 2 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 trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 58 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 31 removals, 11 are ash trees. There are a total of 476 ash trees, and 42 of those have signs and symptoms that have been associated with EAB. In addition, there are 40 trees in total from all species that are in poor health. [*City ownership of the trees recommended for removal should be verified prior to any removal*](#)

Pruning Cycle

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

Planting

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

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (43%) (Appendix A, Figure 1). **Maples should not be planted until this percentage can be lowered.** Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

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 No Additional Funding

Current Budget \$16,000/year, Total \$96,000 over 6 years

FY 2024 - Total: \$16,000

Removal: 3 critical concern trees, 10 mature tree immediate trees = **\$11,700**

Planting and Replacement: 13 x 1.2 = 16 trees, **\$2,400**

Tree Pruning & Maintenance: **\$1,900**

Visual Survey for signs and symptoms of EAB

FY 2025 - Total: \$16,000

Removal: 12 mature tree immediate = **\$10,800**

Planting and Replacement: 12 x 1.2 = 14 trees, **\$2,100**

Tree Pruning & Maintenance: **\$1,100**

Routine trimming: Contract to trim 1/3 of the city trees, **\$2,000**

Visual Survey for signs and symptoms of EAB

FY 2026 - \$16,000

Removal: 2 mature tree immediate, 4 mature tree routine, 7 ash trees = **\$11,700**

Planting and Replacement: 13 x 1.2 = 16 trees, **\$2,400**

Tree Pruning & Maintenance: **\$1,900**

Visual Survey for signs and symptoms of EAB

FY 2027 - Total: \$16,000

Removal: 12 ash trees = **\$10,800**

Planting and Replacement: 12 x 1.2 = 14 trees, **\$2,100**

Tree Pruning & Maintenance: **\$1,100**

Routine trimming: Contract to trim 1/3 of the city trees, **\$2,000**

Visual Survey for signs and symptoms of EAB

FY 2028 - Total: \$16,000

Removal: 13 ash trees = **\$11,700**

Planting and Replacement: 13 x 1.2 = 16 trees, **\$2,400**

Tree Pruning & Maintenance: **\$1,900**

Visual Survey for signs and symptoms of EAB

FY 2029 - Total: \$16,000

Removal: 12 ash trees = **\$10,800**

Planting and Replacement: 12 x 1.2 = 14 trees, **\$2,100**

Tree Pruning & Maintenance: **\$1,100**

Routine trimming: **\$2,000**

Visual Survey for signs and symptoms of EAB

*Amounts given are based on an estimate of \$900/tree for removals and \$150/tree for planting and maintenance

Reduction of Ash

Approximately 55 ash trees can be removed in 6 years (approximately 12% of ash). It will take approximately 40 years to remove and replace all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival. To remove and replace all ash trees within 6 years, the budget would need to be increased to almost \$90,000 a year. If the budget were increased to \$30,000 a year all ash could be removed in 20 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). **City ownership of the tree recommended for removal should be verified prior to any removal**

Treatment of Ash Trees

Chemical treatment can be an 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 the relevant city ordinance. The new plantings will be a diverse mix and should 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 should state the responsibility of the owner, occupant, or person in charge of property with ash trees. An example code is as follows: "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Proposed Budget Increase

EAB could potentially kill all ash trees in Sibley within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to nearly \$90,000 a year. Additionally, it is recommended that Sibley 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. This is an alternative 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 when EAB is found in Rock Rapids. 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

Sibley

Annual Energy Benefits of Public Trees

2/1/2023

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	128.8	9,773	17,426.3	17,078	26,850	(N/A)	28.0	30.1	58.37
Silver maple	124.9	9,482	16,336.1	16,009	25,491	(N/A)	22.9	28.5	67.80
Norway maple	59.1	4,483	8,428.7	8,260	12,743	(N/A)	13.6	14.3	57.15
Honeylocust	25.3	1,919	3,277.9	3,212	5,131	(N/A)	4.9	5.7	63.35
Sugar maple	15.4	1,165	2,030.9	1,990	3,155	(N/A)	3.7	3.5	52.59
Littleleaf linden	9.9	755	1,317.1	1,291	2,045	(N/A)	3.4	2.3	36.52
Northern hackberry	11.0	836	1,589.6	1,558	2,394	(N/A)	2.7	2.7	54.41
Apple	4.8	362	715.3	701	1,063	(N/A)	2.6	1.2	24.72
American basswood	11.8	899	1,723.7	1,689	2,588	(N/A)	2.5	2.9	63.12
Blue spruce	2.5	187	323.0	317	504	(N/A)	1.5	0.6	20.99
Black walnut	5.2	398	699.8	686	1,083	(N/A)	1.1	1.2	60.19
Conifer Evergreen Large	1.8	140	228.2	224	364	(N/A)	1.0	0.4	21.40
Amur maple	1.4	110	229.2	225	334	(N/A)	1.0	0.4	19.67
Boxelder	2.3	177	308.6	302	479	(N/A)	1.0	0.5	29.95
White ash	3.2	245	363.8	356	602	(N/A)	1.0	0.7	37.61
Spruce	1.8	137	218.9	215	352	(N/A)	0.9	0.4	23.46
Elm	1.3	100	187.2	183	283	(N/A)	0.7	0.3	25.74
Lilac	0.1	11	25.3	25	36	(N/A)	0.6	0.0	3.59
Northern red oak	1.3	102	191.4	188	290	(N/A)	0.6	0.3	28.95
Broadleaf Deciduous Small	0.2	12	26.7	26	38	(N/A)	0.5	0.0	4.73
Bur oak	0.7	55	95.9	94	149	(N/A)	0.4	0.2	21.25
Red maple	1.4	103	160.7	158	260	(N/A)	0.4	0.3	37.21
Eastern redbud	0.1	7	17.1	17	24	(N/A)	0.4	0.0	3.46
Pin oak	1.9	147	257.6	252	399	(N/A)	0.3	0.4	79.85
Siberian elm	1.3	96	168.1	165	260	(N/A)	0.3	0.3	52.08
Kwanzan cherry	0.3	22	51.3	50	73	(N/A)	0.2	0.1	18.19
Northern white cedar	0.4	34	53.4	52	86	(N/A)	0.2	0.1	21.50
Paper birch	0.8	61	94.7	93	153	(N/A)	0.2	0.2	38.33
Cottonwood	1.7	129	229.4	225	354	(N/A)	0.2	0.4	88.42
Eastern white pine	0.4	34	53.4	52	86	(N/A)	0.2	0.1	21.50
Catalpa	1.5	116	209.7	206	321	(N/A)	0.2	0.4	80.35
Ohio buckeye	0.8	60	106.4	104	164	(N/A)	0.2	0.2	54.80
Swamp white oak	0.1	9	18.4	18	27	(N/A)	0.2	0.0	8.89
Black poplar	1.4	103	181.1	177	281	(N/A)	0.2	0.3	93.56
Broadleaf Deciduous Large	1.0	77	134.3	132	208	(N/A)	0.2	0.2	69.42
Quaking aspen	0.7	53	81.0	79	133	(N/A)	0.2	0.1	44.23
White mulberry	0.3	20	37.5	37	56	(N/A)	0.1	0.1	28.16
Plum	0.0	1	1.2	1	2	(N/A)	0.1	0.0	0.87
Willow	0.4	28	56.4	55	83	(N/A)	0.1	0.1	41.58
River birch	0.0	1	1.6	2	2	(N/A)	0.1	0.0	1.10
Kentucky coffeetree	0.0	0	0.9	1	1	(N/A)	0.1	0.0	0.66
Ginkgo	0.0	0	0.8	1	1	(N/A)	0.1	0.0	0.57
Austrian pine	0.2	13	24.4	24	37	(N/A)	0.1	0.0	18.30
Callery pear	0.2	16	33.7	33	49	(N/A)	0.1	0.1	24.47
Maple	0.2	17	33.0	32	49	(N/A)	0.1	0.1	24.58
Japanese maple	0.0	0	0.6	1	1	(N/A)	0.1	0.0	0.87
Conifer Evergreen Small	0.0	0	0.7	1	1	(N/A)	0.1	0.0	0.93
Mountain ash	0.1	6	12.8	13	18	(N/A)	0.1	0.0	18.19
Eastern cottonwood	0.4	29	53.7	53	82	(N/A)	0.1	0.1	82.02
Conifer Evergreen Medium	0.1	10	15.2	15	25	(N/A)	0.1	0.0	24.51
American elm	0.6	45	71.2	70	114	(N/A)	0.1	0.1	114.45
Dogwood	0.0	0	0.6	1	1	(N/A)	0.1	0.0	0.87
Broadleaf Evergreen Large	0.1	7	14.0	14	21	(N/A)	0.1	0.0	20.59
Total	429.4	32,589	57,918.5	56,760	89,349	(N/A)	100.0	100.0	54.41

Table 2: Annual Stormwater Benefits

Sibley

Annual Stormwater Benefits of Public Trees

2/1/2023

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	1,427,209	38,677	(N/A)	28.0	28.7	84.08
Silver maple	1,829,612	49,582	(N/A)	22.9	36.8	131.87
Norway maple	572,506	15,515	(N/A)	13.6	11.5	69.57
Honeylocust	269,249	7,297	(N/A)	4.9	5.4	90.08
Sugar maple	148,230	4,017	(N/A)	3.7	3.0	66.95
Littleleaf linden	81,103	2,198	(N/A)	3.4	1.6	39.25
Northern hackberry	105,461	2,858	(N/A)	2.7	2.1	64.95
Apple	19,854	538	(N/A)	2.6	0.4	12.51
American basswood	130,350	3,532	(N/A)	2.5	2.6	86.16
Blue spruce	31,395	851	(N/A)	1.5	0.6	35.45
Black walnut	58,965	1,598	(N/A)	1.1	1.2	88.78
Conifer Evergreen Large	22,872	620	(N/A)	1.0	0.5	36.46
Amur maple	5,188	141	(N/A)	1.0	0.1	8.27
Boxelder	18,600	504	(N/A)	1.0	0.4	31.50
White ash	20,307	550	(N/A)	1.0	0.4	34.40
Spruce	25,102	680	(N/A)	0.9	0.5	45.35
Elm	12,048	326	(N/A)	0.7	0.2	29.68
Lilac	442	12	(N/A)	0.6	0.0	1.20
Northern red oak	13,700	371	(N/A)	0.6	0.3	37.13
Broadleaf Deciduous Small	500	14	(N/A)	0.5	0.0	1.69
Bur oak	6,395	173	(N/A)	0.4	0.1	24.76
Red maple	8,294	225	(N/A)	0.4	0.2	32.11
Eastern redbud	297	8	(N/A)	0.4	0.0	1.15
Pin oak	24,831	673	(N/A)	0.3	0.5	134.58
Siberian elm	11,790	320	(N/A)	0.3	0.2	63.90
Kwanzan cherry	1,058	29	(N/A)	0.2	0.0	7.17
Northern white cedar	5,211	141	(N/A)	0.2	0.1	35.31
Paper birch	5,005	136	(N/A)	0.2	0.1	33.91
Cottonwood	25,459	690	(N/A)	0.2	0.5	172.48
Eastern white pine	5,211	141	(N/A)	0.2	0.1	35.31
Catalpa	22,559	611	(N/A)	0.2	0.5	152.84
Ohio buckeye	6,583	178	(N/A)	0.2	0.1	59.46
Swamp white oak	610	17	(N/A)	0.2	0.0	5.51
Black poplar	21,717	589	(N/A)	0.2	0.4	196.17
Broadleaf Deciduous Large	12,447	337	(N/A)	0.2	0.3	112.43
Quaking aspen	4,397	119	(N/A)	0.2	0.1	39.72
White mulberry	931	25	(N/A)	0.1	0.0	12.62
Plum	15	0	(N/A)	0.1	0.0	0.20
Willow	3,065	83	(N/A)	0.1	0.1	41.53
River birch	24	1	(N/A)	0.1	0.0	0.33
Kentucky coffeetree	36	1	(N/A)	0.1	0.0	0.48
Ginkgo	14	0	(N/A)	0.1	0.0	0.19
Austrian pine	2,569	70	(N/A)	0.1	0.1	34.81
Callery pear	1,172	32	(N/A)	0.1	0.0	15.88
Maple	1,251	34	(N/A)	0.1	0.0	16.95
Japanese maple	7	0	(N/A)	0.1	0.0	0.20
Conifer Evergreen Small	24	1	(N/A)	0.1	0.0	0.66
Mountain ash	264	7	(N/A)	0.1	0.0	7.17
Eastern cottonwood	5,491	149	(N/A)	0.1	0.1	148.79

Conifer Evergreen Medium	1,544	42 (N/A)	0.1	0.0	41.85
American elm	4,551	123 (N/A)	0.1	0.1	123.33
Dogwood	7	0 (N/A)	0.1	0.0	0.20
Broadleaf Evergreen Large	750	20 (N/A)	0.1	0.0	20.32
Citywide total	4,976,273	134,857 (N/A)	100.0	100.0	82.13

Table 3: Annual Air Quality Benefits

Sibley

Annual Air Quality Benefits of Public Trees

2/1/2023

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total Standard (\$)	Standard Error	% of Total Trees	Avg. \$/tree
	O ₃	NO ₂	PM ₁₀	SO ₂		NO ₂	PM ₁₀	VOC	SO ₂								
Green ash	178.6	28.6	85.2	8.0	950	613.0	89.4	85.2	583.6	3,823	0.0	0	1,671.6	4,774 (N/A)		28.0	10.38
Silver maple	319.2	54.1	156.3	14.2	1,720	587.9	86.1	82.3	565.1	3,681	-165.3	-620	1,699.8	4,781 (N/A)		22.9	12.71
Norway maple	120.5	20.8	58.7	5.3	650	285.6	41.3	39.4	268.0	1,771	-27.9	-105	811.7	2,316 (N/A)		13.6	10.38
Honeylocust	52.2	8.6	23.9	2.4	276	118.8	17.4	16.6	114.4	744	-40.4	-151	314.0	869 (N/A)		4.9	10.73
Sugar maple	18.3	3.1	9.4	0.8	100	72.6	10.6	10.1	69.5	454	-14.6	-55	179.9	499 (N/A)		3.7	8.32
Littleleaf linden	12.2	2.1	6.3	0.5	67	47.2	6.9	6.6	45.1	295	-6.2	-23	120.8	338 (N/A)		3.4	6.04
Northern hackberry	16.2	2.8	8.3	0.7	89	53.4	7.7	7.3	50.0	331	0.0	0	146.5	420 (N/A)		2.7	9.54
Apple	6.0	1.0	2.8	0.3	32	23.3	3.4	3.2	21.6	144	0.0	0	61.5	176 (N/A)		2.6	4.08
American basswood	17.4	3.0	8.6	0.8	94	57.6	8.3	7.9	53.7	356	-14.9	-56	142.3	394 (N/A)		2.5	9.62
Blue spruce	3.9	0.8	3.4	0.5	26	11.6	1.7	1.6	11.2	73	-11.1	-42	23.5	57 (N/A)		1.5	2.39
Black walnut	7.5	1.2	3.5	0.3	40	24.9	3.6	3.5	23.7	155	0.0	0	68.3	195 (N/A)		1.1	10.84
Conifer Evergreen Large	2.5	0.5	2.2	0.3	17	8.6	1.3	1.2	8.4	54	-8.2	-31	16.6	40 (N/A)		1.0	2.34
Amur maple	1.2	0.2	0.6	0.1	6	7.2	1.0	1.0	6.6	44	0.0	0	17.8	50 (N/A)		1.0	2.97
Boxelder	1.9	0.3	1.0	0.1	10	11.0	1.6	1.5	10.6	69	-0.9	-3	27.0	76 (N/A)		1.0	4.73
White ash	1.2	0.2	0.8	0.1	7	14.7	2.2	2.1	14.6	93	0.0	0	36.0	101 (N/A)		1.0	6.29
Spruce	2.8	0.6	2.4	0.3	19	8.4	1.2	1.2	8.2	53	-9.8	-37	15.2	35 (N/A)		0.9	2.30
Elm	1.1	0.2	0.6	0.1	6	6.3	0.9	0.9	6.0	39	0.0	0	16.1	46 (N/A)		0.7	4.14
Lilac	0.0	0.0	0.0	0.0	0	0.7	0.1	0.1	0.7	5	0.0	0	1.7	5 (N/A)		0.6	0.47
Northern red oak	2.9	0.5	1.4	0.1	15	6.5	0.9	0.9	6.1	40	-4.1	-16	15.1	40 (N/A)		0.6	4.00
Broadleaf Deciduous Small	0.1	0.0	0.0	0.0	0	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5 (N/A)		0.5	0.64
Bur oak	0.6	0.1	0.3	0.0	3	3.4	0.5	0.5	3.3	21	0.0	0	8.8	25 (N/A)		0.4	3.54
Red maple	1.6	0.3	0.8	0.1	9	6.2	0.9	0.9	6.1	39	-0.6	-2	16.4	46 (N/A)		0.4	6.57
Eastern redbud	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)		0.4	0.45
Pin oak	4.7	0.8	2.4	0.2	26	9.2	1.3	1.3	8.8	57	-8.6	-32	20.0	51 (N/A)		0.3	10.12
Siberian elm	1.7	0.3	0.9	0.1	9	6.0	0.9	0.8	5.7	37	0.0	0	16.3	47 (N/A)		0.3	9.33
Kwanzan cherry	0.2	0.0	0.1	0.0	1	1.5	0.2	0.2	1.3	9	0.0	0	3.6	10 (N/A)		0.2	2.55
Northern white cedar	0.6	0.1	0.5	0.1	4	2.0	0.3	0.3	2.0	13	-1.8	-7	4.1	10 (N/A)		0.2	2.48
Paper birch	0.4	0.1	0.2	0.0	2	3.7	0.5	0.5	3.6	23	0.0	0	9.0	25 (N/A)		0.2	6.31
Cottonwood	4.3	0.7	1.9	0.2	23	8.1	1.2	1.1	7.7	50	0.0	0	25.2	73 (N/A)		0.2	18.25
Eastern white pine	0.6	0.1	0.5	0.1	4	2.0	0.3	0.3	2.0	13	-1.8	-7	4.1	10 (N/A)		0.2	2.48
Catalpa	3.4	0.5	1.5	0.2	18	7.3	1.1	1.0	6.9	45	0.0	0	21.9	63 (N/A)		0.2	15.78
Ohio buckeye	1.3	0.2	0.6	0.1	7	3.8	0.6	0.5	3.6	24	-0.3	-1	10.4	29 (N/A)		0.2	9.81
Swamp white oak	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4 (N/A)		0.2	1.25
Black poplar	3.9	0.6	1.7	0.2	20	6.5	0.9	0.9	6.2	40	0.0	0	20.9	61 (N/A)		0.2	20.21
Broadleaf Deciduous Large	1.7	0.3	0.8	0.1	9	4.8	0.7	0.7	4.6	30	0.0	0	13.6	39 (N/A)		0.2	12.95
Quaking aspen	0.3	0.1	0.2	0.0	2	3.2	0.5	0.5	3.2	20	0.0	0	7.9	22 (N/A)		0.2	7.42
White mulberry	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)		0.1	4.55
Plum	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)		0.1	0.11
Willow	0.5	0.1	0.3	0.0	3	1.8	0.3	0.2	1.7	11	-0.1	-1	4.8	14 (N/A)		0.1	6.81
River birch	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)		0.1	0.14
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.1	0 (N/A)		0.1	0.08
Ginkgo	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)		0.1	0.07
Austrian pine	0.4	0.1	0.3	0.0	2	0.8	0.1	0.1	0.8	5	-1.0	-4	1.6	4 (N/A)		0.1	1.93
Callery pear	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	1.0	6	0.0	0	2.5	7 (N/A)		0.1	3.47
Maple	0.2	0.0	0.1	0.0	1	1.1	0.2	0.1	1.0	7	-0.1	0	2.6	7 (N/A)		0.1	3.64
Japanese maple	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
Conifer Evergreen Small	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	0.09
Mountain ash	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)		0.1	2.55
Eastern cottonwood	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16 (N/A)		0.1	15.71
Conifer Evergreen Medium	0.2	0.0	0.2	0.0	1	0.6	0.1	0.1	0.6	4	-0.6	-2	1.2	3 (N/A)		0.1	2.89
American elm	2.2	0.4	1.0	0.1	12	2.7	0.4	0.4	2.7	17	0.0	0	9.9	29 (N/A)		0.1	28.89
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
Broadleaf Evergreen Large	0.0	0.0	0.1	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2 (N/A)		0.1	2.16
Citywide total	795.7	133.5	390.4	36.3	4,287	2,041.0	297.8	284.0	1,945.1	12,735	-318.7	-1,195	5,605.0	15,826 (N/A)		100.0	9.64

Table 4: Annual Carbon Stored

Sibley

Stored CO2 Benefits of Public Trees						
2/1/2023						
Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	5,846,264	43,847	(N/A)	28.0	31.0	95.32
Silver maple	7,276,633	54,575	(N/A)	22.9	38.6	145.15
Norway maple	1,986,436	14,898	(N/A)	13.6	10.5	66.81
Honeylocust	670,327	5,027	(N/A)	4.9	3.6	62.07
Sugar maple	518,409	3,888	(N/A)	3.7	2.7	64.80
Littleleaf linden	267,644	2,007	(N/A)	3.4	1.4	35.85
Northern hackberry	245,865	1,844	(N/A)	2.7	1.3	41.91
Apple	93,772	703	(N/A)	2.6	0.5	16.36
American basswood	635,421	4,766	(N/A)	2.5	3.4	116.24
Blue spruce	24,367	183	(N/A)	1.5	0.1	7.61
Black walnut	245,081	1,838	(N/A)	1.1	1.3	102.12
Conifer Evergreen La	17,499	131	(N/A)	1.0	0.1	7.72
Amur maple	20,034	150	(N/A)	1.0	0.1	8.84
Boxelder	48,796	366	(N/A)	1.0	0.3	22.87
White ash	42,926	322	(N/A)	1.0	0.2	20.12
Spruce	22,025	165	(N/A)	0.9	0.1	11.01
Elm	38,309	287	(N/A)	0.7	0.2	26.12
Lilac	1,122	8	(N/A)	0.6	0.0	0.84
Northern red oak	63,577	477	(N/A)	0.6	0.3	47.68
Broadleaf Deciduous	1,496	11	(N/A)	0.5	0.0	1.40
Bur oak	20,874	157	(N/A)	0.4	0.1	22.37
Red maple	18,558	139	(N/A)	0.4	0.1	19.88
Eastern redbud	753	6	(N/A)	0.4	0.0	0.81
Pin oak	127,710	958	(N/A)	0.3	0.7	191.56
Siberian elm	41,930	314	(N/A)	0.3	0.2	62.90
Kwanzan cherry	3,632	27	(N/A)	0.2	0.0	6.81
Northern white cedar	3,767	28	(N/A)	0.2	0.0	7.06
Paper birch	12,050	90	(N/A)	0.2	0.1	22.59
Cottonwood	147,127	1,103	(N/A)	0.2	0.8	275.86
Eastern white pine	3,767	28	(N/A)	0.2	0.0	7.06
Catalpa	112,918	847	(N/A)	0.2	0.6	211.72
Ohio buckeye	21,528	161	(N/A)	0.2	0.1	53.82
Swamp white oak	1,134	9	(N/A)	0.2	0.0	2.84
Black poplar	134,499	1,009	(N/A)	0.2	0.7	336.25
Broadleaf Deciduous	55,558	417	(N/A)	0.2	0.3	138.90
Quaking aspen	11,016	83	(N/A)	0.2	0.1	27.54
White mulberry	3,945	30	(N/A)	0.1	0.0	14.79
Plum	28	0	(N/A)	0.1	0.0	0.10
Willow	9,046	68	(N/A)	0.1	0.0	33.92
River birch	34	0	(N/A)	0.1	0.0	0.13
Kentucky coffeetree	24	0	(N/A)	0.1	0.0	0.09
Ginkgo	9	0	(N/A)	0.1	0.0	0.03
Austrian pine	2,704	20	(N/A)	0.1	0.0	10.14
Callery pear	2,201	17	(N/A)	0.1	0.0	8.26
Maple	2,201	17	(N/A)	0.1	0.0	8.26
Japanese maple	14	0	(N/A)	0.1	0.0	0.10
Conifer Evergreen Sm	3	0	(N/A)	0.1	0.0	0.02
Mountain ash	908	7	(N/A)	0.1	0.0	6.81
Eastern cottonwood	25,943	195	(N/A)	0.1	0.1	194.57
Conifer Evergreen Mf	1,118	8	(N/A)	0.1	0.0	8.39
American elm	41,265	309	(N/A)	0.1	0.2	309.48
Dogwood	14	0	(N/A)	0.1	0.0	0.10
Broadleaf Evergreen l	1,025	8	(N/A)	0.1	0.0	7.68
Citywide total	18,873,305	141,550	(N/A)	100.0	100.0	86.21

Table 5: Annual Carbon Sequestered

Sibley

Annual CO₂ Benefits of Public Trees

2/1/2023

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	300,784	2,256	-28,062	-1,334	-220	215,973	1,620	487,361	3,655 (N/A)	28.0	27.6	7.95
Silver maple	529,726	3,973	-34,932	-1,388	-272	209,547	1,572	702,953	5,272 (N/A)	22.9	39.8	14.02
Norway maple	70,807	531	-9,538	-628	-76	99,079	743	159,720	1,198 (N/A)	13.6	9.0	5.37
Honeylocust	51,088	383	-3,219	-194	-26	42,402	318	90,076	676 (N/A)	4.9	5.1	8.34
Sugar maple	30,800	231	-2,490	-157	-20	25,750	193	53,902	404 (N/A)	3.7	3.0	6.74
Littleleaf linden	26,293	197	-1,287	-113	-10	16,678	125	41,571	312 (N/A)	3.4	2.4	5.57
Northern hackberry	13,623	102	-1,182	-107	-10	18,484	139	30,817	231 (N/A)	2.7	1.7	5.25
Apple	7,728	58	-450	-63	-4	8,003	60	15,217	114 (N/A)	2.6	0.9	2.65
American basswood	37,678	283	-3,050	-137	-24	19,863	149	54,353	408 (N/A)	2.5	3.1	9.94
Blue spruce	1,825	14	-117	-41	-1	4,139	31	5,807	44 (N/A)	1.5	0.3	1.81
Black walnut	12,172	91	-1,176	-54	-9	8,788	66	19,730	148 (N/A)	1.1	1.1	8.22
Conifer Evergreen Large	1,722	13	-84	-30	-1	3,100	23	4,707	35 (N/A)	1.0	0.3	2.08
Amur maple	2,187	16	-96	-20	-1	2,427	18	4,497	34 (N/A)	1.0	0.3	1.98
Boxelder	5,331	40	-235	-26	-2	3,907	29	8,978	67 (N/A)	1.0	0.5	4.21
White ash	6,029	45	-206	-27	-2	5,421	41	11,218	84 (N/A)	1.0	0.6	5.26
Spruce	1,788	13	-106	-29	-1	3,036	23	4,689	35 (N/A)	0.9	0.3	2.34
Elm	3,189	24	-184	-16	-1	2,203	17	5,192	39 (N/A)	0.7	0.3	3.54
Lilac	262	2	-6	-4	0	246	2	498	4 (N/A)	0.6	0.0	0.37
Northern red oak	835	6	-305	-18	-2	2,253	17	2,765	21 (N/A)	0.6	0.2	2.07
Broadleaf Deciduous Smal	262	2	-7	-4	0	258	2	510	4 (N/A)	0.5	0.0	0.48
Bur oak	1,665	12	-100	-8	-1	1,210	9	2,766	21 (N/A)	0.4	0.2	2.96
Red maple	2,493	19	-89	-11	-1	2,275	17	4,668	35 (N/A)	0.4	0.3	5.00
Eastern redbud	178	1	-4	-3	0	166	1	337	3 (N/A)	0.4	0.0	0.36
Pin oak	10,990	82	-613	-21	-5	3,245	24	13,600	102 (N/A)	0.3	0.8	20.40
Siberian elm	2,293	17	-202	-13	-2	2,114	16	4,192	31 (N/A)	0.3	0.2	6.29
Kwanzan cherry	455	3	-17	-5	0	497	4	930	7 (N/A)	0.2	0.1	1.74
Northern white cedar	399	3	-18	-7	0	744	6	1,118	8 (N/A)	0.2	0.1	2.10
Paper birch	1,545	12	-58	-7	0	1,337	10	2,817	21 (N/A)	0.2	0.2	5.28
Cottonwood	3,310	25	-706	-20	-5	2,847	21	5,432	41 (N/A)	0.2	0.3	10.18
Eastern white pine	399	3	-18	-7	0	744	6	1,118	8 (N/A)	0.2	0.1	2.10
Catalpa	3,444	26	-542	-17	-4	2,560	19	5,444	41 (N/A)	0.2	0.3	10.21
Ohio buckeye	772	6	-103	-8	-1	1,329	10	1,989	15 (N/A)	0.2	0.1	4.97
Swamp white oak	235	2	-6	-2	0	190	1	418	3 (N/A)	0.2	0.0	1.04
Black poplar	2,303	17	-646	-16	-5	2,282	17	3,923	29 (N/A)	0.2	0.2	9.81
Broadleaf Deciduous Large	2,365	18	-267	-11	-2	1,693	13	3,780	28 (N/A)	0.2	0.2	9.45
Quaking aspen	1,336	10	-53	-6	0	1,179	9	2,456	18 (N/A)	0.2	0.1	6.14
White mulberry	382	3	-19	-3	0	433	3	792	6 (N/A)	0.1	0.0	2.97
Plum	17	0	0	0	0	11	0	28	0 (N/A)	0.1	0.0	0.10
Willow	694	5	-43	-4	0	616	5	1,262	9 (N/A)	0.1	0.1	4.73
River birch	11	0	0	0	0	14	0	25	0 (N/A)	0.1	0.0	0.09
Kentucky coffeetree	5	0	0	0	0	9	0	13	0 (N/A)	0.1	0.0	0.05
Ginkgo	4	0	0	0	0	7	0	11	0 (N/A)	0.1	0.0	0.04
Austrian pine	159	1	-13	-3	0	281	2	424	3 (N/A)	0.1	0.0	1.59
Callery pear	448	3	-11	-2	0	352	3	787	6 (N/A)	0.1	0.0	2.95
Maple	331	2	-11	-2	0	371	3	689	5 (N/A)	0.1	0.0	2.58
Japanese maple	9	0	0	0	0	6	0	14	0 (N/A)	0.1	0.0	0.10
Conifer Evergreen Small	1	0	0	0	0	6	0	6	0 (N/A)	0.1	0.0	0.05
Mountain ash	114	1	-4	-1	0	124	1	232	2 (N/A)	0.1	0.0	1.74
Eastern cottonwood	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.1	0.1	11.11
Conifer Evergreen Medium	91	1	-5	-2	0	213	2	296	2 (N/A)	0.1	0.0	2.22
American elm	724	5	-198	-6	-2	987	7	1,507	11 (N/A)	0.1	0.1	11.31
Dogwood	9	0	0	0	0	6	0	14	0 (N/A)	0.1	0.0	0.10
Broadleaf Evergreen Large	197	1	-5	-1	0	152	1	343	3 (N/A)	0.1	0.0	2.57
Citywide total	1,142,466	8,568	-90,609	-4,584	-714	720,204	5,402	1,767,476	13,256 (N/A)	100.0	100.0	8.07

Table 6: Annual Social and Aesthetic Benefits

Sibley

Annual Aesthetic/Other Benefits of Public Trees

2/1/2023

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	24,827	(N/A)	28.0	24.0	53.97
Silver maple	40,730	(N/A)	22.9	39.3	108.32
Norway maple	6,654	(N/A)	13.6	6.4	29.84
Honeylocust	12,172	(N/A)	4.9	11.8	150.27
Sugar maple	3,339	(N/A)	3.7	3.2	55.65
Littleleaf linden	2,830	(N/A)	3.4	2.7	50.54
Northern hackberry	1,929	(N/A)	2.7	1.9	43.85
Apple	447	(N/A)	2.6	0.4	10.40
American basswood	2,753	(N/A)	2.5	2.7	67.15
Blue spruce	534	(N/A)	1.5	0.5	22.27
Black walnut	983	(N/A)	1.1	0.9	54.60
Conifer Evergreen Large	480	(N/A)	1.0	0.5	28.22
Amur maple	123	(N/A)	1.0	0.1	7.26
Boxelder	549	(N/A)	1.0	0.5	34.30
White ash	838	(N/A)	1.0	0.8	52.37
Spruce	487	(N/A)	0.9	0.5	32.44
Elm	347	(N/A)	0.7	0.3	31.52
Lilac	12	(N/A)	0.6	0.0	1.25
Northern red oak	79	(N/A)	0.6	0.1	7.95
Broadleaf Deciduous Small	13	(N/A)	0.5	0.0	1.59
Bur oak	180	(N/A)	0.4	0.2	25.71
Red maple	344	(N/A)	0.4	0.3	49.14
Eastern redbud	8	(N/A)	0.4	0.0	1.19
Pin oak	793	(N/A)	0.3	0.8	158.64
Siberian elm	183	(N/A)	0.3	0.2	36.57
Kwanzan cherry	26	(N/A)	0.2	0.0	6.40
Northern white cedar	112	(N/A)	0.2	0.1	28.09
Paper birch	166	(N/A)	0.2	0.2	41.53
Cottonwood	220	(N/A)	0.2	0.2	55.03
Eastern white pine	112	(N/A)	0.2	0.1	28.09
Catalpa	241	(N/A)	0.2	0.2	60.24
Ohio buckeye	78	(N/A)	0.2	0.1	26.11
Swamp white oak	32	(N/A)	0.2	0.0	10.56
Black poplar	145	(N/A)	0.2	0.1	48.42
Broadleaf Deciduous Large	179	(N/A)	0.2	0.2	59.68
Quaking aspen	138	(N/A)	0.2	0.1	45.86
White mulberry	22	(N/A)	0.1	0.0	10.94
Plum	0	(N/A)	0.1	0.0	0.03
Willow	69	(N/A)	0.1	0.1	34.64
River birch	5	(N/A)	0.1	0.0	2.74
Kentucky coffeetree	11	(N/A)	0.1	0.0	5.26
Ginkgo	1	(N/A)	0.1	0.0	0.37
Austrian pine	32	(N/A)	0.1	0.0	16.14
Callery pear	52	(N/A)	0.1	0.1	26.22
Maple	60	(N/A)	0.1	0.1	29.84
Japanese maple	0	(N/A)	0.1	0.0	0.03
Conifer Evergreen Small	4	(N/A)	0.1	0.0	4.27
Mountain ash	6	(N/A)	0.1	0.0	6.40

Eastern cottonwood	67 (N/A)	0.1	0.1	66.60
Conifer Evergreen Medium	25 (N/A)	0.1	0.0	25.23
American elm	87 (N/A)	0.1	0.1	86.69
Dogwood	0 (N/A)	0.1	0.0	0.03
Broadleaf Evergreen Large	58 (N/A)	0.1	0.1	58.26
Citywide total	103,584 (N/A)	100.0	100.0	63.08

Table 7: Summary of Benefits in Dollars

Sibley

Total Annual Benefits of Public Trees by Species (\$)

2/1/2023

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Green ash	26,850	3,655	4,774	38,677	24,827	98,783	(N/A)	27.7
Silver maple	25,491	5,272	4,781	49,582	40,730	125,856	(N/A)	35.3
Norway maple	12,743	1,198	2,316	15,515	6,654	38,426	(N/A)	10.8
Honeylocust	5,131	676	869	7,297	12,172	26,144	(N/A)	7.3
Sugar maple	3,155	404	499	4,017	3,339	11,415	(N/A)	3.2
Littleleaf linden	2,045	312	338	2,198	2,830	7,724	(N/A)	2.2
Northern hackberry	2,394	231	420	2,858	1,929	7,832	(N/A)	2.2
Apple	1,063	114	176	538	447	2,338	(N/A)	0.7
American basswood	2,588	408	394	3,532	2,753	9,676	(N/A)	2.7
Blue spruce	504	44	57	851	534	1,990	(N/A)	0.6
Black walnut	1,083	148	195	1,598	983	4,007	(N/A)	1.1
Conifer Evergreen Large	364	35	40	620	480	1,539	(N/A)	0.4
Amur maple	334	34	50	141	123	683	(N/A)	0.2
Boxelder	479	67	76	504	549	1,675	(N/A)	0.5
White ash	602	84	101	550	838	2,175	(N/A)	0.6
Spruce	352	35	35	680	487	1,589	(N/A)	0.4
Elm	283	39	46	326	347	1,041	(N/A)	0.3
Lilac	36	4	5	12	12	69	(N/A)	0.0
Northern red oak	290	21	40	371	79	801	(N/A)	0.2
Broadleaf Deciduous Sm	38	4	5	14	13	73	(N/A)	0.0
Bur oak	149	21	25	173	180	548	(N/A)	0.2
Red maple	260	35	46	225	344	910	(N/A)	0.3
Eastern redbud	24	3	3	8	8	46	(N/A)	0.0
Pin oak	399	102	51	673	793	2,018	(N/A)	0.6
Siberian elm	260	31	47	320	183	841	(N/A)	0.2
Kwanzan cherry	73	7	10	29	26	144	(N/A)	0.0
Northern white cedar	86	8	10	141	112	358	(N/A)	0.1
Paper birch	153	21	25	136	166	501	(N/A)	0.1
Cottonwood	354	41	73	690	220	1,377	(N/A)	0.4
Eastern white pine	86	8	10	141	112	358	(N/A)	0.1
Catalpa	321	41	63	611	241	1,278	(N/A)	0.4
Ohio buckeye	164	15	29	178	78	465	(N/A)	0.1
Swamp white oak	27	3	4	17	32	82	(N/A)	0.0
Black poplar	281	29	61	589	145	1,104	(N/A)	0.3
Broadleaf Deciduous La	208	28	39	337	179	792	(N/A)	0.2
Quaking aspen	133	18	22	119	138	430	(N/A)	0.1
White mulberry	56	6	9	25	22	118	(N/A)	0.0
Plum	2	0	0	0	0	3	(N/A)	0.0
Willow	83	9	14	83	69	259	(N/A)	0.1
River birch	2	0	0	1	5	9	(N/A)	0.0
Kentucky coffeetree	1	0	0	1	11	13	(N/A)	0.0
Ginkgo	1	0	0	0	1	2	(N/A)	0.0
Austrian pine	37	3	4	70	32	146	(N/A)	0.0
Callery pear	49	6	7	32	52	146	(N/A)	0.0
Maple	49	5	7	34	60	155	(N/A)	0.0
Japanese maple	1	0	0	0	0	1	(N/A)	0.0
Conifer Evergreen Smal	1	0	0	1	4	6	(N/A)	0.0
Mountain ash	18	2	3	7	6	36	(N/A)	0.0
Eastern cottonwood	82	11	16	149	67	324	(N/A)	0.1
Conifer Evergreen Medi	25	2	3	42	25	97	(N/A)	0.0
American elm	114	11	29	123	87	365	(N/A)	0.1
Dogwood	1	0	0	0	0	1	(N/A)	0.0
Broadleaf Evergreen Lar	21	3	2	20	58	104	(N/A)	0.0
Citywide Total	89,349	13,256	15,826	134,857	103,584	356,872	(N/A)	100.0

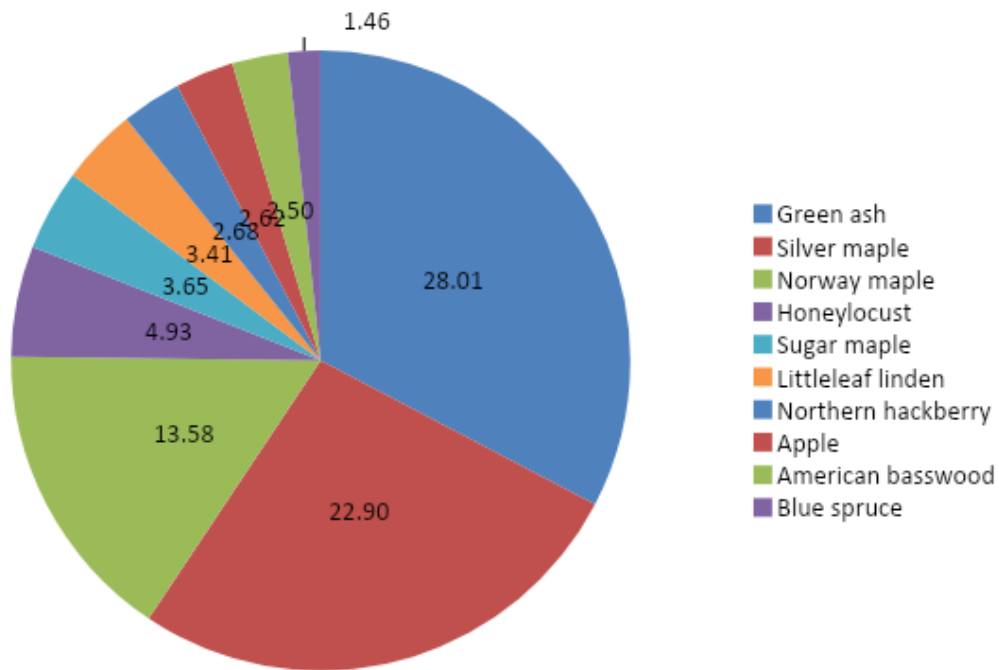


Figure 1: Species Distribution

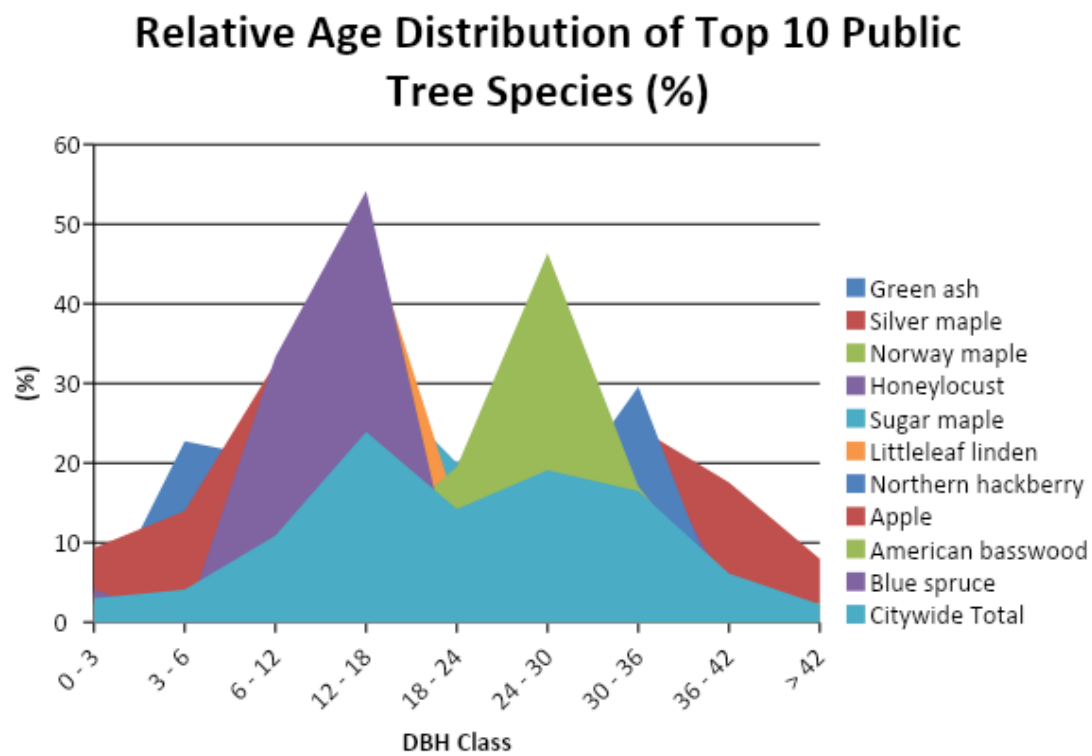


Figure 2: Relative Age Class



Figure 3: Foliage Condition



Figure 4: Wood Condition

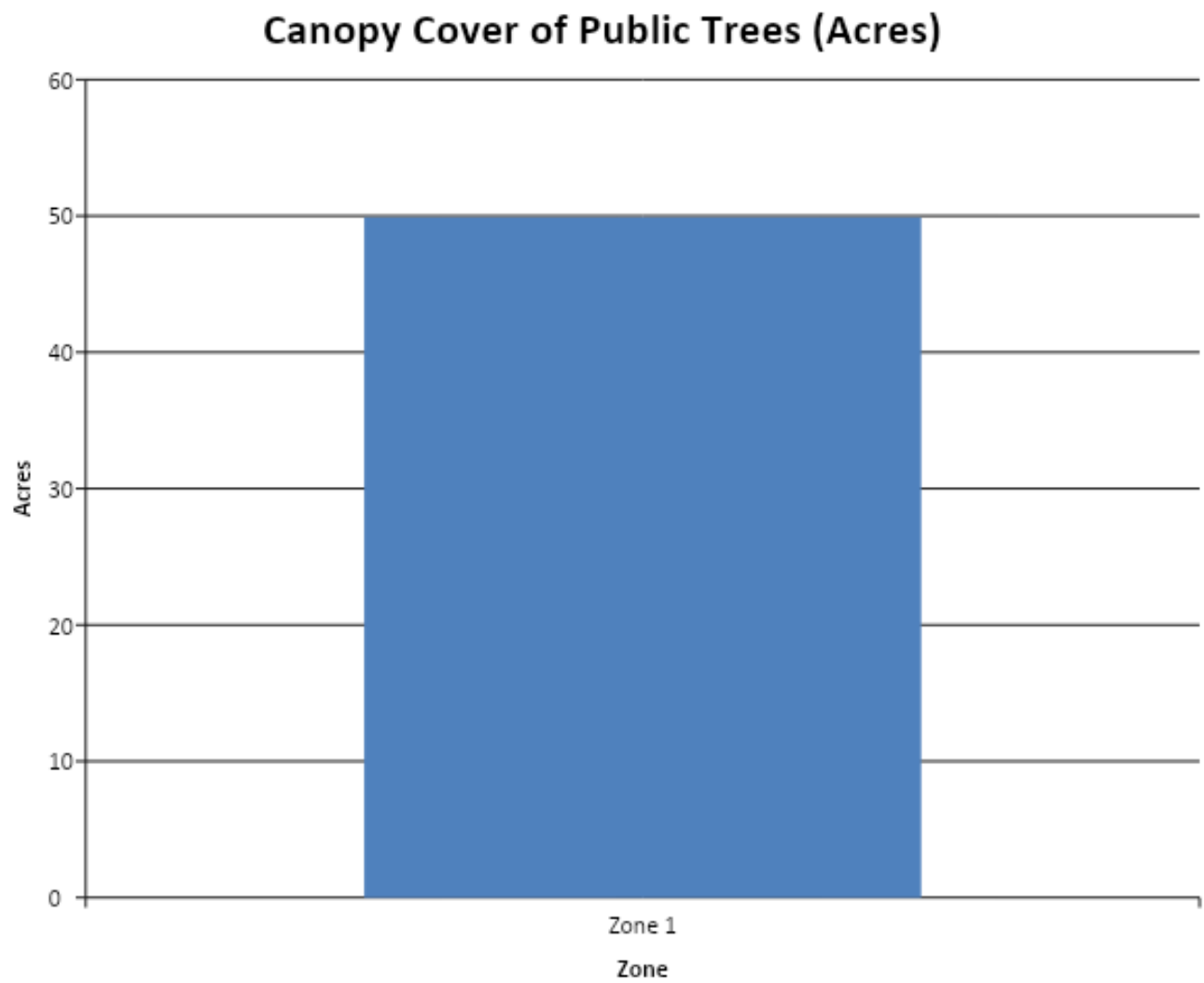


Figure 5: Canopy Cover in Acres

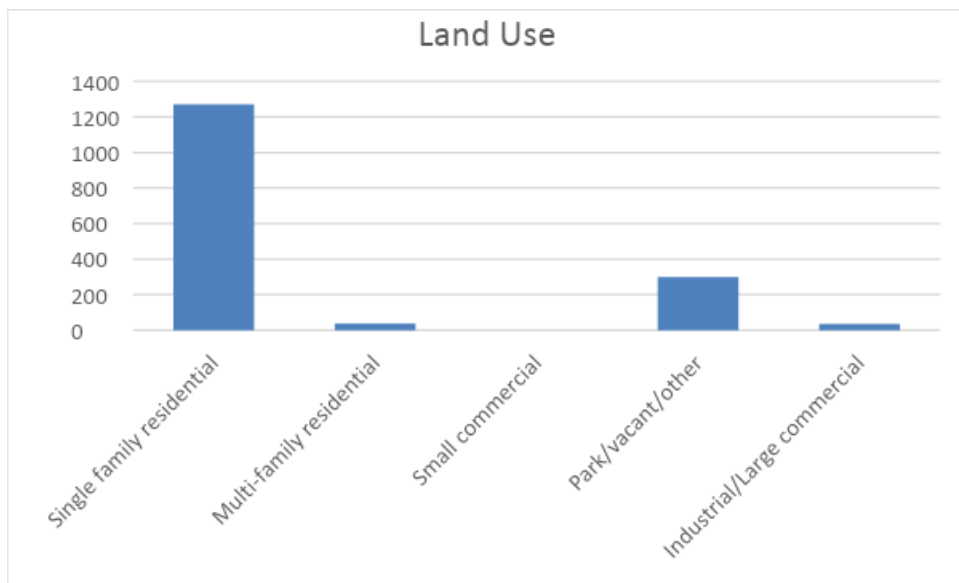


Figure 6: Land Use of city/park trees

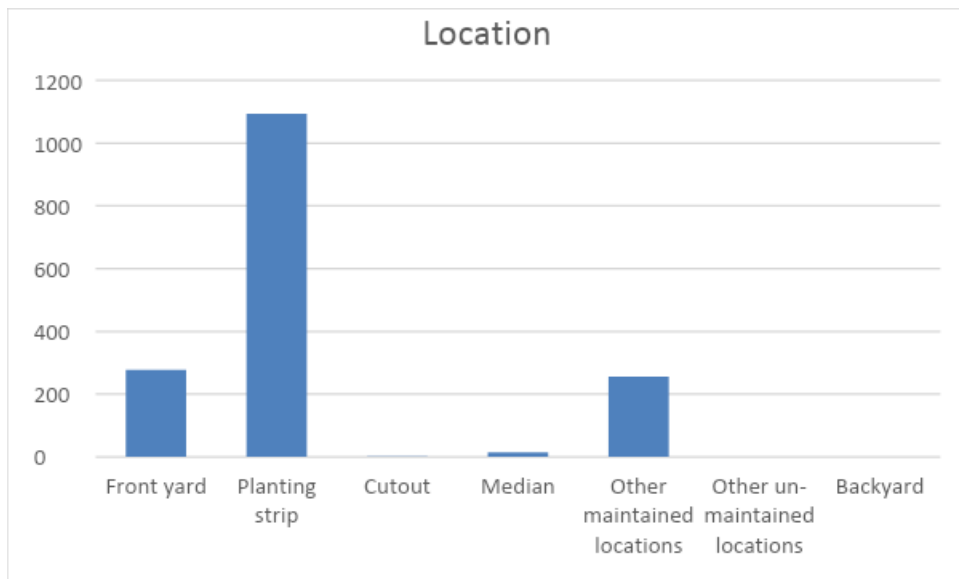


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

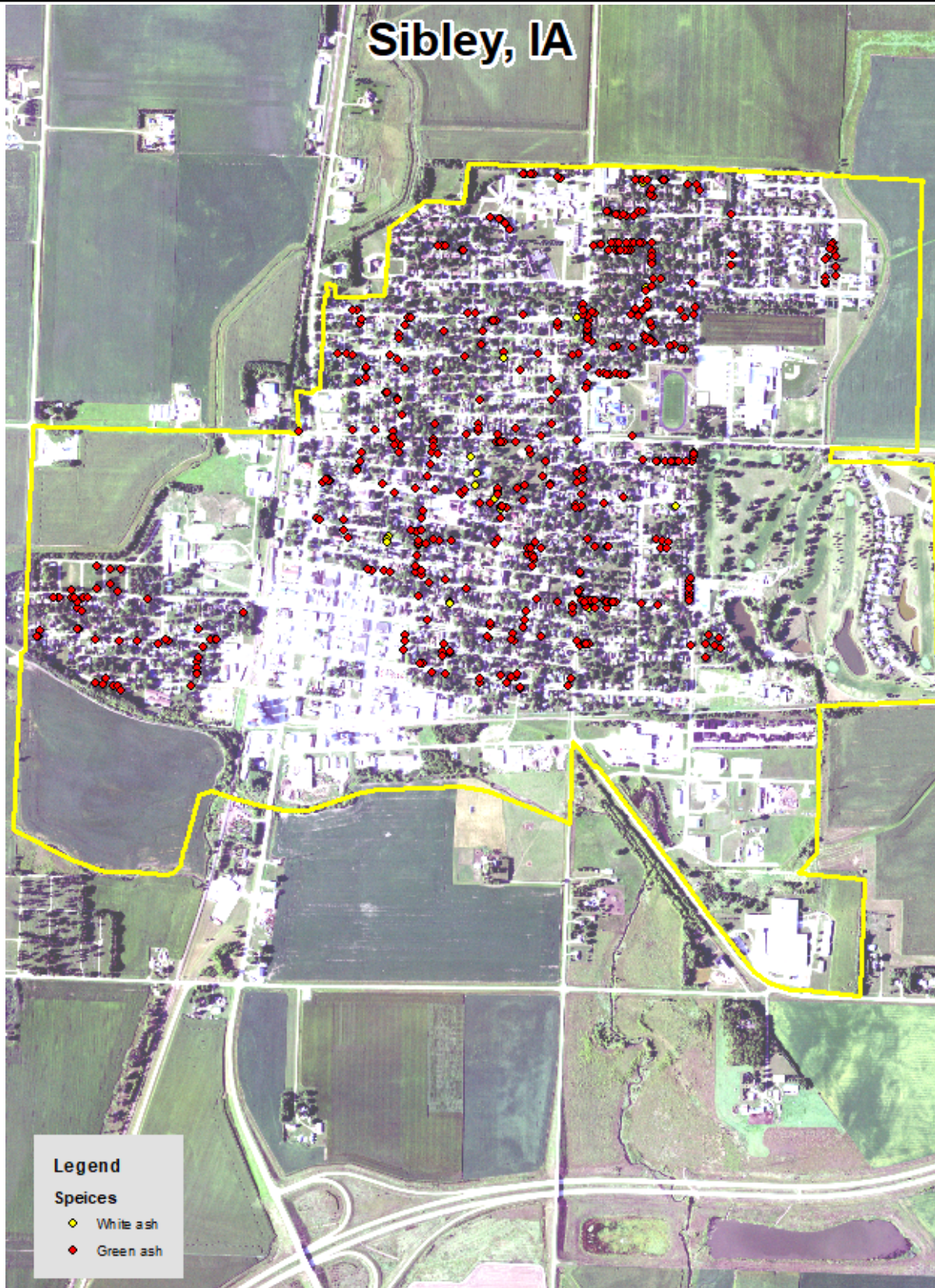


Figure 1: Location of Ash Trees

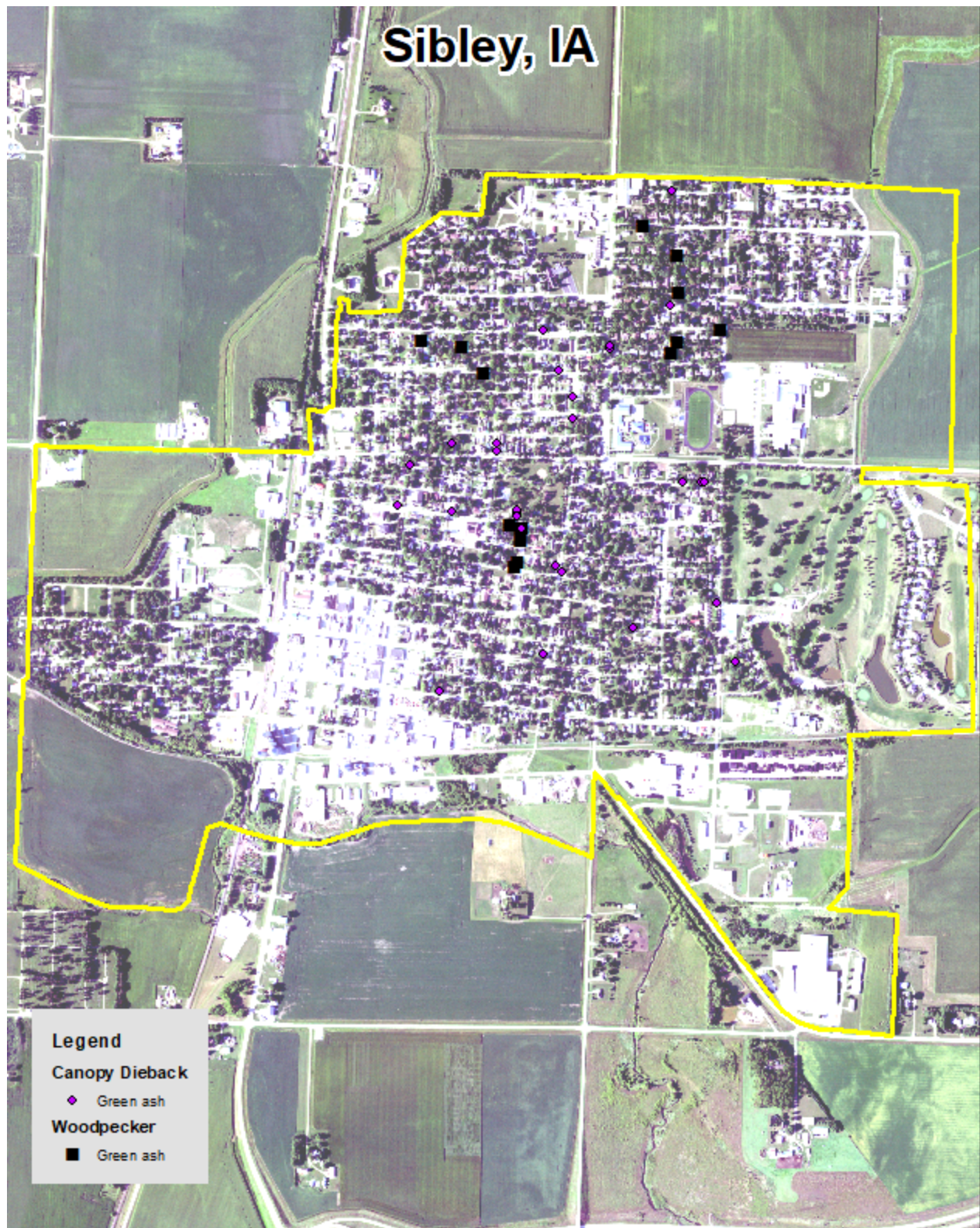


Figure 2: Location of EAB symptoms

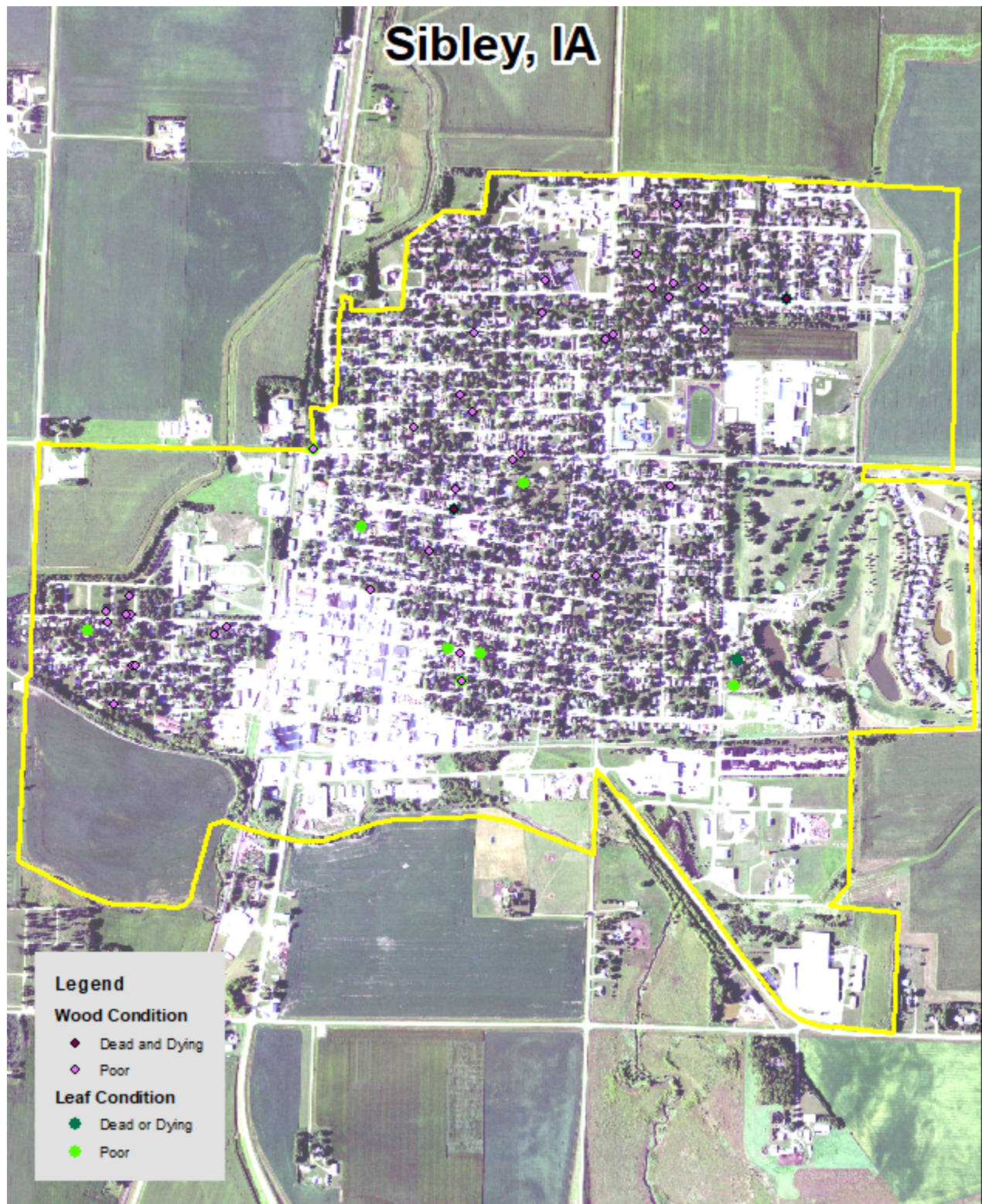


Figure 3: Location of Poor Condition Trees

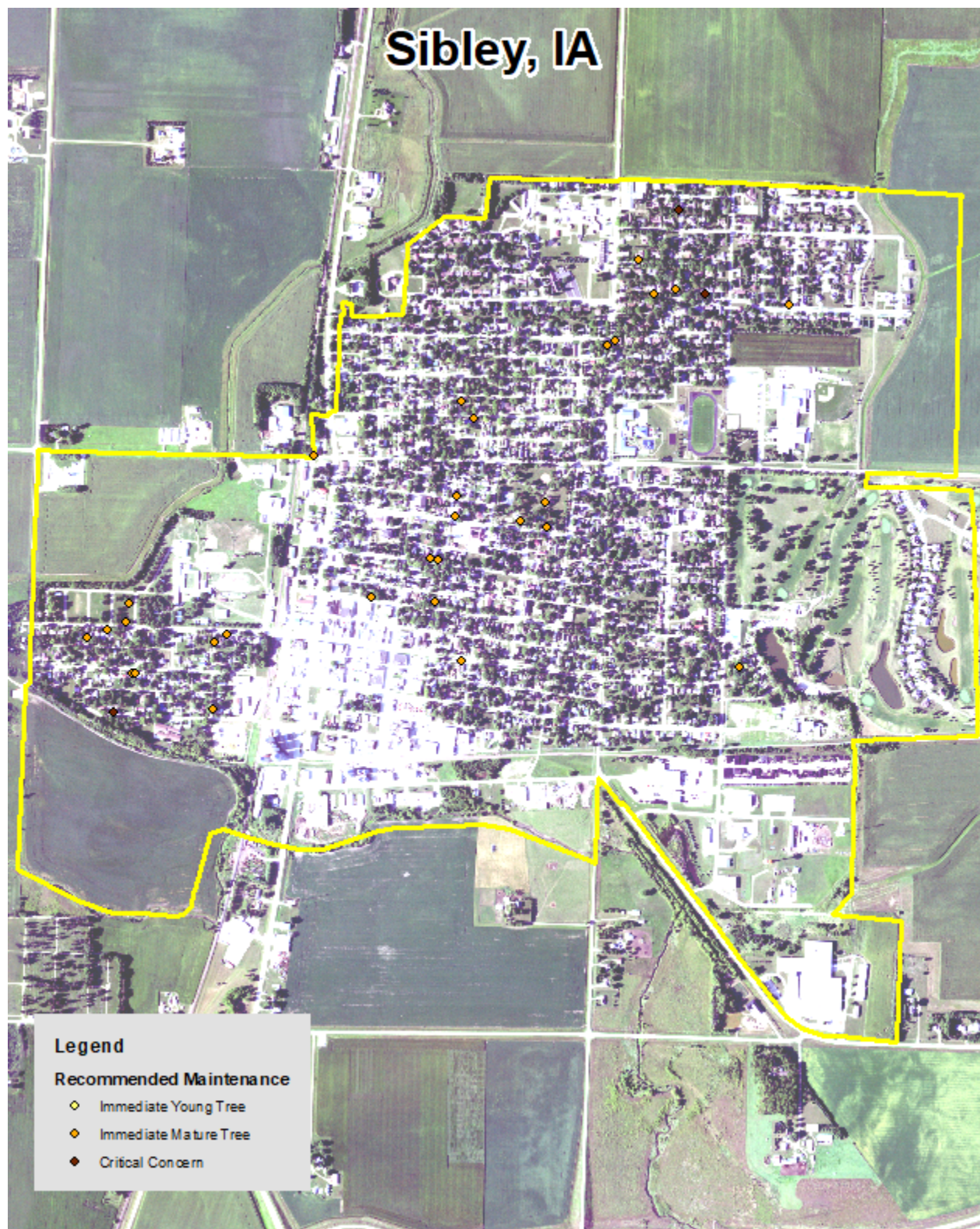


Figure 4: Location of Trees with Recommended Maintenance

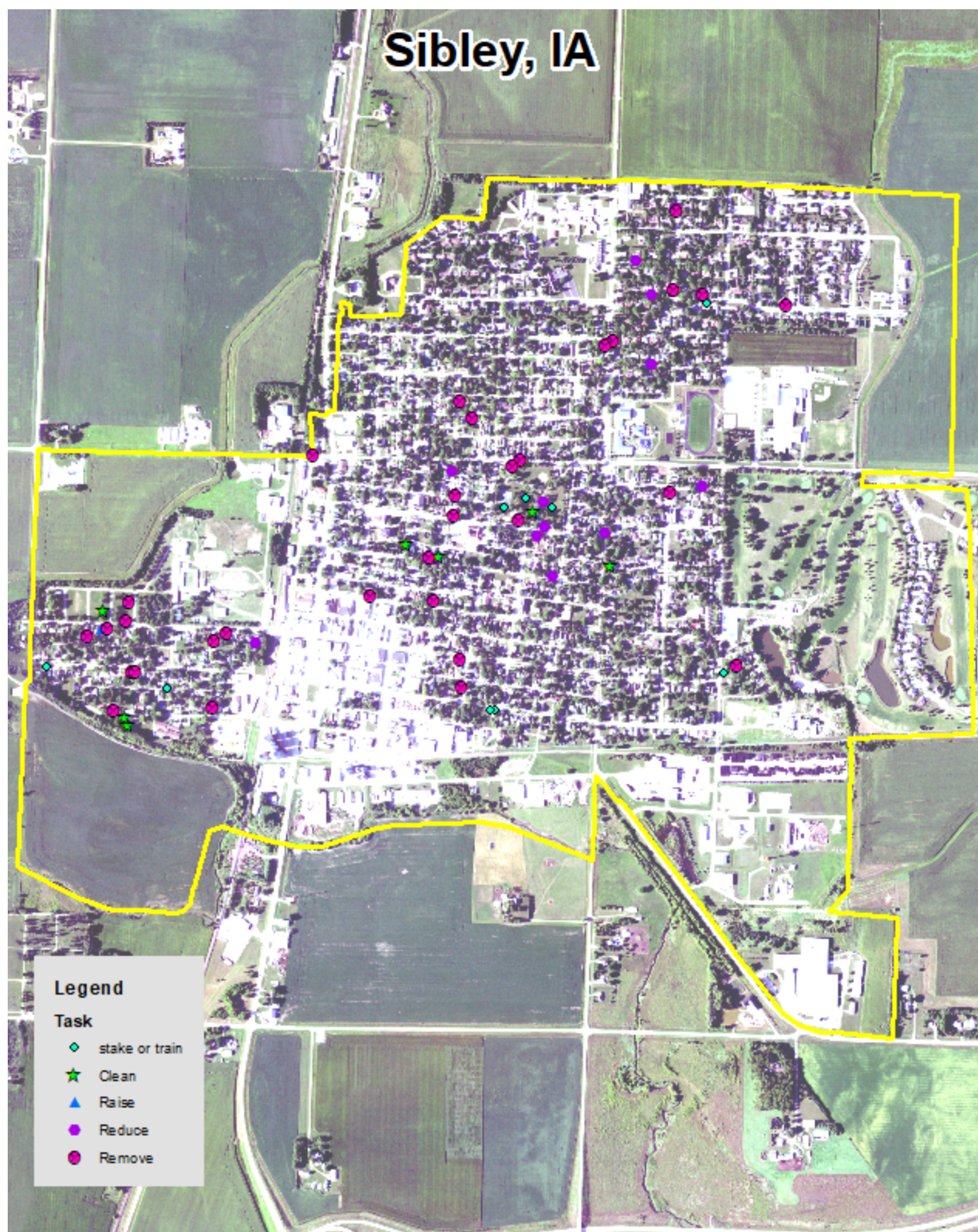


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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