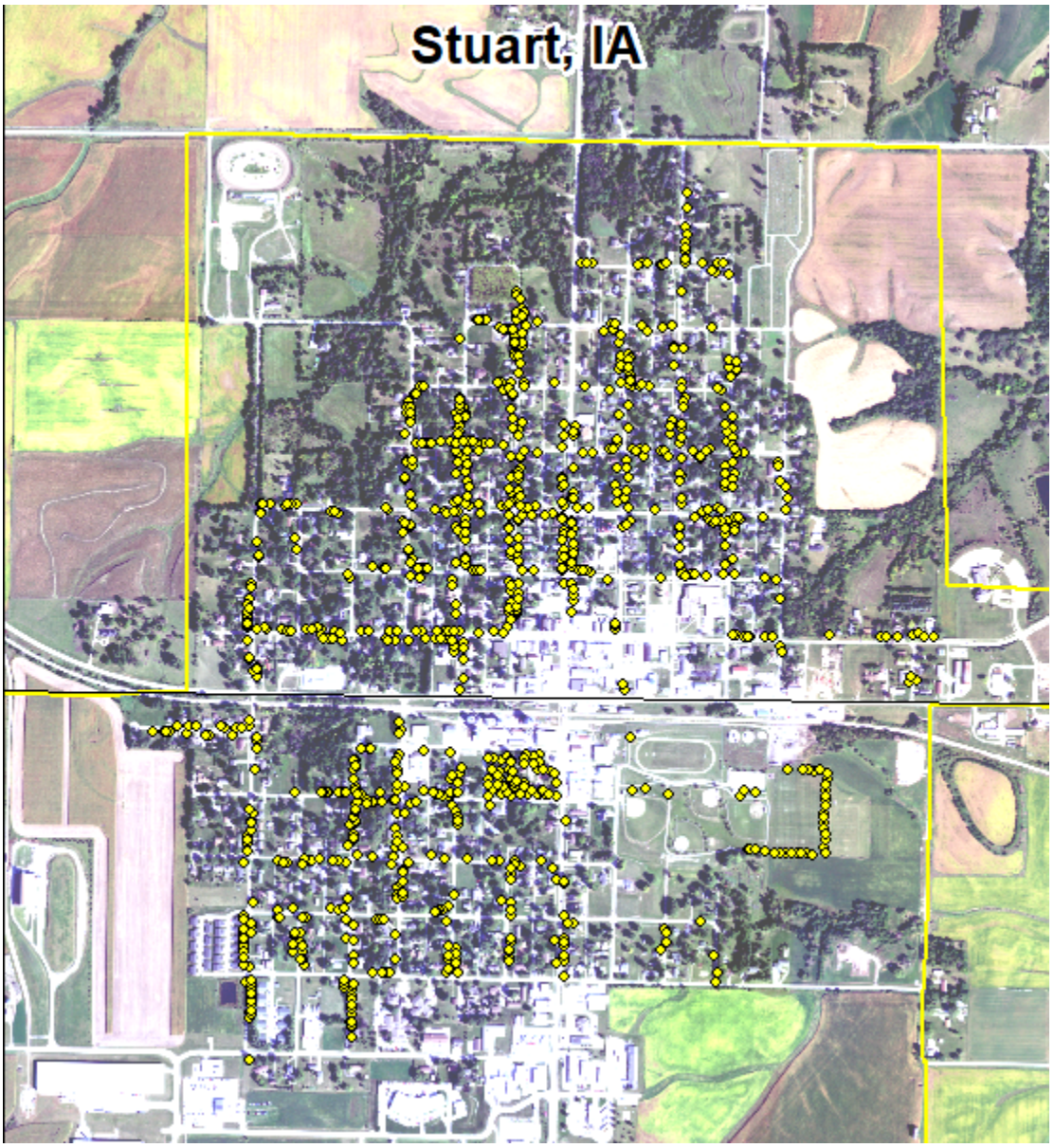
Stuart, IA



2023 Urban Forest Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Stuart 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 14% of Stuart'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 993 trees inventoried.

- Stuart's trees provide $188,767 of benefits annually, an average of $190 a tree
- There are over 54 species of trees
- The top three genera are: Maple 41%, Ash 14%, and Oak 6%
- 16.5% of trees are in need of some type of management
- 164 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 164 trees needing removal, 89 trees are over 18 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*
- Most of the 139 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 Stuart 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 Stuart, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Stuart'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 Stuart 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 Stuart'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 woodpecker damage.

Inventory Results

The data collected for the 993 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. Stuart's trees reduce energy related costs by approximately $50,281 annually (Appendix A, Table 1). These savings are both in Electricity (241 MWh) and in Natural Gas (32,639.5 Therms).

Annual Stormwater Benefits

Stuart's trees intercept about 2,481,496 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $67,249 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 Stuart, it is estimated that trees remove 3,096.5 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 $8,712 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Stuart, trees sequester about 577,983 lbs of carbon a year with an associated value of $4,335 (Appendix A, Table 5). In addition, the trees store 8,731,432 lbs of carbon, with a yearly benefit of $65,486 (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. Stuart receives $55,492 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, Stuart's trees provide $188,767 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 993 trees in Stuart provide approximately $190 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Stuart has over 54 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of the top 16 trees by genera is as follows:

Maple	408	41%
Ash	140	14%

Oak	59	6%
Walnut	59	6%
Apple (Crab)	34	3.4%
Hackberry	30	3%
Basswood/Linden	25	2.5%
Spruce	25	2.5%
Honey Locust	25	2.5%
Willow	18	1.8%
Walnut	10	1%
Red Cedar	16	1.6%
Siberian Elm	14	1.4%
Pine	11	1.1%
Mulberry	11	1.1%
Callery Pear	11	1.1%

Age Class

Most of Stuart's trees (53%) are 18 inches in diameter and over 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. Stuart's size curve is on the larger side, indicating an older than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Stuart indicate that 84% of the trees are in good health, with 14% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 77% of Stuart'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 16% of the population. This 16% 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).

Tree Removal	164	16.5%
Crown Cleaning	100	10%

Canopy Cover

The total canopy with both private and public trees is 13%, 207 acres. The canopy cover on city own properties included in the Stuart inventory includes approximately 26.8 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by %, in 30 years on all lands. To achieve this goal it is estimated that # trees need to be planted annually on public and/or private lands.

Land Use and Location

The majority of Stuart'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	85.6 %
Park/vacant/other	9.9%
Multifamily residential	3.4%
Industrial/Large commercial	1.1%

Location	
Front yard	63%
Planting strip	37%

Changes in Forest Structure Since plan in 2013

Please note any trends you have seen since that last plan, such as: reduction in maintenance needs, increase in tree diversity, loss of canopy cover, changes in age class, etc.

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

Stuart has 3 critical concern trees that need immediate removal. There are also 135 trees needing immediate attention. 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 76 trees over 18 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 routine maintenance.

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 164 removals, 127 are ash trees. There are a total of 140 ash trees, and a majority of those have signs and symptoms that have been associated with EAB. In addition, there are 12 trees 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 Stuart.

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 (41%) (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 woodpecker damage.

Emerald Ash Borer Plan

Six Year Maintenance Plan

Year 1

Removal: 3 critical concern trees plus 25 more trees in poor
Planting and Replacement: 33 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 28 trees in poor health
Planting and Replacement: 33 trees in open locations
Routine trimming: Contract to trim 1/3 of the city trees

Visual Survey for signs and symptoms of EAB

Year 3

Removal: 27 trees in poor health
Planting and Replacement: 33 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 27 trees in poor health
Planting and Replacement: 33 trees in open locations
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 27 trees in poor health
Planting and Replacement: 33 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 27 trees in poor health
Planting and Replacement: 33 trees in open locations
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

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 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 woodpecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Stuart

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
Black maple	53.7	4,078	7,243.9	7,099	11,177	(N/A)	20.1	22.2	55.89
Silver maple	48.3	3,670	6,350.1	6,223	9,893	(N/A)	15.6	19.7	63.82
Green ash	32.9	2,500	4,474.9	4,385	6,885	(N/A)	13.9	13.7	49.89
Norway maple	12.8	975	1,805.1	1,769	2,744	(N/A)	6.1	5.5	44.98
Black walnut	13.8	1,044	1,807.5	1,771	2,815	(N/A)	5.9	5.6	47.72
Apple	3.6	270	533.7	523	793	(N/A)	3.4	1.6	23.32
Northern hackberry	8.1	613	1,107.0	1,085	1,698	(N/A)	3.0	3.4	56.59
Pin oak	8.9	679	1,225.6	1,201	1,880	(N/A)	2.8	3.7	67.14
Honeylocust	6.7	506	889.2	871	1,378	(N/A)	2.5	2.7	55.11
American basswood	5.4	412	789.0	773	1,185	(N/A)	1.9	2.4	62.37
Willow	2.8	212	420.3	412	624	(N/A)	1.8	1.2	34.68
Eastern red cedar	1.3	98	191.4	188	286	(N/A)	1.6	0.6	17.85
Siberian elm	4.7	353	630.7	618	972	(N/A)	1.4	1.9	69.40
Blue spruce	1.2	87	161.8	159	246	(N/A)	1.3	0.5	18.93
Bur oak	3.0	229	392.2	384	614	(N/A)	1.2	1.2	51.15
Northern red oak	2.1	157	274.5	269	426	(N/A)	1.1	0.8	38.69
Mulberry	1.8	135	268.2	263	398	(N/A)	1.1	0.8	36.14
Broadleaf Deciduous Large	4.0	302	540.5	530	832	(N/A)	1.1	1.7	75.59
Callery pear	2.2	163	291.8	286	449	(N/A)	1.1	0.9	40.85
Eastern white pine	1.4	106	171.5	168	274	(N/A)	1.0	0.5	27.44
Red maple	1.8	135	236.0	231	367	(N/A)	0.9	0.7	40.72
Broadleaf Deciduous Mediu	0.8	61	119.9	118	178	(N/A)	0.7	0.4	25.45
Cottonwood	1.8	137	244.5	240	377	(N/A)	0.7	0.7	53.81
Elm	1.9	141	249.8	245	386	(N/A)	0.7	0.8	55.10
Spruce	0.8	64	102.4	100	165	(N/A)	0.7	0.3	23.53
Sugar maple	1.0	76	137.6	135	211	(N/A)	0.6	0.4	35.20
Littleleaf linden	1.1	80	144.1	141	221	(N/A)	0.5	0.4	44.21
American sycamore	1.6	120	221.6	217	338	(N/A)	0.5	0.7	67.52
Catalpa	2.0	150	272.2	267	417	(N/A)	0.5	0.8	83.40
Norway spruce	0.7	56	93.3	91	147	(N/A)	0.5	0.3	29.48
Eastern redbud	0.4	27	58.5	57	84	(N/A)	0.5	0.2	16.85
Kentucky coffeetree	0.7	54	101.1	99	153	(N/A)	0.4	0.3	38.36
Swamp white oak	0.7	52	92.7	91	142	(N/A)	0.4	0.3	35.62
Black cherry	0.4	32	70.1	69	101	(N/A)	0.4	0.2	25.18
Oak	0.5	34	65.6	64	99	(N/A)	0.3	0.2	32.86
Broadleaf Deciduous Small	0.3	20	38.1	37	57	(N/A)	0.3	0.1	19.06
American elm	0.5	34	65.1	64	98	(N/A)	0.3	0.2	32.67
Ginkgo	0.4	32	55.3	54	87	(N/A)	0.3	0.2	28.86
River birch	0.9	67	124.3	122	188	(N/A)	0.3	0.4	62.82
Boxelder	0.5	40	69.6	68	108	(N/A)	0.3	0.2	35.95
Conifer Evergreen Large	0.3	24	39.2	38	62	(N/A)	0.2	0.1	31.15
White ash	0.5	41	56.8	56	96	(N/A)	0.2	0.2	48.12
Hickory	0.5	38	65.1	64	102	(N/A)	0.2	0.2	50.77
Amur maple	0.4	29	56.3	55	84	(N/A)	0.2	0.2	42.14
Tulip tree	0.8	58	105.8	104	162	(N/A)	0.2	0.3	80.97
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.1	0.0	24.14
Conifer Evergreen Medium	0.1	5	10.2	10	15	(N/A)	0.1	0.0	14.80
Dogwood	0.0	2	3.8	4	5	(N/A)	0.1	0.0	5.40
Ohio buckeye	0.2	18	29.5	29	47	(N/A)	0.1	0.1	46.78
Lilac	0.1	6	12.8	13	18	(N/A)	0.1	0.0	18.19
American chestnut	0.4	33	59.0	58	91	(N/A)	0.1	0.2	91.02
Basswood	0.1	7	13.7	13	21	(N/A)	0.1	0.0	20.64
Quaking aspen	0.0	2	3.7	4	6	(N/A)	0.1	0.0	5.82
White oak	0.3	20	38.1	37	57	(N/A)	0.1	0.1	57.32
Total	241.0	18,294	32,639.5	31,987	50,281	(N/A)	100.0	100.0	50.64

Table 2: Annual Stormwater Benefits

Stuart

Annual Stormwater Benefits of Public Trees

2/1/2023

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Black maple	486,560	13,186	(N/A)	20.1	19.6	65.93
Silver maple	665,423	18,033	(N/A)	15.6	26.8	116.34
Green ash	331,558	8,985	(N/A)	13.9	13.4	65.11
Norway maple	102,722	2,784	(N/A)	6.1	4.1	45.64
Black walnut	119,924	3,250	(N/A)	5.9	4.8	55.08
Apple	13,223	358	(N/A)	3.4	0.5	10.54
Northern hackberry	61,611	1,670	(N/A)	3.0	2.5	55.66
Pin oak	92,988	2,520	(N/A)	2.8	3.7	90.00
Honeylocust	60,620	1,643	(N/A)	2.5	2.4	65.71
American basswood	58,771	1,593	(N/A)	1.9	2.4	83.83
Willow	21,729	589	(N/A)	1.8	0.9	32.71
Eastern red cedar	18,738	508	(N/A)	1.6	0.8	31.74
Siberian elm	52,541	1,424	(N/A)	1.4	2.1	101.70
Blue spruce	14,533	394	(N/A)	1.3	0.6	30.30
Bur oak	29,961	812	(N/A)	1.2	1.2	67.66
Northern red oak	18,277	495	(N/A)	1.1	0.7	45.03
Mulberry	9,120	247	(N/A)	1.1	0.4	22.47
Broadleaf Deciduous Large	51,174	1,387	(N/A)	1.1	2.1	126.07
Callery pear	14,563	395	(N/A)	1.1	0.6	35.88
Eastern white pine	22,744	616	(N/A)	1.0	0.9	61.64
Red maple	13,047	354	(N/A)	0.9	0.5	39.29
Broadleaf Deciduous Medium	4,502	122	(N/A)	0.7	0.2	17.43
Cottonwood	18,154	492	(N/A)	0.7	0.7	70.28
Elm	19,902	539	(N/A)	0.7	0.8	77.05
Spruce	11,258	305	(N/A)	0.7	0.5	43.58
Sugar maple	12,252	332	(N/A)	0.6	0.5	55.34
Littleleaf linden	10,467	284	(N/A)	0.5	0.4	56.73
American sycamore	21,022	570	(N/A)	0.5	0.8	113.94
Catalpa	29,402	797	(N/A)	0.5	1.2	159.36
Norway spruce	13,620	369	(N/A)	0.5	0.5	73.82
Eastern redbud	1,718	47	(N/A)	0.5	0.1	9.31
Kentucky coffeetree	8,229	223	(N/A)	0.4	0.3	55.75
Swamp white oak	3,990	108	(N/A)	0.4	0.2	27.03
Black cherry	1,968	53	(N/A)	0.4	0.1	13.33
Oak	3,806	103	(N/A)	0.3	0.2	34.38
Broadleaf Deciduous Small	938	25	(N/A)	0.3	0.0	8.48
American elm	3,644	99	(N/A)	0.3	0.1	32.92
Ginkgo	2,259	61	(N/A)	0.3	0.1	20.40
River birch	8,938	242	(N/A)	0.3	0.4	80.74
Boxelder	4,409	119	(N/A)	0.3	0.2	39.83
Conifer Evergreen Large	6,143	166	(N/A)	0.2	0.2	83.24
White ash	3,325	90	(N/A)	0.2	0.1	45.05
Hickory	4,056	110	(N/A)	0.2	0.2	54.96
Amur maple	1,841	50	(N/A)	0.2	0.1	24.94
Tulip tree	11,182	303	(N/A)	0.2	0.5	151.51
Scotch pine	1,539	42	(N/A)	0.1	0.1	41.70
Conifer Evergreen Medium	755	20	(N/A)	0.1	0.0	20.47
Dogwood	69	2	(N/A)	0.1	0.0	1.86
Ohio buckeye	1,409	38	(N/A)	0.1	0.1	38.19

Lilac	264	7	(N/A)	0.1	0.0	7.17
American chestnut	7,239	196	(N/A)	0.1	0.3	196.17
Basswood	608	16	(N/A)	0.1	0.0	16.47
Quaking aspen	172	5	(N/A)	0.1	0.0	4.65
White oak	2,591	70	(N/A)	0.1	0.1	70.21
Citywide total	2,481,496	67,249	(N/A)	100.0	100.0	67.72

Table 3: Annual Air Quality Benefits

Stuart

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 Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2							
Black maple	121.3	20.7	56.0	5.4	645	255.2	37.2	35.5	243.4	1,593	-40.1	-151	734.7	2,087 (N/A)	20.1	10.43
Silver maple	114.7	19.4	56.6	5.1	619	227.9	33.4	31.9	218.7	1,426	-61.5	-230	646.1	1,814 (N/A)	15.6	11.71
Green ash	39.1	6.2	19.2	1.8	210	156.9	22.9	21.8	149.3	978	0.0	0	417.2	1,188 (N/A)	13.9	8.61
Norway maple	19.1	3.3	9.6	0.8	104	61.9	9.0	8.5	58.3	384	-4.6	-17	165.9	471 (N/A)	6.1	7.71
Black walnut	12.1	1.9	6.3	0.5	66	65.0	9.5	9.1	62.4	407	0.0	0	166.8	472 (N/A)	5.9	8.00
Apple	3.5	0.6	1.7	0.2	19	17.4	2.5	2.4	16.1	107	0.0	0	44.3	126 (N/A)	3.4	3.71
Northern hackberry	8.2	1.4	4.5	0.4	46	38.6	5.6	5.4	36.6	241	0.0	0	100.7	286 (N/A)	3.0	9.54
Pin oak	15.4	2.7	8.0	0.7	85	42.7	6.2	5.9	40.5	266	-29.0	-109	93.2	242 (N/A)	2.8	8.64
Honeylocust	11.2	1.9	5.2	0.5	60	31.6	4.6	4.4	30.2	197	-8.3	-31	81.4	226 (N/A)	2.5	9.04
American basswood	7.8	1.3	3.9	0.3	42	26.4	3.8	3.6	24.6	163	-6.7	-25	65.0	180 (N/A)	1.9	9.48
Willow	3.8	0.6	2.0	0.2	21	13.7	2.0	1.9	12.7	85	-0.9	-4	35.8	102 (N/A)	1.8	5.65
Eastern red cedar	3.8	0.8	3.0	0.5	25	6.3	0.9	0.9	5.8	39	-10.3	-39	11.6	25 (N/A)	1.6	1.56
Siberian elm	9.3	1.6	4.5	0.4	50	22.2	3.2	3.1	21.1	138	0.0	0	65.4	188 (N/A)	1.4	13.44
Blue spruce	1.7	0.3	1.5	0.2	11	5.5	0.8	0.8	5.2	34	-5.0	-19	11.0	27 (N/A)	1.3	2.07
Bur oak	4.0	0.6	1.9	0.2	21	14.2	2.1	2.0	13.7	89	0.0	0	38.7	110 (N/A)	1.2	9.20
Northern red oak	3.7	0.6	1.8	0.2	20	9.8	1.4	1.4	9.3	61	-5.3	-20	23.0	61 (N/A)	1.1	5.58
Mulberry	3.2	0.5	1.5	0.1	17	8.7	1.2	1.2	8.0	54	0.0	0	24.5	71 (N/A)	1.1	6.42
Broadleaf Deciduous Large	8.5	1.4	3.8	0.4	44	19.0	2.8	2.6	18.0	118	0.0	0	56.4	163 (N/A)	1.1	14.78
Callery pear	2.4	0.4	1.3	0.1	13	10.3	1.5	1.4	9.8	64	-0.6	-2	26.5	75 (N/A)	1.1	6.81
Eastern white pine	2.6	0.5	2.2	0.3	17	6.5	1.0	0.9	6.3	41	-10.3	-39	10.1	20 (N/A)	1.0	1.97
Red maple	2.8	0.5	1.3	0.1	15	8.4	1.2	1.2	8.1	53	-1.0	-4	22.6	64 (N/A)	0.9	7.10
Broadleaf Deciduous Medium	0.5	0.1	0.3	0.0	3	3.9	0.6	0.5	3.6	24	-0.2	-1	9.4	26 (N/A)	0.7	3.78
Cottonwood	2.1	0.3	1.0	0.1	11	8.6	1.3	1.2	8.2	54	0.0	0	22.7	65 (N/A)	0.7	9.24
Elm	2.4	0.4	1.2	0.1	13	8.8	1.3	1.2	8.4	55	0.0	0	23.9	68 (N/A)	0.7	9.72
Spruce	1.2	0.2	1.1	0.2	8	3.9	0.6	0.6	3.8	25	-4.3	-16	7.3	17 (N/A)	0.7	2.43
Sugar maple	1.7	0.3	0.8	0.1	9	4.8	0.7	0.7	4.6	30	-1.3	-5	12.3	34 (N/A)	0.6	5.67
Littleleaf linden	1.8	0.3	0.9	0.1	10	5.0	0.7	0.7	4.8	31	-0.9	-3	13.4	38 (N/A)	0.5	7.56
American sycamore	2.9	0.5	1.3	0.1	15	7.6	1.1	1.1	7.2	47	0.0	0	21.8	63 (N/A)	0.5	12.52
Catalpa	4.4	0.7	2.0	0.2	23	9.5	1.4	1.3	9.0	59	0.0	0	28.4	82 (N/A)	0.5	16.39
Norway spruce	1.6	0.3	1.3	0.2	10	3.4	0.5	0.5	3.3	22	-6.7	-25	4.5	7 (N/A)	0.5	1.39
Eastern redbud	0.5	0.1	0.2	0.0	3	1.8	0.3	0.2	1.6	11	0.0	0	4.8	14 (N/A)	0.5	2.73
Kentucky coffeetree	1.0	0.2	0.5	0.0	5	3.4	0.5	0.5	3.2	21	0.0	0	9.3	27 (N/A)	0.4	6.67
Swamp white oak	0.5	0.1	0.3	0.0	3	3.3	0.5	0.5	3.1	20	-0.2	-1	8.1	23 (N/A)	0.4	5.69
Black cherry	0.6	0.1	0.3	0.0	3	2.1	0.3	0.3	1.9	13	0.0	0	5.6	16 (N/A)	0.4	4.00
Oak	0.3	0.1	0.2	0.0	2	2.2	0.3	0.3	2.1	14	0.0	0	5.4	15 (N/A)	0.3	5.11
Broadleaf Deciduous Small	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)	0.3	3.07
American elm	0.3	0.0	0.2	0.0	2	2.2	0.3	0.3	2.0	14	0.0	0	5.3	15 (N/A)	0.3	5.02
Ginkgo	0.5	0.1	0.2	0.0	3	2.0	0.3	0.3	1.9	13	-0.2	-1	5.1	14 (N/A)	0.3	4.83
River birch	1.9	0.3	0.9	0.1	10	4.2	0.6	0.6	4.0	26	-0.4	-2	12.3	35 (N/A)	0.3	11.69
Boxelder	0.5	0.1	0.2	0.0	3	2.5	0.4	0.3	2.4	15	-0.2	-1	6.1	17 (N/A)	0.3	5.73
Conifer Evergreen Large	0.7	0.1	0.6	0.1	5	1.5	0.2	0.2	1.4	9	-3.4	-13	1.5	1 (N/A)	0.2	0.62
White ash	0.2	0.0	0.1	0.0	1	2.4	0.4	0.3	2.4	15	0.0	0	5.9	17 (N/A)	0.2	8.32
Hickory	0.4	0.1	0.2	0.0	2	2.3	0.3	0.3	2.3	15	0.0	0	5.9	17 (N/A)	0.2	8.38
Amur maple	0.6	0.1	0.3	0.0	3	1.9	0.3	0.3	1.7	12	0.0	0	5.2	15 (N/A)	0.2	7.45
Tulip tree	1.7	0.3	0.7	0.1	9	3.7	0.5	0.5	3.5	23	0.0	0	10.9	32 (N/A)	0.2	15.76
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)	0.1	2.82
Conifer Evergreen Medium	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	2 (N/A)	0.1	1.53
Dogwood	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)	0.1	0.71
Ohio buckeye	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8 (N/A)	0.1	7.92
Lilac	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
American chestnut	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19 (N/A)	0.1	19.04
Basswood	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.1	2.99
Quaking aspen	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)	0.1	0.87
White oak	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)	0.1	9.34
Citywide total	428.7	72.5	211.9	20.0	2,317	1,146.8	167.2	159.5	1,092.0	7,153	-202.2	-758	3,096.5	8,712 (N/A)	100.0	8.77

Table 4: Annual Carbon Stored

Stuart

Stored CO2 Benefits of Public Trees

2/1/2023

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Black maple	1,300,234	9,752	(N/A)	20.1	14.9	48.76
Silver maple	2,681,903	20,114	(N/A)	15.6	30.7	129.77
Green ash	1,291,426	9,686	(N/A)	13.9	14.8	70.19
Norway maple	315,665	2,367	(N/A)	6.1	3.6	38.81
Black walnut	393,598	2,952	(N/A)	5.9	4.5	50.03
Apple	56,147	421	(N/A)	3.4	0.6	12.39
Northern hackberry	119,510	896	(N/A)	3.0	1.4	29.88
Pin oak	390,709	2,930	(N/A)	2.8	4.5	104.65
Honeylocust	142,209	1,067	(N/A)	2.5	1.6	42.66
American basswood	287,163	2,154	(N/A)	1.9	3.3	113.35
Willow	64,397	483	(N/A)	1.8	0.7	26.83
Eastern red cedar	12,297	92	(N/A)	1.6	0.1	5.76
Siberian elm	227,466	1,706	(N/A)	1.4	2.6	121.86
Blue spruce	9,408	71	(N/A)	1.3	0.1	5.43
Bur oak	134,192	1,006	(N/A)	1.2	1.5	83.87
Northern red oak	76,906	577	(N/A)	1.1	0.9	52.44
Mulberry	49,759	373	(N/A)	1.1	0.6	33.93
Broadleaf Deciduous	287,738	2,158	(N/A)	1.1	3.3	196.18
Callery pear	40,428	303	(N/A)	1.1	0.5	27.56
Eastern white pine	24,540	184	(N/A)	1.0	0.3	18.40
Red maple	31,166	234	(N/A)	0.9	0.4	25.97
Broadleaf Deciduous	9,346	70	(N/A)	0.7	0.1	10.01
Cottonwood	67,009	503	(N/A)	0.7	0.8	71.80
Elm	80,325	602	(N/A)	0.7	0.9	86.06
Spruce	9,451	71	(N/A)	0.7	0.1	10.13
Sugar maple	50,593	379	(N/A)	0.6	0.6	63.24
Littleleaf linden	38,693	290	(N/A)	0.5	0.4	58.04
American sycamore	94,637	710	(N/A)	0.5	1.1	141.96
Catalpa	146,176	1,096	(N/A)	0.5	1.7	219.26
Norway spruce	16,516	124	(N/A)	0.5	0.2	24.77
Eastern redbud	8,586	64	(N/A)	0.5	0.1	12.88
Kentucky coffeetree	31,916	239	(N/A)	0.4	0.4	59.84
Swamp white oak	9,450	71	(N/A)	0.4	0.1	17.72
Black cherry	9,466	71	(N/A)	0.4	0.1	17.75
Oak	10,527	79	(N/A)	0.3	0.1	26.32
Broadleaf Deciduous	3,959	30	(N/A)	0.3	0.0	9.90
American elm	8,559	64	(N/A)	0.3	0.1	21.40
Ginkgo	6,464	48	(N/A)	0.3	0.1	16.16
River birch	32,184	241	(N/A)	0.3	0.4	80.46
Boxelder	12,670	95	(N/A)	0.3	0.1	31.68
Conifer Evergreen La	8,661	65	(N/A)	0.2	0.1	32.48
White ash	7,344	55	(N/A)	0.2	0.1	27.54
Hickory	12,130	91	(N/A)	0.2	0.1	45.49
Amur maple	9,780	73	(N/A)	0.2	0.1	36.67
Tulip tree	55,031	413	(N/A)	0.2	0.6	206.37
Scotch pine	1,170	9	(N/A)	0.1	0.0	8.78
Conifer Evergreen M	284	2	(N/A)	0.1	0.0	2.13
Dogwood	178	1	(N/A)	0.1	0.0	1.33
Ohio buckeye	3,624	27	(N/A)	0.1	0.0	27.18
Lilac	908	7	(N/A)	0.1	0.0	6.81
American chestnut	39,259	294	(N/A)	0.1	0.4	294.44
Basswood	1,035	8	(N/A)	0.1	0.0	7.76
Quaking aspen	185	1	(N/A)	0.1	0.0	1.39
White oak	8,458	63	(N/A)	0.1	0.1	63.43
Citywide total	8,731,432	65,486	(N/A)	100.0	100.0	65.95

Table 5: Annual Carbon Sequestered

Stuart

Annual CO Benefits of Public Trees

2/1/2023

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Black maple	83,543	627	-6,241	-491	-50	90,127	676	166,938	1,252 (N/A)	20.1	17.8	6.26
Silver maple	199,410	1,496	-12,874	-532	-101	81,098	608	267,103	2,003 (N/A)	15.6	28.5	12.92
Green ash	74,559	559	-6,199	-342	-49	55,246	414	123,264	924 (N/A)	13.9	13.1	6.70
Norway maple	20,689	155	-1,517	-126	-12	21,544	162	40,590	304 (N/A)	6.1	4.3	4.99
Black walnut	30,749	231	-1,889	-134	-15	23,072	173	51,798	388 (N/A)	5.9	5.5	6.58
Apple	5,490	41	-270	-46	-2	5,962	45	11,135	84 (N/A)	3.4	1.2	2.46
Northern hackberry	8,171	61	-574	-70	-5	13,542	102	21,070	158 (N/A)	3.0	2.2	5.27
Pin oak	38,055	285	-1,875	-93	-15	15,004	113	51,090	383 (N/A)	2.8	5.4	13.68
Honeylocust	16,279	122	-683	-53	-6	11,188	84	26,731	200 (N/A)	2.5	2.9	8.02
American basswood	17,140	129	-1,378	-63	-11	9,101	68	24,800	186 (N/A)	1.9	2.6	9.79
Willow	3,683	28	-309	-32	-3	4,692	35	8,034	60 (N/A)	1.8	0.9	3.35
Eastern red cedar	482	4	-59	-24	-1	2,167	16	2,566	19 (N/A)	1.6	0.3	1.20
Siberian elm	9,025	68	-1,092	-51	-9	7,812	59	15,694	118 (N/A)	1.4	1.7	8.41
Blue spruce	819	6	-45	-20	0	1,934	15	2,687	20 (N/A)	1.3	0.3	1.55
Bur oak	6,124	46	-644	-31	-5	5,070	38	10,519	79 (N/A)	1.2	1.1	6.57
Northern red oak	2,739	21	-369	-25	-3	3,460	26	5,805	44 (N/A)	1.1	0.6	3.96
Mulberry	2,763	21	-239	-25	-2	2,977	22	5,477	41 (N/A)	1.1	0.6	3.73
Broadleaf Deciduous Large	7,691	58	-1,381	-44	-11	6,671	50	12,937	97 (N/A)	1.1	1.4	8.82
Callery pear	3,582	27	-194	-20	-2	3,612	27	6,980	52 (N/A)	1.1	0.7	4.76
Eastern white pine	1,511	11	-118	-23	-1	2,349	18	3,719	28 (N/A)	1.0	0.4	2.79
Red maple	3,957	30	-150	-16	-1	2,989	22	6,780	51 (N/A)	0.9	0.7	5.65
Broadleaf Deciduous Medi	1,601	12	-46	-8	0	1,339	10	2,886	22 (N/A)	0.7	0.3	3.09
Cottonwood	4,235	32	-322	-18	-3	3,030	23	6,925	52 (N/A)	0.7	0.7	7.42
Elm	4,188	31	-386	-19	-3	3,114	23	6,897	52 (N/A)	0.7	0.7	7.39
Spruce	818	6	-45	-14	0	1,423	11	2,182	16 (N/A)	0.7	0.2	2.34
Sugar maple	2,454	18	-244	-12	-2	1,688	13	3,886	29 (N/A)	0.6	0.4	4.86
Littleleaf linden	3,488	26	-186	-12	-1	1,763	13	5,053	38 (N/A)	0.5	0.5	7.58
American sycamore	3,944	30	-454	-18	-4	2,661	20	6,134	46 (N/A)	0.5	0.7	9.20
Catalpa	4,600	35	-702	-22	-5	3,321	25	7,197	54 (N/A)	0.5	0.8	10.80
Norway spruce	606	5	-79	-14	-1	1,237	9	1,750	13 (N/A)	0.5	0.2	2.62
Eastern redbud	245	2	-41	-6	0	594	4	792	6 (N/A)	0.5	0.1	1.19
Kentucky coffeetree	1,862	14	-153	-8	-1	1,202	9	2,903	22 (N/A)	0.4	0.3	5.44
Swamp white oak	1,220	9	-45	-6	0	1,142	9	2,310	17 (N/A)	0.4	0.2	4.33
Black cherry	342	3	-45	-7	0	707	5	996	7 (N/A)	0.4	0.1	1.87
Oak	1,077	8	-51	-5	0	759	6	1,781	13 (N/A)	0.3	0.2	4.45
Broadleaf Deciduous Smal	390	3	-19	-3	0	438	3	806	6 (N/A)	0.3	0.1	2.02
American elm	564	4	-41	-5	0	755	6	1,273	10 (N/A)	0.3	0.1	3.18
Ginkgo	417	3	-31	-6	0	715	5	1,096	8 (N/A)	0.3	0.1	2.74
River birch	1,126	8	-154	-9	-1	1,472	11	2,435	18 (N/A)	0.3	0.3	6.09
Boxelder	1,293	10	-61	-6	0	875	7	2,102	16 (N/A)	0.3	0.2	5.26
Conifer Evergreen Large	372	3	-42	-5	0	527	4	852	6 (N/A)	0.2	0.1	3.20
White ash	987	7	-35	-4	0	898	7	1,846	14 (N/A)	0.2	0.2	6.92
Hickory	1,105	8	-58	-5	0	834	6	1,876	14 (N/A)	0.2	0.2	7.04
Amur maple	268	2	-47	-5	0	643	5	859	6 (N/A)	0.2	0.1	3.22
Tulip tree	1,769	13	-264	-9	-2	1,287	10	2,783	21 (N/A)	0.2	0.3	10.44
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	0.1	0.0	2.43
Conifer Evergreen Mediun	39	0	-1	-1	0	106	1	142	1 (N/A)	0.1	0.0	1.07
Dogwood	38	0	-1	-1	0	37	0	74	1 (N/A)	0.1	0.0	0.55
Ohio buckeye	386	3	-17	-2	0	395	3	762	6 (N/A)	0.1	0.1	5.71
Lilac	114	1	-4	-1	0	124	1	232	2 (N/A)	0.1	0.0	1.74
American chestnut	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.1	0.2	10.90
Basswood	209	2	-5	-1	0	159	1	361	3 (N/A)	0.1	0.0	2.71
Quaking aspen	74	1	-1	-1	0	49	0	121	1 (N/A)	0.1	0.0	0.91
White oak	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.1	0.1	7.93
Citywide total	577,983	4,335	-41,916	-2,502	-333	404,302	3,032	937,866	7,034 (N/A)	100.0	100.0	7.08

Table 6: Annual Social and Aesthetic Benefits

Stuart

Annual Aesthetic/Other Benefits of Public Trees

2/1/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Black maple	10,422	(N/A)	20.1	18.8	52.11
Silver maple	15,601	(N/A)	15.6	28.1	100.65
Green ash	6,670	(N/A)	13.9	12.0	48.34
Norway maple	2,053	(N/A)	6.1	3.7	33.65
Black walnut	2,867	(N/A)	5.9	5.2	48.58
Apple	314	(N/A)	3.4	0.6	9.24
Northern hackberry	1,317	(N/A)	3.0	2.4	43.89
Pin oak	3,053	(N/A)	2.8	5.5	109.03
Honeylocust	3,652	(N/A)	2.5	6.6	146.07
American basswood	1,246	(N/A)	1.9	2.2	65.60
Willow	419	(N/A)	1.8	0.8	23.29
Eastern red cedar	195	(N/A)	1.6	0.4	12.16
Siberian elm	621	(N/A)	1.4	1.1	44.35
Blue spruce	290	(N/A)	1.3	0.5	22.27
Bur oak	549	(N/A)	1.2	1.0	45.73
Northern red oak	213	(N/A)	1.1	0.4	19.40
Mulberry	164	(N/A)	1.1	0.3	14.89
Broadleaf Deciduous Large	577	(N/A)	1.1	1.0	52.45
Callery pear	371	(N/A)	1.1	0.7	33.75
Eastern white pine	361	(N/A)	1.0	0.7	36.14
Red maple	535	(N/A)	0.9	1.0	59.46
Broadleaf Deciduous Medium	183	(N/A)	0.7	0.3	26.16
Cottonwood	368	(N/A)	0.7	0.7	52.55
Elm	360	(N/A)	0.7	0.6	51.37
Spruce	224	(N/A)	0.7	0.4	32.01
Sugar maple	250	(N/A)	0.6	0.5	41.66
Littleleaf linden	353	(N/A)	0.5	0.6	70.69
American sycamore	294	(N/A)	0.5	0.5	58.79
Catalpa	315	(N/A)	0.5	0.6	63.09
Norway spruce	159	(N/A)	0.5	0.3	31.76
Eastern redbud	13	(N/A)	0.5	0.0	2.57
Kentucky coffeetree	161	(N/A)	0.4	0.3	40.16
Swamp white oak	131	(N/A)	0.4	0.2	32.69
Black cherry	19	(N/A)	0.4	0.0	4.80
Oak	115	(N/A)	0.3	0.2	38.27
Broadleaf Deciduous Small	22	(N/A)	0.3	0.0	7.31
American elm	91	(N/A)	0.3	0.2	30.26
Ginkgo	36	(N/A)	0.3	0.1	12.10
River birch	102	(N/A)	0.3	0.2	34.03
Boxelder	118	(N/A)	0.3	0.2	39.36
Conifer Evergreen Large	59	(N/A)	0.2	0.1	29.29
White ash	127	(N/A)	0.2	0.2	63.74
Hickory	104	(N/A)	0.2	0.2	51.77
Amur maple	15	(N/A)	0.2	0.0	7.74
Tulip tree	124	(N/A)	0.2	0.2	61.96
Scotch pine	32	(N/A)	0.1	0.1	32.32
Conifer Evergreen Medium	21	(N/A)	0.1	0.0	21.08
Dogwood	2	(N/A)	0.1	0.0	2.06

Ohio buckeye	39 (N/A)	0.1	0.1	39.16
Lilac	6 (N/A)	0.1	0.0	6.40
American chestnut	58 (N/A)	0.1	0.1	58.34
Basswood	29 (N/A)	0.1	0.1	28.56
Quaking aspen	15 (N/A)	0.1	0.0	14.73
White oak	58 (N/A)	0.1	0.1	57.69
Citywide total	55,492 (N/A)	100.0	100.0	55.88

Table 7: Summary of Benefits in Dollars

Stuart

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 $
Black maple	11,177	1,252	2,087	13,186	10,422	38,123	(N/A)	20.2
Silver maple	9,893	2,003	1,814	18,033	15,601	47,344	(N/A)	25.1
Green ash	6,885	924	1,188	8,985	6,670	24,653	(N/A)	13.1
Norway maple	2,744	304	471	2,784	2,053	8,355	(N/A)	4.4
Black walnut	2,815	388	472	3,250	2,867	9,793	(N/A)	5.2
Apple	793	84	126	358	314	1,675	(N/A)	0.9
Northern hackberry	1,698	158	286	1,670	1,317	5,128	(N/A)	2.7
Pin oak	1,880	383	242	2,520	3,053	8,078	(N/A)	4.3
Honeylocust	1,378	200	226	1,643	3,652	7,099	(N/A)	3.8
American basswood	1,185	186	180	1,593	1,246	4,390	(N/A)	2.3
Willow	624	60	102	589	419	1,794	(N/A)	1.0
Eastern red cedar	286	19	25	508	195	1,032	(N/A)	0.5
Siberian elm	972	118	188	1,424	621	3,322	(N/A)	1.8
Blue spruce	246	20	27	394	290	977	(N/A)	0.5
Bur oak	614	79	110	812	549	2,164	(N/A)	1.1
Northern red oak	426	44	61	495	213	1,239	(N/A)	0.7
Mulberry	398	41	71	247	164	920	(N/A)	0.5
Broadleaf Deciduous La	832	97	163	1,387	577	3,055	(N/A)	1.6
Callery pear	449	52	75	395	371	1,343	(N/A)	0.7
Eastern white pine	274	28	20	616	361	1,300	(N/A)	0.7
Red maple	367	51	64	354	535	1,370	(N/A)	0.7
Broadleaf Deciduous M	178	22	26	122	183	531	(N/A)	0.3
Cottonwood	377	52	65	492	368	1,353	(N/A)	0.7
Elm	386	52	68	539	360	1,404	(N/A)	0.7
Spruce	165	16	17	305	224	727	(N/A)	0.4
Sugar maple	211	29	34	332	250	856	(N/A)	0.5
Littleleaf linden	221	38	38	284	353	934	(N/A)	0.5
American sycamore	338	46	63	570	294	1,310	(N/A)	0.7
Catalpa	417	54	82	797	315	1,665	(N/A)	0.9
Norway spruce	147	13	7	369	159	695	(N/A)	0.4
Eastern redbud	84	6	14	47	13	163	(N/A)	0.1
Kentucky coffeetree	153	22	27	223	161	586	(N/A)	0.3
Swamp white oak	142	17	23	108	131	421	(N/A)	0.2
Black cherry	101	7	16	53	19	197	(N/A)	0.1
Oak	99	13	15	103	115	345	(N/A)	0.2
Broadleaf Deciduous Sn	57	6	9	25	22	120	(N/A)	0.1
American elm	98	10	15	99	91	312	(N/A)	0.2
Ginkgo	87	8	14	61	36	207	(N/A)	0.1
River birch	188	18	35	242	102	586	(N/A)	0.3
Boxelder	108	16	17	119	118	378	(N/A)	0.2
Conifer Evergreen Large	62	6	1	166	59	295	(N/A)	0.2
White ash	96	14	17	90	127	344	(N/A)	0.2
Hickory	102	14	17	110	104	346	(N/A)	0.2
Amur maple	84	6	15	50	15	171	(N/A)	0.1
Tulip tree	162	21	32	303	124	641	(N/A)	0.3
Scotch pine	24	2	3	42	32	103	(N/A)	0.1
Conifer Evergreen Medi	15	1	2	20	21	59	(N/A)	0.0
Dogwood	5	1	1	2	2	11	(N/A)	0.0
Ohio buckeye	47	6	8	38	39	138	(N/A)	0.1
Lilac	18	2	3	7	6	36	(N/A)	0.0
American chestnut	91	11	19	196	58	375	(N/A)	0.2
Basswood	21	3	3	16	29	71	(N/A)	0.0
Quaking aspen	6	1	1	5	15	27	(N/A)	0.0
White oak	57	8	9	70	58	202	(N/A)	0.1
Citywide Total	50,281	7,034	8,712	67,249	55,492	188,767	(N/A)	100.0

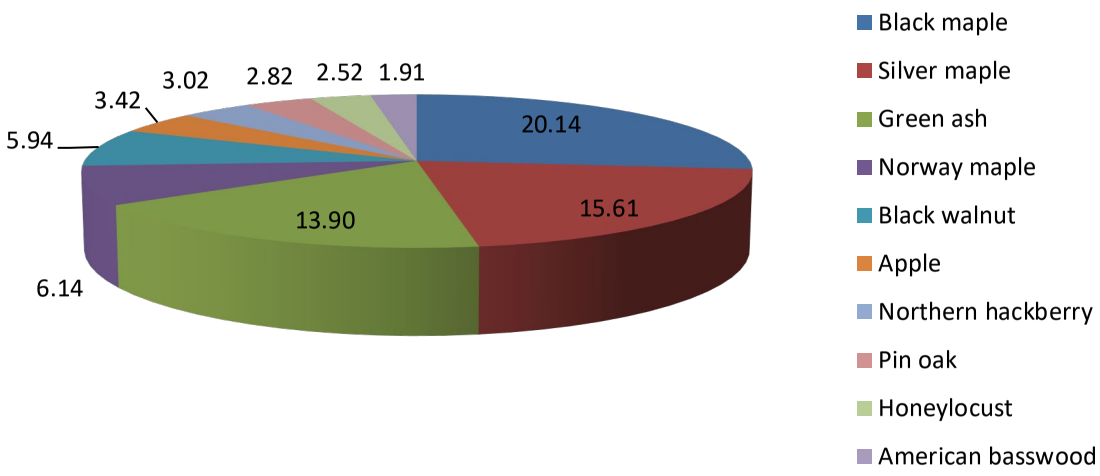

Figure 1: Species Distribution

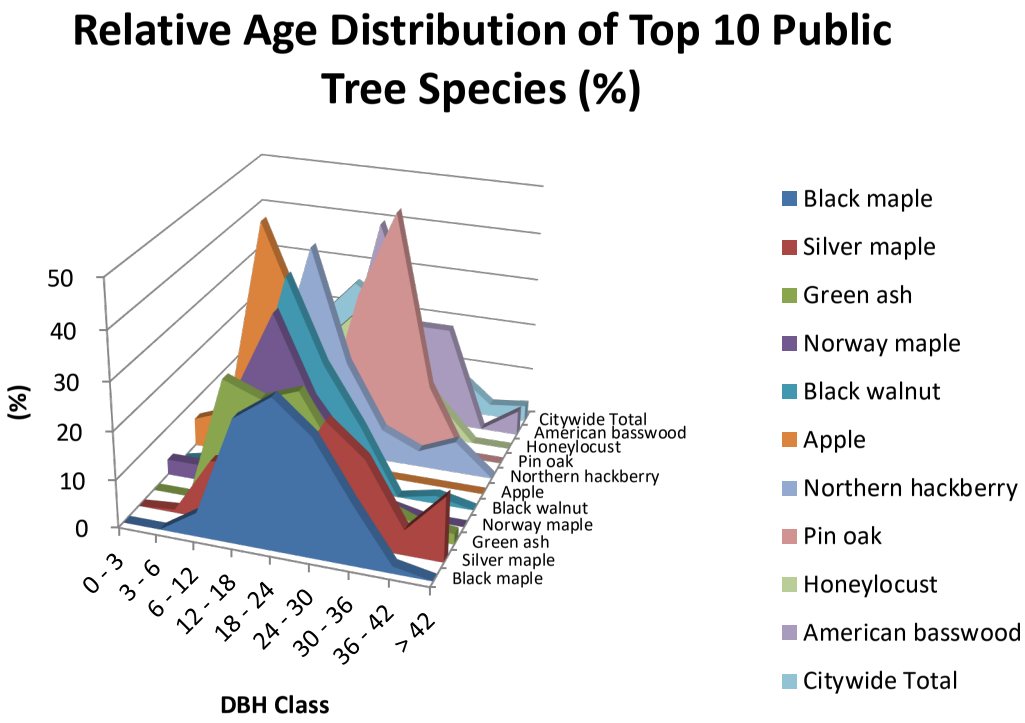

Figure 2: Relative Age Class

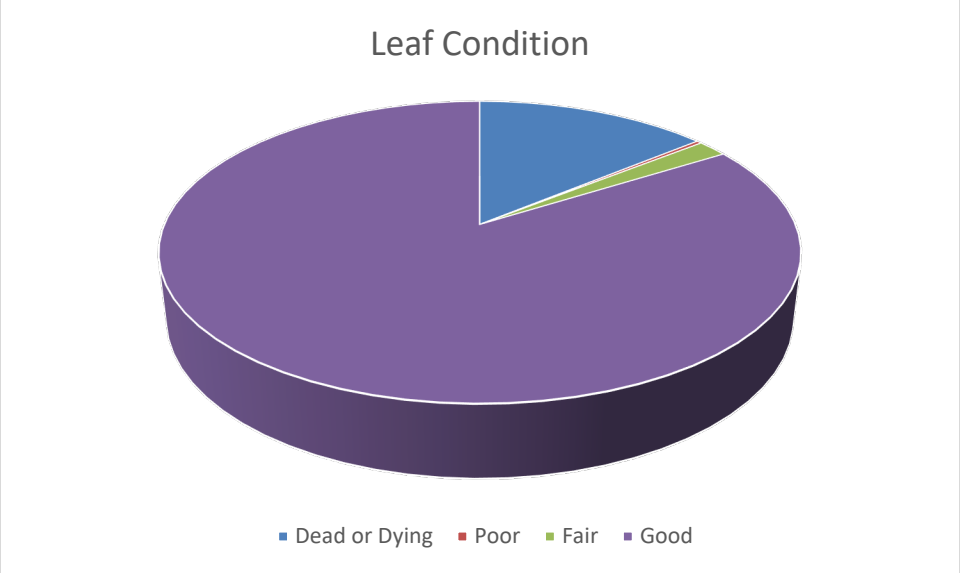

Figure 3: Foliage Condition

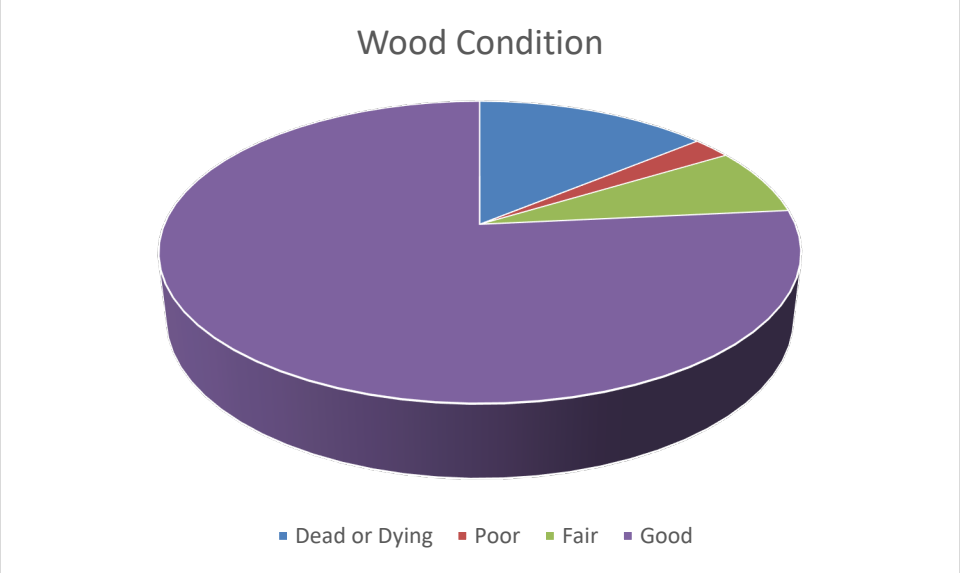

Figure 4: Wood Condition

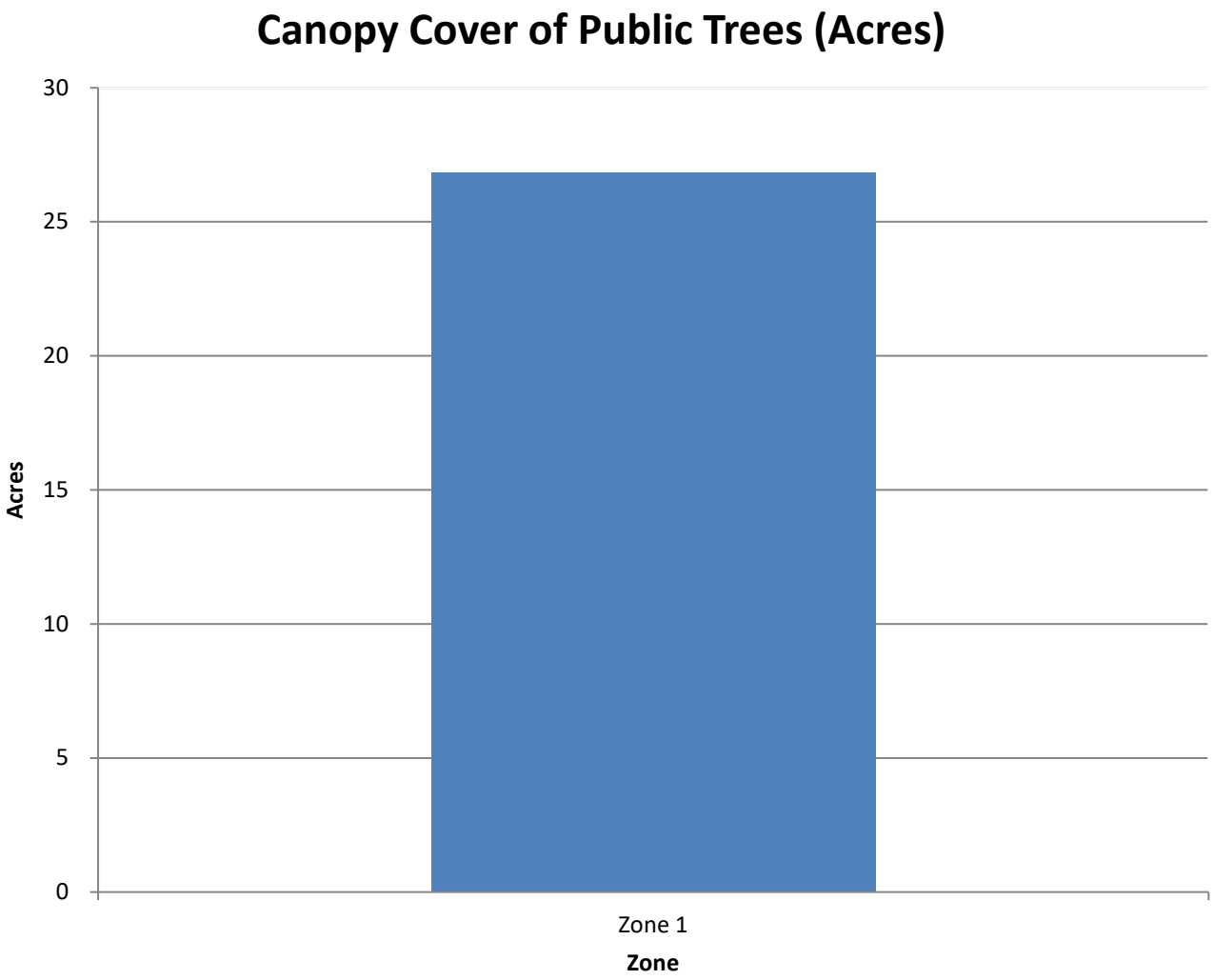

Figure 5: Canopy Cover in Acres

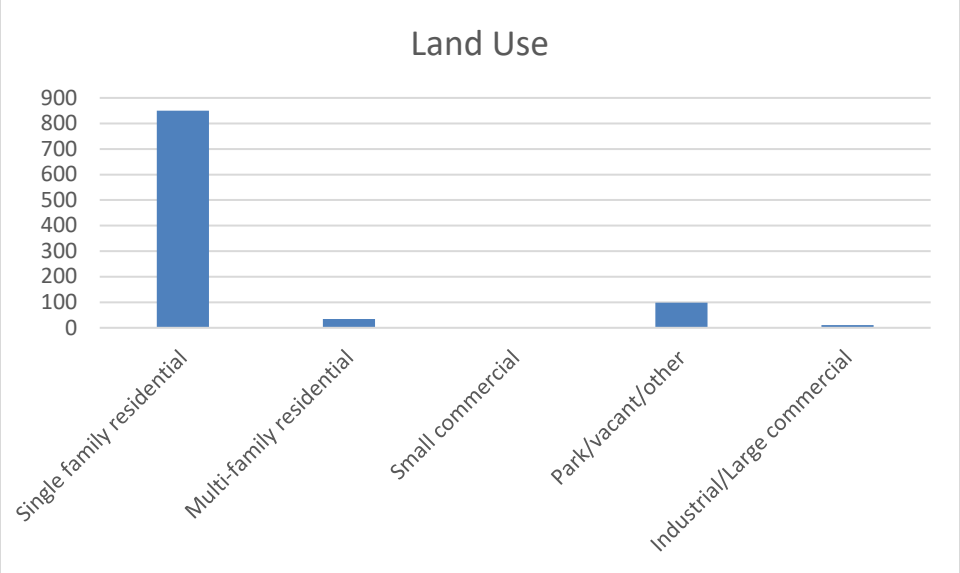

Figure 6: Land Use of city/park trees

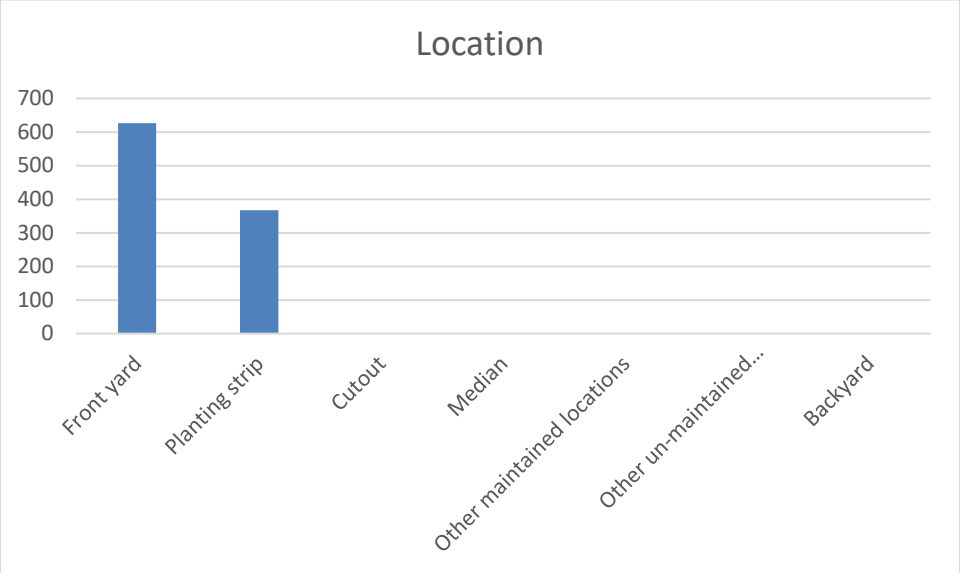

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

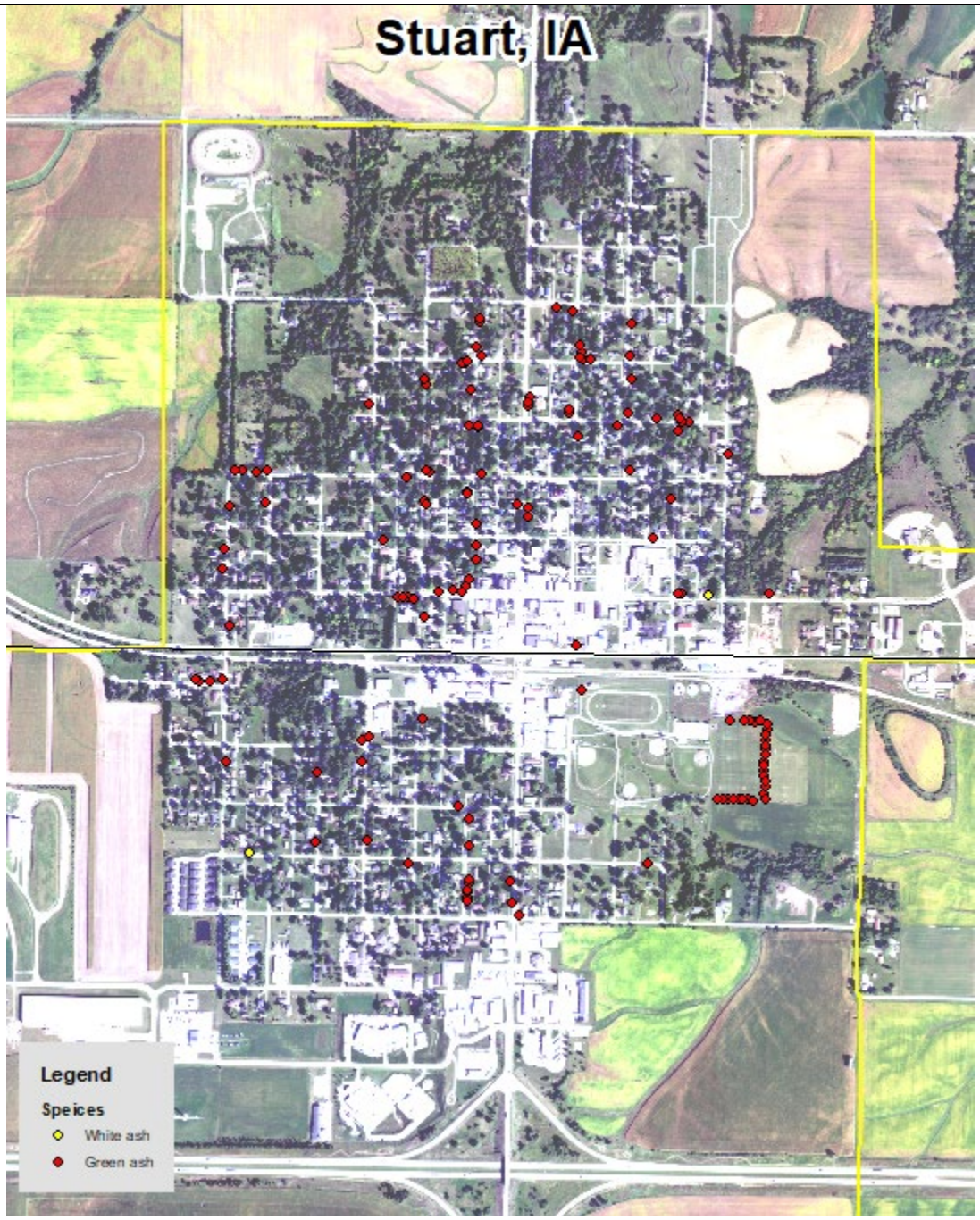

Figure 1: Location of Ash Trees

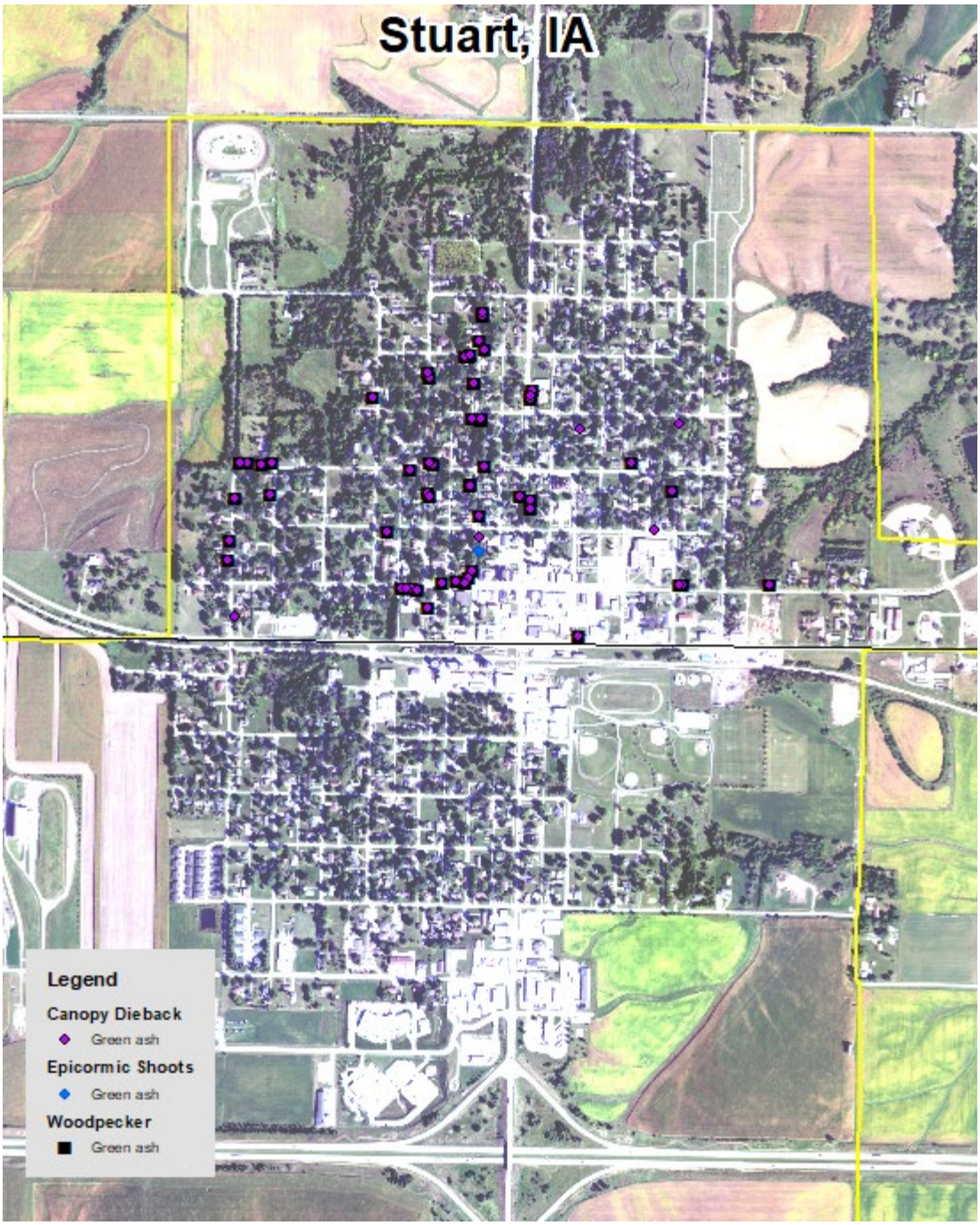

Figure 2: Location of EAB symptoms

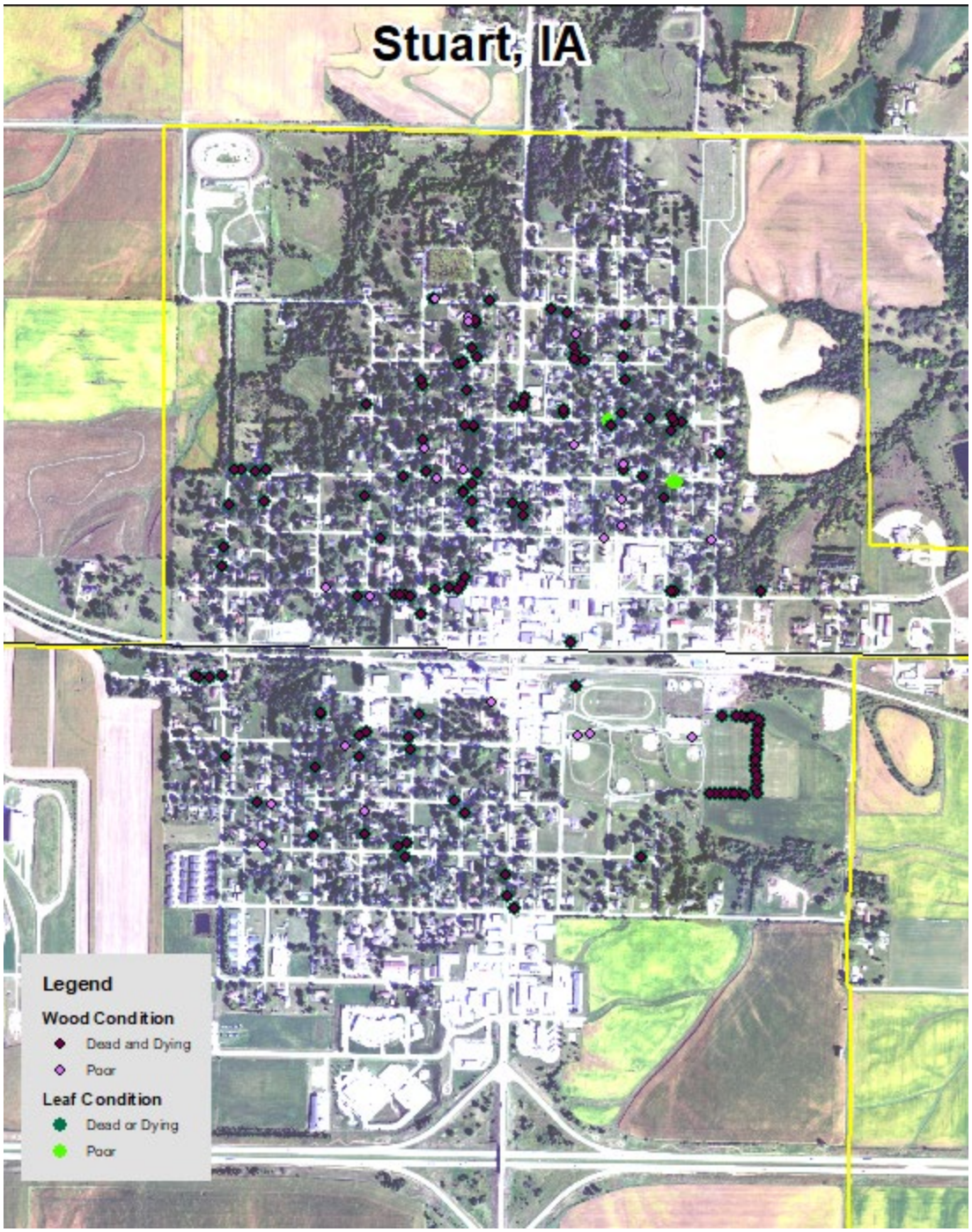

Figure 3: Location of Poor Condition Trees

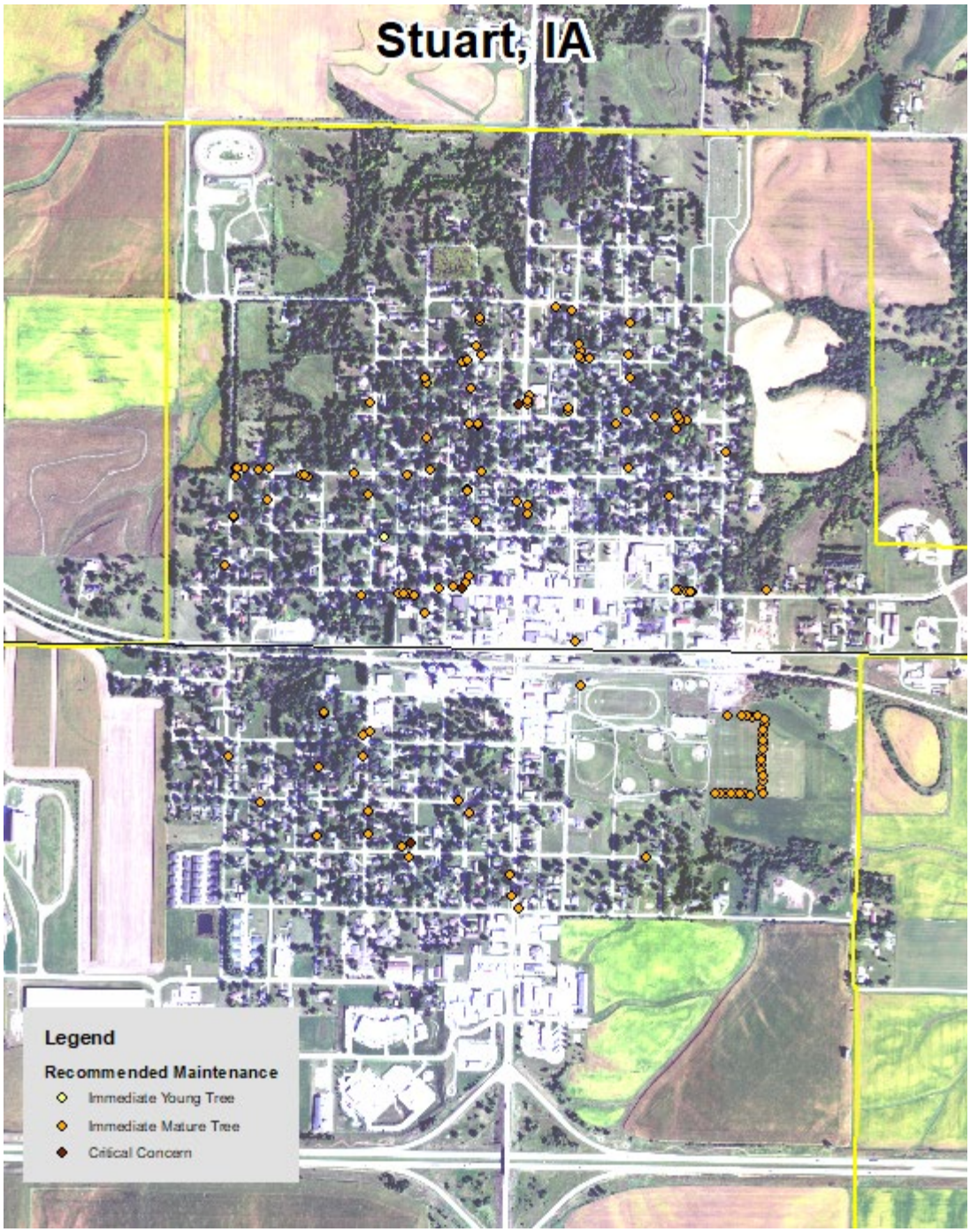

Figure 4: Location of Trees with Recommended Maintenance

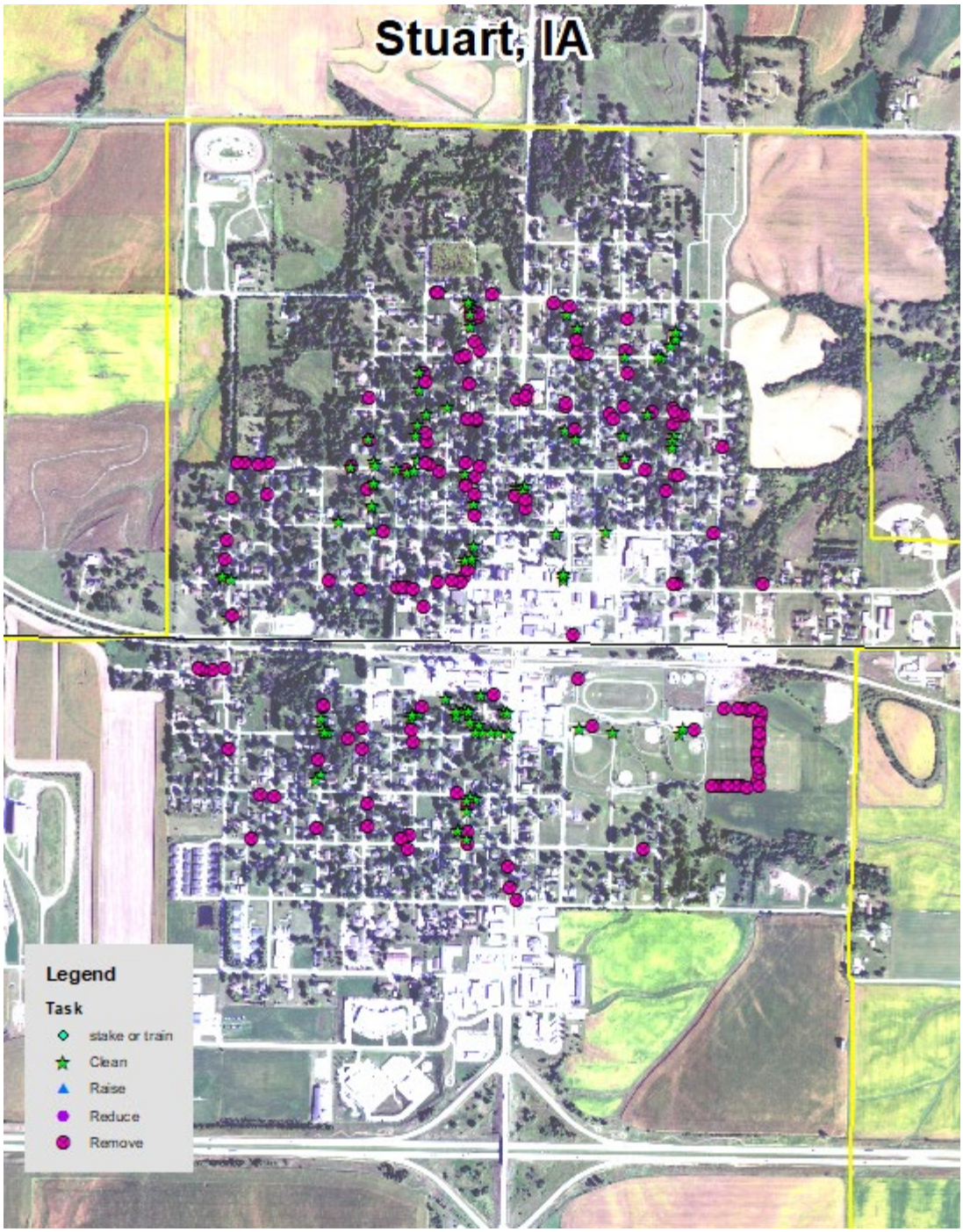

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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