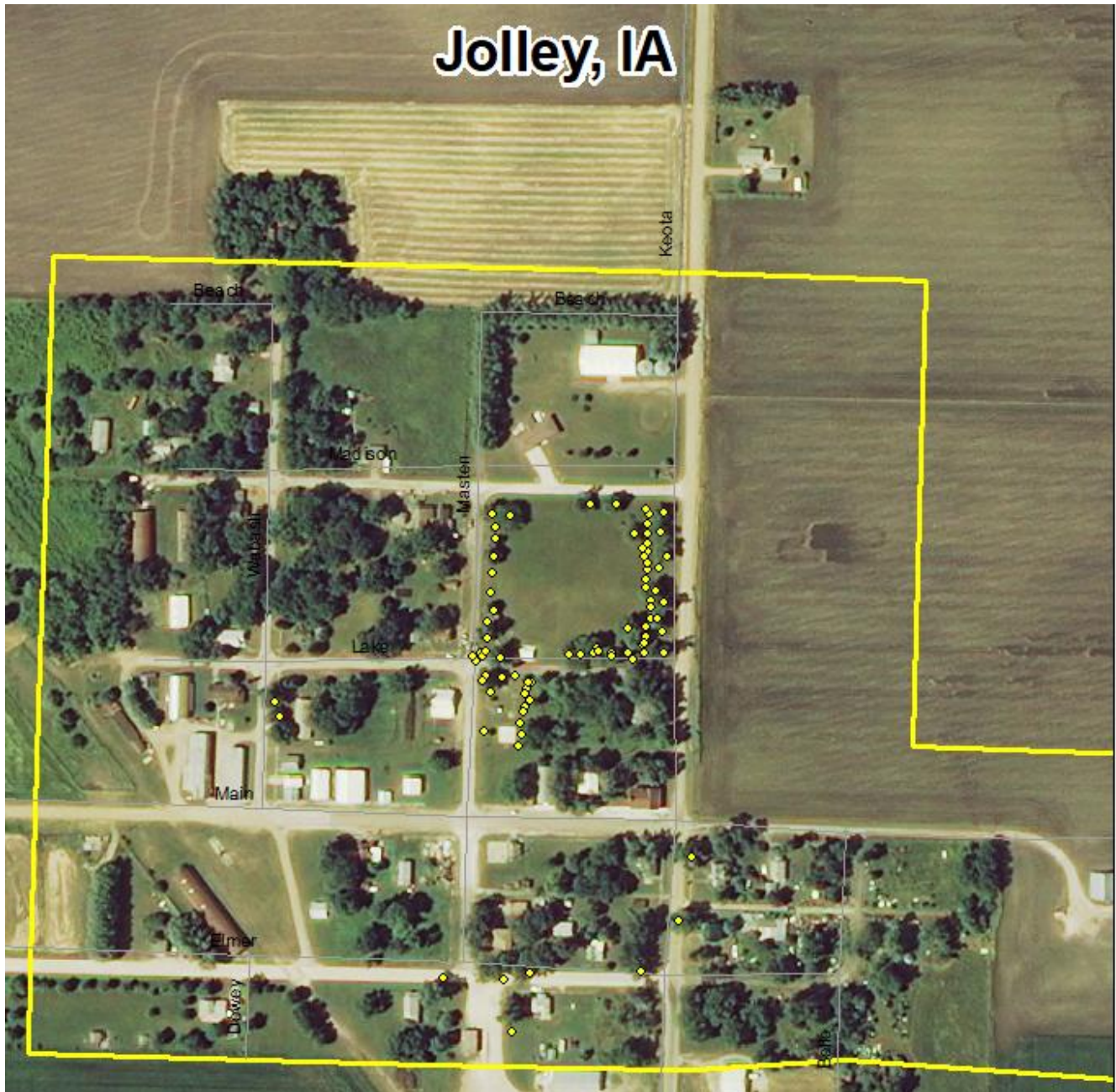


Jolley, IA



2018 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Jolley 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 14.5% of Jolley'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 2018, 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 for the 83 trees inventoried.

- Jolley's trees provide \$11,067 of benefits annually, an average of \$133 a tree
- There are over 10 species of trees
- The top three genera are: Maple 42.2%, Ash 14.5%, and Hackberry 14.5%
- 89% of trees are in need of some type of management
- 9 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 9 trees needing removal, 2 trees are over 30 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*](#)
- 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 a yearly budget of \$1,000 it could take nearly ten years to remove all ash – Suggestion: request a budget increase to \$1,500 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Jolley with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal or treatment and replacement planting. With proper planning and management of the current canopy in Jolley, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2018, a tree inventory was conducted that included 100% of the city-owned street and park trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft., recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms associated with EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory Results

The data collected for the 83 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. Jolley's trees reduce energy related costs by approximately \$2,878 annually (Appendix A, Table 1). These savings are both in Electricity (13.5 MWh) and in Natural Gas (1,889.3 Therms).

Annual Stormwater Benefits

Jolley's trees intercept about 160,074 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$4,338 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 Jolley, it is estimated that trees remove 184.6 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 \$528 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Jolley, trees sequester about 28,208 lbs. of carbon a year with an associated value of \$212 (Appendix A, Table 5). In addition, the trees store 636,619 lbs. of carbon, with a yearly benefit of \$4,775 (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. Jolley receives \$2,966 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, Jolley's trees provide \$11,067 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 83 trees in Jolley provide approximately \$133 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Jolley has over 10 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	35	42.2%
Ash	12	14.5%
Hackberry	12	14.5%
Black Walnut	10	12.0%
Apple	6	7.2%
Honeylocust	1	1.2%
Japanese Tree Lilac	1	1.2%
Littleleaf Linden	1	1.2%
Northern White Cedar	1	1.2%
Spruce	1	1.2%
UNKNOWN	3	3.6%

Age Class

Most of Jolley's trees (61.4%) are less than 24 inches in diameter at 4.5 ft. (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Jolley's size curve is on the smaller side, indicating a younger 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 Jolley indicate that 92.8% of the trees are in fair or good health, with only 7.2% of the foliage classified as dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 85.5% of Jolley's trees are in fair or 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 14.5% of the population. This 14.5% 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).

Stake/Train	35	42.2%
Clean	29	34.9%
Remove	9	10.8%
Raise	1	1.2%

Canopy Cover

The total canopy with both private and public trees is 2.2%. The canopy cover included in the Jolley inventory includes approximately 1.67 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Jolley’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>	
Industrial/Large Commercial	89.2%
Single Family Residential	10.8%
<u>Location</u>	
Front Yard	95.2%
Planting Strip	4.8%

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

Jolley has 3 trees in need of removal as soon as possible. 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 is one trees over 42 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 these trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 71 additional trees with these needs. [*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 Jolley.

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 (42.2%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan with No Additional Funding

Year 1

- Removal: 1 critical concern ash tree
- Planting and Replacement: 1 tree to be planted in open locations
- Young Tree Pruning & Maintenance:
- Visual Survey for signs and symptoms of EAB

Year 2

- Removal: 1 tree requiring immediate attention
- Planting and Replacement: 1 tree to be planted in open locations
- Young Tree Pruning & Maintenance:
- Routine trimming: Contract to trim 1/3 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 3

- Removal: 1 tree - removal of any new critical concern trees and ash in poor health
- *Or saving for ash tree treatment and/or future ash removal
- Planting and Replacement: 2 trees to be planted in open locations and locations from previous removals
- Young Tree Pruning & Maintenance:
- Visual Survey for signs and symptoms of EAB

Year 4

- Removal: 1 tree - removal of any new critical concern trees and ash in poor health
- *Or saving for ash tree treatment and/or future ash removal
- Planting and Replacement: 1 trees in open locations from previous removals
- Routine trimming: Contract to trim 1/3 of the city trees
- Young Tree Pruning & Maintenance:
- Visual Survey for signs and symptoms of EAB

Year 5

Removal: 1 tree - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment and/or future ash removal

Planting and Replacement: 2 trees to be planted in open locations and locations from previous removals

Young Tree Pruning & Maintenance:

Visual Survey for signs and symptoms of EAB

Year 6

Removal: 1 tree - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment and/or future ash removal

Planting and Replacement: 1 trees in open locations from previous removals

Routine trimming: Contract to trim 1/3 of the city trees

Young Tree Pruning & Maintenance:

Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 2 to 6 ash trees removed (17-50% of ash). It will take approximately 10 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.

**To remove all ash trees within 6 years, the budget would need to be increased to more than \$1,500 a year. If the budget were increased to \$2,000 a year all ash could be removed in less than 5 years.

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). **City ownership of the tree recommended for removal should be verified prior to any removal**

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit <http://extension.entm.purdue.edu/treecomputer/>

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)

- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

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

Monitoring

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

Private Ash Trees

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

Budget

Current Budget

Total \$6,000 over 6 years (\$1,000/year)

FY 2020 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$100

Watering & Maintenance: \$25

FY 2021 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$100

Routine trimming: \$75

Watering & Maintenance: \$50

FY 2022 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$200

Watering & Maintenance: \$75

FY 2023 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$100

Routine trimming: \$125

Watering & Maintenance: \$75

FY 2024 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$100

Watering & Maintenance: \$75

FY 2025 Budget

Removal: \$750

*Or saving for ash tree treatment and/or future ash removal

Planting: \$200

Routine trimming: \$125

Watering & Maintenance: \$100

***Reduction of ash over 6 years: approximately 2 to 6 ash trees removed (17-50% of ash). It will take approximately 10 years to remove all ash with a budget of \$1,000 per year.**

Purposed Budget Increase

EAB could potentially kill all ash trees in Jolley within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$1,600 a year. If the budget were increased to \$2,000 a year all ash could be removed within 5 years. Additionally, it is recommended that Jolley apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 32 inches and at \$15 per inch, about 2 trees could be treated per year (every other year treatment). This would be 6 trees selected for treatment, and Jolley would still need to find upwards of \$5,000 for removal of its six additional ash trees.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Jolley

Annual Energy Benefits of Public Trees

3/29/2018

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	1.4	106	193.1	189	295	(N/A)	28.9	10.3	12.31
Green ash	4.5	341	622.8	610	952	(N/A)	14.5	33.1	79.32
Northern hackberry	4.2	317	594.5	583	899	(N/A)	14.5	31.3	74.95
Black walnut	1.4	108	191.1	187	295	(N/A)	12.0	10.3	29.50
Maple	0.3	23	44.3	43	67	(N/A)	8.4	2.3	9.55
Apple	0.3	22	47.0	46	68	(N/A)	7.2	2.4	11.30
Boxelder	0.3	21	38.9	38	59	(N/A)	3.6	2.0	19.62
UNKNOWN	0.0	0	0.0	0	0	(N/A)	3.6	0.0	0.00
Japanese tree lilac	0.2	15	31.6	31	46	(N/A)	1.2	1.6	46.14
Honeylocust	0.4	28	47.4	46	74	(N/A)	1.2	2.6	74.28
Northern white cedar	0.0	0	0.7	1	1	(N/A)	1.2	0.0	0.93
Norway maple	0.2	18	29.5	29	47	(N/A)	1.2	1.6	46.78
Littleleaf linden	0.2	17	33.8	33	50	(N/A)	1.2	1.7	50.34
Spruce	0.1	10	14.6	14	24	(N/A)	1.2	0.8	24.14
Total	13.5	1,026	1,889.3	1,852	2,878	(N/A)	100.0	100.0	34.67

Table 2: Annual Stormwater Benefits

Jolley

Annual Stormwater Benefits of Public Trees

3/29/2018

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	21,136	573	(N/A)	28.9	13.2	23.87
Green ash	61,841	1,676	(N/A)	14.5	38.6	139.66
Northern hackberry	42,396	1,149	(N/A)	14.5	26.5	95.74
Black walnut	15,935	432	(N/A)	12.0	10.0	43.18
Maple	2,937	80	(N/A)	8.4	1.8	11.37
Apple	1,468	40	(N/A)	7.2	0.9	6.63
Boxelder	3,139	85	(N/A)	3.6	2.0	28.36
UNKNOWN	0	0	(N/A)	3.6	0.0	0.00
Japanese tree lilac	1,174	32	(N/A)	1.2	0.7	31.82
Honeylocust	4,685	127	(N/A)	1.2	2.9	126.96
Northern white cedar	49	1	(N/A)	1.2	0.0	1.32
Norway maple	1,409	38	(N/A)	1.2	0.9	38.19
Littleleaf linden	2,366	64	(N/A)	1.2	1.5	64.13
Spruce	1,539	42	(N/A)	1.2	1.0	41.70
Citywide total	160,074	4,338	(N/A)	100.0	100.0	52.27

Table 3: Annual Air Quality Benefits

Jolley

Annual Air Quality Benefits of Public Trees

3/29/2018

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								
Silver maple	3.6	0.6	1.8	0.2	20	6.7	1.0	0.9	6.3	42	-1.8	-7	19.2	54 (N/A)		28.9	2.26
Green ash	9.3	1.5	4.2	0.4	49	21.5	3.1	3.0	20.4	134	0.0	0	63.4	183 (N/A)		14.5	15.22
Northern hackberry	6.8	1.2	3.4	0.3	37	20.2	2.9	2.8	18.9	125	0.0	0	56.5	162 (N/A)		14.5	13.51
Black walnut	2.5	0.4	1.1	0.1	13	6.7	1.0	0.9	6.4	42	0.0	0	19.2	55 (N/A)		12.0	5.52
Maple	0.7	0.1	0.3	0.0	4	1.5	0.2	0.2	1.4	9	-0.2	-1	4.3	12 (N/A)		8.4	1.76
Apple	0.5	0.1	0.2	0.0	3	1.4	0.2	0.2	1.3	9	0.0	0	3.9	11 (N/A)		7.2	1.89
Boxelder	0.4	0.1	0.2	0.0	2	1.3	0.2	0.2	1.2	8	-0.2	-1	3.5	10 (N/A)		3.6	3.27
UNKNOWN	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)		3.6	0.00
Japanese tree lilac	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8 (N/A)		1.2	8.35
Honeylocust	0.9	0.2	0.4	0.0	5	1.7	0.3	0.2	1.7	11	-0.8	-3	4.7	13 (N/A)		1.2	12.87
Northern white cedar	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)		1.2	0.05
Norway maple	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)		1.2	7.92
Littleleaf linden	0.4	0.1	0.2	0.0	2	1.1	0.2	0.2	1.0	7	-0.2	-1	2.9	8 (N/A)		1.2	8.23
Spruce	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)		1.2	2.82
Citywide total	26.0	4.3	12.4	1.2	139	64.9	9.4	9.0	61.3	403	-3.8	-14	184.6	528 (N/A)		100.0	6.36

Table 4: Annual Carbon Stored

Jolley

Stored CO2 Benefits of Public Trees

3/29/2018

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	79,640	597	(N/A)	28.9	12.5	24.89
Green ash	306,675	2,300	(N/A)	14.5	48.2	191.67
Northern hackberry	103,256	774	(N/A)	14.5	16.2	64.54
Black walnut	84,980	637	(N/A)	12.0	13.3	63.73
Maple	8,046	60	(N/A)	8.4	1.3	8.62
Apple	7,706	58	(N/A)	7.2	1.2	9.63
Boxelder	14,314	107	(N/A)	3.6	2.2	35.78
UNKNOWN	0	0	(N/A)	3.6	0.0	0.00
Japanese tree lilac	6,743	51	(N/A)	1.2	1.1	50.57
Honeylocust	12,245	92	(N/A)	1.2	1.9	91.84
Northern white cedar	2	0	(N/A)	1.2	0.0	0.02
Norway maple	3,624	27	(N/A)	1.2	0.6	27.18
Littleleaf linden	8,218	62	(N/A)	1.2	1.3	61.63
Spruce	1,170	9	(N/A)	1.2	0.2	8.78
Citywide total	636,619	4,775	(N/A)	100.0	100.0	57.53

Table 5: Annual Carbon Sequestered

Jolley

Annual CO₂ Benefits of Public Trees

3/29/2018

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
Silver maple	5,663	42	-383	-18	-3	2,345	18	7,607	57 (N/A)	28.9	16.0	2.38
Green ash	10,379	78	-1,472	-50	-11	7,546	57	16,402	123 (N/A)	14.5	34.4	10.25
Northern hackberry	5,488	41	-496	-40	-4	7,002	53	11,954	90 (N/A)	14.5	25.1	7.47
Black walnut	2,663	20	-408	-16	-3	2,380	18	4,618	35 (N/A)	12.0	9.7	3.46
Maple	17	0	-39	-4	0	518	4	492	4 (N/A)	8.4	1.0	0.53
Apple	149	1	-37	-5	0	481	4	587	4 (N/A)	7.2	1.2	0.73
Boxelder	1,070	8	-69	-4	-1	459	3	1,456	11 (N/A)	3.6	3.1	3.64
UNKNOWN	0	0	0	0	0	0	0	0	0 (N/A)	3.6	0.0	0.00
Japanese tree lilac	0	0	-32	-4	0	335	3	299	2 (N/A)	1.2	0.6	2.24
Honeylocust	1,486	11	-59	-3	0	615	5	2,039	15 (N/A)	1.2	4.3	15.29
Northern white cedar	4	0	0	0	0	6	0	9	0 (N/A)	1.2	0.0	0.07
Norway maple	386	3	-17	-2	0	395	3	762	6 (N/A)	1.2	1.6	5.71
Littleleaf linden	789	6	-39	-3	0	380	3	1,127	8 (N/A)	1.2	2.4	8.45
Spruce	116	1	-6	-2	0	216	2	324	2 (N/A)	1.2	0.7	2.43
Citywide total	28,208	212	-3,058	-150	-24	22,678	170	47,678	358 (N/A)	100.0	100.0	4.31

Table 6: Annual Social and Aesthetic Benefits

Jolley

Annual Aesthetic/Other Benefits of Public Trees

3/29/2018

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	616	(N/A)	28.9	20.8	25.66
Green ash	741	(N/A)	14.5	25.0	61.75
Northern hackberry	706	(N/A)	14.5	23.8	58.81
Black walnut	253	(N/A)	12.0	8.5	25.26
Maple	0	(N/A)	8.4	0.0	0.03
Apple	7	(N/A)	7.2	0.2	1.09
Boxelder	96	(N/A)	3.6	3.2	32.10
UNKNOWN	0	(N/A)	3.6	0.0	0.00
Japanese tree lilac	0	(N/A)	1.2	0.0	0.00
Honeylocust	389	(N/A)	1.2	13.1	388.90
Northern white cedar	6	(N/A)	1.2	0.2	5.76
Norway maple	39	(N/A)	1.2	1.3	39.16
Littleleaf linden	81	(N/A)	1.2	2.7	81.48
Spruce	32	(N/A)	1.2	1.1	32.32
Citywide total	2,966	(N/A)	100.0	100.0	35.73

Table 7: Summary of Benefits in Dollars

Jolley

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

3/29/2018

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Silver maple	295	57	54	573	616	1,595	(N/A)	14.4
Green ash	952	123	183	1,676	741	3,674	(N/A)	33.2
Northern hackberry	899	90	162	1,149	706	3,006	(N/A)	27.2
Black walnut	295	35	55	432	253	1,069	(N/A)	9.7
Maple	67	4	12	80	0	163	(N/A)	1.5
Apple	68	4	11	40	7	130	(N/A)	1.2
Boxelder	59	11	10	85	96	261	(N/A)	2.4
UNKNOWN	0	0	0	0	0	0	(N/A)	0.0
Japanese tree lilac	46	2	8	32	0	89	(N/A)	0.8
Honeylocust	74	15	13	127	389	618	(N/A)	5.6
Northern white cedar	1	0	0	1	6	8	(N/A)	0.1
Norway maple	47	6	8	38	39	138	(N/A)	1.2
Littleleaf linden	50	8	8	64	81	213	(N/A)	1.9
Spruce	24	2	3	42	32	103	(N/A)	0.9
Citywide Total	2,878	358	528	4,338	2,966	11,067	(N/A)	100.0

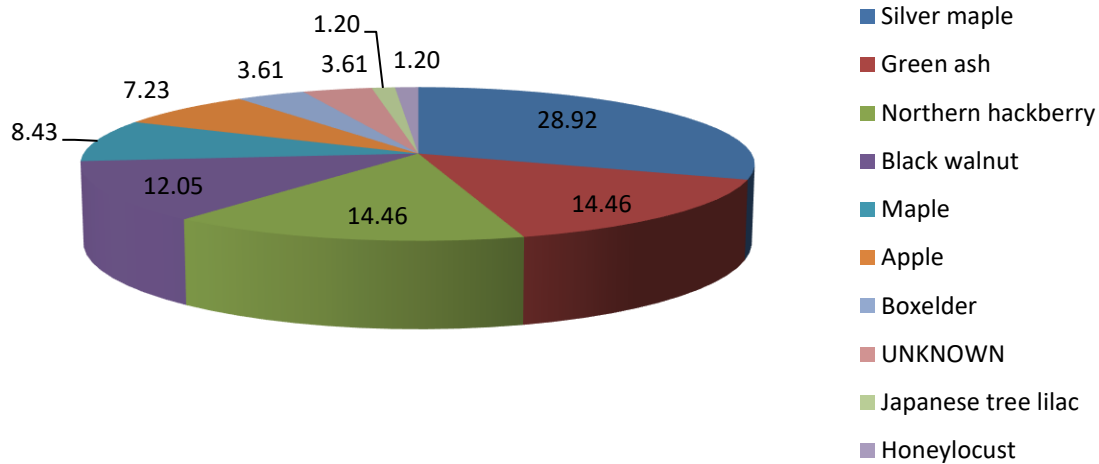


Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)

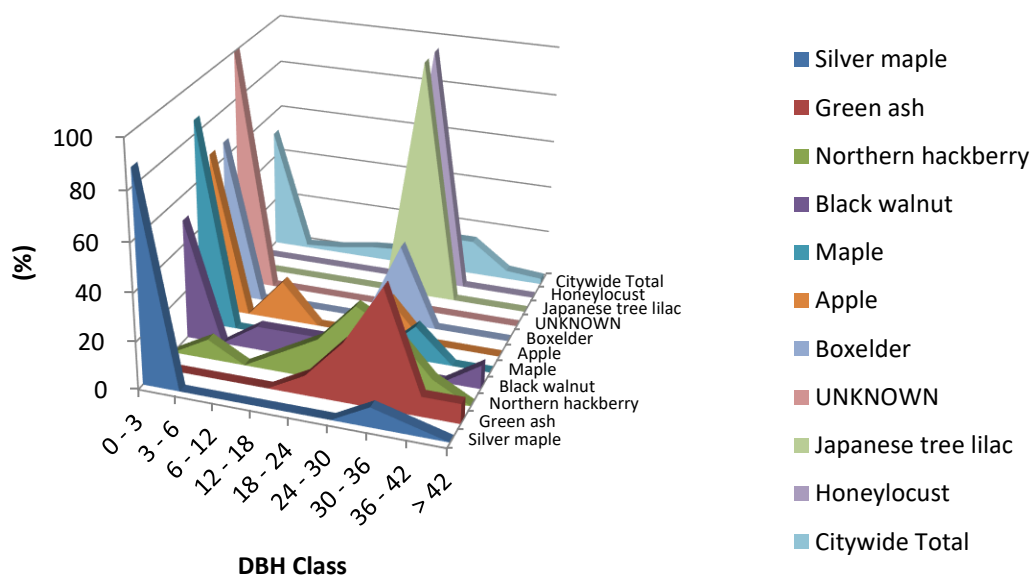


Figure 2: Relative Age Class



Figure 3: Foliage Condition

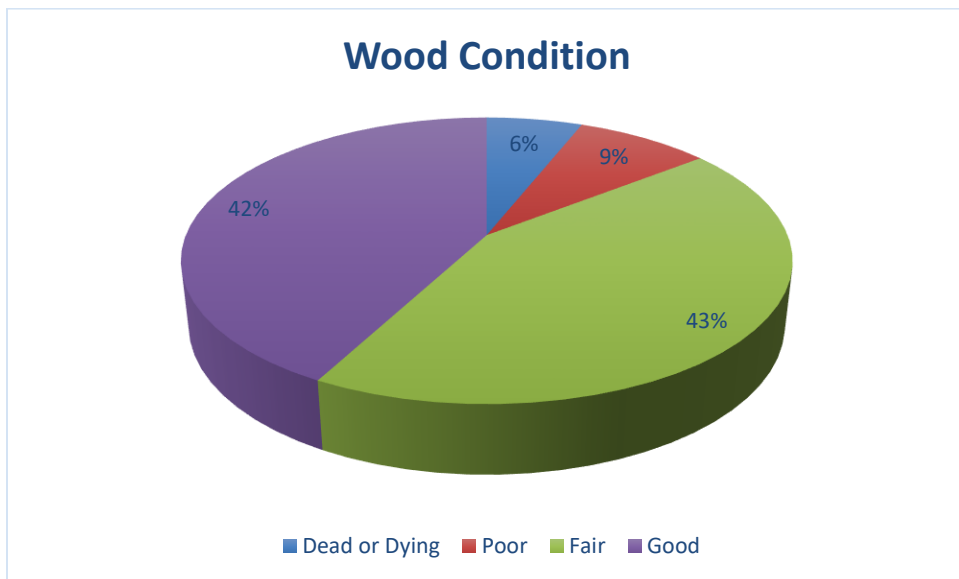


Figure 4: Wood Condition

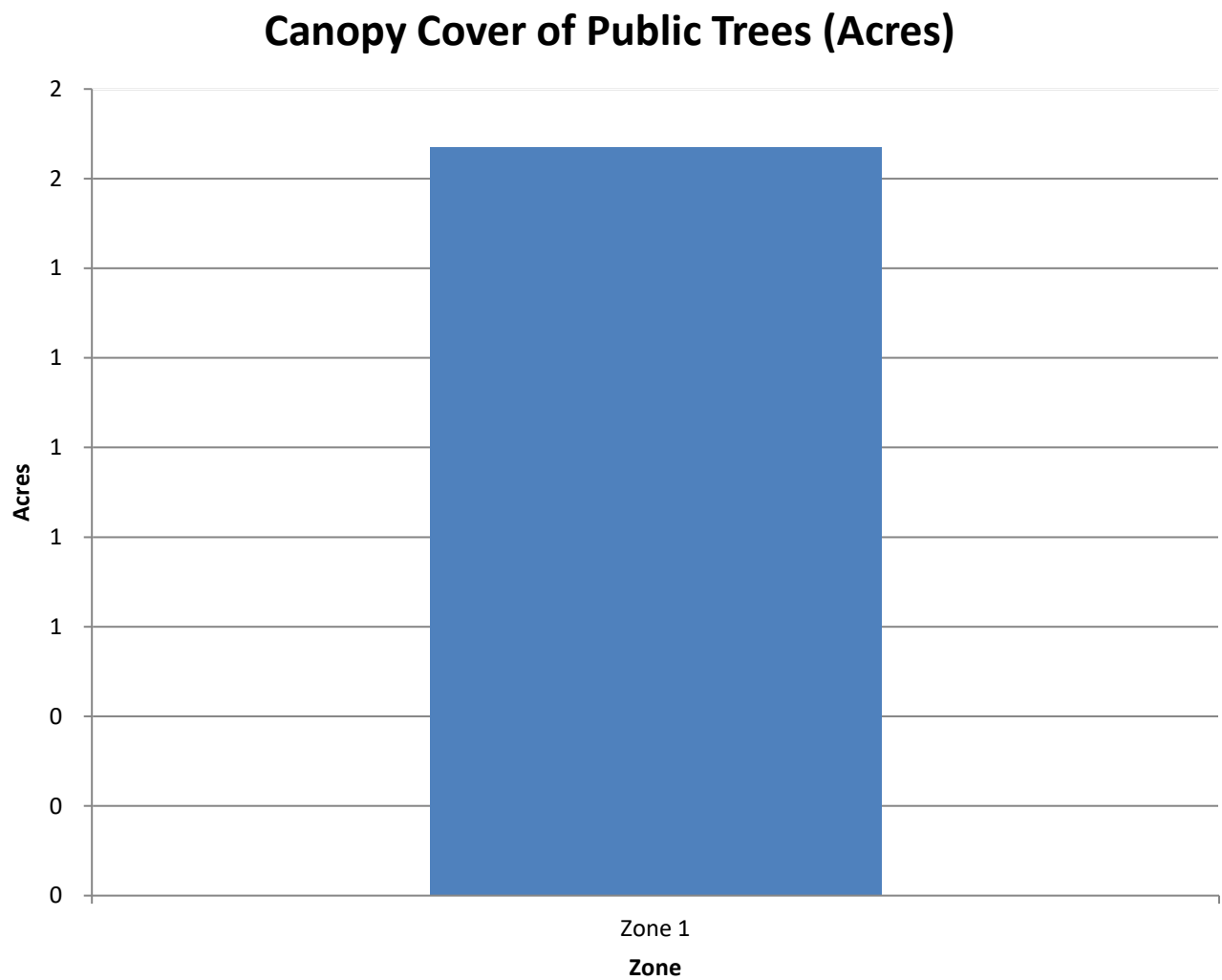


Figure 5: Canopy Cover in Acres

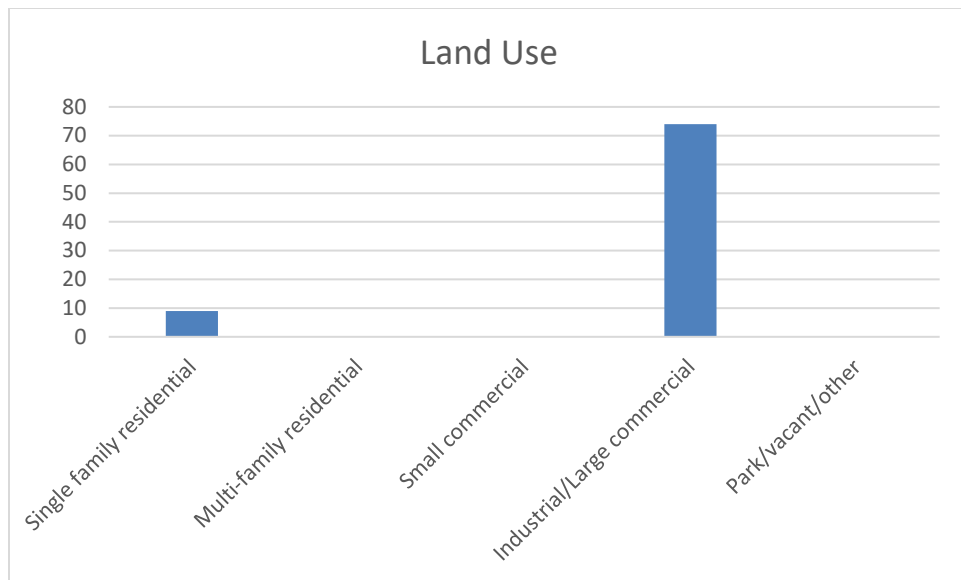


Figure 6: Land Use of city/park trees

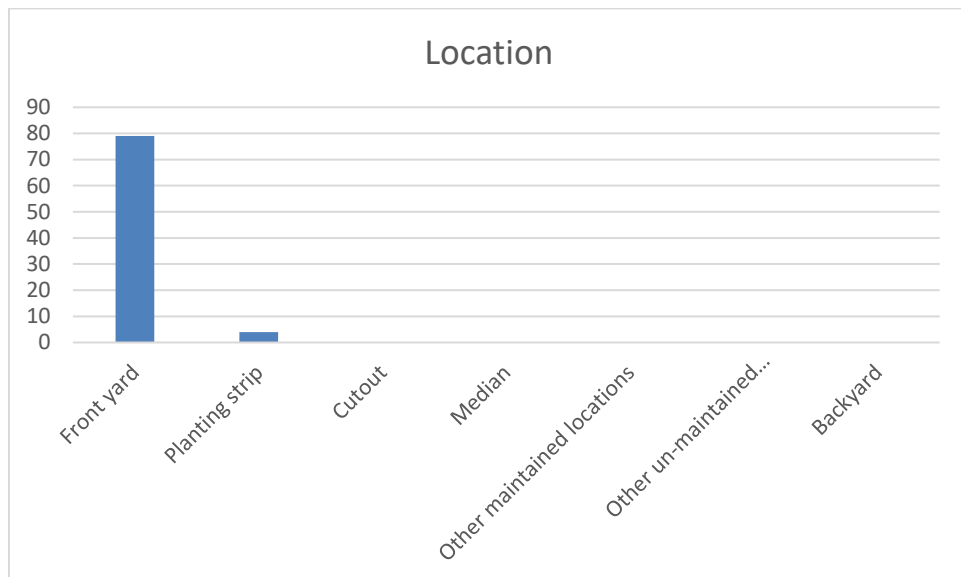


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping



Figure 1: Location of Ash Trees

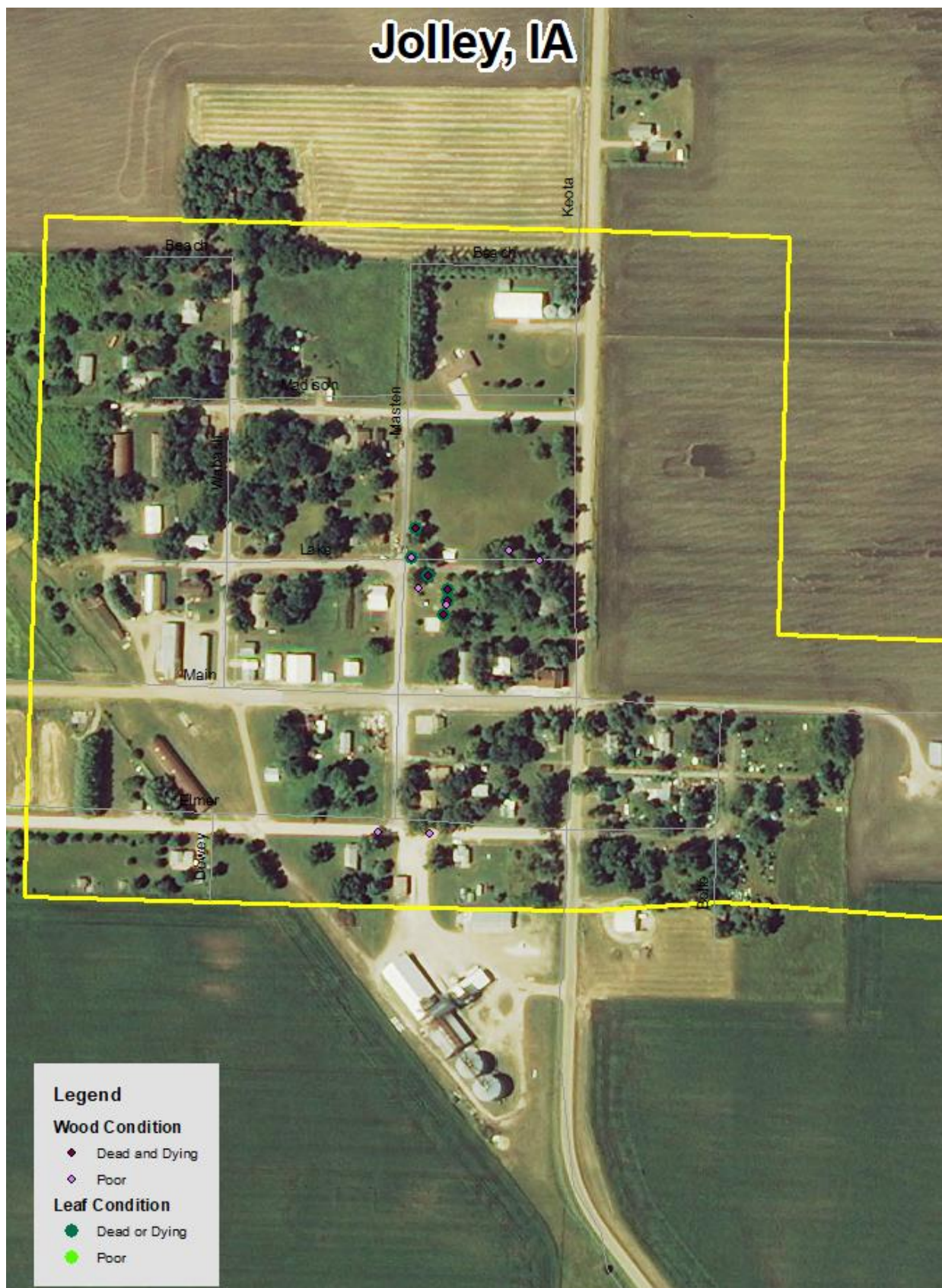


Figure 2: Location of Poor Condition Trees



Figure 3: Location of Trees with Recommended Maintenance

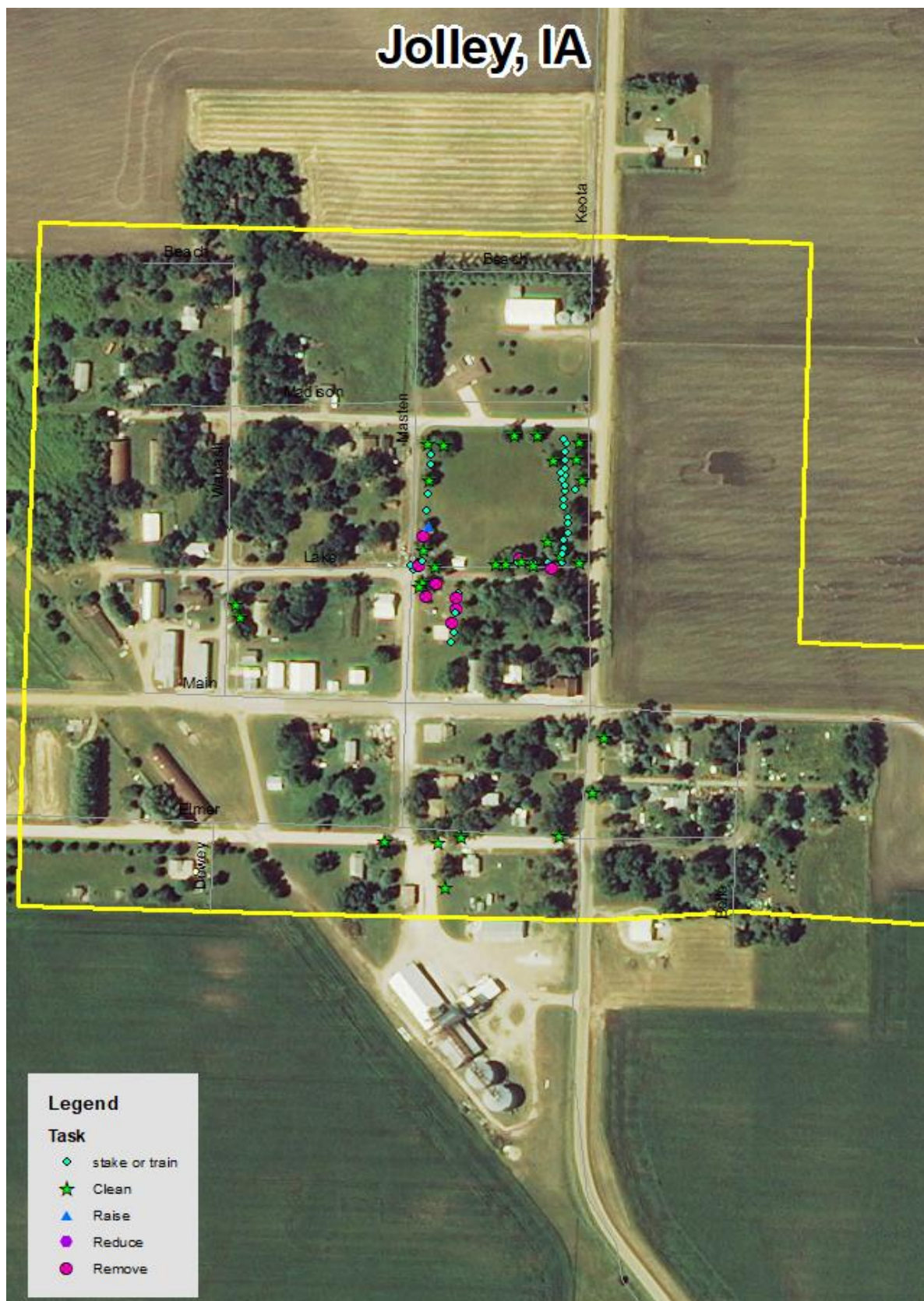


Figure 4: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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