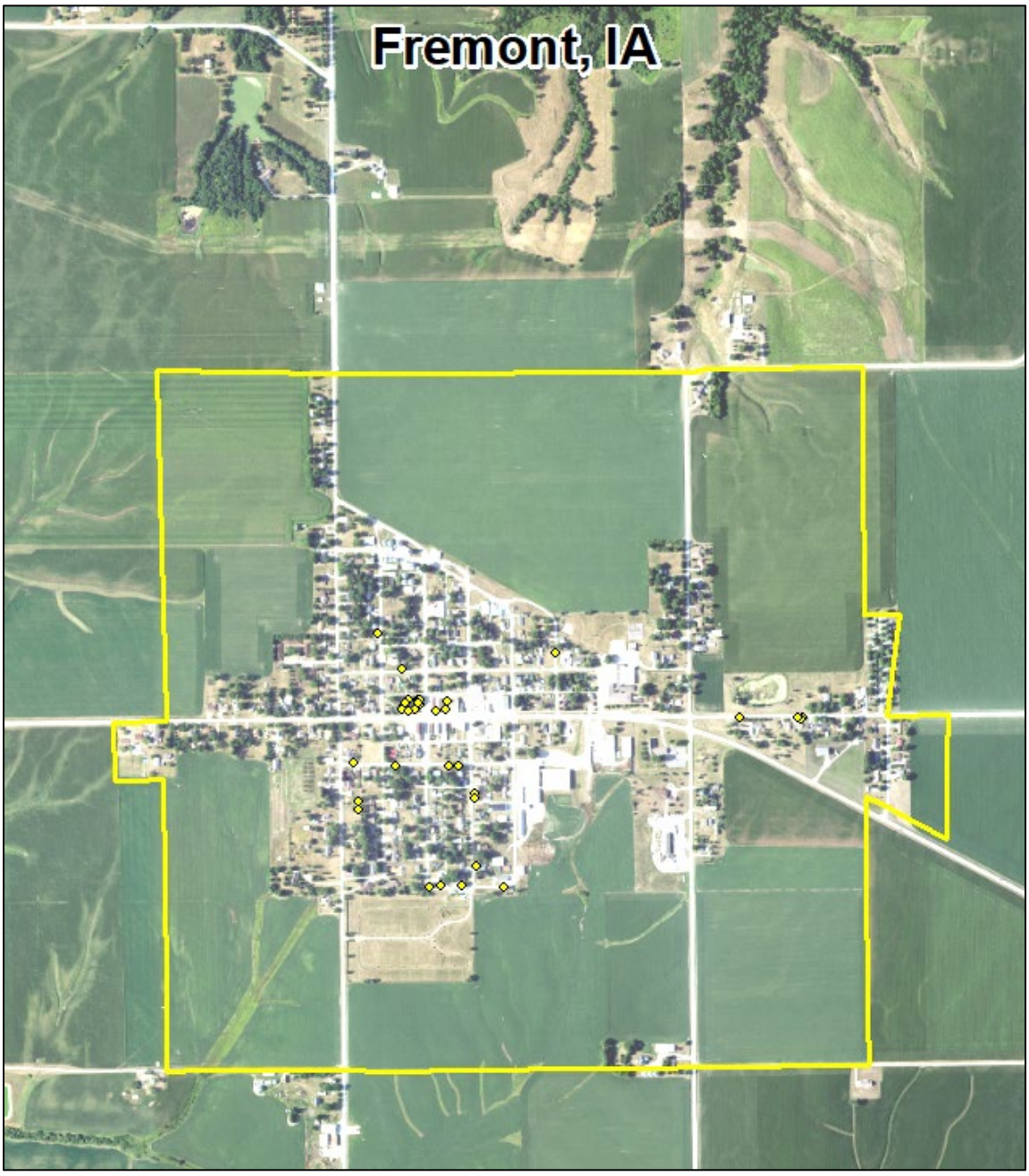
Fremont, IA



2021 Urban Forest Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Fremont 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). The is a strong possibility that >5% of Fremont's city owned trees (ash) will die because EAB is established in the community. 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 2020, 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 34 trees inventoried.

- Fremont's trees provide $6,408 of benefits annually, an average of $188.47 a tree
- There are 17 species of trees representing 13 different genera
- The top three genera are: Maple 45%, Ash 17%, and Oak 15%
- 32% of trees are in need of some type of management
- 5 trees are recommended for removal and replacement

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 5 trees needing removal, one is critical concern and must be addressed immediately; two are considered intermediate priority and should be planned during the next three years; 2 are routine and should be planned in the next 5 years *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
- Budget request should include minimum $10,675 for the next 6 years and apply for grants to plant replacement trees
- Use the online database to "View my community's trees" https://www.iowadnr.gov/Conservation/Forestry/Urban-Forestry

Introduction

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

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

Inventory

In 2020, 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 feet, 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 34 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. Fremont's trees reduce energy related costs by approximately $1,709 annually or average $50.26 per tree (Appendix A, Table 1). These savings are both in Electricity (8.1 MWh) and in Natural Gas (1,112.7 Therms).

Annual Stormwater Benefits

Fremont's trees intercept about 99,037 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $2,684 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 Fremont, it is estimated that trees remove 97.7 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 $267 or average $7.78 per tree (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Fremont, trees sequester about 29,901 lbs. of carbon a year with an associated value of $224 (Appendix A, Table 5). In addition, the trees store 346,523 lbs. of carbon, with a yearly benefit of $2,599 or $76.44 per tree (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. Fremont receives $1,527 in annual social benefits from trees or average $44.91 per tree (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STREETS analysis, Fremont's trees provide $6,408 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 34 trees in Fremont provide approximately $188.47 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Fremont has over 17 different tree species representing 13 different genera along city streets and parks (Appendix A, Figure 1). The top ten species are listed below.
The distribution of trees by genera is as follows:

Species	Percent
Silver maple	14.71
Norway maple	11.76
Blue spruce	11.76
Pin oak	8.82
Bur oak	5.88
Conifer Evergreen Large	5.88
Chinese elm	5.88
Ash	5.88
Honey locust	5.88
Callery pear	5.88
Other Species	17.65

Age Class

Most of Fremont's trees (>58%) are greater than 18 inches in diameter at 4.5 feet (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. Fremont'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 Fremont indicate that 88% of the trees are in good or fair health, with 12% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 76% of Fremont's trees are in good or fair health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 24% 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). The trees needing maintenance include 32% or 11 total trees. You may also use the online database to "View my community's trees" https://www.iowadnr.gov/Conservation/Forestry/Urban-Forestry

1 tree is critical concern-immediate removal-see hazardous trees below

3 Immediate needs (deferring maintenance beyond one to three years would compromise health or longevity of tree) Plan and budget accordingly.

- 2 removal/replacement

- 1 cleaning

7 routine needs (health or longevity of tree is not compromised by deferring maintenance for up to five years) Plan and budget accordingly.

- 2 removal/replacement
- 5 cleaning

23 trees (68%) do not need maintenance today but should be included in a routine 3-year schedule

Canopy Cover

The total canopy with both private and public trees is 60.6 acres, 9% of the total land area. The canopy cover on city owned properties included in the Fremont inventory includes approximately 0.95 acres (Appendix A, Figure 4). The City's canopy goal should be to increase canopy by 1%, in 30 years on all lands. To achieve this goal, it is estimated that 16 trees need to be planted annually on public and/or private lands. Another ambitious goal would be to increase the tree canopy by 3% in 30 years which would include 48 new trees planted annually.

Land Use and Location

The majority of Fremont'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	56%
Park/vacant/other	44%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

Location	
Planting strip	59%
Front yard	41%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%

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

Fremont has 1 critical concern trees that needs immediate removal. This tree can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). 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 10 trees with these needs as previously outlined in the Management 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 Fremont.

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 (45%) (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. All trees planted must meet the restrictions in your city ordinance.

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
Budget minimum $10,675 over 6 years

FY 2022

Removal: 1 critical concern trees, $900
Planting and Replacement: 2 trees to be planted in open locations, $200
Young Tree Pruning & Maintenance: $50

FY 2023

Removal: 2-Immediate Needs trees, $1,800
Planting and Replacement: 3 trees in open locations, $300
Young Tree Pruning & Maintenance: $75
Routine trimming: Contract to trim 1/3 of the city trees, $2,550

FY 2024

Removal: 2-Routine Needs trees, $1,800
Planting and Replacement: 3 trees in open places, $300
Young Tree Pruning & Maintenance: $75

FY 2025

Routine trimming: Contract to trim 1/3 of the city trees, $2,550
Removal: 0 trees - removal of any new critical concern trees
Planting and Replacement: new trees in open locations to increase benefits and canopy cover, $100/tree
Young Tree Pruning & Maintenance: $25/tree

FY 2026

Removal: 0 trees - removal of any new critical concern trees
Planting and Replacement: new trees in open locations to increase benefits and canopy cover, $100/tree
Young Tree Pruning & Maintenance: $25/tree

FY 2027

Routine trimming: Contract to trim 1/3 of the city trees, $2,550
Removal: 0 trees - removal of any new critical concern trees
Planting and Replacement: new trees in open locations to increase benefits and canopy cover, $100/tree
Young Tree Pruning & Maintenance: $25/tree

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.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Fremont

Annual Energy Benefits of Public Trees

3/4/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	1.6	119	211.1	207	326	(N/A)	14.7	19.1	65.12
Norway maple	1.2	89	174.0	170	259	(N/A)	11.8	15.2	64.76
Blue spruce	0.4	34	55.8	55	88	(N/A)	11.8	5.2	22.08
Pin oak	1.2	92	159.7	157	248	(N/A)	8.8	14.5	82.82
Bur oak	0.5	40	76.2	75	115	(N/A)	5.9	6.7	57.32
Conifer Evergreen Large	0.4	28	49.2	48	76	(N/A)	5.9	4.5	38.17
Siberian elm	0.7	50	91.1	89	140	(N/A)	5.9	8.2	69.75
Ash	0.5	38	69.1	68	105	(N/A)	5.9	6.2	52.73
Honeylocust	0.7	56	94.8	93	149	(N/A)	5.9	8.7	74.28
Callery pear	0.3	21	35.7	35	56	(N/A)	5.9	3.3	27.88
Apple	0.2	14	24.7	24	38	(N/A)	2.9	2.2	38.13
Austrian pine	0.1	10	15.2	15	25	(N/A)	2.9	1.4	24.51
Spruce	0.1	4	9.5	9	14	(N/A)	2.9	0.8	13.58
Mulberry	0.2	14	24.7	24	38	(N/A)	2.9	2.2	38.13
Eastern red cedar	0.1	8	16.4	16	25	(N/A)	2.9	1.4	24.57
Southern magnolia	0.0	3	5.6	5	8	(N/A)	2.9	0.5	8.11
Total	8.1	618	1,112.7	1,090	1,709	(N/A)	100.0	100.0	50.26

Table 2: Annual Stormwater Benefits

Fremont

Annual Stormwater Benefits of Public Trees

3/4/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	23,523	637	(N/A)	14.7	23.8	127.49
Norway maple	12,487	338	(N/A)	11.8	12.6	84.60
Blue spruce	5,388	146	(N/A)	11.8	5.4	36.51
Pin oak	16,298	442	(N/A)	8.8	16.5	147.22
Bur oak	5,181	140	(N/A)	5.9	5.2	70.21
Conifer Evergreen Large	9,209	250	(N/A)	5.9	9.3	124.79
Siberian elm	6,858	186	(N/A)	5.9	6.9	92.92
Ash	3,888	105	(N/A)	5.9	3.9	52.69
Honeylocust	9,370	254	(N/A)	5.9	9.5	126.96
Callery pear	1,572	43	(N/A)	5.9	1.6	21.30
Apple	667	18	(N/A)	2.9	0.7	18.06
Austrian pine	1,544	42	(N/A)	2.9	1.6	41.85
Spruce	596	16	(N/A)	2.9	0.6	16.14
Mulberry	667	18	(N/A)	2.9	0.7	18.06
Eastern red cedar	1,635	44	(N/A)	2.9	1.7	44.30
Southern magnolia	155	4	(N/A)	2.9	0.2	4.21
Citywide total	99,037	2,684	(N/A)	100.0	100.0	78.94

Table 3: Annual Air Quality Benefits

Fremont

Annual Air Quality Benefits of Public Trees

3/4/2021

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								
Silver maple	4.2	0.7	2.1	0.2	23	7.4	1.1	1.0	7.1	46	-2.3	-9	21.5	61	(N/A)	14.7	12.11
Norway maple	2.7	0.5	1.3	0.1	15	5.7	0.8	0.8	5.3	35	-0.6	-2	16.6	47	(N/A)	11.8	11.87
Blue spruce	0.6	0.1	0.6	0.1	4	2.1	0.3	0.3	2.0	13	-1.9	-7	4.2	10	(N/A)	11.8	2.55
Pin oak	3.2	0.6	1.6	0.1	17	5.7	0.8	0.8	5.5	36	-5.8	-22	12.5	31	(N/A)	8.8	10.45
Bur oak	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19	(N/A)	5.9	9.34
Conifer Evergreen Large	1.1	0.2	0.9	0.1	7	1.8	0.3	0.2	1.7	11	-5.7	-21	0.6	-3	(N/A)	5.9	-1.58
Siberian elm	1.1	0.2	0.5	0.0	6	3.2	0.5	0.4	3.0	20	0.0	0	8.9	26	(N/A)	5.9	12.79
Ash	0.7	0.1	0.4	0.0	4	2.4	0.3	0.3	2.3	15	-0.2	-1	6.4	18	(N/A)	5.9	9.04
Honeylocust	1.9	0.3	0.8	0.1	10	3.4	0.5	0.5	3.3	22	-1.5	-6	9.3	26	(N/A)	5.9	12.87
Callery pear	0.2	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	-0.1	0	3.2	9	(N/A)	5.9	4.56
Apple	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7	(N/A)	2.9	6.56
Austrian pine	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)	2.9	2.89
Spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	2.9	1.48
Mulberry	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7	(N/A)	2.9	6.56
Eastern red cedar	0.3	0.1	0.3	0.0	2	0.5	0.1	0.1	0.5	3	-0.9	-3	1.0	2	(N/A)	2.9	2.19
Southern magnolia	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1	(N/A)	2.9	1.05
Citywide total	17.4	3.0	9.3	1.0	96	38.8	5.7	5.4	36.9	242	-19.7	-74	97.7	264	(N/A)	100.0	7.78

Table 4: Annual Carbon Stored

Fremont

Stored CO2 Benefits of Public Trees

3/4/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	104,021	780	(N/A)	14.7	30.0	156.03
Norway maple	44,451	333	(N/A)	11.8	12.8	83.35
Blue spruce	3,639	27	(N/A)	11.8	1.1	6.82
Pin oak	87,519	656	(N/A)	8.8	25.3	218.80
Bur oak	16,915	127	(N/A)	5.9	4.9	63.43
Conifer Evergreen La	14,981	112	(N/A)	5.9	4.3	56.18
Siberian elm	26,471	199	(N/A)	5.9	7.6	99.27
Ash	11,569	87	(N/A)	5.9	3.3	43.39
Honeylocust	24,490	184	(N/A)	5.9	7.1	91.84
Callery pear	3,843	29	(N/A)	5.9	1.1	14.41
Apple	3,037	23	(N/A)	2.9	0.9	22.78
Austrian pine	1,118	8	(N/A)	2.9	0.3	8.39
Spruce	257	2	(N/A)	2.9	0.1	1.93
Mulberry	3,037	23	(N/A)	2.9	0.9	22.78
Eastern red cedar	1,102	8	(N/A)	2.9	0.3	8.27
Southern magnolia	73	1	(N/A)	2.9	0.0	0.55
Citywide total	346,523	2,599	(N/A)	100.0	100.0	76.44

Table 5: Annual Carbon Sequestered

Fremont

Annual CO Benefits of Public Trees

3/4/2021

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
Silver maple	7,165	54	-499	-18	-4	2,624	20	9,272	70	(N/A)	14.7	31.0	13.91
Norway maple	940	7	-213	-14	-2	1,957	15	2,670	20	(N/A)	11.8	8.9	5.01
Blue spruce	311	2	-17	-7	0	745	6	1,031	8	(N/A)	11.8	3.4	1.93
Pin oak	4,391	33	-420	-14	-3	2,031	15	5,989	45	(N/A)	8.8	20.0	14.97
Bur oak	1,319	10	-81	-5	-1	883	7	2,115	16	(N/A)	5.9	7.1	7.93
Conifer Evergreen Large	512	4	-72	-7	-1	622	5	1,055	8	(N/A)	5.9	3.5	3.96
Siberian elm	1,281	10	-127	-7	-1	1,109	8	2,256	17	(N/A)	5.9	7.5	8.46
Ash	856	6	-56	-5	0	835	6	1,631	12	(N/A)	5.9	5.5	6.12
Honeylocust	0	0	-118	-5	-1	1,230	9	1,106	8	(N/A)	5.9	3.7	4.15
Callery pear	482	4	-19	-3	0	460	3	919	7	(N/A)	5.9	3.1	3.45
Apple	268	2	-15	-2	0	308	2	560	4	(N/A)	2.9	1.9	4.20
Austrian pine	91	1	-5	-2	0	213	2	296	2	(N/A)	2.9	1.0	2.22
Spruce	53	0	-1	-1	0	94	1	145	1	(N/A)	2.9	0.5	1.08
Mulberry	268	2	-15	-2	0	308	2	560	4	(N/A)	2.9	1.9	4.20
Eastern red cedar	43	0	-5	-2	0	187	1	222	2	(N/A)	2.9	0.7	1.67
Southern magnolia	16	0	0	-1	0	59	0	74	1	(N/A)	2.9	0.2	0.55
Citywide total	17,994	135	-1,664	-95	-13	13,666	102	29,901	224	(N/A)	100.0	100.0	6.60

Table 6: Annual Social and Aesthetic Benefits

Fremont

Annual Aesthetic/Other Benefits of Public Trees

3/4/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	543	(N/A)	14.7	35.5	108.52
Norway maple	86	(N/A)	11.8	5.6	21.53
Blue spruce	97	(N/A)	11.8	6.3	24.19
Pin oak	314	(N/A)	8.8	20.6	104.68
Bur oak	115	(N/A)	5.9	7.6	57.69
Conifer Evergreen Large	53	(N/A)	5.9	3.4	26.25
Siberian elm	91	(N/A)	5.9	5.9	45.31
Ash	82	(N/A)	5.9	5.4	41.11
Honeylocust	0	(N/A)	5.9	0.0	0.00
Callery pear	52	(N/A)	5.9	3.4	26.02
Apple	15	(N/A)	2.9	1.0	15.48
Austrian pine	25	(N/A)	2.9	1.7	25.23
Spruce	15	(N/A)	2.9	1.0	15.42
Mulberry	15	(N/A)	2.9	1.0	15.48
Eastern red cedar	14	(N/A)	2.9	0.9	13.68
Southern magnolia	9	(N/A)	2.9	0.6	9.46
Citywide total	1,527	(N/A)	100.0	100.0	44.91

Table 7: Summary of Benefits in Dollars

Fremont

Total Annual Benefits of Public Trees by Species ($)

3/4/2021

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Silver maple	326	70	61	637	543	1,636	(N/A)	25.5
Norway maple	259	20	47	338	86	751	(N/A)	11.7
Blue spruce	88	8	10	146	97	349	(N/A)	5.4
Pin oak	248	45	31	442	314	1,080	(N/A)	16.9
Bur oak	115	16	19	140	115	405	(N/A)	6.3
Conifer Evergreen Large	76	8	-3	250	53	383	(N/A)	6.0
Siberian elm	140	17	26	186	91	458	(N/A)	7.2
Ash	105	12	18	105	82	323	(N/A)	5.0
Honeylocust	149	8	26	254	0	437	(N/A)	6.8
Callery pear	56	7	9	43	52	166	(N/A)	2.6
Apple	38	4	7	18	15	82	(N/A)	1.3
Austrian pine	25	2	3	42	25	97	(N/A)	1.5
Spruce	14	1	1	16	15	48	(N/A)	0.7
Mulberry	38	4	7	18	15	82	(N/A)	1.3
Eastern red cedar	25	2	2	44	14	86	(N/A)	1.3
Southern magnolia	8	1	1	4	9	23	(N/A)	0.4
Citywide Total	1,709	224	264	2,684	1,527	6,408	(N/A)	100.0

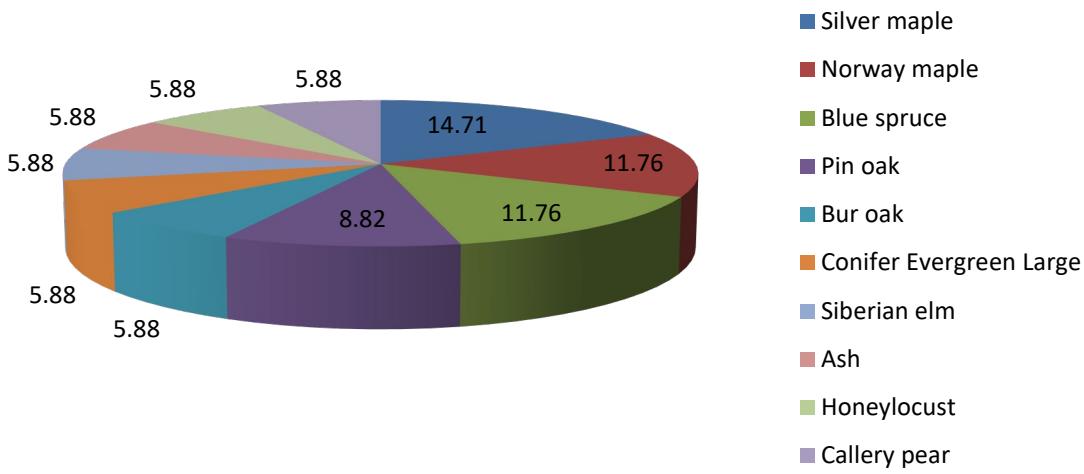

Figure 1: Species Distribution

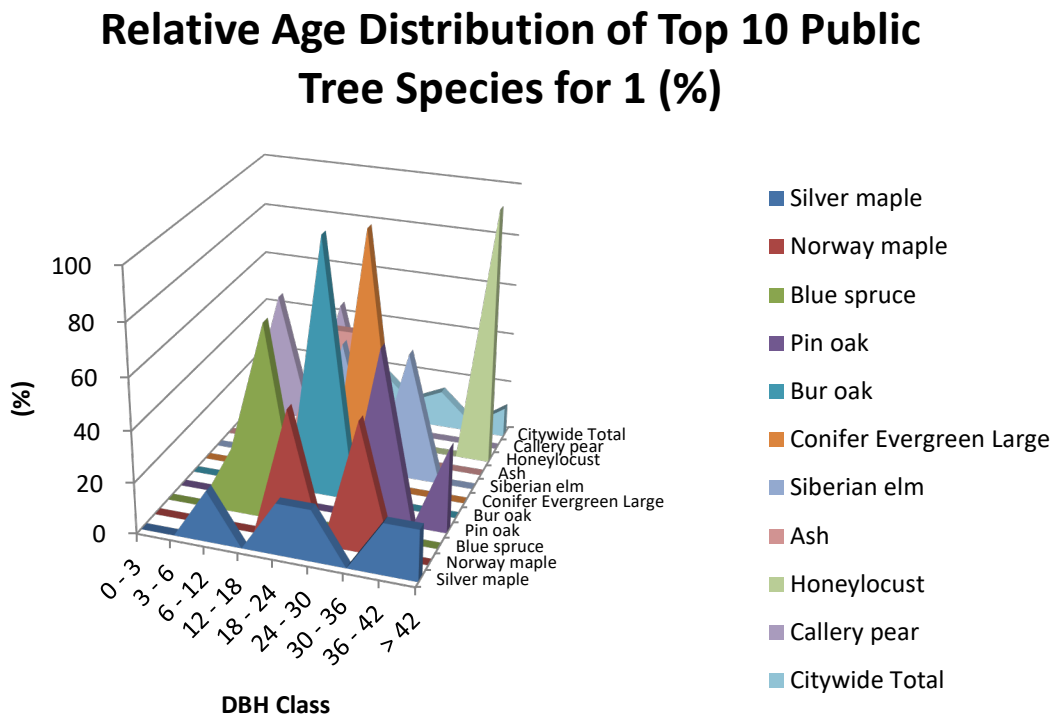

Figure 2: Relative Age Class

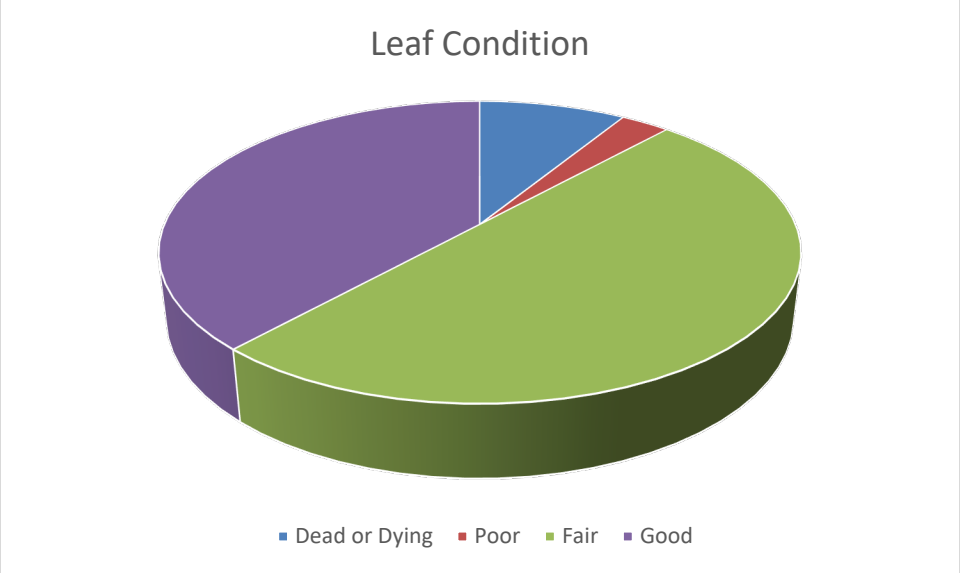

Figure 3: Foliage Condition

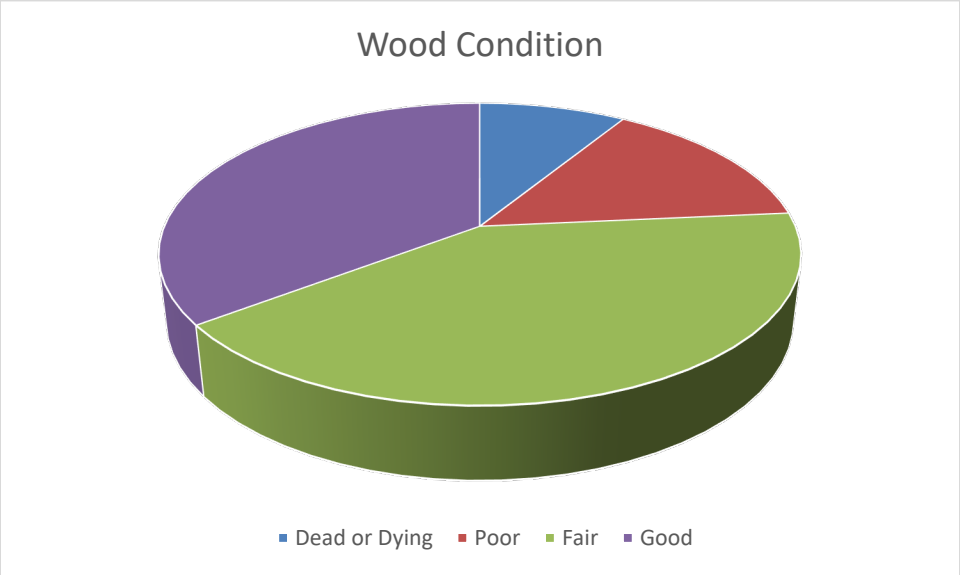

Figure 4: Wood Condition

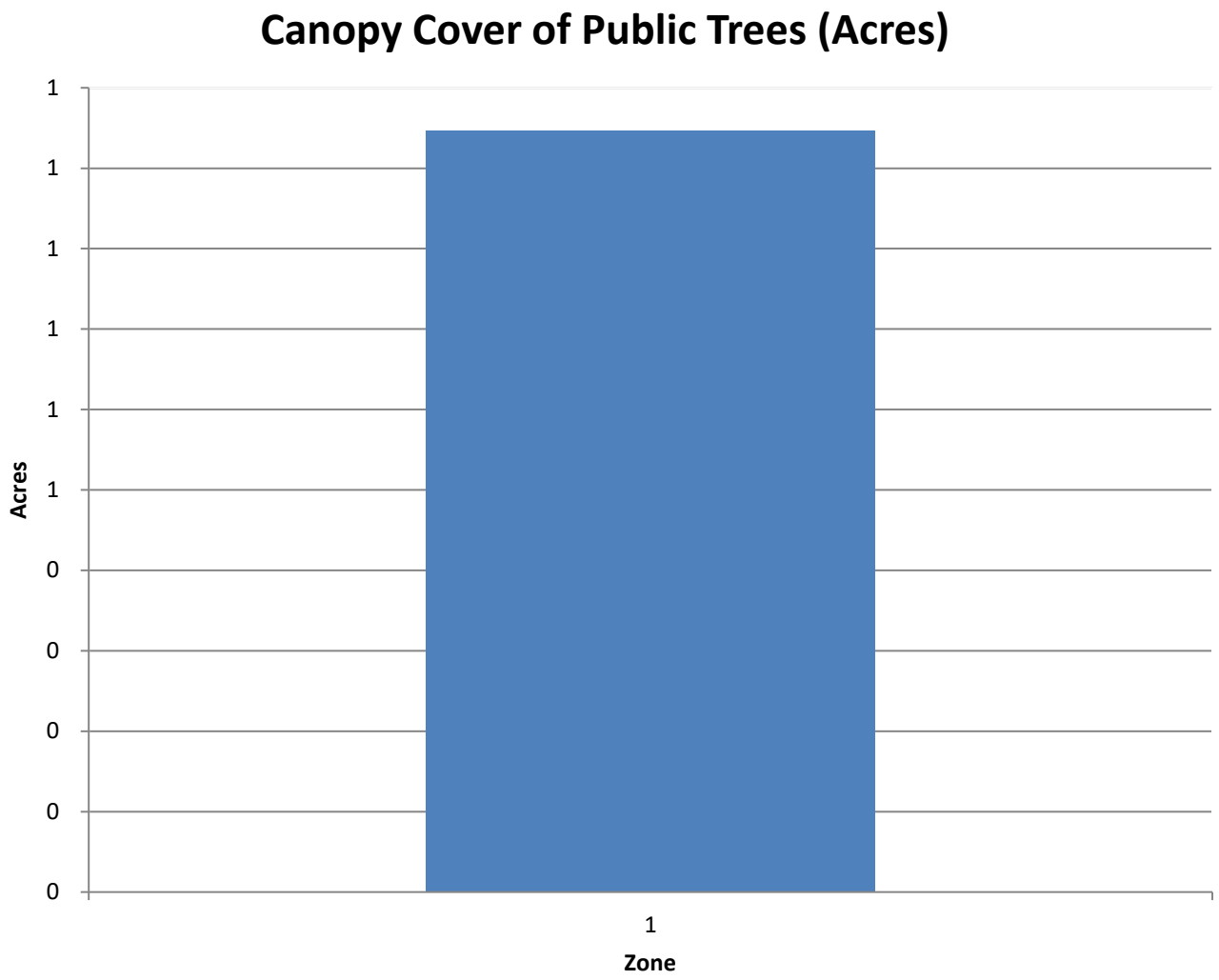

Figure 5: Canopy Cover in Acres

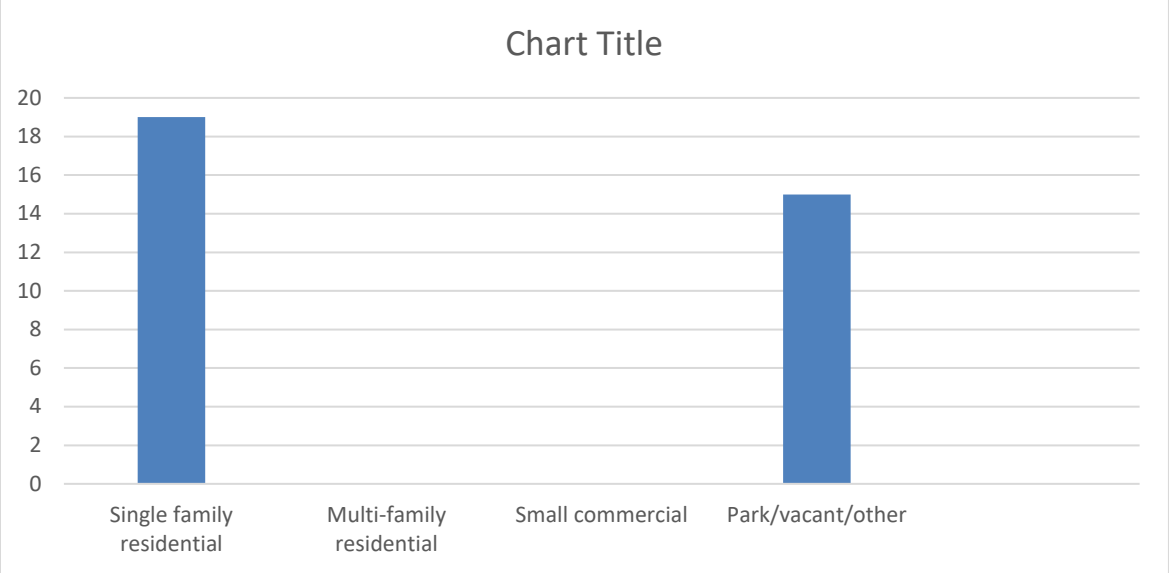

Figure 6: Land Use of city/park trees

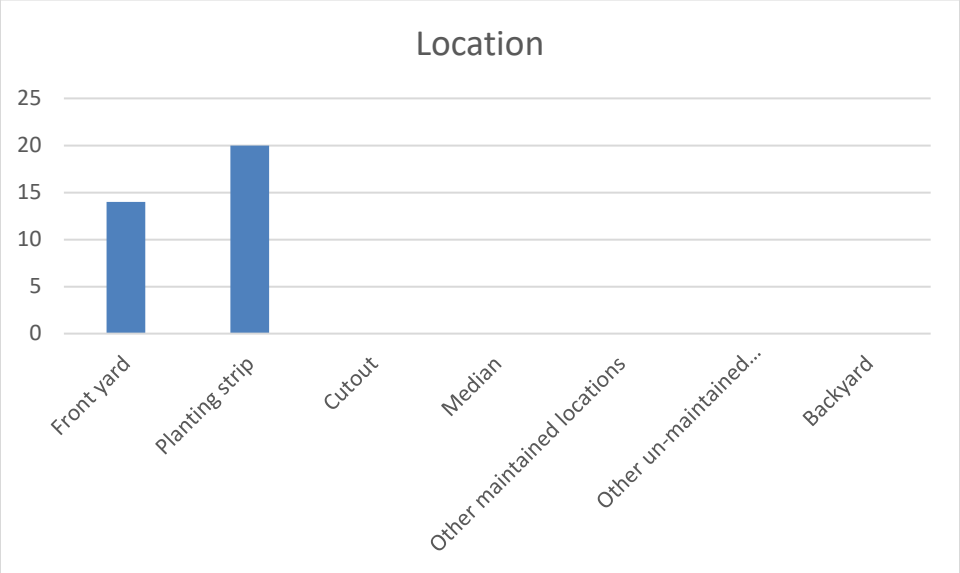

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

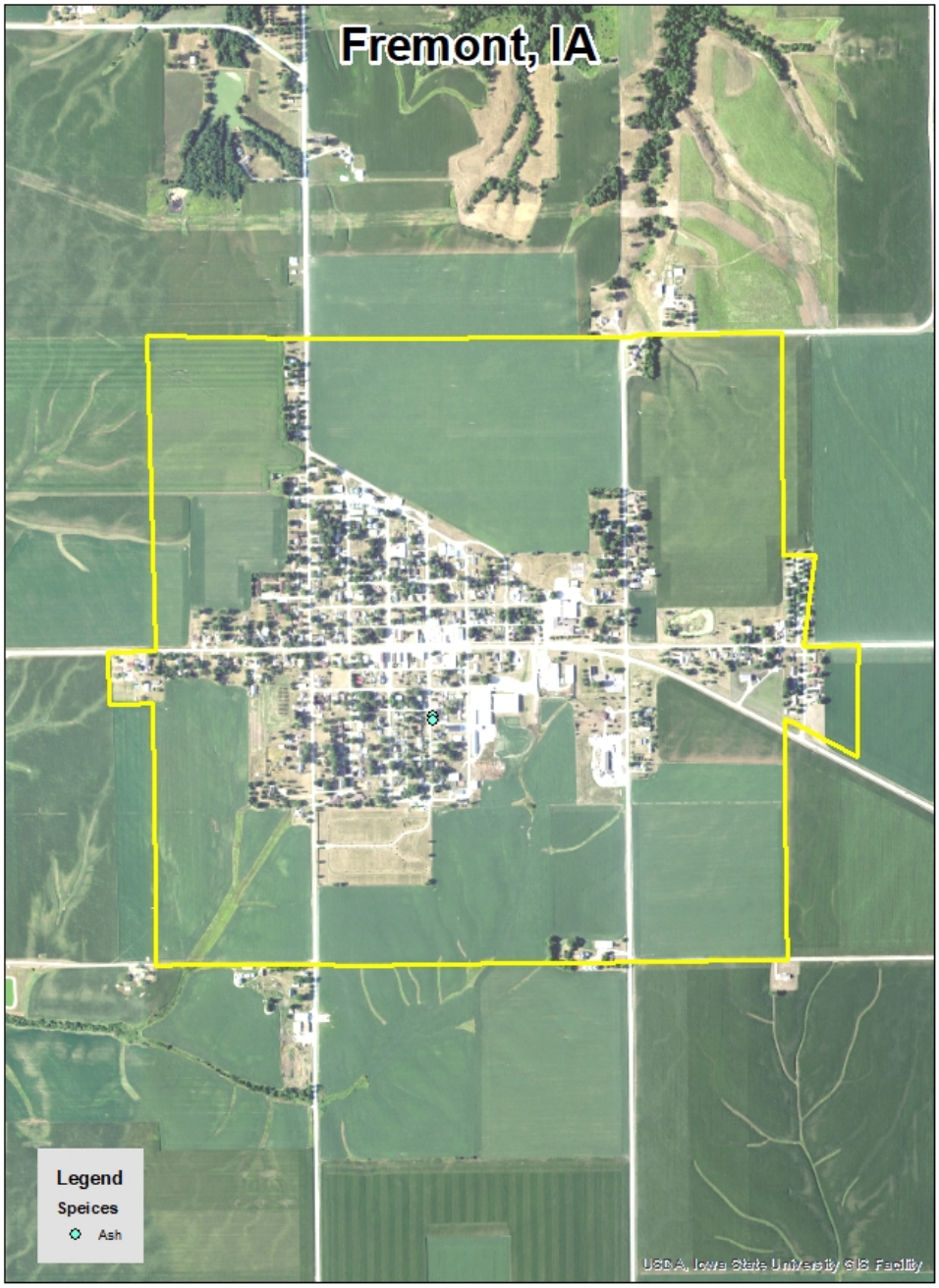

Figure 1: Location of Ash Trees

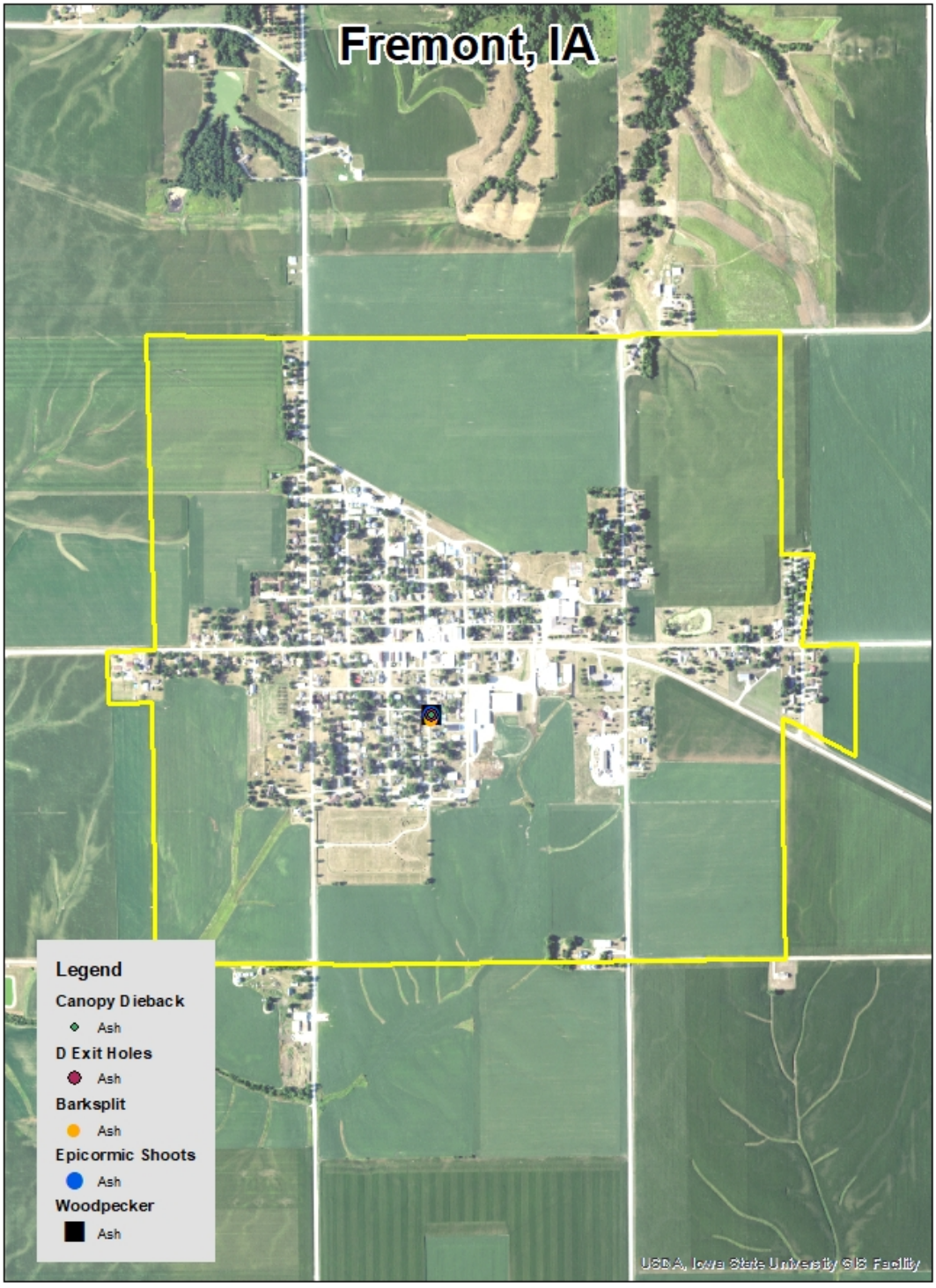

Figure 2: Location of EAB symptoms

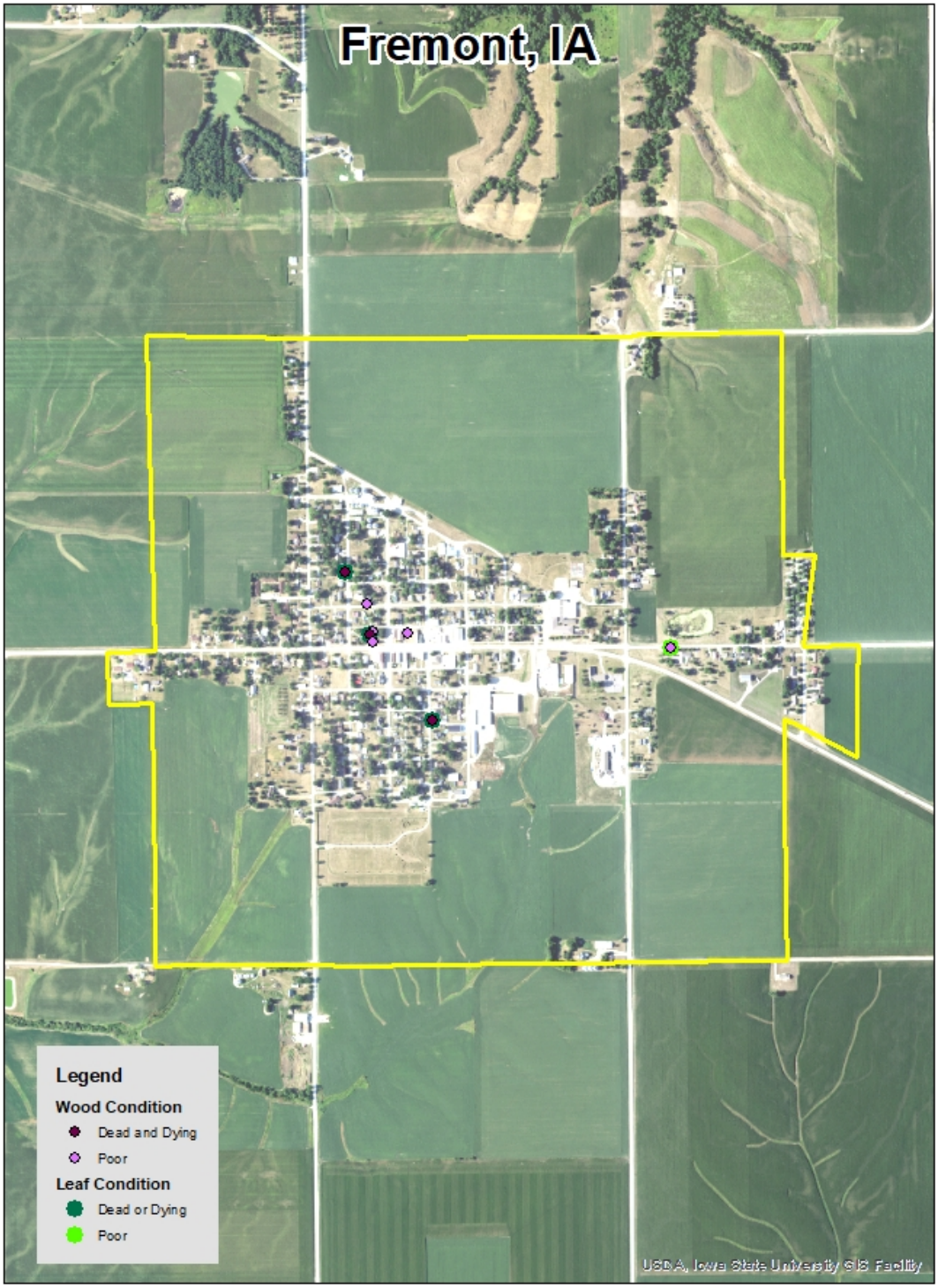

Figure 3: Location of Poor Condition Trees

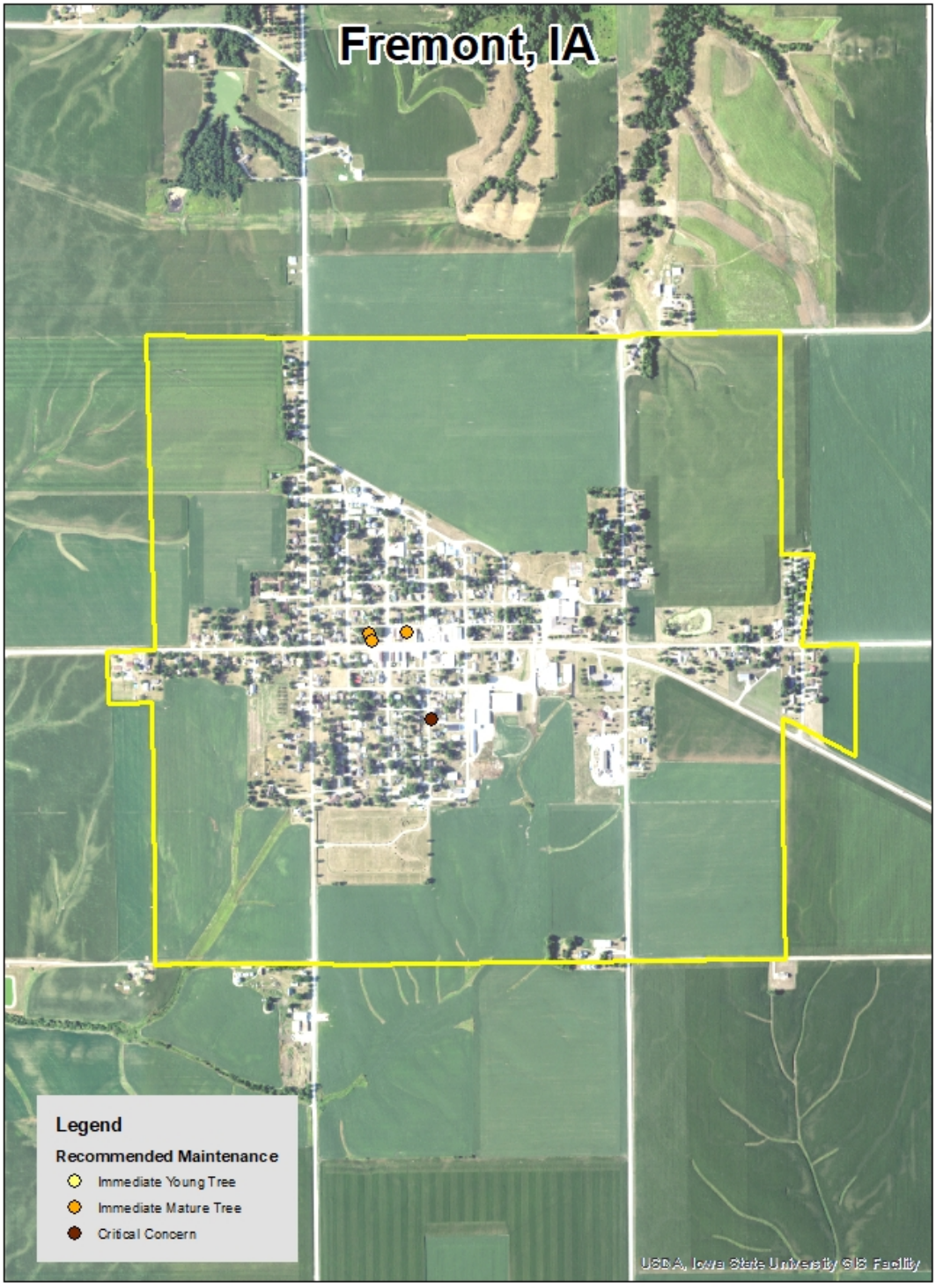

Figure 4: Location of Trees with Recommended Maintenance

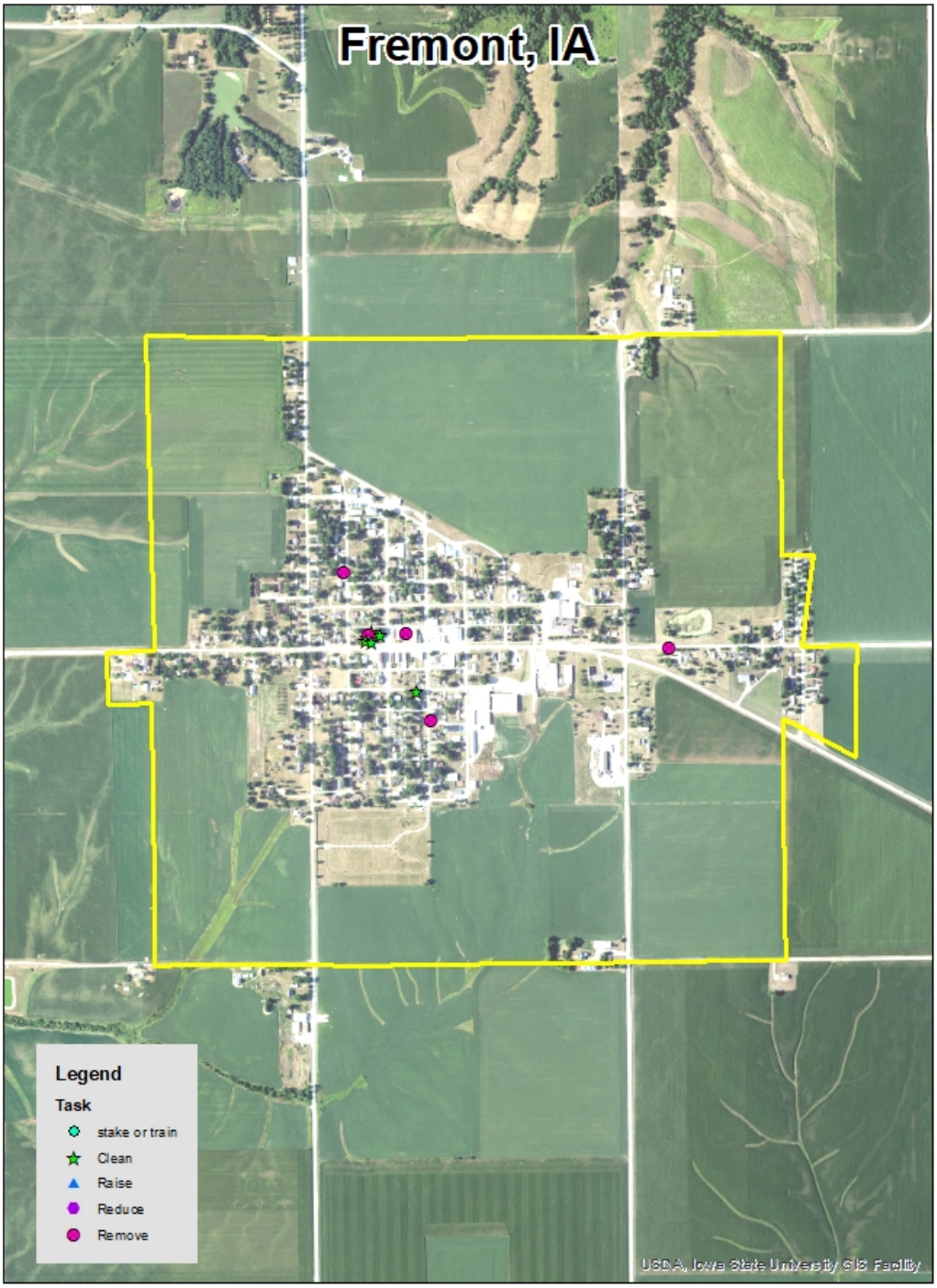

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

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