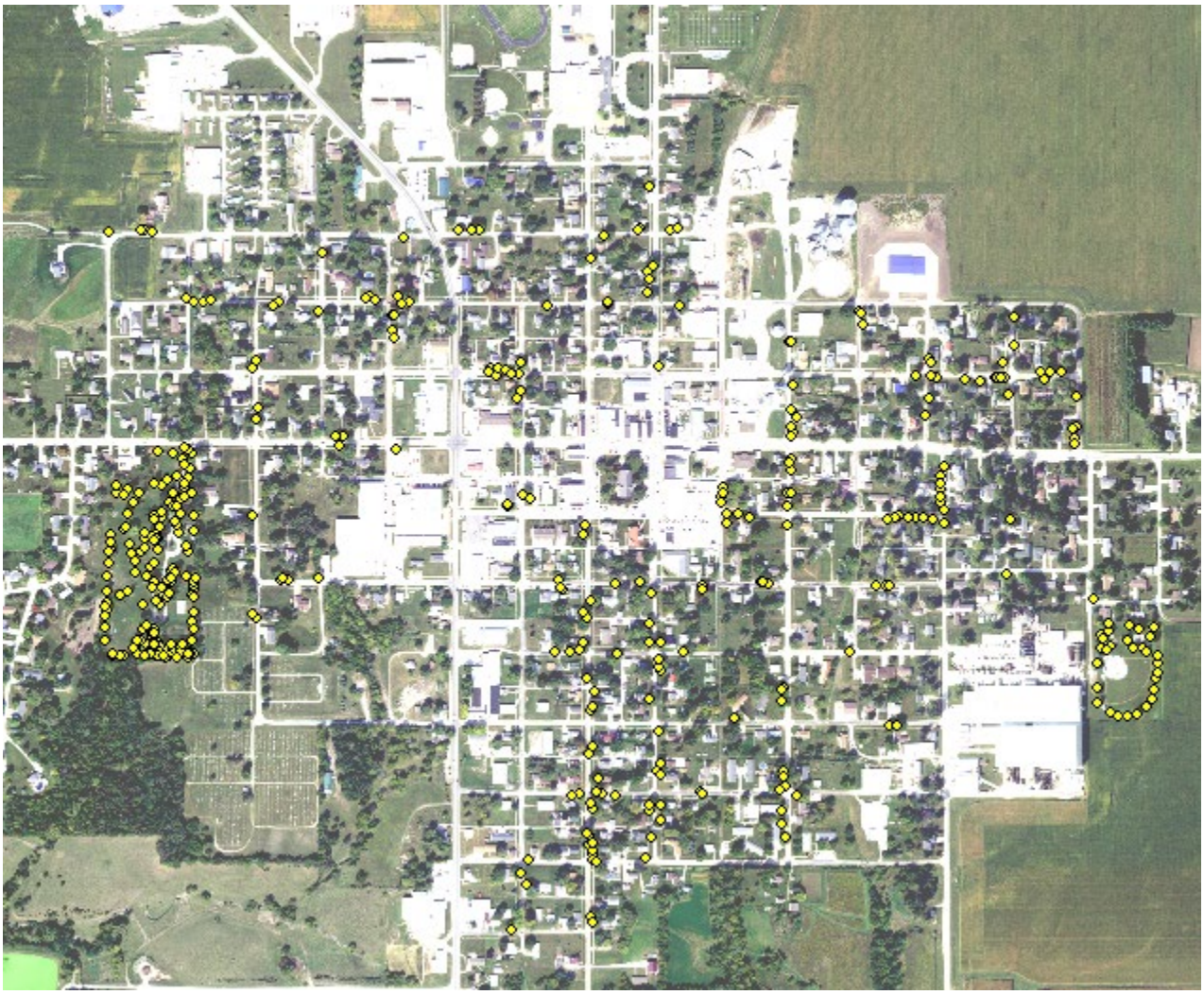
Montezuma, IA



2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Montezuma 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). In Montezuma 9% of the city owned trees are (ash) and many of them are already infested with EAB. With proper planning and management of the community tree resource, impacts of other pest issues like EAB in the future can hopefully be minimized and prepared for.

Inventory and Results

In 2019, 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 413 trees inventoried.

- Montezuma's trees provide $72,829 of benefits annually, an average of $176 a tree
- There are ~ 40 species of trees
- The top four genera are: Maple 28%, Oak 20%, Hickory 12%, and Ash 9%
- 45% of trees are in need of some type of management
- 58 trees are recommended for removal, and 31 are ash trees

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 28 Critical trees needing removal, 15 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. Of the 28 trees 23 of them are ash. *City ownership of the trees recommended for removal should be verified prior to any removal*
- There are a total of 36 public ash trees, and 31 have currently been identified for 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, oak, cottonwood, poplar, boxelder, Chinese elm, evergreen, willow or black walnut
- Check remaining ash trees with a visual survey yearly
- There are 58 trees recommended for removal and 31 of them are ash that have been infested with EAB. There are 5 remaining ash that will most likely also need to be removed fairly soon. If removal costs range from $600 to $1,000 per tree, total estimated costs to remove 31 ash in the community plus the 27 other non-ash recommended for removal (Total 58 trees) would be between $34,800 and $58,000. If planting 10 trees annually, annual estimated costs= $700 to $1,500 and Watering & Maintenance: $500

Introduction

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

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

Inventory

In 2019, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 413 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. Montezuma's trees reduce energy related costs by approximately $19,426 annually (Appendix A, Table 1). These savings are both in Electricity (92.4 MWh) and in Natural Gas (12,669.3 Therms).

Annual Stormwater Benefits

Montezuma's trees intercept about 1,027,076 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $27,834 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 Montezuma, it is estimated that trees remove 1,195 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 $3,376 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Montezuma, trees sequester about 214,193 lbs of carbon a year with an associated value of $2,620 (Appendix A, Table 5). In addition, the trees store 3,895,457 lbs of carbon, with a yearly benefit of $29,216 (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. Montezuma receives $19,573 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, Montezuma's trees provide $72,829 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 413 trees in Montezuma provide approximately $176 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Montezuma has ~41 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	114	28%
Oak	83	20%
Hickory	49	12%
Ash	36	9%
Spruce	25	6%
Apple (Crabapple)	13	3%
Elm	10	2%
Black Walnut	9	2%
Cottonwood	8	2%
Sycamore	7	2%
Pine	6	1%
Mulberry	6	1%
Hackberry	5	1%
Other Species		

Age Class

In Montezuma (46%) of the public trees are between 1 and 18 inches in diameter at 4.5 ft, and 54% are greater than 18 inches in diameter (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. At this point close to half of Montezuma's public trees are still considered young.

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 Montezuma indicate that 66% of the trees are in good health, with 11% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Also, 42% of Montezuma'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).

Crown Cleaning	81	20%
Tree Removal	58	14%
Crown Raising	28	7%
Crown Reduction	18	4%

Canopy Cover

The total canopy with both private and public trees is 11%, 1594.6 acres. The canopy cover included in the Montezuma inventory includes approximately 10.5 acres (Appendix A, Figure 4). The City's Canopy goal is to attempt to replace the ash trees lost. To achieve this goal, it is estimated that 21 trees need to be planted annually on public and private lands over the next 30 years.

Land Use and Location

Montezuma's city and park trees are generally split between single family residential neighborhoods and park areas (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	53%
Park/vacant/other	46%
Industrial/Large commercial	<1%
Small commercial	1%
Multifamily residential	<1%

Location	
Front Yard	61%
Planting Strip	37%
Cutout (surrounded by pavement)	1%

Recommendations

Risk Management

Risk 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.

Risk trees

Montezuma has 29 critical concern trees with 28 needing immediate removal, and 1 needing branches cleaned/removed. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). There is a total of 58 trees that need to be removed. It is recommended to start with the large diameter critical concern trees first. There are 15 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the remaining trees needing removed. There are a total of 30 remaining trees (Total 58) that will need to be removed.

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). Currently there are a total of 58 trees that need to be removed, and 31 are ash trees. There are a total of 36 ash trees, and only 5 of those currently do not have signs and symptoms that have been associated with EAB. Within the next few years these remaining 5 trees will most likely be showing some symptoms associated with EAB. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

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

Planting

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

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 (28%) and oak (20%) (Appendix A, Figure 1). New maple and oak should not be planted until these percentages become lower than 20% due to removal or mortality. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Certain species are prohibited such as fruit-bearing species and other species such as: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

It is recommended that remaining 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. Since the majority of the public ash trees are already infested and in need of removal this will be a short-term need.

Six Year Maintenance Plan (No current tree management budget)

Year 1

Removal: As many of the 28 Critical trees (@ estimate $600 to $1,000/tree) that have been identified
Planting and Replacement: 10 trees (@ $70 to $150/tree) planted in open public locations
Watering & Maintenance: $500
Visual Survey for signs and symptoms of EAB

Year 2

Removal: Removal of any remaining of the original 28 Critical trees identified and begin removal of the remaining 30 trees listed for removal as budget permits
Planting and Replacement: 10 trees planted in open public locations
Visual Survey for signs and symptoms of EAB
Routine trimming: Contract to trim 1/3 of the city trees $2,500

Year 3

Removal: Removal of the remaining 30 trees beyond the 28 Critical trees listed for removal as budget permits
Planting and Replacement: 10 trees planted in open public locations
Visual Survey for signs and symptoms of EAB

Year 4

Removal: Removal of the remaining 30 trees beyond the 28 Critical trees listed for removal, and any new critical concern trees and trees in poor health as budget permits
Planting and Replacement: 10 trees planted in open public locations
Routine trimming: Contract to trim 1/3 of the city trees

Year 5

Removal: Removal of any new critical concern trees and trees in poor health as budget permits
Planting and Replacement: 10 trees planted in open public locations

Year 6

Removal: Removal of any new critical concern trees and trees in poor health as budget permits
Planting and Replacement: 10 trees planted in open public locations
Routine trimming: Contract to trim 1/3 of the city trees

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, risk 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

Since the majority of the public ash trees are infested any type of chemical treatment of remaining ash is not recommended.

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. Iowa is part of a Federally Quarantined area, so no regulated ash material can leave the state of Iowa without approval from the regulatory body. If you have any questions about quarantines or related regulations contact Mike Kintner, IDALS, 515-725-1470 or mike.kintner@iowaagriculture.gov. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort 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?

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple,oak, 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 risk or emergency situations only.

Monitoring

It is recommended that the five remaining public 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. Since the majority of the public ash trees are already infested and in need of removal this will be a short-term need.

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 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Estimated Budget Needed To Remove Current Trees of Concern

EAB is infesting the majority of the 36 public ash in Montezuma and there are 27 non-ash plus 31 ash (Total 58) in need of removal. The goal should be to remove the current 58 trees identified before them become a risk to the adjacent environment. There are 58 trees recommended for removal and 31 of them are ash that have been infested with EAB. If removal costs range from $600 to $1,000 per tree, total estimated costs to remove 31 ash in the community plus the 27 other non-ash recommended for removal (Total 58 trees) would be between $34,800 and $58,000.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees

3/18/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	14.6	1,110	1,982.6	1,943	3,053	(N/A)	12.8	15.7	57.60
Hickory	11.0	831	1,467.7	1,438	2,270	(N/A)	11.9	11.7	46.32
Silver maple	13.8	1,051	1,839.9	1,803	2,854	(N/A)	10.9	14.7	63.43
Norway maple	9.2	696	1,333.5	1,307	2,003	(N/A)	9.9	10.3	48.84
Green ash	8.5	647	1,154.5	1,131	1,778	(N/A)	8.2	9.2	52.30
Sugar maple	4.7	354	624.6	612	966	(N/A)	3.9	5.0	60.40
Blue spruce	1.2	94	171.2	168	262	(N/A)	3.6	1.3	17.46
Apple	1.0	75	158.8	156	231	(N/A)	3.1	1.2	17.77
Northern pin oak	3.2	246	482.3	473	718	(N/A)	2.7	3.7	65.31
Red maple	1.4	104	191.6	188	292	(N/A)	2.4	1.5	29.22
Black walnut	2.7	209	385.3	378	586	(N/A)	2.2	3.0	65.13
Eastern cottonwood	2.5	189	350.0	343	532	(N/A)	1.9	2.7	66.52
American sycamore	2.2	166	294.6	289	455	(N/A)	1.7	2.3	65.00
Swamp white oak	0.4	29	60.4	59	89	(N/A)	1.7	0.5	12.67
Broadleaf Deciduous Large	0.9	72	129.6	127	199	(N/A)	1.5	1.0	33.09
Eastern white pine	0.1	11	17.3	17	28	(N/A)	1.2	0.1	5.57
Northern hackberry	1.4	106	194.4	191	297	(N/A)	1.2	1.5	59.30
Northern red oak	0.6	44	83.6	82	126	(N/A)	1.2	0.6	25.19
Northern white cedar	0.1	9	19.9	19	28	(N/A)	1.2	0.1	5.61
White mulberry	0.1	5	12.0	12	17	(N/A)	1.0	0.1	4.27
Norway spruce	0.6	49	83.5	82	131	(N/A)	1.0	0.7	32.74
Eastern red cedar	0.4	34	65.8	64	98	(N/A)	1.0	0.5	24.57
Siberian elm	1.4	103	178.3	175	277	(N/A)	1.0	1.4	69.35
River birch	0.6	45	88.6	87	132	(N/A)	1.0	0.7	32.93
American elm	1.1	81	142.0	139	221	(N/A)	1.0	1.1	55.14
White oak	0.7	50	81.4	80	130	(N/A)	1.0	0.7	32.43
Willow	0.9	69	134.4	132	200	(N/A)	0.7	1.0	66.79
Honeylocust	1.0	79	137.1	134	213	(N/A)	0.7	1.1	71.11
Broadleaf Deciduous Small	0.0	2	4.4	4	6	(N/A)	0.5	0.0	3.13
Mulberry	0.2	15	32.2	32	47	(N/A)	0.5	0.2	23.50
Broadleaf Deciduous Mediu	0.3	21	35.7	35	56	(N/A)	0.5	0.3	27.88
Elm	0.4	27	51.8	51	78	(N/A)	0.5	0.4	38.98
American basswood	0.7	50	87.2	85	135	(N/A)	0.5	0.7	67.65
Pin oak	0.7	51	92.0	90	141	(N/A)	0.5	0.7	70.52
Spruce	0.3	20	29.3	29	48	(N/A)	0.5	0.2	24.14
White ash	0.6	47	75.5	74	121	(N/A)	0.5	0.6	60.54
Catalpa	0.3	25	40.7	40	65	(N/A)	0.5	0.3	32.43
Maple	0.4	28	46.6	46	74	(N/A)	0.5	0.4	36.76
Black cherry	0.2	17	35.4	35	52	(N/A)	0.5	0.3	25.77
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.2	0.1	24.14
Tulip tree	0.2	18	27.0	26	44	(N/A)	0.2	0.2	44.23
Oak	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Black locust	0.3	20	39.6	39	59	(N/A)	0.2	0.3	58.69
Northern catalpa	0.4	29	53.7	53	82	(N/A)	0.2	0.4	82.02
Eastern redbud	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Black spruce	0.0	2	4.9	5	7	(N/A)	0.2	0.0	6.94
Callery pear	0.0	3	6.2	6	9	(N/A)	0.2	0.0	8.99
Lilac	0.0	2	3.8	4	5	(N/A)	0.2	0.0	5.40
Littleleaf linden	0.1	6	12.5	12	18	(N/A)	0.2	0.1	18.25
Kentucky coffeetree	0.4	33	59.0	58	91	(N/A)	0.2	0.5	91.02
Pear	0.2	15	31.6	31	46	(N/A)	0.2	0.2	46.14
Conifer Evergreen Large	0.1	11	19.7	19	30	(N/A)	0.2	0.2	30.47
Total	92.4	7,010	12,669.3	12,416	19,426	(N/A)	100.0	100.0	47.04

Table 2: Annual Stormwater Benefits

Montezuma

Annual Stormwater Benefits of Public Trees

3/18/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	165,130	4,475	(N/A)	12.8	16.1	84.43
Hickory	91,323	2,475	(N/A)	11.9	8.9	50.51
Silver maple	191,364	5,186	(N/A)	10.9	18.6	115.24
Norway maple	87,261	2,365	(N/A)	9.9	8.5	57.68
Green ash	92,796	2,515	(N/A)	8.2	9.0	73.96
Sugar maple	54,893	1,488	(N/A)	3.9	5.3	92.97
Blue spruce	15,336	416	(N/A)	3.6	1.5	27.71
Apple	4,423	120	(N/A)	3.1	0.4	9.22
Northern pin oak	34,982	948	(N/A)	2.7	3.4	86.18
Red maple	10,251	278	(N/A)	2.4	1.0	27.78
Black walnut	35,603	965	(N/A)	2.2	3.5	107.20
Eastern cottonwood	31,895	864	(N/A)	1.9	3.1	108.04
American sycamore	34,482	934	(N/A)	1.7	3.4	133.49
Swamp white oak	3,126	85	(N/A)	1.7	0.3	12.10
Broadleaf Deciduous Large	11,081	300	(N/A)	1.5	1.1	50.05
Eastern white pine	1,734	47	(N/A)	1.2	0.2	9.40
Northern hackberry	15,781	428	(N/A)	1.2	1.5	85.53
Northern red oak	5,636	153	(N/A)	1.2	0.5	30.55
Northern white cedar	1,064	29	(N/A)	1.2	0.1	5.77
White mulberry	213	6	(N/A)	1.0	0.0	1.45
Norway spruce	13,717	372	(N/A)	1.0	1.3	92.93

Eastern red cedar	6,538	177	(N/A)	1.0	0.6	44.30
Siberian elm	13,992	379	(N/A)	1.0	1.4	94.80
River birch	6,268	170	(N/A)	1.0	0.6	42.47
American elm	9,154	248	(N/A)	1.0	0.9	62.02
White oak	4,147	112	(N/A)	1.0	0.4	28.09
Willow	10,008	271	(N/A)	0.7	1.0	90.41
Honeylocust	12,275	333	(N/A)	0.7	1.2	110.88
Broadleaf Deciduous Small	76	2	(N/A)	0.5	0.0	1.03
Mulberry	1,181	32	(N/A)	0.5	0.1	16.01
Broadleaf Deciduous Medium	1,572	43	(N/A)	0.5	0.2	21.30
Elm	3,199	87	(N/A)	0.5	0.3	43.34
American basswood	8,946	242	(N/A)	0.5	0.9	121.21
Pin oak	7,181	195	(N/A)	0.5	0.7	97.30
Spruce	3,077	83	(N/A)	0.5	0.3	41.70
White ash	8,496	230	(N/A)	0.5	0.8	115.12
Catalpa	2,073	56	(N/A)	0.5	0.2	28.09
Maple	2,229	60	(N/A)	0.5	0.2	30.21
Black cherry	1,243	34	(N/A)	0.5	0.1	16.84
Scotch pine	1,539	42	(N/A)	0.2	0.1	41.70
Tulip tree	1,466	40	(N/A)	0.2	0.1	39.72
Oak	18	0	(N/A)	0.2	0.0	0.48
Black locust	2,479	67	(N/A)	0.2	0.2	67.19
Northern catalpa	5,491	149	(N/A)	0.2	0.5	148.79
Eastern redbud	7	0	(N/A)	0.2	0.0	0.20
Black spruce	256	7	(N/A)	0.2	0.0	6.95
Callery pear	163	4	(N/A)	0.2	0.0	4.41
Lilac	69	2	(N/A)	0.2	0.0	1.86
Littleleaf linden	461	12	(N/A)	0.2	0.0	12.48
Kentucky coffeetree	7,239	196	(N/A)	0.2	0.7	196.17
Pear	1,174	32	(N/A)	0.2	0.1	31.82
Conifer Evergreen Large	2,969	80	(N/A)	0.2	0.3	80.46
Citywide total	1,027,076	27,834	(N/A)	100.0	100.0	67.39

Table 3: Annual Air Quality Benefits

Montezuma

Annual Air Quality Benefits of Public Trees

3/18/2020

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Bur oak	20.8	3.3	9.9	0.9	111	69.7	10.2	9.7	66.3	434	0.0	0	190.7	545	(N/A)	12.8	10.28
Hickory	8.4	1.3	4.6	0.4	46	52.0	7.6	7.2	49.6	325	0.0	0	131.2	371	(N/A)	11.9	7.57
Silver maple	32.8	5.6	16.2	1.5	177	65.5	9.6	9.1	62.7	409	-17.6	-66	185.2	520	(N/A)	10.9	11.56
Norway maple	18.0	3.1	8.8	0.8	97	44.5	6.4	6.1	41.6	276	-4.2	-16	125.2	357	(N/A)	9.9	8.71
Green ash	11.4	1.8	5.5	0.5	61	40.6	5.9	5.6	38.6	253	0.0	0	109.9	314	(N/A)	8.2	9.22
Sugar maple	7.5	1.3	3.7	0.3	40	22.1	3.2	3.1	21.1	138	-5.8	-22	56.5	157	(N/A)	3.9	9.79
Blue spruce	1.8	0.3	1.6	0.2	12	5.9	0.9	0.8	5.6	37	-5.3	-20	11.8	29	(N/A)	3.6	1.93
Apple	1.3	0.2	0.6	0.1	7	4.9	0.7	0.7	4.5	30	0.0	0	13.0	37	(N/A)	3.1	2.85
Northern pin oak	7.6	1.3	3.7	0.3	41	15.8	2.3	2.2	14.7	98	-1.7	-7	46.2	132	(N/A)	2.7	12.02
Red maple	2.2	0.4	1.1	0.1	12	6.6	1.0	0.9	6.2	41	-0.8	-3	17.6	50	(N/A)	2.4	4.98
Black walnut	4.8	0.8	2.2	0.2	25	13.2	1.9	1.8	12.5	82	0.0	0	37.4	108	(N/A)	2.2	11.95
Eastern cottonwood	4.3	0.7	2.0	0.2	23	12.0	1.7	1.7	11.3	74	0.0	0	33.8	97	(N/A)	1.9	12.14
American sycamore	5.9	0.9	2.6	0.3	31	10.4	1.5	1.4	9.9	65	0.0	0	32.9	96	(N/A)	1.7	13.65
Swamp white oak	0.5	0.1	0.3	0.0	3	1.9	0.3	0.3	1.8	12	-0.1	-1	5.0	14	(N/A)	1.7	2.04
Broadleaf Deciduous Large	1.9	0.3	0.9	0.1	10	4.5	0.7	0.6	4.3	28	0.0	0	13.2	38	(N/A)	1.5	6.34
Eastern white pine	0.2	0.0	0.2	0.0	1	0.7	0.1	0.1	0.7	4	-0.6	-2	1.3	3	(N/A)	1.2	0.60
Northern hackberry	3.2	0.6	1.6	0.1	17	6.7	1.0	0.9	6.3	42	0.0	0	20.4	59	(N/A)	1.2	11.80
Northern red oak	1.2	0.2	0.6	0.1	6	2.8	0.4	0.4	2.6	17	-1.6	-6	6.6	17	(N/A)	1.2	3.49
Northern white cedar	0.0	0.0	0.1	0.0	0	0.6	0.1	0.1	0.5	3	-0.3	-1	1.1	3	(N/A)	1.2	0.56
White mulberry	0.0	0.0	0.0	0.0	0	0.4	0.1	0.0	0.3	2	0.0	0	0.8	2	(N/A)	1.0	0.56
Norway spruce	1.7	0.3	1.3	0.2	11	3.0	0.4	0.4	2.9	19	-7.7	-29	2.7	1	(N/A)	1.0	0.28
Eastern red cedar	1.4	0.3	1.1	0.2	9	2.2	0.3	0.3	2.0	13	-3.6	-14	4.1	9	(N/A)	1.0	2.19
Siberian elm	2.3	0.4	1.1	0.1	13	6.4	0.9	0.9	6.1	40	0.0	0	18.3	53	(N/A)	1.0	13.15
River birch	1.4	0.2	0.7	0.1	7	2.9	0.4	0.4	2.7	18	-0.3	-1	8.4	24	(N/A)	1.0	6.00
American elm	1.3	0.2	0.7	0.1	7	5.1	0.7	0.7	4.9	32	0.0	0	13.6	39	(N/A)	1.0	9.68
White oak	0.3	0.0	0.2	0.0	2	3.1	0.5	0.4	3.0	19	0.0	0	7.4	21	(N/A)	1.0	5.21
Willow	2.2	0.4	1.1	0.1	12	4.4	0.6	0.6	4.1	27	-0.5	-2	13.0	37	(N/A)	0.7	12.44
Honeylocust	2.4	0.4	1.1	0.1	13	4.9	0.7	0.7	4.7	31	-1.9	-7	13.2	36	(N/A)	0.7	12.12
Broadleaf Deciduous Small	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)	0.5	0.41
Mulberry	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8	(N/A)	0.5	4.23
Broadleaf Deciduous Medium	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)	0.5	4.56
Elm	0.3	0.0	0.2	0.0	2	1.7	0.3	0.2	1.6	11	0.0	0	4.4	12	(N/A)	0.5	6.17
American basswood	1.4	0.2	0.7	0.1	8	3.1	0.5	0.4	3.0	19	-1.2	-4	8.2	23	(N/A)	0.5	11.37
Pin oak	1.2	0.2	0.6	0.1	7	3.2	0.5	0.4	3.0	20	-2.3	-8	7.0	18	(N/A)	0.5	9.04
Spruce	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.2	7	-1.1	-4	2.3	6	(N/A)	0.5	2.82
White ash	2.0	0.3	0.9	0.1	10	2.9	0.4	0.4	2.8	18	0.0	0	9.7	28	(N/A)	0.5	14.14
Catalpa	0.1	0.0	0.1	0.0	1	1.5	0.2	0.2	1.5	10	0.0	0	3.7	10	(N/A)	0.5	5.21
Maple	0.4	0.1	0.2	0.0	2	1.7	0.3	0.2	1.7	11	-0.2	-1	4.4	12	(N/A)	0.5	6.20
Black cherry	0.4	0.1	0.2	0.0	2	1.1	0.2	0.1	1.0	7	0.0	0	3.1	9	(N/A)	0.5	4.53
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)	0.2	2.82
Tulip tree	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7	(N/A)	0.2	7.42
Oak	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.2	0.08
Black locust	0.5	0.1	0.2	0.0	3	1.3	0.2	0.2	1.2	8	-0.1	0	3.6	10	(N/A)	0.2	10.16
Northern catalpa	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	0.2	15.71
Eastern redbud	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.2	0.11
Black spruce	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	-0.1	0	0.3	1	(N/A)	0.2	0.75
Callery pear	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)	0.2	1.21
Lilac	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)	0.2	0.71
Littleleaf linden	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3	(N/A)	0.2	2.55
Kentucky coffeetree	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)	0.2	19.04
Pear	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8	(N/A)	0.2	8.35
Conifer Evergreen Large	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1	(N/A)	0.2	1.45
Citywide total	157.0	26.3	78.3	7.5	850	441.1	64.2	61.2	418.5	2,747	-59.0	-221	1,195.0	3,376	(N/A)	100.0	8.17

Table 4: Annual Carbon Stored

Montezuma

Stored CO2 Benefits of Public Trees

3/18/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	680,051	5,100	(N/A)	12.8	17.5	96.23
Hickory	273,574	2,052	(N/A)	11.9	7.0	41.87
Silver maple	768,584	5,764	(N/A)	10.9	19.7	128.10
Norway maple	296,023	2,220	(N/A)	9.9	7.6	54.15
Green ash	372,998	2,797	(N/A)	8.2	9.6	82.28
Sugar maple	214,552	1,609	(N/A)	3.9	5.5	100.57
Blue spruce	10,086	76	(N/A)	3.6	0.3	5.04
Apple	21,057	158	(N/A)	3.1	0.5	12.15
Northern pin oak	125,407	941	(N/A)	2.7	3.2	85.50
Red maple	24,573	184	(N/A)	2.4	0.6	18.43
Black walnut	158,709	1,190	(N/A)	2.2	4.1	132.26
Eastern cottonwood	140,640	1,055	(N/A)	1.9	3.6	131.85
American sycamore	199,725	1,498	(N/A)	1.7	5.1	213.99
Swamp white oak	9,130	68	(N/A)	1.7	0.2	9.78
Broadleaf Deciduous	66,533	499	(N/A)	1.5	1.7	83.17
Eastern white pine	1,180	9	(N/A)	1.2	0.0	1.77
Northern hackberry	53,725	403	(N/A)	1.2	1.4	80.59
Northern red oak	24,507	184	(N/A)	1.2	0.6	36.76
Northern white cedar	191	1	(N/A)	1.2	0.0	0.29
White mulberry	547	4	(N/A)	1.0	0.0	1.03
Norway spruce	19,494	146	(N/A)	1.0	0.5	36.55
Eastern red cedar	4,408	33	(N/A)	1.0	0.1	8.27
Siberian elm	56,880	427	(N/A)	1.0	1.5	106.65

River birch	22,259	167	(N/A)	1.0	0.6	41.74
American elm	30,416	228	(N/A)	1.0	0.8	57.03
White oak	9,413	71	(N/A)	1.0	0.2	17.65
Willow	36,506	274	(N/A)	0.7	0.9	91.26
Honeylocust	31,232	234	(N/A)	0.7	0.8	78.08
Broadleaf Deciduous	192	1	(N/A)	0.5	0.0	0.72
Mulberry	6,756	51	(N/A)	0.5	0.2	25.34
Broadleaf Deciduous	3,843	29	(N/A)	0.5	0.1	14.41
Elm	9,492	71	(N/A)	0.5	0.2	35.60
American basswood	57,061	428	(N/A)	0.5	1.5	213.98
Pin oak	30,478	229	(N/A)	0.5	0.8	114.29
Spruce	2,340	18	(N/A)	0.5	0.1	8.78
White ash	26,978	202	(N/A)	0.5	0.7	101.17
Catalpa	4,706	35	(N/A)	0.5	0.1	17.65
Maple	4,725	35	(N/A)	0.5	0.1	17.72
Black cherry	6,921	52	(N/A)	0.5	0.2	25.95
Scotch pine	1,170	9	(N/A)	0.2	0.0	8.78
Tulip tree	3,672	28	(N/A)	0.2	0.1	27.54
Oak	12	0	(N/A)	0.2	0.0	0.09
Black locust	7,945	60	(N/A)	0.2	0.2	59.59
Northern catalpa	25,943	195	(N/A)	0.2	0.7	194.57
Eastern redbud	14	0	(N/A)	0.2	0.0	0.10
Black spruce	43	0	(N/A)	0.2	0.0	0.32
Callery pear	218	2	(N/A)	0.2	0.0	1.64
Lilac	178	1	(N/A)	0.2	0.0	1.33
Littleleaf linden	1,025	8	(N/A)	0.2	0.0	7.68
Kentucky coffeetree	39,259	294	(N/A)	0.2	1.0	294.44
Pear	6,743	51	(N/A)	0.2	0.2	50.57
Conifer Evergreen La	3,343	25	(N/A)	0.2	0.1	25.07
Citywide total	3,895,457	29,216	(N/A)	100.0	100.0	70.74

Table 5: Annual Carbon Sequestered

Montezuma

Annual CO Benefits of Public Trees

3/18/2020

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
Bur oak	34,272	257	-3,264	-152	-26	24,527	184	55,384	415	(N/A)	12.8	15.9	7.84
Hickory	24,820	186	-1,313	-107	-11	18,370	138	41,770	313	(N/A)	11.9	12.0	6.39
Silver maple	57,351	430	-3,689	-153	-29	23,229	174	76,738	576	(N/A)	10.9	22.0	12.79
Norway maple	12,144	91	-1,427	-99	-11	15,376	115	25,994	195	(N/A)	9.9	7.4	4.76
Green ash	19,749	148	-1,790	-89	-14	14,294	107	32,163	241	(N/A)	8.2	9.2	7.09
Sugar maple	10,831	81	-1,030	-51	-8	7,829	59	17,580	132	(N/A)	3.9	5.0	8.24
Blue spruce	868	7	-48	-21	-1	2,079	16	2,878	22	(N/A)	3.6	0.8	1.44
Apple	1,400	10	-101	-16	-1	1,666	12	2,949	22	(N/A)	3.1	0.8	1.70
Northern pin oak	2,720	20	-602	-39	-5	5,432	41	7,511	56	(N/A)	2.7	2.1	5.12
Red maple	3,107	23	-118	-14	-1	2,308	17	5,284	40	(N/A)	2.4	1.5	3.96
Black walnut	6,645	50	-762	-30	-6	4,609	35	10,462	78	(N/A)	2.2	3.0	8.72
Eastern cottonwood	6,073	46	-675	-27	-5	4,180	31	9,551	72	(N/A)	1.9	2.7	8.95
American sycamore	4,180	31	-959	-26	-7	3,675	28	6,870	52	(N/A)	1.7	2.0	7.36
Swamp white oak	721	5	-44	-5	0	652	5	1,324	10	(N/A)	1.7	0.4	1.42
Broadleaf Deciduous Large	1,561	12	-319	-11	-2	1,581	12	2,811	21	(N/A)	1.5	0.8	3.51
Eastern white pine	130	1	-6	-3	0	241	2	362	3	(N/A)	1.2	0.1	0.54
Northern hackberry	1,858	14	-258	-15	-2	2,342	18	3,927	29	(N/A)	1.2	1.1	5.89
Northern red oak	539	4	-118	-8	-1	974	7	1,387	10	(N/A)	1.2	0.4	2.08
Northern white cedar	90	1	-1	-3	0	189	1	275	2	(N/A)	1.2	0.1	0.41
White mulberry	123	1	-3	-2	0	117	1	235	2	(N/A)	1.0	0.1	0.44
Norway spruce	815	6	-94	-12	-1	1,085	8	1,795	13	(N/A)	1.0	0.5	3.36
Eastern red cedar	86	1	-21	-8	0	747	6	804	6	(N/A)	1.0	0.2	1.51
Siberian elm	2,504	19	-273	-14	-2	2,269	17	4,486	34	(N/A)	1.0	1.3	8.41
River birch	851	6	-107	-7	-1	993	7	1,730	13	(N/A)	1.0	0.5	3.24
American elm	1,241	9	-146	-10	-1	1,799	13	2,883	22	(N/A)	1.0	0.8	5.41
White oak	1,308	10	-45	-6	0	1,103	8	2,360	18	(N/A)	1.0	0.7	4.43
Willow	840	6	-175	-11	-1	1,517	11	2,171	16	(N/A)	0.7	0.6	5.43
Honeylocust	3,908	29	-150	-8	-1	1,745	13	5,495	41	(N/A)	0.7	1.6	13.74
Broadleaf Deciduous Smal	47	0	-1	-1	0	43	0	88	1	(N/A)	0.5	0.0	0.33
Mulberry	9	0	-32	-4	0	340	3	313	2	(N/A)	0.5	0.1	1.17
Broadleaf Deciduous Medi	482	4	-19	-3	0	460	3	919	7	(N/A)	0.5	0.3	3.45
Elm	868	7	-46	-4	0	600	5	1,419	11	(N/A)	0.5	0.4	5.32
American basswood	2,890	22	-274	-8	-2	1,102	8	3,710	28	(N/A)	0.5	1.1	13.91
Pin oak	2,982	22	-146	-7	-1	1,123	8	3,953	30	(N/A)	0.5	1.1	14.82
Spruce	231	2	-11	-4	0	433	3	649	5	(N/A)	0.5	0.2	2.43
White ash	182	1	-129	-6	-1	1,041	8	1,088	8	(N/A)	0.5	0.3	4.08
Catalpa	654	5	-23	-3	0	552	4	1,180	9	(N/A)	0.5	0.3	4.43
Maple	648	5	-23	-3	0	616	5	1,239	9	(N/A)	0.5	0.4	4.65
Black cherry	516	4	-33	-3	0	372	3	852	6	(N/A)	0.5	0.2	3.19
Scotch pine	116	1	-6	-2	0	216	2	324	2	(N/A)	0.2	0.1	2.43
Tulip tree	445	3	-18	-2	0	393	3	819	6	(N/A)	0.2	0.2	6.14
Oak	3	0	0	0	0	4	0	7	0	(N/A)	0.2	0.0	0.05
Black locust	470	4	-38	-3	0	440	3	869	7	(N/A)	0.2	0.2	6.52
Northern catalpa	960	7	-125	-4	-1	650	5	1,481	11	(N/A)	0.2	0.4	11.11
Eastern redbud	9	0	0	0	0	6	0	14	0	(N/A)	0.2	0.0	0.10
Black spruce	12	0	0	-1	0	48	0	60	0	(N/A)	0.2	0.0	0.45
Callery pear	96	1	-2	-1	0	65	0	158	1	(N/A)	0.2	0.0	1.18
Lilac	38	0	-1	-1	0	37	0	74	1	(N/A)	0.2	0.0	0.55
Littleleaf linden	223	2	-5	-1	0	134	1	351	3	(N/A)	0.2	0.1	2.63
Kentucky coffeetree	912	7	-188	-5	-1	734	6	1,453	11	(N/A)	0.2	0.4	10.90
Pear	478	4	-32	-3	0	335	3	778	6	(N/A)	0.2	0.2	5.84
Conifer Evergreen Large	187	1	-16	-3	0	246	2	415	3	(N/A)	0.2	0.1	3.11
Citywide total	214,193	1,606	-18,707	-1,015	-148	154,920	1,162	349,390	2,620	(N/A)	100.0	100.0	6.34

Table 6: Annual Social and Aesthetic Benefits

Montezuma

Annual Aesthetic/Other Benefits of Public Trees

3/18/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	2,794	(N/A)	12.8	14.3	52.73
Hickory	2,371	(N/A)	11.9	12.1	48.39
Silver maple	4,495	(N/A)	10.9	23.0	99.90
Norway maple	1,167	(N/A)	9.9	6.0	28.45
Green ash	1,677	(N/A)	8.2	8.6	49.34
Sugar maple	1,102	(N/A)	3.9	5.6	68.89
Blue spruce	310	(N/A)	3.6	1.6	20.64
Apple	80	(N/A)	3.1	0.4	6.17
Northern pin oak	247	(N/A)	2.7	1.3	22.43
Red maple	425	(N/A)	2.4	2.2	42.52
Black walnut	509	(N/A)	2.2	2.6	56.57
Eastern cottonwood	467	(N/A)	1.9	2.4	58.33
American sycamore	281	(N/A)	1.7	1.4	40.10
Swamp white oak	83	(N/A)	1.7	0.4	11.85
Broadleaf Deciduous Large	154	(N/A)	1.5	0.8	25.65
Eastern white pine	55	(N/A)	1.2	0.3	11.07
Northern hackberry	234	(N/A)	1.2	1.2	46.76
Northern red oak	47	(N/A)	1.2	0.2	9.36
Northern white cedar	34	(N/A)	1.2	0.2	6.83
White mulberry	6	(N/A)	1.0	0.0	1.55
Norway spruce	132	(N/A)	1.0	0.7	32.98
Eastern red cedar	27	(N/A)	1.0	0.1	6.84
Siberian elm	178	(N/A)	1.0	0.9	44.38
River birch	80	(N/A)	1.0	0.4	20.00
American elm	182	(N/A)	1.0	0.9	45.54
White oak	149	(N/A)	1.0	0.8	37.21
Willow	75	(N/A)	0.7	0.4	24.84
Honeylocust	972	(N/A)	0.7	5.0	324.13
Broadleaf Deciduous Small	2	(N/A)	0.5	0.0	1.05
Mulberry	0	(N/A)	0.5	0.0	0.02
Broadleaf Deciduous Medium	52	(N/A)	0.5	0.3	26.02
Elm	86	(N/A)	0.5	0.4	43.12
American basswood	182	(N/A)	0.5	0.9	90.97
Pin oak	233	(N/A)	0.5	1.2	116.38
Spruce	65	(N/A)	0.5	0.3	32.32
White ash	33	(N/A)	0.5	0.2	16.71
Catalpa	74	(N/A)	0.5	0.4	37.21
Maple	96	(N/A)	0.5	0.5	47.86
Black cherry	31	(N/A)	0.5	0.2	15.43
Scotch pine	32	(N/A)	0.2	0.2	32.32
Tulip tree	46	(N/A)	0.2	0.2	45.86
Oak	5	(N/A)	0.2	0.0	5.26
Black locust	43	(N/A)	0.2	0.2	43.05
Northern catalpa	67	(N/A)	0.2	0.3	66.60
Eastern redbud	0	(N/A)	0.2	0.0	0.03
Black spruce	12	(N/A)	0.2	0.1	12.31
Callery pear	13	(N/A)	0.2	0.1	12.89

Lilac	2	(N/A)	0.2	0.0	2.06
Littleleaf linden	31	(N/A)	0.2	0.2	31.20
Kentucky coffeetree	58	(N/A)	0.2	0.3	58.34
Pear	29	(N/A)	0.2	0.1	28.80
Conifer Evergreen Large	47	(N/A)	0.2	0.2	47.08
Citywide total	19,573	(N/A)	100.0	100.0	47.39

Table 7: Summary of Benefits in Dollars

Montezuma

Total Annual Benefits of Public Trees by Species ($)

3/18/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Bur oak	3,053	415	545	4,475	2,794	11,283	(N/A)	15.5
Hickory	2,270	313	371	2,475	2,371	7,800	(N/A)	10.7
Silver maple	2,854	576	520	5,186	4,495	13,631	(N/A)	18.7
Norway maple	2,003	195	357	2,365	1,167	6,086	(N/A)	8.4
Green ash	1,778	241	314	2,515	1,677	6,525	(N/A)	9.0
Sugar maple	966	132	157	1,488	1,102	3,845	(N/A)	5.3
Blue spruce	262	22	29	416	310	1,038	(N/A)	1.4
Apple	231	22	37	120	80	490	(N/A)	0.7
Northern pin oak	718	56	132	948	247	2,102	(N/A)	2.9
Red maple	292	40	50	278	425	1,085	(N/A)	1.5
Black walnut	586	78	108	965	509	2,246	(N/A)	3.1
Eastern cottonwood	532	72	97	864	467	2,032	(N/A)	2.8
American sycamore	455	52	96	934	281	1,817	(N/A)	2.5
Swamp white oak	89	10	14	85	83	281	(N/A)	0.4
Broadleaf Deciduous La	199	21	38	300	154	712	(N/A)	1.0
Eastern white pine	28	3	3	47	55	136	(N/A)	0.2
Northern hackberry	297	29	59	428	234	1,046	(N/A)	1.4
Northern red oak	126	10	17	153	47	353	(N/A)	0.5
Northern white cedar	28	2	3	29	34	96	(N/A)	0.1
White mulberry	17	2	2	6	6	33	(N/A)	0.0
Norway spruce	131	13	1	372	132	649	(N/A)	0.9
Eastern red cedar	98	6	9	177	27	318	(N/A)	0.4
Siberian elm	277	34	53	379	178	920	(N/A)	1.3
River birch	132	13	24	170	80	419	(N/A)	0.6
American elm	221	22	39	248	182	711	(N/A)	1.0
White oak	130	18	21	112	149	429	(N/A)	0.6

Willow	200	16	37	271	75	600	(N/A)	0.8
Honeylocust	213	41	36	333	972	1,596	(N/A)	2.2
Broadleaf Deciduous Sn	6	1	1	2	2	12	(N/A)	0.0
Mulberry	47	2	8	32	0	90	(N/A)	0.1
Broadleaf Deciduous M	56	7	9	43	52	166	(N/A)	0.2
Elm	78	11	12	87	86	274	(N/A)	0.4
American basswood	135	28	23	242	182	610	(N/A)	0.8
Pin oak	141	30	18	195	233	616	(N/A)	0.8
Spruce	48	5	6	83	65	207	(N/A)	0.3
White ash	121	8	28	230	33	421	(N/A)	0.6
Catalpa	65	9	10	56	74	215	(N/A)	0.3
Maple	74	9	12	60	96	251	(N/A)	0.3
Black cherry	52	6	9	34	31	132	(N/A)	0.2
Scotch pine	24	2	3	42	32	103	(N/A)	0.1
Tulip tree	44	6	7	40	46	143	(N/A)	0.2
Oak	1	0	0	0	5	7	(N/A)	0.0
Black locust	59	7	10	67	43	186	(N/A)	0.3
Northern catalpa	82	11	16	149	67	324	(N/A)	0.4
Eastern redbud	1	0	0	0	0	1	(N/A)	0.0
Black spruce	7	0	1	7	12	27	(N/A)	0.0
Callery pear	9	1	1	4	13	29	(N/A)	0.0
Lilac	5	1	1	2	2	11	(N/A)	0.0
Littleleaf linden	18	3	3	12	31	67	(N/A)	0.1
Kentucky coffeetree	91	11	19	196	58	375	(N/A)	0.5
Pear	46	6	8	32	29	121	(N/A)	0.2
Conifer Evergreen Large	30	3	1	80	47	163	(N/A)	0.2
Citywide Total	19,426	2,620	3,376	27,834	19,573	72,829	(N/A)	100.0

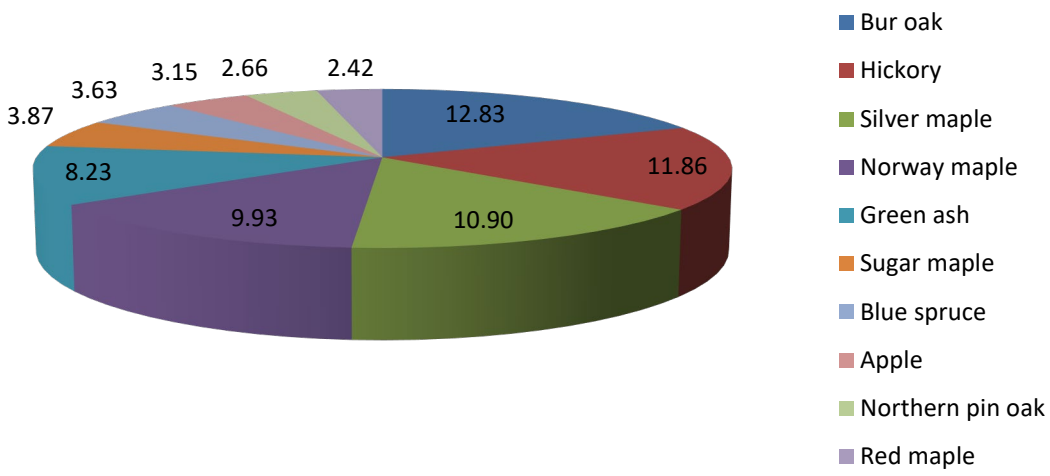

Figure 1: Species Distribution

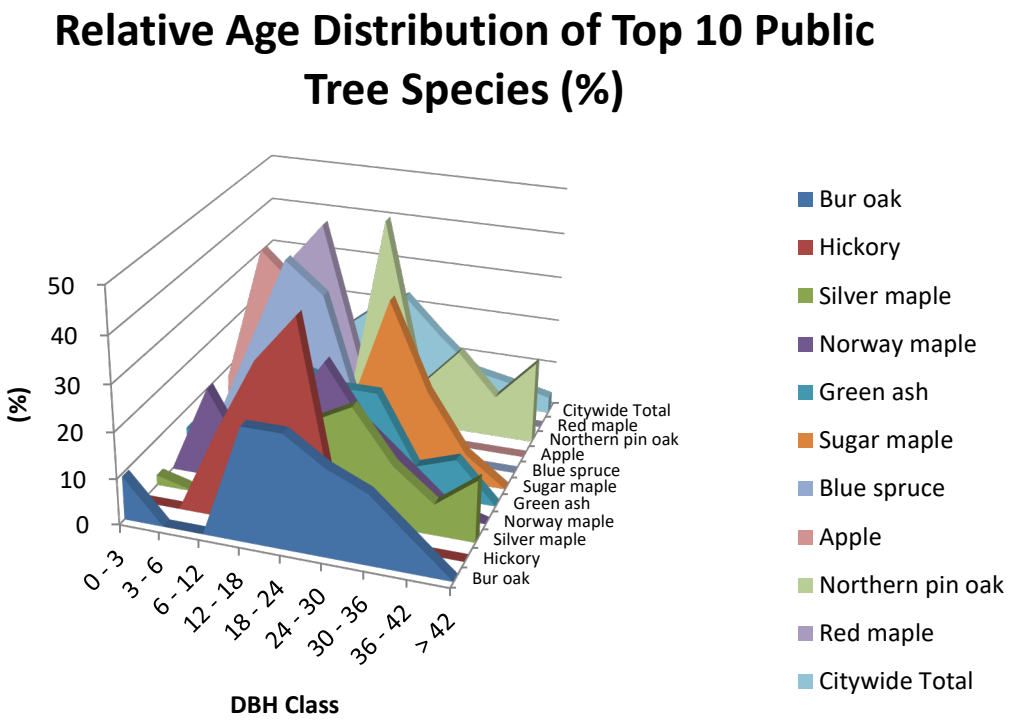

Figure 2: Relative Age Class

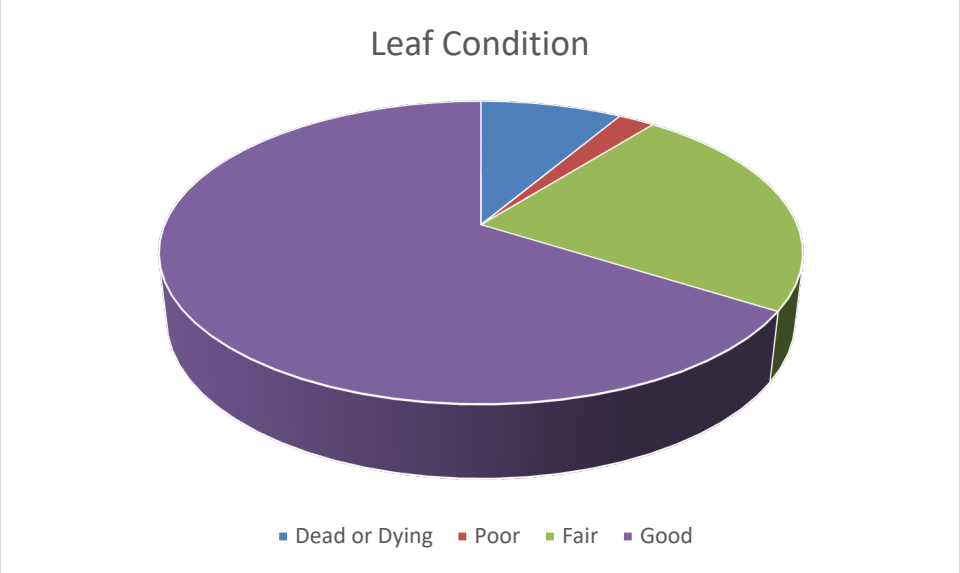

Figure 3: Foliage Condition

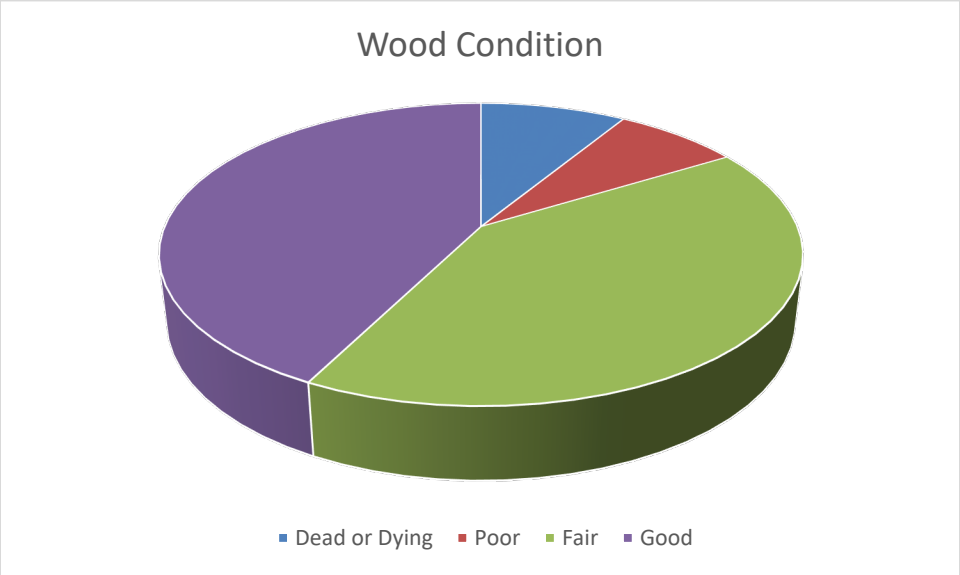

Figure 4: Wood Condition

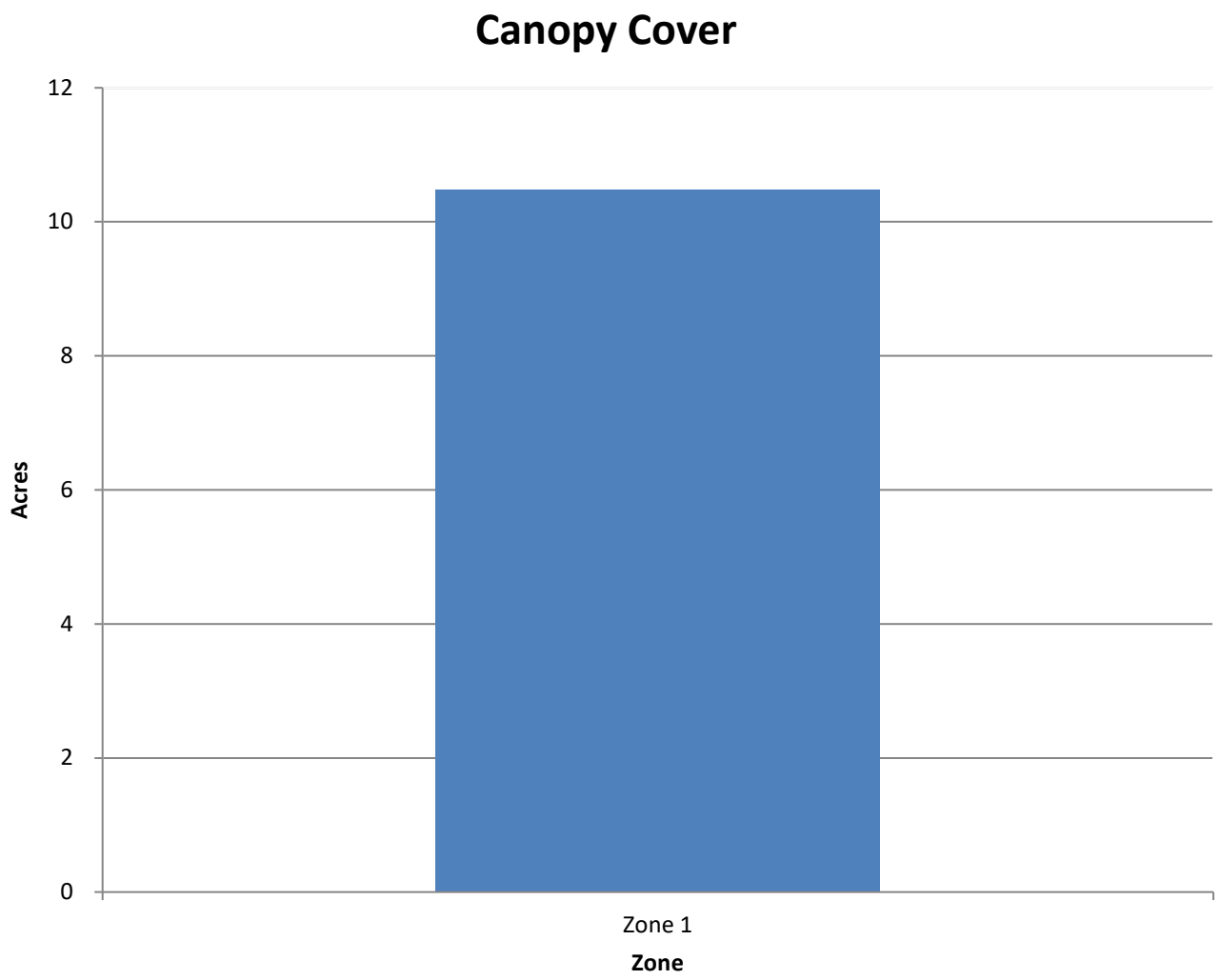

Figure 5: Canopy Cover in Acres

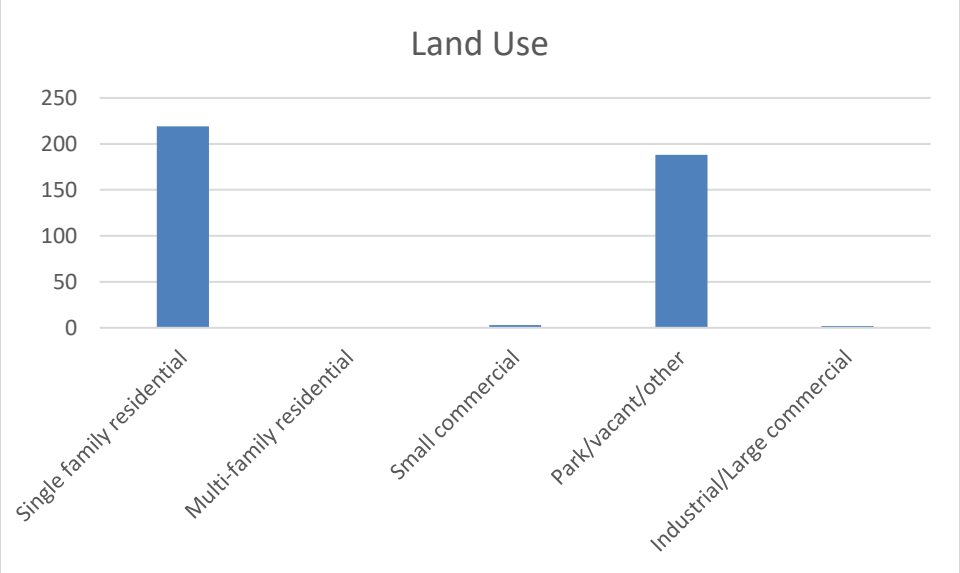

Figure 6: Land Use of city/park trees

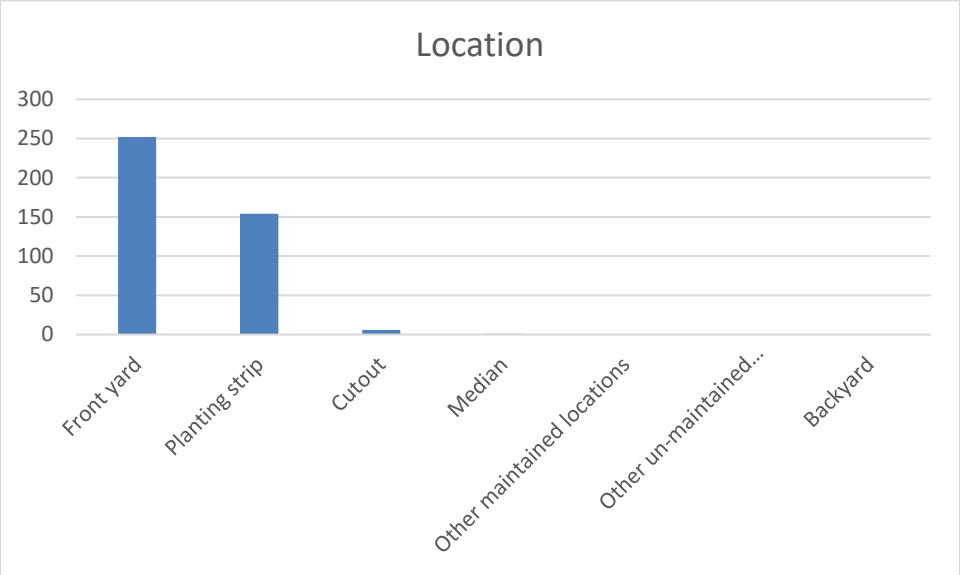

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

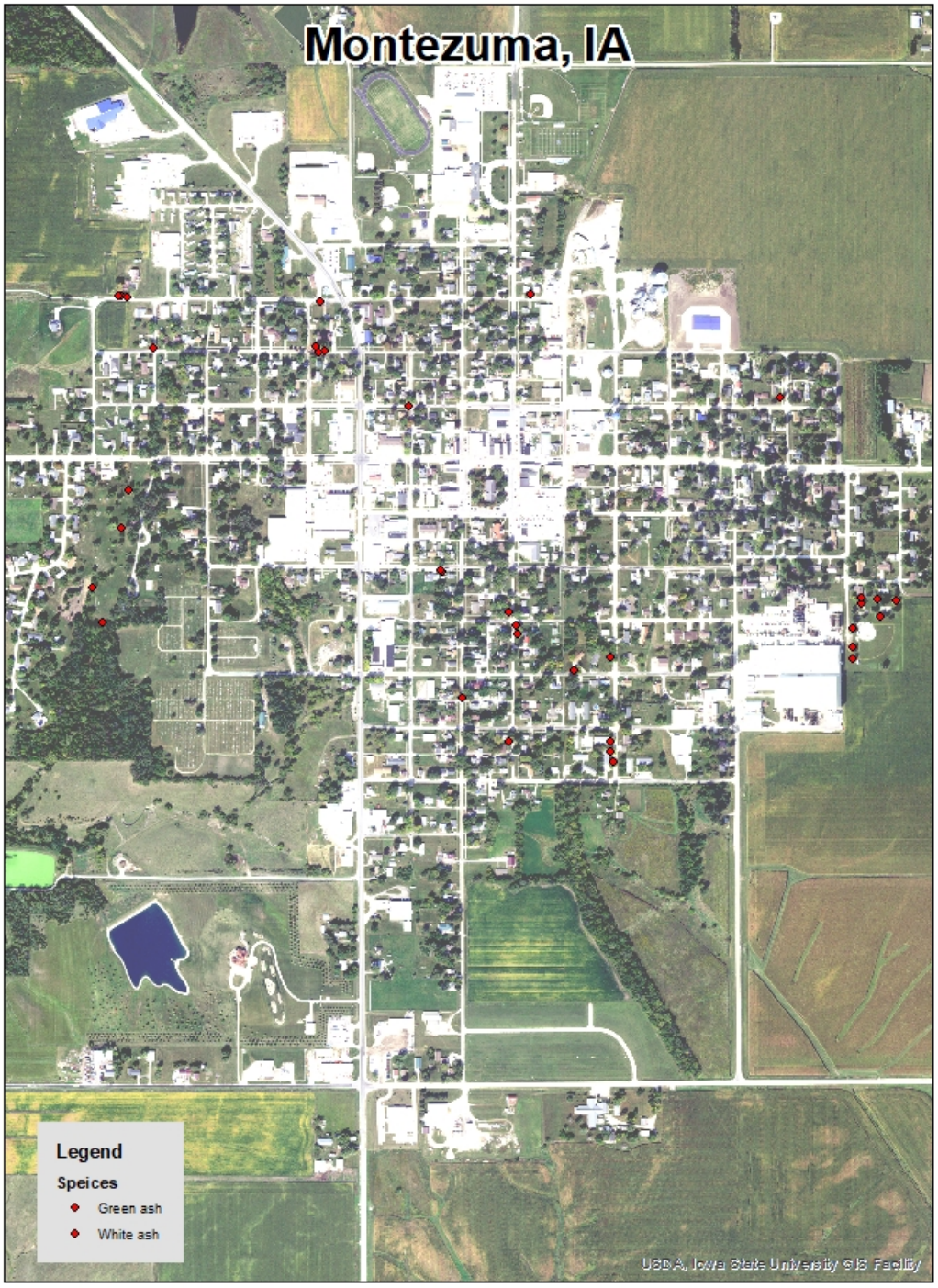

Figure 1: Location of Ash Trees

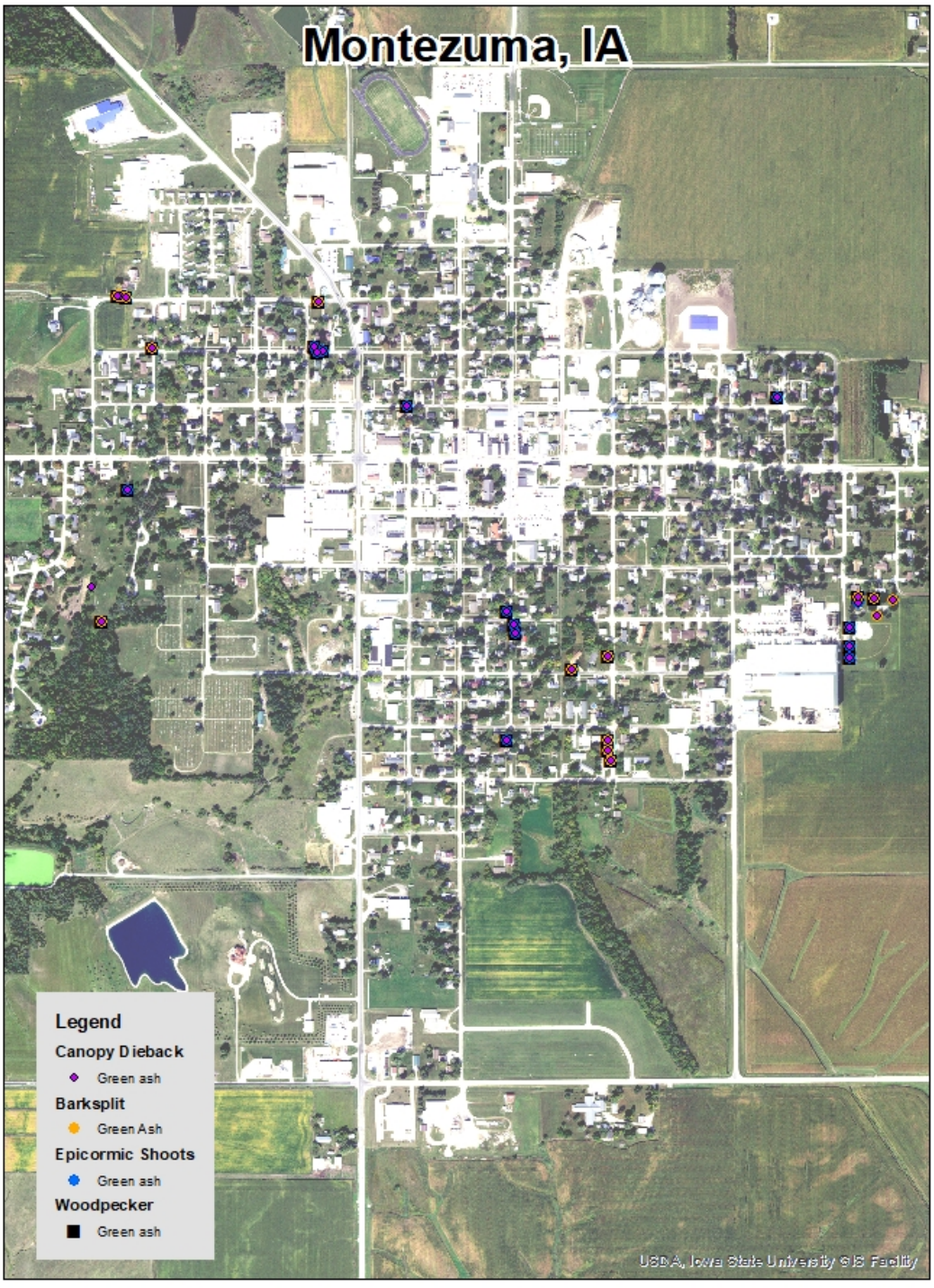

Figure 2: Location of EAB symptoms

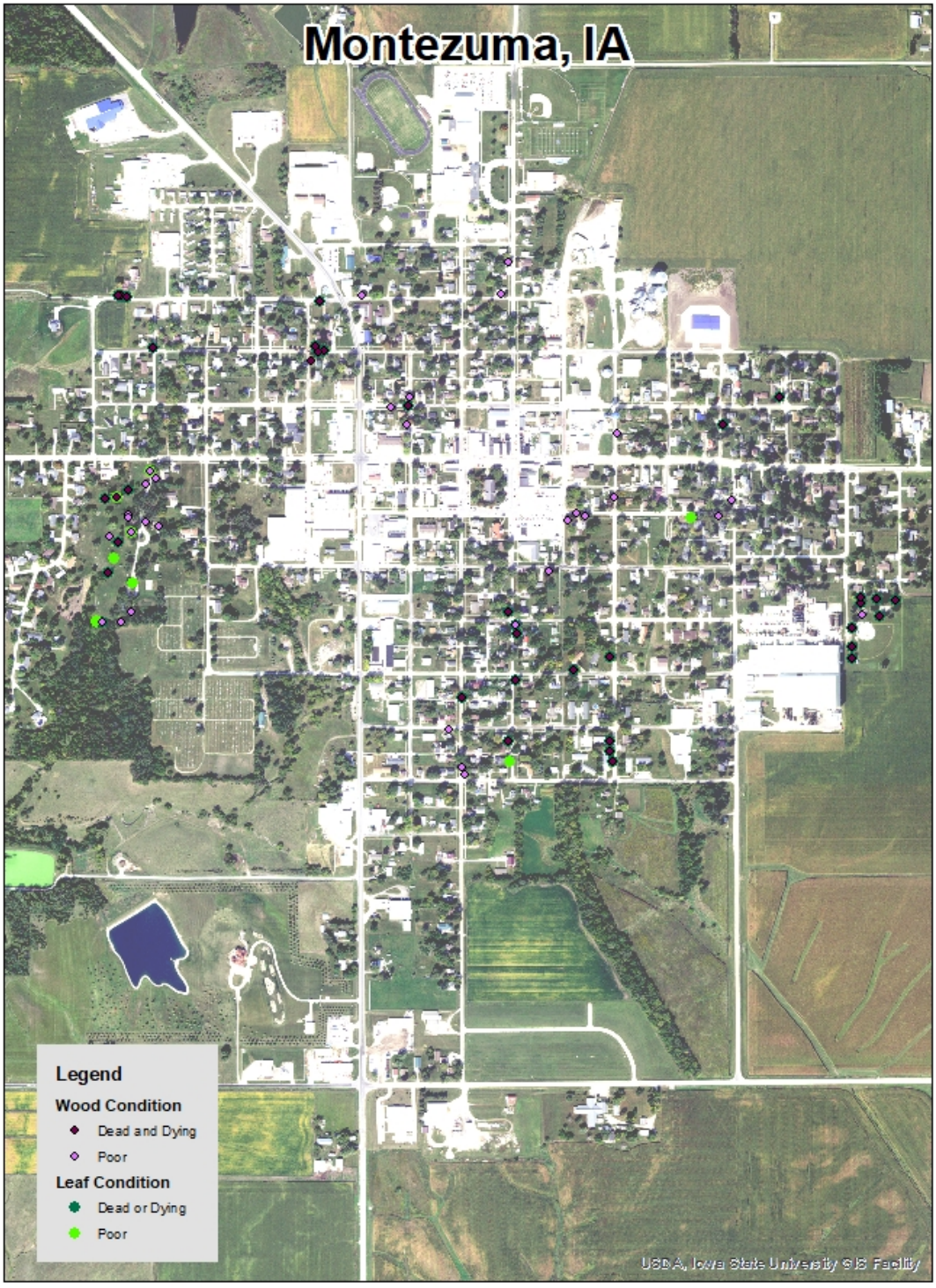

Figure 3: Location of Poor Condition Trees

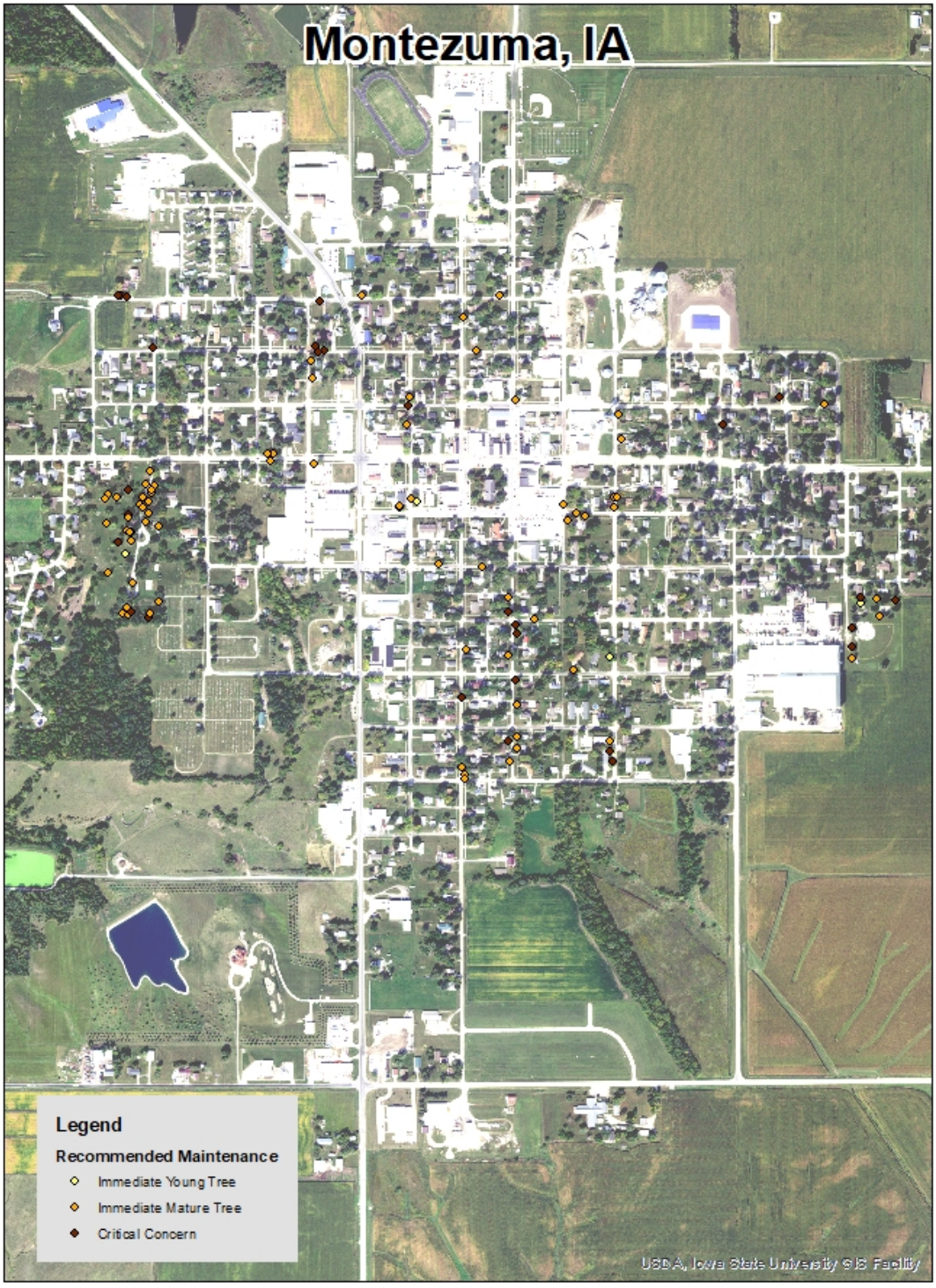

Figure 4: Location of Trees with Recommended Maintenance

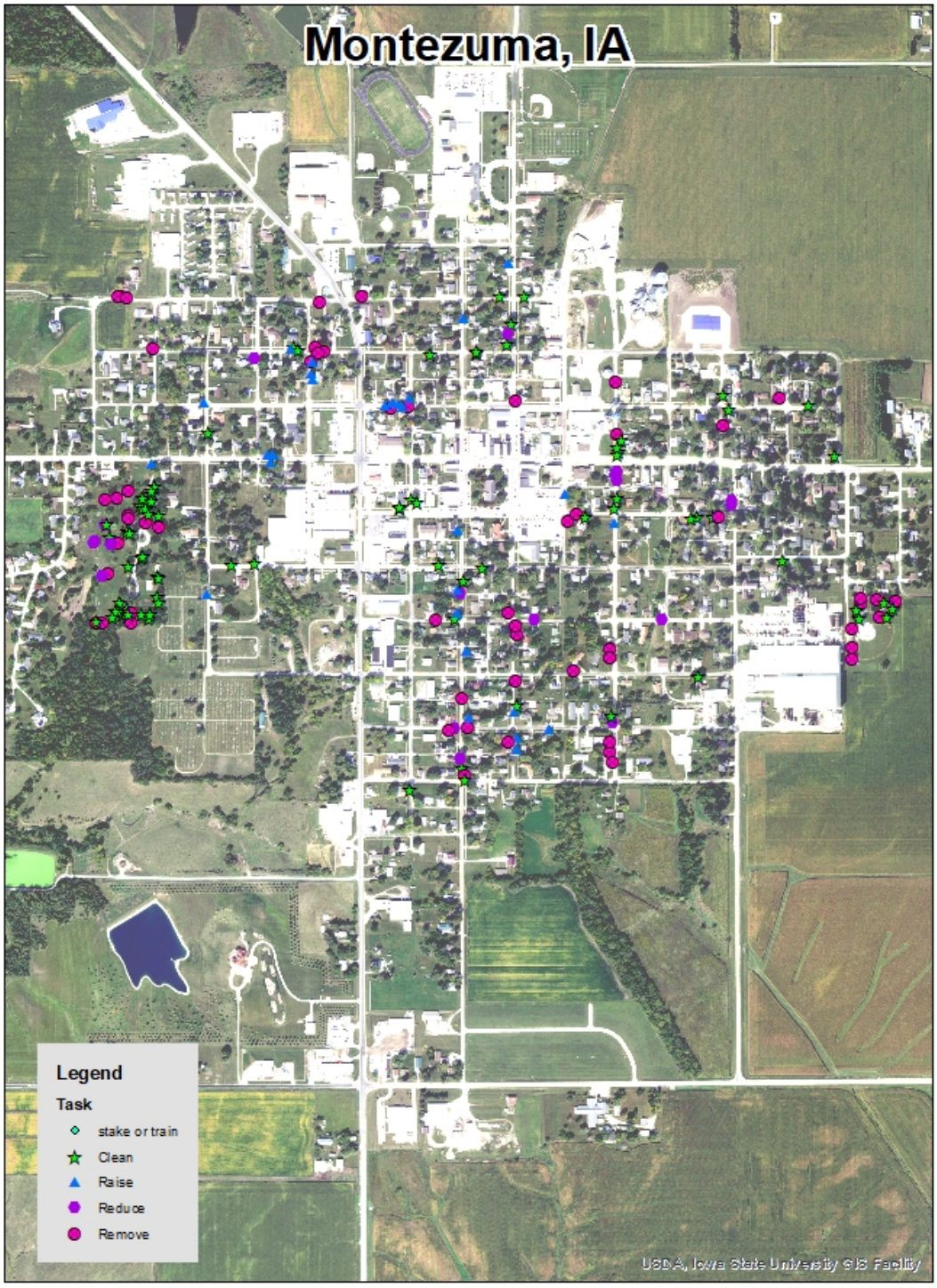

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Montezuma Tree Ordinances

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.

2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

(Code of Iowa, Sec. 364.12[3b & h])

[The next page is 725]

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If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-725-8200.