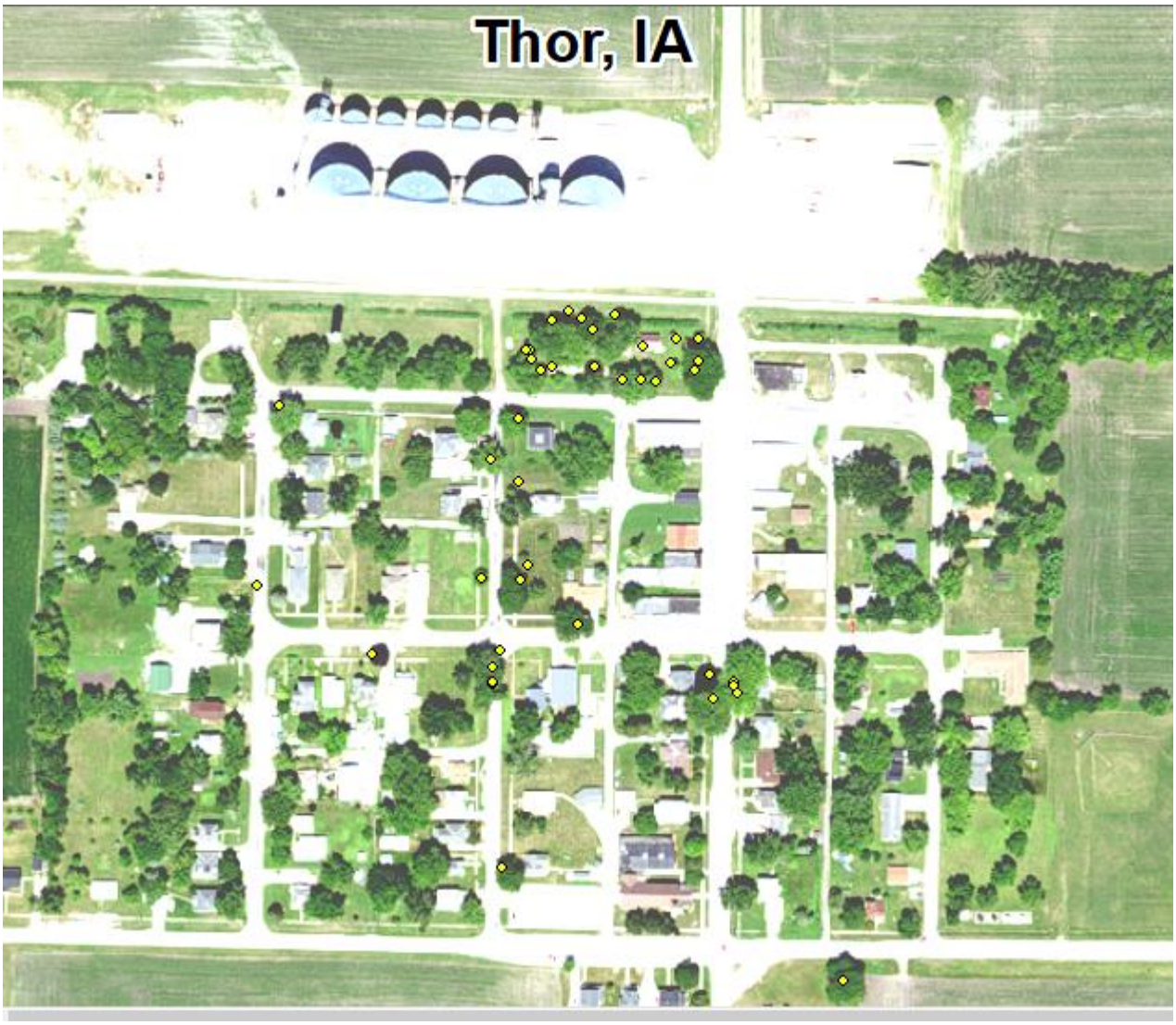
Thor, IA



2020 Urban Forest Management Plan
Prepared by Emma Hanigan
Iowa Department of Natural Resources

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Executive Summary

Overview

This plan was developed to assist the City of Thor 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 17% of Thor'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 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 41 trees inventoried.

- Thor's trees provide $2,746 of benefits annually, an average of $67 a tree
- There are over 12 species of trees
- The top three genera are: Maple 51%, Ash 17%, and Walnut 7%

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.

- 1 of the 7 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 5 years to remove ash – Suggestion: apply for grants to plant replacement trees

Introduction

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

Trees are an important component of Thor'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 Thor 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 Thor'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 41 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. Thor's trees reduce energy related costs by approximately $2,533 annually (Appendix A, Table 1). These savings are both in Electricity (12.2 MWh) and in Natural Gas (1,640.3 Therms).

Annual Stormwater Benefits

Thor's trees intercept about 169,209 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $4,586 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 Thor, it is estimated that trees remove 167.6 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 $474 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Thor, trees sequester about 35,781 lbs of carbon a year with an associated value of $268 (Appendix A, Table 5). In addition, the trees store 675,214 lbs of carbon, with a yearly benefit of $5,064 (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. Thor receives $33,656 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, Thor's trees provide $2,746 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 41 trees in Thor provide approximately $67 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Thor has over 12 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Maple	21	51%
Ash	7	17%
Black Walnut	3	7%
Hackberry	2	5%
Honey locust	2	5%
Spruce	2	5%
Birch	1	2%
Crabapple	1	2%
Mulberry	1	2%
Oak	1	2%

Age Class

Most of Thor's trees (56%) are over 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Thor's size curve is on the large side, indicating a older than average stand and a slowing of tree planting in recent years.

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 Thor indicate that 95% of the trees are in good health, with only none of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Also, 15% of Thor'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 9% of the population. This 9% is an estimate of trees that need management follow up.

Management Needs

At this time there are no immediate management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Canopy Cover

The total canopy with both private and public trees is 4%, 23 acres. The canopy cover included in the Thor inventory includes approximately 1.5 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 47 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Thor'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	51%
Industrial/Large commercial	49%

Location	
Planting strip	49%
Front yard	51%

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

Thor has no trees that have a high risk.

Poor tree species

There are a total of 7 ash trees, and 1 of those has sign/symptoms that have been associated with EAB. In addition, there is one ash tree that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

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

Planting

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

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 (51%) (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 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.

Six Year Maintenance Plan with <u>No Additional Funding</u>

Year 1

Removal: 2 ash tree
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 3 trees to be planted in open locations
Young Tree Pruning & Maintenance
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 1 ash tree
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 2 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim as need
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 2 ash tree
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 3 trees to be planted in open locations
Young Tree Pruning & Maintenance
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 1 ash tree
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 2 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim as need
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 1 ash tree *Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 2 trees to be planted in open locations
Young Tree Pruning & Maintenance
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 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

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. All trees will meet the restrictions in city ordinance. The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

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

Monitoring

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

Budget

Current Budget

Total $12,00 over 6 years ($2,000/year)

FY 2020 Budget

Removal: $1,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $300
Watering & Maintenance: $100

FY 2021 Budget

Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $100
Routine trimming: $900
Watering & Maintenance: $100

FY 2022 Budget

Removal: $1,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $300
Watering & Maintenance: $100

FY 2023 Budget

Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $100
Routine trimming: $900
Watering & Maintenance: $100

FY 2024 Budget

Removal: $1,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $300
Watering & Maintenance: $100

FY 2025 Budget

Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $100
Routine trimming: $900
Watering & Maintenance: $100

Purposed Ash Treatment

EAB could potentially kill all ash trees in Thor within 4 years of its arrival. Additionally, it is recommended that Thor apply for grants to fund replacement trees.

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 28 inches and at $15 per inch, about 3 trees could be treated per year for $420 (every other year treatment). This would be 6 trees selected for treatment, and Thor would still need to find $800 for removal of the ash in poor condition. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Thor

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Thor

Annual Energy Benefits of Public Trees

4/10/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	5.6	425	730.8	716	1,141	(N/A)	39.0	45.1	71.34
Green ash	2.5	190	333.0	326	517	(N/A)	17.1	20.4	73.79
Norway maple	1.3	97	189.7	186	283	(N/A)	9.8	11.2	70.84
Black walnut	0.8	58	103.2	101	159	(N/A)	7.3	6.3	52.96
Northern hackberry	0.6	46	90.0	88	134	(N/A)	4.9	5.3	67.04
Honeylocust	0.7	56	94.8	93	149	(N/A)	4.9	5.9	74.28
Blue spruce	0.3	22	38.5	38	60	(N/A)	4.9	2.4	29.99
Red maple	0.0	3	5.2	5	8	(N/A)	2.4	0.3	7.85
River birch	0.1	8	16.9	17	24	(N/A)	2.4	1.0	24.47
Apple	0.1	6	12.8	13	18	(N/A)	2.4	0.7	18.19
Mulberry	0.2	14	24.7	24	38	(N/A)	2.4	1.5	38.13
Swamp white oak	0.0	0	0.8	1	1	(N/A)	2.4	0.0	1.10
Total	12.2	925	1,640.3	1,607	2,533	(N/A)	100.0	100.0	61.77

Table 2: Annual Stormwater Benefits

Thor

Annual Stormwater Benefits of Public Trees

4/10/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	93,256	2,527	(N/A)	39.0	55.1	157.95
Green ash	33,881	918	(N/A)	17.1	20.0	131.17
Norway maple	15,057	408	(N/A)	9.8	8.9	102.01
Black walnut	6,647	180	(N/A)	7.3	3.9	60.04
Northern hackberry	4,863	132	(N/A)	4.9	2.9	65.89
Honeylocust	9,370	254	(N/A)	4.9	5.5	126.96
Blue spruce	4,469	121	(N/A)	4.9	2.6	60.55
Red maple	137	4	(N/A)	2.4	0.1	3.72
River birch	586	16	(N/A)	2.4	0.3	15.88
Apple	264	7	(N/A)	2.4	0.2	7.17
Mulberry	667	18	(N/A)	2.4	0.4	18.06
Swamp white oak	12	0	(N/A)	2.4	0.0	0.33
Citywide total	169,209	4,586	(N/A)	100.0	100.0	111.84

Table 3: Annual Air Quality Benefits

Thor

Annual Air Quality Benefits of Public Trees

4/10/2020

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
Silver maple	17.2	2.9	8.3	0.8	92	26.3	3.9	3.7	25.3	165	-8.5	-32	79.9	225	(N/A)	39.0	14.08
Green ash	4.9	0.8	2.2	0.2	26	11.9	1.7	1.7	11.4	74	0.0	0	34.8	100	(N/A)	17.1	14.29
Norway maple	3.5	0.6	1.6	0.2	19	6.3	0.9	0.9	5.8	39	-0.8	-3	18.9	54	(N/A)	9.8	13.58
Black walnut	0.6	0.1	0.3	0.0	4	3.6	0.5	0.5	3.4	23	0.0	0	9.2	26	(N/A)	7.3	8.70
Northern hackberry	0.6	0.1	0.3	0.0	3	3.0	0.4	0.4	2.7	18	0.0	0	7.6	22	(N/A)	4.9	10.85
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)	4.9	12.87
Blue spruce	0.7	0.1	0.6	0.1	5	1.4	0.2	0.2	1.3	9	-1.7	-6	3.0	7	(N/A)	4.9	3.53
Red maple	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)	2.4	1.12
River birch	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	2.4	3.47
Apple	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3	(N/A)	2.4	2.55
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)	2.4	6.56
Swamp white 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)	2.4	0.14
Citywide total	29.8	5.0	14.5	1.4	160	57.9	8.4	8.1	55.2	361	-12.6	-47	167.6	474	(N/A)	100.0	11.56

Table 4: Annual Carbon Stored

Thor

Stored CO2 Benefits of Public Trees

4/10/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	389,749	2,923	(N/A)	39.0	57.7	182.70
Green ash	163,690	1,228	(N/A)	17.1	24.2	175.38
Norway maple	57,121	428	(N/A)	9.8	8.5	107.10
Black walnut	20,587	154	(N/A)	7.3	3.0	51.47
Northern hackberry	8,284	62	(N/A)	4.9	1.2	31.07
Honeylocust	24,490	184	(N/A)	4.9	3.6	91.84
Blue spruce	6,012	45	(N/A)	4.9	0.9	22.54
Red maple	218	2	(N/A)	2.4	0.0	1.64
River birch	1,101	8	(N/A)	2.4	0.2	8.26
Apple	908	7	(N/A)	2.4	0.1	6.81
Mulberry	3,037	23	(N/A)	2.4	0.4	22.78
Swamp white oak	17	0	(N/A)	2.4	0.0	0.13
Citywide total	675,214	5,064	(N/A)	100.0	100.0	123.51

Table 5: Annual Carbon Sequestered

Thor

Annual CO $_2$ Benefits of Public Trees

4/10/2020

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
Silver maple	26,416	198	-1,872	-66	-15	9,399	70	33,877	254 (N/A)	39.0	64.1	15.88
Green ash	5,594	42	-786	-27	-6	4,204	32	8,986	67 (N/A)	17.1	17.0	9.63
Norway maple	370	3	-274	-16	-2	2,154	16	2,234	17 (N/A)	9.8	4.2	4.19
Black walnut	1,765	13	-99	-7	-1	1,276	10	2,934	22 (N/A)	7.3	5.6	7.34
Northern hackberry	708	5	-40	-5	0	1,013	8	1,677	13 (N/A)	4.9	3.2	6.29
Honeylocust	0	0	-118	-5	-1	1,230	9	1,106	8 (N/A)	4.9	2.1	4.15
Blue spruce	279	2	-29	-5	0	493	4	738	6 (N/A)	4.9	1.4	2.77
Red maple	39	0	-1	-1	0	60	0	97	1 (N/A)	2.4	0.2	0.73
River birch	224	2	-5	-1	0	176	1	393	3 (N/A)	2.4	0.7	2.95
Apple	114	1	-4	-1	0	124	1	232	2 (N/A)	2.4	0.4	1.74
Mulberry	268	2	-15	-2	0	308	2	560	4 (N/A)	2.4	1.1	4.20
Swamp white oak	5	0	0	0	0	7	0	12	0 (N/A)	2.4	0.0	0.89
Citywide total	35,781	268	-3,242	-138	-25	20,445	153	52,846	396 (N/A)	100.0	100.0	9.67

Table 6: Annual Social and Aesthetic Benefits

Thor

Annual Aesthetic/Other Benefits of Public Trees

4/10/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	1,944	(N/A)	39.0	70.8	121.52
Green ash	408	(N/A)	17.1	14.9	58.31
Norway maple	31	(N/A)	9.8	1.1	7.87
Black walnut	161	(N/A)	7.3	5.9	53.74
Northern hackberry	105	(N/A)	4.9	3.8	52.26
Honeylocust	0	(N/A)	4.9	0.0	0.00
Blue spruce	38	(N/A)	4.9	1.4	19.02
Red maple	7	(N/A)	2.4	0.3	7.28
River birch	26	(N/A)	2.4	1.0	26.22
Apple	6	(N/A)	2.4	0.2	6.40
Mulberry	15	(N/A)	2.4	0.6	15.48
Swamp white oak	3	(N/A)	2.4	0.1	2.74
Citywide total	2,746	(N/A)	100.0	100.0	66.97

Table 7: Summary of Benefits in Dollars

Thor

Total Annual Benefits of Public Trees by Species ($)

4/10/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Silver maple	1,141	254	225	2,527	1,944	6,092	(N/A)	56.8
Green ash	517	67	100	918	408	2,010	(N/A)	18.7
Norway maple	283	17	54	408	31	794	(N/A)	7.4
Black walnut	159	22	26	180	161	548	(N/A)	5.1
Northern hackberry	134	13	22	132	105	405	(N/A)	3.8
Honeylocust	149	8	26	254	0	437	(N/A)	4.1
Blue spruce	60	6	7	121	38	232	(N/A)	2.2
Red maple	8	1	1	4	7	21	(N/A)	0.2
River birch	24	3	3	16	26	73	(N/A)	0.7
Apple	18	2	3	7	6	36	(N/A)	0.3
Mulberry	38	4	7	18	15	82	(N/A)	0.8
Swamp white oak	1	0	0	0	3	4	(N/A)	0.0
Citywide Total	2,533	396	474	4,586	2,746	10,735	(N/A)	100.0

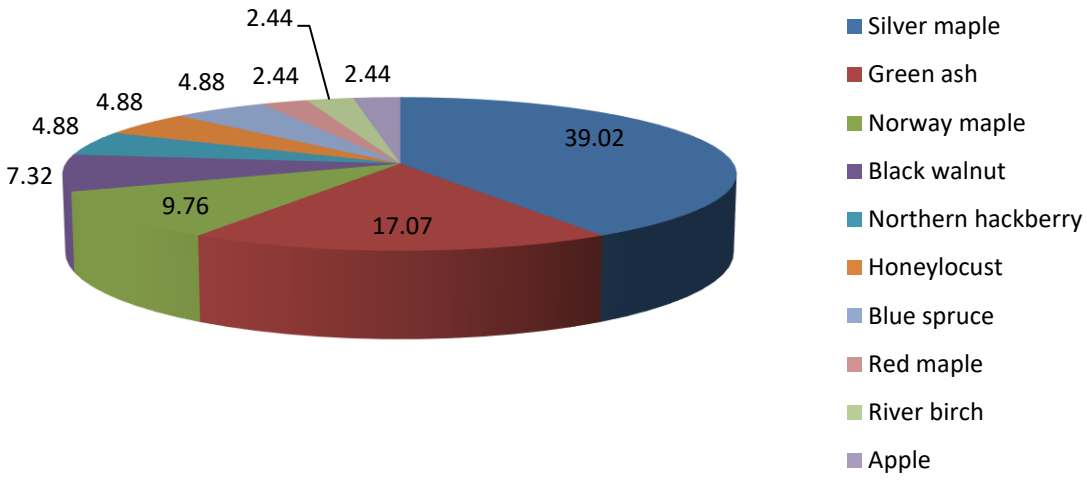

Figure 1: Species Distribution

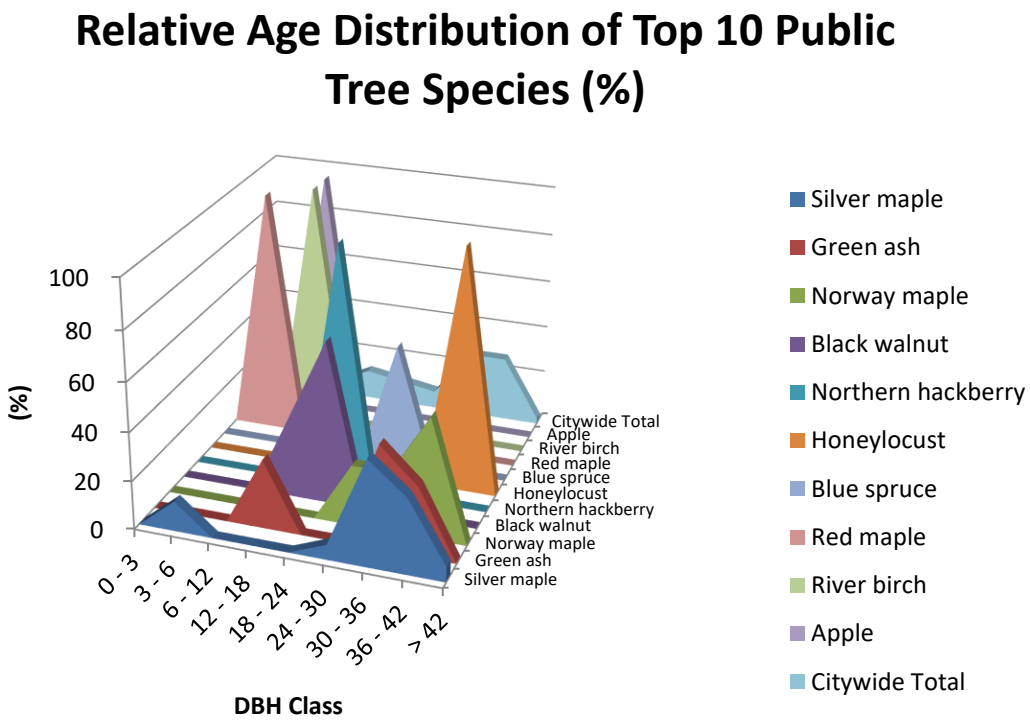

Figure 2: Relative Age Class

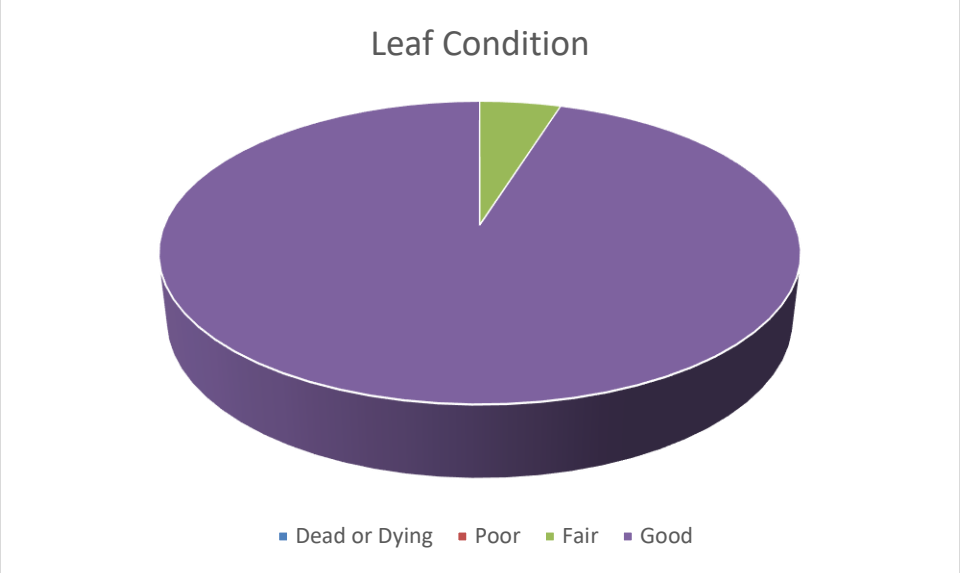

Figure 3: Foliage Condition

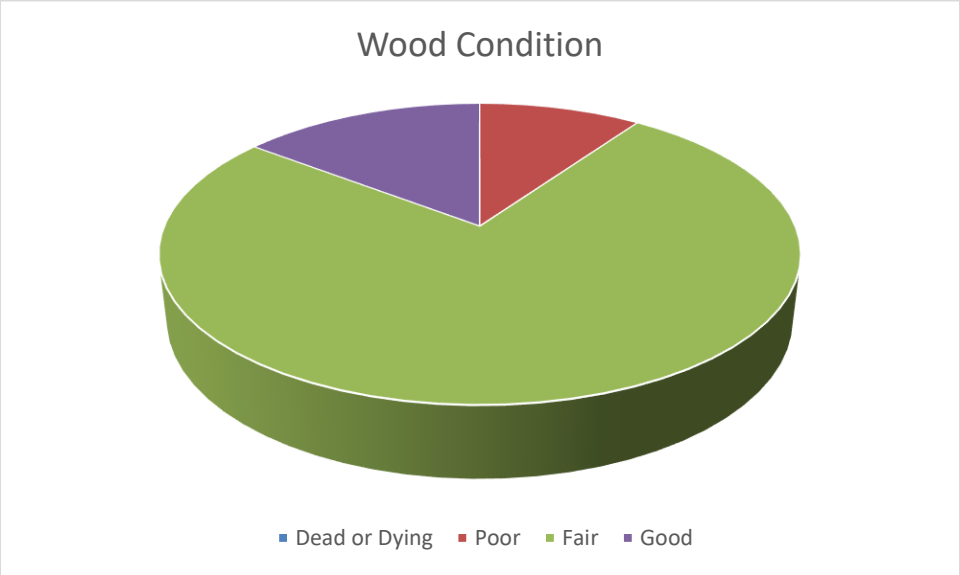

Figure 4: Wood Condition

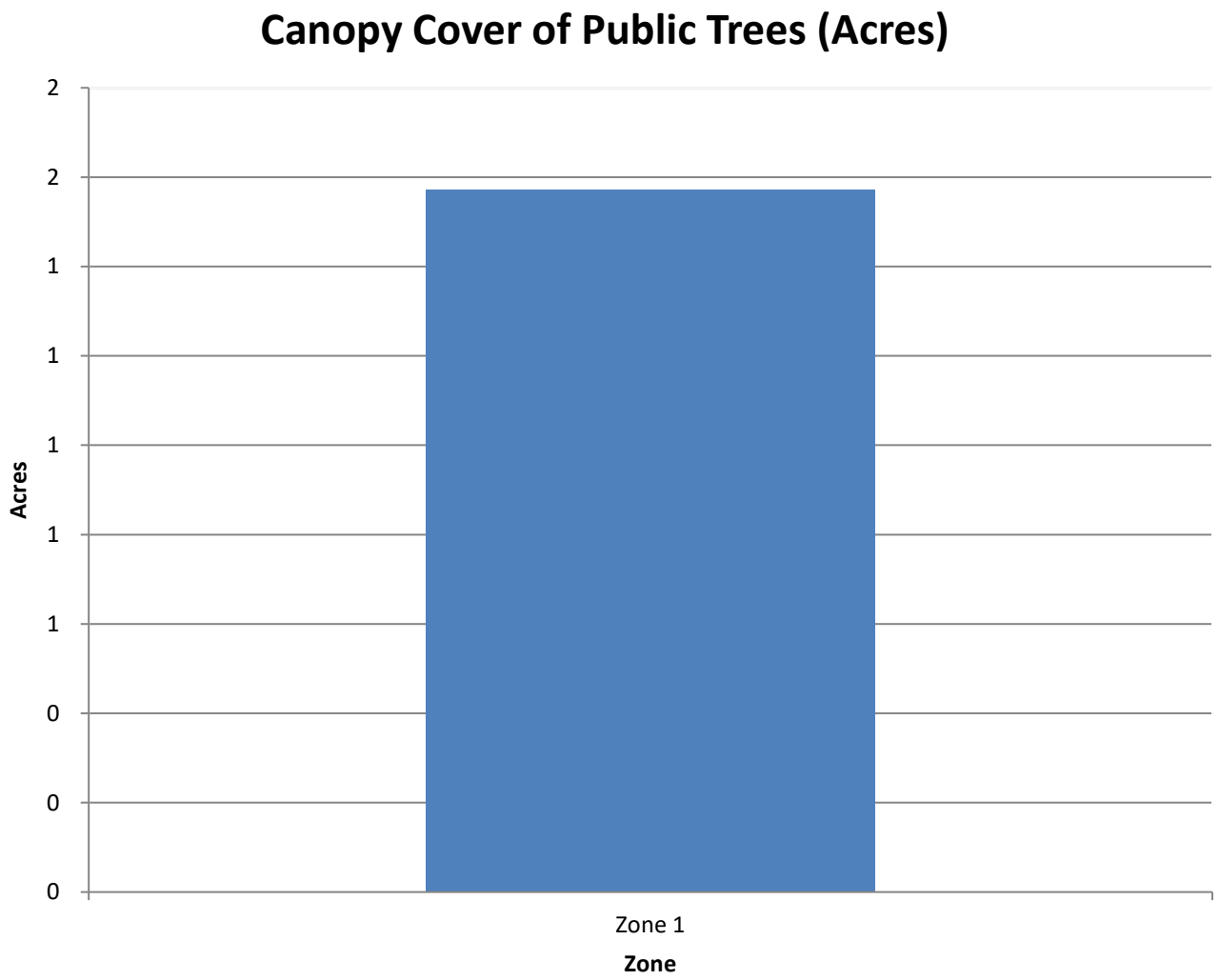

Figure 5: Canopy Cover in Acres

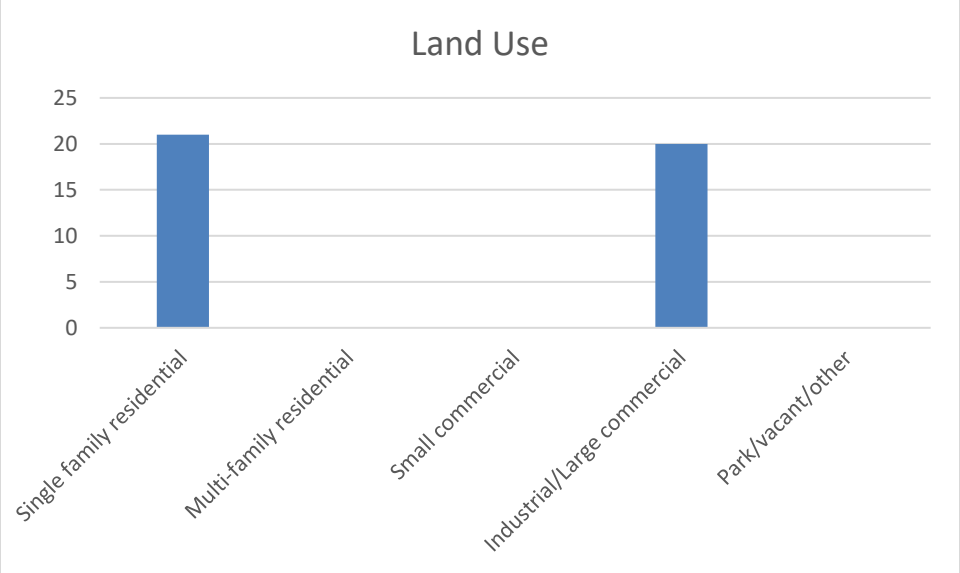

Figure 6: Land Use of city/park trees

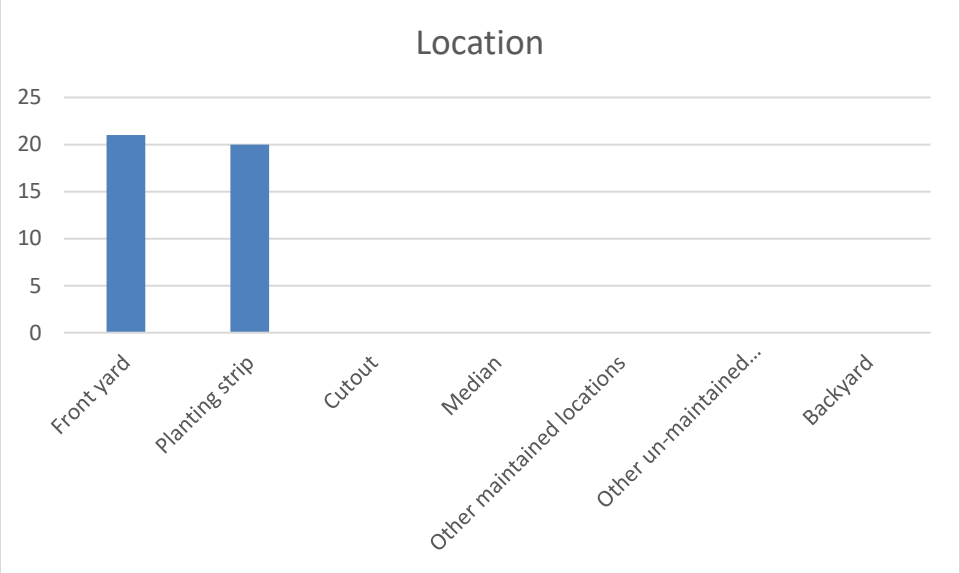

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

None

Figure 4: Location of Trees with Recommended Maintenance

None

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

Appendix C: Thor Tree Ordinances

The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E 9th St, Des Moines IA 50319.

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