Anamosa, IA

Urban Forestry Management Plan

SUMMER 2022

JEO CONSULTING GROUP

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Anamosa in managing its urban forest, including budgeting and future planning. Trees bring numerous benefits to a community, and sound management helps leaders take advantage of these benefits. Management is especially important now considering the serious threats posed by forest pests like 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 except mountain ash. There is a strong possibility that 10% of Anamosa city-owned trees will die once EAB becomes established in the community, unless local leaders begin preventative treatment. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2022, JEO conducted a tree inventory 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 812 trees inventoried.

- Anamosa trees provide $142,664 of benefits annually, an average of $176 per tree
- There are over 50 species of trees
- The top three genera are: Maple 42%, Ash 10%, and Cedar 9%
- 24% of trees need some type of management
- 27 trees should be removed

Recommendations

We detail our core recommendations in the Recommendations Section. In the Emerald Ash Borer Plan, we include management recommendations. Below are some key recommendations.

- Out of the 27 trees needing removal, 12 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 24 of the 80 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 yearly with a visual survey.
- With the current budget it could take 6 years to remove ash. We suggest that city officials request a budget increase to $15,000 annually and apply for grants to plant replacement trees.

Introduction

INTRODUCTION

This plan was developed to assist Anamosa with managing, budgeting, and future planning of their urban forest. Across the state, forestry budgets continue to decrease as a higher percentage of the budgets are devoted to 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, treatment, and replacement planting. With proper planning and management of the current canopy in Anamosa, these costs can be spread out over the years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important part of Anamosa's infrastructure and one of the city's greatest assets. The benefits of trees are immense. Trees improve air quality, intercept stormwater runoff, conserve energy, lower traffic speeds, increase property values, reduce crime, improve mental health, and create a desirable place to live, to name just a few. Good urban forestry management will maintain these important benefits for the people of Anamosa and future generations.

Urban forestry management sets goals and develops management strategies to achieve them. To develop management strategies, a comprehensive public tree inventory must be conducted. The inventory informs maintenance, removal schedules, tree planting, and budgeting. Aligning management actions with the tree inventory results will help meet Anamosa's urban forestry goals.

Assist Anamosa with Managing its Urban Forest

Inform on the Benefits of a Healthy Urban Forest

Establish Preventative Treatment for Emerald Ash Borer

Develop Efficient City Tree Management Techniques

Mitigate Public Safety Issues

Findings

INVENTORY

In 2022, JEO conducted a tree inventory that included 100% of the city-owned trees on both streets and parks. The team collected tree data 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 data collectors' programming 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, for all ash trees, the team notes signs and symptoms associated with EAB including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

INVENTORY RESULTS

JEO entered the data collected for the 812 city trees into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. Following are results from the i-Tree STREETS analysis.

ANNUAL BENEFITS

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Anamosa's trees reduce energy-related costs by approximately $38,047 annually (Appendix A, Table 1). These savings are both in electricity (180.3 MWh) and in natural gas (24,862.2 Therms).

Annual Stormwater Benefits

Anamosa trees intercept about 1,917,085 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $51,953 in benefit 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 lessens emissions of volatile organic matter (ozone). In Anamosa, it is estimated that trees remove 2,302 lbs of air pollution (ozone (O3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and sulfur dioxide (SO2)) per year with a net value of $6,459 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Anamosa, trees sequester about 409,375 lbs of carbon per year with an associated value of $5,093 (Appendix A, Table 5). In addition, the trees store 6,411,828 lbs of carbon, with a yearly benefit of $48,089 (Appendix A, Table 4).

Annual Aesthetics Benefits

The social benefits of trees are hard to capture. The i-Tree 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. Anamosa receives $41,112 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, Anamosa trees provide $142,664 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 812 trees in Anamosa provide approximately $176 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$38,047**	• Intercept **1,917,085 gallons** • Provides **$51,953** benefit	• Remove **2,302 lbs** of pollution • Net value of **$6,459**	• Sequester **409,375 lbs** • Value of **$5,093** • Store **6,411,828 lbs** • Value of **$48,089**	• **$41,112** in social benefits	• **$142,664** annual benefits • Each tree provides **$176** annually

FOREST STRUCTURE

Species Distribution

Anamosa has over 50 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	343	42%
Ash	80	10%
Cedar	74	9%
Apple	44	5%
Oak	39	5%
Walnut	39	5%
Locust	37	5%
Spruce	27	3%
Lilac	18	2%
Hackberry	17	2%
Basswood/Linden	15	2%
Sycamore	13	2%
Elm	9	1%
Cherry	8	<1%
Ginkgo	7	<1%
Magnolia	5	<1%

Pear	4	<1%
Tree of Heaven	4	<1%
Mulberry	4	<1%
Cottonwood	4	<1%
Birch	4	<1%
Pine	3	<1%
Willow	3	<1%
Redbud	3	<1%
Buckeye	2	<1%
Other Deciduous	2	<1%
Hemlock	1	<1%
Dogwood	1	<1%
Evergreen	1	<1%

Age Class

Most of Anamosa's trees (21%) are between 18 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Anamosa's size curve is on the normal side, indicating an average age stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Anamosa indicate that 90% of the trees are in good health, with only 4% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 90% of Anamosa's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Three percent of the tree population's wood condition is in poor health, dead, or dying. This 3% 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).

Action	Number of Trees	Percentage
Crown Cleaning	86	11%
Crown Raising	38	5%
Tree Removal	27	3%
Crown Reduction	7	1%
Tree Staking	1	<1%

Canopy Cover

The total canopy with both private and public trees is 459 acres or 27% cover. The canopy cover included in the Anamosa inventory includes approximately 20 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 5% in 30 years. To achieve this goal it is estimated that 5 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Anamosa'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	Percentage
Single Family Residential	68%
Park/Vacant/Other	23%
Industrial/Large Commercial	8%
Multifamily Residential	1%
Small Commercial	<1%

Recommendations

RECOMMENDATIONS

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead, dying, or have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorists' vision of pedestrians, vehicles, traffic signs and signals should be removed.

HAZARDOUS TREES

Anamosa has 11 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 4 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 trees marked as needing maintenance. There are a total of 33 trees with maintenance needs.

POOR TREE SPECIES

After removing the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 27 removals, 15 are ash trees. There are a total of 80 ash trees, and 12 of those have signs and symptoms that have been associated with EAB. In addition, there are 15 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising removes lower branches that are two inches in diameter or larger to provide clearance for pedestrians or vehicles. Crown reduction removes individual limbs from structures or utility wires. We recommend 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 five years will replace the trees that are removed. We recommend planting 1.2 trees for every tree removed, since survival rates will not be 100%. 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 Anamosa.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (42%) (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: crabapple, Japanese Lilac, serviceberry, oak (red, white), hackberry, linden, elm (disease resistant), cork, London plane, ironwood hornbeam as outlined in section 150.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 150.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. We recommend 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.

EMERALD ASH BORER PLAN

Ash Tree Removal

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

Treatment of Ash Trees

Chemical treatment can be an effective tool for communities to spread removal costs out over several years while allowing trees to continue providing 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 normally disposed of 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 150.02 (Appendix C). The new plantings will be a diverse mix and will not include crabapple, Japanese Lilac, serviceberry, oak (red, white), hackberry, linden, elm (disease resistant), cork, London plane, ironwood hornbeam.

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.

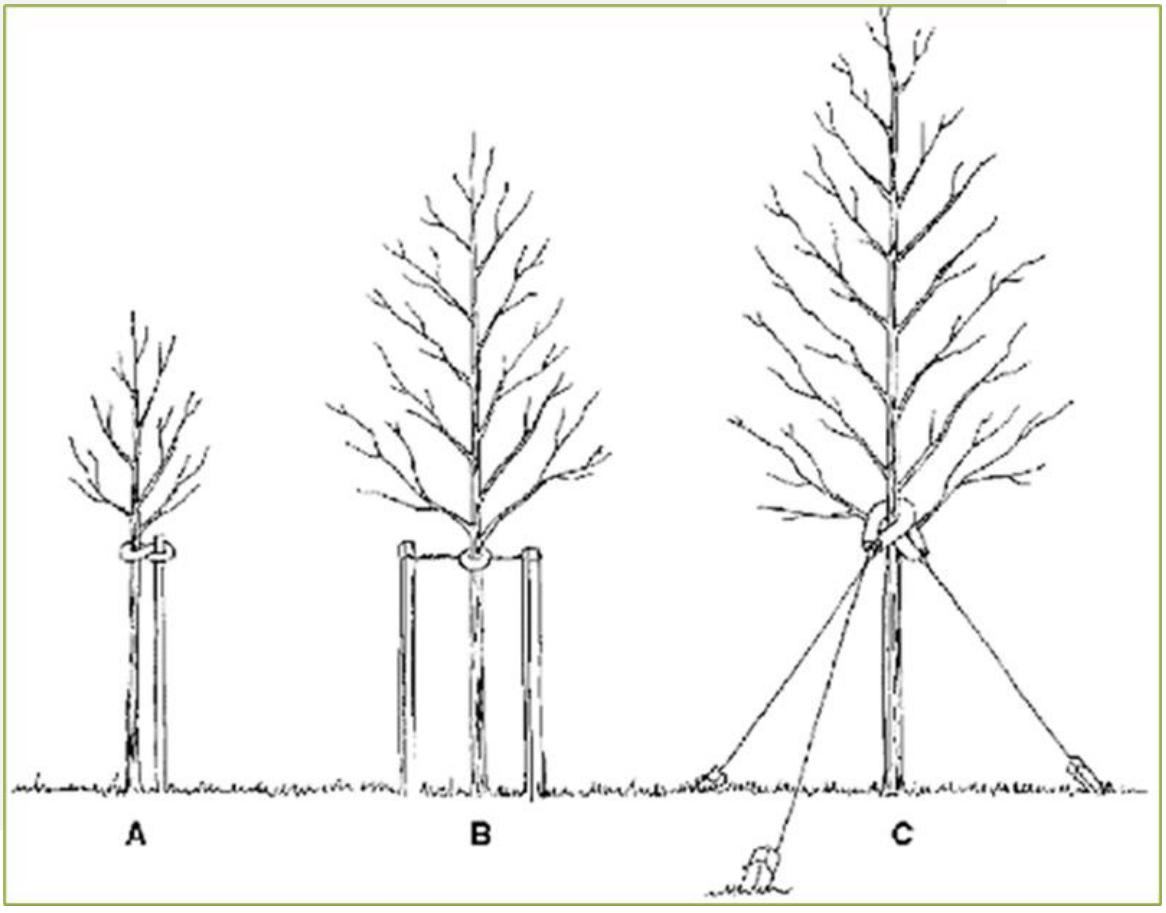
Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 150.06 states “A property owner may remove a tree that is on personal property as long as the property owner does the actual work. Otherwise, the property owner must hire a licensed tree surgeon to remove the tree.”

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $10,000/Year – (Based off $2/Resident Estimation)

YEAR 1	Est. Cost
Remove 6 trees recommended for immediate removal	$4,200
Remove 6 ash tree in poor condition	$4,200
Plant 10 trees in open locations	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,900**

YEAR 2	Est. Cost
Remove 6 trees recommended for immediate removal	$4,200
Plant 11 trees in open locations	$1,650
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,910**

YEAR 3	Est. Cost
Remove 5 tree recommended for immediate removal	$3,500
Remove 6 ash trees in poor condition	$4,200
Plant 15 trees in open locations	$2,250
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,950**

YEAR 4	Est. Cost
Remove 6 trees recommended for immediate removal	$4,200
Plant 11 trees in open locations	$1,650
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,910**

YEAR 5	Est. Cost
Remove 11 trees recommended for immediate removal	$7,700
Plant 15 trees in open locations	$2,250
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,950**

YEAR 6	Est. Cost
Remove 6 ash trees	$4,200
Plant 11 trees in open locations	$1,650
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$9,910**

Estimated costs based on average costs of $700/tree for removal, $150/tree for planting and maintenance, and $15/tree for pruning.

***To remove all ash trees within 6 years alone, the budget would need to be $10,000 a year. If the budget were increased to $15,000 a year all ash could be removed in 4 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $15,000/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 10 trees recommended for immediate removal	$7,000
Remove 6 ash trees in poor condition	$4,200
Plant 25 trees in open locations	$3,750
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,950**

YEAR 2	Est. Cost
Remove 11 trees recommended for immediate removal	$7,700
Plant 21 trees in open locations	$3,150
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,910**

YEAR 3	Est. Cost
Remove 15 trees recommended for removal	$10,500
Plant 30 trees in open locations	$4,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$15,000**

YEAR 4	Est. Cost
Remove 11 trees recommended for removal	$7,700
Plant 21 trees in open locations	$3,150
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,910**

YEAR 5	Est. Cost
Remove 15 ash trees	$10,500
Plant 30 trees in open locations	$4,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$15,000**

YEAR 6	Est. Cost
Remove 11 ash trees	$7,700
Plant 21 trees in open locations	$3,150
Prune 1/3 of city owned trees	$4,060
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,910**

Purposed Budget Increase

EAB could potentially kill all ash trees in Anamosa within four years of its arrival. To remove all ash trees within six years, the budget would need to be $10,000 a year. If the budget were

increased to $15,000 per year all ash could be removed within 4 years. Additionally, we recommend that Anamosa apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option considered by many communities is treating 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 removal 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 20 inches and at $15 per inch, about 4 trees could be treated per year (every other year treatment). Eight trees would be selected for treatment, and Anamosa would still need to find $54,800 for removal. Alternatively, if there are 16 treatable trees, it would cost approximately $2,400 a year for treatment and leave $7,600 for removal. These are alternatives to straight removal of ash trees. 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 Anamosa. We suggest considering an increased budget to plan for this.

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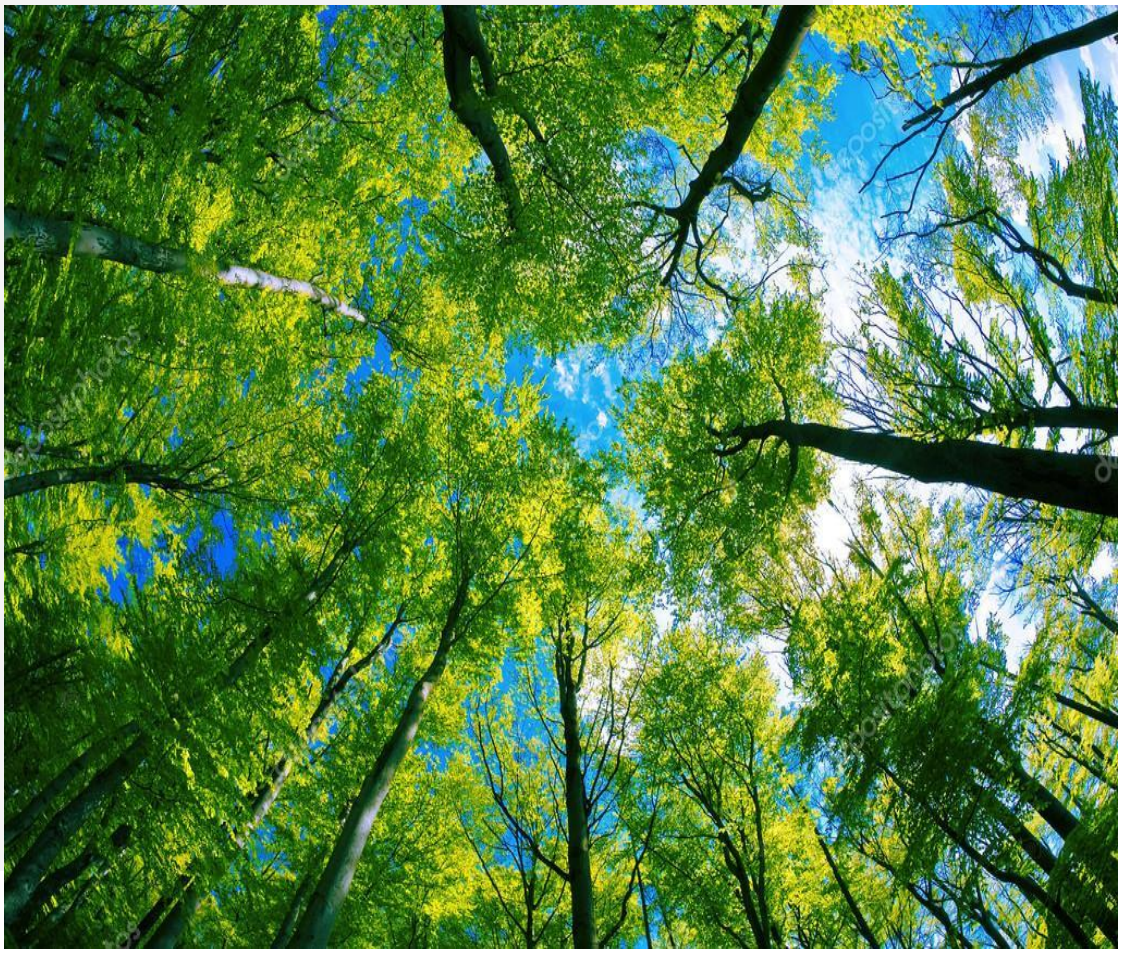
Appendices



APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Anamosa

Annual Energy Benefits of Public Trees

2/6/2023

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	33.7	2,556	4,382.9	4,295	6,851	(N/A)	13.1	18.0	64.64
Norway maple	24.9	1,892	3,569.0	3,498	5,390	(N/A)	12.4	14.2	53.37
Red maple	16.2	1,232	2,187.8	2,144	3,376	(N/A)	11.1	8.9	37.51
Green ash	19.0	1,443	2,611.4	2,559	4,002	(N/A)	8.5	10.5	58.01
Northern white cedar	4.5	341	655.5	642	983	(N/A)	7.0	2.6	17.25
Apple	4.9	375	765.4	750	1,125	(N/A)	5.4	3.0	25.56
Black walnut	12.0	913	1,671.2	1,638	2,551	(N/A)	4.8	6.7	65.40
Honeylocust	8.6	654	1,179.1	1,155	1,809	(N/A)	4.6	4.8	48.90
Blue spruce	2.1	157	297.6	292	449	(N/A)	2.6	1.2	21.37
Sugar maple	5.5	417	745.1	730	1,147	(N/A)	2.6	3.0	54.63
Black maple	4.9	373	674.9	661	1,034	(N/A)	2.5	2.7	51.70
Lilac	1.4	108	217.8	213	321	(N/A)	2.2	0.8	17.86
Northern hackberry	6.3	477	891.7	874	1,351	(N/A)	2.1	3.6	79.48
Eastern red cedar	1.6	120	234.6	230	350	(N/A)	2.1	0.9	20.56
Northern pin oak	4.1	308	598.8	587	895	(N/A)	1.7	2.4	63.91
Bur oak	4.2	320	578.0	566	887	(N/A)	1.7	2.3	63.33
American sycamore	4.8	367	670.9	657	1,024	(N/A)	1.6	2.7	78.78
American basswood	2.8	210	390.4	383	592	(N/A)	1.1	1.6	65.83
Cherry plum	0.4	29	66.5	65	94	(N/A)	1.0	0.2	11.80
White ash	1.9	142	235.4	231	373	(N/A)	0.9	1.0	53.23
Ginkgo	0.7	54	102.4	100	154	(N/A)	0.9	0.4	22.06
Littleleaf linden	1.2	89	156.0	153	242	(N/A)	0.7	0.6	40.34
Siberian elm	1.8	135	242.6	238	373	(N/A)	0.6	1.0	74.52
Southern magnolia	1.2	90	144.4	141	231	(N/A)	0.6	0.6	46.26
Cottonwood	1.6	118	214.7	210	328	(N/A)	0.5	0.9	82.02
Spruce	0.5	39	58.5	57	97	(N/A)	0.5	0.3	24.14
Swamp white oak	0.8	62	105.3	103	165	(N/A)	0.5	0.4	41.20
Amur maple	0.5	35	66.0	65	100	(N/A)	0.5	0.3	24.96
Tree of Heaven	0.7	52	92.7	91	142	(N/A)	0.5	0.4	35.62
Callery pear	0.6	42	80.0	78	120	(N/A)	0.5	0.3	30.05
Ash	0.6	44	76.6	75	119	(N/A)	0.5	0.3	29.78
White mulberry	0.2	19	42.3	41	60	(N/A)	0.5	0.2	15.00
Birch	0.6	48	96.0	94	142	(N/A)	0.4	0.4	47.28
Eastern redbud	0.3	21	41.3	40	62	(N/A)	0.4	0.2	20.58
Willow	0.7	50	93.8	92	142	(N/A)	0.4	0.4	47.36
Eastern white pine	0.5	35	58.9	58	93	(N/A)	0.4	0.2	30.93
Northern red oak	0.6	43	81.2	80	123	(N/A)	0.4	0.3	40.87
American elm	0.7	55	90.5	89	144	(N/A)	0.4	0.4	47.84
Broadleaf Deciduous Mediu	0.5	36	59.0	58	94	(N/A)	0.2	0.2	46.78
Norway spruce	0.2	15	29.2	29	44	(N/A)	0.2	0.1	22.02
Ohio buckeye	0.2	16	33.7	33	49	(N/A)	0.2	0.1	24.47
Pin oak	0.7	55	97.8	96	151	(N/A)	0.2	0.4	75.38
Oak	0.0	2	4.2	4	6	(N/A)	0.2	0.0	3.24
Conifer Evergreen Large	0.1	10	14.6	14	24	(N/A)	0.1	0.1	24.14
Elm	0.3	25	46.9	46	71	(N/A)	0.1	0.2	70.91
Maple	0.0	3	5.2	5	8	(N/A)	0.1	0.0	7.85
River birch	0.1	8	16.9	17	24	(N/A)	0.1	0.1	24.47
Eastern cottonwood	0.4	33	59.0	58	91	(N/A)	0.1	0.2	91.02
Dogwood	0.2	14	24.7	24	38	(N/A)	0.1	0.1	38.13
Eastern hemlock	0.0	2	4.0	4	6	(N/A)	0.1	0.0	5.61
Total	180.3	13,682	24,862.2	24,365	38,047	(N/A)	100.0	100.0	46.86

Table 2: Annual Stormwater Benefits

Anamosa

Annual Stormwater Benefits of Public Trees

2/6/2023

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	446,682	12,105	(N/A)	13.1	23.3	114.20
Norway maple	222,029	6,017	(N/A)	12.4	11.6	59.57
Red maple	131,480	3,563	(N/A)	11.1	6.9	39.59
Green ash	201,770	5,468	(N/A)	8.5	10.5	79.25
Northern white cedar	76,150	2,064	(N/A)	7.0	4.0	36.20
Apple	20,467	555	(N/A)	5.4	1.1	12.61
Black walnut	140,609	3,810	(N/A)	4.8	7.3	97.70
Honeylocust	86,057	2,332	(N/A)	4.6	4.5	63.03
Blue spruce	30,849	836	(N/A)	2.6	1.6	39.81
Sugar maple	55,116	1,494	(N/A)	2.6	2.9	71.13
Black maple	44,584	1,208	(N/A)	2.5	2.3	60.41
Lilac	5,072	137	(N/A)	2.2	0.3	7.64
Northern hackberry	63,601	1,724	(N/A)	2.1	3.3	101.39
Eastern red cedar	22,934	622	(N/A)	2.1	1.2	36.56
Northern pin oak	42,635	1,155	(N/A)	1.7	2.2	82.53
Bur oak	50,233	1,361	(N/A)	1.7	2.6	97.24
American sycamore	67,532	1,830	(N/A)	1.6	3.5	140.78
American basswood	32,999	894	(N/A)	1.1	1.7	99.36
Cherry plum	1,333	36	(N/A)	1.0	0.1	4.51
White ash	18,376	498	(N/A)	0.9	1.0	71.14
Ginkgo	3,986	108	(N/A)	0.9	0.2	15.43
Littleleaf linden	11,273	306	(N/A)	0.7	0.6	50.92
Siberian elm	19,479	528	(N/A)	0.6	1.0	105.58
Southern magnolia	12,155	329	(N/A)	0.6	0.6	65.88
Cottonwood	21,962	595	(N/A)	0.5	1.1	148.79
Spruce	6,154	167	(N/A)	0.5	0.3	41.70
Swamp white oak	4,813	130	(N/A)	0.5	0.3	32.61
Amur maple	1,666	45	(N/A)	0.5	0.1	11.29
Tree of Heaven	3,990	108	(N/A)	0.5	0.2	27.03
Callery pear	3,167	86	(N/A)	0.5	0.2	21.46
Ash	3,416	93	(N/A)	0.5	0.2	23.15
White mulberry	862	23	(N/A)	0.5	0.0	5.84
Birch	5,545	150	(N/A)	0.4	0.3	50.09
Eastern redbud	1,000	27	(N/A)	0.4	0.1	9.03
Willow	5,759	156	(N/A)	0.4	0.3	52.03
Eastern white pine	9,112	247	(N/A)	0.4	0.5	82.32
Northern red oak	5,598	152	(N/A)	0.4	0.3	50.57
American elm	6,040	164	(N/A)	0.4	0.3	54.56
Broadleaf Deciduous Medium	2,818	76	(N/A)	0.2	0.1	38.19
Norway spruce	3,565	97	(N/A)	0.2	0.2	48.30
Ohio buckeye	1,172	32	(N/A)	0.2	0.1	15.88
Pin oak	8,533	231	(N/A)	0.2	0.4	115.63
Oak	190	5	(N/A)	0.2	0.0	2.57
Conifer Evergreen Large	1,539	42	(N/A)	0.1	0.1	41.70
Elm	3,943	107	(N/A)	0.1	0.2	106.85
Maple	137	4	(N/A)	0.1	0.0	3.72
River birch	586	16	(N/A)	0.1	0.0	15.88
Eastern cottonwood	7,239	196	(N/A)	0.1	0.4	196.17

Annual Stormwater Benefits of Public Trees

2/6/2023

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Dogwood	667	18	(N/A)	0.1	0.0	18.06
Eastern hemlock	213	6	(N/A)	0.1	0.0	5.77
Citywide total	1,917,085	51,953	(N/A)	100.0	100.0	63.98

Table 3: Annual Air Quality Benefits

Anamosa

Annual Air Quality Benefits of Public Trees

2/6/2023

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Silver maple	73.1	12.4	36.4	3.2	395	158.4	23.2	22.2	152.4	992	-38.8	-145	442.4	1,242	(N/A)	13.1	11.72
Norway maple	44.0	7.6	21.8	1.9	238	120.6	17.5	16.6	113.1	748	-10.4	-39	332.7	947	(N/A)	12.4	9.38
Red maple	30.3	5.2	14.3	1.3	162	77.1	11.3	10.7	73.5	481	-10.3	-39	213.4	604	(N/A)	11.1	6.72
Green ash	23.7	3.8	11.6	1.1	127	90.9	13.2	12.6	86.2	566	0.0	0	243.1	693	(N/A)	8.5	10.04
Northern white cedar	8.4	1.7	7.1	1.0	56	21.7	3.1	3.0	20.3	135	-36.5	-137	29.9	54	(N/A)	7.0	0.94
Apple	5.8	1.0	2.8	0.3	31	24.4	3.5	3.3	22.4	150	0.0	0	63.3	181	(N/A)	5.4	4.11
Black walnut	17.8	2.8	8.4	0.8	94	57.7	8.4	8.0	54.5	359	0.0	0	158.4	453	(N/A)	4.8	11.62
Honeylocust	16.1	2.7	7.5	0.7	86	41.0	6.0	5.7	39.0	256	-12.3	-46	106.4	295	(N/A)	4.6	7.97
Blue spruce	4.5	0.9	3.7	0.6	30	10.0	1.4	1.4	9.4	62	-11.3	-42	20.6	49	(N/A)	2.6	2.35
Sugar maple	6.8	1.2	3.5	0.3	37	26.1	3.8	3.6	24.9	163	-5.4	-20	64.9	180	(N/A)	2.6	8.57
Black maple	11.0	1.9	5.1	0.5	59	23.4	3.4	3.3	22.2	146	-3.7	-14	67.2	191	(N/A)	2.5	9.54
Lilac	1.2	0.2	0.6	0.1	7	7.0	1.0	1.0	6.5	43	0.0	0	17.5	50	(N/A)	2.2	2.76
Northern hackberry	10.2	1.8	5.1	0.5	56	30.4	4.4	4.2	28.5	188	0.0	0	85.0	244	(N/A)	2.1	14.35
Eastern red cedar	4.6	0.9	3.7	0.6	30	7.7	1.1	1.1	7.1	47	-12.6	-47	14.1	30	(N/A)	2.1	1.77
Northern pin oak	9.2	1.6	4.5	0.4	50	19.8	2.9	2.7	18.4	122	-2.1	-8	57.3	164	(N/A)	1.7	11.71
Bur oak	7.0	1.1	3.3	0.3	37	20.1	2.9	2.8	19.1	126	0.0	0	56.7	163	(N/A)	1.7	11.62
American sycamore	9.7	1.5	4.4	0.4	51	23.2	3.4	3.2	21.9	144	0.0	0	67.7	195	(N/A)	1.6	14.99
American basswood	4.8	0.8	2.3	0.2	26	13.3	1.9	1.8	12.5	83	-4.0	-15	33.8	93	(N/A)	1.1	10.38
Cherry plum	0.2	0.0	0.1	0.0	1	2.0	0.3	0.3	1.7	12	0.0	0	4.6	13	(N/A)	1.0	1.63
White ash	2.5	0.4	1.2	0.1	13	8.7	1.3	1.2	8.5	55	0.0	0	23.9	68	(N/A)	0.9	9.72
Ginkgo	0.8	0.1	0.4	0.0	4	3.4	0.5	0.5	3.2	21	-0.3	-1	8.7	24	(N/A)	0.9	3.49
Littleleaf linden	1.9	0.3	1.0	0.1	10	5.6	0.8	0.8	5.3	35	-0.9	-3	14.9	42	(N/A)	0.7	6.96
Siberian elm	3.3	0.6	1.6	0.1	18	8.5	1.2	1.2	8.0	53	0.0	0	24.6	71	(N/A)	0.6	14.13
Southern magnolia	1.3	0.3	1.3	0.2	9	5.5	0.8	0.8	5.3	34	-3.4	-13	11.8	30	(N/A)	0.6	6.09
Cottonwood	3.2	0.5	1.4	0.1	17	7.4	1.1	1.0	7.0	46	0.0	0	21.8	63	(N/A)	0.5	15.71
Spruce	0.7	0.1	0.6	0.1	5	2.4	0.4	0.3	2.3	15	-2.2	-8	4.7	11	(N/A)	0.5	2.82
Swamp white oak	0.7	0.1	0.4	0.0	4	3.8	0.6	0.5	3.7	24	-0.2	-1	9.7	27	(N/A)	0.5	6.81
Amur maple	0.5	0.1	0.2	0.0	2	2.2	0.3	0.3	2.1	14	0.0	0	5.8	16	(N/A)	0.5	4.09
Tree of Heaven	0.5	0.1	0.3	0.0	3	3.3	0.5	0.5	3.1	20	-0.2	-1	8.1	23	(N/A)	0.5	5.69
Callery pear	0.4	0.1	0.2	0.0	2	2.7	0.4	0.4	2.5	17	-0.1	0	6.5	18	(N/A)	0.5	4.58
Ash	0.5	0.1	0.3	0.0	3	2.8	0.4	0.4	2.6	17	-0.1	-1	6.9	19	(N/A)	0.5	4.86
White mulberry	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	0.0	0	2.9	8	(N/A)	0.5	2.09
Birch	1.0	0.2	0.5	0.0	6	3.1	0.4	0.4	2.9	19	-0.3	-1	8.4	24	(N/A)	0.4	7.93
Eastern redbud	0.3	0.0	0.1	0.0	1	1.4	0.2	0.2	1.3	8	0.0	0	3.5	10	(N/A)	0.4	3.27

Anamosa

Annual Air Quality Benefits of Public Trees

2/6/2023

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Willow	1.1	0.2	0.6	0.1	6	3.2	0.5	0.4	3.0	20	-0.3	-1	8.8	25	(N/A)	0.4	8.32
Eastern white pine	1.1	0.2	0.9	0.1	7	2.2	0.3	0.3	2.1	14	-4.8	-18	2.4	3	(N/A)	0.4	0.90
Northern red oak	1.2	0.2	0.6	0.1	6	2.7	0.4	0.4	2.6	17	-1.6	-6	6.4	17	(N/A)	0.4	5.68
American elm	1.0	0.2	0.5	0.0	6	3.4	0.5	0.5	3.3	21	0.0	0	9.4	27	(N/A)	0.4	8.91
Broadleaf Deciduous Medium	0.4	0.1	0.2	0.0	2	2.2	0.3	0.3	2.1	14	-0.1	0	5.6	16	(N/A)	0.2	7.92
Norway spruce	0.4	0.1	0.3	0.0	3	1.0	0.1	0.1	0.9	6	-1.5	-6	1.5	3	(N/A)	0.2	1.46
Ohio buckeye	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	1.0	6	0.0	0	2.5	7	(N/A)	0.2	3.47
Pin oak	1.5	0.3	0.8	0.1	8	3.4	0.5	0.5	3.3	21	-2.8	-11	7.5	19	(N/A)	0.2	9.62
Oak	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	0.48
Conifer Evergreen Large	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	0.1	2.82
Elm	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.1	12.48
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)	0.1	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)	0.1	3.47
Eastern cottonwood	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19	(N/A)	0.1	19.04
Dogwood	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)	0.1	6.56
Eastern hemlock	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	-0.1	0	0.2	1	(N/A)	0.1	0.56
Citywide total	315.1	53.6	160.8	15.7	1,720	861.8	125.4	119.5	816.7	5,365	-167.0	-626	2,301.6	6,459	(N/A)	100.0	7.95

Table 4: Annual Carbon Stored

Anamosa

Stored CO2 Benefits of Public Trees

2/6/2023

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	1,629,776	12,223	(N/A)	13.1	25.4	115.31
Norway maple	722,079	5,416	(N/A)	12.4	11.3	53.62
Red maple	333,290	2,500	(N/A)	11.1	5.2	27.77
Green ash	767,556	5,757	(N/A)	8.5	12.0	83.43
Northern white cedar	86,698	650	(N/A)	7.0	1.4	11.41
Apple	93,895	704	(N/A)	5.4	1.5	16.00
Black walnut	577,883	4,334	(N/A)	4.8	9.0	111.13
Honeylocust	207,559	1,557	(N/A)	4.6	3.2	42.07
Blue spruce	34,857	261	(N/A)	2.6	0.5	12.45
Sugar maple	192,009	1,440	(N/A)	2.6	3.0	68.57
Black maple	118,564	889	(N/A)	2.5	1.8	44.46
Lilac	20,151	151	(N/A)	2.2	0.3	8.40
Northern hackberry	155,218	1,164	(N/A)	2.1	2.4	68.48
Eastern red cedar	14,967	112	(N/A)	2.1	0.2	6.60
Northern pin oak	151,257	1,134	(N/A)	1.7	2.4	81.03
Bur oak	235,339	1,765	(N/A)	1.7	3.7	126.07
American sycamore	319,040	2,393	(N/A)	1.6	5.0	184.06
American basswood	179,851	1,349	(N/A)	1.1	2.8	149.88
Cherry plum	4,343	33	(N/A)	1.0	0.1	4.07
White ash	49,416	371	(N/A)	0.9	0.8	52.95
Ginkgo	10,777	81	(N/A)	0.9	0.2	11.55
Littleleaf linden	41,275	310	(N/A)	0.7	0.6	51.59
Siberian elm	80,314	602	(N/A)	0.6	1.3	120.47
Southern magnolia	16,906	127	(N/A)	0.6	0.3	25.36
Cottonwood	103,773	778	(N/A)	0.5	1.6	194.57
Spruce	4,681	35	(N/A)	0.5	0.1	8.78
Swamp white oak	11,973	90	(N/A)	0.5	0.2	22.45
Amur maple	7,160	54	(N/A)	0.5	0.1	13.43
Tree of Heaven	9,450	71	(N/A)	0.5	0.1	17.72
Callery pear	6,926	52	(N/A)	0.5	0.1	12.99
Ash	8,366	63	(N/A)	0.5	0.1	15.69
White mulberry	2,902	22	(N/A)	0.5	0.0	5.44
Birch	16,991	127	(N/A)	0.4	0.3	42.48
Eastern redbud	4,123	31	(N/A)	0.4	0.1	10.31
Willow	19,005	143	(N/A)	0.4	0.3	47.51
Eastern white pine	12,003	90	(N/A)	0.4	0.2	30.01
Northern red oak	24,482	184	(N/A)	0.4	0.4	61.20
American elm	22,943	172	(N/A)	0.4	0.4	57.36
Broadleaf Deciduous	7,248	54	(N/A)	0.2	0.1	27.18
Norway spruce	3,599	27	(N/A)	0.2	0.1	13.50
Ohio buckeye	2,201	17	(N/A)	0.2	0.0	8.26
Pin oak	40,191	301	(N/A)	0.2	0.6	150.71
Oak	198	1	(N/A)	0.2	0.0	0.74
Conifer Evergreen La	1,170	9	(N/A)	0.1	0.0	8.78
Elm	15,773	118	(N/A)	0.1	0.2	118.30
Maple	218	2	(N/A)	0.1	0.0	1.64
River birch	1,101	8	(N/A)	0.1	0.0	8.26
Eastern cottonwood	39,259	294	(N/A)	0.1	0.6	294.44
Dogwood	3,037	23	(N/A)	0.1	0.0	22.78
Eastern hemlock	38	0	(N/A)	0.1	0.0	0.29
Citywide total	6,411,828	48,089	(N/A)	100.0	100.0	59.22

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Table 5: Annual Carbon Sequestered

Anamosa

Annual CO $_2$ Benefits of Public Trees

2/6/2023

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	128,862	966	-7,823	-356	-61	56,490	424	177,173	1,329 (N/A)	13.1	26.1	12.54
Norway maple	39,802	299	-3,466	-249	-28	41,820	314	77,907	584 (N/A)	12.4	11.5	5.79
Red maple	28,872	217	-1,600	-152	-13	27,224	204	54,343	408 (N/A)	11.1	8.0	4.53
Green ash	45,768	343	-3,684	-195	-29	31,897	239	73,785	553 (N/A)	8.5	10.9	8.02
Northern white cedar	5,077	38	-416	-88	-4	7,528	56	12,100	91 (N/A)	7.0	1.8	1.59
Apple	8,000	60	-451	-67	-4	8,277	62	15,759	118 (N/A)	5.4	2.3	2.69
Black walnut	29,317	220	-2,774	-127	-22	20,176	151	46,593	349 (N/A)	4.8	6.9	8.96
Honeylocust	24,411	183	-999	-71	-8	14,449	108	37,791	283 (N/A)	4.6	5.6	7.66
Blue spruce	1,680	13	-167	-40	-2	3,470	26	4,943	37 (N/A)	2.6	0.7	1.77
Sugar maple	11,434	86	-922	-58	-7	9,219	69	19,674	148 (N/A)	2.6	2.9	7.03
Black maple	3,957	30	-569	-46	-5	8,235	62	11,578	87 (N/A)	2.5	1.7	4.34
Lilac	2,151	16	-97	-20	-1	2,387	18	4,421	33 (N/A)	2.2	0.7	1.84
Northern hackberry	8,197	61	-745	-60	-6	10,549	79	17,941	135 (N/A)	2.1	2.6	7.92
Eastern red cedar	364	3	-72	-29	-1	2,646	20	2,908	22 (N/A)	2.1	0.4	1.28
Northern pin oak	4,316	32	-726	-46	-6	6,805	51	10,349	78 (N/A)	1.7	1.5	5.54
Bur oak	9,177	69	-1,130	-45	-9	7,077	53	15,079	113 (N/A)	1.7	2.2	8.08
American sycamore	11,621	87	-1,531	-53	-12	8,104	61	18,140	136 (N/A)	1.6	2.7	10.47
American basswood	9,994	75	-863	-32	-7	4,640	35	13,738	103 (N/A)	1.1	2.0	11.45
Cherry plum	607	5	-21	-7	0	645	5	1,225	9 (N/A)	1.0	0.2	1.15
White ash	4,827	36	-237	-16	-2	3,136	24	7,709	58 (N/A)	0.9	1.1	8.26
Ginkgo	739	6	-52	-11	0	1,194	9	1,870	14 (N/A)	0.9	0.3	2.00
Littleleaf linden	3,797	28	-198	-13	-2	1,970	15	5,556	42 (N/A)	0.7	0.8	6.94
Siberian elm	3,471	26	-386	-19	-3	2,981	22	6,048	45 (N/A)	0.6	0.9	9.07
Southern magnolia	1,021	8	-81	-11	-1	1,985	15	2,914	22 (N/A)	0.6	0.4	4.37
Cottonwood	3,838	29	-498	-17	-4	2,600	20	5,923	44 (N/A)	0.5	0.9	11.11
Spruce	462	3	-22	-8	0	866	6	1,298	10 (N/A)	0.5	0.2	2.43
Swamp white oak	1,382	10	-57	-7	0	1,361	10	2,678	20 (N/A)	0.5	0.4	5.02
Amur maple	687	5	-34	-6	0	778	6	1,425	11 (N/A)	0.5	0.2	2.67
Tree of Heaven	1,220	9	-45	-6	0	1,142	9	2,310	17 (N/A)	0.5	0.3	4.33
Callery pear	1,058	8	-33	-5	0	923	7	1,942	15 (N/A)	0.5	0.3	3.64
Ash	1,001	8	-40	-5	0	973	7	1,929	14 (N/A)	0.5	0.3	3.62

Annual CO $_2$ Benefits of Public Trees

2/6/2023

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
White mulberry	380	3	-14	-4	0	410	3	771	6 (N/A)	0.5	0.1	1.45
Birch	1,164	9	-82	-7	-1	1,056	8	2,131	16 (N/A)	0.4	0.3	5.33
Eastern redbud	419	3	-20	-4	0	470	4	866	6 (N/A)	0.4	0.1	2.16
Willow	610	5	-91	-7	-1	1,109	8	1,621	12 (N/A)	0.4	0.2	4.05
Eastern white pine	303	2	-58	-10	-1	774	6	1,009	8 (N/A)	0.4	0.1	2.52
Northern red oak	899	7	-118	-7	-1	952	7	1,726	13 (N/A)	0.4	0.3	4.32
American elm	832	6	-111	-7	-1	1,211	9	1,926	14 (N/A)	0.4	0.3	4.81
Broadleaf Deciduous Medi	772	6	-35	-4	0	790	6	1,523	11 (N/A)	0.2	0.2	5.71
Norway spruce	240	2	-17	-4	0	341	3	560	4 (N/A)	0.2	0.1	2.10
Ohio buckeye	448	3	-11	-2	0	352	3	787	6 (N/A)	0.2	0.1	2.95
Pin oak	3,687	28	-193	-8	-2	1,214	9	4,700	35 (N/A)	0.2	0.7	17.62
Oak	77	1	-1	-1	0	53	0	128	1 (N/A)	0.2	0.0	0.48
Conifer Evergreen Large	116	1	-6	-2	0	216	2	324	2 (N/A)	0.1	0.0	2.43
Elm	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.1	0.2	9.97
Maple	39	0	-1	-1	0	60	0	97	1 (N/A)	0.1	0.0	0.73
River birch	224	2	-5	-1	0	176	1	393	3 (N/A)	0.1	0.1	2.95
Eastern cottonwood	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.1	0.2	10.90
Dogwood	268	2	-15	-2	0	308	2	560	4 (N/A)	0.1	0.1	4.20
Eastern hemlock	18	0	0	-1	0	38	0	55	0 (N/A)	0.1	0.0	0.41
Citywide total	409,375	3,070	-30,781	-1,946	-245	302,364	2,268	679,012	5,093 (N/A)	100.0	100.0	6.27

Table 6: Annual Social and Aesthetic Benefits

Anamosa

Annual Aesthetic/Other Benefits of Public Trees

2/6/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	10,396	(N/A)	13.1	25.3	98.07
Norway maple	3,768	(N/A)	12.4	9.2	37.30
Red maple	3,828	(N/A)	11.1	9.3	42.53
Green ash	3,829	(N/A)	8.5	9.3	55.49
Northern white cedar	1,113	(N/A)	7.0	2.7	19.53
Apple	463	(N/A)	5.4	1.1	10.52
Black walnut	2,326	(N/A)	4.8	5.7	59.63
Honeylocust	5,723	(N/A)	4.6	13.9	154.66
Blue spruce	374	(N/A)	2.6	0.9	17.83
Sugar maple	1,226	(N/A)	2.6	3.0	58.39
Black maple	535	(N/A)	2.5	1.3	26.76
Lilac	121	(N/A)	2.2	0.3	6.75
Northern hackberry	1,053	(N/A)	2.1	2.6	61.97
Eastern red cedar	152	(N/A)	2.1	0.4	8.91
Northern pin oak	392	(N/A)	1.7	1.0	27.99
Bur oak	744	(N/A)	1.7	1.8	53.13
American sycamore	828	(N/A)	1.6	2.0	63.70
American basswood	683	(N/A)	1.1	1.7	75.90
Cherry plum	34	(N/A)	1.0	0.1	4.23
White ash	548	(N/A)	0.9	1.3	78.34
Ginkgo	69	(N/A)	0.9	0.2	9.83
Littleleaf linden	380	(N/A)	0.7	0.9	63.35
Siberian elm	236	(N/A)	0.6	0.6	47.23
Southern magnolia	172	(N/A)	0.6	0.4	34.32
Cottonwood	266	(N/A)	0.5	0.6	66.60
Spruce	129	(N/A)	0.5	0.3	32.32
Swamp white oak	144	(N/A)	0.5	0.3	35.92
Amur maple	39	(N/A)	0.5	0.1	9.86
Tree of Heaven	131	(N/A)	0.5	0.3	32.69
Callery pear	118	(N/A)	0.5	0.3	29.46
Ash	107	(N/A)	0.5	0.3	26.82
White mulberry	21	(N/A)	0.5	0.1	5.32
Birch	112	(N/A)	0.4	0.3	37.44
Eastern redbud	24	(N/A)	0.4	0.1	7.98
Willow	65	(N/A)	0.4	0.2	21.79
Eastern white pine	79	(N/A)	0.4	0.2	26.47
Northern red oak	68	(N/A)	0.4	0.2	22.52
American elm	117	(N/A)	0.4	0.3	38.88
Broadleaf Deciduous Medium	78	(N/A)	0.2	0.2	39.16
Norway spruce	63	(N/A)	0.2	0.2	31.25
Ohio buckeye	52	(N/A)	0.2	0.1	26.22
Pin oak	273	(N/A)	0.2	0.7	136.70
Oak	20	(N/A)	0.2	0.0	10.00
Conifer Evergreen Large	32	(N/A)	0.1	0.1	32.32
Elm	66	(N/A)	0.1	0.2	65.59
Maple	7	(N/A)	0.1	0.0	7.28
River birch	26	(N/A)	0.1	0.1	26.22

Annual Aesthetic/Other Benefits of Public Trees

2/6/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Eastern cottonwood	58	(N/A)	0.1	0.1	58.34
Dogwood	15	(N/A)	0.1	0.0	15.48
Eastern hemlock	7	(N/A)	0.1	0.0	6.83
Citywide total	41,112	(N/A)	100.0	100.0	50.63

Table 7: Summary of Benefits in Dollars

Anamosa

Total Annual Benefits, Net Benefits, and Costs for Public Trees

2/6/2023

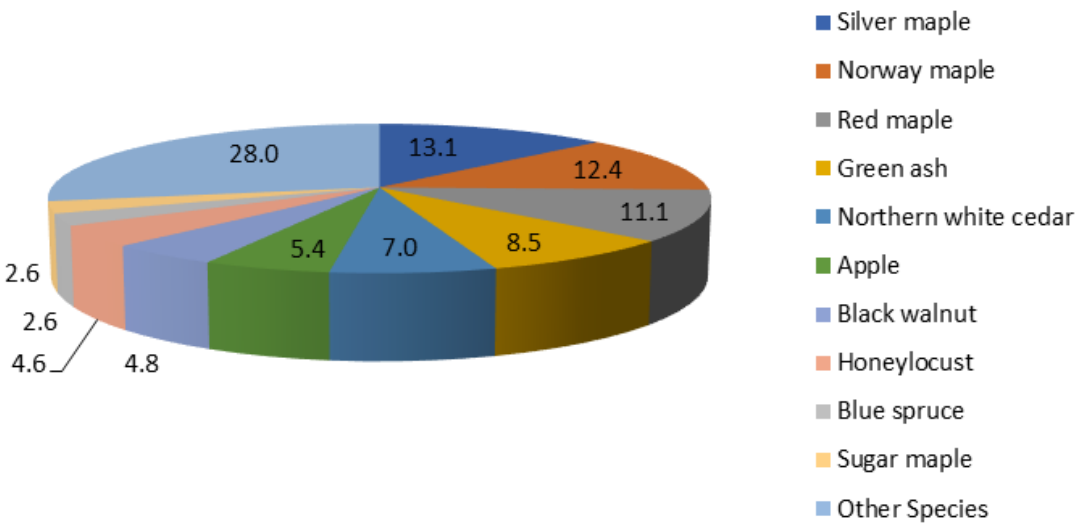
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	38,047	(N/A)	46.86	(N/A)	7.11	(N/A)
CO2	5,093	(N/A)	6.27	(N/A)	0.95	(N/A)
Air Quality	6,459	(N/A)	7.95	(N/A)	1.21	(N/A)
Stormwater	51,953	(N/A)	63.98	(N/A)	9.71	(N/A)
Aesthetic/Other	41,112	(N/A)	50.63	(N/A)	7.68	(N/A)
Total Benefits	142,664	(N/A)	175.69	(N/A)	26.67	(N/A)
Costs						
Planting	0		0.00		0.00	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	0		0.00		0.00	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	0		0.00		0.00	
Total Costs	0		0.00		0.00	
Net Benefits	142,664	(N/A)	175.69	(N/A)	26.67	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Anamosa

Species Distribution of Public Trees

2/6/2023



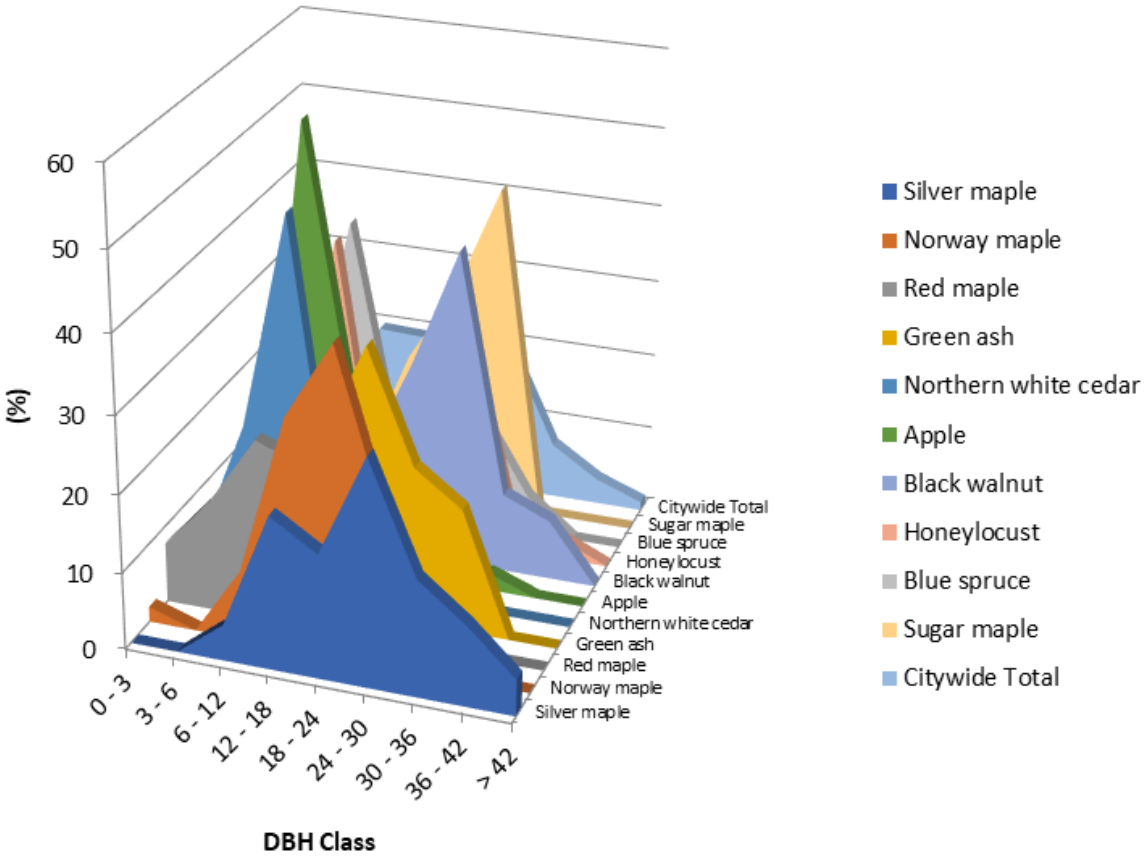
Species	Percent
Silver maple	13.1
Norway maple	12.4
Red maple	11.1
Green ash	8.5
Northern white cedar	7.0
Apple	5.4
Black walnut	4.8
Honeylocust	4.6
Blue spruce	2.6
Sugar maple	2.6
Other Species	28.0
Total	100.0

Figure 2: Relative Age Class

Anamosa

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

2/6/2023



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Silver maple	0.00	0.00	4.72	19.81	16.04	29.25	15.09	10.38	4.72
Norway maple	1.98	0.00	8.91	29.70	39.60	19.80	0.00	0.00	0.00
Red maple	7.78	14.44	23.33	21.11	18.89	13.33	1.11	0.00	0.00
Green ash	1.45	1.45	4.35	21.74	34.78	20.29	15.94	0.00	0.00
Northern white cedar	3.51	19.30	47.37	5.26	12.28	12.28	0.00	0.00	0.00
Apple	2.27	4.55	56.82	22.73	11.36	0.00	2.27	0.00	0.00
Black walnut	0.00	0.00	2.56	12.82	25.64	41.03	10.26	7.69	0.00
Honeylocust	0.00	10.81	37.84	0.00	18.92	27.03	2.70	2.70	0.00
Blue spruce	0.00	14.29	38.10	9.52	19.05	14.29	4.76	0.00	0.00
Sugar maple	0.00	4.76	4.76	19.05	28.57	42.86	0.00	0.00	0.00
Citywide Total	2.22	6.40	19.70	19.46	21.06	19.58	7.14	3.33	1.11

Figure 3: Foliage Condition

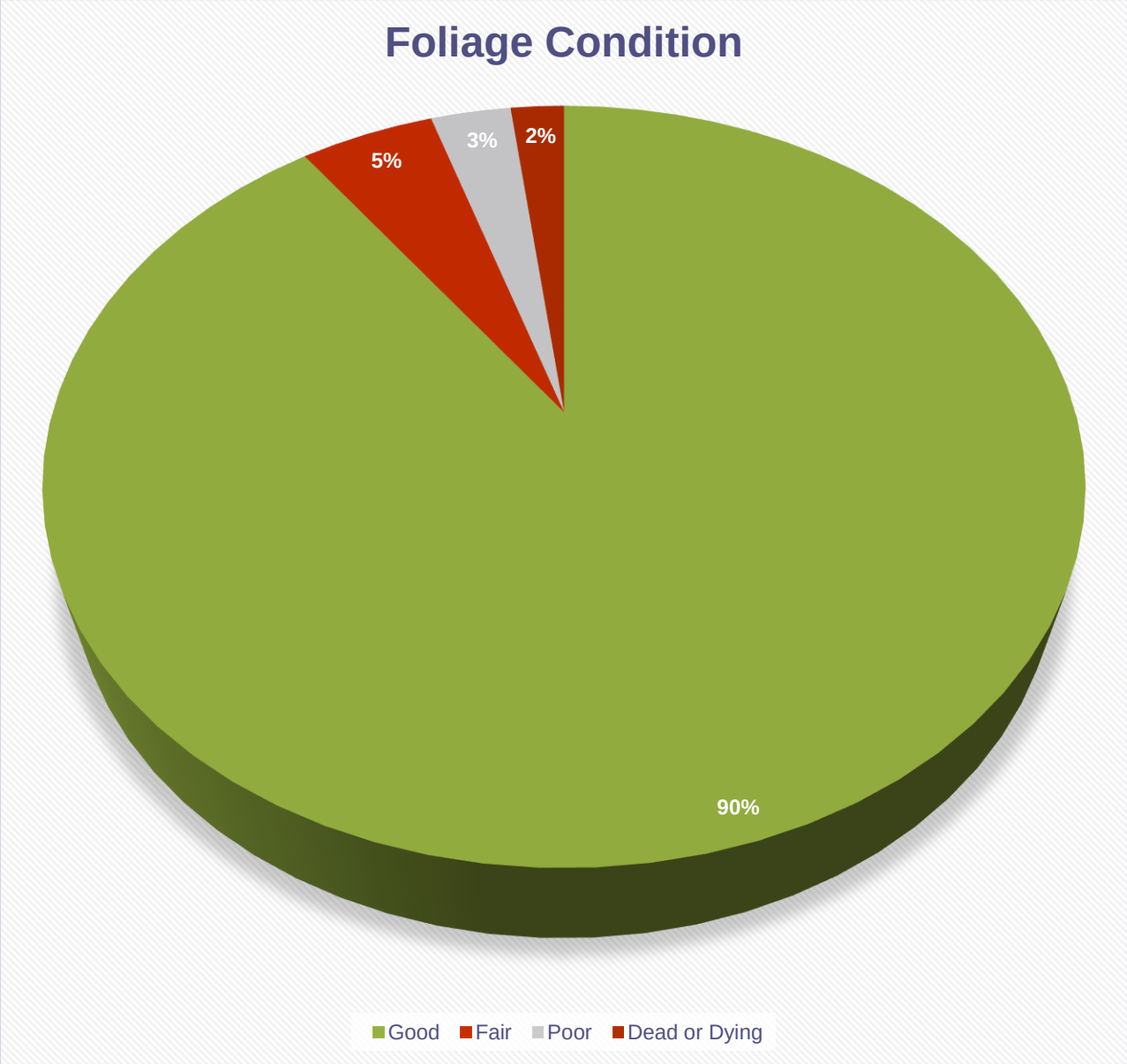


Figure 4: Wood Condition

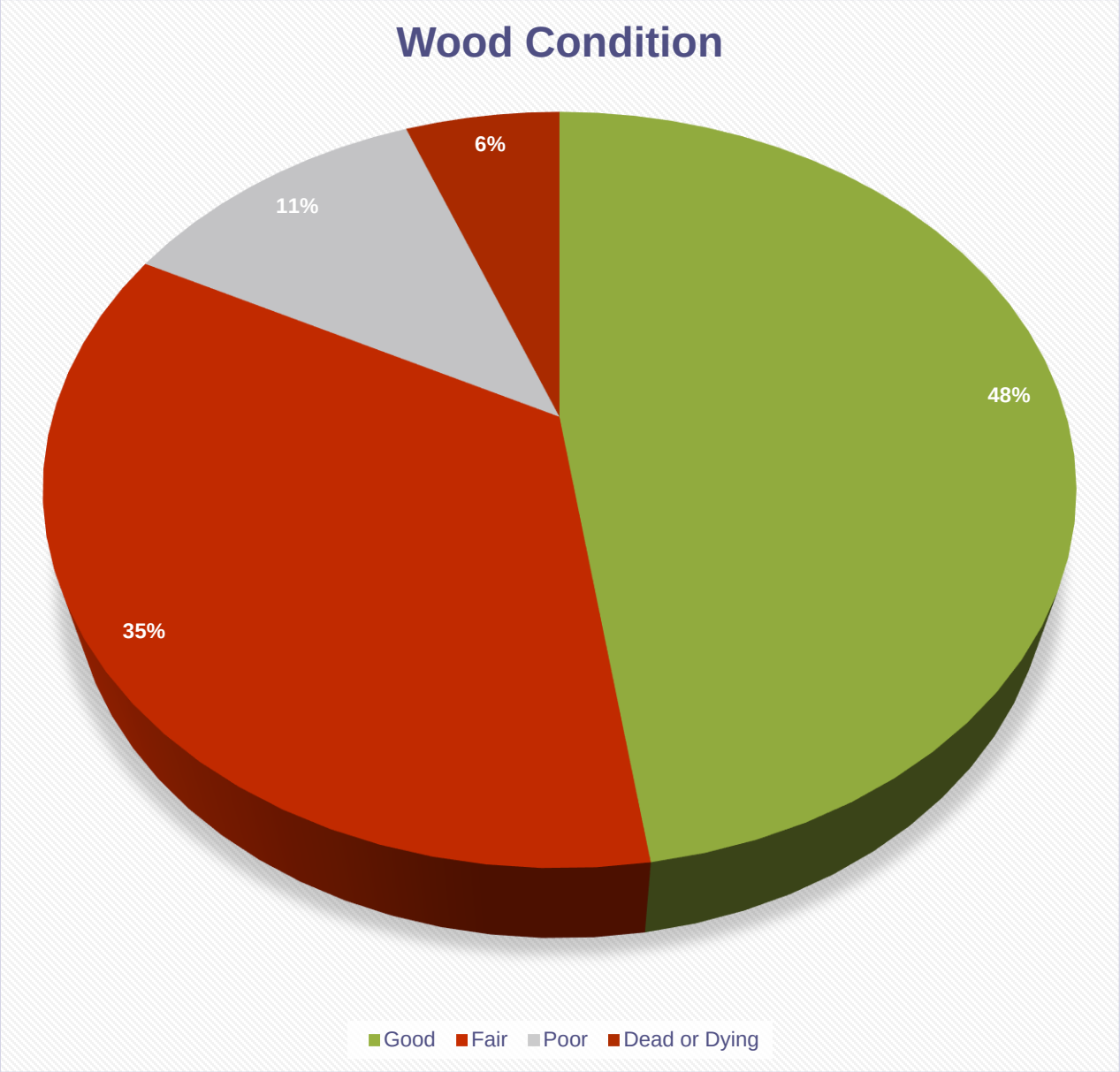
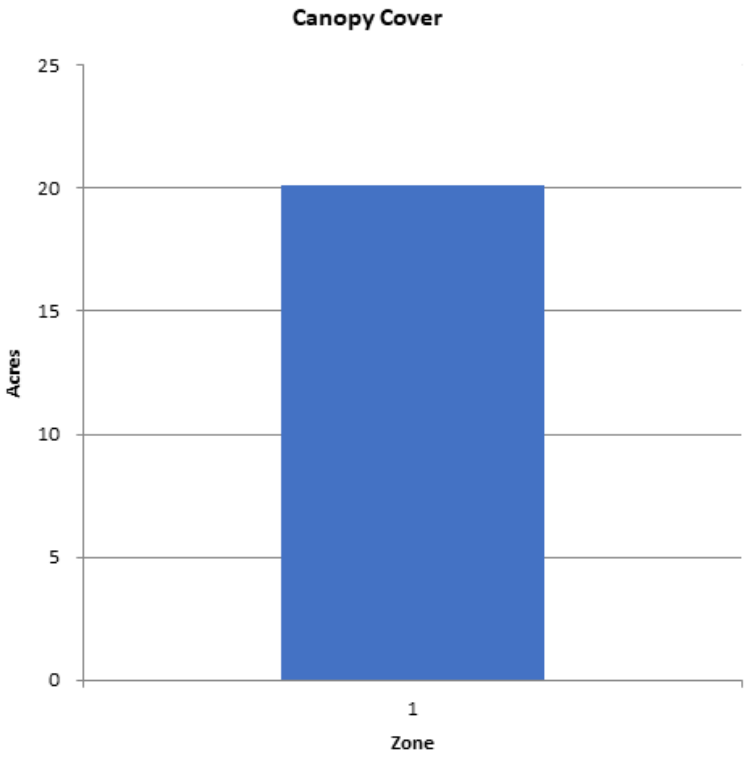


Figure 5: Canopy Cover in Acres

Anamosa

Canopy Cover of Public Trees (Acres)

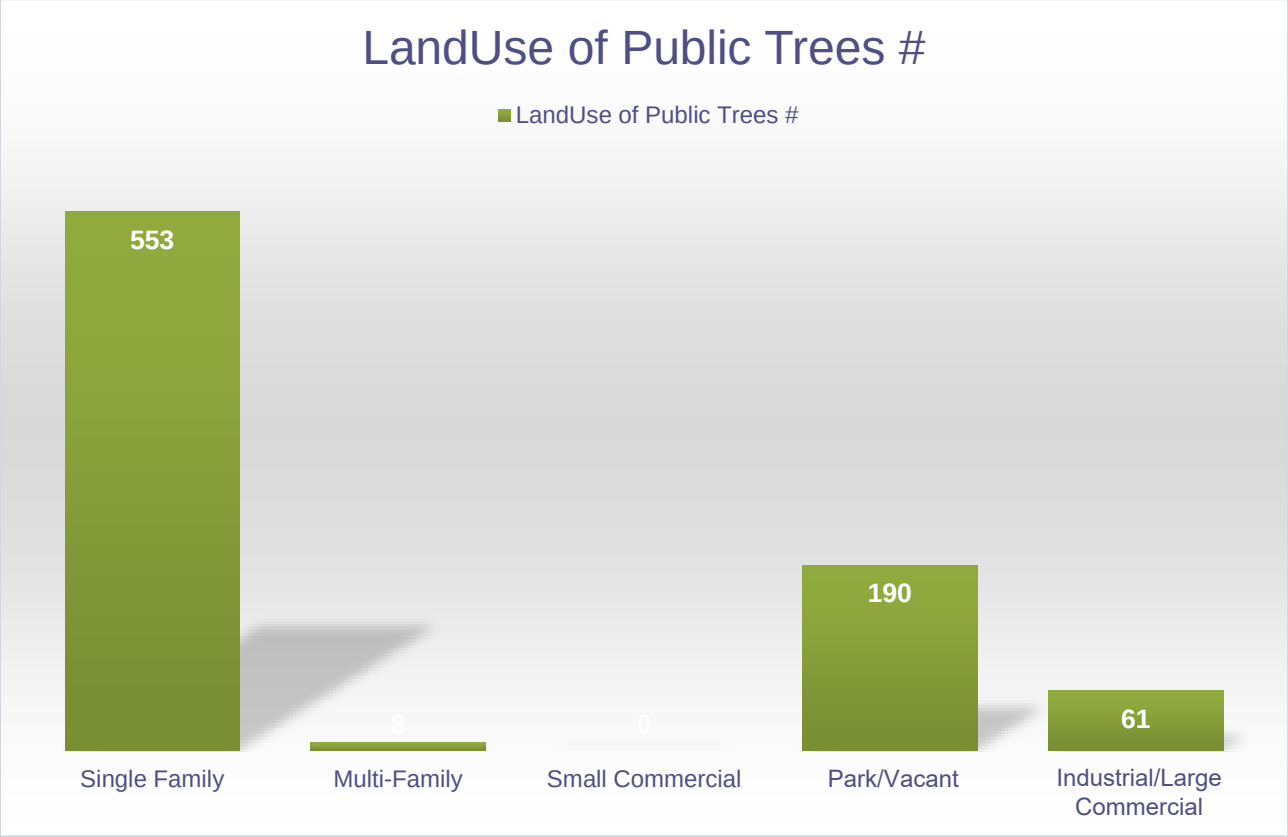
2/6/2023



Zone	Acres	% of Total Canopy Cover
1	20	100.0
Citywide total	20	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide Total	1,619	0	20	1.24	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

Figure 1: Location of Ash Trees

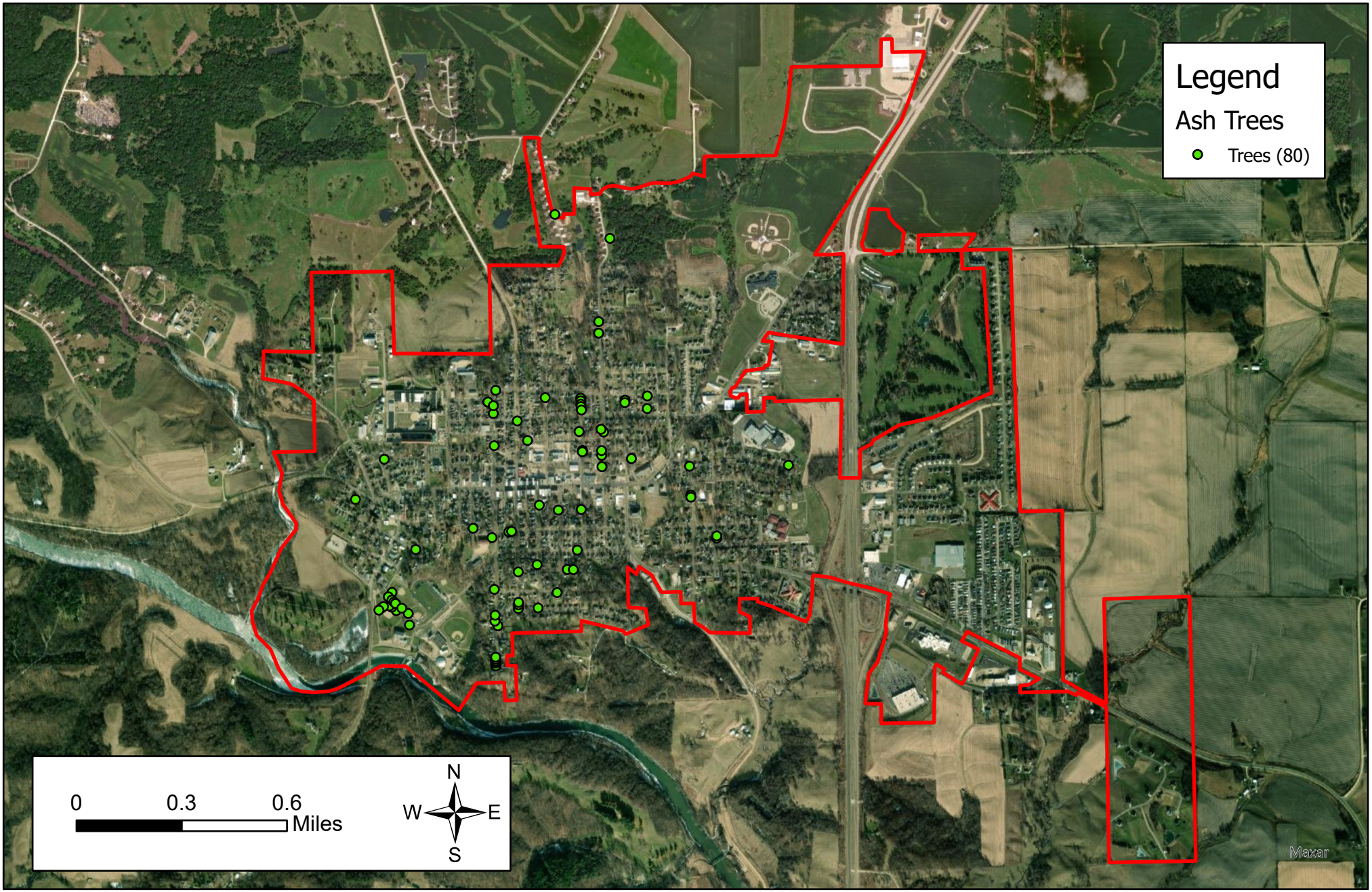
Figure 2: Location of EAB Symptoms

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



Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 1 - Ash Tree Location
Anamosa, Iowa

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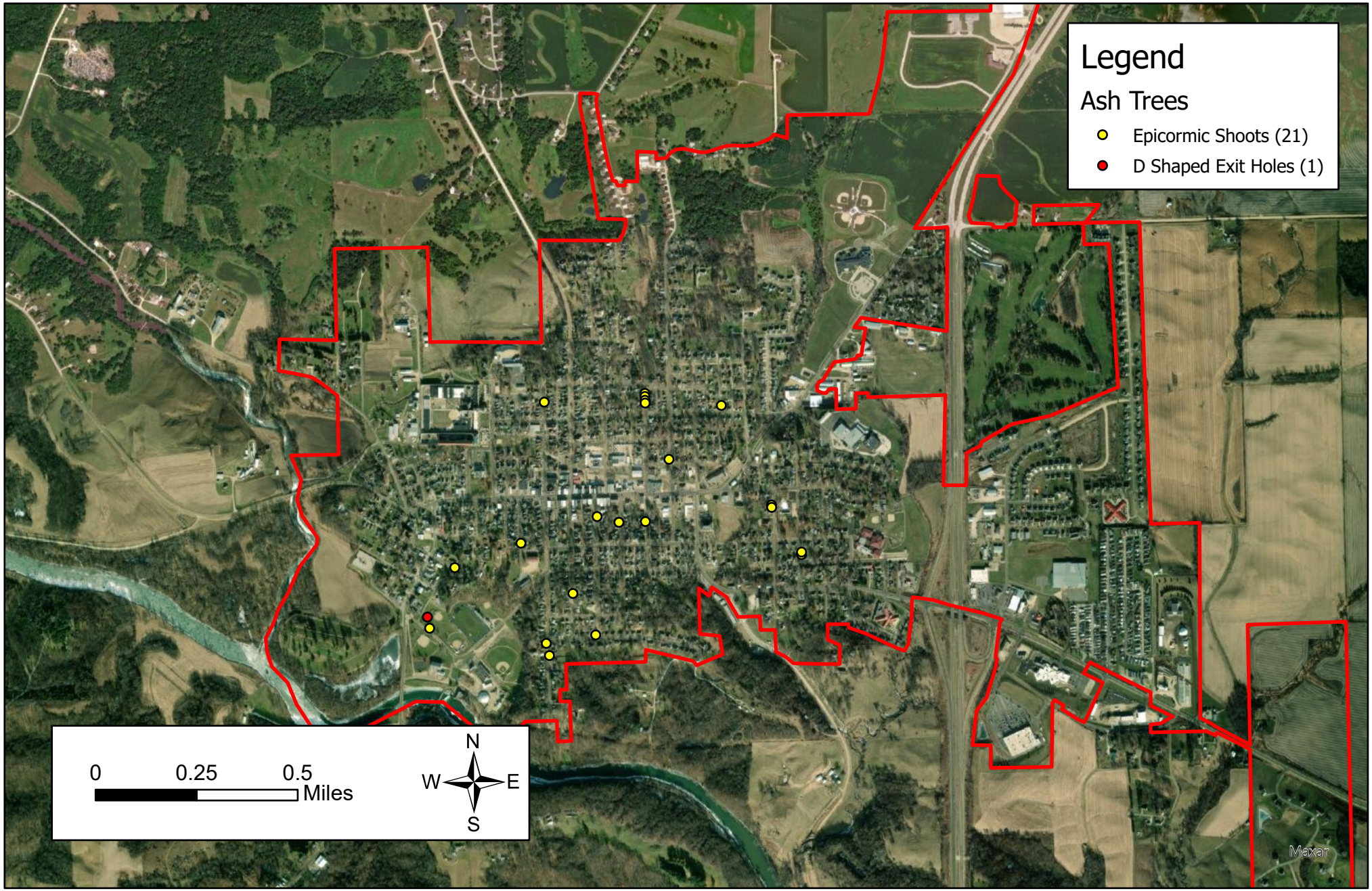

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Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 2 - EAB Symptoms
Anamosa, Iowa

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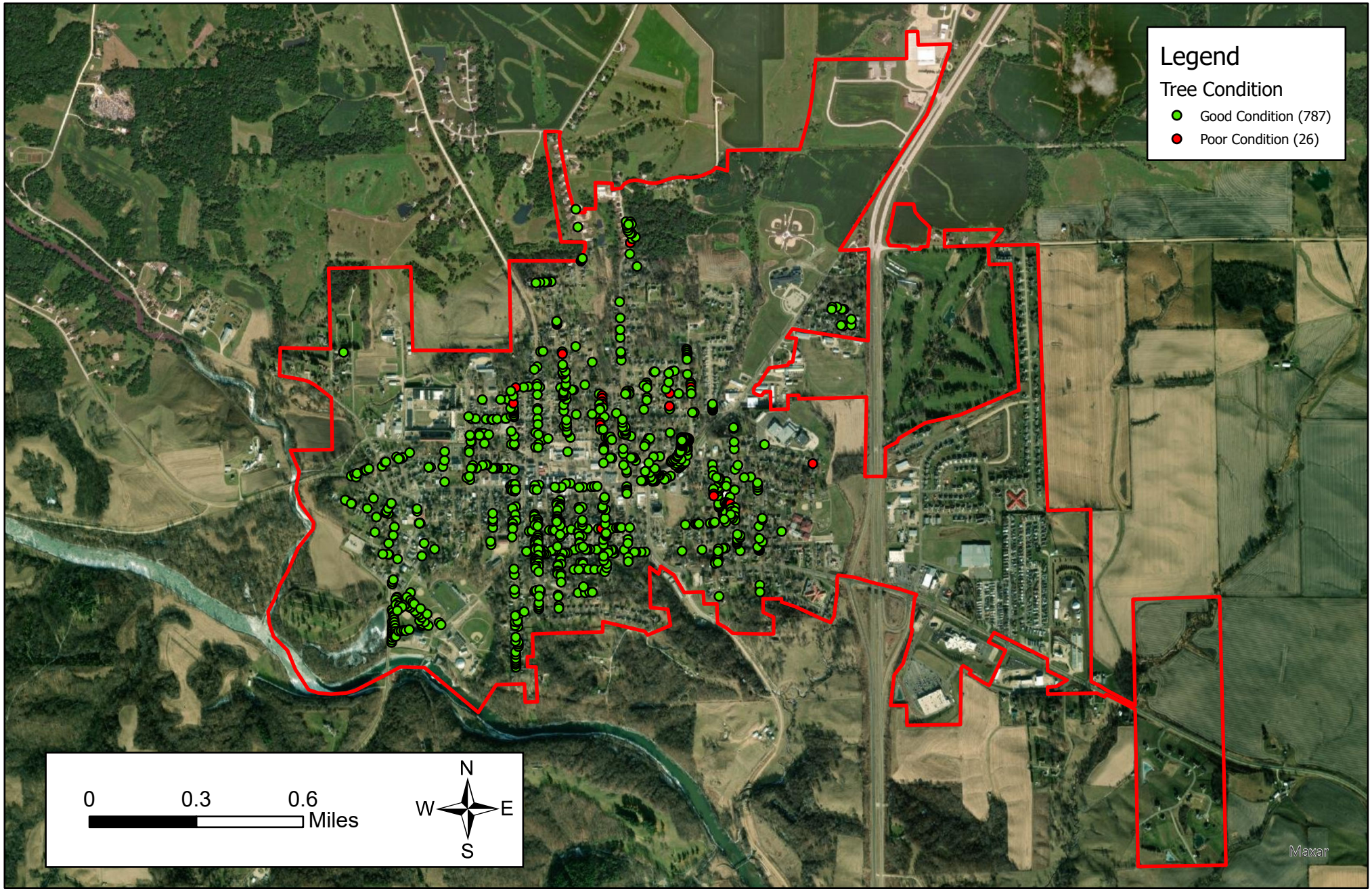

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 3 - Poor Condition Trees
Anamosa, Iowa

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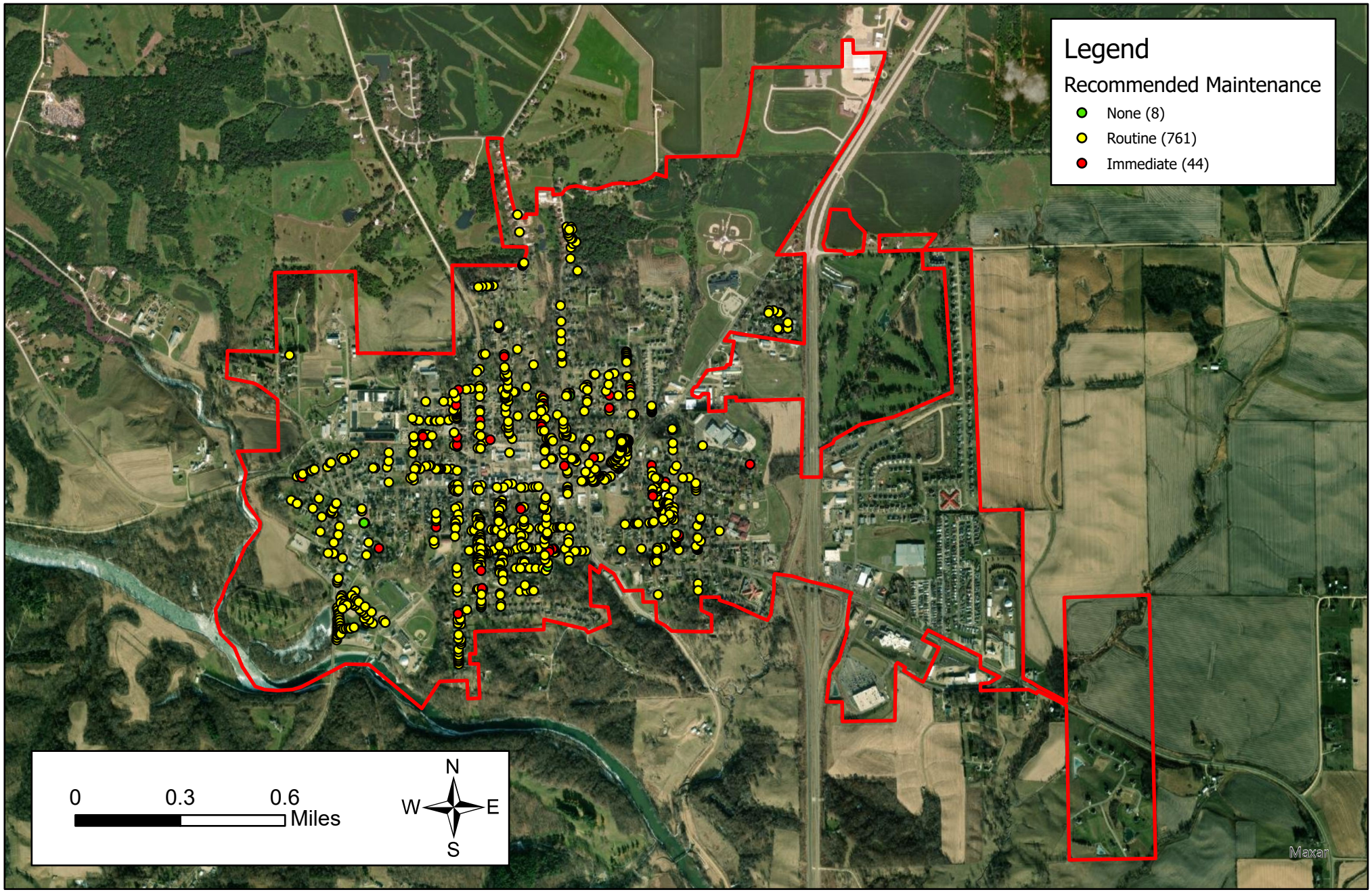

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Date: 1/26/2023
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File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 4 - Recommended Maintenance
Anamosa, Iowa

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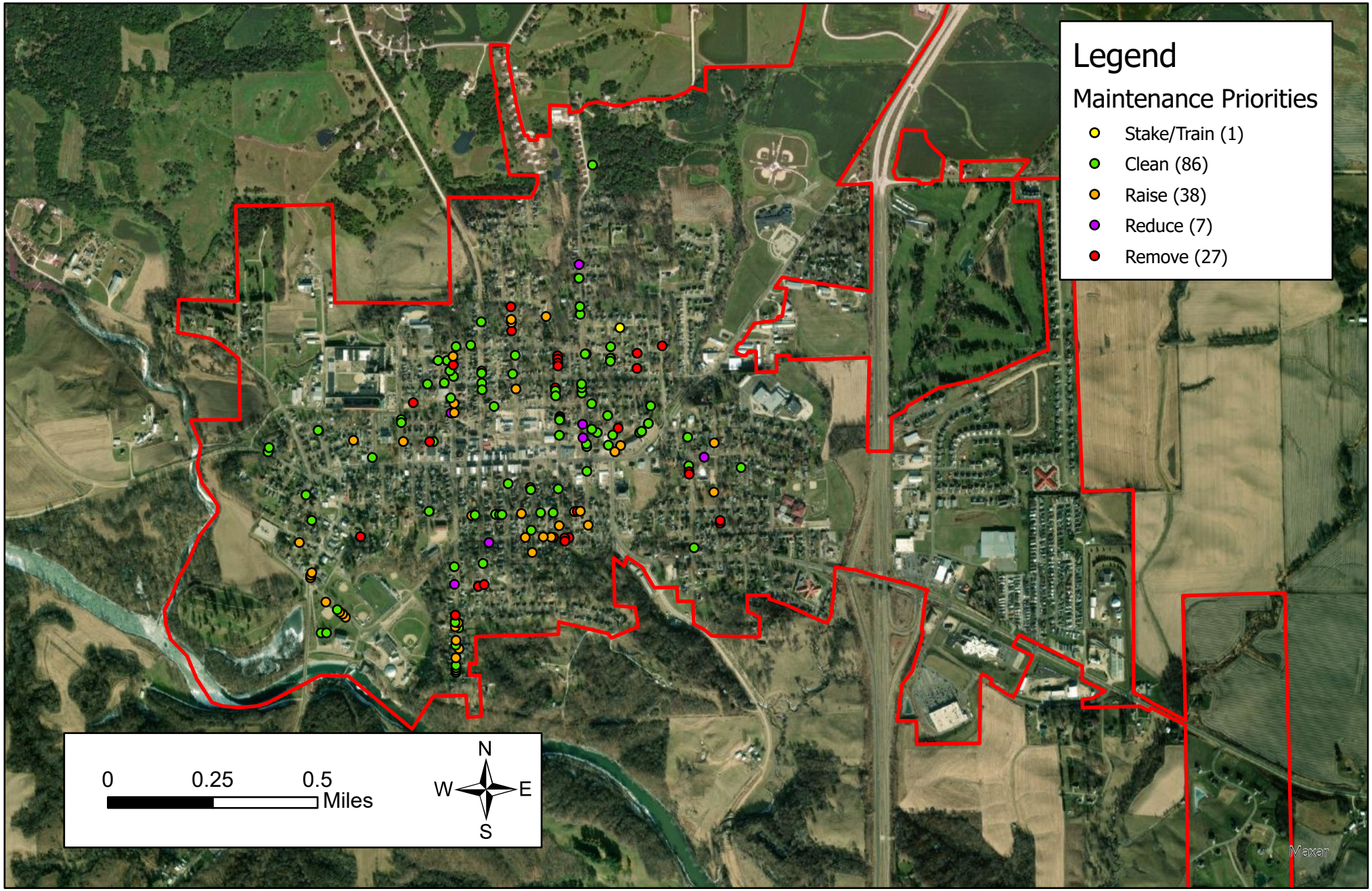

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Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 5 - Maintenance Priorities
Anamosa, Iowa

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APPENDIX C: ANAMOSA TREE ORDINANCES

CHAPTER 150

TREES

150.01 Definition 150.03 Duty to Maintain and Trim Trees

150.02 Prohibition on Planting of Trees Within City 150.04 Trimming Trees to be Supervised

Right-of-Ways and Minimum Setback Requirements 150.05 Disease Control

for Planting of Trees on Private Property 150.06 Inspection and Removal

150.01 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.

150.02 PROHIBITION ON PLANTING OF TREES WITHIN THE CITY RIGHT-OF-WAYS AND MINIMUM SETBACK REQUIREMENTS FOR PLANTING OF TREES ON PRIVATE PROPERTY. The planting of trees and shrubs within the public right-of-ways and other public places of the City is prohibited. Trees planted on private property shall be set back at least six feet from the City right-of-ways. (Ord. 861 – Apr. 10 Supp.)

150.03 DUTY TO MAINTAIN AND TRIM TREES. Adjoining property owners shall be responsible for maintenance of all trees growing within the parking and for the cleanup and removal of any such trees or parts thereof that fall to the ground provided the trees exhibited no signs of disease or dead wood prior to the required cleanup. Adjoining property owners shall not be required to remove any diseased or dead wood from trees within the parking. All trees within the parking, and all trees owned by the adjoining property owner, shall be 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 maintain and trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within a reasonable period of time. 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.

(Ord. 650 – Oct. 00 Supp. and Ord. 861 – Apr. 10 Supp.)

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

150.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 150.03, it is unlawful for any person to trim or cut any tree in a street right-of-way or public place unless the work is done under the supervision of the City. Before any tree within the parking, street right-of-way or any other public place is trimmed or cut other than to meet the clearance requirements of the preceding section, advance permission of the Public Service Supervisor shall be secured. A written indemnification agreement shall be signed by the property owner agreeing to hold the City of Anamosa safe and harmless and to indemnify the City for any

damages arising from their removal of City-owned trees. (Ord. 650 – Oct. 00 Supp. and Ord. 854 – Apr. 10 Supp.)

150.05 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.

150.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

1. Removal from 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, and that danger to other trees within the City is imminent, the Council shall immediately cause such condition to be corrected by treatment or removal so as to destroy or prevent as fully as possible the spread of the disease or the insect or disease pests. 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. Removal from Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that the danger to other trees within the City is imminent, the Council shall immediately 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 nuisance to be removed and the cost assessed against the property.

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