Early, 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 Early 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 17% of Early's 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 528 trees inventoried.

- Early trees provide $121,792 of benefits annually, an average of $231 per tree
- There are over 34 species of trees
- The top three genera are: Maple 49%, Ash 17%, and Spruce 9%
- 6% of trees need some type of management
- 8 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 8 trees needing removal, 7 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*
- 39 of the 90 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 53 years to remove ash. We suggest that city officials request a budget increase to $5,000 annually and apply for grants to plant replacement trees.

Introduction

INTRODUCTION

This plan was developed to assist Early 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 Early, 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 Early'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 Early 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 Early's urban forestry goals.

Assist Early 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 528 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. Early's trees reduce energy-related costs by approximately $28,888 annually (Appendix A, Table 1). These savings are both in electricity (139.1 MWh) and in natural gas (18,703.3 Therms).

Annual Stormwater Benefits

Early trees intercept about 1,803,663 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $48,879 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 Early, it is estimated that trees remove 1,793 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 $5,001 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Early, trees sequester about 401,089 lbs of carbon per year with an associated value of $4,495 (Appendix A, Table 5). In addition, the trees store 6,968,951 lbs of carbon, with a yearly benefit of $52,267 (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. Early receives $34,529 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, Early's trees provide $121,792 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 528 trees in Early provide approximately $231 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$28,888**	• Intercept 1,803,663 **gallons** • Provides **$48,879** benefit	• Remove 1,793 **lbs** of pollution • Net value of **$5,001**	• Sequester 401,089 **lbs** • Value of **$4,495** • Store 6,968,951 **lbs** • Value of **$52,267**	• **$34,529** in social benefits	• **$121,792** annual benefits • Each tree provides **$231** annually

FOREST STRUCTURE

Species Distribution

Early has over 42 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	259	49%	Poplar	2	<1%
Ash	90	17%	Buckeye	2	<1%
Spruce	46	9%	Hickory	1	<1%
Basswood/Linden	40	8%	Sycamore	1	<1%
Pine	16	3%	Other Deciduous	2	<1%
Oak	15	3%			
Locust	13	2%			
Hackberry	12	2%			
Walnut	7	1%			
Apple	5	1%			
Mulberry	5	1%			
Cedar	3	<1%			
Lilac	3	<1%			
Ginkgo	2	<1%			
Birch	2	<1%			
Pear	2	<1%			

Age Class

Most of Early's trees (22%) are between 30 and 36 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. Early's size curve is on the larger side, indicating a older than average 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 Early indicate that 93% of the trees are in good health, with only 1% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 63% of Early's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Five percent of the tree population's wood condition is in poor health, dead, or dying. This 5% is an estimate of trees that need management follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Action	Number of Trees	Percentage
Crown Cleaning	19	4%
Tree Removal	8	2%
Crown Reduction	0	0%
Crown Raising	0	0%
Tree Staking	0	0%

Canopy Cover

The total canopy with both private and public trees is 57 acres or 23% cover. The canopy cover included in the Early inventory includes approximately 17 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 Early'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	30%
Industrial/Large Commercial	2%
Multi-family Residential	1%
Small Commercial	0%

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

Early has 1 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 1 tree over 30 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 7 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 8 removals, 4 are ash trees. There are a total of 90 ash trees, and 10 of those have signs and symptoms that have been associated with EAB. In addition, there are 9 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 Early.

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 (49%) (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 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (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 151.02 (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.

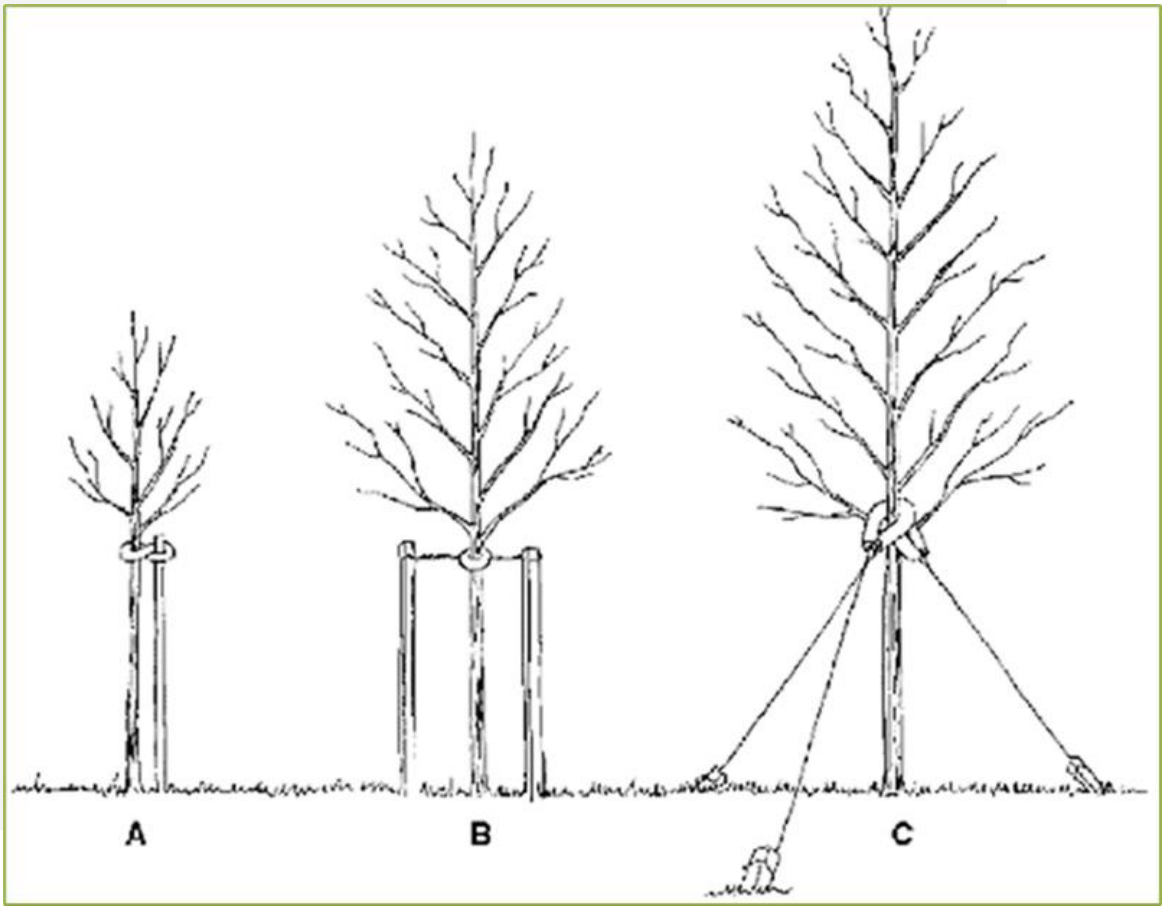
Monitoring

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 151.06

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $1,200/Year – (Based off Reported Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,150**

YEAR 2	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,250**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,150**

YEAR 4	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open locations	$150
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,250**

YEAR 5	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,150**

YEAR 6	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,250**

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 $11,550 a year. If the budget were increased to $10,000 a year all ash could be removed in 7 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $2,400/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 4 trees in open locations	$600
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

YEAR 2	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Plant 4 trees in open locations	$600
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

YEAR 3	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Plant 4 trees in open locations	$600
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

YEAR 4	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Plant 4 trees in open locations	$600
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

YEAR 5	Est. Cost
Remove 2 ash trees	$1,400
Plant 4 trees in open locations	$600
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

YEAR 6	Est. Cost
Remove 2 ash trees	$1,400
Plant 4 trees in open locations	$600
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,400**

Purposed Budget Increase

EAB could potentially kill all ash trees in Early within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $10,500 a year. If the budget

were increased to $5,000 per year all ash could be removed within 13 years. Additionally, we recommend that Early 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 2 trees could be treated per year (every other year treatment). Four trees would be selected for treatment, and Early would still need to find $62,400 for removal. Alternatively, if there are 8 treatable trees, it would cost approximately $1,200 a year for treatment and leave $0 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 Early. We suggest considering an increased budget to plan for this.

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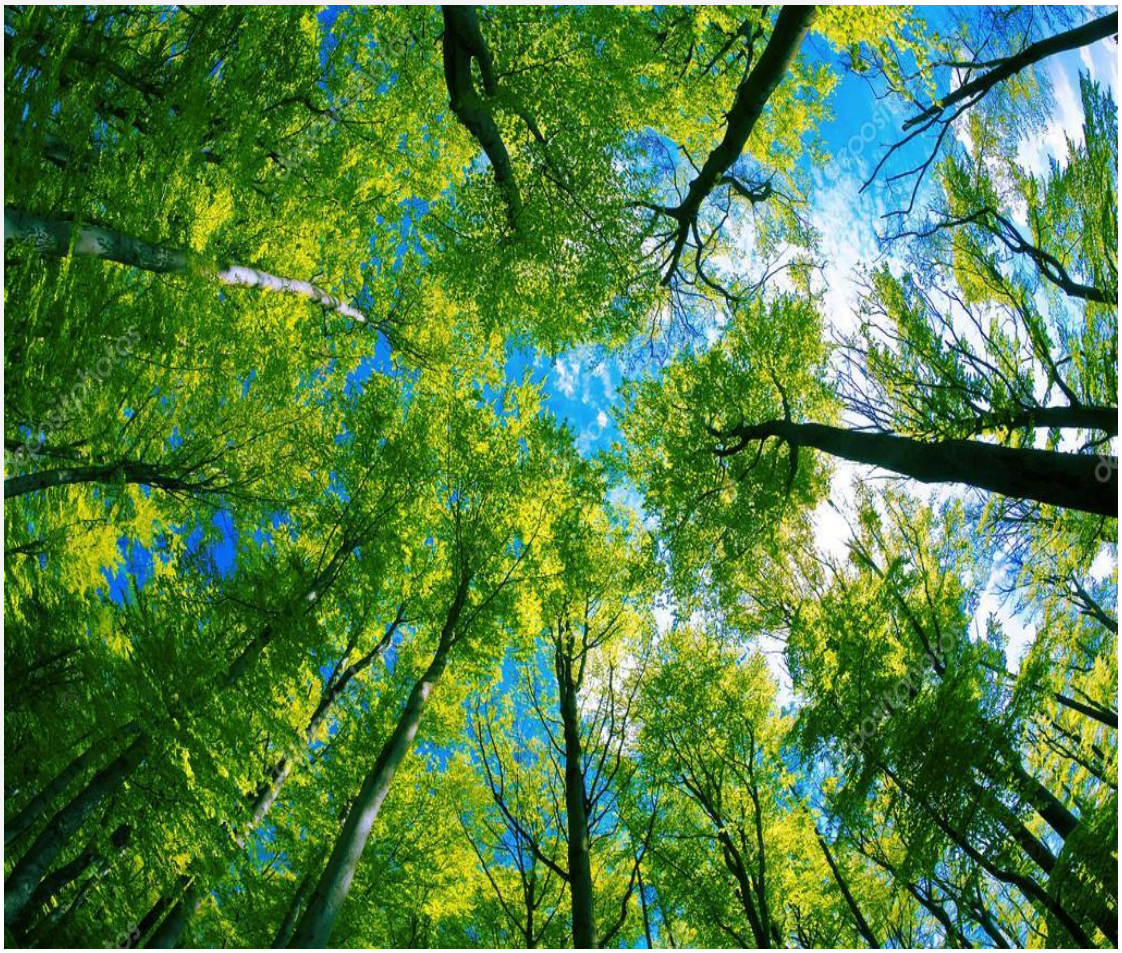
Appendices



APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Early

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	46.3	3,518	6,014.0	5,894	9,412	(N/A)	24.6	32.6	72.40
Green ash	26.6	2,019	3,566.7	3,495	5,515	(N/A)	16.3	19.1	64.13
Norway maple	12.2	925	1,731.0	1,696	2,621	(N/A)	10.8	9.1	45.99
Sugar maple	14.6	1,110	1,982.5	1,943	3,053	(N/A)	9.7	10.6	59.86
Norway spruce	4.4	338	556.6	545	883	(N/A)	6.6	3.1	25.23
American basswood	8.0	606	1,159.9	1,137	1,742	(N/A)	4.9	6.0	67.01
Littleleaf linden	2.1	160	273.4	268	428	(N/A)	2.7	1.5	30.54
Red maple	0.5	37	73.4	72	109	(N/A)	2.7	0.4	7.76
Honeylocust	4.1	314	540.8	530	844	(N/A)	2.5	2.9	64.93
Northern hackberry	4.7	355	660.4	647	1,002	(N/A)	2.3	3.5	83.49
Austrian pine	1.2	94	171.3	168	262	(N/A)	1.7	0.9	29.08
Blue spruce	0.8	64	118.7	116	181	(N/A)	1.3	0.6	25.80
Black walnut	2.5	188	346.9	340	528	(N/A)	1.3	1.8	75.37
Pin oak	2.5	191	328.2	322	512	(N/A)	1.1	1.8	85.40
Apple	0.2	12	27.5	27	39	(N/A)	0.9	0.1	7.80
White mulberry	0.9	71	130.3	128	199	(N/A)	0.9	0.7	39.73
Conifer Evergreen Large	0.8	61	107.9	106	166	(N/A)	0.9	0.6	33.26
Maple	0.1	9	17.1	17	26	(N/A)	0.9	0.1	5.12
Northern red oak	0.9	66	123.4	121	187	(N/A)	0.8	0.6	46.70
Northern white cedar	0.6	42	73.8	72	115	(N/A)	0.6	0.4	38.17
Black spruce	0.2	14	24.9	24	38	(N/A)	0.6	0.1	12.80
White ash	0.6	48	70.1	69	116	(N/A)	0.6	0.4	38.78
Black poplar	0.7	57	101.2	99	156	(N/A)	0.4	0.5	77.98
Ginkgo	0.5	36	64.0	63	99	(N/A)	0.4	0.3	49.28
Lilac	0.0	2	4.4	4	6	(N/A)	0.4	0.0	3.13
Northern pin oak	0.6	49	94.8	93	142	(N/A)	0.4	0.5	70.84
Pear	0.0	1	1.2	1	2	(N/A)	0.4	0.0	0.87
Bur oak	0.3	25	47.3	46	72	(N/A)	0.4	0.2	35.78
Red pine	0.1	9	19.0	19	27	(N/A)	0.4	0.1	13.58
Ohio buckeye	0.3	20	40.4	40	60	(N/A)	0.4	0.2	29.89
Hickory	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
American sycamore	0.4	33	59.0	58	91	(N/A)	0.2	0.3	91.02
Birch	0.1	8	16.9	17	24	(N/A)	0.2	0.1	24.47
Amur maple	0.0	2	3.8	4	5	(N/A)	0.2	0.0	5.40
Ash	0.3	24	47.4	46	71	(N/A)	0.2	0.2	70.84
Japanese tree lilac	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Paper birch	0.3	25	46.9	46	71	(N/A)	0.2	0.2	70.91
Broadleaf Deciduous Small	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Black maple	0.3	22	39.9	39	61	(N/A)	0.2	0.2	60.68
Broadleaf Deciduous Mediu	0.0	0	0.8	1	1	(N/A)	0.2	0.0	1.10
Spruce	0.1	4	9.5	9	14	(N/A)	0.2	0.0	13.58
Swamp white oak	0.0	3	6.2	6	9	(N/A)	0.2	0.0	8.99
Total	139.1	10,559	18,703.3	18,329	28,888	(N/A)	100.0	100.0	54.71

Table 2: Annual Stormwater Benefits

Early

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	716,170	19,408	(N/A)	24.6	39.7	149.29
Green ash	314,136	8,513	(N/A)	16.3	17.4	98.99
Norway maple	108,913	2,952	(N/A)	10.8	6.0	51.78
Sugar maple	176,659	4,787	(N/A)	9.7	9.8	93.87
Norway spruce	70,977	1,923	(N/A)	6.6	3.9	54.96
American basswood	97,334	2,638	(N/A)	4.9	5.4	101.45
Littleleaf linden	14,945	405	(N/A)	2.7	0.8	28.93
Red maple	2,618	71	(N/A)	2.7	0.1	5.07
Honeylocust	47,770	1,295	(N/A)	2.5	2.6	99.58
Northern hackberry	50,072	1,357	(N/A)	2.3	2.8	113.08
Austrian pine	20,043	543	(N/A)	1.7	1.1	60.35
Blue spruce	14,699	398	(N/A)	1.3	0.8	56.91
Black walnut	32,444	879	(N/A)	1.3	1.8	125.61
Pin oak	35,533	963	(N/A)	1.1	2.0	160.49
Apple	551	15	(N/A)	0.9	0.0	2.99
White mulberry	3,840	104	(N/A)	0.9	0.2	20.81
Conifer Evergreen Large	19,014	515	(N/A)	0.9	1.1	103.06
Maple	435	12	(N/A)	0.9	0.0	2.36
Northern red oak	9,620	261	(N/A)	0.8	0.5	65.17
Northern white cedar	13,814	374	(N/A)	0.6	0.8	124.79
Black spruce	2,057	56	(N/A)	0.6	0.1	18.58
White ash	3,939	107	(N/A)	0.6	0.2	35.58
Black poplar	9,830	266	(N/A)	0.4	0.5	133.19
Ginkgo	3,715	101	(N/A)	0.4	0.2	50.33
Lilac	76	2	(N/A)	0.4	0.0	1.03
Northern pin oak	7,529	204	(N/A)	0.4	0.4	102.01
Pear	15	0	(N/A)	0.4	0.0	0.20
Bur oak	3,961	107	(N/A)	0.4	0.2	53.67
Red pine	1,191	32	(N/A)	0.4	0.1	16.14
Ohio buckeye	2,491	68	(N/A)	0.4	0.1	33.76
Hickory	18	0	(N/A)	0.2	0.0	0.48
American sycamore	7,239	196	(N/A)	0.2	0.4	196.17
Birch	586	16	(N/A)	0.2	0.0	15.88
Amur maple	69	2	(N/A)	0.2	0.0	1.86
Ash	3,764	102	(N/A)	0.2	0.2	102.01
Japanese tree lilac	7	0	(N/A)	0.2	0.0	0.20
Paper birch	3,943	107	(N/A)	0.2	0.2	106.85
Broadleaf Deciduous Small	7	0	(N/A)	0.2	0.0	0.20
Black maple	2,867	78	(N/A)	0.2	0.2	77.70
Broadleaf Deciduous Medium	12	0	(N/A)	0.2	0.0	0.33
Spruce	596	16	(N/A)	0.2	0.0	16.14
Swamp white oak	163	4	(N/A)	0.2	0.0	4.41
Citywide total	1,803,663	48,879	(N/A)	100.0	100.0	92.57

Table 3: Annual Air Quality Benefits

Early

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	127.5	21.6	62.0	5.7	686	217.7	31.9	30.5	209.6	1,364	-64.2	-241	642.3	1,809	(N/A)	24.6	13.91
Green ash	43.2	6.9	20.1	1.9	229	126.4	18.4	17.6	120.6	789	0.0	0	355.2	1,018	(N/A)	16.3	11.83
Norway maple	21.9	3.8	10.8	1.0	118	58.9	8.5	8.1	55.3	365	-5.2	-19	163.1	464	(N/A)	10.8	8.14
Sugar maple	24.2	4.1	11.9	1.1	130	69.6	10.1	9.7	66.2	434	-18.8	-71	178.0	494	(N/A)	9.7	9.68
Norway spruce	8.0	1.6	6.7	1.0	53	20.7	3.1	2.9	20.1	130	-30.5	-114	33.7	69	(N/A)	6.6	1.98
American basswood	13.8	2.4	6.7	0.6	74	38.8	5.6	5.3	36.2	240	-11.6	-43	97.8	271	(N/A)	4.9	10.42
Littleleaf linden	2.0	0.3	1.1	0.1	11	9.9	1.5	1.4	9.5	62	-1.1	-4	24.8	69	(N/A)	2.7	4.94
Red maple	0.3	0.1	0.2	0.0	2	2.4	0.3	0.3	2.2	15	-0.1	-1	5.6	16	(N/A)	2.7	1.13
Honeylocust	9.4	1.6	4.3	0.4	50	19.5	2.9	2.7	18.7	122	-7.4	-28	52.1	144	(N/A)	2.5	11.07
Northern hackberry	8.3	1.4	4.2	0.4	45	22.5	3.3	3.1	21.2	140	0.0	0	64.4	185	(N/A)	2.3	15.43
Austrian pine	3.0	0.6	2.4	0.4	20	5.9	0.9	0.8	5.6	37	-7.7	-29	11.9	28	(N/A)	1.7	3.07
Blue spruce	2.7	0.5	2.1	0.3	17	4.1	0.6	0.6	3.8	25	-5.7	-21	9.0	21	(N/A)	1.3	3.02
Black walnut	4.4	0.7	2.0	0.2	23	11.9	1.7	1.6	11.2	74	0.0	0	33.8	97	(N/A)	1.3	13.88
Pin oak	7.2	1.3	3.5	0.3	39	11.8	1.7	1.7	11.4	74	-13.0	-49	25.9	64	(N/A)	1.1	10.71
Apple	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.7	5	0.0	0	1.9	5	(N/A)	0.9	1.08
White mulberry	1.3	0.2	0.6	0.1	7	4.5	0.7	0.6	4.2	28	0.0	0	12.1	35	(N/A)	0.9	6.91
Conifer Evergreen Large	2.3	0.5	1.8	0.3	15	3.8	0.6	0.5	3.6	24	-11.6	-44	1.8	-5	(N/A)	0.9	-0.96
Maple	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	0.9	0.72
Northern red oak	2.1	0.4	1.0	0.1	11	4.2	0.6	0.6	3.9	26	-3.0	-11	9.8	26	(N/A)	0.8	6.46
Northern white cedar	1.7	0.3	1.3	0.2	11	2.6	0.4	0.4	2.5	16	-8.6	-32	0.9	-5	(N/A)	0.6	-1.58
Black spruce	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.8	4	(N/A)	0.6	1.47
White ash	0.2	0.0	0.2	0.0	1	2.9	0.4	0.4	2.8	18	0.0	0	7.0	20	(N/A)	0.6	6.51
Black poplar	1.9	0.3	0.8	0.1	10	3.6	0.5	0.5	3.4	22	0.0	0	11.0	32	(N/A)	0.4	15.94
Ginkgo	1.1	0.2	0.5	0.0	6	2.2	0.3	0.3	2.1	14	-0.3	-1	6.5	19	(N/A)	0.4	9.29
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)	0.4	0.41
Northern pin oak	1.7	0.3	0.8	0.1	9	3.1	0.5	0.4	2.9	19	-0.4	-1	9.5	27	(N/A)	0.4	13.58
Pear	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.1	0	(N/A)	0.4	0.11
Bur oak	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	13	(N/A)	0.4	6.28
Red pine	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	3	-0.3	-1	1.1	3	(N/A)	0.4	1.48
Ohio buckeye	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)	0.4	5.15
Hickory	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
American sycamore	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
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)	0.2	3.47
Amur maple	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

Early

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								
Ash	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14	(N/A)	0.2	13.58
Japanese tree lilac	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
Paper birch	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)	0.2	12.48
Broadleaf Deciduous Small	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 maple	0.7	0.1	0.3	0.0	4	1.4	0.2	0.2	1.3	8	-0.2	-1	4.0	12	(N/A)	0.2	11.54
Broadleaf Deciduous Medium	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	0.14
Spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	0.2	1.48
Swamp white oak	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
Citywide total	293.2	49.9	147.5	14.5	1,594	660.5	96.4	92.0	630.0	4,123	-190.9	-716	1,793.0	5,001	(N/A)	100.0	9.47

Table 4: Annual Carbon Stored

Early

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	2,859,154	21,444	(N/A)	24.6	41.0	164.95
Green ash	1,436,063	10,770	(N/A)	16.3	20.6	125.24
Norway maple	363,668	2,728	(N/A)	10.8	5.2	47.85
Sugar maple	696,308	5,222	(N/A)	9.7	10.0	102.40
Norway spruce	71,430	536	(N/A)	6.6	1.0	15.31
American basswood	508,750	3,816	(N/A)	4.9	7.3	146.75
Littleleaf linden	44,700	335	(N/A)	2.7	0.6	23.95
Red maple	4,571	34	(N/A)	2.7	0.1	2.45
Honeylocust	121,238	909	(N/A)	2.5	1.7	69.94
Northern hackberry	129,160	969	(N/A)	2.3	1.9	80.73
Austrian pine	22,408	168	(N/A)	1.7	0.3	18.67
Blue spruce	24,472	184	(N/A)	1.3	0.4	26.22
Black walnut	144,065	1,080	(N/A)	1.3	2.1	154.36
Pin oak	200,367	1,503	(N/A)	1.1	2.9	250.46
Apple	1,857	14	(N/A)	0.9	0.0	2.79
White mulberry	18,891	142	(N/A)	0.9	0.3	28.34
Conifer Evergreen La	30,218	227	(N/A)	0.9	0.4	45.33
Maple	689	5	(N/A)	0.9	0.0	1.03
Northern red oak	46,741	351	(N/A)	0.8	0.7	87.64
Northern white cedar	22,471	169	(N/A)	0.6	0.3	56.18
Black spruce	1,204	9	(N/A)	0.6	0.0	3.01
White ash	8,378	63	(N/A)	0.6	0.1	20.95
Black poplar	64,440	483	(N/A)	0.4	0.9	241.65
Ginkgo	15,601	117	(N/A)	0.4	0.2	58.50
Lilac	192	1	(N/A)	0.4	0.0	0.72
Northern pin oak	28,560	214	(N/A)	0.4	0.4	107.10
Pear	28	0	(N/A)	0.4	0.0	0.10
Bur oak	15,785	118	(N/A)	0.4	0.2	59.19
Red pine	513	4	(N/A)	0.4	0.0	1.93
Ohio buckeye	7,962	60	(N/A)	0.4	0.1	29.86
Hickory	12	0	(N/A)	0.2	0.0	0.09
American sycamore	39,259	294	(N/A)	0.2	0.6	294.44
Birch	1,101	8	(N/A)	0.2	0.0	8.26
Amur maple	178	1	(N/A)	0.2	0.0	1.33
Ash	14,280	107	(N/A)	0.2	0.2	107.10
Japanese tree lilac	14	0	(N/A)	0.2	0.0	0.10
Paper birch	15,773	118	(N/A)	0.2	0.2	118.30
Broadleaf Deciduous	14	0	(N/A)	0.2	0.0	0.10
Black maple	7,945	60	(N/A)	0.2	0.1	59.59
Broadleaf Deciduous	17	0	(N/A)	0.2	0.0	0.13
Spruce	257	2	(N/A)	0.2	0.0	1.93
Swamp white oak	218	2	(N/A)	0.2	0.0	1.64
Citywide total	6,968,951	52,267	(N/A)	100.0	100.0	98.99

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

Early

Annual CO 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	203,026	1,523	-13,724	-522	-107	77,744	583	266,523	1,999 (N/A)	24.6	44.5	15.38
Green ash	59,042	443	-6,893	-279	-54	44,630	335	96,500	724 (N/A)	16.3	16.1	8.42
Norway maple	15,094	113	-1,749	-130	-14	20,441	153	33,656	252 (N/A)	10.8	5.6	4.43
Sugar maple	34,754	261	-3,342	-161	-26	24,535	184	55,785	418 (N/A)	9.7	9.3	8.20
Norway spruce	4,797	36	-343	-76	-3	7,459	56	11,838	89 (N/A)	6.6	2.0	2.54
American basswood	28,635	215	-2,442	-96	-19	13,384	100	39,481	296 (N/A)	4.9	6.6	11.39
Littleleaf linden	5,884	44	-215	-23	-2	3,526	26	9,173	69 (N/A)	2.7	1.5	4.91
Red maple	689	5	-22	-7	0	810	6	1,470	11 (N/A)	2.7	0.2	0.79
Honeylocust	7,752	58	-582	-32	-5	6,941	52	14,078	106 (N/A)	2.5	2.3	8.12
Northern hackberry	6,290	47	-620	-45	-5	7,838	59	13,463	101 (N/A)	2.3	2.2	8.41
Austrian pine	1,267	10	-108	-24	-1	2,073	16	3,209	24 (N/A)	1.7	0.5	2.67
Blue spruce	380	3	-117	-18	-1	1,420	11	1,665	12 (N/A)	1.3	0.3	1.78
Black walnut	6,156	46	-692	-27	-5	4,146	31	9,583	72 (N/A)	1.3	1.6	10.27
Pin oak	16,038	120	-962	-29	-7	4,214	32	19,262	144 (N/A)	1.1	3.2	24.08
Apple	254	2	-9	-3	0	265	2	507	4 (N/A)	0.9	0.1	0.76
White mulberry	1,549	12	-91	-11	-1	1,569	12	3,017	23 (N/A)	0.9	0.5	4.52
Conifer Evergreen Large	565	4	-145	-17	-1	1,338	10	1,741	13 (N/A)	0.9	0.3	2.61
Maple	122	1	-3	-2	0	195	1	311	2 (N/A)	0.9	0.1	0.47
Northern red oak	887	7	-224	-12	-2	1,456	11	2,107	16 (N/A)	0.8	0.4	3.95
Northern white cedar	768	6	-108	-11	-1	933	7	1,583	12 (N/A)	0.6	0.3	3.96
Black spruce	115	1	-6	-3	0	310	2	416	3 (N/A)	0.6	0.1	1.04
White ash	1,169	9	-40	-5	0	1,053	8	2,177	16 (N/A)	0.6	0.4	5.44
Black poplar	1,139	9	-309	-9	-2	1,254	9	2,075	16 (N/A)	0.4	0.3	7.78
Ginkgo	638	5	-75	-7	-1	792	6	1,348	10 (N/A)	0.4	0.2	5.06
Lilac	47	0	-1	-1	0	43	0	88	1 (N/A)	0.4	0.0	0.33
Northern pin oak	0	0	-137	-9	-1	1,077	8	932	7 (N/A)	0.4	0.2	3.49
Pear	17	0	0	0	0	11	0	28	0 (N/A)	0.4	0.0	0.10
Bur oak	859	6	-76	-4	-1	557	4	1,337	10 (N/A)	0.4	0.2	5.01
Red pine	105	1	-2	-2	0	189	1	289	2 (N/A)	0.4	0.0	1.08
Ohio buckeye	475	4	-38	-3	0	447	3	881	7 (N/A)	0.4	0.1	3.31
Hickory	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05

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
American sycamore	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.2	0.2	10.90
Birch	224	2	-5	-1	0	176	1	393	3 (N/A)	0.2	0.1	2.95
Amur maple	38	0	-1	-1	0	37	0	74	1 (N/A)	0.2	0.0	0.55
Ash	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.2	0.1	6.27
Japanese tree lilac	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Paper birch	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.2	0.2	9.97
Broadleaf Deciduous Smal	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Black maple	0	0	-38	-3	0	477	4	436	3 (N/A)	0.2	0.1	3.27
Broadleaf Deciduous Medi	5	0	0	0	0	7	0	12	0 (N/A)	0.2	0.0	0.09
Spruce	53	0	-1	-1	0	94	1	145	1 (N/A)	0.2	0.0	1.08
Swamp white oak	96	1	-2	-1	0	65	0	158	1 (N/A)	0.2	0.0	1.18
Citywide total	401,089	3,008	-33,457	-1,584	-263	233,347	1,750	599,395	4,495 (N/A)	100.0	100.0	8.51

Table 6: Annual Social and Aesthetic Benefits

Early

Annual Aesthetic/Other Benefits of Public Trees

2/6/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	15,288	(N/A)	24.6	44.3	117.60
Green ash	4,702	(N/A)	16.3	13.6	54.67
Norway maple	1,511	(N/A)	10.8	4.4	26.51
Sugar maple	3,522	(N/A)	9.7	10.2	69.07
Norway spruce	1,232	(N/A)	6.6	3.6	35.21
American basswood	2,011	(N/A)	4.9	5.8	77.35
Littleleaf linden	648	(N/A)	2.7	1.9	46.26
Red maple	120	(N/A)	2.7	0.3	8.55
Honeylocust	1,854	(N/A)	2.5	5.4	142.58
Northern hackberry	782	(N/A)	2.3	2.3	65.19
Austrian pine	185	(N/A)	1.7	0.5	20.55
Blue spruce	36	(N/A)	1.3	0.1	5.10
Black walnut	453	(N/A)	1.3	1.3	64.70
Pin oak	1,137	(N/A)	1.1	3.3	189.50
Apple	13	(N/A)	0.9	0.0	2.58
White mulberry	91	(N/A)	0.9	0.3	18.15
Conifer Evergreen Large	68	(N/A)	0.9	0.2	13.59
Maple	22	(N/A)	0.9	0.1	4.38
Northern red oak	64	(N/A)	0.8	0.2	15.98
Northern white cedar	79	(N/A)	0.6	0.2	26.25
Black spruce	50	(N/A)	0.6	0.1	16.62
White ash	161	(N/A)	0.6	0.5	53.63
Black poplar	86	(N/A)	0.4	0.2	43.13
Ginkgo	46	(N/A)	0.4	0.1	22.94
Lilac	2	(N/A)	0.4	0.0	1.05
Northern pin oak	0	(N/A)	0.4	0.0	0.00
Pear	0	(N/A)	0.4	0.0	0.03
Bur oak	71	(N/A)	0.4	0.2	35.43
Red pine	31	(N/A)	0.4	0.1	15.42
Ohio buckeye	46	(N/A)	0.4	0.1	22.89
Hickory	5	(N/A)	0.2	0.0	5.26
American sycamore	58	(N/A)	0.2	0.2	58.34
Birch	26	(N/A)	0.2	0.1	26.22
Amur maple	2	(N/A)	0.2	0.0	2.06
Ash	31	(N/A)	0.2	0.1	31.46
Japanese tree lilac	0	(N/A)	0.2	0.0	0.03
Paper birch	66	(N/A)	0.2	0.2	65.59
Broadleaf Deciduous Small	0	(N/A)	0.2	0.0	0.03
Black maple	0	(N/A)	0.2	0.0	0.00
Broadleaf Deciduous Medium	3	(N/A)	0.2	0.0	2.74
Spruce	15	(N/A)	0.2	0.0	15.42
Swamp white oak	13	(N/A)	0.2	0.0	12.89
Citywide total	34,529	(N/A)	100.0	100.0	65.40

Table 7: Summary of Benefits in Dollars

Early

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

2/6/2023

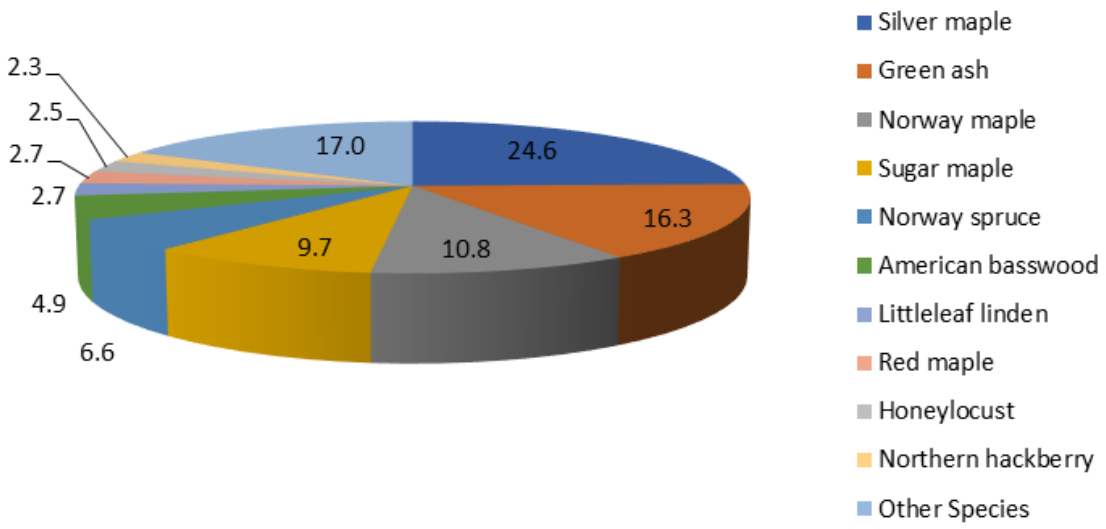
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	28,888	(N/A)	54.71	(N/A)	49.47	(N/A)
CO2	4,495	(N/A)	8.51	(N/A)	7.70	(N/A)
Air Quality	5,001	(N/A)	9.47	(N/A)	8.56	(N/A)
Stormwater	48,879	(N/A)	92.57	(N/A)	83.70	(N/A)
Aesthetic/Other	34,529	(N/A)	65.40	(N/A)	59.12	(N/A)
Total Benefits	121,792	(N/A)	230.67	(N/A)	208.55	(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	121,792	(N/A)	230.67	(N/A)	208.55	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Early

Species Distribution of Public Trees

2/6/2023



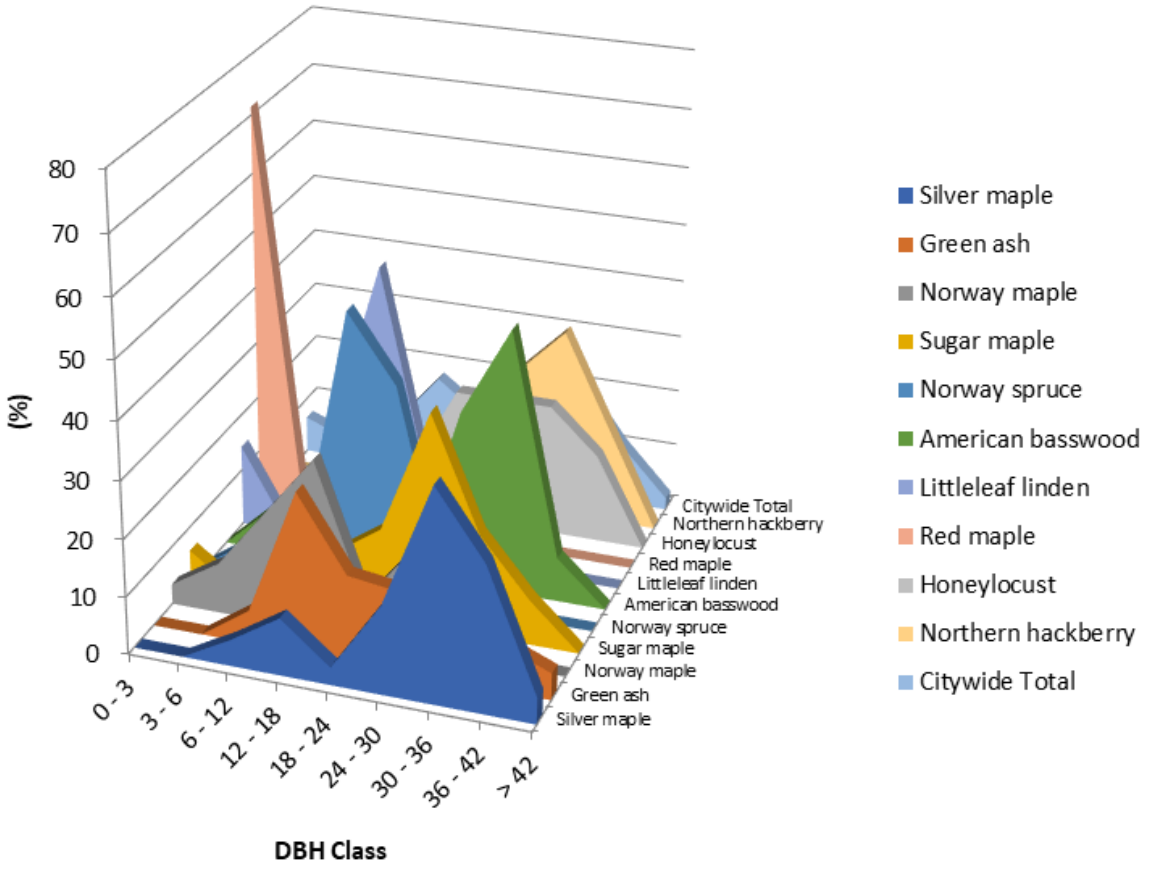
Species	Percent
Silver maple	24.6
Green ash	16.3
Norway maple	10.8
Sugar maple	9.7
Norway spruce	6.6
American basswood	4.9
Littleleaf linden	2.7
Red maple	2.7
Honeylocust	2.5
Northern hackberry	2.3
Other Species	17.0
Total	100.0

Figure 2: Relative Age Class

Early

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	4.62	10.00	3.08	15.38	36.92	25.38	4.62
Green ash	0.00	0.00	5.81	27.91	15.12	13.95	24.42	8.14	4.65
Norway maple	3.51	8.77	19.30	29.82	7.02	17.54	14.04	0.00	0.00
Sugar maple	5.88	0.00	5.88	9.80	15.69	37.25	17.65	7.84	0.00
Norway spruce	0.00	5.71	5.71	48.57	37.14	2.86	0.00	0.00	0.00
American basswood	0.00	7.69	0.00	3.85	3.85	30.77	46.15	7.69	0.00
Littleleaf linden	14.29	0.00	21.43	50.00	14.29	0.00	0.00	0.00	0.00
Red maple	71.43	0.00	28.57	0.00	0.00	0.00	0.00	0.00	0.00
Honeylocust	7.69	0.00	0.00	7.69	23.08	23.08	23.08	15.38	0.00
Northern hackberry	0.00	0.00	0.00	8.33	16.67	25.00	33.33	16.67	0.00
Citywide Total	6.44	3.22	8.14	17.80	11.55	17.99	21.97	10.80	2.08

Figure 3: Foliage Condition

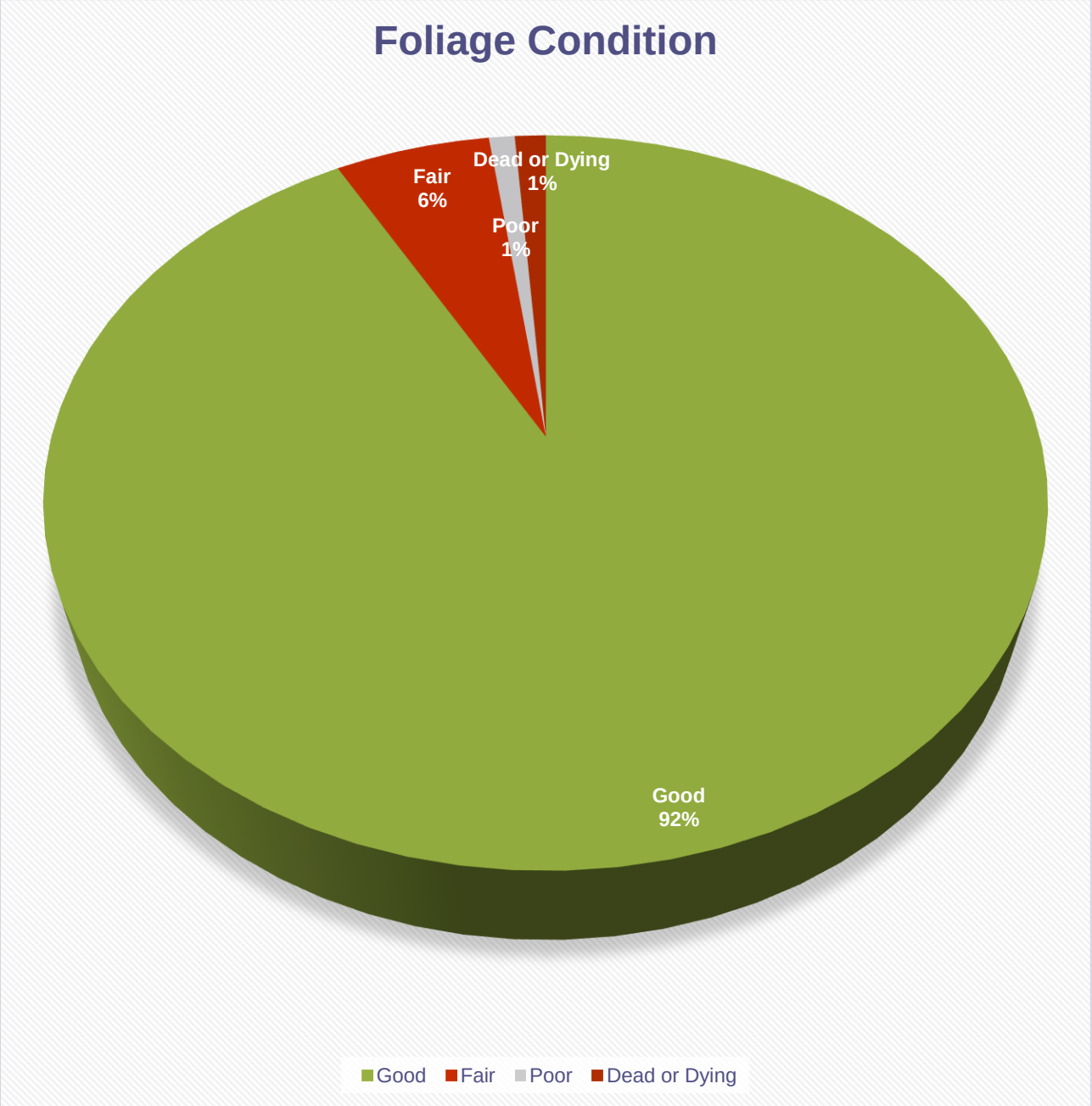


Figure 4: Wood Condition

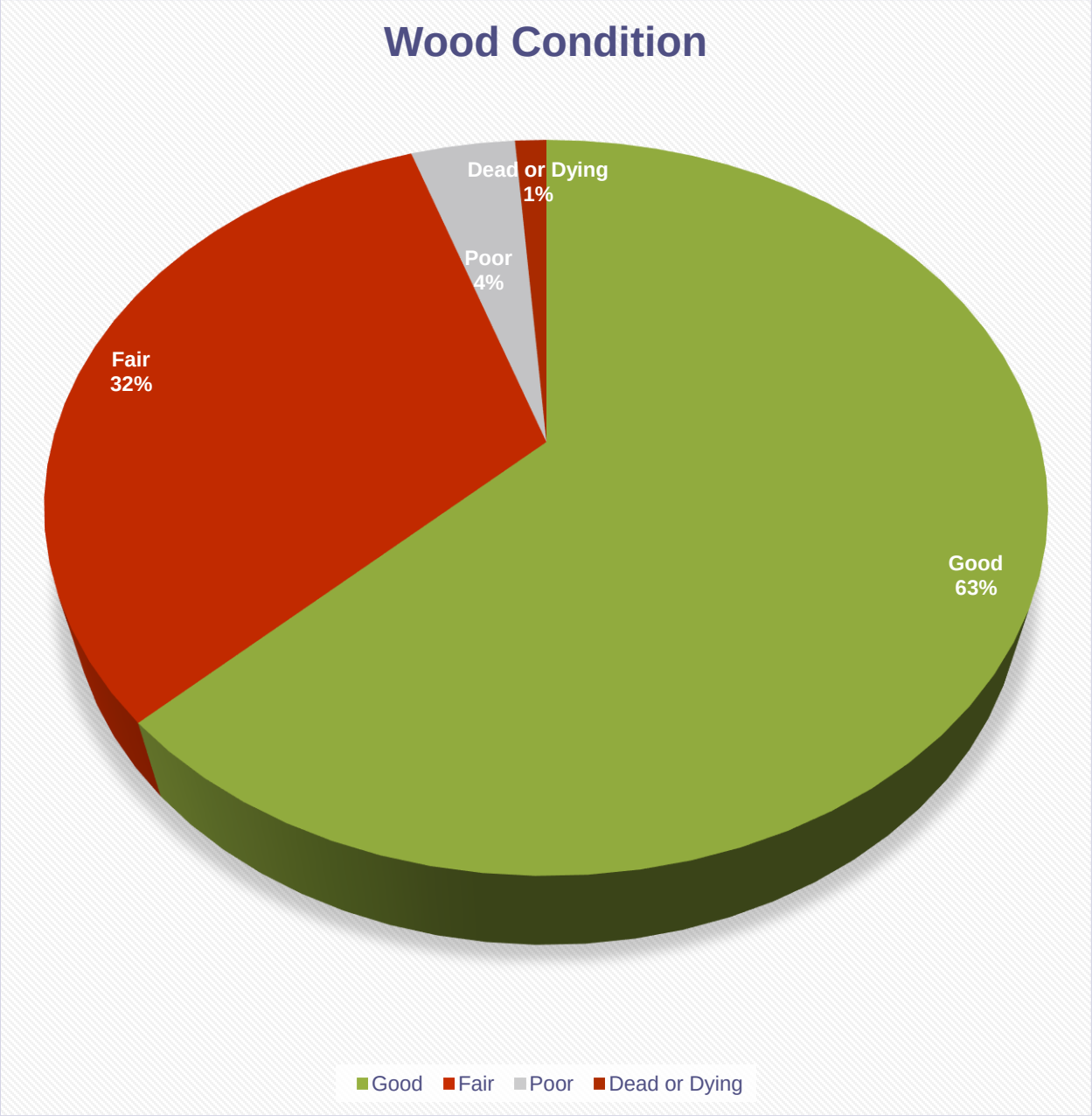
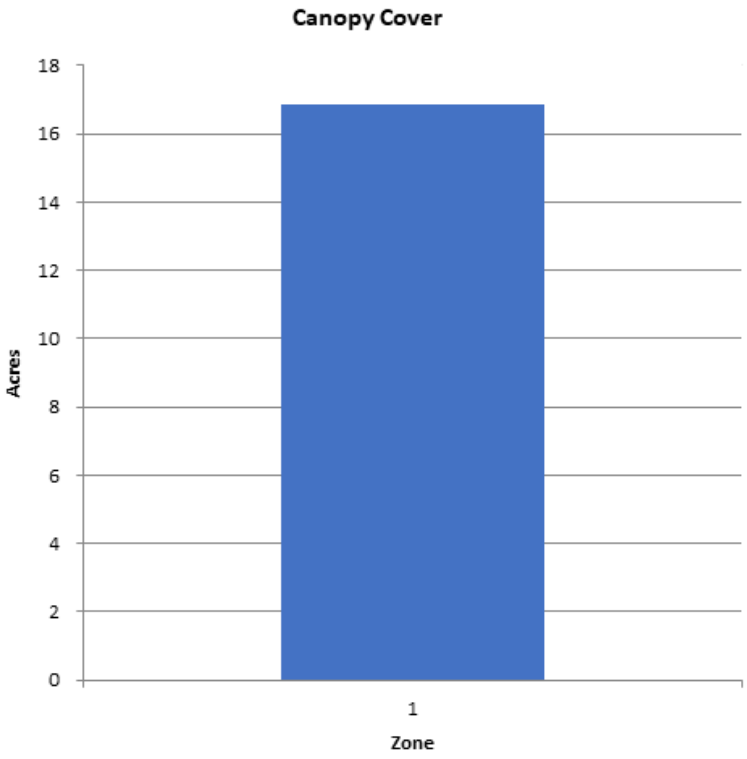


Figure 5: Canopy Cover in Acres

Early

Canopy Cover of Public Trees (Acres)

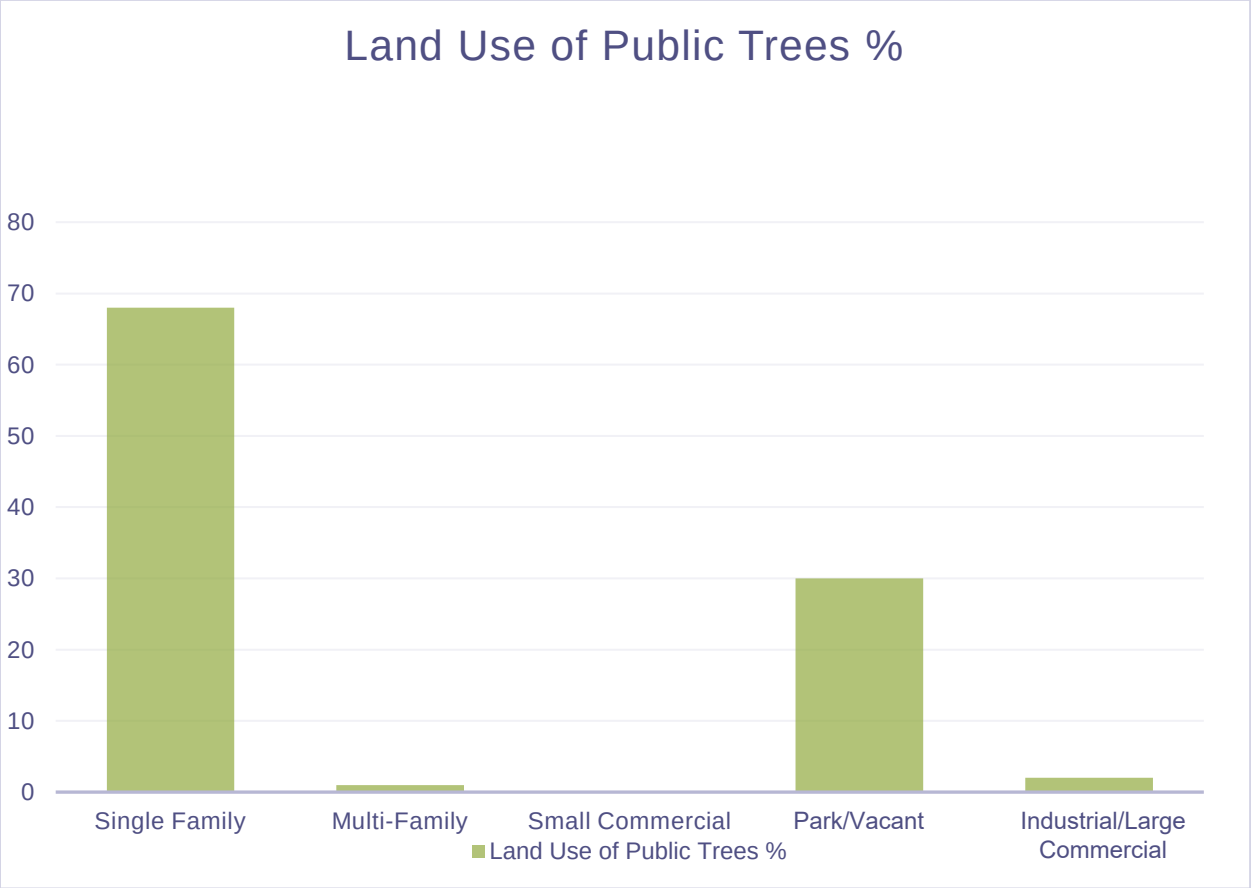
2/6/2023



Zone	Acres	% of Total Canopy Cover
1	17	100.0
Citywide total	17	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	0	0	17	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

Figure 1: Location of Ash Trees

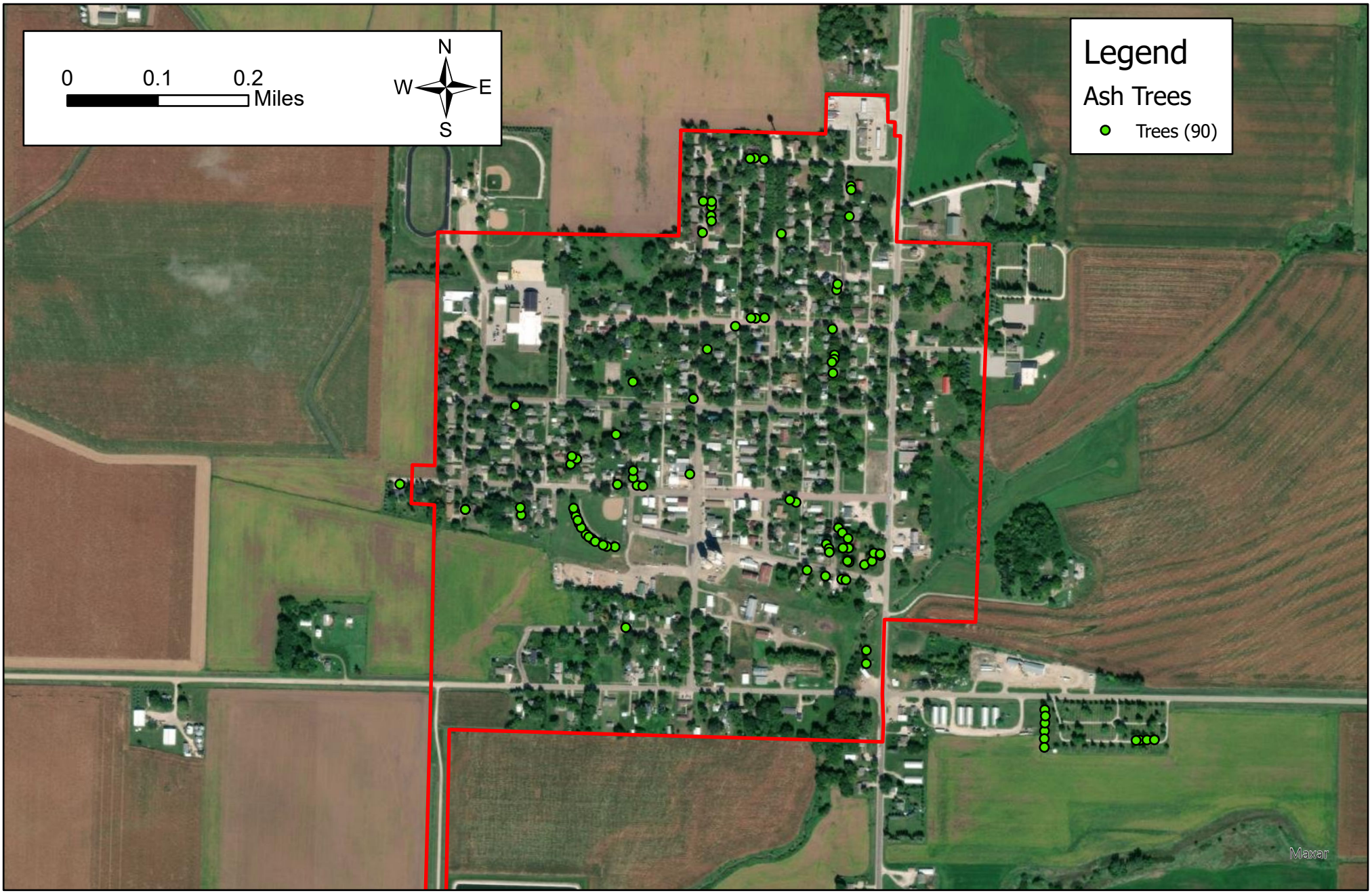
Figure 2: Location of EAB Symptoms

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
Early, Iowa

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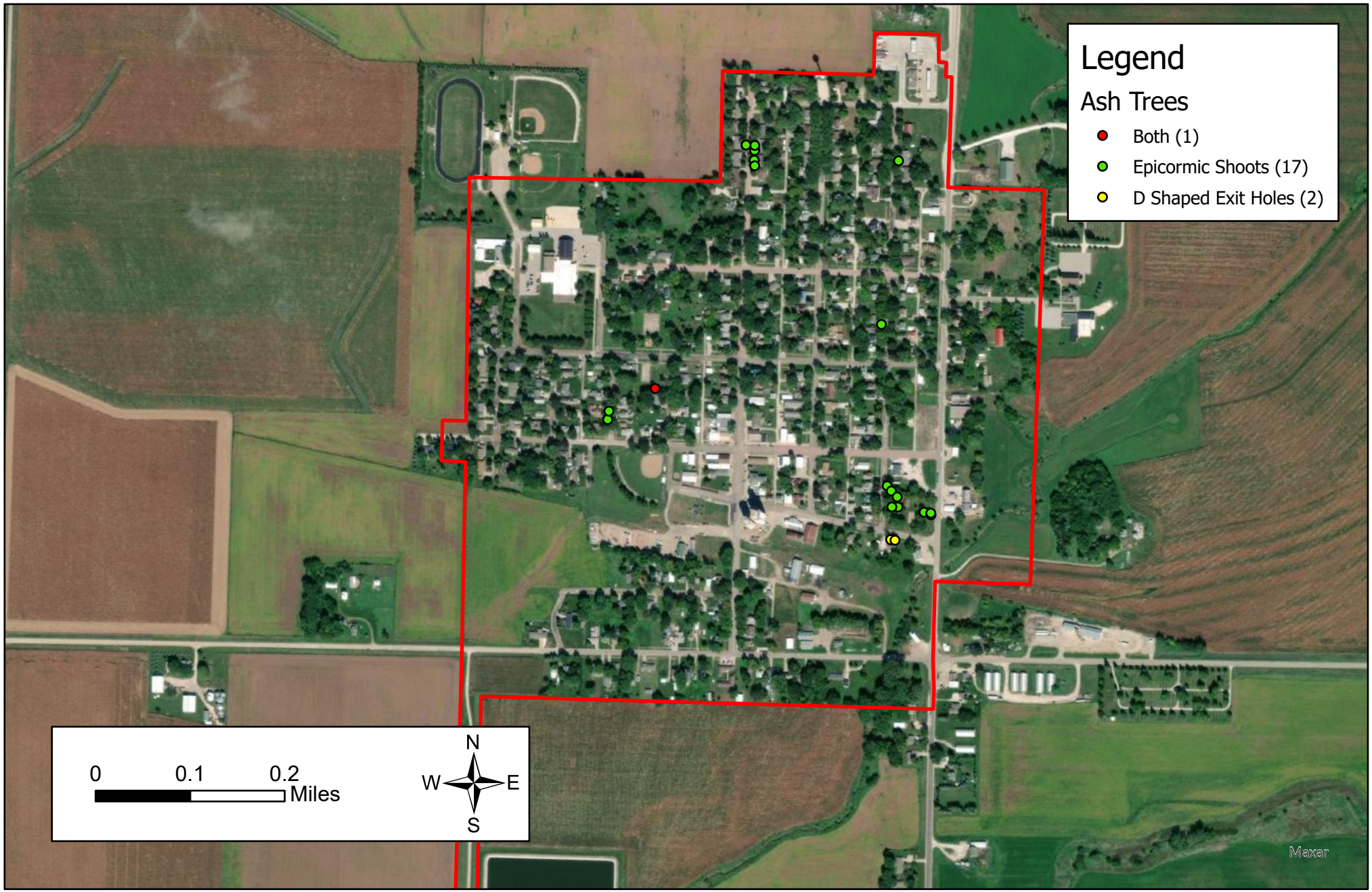

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 2 - EAB Symptoms
Early, Iowa

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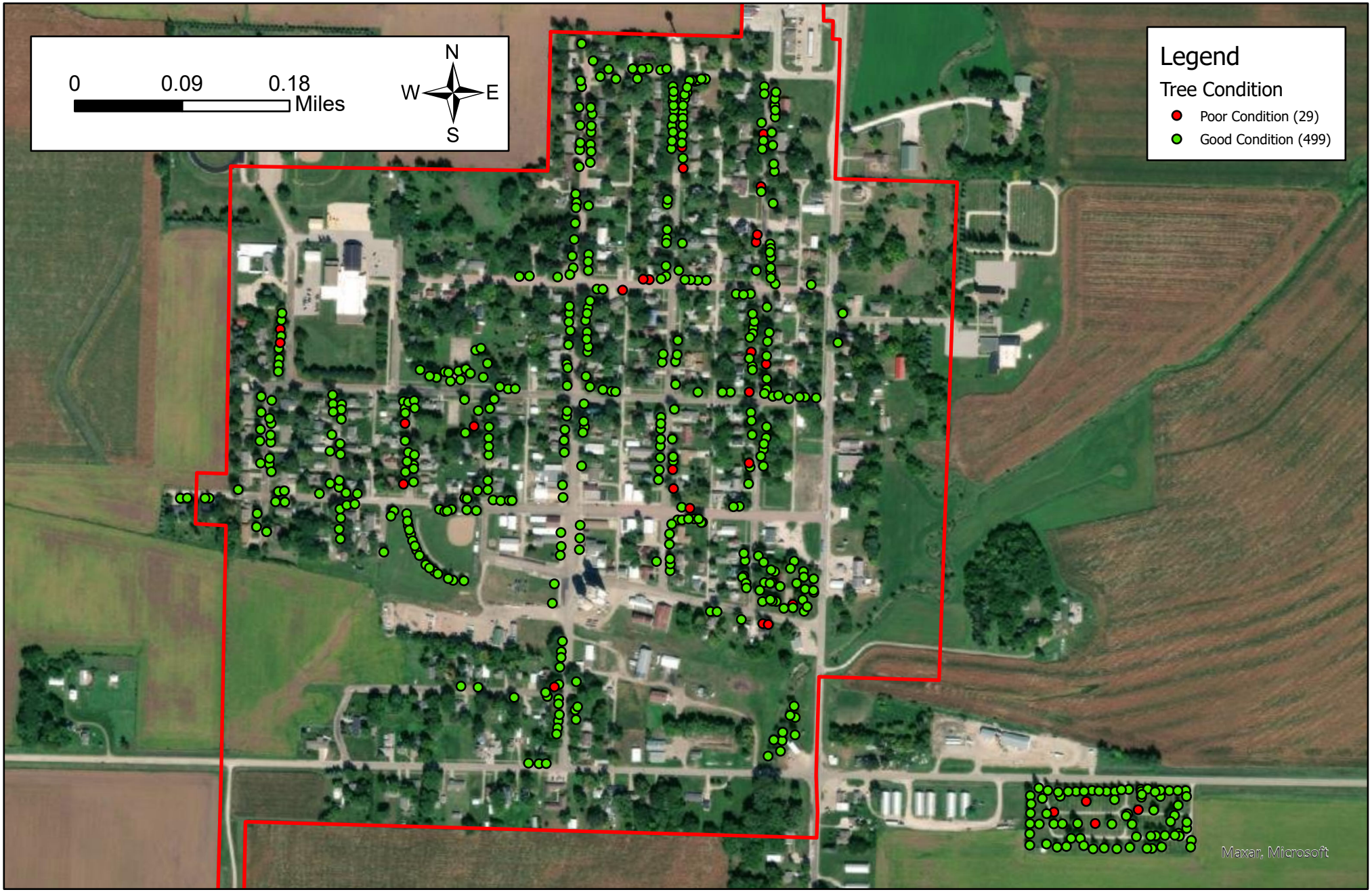

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 3 - Poor Condition Trees
Early, Iowa

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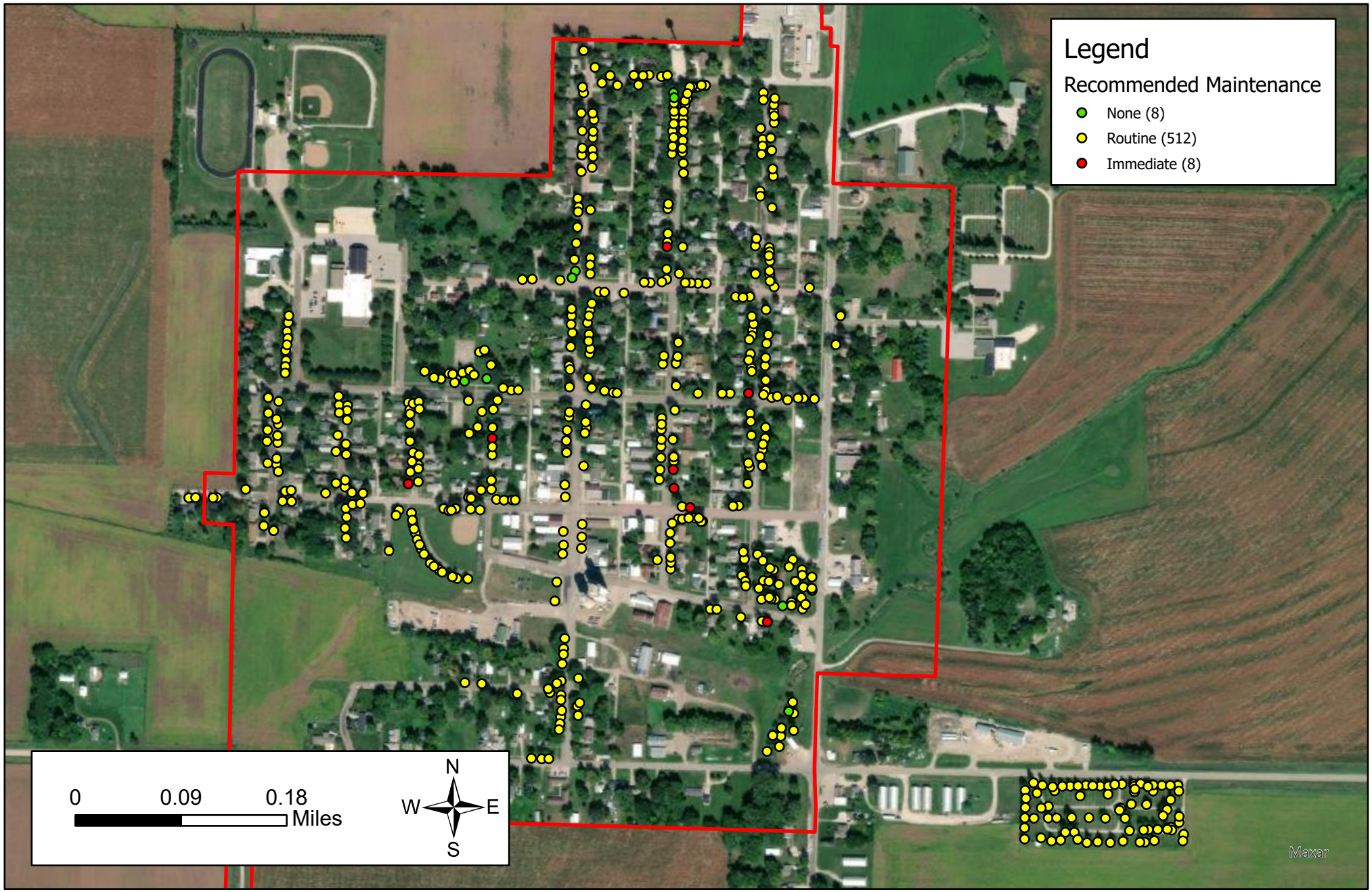

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 4 - Recommended Maintenance
Early, Iowa

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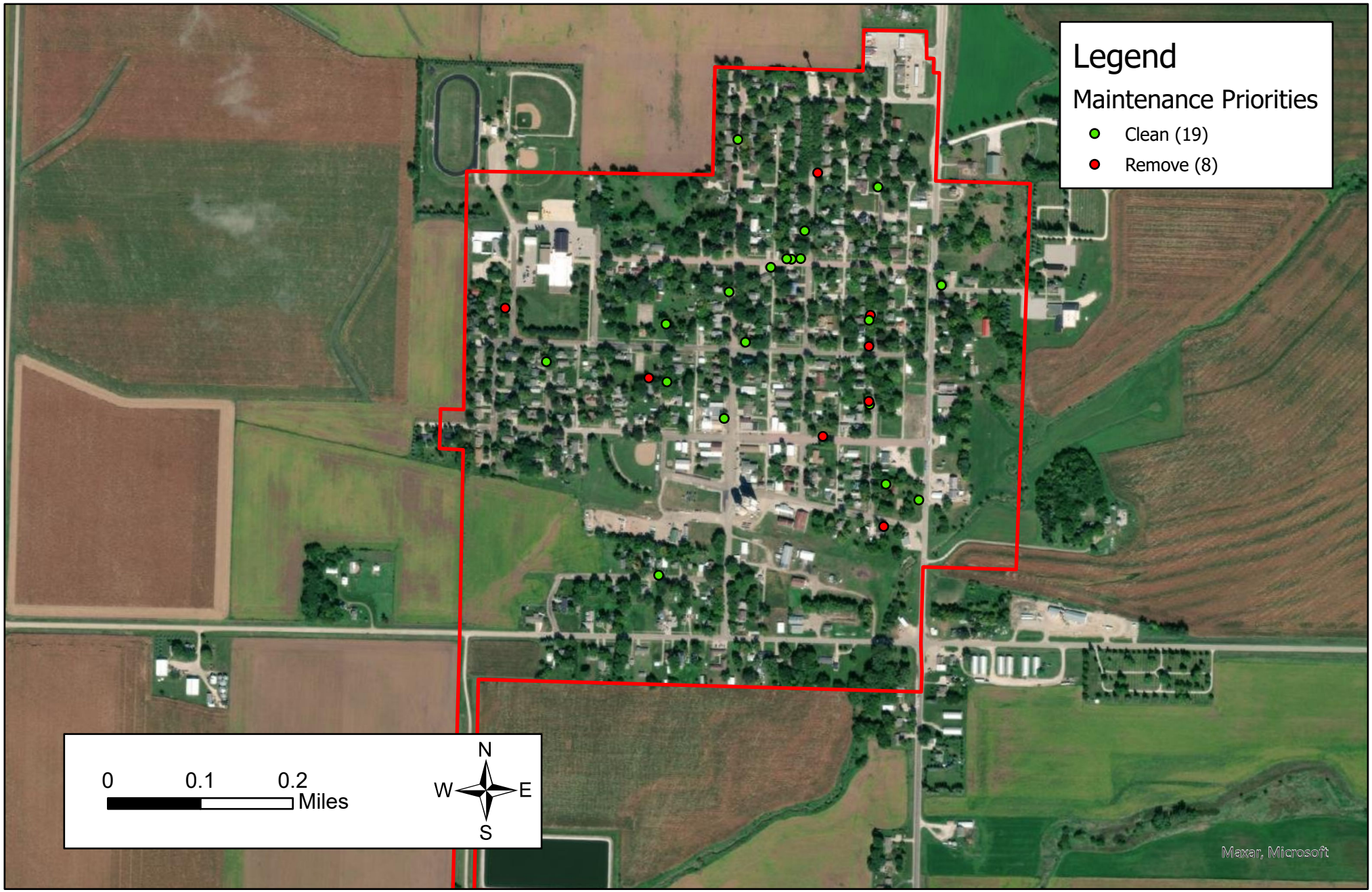

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 5 - Maintenance Priorities
Early, Iowa

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APPENDIX C: EARLY TREE ORDINANCES

CHAPTER151

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 & el)

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:

CHAPTER 151 TREES

151 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.

152 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 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])