University Heights, 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 University Heights 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 1% of University Heights 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.

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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 268 trees inventoried.

- University Heights trees provide $30,005 of benefits annually, an average of $112 per tree
- There are over 44 species of trees
- The top three genera are: Maple 28%, Basswood/Linden 13%, and Oak 11%
- 35% of trees need some type of management
- 0 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.

- Currently University Heights has no trees for removal. *City ownership of the trees recommended for removal should be verified prior to any removal*
- None of the 4 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 2 years to remove ash. We suggest that city officials request a budget increase to $3,000 annually and apply for grants to plant replacement trees.

Introduction

INTRODUCTION

This plan was developed to assist University Heights 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 University Heights, 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 University Heights 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 University Heights 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 University Heights urban forestry goals.

Assist University Heights with Managing its

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 268 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. University Heights trees reduce energy-related costs by approximately $7,455 annually (Appendix A, Table 1). These savings are both in electricity (35.5 MWh) and in natural gas (4,860.9 Therms).

Annual Stormwater Benefits

University Heights trees intercept about 414,080 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $11,222 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 University Heights, it is estimated that trees remove 428 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 $1,171 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In University Heights, trees sequester about 93,546 lbs of carbon per year with an associated value of $1,093 (Appendix A, Table 5). In addition, the trees store 1,433,345 lbs of carbon, with a yearly benefit of $10,750 (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. University Heights receives $9,065 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, University Heights trees provide $30,005 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 268 trees in University Heights provide approximately $112 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$7,455**	• Intercept 414,080 **gallons** • Provides **$11,222** benefit	• Remove 428 **lbs** of pollution • Net value of **$1,171**	• Sequester 93,546 **lbs** • Value of **$1,093** • Store 1,433,345 **lbs** • Value of **$11,750**	• **$9,065** in social benefits	• **$30,005** annual benefits • Each tree provides **$112** annually

FOREST STRUCTURE

Species Distribution

University Heights has over 44 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	76	28%	Hickory	4	1%
Basswood/Linden	37	13%	Locust	4	1%
Oak	30	11%	Pine	3	1%
Apple	20	7%	Walnut	3	1%
Spruce	19	7%	Boxelder	2	1%
Elm	15	6%	Cedar	2	1%
Sycamore	9	3%	Magnolia	2	1%
Ginkgo	7	3%	Buckeye	1	<1%
Hackberry	7	3%	Dogwood	1	<1%
Birch	6	2%	Lilac	1	<1%
Coffee Tree	6	2%	Pear	1	<1%
Poplar	5	2%	Redbud	1	<1%
Ash	4	1%	Tree of Heaven	1	<1%

Age Class

Most of University Heights trees (32%) are between 0 and 3 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. University Heights size curve is on the smaller side, indicating a younger 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 University Heights indicate that 98% of the trees are in good

health, with only 0% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 90% of University Heights trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Zero percent of the tree population's wood condition is in poor health, dead, or dying. This 0% 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 Raising	77	29%
Crown Cleaning	15	6%
Crown Reduction	1	<1%
Tree Removal	0	0%
Tree Staking	0	0%

Canopy Cover

The total canopy with both private and public trees is 93 acres or 54% cover. The canopy cover included in the University Heights inventory includes approximately 4 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 1 tree needs to be planted annually on public and private lands.

Land Use and Location

The majority of University Heights 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	98%
Park/Vacant/Other	2%
Industrial/Large Commercial	0%
Small Commercial	0%
Multifamily Residential	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

University Heights 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 6 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 13 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). There are a total of 4 ash trees, and 0 of those have signs and symptoms that have been associated with EAB. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising 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 University Heights.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (28%) (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 52 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 52 (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 52 Section 3 (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.

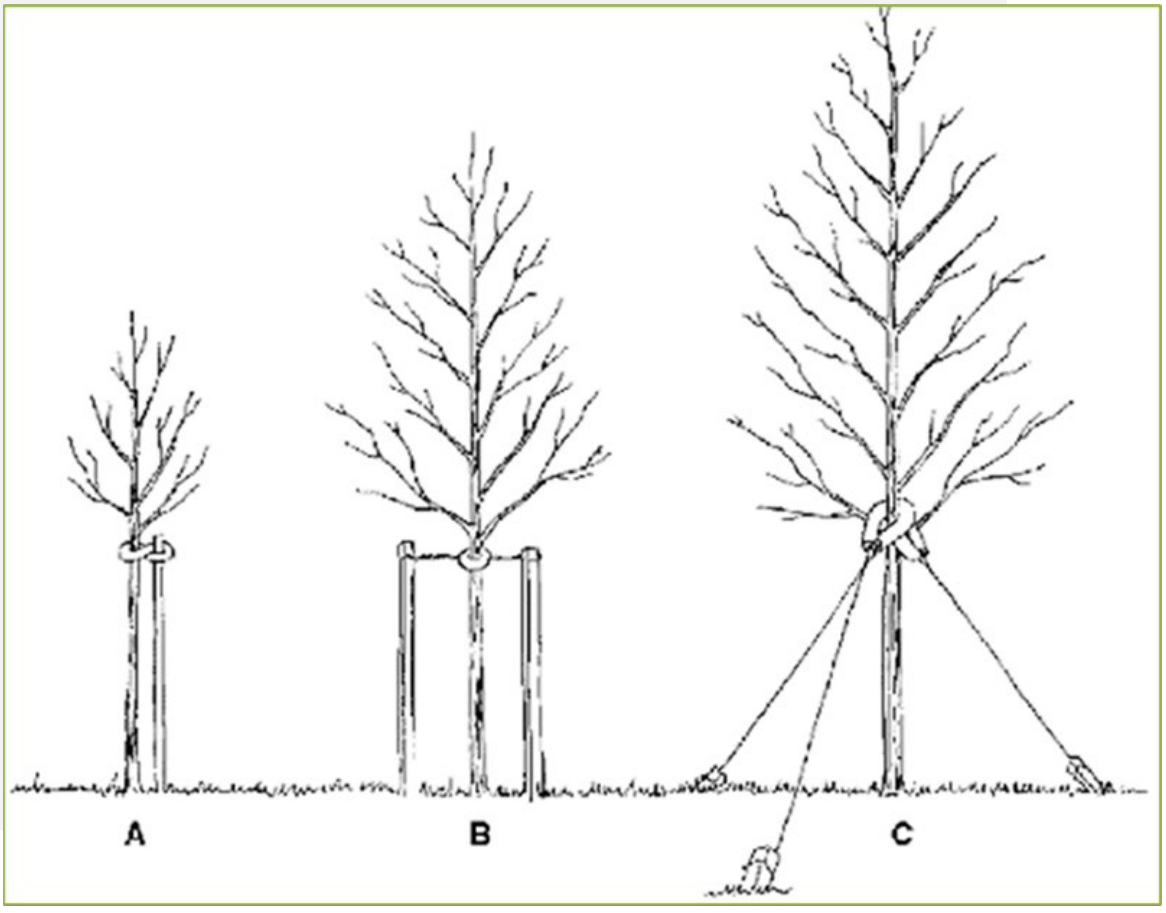
Monitoring

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 52 Section 6 (Appendix C).

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $2,500/Year – (Based off $2/person Yearly Tree Budget)

YEAR 1	Est. Cost
Prune 1/6 of city owned trees	$700
Remove 1 ash tree in poor condition	$700
Plant 7 trees in open locations	$1,050
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,450**

YEAR 2	Est. Cost
Remove 1 ash tree	$700
Plant 7 trees in open locations	$1,050
Prune 1/6 of city owned trees	$700
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,450**

YEAR 3	Est. Cost
Prune 1/6 of city owned trees	$700
Remove 1 ash tree in poor condition	$700
Plant 7 trees in open locations	1,050
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,450**

YEAR 4	Est. Cost
Remove 1 ash tree	$700
Plant 7 trees in open locations	$1,050
Prune 1/6 of city owned trees	$700
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,450**

YEAR 5	Est. Cost
Prune 1/6 of city owned trees	$700
Plant 12 trees in open locations	$1,800
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,500**

YEAR 6	Est. Cost
	$
Plant 12 trees in open locations	$1,800
Prune 1/6 of city owned trees	$700
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,500**

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 $1,000 a year. If the budget were to remain at $2,500 a year all ash could be removed in 2 years.*

Purposed Budget Increase

EAB could potentially kill all ash trees in University Heights within four years of its arrival. To remove all ash trees within six years, the budget would need to be at least $1,000 a year. If the budget were to remain $2,500 per year all ash could be removed within 2 years. Additionally, we recommend that University Heights 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). Four trees would be selected for treatment, and University Heights would not need funding 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 University Heights. We suggest considering an increased budget to plan for this.

WORKS CITED

Census Bureau. 2010. http://censtats.census.gov/data/IA/1601964290.pdf(April, 2013)

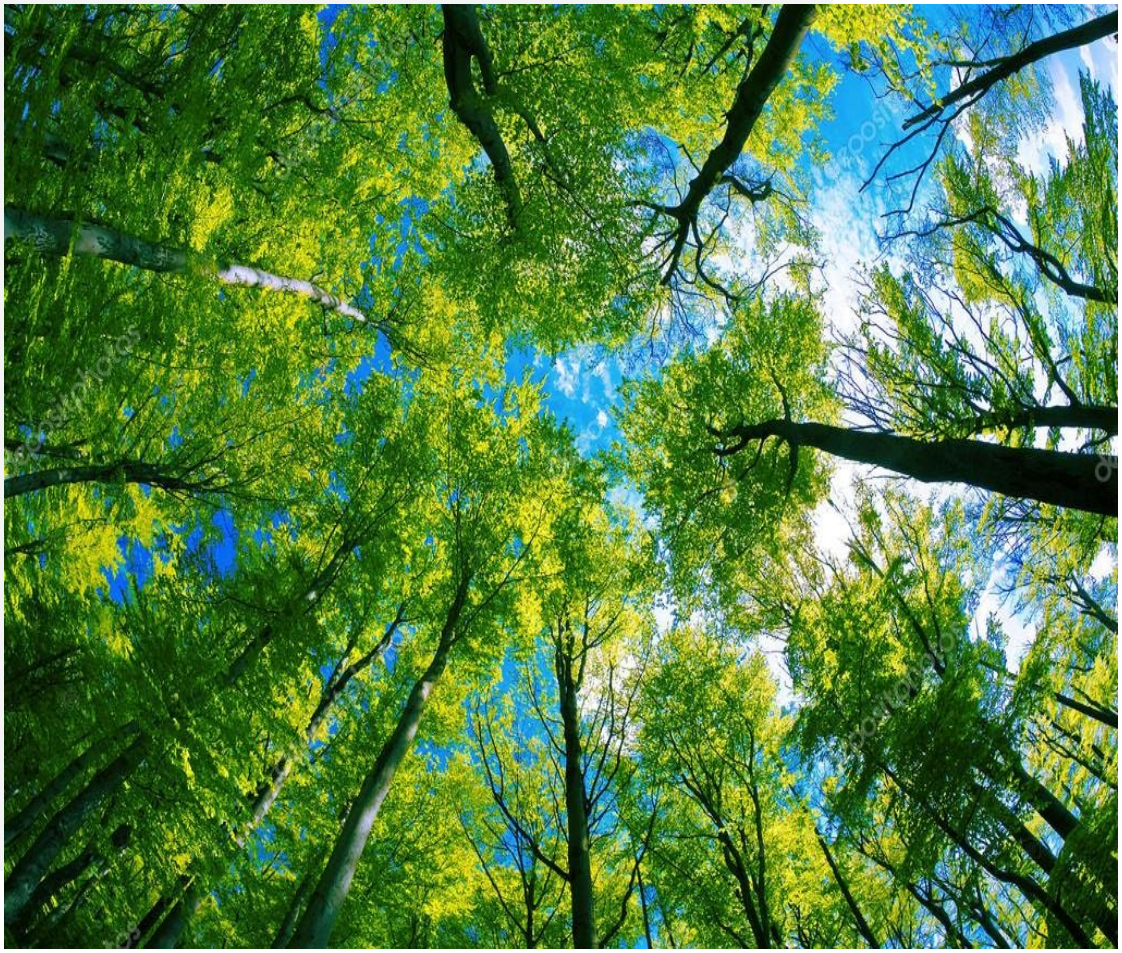
USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, DJ and JF Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J; McPherson, E Gregory; Simpson, James R; Vargas, Kelaine E; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

Appendices



APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

University Heights

Annual Energy Benefits of Public Trees

2/8/2023

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
American basswood	0.3	27	56.8	56	82	(N/A)	11.2	1.1	2.74
Silver maple	7.5	570	985.1	965	1,536	(N/A)	9.0	20.6	63.98
Sugar maple	4.2	321	571.8	560	881	(N/A)	7.5	11.8	44.07
Apple	1.3	100	212.3	208	308	(N/A)	7.5	4.1	15.40
Red maple	1.5	112	201.2	197	309	(N/A)	5.6	4.1	20.61
Norway maple	2.9	217	412.0	404	621	(N/A)	4.5	8.3	51.75
American elm	0.1	8	14.8	15	23	(N/A)	3.7	0.3	2.28
Northern red oak	0.8	59	110.7	108	167	(N/A)	3.7	2.2	16.72
American sycamore	3.0	231	421.3	413	644	(N/A)	3.4	8.6	71.57
Bur oak	0.2	12	20.3	20	32	(N/A)	3.4	0.4	3.52
Pin oak	3.4	259	455.7	447	706	(N/A)	3.4	9.5	78.45
Norway spruce	1.5	114	196.8	193	306	(N/A)	3.4	4.1	34.05
Ginkgo	0.6	42	73.6	72	115	(N/A)	2.6	1.5	16.36
Northern hackberry	1.9	141	269.3	264	405	(N/A)	2.6	5.4	57.84
Blue spruce	0.7	55	102.5	100	156	(N/A)	2.2	2.1	25.95
Kentucky coffeetree	0.0	3	6.0	6	9	(N/A)	2.2	0.1	1.52
River birch	0.7	56	106.1	104	160	(N/A)	1.9	2.1	32.01
Tulip tree	0.1	5	8.8	9	14	(N/A)	1.9	0.2	2.72
Honeylocust	0.9	70	122.7	120	190	(N/A)	1.5	2.5	47.45
Hickory	0.0	3	5.1	5	8	(N/A)	1.5	0.1	1.95
Spruce	0.2	16	28.8	28	44	(N/A)	1.5	0.6	11.06
Eastern white pine	0.6	42	73.3	72	114	(N/A)	1.5	1.5	28.52
Basswood	0.1	5	8.3	8	13	(N/A)	1.5	0.2	3.24
Green ash	0.9	65	107.7	106	170	(N/A)	1.1	2.3	56.82
Littleleaf linden	0.0	0	1.2	1	2	(N/A)	1.1	0.0	0.57
Maple	0.1	6	11.2	11	17	(N/A)	1.1	0.2	5.58
Black walnut	1.0	77	134.3	132	208	(N/A)	1.1	2.8	69.42
Elm	0.0	2	4.2	4	6	(N/A)	0.7	0.1	3.24
Southern magnolia	0.0	2	5.7	6	8	(N/A)	0.7	0.1	3.94
Amur maple	0.0	3	7.6	7	11	(N/A)	0.7	0.1	5.40
Chinese elm	0.1	4	7.4	7	12	(N/A)	0.7	0.2	5.82
Eastern red cedar	0.1	7	15.9	16	23	(N/A)	0.7	0.3	11.47
Boxelder	0.0	1	2.6	3	4	(N/A)	0.7	0.0	1.86
Tree of Heaven	0.0	0	0.8	1	1	(N/A)	0.4	0.0	1.10
Ohio buckeye	0.0	0	0.8	1	1	(N/A)	0.4	0.0	1.10
Dogwood	0.0	0	0.6	1	1	(N/A)	0.4	0.0	0.87
Eastern redbud	0.0	0	0.6	1	1	(N/A)	0.4	0.0	0.87
Oak	0.0	0	0.5	0	1	(N/A)	0.4	0.0	0.66
Callery pear	0.1	8	16.9	17	24	(N/A)	0.4	0.3	24.47
Birch	0.0	0	0.8	1	1	(N/A)	0.4	0.0	1.10
Northern pin oak	0.3	24	47.4	46	71	(N/A)	0.4	1.0	70.84
Ash	0.0	0	0.8	1	1	(N/A)	0.4	0.0	1.10
Siberian elm	0.2	18	26.8	26	44	(N/A)	0.4	0.6	44.29
Lilac	0.0	2	3.8	4	5	(N/A)	0.4	0.1	5.40
Total	35.5	2,691	4,860.9	4,764	7,455	(N/A)	100.0	100.0	27.82

Table 2: Annual Stormwater Benefits

University Heights

Annual Stormwater Benefits of Public Trees

2/8/2023

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
American basswood	1,477	40	(N/A)	11.2	0.4	1.33
Silver maple	105,924	2,871	(N/A)	9.0	25.6	119.61
Sugar maple	42,492	1,152	(N/A)	7.5	10.3	57.58
Apple	6,034	164	(N/A)	7.5	1.5	8.18
Red maple	9,660	262	(N/A)	5.6	2.3	17.45
Norway maple	26,186	710	(N/A)	4.5	6.3	59.14
American elm	556	15	(N/A)	3.7	0.1	1.51
Northern red oak	6,473	175	(N/A)	3.7	1.6	17.54
American sycamore	43,145	1,169	(N/A)	3.4	10.4	129.92
Bur oak	930	25	(N/A)	3.4	0.2	2.80
Pin oak	43,525	1,180	(N/A)	3.4	10.5	131.06
Norway spruce	33,469	907	(N/A)	3.4	8.1	100.78
Ginkgo	3,226	87	(N/A)	2.6	0.8	12.49
Northern hackberry	18,311	496	(N/A)	2.6	4.4	70.89
Blue spruce	12,212	331	(N/A)	2.2	2.9	55.16
Kentucky coffeetree	261	7	(N/A)	2.2	0.1	1.18
River birch	6,085	165	(N/A)	1.9	1.5	32.98
Tulip tree	397	11	(N/A)	1.9	0.1	2.15
Honeylocust	10,177	276	(N/A)	1.5	2.5	68.95
Hickory	225	6	(N/A)	1.5	0.1	1.53
Spruce	2,396	65	(N/A)	1.5	0.6	16.23
Eastern white pine	11,343	307	(N/A)	1.5	2.7	76.85
Basswood	379	10	(N/A)	1.5	0.1	2.57
Green ash	8,422	228	(N/A)	1.1	2.0	76.08
Littleleaf linden	21	1	(N/A)	1.1	0.0	0.19
Maple	286	8	(N/A)	1.1	0.1	2.59
Black walnut	12,447	337	(N/A)	1.1	3.0	112.43
Elm	190	5	(N/A)	0.7	0.0	2.57
Southern magnolia	113	3	(N/A)	0.7	0.0	1.53
Amur maple	137	4	(N/A)	0.7	0.0	1.86
Chinese elm	343	9	(N/A)	0.7	0.1	4.65
Eastern red cedar	1,318	36	(N/A)	0.7	0.3	17.86
Boxelder	49	1	(N/A)	0.7	0.0	0.67
Tree of Heaven	12	0	(N/A)	0.4	0.0	0.33
Ohio buckeye	12	0	(N/A)	0.4	0.0	0.33
Dogwood	7	0	(N/A)	0.4	0.0	0.20
Eastern redbud	7	0	(N/A)	0.4	0.0	0.20
Oak	18	0	(N/A)	0.4	0.0	0.48
Callery pear	586	16	(N/A)	0.4	0.1	15.88
Birch	12	0	(N/A)	0.4	0.0	0.33
Northern pin oak	3,764	102	(N/A)	0.4	0.9	102.01
Ash	12	0	(N/A)	0.4	0.0	0.33
Siberian elm	1,370	37	(N/A)	0.4	0.3	37.14
Lilac	69	2	(N/A)	0.4	0.0	1.86
Citywide total	414,080	11,222	(N/A)	100.0	100.0	41.87

Table 3: Annual Air Quality Benefits

University Heights

Annual Air Quality Benefits of Public Trees

2/8/2023

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								
American basswood	0.0	0.0	0.1	0.0	0	1.8	0.2	0.2	1.6	11	-0.1	0	3.9	11	(N/A)	11.2	0.36
Silver maple	18.0	3.0	8.9	0.8	97	35.4	5.2	4.9	34.0	221	-9.2	-35	100.9	284	(N/A)	9.0	11.82
Sugar maple	5.3	0.9	2.7	0.2	29	20.1	2.9	2.8	19.2	125	-4.2	-16	49.9	139	(N/A)	7.5	6.93
Apple	1.8	0.3	0.9	0.1	10	6.6	0.9	0.9	6.0	40	0.0	0	17.4	50	(N/A)	7.5	2.49
Red maple	1.8	0.3	0.9	0.1	10	7.0	1.0	1.0	6.7	44	-0.7	-2	18.1	51	(N/A)	5.6	3.41
Norway maple	5.3	0.9	2.6	0.2	29	13.9	2.0	1.9	13.0	86	-1.2	-5	38.6	110	(N/A)	4.5	9.15
American elm	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	3.7	0.33
Northern red oak	1.2	0.2	0.6	0.1	7	3.7	0.5	0.5	3.5	23	-1.7	-7	8.6	23	(N/A)	3.7	2.32
American sycamore	6.3	1.0	2.8	0.3	33	14.6	2.1	2.0	13.8	91	0.0	0	42.9	124	(N/A)	3.4	13.73
Bur oak	0.0	0.0	0.0	0.0	0	0.7	0.1	0.1	0.7	5	0.0	0	1.7	5	(N/A)	3.4	0.52
Pin oak	8.3	1.4	4.1	0.4	45	16.2	2.4	2.3	15.5	101	-15.1	-57	35.4	90	(N/A)	3.4	9.95
Norway spruce	4.0	0.8	3.2	0.5	26	7.1	1.0	1.0	6.8	44	-19.0	-71	5.4	-1	(N/A)	3.4	-0.08
Ginkgo	0.7	0.1	0.4	0.0	4	2.6	0.4	0.4	2.5	17	-0.2	-1	6.9	20	(N/A)	2.6	2.79
Northern hackberry	2.8	0.5	1.4	0.1	15	9.0	1.3	1.2	8.4	56	0.0	0	24.9	71	(N/A)	2.6	10.19
Blue spruce	1.9	0.4	1.6	0.2	13	3.5	0.5	0.5	3.3	22	-4.7	-18	7.2	17	(N/A)	2.2	2.79
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	2.2	0.21
River birch	1.2	0.2	0.6	0.1	6	3.6	0.5	0.5	3.4	22	-0.3	-1	9.6	27	(N/A)	1.9	5.48
Tulip tree	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.7	2	(N/A)	1.9	0.40
Honeylocust	2.0	0.3	0.9	0.1	10	4.3	0.6	0.6	4.1	27	-1.6	-6	11.4	32	(N/A)	1.5	7.90
Hickory	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)	1.5	0.28
Spruce	0.2	0.0	0.2	0.0	2	1.0	0.1	0.1	1.0	6	-0.8	-3	2.0	5	(N/A)	1.5	1.23
Eastern white pine	1.4	0.3	1.1	0.2	9	2.6	0.4	0.4	2.5	16	-6.4	-24	2.3	1	(N/A)	1.5	0.29
Basswood	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.7	2	(N/A)	1.5	0.48
Green ash	1.0	0.2	0.5	0.0	5	4.0	0.6	0.6	3.9	25	0.0	0	10.7	31	(N/A)	1.1	10.18
Littleleaf linden	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)	1.1	0.07
Maple	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.8	2	(N/A)	1.1	0.79
Black walnut	1.7	0.3	0.8	0.1	9	4.8	0.7	0.7	4.6	30	0.0	0	13.6	39	(N/A)	1.1	12.95
Elm	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)	0.7	0.48
Southern magnolia	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.7	0.47
Amur maple	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	0.7	0.71
Chinese elm	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.6	2	(N/A)	0.7	0.87
Eastern red cedar	0.1	0.0	0.1	0.0	1	0.5	0.1	0.1	0.4	3	-0.7	-3	0.6	1	(N/A)	0.7	0.62
Boxelder	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.2	1	(N/A)	0.7	0.25
Tree of Heaven	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)	0.4	0.14
Ohio buckeye	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)	0.4	0.14

University Heights

Annual Air Quality Benefits of Public Trees

2/8/2023

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								
Dogwood	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)	0.4	0.11
Eastern redbud	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.4	0.11
Oak	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.4	0.08
Callery pear	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)	0.4	3.47
Birch	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)	0.4	0.14
Northern pin oak	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)	0.4	13.58
Ash	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)	0.4	0.14
Siberian elm	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.7	7	(N/A)	0.4	7.49
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	0.71
Citywide total	66.1	11.4	35.0	3.6	366	169.2	24.6	23.5	160.6	1,054	-66.3	-248	427.7	1,171	(N/A)	100.0	4.37

Table 4: Annual Carbon Stored

University Heights

Stored CO2 Benefits of Public Trees

2/8/2023

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
American basswood	2,607	20	(N/A)	11.2	0.2	0.65
Silver maple	393,042	2,948	(N/A)	9.0	27.4	122.83
Sugar maple	152,433	1,143	(N/A)	7.5	10.6	57.16
Apple	29,343	220	(N/A)	7.5	2.0	11.00
Red maple	21,420	161	(N/A)	5.6	1.5	10.71
Norway maple	86,813	651	(N/A)	4.5	6.1	54.26
American elm	1,196	9	(N/A)	3.7	0.1	0.90
Northern red oak	25,440	191	(N/A)	3.7	1.8	19.08
American sycamore	206,706	1,550	(N/A)	3.4	14.4	172.25
Bur oak	976	7	(N/A)	3.4	0.1	0.81
Pin oak	223,447	1,676	(N/A)	3.4	15.6	186.21
Norway spruce	48,650	365	(N/A)	3.4	3.4	40.54
Ginkgo	10,211	77	(N/A)	2.6	0.7	10.94
Northern hackberry	41,801	314	(N/A)	2.6	2.9	44.79
Blue spruce	15,541	117	(N/A)	2.2	1.1	19.43
Kentucky coffeetree	246	2	(N/A)	2.2	0.0	0.31
River birch	19,442	146	(N/A)	1.9	1.4	29.16
Tulip tree	407	3	(N/A)	1.9	0.0	0.61
Honeylocust	25,575	192	(N/A)	1.5	1.8	47.95
Hickory	222	2	(N/A)	1.5	0.0	0.42
Spruce	1,468	11	(N/A)	1.5	0.1	2.75
Eastern white pine	16,408	123	(N/A)	1.5	1.1	30.76
Basswood	395	3	(N/A)	1.5	0.0	0.74
Green ash	33,287	250	(N/A)	1.1	2.3	83.22
Littleleaf linden	38	0	(N/A)	1.1	0.0	0.09
Maple	454	3	(N/A)	1.1	0.0	1.13
Black walnut	55,558	417	(N/A)	1.1	3.9	138.90
Elm	198	1	(N/A)	0.7	0.0	0.74
Southern magnolia	6	0	(N/A)	0.7	0.0	0.02
Amur maple	356	3	(N/A)	0.7	0.0	1.33
Chinese elm	371	3	(N/A)	0.7	0.0	1.39
Eastern red cedar	554	4	(N/A)	0.7	0.0	2.08
Boxelder	34	0	(N/A)	0.7	0.0	0.13
Tree of Heaven	17	0	(N/A)	0.4	0.0	0.13
Ohio buckeye	17	0	(N/A)	0.4	0.0	0.13
Dogwood	14	0	(N/A)	0.4	0.0	0.10
Eastern redbud	14	0	(N/A)	0.4	0.0	0.10
Oak	12	0	(N/A)	0.4	0.0	0.09
Callery pear	1,101	8	(N/A)	0.4	0.1	8.26
Birch	17	0	(N/A)	0.4	0.0	0.13
Northern pin oak	14,280	107	(N/A)	0.4	1.0	107.10
Ash	17	0	(N/A)	0.4	0.0	0.13
Siberian elm	3,037	23	(N/A)	0.4	0.2	22.78
Lilac	178	1	(N/A)	0.4	0.0	1.33
Citywide total	1,433,345	10,750	(N/A)	100.0	100.0	40.11

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

University Heights

Annual CO 2 Benefits of Public Trees

2/8/2023

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 basswood	432	3	-13	-10	0	586	4	995	7 (N/A)	11.2	0.7	0.25
Silver maple	30,452	228	-1,887	-82	-15	12,600	94	41,083	308 (N/A)	9.0	28.2	12.84
Sugar maple	8,796	66	-733	-45	-6	7,094	53	15,112	113 (N/A)	7.5	10.4	5.67
Apple	2,561	19	-141	-20	-1	2,209	17	4,608	35 (N/A)	7.5	3.2	1.73
Red maple	2,844	21	-103	-15	-1	2,475	19	5,200	39 (N/A)	5.6	3.6	2.60
Norway maple	4,467	34	-417	-29	-3	4,801	36	8,822	66 (N/A)	4.5	6.1	5.51
American elm	214	2	-7	-3	0	183	1	387	3 (N/A)	3.7	0.3	0.29
Northern red oak	815	6	-122	-11	-1	1,298	10	1,980	15 (N/A)	3.7	1.4	1.48
American sycamore	7,253	54	-992	-34	-8	5,111	38	11,338	85 (N/A)	3.4	7.8	9.45
Bur oak	381	3	-5	-4	0	261	2	634	5 (N/A)	3.4	0.4	0.53
Pin oak	19,173	144	-1,073	-38	-8	5,734	43	23,797	178 (N/A)	3.4	16.3	19.83
Norway spruce	1,702	13	-234	-28	-2	2,510	19	3,950	30 (N/A)	3.4	2.7	3.29
Ginkgo	594	4	-49	-8	0	937	7	1,474	11 (N/A)	2.6	1.0	1.58
Northern hackberry	2,475	19	-201	-18	-2	3,115	23	5,372	40 (N/A)	2.6	3.7	5.76
Blue spruce	778	6	-75	-15	-1	1,221	9	1,910	14 (N/A)	2.2	1.3	2.39
Kentucky coffeetree	87	1	-1	-2	0	71	1	155	1 (N/A)	2.2	0.1	0.19
River birch	1,171	9	-95	-8	-1	1,238	9	2,307	17 (N/A)	1.9	1.6	3.46
Tulip tree	156	1	-2	-2	0	110	1	263	2 (N/A)	1.9	0.2	0.39
Honeylocust	3,218	24	-123	-7	-1	1,537	12	4,625	35 (N/A)	1.5	3.2	8.67
Hickory	82	1	-1	-1	0	62	0	141	1 (N/A)	1.5	0.1	0.27
Spruce	190	1	-7	-4	0	355	3	534	4 (N/A)	1.5	0.4	1.00
Eastern white pine	168	1	-79	-12	-1	933	7	1,011	8 (N/A)	1.5	0.7	1.89
Basswood	154	1	-2	-2	0	106	1	256	2 (N/A)	1.5	0.2	0.48
Green ash	1,850	14	-160	-8	-1	1,436	11	3,118	23 (N/A)	1.1	2.1	7.80
Littleleaf linden	54	0	0	-1	0	11	0	65	0 (N/A)	1.1	0.0	0.16
Maple	80	1	-2	-1	0	128	1	204	2 (N/A)	1.1	0.1	0.51
Black walnut	2,365	18	-267	-11	-2	1,693	13	3,780	28 (N/A)	1.1	2.6	9.45
Elm	77	1	-1	-1	0	53	0	128	1 (N/A)	0.7	0.1	0.48
Southern magnolia	3	0	0	0	0	51	0	54	0 (N/A)	0.7	0.0	0.20
Amur maple	76	1	-2	-1	0	74	1	147	1 (N/A)	0.7	0.1	0.55
Chinese elm	148	1	-2	-1	0	97	1	243	2 (N/A)	0.7	0.2	0.91
Eastern red cedar	80	1	-3	-2	0	164	1	239	2 (N/A)	0.7	0.2	0.89

Annual CO ₂ Benefits of Public Trees

2/8/2023

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
Boxelder	31	0	0	0	0	26	0	57	0 (N/A)	0.7	0.0	0.21
Tree of Heaven	5	0	0	0	0	7	0	12	0 (N/A)	0.4	0.0	0.09
Ohio buckeye	5	0	0	0	0	7	0	12	0 (N/A)	0.4	0.0	0.09
Dogwood	9	0	0	0	0	6	0	14	0 (N/A)	0.4	0.0	0.10
Eastern redbud	9	0	0	0	0	6	0	14	0 (N/A)	0.4	0.0	0.10
Oak	3	0	0	0	0	4	0	7	0 (N/A)	0.4	0.0	0.05
Callery pear	224	2	-5	-1	0	176	1	393	3 (N/A)	0.4	0.3	2.95
Birch	5	0	0	0	0	7	0	12	0 (N/A)	0.4	0.0	0.09
Northern pin oak	0	0	-69	-4	-1	539	4	466	3 (N/A)	0.4	0.3	3.49
Ash	5	0	0	0	0	7	0	12	0 (N/A)	0.4	0.0	0.09
Siberian elm	314	2	-15	-2	0	397	3	695	5 (N/A)	0.4	0.5	5.21
Lilac	38	0	-1	-1	0	37	0	74	1 (N/A)	0.4	0.1	0.55
Citywide total	93,546	702	-6,889	-433	-55	59,475	446	145,699	1,093 (N/A)	100.0	100.0	4.08

Table 6: Annual Social and Aesthetic Benefits

University Heights

Annual Aesthetic/Other Benefits of Public Trees

2/8/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
American basswood	82	(N/A)	11.2	0.9	2.75
Silver maple	2,393	(N/A)	9.0	26.4	99.73
Sugar maple	956	(N/A)	7.5	10.5	47.79
Apple	147	(N/A)	7.5	1.6	7.34
Red maple	412	(N/A)	5.6	4.5	27.47
Norway maple	423	(N/A)	4.5	4.7	35.26
American elm	41	(N/A)	3.7	0.4	4.06
Northern red oak	83	(N/A)	3.7	0.9	8.28
American sycamore	521	(N/A)	3.4	5.7	57.90
Bur oak	95	(N/A)	3.4	1.0	10.52
Pin oak	1,396	(N/A)	3.4	15.4	155.12
Norway spruce	279	(N/A)	3.4	3.1	30.95
Ginkgo	48	(N/A)	2.6	0.5	6.93
Northern hackberry	323	(N/A)	2.6	3.6	46.14
Blue spruce	98	(N/A)	2.2	1.1	16.29
Kentucky coffeetree	41	(N/A)	2.2	0.5	6.84
River birch	123	(N/A)	1.9	1.4	24.52
Tulip tree	45	(N/A)	1.9	0.5	9.05
Honeylocust	817	(N/A)	1.5	9.0	204.23
Hickory	31	(N/A)	1.5	0.3	7.63
Spruce	60	(N/A)	1.5	0.7	15.08
Eastern white pine	48	(N/A)	1.5	0.5	11.94
Basswood	40	(N/A)	1.5	0.4	10.00
Green ash	158	(N/A)	1.1	1.7	52.77
Littleleaf linden	8	(N/A)	1.1	0.1	2.74
Maple	15	(N/A)	1.1	0.2	4.87
Black walnut	179	(N/A)	1.1	2.0	59.68
Elm	20	(N/A)	0.7	0.2	10.00
Southern magnolia	0	(N/A)	0.7	0.0	0.01
Amur maple	4	(N/A)	0.7	0.0	2.06
Chinese elm	29	(N/A)	0.7	0.3	14.73
Eastern red cedar	43	(N/A)	0.7	0.5	21.34
Boxelder	31	(N/A)	0.7	0.3	15.44
Tree of Heaven	3	(N/A)	0.4	0.0	2.74
Ohio buckeye	3	(N/A)	0.4	0.0	2.74
Dogwood	0	(N/A)	0.4	0.0	0.03
Eastern redbud	0	(N/A)	0.4	0.0	0.03
Oak	5	(N/A)	0.4	0.1	5.26
Callery pear	26	(N/A)	0.4	0.3	26.22
Birch	3	(N/A)	0.4	0.0	2.74
Northern pin oak	0	(N/A)	0.4	0.0	0.00
Ash	3	(N/A)	0.4	0.0	2.74
Siberian elm	32	(N/A)	0.4	0.4	32.00
Lilac	2	(N/A)	0.4	0.0	2.06
Citywide total	9,065	(N/A)	100.0	100.0	33.82

Table 7: Summary of Benefits in Dollars

University Heights

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

2/8/2023

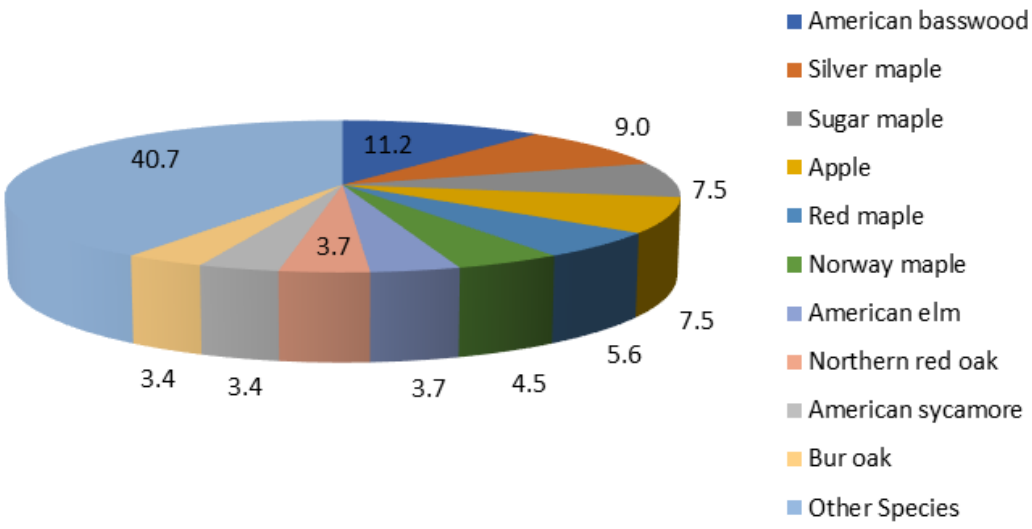
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	7,455	(N/A)	27.82	(N/A)	6.07	(N/A)
CO2	1,093	(N/A)	4.08	(N/A)	0.89	(N/A)
Air Quality	1,171	(N/A)	4.37	(N/A)	0.95	(N/A)
Stormwater	11,222	(N/A)	41.87	(N/A)	9.14	(N/A)
Aesthetic/Other	9,065	(N/A)	33.82	(N/A)	7.38	(N/A)
Total Benefits	30,005	(N/A)	111.96	(N/A)	24.43	(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	30,005	(N/A)	111.96	(N/A)	24.43	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

University Heights

Species Distribution of Public Trees

2/8/2023



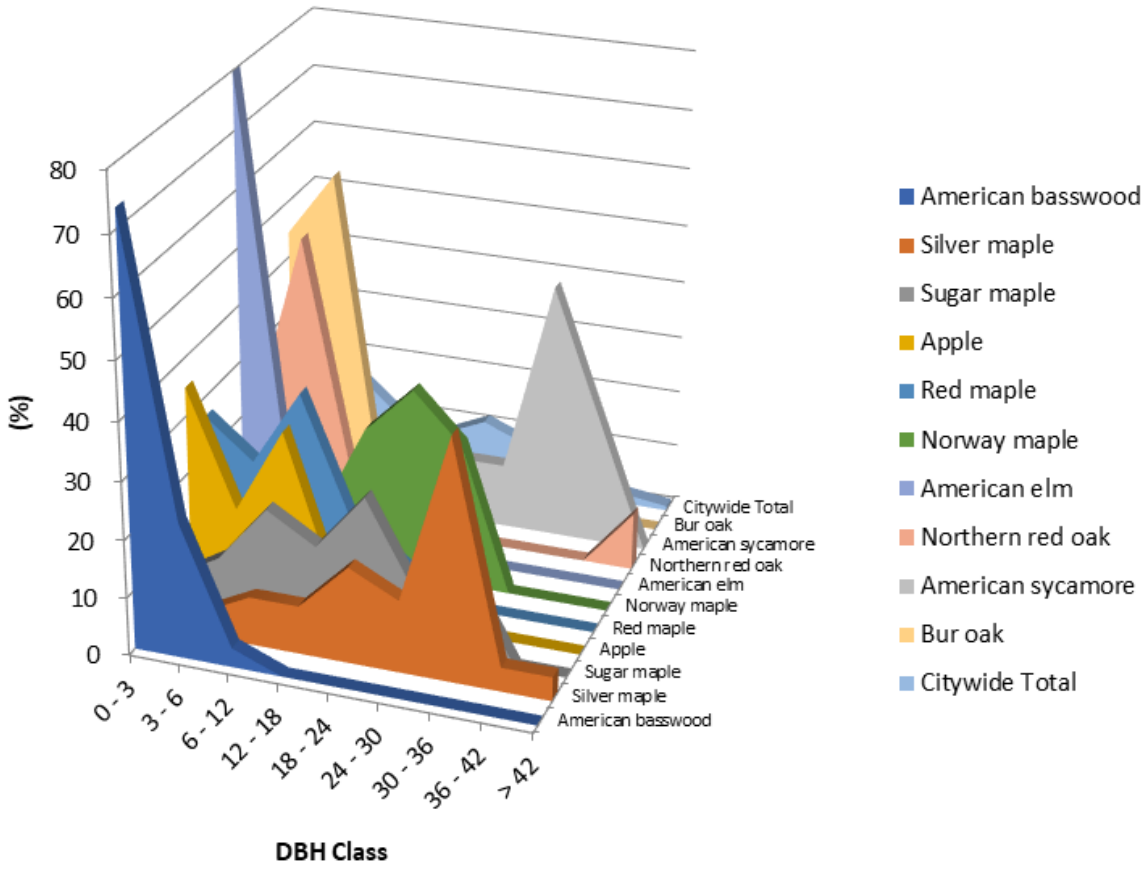
Species	Percent
American basswood	11.2
Silver maple	9.0
Sugar maple	7.5
Apple	7.5
Red maple	5.6
Norway maple	4.5
American elm	3.7
Northern red oak	3.7
American sycamore	3.4
Bur oak	3.4
Other Species	40.7
Total	100.0

Figure 2: Relative Age Class

University Heights

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

2/8/2023



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
American basswood	73.33	23.33	3.33	0.00	0.00	0.00	0.00	0.00	0.00
Silver maple	0.00	4.17	8.33	8.33	16.67	12.50	41.67	4.17	4.17
Sugar maple	5.00	10.00	20.00	15.00	25.00	10.00	15.00	0.00	0.00
Apple	35.00	15.00	30.00	5.00	15.00	0.00	0.00	0.00	0.00
Red maple	26.67	20.00	33.33	13.33	6.67	0.00	0.00	0.00	0.00
Norway maple	0.00	8.33	8.33	25.00	33.33	25.00	0.00	0.00	0.00
American elm	80.00	10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern red oak	20.00	50.00	10.00	0.00	10.00	0.00	0.00	0.00	10.00
American sycamore	0.00	11.11	0.00	0.00	11.11	11.11	44.44	22.22	0.00
Bur oak	44.44	55.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Citywide Total	31.72	17.54	10.45	7.46	11.19	7.84	11.19	1.87	0.75

Figure 3: Foliage Condition

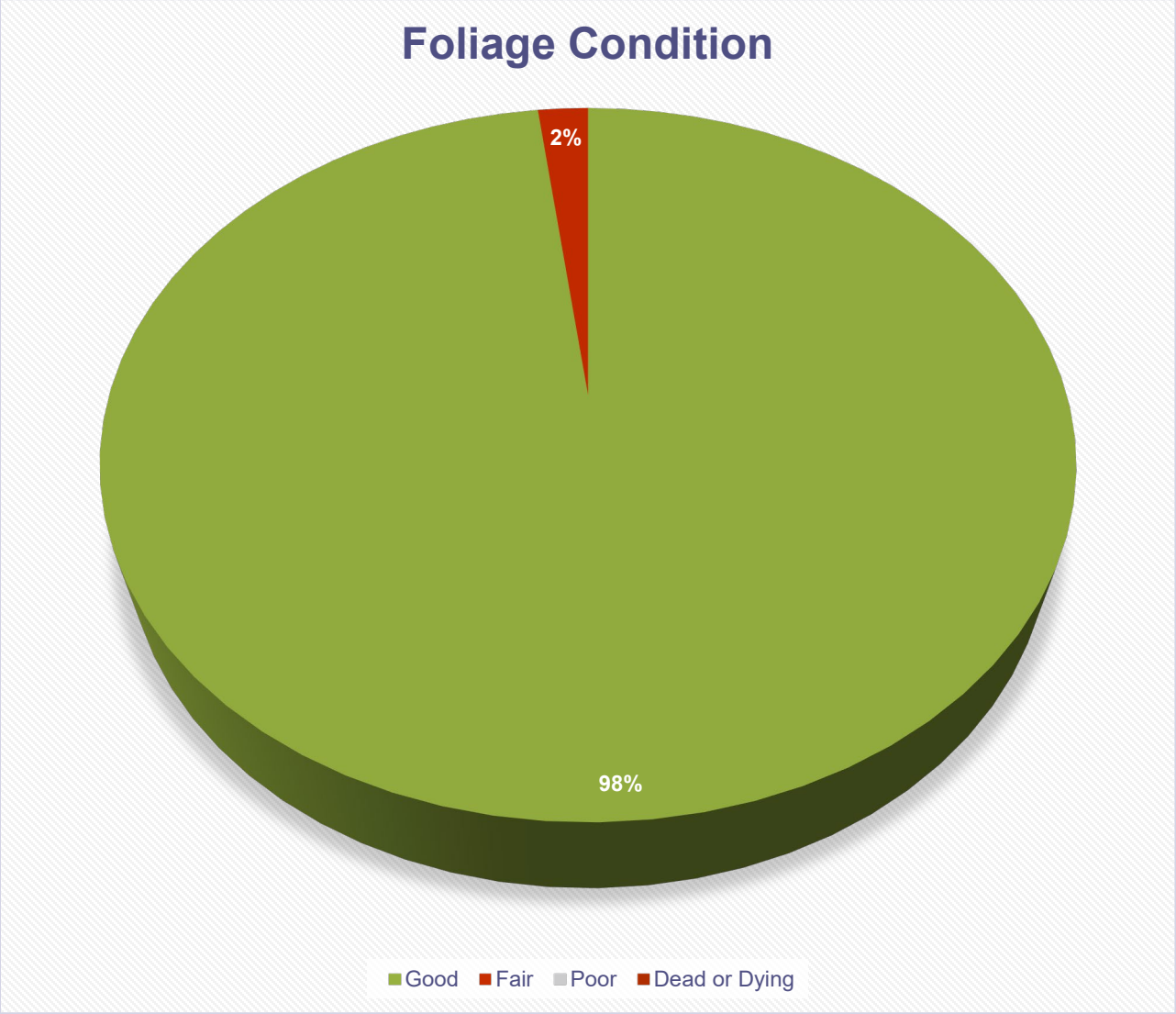


Figure 4: Wood Condition

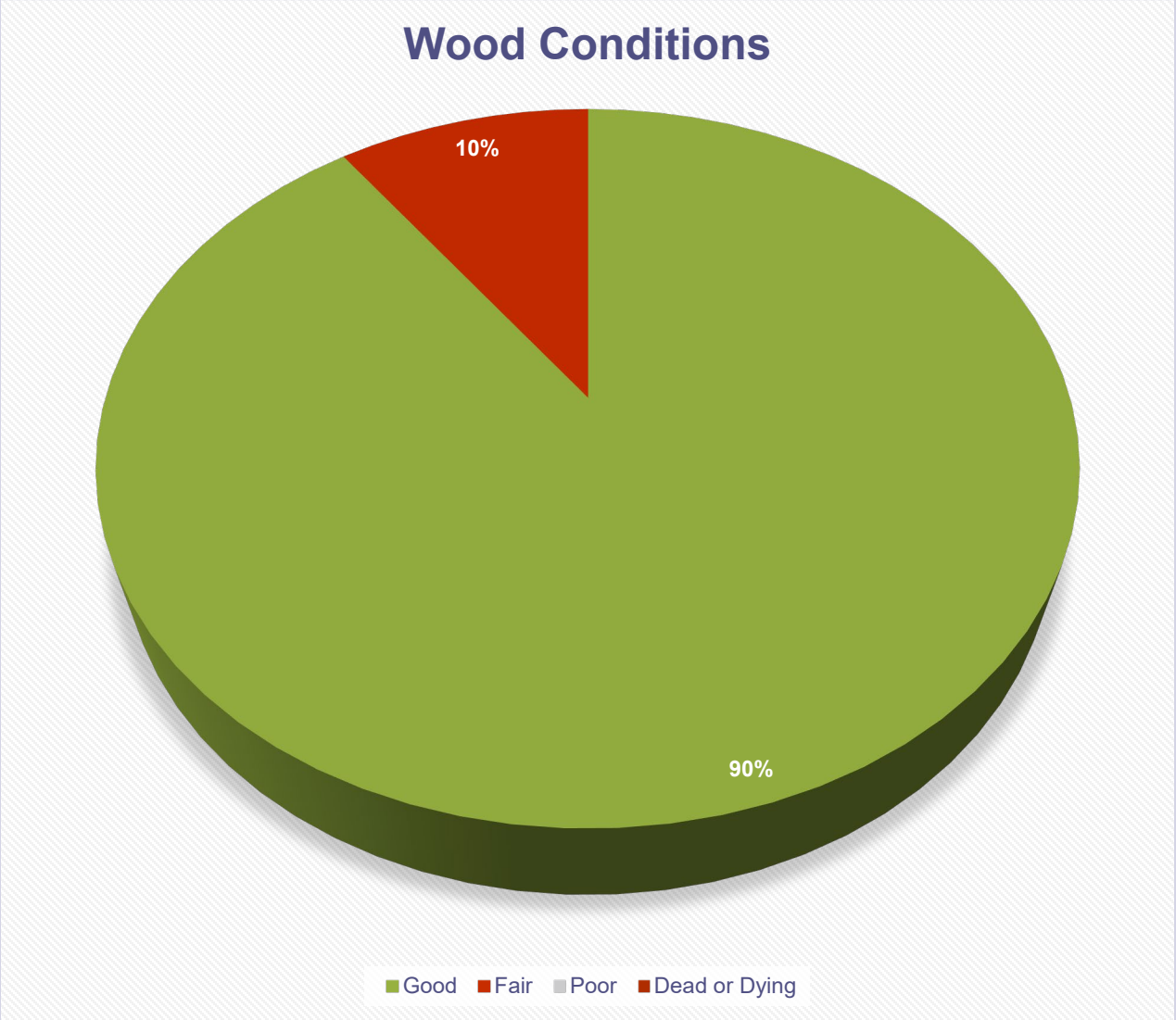
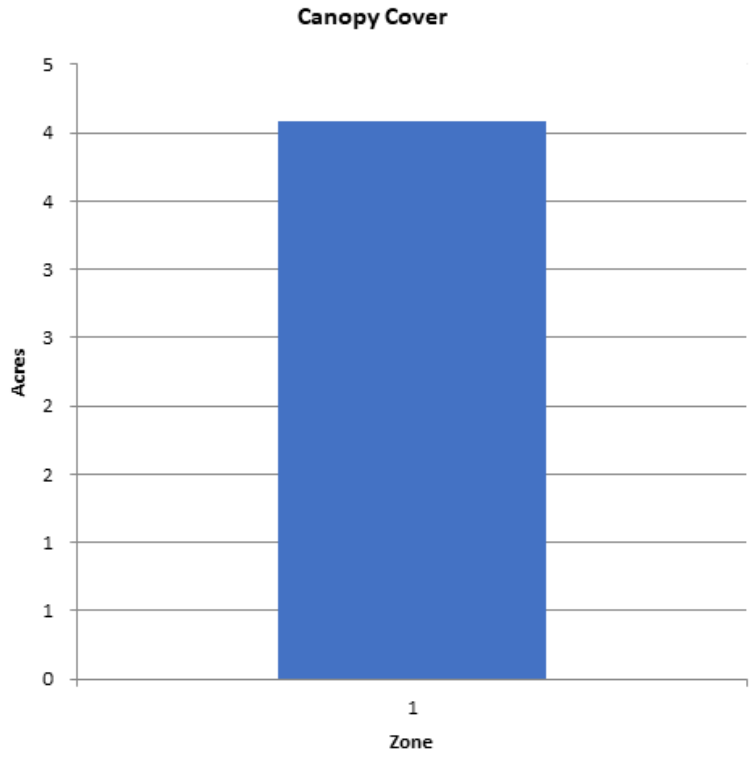


Figure 5: Canopy Cover in Acres

University Heights

Canopy Cover of Public Trees (Acres)

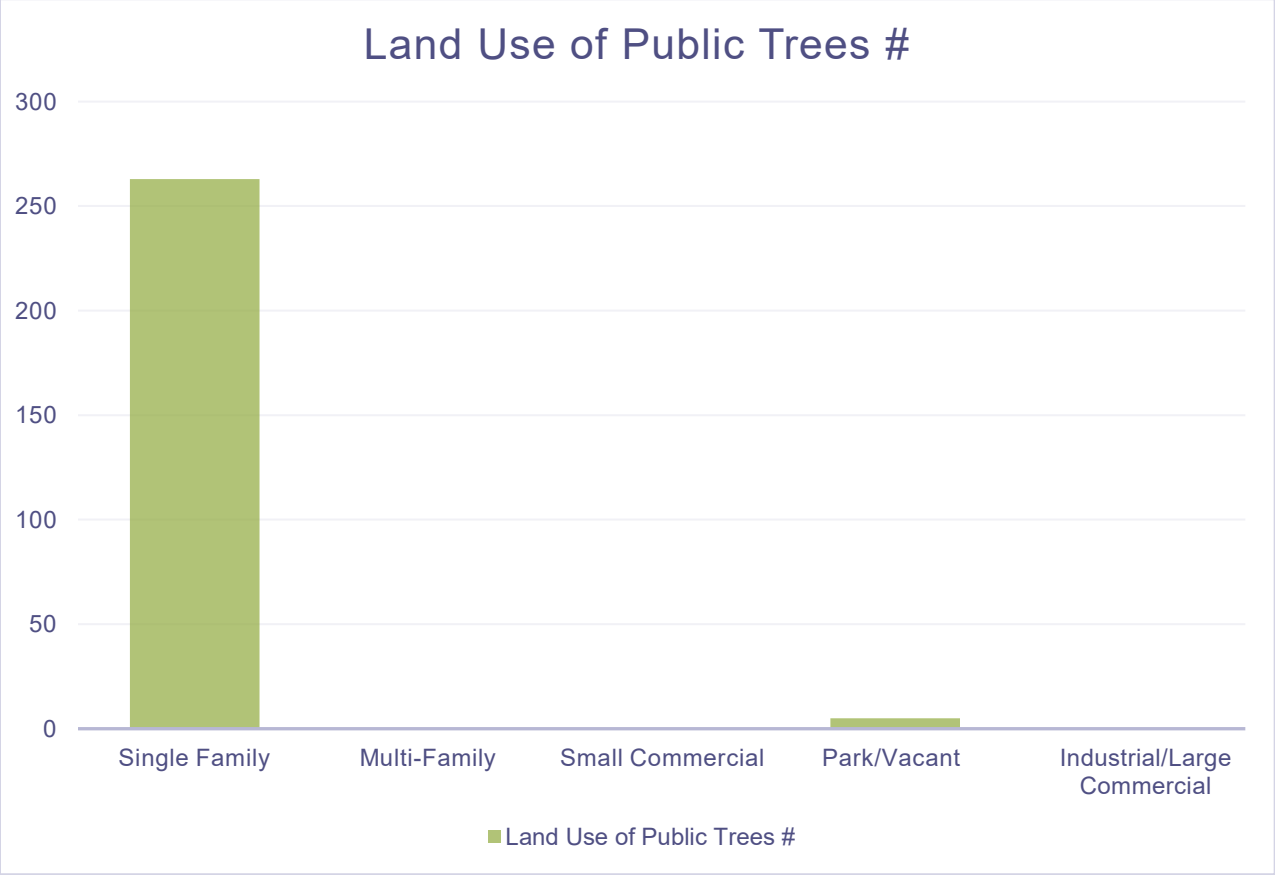
2/8/2023



Zone	Acres	% of Total Canopy Cover
1	4	100.0
Citywide total	4	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	4	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

Figure 1: Location of Ash Trees

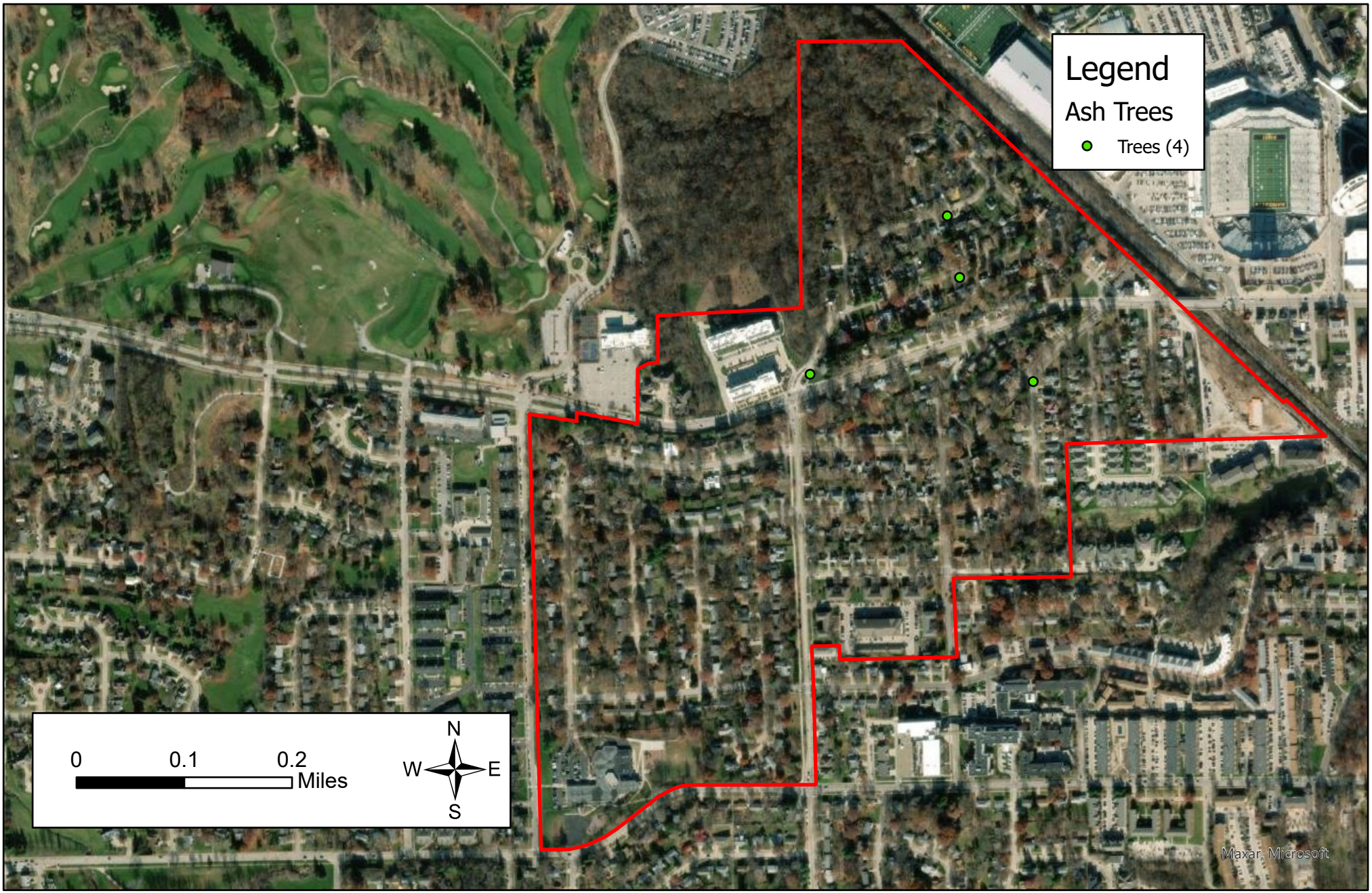
Figure 2: Location of EAB Symptoms

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

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2022 IDNR Tree Inventory

Figure 1 - Ash Tree Location
University Heights, Iowa

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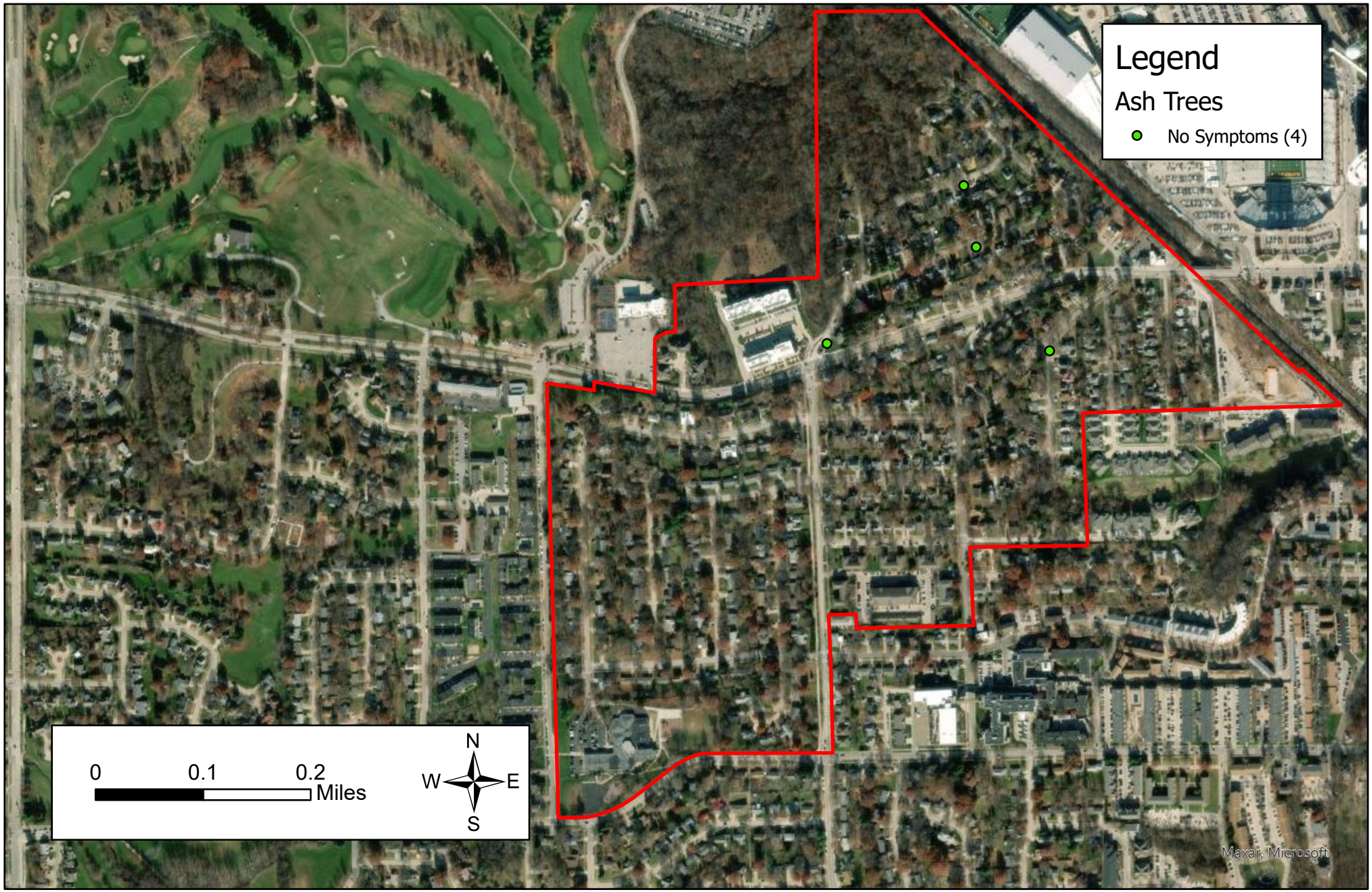

Created By: D. Genereux
Date: 1/26/2023
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File: 2022 IDNR Tree Inventory.aprx

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2022 IDNR Tree Inventory

Figure 2 - EAB Symptoms
University Heights, Iowa

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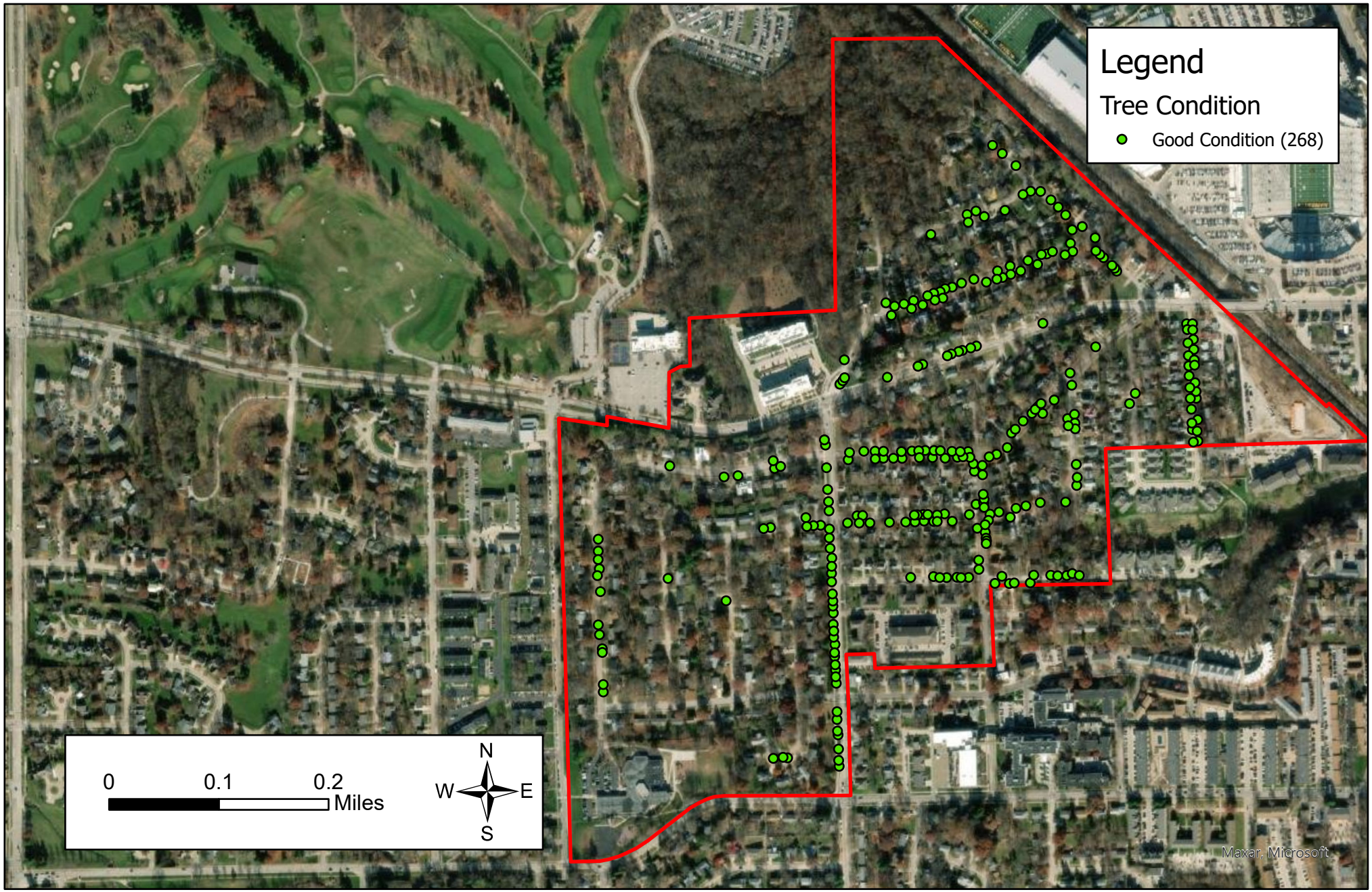

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Date: 1/26/2023
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2022 IDNR Tree Inventory

Figure 3 - Poor Condition Trees
University Heights, Iowa

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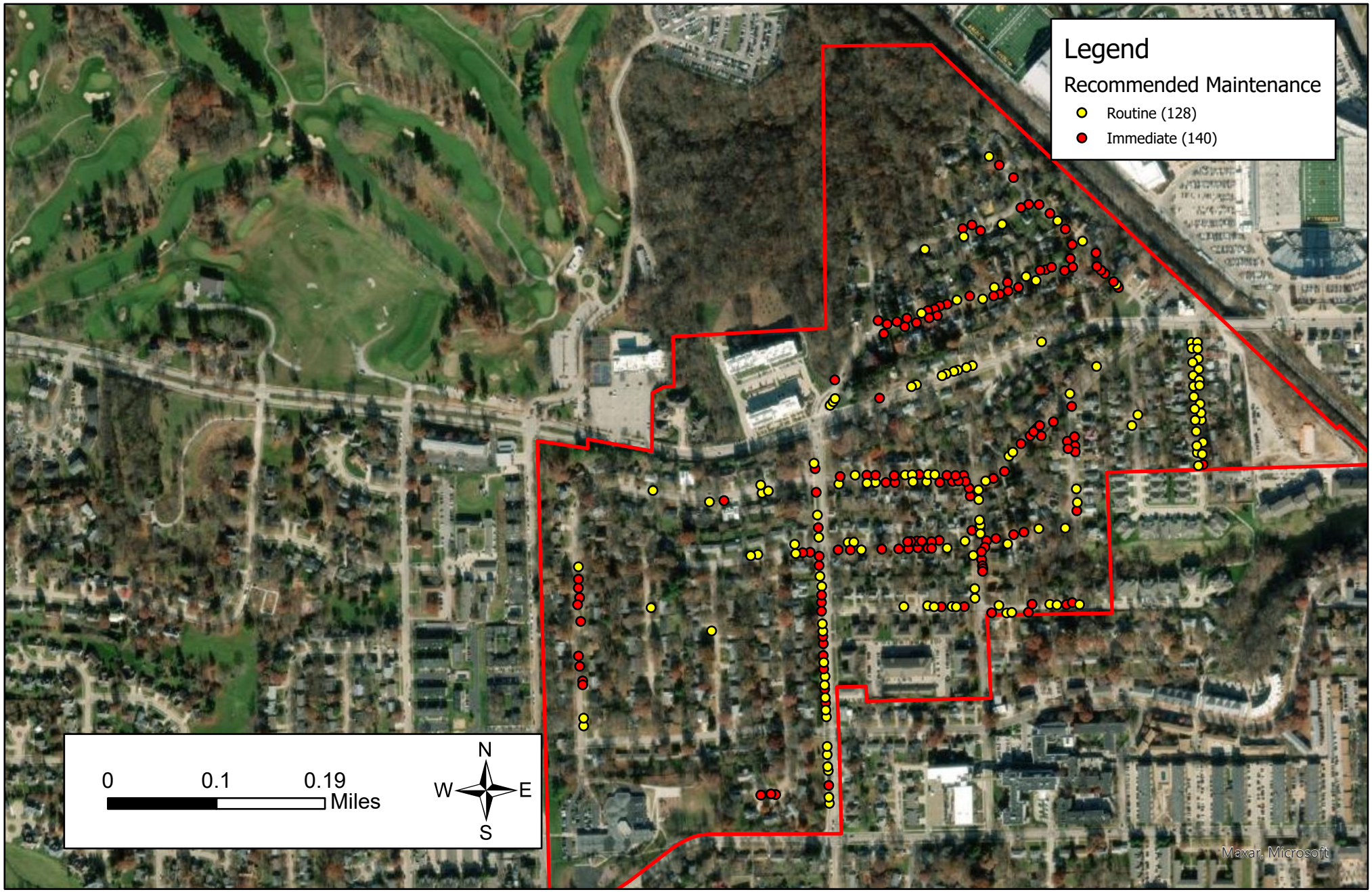

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2022 IDNR Tree Inventory

Figure 4 - Recommended Maintenance
University Heights, Iowa

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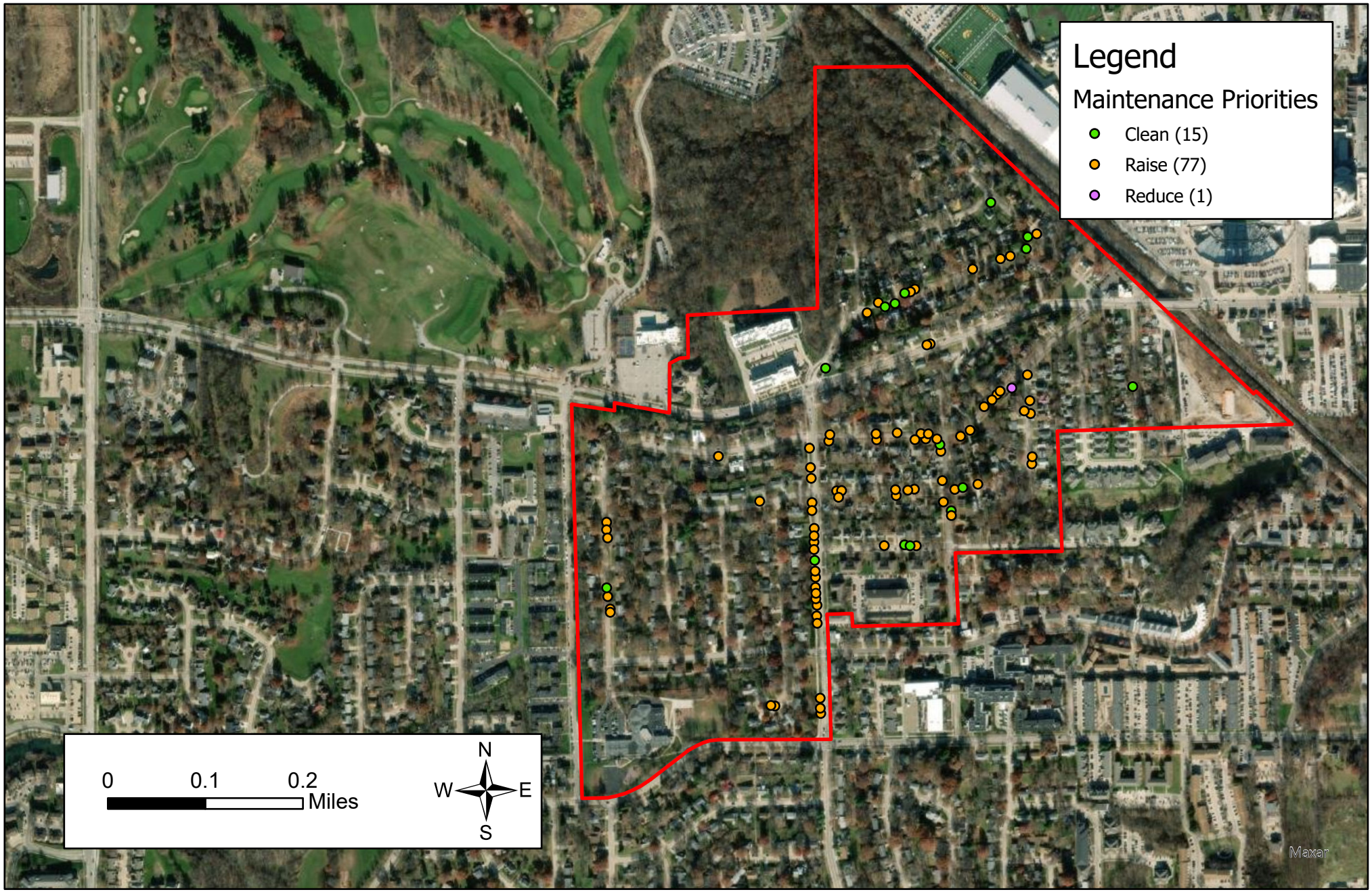

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

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2022 IDNR Tree Inventory

Figure 5 - Maintenance Priorities
University Heights, Iowa

JEO CONSULTING GROUP INC

APPENDIX C: UNIVERSITY HEIGHTS TREE ORDINANCES

ORDINANCE NUMBER 52 (as amended) AN ORDINANCE REGULATING THE PLANTING, CARE, AND MAINTENANCE OF TREES AND SHRUBBERY UPON AND ADJOINING PUBIIC PROPERTY IN THE TOWN OF UNIVERSITY HEIGHTS, JOHNSON COUNTY, IOWA.

BE IT ENACTED by the Council of the City of University Heights, Iowa:

Section 1. Definitions. For the purpose of this ordinance, certain terms and words used herein shall be interpreted or defined as follows:

1. “Public property” means any property owned by the City of University Heights, and shall specifically include that portion of the street rights-of-way located between the private property lines and streets or sidewalk(s).

2. “Trees and shrubs” shall mean all wood vegetation.

3. “Parking” shall mean that part of the street right-ofway lying between the private lot line and the curb line of the improved streets, and on unimproved streets it shall mean that portion of the public right-of-way lying between the lot lines and that portion of the street usually traveled by vehicular traffic.

4. “City Tree Board” shall mean the Board created and established pursuant to Section 6 of this Ordinance.

Section 2. No person, firm or corporation shall plant or remove any tree or shrub on Public Property without specific approval of the City Tree Board of University Heights, Iowa.

Section 3. The owners of private property shall be responsible for the proper care and maintenance of all trees and shrubs located in the parking adjoining said private property.

Section 4. All trees and shrubs on public or private property bordering on any street shall be trimmed to a sufficient height to allow free passage of pedestrians and vehicular traffic and so that they will not obstruct or shade street lights, the vision of traffic signs, or the view of any street intersection. The minimum clearance of any overhanging 2 portion of such trees or shrubs shall be eight (8) feet over sidewalks and thirteen (13) feet over all streets.

Section 5. If the owner of any property fails to maintain trees and shrubs in compliance with the provisions of this ordinance, the City Council or the City Tree Board shall cause written notice to be served upon the property owner, requiring compliance with this ordinance within thirty (30) days after receipt of said notice. The notice required herein shall be served by mailing a copy of said notice to the property address or address used by the Johnson County Treasurer to mail property tax statements. If this Ordinance is not complied with by said property owner within the date specified in the written notice the City Council shall cause such work to be done as necessary to bring the trees on the property in compliance with the provisions of this Ordinance and the exact cost of such work shall be certified by the City Council to the Johnson County Auditor to be collected with and in the same manner as general property taxes.

Section 6. City Tree Board

1. Creation and Establishment of a City Tree Board. A City Tree Board is created and established. The Board shall consist of five (5) residents of the City who shall be appointed by the mayor.

2. Term of Office. The term of each Board member shall be five (5) years; provided, however, that the term of one member appointed to the first board shall be for only one (1) year, the term of one member of the first board shall be for two (2) years, the term of one of the member appointed to the first board shall be for three (3) years, and the term of one of the members appointed to the first board shall be for four (4) years. In the event that a vacancy shall occur during the term of any member, the Mayor shall appoint a successor for the unexpired portion of that member's term.

3. Compensation. The Board members shall serve without compensation.

4. Duties and Responsibilities.

a. The Board shall develop a written plan for the car, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs on 3 Public Property, including Parking areas. This written plan shall constitute the Comprehensive City Tree Plan for the City of University Heights.

b. The Board shall update the Comprehensive City Tree Plan annually.

c. The Board shall study and advise the City Council with respect to selection, maintenance, and care of trees and shrubs and with respect to such other matters as the City Council may request from time to time.

d. The Board, when requested by the City Council, shall consider, investigate, make findings, report, and make recommendations upon any special matter of question coming within the scope of its work.

e. The Board shall meet from time to time to consider and approve or reject requests from owners of private property to plant or remove trees or shrubs from Public Property, including Parking areas, adjoining the respective private property.

5. Operation. The Board shall choose its own chairperson, make its own rules and regulations, and keep minutes of its proceedings. A majority of the members shall constitute a quorum for the transaction of Board business.

6. Appeal. Any person aggrieved by a decision of the Board may appeal to the City Council by submitting a written appeal request that sets forth the basis for the appeal. The City Council may affirm, reverse, or modify any decision of the Board.

Section 7. Violation of this ordinance shall constitute a misdemeanor and shall be punishable by a fine not to exceed $100.00.

Passed by the City Council on the 10th day of December, 1974, and approved this 10th day of December, 1974.

*The signed original ordinance is on file with the University Heights City Attorney.

Ordinance No. 190, amending several provisions, was passed and approved on November 10, 2015, and published in the Iowa City Press-Citizen on November 26, 2016. Ordinance No. 190 amends certain definitions (Section 1), changes the addresses to which notices are sent (Section 5), and establishes the City Tree Board (Section 6).