Lost Nation, IA

Urban Forestry Management Plan

SUMMER 2021

JEO CONSULTING GROUP

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Lost Nation 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 19% of Lost Nation'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 2021, 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 157 trees inventoried.

- Lost Nation's trees provide $33,789 of benefits annually, an average of $215.22 per tree
- There are over 20 species of trees
- The top three genera are: Maple 69%, Ash 19%, and Basswood/Linden 3%
- 39% of trees need some type of management
- 30 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 30 trees needing removal, 15 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*
- 23 of the 30 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 21 years to remove ash. We suggest that city officials request a budget increase to $2,500 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

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

Assist Lost Nation 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 2021, 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 157 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. Lost Nation's trees reduce energy-related costs by approximately $8,603 annually (Appendix A, Table 1). These savings are both in electricity (41.1 MWh) and in natural gas (5,595.5 Therms).

Annual Stormwater Benefits

Lost Nation's trees intercept about 471,437 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $12,776 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 Lost Nation, it is estimated that trees remove 525.6 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 $1,474 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Lost Nation, trees sequester about 107,201 lbs of carbon per year with an associated value of $1,254 (Appendix A, Table 5). In addition, the trees store 1,774,227 lbs of carbon, with a yearly benefit of $13,307 (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. Lost Nation receives $9,683 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, Lost Nation's trees provide $33,789 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 157 trees in Lost Nation provide approximately $215.22 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$8,603**	• Intercept **471,437 gallons** • Provides **$12,776** benefit	• Remove **525.6 lbs** of pollution • Net value of **$1,474**	• Sequester **107,201 lbs** • Value of **$1,254** • Store **1,774,227 lbs** • Value of **$13,307**	• **$9,683** in social benefits	• **$33,789** annual benefits • Each tree provides **$215.22** annually

FOREST STRUCTURE

Species Distribution

Lost Nation has over 20 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	108	69%	Hackberry	1	<1%
Ash	30	19%	Walnut	1	<1%
Basswood/Linden	5	3%	Buckeye	1	<1%
Oak	3	2%	Elm	1	<1%
Spruce	3	2%	Lilac	1	<1%
Pine	2	1%	Southern magnolia	1	<1%

Age Class

Most of Lost Nation's trees (45%) are between 12 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Lost Nation's size curve is on the smaller side, indicating a middle-aged, 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 Lost Nation indicate that 51% of the trees are in good health, with only 18% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 42% of Lost Nation's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Twenty-six percent of the tree population's wood condition is in poor health, dead, or dying. This 26% 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	41	26%
Crown Reduction	6	4%
Tree Removal	30	19%
Crown Raising	14	9%
Tree Staking	0	0%

Canopy Cover

The total canopy with both private and public trees is 50.52 acres or around 12% cover. The canopy cover included in the Lost Nation inventory includes approximately 5 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 20% in 30 years. To achieve this goal it is estimated that 10 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Lost Nation'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	99%
Industrial/Large Commercial	0%
Park/Vacant/Other	0%
Small Commercial	0%
Multifamily Residential	1%

Recommendations

RECOMMENDATIONS

Risk Management

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

HAZARDOUS TREES

Lost Nation has 30 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 15 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the Proposed Budget and Schedule 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 61 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 30 removals, 24 are ash trees. There are a total of 30 ash trees, and 23 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 Proposed Budget and Schedule 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 Lost Nation.

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 (69%) (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. We recommend planting species such as honey locust, Kentucky coffeetree, tulip tree, ginkgo, swamp white oak, and eastern redbud.

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. There is no record of a city ordinance referring the planting of trees in Lost Nation, however we strongly recommend the city create a list of recommended species and species to avoid. We encourage planting species such as honey locust, Kentucky coffeetree, tulip tree, ginkgo, swamp white oak, and eastern redbud.

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. We strongly encourage the city communicate with residents on expectations for removal of ash trees within Lost Nation.

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $1,000/Year – (Based off Estimated Minimum Yearly Costs)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

YEAR 2	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

YEAR 4	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

YEAR 5	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

YEAR 6	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Prune 1/6 of city owned trees	$400
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,100**

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 $3,500 a year. If the budget were increased to $2,000 a year all ash could be removed in 10.5 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $2,000/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 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

YEAR 2	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

YEAR 3	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

YEAR 4	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

YEAR 5	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

YEAR 6	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Prune 1/6 of city owned trees	$400
Plant 1 tree in an open location	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,950**

Proposed Budget Increase

EAB could potentially kill all ash trees in Lost Nation within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $3,500 a year. If the budget were increased to $2,000 per year all ash could be removed within 10.5 years. Additionally, we recommend that Lost Nation 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 3 trees could be treated per year (every other year treatment). Three trees would be selected for treatment, and Lost Nation would still need to find $18,900 for removal. Alternatively, if there are 6 treatable trees, it would cost approximately $1,800 a year for treatment and leave $16,800 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 Lost Nation. 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

Lost Nation

Annual Energy Benefits of Public Trees

2/7/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	8.5	649	1,261.9	1,237	1,886	(N/A)	26.8	21.9	44.89
Silver maple	10.0	757	1,294.2	1,268	2,025	(N/A)	20.4	23.5	63.29
Green ash	7.1	539	986.8	967	1,506	(N/A)	14.6	17.5	65.47
Sugar maple	6.3	477	848.6	832	1,309	(N/A)	11.5	15.2	72.71
Red maple	3.0	227	383.2	376	603	(N/A)	10.2	7.0	37.66
White ash	1.3	98	154.8	152	250	(N/A)	3.8	2.9	41.69
Norway spruce	0.5	36	64.0	63	99	(N/A)	1.9	1.2	33.04
Littleleaf linden	0.6	46	71.8	70	116	(N/A)	1.9	1.3	38.70
Bur oak	0.5	40	76.2	75	115	(N/A)	1.3	1.3	57.32
American basswood	0.9	67	122.3	120	187	(N/A)	1.3	2.2	93.47
Northern hackberry	0.3	23	45.0	44	67	(N/A)	0.6	0.8	67.04
Red pine	0.1	11	19.7	19	30	(N/A)	0.6	0.4	30.47
Ohio buckeye	0.3	20	39.6	39	59	(N/A)	0.6	0.7	58.69
Northern pin oak	0.3	24	47.4	46	71	(N/A)	0.6	0.8	70.84
Black walnut	0.2	18	27.0	26	44	(N/A)	0.6	0.5	44.23
Eastern white pine	0.2	14	24.6	24	38	(N/A)	0.6	0.4	38.17
Southern magnolia	0.3	20	36.3	36	56	(N/A)	0.6	0.7	55.99
Siberian elm	0.3	20	37.9	37	57	(N/A)	0.6	0.7	57.41
Ash	0.2	18	29.5	29	47	(N/A)	0.6	0.5	46.78
Lilac	0.2	14	24.7	24	38	(N/A)	0.6	0.4	38.13
Total	41.1	3,119	5,595.5	5,484	8,603	(N/A)	100.0	100.0	54.79

Table 2: Annual Stormwater Benefits

Lost Nation

Annual Stormwater Benefits of Public Trees

2/7/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	75,229	2,039	(N/A)	26.8	16.0	48.54
Silver maple	140,581	3,810	(N/A)	20.4	29.8	119.05
Green ash	80,181	2,173	(N/A)	14.6	17.0	94.47
Sugar maple	85,359	2,313	(N/A)	11.5	18.1	128.51
Red maple	20,362	552	(N/A)	10.2	4.3	34.49
White ash	9,440	256	(N/A)	3.8	2.0	42.64
Norway spruce	10,543	286	(N/A)	1.9	2.2	95.24
Littleleaf linden	3,779	102	(N/A)	1.9	0.8	34.14
Bur oak	5,181	140	(N/A)	1.3	1.1	70.21
American basswood	15,514	420	(N/A)	1.3	3.3	210.22
Northern hackberry	2,432	66	(N/A)	0.6	0.5	65.89
Red pine	2,969	80	(N/A)	0.6	0.6	80.46
Ohio buckeye	2,479	67	(N/A)	0.6	0.5	67.19
Northern pin oak	3,764	102	(N/A)	0.6	0.8	102.01
Black walnut	1,466	40	(N/A)	0.6	0.3	39.72
Eastern white pine	4,605	125	(N/A)	0.6	1.0	124.79
Southern magnolia	3,187	86	(N/A)	0.6	0.7	86.37
Siberian elm	2,290	62	(N/A)	0.6	0.5	62.07
Ash	1,409	38	(N/A)	0.6	0.3	38.19
Lilac	667	18	(N/A)	0.6	0.1	18.06
Citywide total	471,437	12,776	(N/A)	100.0	100.0	81.38

Table 3: Annual Air Quality Benefits

Lost Nation

Annual Air Quality Benefits of Public Trees

2/7/2022

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								
Norway maple	14.5	2.5	7.3	0.6	79	41.7	6.0	5.7	38.8	258	-3.5	-13	113.7	324	(N/A)	26.8	7.70
Silver maple	23.6	4.0	11.6	1.0	127	46.9	6.9	6.6	45.1	294	-12.4	-46	133.3	375	(N/A)	20.4	11.71
Green ash	10.3	1.6	4.9	0.5	55	34.0	4.9	4.7	32.2	212	0.0	0	93.2	266	(N/A)	14.6	11.58
Sugar maple	13.1	2.2	6.2	0.6	70	29.9	4.4	4.2	28.5	186	-10.1	-38	78.9	219	(N/A)	11.5	12.15
Red maple	4.2	0.7	2.0	0.2	22	14.0	2.1	2.0	13.6	88	-1.5	-6	37.2	105	(N/A)	10.2	6.55
White ash	0.7	0.1	0.4	0.0	4	6.0	0.9	0.8	5.9	38	0.0	0	14.9	42	(N/A)	3.8	6.99
Norway spruce	1.3	0.2	1.0	0.2	8	2.3	0.3	0.3	2.2	14	-5.6	-21	2.1	1	(N/A)	1.9	0.44
Littleleaf linden	0.5	0.1	0.3	0.0	3	2.8	0.4	0.4	2.7	18	-0.3	-1	6.9	19	(N/A)	1.9	6.42
Bur oak	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19	(N/A)	1.3	9.34
American basswood	2.7	0.5	1.2	0.1	14	4.2	0.6	0.6	4.0	26	-2.1	-8	11.8	33	(N/A)	1.3	16.28
Northern hackberry	0.3	0.1	0.2	0.0	2	1.5	0.2	0.2	1.4	9	0.0	0	3.8	11	(N/A)	0.6	10.85
Red pine	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1	(N/A)	0.6	1.45
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)	0.6	10.16
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)	0.6	13.58
Black walnut	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7	(N/A)	0.6	7.42
Eastern white pine	0.6	0.1	0.4	0.1	4	0.9	0.1	0.1	0.8	5	-2.9	-11	0.3	-2	(N/A)	0.6	-1.58
Southern magnolia	0.3	0.1	0.3	0.0	2	1.3	0.2	0.2	1.2	8	-0.9	-3	2.6	7	(N/A)	0.6	6.63
Siberian elm	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	0.6	9.47
Ash	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8	(N/A)	0.6	7.92
Lilac	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7	(N/A)	0.6	6.56
Citywide total	75.0	12.7	37.6	3.5	407	195.8	28.5	27.2	186.2	1,221	-41.0	-154	525.6	1,474	(N/A)	100.0	9.39

Table 4: Annual Carbon Stored

Lost Nation

Stored CO2 Benefits of Public Trees

2/7/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	241,012	1,808	(N/A)	26.8	13.6	43.04
Silver maple	534,050	4,005	(N/A)	20.4	30.1	125.17
Green ash	335,815	2,519	(N/A)	14.6	18.9	109.50
Sugar maple	387,125	2,903	(N/A)	11.5	21.8	161.30
Red maple	47,200	354	(N/A)	10.2	2.7	22.12
White ash	21,542	162	(N/A)	3.8	1.2	26.93
Norway spruce	14,176	106	(N/A)	1.9	0.8	35.44
Littleleaf linden	10,785	81	(N/A)	1.9	0.6	26.96
Bur oak	16,915	127	(N/A)	1.3	1.0	63.43
American basswood	106,933	802	(N/A)	1.3	6.0	401.00
Northern hackberry	4,142	31	(N/A)	0.6	0.2	31.07
Red pine	3,343	25	(N/A)	0.6	0.2	25.07
Ohio buckeye	7,945	60	(N/A)	0.6	0.4	59.59
Northern pin oak	14,280	107	(N/A)	0.6	0.8	107.10
Black walnut	3,672	28	(N/A)	0.6	0.2	27.54
Eastern white pine	7,490	56	(N/A)	0.6	0.4	56.18
Southern magnolia	4,397	33	(N/A)	0.6	0.2	32.98
Siberian elm	6,743	51	(N/A)	0.6	0.4	50.57
Ash	3,624	27	(N/A)	0.6	0.2	27.18
Lilac	3,037	23	(N/A)	0.6	0.2	22.78
Citywide total	1,774,227	13,307	(N/A)	100.0	100.0	84.76

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

Lost Nation

Annual CO ₂ Benefits of Public Trees

2/7/2022

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
Norway maple	12,924	97	-1,157	-91	-9	14,340	108	26,015	195 (N/A)	26.8	15.6	4.65
Silver maple	40,249	302	-2,563	-108	-20	16,732	125	54,310	407 (N/A)	20.4	32.5	12.73
Green ash	16,921	127	-1,612	-74	-13	11,904	89	27,138	204 (N/A)	14.6	16.2	8.85
Sugar maple	16,789	126	-1,858	-73	-14	10,546	79	25,405	191 (N/A)	11.5	15.2	10.59
Red maple	6,133	46	-227	-26	-2	5,018	38	10,899	82 (N/A)	10.2	6.5	5.11
White ash	2,690	20	-103	-11	-1	2,176	16	4,752	36 (N/A)	3.8	2.8	5.94
Norway spruce	375	3	-68	-10	-1	804	6	1,101	8 (N/A)	1.9	0.7	2.75
Littleleaf linden	1,543	12	-52	-6	0	1,011	8	2,496	19 (N/A)	1.9	1.5	6.24
Bur oak	1,319	10	-81	-5	-1	883	7	2,115	16 (N/A)	1.3	1.3	7.93
American basswood	5,147	39	-513	-12	-4	1,483	11	6,105	46 (N/A)	1.3	3.7	22.89
Northern hackberry	354	3	-20	-3	0	507	4	838	6 (N/A)	0.6	0.5	6.29
Red pine	187	1	-16	-3	0	246	2	415	3 (N/A)	0.6	0.2	3.11
Ohio buckeye	470	4	-38	-3	0	440	3	869	7 (N/A)	0.6	0.5	6.52
Northern pin oak	0	0	-69	-4	-1	539	4	466	3 (N/A)	0.6	0.3	3.49
Black walnut	445	3	-18	-2	0	393	3	819	6 (N/A)	0.6	0.5	6.14
Eastern white pine	256	2	-36	-4	0	311	2	528	4 (N/A)	0.6	0.3	3.96
Southern magnolia	260	2	-21	-3	0	451	3	687	5 (N/A)	0.6	0.4	5.15
Siberian elm	485	4	-32	-3	0	447	3	897	7 (N/A)	0.6	0.5	6.73
Ash	386	3	-17	-2	0	395	3	762	6 (N/A)	0.6	0.5	5.71
Lilac	268	2	-15	-2	0	308	2	560	4 (N/A)	0.6	0.3	4.20
Citywide total	107,201	804	-8,516	-443	-67	68,933	517	167,174	1,254 (N/A)	100.0	100.0	7.99

Table 6: Annual Social and Aesthetic Benefits

Lost Nation

Annual Aesthetic/Other Benefits of Public Trees

2/7/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,288	(N/A)	26.8	13.3	30.67
Silver maple	3,174	(N/A)	20.4	32.8	99.18
Green ash	1,359	(N/A)	14.6	14.0	59.09
Sugar maple	1,627	(N/A)	11.5	16.8	90.41
Red maple	843	(N/A)	10.2	8.7	52.69
White ash	359	(N/A)	3.8	3.7	59.90
Norway spruce	94	(N/A)	1.9	1.0	31.39
Littleleaf linden	165	(N/A)	1.9	1.7	55.09
Bur oak	115	(N/A)	1.3	1.2	57.69
American basswood	306	(N/A)	1.3	3.2	153.23
Northern hackberry	52	(N/A)	0.6	0.5	52.26
Red pine	47	(N/A)	0.6	0.5	47.08
Ohio buckeye	43	(N/A)	0.6	0.4	43.05
Northern pin oak	0	(N/A)	0.6	0.0	0.00
Black walnut	46	(N/A)	0.6	0.5	45.86
Eastern white pine	26	(N/A)	0.6	0.3	26.25
Southern magnolia	41	(N/A)	0.6	0.4	41.22
Siberian elm	40	(N/A)	0.6	0.4	39.94
Ash	39	(N/A)	0.6	0.4	39.16
Lilac	15	(N/A)	0.6	0.2	15.48
Citywide total	9,683	(N/A)	100.0	100.0	61.67

Table 7: Summary of Benefits in Dollars

Lost Nation

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

2/7/2022

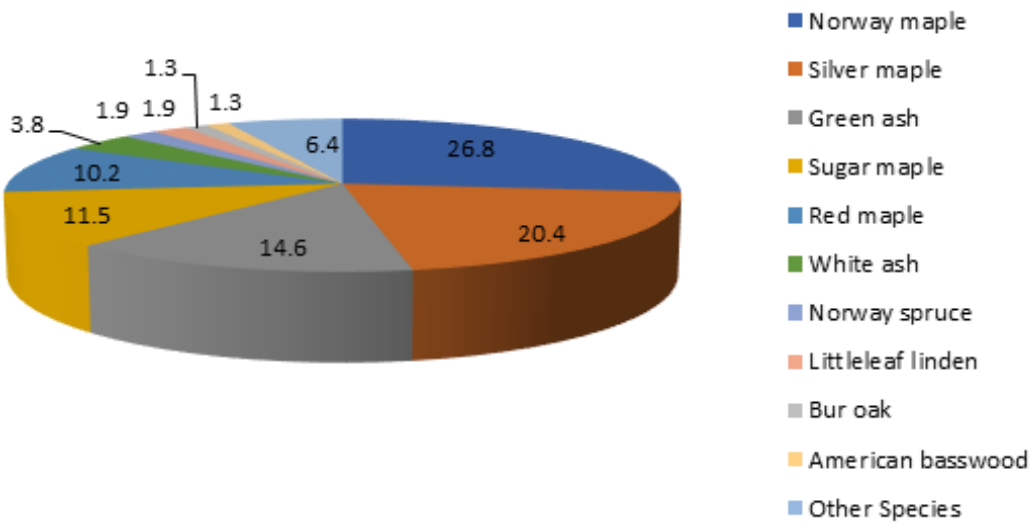
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	8,603	(N/A)	54.79	(N/A)	0.00	(N/A)
CO2	1,254	(N/A)	7.99	(N/A)	0.00	(N/A)
Air Quality	1,474	(N/A)	9.39	(N/A)	0.00	(N/A)
Stormwater	12,776	(N/A)	81.38	(N/A)	0.00	(N/A)
Aesthetic/Other	9,683	(N/A)	61.67	(N/A)	0.00	(N/A)
Total Benefits	33,789	(N/A)	215.22	(N/A)	0.00	(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	33,789	(N/A)	215.22	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Lost Nation

Species Distribution of Public Trees

2/7/2022



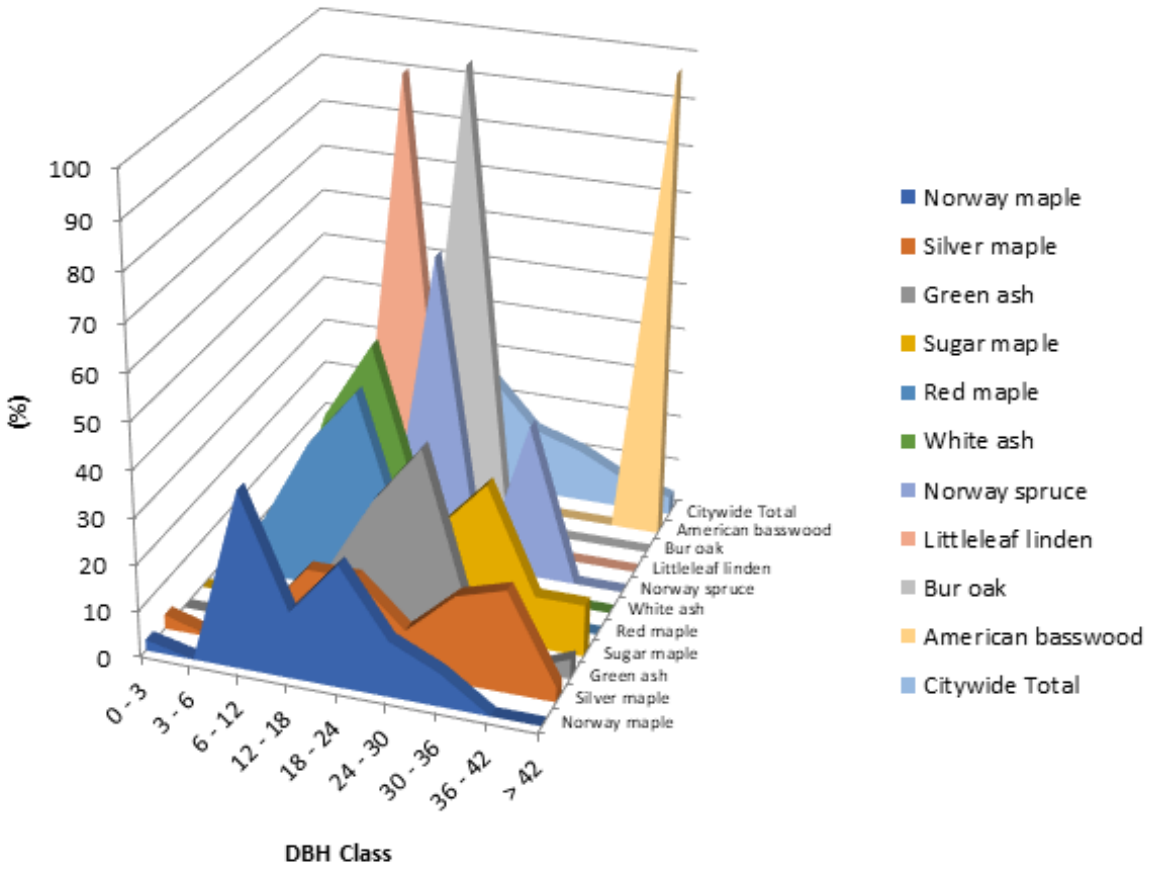
Species	Percent
Norway maple	26.8
Silver maple	20.4
Green ash	14.6
Sugar maple	11.5
Red maple	10.2
White ash	3.8
Norway spruce	1.9
Littleleaf linden	1.9
Bur oak	1.3
American basswood	1.3
Other Species	6.4
Total	100.0

Figure 2: Relative Age Class

Lost Nation

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

2/7/2022



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Norway maple	2.38	0.00	38.10	14.29	26.19	11.90	7.14	0.00	0.00
Silver maple	3.13	0.00	6.25	18.75	18.75	9.38	18.75	21.88	3.13
Green ash	0.00	0.00	0.00	13.04	30.43	43.48	8.70	0.00	4.35
Sugar maple	0.00	0.00	0.00	0.00	22.22	22.22	33.33	11.11	11.11
Red maple	0.00	12.50	31.25	43.75	12.50	0.00	0.00	0.00	0.00
White ash	0.00	0.00	33.33	50.00	16.67	0.00	0.00	0.00	0.00
Norway spruce	0.00	0.00	0.00	0.00	66.67	0.00	33.33	0.00	0.00
Littleleaf linden	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Bur oak	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
American basswood	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Citywide Total	1.27	1.27	15.92	19.75	25.48	14.65	11.46	6.37	3.82

Figure 3: Foliage Condition

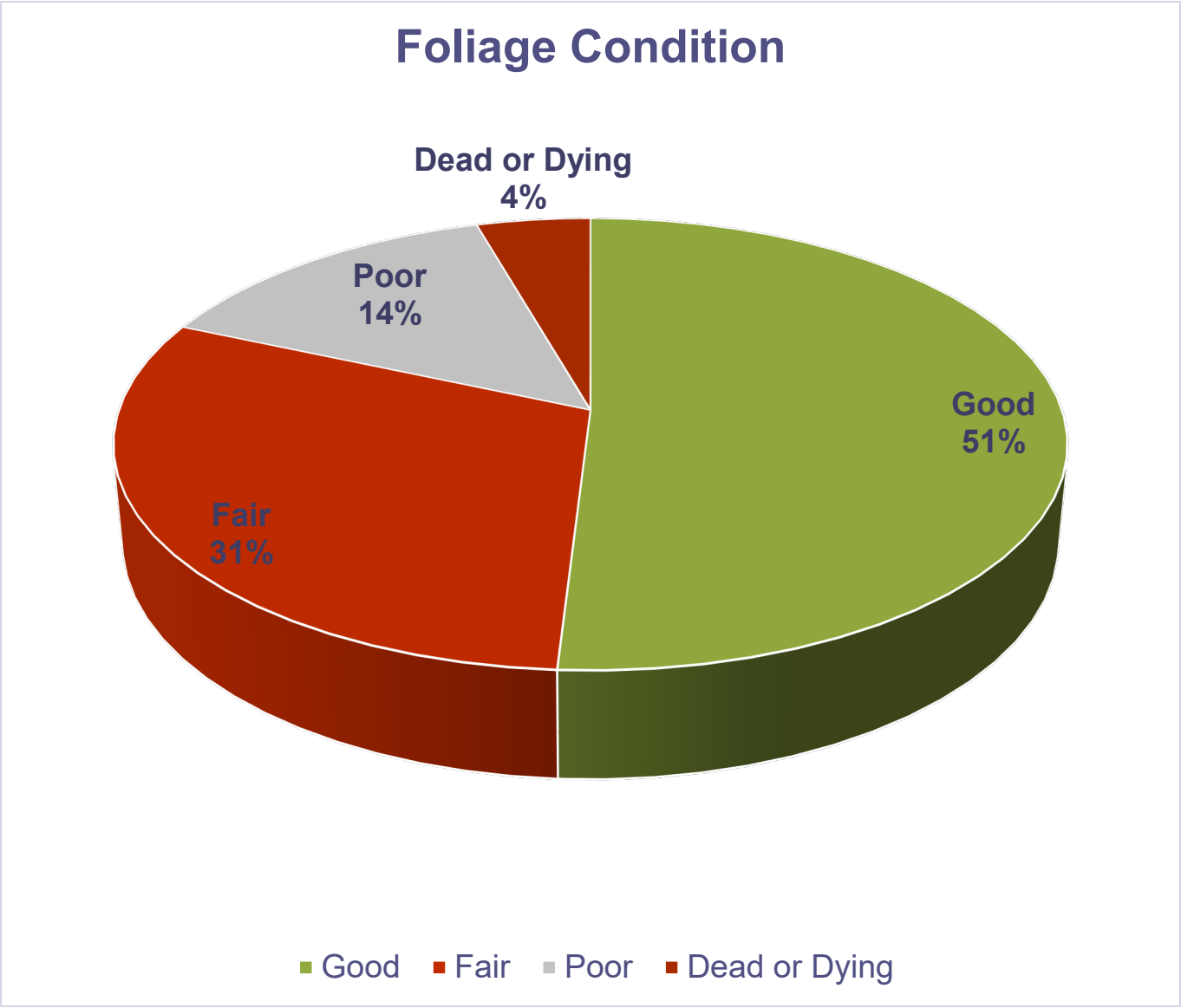


Figure 4: Wood Condition

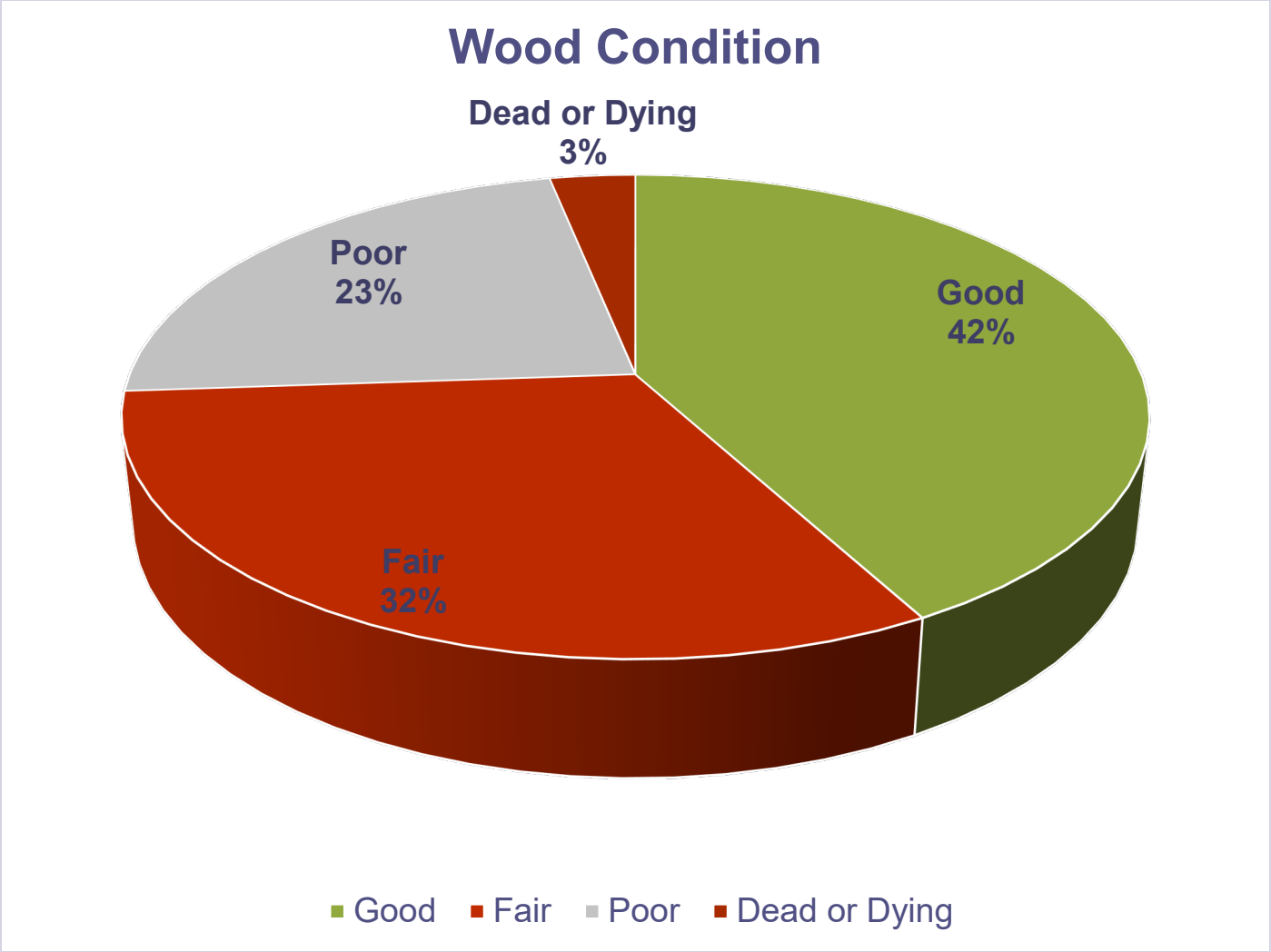
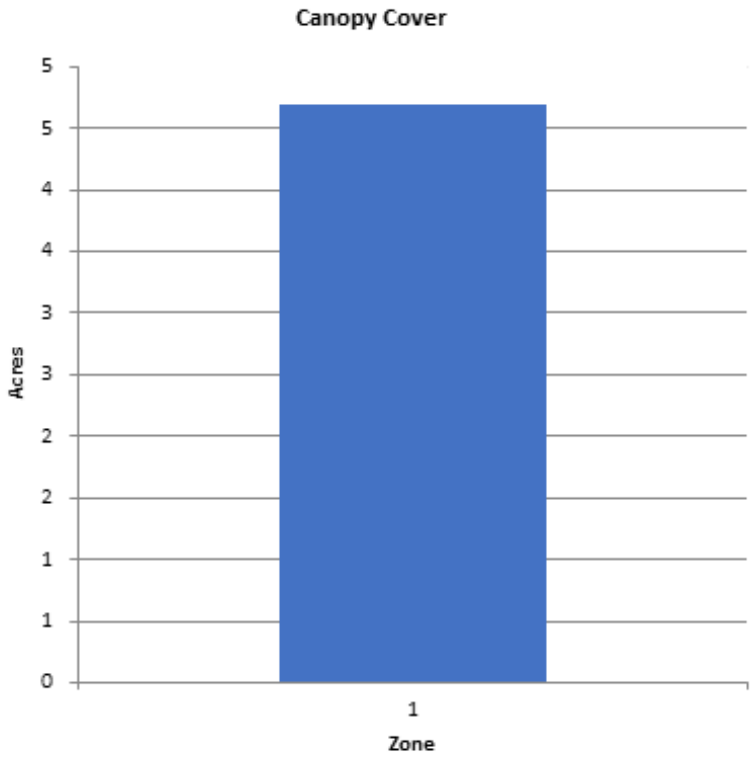


Figure 5: Canopy Cover in Acres

Lost Nation

Canopy Cover of Public Trees (Acres)

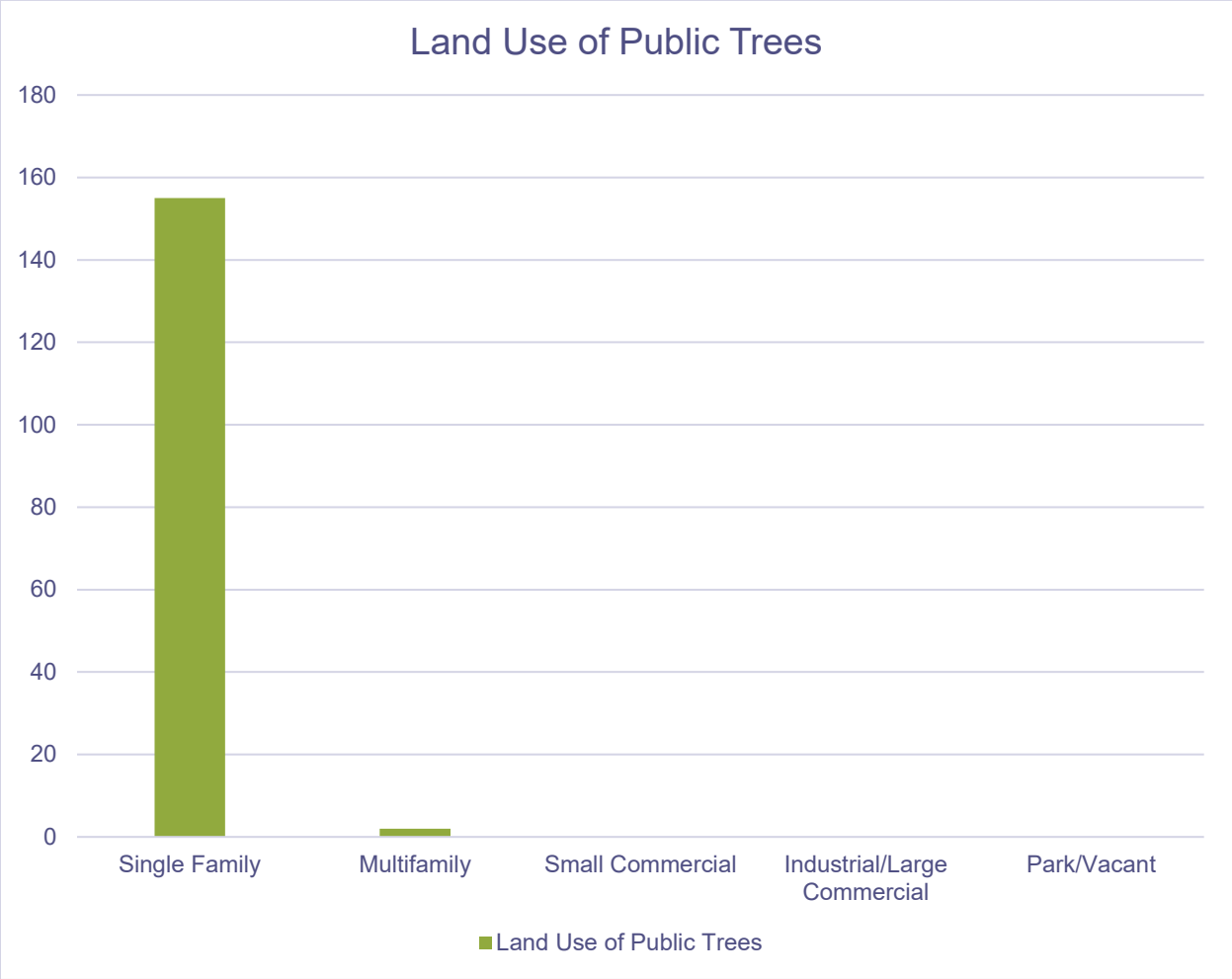
2/7/2022



Zone	Acres	% of Total Canopy Cover
1	5	100.0
Citywide total	5	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	5	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

City ownership of the trees recommended for removal should be verified prior to any removal

Ash Tree Location

0 260 520 1,040 Feet

N

EAB Signs/Symptoms

0 260 520 1,040 Feet

N

Poor Condition Trees

0 260 520 1,040 Feet

N

Priority Task

0 260 520 1,040 Feet

N

APPENDIX C: LOST NATION TREE ORDINANCES

No ordinances provided.

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

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

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