Independence, IA:

2020 Urban Forest Management Plan

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Independence 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 14% of Independence'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 2020, 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 2,166 trees inventoried.

- Independence's trees provide $442,083 of benefits annually, an average of $204.10 per tree
- There are over 36 species of trees
- The top three genera are: maple 37%, ash 14%, and oak 9%
- 28% of trees need some type of management
- 77 trees should be removed

Recommendations

Below are some key recommendations, for further details see the Recommendation and Emerald Ash Borer Plan Sections:

- Out of the 77 trees needing removal, 34 trees are over 24 inches in diameter at 4.5 feet and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 42 of the 309 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 18 years to remove ash. We suggest that city officials request a budget increase to between $12,000 and $15,000 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

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

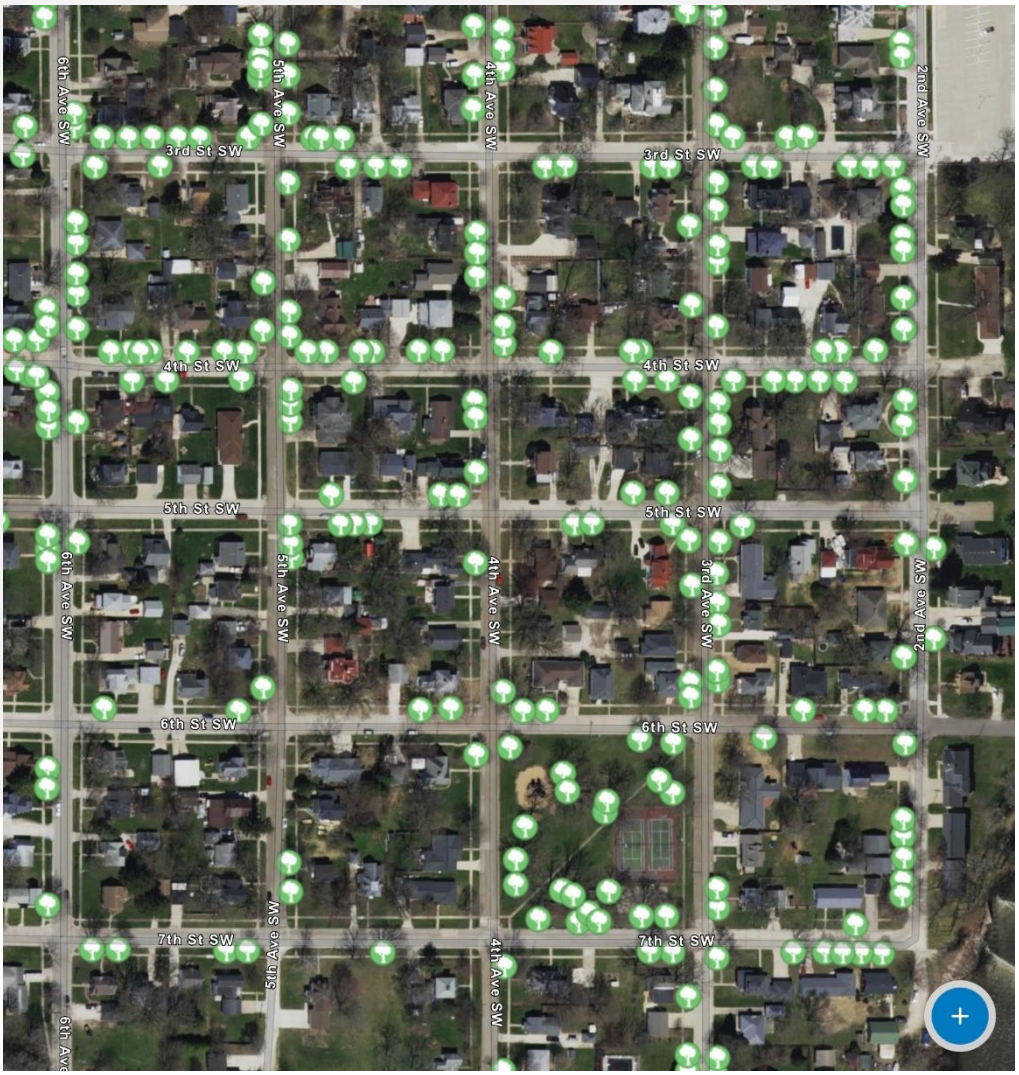
Assist Independence with Managing its Urban Forest

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



*Representative imagery of a tree inventory collection via ArcGIS Collector.

Inventory Results

INVENTORY

In 2020, 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 three meters, which can be used in ArcGIS 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 feet, 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 2,166 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. Independence's trees reduce energy-related costs by approximately $113,399 annually (Appendix A, Table 1). These savings are both in electricity (540.6 MWh) and in natural gas (73,844.4 Therms).

Annual Stormwater Benefits

Independence's trees intercept about 6,701,078 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $181,599 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 Independence, it is estimated that trees remove 7,223.2 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $20,372 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Independence, trees sequester about 1,305,022 lbs of carbon per year with an associated value of $9,778 (Appendix A, Table 5). In addition, the trees store 28,115,769 lbs of carbon, with a yearly benefit of $210,868 (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. Independence receives $111,184 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, Independence's trees provide $442,083 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 2,166 trees in Independence provide approximately $204.10 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$113,399**	• Intercept **6,701,078 gallons** • Provides **$181,599** benefit	• Remove **7,223.2 lbs** of pollution • Net value of **$20,372**	• Sequester **1,305,022 lbs** • Value of **$9,778** • Store **28,115,769 lbs** • Value of **$210,868**	• **$111,184** in social benefits	• **$442,083** annual benefits • Each tree provides **$204.10** annually

FOREST STRUCTURE

Species Distribution

Independence has over 36 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	801	37%	Cherry	11	<1%
Ash	309	14%	Cedar	11	<1%
Oak	198	9%	Dogwood	11	<1%
Apple	174	8%	Sycamore	10	<1%
Spruce	129	6%	Catalpa	8	<1%
Walnut	73	3%	Amur maple	7	<1%
Hackberry	55	2.5%	Magnolia	7	<1%
Pine	46	2%	Buckeye	5	<1%
Basswood/Linden	43	2%	Eastern redbud	5	<1%
Birch	35	1.5%	Mulberry	4	<1%
Elm	32	1.5%	Poplar	3	<1%
Plum	31	1%	Kentucky coffee	2	<1%
Pear	29	1%	Aspen	2	<1%
Locust	24	1%	Tulip tree	1	<1%
Cottonwood	17	<1%	Willow	1	<1%
Lilac	16	<1%	Other Deciduous	26	1%
Boxelder	14	<1%	Other Evergreen	14	<1%
Japanese tree lilac	12	<1%			

Age Class

Most of Independence's trees (33%) are between 18 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Independence's size curve is on the larger side, indicating an older, but mostly 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 Independence indicate that 86 percent of the trees are in good health, with only 1.5 percent of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 53 percent of Independence's trees are in good health for wood condition
(Appendix A, Figure 4 & Appendix B, Figure 3). Three percent of the tree population's wood condition is in poor health, dead, or dying. This 3 percent 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	373	17%
Crown Reduction	110	5%
Tree Removal	77	3%
Crown Raising	75	3%
Tree Staking	53	2%

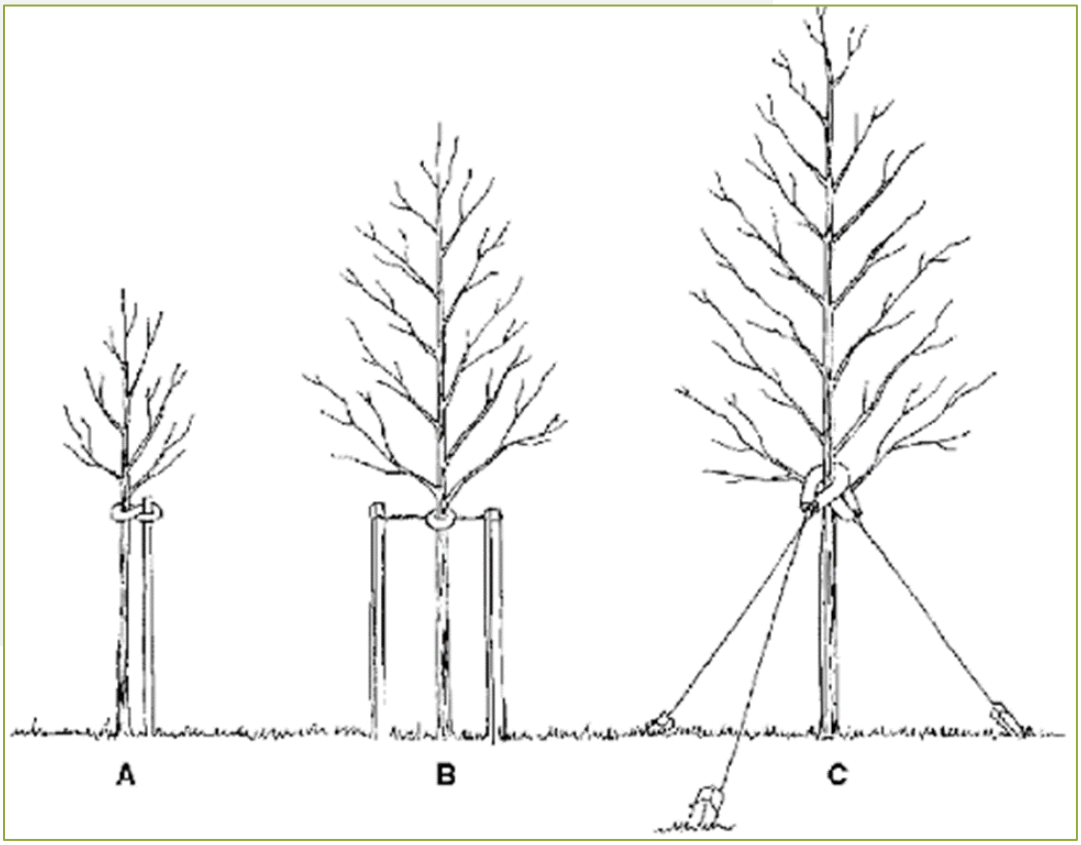
Canopy Cover

The total canopy with both private and public trees is 708.9 acres or around 18 percent. The canopy cover included in the Independence inventory includes approximately 65 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 5 percent in 30 years. To achieve this goal it is estimated that 200 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Independence'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	60.5%
Industrial/Large Commercial	1.5%
Park/Vacant/Other	36%
Small Commercial	1%
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

Independence has 34 concerning 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 34 trees over 24 inches in diameter at 4.5 feet that should be addressed immediately. Please refer to the Proposed Schedule and Budget 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 611 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 77 removals, 43 are ash trees. There are a total of 309 ash trees, and 42 of those have signs and symptoms that have been associated with EAB. In addition, there are 130 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 Proposed Schedule and Budget 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 Independence.

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 percent of the total urban forest. Presently, the forest is heavily planted with maple (37%) (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, elm, cork, London plane, and ironwood hornbeam. 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 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 "any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut." We strongly recommend to also include ash on this list.

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 states “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.”

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $12,456/Year – (Based off $2/Capita Calculation Due to no Annual Budget Allocation)

YEAR 1	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

YEAR 2	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

YEAR 3	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

YEAR 4	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

YEAR 5	Est. Cost
Remove 2 trees recommended for immediate removal	$5,600
Remove 6 ash trees	$4,200
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

YEAR 6	Est. Cost
Remove 8 ash trees	$5,600
Plant 9 trees in open locations	$1,350
Rotational Pruning (361 trees)	$5,415
Visual Survey of Ash Trees	n/a
TOTAL	**$12,365**

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 nearly $36,000 a year. If the budget were increased to $15,000 a year all ash could be removed in 14 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

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

YEAR 1	Est. Cost
Remove 10 trees recommended for immediate removal	$7,000
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

YEAR 2	Est. Cost
Remove 10 trees recommended for immediate removal	$7,000
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

YEAR 3	Est. Cost
Remove 10 trees recommended for immediate removal	$7,000
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

YEAR 4	Est. Cost
Remove 4 trees recommended for immediate removal	$2,800
Remove 6 ash trees	$4,200
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

YEAR 5	Est. Cost
Remove 10 ash trees	$7,000
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

YEAR 6	Est. Cost
Remove 10 ash trees	$7,000
Plant 17 trees in open locations	$2,550
Rotational Pruning (361 trees)	$5,415
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,965**

Proposed Budget Increase

EAB could potentially kill all ash trees in Independence within four years of its arrival. To remove all ash trees within ten years, the budget would need to be increased to around $21,000 a year. If the budget were increased to $15,000 per year all ash could be removed within 14.5 years. Additionally, we recommend that Independence apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option considered by many communities is treating selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removal all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at $15 per inch, about 4 trees could be treated per year (every other year treatment). Eight trees would be selected for treatment, and Independence would still need to find $210,700 for removal of all the ash trees. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 a year for treatment and leave $7,500 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 Independence. 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

Annual Energy Benefits of Public Trees

1/28/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	121.0	9,185	15,929.8	15,611	24,796	(N/A)	15.7	21.9	72.93
Green ash	79.4	6,027	10,834.8	10,618	16,645	(N/A)	12.6	14.7	60.97
Norway maple	63.4	4,810	9,149.8	8,967	13,776	(N/A)	11.5	12.1	55.11
Apple	13.6	1,031	2,060.0	2,019	3,050	(N/A)	8.0	2.7	17.53
Sugar maple	40.8	3,096	5,465.8	5,356	8,453	(N/A)	6.0	7.5	65.52
Blue spruce	9.4	712	1,276.9	1,251	1,963	(N/A)	3.6	1.7	25.50
Northern red oak	5.9	445	805.1	789	1,234	(N/A)	3.5	1.1	16.46
Black walnut	26.3	1,997	3,609.5	3,537	5,534	(N/A)	3.4	4.9	75.81
Red maple	11.8	896	1,573.0	1,542	2,438	(N/A)	2.8	2.1	40.63
Northern hackberry	22.4	1,697	3,142.8	3,080	4,777	(N/A)	2.5	4.2	86.85
Bur oak	22.0	1,672	2,912.5	2,854	4,526	(N/A)	2.5	4.0	82.30
White ash	11.0	835	1,387.4	1,360	2,195	(N/A)	1.6	1.9	64.56
Plum	0.3	24	54.3	53	77	(N/A)	1.4	0.1	2.48
Littleleaf linden	6.6	498	937.9	919	1,417	(N/A)	1.3	1.2	48.87
Spruce	1.3	99	186.1	182	281	(N/A)	1.3	0.2	10.04
Northern pin oak	7.5	572	1,089.1	1,067	1,639	(N/A)	1.3	1.4	58.53
River birch	6.2	474	918.7	900	1,374	(N/A)	1.2	1.2	50.91
Eastern white pine	4.1	310	531.1	520	831	(N/A)	1.2	0.7	30.77
Chinese elm	9.1	689	1,251.0	1,226	1,915	(N/A)	1.2	1.7	73.67
Norway spruce	2.7	207	357.1	350	557	(N/A)	1.1	0.5	23.19
Honeylocust	7.9	602	1,040.7	1,020	1,621	(N/A)	1.1	1.4	70.50
Black maple	6.2	473	867.9	851	1,323	(N/A)	1.0	1.2	60.15
Callery pear	0.9	66	131.4	129	194	(N/A)	1.0	0.2	9.26
White oak	8.0	606	1,052.6	1,032	1,638	(N/A)	1.0	1.4	77.99
Broadleaf Deciduous Small	1.3	101	211.3	207	308	(N/A)	0.8	0.3	17.10
Swamp white oak	1.9	143	245.8	241	384	(N/A)	0.7	0.3	24.02
Lilac	3.1	233	487.2	477	710	(N/A)	0.7	0.6	44.39
Boxelder	2.9	222	403.0	395	617	(N/A)	0.6	0.5	44.07
Eastern cottonwood	6.1	460	798.6	783	1,243	(N/A)	0.6	1.1	95.60
American basswood	4.3	328	632.0	619	948	(N/A)	0.6	0.8	72.91
Japanese tree lilac	0.8	63	133.1	130	193	(N/A)	0.6	0.2	16.10
Black cherry	0.3	26	56.9	56	82	(N/A)	0.5	0.1	7.46
Scotch pine	1.6	119	196.3	192	311	(N/A)	0.5	0.3	28.29
American sycamore	4.3	324	576.8	565	889	(N/A)	0.5	0.8	88.94
Flowering dogwood	0.0	2	5.6	6	8	(N/A)	0.4	0.0	0.87
Catalpa	3.1	235	416.2	408	642	(N/A)	0.4	0.6	80.31
Pear	0.0	2	5.0	5	7	(N/A)	0.4	0.0	0.87
Northern white cedar	1.1	86	146.5	144	229	(N/A)	0.4	0.2	28.67
Austrian pine	1.0	76	132.3	130	205	(N/A)	0.4	0.2	25.68
Conifer Evergreen Small	0.8	59	115.1	113	172	(N/A)	0.3	0.2	24.57
Southern magnolia	1.8	133	210.4	206	340	(N/A)	0.3	0.3	48.50
Amur maple	1.3	100	186.6	183	283	(N/A)	0.3	0.2	40.42
Conifer Evergreen Large	1.3	96	167.3	164	260	(N/A)	0.3	0.2	37.07
Broadleaf Deciduous Mediu	0.6	45	78.3	77	122	(N/A)	0.3	0.1	20.27
Paper birch	1.3	100	170.9	168	268	(N/A)	0.3	0.2	44.66
Ohio buckeye	0.9	68	124.0	122	190	(N/A)	0.2	0.2	37.99
Eastern redbud	0.7	55	113.6	111	167	(N/A)	0.2	0.1	33.36
Cottonwood	1.9	144	248.3	243	387	(N/A)	0.2	0.3	96.73
Mulberry	0.6	49	93.8	92	141	(N/A)	0.2	0.1	35.15
American elm	1.6	122	208.4	204	326	(N/A)	0.2	0.3	81.54
Black poplar	1.5	110	189.3	186	296	(N/A)	0.1	0.3	98.63
Eastern red cedar	0.3	25	49.3	48	74	(N/A)	0.1	0.1	24.57
Birch	0.6	49	94.8	93	142	(N/A)	0.1	0.1	70.84
Pin oak	0.4	30	52.6	52	81	(N/A)	0.1	0.1	40.69
Dogwood	0.0	1	1.2	1	2	(N/A)	0.1	0.0	0.87
Kentucky coffeetree	0.8	59	107.4	105	164	(N/A)	0.1	0.1	82.02

Annual Energy Benefits of Public Trees

1/28/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Broadleaf Deciduous Large	0.9	70	122.1	120	190	(N/A)	0.1	0.2	94.83
Quaking aspen	0.7	54	100.5	99	153	(N/A)	0.1	0.1	76.46
Siberian elm	0.4	34	58.3	57	91	(N/A)	0.0	0.1	91.06
Willow	0.0	0	0.8	1	1	(N/A)	0.0	0.0	1.10
Ash	0.3	24	47.4	46	71	(N/A)	0.0	0.1	70.84
Elm	0.4	33	59.0	58	91	(N/A)	0.0	0.1	91.02
Black locust	0.3	20	39.6	39	59	(N/A)	0.0	0.1	58.69
Black ash	0.2	18	29.5	29	47	(N/A)	0.0	0.0	46.78
Tulip tree	0.3	25	46.9	46	71	(N/A)	0.0	0.1	70.91
Oak	0.5	37	63.1	62	99	(N/A)	0.0	0.1	98.63
Basswood	0.4	29	53.7	53	82	(N/A)	0.0	0.1	82.02
Total	540.6	41,032	73,844.4	72,367	113,399	(N/A)	100.0	100.0	52.35

Annual Stormwater Benefits of Public Trees

1/28/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	1,857,539	50,339	(N/A)	15.7	27.7	148.06
Green ash	906,517	24,567	(N/A)	12.6	13.5	89.99
Norway maple	612,744	16,605	(N/A)	11.5	9.1	66.42
Apple	56,986	1,544	(N/A)	8.0	0.9	8.88
Sugar maple	524,315	14,209	(N/A)	6.0	7.8	110.15
Blue spruce	143,935	3,901	(N/A)	3.6	2.1	50.66
Northern red oak	47,021	1,274	(N/A)	3.5	0.7	16.99
Black walnut	353,848	9,589	(N/A)	3.4	5.3	131.36
Red maple	96,259	2,609	(N/A)	2.8	1.4	43.48
Northern hackberry	249,576	6,764	(N/A)	2.5	3.7	122.97
Bur oak	319,515	8,659	(N/A)	2.5	4.8	157.43
White ash	123,467	3,346	(N/A)	1.6	1.8	98.41
Plum	904	25	(N/A)	1.4	0.0	0.79
Littleleaf linden	71,052	1,926	(N/A)	1.3	1.1	66.40
Spruce	23,243	630	(N/A)	1.3	0.3	22.50
Northern pin oak	79,915	2,166	(N/A)	1.3	1.2	77.35
River birch	66,669	1,807	(N/A)	1.2	1.0	66.92
Eastern white pine	81,397	2,206	(N/A)	1.2	1.2	81.70
Chinese elm	120,948	3,278	(N/A)	1.2	1.8	126.06
Norway spruce	53,778	1,457	(N/A)	1.1	0.8	60.72
Honeylocust	92,165	2,498	(N/A)	1.1	1.4	108.59
Black maple	61,810	1,675	(N/A)	1.0	0.9	76.14
Callery pear	4,306	117	(N/A)	1.0	0.1	5.56
White oak	110,656	2,999	(N/A)	1.0	1.7	142.80
Broadleaf Deciduous Small	6,549	177	(N/A)	0.8	0.1	9.86
Swamp white oak	10,999	298	(N/A)	0.7	0.2	18.63
Lilac	17,875	484	(N/A)	0.7	0.3	30.28
Boxelder	30,601	829	(N/A)	0.6	0.5	59.23
Eastern cottonwood	92,358	2,503	(N/A)	0.6	1.4	192.53
American basswood	53,630	1,453	(N/A)	0.6	0.8	111.80
Japanese tree lilac	3,384	92	(N/A)	0.6	0.1	7.64
Black cherry	1,616	44	(N/A)	0.5	0.0	3.98
Scotch pine	27,144	736	(N/A)	0.5	0.4	66.87
American sycamore	65,396	1,772	(N/A)	0.5	1.0	177.22
Flowering dogwood	67	2	(N/A)	0.4	0.0	0.20
Catalpa	44,488	1,206	(N/A)	0.4	0.7	150.70
Pear	60	2	(N/A)	0.4	0.0	0.20
Northern white cedar	23,042	624	(N/A)	0.4	0.3	78.06
Austrian pine	15,145	410	(N/A)	0.4	0.2	51.30
Conifer Evergreen Small	11,442	310	(N/A)	0.3	0.2	44.30
Southern magnolia	19,949	541	(N/A)	0.3	0.3	77.23
Amur maple	5,681	154	(N/A)	0.3	0.1	21.99
Conifer Evergreen Large	30,597	829	(N/A)	0.3	0.5	118.45
Broadleaf Deciduous Medium	3,319	90	(N/A)	0.3	0.0	14.99
Paper birch	10,186	276	(N/A)	0.3	0.2	46.01
Ohio buckeye	7,181	195	(N/A)	0.2	0.1	38.92
Eastern redbud	3,544	96	(N/A)	0.2	0.1	19.21
Cottonwood	28,956	785	(N/A)	0.2	0.4	196.17
Mulberry	2,772	75	(N/A)	0.2	0.0	18.78

Annual Stormwater Benefits of Public Trees

1/28/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
American elm	15,044	408	(N/A)	0.2	0.2	101.92
Black poplar	21,717	589	(N/A)	0.1	0.3	196.17
Eastern red cedar	4,904	133	(N/A)	0.1	0.1	44.30
Birch	7,529	204	(N/A)	0.1	0.1	102.01
Pin oak	4,955	134	(N/A)	0.1	0.1	67.14
Dogwood	15	0	(N/A)	0.1	0.0	0.20
Kentucky coffeetree	10,981	298	(N/A)	0.1	0.2	148.79
Broadleaf Deciduous Large	14,478	392	(N/A)	0.1	0.2	196.17
Quaking aspen	9,433	256	(N/A)	0.1	0.1	127.82
Siberian elm	5,904	160	(N/A)	0.0	0.1	159.99
Willow	12	0	(N/A)	0.0	0.0	0.33
Ash	3,764	102	(N/A)	0.0	0.1	102.01
Elm	7,239	196	(N/A)	0.0	0.1	196.17
Black locust	2,479	67	(N/A)	0.0	0.0	67.19
Black ash	1,409	38	(N/A)	0.0	0.0	38.19
Tulip tree	3,943	107	(N/A)	0.0	0.1	106.85
Oak	7,239	196	(N/A)	0.0	0.1	196.17
Basswood	5,491	149	(N/A)	0.0	0.1	148.79
Citywide total	6,701,078	181,599	(N/A)	100.0	100.0	83.84

Annual Air Quality Benefits of Public Trees

1/28/2021

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	343.2	58.2	166.3	15.2	1,844	570.5	83.5	79.7	547.3	3,569	-179.9	-674	1,684.2	4,739	(N/A)	15.7	13.94
Green ash	117.8	18.8	55.7	5.3	626	378.8	55.2	52.6	359.9	2,361	0.0	0	1,044.2	2,986	(N/A)	12.6	10.94
Norway maple	127.8	22.1	62.5	5.7	690	307.3	44.4	42.3	287.5	1,903	-29.7	-112	869.8	2,482	(N/A)	11.5	9.93
Apple	16.9	2.8	8.1	0.8	90	66.6	9.6	9.1	61.5	411	-0.1	0	175.3	501	(N/A)	8.0	2.88
Sugar maple	76.2	13.0	36.8	3.4	409	193.5	28.3	27.0	184.7	1,208	-59.0	-221	503.7	1,396	(N/A)	6.0	10.82
Blue spruce	21.9	4.3	17.8	2.7	144	44.6	6.5	6.2	42.5	278	-54.2	-203	92.2	218	(N/A)	3.6	2.84
Northern red oak	9.0	1.6	4.6	0.4	49	28.0	4.1	3.9	26.6	174	-12.7	-48	65.3	176	(N/A)	3.5	2.34
Black walnut	53.2	8.5	24.1	2.4	280	125.7	18.3	17.4	119.2	783	0.0	0	368.9	1,062	(N/A)	3.4	14.55
Red maple	22.5	3.8	10.6	1.0	120	55.9	8.2	7.8	53.5	349	-7.6	-29	155.6	441	(N/A)	2.8	7.35
Northern hackberry	44.6	7.7	21.9	2.0	241	107.6	15.6	14.9	101.4	668	0.0	0	315.7	909	(N/A)	2.5	16.53
Bur oak	62.7	10.0	27.5	2.8	327	104.3	15.2	14.6	99.8	652	0.0	0	337.0	979	(N/A)	2.5	17.80
White ash	20.6	3.3	9.5	0.9	109	51.4	7.6	7.2	49.8	323	0.0	0	150.4	432	(N/A)	1.6	12.70
Plum	0.0	0.0	0.1	0.0	0	1.6	0.2	0.2	1.4	10	0.0	0	3.5	10	(N/A)	1.4	0.32
Littleleaf linden	12.5	2.2	6.1	0.6	67	31.7	4.6	4.4	29.8	197	-6.0	-22	85.8	242	(N/A)	1.3	8.34
Spruce	2.5	0.5	2.1	0.3	17	6.3	0.9	0.9	5.9	39	-11.4	-43	7.9	13	(N/A)	1.3	0.45
Northern pin oak	17.6	3.0	8.5	0.8	95	36.5	5.3	5.0	34.2	226	-4.0	-15	106.9	306	(N/A)	1.3	10.93
River birch	14.6	2.5	7.1	0.6	79	30.4	4.4	4.2	28.3	188	-3.3	-13	88.8	254	(N/A)	1.2	9.42
Eastern white pine	9.6	1.9	7.8	1.2	63	19.2	2.8	2.7	18.5	120	-41.1	-154	22.6	29	(N/A)	1.2	1.08
Chinese elm	18.4	2.9	8.3	0.8	96	43.4	6.3	6.0	41.2	270	0.0	0	127.4	367	(N/A)	1.2	14.11
Norway spruce	6.3	1.3	5.1	0.8	42	12.8	1.9	1.8	12.3	80	-28.8	-108	13.5	14	(N/A)	1.1	0.57
Honeylocust	18.2	3.0	8.2	0.8	96	37.4	5.5	5.2	35.9	234	-14.2	-53	99.9	276	(N/A)	1.1	12.01
Black maple	16.1	2.7	7.4	0.7	85	29.8	4.3	4.1	28.2	186	-5.2	-20	88.1	251	(N/A)	1.0	11.41
Callery pear	0.4	0.1	0.3	0.0	2	4.3	0.6	0.6	3.9	26	-0.1	-1	10.0	28	(N/A)	1.0	1.34
White oak	19.6	3.1	8.7	0.9	103	37.8	5.5	5.3	36.2	236	0.0	0	117.1	339	(N/A)	1.0	16.14
Broadleaf Deciduous Small	2.1	0.4	1.0	0.1	11	6.6	0.9	0.9	6.0	40	0.0	0	18.0	52	(N/A)	0.8	2.87
Swamp white oak	1.6	0.3	0.9	0.1	9	8.9	1.3	1.2	8.6	56	-0.4	-2	22.5	63	(N/A)	0.7	3.95
Lilac	6.6	1.1	3.0	0.3	35	15.2	2.2	2.1	13.9	93	0.0	0	44.2	128	(N/A)	0.7	7.98
Boxelder	3.9	0.6	1.8	0.2	21	14.0	2.0	1.9	13.2	87	-1.6	-6	36.1	102	(N/A)	0.6	7.27
Eastern cottonwood	18.5	3.0	8.1	0.8	96	28.7	4.2	4.0	27.5	179	0.0	0	94.8	276	(N/A)	0.6	21.21
American basswood	7.7	1.3	3.7	0.3	41	21.1	3.0	2.9	19.6	130	-6.4	-24	53.2	147	(N/A)	0.6	11.34
Japanese tree lilac	0.9	0.1	0.4	0.0	5	4.1	0.6	0.6	3.7	25	0.0	0	10.5	30	(N/A)	0.6	2.50
Black cherry	0.5	0.1	0.2	0.0	2	1.7	0.2	0.2	1.6	11	0.0	0	4.6	13	(N/A)	0.5	1.19
Scotch pine	3.1	0.6	2.6	0.4	21	7.3	1.1	1.0	7.1	46	-12.5	-47	10.7	20	(N/A)	0.5	1.80
American sycamore	11.0	1.8	4.9	0.5	57	20.3	3.0	2.8	19.4	127	0.0	0	63.5	184	(N/A)	0.5	18.41
Flowering dogwood	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)	0.4	0.11

Annual Air Quality Benefits of Public Trees

1/28/2021

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								
Catalpa	8.0	1.3	3.5	0.4	42	14.7	2.1	2.0	14.0	92	0.0	0	46.1	134	(N/A)	0.4	16.70
Pear	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	0.11
Northern white cedar	2.7	0.5	2.2	0.3	18	5.3	0.8	0.7	5.1	33	-12.5	-47	5.3	4	(N/A)	0.4	0.55
Austrian pine	2.3	0.5	1.9	0.3	15	4.7	0.7	0.7	4.5	29	-5.7	-21	9.8	23	(N/A)	0.4	2.92
Conifer Evergreen Small	2.4	0.5	1.9	0.3	16	3.8	0.5	0.5	3.5	23	-6.3	-24	7.1	15	(N/A)	0.3	2.19
Southern magnolia	3.6	0.7	3.1	0.4	24	8.1	1.2	1.1	7.9	51	-5.4	-20	20.7	55	(N/A)	0.3	7.80
Amur maple	1.9	0.3	0.9	0.1	10	6.4	0.9	0.9	6.0	39	0.0	0	17.3	49	(N/A)	0.3	7.07
Conifer Evergreen Large	3.8	0.7	3.0	0.5	24	6.0	0.9	0.8	5.7	37	-18.6	-70	2.7	-8	(N/A)	0.3	-1.14
Broadleaf Deciduous Medium	0.5	0.1	0.3	0.0	3	2.8	0.4	0.4	2.7	18	-0.1	0	7.0	20	(N/A)	0.3	3.27
Paper birch	0.9	0.1	0.5	0.0	5	6.2	0.9	0.9	6.0	39	0.0	0	15.6	44	(N/A)	0.3	7.32
Ohio buckeye	1.4	0.2	0.7	0.1	7	4.3	0.6	0.6	4.1	27	-0.3	-1	11.6	33	(N/A)	0.2	6.60
Eastern redbud	1.2	0.2	0.5	0.1	6	3.6	0.5	0.5	3.3	22	0.0	0	9.9	28	(N/A)	0.2	5.67
Cottonwood	5.9	0.9	2.6	0.3	31	8.9	1.3	1.2	8.6	56	0.0	0	29.8	87	(N/A)	0.2	21.67
Mulberry	0.9	0.1	0.4	0.0	5	3.1	0.4	0.4	2.9	19	0.0	0	8.4	24	(N/A)	0.2	6.00
American elm	3.0	0.5	1.5	0.1	16	7.6	1.1	1.1	7.3	47	0.0	0	22.2	64	(N/A)	0.2	15.94
Black poplar	4.8	0.8	2.1	0.2	25	6.9	1.0	1.0	6.6	43	0.0	0	23.2	68	(N/A)	0.1	22.55
Eastern red cedar	1.0	0.2	0.8	0.1	7	1.6	0.2	0.2	1.5	10	-2.7	-10	3.1	7	(N/A)	0.1	2.19
Birch	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)	0.1	13.58
Pin oak	0.9	0.2	0.5	0.0	5	1.9	0.3	0.3	1.8	12	-1.7	-6	4.1	10	(N/A)	0.1	5.17
Dogwood	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)	0.1	0.11
Kentucky coffeetree	1.6	0.3	0.7	0.1	8	3.7	0.5	0.5	3.5	23	0.0	0	10.9	31	(N/A)	0.1	15.71
Broadleaf Deciduous Large	2.7	0.4	1.2	0.1	14	4.4	0.6	0.6	4.2	27	0.0	0	14.3	42	(N/A)	0.1	20.79
Quaking aspen	1.3	0.2	0.6	0.1	7	3.4	0.5	0.5	3.2	21	0.0	0	9.8	28	(N/A)	0.1	14.09
Siberian elm	1.2	0.2	0.6	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.8	20	(N/A)	0.0	19.64
Willow	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)	0.0	0.14
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)	0.0	13.58
Elm	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)	0.0	19.04
Black locust	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)	0.0	10.16
Black 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)	0.0	7.92
Tulip tree	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)	0.0	12.48
Oak	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23	(N/A)	0.0	22.55
Basswood	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	0.0	15.71
Citywide total	1,167.5	196.8	574.2	56.6	6,304	2,578.2	375.5	358.0	2,448.9	16,065	-532.7	-1,998	7,223.2	20,372	(N/A)	100.0	9.41

Stored CO2 Benefits of Public Trees

1/28/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	8,240,011	61,800	(N/A)	15.7	29.3	181.76
Green ash	3,879,253	29,094	(N/A)	12.6	13.8	106.57
Norway maple	2,108,067	15,811	(N/A)	11.5	7.5	63.24
Apple	269,170	2,019	(N/A)	8.0	1.0	11.60
Sugar maple	2,231,265	16,734	(N/A)	6.0	7.9	129.72
Blue spruce	169,991	1,275	(N/A)	3.6	0.6	16.56
Northern red oak	181,935	1,365	(N/A)	3.5	0.6	18.19
Black walnut	1,774,935	13,312	(N/A)	3.4	6.3	182.36
Red maple	245,806	1,844	(N/A)	2.8	0.9	30.73
Northern hackberry	708,937	5,317	(N/A)	2.5	2.5	96.67
Bur oak	2,188,520	16,414	(N/A)	2.5	7.8	298.43
White ash	355,577	2,667	(N/A)	1.6	1.3	78.44
Plum	2,231	17	(N/A)	1.4	0.0	0.54
Littleleaf linden	265,396	1,990	(N/A)	1.3	0.9	68.64
Spruce	26,916	202	(N/A)	1.3	0.1	7.21
Northern pin oak	291,880	2,189	(N/A)	1.3	1.0	78.18
River birch	241,237	1,809	(N/A)	1.2	0.9	67.01
Eastern white pine	102,104	766	(N/A)	1.2	0.4	28.36
Chinese elm	614,955	4,612	(N/A)	1.2	2.2	177.39
Norway spruce	72,290	542	(N/A)	1.1	0.3	22.59
Honeylocust	233,909	1,754	(N/A)	1.1	0.8	76.27
Black maple	170,475	1,279	(N/A)	1.0	0.6	58.12
Callery pear	8,145	61	(N/A)	1.0	0.0	2.91
White oak	677,150	5,079	(N/A)	1.0	2.4	241.84
Broadleaf Deciduous	33,928	254	(N/A)	0.8	0.1	14.14
Swamp white oak	27,209	204	(N/A)	0.7	0.1	12.75
Lilac	102,049	765	(N/A)	0.7	0.4	47.84
Boxelder	121,885	914	(N/A)	0.6	0.4	65.30
Eastern cottonwood	647,557	4,857	(N/A)	0.6	2.3	373.59
American basswood	281,452	2,111	(N/A)	0.6	1.0	162.38
Japanese tree lilac	14,880	112	(N/A)	0.6	0.1	9.30
Black cherry	7,865	59	(N/A)	0.5	0.0	5.36
Scotch pine	30,055	225	(N/A)	0.5	0.1	20.49
American sycamore	372,771	2,796	(N/A)	0.5	1.3	279.58
Flowering dogwood	124	1	(N/A)	0.4	0.0	0.10
Catalpa	275,898	2,069	(N/A)	0.4	1.0	258.65
Pear	110	1	(N/A)	0.4	0.0	0.10
Northern white cedar	31,535	237	(N/A)	0.4	0.1	29.56
Austrian pine	18,466	138	(N/A)	0.4	0.1	17.31
Conifer Evergreen Sn	7,714	58	(N/A)	0.3	0.0	8.27
Southern magnolia	36,174	271	(N/A)	0.3	0.1	38.76
Amur maple	28,671	215	(N/A)	0.3	0.1	30.72
Conifer Evergreen La	48,285	362	(N/A)	0.3	0.2	51.73
Broadleaf Deciduous	7,921	59	(N/A)	0.3	0.0	9.90
Paper birch	28,965	217	(N/A)	0.3	0.1	36.21
Ohio buckeye	22,646	170	(N/A)	0.2	0.1	33.97
Eastern redbud	18,338	138	(N/A)	0.2	0.1	27.51
Cottonwood	207,204	1,554	(N/A)	0.2	0.7	388.51
Mulberry	13,725	103	(N/A)	0.2	0.0	25.73
American elm	64,363	483	(N/A)	0.2	0.2	120.68
Black poplar	167,946	1,260	(N/A)	0.1	0.6	419.86
Eastern red cedar	3,306	25	(N/A)	0.1	0.0	8.27
Birch	28,560	214	(N/A)	0.1	0.1	107.10
Pin oak	24,964	187	(N/A)	0.1	0.1	93.62
Dogwood	28	0	(N/A)	0.1	0.0	0.10

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.

Stored CO2 Benefits of Public Trees

1/28/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Kentucky coffeetree	51,886	389	(N/A)	0.1	0.2	194.57
Broadleaf Deciduous	95,241	714	(N/A)	0.1	0.3	357.15
Quaking aspen	41,716	313	(N/A)	0.1	0.1	156.43
Siberian elm	29,353	220	(N/A)	0.0	0.1	220.15
Willow	17	0	(N/A)	0.0	0.0	0.13
Ash	14,280	107	(N/A)	0.0	0.1	107.10
Elm	39,259	294	(N/A)	0.0	0.1	294.44
Black locust	7,945	60	(N/A)	0.0	0.0	59.59
Black ash	3,624	27	(N/A)	0.0	0.0	27.18
Tulip tree	15,773	118	(N/A)	0.0	0.1	118.30
Oak	55,982	420	(N/A)	0.0	0.2	419.86
Basswood	25,943	195	(N/A)	0.0	0.1	194.57
Citywide total	28,115,769	210,868	(N/A)	100.0	100.0	97.35

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

Independence

Annual CO 2 Benefits of Public Trees

1/28/2021

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	559,166	4,194	-39,558	-1,397	-307	202,978	1,522	721,189	5,409 (N/A)	15.7	34.8	15.91
Green ash	183,346	1,375	-18,620	-834	-146	133,195	999	297,086	2,228 (N/A)	12.6	14.3	8.16
Norway maple	77,498	581	-10,125	-684	-81	106,292	797	172,981	1,297 (N/A)	11.5	8.4	5.19
Apple	20,607	155	-1,294	-196	-11	22,780	171	41,897	314 (N/A)	8.0	2.0	1.81
Sugar maple	102,419	768	-10,712	-458	-84	68,422	513	159,671	1,198 (N/A)	6.0	7.7	9.28
Blue spruce	8,765	66	-816	-177	-7	15,733	118	23,506	176 (N/A)	3.6	1.1	2.29
Northern red oak	6,916	52	-875	-76	-7	9,838	74	15,803	119 (N/A)	3.5	0.8	1.58
Black walnut	58,489	439	-8,520	-290	-66	44,132	331	93,811	704 (N/A)	3.4	4.5	9.64
Red maple	19,898	149	-1,180	-109	-10	19,806	149	38,415	288 (N/A)	2.8	1.9	4.80
Northern hackberry	30,619	230	-3,403	-222	-27	37,497	281	64,491	484 (N/A)	2.5	3.1	8.79
Bur oak	30,817	231	-10,505	-259	-81	36,951	277	57,003	428 (N/A)	2.5	2.8	7.77
White ash	25,867	194	-1,707	-95	-14	18,463	138	42,528	319 (N/A)	1.6	2.1	9.38
Plum	591	4	-12	-10	0	521	4	1,090	8 (N/A)	1.4	0.1	0.26
Littleleaf linden	17,405	131	-1,274	-82	-10	11,007	83	27,055	203 (N/A)	1.3	1.3	7.00
Spruce	1,234	9	-129	-28	-1	2,180	16	3,257	24 (N/A)	1.3	0.2	0.87
Northern pin oak	3,219	24	-1,402	-93	-11	12,632	95	14,356	108 (N/A)	1.3	0.7	3.85
River birch	7,567	57	-1,158	-69	-9	10,478	79	16,818	126 (N/A)	1.2	0.8	4.67
Eastern white pine	3,760	28	-490	-81	-4	6,860	51	10,050	75 (N/A)	1.2	0.5	2.79
Chinese elm	19,739	148	-2,952	-101	-23	15,238	114	31,924	239 (N/A)	1.2	1.5	9.21
Norway spruce	2,777	21	-347	-52	-3	4,565	34	6,943	52 (N/A)	1.1	0.3	2.17
Honeylocust	15,944	120	-1,123	-62	-9	13,294	100	28,053	210 (N/A)	1.1	1.4	9.15
Black maple	4,177	31	-818	-59	-7	10,447	78	13,746	103 (N/A)	1.0	0.7	4.69
Callery pear	1,833	14	-47	-12	0	1,449	11	3,225	24 (N/A)	1.0	0.2	1.15
White oak	13,433	101	-3,250	-90	-25	13,399	100	23,492	176 (N/A)	1.0	1.1	8.39
Broadleaf Deciduous Smal	2,744	21	-163	-20	-1	2,226	17	4,788	36 (N/A)	0.8	0.2	1.99
Swamp white oak	3,240	24	-133	-18	-1	3,170	24	6,259	47 (N/A)	0.7	0.3	2.93
Lilac	592	4	-490	-53	-4	5,146	39	5,195	39 (N/A)	0.7	0.3	2.44
Boxelder	9,810	74	-586	-37	-5	4,907	37	14,094	106 (N/A)	0.6	0.7	7.55
Eastern cottonwood	8,006	60	-3,108	-72	-24	10,169	76	14,995	112 (N/A)	0.6	0.7	8.65
American basswood	15,789	118	-1,351	-52	-11	7,260	54	21,646	162 (N/A)	0.6	1.0	12.49
Japanese tree lilac	968	7	-72	-13	-1	1,387	10	2,270	17 (N/A)	0.6	0.1	1.42
Black cherry	262	2	-38	-8	0	580	4	797	6 (N/A)	0.5	0.0	0.54

Annual CO2 Benefits of Public Trees

Table 5 Continued

1/28/2021

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
Scotch pine	1,771	13	-144	-27	-1	2,625	20	4,225	32 (N/A)	0.5	0.2	2.88
American sycamore	8,445	63	-1,789	-49	-14	7,163	54	13,769	103 (N/A)	0.5	0.7	10.33
Flowering dogwood	78	1	-1	-2	0	51	0	126	1 (N/A)	0.4	0.0	0.10
Catalpa	5,334	40	-1,324	-36	-10	5,184	39	9,158	69 (N/A)	0.4	0.4	8.59
Pear	69	1	-1	-2	0	45	0	112	1 (N/A)	0.4	0.0	0.10
Northern white cedar	880	7	-151	-22	-1	1,896	14	2,603	20 (N/A)	0.4	0.1	2.44
Austrian pine	945	7	-89	-19	-1	1,674	13	2,512	19 (N/A)	0.4	0.1	2.35
Conifer Evergreen Small	300	2	-37	-14	0	1,308	10	1,557	12 (N/A)	0.3	0.1	1.67
Southern magnolia	1,810	14	-174	-17	-1	2,947	22	4,567	34 (N/A)	0.3	0.2	4.89
Amur maple	1,817	14	-138	-16	-1	2,212	17	3,875	29 (N/A)	0.3	0.2	4.15
Conifer Evergreen Large	187	1	-232	-32	-2	2,112	16	2,035	15 (N/A)	0.3	0.1	2.18
Broadleaf Deciduous Medi	1,064	8	-40	-6	0	991	7	2,009	15 (N/A)	0.3	0.1	2.51
Paper birch	2,864	21	-139	-12	-1	2,220	17	4,933	37 (N/A)	0.3	0.2	6.17
Ohio buckeye	1,001	8	-109	-10	-1	1,512	11	2,395	18 (N/A)	0.2	0.1	3.59
Eastern redbud	1,452	11	-88	-10	-1	1,226	9	2,581	19 (N/A)	0.2	0.1	3.87
Cottonwood	2,349	18	-995	-23	-8	3,173	24	4,505	34 (N/A)	0.2	0.2	8.45
Mulberry	1,128	8	-66	-8	-1	1,076	8	2,130	16 (N/A)	0.2	0.1	3.99
American elm	1,897	14	-309	-15	-2	2,695	20	4,268	32 (N/A)	0.2	0.2	8.00
Black poplar	1,437	11	-806	-18	-6	2,439	18	3,052	23 (N/A)	0.1	0.1	7.63
Eastern red cedar	0	0	-16	-6	0	561	4	539	4 (N/A)	0.1	0.0	1.35
Birch	0	0	-137	-9	-1	1,077	8	932	7 (N/A)	0.1	0.0	3.49
Pin oak	2,206	17	-120	-4	-1	659	5	2,741	21 (N/A)	0.1	0.1	10.28
Dogwood	17	0	0	0	0	11	0	28	0 (N/A)	0.1	0.0	0.10
Kentucky coffeetree	1,919	14	-249	-9	-2	1,300	10	2,962	22 (N/A)	0.1	0.1	11.11
Broadleaf Deciduous Large	1,391	10	-457	-11	-4	1,547	12	2,470	19 (N/A)	0.1	0.1	9.26
Quaking aspen	1,816	14	-200	-8	-2	1,202	9	2,811	21 (N/A)	0.1	0.1	10.54
Siberian elm	911	7	-141	-5	-1	749	6	1,514	11 (N/A)	0.0	0.1	11.36
Willow	5	0	0	0	0	7	0	12	0 (N/A)	0.0	0.0	0.09
Ash	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.0	0.0	6.27
Elm	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.0	0.1	10.90
Black locust	470	4	-38	-3	0	440	3	869	7 (N/A)	0.0	0.0	6.52
Black ash	386	3	-17	-2	0	395	3	762	6 (N/A)	0.0	0.0	5.71
Tulip tree	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.0	0.1	9.97
Oak	479	4	-269	-6	-2	813	6	1,017	8 (N/A)	0.0	0.0	7.63
Basswood	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.0	0.1	11.11

Annual CO $_2$ Benefits of Public Trees

Table 5 Continued

1/28/2021

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
Citywide total	1,305,022	9,788	-134,991	-6,221	-1,059	906,791	6,801	2,070,601	15,530 (N/A)	100.0	100.0	7.17

Annual Aesthetic/Other Benefits of Public Trees

1/28/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	41,192	(N/A)	15.7	37.0	121.15
Green ash	14,945	(N/A)	12.6	13.4	54.74
Norway maple	7,351	(N/A)	11.5	6.6	29.41
Apple	1,171	(N/A)	8.0	1.1	6.73
Sugar maple	10,138	(N/A)	6.0	9.1	78.59
Blue spruce	1,442	(N/A)	3.6	1.3	18.72
Northern red oak	645	(N/A)	3.5	0.6	8.60
Black walnut	4,270	(N/A)	3.4	3.8	58.49
Red maple	2,618	(N/A)	2.8	2.4	43.63
Northern hackberry	3,715	(N/A)	2.5	3.3	67.54
Bur oak	2,102	(N/A)	2.5	1.9	38.21
White ash	2,881	(N/A)	1.6	2.6	84.72
Plum	23	(N/A)	1.4	0.0	0.75
Littleleaf linden	1,773	(N/A)	1.3	1.6	61.14
Spruce	349	(N/A)	1.3	0.3	12.47
Northern pin oak	327	(N/A)	1.3	0.3	11.67
River birch	694	(N/A)	1.2	0.6	25.71
Eastern white pine	926	(N/A)	1.2	0.8	34.31
Chinese elm	1,467	(N/A)	1.2	1.3	56.43
Norway spruce	550	(N/A)	1.1	0.5	22.91
Honeylocust	3,798	(N/A)	1.1	3.4	165.14
Black maple	502	(N/A)	1.0	0.5	22.83
Callery pear	242	(N/A)	1.0	0.2	11.54
White oak	967	(N/A)	1.0	0.9	46.05
Broadleaf Deciduous Small	159	(N/A)	0.8	0.1	8.81
Swamp white oak	353	(N/A)	0.7	0.3	22.04
Lilac	35	(N/A)	0.7	0.0	2.20
Boxelder	710	(N/A)	0.6	0.6	50.68
Eastern cottonwood	499	(N/A)	0.6	0.4	38.37
American basswood	1,105	(N/A)	0.6	1.0	84.98
Japanese tree lilac	54	(N/A)	0.6	0.0	4.48
Black cherry	12	(N/A)	0.5	0.0	1.14
Scotch pine	423	(N/A)	0.5	0.4	38.48
American sycamore	557	(N/A)	0.5	0.5	55.69
Flowering dogwood	0	(N/A)	0.4	0.0	0.03
Catalpa	371	(N/A)	0.4	0.3	46.42
Pear	0	(N/A)	0.4	0.0	0.03
Northern white cedar	192	(N/A)	0.4	0.2	23.99
Austrian pine	146	(N/A)	0.4	0.1	18.28
Conifer Evergreen Small	96	(N/A)	0.3	0.1	13.68
Southern magnolia	183	(N/A)	0.3	0.2	26.14
Amur maple	106	(N/A)	0.3	0.1	15.17
Conifer Evergreen Large	47	(N/A)	0.3	0.0	6.73
Broadleaf Deciduous Medium	120	(N/A)	0.3	0.1	19.95
Paper birch	281	(N/A)	0.3	0.3	46.92
Ohio buckeye	107	(N/A)	0.2	0.1	21.46
Eastern redbud	86	(N/A)	0.2	0.1	17.18
Cottonwood	144	(N/A)	0.2	0.1	36.01

Annual Aesthetic/Other Benefits of Public Trees

1/28/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Mulberry	66	(N/A)	0.2	0.1	16.54
American elm	258	(N/A)	0.2	0.2	64.49
Black poplar	86	(N/A)	0.1	0.1	28.57
Eastern red cedar	0	(N/A)	0.1	0.0	0.00
Birch	0	(N/A)	0.1	0.0	0.00
Pin oak	158	(N/A)	0.1	0.1	78.89
Dogwood	0	(N/A)	0.1	0.0	0.03
Kentucky coffeetree	133	(N/A)	0.1	0.1	66.60
Broadleaf Deciduous Large	87	(N/A)	0.1	0.1	43.45
Quaking aspen	132	(N/A)	0.1	0.1	66.10
Siberian elm	54	(N/A)	0.0	0.0	53.50
Willow	3	(N/A)	0.0	0.0	2.74
Ash	31	(N/A)	0.0	0.0	31.46
Elm	58	(N/A)	0.0	0.1	58.34
Black locust	43	(N/A)	0.0	0.0	43.05
Black ash	39	(N/A)	0.0	0.0	39.16
Tulip tree	66	(N/A)	0.0	0.1	65.59
Oak	29	(N/A)	0.0	0.0	28.57
Basswood	67	(N/A)	0.0	0.1	66.60
Citywide total	111,184	(N/A)	100.0	100.0	51.33

Total Annual Benefits of Public Trees by Species ($)

1/28/2021

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Silver maple	24,796	5,409	4,739	50,339	41,192	126,475	(N/A)	28.6
Green ash	16,645	2,228	2,986	24,567	14,945	61,371	(N/A)	13.9
Norway maple	13,776	1,297	2,482	16,605	7,351	41,512	(N/A)	9.4
Apple	3,050	314	501	1,544	1,171	6,580	(N/A)	1.5
Sugar maple	8,453	1,198	1,396	14,209	10,138	35,393	(N/A)	8.0
Blue spruce	1,963	176	218	3,901	1,442	7,700	(N/A)	1.7
Northern red oak	1,234	119	176	1,274	645	3,447	(N/A)	0.8
Black walnut	5,534	704	1,062	9,589	4,270	21,160	(N/A)	4.8
Red maple	2,438	288	441	2,609	2,618	8,393	(N/A)	1.9
Northern hackberry	4,777	484	909	6,764	3,715	16,648	(N/A)	3.8
Bur oak	4,526	428	979	8,659	2,102	16,693	(N/A)	3.8
White ash	2,195	319	432	3,346	2,881	9,172	(N/A)	2.1
Plum	77	8	10	25	23	143	(N/A)	0.0
Littleleaf linden	1,417	203	242	1,926	1,773	5,560	(N/A)	1.3
Spruce	281	24	13	630	349	1,297	(N/A)	0.3
Northern pin oak	1,639	108	306	2,166	327	4,545	(N/A)	1.0
River birch	1,374	126	254	1,807	694	4,256	(N/A)	1.0
Eastern white pine	831	75	29	2,206	926	4,068	(N/A)	0.9
Chinese elm	1,915	239	367	3,278	1,467	7,267	(N/A)	1.6
Norway spruce	557	52	14	1,457	550	2,629	(N/A)	0.6
Honeylocust	1,621	210	276	2,498	3,798	8,404	(N/A)	1.9
Black maple	1,323	103	251	1,675	502	3,855	(N/A)	0.9
Callery pear	194	24	28	117	242	606	(N/A)	0.1
White oak	1,638	176	339	2,999	967	6,119	(N/A)	1.4
Broadleaf Deciduous Sn	308	36	52	177	159	731	(N/A)	0.2
Swamp white oak	384	47	63	298	353	1,145	(N/A)	0.3
Lilac	710	39	128	484	35	1,397	(N/A)	0.3
Boxelder	617	106	102	829	710	2,363	(N/A)	0.5
Eastern cottonwood	1,243	112	276	2,503	499	4,633	(N/A)	1.0
American basswood	948	162	147	1,453	1,105	3,816	(N/A)	0.9
Japanese tree lilac	193	17	30	92	54	386	(N/A)	0.1
Black cherry	82	6	13	44	12	157	(N/A)	0.0
Scotch pine	311	32	20	736	423	1,521	(N/A)	0.3
American sycamore	889	103	184	1,772	557	3,506	(N/A)	0.8
Flowering dogwood	8	1	1	2	0	12	(N/A)	0.0
Catalpa	642	69	134	1,206	371	2,422	(N/A)	0.5
Pear	7	1	1	2	0	11	(N/A)	0.0
Northern white cedar	229	20	4	624	192	1,070	(N/A)	0.2
Austrian pine	205	19	23	410	146	804	(N/A)	0.2
Conifer Evergreen Smal	172	12	15	310	96	605	(N/A)	0.1
Southern magnolia	340	34	55	541	183	1,152	(N/A)	0.3
Amur maple	283	29	49	154	106	622	(N/A)	0.1
Conifer Evergreen Large	260	15	-8	829	47	1,143	(N/A)	0.3
Broadleaf Deciduous M	122	15	20	90	120	366	(N/A)	0.1
Paper birch	268	37	44	276	281	906	(N/A)	0.2
Ohio buckeye	190	18	33	195	107	543	(N/A)	0.1
Eastern redbud	167	19	28	96	86	396	(N/A)	0.1
Cottonwood	387	34	87	785	144	1,436	(N/A)	0.3

Total Annual Benefits of Public Trees by Species ($)

1/28/2021

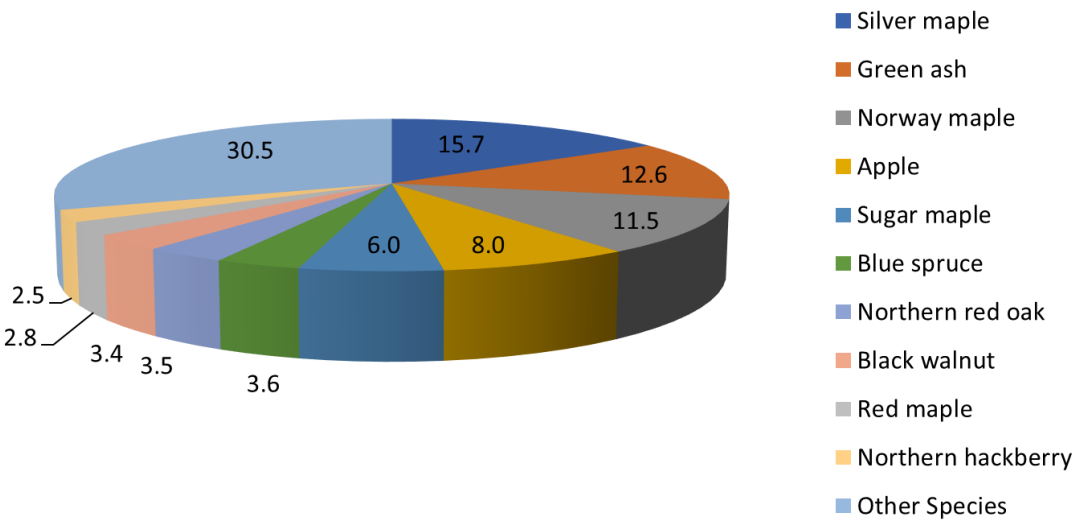
Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Mulberry	141	16	24	75	66	322	(N/A)	0.1
American elm	326	32	64	408	258	1,088	(N/A)	0.2
Black poplar	296	23	68	589	86	1,061	(N/A)	0.2
Eastern red cedar	74	4	7	133	0	217	(N/A)	0.0
Birch	142	7	27	204	0	380	(N/A)	0.1
Pin oak	81	21	10	134	158	404	(N/A)	0.1
Dogwood	2	0	0	0	0	3	(N/A)	0.0
Kentucky coffeetree	164	22	31	298	133	648	(N/A)	0.1
Broadleaf Deciduous La	190	19	42	392	87	729	(N/A)	0.2
Quaking aspen	153	21	28	256	132	590	(N/A)	0.1
Siberian elm	91	11	20	160	54	336	(N/A)	0.1
Willow	1	0	0	0	3	4	(N/A)	0.0
Ash	71	6	14	102	31	224	(N/A)	0.1
Elm	91	11	19	196	58	375	(N/A)	0.1
Black locust	59	7	10	67	43	186	(N/A)	0.0
Black ash	47	6	8	38	39	138	(N/A)	0.0
Tulip tree	71	10	12	107	66	266	(N/A)	0.1
Oak	99	8	23	196	29	354	(N/A)	0.1
Basswood	82	11	16	149	67	324	(N/A)	0.1
Citywide Total	113,399	15,530	20,372	181,599	111,184	442,083	(N/A)	100.0

Independence

Species Distribution of Public Trees

1/28/2021

Figure 1: Species Distribution



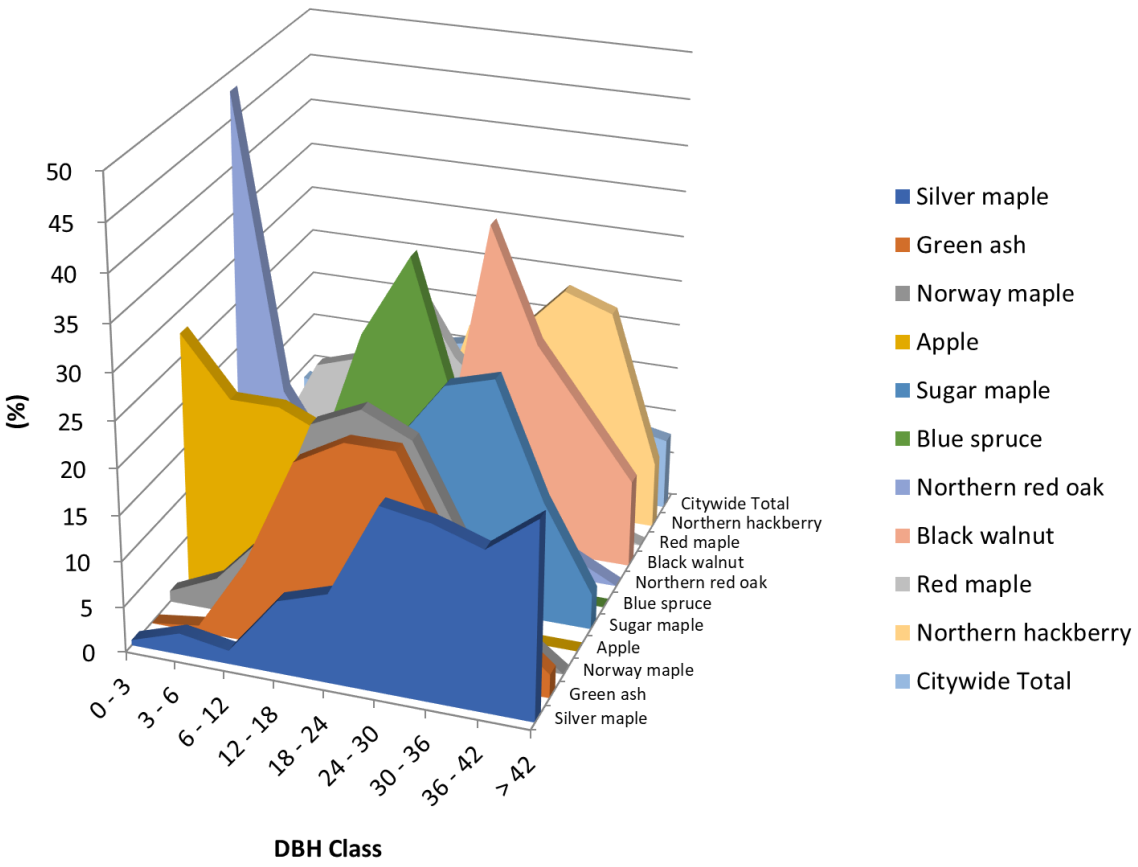
Species	Percent
Silver maple	15.7
Green ash	12.6
Norway maple	11.5
Apple	8.0
Sugar maple	6.0
Blue spruce	3.6
Northern red oak	3.5
Black walnut	3.4
Red maple	2.8
Northern hackberry	2.5
Other Species	30.5
Total	100.0

Independence

Figure 2: Relative Age Class

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

1/28/2021



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Silver maple	0.59	2.35	1.47	7.94	9.71	20.00	19.12	17.35	21.47
Green ash	0.00	0.73	8.79	20.51	23.44	23.44	13.55	6.96	2.56
Norway maple	1.20	3.60	9.20	22.40	24.80	22.40	12.40	4.00	0.00
Apple	27.59	21.26	21.26	18.97	6.90	2.87	1.15	0.00	0.00
Sugar maple	1.55	2.33	1.55	10.85	17.05	24.03	25.58	13.18	3.88
Blue spruce	6.49	2.60	10.39	25.97	35.06	18.18	1.30	0.00	0.00
Northern red oak	48.00	16.00	8.00	12.00	8.00	1.33	4.00	2.67	0.00
Black walnut	0.00	1.37	0.00	6.85	6.85	35.62	23.29	16.44	9.59
Red maple	5.00	15.00	16.67	26.67	18.33	13.33	3.33	1.67	0.00
Northern hackberry	0.00	0.00	0.00	3.64	20.00	20.00	25.45	23.64	7.27
Citywide Total	8.73	6.60	7.06	15.10	16.11	16.90	12.74	8.91	7.85

Figure 3: Foliage Condition

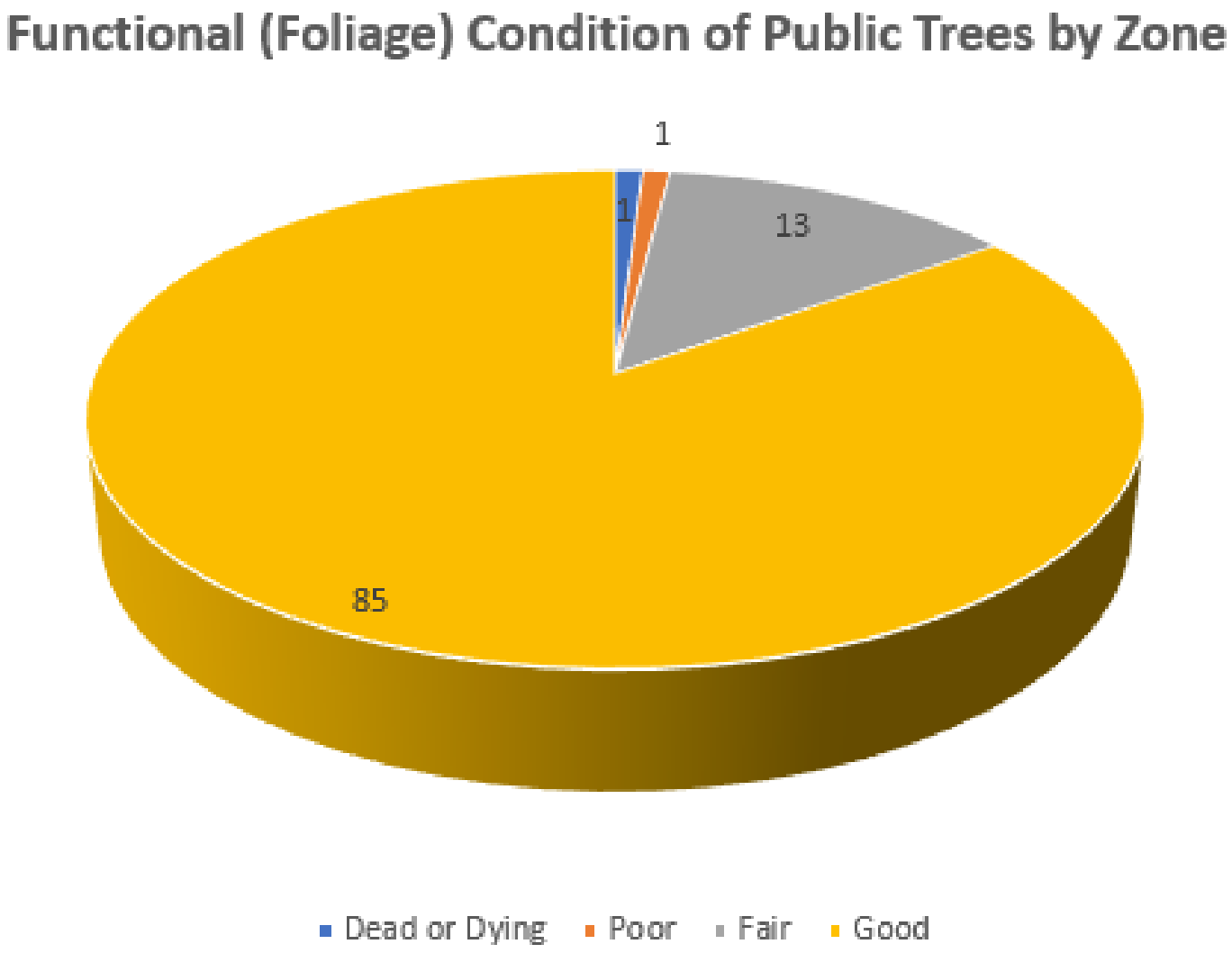


Figure 4: Wood Condition

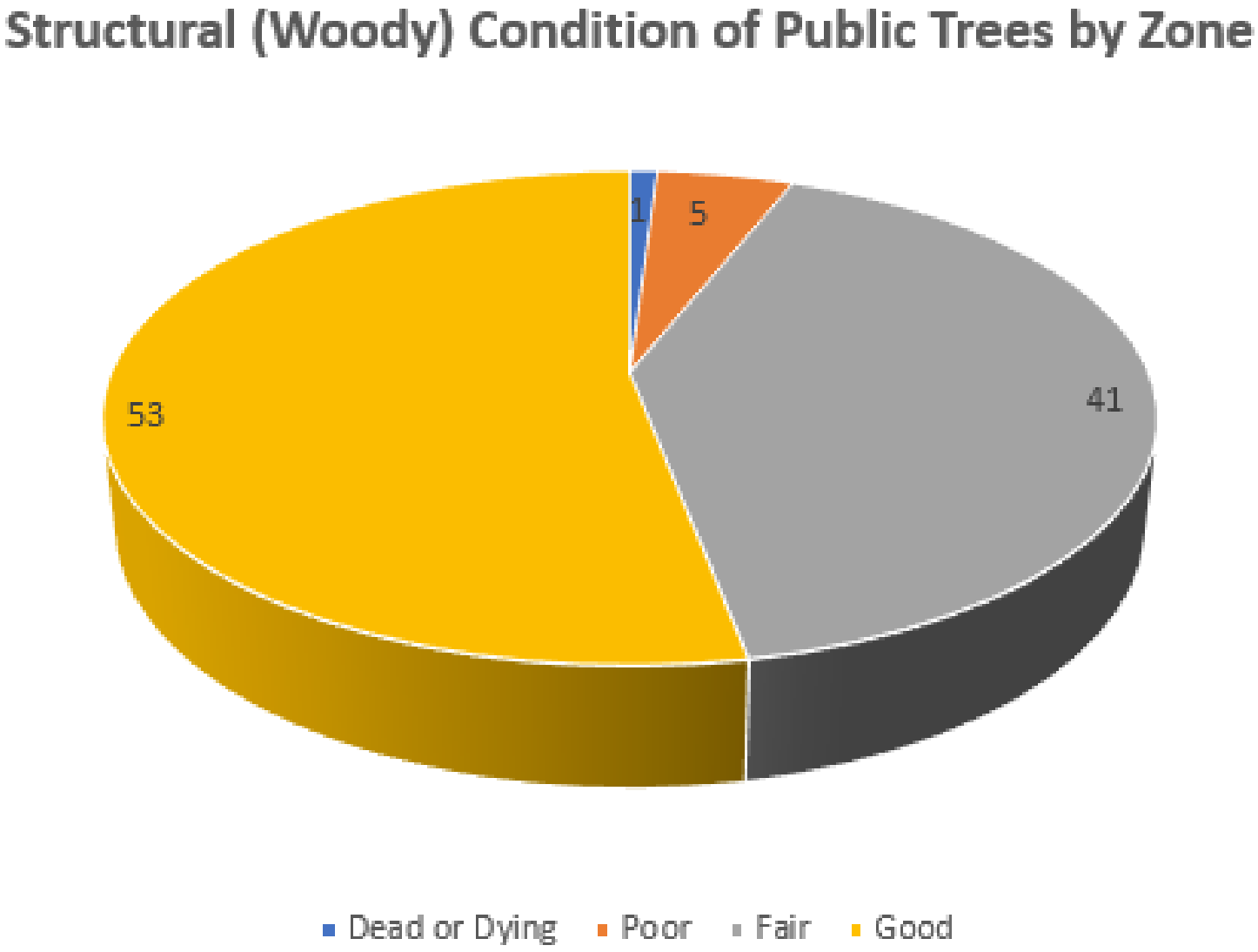
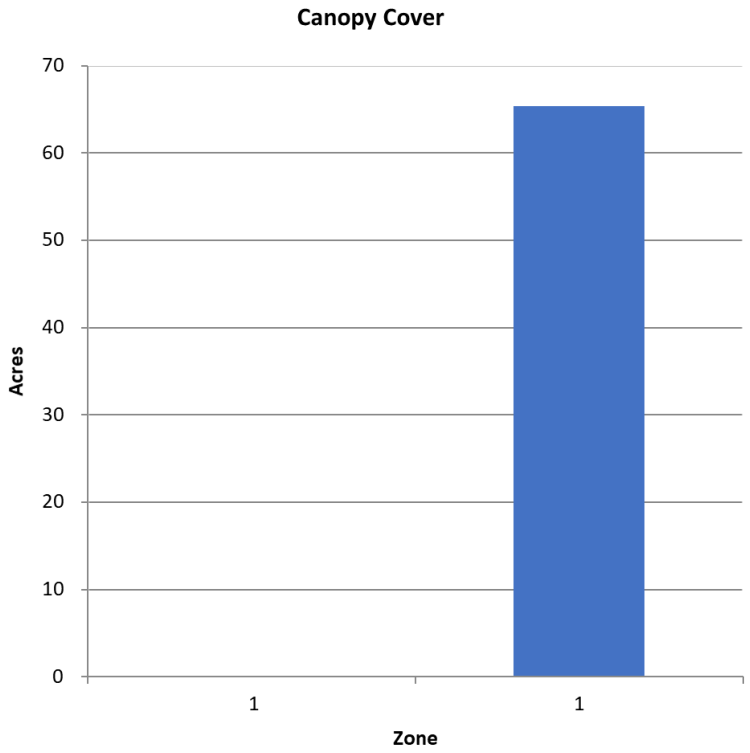


Figure 5: Canopy Cover in Acres

Independence

Canopy Cover of Public Trees (Acres)

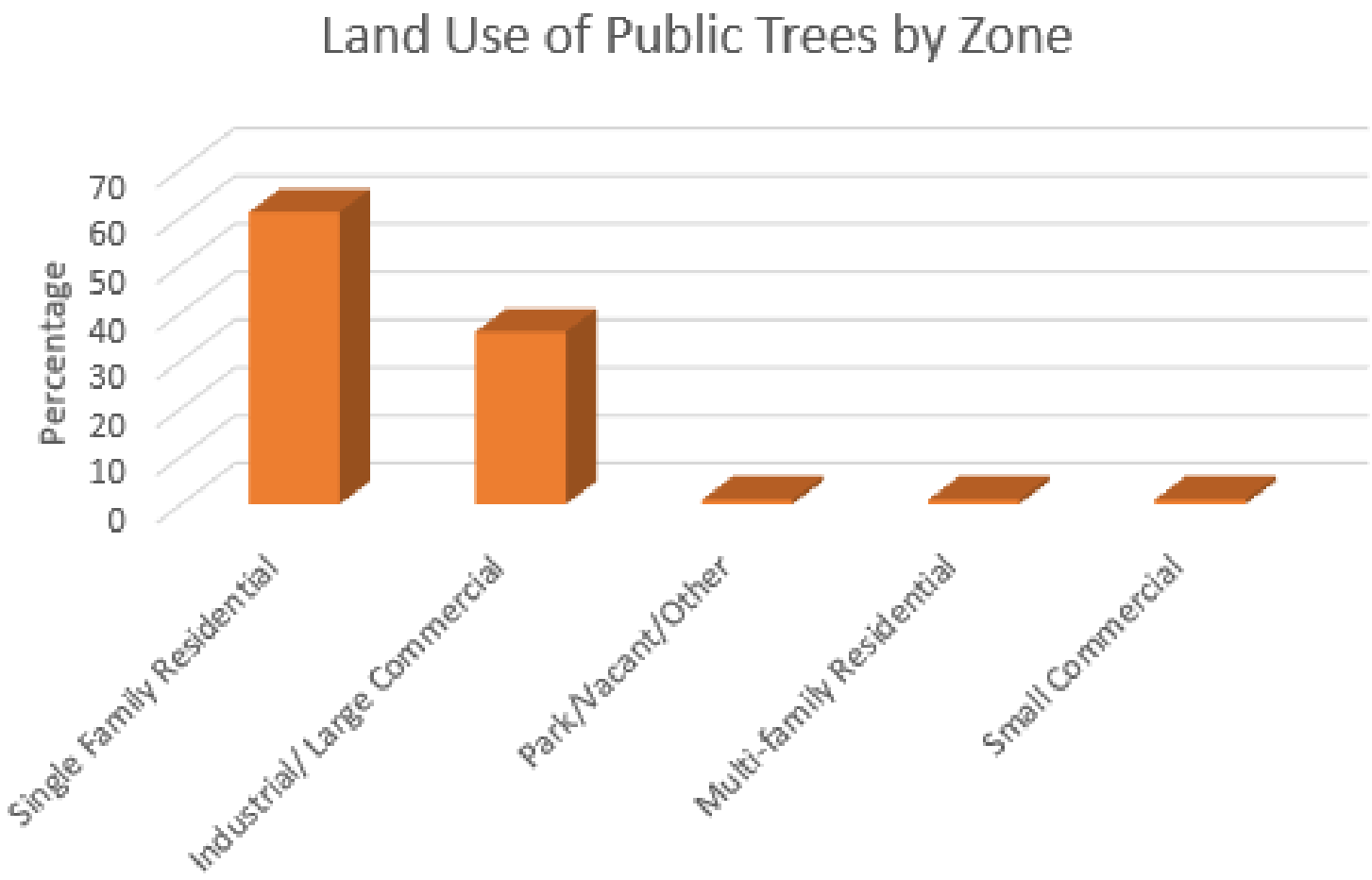
1/28/2021



Zone	Acres	% of Total Canopy Cover
1	0	0.0
1	65	100.0
Citywide total	65	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	65	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

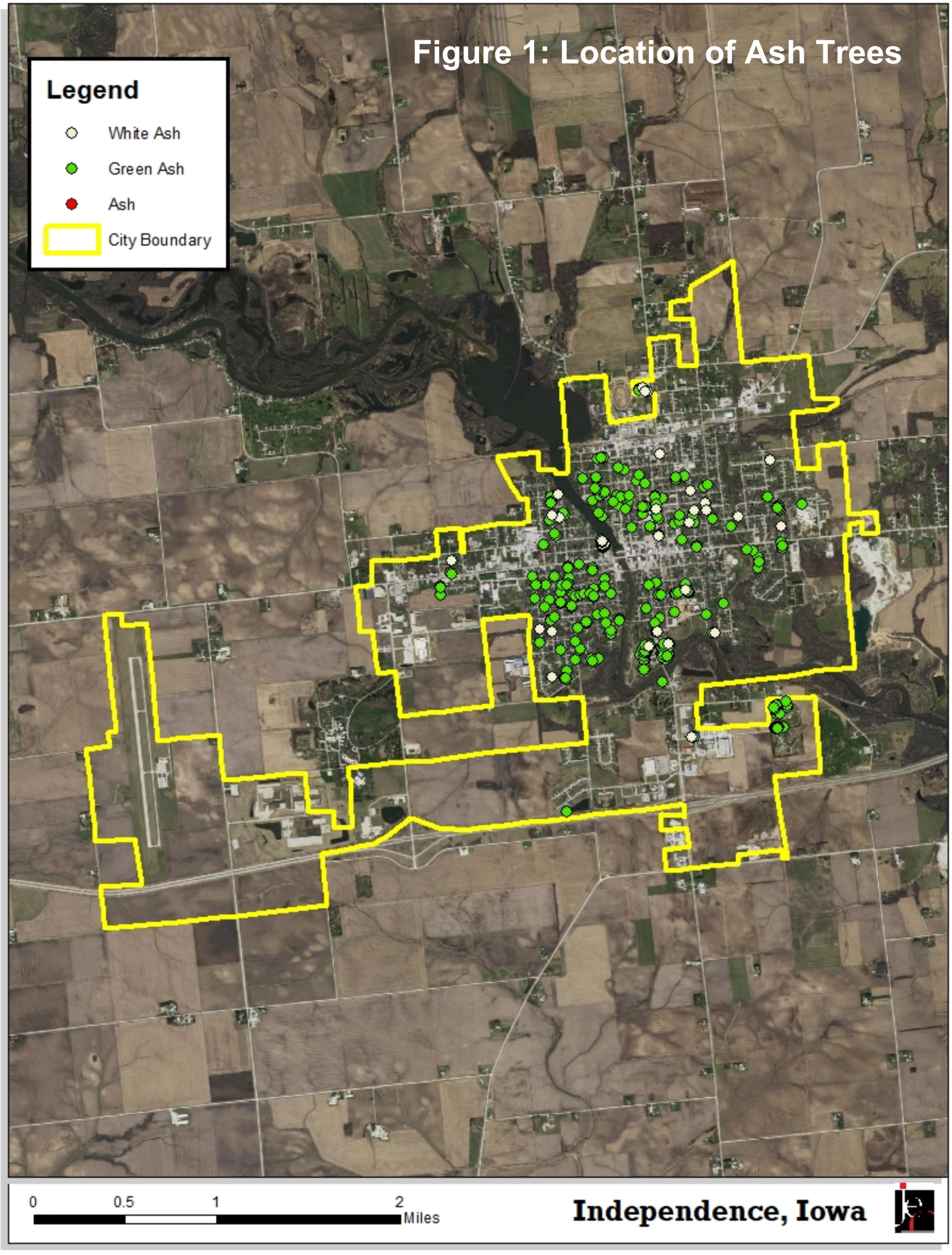
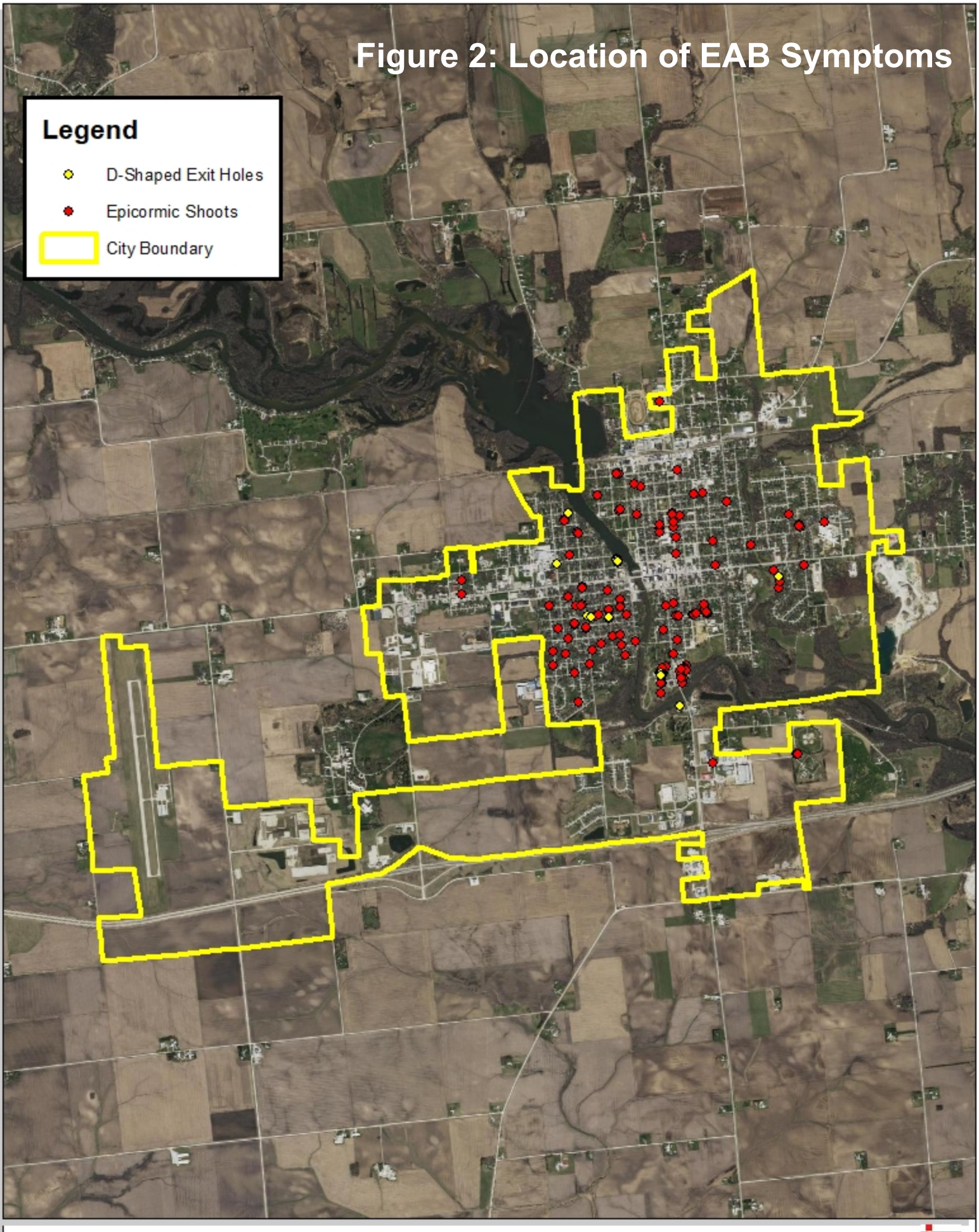


Figure 1: Location of Ash Trees
Legend
White Ash
Green Ash
Ash
City Boundary
0
0.5
1
2
Miles
Independence, Iowa

Figure 2: Location of EAB Symptoms



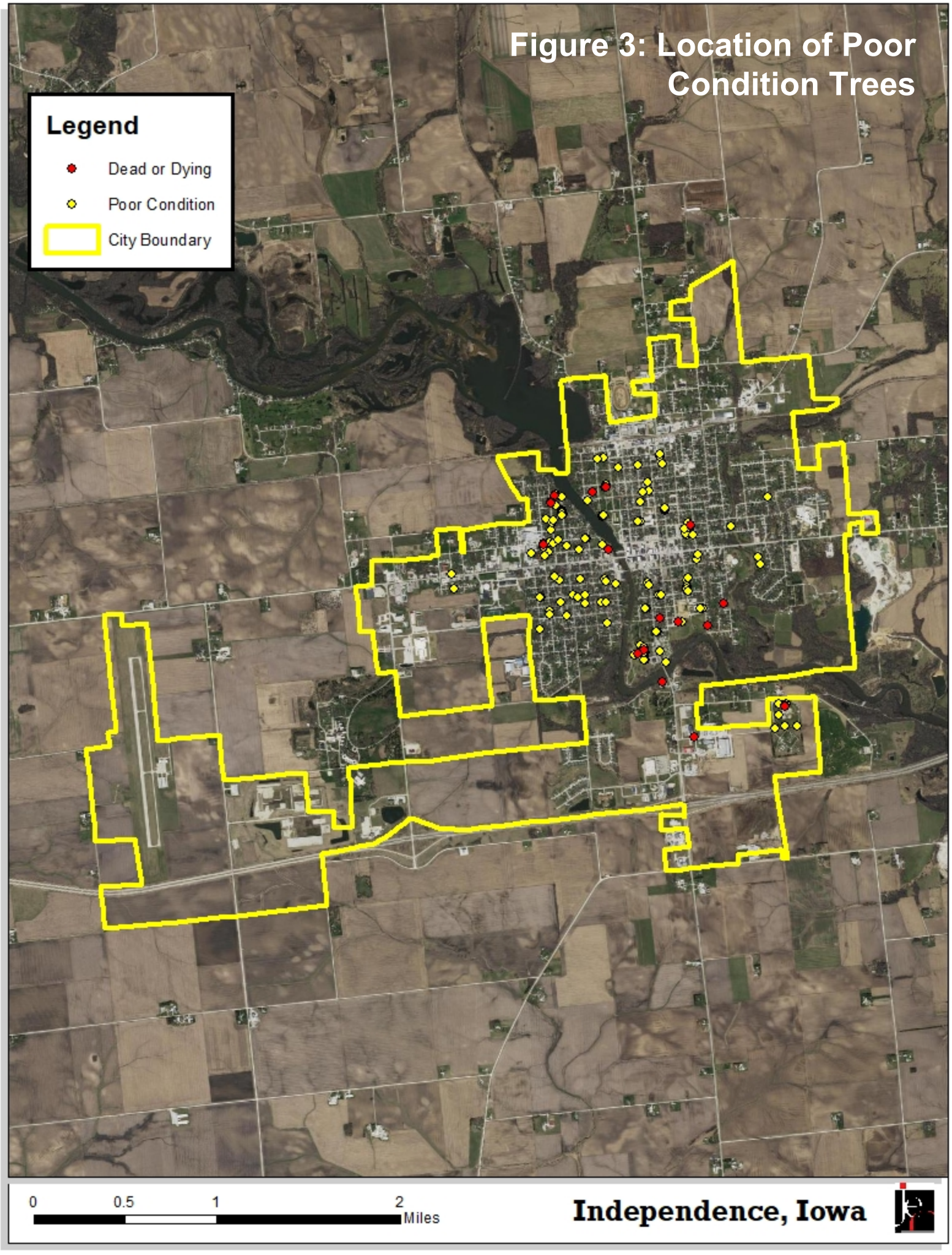
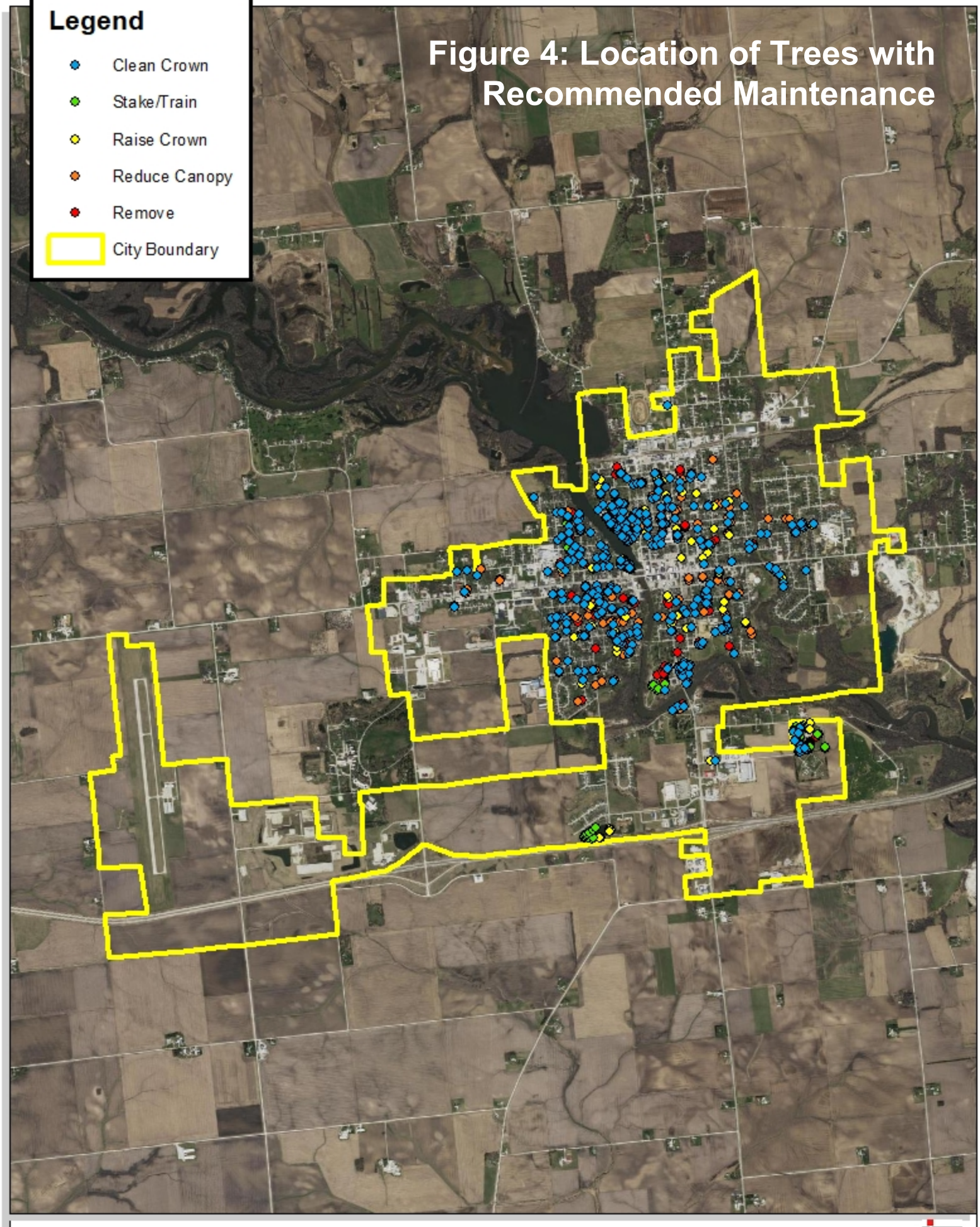


Figure 3: Location of Poor Condition Trees
Legend
Dead or Dying
Poor Condition
City Boundary
0
0.5
1
2
Miles
Independence, Iowa


Legend
Clean Crown
Stake/Train
Raise Crown
Reduce Canopy
Remove
City Boundary
Figure 4: Location of Trees with Recommended Maintenance
0
0.5
1
2
Miles
Independence, Iowa

APPENDIX C: INDEPENDENCE TREE ORDINANCES

151.01 DEFINITION.

For use in this chapter, “boulevard” 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 porϴon of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS.

No tree shall be planted in any boulevard or street except in accordance with the following:

1. Alignment. All tress planted in any street shall be planted in the boulevard 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 boulevard 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 over- hanging the street, trimmed so that all branches will be at least eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, 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, & e])*

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 infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

1. 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.
2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that the 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])*