Durant, IA:

2020 Urban Forest Management Plan

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Obtained from MSA Professional Services (msa-ps.com)

Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Durant 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 7% of Durant'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 survey of street and park trees. Below are some key findings of the 516 trees inventoried.

- Durant trees provide $104,535 of benefits annually, an average of $203 per tree
- There are over 47 species of trees
- The top three genera are: maple 47%, oak 13%, and ash 7%
- 51% of trees need some type of management
- 48 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 48 trees needing removal, 26 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*
- 28 of the 35 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 will take 4 years to remove ash. We suggest that city officials apply for grants to plant replacement trees.

Introduction

INTRODUCTION

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

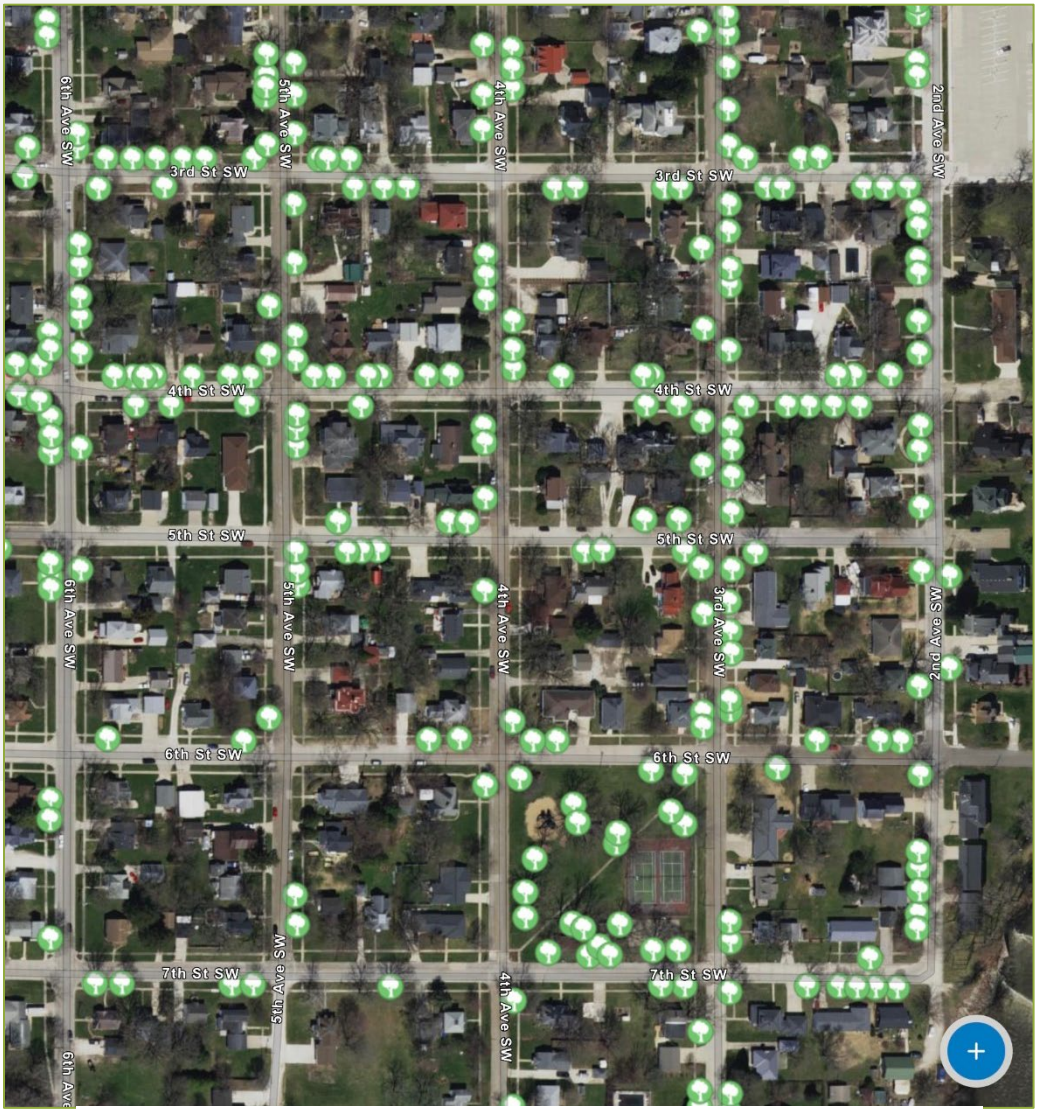
Assist Durant with Managing its Urban Forest

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 516 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. Durant's trees reduce energy-related costs by approximately $28,012 annually (Appendix A, Table 1). These savings are both in electricity (133.5 MWh) and in natural gas (18,245 Therms).

Annual Stormwater Benefits

Durant's trees intercept about 1,528,821 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $41,431 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 Durant, it is estimated that trees remove 1,739.2 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 $4,878 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Durant, trees sequester about 287,316 lbs of carbon per year with an associated value of $2,155 (Appendix A, Table 5). In addition, the trees store 6,036,340 lbs of carbon, with a yearly benefit of $45,273 (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. Durant receives $26,609 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, Durant's trees provide $104,535 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 516 trees in Durant provide approximately $203 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$28,012**	• Intercept **1,528,821 gallons** • Provides **$41,431** benefit	• Remove **1,739 lbs** of pollution • Net value of **$4,878**	• Sequester **287,316 lbs** • Value of **$2,155** • Store **6,036,340 lbs** • Value of **$45,273**	• **$26,609** in social benefits	• **$104,535** annual benefits • Each tree provides **$203** annually

FOREST STRUCTURE

Species Distribution

Durant has over 47 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	241	47%	Elm	6	<1%
Oak	68	13%	Pine	5	<1%
Ash	35	7%	Sycamore	3	<1%
Spruce	26	5%	Redbud	3	<1%
Hackberry	18	3%	Catalpa	2	<1%
Basswood/Linden	15	3%	Ginkgo	2	<1%
Walnut	14	3%	Cottonwood	1	<1%
Apple	13	3%	Pear	1	<1%
Tulip Tree	10	2%	Buckeye	1	<1%
Honey Locust	10	2%	Plum	1	<1%
Birch	8	2%	Other Deciduous	21	4%
Cedar	8	2%	Other Evergreen	4	<1%

Age Class

Most of Durant's trees (38%) are between 12 and 24 inches in diameter at 4.5 feet (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. Durant's size curve is a middle aged stand, indicating it is lacking a younger generation in the 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 Durant indicate that 94 percent of the trees are in good health, with only 6 percent of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 91 percent of Durant'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 9 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	153	30%
Crown Raising	65	13%
Tree Removal	48	9%
Crown Reduction	41	8%
Tree Staking	3	<1%

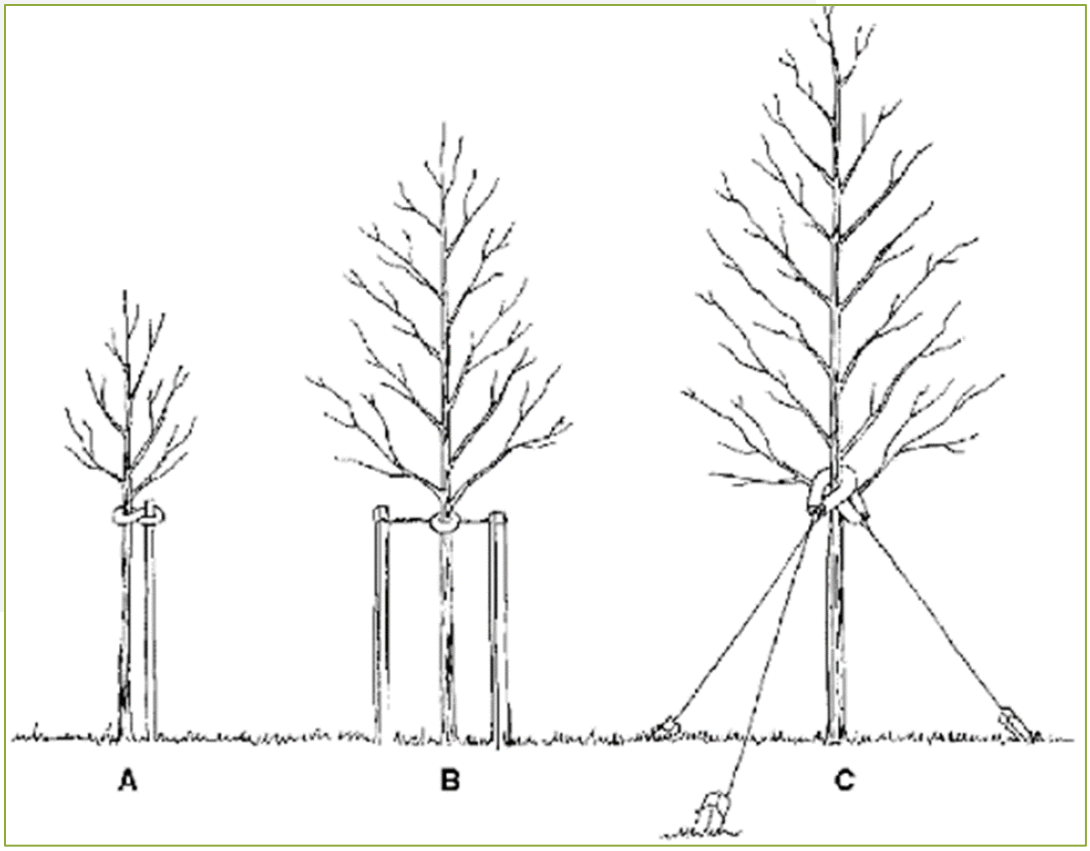
Canopy Cover

The total canopy with both private and public trees is 103.62 acres or around 14 percent. The canopy cover included in the Durant inventory includes approximately 15 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 25 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Durant's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure 7). The following describes the land use and locations for the street and park trees.

Land Use	Percentage
Single Family Residential	56%
Industrial/Large Commercial	42%
Park/Vacant/Other	2%
Multifamily Residential	<1%
Small Commercial	0%



Recommendations

RECOMMENDATIONS

Risk Management

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

HAZARDOUS TREES

Durant has 21 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 15 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 48 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 48 removals, 20 are ash trees. There are a total of 35 ash trees, and 28 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 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 percent. 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 Durant.

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 percent 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 (47%) (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. It is currently outlined in section 52-7 of the city ordinance that the only species to be planted include crab, magnolia, American maple, Aristocrat pear, ashes, white spire birch, Norway maple, elms (resistant to disease), tulip, hackberry chestnut, walnut, oak, and approved evergreens. We strongly recommend that this list be changed to be a “don’t plant” list, to help increase canopy diversity. This “do not plant list” should include ash, maple, chestnut, Callery pear, Amur maple, cottonwood, poplar, box elder, and Chinese elm.

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. According to the current city ordinances in section 52-7, the only trees permeated to be planted as replacements include crab, magnolia, American maple, Aristocrat pear, ashes, white spire birch, Norway maple, elms (resistant to disease), tulip, hackberry chestnut, walnut, oak, and approved evergreens. We strongly recommend that this list be changed to be a "don't plant" list, to help increase canopy diversity. This "do not plant list" should include ash, maple, chestnut, Callery pear, Amur maple, cottonwood, poplar, box elder, and Chinese elm.

Postponed Work

While finances, staffing, and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 52-12 states “The City shall have the right to cause the removal of any dead or diseased trees on private property within the City, when such trees constitute a hazard to life and property or harbor insects or disease which constitute a potential threat to other trees within the City. The Administrator will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within sixty (60) days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owner’s property tax notice.”

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $15,000/Year – (Based off Reported Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 17 trees recommended for immediate removal	$11,900
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,900**

YEAR 2	Est. Cost
Remove 14 trees recommended for immediate removal	$9,800
Plant 17 trees in open locations	$2,550
Prune 1/3 of city owned trees	$2,580
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,930**

YEAR 3	Est. Cost
Remove 17 trees recommended for immediate removal	$11,900
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$14,900**

YEAR 4	Est. Cost
Remove 6 remaining ash trees	$4,200
Plant 8 trees in open locations	$1,200
Prune 1/3 of city owned trees	$2,580
Visual Survey of EAB Signs/Symptoms	n/a
Additional removal, planting, and maintenance	$7,020
TOTAL	**$15,000**

YEAR 5	Est. Cost
Additional removal, planting, and maintenance	$15,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$15,000**

YEAR 6	Est. Cost
Additional removal, planting, and maintenance	$12,420
Prune 1/3 of city owned trees	$2,580
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$15,000**

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

***Reported city budget has been proven sufficient for removal and replacement of all dead or dying, dangerous, and ash trees. It is strongly advised to continue this practice to ensure sufficient funding for care and maintenance of new trees.*

Proposed Budget Increase

EAB could potentially kill all ash trees in Durant within four years of its arrival. To remove all ash trees alone within six years, the budget would need to be around $4,500 a year. Fortunately, the budget in Durant allows for the removal of all critical trees and ash trees in just under four years. We do recommend that Durant 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, all remaining ash trees could be treated per year (every other year treatment). 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 Durant. We suggest considering an increased budget to plan for this.

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Appendices

APPENDIX A: i-TREE DATA

Durant

Annual Energy Benefits of Public Trees

1/29/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	23.7	1,802	3,420.8	3,352	5,154	(N/A)	18.6	18.4	53.69
Silver maple	18.3	1,389	2,399.1	2,351	3,740	(N/A)	10.3	13.4	70.56
Red maple	7.3	555	999.1	979	1,534	(N/A)	7.9	5.5	37.41
Green ash	9.6	726	1,319.0	1,293	2,019	(N/A)	5.6	7.2	69.61
Sugar maple	7.7	586	1,026.2	1,006	1,591	(N/A)	5.2	5.7	58.94
Blue spruce	2.2	169	313.9	308	477	(N/A)	4.1	1.7	22.72
Pin oak	8.1	618	1,071.5	1,050	1,668	(N/A)	4.1	6.0	79.42
Bur oak	4.6	348	575.6	564	912	(N/A)	3.7	3.3	48.00
Northern pin oak	5.8	439	853.5	836	1,275	(N/A)	3.5	4.6	70.84
Northern hackberry	6.7	509	931.0	912	1,422	(N/A)	3.5	5.1	78.98
Black walnut	4.0	305	559.5	548	854	(N/A)	2.7	3.0	60.97
Apple	1.5	111	218.3	214	325	(N/A)	2.5	1.2	24.98
Maple	2.3	173	305.3	299	472	(N/A)	2.3	1.7	39.35
Honeylocust	3.0	228	402.5	394	623	(N/A)	1.9	2.2	62.27
Tulip tree	4.5	339	595.7	584	923	(N/A)	1.9	3.3	92.27
Black maple	2.6	201	365.8	358	559	(N/A)	1.9	2.0	55.90
Northern red oak	1.2	91	162.8	160	250	(N/A)	1.7	0.9	27.80
Broadleaf Deciduous Large	2.6	198	357.1	350	548	(N/A)	1.6	2.0	68.46
Eastern red cedar	0.9	68	131.5	129	197	(N/A)	1.6	0.7	24.57
American basswood	2.4	183	325.0	318	501	(N/A)	1.6	1.8	62.69
Broadleaf Deciduous Mediu	1.3	96	188.1	184	281	(N/A)	1.4	1.0	40.11
Elm	0.6	48	83.5	82	129	(N/A)	1.2	0.5	21.55
Broadleaf Deciduous Small	0.3	22	43.2	42	64	(N/A)	1.2	0.2	10.72
White ash	1.7	131	214.1	210	341	(N/A)	1.2	1.2	56.86
Basswood	1.7	131	222.9	218	349	(N/A)	1.0	1.2	69.80
Eastern white pine	0.7	52	88.4	87	139	(N/A)	0.8	0.5	34.66
River birch	0.9	69	134.4	132	200	(N/A)	0.6	0.7	66.79
Spruce	0.5	35	58.9	58	93	(N/A)	0.6	0.3	30.93
Eastern redbud	0.3	20	38.1	37	57	(N/A)	0.6	0.2	19.06
Birch	0.7	50	93.8	92	142	(N/A)	0.6	0.5	47.36
American sycamore	1.4	107	185.2	181	288	(N/A)	0.6	1.0	96.09
Ginkgo	0.1	10	19.8	19	29	(N/A)	0.4	0.1	14.72
Paper birch	0.5	38	65.1	64	102	(N/A)	0.4	0.4	50.77
Norway spruce	0.2	16	28.6	28	44	(N/A)	0.4	0.2	21.89
Broadleaf Evergreen Large	0.9	67	100.4	98	166	(N/A)	0.4	0.6	82.76
Littleleaf linden	0.4	30	47.9	47	77	(N/A)	0.4	0.3	38.70
Amur maple	0.3	20	37.5	37	56	(N/A)	0.4	0.2	28.16
Broadleaf Evergreen Small	0.0	1	1.5	1	2	(N/A)	0.2	0.0	2.12
Scotch pine	0.1	11	19.7	19	30	(N/A)	0.2	0.1	30.47
Plum	0.0	2	3.8	4	5	(N/A)	0.2	0.0	5.40
Cottonwood	0.4	29	53.7	53	82	(N/A)	0.2	0.3	82.02
Broadleaf Evergreen Mediur	0.2	18	24.2	24	41	(N/A)	0.2	0.1	41.29
White oak	0.4	33	59.0	58	91	(N/A)	0.2	0.3	91.02
Callery pear	0.1	8	16.9	17	24	(N/A)	0.2	0.1	24.47
Ohio buckeye	0.2	18	29.5	29	47	(N/A)	0.2	0.2	46.78
Catalpa	0.2	18	27.0	26	44	(N/A)	0.2	0.2	44.23
Northern catalpa	0.2	18	27.0	26	44	(N/A)	0.2	0.2	44.23
Total	133.5	10,132	18,245.0	17,880	28,012	(N/A)	100.0	100.0	54.29

Annual Stormwater Benefits of Public Trees

1/29/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	225,109	6,100	(N/A)	18.6	14.7	63.55
Silver maple	269,667	7,308	(N/A)	10.3	17.6	137.89
Red maple	58,450	1,584	(N/A)	7.9	3.8	38.63
Green ash	116,653	3,161	(N/A)	5.6	7.6	109.01
Sugar maple	92,072	2,495	(N/A)	5.2	6.0	92.41
Blue spruce	33,921	919	(N/A)	4.1	2.2	43.77
Pin oak	106,970	2,899	(N/A)	4.1	7.0	138.04
Bur oak	41,151	1,115	(N/A)	3.7	2.7	58.69
Northern pin oak	67,758	1,836	(N/A)	3.5	4.4	102.01
Northern hackberry	72,950	1,977	(N/A)	3.5	4.8	109.83
Black walnut	49,742	1,348	(N/A)	2.7	3.3	96.29
Apple	6,156	167	(N/A)	2.5	0.4	12.83
Maple	18,304	496	(N/A)	2.3	1.2	41.34
Honeylocust	33,285	902	(N/A)	1.9	2.2	90.20
Tulip tree	68,892	1,867	(N/A)	1.9	4.5	186.70
Black maple	25,165	682	(N/A)	1.9	1.6	68.20
Northern red oak	9,228	250	(N/A)	1.7	0.6	27.79
Broadleaf Deciduous Large	31,601	856	(N/A)	1.6	2.1	107.05
Eastern red cedar	13,076	354	(N/A)	1.6	0.9	44.30
American basswood	27,826	754	(N/A)	1.6	1.8	94.26
Broadleaf Deciduous Medium	10,182	276	(N/A)	1.4	0.7	39.42
Elm	4,871	132	(N/A)	1.2	0.3	22.00
Broadleaf Deciduous Small	1,022	28	(N/A)	1.2	0.1	4.62
White ash	14,663	397	(N/A)	1.2	1.0	66.23
Basswood	21,352	579	(N/A)	1.0	1.4	115.73
Eastern white pine	15,353	416	(N/A)	0.8	1.0	104.01
River birch	10,008	271	(N/A)	0.6	0.7	90.41
Spruce	9,112	247	(N/A)	0.6	0.6	82.32
Eastern redbud	938	25	(N/A)	0.6	0.1	8.48
Birch	5,759	156	(N/A)	0.6	0.4	52.03
American sycamore	21,717	589	(N/A)	0.6	1.4	196.17
Ginkgo	603	16	(N/A)	0.4	0.0	8.17
Paper birch	4,056	110	(N/A)	0.4	0.3	54.96
Norway spruce	4,817	131	(N/A)	0.4	0.3	65.28
Broadleaf Evergreen Large	10,447	283	(N/A)	0.4	0.7	141.56
Littleleaf linden	2,519	68	(N/A)	0.4	0.2	34.14
Amur maple	931	25	(N/A)	0.4	0.1	12.62
Broadleaf Evergreen Small	24	1	(N/A)	0.2	0.0	0.64
Scotch pine	2,969	80	(N/A)	0.2	0.2	80.46
Plum	69	2	(N/A)	0.2	0.0	1.86
Cottonwood	5,491	149	(N/A)	0.2	0.4	148.79
Broadleaf Evergreen Medium	1,775	48	(N/A)	0.2	0.1	48.11
White oak	7,239	196	(N/A)	0.2	0.5	196.17
Callery pear	586	16	(N/A)	0.2	0.0	15.88
Ohio buckeye	1,409	38	(N/A)	0.2	0.1	38.19
Catalpa	1,466	40	(N/A)	0.2	0.1	39.72
Northern catalpa	1,466	40	(N/A)	0.2	0.1	39.72
Citywide total	1,528,821	41,431	(N/A)	100.0	100.0	80.29

Annual Air Quality Benefits of Public Trees

1/29/2021

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								
Norway maple	46.4	8.0	22.8	2.1	251	115.1	16.6	15.8	107.7	713	-10.8	-41	323.7	923	(N/A)	18.6	9.61
Silver maple	48.3	8.2	23.6	2.1	260	86.2	12.6	12.0	82.8	539	-25.6	-96	250.3	704	(N/A)	10.3	13.28
Red maple	13.2	2.2	6.3	0.6	71	34.8	5.1	4.8	33.1	217	-4.5	-17	95.6	271	(N/A)	7.9	6.60
Green ash	15.8	2.5	7.3	0.7	84	45.8	6.7	6.3	43.4	285	0.0	0	128.5	368	(N/A)	5.6	12.70
Sugar maple	13.1	2.2	6.4	0.6	70	36.5	5.3	5.1	34.9	228	-10.2	-38	94.0	260	(N/A)	5.2	9.65
Blue spruce	5.0	1.0	4.1	0.6	33	10.7	1.6	1.5	10.1	67	-12.6	-47	21.9	52	(N/A)	4.1	2.48
Pin oak	20.8	3.6	10.4	0.9	113	38.4	5.6	5.4	36.9	240	-38.0	-142	84.1	211	(N/A)	4.1	10.05
Bur oak	5.0	0.8	2.5	0.2	27	21.4	3.2	3.0	20.8	135	0.0	0	56.9	162	(N/A)	3.7	8.50
Northern pin oak	15.6	2.7	7.4	0.7	83	28.2	4.1	3.9	26.2	174	-3.5	-13	85.2	244	(N/A)	3.5	13.58
Northern hackberry	13.8	2.4	6.8	0.6	75	32.2	4.7	4.5	30.4	200	0.0	0	95.3	275	(N/A)	3.5	15.26
Black walnut	6.6	1.1	3.1	0.3	35	19.3	2.8	2.7	18.2	120	0.0	0	54.0	155	(N/A)	2.7	11.06
Apple	1.9	0.3	0.9	0.1	10	7.1	1.0	1.0	6.6	44	0.0	0	18.9	54	(N/A)	2.5	4.16
Maple	4.2	0.7	2.0	0.2	22	10.8	1.6	1.5	10.3	68	-1.4	-5	29.9	85	(N/A)	2.3	7.05
Honeylocust	6.5	1.1	3.0	0.3	34	14.2	2.1	2.0	13.6	89	-4.9	-19	37.8	105	(N/A)	1.9	10.48
Tulip tree	12.6	2.0	5.5	0.6	65	21.2	3.1	3.0	20.2	132	0.0	0	68.1	198	(N/A)	1.9	19.78
Black maple	6.4	1.1	2.9	0.3	34	12.6	1.8	1.8	12.0	79	-2.1	-8	36.8	105	(N/A)	1.9	10.47
Northern red oak	1.7	0.3	0.9	0.1	9	5.7	0.8	0.8	5.4	35	-2.4	-9	13.3	36	(N/A)	1.7	3.97
Broadleaf Deciduous Large	4.6	0.7	2.1	0.2	24	12.4	1.8	1.7	11.8	77	0.0	0	35.5	102	(N/A)	1.6	12.75
Eastern red cedar	2.7	0.5	2.2	0.3	18	4.3	0.6	0.6	4.0	27	-7.2	-27	8.1	17	(N/A)	1.6	2.19
American basswood	4.1	0.7	2.0	0.2	22	11.5	1.7	1.6	10.9	72	-3.4	-13	29.2	81	(N/A)	1.6	10.09
Broadleaf Deciduous Medium	1.8	0.3	0.9	0.1	10	6.2	0.9	0.9	5.8	38	-0.4	-2	16.4	47	(N/A)	1.4	6.65
Elm	0.4	0.1	0.2	0.0	2	3.0	0.4	0.4	2.8	19	0.0	0	7.4	21	(N/A)	1.2	3.47
Broadleaf Deciduous Small	0.3	0.0	0.1	0.0	1	1.4	0.2	0.2	1.3	9	0.0	0	3.6	10	(N/A)	1.2	1.69
White ash	1.4	0.2	0.8	0.1	8	8.0	1.2	1.1	7.8	51	0.0	0	20.7	59	(N/A)	1.2	9.75
Basswood	3.5	0.6	1.6	0.2	18	8.1	1.2	1.1	7.8	51	0.0	0	23.9	69	(N/A)	1.0	13.78
Eastern white pine	1.9	0.4	1.5	0.2	12	3.2	0.5	0.5	3.1	20	-9.1	-34	2.1	-2	(N/A)	0.8	-0.48
River birch	2.2	0.4	1.1	0.1	12	4.4	0.6	0.6	4.1	27	-0.5	-2	13.0	37	(N/A)	0.6	12.44
Spruce	1.1	0.2	0.9	0.1	7	2.2	0.3	0.3	2.1	14	-4.8	-18	2.4	3	(N/A)	0.6	0.90
Eastern redbud	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.2	9	(N/A)	0.6	3.07
Birch	1.1	0.2	0.6	0.1	6	3.2	0.5	0.4	3.0	20	-0.3	-1	8.8	25	(N/A)	0.6	8.32
American sycamore	4.3	0.7	1.9	0.2	23	6.7	1.0	0.9	6.4	42	0.0	0	22.0	64	(N/A)	0.6	21.38
Ginkgo	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.5	4	(N/A)	0.4	2.12
Paper birch	0.4	0.1	0.2	0.0	2	2.3	0.3	0.3	2.3	15	0.0	0	5.9	17	(N/A)	0.4	8.38
Norway spruce	0.6	0.1	0.5	0.1	4	1.0	0.1	0.1	0.9	6	-2.9	-11	0.5	-1	(N/A)	0.4	-0.51
Broadleaf Evergreen Large	1.7	0.3	1.4	0.2	11	4.0	0.6	0.6	4.0	26	-4.8	-18	8.0	19	(N/A)	0.4	9.29
Littleleaf linden	0.3	0.1	0.2	0.0	2	1.9	0.3	0.3	1.8	12	-0.2	-1	4.6	13	(N/A)	0.4	6.42

Durant

Annual Air Quality Benefits of Public Trees

1/29/2021

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								
Amur maple	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.2	9	(N/A)	0.4	4.55
Broadleaf Evergreen Small	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)	0.2	0.27
Scotch 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)	0.2	1.45
Plum	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.2	0.71
Cottonwood	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)	0.2	15.71
Broadleaf Evergreen Medium	0.1	0.0	0.1	0.0	1	1.0	0.2	0.1	1.0	7	-0.5	-2	2.1	5	(N/A)	0.2	5.49
White oak	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19	(N/A)	0.2	19.04
Callery pear	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	0.2	3.47
Ohio buckeye	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)	0.2	7.92
Catalpa	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)	0.2	7.42
Northern catalpa	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)	0.2	7.42
Citywide total	272.7	46.4	135.6	13.2	1,478	637.0	92.8	88.4	604.9	3,969	-151.8	-569	1,739.2	4,878	(N/A)	100.0	9.45

Durant

Stored CO2 Benefits of Public Trees

1/29/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	765,407	5,741	(N/A)	18.6	12.7	59.80
Silver maple	1,151,156	8,634	(N/A)	10.3	19.1	162.90
Red maple	146,075	1,096	(N/A)	7.9	2.4	26.72
Green ash	517,779	3,883	(N/A)	5.6	8.6	133.91
Sugar maple	381,787	2,863	(N/A)	5.2	6.3	106.05
Blue spruce	38,173	286	(N/A)	4.1	0.6	13.63
Pin oak	573,687	4,303	(N/A)	4.1	9.5	204.89
Bur oak	169,659	1,272	(N/A)	3.7	2.8	66.97
Northern pin oak	257,043	1,928	(N/A)	3.5	4.3	107.10
Northern hackberry	224,136	1,681	(N/A)	3.5	3.7	93.39
Black walnut	216,271	1,622	(N/A)	2.7	3.6	115.86
Apple	29,471	221	(N/A)	2.5	0.5	17.00
Maple	46,191	346	(N/A)	2.3	0.8	28.87
Honeylocust	82,707	620	(N/A)	1.9	1.4	62.03
Tulip tree	432,848	3,246	(N/A)	1.9	7.2	324.64
Black maple	68,287	512	(N/A)	1.9	1.1	51.22
Northern red oak	33,920	254	(N/A)	1.7	0.6	28.27
Broadleaf Deciduous	155,831	1,169	(N/A)	1.6	2.6	146.09
Eastern red cedar	8,817	66	(N/A)	1.6	0.1	8.27
American basswood	155,366	1,165	(N/A)	1.6	2.6	145.66
Broadleaf Deciduous	29,880	224	(N/A)	1.4	0.5	32.01
Elm	13,374	100	(N/A)	1.2	0.2	16.72
Broadleaf Deciduous	4,164	31	(N/A)	1.2	0.1	5.21
White ash	36,389	273	(N/A)	1.2	0.6	45.49
Basswood	118,357	888	(N/A)	1.0	2.0	177.54
Eastern white pine	23,641	177	(N/A)	0.8	0.4	44.33
River birch	36,506	274	(N/A)	0.6	0.6	91.26
Spruce	12,003	90	(N/A)	0.6	0.2	30.01
Eastern redbud	3,959	30	(N/A)	0.6	0.1	9.90
Birch	19,005	143	(N/A)	0.6	0.3	47.51
American sycamore	151,222	1,134	(N/A)	0.6	2.5	378.06
Ginkgo	948	7	(N/A)	0.4	0.0	3.56
Paper birch	12,130	91	(N/A)	0.4	0.2	45.49
Norway spruce	7,528	56	(N/A)	0.4	0.1	28.23
Broadleaf Evergreen I	18,834	141	(N/A)	0.4	0.3	70.63
Littleleaf linden	7,190	54	(N/A)	0.4	0.1	26.96
Amur maple	3,945	30	(N/A)	0.4	0.1	14.79
Broadleaf Evergreen S	14	0	(N/A)	0.2	0.0	0.10
Scotch pine	3,343	25	(N/A)	0.2	0.1	25.07
Plum	178	1	(N/A)	0.2	0.0	1.33
Cottonwood	25,943	195	(N/A)	0.2	0.4	194.57
Broadleaf Evergreen I	1,851	14	(N/A)	0.2	0.0	13.88
White oak	39,259	294	(N/A)	0.2	0.7	294.44
Callery pear	1,101	8	(N/A)	0.2	0.0	8.26
Ohio buckeye	3,624	27	(N/A)	0.2	0.1	27.18
Catalpa	3,672	28	(N/A)	0.2	0.1	27.54
Northern catalpa	3,672	28	(N/A)	0.2	0.1	27.54
Citywide total	6,036,340	45,273	(N/A)	100.0	100.0	87.74

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.

Durant

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees

1/29/2021

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
Norway maple	32,361	243	-3,674	-249	-29	39,822	299	68,260	512 (N/A)	18.6	14.2	5.33
Silver maple	80,693	605	-5,526	-206	-43	30,686	230	105,647	792 (N/A)	10.3	22.0	14.95
Red maple	13,409	101	-701	-69	-6	12,255	92	24,893	187 (N/A)	7.9	5.2	4.55
Green ash	22,661	170	-2,485	-102	-19	16,048	120	36,122	271 (N/A)	5.6	7.5	9.34
Sugar maple	18,319	137	-1,833	-85	-14	12,944	97	29,345	220 (N/A)	5.2	6.1	8.15
Blue spruce	2,086	16	-183	-43	-2	3,744	28	5,604	42 (N/A)	4.1	1.2	2.00
Pin oak	27,032	203	-2,754	-91	-21	13,652	102	37,839	284 (N/A)	4.1	7.9	13.51
Bur oak	9,005	68	-814	-44	-6	7,687	58	15,834	119 (N/A)	3.7	3.3	6.25
Northern pin oak	1,110	8	-1,234	-75	-10	9,695	73	9,496	71 (N/A)	3.5	2.0	3.96
Northern hackberry	8,868	67	-1,076	-67	-9	11,255	84	18,980	142 (N/A)	3.5	3.9	7.91
Black walnut	9,610	72	-1,038	-43	-8	6,747	51	15,275	115 (N/A)	2.7	3.2	8.18
Apple	2,538	19	-142	-19	-1	2,449	18	4,826	36 (N/A)	2.5	1.0	2.78
Maple	1,987	15	-222	-21	-2	3,824	29	5,568	42 (N/A)	2.3	1.2	3.48
Honeylocust	9,150	69	-397	-25	-3	5,046	38	13,774	103 (N/A)	1.9	2.9	10.33
Tulip tree	7,483	56	-2,078	-52	-16	7,489	56	12,842	96 (N/A)	1.9	2.7	9.63
Black maple	2,495	19	-328	-25	-3	4,432	33	6,575	49 (N/A)	1.9	1.4	4.93
Northern red oak	1,447	11	-163	-14	-1	2,004	15	3,274	25 (N/A)	1.7	0.7	2.73
Broadleaf Deciduous Large	5,529	41	-748	-28	-6	4,369	33	9,122	68 (N/A)	1.6	1.9	8.55
Eastern red cedar	129	1	-42	-16	0	1,495	11	1,565	12 (N/A)	1.6	0.3	1.47
American basswood	8,508	64	-746	-27	-6	4,045	30	11,780	88 (N/A)	1.6	2.5	11.04
Broadleaf Deciduous Medi	2,339	18	-144	-13	-1	2,131	16	4,313	32 (N/A)	1.4	0.9	4.62
Elm	1,393	10	-64	-7	-1	1,050	8	2,373	18 (N/A)	1.2	0.5	2.97
Broadleaf Deciduous Smal	446	3	-20	-4	0	487	4	908	7 (N/A)	1.2	0.2	1.13
White ash	4,016	30	-175	-14	-1	2,902	22	6,729	50 (N/A)	1.2	1.4	8.41
Basswood	3,139	24	-568	-18	-4	2,885	22	5,437	41 (N/A)	1.0	1.1	8.16
Eastern white pine	372	3	-113	-15	-1	1,149	9	1,393	10 (N/A)	0.8	0.3	2.61
River birch	840	6	-175	-11	-1	1,517	11	2,171	16 (N/A)	0.6	0.5	5.43
Spruce	303	2	-58	-9	0	774	6	1,010	8 (N/A)	0.6	0.2	2.53
Eastern redbud	390	3	-19	-3	0	438	3	806	6 (N/A)	0.6	0.2	2.02
Birch	980	7	-91	-7	-1	1,109	8	1,992	15 (N/A)	0.6	0.4	4.98
American sycamore	1,870	14	-726	-17	-6	2,360	18	3,487	26 (N/A)	0.6	0.7	8.72
Ginkgo	115	1	-5	-2	0	223	2	331	2 (N/A)	0.4	0.1	1.24
Paper birch	1,105	8	-58	-5	0	834	6	1,876	14 (N/A)	0.4	0.4	7.04

Annual CO $_2$ Benefits of Public Trees

1/29/2021

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
Norway spruce	18	0	-36	-5	0	349	3	326	2 (N/A)	0.4	0.1	1.22
Broadleaf Evergreen Large	419	3	-90	-6	-1	1,484	11	1,806	14 (N/A)	0.4	0.4	6.77
Littleleaf linden	1,029	8	-35	-4	0	674	5	1,664	12 (N/A)	0.4	0.3	6.24
Amur maple	382	3	-19	-3	0	433	3	792	6 (N/A)	0.4	0.2	2.97
Broadleaf Evergreen Small	4	0	0	0	0	14	0	18	0 (N/A)	0.2	0.0	0.13
Scotch pine	187	1	-16	-3	0	246	2	415	3 (N/A)	0.2	0.1	3.11
Plum	38	0	-1	-1	0	37	0	74	1 (N/A)	0.2	0.0	0.55
Cottonwood	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.2	0.3	11.11
Broadleaf Evergreen Medi	143	1	-9	-2	0	388	3	520	4 (N/A)	0.2	0.1	3.90
White oak	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.2	0.3	10.90
Callery pear	224	2	-5	-1	0	176	1	393	3 (N/A)	0.2	0.1	2.95
Ohio buckeye	386	3	-17	-2	0	395	3	762	6 (N/A)	0.2	0.2	5.71
Catalpa	445	3	-18	-2	0	393	3	819	6 (N/A)	0.2	0.2	6.14
Northern catalpa	445	3	-18	-2	0	393	3	819	6 (N/A)	0.2	0.2	6.14
Citywide total	287,316	2,155	-28,977	-1,466	-228	223,915	1,679	480,789	3,606 (N/A)	100.0	100.0	6.99

Annual Aesthetic/Other Benefits of Public Trees

1/29/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	3,063	(N/A)	18.6	11.5	31.90
Silver maple	6,065	(N/A)	10.3	22.8	114.43
Red maple	1,811	(N/A)	7.9	6.8	44.16
Green ash	1,745	(N/A)	5.6	6.6	60.18
Sugar maple	1,853	(N/A)	5.2	7.0	68.63
Blue spruce	389	(N/A)	4.1	1.5	18.52
Pin oak	1,999	(N/A)	4.1	7.5	95.17
Bur oak	842	(N/A)	3.7	3.2	44.32
Northern pin oak	94	(N/A)	3.5	0.4	5.25
Northern hackberry	1,106	(N/A)	3.5	4.2	61.47
Black walnut	757	(N/A)	2.7	2.8	54.08
Apple	147	(N/A)	2.5	0.6	11.33
Maple	295	(N/A)	2.3	1.1	24.54
Honeylocust	2,140	(N/A)	1.9	8.0	214.01
Tulip tree	481	(N/A)	1.9	1.8	48.08
Black maple	314	(N/A)	1.9	1.2	31.39
Northern red oak	133	(N/A)	1.7	0.5	14.79
Broadleaf Deciduous Large	437	(N/A)	1.6	1.6	54.63
Eastern red cedar	41	(N/A)	1.6	0.2	5.13
American basswood	576	(N/A)	1.6	2.2	71.96
Broadleaf Deciduous Medium	234	(N/A)	1.4	0.9	33.38
Elm	157	(N/A)	1.2	0.6	26.23
Broadleaf Deciduous Small	24	(N/A)	1.2	0.1	4.01
White ash	495	(N/A)	1.2	1.9	82.55
Basswood	244	(N/A)	1.0	0.9	48.84
Eastern white pine	59	(N/A)	0.8	0.2	14.64
River birch	75	(N/A)	0.6	0.3	24.84
Spruce	79	(N/A)	0.6	0.3	26.47
Eastern redbud	22	(N/A)	0.6	0.1	7.31
Birch	97	(N/A)	0.6	0.4	32.28
American sycamore	115	(N/A)	0.6	0.4	38.49
Ginkgo	14	(N/A)	0.4	0.1	6.77
Paper birch	104	(N/A)	0.4	0.4	51.77
Norway spruce	7	(N/A)	0.4	0.0	3.42
Broadleaf Evergreen Large	97	(N/A)	0.4	0.4	48.62
Littleleaf linden	110	(N/A)	0.4	0.4	55.09
Amur maple	22	(N/A)	0.4	0.1	10.94
Broadleaf Evergreen Small	0	(N/A)	0.2	0.0	0.50
Scotch pine	47	(N/A)	0.2	0.2	47.08
Plum	2	(N/A)	0.2	0.0	2.06
Cottonwood	67	(N/A)	0.2	0.3	66.60
Broadleaf Evergreen Medium	35	(N/A)	0.2	0.1	34.98
White oak	58	(N/A)	0.2	0.2	58.34
Callery pear	26	(N/A)	0.2	0.1	26.22
Ohio buckeye	39	(N/A)	0.2	0.1	39.16
Catalpa	46	(N/A)	0.2	0.2	45.86
Northern catalpa	46	(N/A)	0.2	0.2	45.86
Citywide total	26,609	(N/A)	100.0	100.0	51.57

Table 7: Summary of Benefits in Dollars

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

1/29/2021

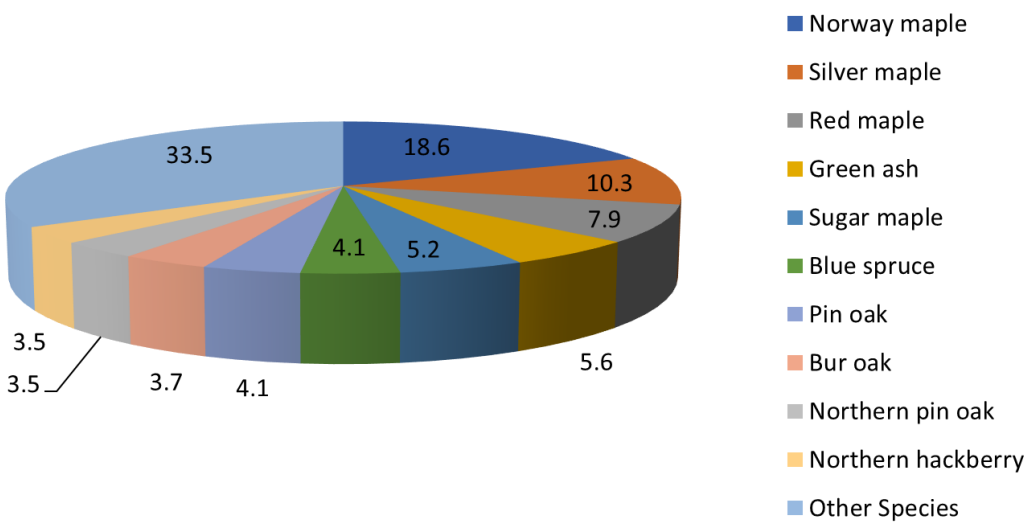
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	28,012	(N/A)	54.29	(N/A)	0.00	(N/A)
CO2	3,606	(N/A)	6.99	(N/A)	0.00	(N/A)
Air Quality	4,878	(N/A)	9.45	(N/A)	0.00	(N/A)
Stormwater	41,431	(N/A)	80.29	(N/A)	0.00	(N/A)
Aesthetic/Other	26,609	(N/A)	51.57	(N/A)	0.00	(N/A)
Total Benefits	104,535	(N/A)	202.59	(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	104,535	(N/A)	202.59	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Durant

Species Distribution of Public Trees

1/29/2021

Figure 1: Species Distribution



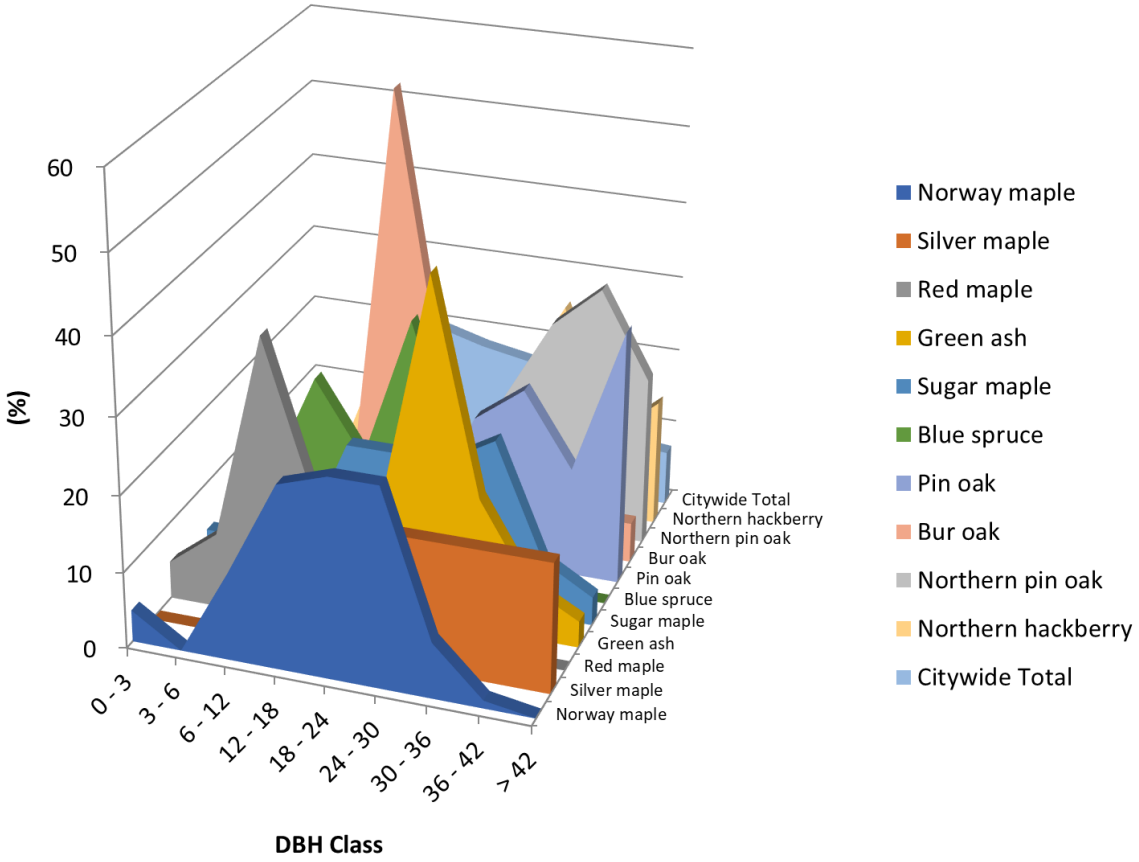
Species	Percent
Norway maple	18.6
Silver maple	10.3
Red maple	7.9
Green ash	5.6
Sugar maple	5.2
Blue spruce	4.1
Pin oak	4.1
Bur oak	3.7
Northern pin oak	3.5
Northern hackberry	3.5
Other Species	33.5
Total	100.0

Durant

Figure 2: Relative Age Class

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

1/29/2021



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Norway maple	4.17	0.00	11.46	23.96	26.04	26.04	7.29	1.04	0.00
Silver maple	0.00	0.00	3.77	13.21	15.09	16.98	16.98	16.98	16.98
Red maple	4.88	9.76	36.59	17.07	19.51	9.76	2.44	0.00	0.00
Green ash	0.00	0.00	0.00	13.79	13.79	44.83	17.24	6.90	3.45
Sugar maple	3.70	3.70	3.70	18.52	18.52	18.52	22.22	7.41	3.70
Blue spruce	4.76	9.52	23.81	14.29	33.33	14.29	0.00	0.00	0.00
Pin oak	0.00	0.00	0.00	4.76	4.76	19.05	23.81	14.29	33.33
Bur oak	5.26	5.26	0.00	57.89	21.05	0.00	0.00	5.26	5.26
Northern pin oak	0.00	0.00	0.00	0.00	0.00	16.67	27.78	33.33	22.22
Northern hackberry	0.00	0.00	16.67	11.11	0.00	16.67	27.78	11.11	16.67
Citywide Total	4.26	3.10	11.43	19.96	18.22	17.05	11.05	7.75	7.17

Figure 3: Foliage Condition

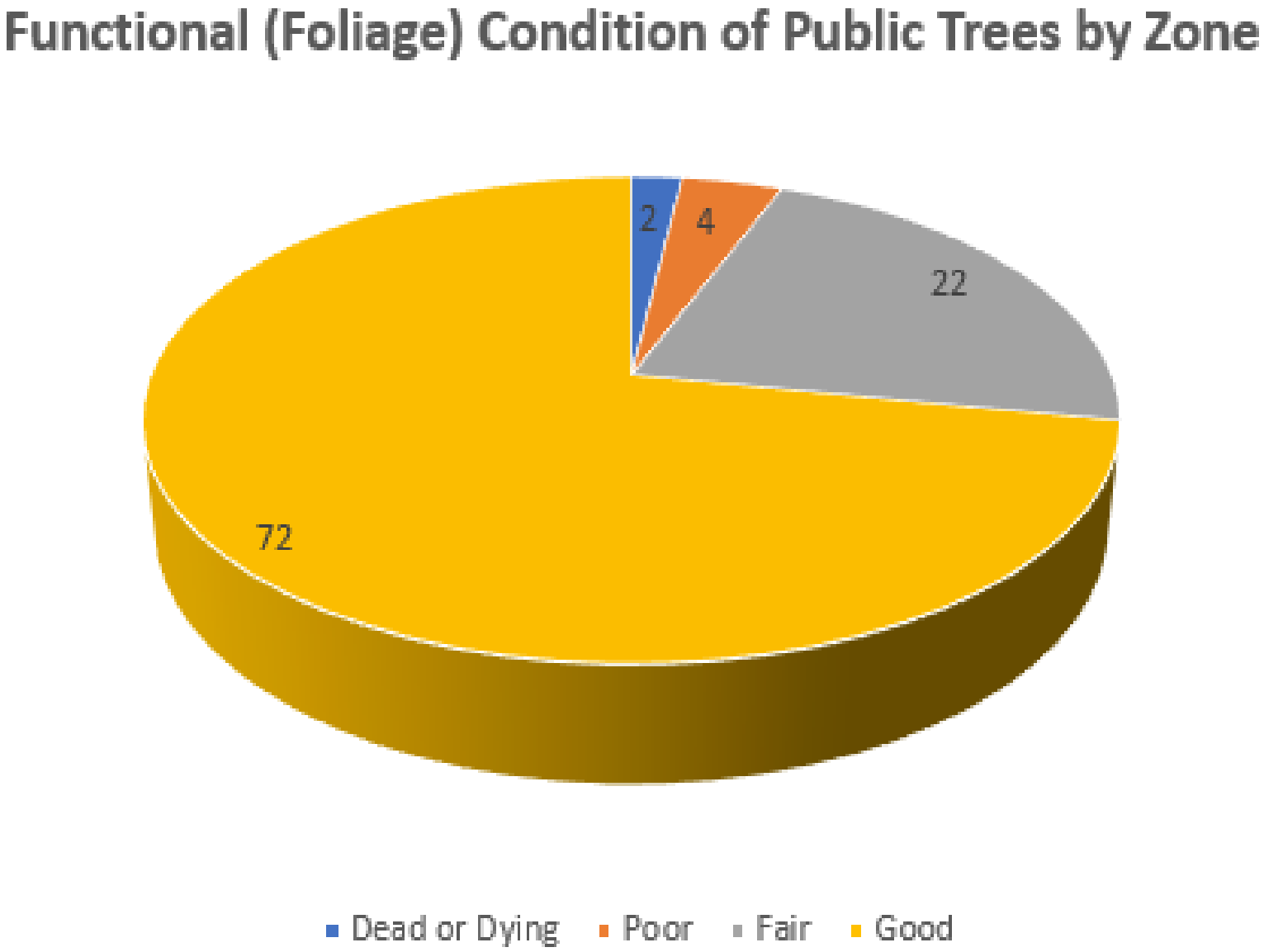


Figure 4: Wood Condition

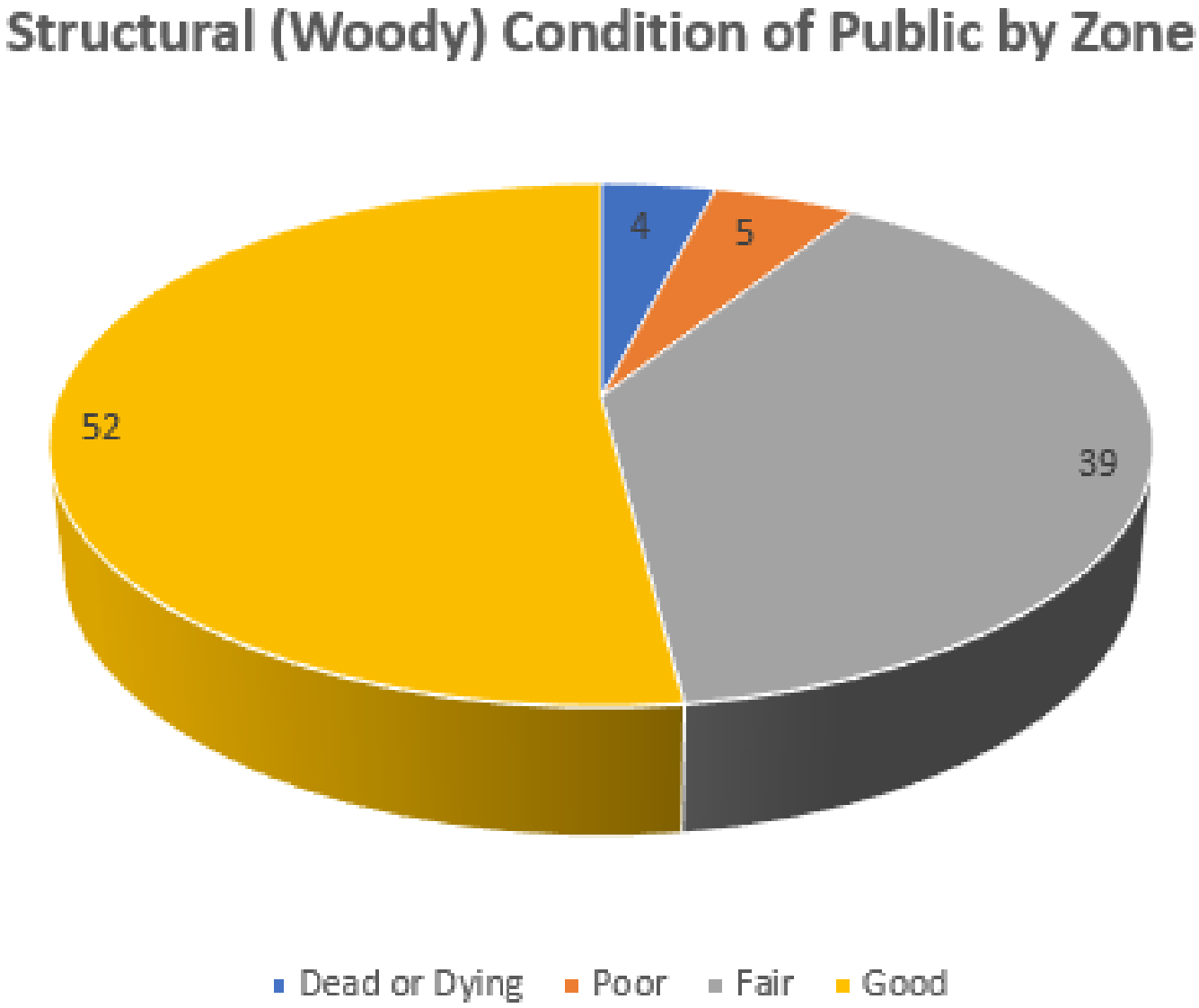


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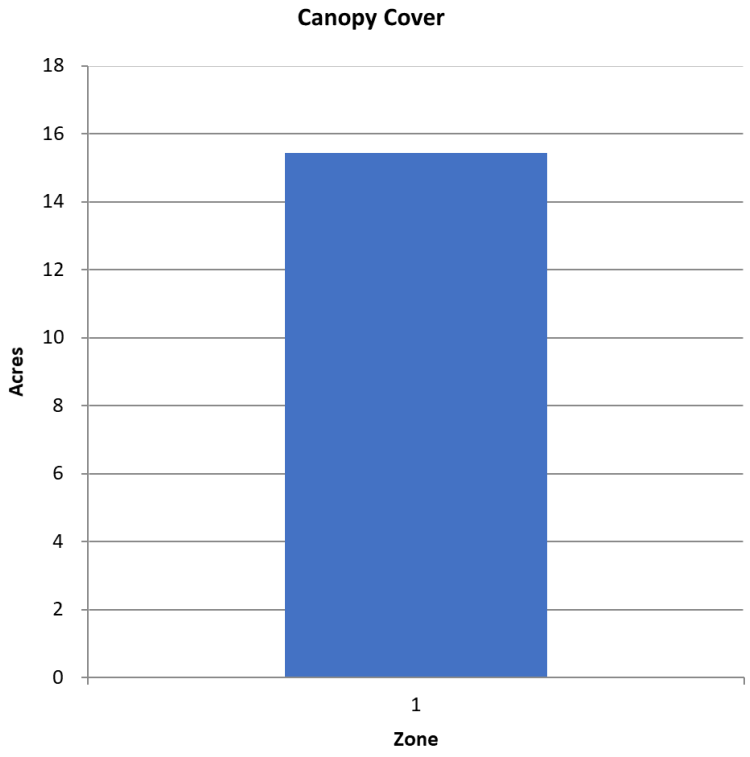
Figure 5: Canopy Cover in Acres

Canopy Cover of Public Trees (Acres)

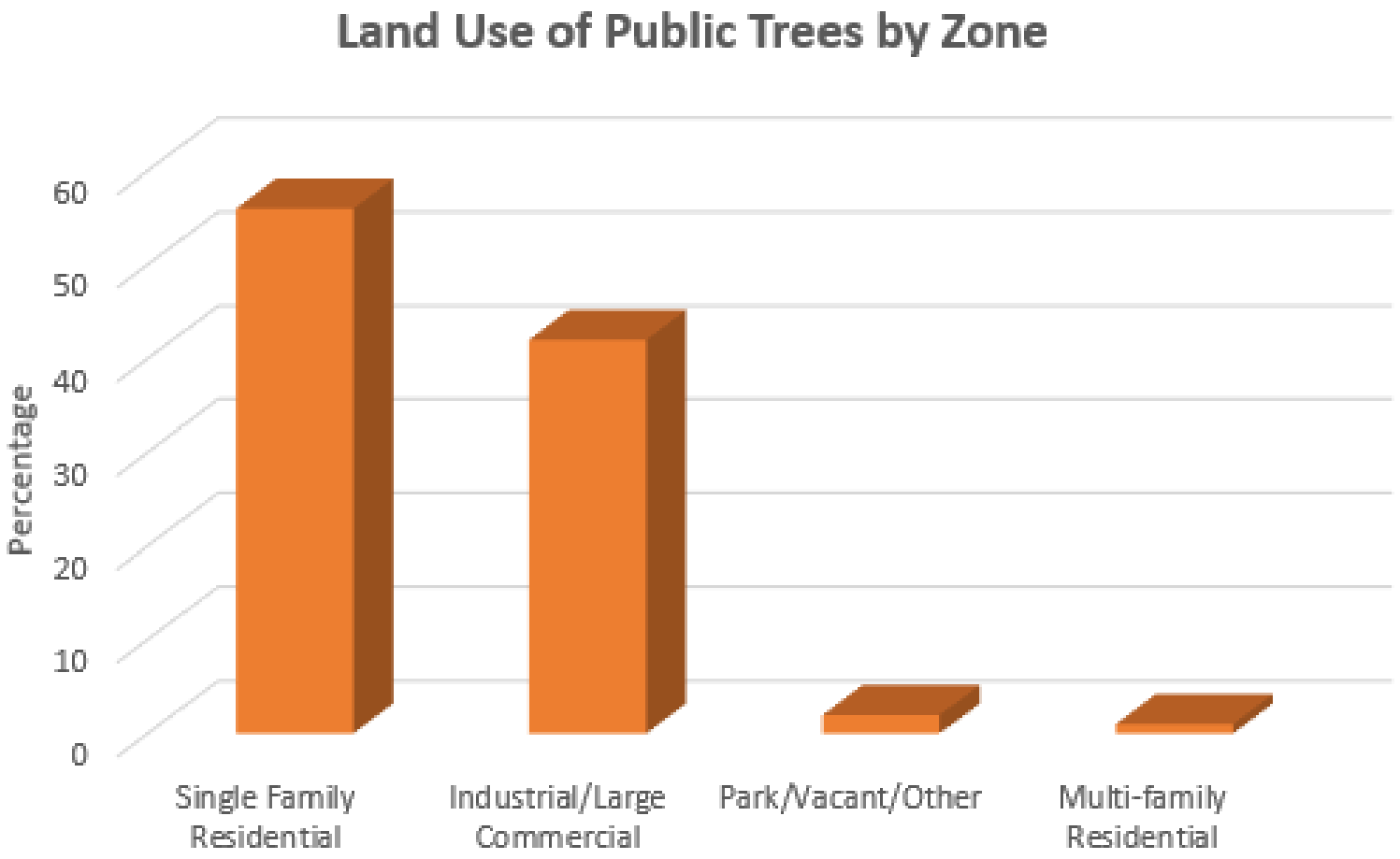
1/29/2021



Zone	Acres	% of Total Canopy Cover
1	15	100.0
Citywide total	15	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	15	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

Figure 1: Location of Ash Trees

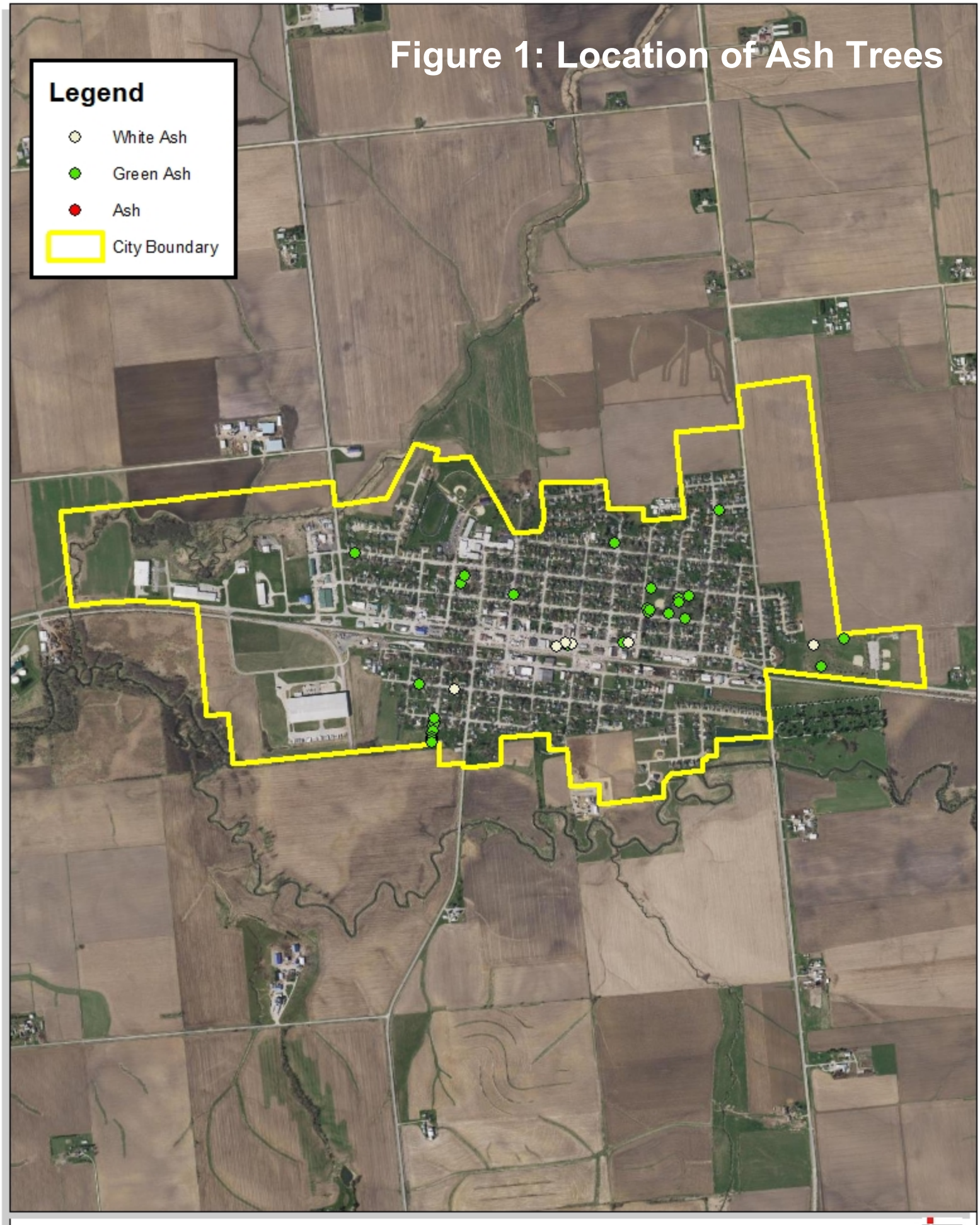
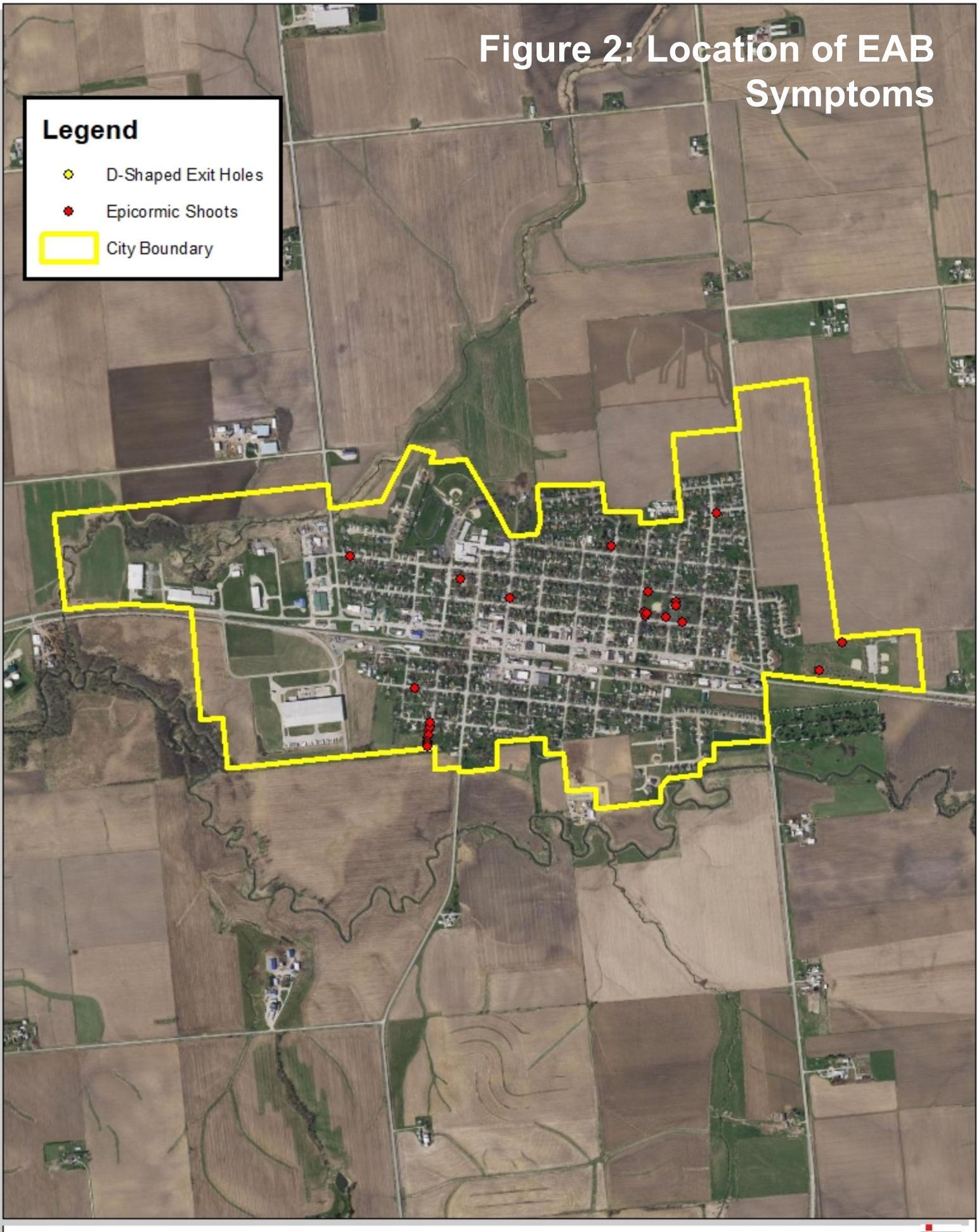


Figure 2: Location of EAB Symptoms



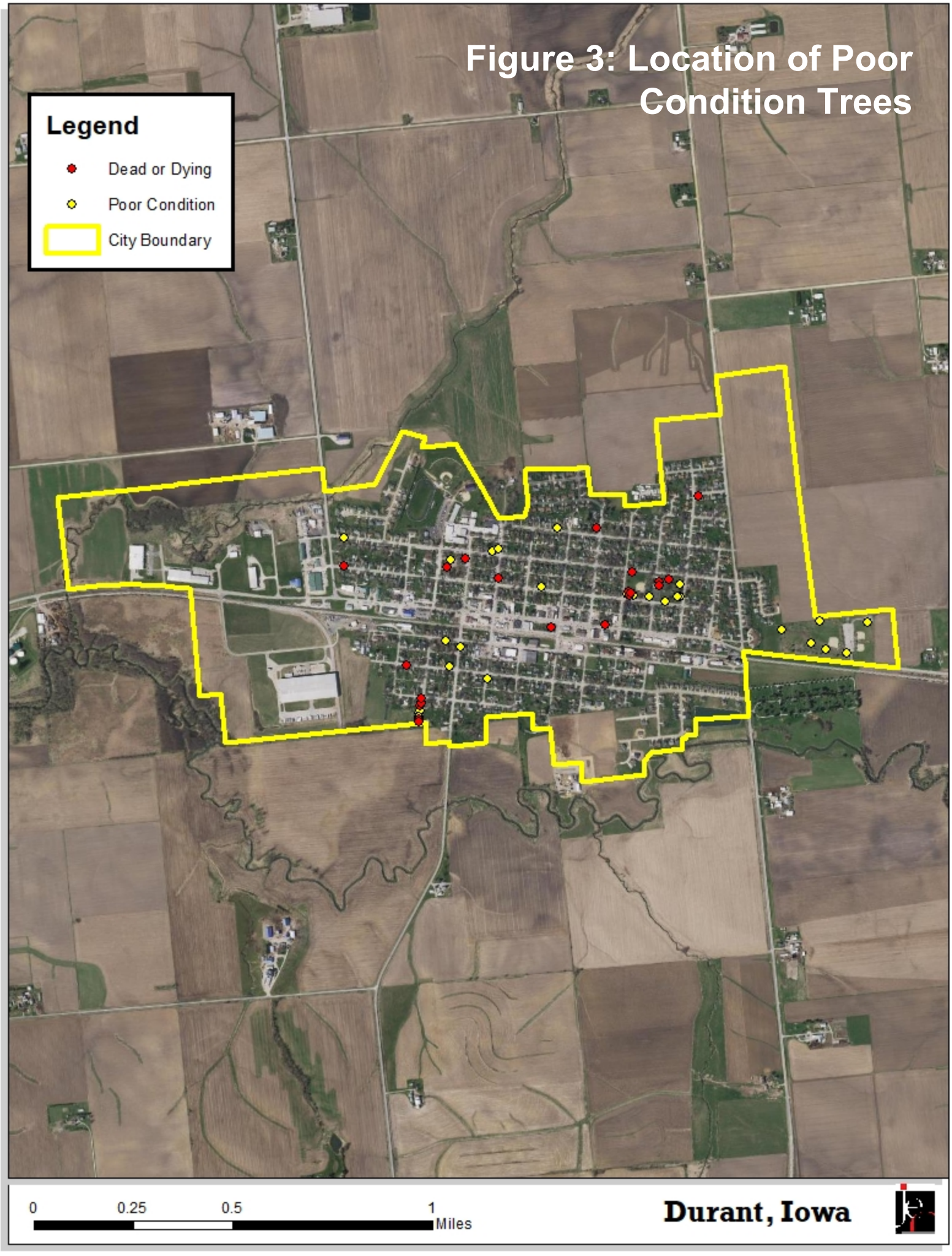
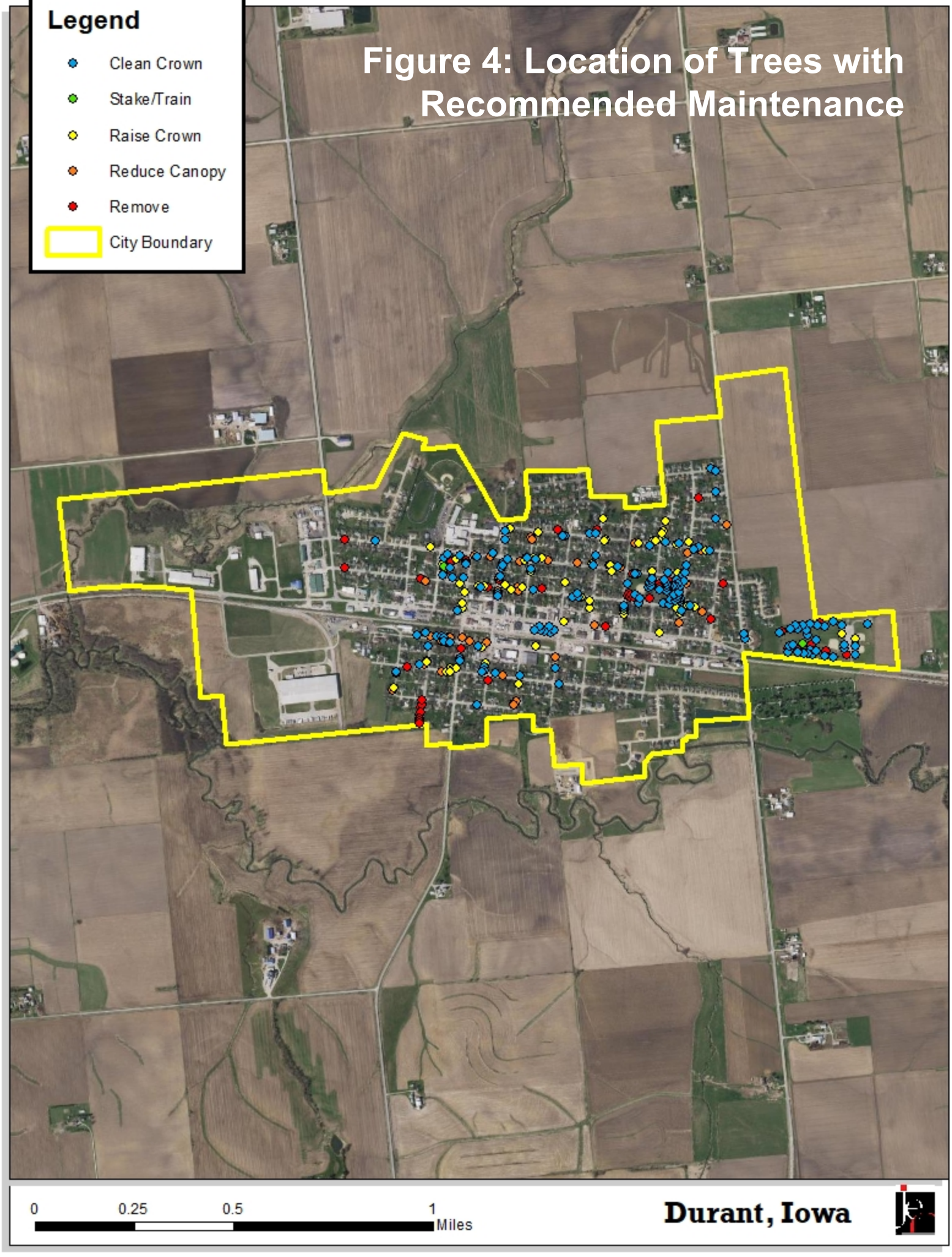


Figure 3: Location of Poor Condition Trees
Legend
Dead or Dying
Poor Condition
City Boundary
0
0.25
0.5
1
Miles
Durant, Iowa


Legend
Clean Crown
Stake/Train
Raise Crown
Reduce Canopy
Remove
City Boundary
Figure 4: Location of Trees with Recommended Maintenance
0
0.25
0.5
1
Miles
Durant, Iowa

APPENDIX C: DURANT TREE ORDINANCES

CHAPTER 52 TREE REGULATIONS

52-1 DEFINITIONS.

1. "Street Trees" are herein defined as trees, shrubs, bushes, and all other woody vegetation on land lying between property lines on either side of all streets, avenues, or ways within the City.

2. "Park Trees" are herein defined as trees, shrubs, bushes and all other woody vegetation in public parks having individual names, and all areas owned by the City, or to which the public has free access as a park.

52-2 CREATION AND ESTABLISHMENT OF A CITY TREE BOARD. There is hereby created and established a City Tree Board for the City of Durant which shall consist of five (5) members, citizens and residents of this City, who shall be appointed by the Mayor with the approval of the City Council.

52-3 TERM OF OFFICE. The term of the five persons to be appointed by the Mayor shall be three (3) years except that the term of two of the members appointed to the first board shall be for only one (1) year and the term of two of the members of the first board shall be for two (2)

years. In the event that a vacancy shall occur during the term of any member, a successor shall be appointed for the unexpired portion of the term.

52-4 COMPENSATION. Members of the Board shall serve without compensation.

52-5 DUTIES AND RESPONSIBILITIES. It shall be the responsibility of the Board to study, investigate, counsel and develop and/or update annually, and administer a written plan for the care, preservation, pruning, planting, replanting, removal or disposition of trees, shrubs in parks, along streets and in other public areas but not street trees or any other trees or plants located in the boulevards. Such plan will be presented annually to the City Council and upon their acceptance and approval shall constitute the official comprehensive City tree plan for the City. The Board, when requested by the City Council, shall consider, investigate, make findings, report and recommend upon any special matter of questions coming within the scope of its work.

52-6 OPERATION. The Board shall choose its own officers, make its own rules and regulations and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business.

52-7 PARK TREE SPECIES TO BE PLANTED. The following list constitutes the official park tree species for the City. No species other than those included in this list may be planted as park trees without written permission of the City Tree Board:

1. Small Trees: Any Crab, Magnolia, American Maple, Aristocrat Pear.

2. Medium Trees: Any ashes (Marshall, White, Purple), White Spire Birch, Aspen, Norway Red Maple, Elms (when they get them developed against disease).

3. Large Trees: Tulip, Hackberry, Chestnut, Walnut, any Oak.

4. Before any Evergreen tree is planted, it must be approved by the Tree Committee.

52-8 SPACING. The spacing of park trees will be in accordance with the three species size classes listed in Section 52-7 above, and no trees may be planted closer together than the following: small trees, 30 feet; medium trees, 40 feet; and large trees, 50 feet; except in special plantings designed and approved by a landscape architect and/or City Tree Board.

52-9 PUBLIC TREE CARE. The City shall have the right to plant, prune, maintain, and remove trees, plants, and shrubs within the lines of all streets, alleys, avenues, lanes, easements, squares, and public grounds, as may be necessary to insure public safety or to preserve or enhance the symmetry and beauty of such public grounds. The Board may remove, or cause or order to be removed, any tree or part thereof which is in an unsafe condition or which, by reason of its nature, is injurious to sewers, electric power lines, gas lines, water lines, or other public improvements, or is affected with any injurious fungus, insect or other pest.

52-10 TREE TOPPING. It shall be unlawful as a normal practice for any person, firm, or City Department to top any park tree, or other tree on public property. Topping is defined as the severe cutting back of limbs to stubs larger than tree inches in diameter within the tree's crown to such degree City of Durant, Iowa page 201 so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes, or certain trees under utility wires

or other obstructions where other pruning practices are impractical, may be exempted from this Ordinance at the determinations of the City Tree Board or Municipal Electrical Board.

52-11 PRUNING, CORNER CLEARANCE. Every owner of any tree overhanging any street or right-of-way within the City shall prune the branches so that such branches shall not obstruct the light from any street lamp or obstruct the view of any street intersection and so that there shall be a clear space of eight feet (8') above the surface of the street or sidewalk. Said owners shall remove all dead, diseased, or dangerous trees, or broken or decayed limbs which constitute a menace to the safety of the public. The City shall have the right to prune any tree or shrub on private property when it interferes with the proper spread of light along the street from a street light or interferes with visibility of any traffic control device or sign or interferes with the normal flow of traffic.

52-12 DEAD OR DISEASED TREE REMOVAL ON PRIVATE PROPERTY. The City shall have the right to cause the removal of any dead or diseased trees on private property within the City, when such trees constitute a hazard to life and property or harbor insects or disease which constitute a potential threat to other trees within the City. The Administrator will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within sixty (60) days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owner's property tax notice.

52-13 REMOVAL OF STUMPS. All stumps of street and park trees shall be removed below the surface of the ground so that the top of the stump shall not project above the surface of the ground.

52-14 INTERFERENCE WITH CITY TREE BOARD. It shall be unlawful for any person to prevent, delay or interfere with the City Tree Board, or any of its agents, while engaging in and about the planting, cultivating, mulching, pruning, spraying, or removing of any park trees, or trees on private grounds, as authorized in this ordinance.

52-15 REVIEW BY CITY COUNCIL. The City Council shall have the right to review the conduct, acts, and decisions of the City Tree Board. Any person may appeal from any ruling or order of the City Tree Board to the City Council who may hear the matter and make final decision.

52-16 STREET TREE PROHIBITED. Street trees are prohibited in the City of Durant. No person shall plant any tree, shrub, bush or other woody vegetation in any boulevard in the City. Flowers may be planted, on condition that the owner of the real estate fronting the boulevard where flowers are planted shall maintain all plantings in good condition and the City may at any time remove such plantings for any reason without compensation to any person.

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.