Breda, IA:

2020 Urban Forest Management Plan

PREPARED BY:

Andrew Larson & Morgan Langer
Iowa Department of Natural Resources

JEO CONSULTING GROUP

Table of Contents

Table of Contents

Executive Summary

Do

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Breda 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 12% of Breda'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 352 trees inventoried.

- Breda's trees provide $68,892 of benefits annually, an average of $196 per tree
- There are over 25 species of trees
- The top three genera are: maple 46%, ash 12%, and spruce 11%
- 45% of trees need some type of management
- 56 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 56 trees needing removal, 38 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 34 of the 43 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 6 years to remove ash. We suggest that city officials request a budget increase to $6,500 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

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

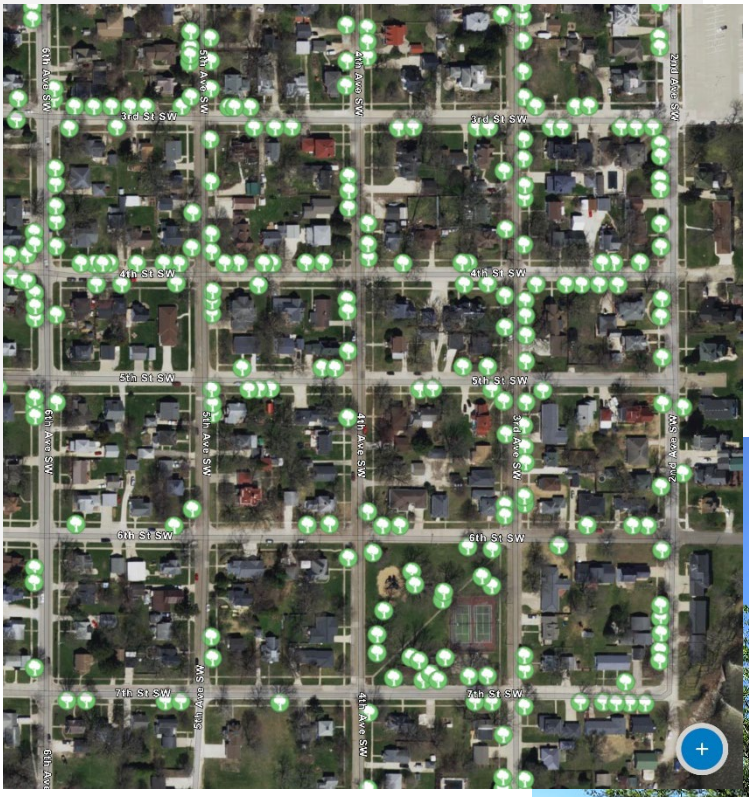
Assist Breda with Managing its Urban Forest

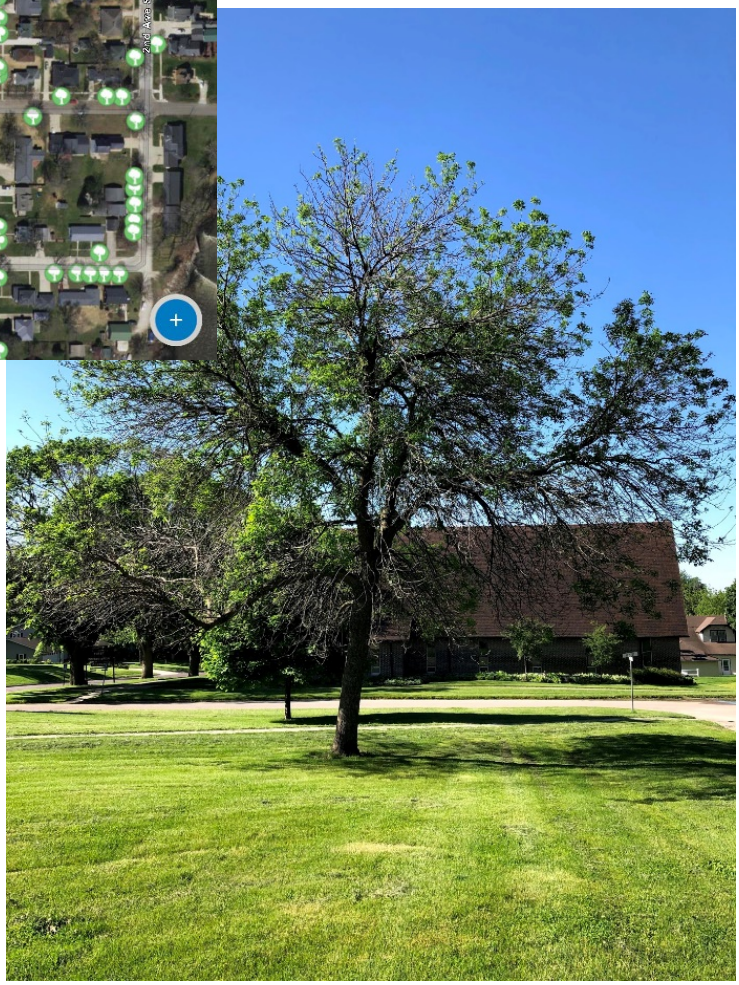
Inform on the Benefits of a Healthy Urban Forest

Establish Preventative Treatment for Emerald Ash Borer

Develop Efficient City Tree Management Techniques

Mitigate Public Safety Issues





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 3 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 352 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. Breda's trees reduce energy-related costs by approximately $18,125 annually (Appendix A, Table 1). These savings are both in electricity (85.4 MWh) and in natural gas (11,884.0 Therms).

Annual Stormwater Benefits

Breda's trees intercept about 1,041,566 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $28,226 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 Breda, it is estimated that trees remove 1,097.8 pounds 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 $3,053 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Breda, trees sequester about 191,435 pounds of carbon per year with an associated value of $1,436 (Appendix A, Table 5). In addition, the trees store 3,923,439 pounds of carbon, with a yearly benefit of $29,426 (Appendix A, Table 4).

Annual Aesthetics Benefits

The social benefits of trees can be difficult 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. Breda receives $17,127 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, Breda's trees provide $97,393 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 352 trees in Breda provide approximately $195 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$18,125**	• Intercept **1,041,566 gallons** • Provides **$28,226** benefit	• Remove **1,097.8 lbs** of pollution • Net value of **$3,053**	• Sequester **191,435 lbs** • Value of **$1,436** • Store **3,923,439 lbs** • Value of **$29,426**	• **$17,127** in social benefits	• **$97,393** annual benefits • Each tree provides **$195** annually

FOREST STRUCTURE

Species Distribution

Breda has over 24 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	161	46%	Oak	6	2%
Ash	43	12%	Pear	2	<1%
Spruce	40	11%	Plum	2	<1%
Apple	26	7%	Birch	1	<1%
Basswood/Linden	23	7%	Willow	1	<1%
Pine	19	5%	Cedar	1	<1%
Honey Locust	14	4%	Other	3	<1%
Hackberry	10	3%			

Age Class

Most of Breda's trees (37 percent) are between 24 and 36 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Breda's size curve is on the larger side, indicating an older than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Breda indicate that 82 percent of the trees are in good health, with only 18 percent of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 87 percent of Breda's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Thirteen percent of the tree population's wood condition is in poor health, dead, or dying. This 13 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	70	20%
Tree Removal	56	16%
Crown Raising	12	3%
Crown Reduction	9	3%
Tree Staking	2	<1%

Canopy Cover

The total canopy with both private and public trees is 32.1 acres or around 7 percent. The canopy cover included in the Breda inventory includes approximately 10 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 13 percent in 30 years. To achieve this goal it is estimated that 72 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Breda's city and park trees are in Industrial/Large Commercial zones or 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
Industrial/Large Commercial	77%
Single Family Residential	23%
Park/Vacant/Other	0%
Small Commercial	0%
Multifamily Residential	0%

Recommendations

RECOMMENDATIONS

Risk Management

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

HAZARDOUS TREES

Breda has 56 trees recommended for 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 48 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 159 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 56 removals, 8 are ash trees. There are a total of 43 ash trees, and 26 of those have signs and symptoms that have been associated with EAB. In addition, there are 5 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 Work 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 Breda.

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 (46 percent) (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 due to public safety concerns and other considerations iclude cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut as state in the city ordinance 151.02 (3).

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 die back, 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 (3). The new plantings will be a diverse mix and will not include any fruit-bearing trees, or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

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 (2) states, " 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])

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $5,000/Year – (Based off Reported Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Remove 1 ash tree in poor condition	$700
Plant 5 trees in open locations	$750
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,950**

YEAR 2	Est. Cost
Remove 4 trees recommended for immediate removal	$2,800
Plant 2 trees in open locations	$300
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,860**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Remove 5 ash trees in poor condition	$3,500
Plant 5 trees in open locations	$750
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,950**

YEAR 4	Est. Cost
Remove 4 trees recommended for immediate removal	$2,800
Plant 2 trees in open locations	$300
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,860**

YEAR 5	Est. Cost
Remove 6 trees recommended for immediate removal	$4,200
Plant 5 trees in open locations	$750
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,950**

YEAR 6	Est. Cost
Remove 2 trees recommended for immediate removal	$1,400
Remove 2 ash in poor condition	$1,400
Plant 2 trees in open locations	$300
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,860**

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 $5,016 a year. If the budget were increased to $6,500 a year all ash and other damaged trees could be removed in 7 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $6,500/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 6 trees in open locations	$900
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,500**

YEAR 2	Est. Cost
Remove 6 ash trees in poor condition	$4,200
Plant 3 trees in open locations	$450
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,410**

YEAR 3	Est. Cost
Remove 8 trees recommended for immediate removal	$5,600
Plant 6 trees in open locations	$900
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,500**

YEAR 4	Est. Cost
Remove 6 trees recommended for immediate removal	$4,200
Plant 3 trees in open locations	$450
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,410**

YEAR 5	Est. Cost
Remove 8 ash in poor health	$5,600
Plant 6 trees in open locations	$900
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,500**

YEAR 6	Est. Cost
Remove 6 ash in poor health	$4,200
Plant 3 trees in open locations	$450
Prune 1/3 of city owned trees	$1,760
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,410**

Proposed Budget Increase

EAB could potentially kill all ash trees in Breda within four years of its arrival. To remove all ash and other damaged trees within six years, the budget would need to be increased to $6,500 a year. Additionally, we recommend that Breda 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 16 trees could be treated per year (every other year treatment). Sixteen trees would be selected for treatment, and Breda would still need to find $18,900 for removal. Alternatively, if there are 21 treatable trees, it would cost approximately $6,300 a year for treatment and leave $15,400 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 Breda. 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

Breda

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
Norway maple	22.6	1,714	3,288.4	3,223	4,936	(N/A)	24.1	27.2	58.08
Silver maple	17.1	1,296	2,227.5	2,183	3,479	(N/A)	14.8	19.2	66.90
Green ash	14.3	1,088	1,989.5	1,950	3,037	(N/A)	12.2	16.8	70.64
Blue spruce	2.8	209	388.4	381	590	(N/A)	7.4	3.3	22.69
Apple	3.3	253	486.1	476	730	(N/A)	7.4	4.0	28.07
Sugar maple	4.4	337	587.2	575	913	(N/A)	5.1	5.0	50.70
Scotch pine	2.8	211	369.1	362	572	(N/A)	4.5	3.2	35.77
Honeylocust	2.6	195	349.7	343	538	(N/A)	4.0	3.0	38.43
American basswood	4.2	322	609.4	597	919	(N/A)	3.7	5.1	70.72
Spruce	1.7	127	215.8	211	339	(N/A)	3.4	1.9	28.24
Littleleaf linden	2.1	157	307.7	302	459	(N/A)	2.8	2.5	45.86
Northern hackberry	3.6	275	498.0	488	763	(N/A)	2.8	4.2	76.26
Red maple	0.8	60	112.8	111	171	(N/A)	1.1	0.9	42.63
Austrian pine	0.5	38	69.8	68	106	(N/A)	0.9	0.6	35.47
Broadleaf Deciduous Small	0.3	20	38.1	37	57	(N/A)	0.9	0.3	19.06
Bur oak	0.8	57	107.4	105	162	(N/A)	0.9	0.9	54.15
Callery pear	0.2	16	33.7	33	49	(N/A)	0.6	0.3	24.47
Swamp white oak	0.4	28	56.4	55	83	(N/A)	0.6	0.5	41.58
Maple	0.0	1	1.5	1	2	(N/A)	0.6	0.0	1.03
Cherry plum	0.1	6	13.5	13	19	(N/A)	0.6	0.1	9.53
Black spruce	0.3	21	39.0	38	59	(N/A)	0.6	0.3	29.65
Northern red oak	0.1	7	14.2	14	21	(N/A)	0.3	0.1	21.11
Willow	0.3	24	47.4	46	71	(N/A)	0.3	0.4	70.84
Eastern red cedar	0.1	8	16.4	16	25	(N/A)	0.3	0.1	24.57
Birch	0.1	8	16.9	17	24	(N/A)	0.3	0.1	24.47
Total	85.4	6,478	11,884.0	11,646	18,125	(N/A)	100.0	100.0	51.49

Annual Stormwater Benefits of Public Trees

1/28/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	233,946	6,340	(N/A)	24.1	22.5	74.59
Silver maple	239,705	6,496	(N/A)	14.8	23.0	124.92
Green ash	185,309	5,022	(N/A)	12.2	17.8	116.79
Blue spruce	41,207	1,117	(N/A)	7.4	4.0	42.95
Apple	12,933	350	(N/A)	7.4	1.2	13.48
Sugar maple	48,537	1,315	(N/A)	5.1	4.7	73.08
Scotch pine	65,497	1,775	(N/A)	4.5	6.3	110.94
Honeylocust	26,675	723	(N/A)	4.0	2.6	51.64
American basswood	54,202	1,469	(N/A)	3.7	5.2	112.99
Spruce	30,805	835	(N/A)	3.4	3.0	69.57
Littleleaf linden	23,531	638	(N/A)	2.8	2.3	63.77
Northern hackberry	38,357	1,039	(N/A)	2.8	3.7	103.95
Red maple	6,985	189	(N/A)	1.1	0.7	47.32
Austrian pine	8,774	238	(N/A)	0.9	0.8	79.26
Broadleaf Deciduous Small	938	25	(N/A)	0.9	0.1	8.48
Bur oak	8,494	230	(N/A)	0.9	0.8	76.73
Callery pear	1,172	32	(N/A)	0.6	0.1	15.88
Swamp white oak	3,065	83	(N/A)	0.6	0.3	41.53
Maple	23	1	(N/A)	0.6	0.0	0.32
Cherry plum	272	7	(N/A)	0.6	0.0	3.68
Black spruce	4,625	125	(N/A)	0.6	0.4	62.66
Northern red oak	529	14	(N/A)	0.3	0.1	14.33
Willow	3,764	102	(N/A)	0.3	0.4	102.01
Eastern red cedar	1,635	44	(N/A)	0.3	0.2	44.30
Birch	586	16	(N/A)	0.3	0.1	15.88
Citywide total	1,041,566	28,226	(N/A)	100.0	100.0	80.19

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								
Norway maple	50.7	8.7	24.5	2.2	273	109.8	15.8	15.1	102.4	679	-11.6	-44	317.7	908	(N/A)	24.1	10.69
Silver maple	43.4	7.3	21.2	1.9	234	80.4	11.8	11.2	77.3	503	-23.7	-89	230.8	648	(N/A)	14.8	12.46
Green ash	27.1	4.3	12.4	1.2	143	68.7	10.0	9.5	64.9	427	0.0	0	198.2	570	(N/A)	12.2	13.26
Blue spruce	5.9	1.2	4.9	0.7	39	13.2	1.9	1.8	12.5	82	-15.2	-57	26.8	64	(N/A)	7.4	2.46
Apple	3.8	0.6	1.8	0.2	20	16.2	2.3	2.2	15.1	100	0.0	0	42.3	120	(N/A)	7.4	4.63
Sugar maple	6.8	1.2	3.4	0.3	37	21.0	3.1	2.9	20.1	131	-5.4	-20	53.4	148	(N/A)	5.1	8.23
Scotch pine	8.0	1.6	6.3	1.0	52	13.1	1.9	1.8	12.6	82	-38.4	-144	7.9	-10	(N/A)	4.5	-0.63
Honeylocust	5.0	0.8	2.3	0.2	27	12.2	1.8	1.7	11.6	76	-4.0	-15	31.8	88	(N/A)	4.0	6.28
American basswood	8.0	1.4	3.8	0.4	43	20.6	3.0	2.8	19.3	127	-6.6	-25	52.5	145	(N/A)	3.7	11.18
Spruce	3.6	0.7	2.9	0.4	24	7.9	1.2	1.1	7.6	49	-15.0	-56	10.4	17	(N/A)	3.4	1.40
Littleleaf linden	4.2	0.7	2.0	0.2	22	10.1	1.5	1.4	9.4	62	-2.0	-7	27.4	77	(N/A)	2.8	7.74
Northern hackberry	6.9	1.2	3.4	0.3	37	17.3	2.5	2.4	16.4	108	0.0	0	50.5	145	(N/A)	2.8	14.53
Red maple	1.7	0.3	0.8	0.1	9	3.8	0.6	0.5	3.6	24	-0.6	-2	10.7	30	(N/A)	1.1	7.59
Austrian pine	1.6	0.3	1.3	0.2	10	2.4	0.3	0.3	2.3	15	-3.4	-13	5.3	12	(N/A)	0.9	4.16
Broadleaf Deciduous Small	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)	0.9	3.07
Bur oak	1.0	0.2	0.5	0.0	5	3.6	0.5	0.5	3.4	23	0.0	0	9.8	28	(N/A)	0.9	9.31
Callery pear	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	1.0	6	0.0	0	2.5	7	(N/A)	0.6	3.47
Swamp white oak	0.5	0.1	0.3	0.0	3	1.8	0.3	0.2	1.7	11	-0.1	-1	4.8	14	(N/A)	0.6	6.81
Maple	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)	0.6	0.13
Cherry plum	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3	(N/A)	0.6	1.33
Black spruce	0.7	0.1	0.6	0.1	5	1.3	0.2	0.2	1.3	8	-1.8	-7	2.7	6	(N/A)	0.6	3.10
Northern red oak	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	-0.1	0	1.1	3	(N/A)	0.3	2.89
Willow	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)	0.3	13.58
Eastern red cedar	0.3	0.1	0.3	0.0	2	0.5	0.1	0.1	0.5	3	-0.9	-3	1.0	2	(N/A)	0.3	2.19
Birch	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	0.3	3.47
Citywide total	180.6	31.1	93.4	9.6	992	409.2	59.5	56.7	386.8	2,545	-129.1	-484	1,097.8	3,053	(N/A)	100.0	8.67

Breda

Stored CO2 Benefits of Public Trees

1/28/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	837,382	6,280	(N/A)	24.1	21.3	73.89
Silver maple	1,074,459	8,058	(N/A)	14.8	27.4	154.97
Green ash	900,163	6,751	(N/A)	12.2	22.9	157.01
Blue spruce	42,990	322	(N/A)	7.4	1.1	12.40
Apple	58,636	440	(N/A)	7.4	1.5	16.91
Sugar maple	202,184	1,516	(N/A)	5.1	5.2	84.24
Scotch pine	99,107	743	(N/A)	4.5	2.5	46.46
Honeylocust	65,581	492	(N/A)	4.0	1.7	35.13
American basswood	303,083	2,273	(N/A)	3.7	7.7	174.86
Spruce	36,632	275	(N/A)	3.4	0.9	22.89
Littleleaf linden	87,844	659	(N/A)	2.8	2.2	65.88
Northern hackberry	111,035	833	(N/A)	2.8	2.8	83.28
Red maple	18,092	136	(N/A)	1.1	0.5	33.92
Austrian pine	14,680	110	(N/A)	0.9	0.4	36.70
Broadleaf Deciduous	3,959	30	(N/A)	0.9	0.1	9.90
Bur oak	32,580	244	(N/A)	0.9	0.8	81.45
Callery pear	2,201	17	(N/A)	0.6	0.1	8.26
Swamp white oak	9,046	68	(N/A)	0.6	0.2	33.92
Maple	34	0	(N/A)	0.6	0.0	0.13
Cherry plum	922	7	(N/A)	0.6	0.0	3.46
Black spruce	5,322	40	(N/A)	0.6	0.1	19.96
Northern red oak	1,025	8	(N/A)	0.3	0.0	7.68
Willow	14,280	107	(N/A)	0.3	0.4	107.10
Eastern red cedar	1,102	8	(N/A)	0.3	0.0	8.27
Birch	1,101	8	(N/A)	0.3	0.0	8.26
Citywide total	3,923,439	29,426	(N/A)	100.0	100.0	83.60

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.

Breda

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
Norway maple	25,322	190	-4,022	-249	-32	37,875	284	58,927	442 (N/A)	24.1	18.7	5.20
Silver maple	74,833	561	-5,158	-191	-40	28,639	215	98,123	736 (N/A)	14.8	31.2	14.15
Green ash	32,743	246	-4,321	-158	-34	24,040	180	52,304	392 (N/A)	12.2	16.6	9.12
Blue spruce	2,517	19	-206	-52	-2	4,625	35	6,884	52 (N/A)	7.4	2.2	1.99
Apple	5,307	40	-281	-41	-2	5,600	42	10,585	79 (N/A)	7.4	3.4	3.05
Sugar maple	9,990	75	-970	-48	-8	7,450	56	16,421	123 (N/A)	5.1	5.2	6.84
Scotch pine	2,217	17	-476	-59	-4	4,652	35	6,335	48 (N/A)	4.5	2.0	2.97
Honeylocust	5,453	41	-317	-21	-3	4,316	32	9,431	71 (N/A)	4.0	3.0	5.05
American basswood	16,503	124	-1,455	-51	-11	7,119	53	22,117	166 (N/A)	3.7	7.0	12.76
Spruce	1,964	15	-176	-30	-2	2,814	21	4,573	34 (N/A)	3.4	1.5	2.86
Littleleaf linden	5,306	40	-422	-27	-3	3,470	26	8,328	62 (N/A)	2.8	2.6	6.25
Northern hackberry	4,702	35	-533	-35	-4	6,068	46	10,201	77 (N/A)	2.8	3.2	7.65
Red maple	331	2	-87	-8	-1	1,325	10	1,561	12 (N/A)	1.1	0.5	2.93
Austrian pine	0	0	-70	-11	-1	840	6	759	6 (N/A)	0.9	0.2	1.90
Broadleaf Deciduous Smal	390	3	-19	-3	0	438	3	806	6 (N/A)	0.9	0.3	2.02
Bur oak	1,923	14	-156	-8	-1	1,263	9	3,021	23 (N/A)	0.9	1.0	7.55
Callery pear	448	3	-11	-2	0	352	3	787	6 (N/A)	0.6	0.2	2.95
Swamp white oak	694	5	-43	-4	0	616	5	1,262	9 (N/A)	0.6	0.4	4.73
Maple	6	0	0	0	0	14	0	19	0 (N/A)	0.6	0.0	0.07
Cherry plum	123	1	-4	-1	0	130	1	246	2 (N/A)	0.6	0.1	0.92
Black spruce	294	2	-26	-5	0	465	3	728	5 (N/A)	0.6	0.2	2.73
Northern red oak	147	1	-5	-1	0	160	1	301	2 (N/A)	0.3	0.1	2.26
Willow	0	0	-69	-4	-1	539	4	466	3 (N/A)	0.3	0.1	3.49
Eastern red cedar	0	0	-5	-2	0	187	1	180	1 (N/A)	0.3	0.1	1.35
Birch	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.1	2.95
Citywide total	191,435	1,436	-18,838	-1,015	-149	143,173	1,074	314,755	2,361 (N/A)	100.0	100.0	6.71

Annual Aesthetic/Other Benefits of Public Trees

1/28/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	2,347	(N/A)	24.1	13.7	27.61
Silver maple	5,631	(N/A)	14.8	32.9	108.29
Green ash	2,465	(N/A)	12.2	14.4	57.32
Blue spruce	511	(N/A)	7.4	3.0	19.64
Apple	307	(N/A)	7.4	1.8	11.81
Sugar maple	1,040	(N/A)	5.1	6.1	57.76
Scotch pine	367	(N/A)	4.5	2.1	22.92
Honeylocust	1,324	(N/A)	4.0	7.7	94.54
American basswood	1,113	(N/A)	3.7	6.5	85.63
Spruce	433	(N/A)	3.4	2.5	36.05
Littleleaf linden	547	(N/A)	2.8	3.2	54.74
Northern hackberry	591	(N/A)	2.8	3.5	59.15
Red maple	60	(N/A)	1.1	0.3	14.92
Austrian pine	0	(N/A)	0.9	0.0	0.00
Broadleaf Deciduous Small	22	(N/A)	0.9	0.1	7.31
Bur oak	160	(N/A)	0.9	0.9	53.25
Callery pear	52	(N/A)	0.6	0.3	26.22
Swamp white oak	69	(N/A)	0.6	0.4	34.64
Maple	0	(N/A)	0.6	0.0	0.04
Cherry plum	6	(N/A)	0.6	0.0	3.22
Black spruce	40	(N/A)	0.6	0.2	19.97
Northern red oak	16	(N/A)	0.3	0.1	16.24
Willow	0	(N/A)	0.3	0.0	0.00
Eastern red cedar	0	(N/A)	0.3	0.0	0.00
Birch	26	(N/A)	0.3	0.2	26.22
Citywide total	17,127	(N/A)	100.0	100.0	48.66

Total Annual Benefits of Public Trees by Species ($)

1/28/2021

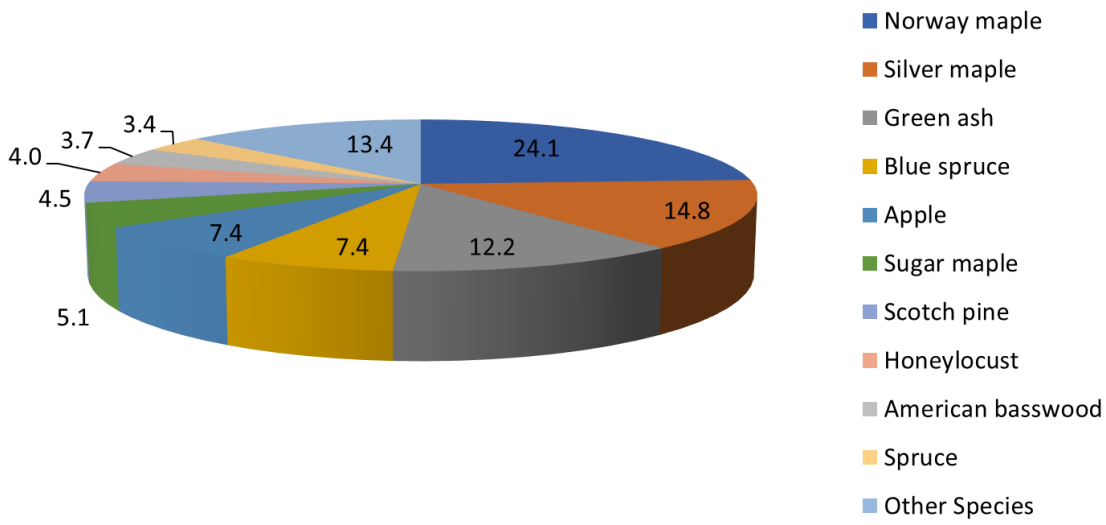
Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	4,936	442	908	6,340	2,347	14,973	(N/A)	21.7
Silver maple	3,479	736	648	6,496	5,631	16,990	(N/A)	24.7
Green ash	3,037	392	570	5,022	2,465	11,487	(N/A)	16.7
Blue spruce	590	52	64	1,117	511	2,333	(N/A)	3.4
Apple	730	79	120	350	307	1,587	(N/A)	2.3
Sugar maple	913	123	148	1,315	1,040	3,539	(N/A)	5.1
Scotch pine	572	48	-10	1,775	367	2,751	(N/A)	4.0
Honeylocust	538	71	88	723	1,324	2,743	(N/A)	4.0
American basswood	919	166	145	1,469	1,113	3,813	(N/A)	5.5
Spruce	339	34	17	835	433	1,657	(N/A)	2.4
Littleleaf linden	459	62	77	638	547	1,783	(N/A)	2.6
Northern hackberry	763	77	145	1,039	591	2,615	(N/A)	3.8
Red maple	171	12	30	189	60	462	(N/A)	0.7
Austrian pine	106	6	12	238	0	362	(N/A)	0.5
Broadleaf Deciduous Sn	57	6	9	25	22	120	(N/A)	0.2
Bur oak	162	23	28	230	160	603	(N/A)	0.9
Callery pear	49	6	7	32	52	146	(N/A)	0.2
Swamp white oak	83	9	14	83	69	259	(N/A)	0.4
Maple	2	0	0	1	0	3	(N/A)	0.0
Cherry plum	19	2	3	7	6	37	(N/A)	0.1
Black spruce	59	5	6	125	40	236	(N/A)	0.3
Northern red oak	21	2	3	14	16	57	(N/A)	0.1
Willow	71	3	14	102	0	190	(N/A)	0.3
Eastern red cedar	25	1	2	44	0	72	(N/A)	0.1
Birch	24	3	3	16	26	73	(N/A)	0.1
Citywide Total	18,125	2,361	3,053	28,226	17,127	68,892	(N/A)	100.0

Figure 1: Species Distribution

Breda

Species Distribution of Public Trees

1/28/2021



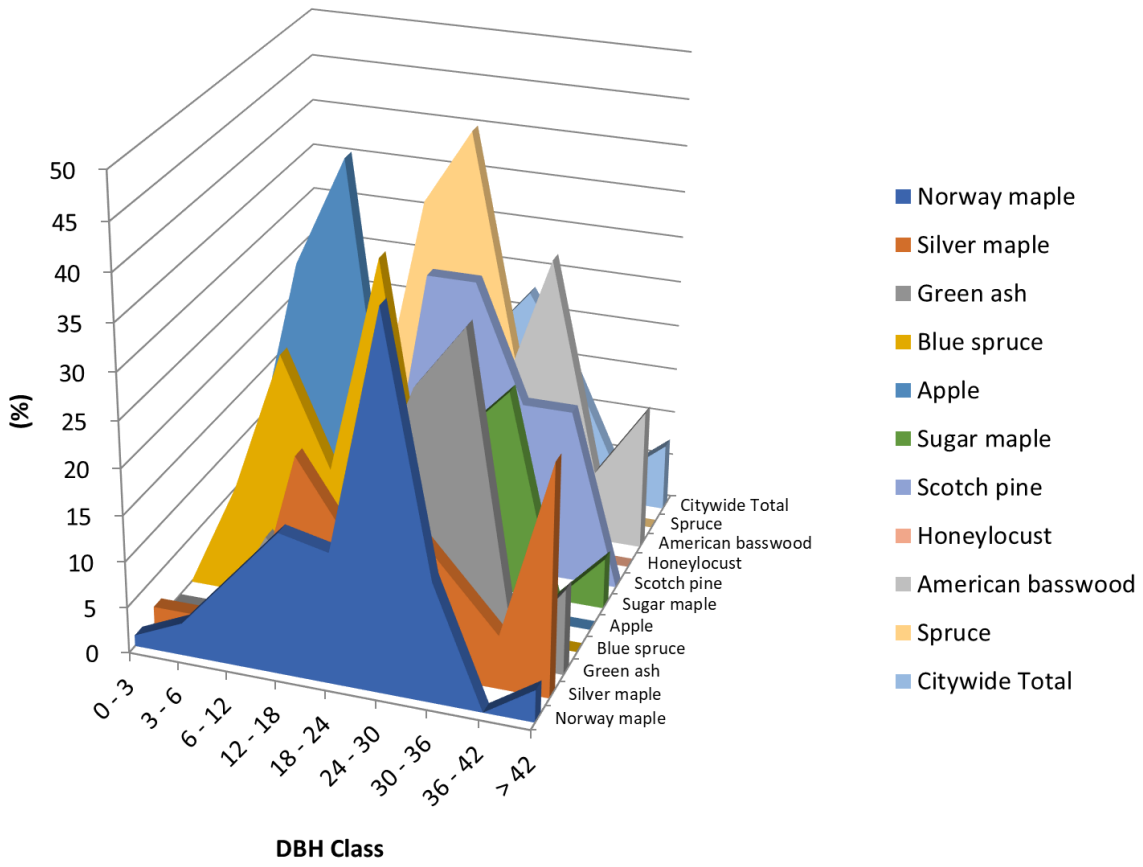
Species	Percent
Norway maple	24.1
Silver maple	14.8
Green ash	12.2
Blue spruce	7.4
Apple	7.4
Sugar maple	5.1
Scotch pine	4.5
Honeylocust	4.0
American basswood	3.7
Spruce	3.4
Other Species	13.4
Total	100.0

Breda

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
Norway maple	1.18	3.53	9.41	15.29	14.12	40.00	12.94	0.00	3.53
Silver maple	1.92	1.92	1.92	21.15	13.46	17.31	11.54	5.77	25.00
Green ash	0.00	0.00	9.30	2.33	13.95	27.91	34.88	2.33	9.30
Blue spruce	0.00	11.54	26.92	15.38	38.46	7.69	0.00	0.00	0.00
Apple	0.00	11.54	34.62	46.15	7.69	0.00	0.00	0.00	0.00
Sugar maple	0.00	0.00	33.33	22.22	0.00	16.67	22.22	0.00	5.56
Scotch pine	0.00	0.00	0.00	0.00	31.25	31.25	18.75	18.75	0.00
Honeylocust	7.14	28.57	28.57	0.00	0.00	21.43	14.29	0.00	0.00
American basswood	0.00	0.00	0.00	7.69	23.08	15.38	30.77	7.69	15.38
Spruce	0.00	0.00	8.33	33.33	41.67	16.67	0.00	0.00	0.00
Citywide Total	2.27	4.26	14.49	15.06	16.48	22.73	14.20	3.13	7.39

Figure 3: Foliage Condition

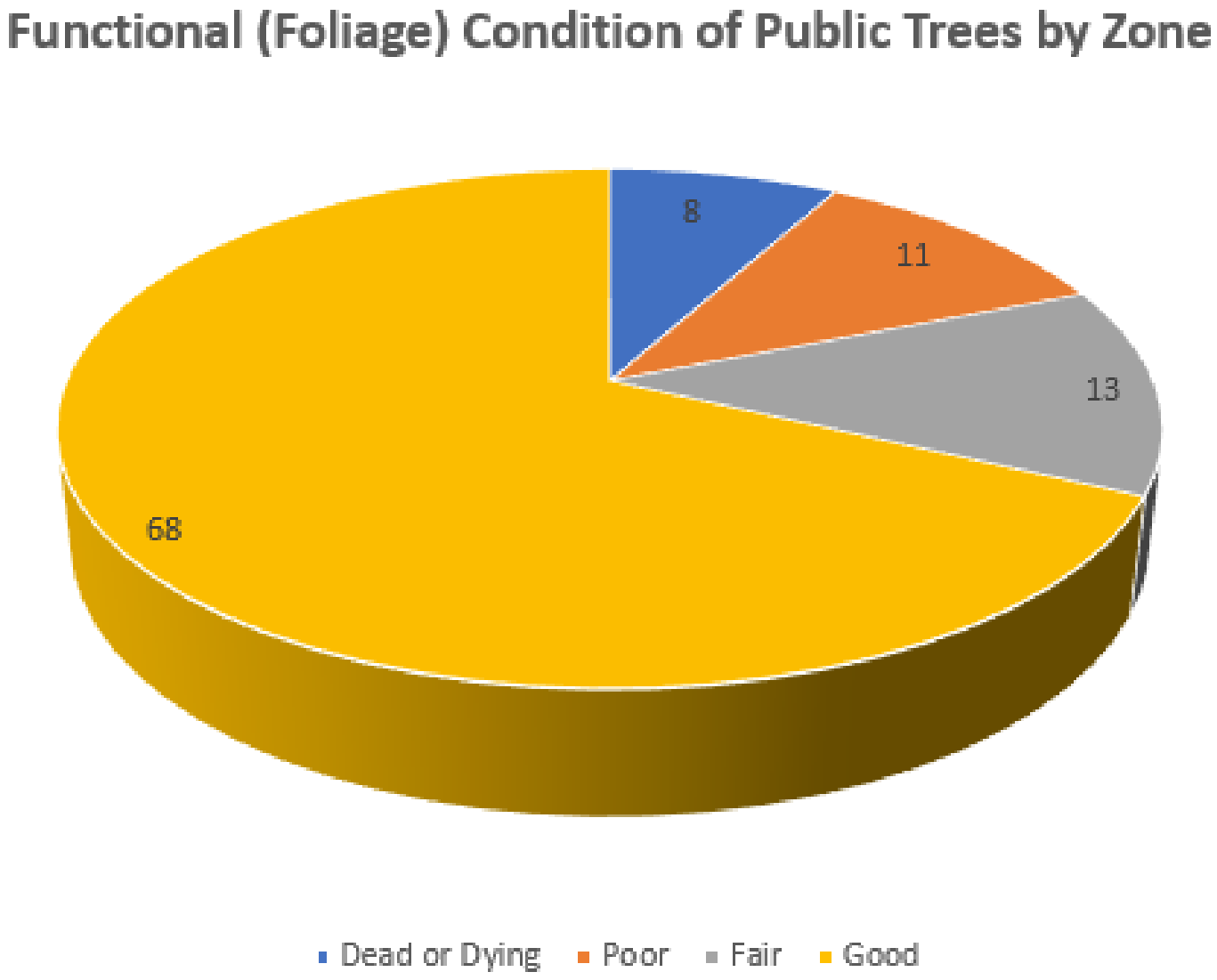


Figure 4: Wood Condition

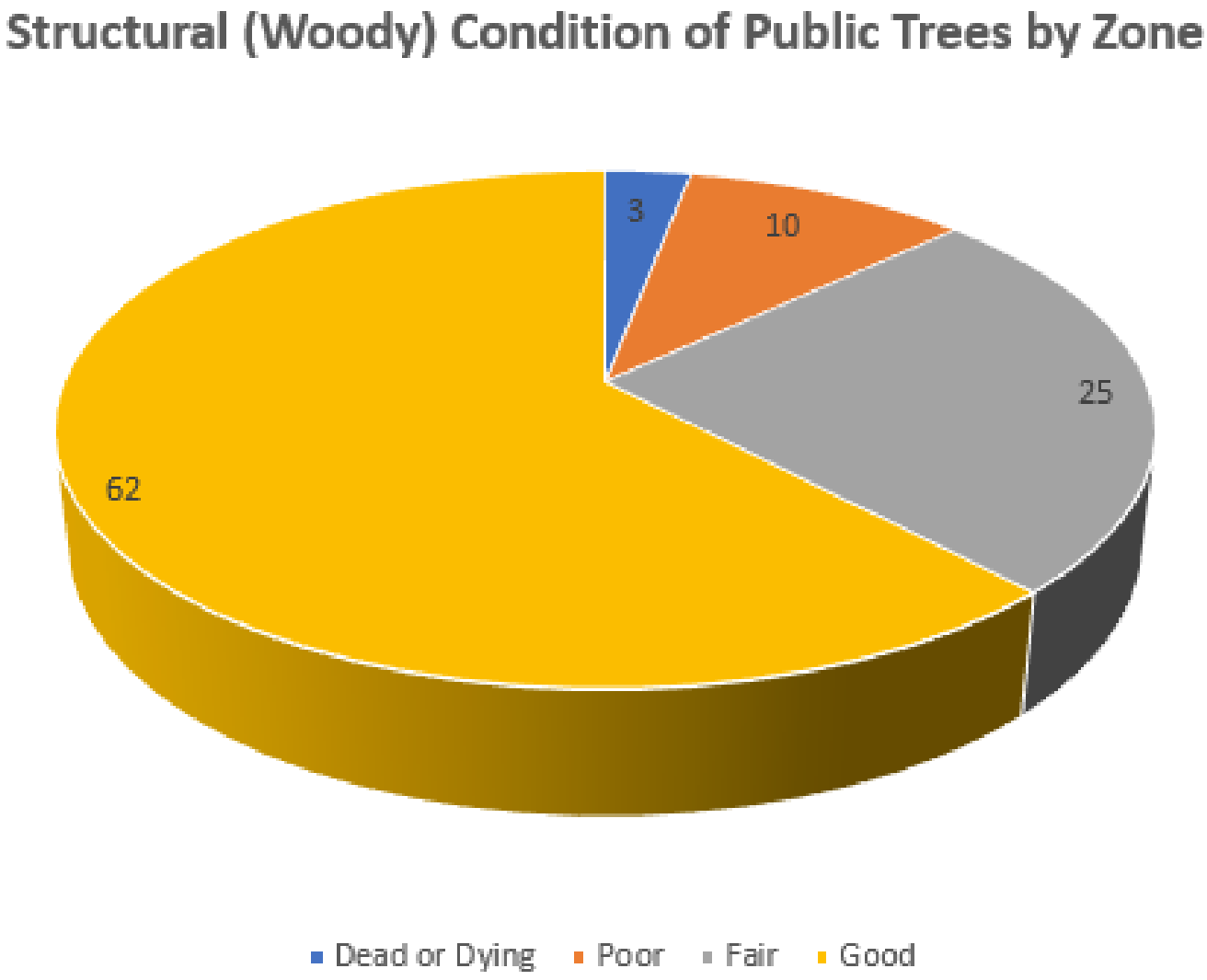
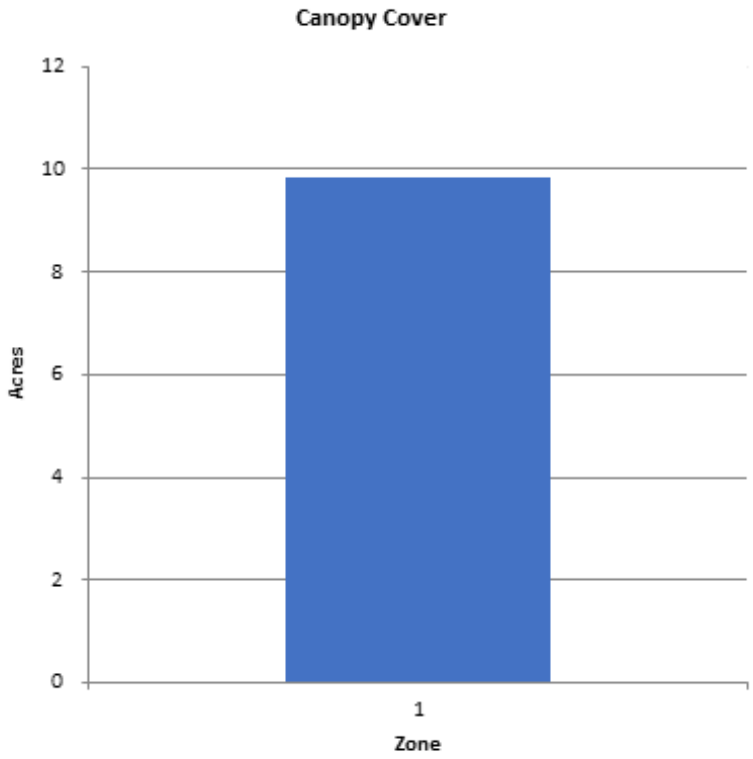


Figure 5: Canopy Cover in Acres

Breda

Canopy Cover of Public Trees (Acres)

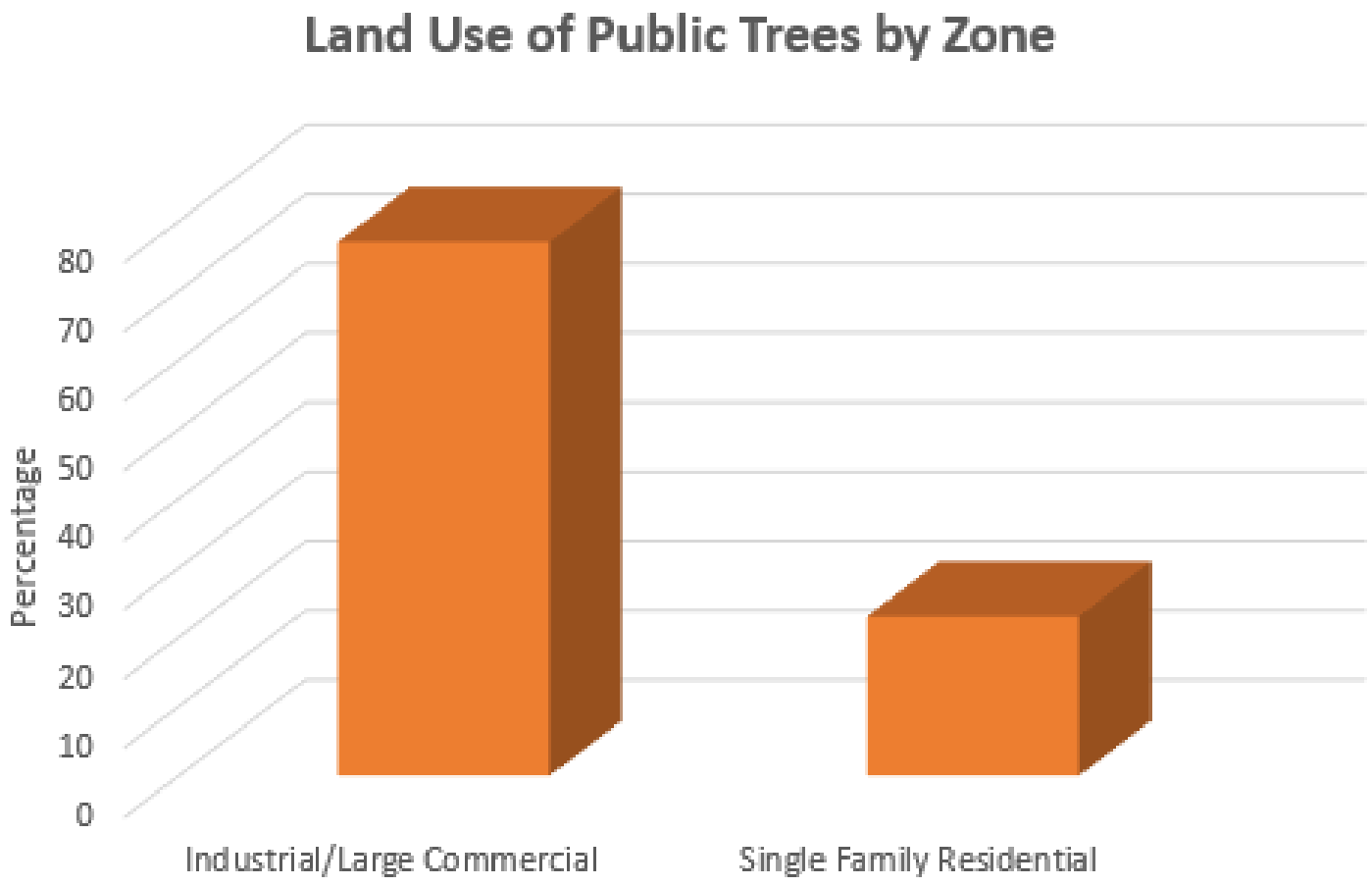
2/8/2021



Zone	Acres	% of Total Canopy Cover
1	10	100.0
Citywide total	10	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	10	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

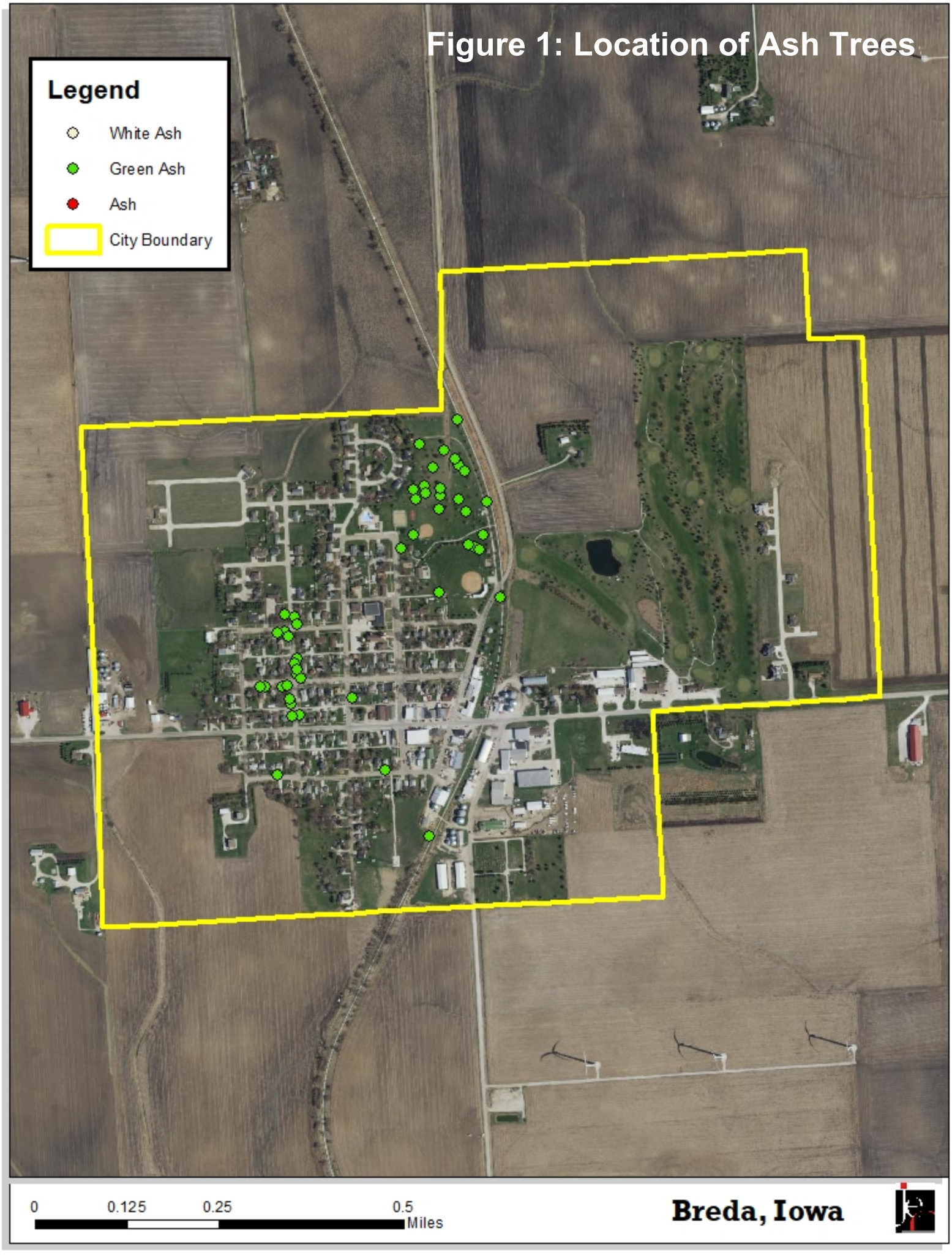


Figure 1: Location of Ash Trees
Legend
White Ash
Green Ash
Ash
City Boundary
0
0.125
0.25
0.5
Miles
Breda, Iowa

Figure 2: Location of EAB Symptoms

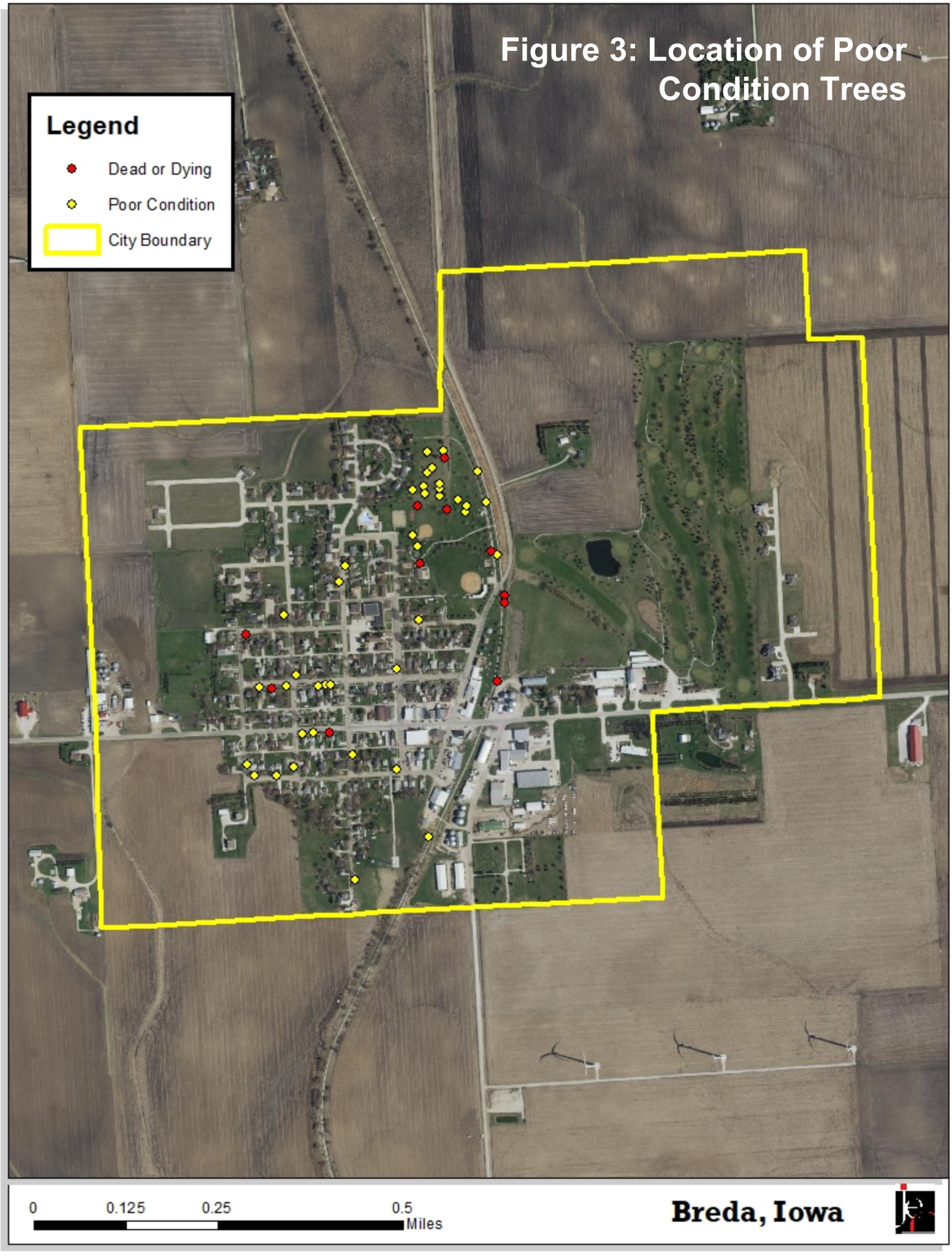
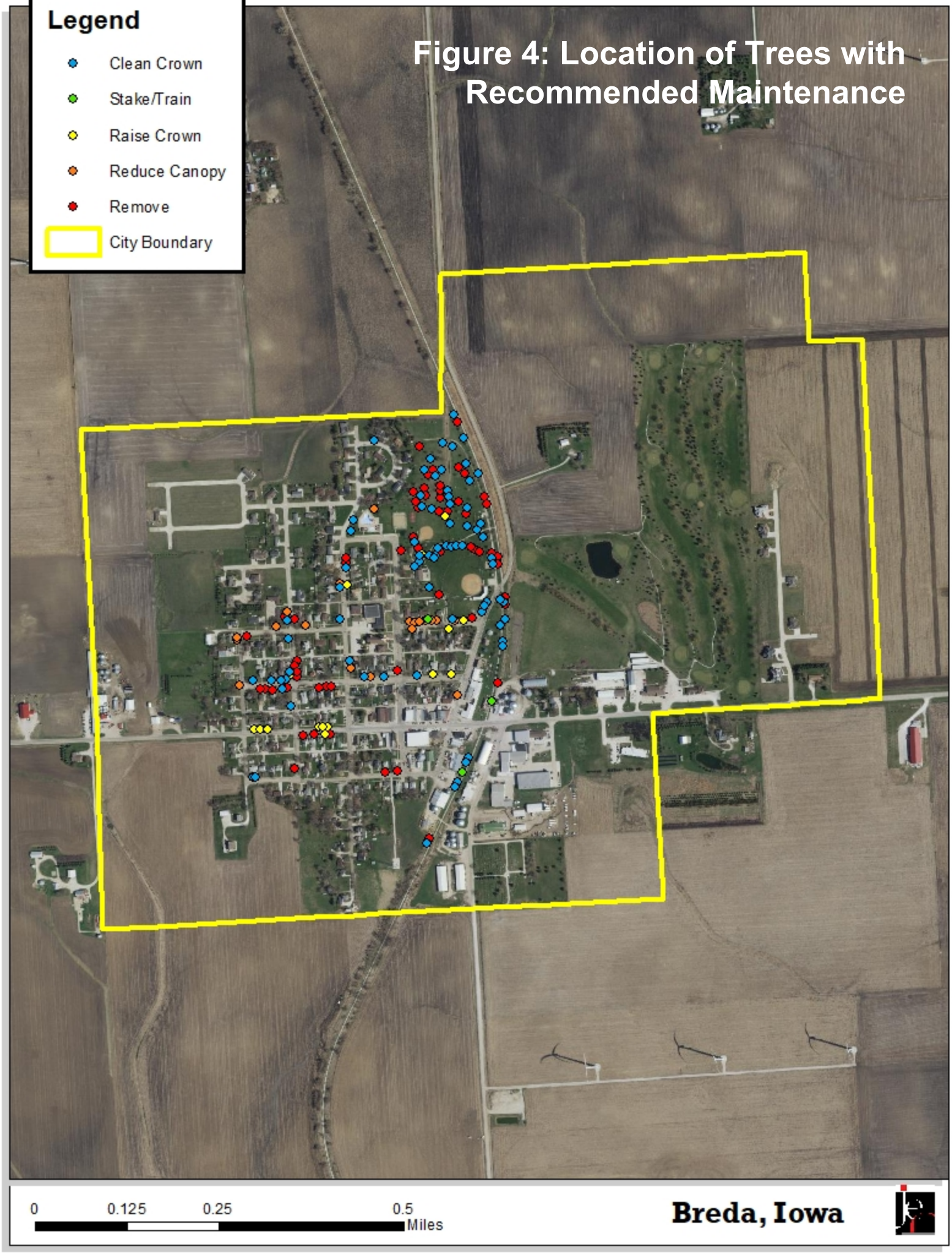


Figure 3: Location of Poor Condition Trees
Legend
Dead or Dying
Poor Condition
City Boundary
0
0.125
0.25
0.5
Miles
Breda, Iowa


Legend
Clean Crown
Stake/Train
Raise Crown
Reduce Canopy
Remove
City Boundary
Figure 4: Location of Trees with Recommended Maintenance
0
0.125
0.25
0.5
Miles
Breda, Iowa

APPENDIX C: BREDA TREE ORDINANCES

Appendix C: Breda Tree Ordinances

CHAPTER 151
TREES AND GRASS

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 portion 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 overhanging 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])

151.07 CUTTING OR MOWING OF GRASS.
1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.
2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

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.