# Hazleton, IA
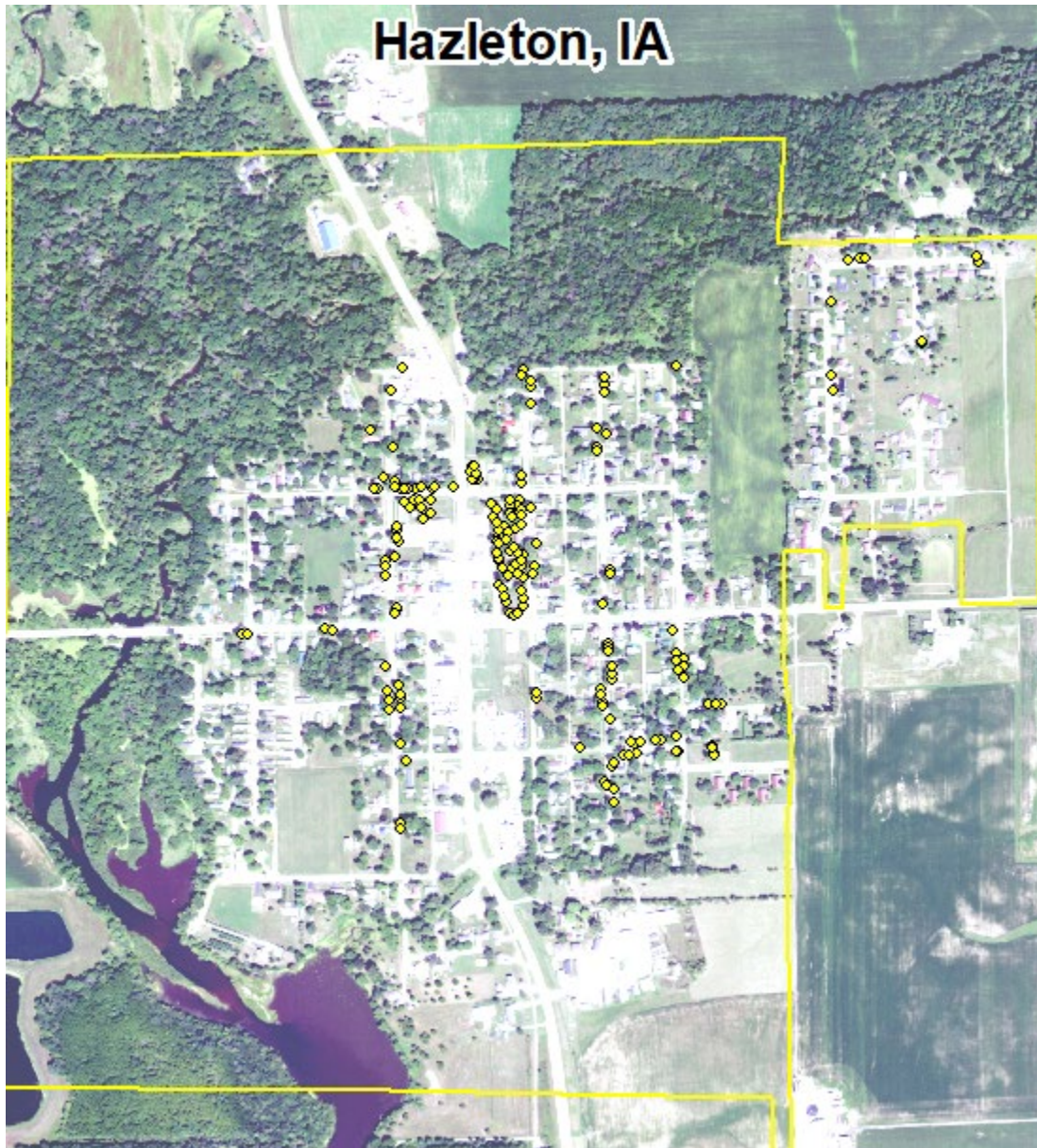


Hazleton, IA

2023 Urban Forest Management Plan
Prepared by Emma Hanigan
Iowa Department of Natural Resources

# Table of Contents

# Executive Summary

## Overview

This plan was developed to assist the City of Hazleton with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as 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 (this does not include mountain ash). There is a strong possibility that 8% of Hazleton's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. 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 2022, a tree inventory was conducted 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 188 trees inventoried.

- Hazleton's trees provide $36,300 of benefits annually, an average of $198 a tree
- There are over 31 species of trees
- The top three genera are: Maple 34%, Oak 10% and Spruce 9%
- 12% of trees are in need of some type of management
- 18 trees are recommended for removal

## Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 18 trees needing removal 14 are ash *City ownership of the trees recommended for removal should be verified prior to any removal*
- 14 of the 15 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 with a visual survey yearly
- With ash removal needed the next two year will need more funding than usual– Suggestion: request a budget increase and apply for grants to plant replacement trees

# Introduction

This plan was developed to assist Hazleton with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the recovery from Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal or treatment and replacement planting. With proper planning and management of the current canopy in Hazleton, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Hazleton's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of Hazleton and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Hazleton's urban forestry goals.

# Inventory

In 2022, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms associated with EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

# Inventory Results

The data collected for the 188 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

# Annual Benefits

**Annual Energy Benefits**
Trees conserve energy by shading buildings and blocking winds. Hazleton's trees reduce energy related costs by approximately $8,970 annually (Appendix A, Table 1). These savings are both in Electricity (43.3MWh) and in Natural Gas (3,288 Therms).

**Annual Stormwater Benefits**
Hazleton's trees intercept about 517,287 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $14,018 of benefits 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 emitting volatile organic matter (ozone). In Hazleton, it is estimated that trees remove 552.6 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 $1,549 (Appendix A, Table 3).

**Annual Carbon Benefits**
Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Hazleton, trees sequester about 113,280 lbs of carbon a year with an associated value of $1,326 (Appendix A, Table 5). In addition, the trees store 1,808,027lbs of carbon, with a yearly benefit of $13,560 (Appendix A, Table 4).

**Annual Aesthetics Benefits**
Social benefits of trees are hard to capture. The 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. Hazleton receives $10,436 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, Hazleton's trees provide $36,300 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 188 trees in Hazleton provide approximately $198 annually (Appendix A, Table 7).

# Forest Structure

**Species Distribution**
Hazleton has over 31 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

| | | |
|---|---|---|
| Maple | 63 | 34% |
| Oak | 19 | 10% |

| | | |
|---|---|---|
| Spruce | 17 | 9% |
| Ash | 15 | 8% |
| Walnut | 14 | 7% |
| Hackberry | 13 | 7% |
| Linden/Basswood | 7 | 4% |
| Hickory | 6 | 3% |
| Arborvitae | 6 | 3% |
| Honey Locust | 5 | 3% |
| Cedar | 5 | 3% |
| Japanese Lilac | 5 | 3% |
| Ginkgo | 4 | 2% |
| Birch | 3 | 2% |
| Pine | 2 | 1% |
| Elm | 2 | 1% |
| Kentucky Coffeetree | 1 | 1% |
| Sycamore | 1 | 1% |

## Age Class

Largest size class of trees (27%) are between 12 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Hazleton's size curve is bell shaped, indicating a midsized stand.

## Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Hazleton indicate that 85% of the trees are in good health, with only 8% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). 43% of Hazleton's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 14% of the population. This 14% 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).

| | | |
|---|---|---|
| Crown Cleaning | 5 | 3% |
| Tree Removal | 18 | 10% |

## Canopy Cover

The total canopy with both private and public trees is 41%, 204 acres. The canopy cover on city own properties included in the Hazleton inventory includes approximately 5 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years on all lands. To achieve this goal it is estimated that 37 trees need to be planted annually on public and/or private lands.

**Land Use and Location**

The majority of Hazleton's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

<u>Land Use</u>

| | |
|---|---|
| Single family residential | 62% |
| Park/vacant/other | 38% |

<u>Location</u>

| | |
|---|---|
| Front Yard | 66% |
| Planting strip | 34% |

**Changes in Forest Structure Since plan in 2013**

Over all the number of public trees has reduced over the 10 years. Species composition has change slightly with a reduction of ash and an increase in oak.  Removal has stayed about the same, but pruning needs have reduced.  For site type and locations, there are fewer street trees than in 2013, while park trees remain about the same.

# Recommendations

**Risk Management**

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

<u>Hazardous trees</u>

Hazleton has 9 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). It is recommended to start with the large diameter critical concern trees first. There are 4 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 13 trees with these needs.

<u>Poor tree species</u>

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 18 removals, 14 are ash trees. There are a total of 15 ash trees, and 14 of those have signs and symptoms that have been associated with EAB. In addition, all ash 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 is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

### Planting
Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. 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 Hazleton.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (34%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 150.3 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 150.3 (Appendix C).

### Continual Monitoring
Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended 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.

# Budget and Emerald Ash Borer Plan

**Six Year Maintenance Plan**
**Current Budget need estimate:** $7,917/year, Total $47,500 over 6 years – The first years will need to be funded at a higher than average rate to address critical concerns and the poor condition ash trees.

**Removal**
18 marked removals estimate: $18,000
Additional ash tree and other issues as they arise in the next 6 years estimate: $12,000

**Pruning**
5 marked trees estimate: $2,500
Additional issues as they arise in the next 6 years estimate: $6,000

**Planting and watering**

Planting ten trees per year for 60 trees total estimate: $9,000

**Ash Tree Removal**

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (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 effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide 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 disposed of as you normally would 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 150.3 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, 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 the following signs and symptoms: 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 150.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) 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."

Proposed Budget Increase

EAB could potentially kill all ash trees in Hazleton within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased in the first years to address these trees immediately. Additionally, it is recommended that Hazleton 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.

# 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

# Appendix A: i-Tree Data

**Table 1: Annual Energy Benefits**

## Annual Energy Benefits of Public Trees

2/4/2023

| Species | Total Electricity (MWh) | Electricity ($) | Total Natural Gas (Therms) | Natural Gas ($) | Total ($) | Standard Error | % of Total Trees | % of Total $ | Avg. $/tree |
|---|---|---|---|---|---|---|---|---|---|
| Silver maple | 12.5 | 947 | 1,635.9 | 1,603 | 2,550 | (N/A) | 19.7 | 28.4 | 68.92 |
| Black walnut | 3.4 | 256 | 460.0 | 451 | 707 | (N/A) | 7.4 | 7.9 | 50.47 |
| Norway maple | 2.9 | 217 | 380.3 | 373 | 590 | (N/A) | 7.4 | 6.6 | 42.12 |
| Green ash | 4.4 | 333 | 575.8 | 564 | 897 | (N/A) | 7.4 | 10.0 | 64.06 |
| Bur oak | 4.5 | 339 | 619.5 | 607 | 946 | (N/A) | 6.9 | 10.5 | 72.75 |
| Northern hackberry | 3.8 | 291 | 550.5 | 539 | 831 | (N/A) | 6.9 | 9.3 | 63.90 |
| Spruce | 1.1 | 80 | 123.5 | 121 | 201 | (N/A) | 5.3 | 2.2 | 20.13 |
| American basswood | 0.6 | 44 | 84.8 | 83 | 127 | (N/A) | 3.2 | 1.4 | 21.18 |
| Northern white cedar | 0.5 | 40 | 59.9 | 59 | 98 | (N/A) | 3.2 | 1.1 | 16.40 |
| Catalpa | 2.1 | 156 | 281.7 | 276 | 432 | (N/A) | 3.2 | 4.8 | 72.02 |
| Honeylocust | 1.3 | 101 | 167.7 | 164 | 266 | (N/A) | 2.7 | 3.0 | 53.11 |
| Eastern red cedar | 0.5 | 38 | 73.7 | 72 | 110 | (N/A) | 2.7 | 1.2 | 21.95 |
| Japanese tree lilac | 0.0 | 1 | 3.1 | 3 | 4 | (N/A) | 2.7 | 0.0 | 0.87 |
| Blue spruce | 0.4 | 29 | 56.0 | 55 | 84 | (N/A) | 2.7 | 0.9 | 16.74 |
| Sugar maple | 1.1 | 82 | 138.0 | 135 | 218 | (N/A) | 2.7 | 2.4 | 43.53 |
| Ginkgo | 0.0 | 1 | 1.6 | 2 | 2 | (N/A) | 2.1 | 0.0 | 0.57 |
| Red maple | 0.5 | 38 | 72.9 | 71 | 110 | (N/A) | 1.6 | 1.2 | 36.61 |
| Boxelder | 0.6 | 47 | 78.6 | 77 | 124 | (N/A) | 1.6 | 1.4 | 41.34 |
| Paper birch | 0.3 | 22 | 41.2 | 40 | 62 | (N/A) | 1.6 | 0.7 | 20.64 |
| Northern red oak | 0.3 | 20 | 37.6 | 37 | 57 | (N/A) | 1.1 | 0.6 | 28.45 |
| Elm | 0.6 | 47 | 80.7 | 79 | 126 | (N/A) | 1.1 | 1.4 | 63.12 |
| Norway spruce | 0.3 | 24 | 39.2 | 38 | 62 | (N/A) | 1.1 | 0.7 | 31.15 |
| Swamp white oak | 0.0 | 3 | 7.0 | 7 | 10 | (N/A) | 1.1 | 0.1 | 5.04 |
| Pin oak | 0.2 | 16 | 31.6 | 31 | 47 | (N/A) | 1.1 | 0.5 | 23.64 |
| American sycamore | 0.3 | 25 | 46.9 | 46 | 71 | (N/A) | 0.5 | 0.8 | 70.91 |
| White ash | 0.4 | 32 | 54.5 | 53 | 85 | (N/A) | 0.5 | 1.0 | 85.27 |
| Red pine | 0.1 | 10 | 14.6 | 14 | 24 | (N/A) | 0.5 | 0.3 | 24.14 |
| Eastern white pine | 0.2 | 14 | 24.6 | 24 | 38 | (N/A) | 0.5 | 0.4 | 38.17 |
| Littleleaf linden | 0.2 | 15 | 23.9 | 23 | 39 | (N/A) | 0.5 | 0.4 | 38.70 |
| Maple | 0.0 | 3 | 5.2 | 5 | 8 | (N/A) | 0.5 | 0.1 | 7.85 |
| Kentucky coffeetree | 0.2 | 18 | 27.0 | 26 | 44 | (N/A) | 0.5 | 0.5 | 44.23 |
| Total | 43.3 | 3,288 | 5,797.6 | 5,682 | 8,970 | (N/A) | 100.0 | 100.0 | 47.71 |

**Table 2: Annual Stormwater Benefits**

## Annual Stormwater Benefits of Public Trees

2/4/2023

| Species | Total rainfall interception (Gal) | Total ($) | Standard Error | % of Total Trees | % of Total $ | Avg. $/tree |
|---|---|---|---|---|---|---|
| Silver maple | 186,857 | 5,064 | (N/A) | 19.7 | 36.1 | 136.86 |
| Black walnut | 34,819 | 944 | (N/A) | 7.4 | 6.7 | 67.40 |
| Norway maple | 18,790 | 509 | (N/A) | 7.4 | 3.6 | 36.37 |
| Green ash | 49,818 | 1,350 | (N/A) | 7.4 | 9.6 | 96.43 |
| Bur oak | 56,909 | 1,542 | (N/A) | 6.9 | 11.0 | 118.63 |
| Northern hackberry | 37,712 | 1,022 | (N/A) | 6.9 | 7.3 | 78.62 |
| Spruce | 13,837 | 375 | (N/A) | 5.3 | 2.7 | 37.50 |
| American basswood | 6,932 | 188 | (N/A) | 3.2 | 1.3 | 31.31 |
| Northern white cedar | 6,252 | 169 | (N/A) | 3.2 | 1.2 | 28.24 |
| Catalpa | 25,823 | 700 | (N/A) | 3.2 | 5.0 | 116.63 |
| Honeylocust | 9,983 | 271 | (N/A) | 2.7 | 1.9 | 54.11 |
| Eastern red cedar | 7,197 | 195 | (N/A) | 2.7 | 1.4 | 39.01 |
| Japanese tree lilac | 37 | 1 | (N/A) | 2.7 | 0.0 | 0.20 |
| Blue spruce | 4,566 | 124 | (N/A) | 2.7 | 0.9 | 24.75 |
| Sugar maple | 10,910 | 296 | (N/A) | 2.7 | 2.1 | 59.13 |
| Ginkgo | 28 | 1 | (N/A) | 2.1 | 0.0 | 0.19 |
| Red maple | 4,118 | 112 | (N/A) | 1.6 | 0.8 | 37.20 |
| Boxelder | 5,145 | 139 | (N/A) | 1.6 | 1.0 | 46.48 |
| Paper birch | 1,824 | 49 | (N/A) | 1.6 | 0.4 | 16.47 |
| Northern red oak | 3,049 | 83 | (N/A) | 1.1 | 0.6 | 41.32 |
| Elm | 6,956 | 189 | (N/A) | 1.1 | 1.3 | 94.25 |
| Norway spruce | 6,143 | 166 | (N/A) | 1.1 | 1.2 | 83.24 |
| Swamp white oak | 175 | 5 | (N/A) | 1.1 | 0.0 | 2.37 |
| Pin oak | 1,158 | 31 | (N/A) | 1.1 | 0.2 | 15.69 |
| American sycamore | 3,943 | 107 | (N/A) | 0.5 | 0.8 | 106.85 |
| White ash | 5,299 | 144 | (N/A) | 0.5 | 1.0 | 143.62 |
| Red pine | 1,539 | 42 | (N/A) | 0.5 | 0.3 | 41.70 |
| Eastern white pine | 4,605 | 125 | (N/A) | 0.5 | 0.9 | 124.79 |
| Littleleaf linden | 1,260 | 34 | (N/A) | 0.5 | 0.2 | 34.14 |
| Maple | 137 | 4 | (N/A) | 0.5 | 0.0 | 3.72 |
| Kentucky coffeetree | 1,466 | 40 | (N/A) | 0.5 | 0.3 | 39.72 |
| Citywide total | 517,287 | 14,018 | (N/A) | 100.0 | 100.0 | 74.57 |

# Table 3: Annual Air Quality Benefits

**Annual Air Quality Benefits of Public Trees**

2/4/2023

| Species | Deposition (lb) O₃ | NO₂ | PM₁₀ | SO₂ | Total Depos. ($) | Avoided (lb) NO₂ | PM₁₀ | VOC | SO₂ | Total Avoided ($) | BVOC Emissions (lb) | BVOC Emissions ($) | Total (lb) | Total ($) Standard Error | % of Total Trees | Avg. $/tree |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silver maple | 32.1 | 5.5 | 15.7 | 1.4 | 173 | 58.7 | 8.6 | 8.2 | 56.4 | 368 | -16.2 | -61 | 170.6 | 480 (N/A) | 19.7 | 12.98 |
| Black walnut | 4.0 | 0.6 | 2.0 | 0.2 | 22 | 16.1 | 2.3 | 2.2 | 15.3 | 100 | 0.0 | 0 | 42.8 | 122 (N/A) | 7.4 | 8.70 |
| Norway maple | 3.1 | 0.5 | 1.6 | 0.1 | 17 | 13.6 | 2.0 | 1.9 | 13.0 | 85 | -0.8 | -3 | 35.0 | 99 (N/A) | 7.4 | 7.05 |
| Green ash | 6.5 | 1.0 | 3.0 | 0.3 | 34 | 20.7 | 3.0 | 2.9 | 19.9 | 130 | 0.0 | 0 | 57.3 | 164 (N/A) | 7.4 | 11.70 |
| Bur oak | 7.7 | 1.2 | 3.5 | 0.3 | 41 | 21.4 | 3.1 | 3.0 | 20.2 | 133 | 0.0 | 0 | 60.5 | 174 (N/A) | 6.9 | 13.35 |
| Northern hackberry | 5.9 | 1.0 | 3.0 | 0.3 | 32 | 18.6 | 2.7 | 2.6 | 17.4 | 115 | 0.0 | 0 | 51.4 | 147 (N/A) | 6.9 | 11.33 |
| Spruce | 1.5 | 0.3 | 1.3 | 0.2 | 10 | 4.8 | 0.7 | 0.7 | 4.8 | 31 | -5.2 | -20 | 9.1 | 21 (N/A) | 5.3 | 2.13 |
| American basswood | 1.0 | 0.2 | 0.5 | 0.0 | 5 | 2.8 | 0.4 | 0.4 | 2.6 | 17 | -0.8 | -3 | 7.1 | 20 (N/A) | 3.2 | 3.29 |
| Northern white cedar | 0.7 | 0.1 | 0.6 | 0.1 | 5 | 2.4 | 0.4 | 0.3 | 2.4 | 15 | -2.2 | -8 | 4.7 | 11 (N/A) | 3.2 | 1.90 |
| Catalpa | 3.5 | 0.6 | 1.6 | 0.2 | 18 | 9.8 | 1.4 | 1.4 | 9.3 | 61 | 0.0 | 0 | 27.7 | 80 (N/A) | 3.2 | 13.25 |
| Honeylocust | 1.8 | 0.3 | 0.8 | 0.1 | 9 | 6.2 | 0.9 | 0.9 | 6.0 | 39 | -1.3 | -5 | 15.8 | 44 (N/A) | 2.7 | 8.77 |
| Eastern red cedar | 1.4 | 0.3 | 1.1 | 0.2 | 9 | 2.4 | 0.3 | 0.3 | 2.2 | 15 | -4.0 | -15 | 4.4 | 9 (N/A) | 2.7 | 1.87 |
| Japanese tree lilac | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.1 | 0.0 | 0.0 | 0.1 | 1 | 0.0 | 0 | 0.2 | 1 (N/A) | 2.7 | 0.11 |
| Blue spruce | 0.5 | 0.1 | 0.4 | 0.1 | 3 | 1.8 | 0.3 | 0.3 | 1.7 | 11 | -1.5 | -6 | 3.6 | 9 (N/A) | 2.7 | 1.81 |
| Sugar maple | 1.4 | 0.2 | 0.7 | 0.1 | 8 | 5.1 | 0.7 | 0.7 | 4.9 | 32 | -1.1 | -4 | 12.8 | 35 (N/A) | 2.7 | 7.08 |
| Ginkgo | 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) | 2.1 | 0.07 |
| Red maple | 0.9 | 0.2 | 0.4 | 0.0 | 5 | 2.4 | 0.4 | 0.3 | 2.3 | 15 | -0.3 | -1 | 6.6 | 19 (N/A) | 1.6 | 6.27 |
| Boxelder | 0.6 | 0.1 | 0.3 | 0.0 | 3 | 2.9 | 0.4 | 0.4 | 2.8 | 18 | -0.3 | -1 | 7.2 | 20 (N/A) | 1.6 | 6.76 |
| Paper birch | 0.1 | 0.0 | 0.1 | 0.0 | 0 | 1.4 | 0.2 | 0.2 | 1.3 | 9 | 0.0 | 0 | 3.2 | 9 (N/A) | 1.6 | 2.99 |
| Northern red oak | 0.7 | 0.1 | 0.3 | 0.0 | 4 | 1.3 | 0.2 | 0.2 | 1.2 | 8 | -1.0 | -4 | 3.0 | 8 (N/A) | 1.1 | 3.93 |
| Elm | 0.9 | 0.1 | 0.4 | 0.0 | 5 | 2.9 | 0.4 | 0.4 | 2.8 | 18 | 0.0 | 0 | 8.1 | 23 (N/A) | 1.1 | 11.57 |
| Norway spruce | 0.7 | 0.1 | 0.6 | 0.1 | 5 | 1.5 | 0.2 | 0.2 | 1.4 | 9 | -3.4 | -13 | 1.5 | 1 (N/A) | 1.1 | 0.62 |
| Swamp white oak | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.2 | 0.0 | 0.0 | 0.2 | 1 | 0.0 | 0 | 0.5 | 1 (N/A) | 1.1 | 0.67 |
| Pin oak | 0.1 | 0.0 | 0.1 | 0.0 | 0 | 1.0 | 0.2 | 0.1 | 1.0 | 6 | -0.2 | -1 | 2.2 | 6 (N/A) | 1.1 | 3.05 |
| American sycamore | 0.5 | 0.1 | 0.2 | 0.0 | 3 | 1.6 | 0.2 | 0.2 | 1.5 | 10 | 0.0 | 0 | 4.4 | 12 (N/A) | 0.5 | 12.48 |
| White ash | 0.9 | 0.1 | 0.4 | 0.0 | 5 | 2.0 | 0.3 | 0.3 | 1.9 | 12 | 0.0 | 0 | 6.0 | 17 (N/A) | 0.5 | 17.19 |
| Red pine | 0.2 | 0.0 | 0.1 | 0.0 | 1 | 0.6 | 0.1 | 0.1 | 0.6 | 4 | -0.5 | -2 | 1.2 | 3 (N/A) | 0.5 | 2.82 |
| Eastern white pine | 0.6 | 0.1 | 0.4 | 0.1 | 4 | 0.9 | 0.1 | 0.1 | 0.8 | 5 | -2.9 | -11 | 0.3 | -2 (N/A) | 0.5 | -1.58 |
| Littleleaf linden | 0.2 | 0.0 | 0.1 | 0.0 | 1 | 0.9 | 0.1 | 0.1 | 0.9 | 6 | -0.1 | 0 | 2.3 | 6 (N/A) | 0.5 | 6.42 |
| Maple | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.2 | 0.0 | 0.0 | 0.2 | 1 | 0.0 | 0 | 0.4 | 1 (N/A) | 0.5 | 1.12 |
| Kentucky coffeetree | 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) | 0.5 | 7.42 |
| Citywide total | 77.5 | 13.1 | 39.6 | 3.9 | 423 | 205.5 | 30.0 | 28.6 | 196.2 | 1,283 | -41.8 | -157 | 552.6 | 1,549 (N/A) | 100.0 | 8.24 |

**Table 4: Annual Carbon Stored**

## Stored CO2 Benefits of Public Trees

2/4/2023

| Species | Total Stored CO2 (lbs) | Total ($) | Standard Error | % of Total Trees | % of Total $ | Avg. $/tree |
|---|---|---|---|---|---|---|
| Silver maple | 701,828 | 5,264 | (N/A) | 19.7 | 38.8 | 142.26 |
| Black walnut | 131,274 | 985 | (N/A) | 7.4 | 7.3 | 70.33 |
| Norway maple | 51,300 | 385 | (N/A) | 7.4 | 2.8 | 27.48 |
| Green ash | 212,091 | 1,591 | (N/A) | 7.4 | 11.7 | 113.62 |
| Bur oak | 249,508 | 1,871 | (N/A) | 6.9 | 13.8 | 143.95 |
| Northern hackberry | 89,179 | 669 | (N/A) | 6.9 | 4.9 | 51.45 |
| Spruce | 11,539 | 87 | (N/A) | 5.3 | 0.6 | 8.65 |
| American basswood | 39,213 | 294 | (N/A) | 3.2 | 2.2 | 49.02 |
| Northern white cedar | 4,686 | 35 | (N/A) | 3.2 | 0.3 | 5.86 |
| Catalpa | 113,047 | 848 | (N/A) | 3.2 | 6.3 | 141.31 |
| Honeylocust | 22,264 | 167 | (N/A) | 2.7 | 1.2 | 33.40 |
| Eastern red cedar | 4,685 | 35 | (N/A) | 2.7 | 0.3 | 7.03 |
| Japanese tree lilac | 69 | 1 | (N/A) | 2.7 | 0.0 | 0.10 |
| Blue spruce | 2,255 | 17 | (N/A) | 2.7 | 0.1 | 3.38 |
| Sugar maple | 43,124 | 323 | (N/A) | 2.7 | 2.4 | 64.69 |
| Ginkgo | 18 | 0 | (N/A) | 2.1 | 0.0 | 0.03 |
| Red maple | 10,147 | 76 | (N/A) | 1.6 | 0.6 | 25.37 |
| Boxelder | 15,194 | 114 | (N/A) | 1.6 | 0.8 | 37.98 |
| Paper birch | 3,104 | 23 | (N/A) | 1.6 | 0.2 | 7.76 |
| Northern red oak | 15,251 | 114 | (N/A) | 1.1 | 0.8 | 57.19 |
| Elm | 29,615 | 222 | (N/A) | 1.1 | 1.6 | 111.06 |
| Norway spruce | 8,661 | 65 | (N/A) | 1.1 | 0.5 | 32.48 |
| Swamp white oak | 235 | 2 | (N/A) | 1.1 | 0.0 | 0.88 |
| Pin oak | 2,049 | 15 | (N/A) | 1.1 | 0.1 | 7.68 |
| American sycamore | 15,773 | 118 | (N/A) | 0.5 | 0.9 | 118.30 |
| White ash | 15,773 | 118 | (N/A) | 0.5 | 0.9 | 118.30 |
| Red pine | 1,170 | 9 | (N/A) | 0.5 | 0.1 | 8.78 |
| Eastern white pine | 7,490 | 56 | (N/A) | 0.5 | 0.4 | 56.18 |
| Littleleaf linden | 3,595 | 27 | (N/A) | 0.5 | 0.2 | 26.96 |
| Maple | 218 | 2 | (N/A) | 0.5 | 0.0 | 1.64 |
| Kentucky coffeetree | 3,672 | 28 | (N/A) | 0.5 | 0.2 | 27.54 |
| Citywide total | 1,808,027 | 13,560 | (N/A) | 100.0 | 100.0 | 72.13 |

## Table 5: Annual Carbon Sequestered

Annual CO₂ Benefits of Public Trees

2/4/2023

| Species | Sequestered (lb) | Sequestered ($) | Decomposition Release (lb) | Maintenance Release (lb) | Total Released ($) | Avoided (lb) | Avoided ($) | Net Total (lb) | Total Standard ($) Error | % of Total Trees | % of Total $ | Avg. $/tree |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silver maple | 52,317 | 392 | -3,369 | -138 | -26 | 20,928 | 157 | 69,738 | 523 (N/A) | 19.7 | 39.4 | 14.14 |
| Black walnut | 7,980 | 60 | -630 | -35 | -5 | 5,653 | 42 | 12,968 | 97 (N/A) | 7.4 | 7.3 | 6.95 |
| Norway maple | 4,739 | 36 | -246 | -26 | -2 | 4,797 | 36 | 9,264 | 69 (N/A) | 7.4 | 5.2 | 4.96 |
| Green ash | 10,049 | 75 | -1,018 | -44 | -8 | 7,349 | 55 | 16,335 | 123 (N/A) | 7.4 | 9.2 | 8.75 |
| Bur oak | 11,052 | 83 | -1,198 | -48 | -9 | 7,483 | 56 | 17,289 | 130 (N/A) | 6.9 | 9.8 | 9.97 |
| Northern hackberry | 4,901 | 37 | -428 | -37 | -3 | 6,437 | 48 | 10,873 | 82 (N/A) | 6.9 | 6.1 | 6.27 |
| Spruce | 1,003 | 8 | -55 | -17 | -1 | 1,774 | 13 | 2,705 | 20 (N/A) | 5.3 | 1.5 | 2.03 |
| American basswood | 2,165 | 16 | -188 | -8 | -1 | 972 | 7 | 2,941 | 22 (N/A) | 3.2 | 1.7 | 3.68 |
| Northern white cedar | 469 | 4 | -23 | -8 | 0 | 878 | 7 | 1,317 | 10 (N/A) | 3.2 | 0.7 | 1.65 |
| Catalpa | 5,038 | 38 | -543 | -22 | -4 | 3,447 | 26 | 7,921 | 59 (N/A) | 3.2 | 4.5 | 9.90 |
| Honeylocust | 3,110 | 23 | -107 | -10 | -1 | 2,236 | 17 | 5,229 | 39 (N/A) | 2.7 | 3.0 | 7.84 |
| Eastern red cedar | 211 | 2 | -22 | -9 | 0 | 829 | 6 | 1,009 | 8 (N/A) | 2.7 | 0.6 | 1.51 |
| Japanese tree lilac | 43 | 0 | -1 | -1 | 0 | 28 | 0 | 70 | 1 (N/A) | 2.7 | 0.0 | 0.10 |
| Blue spruce | 245 | 2 | -11 | -7 | 0 | 638 | 5 | 865 | 6 (N/A) | 2.7 | 0.5 | 1.30 |
| Sugar maple | 2,220 | 17 | -207 | -11 | -2 | 1,821 | 14 | 3,823 | 29 (N/A) | 2.7 | 2.2 | 5.73 |
| Ginkgo | 9 | 0 | 0 | -1 | 0 | 15 | 0 | 23 | 0 (N/A) | 2.1 | 0.0 | 0.04 |
| Red maple | 331 | 2 | -49 | -5 | 0 | 848 | 6 | 1,125 | 8 (N/A) | 1.6 | 0.6 | 2.81 |
| Boxelder | 1,531 | 11 | -73 | -7 | -1 | 1,039 | 8 | 2,490 | 19 (N/A) | 1.6 | 1.4 | 6.23 |
| Paper birch | 626 | 5 | -15 | -4 | 0 | 476 | 4 | 1,084 | 8 (N/A) | 1.6 | 0.6 | 2.71 |
| Northern red oak | 5 | 0 | -73 | -4 | -1 | 443 | 3 | 371 | 3 (N/A) | 1.1 | 0.2 | 1.39 |
| Elm | 1,405 | 11 | -142 | -6 | -1 | 1,043 | 8 | 2,299 | 17 (N/A) | 1.1 | 1.3 | 8.62 |
| Norway spruce | 116 | 1 | -42 | -6 | 0 | 527 | 4 | 595 | 4 (N/A) | 1.1 | 0.3 | 2.23 |
| Swamp white oak | 101 | 1 | -2 | -1 | 0 | 72 | 1 | 170 | 1 (N/A) | 1.1 | 0.1 | 0.64 |
| Pin oak | 327 | 2 | -10 | -2 | 0 | 360 | 3 | 675 | 5 (N/A) | 1.1 | 0.4 | 2.53 |
| American sycamore | 857 | 6 | -76 | -4 | -1 | 552 | 4 | 1,330 | 10 (N/A) | 0.5 | 0.8 | 9.97 |
| White ash | 1,315 | 10 | -76 | -4 | -1 | 704 | 5 | 1,940 | 15 (N/A) | 0.5 | 1.1 | 14.55 |
| Red pine | 116 | 1 | -6 | -2 | 0 | 216 | 2 | 324 | 2 (N/A) | 0.5 | 0.2 | 2.43 |
| Eastern white pine | 0 | 0 | -36 | -4 | 0 | 311 | 2 | 271 | 2 (N/A) | 0.5 | 0.2 | 2.03 |
| Littleleaf linden | 514 | 4 | -17 | -2 | 0 | 337 | 3 | 832 | 6 (N/A) | 0.5 | 0.5 | 6.24 |
| Maple | 39 | 0 | -1 | -1 | 0 | 60 | 0 | 97 | 1 (N/A) | 0.5 | 0.1 | 0.73 |
| Kentucky coffeetree | 445 | 3 | -18 | -2 | 0 | 393 | 3 | 819 | 6 (N/A) | 0.5 | 0.5 | 6.14 |
| Citywide total | 113,280 | 850 | -8,680 | -474 | -69 | 72,667 | 545 | 176,793 | 1,326 (N/A) | 100.0 | 100.0 | 7.05 |

**Table 6: Annual Social and Aesthetic Benefits**

## Annual Aesthetic/Other Benefits of Public Trees

2/4/2023

| Species | Total ($) Error | Standard | % of Total Trees | % of Total $ | Avg. $/tree |
|---|---|---|---|---|---|
| Silver maple | 4,046 (N/A) | | 19.7 | 38.8 | 109.36 |
| Black walnut | 697 (N/A) | | 7.4 | 6.7 | 49.80 |
| Norway maple | 489 (N/A) | | 7.4 | 4.7 | 34.91 |
| Green ash | 799 (N/A) | | 7.4 | 7.7 | 57.07 |
| Bur oak | 824 (N/A) | | 6.9 | 7.9 | 63.40 |
| Northern hackberry | 661 (N/A) | | 6.9 | 6.3 | 50.84 |
| Spruce | 285 (N/A) | | 5.3 | 2.7 | 28.48 |
| American basswood | 147 (N/A) | | 3.2 | 1.4 | 24.54 |
| Northern white cedar | 141 (N/A) | | 3.2 | 1.3 | 23.46 |
| Catalpa | 377 (N/A) | | 3.2 | 3.6 | 62.81 |
| Honeylocust | 729 (N/A) | | 2.7 | 7.0 | 145.70 |
| Eastern red cedar | 76 (N/A) | | 2.7 | 0.7 | 15.21 |
| Japanese tree lilac | 0 (N/A) | | 2.7 | 0.0 | 0.03 |
| Blue spruce | 110 (N/A) | | 2.7 | 1.0 | 21.91 |
| Sugar maple | 238 (N/A) | | 2.7 | 2.3 | 47.60 |
| Ginkgo | 1 (N/A) | | 2.1 | 0.0 | 0.37 |
| Red maple | 60 (N/A) | | 1.6 | 0.6 | 19.89 |
| Boxelder | 130 (N/A) | | 1.6 | 1.2 | 43.45 |
| Paper birch | 86 (N/A) | | 1.6 | 0.8 | 28.56 |
| Northern red oak | 2 (N/A) | | 1.1 | 0.0 | 0.77 |
| Elm | 112 (N/A) | | 1.1 | 1.1 | 56.23 |
| Norway spruce | 32 (N/A) | | 1.1 | 0.3 | 16.16 |
| Swamp white oak | 16 (N/A) | | 1.1 | 0.1 | 7.81 |
| Pin oak | 46 (N/A) | | 1.1 | 0.4 | 23.14 |
| American sycamore | 66 (N/A) | | 0.5 | 0.6 | 65.59 |
| White ash | 126 (N/A) | | 0.5 | 1.2 | 126.36 |
| Red pine | 32 (N/A) | | 0.5 | 0.3 | 32.32 |
| Eastern white pine | 0 (N/A) | | 0.5 | 0.0 | 0.00 |
| Littleleaf linden | 55 (N/A) | | 0.5 | 0.5 | 55.09 |
| Maple | 7 (N/A) | | 0.5 | 0.1 | 7.28 |
| Kentucky coffeetree | 46 (N/A) | | 0.5 | 0.4 | 45.86 |
| Citywide total | 10,436 (N/A) | | 100.0 | 100.0 | 55.51 |

**Table 7: Summary of Benefits in Dollars**

## Total Annual Benefits of Public Trees by Species ($)

2/4/2023

| Species | Energy | $CO_2$ | Air Quality | Stormwater | Aesthetic/Other | Total ($) | Standard Error | % of Total $ |
|---|---|---|---|---|---|---|---|---|
| Silver maple | 2,550 | 523 | 480 | 5,064 | 4,046 | 12,663 | (N/A) | 34.9 |
| Black walnut | 707 | 97 | 122 | 944 | 697 | 2,566 | (N/A) | 7.1 |
| Norway maple | 590 | 69 | 99 | 509 | 489 | 1,756 | (N/A) | 4.8 |
| Green ash | 897 | 123 | 164 | 1,350 | 799 | 3,332 | (N/A) | 9.2 |
| Bur oak | 946 | 130 | 174 | 1,542 | 824 | 3,615 | (N/A) | 10.0 |
| Northern hackberry | 831 | 82 | 147 | 1,022 | 661 | 2,743 | (N/A) | 7.6 |
| Spruce | 201 | 20 | 21 | 375 | 285 | 903 | (N/A) | 2.5 |
| American basswood | 127 | 22 | 20 | 188 | 147 | 504 | (N/A) | 1.4 |
| Northern white cedar | 98 | 10 | 11 | 169 | 141 | 430 | (N/A) | 1.2 |
| Catalpa | 432 | 59 | 80 | 700 | 377 | 1,648 | (N/A) | 4.5 |
| Honeylocust | 266 | 39 | 44 | 271 | 729 | 1,348 | (N/A) | 3.7 |
| Eastern red cedar | 110 | 8 | 9 | 195 | 76 | 398 | (N/A) | 1.1 |
| Japanese tree lilac | 4 | 1 | 1 | 1 | 0 | 7 | (N/A) | 0.0 |
| Blue spruce | 84 | 6 | 9 | 124 | 110 | 333 | (N/A) | 0.9 |
| Sugar maple | 218 | 29 | 35 | 296 | 238 | 815 | (N/A) | 2.2 |
| Ginkgo | 2 | 0 | 0 | 1 | 1 | 5 | (N/A) | 0.0 |
| Red maple | 110 | 8 | 19 | 112 | 60 | 308 | (N/A) | 0.8 |
| Boxelder | 124 | 19 | 20 | 139 | 130 | 433 | (N/A) | 1.2 |
| Paper birch | 62 | 8 | 9 | 49 | 86 | 214 | (N/A) | 0.6 |
| Northern red oak | 57 | 3 | 8 | 83 | 2 | 152 | (N/A) | 0.4 |
| Elm | 126 | 17 | 23 | 189 | 112 | 468 | (N/A) | 1.3 |
| Norway spruce | 62 | 4 | 1 | 166 | 32 | 267 | (N/A) | 0.7 |
| Swamp white oak | 10 | 1 | 1 | 5 | 16 | 33 | (N/A) | 0.1 |
| Pin oak | 47 | 5 | 6 | 31 | 46 | 136 | (N/A) | 0.4 |
| American sycamore | 71 | 10 | 12 | 107 | 66 | 266 | (N/A) | 0.7 |
| White ash | 85 | 15 | 17 | 144 | 126 | 387 | (N/A) | 1.1 |
| Red pine | 24 | 2 | 3 | 42 | 32 | 103 | (N/A) | 0.3 |
| Eastern white pine | 38 | 2 | -2 | 125 | 0 | 163 | (N/A) | 0.5 |
| Littleleaf linden | 39 | 6 | 6 | 34 | 55 | 141 | (N/A) | 0.4 |
| Maple | 8 | 1 | 1 | 4 | 7 | 21 | (N/A) | 0.1 |
| Kentucky coffeetree | 44 | 6 | 7 | 40 | 46 | 143 | (N/A) | 0.4 |
| Citywide Total | 8,970 | 1,326 | 1,549 | 14,018 | 10,436 | 36,300 | (N/A) | 100.0 |

**Figure 1: Species Distribution**



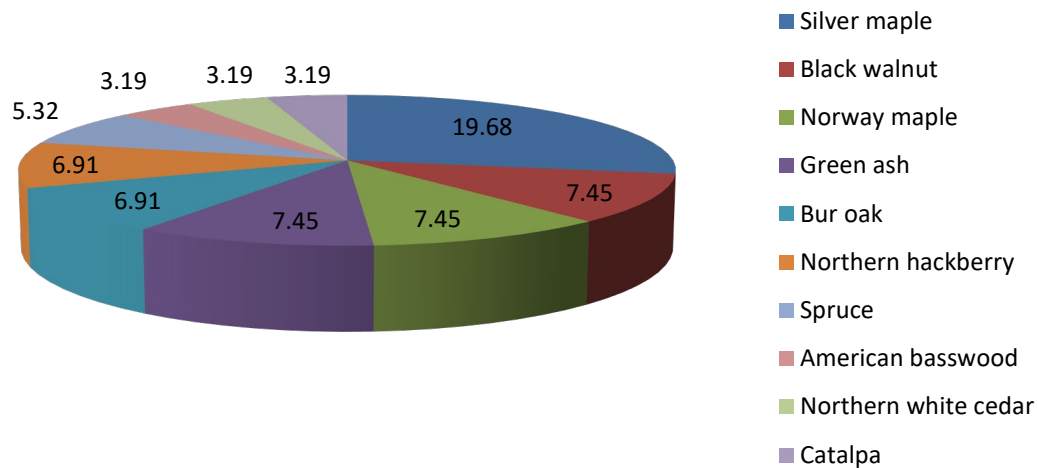**Figure 2: Relative Age Class**



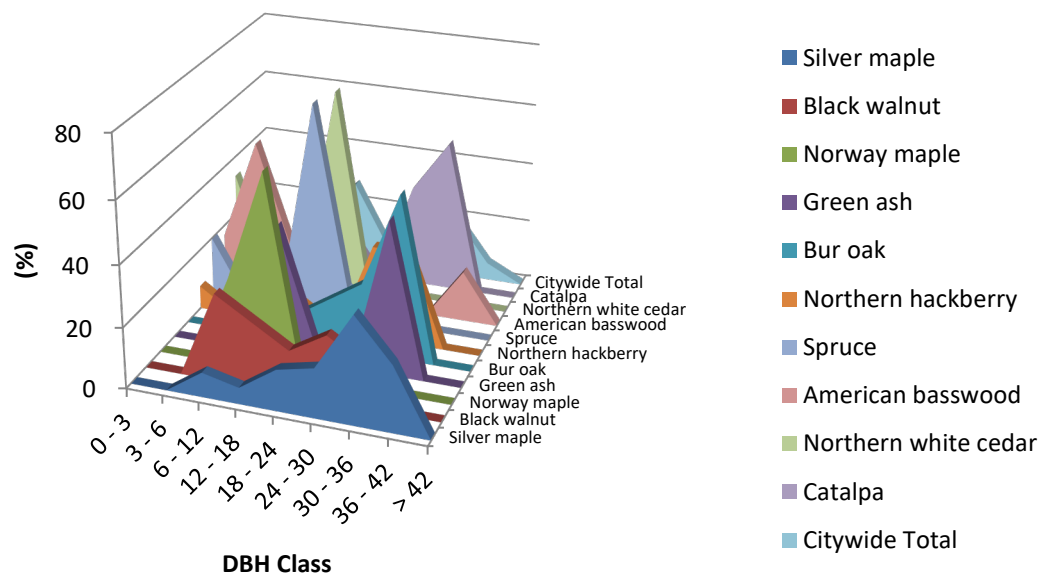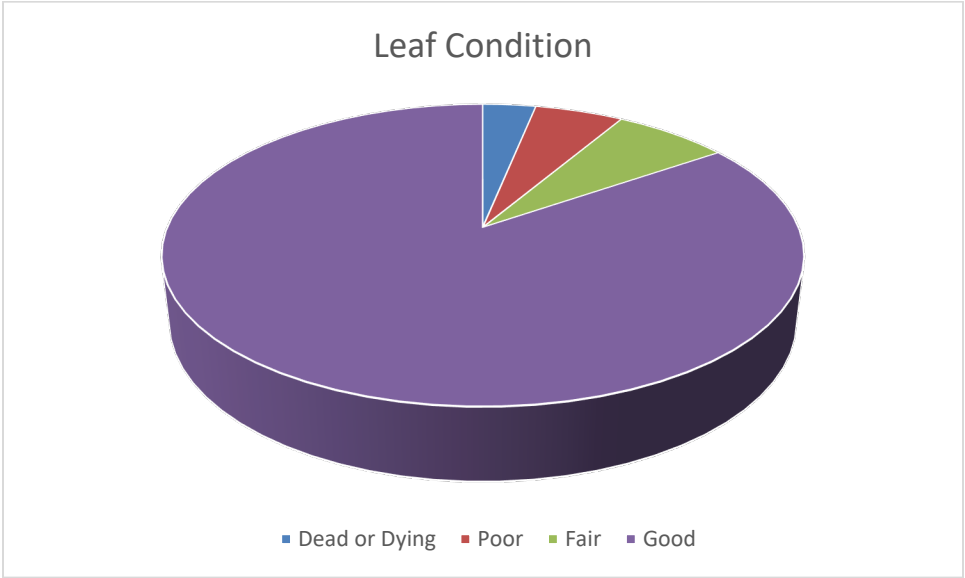Relative Age Distribution of Top 10 Public Tree Species (%)

**Figure 3: Foliage Condition**



Leaf Condition

■ Dead or Dying  ■ Poor  ■ Fair  ■ Good

**Figure 4: Wood Condition**



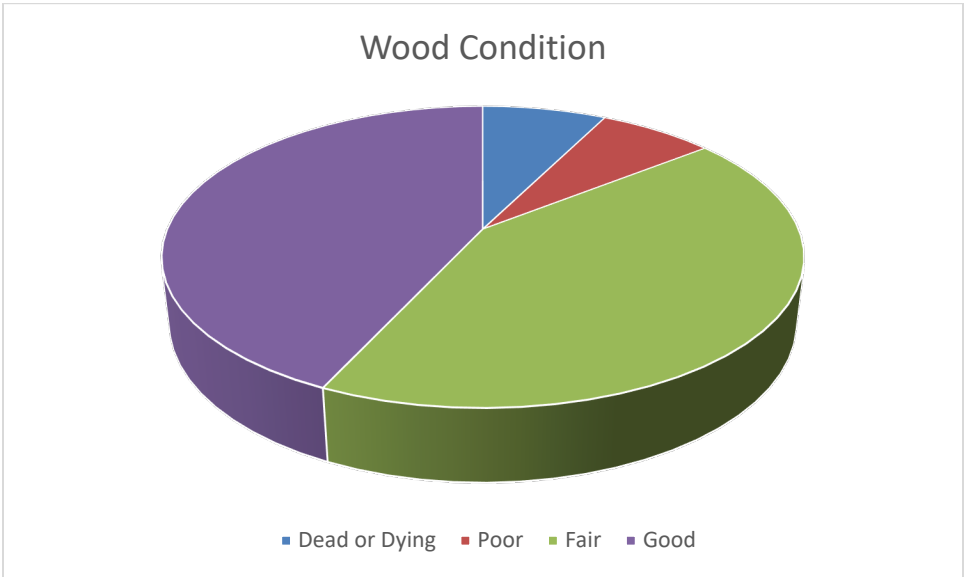Wood Condition

■ Dead or Dying  ■ Poor  ■ Fair  ■ Good

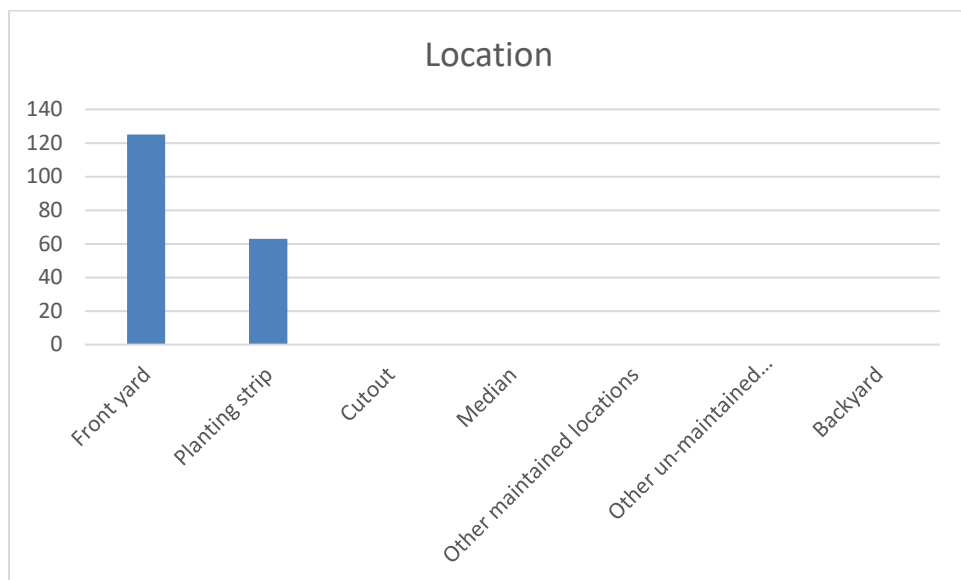**Figure 5: Canopy Cover in Acres**
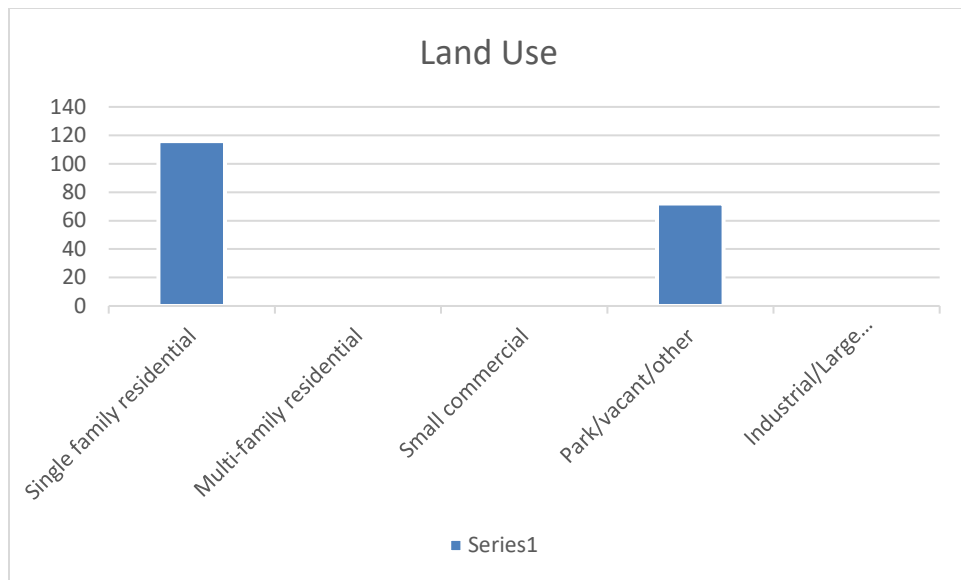
**Figure 6: Land Use of city/park trees**



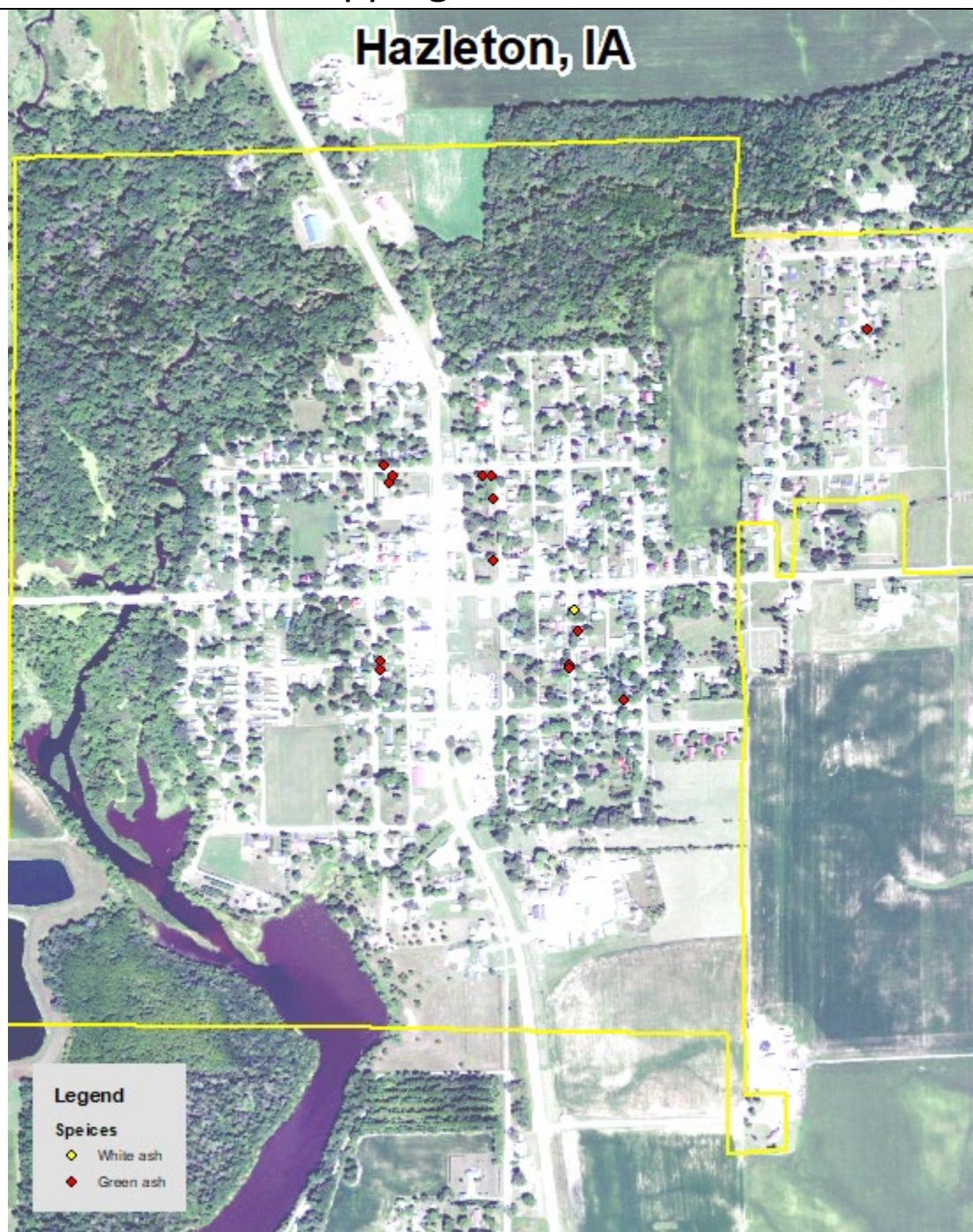**Figure 7: Location of city/park trees**

# Appendix B: ArcGIS Mapping

**Figure 1: Location of Ash Trees**
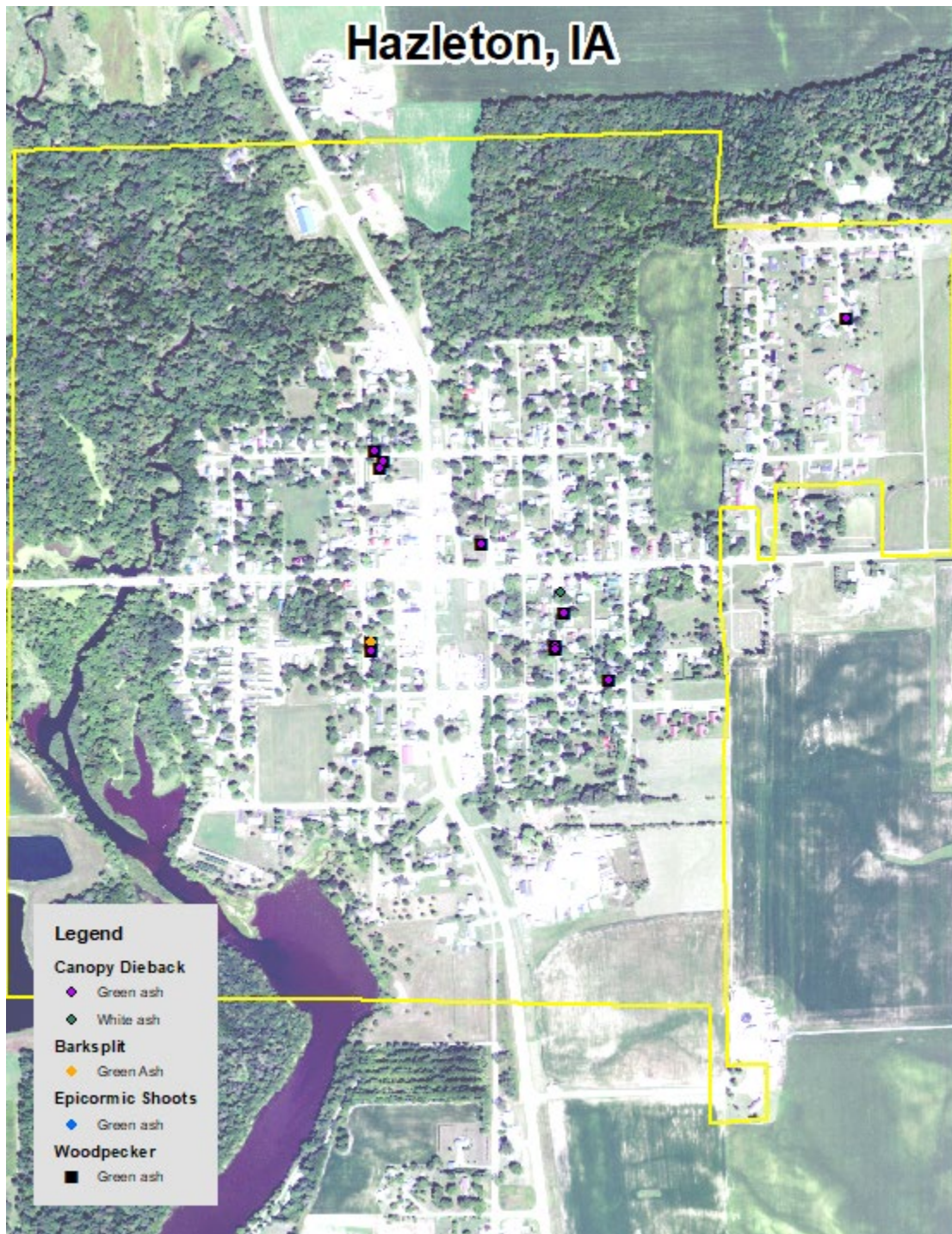


**Figure 2: Location of EAB symptoms**
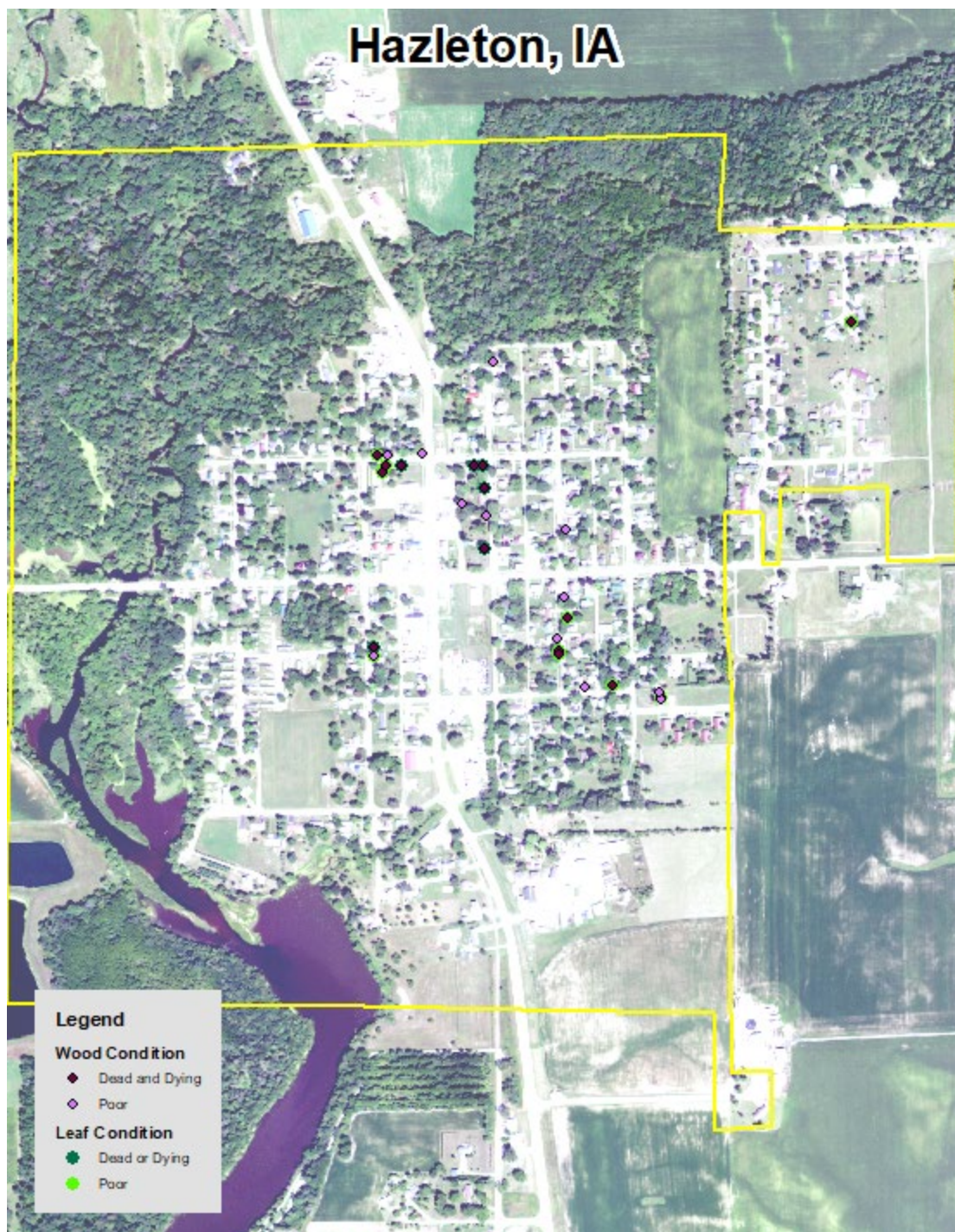
Hazleton, IA

**Figure 3: Location of Poor Condition Trees**
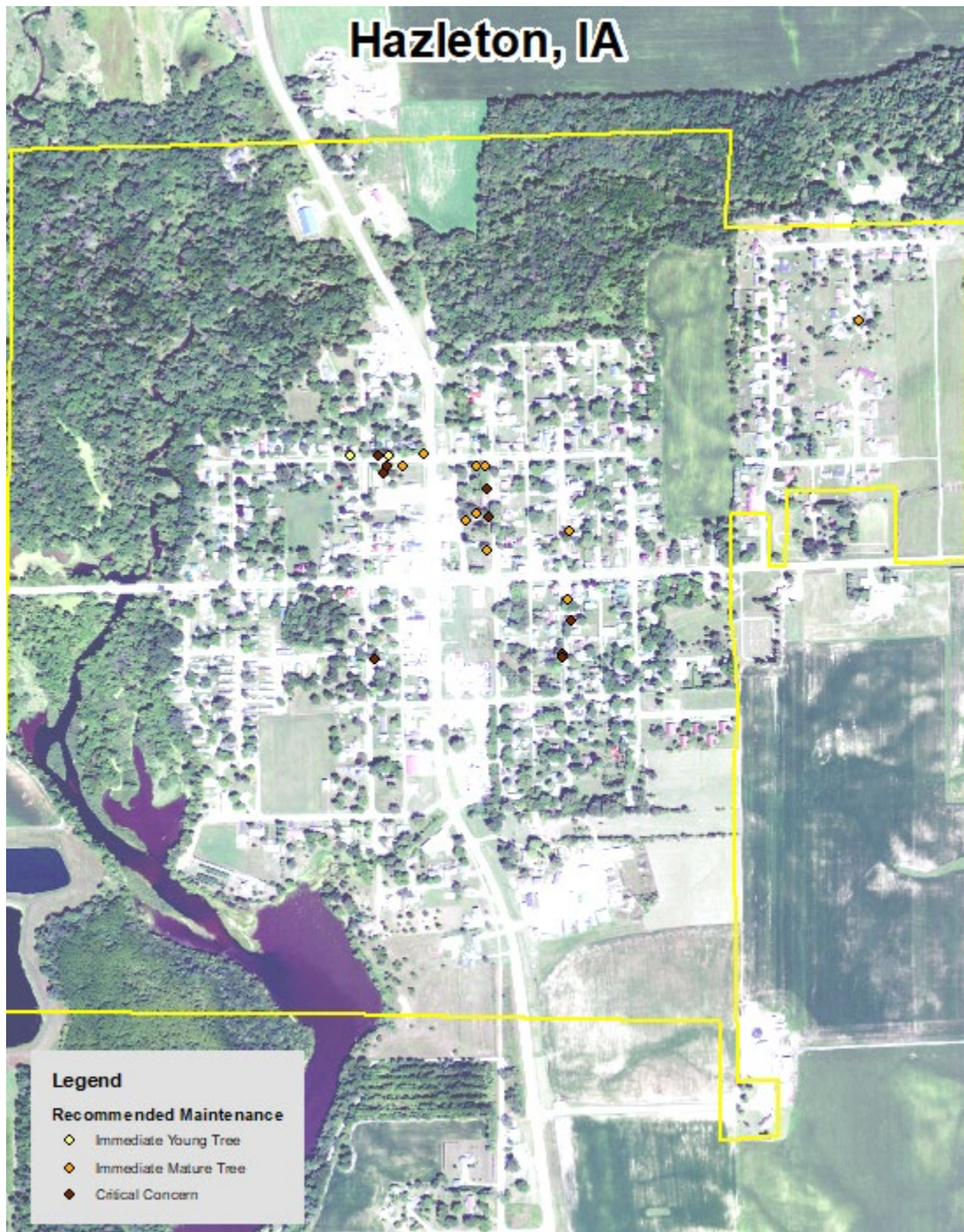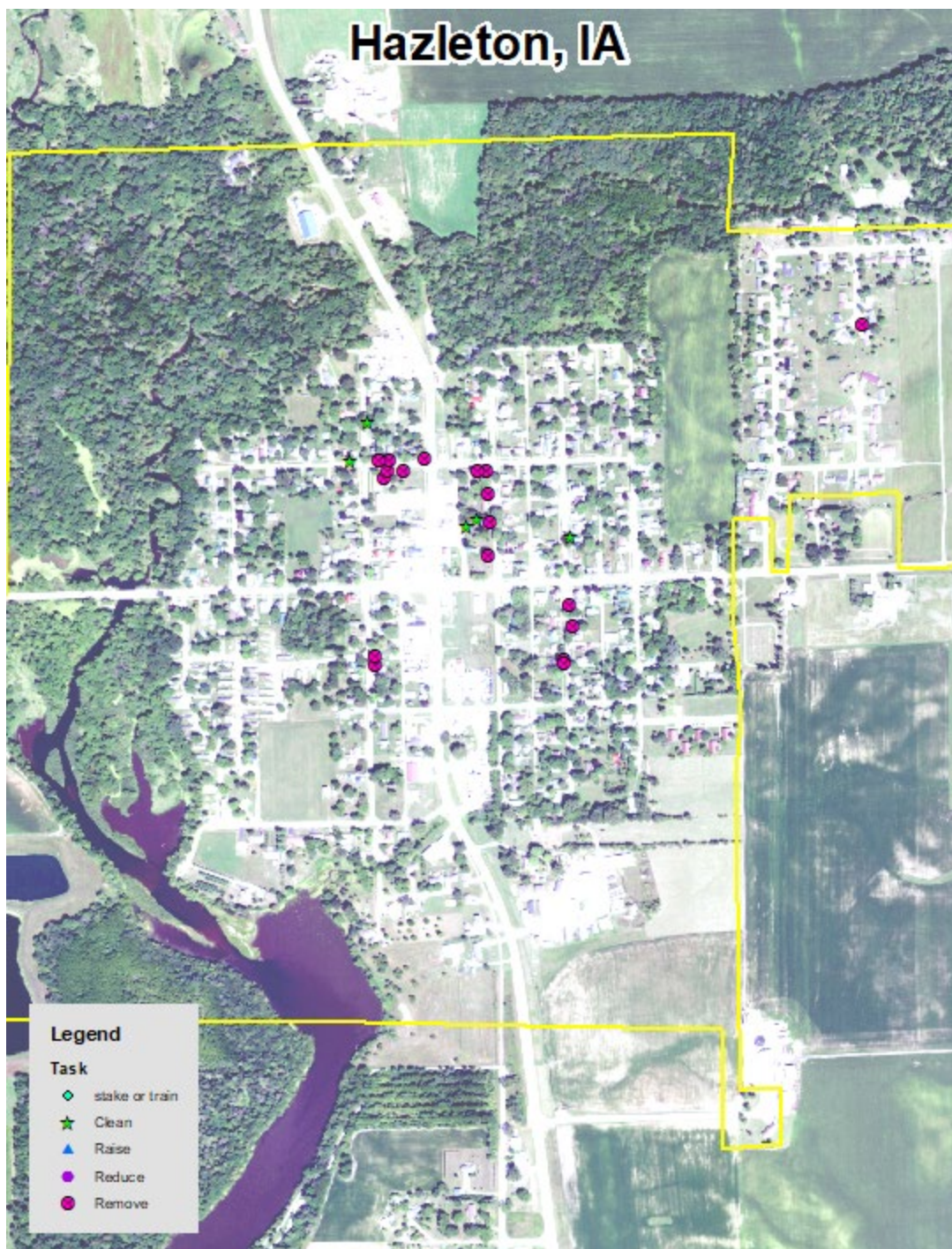


**Figure 4: Location of Trees with Recommended Maintenance**

**Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal***

# Appendix C: Hazleton Tree Ordinances

**CHAPTER 150**

## TREES

**150.01 DEFINITION.** For use in this chapter, "parking" 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.

**150.02 PLANTING RESTRICTIONS.** No tree shall be planted in any parking or street except in accordance with the following:

1.         Alignment. All trees planted in any street shall be planted in the parking 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 parking 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.

**150.03 DUTY TO TRIM TREES.** The owner or agent of the abutting property shall keep the trees, shrubs or other vegetation on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, shrubs or other vegetation, 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])*

**150.04   TRIMMING TREES TO BE SUPERVISED.**  Except as allowed in Section 150.03, 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.

**150.05   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.

**150.06   INSPECTION AND REMOVAL.**  The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

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 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])*

[The next page is 731]

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.