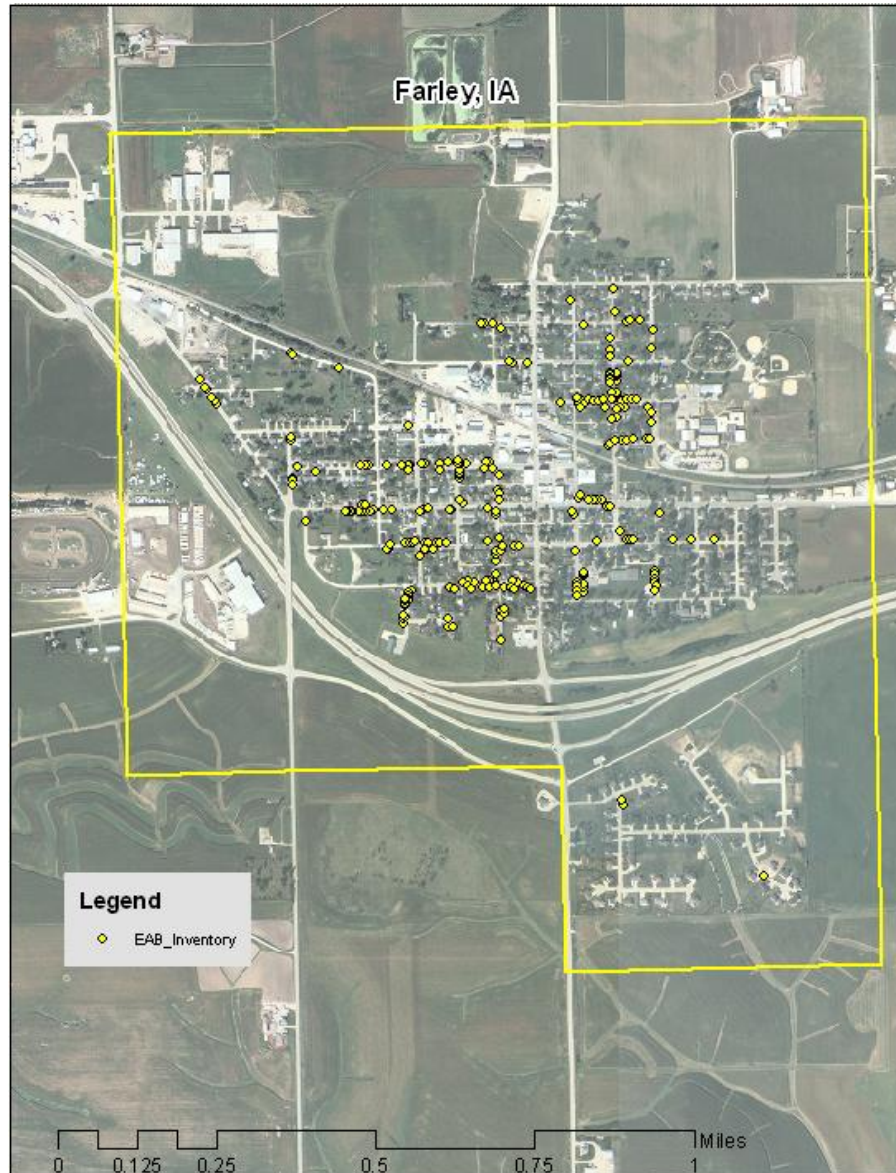


FARLEY, IA



2010 Management Plan

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Table of Contents

| | |
|---|-----------|
| Executive Summary | 4 |
| Overview | 4 |
| Inventory and Results | 4 |
| Recommendations | 4 |
| Introduction | 5 |
| Inventory | 5 |
| Inventory Results | 6 |
| <i>Annual Benefits</i> | 6 |
| Annual Energy Benefits | 6 |
| Annual Storm water Benefits | 6 |
| Annual Air Quality Benefits | 6 |
| Annual Carbon Benefits | 6 |
| Annual Aesthetics Benefits | 6 |
| Financial Summary of all Benefits | 7 |
| <i>Forest Structure</i> | 7 |
| Species Distribution | 7 |
| Condition: Wood and Foliage | 8 |
| Management Needs | 9 |
| Land Use and Location | 9 |
| Recommendations | 10 |
| Risk Management | 10 |
| Pruning Cycle | 10 |
| Planting | 11 |
| Continual Monitoring | 11 |
| Emerald Ash Borer | 11 |
| Ash Tree Removal | 11 |
| EAB Quarantines | 11 |
| Wood Disposal | 12 |
| Canopy Replacement | 12 |
| Postponed Work | 12 |
| Monitoring | 12 |
| Private Ash Trees | 12 |
| Budget | 13 |
| Works Cited | 14 |
| Appendix A: i-Tree Data | 15 |

| | |
|--|-----------|
| Appendix B: ArcGIS Mapping..... | 25 |
| Appendix C: *CITY* Tree Ordinances..... | 30 |

Executive Summary

Overview

This plan was developed to assist the City of Farley with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities 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 that kills all species of our native ash trees. There is a strong possibility that over 30% of Farley's city owned ash trees could die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over several years mitigating public safety issues.

Inventory and Results

In 2010, a street tree inventory was conducted using an integrated Global Positioning System (GPS) data collector. This involved a complete inventory of street trees within the City's Right-of-Way. Below are some key findings of the 292 trees inventoried.

- Farley's street trees provide roughly \$29,346 of annual benefits, an average of \$101 per tree.
- The top three species groups are: Maples 49%, Ash 30% and Evergreens 4%.
- Approximately 33% of trees are in need of some type of management.
- For various reasons, 30 trees are recommended for removal.

Recommendations

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

- Of the 30 trees needing removal, 2 of the trees should be removed very soon due to public safety concerns.
- Ten of the 86 ash trees inventoried are in need of follow up checking because they are displaying some signs and symptoms associated with EAB.
- 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, soft maple, autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar and tree-of-heaven.
- Check ash trees with a visual survey yearly.

Introduction

This plan was developed to assist Farley 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 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 and replacement planting. With proper planning and management of the current canopy in Farley, these costs can be extended over several years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important component of Farley's infrastructure and are one of the greatest assets to the community. Through research, it has been shown that trees provide a community with numerous public benefits including: improved air quality, storm water runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and creating a desirable place to live. It is essential that these benefits be maintained for the people of Farley and future generations through sound urban forestry management.

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

Inventory

In 2010, a tree inventory was conducted that included just the city owned street trees. If the City of Farley wishes, I would be happy to inventory the City Park at a later time. The tree data was collected using a handheld Global Positioning System (GPS) receiver/data logger. This device records Geographic Information System (GIS) coordinates with an accuracy of 3 meters. The data can then 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 collector was written to be compatible with a state-of-the-art software suite called i-Tree. This software was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. This software is in the public domain and can be accessed for free.

To quantify the urban forest structure and its benefits, specific data is collected for each tree. This data includes: location, land use, tree species, diameter at 4.5 ft (DBH), recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms of 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 by the data loggers was downloaded and analyzed by software developed by the USDA Forest service called *Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM)*. This software is also part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis of Farley's inventory data.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Farley's trees reduce energy related costs by approximately \$9,544 annually (Appendix A, Table 1). These savings are both in Electricity (45.8 MWh) and in Natural Gas (6,189 Therms).

Annual Storm water Benefits

Farley's trees intercept about 438,320 gallons of rainfall and snow melt per year (Appendix A, Table 2). This interception provides \$11,879 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 that emit volatile organic matter (ozone). In Farley, it is estimated that trees remove 364.3 lbs. of air pollution (ozone (O₃), particulate matter less than 10 microns (PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$1,622 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. Of the 262 trees inventoried, the amount of carbon stored amounts to approximately 1,503,128 total lbs of CO₂ (Appendix A, Table 4). Those trees are sequestering about 101,696 lbs of carbon per year (Appendix A, Table 5). The benefits these trees provide from summer shading and from reductions in household wind infiltration in the winter result in approximately 76,882 fewer lbs of CO₂ being released into the atmosphere (Appendix A Table 5).

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. Farley receives approximately \$10,666 in annual social benefits from its street trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Farley's trees provide \$29,346 of benefits annually. Benefits of individual trees vary based on size, species, health and location. On average, each of the 292 trees in Farley's inventory provides approximately \$100 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

There were over 33 different tree species surveyed. The distribution of trees by genus is as follows:

| Genus | # of trees | % of total |
|--|------------|------------|
| Maple (<i>acer</i>) | 144 | 49.3% |
| Ash (<i>fraxius</i>) | 86 | 29.5% |
| Spruce (<i>picea</i>) | 12 | 4.1% |
| Apple (<i>malus</i>) | 11 | 3.8% |
| Walnut (<i>juglans</i>) | 8 | 2.7% |
| Oak (<i>quercus</i>) | 8 | 2.7% |
| Poplar (<i>populus</i>) | 4 | 1.4% |
| Other | 4 | 1.4% |
| Honeylocust (<i>gleditsia</i>) | 3 | 1.0% |
| Linden (<i>tilia</i>) | 3 | 1.0% |
| Elm (<i>ulmus</i>) | 3 | 1.0% |
| Birch (<i>betula</i>) | 2 | 0.7% |
| Ginkgo (<i>ginkgo</i>) | 1 | 0.3% |
| Eastern Red Cedar (<i>juniperus</i>) | 1 | 0.3% |
| Cherry (<i>prunus</i>) | 1 | 0.3% |
| Lilac (<i>syringa</i>) | 1 | 0.3% |

The table below summarizes distribution of surveyed trees by their diameter in inches when measured at 4.5 above the ground. Trees between 12 and 18" in diameter were most abundant (29.8%). There were also many smaller trees in the 3 to 12 inch size range (36.3%). The size distribution indicates there should be plenty of younger trees to replace older trees as they are removed. See Appendix A, Figure 2 for a breakdown of size distributions by species.

| Size Classes (inches of diameter at 4.5 feet) | # of trees | % of trees |
|---|------------|------------|
| 0 - 3 | 33 | 11.3% |
| 3 - 6 | 26 | 8.9% |
| 6 - 12 | 47 | 16.1% |
| 12 - 18 | 87 | 29.8% |
| 18 - 24 | 53 | 18.2% |
| 24 - 30 | 26 | 8.9% |
| 30 - 36 | 5 | 1.7% |
| 36 - 42 | 8 | 2.7% |
| 42+ | 7 | 2.4% |

Condition: Wood and Foliage

Leaf condition is a good indicator of the overall health of urban trees. The foliage condition results for Farley indicated that 67% of the trees were in good health, 28% in fair health, 4% in poor health and 1% dead or dying. (Appendix A, Figure 3). The high proportion that was in fair health likely is a result of the many leaf diseases (like *anthracnose sp.*) associated with last summer's wet/warm weather. Wet/warm conditions tend to be more conducive to the development of leaf diseases. These leaf ailments should go away next summer if the weather is more nominal.

The condition of the wood in urban trees is another important indicator of tree health. The wood forms the structural support system for the leaves and branches. Extensive decay in the main stem makes a tree structurally unsafe which leads to a tree becoming a safety hazard. In Farley, 62% of the surveyed trees were in good health, 28% in fair health, 9% in poor health and 1% dead or dying for wood condition (Appendix A, Figure 4). The 10% in poor or dead or dying condition should be assessed more carefully. Many of these trees we are recommending be removed for the sake of public safety.

Management Needs

Each tree was assessed for any recommended maintenance needs. The following table lists the specific management needs and recommendations for the surveyed trees. Of the trees recommended for removal, only 2 of were judged to be of critical concern for public safety, so such be removed as soon as possible (See Appendix B, figure 4).

| Priority Task | # of trees | % of trees |
|---------------|------------|------------|
| none | 197 | 67.5% |
| stake/train | 23 | 7.9% |
| clean | 26 | 8.9% |
| raise | 14 | 4.8% |
| reduce | 2 | 0.7% |
| remove | 30 | 10.3% |

| Maintenance Recommendation | # of trees | % of trees |
|----------------------------------|------------|------------|
| None | 198 | 67.8% |
| young tree (routine) | 22 | 7.5% |
| young tree (immediate) | 2 | 0.7% |
| mature tree (routine) | 53 | 18.2% |
| mature tree (immediate) | 15 | 5.1% |
| critical concern (public safety) | 2 | 0.7% |

Land Use and Location

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

Land Use

| | |
|---------------------------|-----|
| Single family residential | 89% |
| Park/vacant/other | 10% |
| Small commercial | <1% |

Location

| | |
|------------------------------|-----|
| Front yard | 24% |
| Planting strip | 62% |
| Back yard | 2% |
| Other maintained locations | 11% |
| Other unmaintained locations | <1% |

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.

Hazardous trees

Farley has 2 trees of "critical concern" that should be removed immediate. These trees can be seen on the *Location of Trees with Recommended Maintenance* map (Appendix B, Figure 4). A total of 30 trees were recommended for removal for one reason or another. Of those, 3 were dead or dying and 17 have poor wood condition or showed signs of severe decay. Therefore, they could easily break off or topple over in storms or under ice and snow loads.

Poor tree species

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 30 trees recommended for removal, 2 trees were green ash with poor wood condition and 2 trees were green ash with canopy dieback problems. There were a total of 86 ash trees inventoried, and 10 of those have potential signs and symptoms that have been associated with EAB.

Pruning Cycle

Proper pruning can extend the life and improve the overall health of trees, and can reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning (stake/train), crown cleaning (clean), crown raising (raise), and crown reduction (reduce). 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. Staking and training is recommended for younger trees so they can develop good architecture. It is recommended that all trees be pruned on a routine schedule every five to seven years.

| Priority Task | # of trees | % of trees |
|---------------|------------|------------|
| none | 197 | 67.5% |
| stake/train | 23 | 7.9% |
| clean | 26 | 8.9% |
| raise | 14 | 4.8% |
| reduce | 2 | 0.7% |
| remove | 30 | 10.3% |

Planting

Most of the planting over the next six years should replace the trees that are recommended for removal. It is recommended to plant two trees for every tree removed since survival rates will not be 100%. It is not essential that the new trees be planted in the same location as the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Farley.

Since most insects and diseases target a particular genus (e.g. ash) or species (e.g. green ash) of trees, it is important to always plant a diverse mix of species. Current diversity recommendations advise that any genus (e.g. maple, oak or ash) not make up more than 20% of the urban forest. Any single species (e.g. silver maple, sugar maple, white oak or bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (49%) and ash (30%) (Appendix A, Figure 1). Maples should not be planted until this percentage is dramatically 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: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, and willow.

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 death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Emerald Ash Borer (EAB) Plan

Ash Tree Removal

Tree removal should 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*](#)

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of many millions ash trees throughout the Eastern United States and Canada. Ash in both forestlands and urban settings constitutes a very significant portion of the canopy cover. 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 its spread beyond its known locations 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 urban 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 your budget permits, all removed ash trees should be replaced. All trees should meet the restrictions in your city's ordinance (Appendix C). The new plantings should be a diverse mix and should not include ash, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genus's 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 as trees are infested with Emerald Ash Borer. Trees that are on private property are part of Farley's urban forest. Private property owners should be given direction to the proper species to plant, spacing, and location. Farley has a city ordinance for trees. This ordinance dates back to the Dutch elm disease days and needs to be updated.

Budget

Suggested Budget Increase

EAB could potentially kill all ash trees in Farley within a decade after its arrival. It is recommended that the City apply for grants to fund replacement tree planting. 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. There were a total of 86 ash trees surveyed. We strongly recommend at least 1/3 (28 trees) of them be removed and replaced over the next 6 years. First, remove the 2 trees with poor wood condition and the 2 trees with canopy dieback. Next, remove all the additional trees with signs and symptoms of possible EAB infestation. Finally, remove any of the remaining 28 trees where they occur in groups throughout the City. You can look at the various maps to locate all these trees. Finally, we recommend that the City adopt a policy of allocating somewhere from \$2 to \$4 per capita per year into a forestry budget to be used for planting, removals and maintenance of Farley's urban forest.

Suggested Budget for the next 6 years

Total of \$19,560

FY 2012 Budget

Removal: \$2500
Planting: \$500
Routine trimming: \$400
Watering & Other Maintenance: \$100

FY 2013 Budget

Removal: \$2500
Planting: \$500
Routine trimming: \$400
Watering & Other Maintenance: \$100

FY 2014 Budget

Removal: \$2500
Planting: \$500
Routine trimming: \$400
Watering & Other Maintenance: \$100

FY 2015 Budget

Removal: \$2500
Planting: \$500
Routine trimming: \$400
Watering & Other Maintenance: \$100

FY 2016 Budget

Removal: \$2000
Planting: \$400
Routine trimming: \$300
Watering & Other Maintenance: \$80

FY 2017 Budget

Removal: \$2000

Planting: \$400

Routine trimming: \$300

Watering & Other Maintenance: \$80

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

8/12/2010

| Species | Total Electricity (MWh) | Electricity (\$) | Total Natural Gas (Therms) | Natural Gas (\$) | Total (\$) | Standard Error | % of Total Trees | % of Total \$ | Avg. \$/tree |
|---------------------|----------------------------|---------------------|-------------------------------|---------------------|---------------|-------------------|---------------------|------------------|-----------------|
| Norway maple | 11.4 | 869 | 1,640.0 | 1,607 | 2,476 | (N/A) | 22.7 | 25.9 | 43.44 |
| Silver maple | 10.6 | 808 | 1,418.8 | 1,390 | 2,198 | (N/A) | 21.1 | 23.0 | 41.47 |
| Green ash | 9.2 | 702 | 1,191.5 | 1,168 | 1,869 | (N/A) | 15.9 | 19.6 | 46.73 |
| Sugar maple | 4.1 | 308 | 525.9 | 515 | 823 | (N/A) | 8.0 | 8.6 | 41.16 |
| Apple | 0.7 | 49 | 98.5 | 97 | 146 | (N/A) | 4.8 | 1.5 | 12.17 |
| Black walnut | 1.3 | 101 | 184.9 | 181 | 283 | (N/A) | 3.2 | 3.0 | 35.34 |
| Blue spruce | 0.6 | 45 | 81.0 | 79 | 125 | (N/A) | 2.8 | 1.3 | 17.84 |
| Red maple | 0.7 | 50 | 88.7 | 87 | 137 | (N/A) | 2.4 | 1.4 | 22.88 |
| Black maple | 0.9 | 69 | 116.5 | 114 | 183 | (N/A) | 1.6 | 1.9 | 45.79 |
| Broadleaf Deciduous | 0.0 | 2 | 5.7 | 6 | 8 | (N/A) | 1.6 | 0.1 | 2.00 |
| Northern red oak | 0.0 | 2 | 4.8 | 5 | 7 | (N/A) | 1.6 | 0.1 | 1.67 |
| Maple | 0.5 | 39 | 60.8 | 60 | 99 | (N/A) | 1.2 | 1.0 | 32.98 |
| Honeylocust | 0.9 | 70 | 127.0 | 124 | 194 | (N/A) | 1.2 | 2.0 | 64.79 |
| Spruce | 0.1 | 10 | 16.0 | 16 | 26 | (N/A) | 1.2 | 0.3 | 8.66 |
| Black poplar | 1.0 | 74 | 138.6 | 136 | 210 | (N/A) | 1.2 | 2.2 | 70.08 |
| Other street trees | 3.7 | 279 | 490.3 | 480 | 759 | (N/A) | 9.6 | 8.0 | 31.64 |
| Citywide total | 45.8 | 3,479 | 6,189.0 | 6,065 | 9,544 | (N/A) | 100.0 | 100.0 | 38.02 |

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

8/12/2010

| Species | Total rainfall interception (Gal) | Total (\$) | Standard Error | % of Total Trees | % of Total \$ | Avg. \$/tree |
|---------------------|--------------------------------------|---------------|-------------------|---------------------|------------------|-----------------|
| Norway maple | 97,964 | 2,655 | (N/A) | 22.7 | 22.4 | 46.58 |
| Silver maple | 144,594 | 3,919 | (N/A) | 21.1 | 33.0 | 73.94 |
| Green ash | 78,407 | 2,125 | (N/A) | 15.9 | 17.9 | 53.12 |
| Sugar maple | 31,246 | 847 | (N/A) | 8.0 | 7.1 | 42.34 |
| Apple | 2,301 | 62 | (N/A) | 4.8 | 0.5 | 5.20 |
| Black walnut | 12,148 | 329 | (N/A) | 3.2 | 2.8 | 41.15 |
| Blue spruce | 7,155 | 194 | (N/A) | 2.8 | 1.6 | 27.70 |
| Red maple | 5,131 | 139 | (N/A) | 2.4 | 1.2 | 23.18 |
| Black maple | 6,700 | 182 | (N/A) | 1.6 | 1.5 | 45.39 |
| Broadleaf Deciduous | 91 | 2 | (N/A) | 1.6 | 0.0 | 0.62 |
| Northern red oak | 76 | 2 | (N/A) | 1.6 | 0.0 | 0.51 |
| Maple | 3,219 | 87 | (N/A) | 1.2 | 0.7 | 29.08 |
| Honeylocust | 8,715 | 236 | (N/A) | 1.2 | 2.0 | 78.73 |
| Spruce | 1,636 | 44 | (N/A) | 1.2 | 0.4 | 14.78 |
| Black poplar | 12,023 | 326 | (N/A) | 1.2 | 2.7 | 108.62 |
| Other street trees | 26,914 | 729 | (N/A) | 9.6 | 6.1 | 30.39 |
| Citywide total | 438,320 | 11,879 | (N/A) | 100.0 | 100.0 | 47.33 |

Table 3: Annual Air Quality Benefits**Annual Air Quality Benefits of Public Trees by Species**

8/12/2010

| 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 | 18.9 | 3.3 | 9.5 | 0.8 | 103 | 55.4 | 8.0 | 7.6 | 51.9 | 343 | -4.5 | -17 | 151.0 | 429 | (N/A) | 22.7 | 7.53 |
| Silver maple | 24.6 | 4.2 | 12.2 | 1.1 | 133 | 50.3 | 7.4 | 7.0 | 48.1 | 314 | -13.7 | -51 | 141.2 | 396 | (N/A) | 21.1 | 7.47 |
| Green ash | 7.8 | 1.2 | 4.1 | 0.4 | 43 | 43.5 | 6.4 | 6.1 | 41.9 | 273 | 0.0 | 0 | 111.4 | 315 | (N/A) | 15.9 | 7.88 |
| Sugar maple | 3.3 | 0.6 | 1.9 | 0.1 | 19 | 19.1 | 2.8 | 2.7 | 18.4 | 120 | -2.8 | -10 | 46.1 | 128 | (N/A) | 8.0 | 6.39 |
| Apple | 0.6 | 0.1 | 0.3 | 0.0 | 3 | 3.2 | 0.5 | 0.4 | 3.0 | 20 | 0.0 | 0 | 8.0 | 23 | (N/A) | 4.8 | 1.89 |
| Black walnut | 1.2 | 0.2 | 0.6 | 0.1 | 6 | 6.4 | 0.9 | 0.9 | 6.1 | 40 | 0.0 | 0 | 16.3 | 46 | (N/A) | 3.2 | 5.79 |
| Blue spruce | 0.8 | 0.2 | 0.7 | 0.1 | 5 | 2.8 | 0.4 | 0.4 | 2.7 | 18 | -2.4 | -9 | 5.7 | 14 | (N/A) | 2.8 | 2.00 |
| Red maple | 1.1 | 0.2 | 0.5 | 0.1 | 6 | 3.1 | 0.5 | 0.4 | 3.0 | 20 | -0.4 | -1 | 8.6 | 24 | (N/A) | 2.4 | 4.05 |
| Black maple | 1.5 | 0.3 | 0.7 | 0.1 | 8 | 4.3 | 0.6 | 0.6 | 4.1 | 27 | -0.5 | -2 | 11.6 | 33 | (N/A) | 1.6 | 8.17 |
| Broadleaf Deciduous | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.2 | 0.0 | 0.0 | 0.1 | 1 | 0.0 | 0 | 0.4 | 1 | (N/A) | 1.6 | 0.26 |
| Northern red oak | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.1 | 0.0 | 0.0 | 0.1 | 1 | 0.0 | 0 | 0.3 | 1 | (N/A) | 1.6 | 0.21 |
| Maple | 0.6 | 0.1 | 0.3 | 0.0 | 3 | 2.4 | 0.4 | 0.3 | 2.3 | 15 | -0.2 | -1 | 6.3 | 18 | (N/A) | 1.2 | 5.88 |
| Honeylocust | 1.6 | 0.3 | 0.8 | 0.1 | 9 | 4.4 | 0.6 | 0.6 | 4.2 | 27 | -1.1 | -4 | 11.4 | 32 | (N/A) | 1.2 | 10.61 |
| Spruce | 0.2 | 0.0 | 0.1 | 0.0 | 1 | 0.6 | 0.1 | 0.1 | 0.6 | 4 | -0.6 | -2 | 1.2 | 3 | (N/A) | 1.2 | 0.97 |
| Black poplar | 1.6 | 0.2 | 0.7 | 0.1 | 8 | 4.7 | 0.7 | 0.7 | 4.4 | 29 | 0.0 | 0 | 13.1 | 38 | (N/A) | 1.2 | 12.51 |
| Other street trees | 3.6 | 0.6 | 2.0 | 0.2 | 20 | 17.4 | 2.5 | 2.4 | 16.7 | 109 | -1.7 | -6 | 43.7 | 122 | (N/A) | 9.6 | 5.10 |
| Citywide total | 67.5 | 11.4 | 34.4 | 3.1 | 367 | 218.0 | 31.8 | 30.3 | 207.7 | 1,360 | -28.1 | -105 | 576.2 | 1,622 | (N/A) | 100.0 | 6.46 |

Table 4: Annual Carbon Stored**Stored CO2 Benefits of Public Trees by Species**

8/12/2010

| Species | Total Stored CO ₂ (lbs) | Total (\$) | Standard Error | % of Total Trees | % of Total \$ | Avg. \$/tree |
|--------------------|------------------------------------|------------|----------------|------------------|---------------|--------------|
| Norway maple | 313,874 | 2,354 | (N/A) | 22.7 | 20.9 | 41.30 |
| Silver maple | 600,399 | 4,503 | (N/A) | 21.1 | 39.9 | 84.96 |
| Green ash | 256,414 | 1,923 | (N/A) | 15.9 | 17.1 | 48.08 |
| Sugar maple | 93,707 | 703 | (N/A) | 8.0 | 6.2 | 35.14 |
| Apple | 9,223 | 69 | (N/A) | 4.8 | 0.6 | 5.76 |
| Black walnut | 38,800 | 291 | (N/A) | 3.2 | 2.6 | 36.37 |
| Blue spruce | 4,250 | 32 | (N/A) | 2.8 | 0.3 | 4.55 |
| Red maple | 12,721 | 95 | (N/A) | 2.4 | 0.9 | 15.90 |
| Black maple | 16,294 | 122 | (N/A) | 1.6 | 1.1 | 30.55 |
| Broadleaf | 219 | 2 | (N/A) | 1.6 | 0.0 | 0.41 |
| Northern red oak | 50 | 0 | (N/A) | 1.6 | 0.0 | 0.09 |
| Maple | 7,265 | 54 | (N/A) | 1.2 | 0.5 | 18.16 |
| Honeylocust | 20,228 | 152 | (N/A) | 1.2 | 1.4 | 50.57 |
| Spruce | 1,175 | 9 | (N/A) | 1.2 | 0.1 | 2.94 |
| Black poplar | 50,174 | 376 | (N/A) | 1.2 | 3.3 | 125.43 |
| Other street trees | 35,532 | 588 | (N/A) | 9.6 | 5.2 | 24.48 |
| Citywide total | 1,503,128 | 11,273 | (N/A) | 100.0 | 100.0 | 44.91 |

Table 5: Annual Carbon Sequestered**Annual CO₂ Benefits of Public Trees by Species**

8/12/2010

| 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 | 17,138 | 129 | -1,507 | -11 | -11 | 19,198 | 144 | 34,819 | 261 (N/A) | | 22.7 | 19.5 | 4.58 |
| Silver maple | 44,178 | 331 | -2,882 | -10 | -22 | 17,847 | 134 | 59,132 | 443 (N/A) | | 21.1 | 33.1 | 8.37 |
| Green ash | 20,167 | 151 | -1,231 | -8 | -9 | 15,506 | 116 | 34,434 | 258 (N/A) | | 15.9 | 19.3 | 6.46 |
| Sugar maple | 6,936 | 52 | -450 | -4 | -3 | 6,805 | 51 | 13,287 | 100 (N/A) | | 8.0 | 7.4 | 4.98 |
| Apple | 996 | 7 | -44 | -2 | 0 | 1,092 | 8 | 2,041 | 15 (N/A) | | 4.8 | 1.1 | 1.28 |
| Black walnut | 3,188 | 24 | -186 | -2 | -1 | 2,243 | 17 | 5,242 | 39 (N/A) | | 3.2 | 2.9 | 4.91 |
| Blue spruce | 400 | 3 | -20 | -1 | 0 | 1,006 | 8 | 1,384 | 10 (N/A) | | 2.8 | 0.8 | 1.48 |
| Red maple | 1,580 | 12 | -61 | -1 | 0 | 1,114 | 8 | 2,632 | 20 (N/A) | | 2.4 | 1.5 | 3.29 |
| Black maple | 1,132 | 8 | -78 | -1 | -1 | 1,524 | 11 | 2,577 | 19 (N/A) | | 1.6 | 1.4 | 4.83 |
| Broadleaf Deciduous | 64 | 0 | -1 | -1 | 0 | 54 | 0 | 116 | 1 (N/A) | | 1.6 | 0.1 | 0.22 |
| Northern red oak | 20 | 0 | 0 | -1 | 0 | 43 | 0 | 62 | 0 (N/A) | | 1.6 | 0.0 | 0.12 |
| Maple | 969 | 7 | -35 | -1 | 0 | 868 | 7 | 1,802 | 14 (N/A) | | 1.2 | 1.0 | 4.51 |
| Honeylocust | 2,809 | 21 | -97 | -1 | -1 | 1,546 | 12 | 4,257 | 32 (N/A) | | 1.2 | 2.4 | 10.64 |
| Spruce | 123 | 1 | -6 | -1 | 0 | 229 | 2 | 345 | 3 (N/A) | | 1.2 | 0.2 | 0.86 |
| Black poplar | 2,476 | 19 | -241 | -1 | -2 | 1,644 | 12 | 3,878 | 29 (N/A) | | 1.2 | 2.2 | 9.70 |
| Other street trees | 6,783 | 51 | -376 | -5 | -3 | 6,164 | 46 | 12,567 | 94 (N/A) | | 9.6 | 7.0 | 3.93 |
| Citywide total | 108,960 | 817 | -7,215 | -49 | -54 | 76,882 | 577 | 178,577 | 1,339 (N/A) | | 100.0 | 100.0 | 5.34 |

Table 6: Annual Social and Aesthetic Benefits**Annual Aesthetic/Other Benefits of Public Trees by Species**

8/12/2010

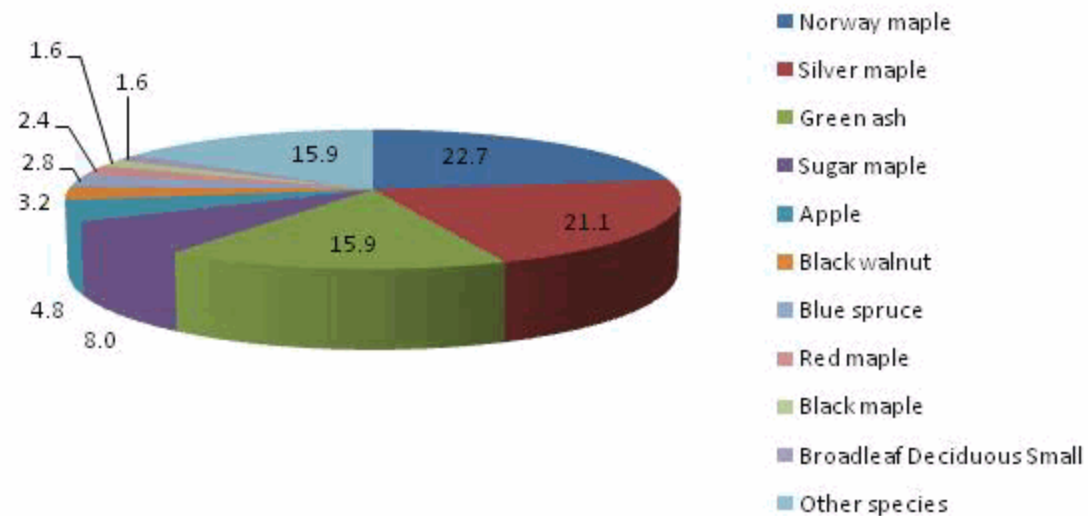
| Species | Total (\$) | Standard Error | % of Total Trees | % of Total \$ | Avg. \$/tree |
|---------------------|------------|----------------|------------------|---------------|--------------|
| Norway maple | 1,703 | (N/A) | 22.7 | 16.0 | 29.88 |
| Silver maple | 3,704 | (N/A) | 21.1 | 34.7 | 69.89 |
| Green ash | 1,901 | (N/A) | 15.9 | 17.8 | 47.52 |
| Sugar maple | 808 | (N/A) | 8.0 | 7.6 | 40.39 |
| Apple | 54 | (N/A) | 4.8 | 0.5 | 4.54 |
| Black walnut | 313 | (N/A) | 3.2 | 2.9 | 39.18 |
| Blue spruce | 151 | (N/A) | 2.8 | 1.4 | 21.61 |
| Red maple | 205 | (N/A) | 2.4 | 1.9 | 34.15 |
| Black maple | 162 | (N/A) | 1.6 | 1.5 | 40.40 |
| Broadleaf Deciduous | 2 | (N/A) | 1.6 | 0.0 | 0.54 |
| Northern red oak | 6 | (N/A) | 1.6 | 0.1 | 1.54 |
| Maple | 132 | (N/A) | 1.2 | 1.2 | 43.94 |
| Honeylocust | 584 | (N/A) | 1.2 | 5.5 | 194.60 |
| Spruce | 44 | (N/A) | 1.2 | 0.4 | 14.61 |
| Black poplar | 190 | (N/A) | 1.2 | 1.8 | 63.29 |
| Other street trees | 707 | (N/A) | 9.6 | 6.6 | 29.44 |
| Citywide total | 10,666 | (N/A) | 100.0 | 100.0 | 42.49 |

Table 7: Summary of Benefits in Dollars

| Annual Benefits of Public Trees by Species (\$/tree) | | | | | | | |
|---|--------|-----------------|-------------|------------|-----------------|--------------|----------------|
| 8/12/2010 | | | | | | | |
| Species | Energy | CO ₂ | Air Quality | Stormwater | Aesthetic/Other | Total (\$) | Standard Error |
| Norway maple | 43.44 | 4.58 | 7.53 | 46.58 | 29.88 | 132.01 (N/A) | |
| Silver maple | 41.47 | 8.37 | 7.47 | 73.94 | 69.89 | 201.14 (N/A) | |
| Green ash | 46.73 | 6.46 | 7.88 | 53.12 | 47.52 | 161.71 (N/A) | |
| Sugar maple | 41.16 | 4.98 | 6.39 | 42.34 | 40.39 | 135.27 (N/A) | |
| Apple | 12.17 | 1.28 | 1.89 | 5.20 | 4.54 | 25.07 (N/A) | |
| Black walnut | 35.34 | 4.91 | 5.79 | 41.15 | 39.18 | 126.37 (N/A) | |
| Blue spruce | 17.84 | 1.48 | 2.00 | 27.70 | 21.61 | 70.64 (N/A) | |
| Red maple | 22.88 | 3.29 | 4.05 | 23.18 | 34.15 | 87.55 (N/A) | |
| Black maple | 45.79 | 4.83 | 8.17 | 45.39 | 40.40 | 144.59 (N/A) | |
| Broadleaf | 2.00 | 0.22 | 0.26 | 0.62 | 0.54 | 3.63 (N/A) | |
| Northern red oak | 1.67 | 0.12 | 0.21 | 0.51 | 1.54 | 4.04 (N/A) | |
| Maple | 32.98 | 4.51 | 5.88 | 29.08 | 43.94 | 116.38 (N/A) | |
| Honeylocust | 64.79 | 10.64 | 10.61 | 78.73 | 194.60 | 359.38 (N/A) | |
| Spruce | 8.66 | 0.86 | 0.97 | 14.78 | 14.61 | 39.89 (N/A) | |
| Black poplar | 70.08 | 9.70 | 12.51 | 108.62 | 63.29 | 264.20 (N/A) | |
| Other street trees | 31.64 | 3.93 | 5.10 | 30.39 | 29.44 | 100.50 (N/A) | |

Species Distribution of Public Trees (%)

8/12/2010

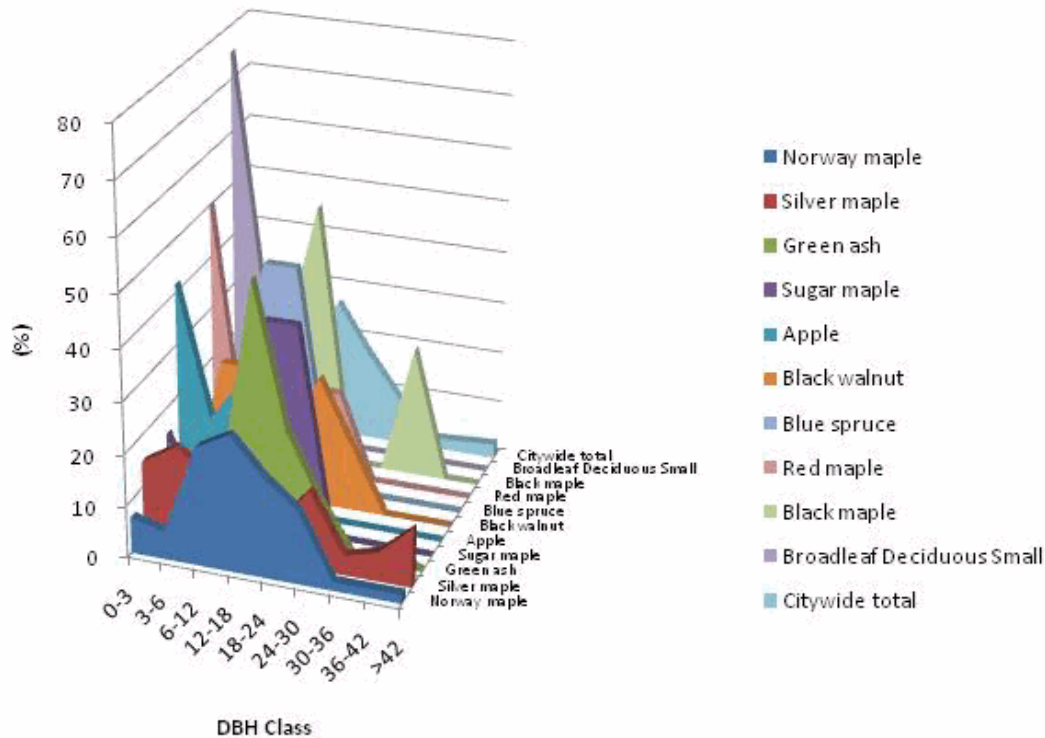


| Species | Percent |
|---------------------|---------|
| Norway maple | 22.7 |
| Silver maple | 21.1 |
| Green ash | 15.9 |
| Sugar maple | 8.0 |
| Apple | 4.8 |
| Black walnut | 3.2 |
| Blue spruce | 2.8 |
| Red maple | 2.4 |
| Black maple | 1.6 |
| Broadleaf Deciduous | 1.6 |
| Other species | 15.9 |
| Total | 100.0 |

Figure 1: Species Distribution

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

8/12/2010



| Species | DBH class (in) | | | | | | | | |
|---------------------|----------------|------|------|-------|-------|-------|-------|-------|------|
| | 0-3 | 3-6 | 6-12 | 12-18 | 18-24 | 24-30 | 30-36 | 36-42 | >42 |
| Norway maple | 7.0 | 5.3 | 22.8 | 26.3 | 19.3 | 14.0 | 1.8 | 1.8 | 1.8 |
| Silver maple | 15.1 | 18.9 | 15.1 | 7.5 | 7.5 | 15.1 | 3.8 | 5.7 | 11.3 |
| Green ash | 0.0 | 5.0 | 10.0 | 50.0 | 22.5 | 10.0 | 0.0 | 2.5 | 0.0 |
| Sugar maple | 15.0 | 0.0 | 5.0 | 40.0 | 40.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Apple | 41.7 | 16.7 | 25.0 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Black walnut | 0.0 | 25.0 | 25.0 | 12.5 | 25.0 | 12.5 | 0.0 | 0.0 | 0.0 |
| Blue spruce | 0.0 | 14.3 | 42.9 | 42.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Red maple | 50.0 | 0.0 | 16.7 | 16.7 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Black maple | 0.0 | 0.0 | 25.0 | 50.0 | 0.0 | 0.0 | 25.0 | 0.0 | 0.0 |
| Broadleaf Deciduous | 75.0 | 25.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Citywide total | 13.5 | 10.0 | 16.7 | 26.7 | 17.1 | 8.8 | 2.0 | 2.4 | 2.8 |

Figure 2: Relative Age Class

Functional (Foliage) Condition of Public Trees by Species (%)

8/12/2010

Citywide total

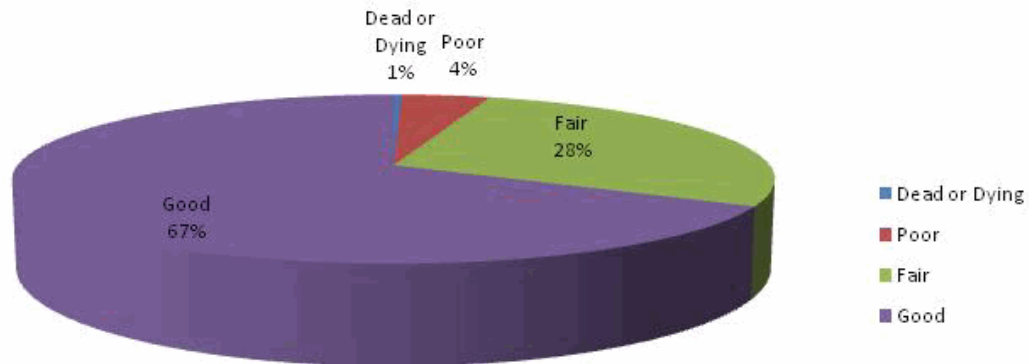


Figure 3: Foliage Condition

Structural (Woody) Condition of Public Trees by Species (%)

8/12/2010

Citywide total

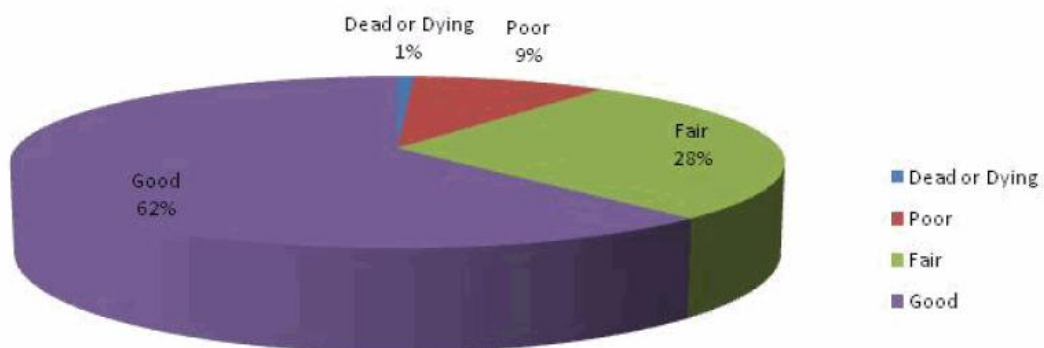
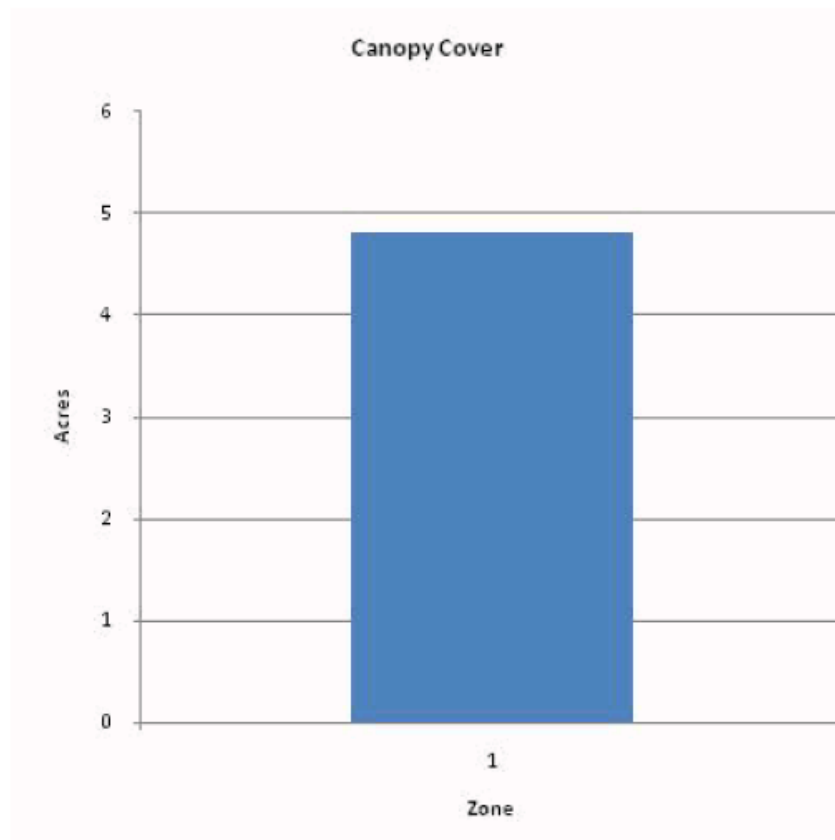


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

8/12/2010



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

| | Total Land Area | Total Street and Sidewalk Area | Total Canopy Cover | Canopy Cover as % of Total Land Area | Canopy Cover as % of Total Streets and Sidewalks |
|----------|-----------------|--------------------------------|--------------------|--------------------------------------|--|
| Citywide | 0 | 0 | 5 | | |

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

8/12/2010

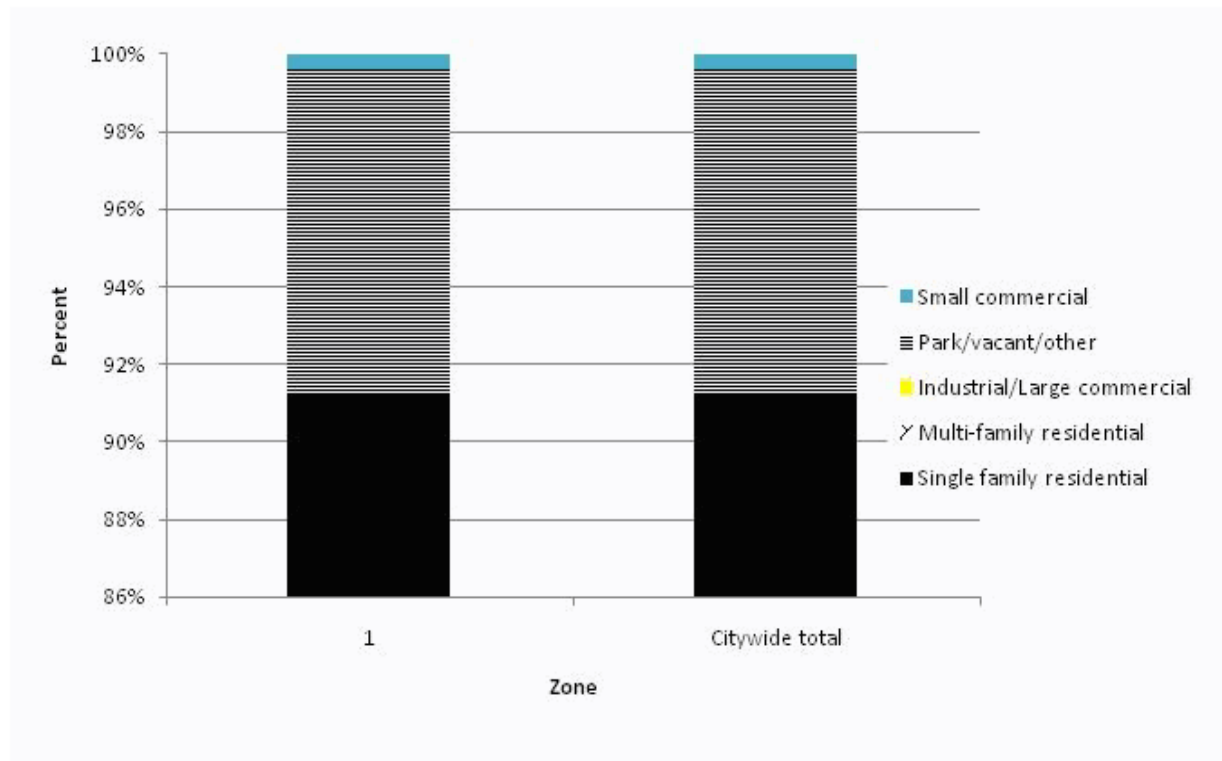


Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

8/12/2010

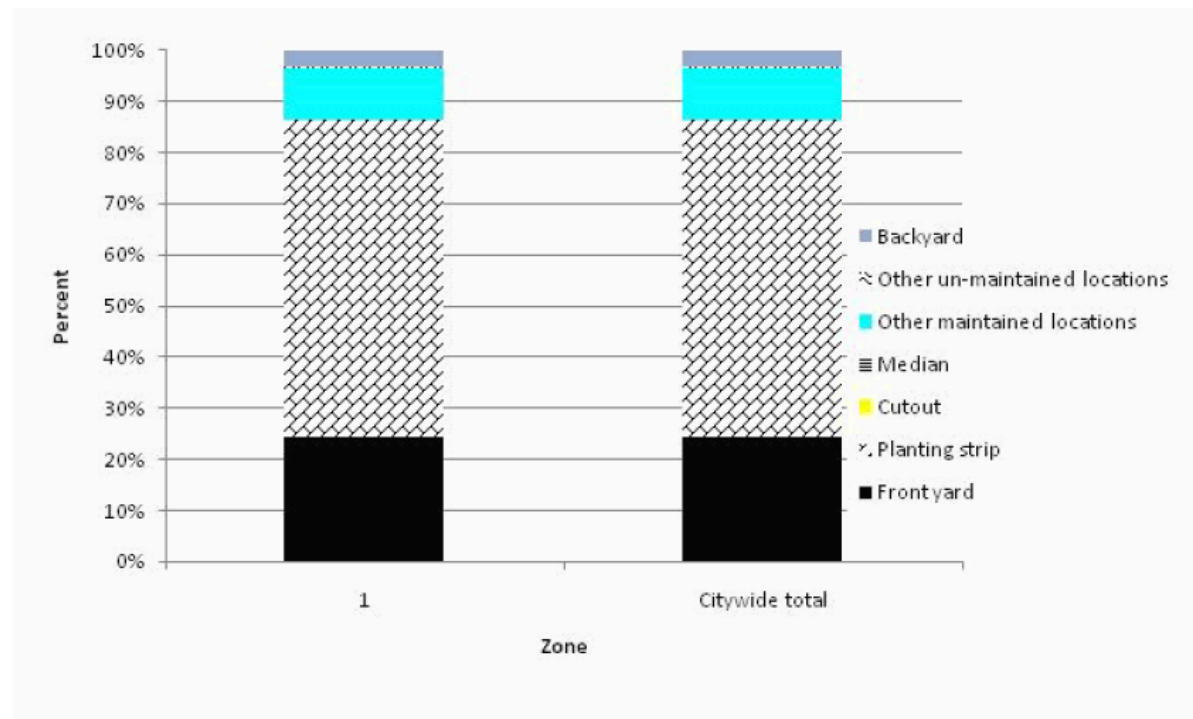


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

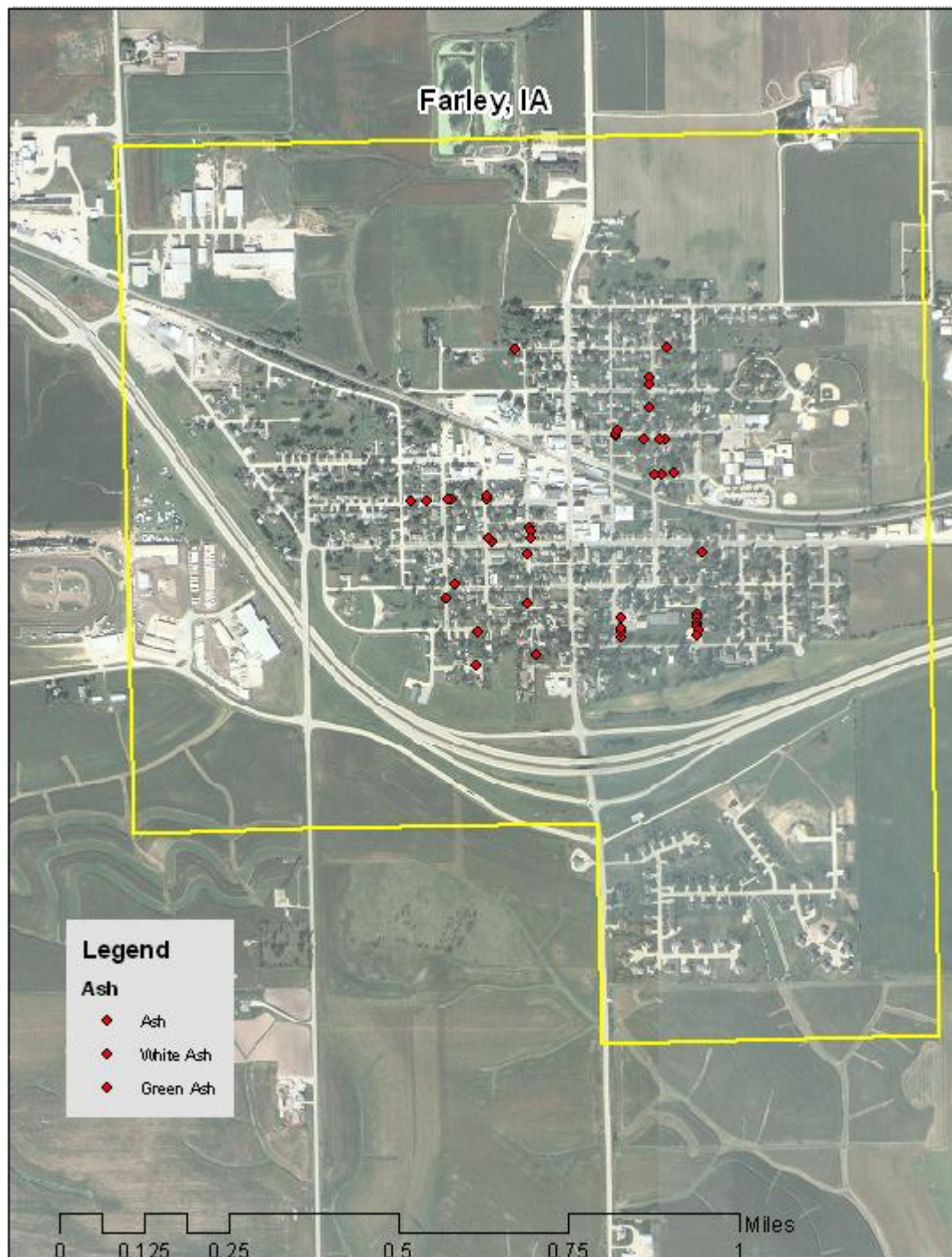


Figure 1: Location of Ash Trees



Figure 2: Location of EAB symptoms

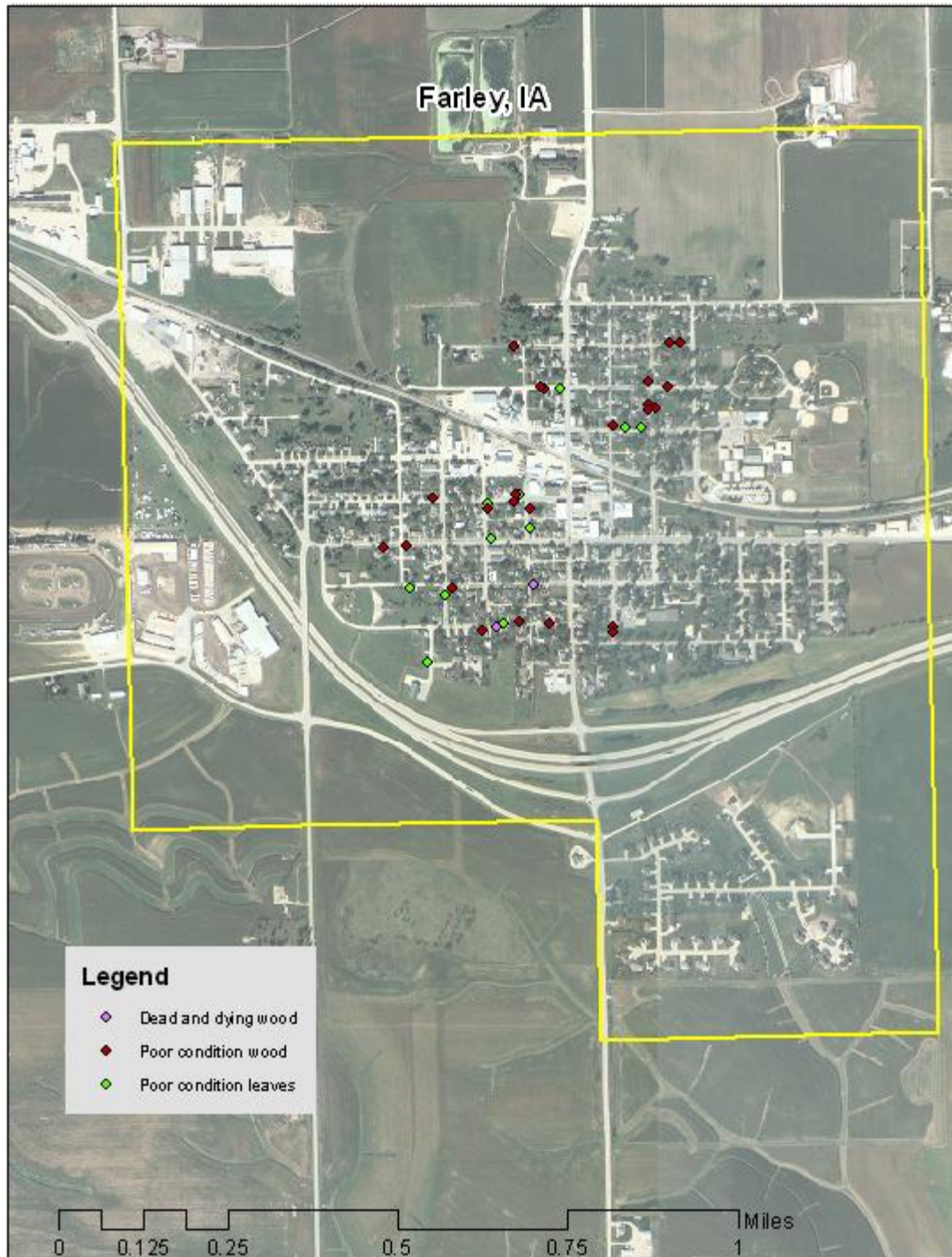


Figure 3: Location of Poor Condition Trees



Figure 4: Location of Trees with Recommended Maintenance

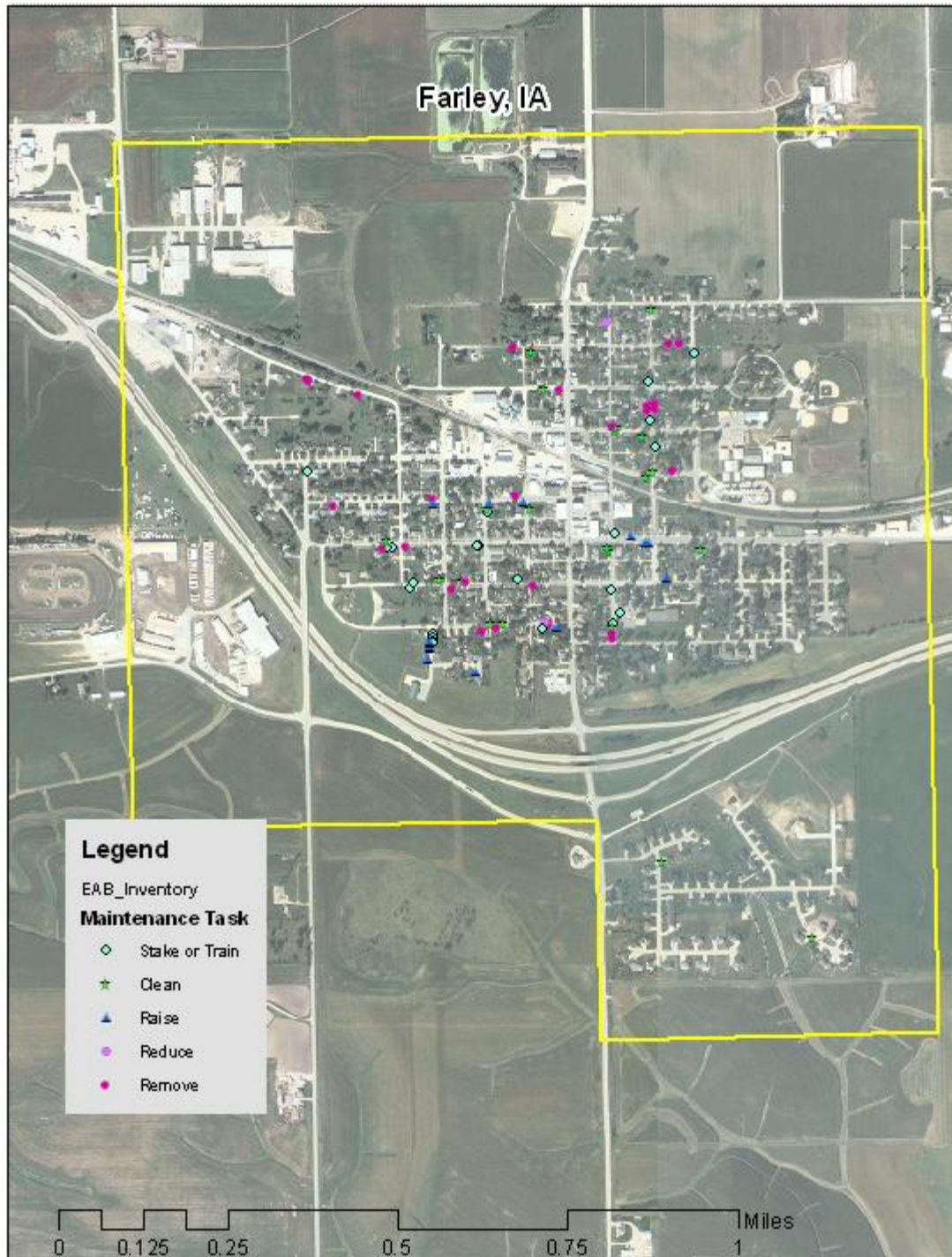


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: *CITY* Tree Ordinances

TITLE III COMMUNITY PROTECTION

CHAPTER 2 NUISANCES

3-2-1 DEFINITIONS. For use in this Ordinance, the following terms are defined:

1. The term "nuisance" means whatever is injurious to health, indecent, or unreasonably offensive to the senses or an obstacle to the free use of property, so as essentially to unreasonably interfere with the comfortable enjoyment of life or property. The following are declared to be nuisances:

h. Cotton-bearing cottonwood trees and all other cotton-bearing poplar trees in the City.

l. Dense growth of all weeds, grasses, vines, brush, or other vegetation in the City so as to constitute a health, safety, or fire hazard including any City owned property between the abutting property line and the street right-of-way.

m. Trees infected with Dutch elm disease.

TITLE VI PHYSICAL ENVIRONMENT

CHAPTER 6 TREES

6-6-1 Short Title

6-6-2 City Forester

6-6-3 Duties of City Forester

6-6-4 Duties of Private Owners

6-6-5 Removal of Trees Infected with Dutch Elm Disease

6-6-6 Mutilation of Trees

6-6-1 SHORT TITLE. This chapter shall be known any may be cited as the "Farley Tree Ordinance."

6-6-2 CITY FORESTER.

1. The Council shall designate a person to act as City Forester.

2. The City Forester shall have jurisdiction over all trees and other plantings on the street right of way within the City in order to provide orderly tree planting, to protect the health of all trees from disease, and to require trees and plantings

to be maintained in a manner not dangerous to public safety.

6-6-3 DUTIES OF CITY FORESTER. The City Forester shall have the authority and duty to prevent the indiscriminate trimming or removal of trees or plants within street right of way. The City Forester shall regulate new planting of trees or other plantings in the right of way in accordance with street tree planting regulations approved by the Council and on file in the office of the Clerk-Treasurer. The City Forester shall order private persons to comply with duties placed upon them by this chapter. The City Forester shall supervise all work by city employees or contractors in the trimming, preservation, planting, or removal of trees or other plantings in the right of way.

6-6-4 DUTIES OF PRIVATE OWNERS. It shall be the duty of any person growing a tree or other plantings on private property abutting on streets or public places:

1. To trim trees or plantings so that they shall not cause a hazard to the public or block public walks or ways or interfere with property lighting of public streets or places. The minimum clearance of any overhanging portion shall be eight (8) feet over walks and fourteen (14) feet above the surface of the traveled portion of the street.
2. To not plant any tree or other planting on private property that would cause a public nuisance or danger.
3. To not plant trees or other plantings on corner lots adjacent to an alley in the area bounded by the street or alley lines of such lots and a line joining points along said street or alley lines twenty-five (25) feet from the point of intersection of the right of way lines.
4. To not plant any tree closer than four (4) feet to the sidewalk line or alley right of way line.
5. To treat in an accepted manner or remove any tree or plant diseased or insect ridden as to constitute a hazard to other trees and especially those dangerous to trees or plants in public streets or places.
6. To not plant any of the following species: Cottonwood (unless cottonless), cotton-bearing poplar, or box-elder.

6-6-5 REMOVAL OF TREES INFECTED WITH DUTCH ELM DISEASE. In accordance with Section 364.12, Code of Iowa, any owner occupant or person in charge of any property shall remove at that person's expense any tree, brush, wood, or debris infected with Dutch elm disease found thereon when so notified by the City Forester. The City Forester shall cause to be mailed to such owner, occupant, or person written notice that they may appear before the City Council at an appointed time not less than fourteen (14) days from the date of mailing to show cause why said tree, brush, wood, or debris should not be declared a public nuisance. At said meeting, the

Council may resolve and declare the same to be a public nuisance and may order its removal by said owner, occupant, or person. In the event said owner, occupant, or person fails to comply with the resolution and order of the Council to so remove said public nuisance, the City Forester shall cause said public nuisance to be removed and shall submit the costs incident to said services and removal to the Council, which shall certify the same to the County Auditor for collection with and in the same manner as general property taxes.

6-6-6 MUTILATION OF TREES. No person shall willfully damage, cut, carve, pick the seeds of, or injure the bark of any tree or plant on the streets or public places of the City. Tree trimming shall be done in accordance with good practice and the regulations of the City.

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 Director Richard Leopold at 515-281-5918.