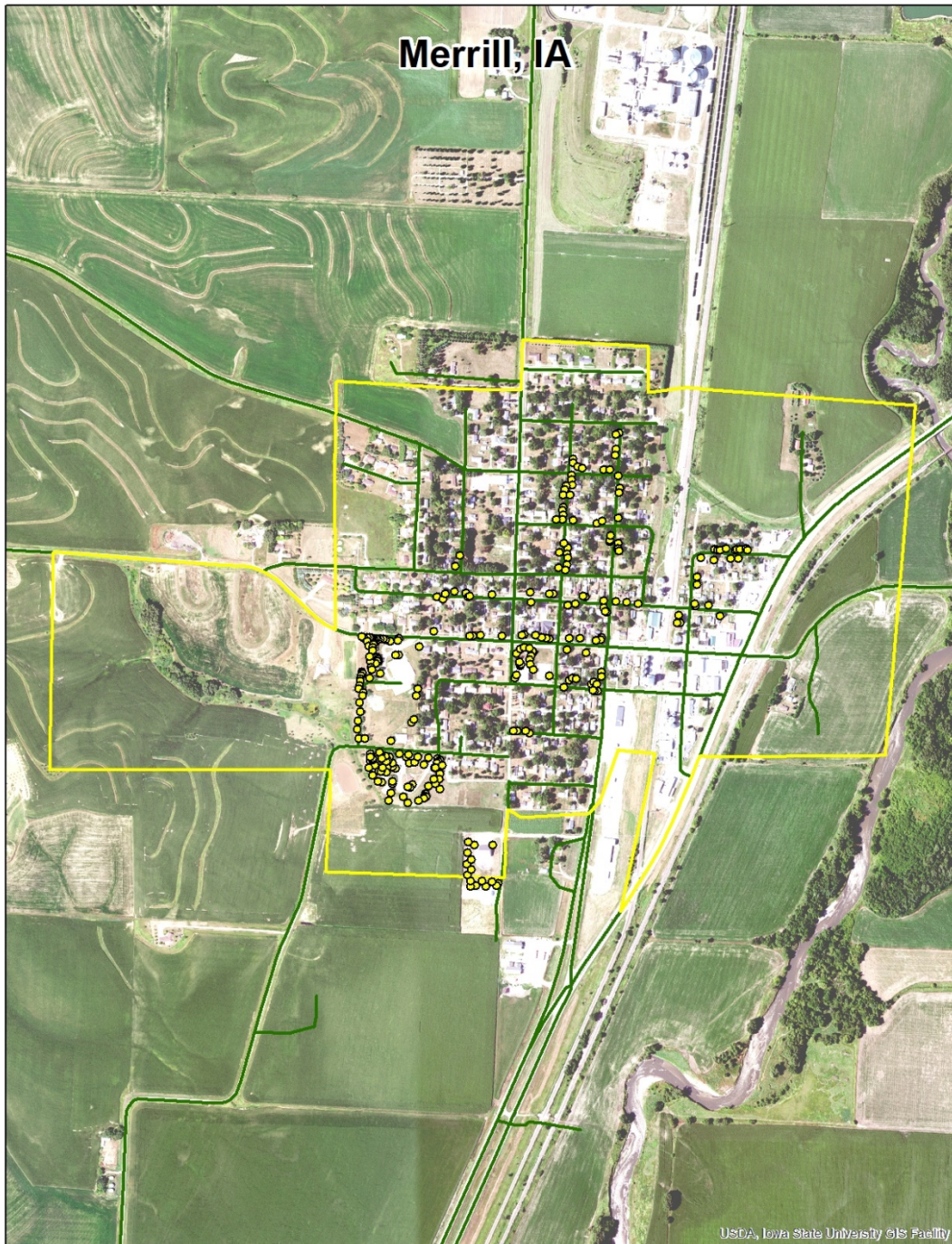


# Merrill, IA



2020 Urban Forest Management Plan  
Prepared by Vince Grube  
Iowa Department of Natural Resources



## Table of Contents

Executive Summary.....	1
Overview .....	1
Inventory and Results .....	1
Recommendations .....	1
Introduction .....	2
Inventory.....	2
Inventory Results .....	3
Annual Benefits.....	3
Annual Energy Benefits.....	3
Annual Stormwater Benefits.....	3
Annual Air Quality Benefits.....	3
Annual Carbon Benefits .....	3
Annual Aesthetics Benefits .....	3
Financial Summary of all Benefits.....	3
Forest Structure .....	3
Species Distribution .....	3
Age Class .....	4
Condition: Wood and Foliage .....	4
Management Needs.....	4
Canopy Cover .....	4
Land Use and Location.....	5
Recommendations .....	5
Risk Management .....	5
Pruning Cycle.....	5
Planting .....	6
Continual Monitoring.....	6
Emerald Ash Borer Plan .....	6
Ash Tree Removal .....	6
Treatment of Ash Trees .....	6
EAB Quarantines .....	6
Wood Disposal .....	7
Canopy Replacement .....	7
Postponed Work .....	7
Monitoring .....	7
Private Ash Trees .....	7
Budget and 6 year Plan .....	8
Works Cited.....	9
Appendix A: i-Tree Data .....	10
Table 1: Annual Energy Benefits.....	10
Table 2: Annual Stormwater Benefits.....	11
Table 3: Annual Air Quality Benefits .....	11
Table 4: Annual Carbon Stored .....	12
Table 5: Annual Carbon Sequestered .....	12
Table 6: Annual Social and Aesthetic Benefits.....	13

Table 7: Summary of Benefits in Dollars.....	14
Figure 1: Species Distribution .....	15
Figure 2: Relative Age Class .....	15
Figure 3: Foliage Condition .....	16
Figure 5: Canopy Cover in Acres .....	17
Figure 6: Land Use of city/park trees.....	18
Figure 7: Location of city/park trees.....	18
Appendix B: ArcGIS Mapping .....	19
Figure 1: Location of Ash Trees.....	19
Figure 2: Location of EAB symptoms .....	20
Figure 3: Location of Poor Condition Trees .....	21
Figure 4: Location of Trees with Recommended Maintenance.....	22
Figure 5: Maintenance Tasks	
Appendix C: Merrill Tree Ordinances.....	24

# Executive Summary

---

## Overview

This plan was developed to assist the City of Merrill 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 27% of Merrill'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 2020, 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 274 trees inventoried.

- Merrill's trees provide \$48,429 of benefits annually, an average of \$175.75 a tree
- There are over 24 species of trees from 12 different genera.
- The top three genera are: Maple 32%, Ash 27%, and Spruce 17%
- 18% 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, 9 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately [\\*City ownership of the trees recommended for removal should be verified prior to any removal\\*](#)
- 21 of the 74 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, black walnut or ash
- Check ash trees with a visual survey yearly
- With the current budget it could take 12 years to remove ash – Suggestion: request a budget increase to \$10,000 annually and apply for grants to plant replacement trees

# Introduction

---

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

Trees are an important component of Merrill'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 Merrill 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 Merrill's urban forestry goals.

## Inventory

---

In 2020, 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 274 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. Merrill's trees reduce energy related costs by approximately \$12,375 annually (Appendix A, Table 1). These savings are both in Electricity (59.2 MWh) and in Natural Gas (8,040.3 Therms).

### **Annual Stormwater Benefits**

Merrill's trees intercept about 667,736 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$18,096 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 Merrill, it is estimated that trees remove 745.4 lbs of air pollution (ozone (O<sub>3</sub>), particulate matter less than 10 microns (PM<sub>10</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>)) per year with a net value of \$2,090 (Appendix A, Table 3).

### **Annual Carbon Benefits**

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Merrill, trees sequester about 153,204 lbs of carbon a year with an associated value of \$1,149 (Appendix A, Table 5). In addition, the trees store 2,330,394 lbs of carbon, with a yearly benefit of \$17,478 (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. Merrill receives \$14,064 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, Merrill's trees provide \$48,429 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 274 trees in Merrill provide approximately \$174.75 annually (Appendix A, Table 7).

## Forest Structure

---

### **Species Distribution**

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

The distribution of trees by genera is as follows:

Genus	Count	Percent
Maple	88	32%
Ash	74	27%
Spruce	47	17%
Pine	13	5%
Walnut	12	4%
Apple	10	4%
Basswood	10	4%
Hackberry	7	3%
Broadleaf		
S/M/L	4	1%
Oak	4	1%
Honeylocust	3	1%
Elm	2	1%

### Age Class

Most of Merrill’s trees (42%) are between 12 and 24 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. Merrill’s size curve is on the smaller side, indicating a younger than average 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 Merrill indicate that 71% of the trees are in good health, with only 6% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 39% of Merrill’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 17% of the population. This 17% 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	22	8%
Crown Raising	8	3%
Tree Removal	18	7%

### Canopy Cover

The total canopy with both private and public trees is 12%, 42.01 acres. The canopy cover included in the Merrill inventory includes approximately 6.64 acres (Appendix A, Figure 4). The City’s Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal, it is estimated that 26 trees need to be planted annually on public and private lands.

## Land Use and Location

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

### Land Use

Single family residential	43%
Park/Vacant/Other	57%

### Location

Planting strip	44%
Front yard	56%

## 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

Merrill has 7 critical concern trees that need immediate maintenance. 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. 3 of the critical concern trees are 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 41 trees with these needs.

### 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 18 removals, 7 are ash trees. There are a total of 74 ash trees, and 21 of those have signs and symptoms that have been associated with EAB. In addition, there are 43 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 Merrill.

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 (32%) (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, black walnut, or ash, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

## **Continual Monitoring**

Due to the threat of EAB, it is important to continuously check the health of ash trees. 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.

# **Emerald Ash Borer Plan**

---

## **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](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 151.02 (Appendix C). The new plantings will be a diverse mix and will not include fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

### **Postponed Work**

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

### **Monitoring**

It is recommended that ash trees be checked with a visual survey every year for tree death and for 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 151.06 states "If it is determined with reasonable certainty that any such condition exists on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such

owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

## Budget and 6 year Plan

---

### **Current Budget**

Total \$42,000 over 6 years (\$7,000/year)

### **FY 2020 Budget**

Removal: 8 Trees \$5,600

Planting: 9 trees \$900

Watering & Maintenance: \$500

### **FY 2021 Budget**

Removal: 6 trees \$4,200

Planting: 6 trees \$600

Routine trimming: \$1,700

Watering & Maintenance: \$500

### **FY 2022 Budget**

Removal: 8 Trees \$5,600

Planting: 9 trees \$900

Watering & Maintenance: \$500

### **FY 2023 Budget**

Removal: \$4,200

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$600

Routine trimming: \$1,700

Watering & Maintenance: \$500

### **FY 2024 Budget**

Removal: \$5,600

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$900

Watering & Maintenance: \$500

### **FY 2025 Budget**

Removal: \$4,200

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$600

Routine trimming: \$1,700

Watering & Maintenance: \$500

**\*Reduction of ash over 6 years: approximately 31 ash trees removed (approximately 42% of ash). It will take approximately 12 years to remove all ash with the current budget.**

### Proposed Budget Increase

EAB could potentially kill all ash trees in Merrill within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$14,000 a year. If the budget were increased to \$10,000 a year all ash could be removed within 9 years. Additionally, it is recommended that Merrill apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at \$15 per inch, about 4 trees could be treated per year (every other year treatment) for \$1,200. This would be 8 trees selected for treatment, and Merrill would still need to find \$46,200 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately \$2,250 a year for treatment and leave \$41,300 for removal. These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Merrill. It is suggested to consider increasing the budget to plan for this.

## Works Cited

---

Census Bureau. 2010. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2013)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, DJ and JF Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J; McPherson, E Gregory; Simpson, James R; Vargas, Kelaine E; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

# Appendix A: i-Tree Data

**Table 1: Annual Energy Benefits**

Merrill

## Annual Energy Benefits of Public Trees

8/6/2020

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total Standard (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	20.9	1,585	2,862.8	2,806	4,391	(N/A)	26.3	35.5	60.98
Silver maple	15.7	1,191	2,096.3	2,054	3,245	(N/A)	16.8	26.2	70.55
Norway maple	5.0	378	725.9	711	1,090	(N/A)	9.1	8.8	43.59
Blue spruce	1.1	86	154.5	151	238	(N/A)	9.1	1.9	9.51
Spruce	1.8	138	250.0	245	383	(N/A)	8.0	3.1	17.42
Black walnut	3.5	268	494.8	485	753	(N/A)	4.4	6.1	62.74
Red pine	1.5	111	175.7	172	283	(N/A)	4.0	2.3	25.73
Sugar maple	1.9	147	245.5	241	387	(N/A)	4.0	3.1	35.21
Apple	0.6	44	85.6	84	128	(N/A)	3.6	1.0	12.77
Littleleaf linden	1.8	139	225.3	221	360	(N/A)	3.3	2.9	40.00
Northern hackberry	2.2	166	309.7	304	470	(N/A)	2.6	3.8	67.08
Broadleaf Evergreen Large	0.8	57	85.1	83	141	(N/A)	1.1	1.1	46.87
Honeylocust	0.9	65	109.0	107	172	(N/A)	1.1	1.4	57.44
Maple	0.1	8	15.7	15	24	(N/A)	1.1	0.2	7.85
White ash	0.1	8	15.2	15	23	(N/A)	0.7	0.2	11.33
Red maple	0.1	9	17.2	17	26	(N/A)	0.7	0.2	12.80
Northern red oak	0.3	20	37.6	37	57	(N/A)	0.7	0.5	28.45
Siberian elm	0.1	9	17.2	17	26	(N/A)	0.7	0.2	13.04
Scotch pine	0.2	12	18.6	18	30	(N/A)	0.7	0.2	14.87
Bur oak	0.3	25	46.9	46	71	(N/A)	0.4	0.6	70.91
Basswood	0.2	18	27.0	26	44	(N/A)	0.4	0.4	44.23
Amur maple	0.1	6	12.8	13	18	(N/A)	0.4	0.1	18.19
Swamp white oak	0.0	3	6.2	6	9	(N/A)	0.4	0.1	8.99
Broadleaf Evergreen Medium	0.0	3	5.6	5	8	(N/A)	0.4	0.1	8.11
<b>Total</b>	<b>59.2</b>	<b>4,495</b>	<b>8,040.3</b>	<b>7,879</b>	<b>12,375</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>45.16</b>

**Table 2: Annual Stormwater Benefits**

Merrill

**Annual Stormwater Benefits of Public Trees**

8/6/2020

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	233,542	6,329	(N/A)	26.3	35.0	87.90
Silver maple	223,264	6,050	(N/A)	16.8	33.4	131.53
Norway maple	42,177	1,143	(N/A)	9.1	6.3	45.72
Blue spruce	14,467	392	(N/A)	9.1	2.2	15.68
Spruce	20,646	560	(N/A)	8.0	3.1	25.43
Black walnut	40,737	1,104	(N/A)	4.4	6.1	92.00
Red pine	22,114	599	(N/A)	4.0	3.3	54.48
Sugar maple	12,035	326	(N/A)	4.0	1.8	29.65
Apple	2,017	55	(N/A)	3.6	0.3	5.47
Littleleaf linden	12,443	337	(N/A)	3.3	1.9	37.47
Northern hackberry	17,387	471	(N/A)	2.6	2.6	67.31
Broadleaf Evergreen Large	7,582	205	(N/A)	1.1	1.1	68.49
Honeylocust	6,019	163	(N/A)	1.1	0.9	54.37
Maple	412	11	(N/A)	1.1	0.1	3.72
White ash	643	17	(N/A)	0.7	0.1	8.71
Red maple	637	17	(N/A)	0.7	0.1	8.63
Northern red oak	3,049	83	(N/A)	0.7	0.5	41.32
Siberian elm	823	22	(N/A)	0.7	0.1	11.15
Scotch pine	1,751	47	(N/A)	0.7	0.3	23.73
Bur oak	3,943	107	(N/A)	0.4	0.6	106.85
Basswood	1,466	40	(N/A)	0.4	0.2	39.72
Amur maple	264	7	(N/A)	0.4	0.0	7.17
Swamp white oak	163	4	(N/A)	0.4	0.0	4.41
Broadleaf Evergreen Medium	155	4	(N/A)	0.4	0.0	4.21
Citywide total	667,736	18,096	(N/A)	100.0	100.0	66.04

**Table 3: Annual Air Quality Benefits**

Merrill

**Annual Air Quality Benefits of Public Trees**

8/6/2020

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total Standard (\$)	Standard Error	% of Total Trees	Avg. \$/tree
	O <sub>3</sub>	NO <sub>2</sub>	PM <sub>10</sub>	SO <sub>2</sub>		NO <sub>2</sub>	PM <sub>10</sub>	VOC	SO <sub>2</sub>								
Green ash	28.8	4.6	13.8	1.3	154	99.8	14.5	13.8	94.7	621	0.0	0	271.3	775	(N/A)	26.3	10.76
Silver maple	38.4	6.5	18.9	1.7	207	74.2	10.8	10.4	71.0	464	-20.2	-76	211.8	596	(N/A)	16.8	12.95
Norway maple	8.0	1.4	4.0	0.4	43	24.2	3.5	3.3	22.6	150	-1.9	-7	65.5	186	(N/A)	9.1	7.44
Blue spruce	1.8	0.4	1.5	0.2	12	5.4	0.8	0.8	5.2	34	-5.1	-19	10.9	27	(N/A)	9.1	1.06
Spruce	2.1	0.4	1.9	0.3	14	8.7	1.3	1.2	8.2	54	-6.7	-25	17.4	43	(N/A)	8.0	1.97
Black walnut	5.1	0.8	2.4	0.2	27	17.0	2.5	2.3	16.0	105	0.0	0	46.3	132	(N/A)	4.4	11.03
Red pine	2.5	0.5	2.1	0.3	17	6.7	1.0	1.0	6.6	43	-10.3	-38	10.5	21	(N/A)	4.0	1.90
Sugar maple	1.1	0.2	0.7	0.0	6	9.1	1.3	1.3	8.8	57	-1.0	-4	21.4	59	(N/A)	4.0	5.40
Apple	0.5	0.1	0.2	0.0	3	2.8	0.4	0.4	2.6	17	0.0	0	7.1	20	(N/A)	3.6	2.00
Littleleaf linden	1.7	0.3	0.9	0.1	9	8.5	1.3	1.2	8.3	54	-0.9	-3	21.4	60	(N/A)	3.3	6.62
Northern hackberry	2.3	0.4	1.2	0.1	13	10.6	1.5	1.5	9.9	65	0.0	0	27.5	78	(N/A)	2.6	11.18
Broadleaf Evergreen Large	0.6	0.1	0.6	0.1	4	3.4	0.5	0.5	3.4	22	-3.2	-12	6.1	14	(N/A)	1.1	4.77
Honeylocust	1.1	0.2	0.5	0.0	6	4.0	0.6	0.6	3.9	25	-0.7	-3	10.2	28	(N/A)	1.1	9.47
Maple	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	1.1	1.12
White ash	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.1	3	(N/A)	0.7	1.61
Red maple	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	0.7	1.88
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)	0.7	3.93
Siberian elm	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.4	4	(N/A)	0.7	1.90
Scotch pine	0.2	0.0	0.2	0.0	1	0.7	0.1	0.1	0.7	4	-0.6	-2	1.4	3	(N/A)	0.7	1.69
Bur oak	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)	0.4	12.48
Basswood	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)	0.4	7.42
Amur maple	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3	(N/A)	0.4	2.55
Swamp white oak	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1	(N/A)	0.4	1.21
Broadleaf Evergreen Medium	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)	0.4	1.05
Citywide total	95.6	16.1	49.8	4.8	525	282.0	41.1	39.2	268.3	1,758	-51.5	-193	745.4	2,090	(N/A)	100.0	7.63

**Table 4: Annual Carbon Stored**

Merrill

**Stored CO2 Benefits of Public Trees**

8/6/2020

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	937,560	7,032	(N/A)	26.3	40.2	97.66
Silver maple	875,192	6,564	(N/A)	16.8	37.6	142.69
Norway maple	131,783	988	(N/A)	9.1	5.7	39.53
Blue spruce	11,518	86	(N/A)	9.1	0.5	3.46
Spruce	12,956	97	(N/A)	8.0	0.6	4.42
Black walnut	163,685	1,228	(N/A)	4.4	7.0	102.30
Red pine	24,599	184	(N/A)	4.0	1.1	16.77
Sugar maple	31,569	237	(N/A)	4.0	1.4	21.52
Apple	8,063	60	(N/A)	3.6	0.3	6.05
Littleleaf linden	36,978	277	(N/A)	3.3	1.6	30.82
Northern hackberry	31,880	239	(N/A)	2.6	1.4	34.16
Broadleaf Evergreen I	10,785	81	(N/A)	1.1	0.5	26.96
Honeylocust	12,817	96	(N/A)	1.1	0.5	32.04
Maple	655	5	(N/A)	1.1	0.0	1.64
White ash	1,047	8	(N/A)	0.7	0.0	3.93
Red maple	1,118	8	(N/A)	0.7	0.0	4.19
Northern red oak	15,251	114	(N/A)	0.7	0.7	57.19
Siberian elm	1,086	8	(N/A)	0.7	0.0	4.07
Scotch pine	1,208	9	(N/A)	0.7	0.1	4.53
Bur oak	15,773	118	(N/A)	0.4	0.7	118.30
Basswood	3,672	28	(N/A)	0.4	0.2	27.54
Amur maple	908	7	(N/A)	0.4	0.0	6.81
Swamp white oak	218	2	(N/A)	0.4	0.0	1.64
Broadleaf Evergreen I	73	1	(N/A)	0.4	0.0	0.55
Citywide total	2,330,394	17,478	(N/A)	100.0	100.0	63.79

**Table 5: Annual Carbon Sequestered**

Merrill

**Annual CO2 Benefits of Public Trees**

8/6/2020

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	50,090	376	-4,500	-217	-35	35,031	263	80,404	603 (N/A)	26.3	33.4	8.38
Silver maple	65,328	490	-4,201	-173	-33	26,314	197	87,268	655 (N/A)	16.8	36.3	14.23
Norway maple	8,060	60	-635	-52	-5	8,360	63	15,733	118 (N/A)	9.1	6.5	4.72
Blue spruce	852	6	-55	-21	-1	1,908	14	2,684	20 (N/A)	9.1	1.1	0.81
Spruce	1,661	12	-62	-32	-1	3,054	23	4,621	35 (N/A)	8.0	1.9	1.58
Black walnut	8,742	66	-786	-37	-6	5,924	44	13,843	104 (N/A)	4.4	5.8	8.65
Red pine	1,489	11	-118	-24	-1	2,448	18	3,795	28 (N/A)	4.0	1.6	2.59
Sugar maple	2,864	21	-152	-18	-1	3,244	24	5,938	45 (N/A)	4.0	2.5	4.05
Apple	885	7	-39	-9	0	970	7	1,808	14 (N/A)	3.6	0.8	1.36
Littleleaf linden	4,903	37	-177	-18	-1	3,075	23	7,782	58 (N/A)	3.3	3.2	6.49
Northern hackberry	2,460	18	-153	-19	-1	3,668	28	5,956	45 (N/A)	2.6	2.5	6.38
Broadleaf Evergreen Large	1,256	9	-52	-6	0	1,264	9	2,462	18 (N/A)	1.1	1.0	6.15
Honeylocust	1,885	14	-62	-7	-1	1,447	11	3,264	24 (N/A)	1.1	1.4	8.16
Maple	116	1	-3	-2	0	181	1	292	2 (N/A)	1.1	0.1	0.73
White ash	188	1	-5	-1	0	172	1	354	3 (N/A)	0.7	0.1	1.33
Red maple	168	1	-5	-1	0	192	1	354	3 (N/A)	0.7	0.1	1.33
Northern red oak	375	3	-73	-4	-1	443	3	741	6 (N/A)	0.7	0.3	2.78
Siberian elm	219	2	-6	-2	0	204	2	416	3 (N/A)	0.7	0.2	1.56
Scotch pine	134	1	-6	-3	0	254	2	380	3 (N/A)	0.7	0.2	1.42
Bur oak	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.4	0.6	9.97
Basswood	445	3	-18	-2	0	393	3	819	6 (N/A)	0.4	0.3	6.14
Amur maple	114	1	-4	-1	0	124	1	232	2 (N/A)	0.4	0.1	1.74
Swamp white oak	96	1	-2	-1	0	65	0	158	1 (N/A)	0.4	0.1	1.18
Broadleaf Evergreen Medi	16	0	0	-1	0	59	0	74	1 (N/A)	0.4	0.0	0.55
Citywide total	153,204	1,149	-11,190	-653	-89	99,346	745	240,707	1,805 (N/A)	100.0	100.0	6.59

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

**Merrill**

**Annual Aesthetic/Other Benefits of Public Trees**

8/6/2020

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	4,083	(N/A)	26.3	29.0	56.70
Silver maple	5,074	(N/A)	16.8	36.1	110.30
Norway maple	799	(N/A)	9.1	5.7	31.97
Blue spruce	289	(N/A)	9.1	2.1	11.55
Spruce	474	(N/A)	8.0	3.4	21.57
Black walnut	702	(N/A)	4.4	5.0	58.48
Red pine	326	(N/A)	4.0	2.3	29.68
Sugar maple	363	(N/A)	4.0	2.6	32.99
Apple	50	(N/A)	3.6	0.4	4.97
Littleleaf linden	522	(N/A)	3.3	3.7	58.02
Northern hackberry	363	(N/A)	2.6	2.6	51.86
Broadleaf Evergreen Large	292	(N/A)	1.1	2.1	97.24
Honeylocust	400	(N/A)	1.1	2.8	133.34
Maple	22	(N/A)	1.1	0.2	7.28
White ash	35	(N/A)	0.7	0.2	17.47
Red maple	30	(N/A)	0.7	0.2	14.94
Northern red oak	25	(N/A)	0.7	0.2	12.69
Siberian elm	36	(N/A)	0.7	0.3	18.15
Scotch pine	39	(N/A)	0.7	0.3	19.58
Bur oak	66	(N/A)	0.4	0.5	65.59
Basswood	46	(N/A)	0.4	0.3	45.86
Amur maple	6	(N/A)	0.4	0.0	6.40
Swamp white oak	13	(N/A)	0.4	0.1	12.89
Broadleaf Evergreen Medium	9	(N/A)	0.4	0.1	9.46
Citywide total	14,064	(N/A)	100.0	100.0	51.33



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

**Merrill**

**Total Annual Benefits of Public Trees by Species (\$)**

8/6/2020

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Green ash	4,391	603	775	6,329	4,083	16,180	(N/A)	33.4
Silver maple	3,245	655	596	6,050	5,074	15,619	(N/A)	32.3
Norway maple	1,090	118	186	1,143	799	3,336	(N/A)	6.9
Blue spruce	238	20	27	392	289	965	(N/A)	2.0
Spruce	383	35	43	560	474	1,495	(N/A)	3.1
Black walnut	753	104	132	1,104	702	2,795	(N/A)	5.8
Red pine	283	28	21	599	326	1,258	(N/A)	2.6
Sugar maple	387	45	59	326	363	1,180	(N/A)	2.4
Apple	128	14	20	55	50	266	(N/A)	0.5
Littleleaf linden	360	58	60	337	522	1,337	(N/A)	2.8
Northern hackberry	470	45	78	471	363	1,427	(N/A)	2.9
Broadleaf Evergreen Lar	141	18	14	205	292	671	(N/A)	1.4
Honeylocust	172	24	28	163	400	788	(N/A)	1.6
Maple	24	2	3	11	22	62	(N/A)	0.1
White ash	23	3	3	17	35	81	(N/A)	0.2
Red maple	26	3	4	17	30	79	(N/A)	0.2
Northern red oak	57	6	8	83	25	178	(N/A)	0.4
Siberian elm	26	3	4	22	36	92	(N/A)	0.2
Scotch pine	30	3	3	47	39	123	(N/A)	0.3
Bur oak	71	10	12	107	66	266	(N/A)	0.5
Basswood	44	6	7	40	46	143	(N/A)	0.3
Amur maple	18	2	3	7	6	36	(N/A)	0.1
Swamp white oak	9	1	1	4	13	29	(N/A)	0.1
Broadleaf Evergreen Mc	8	1	1	4	9	23	(N/A)	0.0
<b>Citywide Total</b>	<b>12,375</b>	<b>1,805</b>	<b>2,090</b>	<b>18,096</b>	<b>14,064</b>	<b>48,429</b>	<b>(N/A)</b>	<b>100.0</b>

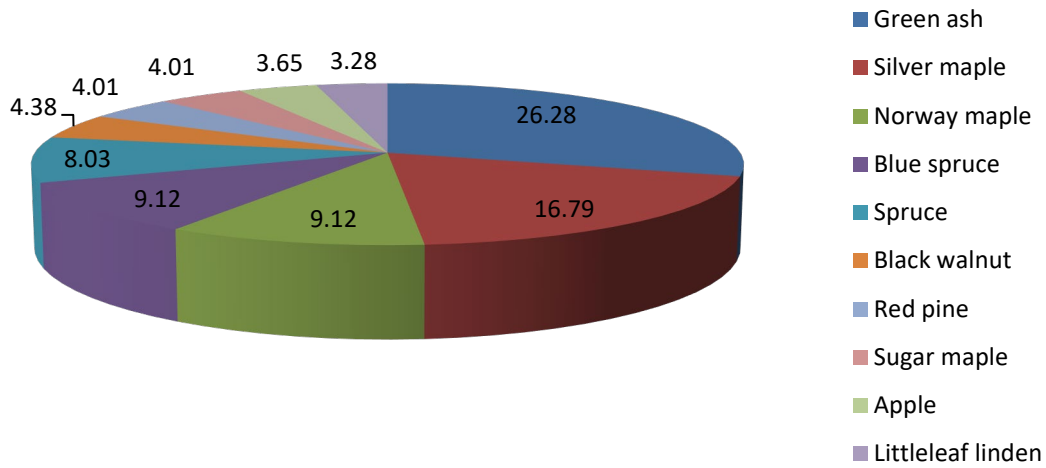


Figure 1: Species Distribution

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

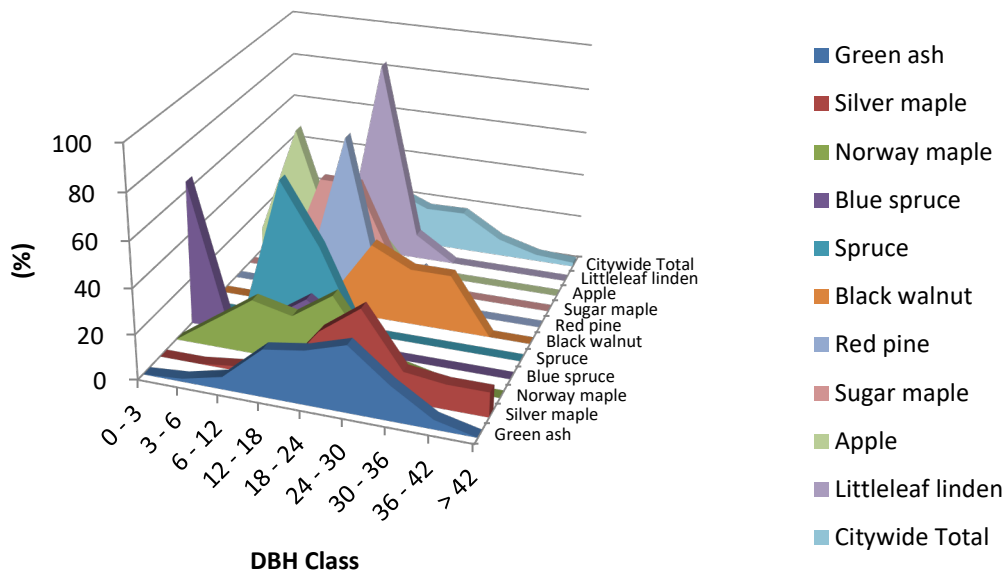
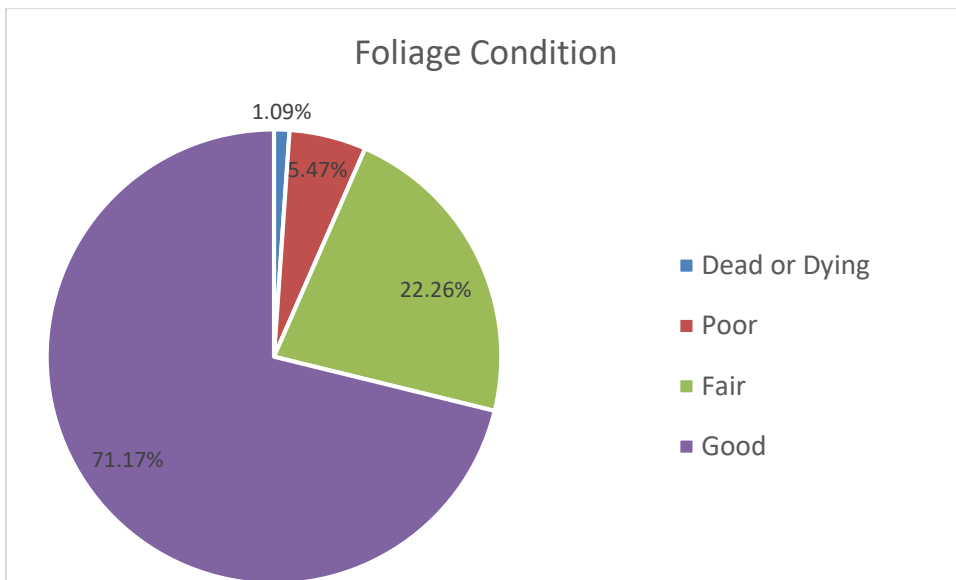
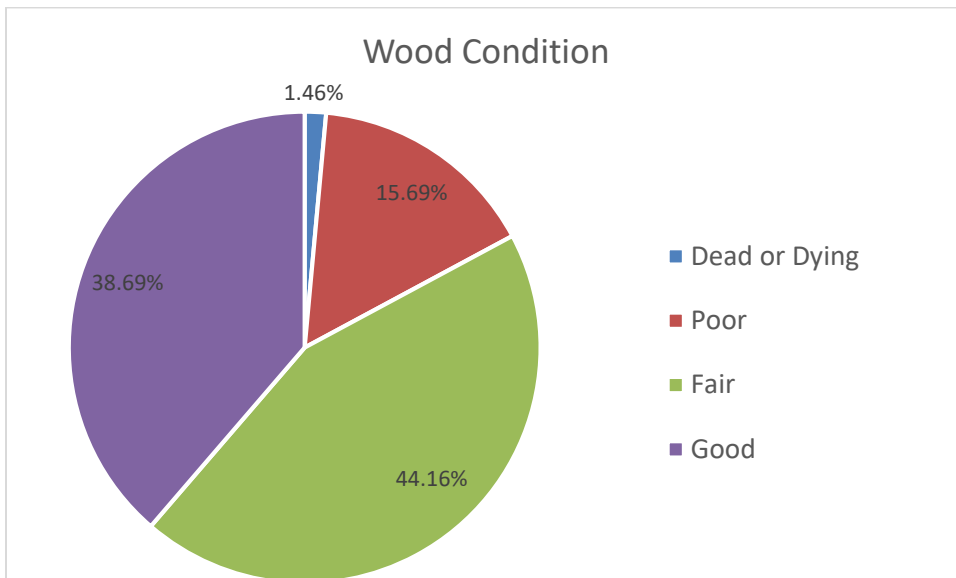


Figure 2: Relative Age Class



**Figure 3: Foliage Condition**



**Figure 4: Wood Condition**

# Canopy Cover of Public Trees (Acres)

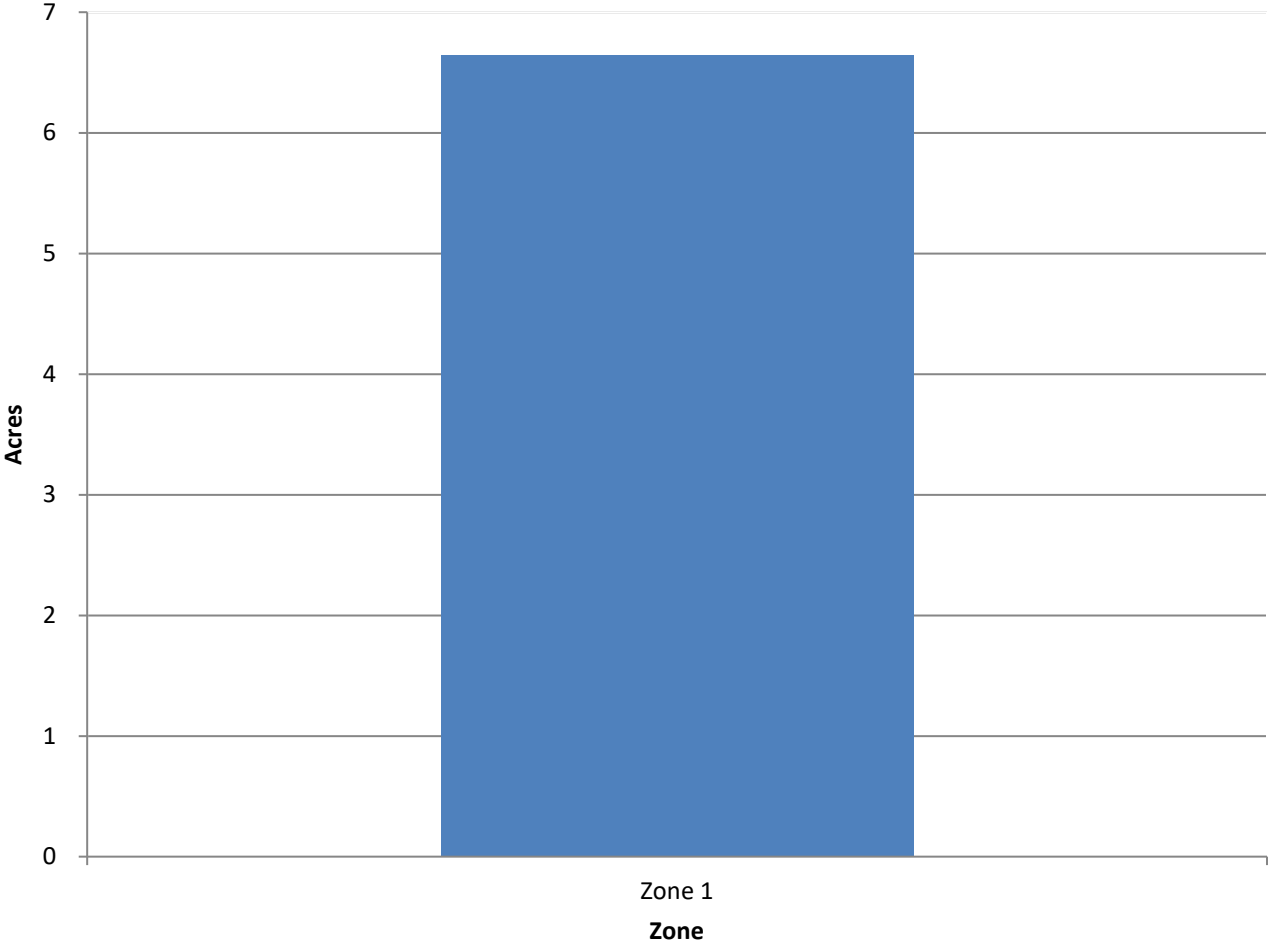
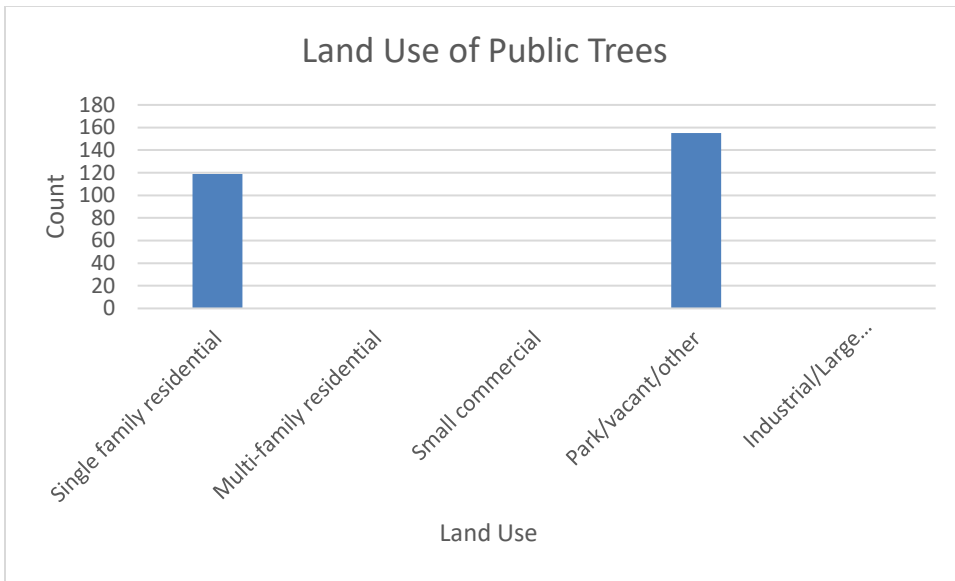
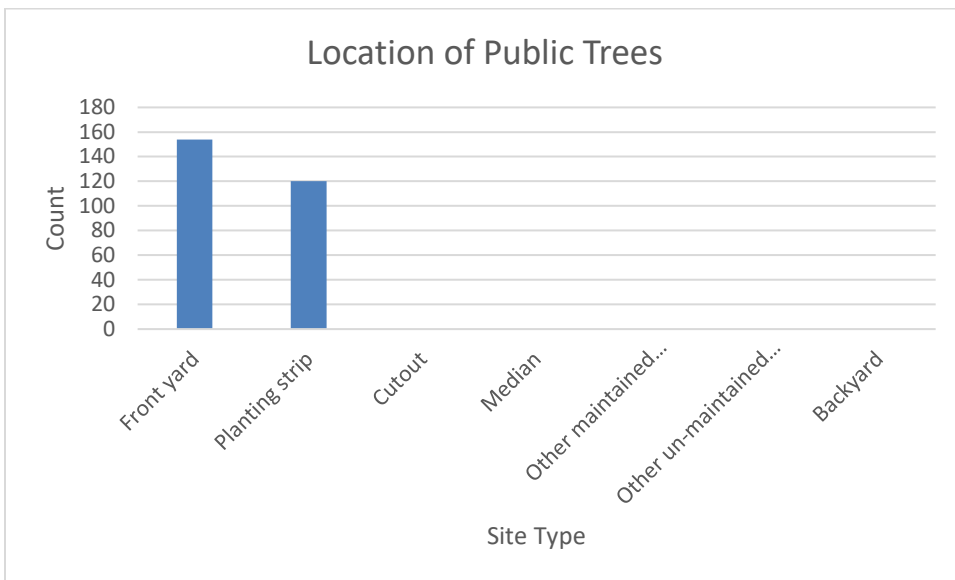


Figure 5: Canopy Cover in Acres



**Figure 6: Land Use of city/park trees**



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

## Appendix B: ArcGIS Mapping

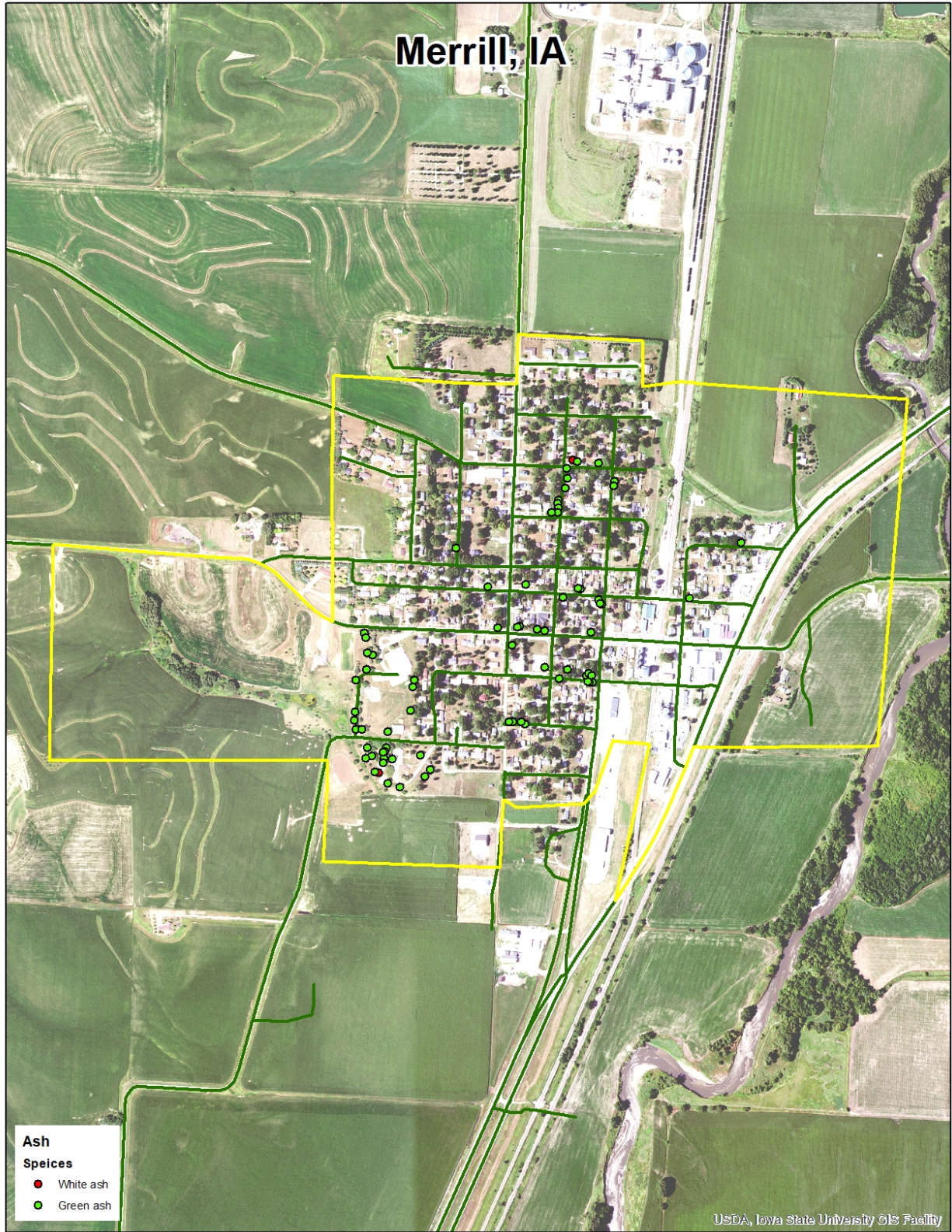
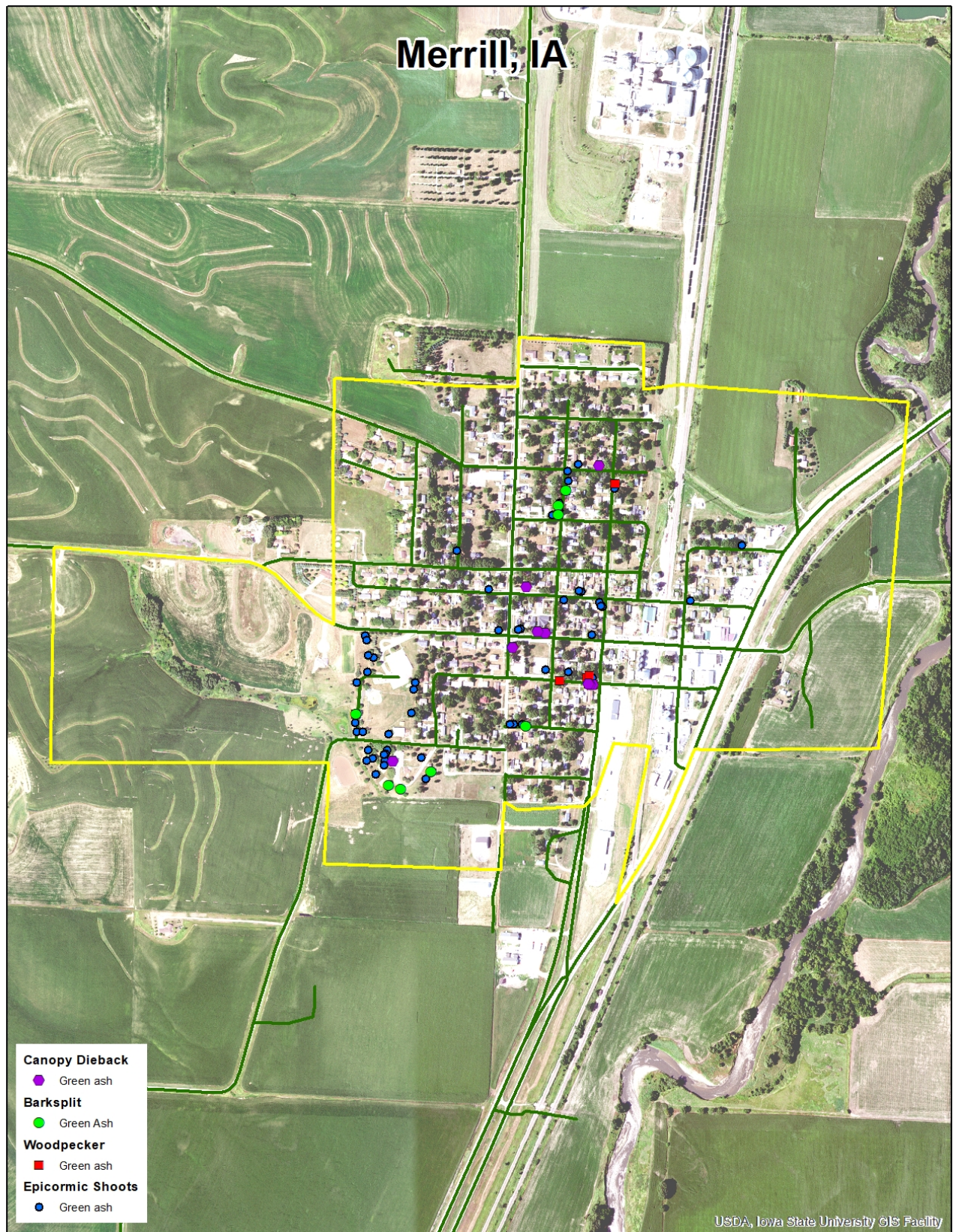
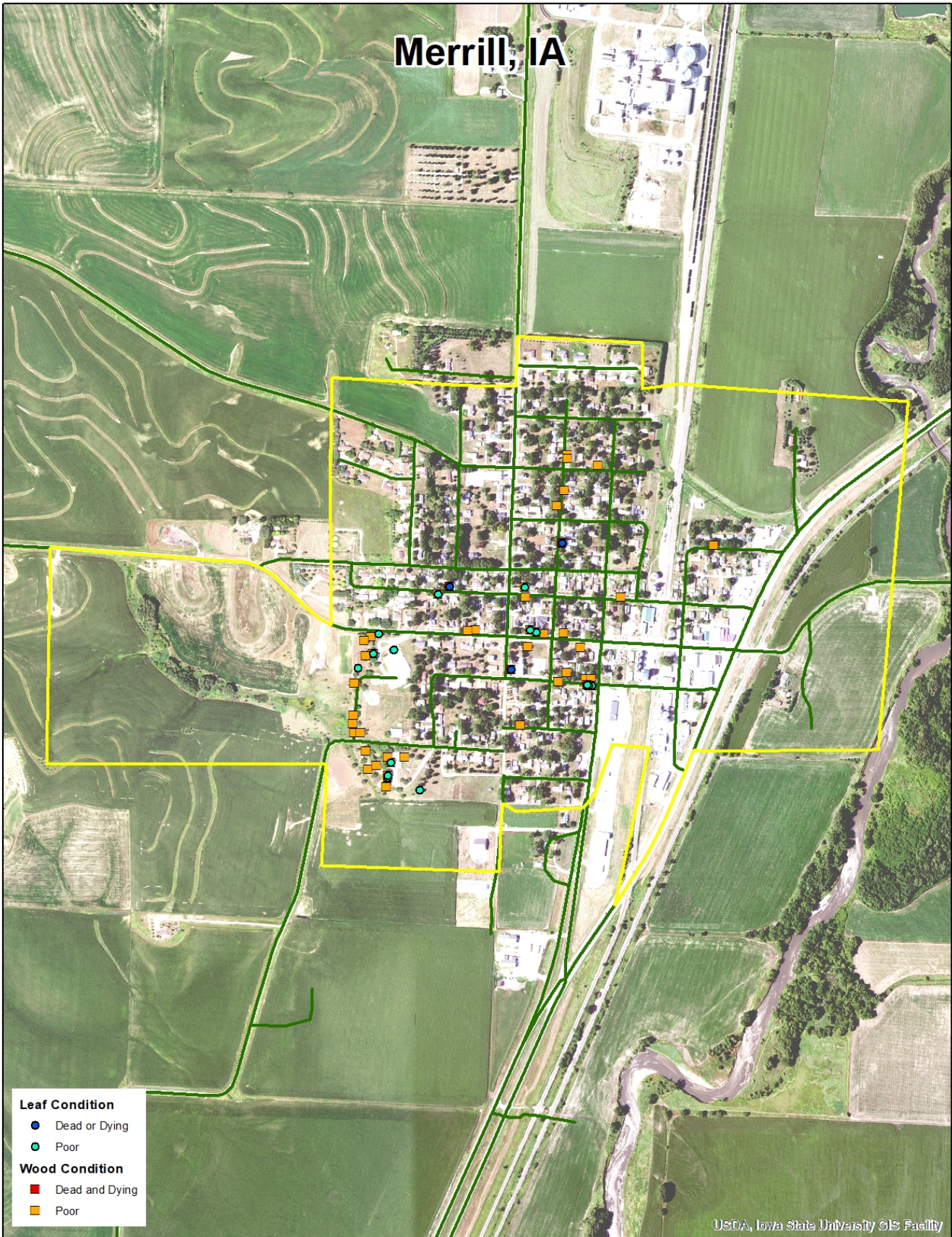


Figure 1: Location of Ash Trees

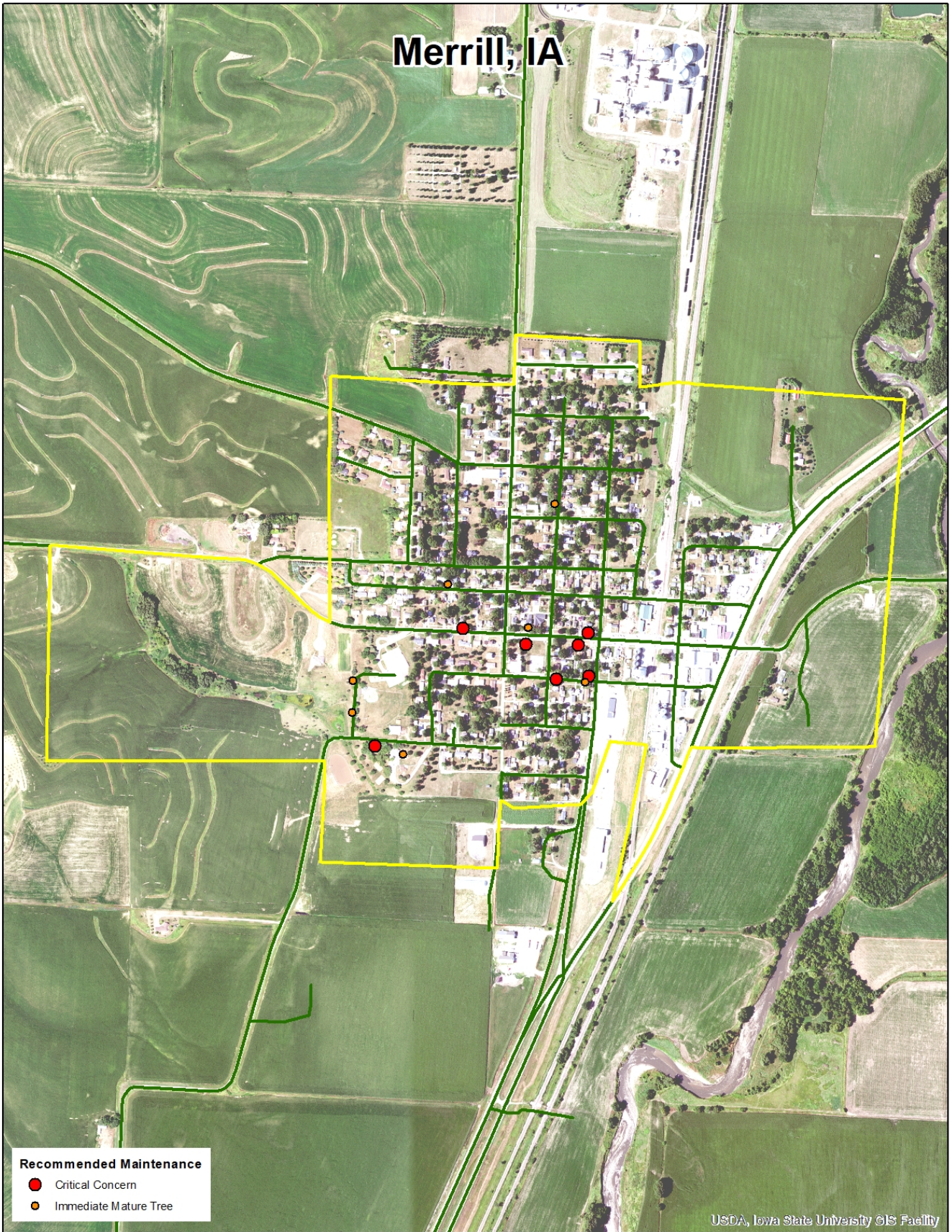


**Figure 2: Location of EAB symptoms**

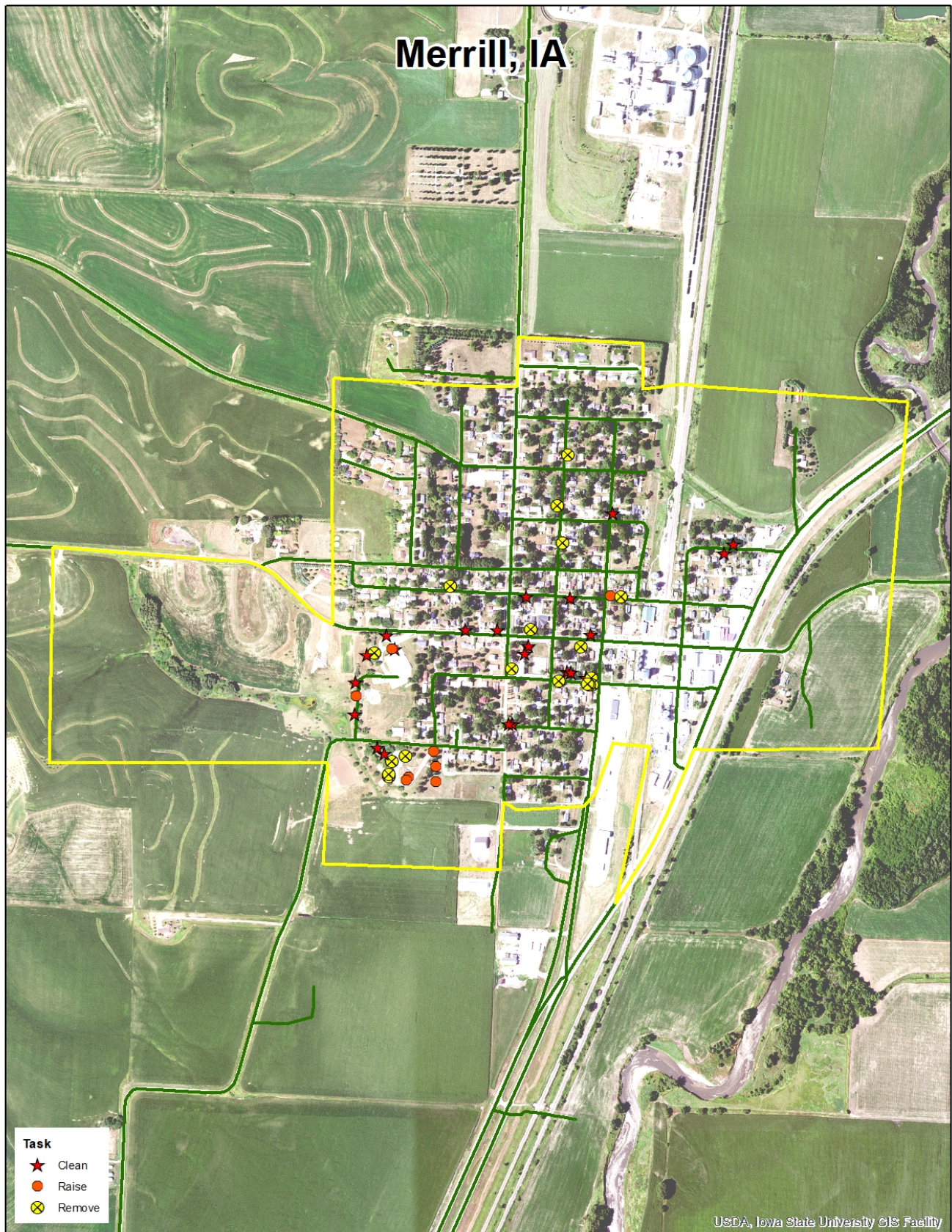


**Figure 3: Location of Poor Condition Trees**





**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: Merrill Tree Ordinances

---

## CHAPTER 151 TREES AND GRASS

- 151.01 Definition
- 151.02 Planting Restrictions
- 151.03 Duty to Trim Trees
- 151.04 Trimming Trees to be Supervised
- 151.05 Disease Control
- 151.06 Inspection and Removal
- 151.07 Cutting or Mowing of Grass

This is a copy of the current state tree and grass code. Items highlighted in the medium green shading are differences, changes, or additions between Merrill's your current code and the State Code. Items in the medium blue are suggested additions from Forestry.

**151.01 DEFINITION.** For use in this chapter, "boulevard" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

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

1. Alignment. All trees planted in any street shall be planted in the boulevard midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any boulevard which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.
3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut. [See page 10 for adding ash and maple to this restricted list.](#)

**151.03 DUTY TO TRIM TREES.** The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

*(Code of Iowa, Sec. 364.12[2c, d, & e])*

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.
2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

*(Code of Iowa, Sec. 364.12[3b & h])*

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 9<sup>th</sup> 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.