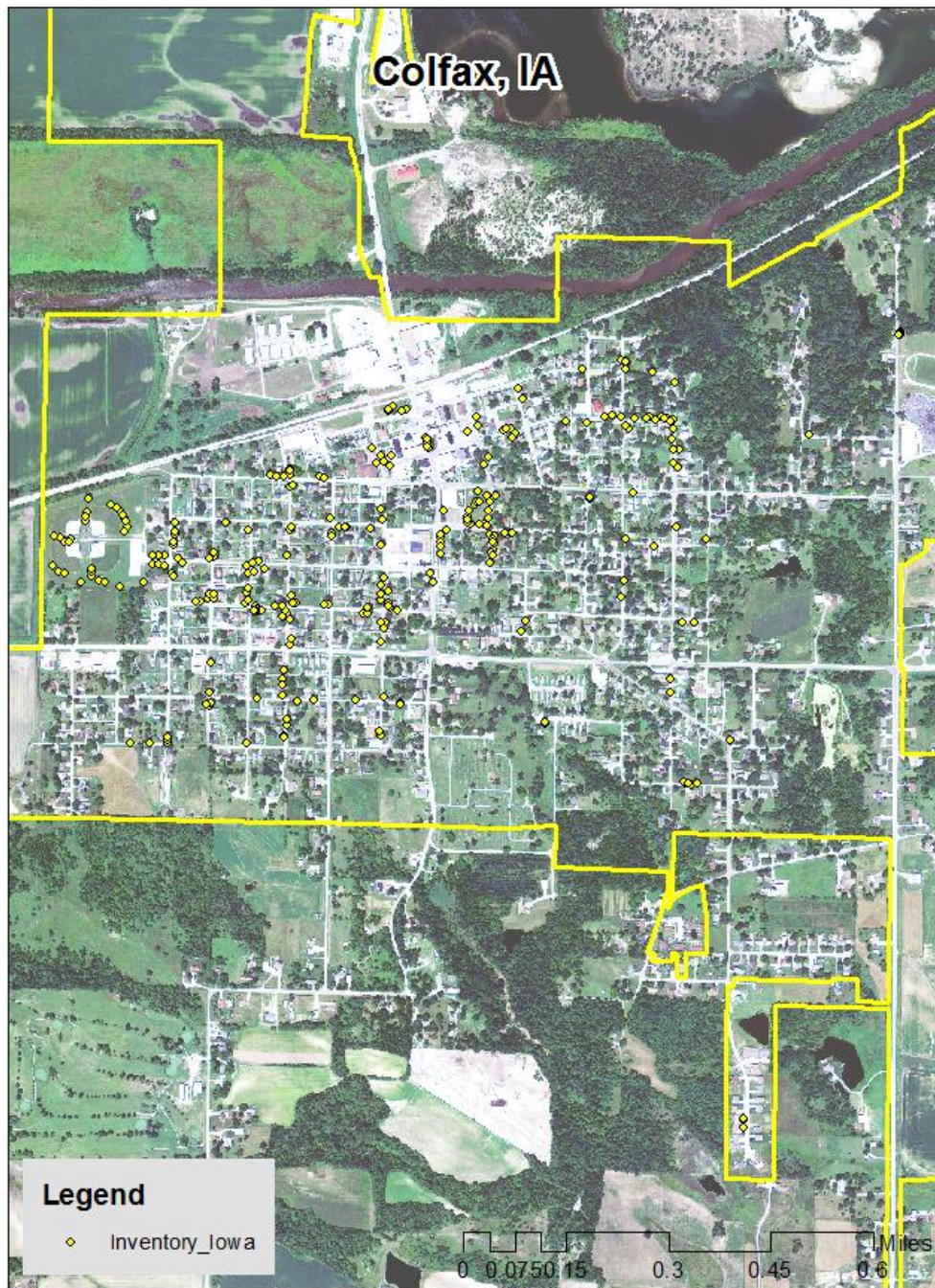


# Colfax, IA



2013 Management Plan  
Prepared by George Warford  
Bureau of Forestry, Iowa DNR



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# Executive Summary

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## Overview

This plan was developed to assist the City of Colfax 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 11% of Colfax's city owned trees (ash) will 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 years, mitigating public safety issues.

## Inventory and Results

In 2013, 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 436 trees inventoried.

- Colfax's trees provide \$88,470 of benefits annually, an average of \$203 a tree
- There are over 35 species of trees
- The top three genus are: Maple 52%, Ash 11%, and Elm 5%
- 32% of trees are in need of some type of management
- 23 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 23 trees needing removal, 8 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\\*](#)
- 10 of the 48 ash trees are in need of follow up because they are displaying 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, maple, cottonwood, poplar, box elder, Siberian elm, evergreens, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take several years to remove ash – Suggestion: request a budget increase to \$9,600 annually and apply for grants to plant replacement trees

## Introduction

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This plan was developed to assist Colfax 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 Colfax, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

## Inventory

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In 2013, a tree inventory was conducted that included 100% of the city owned trees in parking strips along streets. 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 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**

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The data collected for the 436 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis. Findings

### **Annual Benefits**

#### **Annual Energy Benefits**

Trees conserve energy by shading buildings and blocking winds. Colfax's trees reduce energy related costs by approximately \$22,235 annually (Appendix A, Table 1). These savings are both in Electricity (105.6 MWh) and in Natural Gas (14,513.5 Therms).

#### **Annual Stormwater Benefits**

Colfax's trees intercept about 1,278,403 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$34,647 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 mater (ozone). In Colfax, it is estimated that trees remove 1,402 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 \$3,956 (Appendix A, Table 3).

#### **Annual Carbon Benefits**

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Colfax, trees sequester about 425,996 lbs of carbon a year with an associated value of \$3,195 (Appendix A, Table 4). In addition, the trees store 4,847,066 lbs of carbon, with a yearly benefit of \$36,353 (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. Colfax receives \$24,437 in annual social benefits from trees (Appendix A, Table 6).

#### **Financial Summary of all Benefits**

According to the USDA Forest Service i-Tree STRATUM analysis, Colfax's trees provide \$88,470 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 436 trees in Colfax provide approximately \$203 annually (Appendix A, Table 7).

## **Forest Structure**

### **Species Distribution**

Colfax has over 35 different tree species along city streets (Appendix A, Figure 1).

The distribution of trees by genus is as follows:

Maple	226	52%
Ash	48	11%
Elm	22	5%
Oak	21	5%
Hackberry	18	4%
Honeylocust	14	3%
Apple (Crab)	14	3%
Walnut	10	2%
Pine	9	2%
Lilac	8	2%
Mulberry	6	1%
Catalpa	4	1%
Spruce	4	1%
Cottonwood	3	<1%
E. Redbud	3	<1%
N. White Cedar	3	<1%
E. Red Cedar	2	<1%
All other deciduous	21	5%

### **Age Class**

Most of Colfax's trees (45%) are between 18 and 36 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 24 inches in diameter at 4.5 ft. Colfax's size curve is on the larger side, indicating an older than average stand.

### **Condition: Wood and Foliage**

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Colfax indicate that 87% of the trees are in good health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 61% of Colfax'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 11% of the population. This 11% 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 5).

Crown Cleaning	108	25%
Tree Removal	23	5%
Crown Raising	7	2%
Crown Reduction	2	<1%

## Canopy Cover

The canopy cover of Colfax is approximately 13 acres (Appendix A, Figure 4). According to the 2000 census, Colfax occupies 1,145 acres. Thus the canopy cover on city land is about 1%.

## Land Use and Location

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

### Land Use

Single family residential	71%
Park/vacant/other	25%
Small commercial	3%
Industrial/Large commercial	1%

### Location

Planting strip	72%
Front yard	26%
Cutout (surrounded by pavement)	1%

## Recommendations

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### 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



Colfax has 7 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 2 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are a total of 32 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 23 removals, none are ash trees. There are a total of 48 ash trees, and 10 of those have signs and symptoms that have been associated with EAB. There are no ash trees that are in poor health. [\*\\*City ownership of the trees recommended for removal should be verified prior to any removal\\*\*](#)

### **Pruning Cycle**

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

### **Planting**

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Colfax.

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 (52%) (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, Siberian elm, evergreen, willow or black walnut, as outlined in section 151.02 of the Sample 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 death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

## **Six Year Maintenance Plan with No Additional Funding**

### **Year 1**

Removal: 11 trees - 2 largest critical concern trees, plus 9 others recommended for removal

Planting and Replacement: 12 trees to be planted in open locations

Visual Survey for signs and symptoms of EAB

### **Years 2 through 6**

Removal: 12 trees each year - critical concern trees, those recommended for removal, and ash trees with poor health

Planting and Replacement: 14-15 trees each year in open locations

Routine trimming: Contract to trim 1/3 of the city trees in Years 2, 4, and 6

Visual Survey for signs and symptoms of EAB

EAB could potentially kill all ash within 4 years of its arrival. Estimated cost for tree removal is \$500 per tree (multiplied by 71 = \$35,500). Estimated cost for replacement plantings is \$150 per tree (multiplied by 85 = \$12,750). Estimated trimming cost is \$2,360 in years 2,4, and 6 (\$7,080 total) and watering and maintenance cost is estimated at \$400 annually (\$2,400 total). Grand total of estimated urban forestry costs equals \$57,730. To remove all ash trees within 6 years, plant replacement trees, do the recommended trimming, plus routine watering and maintenance each year, the budget would need to be increased to about \$9,600 a year. As stated earlier, the city is encouraged to apply for grants to help with the cost of replacement plantings.

## **Emerald Ash Borer Plan**

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### **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, spreading 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 over 25 million 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 ash trees will be replaced. All trees should meet the restrictions in the sample city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Siberian 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 genus 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. Sample City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

## Budget

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### **Current Budget**

**Total \$57,730 over 6 years (\$9,600/year on average)**

### **FY 2014 Budget**

Removal: \$5,500

Planting: \$1,800

Watering & Maintenance: \$400

### **FY 2015-2019 Budget**

Removal: \$6,000 annually

Planting: \$2,100 to \$2,250 annually

Routine trimming: \$2,360 in each of the years 2015, 2017, and 2019

Watering & Maintenance: \$400 each year

### **Purposed Budget Increase**

As stated earlier, total estimated costs of a 6 year period are \$57,730. Part of this cost could be reduced if Colfax applies for grants to help 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.

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## Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

### Colfax

#### Annual Energy Benefits of Public Trees by Species

3/5/2014

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	32.2	2,444	4,253.1	4,168	6,612	(N/A)	23.2	29.7	65.46
Sugar maple	19.0	1,441	2,573.1	2,522	3,962	(N/A)	13.5	17.8	67.16
Maple	6.7	509	917.3	899	1,408	(N/A)	11.0	6.3	29.32
Ash	12.5	951	1,875.3	1,838	2,789	(N/A)	11.0	12.5	58.09
Siberian elm	6.8	515	897.1	879	1,394	(N/A)	4.4	6.3	73.37
Northern hackberry	5.7	434	813.0	797	1,231	(N/A)	4.1	5.5	68.38
Honeylocust	3.4	257	436.8	428	685	(N/A)	3.2	3.1	48.94
Apple	1.1	80	160.9	158	238	(N/A)	3.2	1.1	16.98
Black walnut	3.0	225	405.5	397	623	(N/A)	2.3	2.8	62.27
Northern red oak	0.5	41	81.1	79	120	(N/A)	2.3	0.5	12.05
Lilac	0.0	2	5.0	5	7	(N/A)	1.8	0.0	0.87
Broadleaf Deciduous	1.5	111	218.9	215	326	(N/A)	1.6	1.5	46.54
Eastern white pine	0.7	55	101.8	100	155	(N/A)	1.6	0.7	22.09
Norway maple	1.3	98	189.7	186	284	(N/A)	1.4	1.3	47.32
Red maple	0.2	16	31.3	31	47	(N/A)	1.4	0.2	7.85
Mulberry	0.3	23	52.6	52	75	(N/A)	1.4	0.3	12.42
Other street trees	10.7	810	1,500.8	1,471	2,281	(N/A)	12.6	10.3	41.47
Citywide total	105.6	8,011	14,513.5	14,223	22,235	(N/A)	100.0	100.0	51.00

**Table 2: Annual Stormwater Benefits**

**Colfax**

**Annual Stormwater Benefits of Public Trees by Species**

3/5/2014

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	469,712	12,730	(N/A)	23.2	36.7	126.04
Sugar maple	234,617	6,359	(N/A)	13.5	18.4	107.77
Maple	56,220	1,524	(N/A)	11.0	4.4	31.74
Ash	131,513	3,564	(N/A)	11.0	10.3	74.26
Siberian elm	81,759	2,216	(N/A)	4.4	6.4	116.62
Northern hackberry	63,633	1,725	(N/A)	4.1	5.0	95.81
Honeylocust	28,817	781	(N/A)	3.2	2.3	55.78
Apple	3,734	101	(N/A)	3.2	0.3	7.23
Black walnut	34,623	938	(N/A)	2.3	2.7	93.83
Northern red oak	2,887	78	(N/A)	2.3	0.2	7.82
Lilac	60	2	(N/A)	1.8	0.0	0.20
Broadleaf Deciduous	15,968	433	(N/A)	1.6	1.3	61.82
Eastern white pine	13,280	360	(N/A)	1.6	1.0	51.41
Norway maple	11,303	306	(N/A)	1.4	0.9	51.06
Red maple	824	22	(N/A)	1.4	0.1	3.72
Mulberry	1,073	29	(N/A)	1.4	0.1	4.85
Other street trees	128,383	3,479	(N/A)	12.6	10.0	63.26
Citywide total	1,278,403	34,647	(N/A)	100.0	100.0	79.47

**Table 3: Annual Air Quality Benefits**

**Colfax**

**Annual Air Quality Benefits of Public Trees by Species**

3/5/2014

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 <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>								
Silver maple	80.9	13.7	39.7	3.6	436	151.9	22.2	21.2	145.6	950	-41.9	-157	437.0	1,229	(N/A)	23.2	12.17
Sugar maple	32.4	5.5	15.8	1.4	175	90.3	13.2	12.6	86.0	563	-25.2	-94	232.0	643	(N/A)	13.5	10.91
Maple	13.2	2.2	6.2	0.6	70	32.0	4.7	4.4	30.4	199	-4.5	-17	89.2	253	(N/A)	11.0	5.27
Ash	28.2	4.9	13.7	1.3	152	61.3	8.8	8.4	56.8	378	-6.5	-24	176.9	506	(N/A)	11.0	10.54
Siberian elm	15.6	2.7	7.4	0.7	83	32.1	4.7	4.5	30.7	201	0.0	0	98.3	284	(N/A)	4.4	14.94
Northern hackberry	10.8	1.9	5.3	0.5	58	27.6	4.0	3.8	25.9	171	0.0	0	79.9	230	(N/A)	4.1	12.77
Honeylocust	5.3	0.9	2.5	0.2	28	15.9	2.3	2.2	15.3	100	-3.9	-14	40.8	113	(N/A)	3.2	8.09
Apple	0.9	0.1	0.4	0.0	5	5.2	0.7	0.7	4.8	32	0.0	0	12.9	37	(N/A)	3.2	2.62
Black walnut	4.4	0.7	2.1	0.2	24	14.2	2.1	2.0	13.5	88	0.0	0	39.1	112	(N/A)	2.3	11.18
Northern red oak	0.3	0.1	0.2	0.0	2	2.6	0.4	0.4	2.4	16	-0.5	-2	6.0	16	(N/A)	2.3	1.64
Lilac	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)	1.8	0.11
Broadleaf Deciduous	3.5	0.6	1.7	0.2	19	7.2	1.0	1.0	6.7	44	-0.8	-3	21.0	60	(N/A)	1.6	8.60
Eastern white pine	1.5	0.3	1.2	0.2	10	3.5	0.5	0.5	3.3	22	-5.9	-22	5.0	9	(N/A)	1.6	1.33
Norway maple	2.2	0.4	1.1	0.1	12	6.3	0.9	0.9	5.9	39	-0.5	-2	17.1	49	(N/A)	1.4	8.12
Red maple	0.0	0.0	0.0	0.0	0	1.0	0.2	0.1	1.0	6	0.0	0	2.4	7	(N/A)	1.4	1.12
Mulberry	0.2	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	0.0	0	3.7	10	(N/A)	1.4	1.73
Other street trees	21.3	3.5	10.3	1.0	114	51.3	7.4	7.1	48.3	319	-9.6	-36	140.7	397	(N/A)	12.6	7.21
Citywide total	220.8	37.5	107.9	10.0	1,190	504.0	73.4	69.9	478.1	3,139	-99.2	-372	1,402.3	3,956	(N/A)	100.0	9.07

Table 4: Annual Carbon Stored

## Colfax

Stored CO<sub>2</sub> Benefits of Public Trees by Species

3/5/2014

Species	Total Stored CO <sub>2</sub> (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	1,824,476	13,684	(N/A)	23.2	37.6	135.48
Sugar maple	930,905	6,982	(N/A)	13.5	19.2	118.34
Maple	144,289	1,082	(N/A)	11.0	3.0	22.55
Ash	465,474	3,491	(N/A)	11.0	9.6	72.73
Siberian elm	377,676	2,833	(N/A)	4.4	7.8	149.08
Northern	168,012	1,260	(N/A)	4.1	3.5	70.00
Honeylocust	66,847	501	(N/A)	3.2	1.4	35.81
Apple	14,718	110	(N/A)	3.2	0.3	7.88
Black walnut	144,839	1,086	(N/A)	2.3	3.0	108.63
Northern red oak	5,360	40	(N/A)	2.3	0.1	4.02
Lilac	110	1	(N/A)	1.8	0.0	0.10
Broadleaf	58,658	440	(N/A)	1.6	1.2	62.85
Eastern white pine	13,923	104	(N/A)	1.6	0.3	14.92
Norway maple	35,996	270	(N/A)	1.4	0.7	45.00
Red maple	1,311	10	(N/A)	1.4	0.0	1.64
Mulberry	3,659	27	(N/A)	1.4	0.1	4.57
Other street trees	267,988	4,431	(N/A)	12.6	12.2	80.57
Citywide total	4,847,066	36,353	(N/A)	100.0	100.0	83.38

Table 5: Annual Carbon Sequestered

## Colfax

Annual CO<sub>2</sub> Benefits of Public Trees by Species

3/5/2014

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard (\$ Error)	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	135,209	1,014	-8,757	-20	-66	54,009	405	180,441	1,353 (N/A)	23.2	42.4	13.40
Sugar maple	45,648	342	-4,468	-12	-34	31,836	239	73,004	548 (N/A)	13.5	17.1	9.28
Maple	10,143	76	-693	-9	-5	11,241	84	20,681	155 (N/A)	11.0	4.9	3.23
Ash	13,975	105	-2,234	-9	-17	21,011	158	32,742	246 (N/A)	11.0	7.7	5.12
Siberian elm	13,493	101	-1,813	-4	-14	11,378	85	23,054	173 (N/A)	4.4	5.4	9.10
Northern hackberry	7,957	60	-806	-4	-6	9,592	72	16,739	126 (N/A)	4.1	3.9	6.97
Honeylocust	6,066	45	-321	-3	-2	5,681	43	11,423	86 (N/A)	3.2	2.7	6.12
Apple	1,600	12	-71	-3	-1	1,769	13	3,296	25 (N/A)	3.2	0.8	1.77
Black walnut	7,114	53	-695	-2	-5	4,980	37	11,397	85 (N/A)	2.3	2.7	8.55
Northern red oak	812	6	-26	-2	0	907	7	1,691	13 (N/A)	2.3	0.4	1.27
Lilac	69	1	-1	-2	0	45	0	112	1 (N/A)	1.8	0.0	0.11
Broadleaf Deciduous	415	3	-282	-1	-2	2,459	18	2,592	19 (N/A)	1.6	0.6	2.78
Eastern white pine	873	7	-67	-1	-1	1,212	9	2,017	15 (N/A)	1.6	0.5	2.16
Norway maple	2,144	16	-173	-1	-1	2,165	16	4,135	31 (N/A)	1.4	1.0	5.17
Red maple	232	2	-6	-1	0	362	3	587	4 (N/A)	1.4	0.1	0.73
Mulberry	473	4	-18	-1	0	508	4	962	7 (N/A)	1.4	0.2	1.20
Other street trees	26,074	196	-2,836	-11	-21	17,896	134	41,124	308 (N/A)	12.6	9.7	5.61
Citywide total	272,296	2,042	-23,266	-85	-175	177,051	1,328	425,996	3,195 (N/A)	100.0	100.0	7.33



Table 6: Annual Social and Aesthetic Benefits

**Colfax**

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

3/5/2014

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	10,518	(N/A)	23.2	43.0	104.14
Sugar maple	4,627	(N/A)	13.5	18.9	78.43
Maple	1,349	(N/A)	11.0	5.5	28.10
Ash	1,302	(N/A)	11.0	5.3	27.13
Siberian elm	870	(N/A)	4.4	3.6	45.80
Northern hackberry	974	(N/A)	4.1	4.0	54.12
Honeylocust	1,346	(N/A)	3.2	5.5	96.14
Apple	91	(N/A)	3.2	0.4	6.49
Black walnut	568	(N/A)	2.3	2.3	56.76
Northern red oak	95	(N/A)	2.3	0.4	9.46
Lilac	0	(N/A)	1.8	0.0	0.03
Broadleaf Deciduous	52	(N/A)	1.6	0.2	7.43
Eastern white pine	226	(N/A)	1.6	0.9	32.29
Norway maple	209	(N/A)	1.4	0.9	34.86
Red maple	44	(N/A)	1.4	0.2	7.28
Mulberry	26	(N/A)	1.4	0.1	4.28
Other street trees	2,141	(N/A)	12.6	8.8	38.92
Citywide total	24,437	(N/A)	100.0	100.0	56.05

**Table 7: Summary of Benefits in Dollars**  
**Average Annual Benefits of Public Trees by**  
**Species**

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Silver maple	6,612	1,353	1,229	12,730	10,518	\$32,442.45	(±0)	36.67
Sugar maple	3,962	548	643	6,359	4,627	\$16,139.05	(±0)	18.24
Maple	1,408	155	253	1,524	1,349	\$4,687.97	(±0)	5.30
Ash	2,789	246	506	3,564	1,302	\$8,406.81	(±0)	9.50
Siberian elm	1,394	173	284	2,216	870	\$4,936.77	(±0)	5.58
Northern hackberry	1,231	126	230	1,725	974	\$4,284.97	(±0)	4.84
Honeylocust	685	86	113	781	1,346	\$3,011.07	(±0)	3.40
Apple	238	25	37	101	91	\$491.15	(±0)	0.56
Black walnut	623	85	112	938	568	\$2,326.02	(±0)	2.63
Northern red oak	120	13	16	78	95	\$322.39	(±0)	0.36
Lilac	7	1	1	2	0	\$10.51	(±0)	0.01
Broadleaf Deciduous Medium	326	19	60	433	52	\$890.21	(±0)	1.01
Eastern white pine	155	15	9	360	226	\$764.97	(±0)	0.86
Norway maple	284	31	49	306	209	\$879.20	(±0)	0.99
Red maple	47	4	7	22	44	\$124.25	(±0)	0.14
Mulberry	75	7	10	29	26	\$146.87	(±0)	0.17
Other street trees	2,281	308	397	3,479	2,141	\$8,605.91	(±0)	9.73
Citywide total	22,235	3,195	3,956	34,647	24,437	\$88,470.56	(±0)	100.00

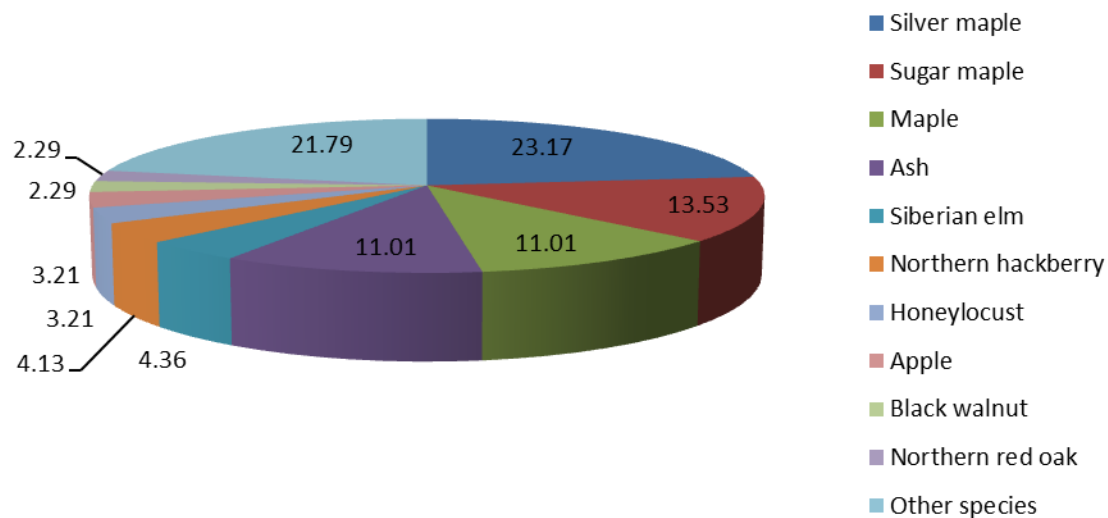


Figure 1: Species Distribution

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

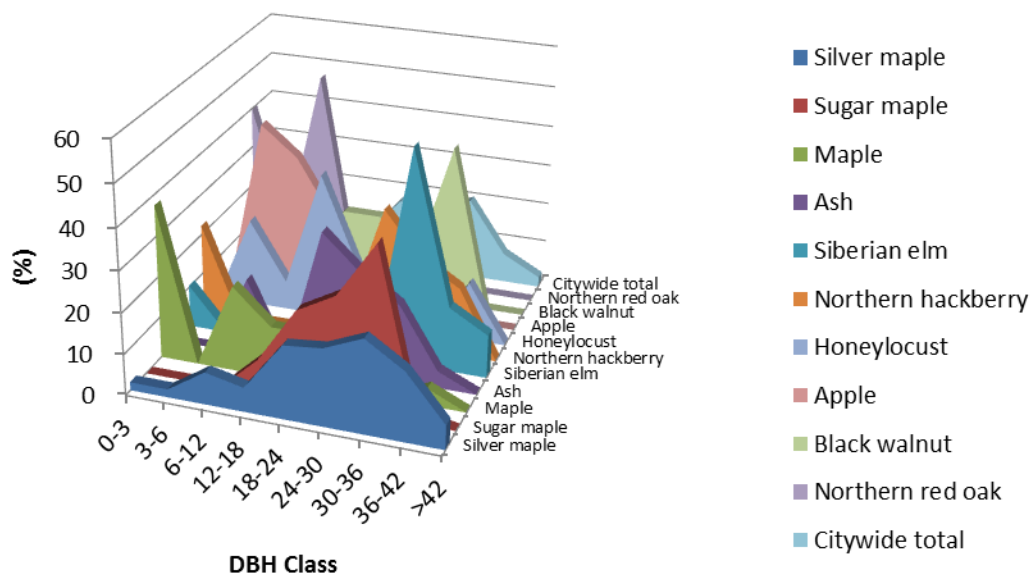


Figure 2: Relative Age Class

## Leaf Condition

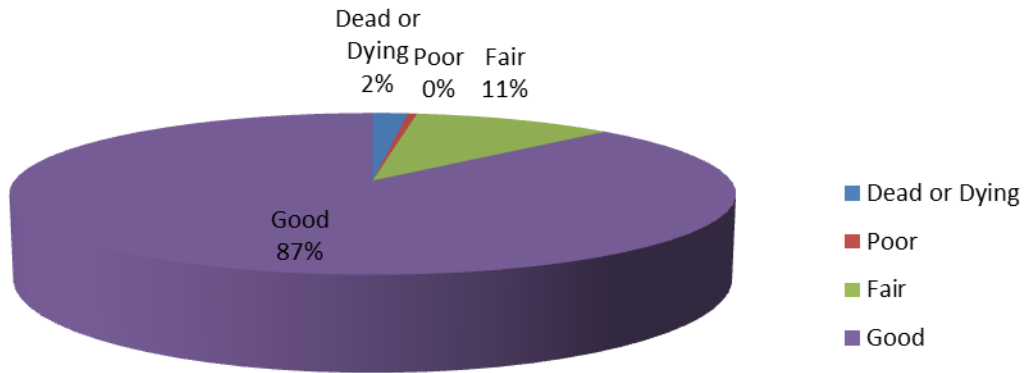


Figure 3: Foliage Condition

## Wood Condition

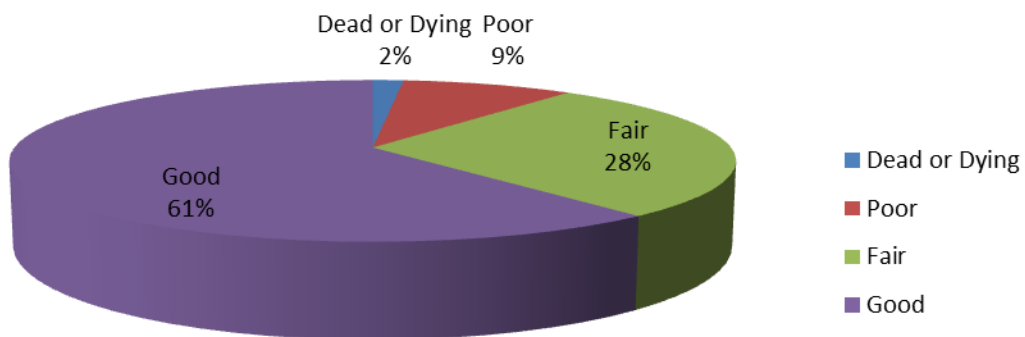


Figure 4: Wood Condition

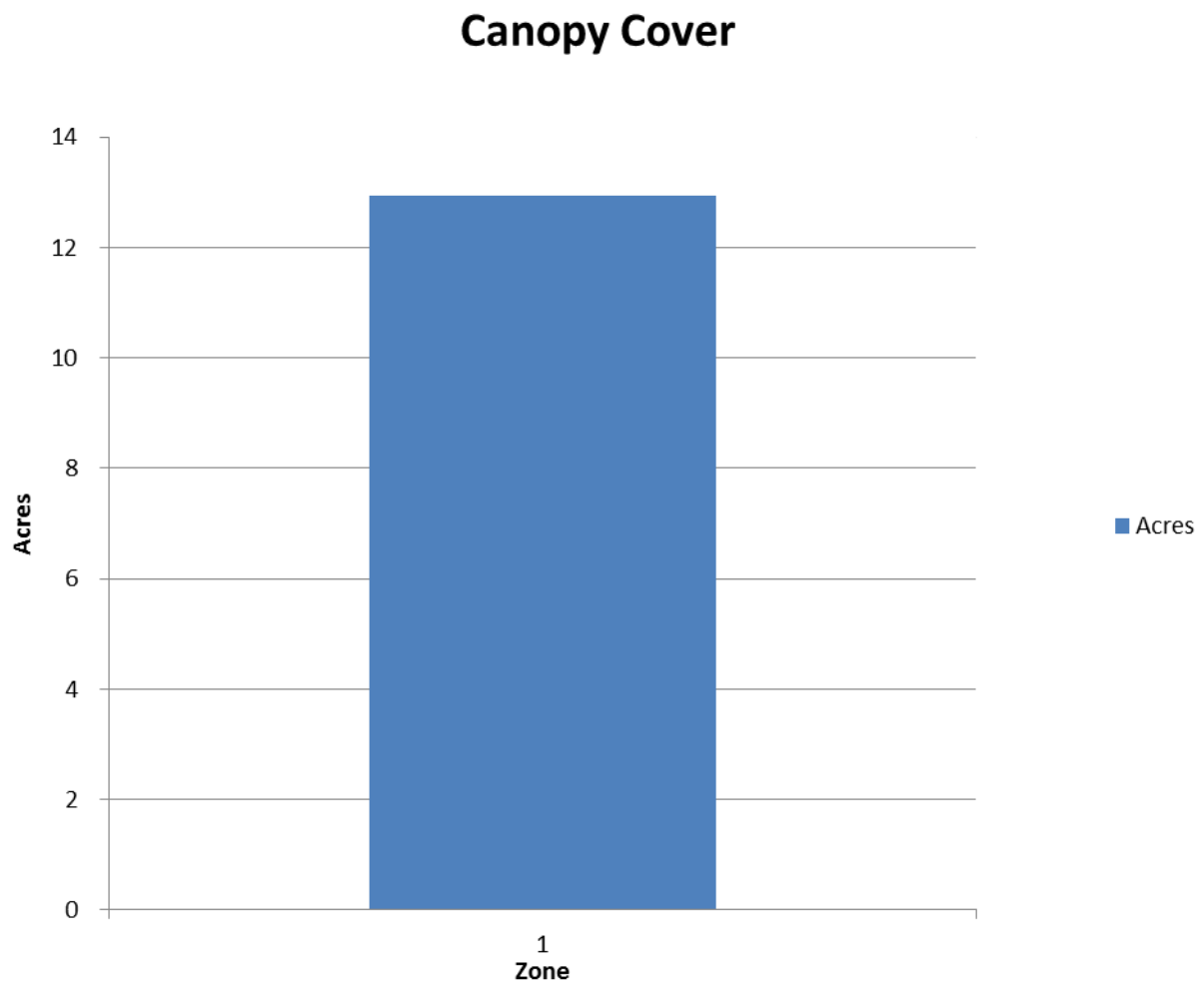


Figure 5: Canopy Cover in Acres

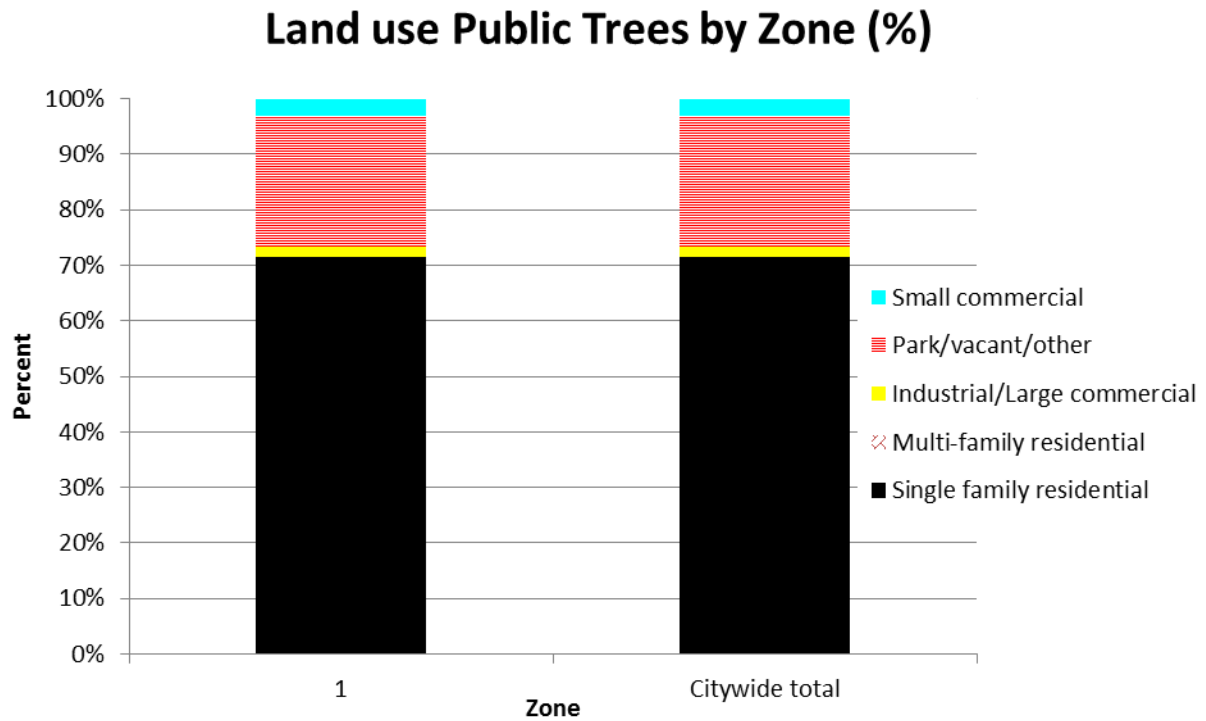


Figure 6: Land Use of city/park trees

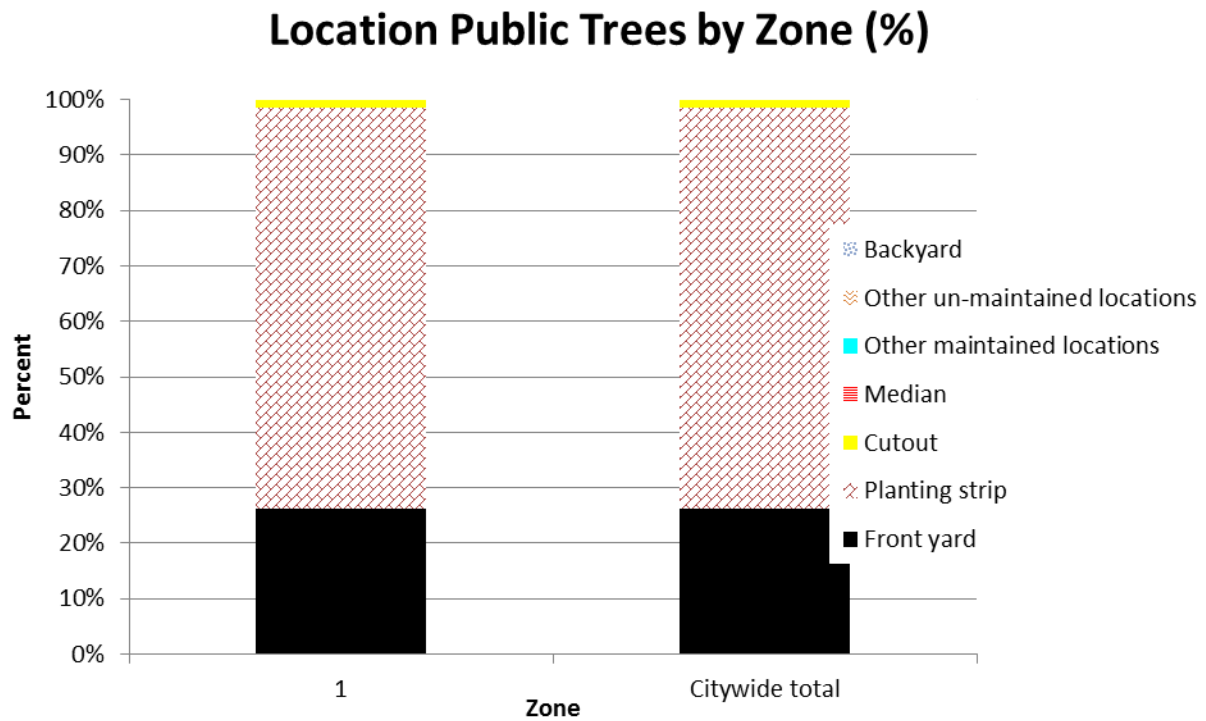


Figure 7: Location of city/park trees



## Appendix B: ArcGIS Mapping

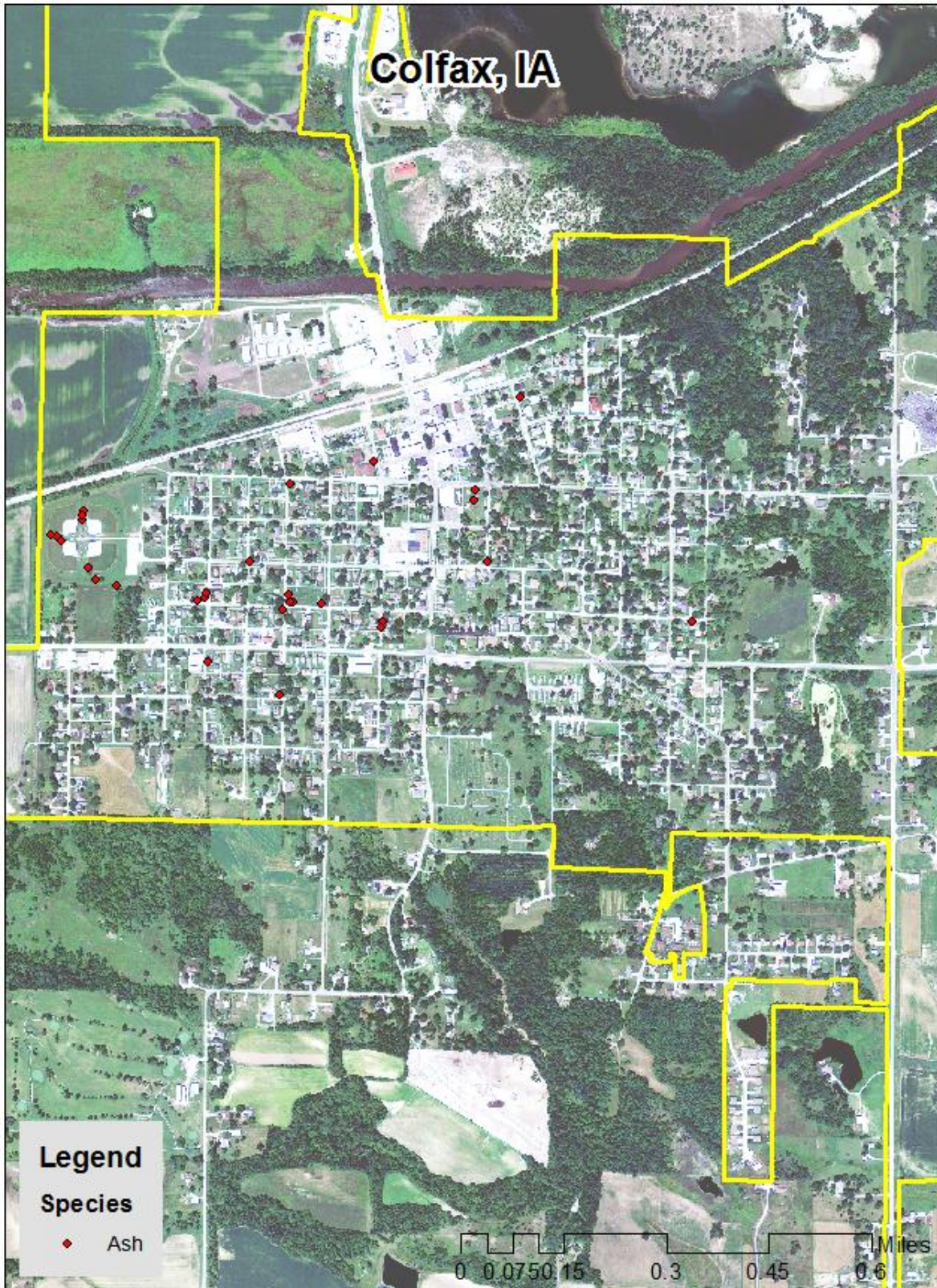


Figure 1: Location of Ash Trees



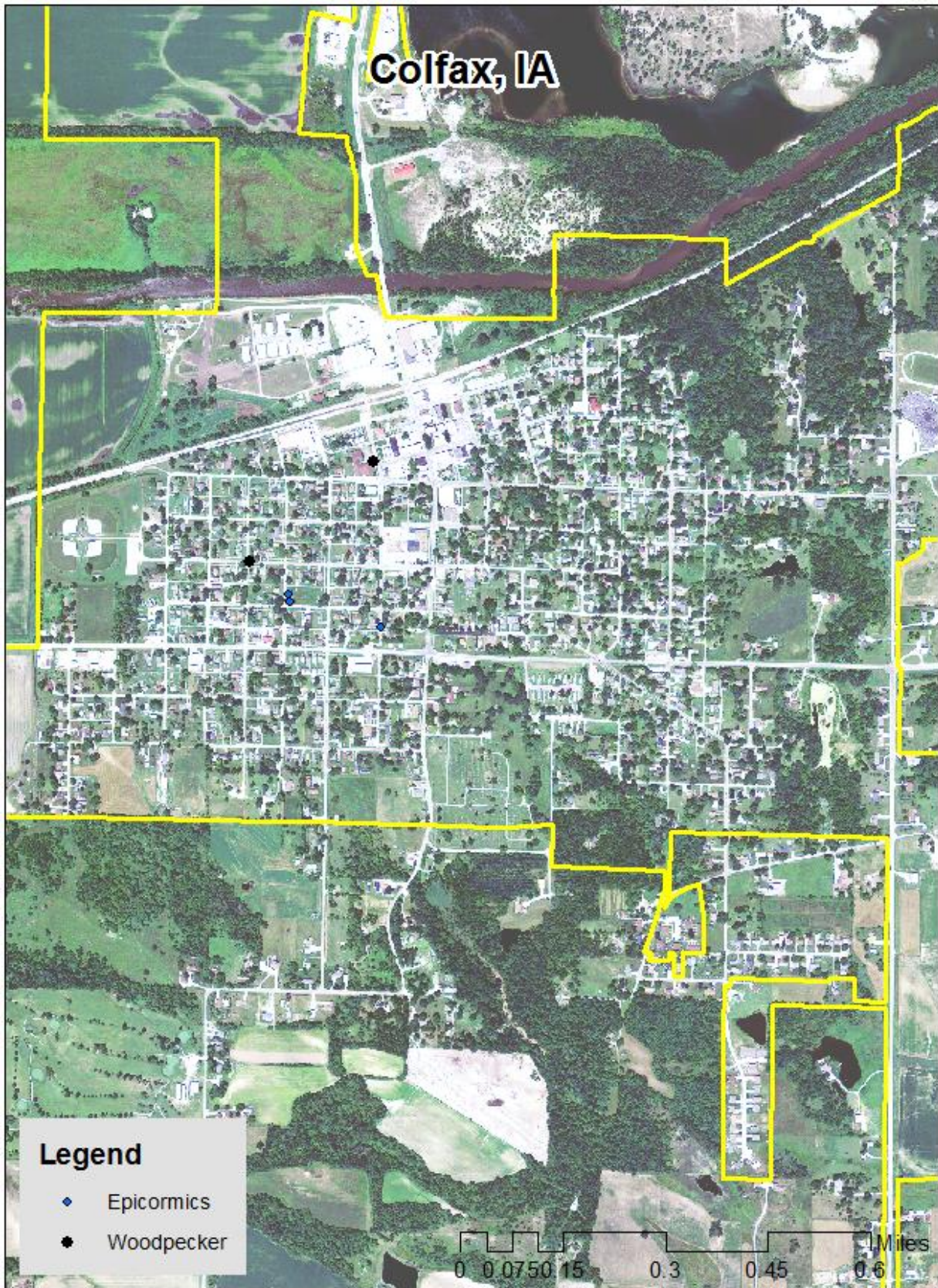


Figure 2: Location of EAB symptoms



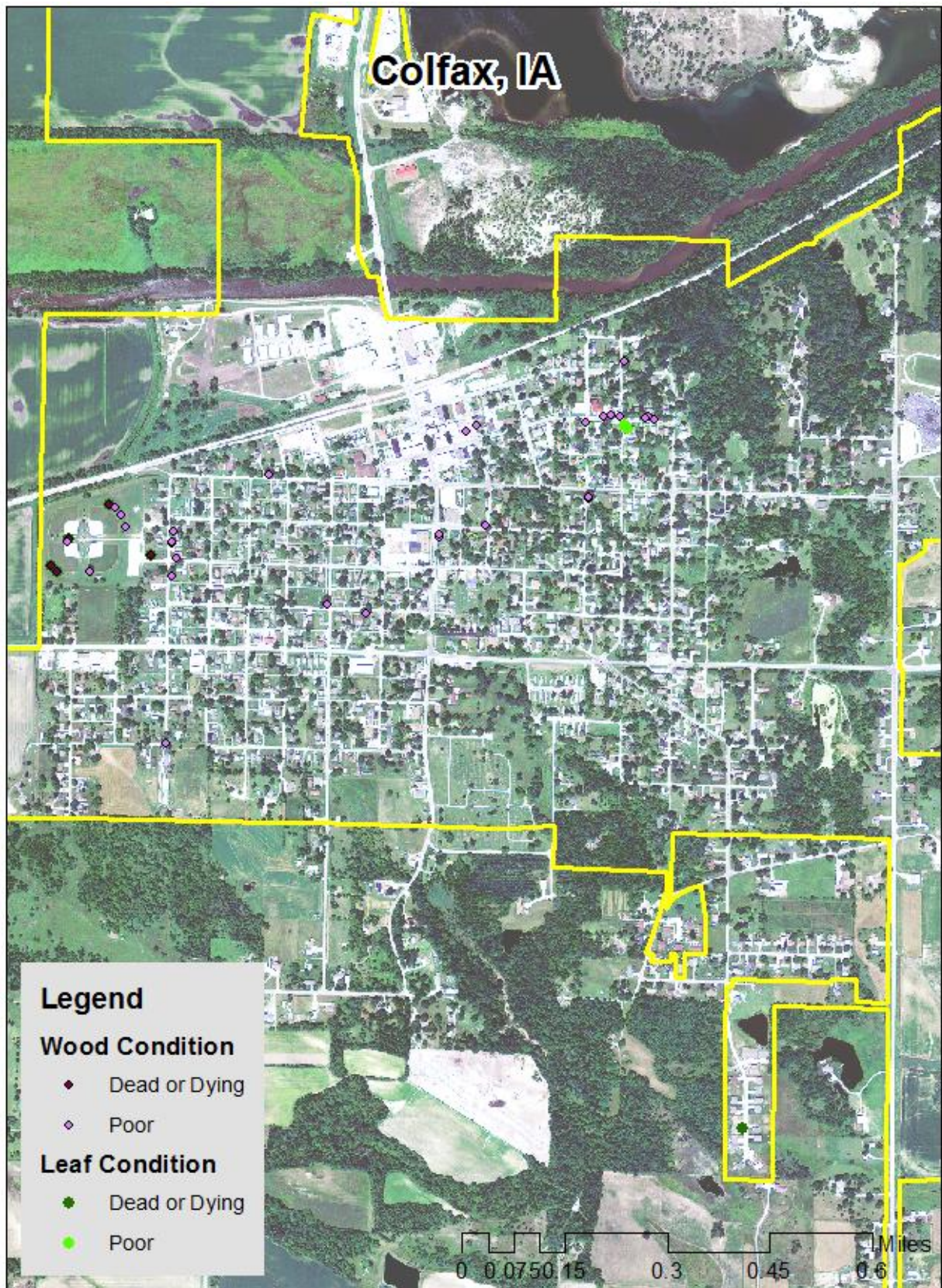


Figure 3: Location of Poor Condition Trees



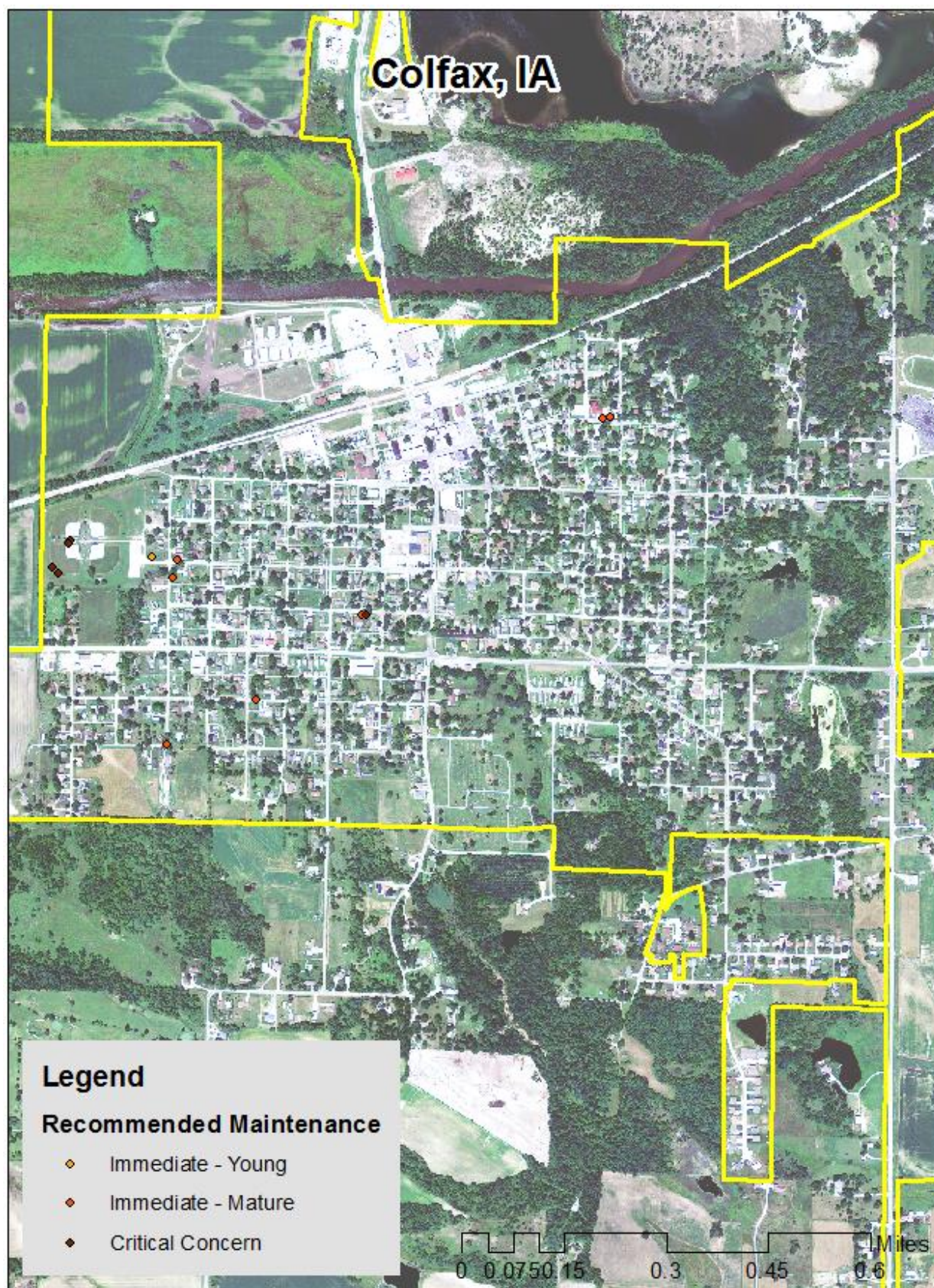
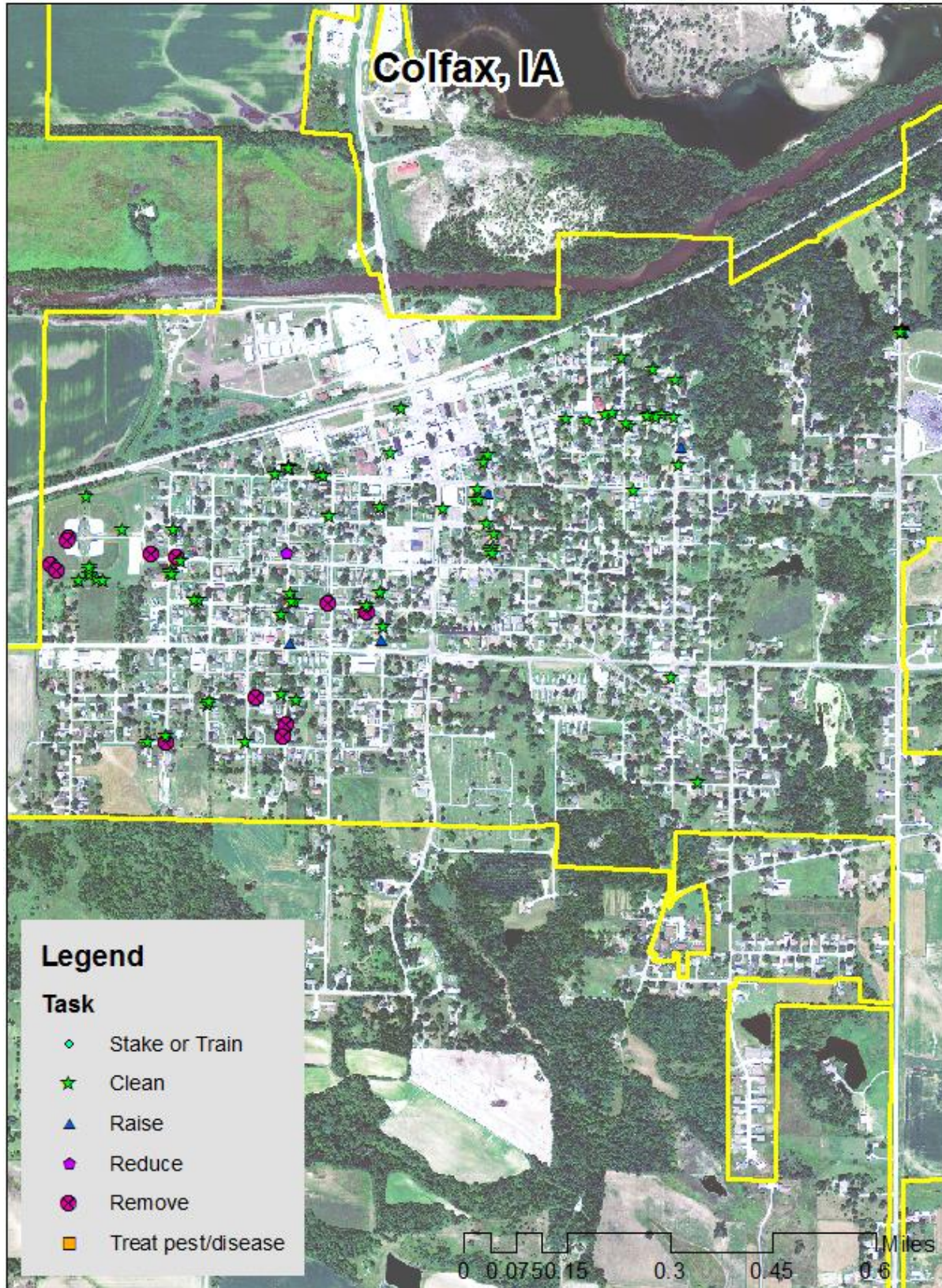


Figure 4: Location of Trees with Recommended Maintenance





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

## Appendix C: Sample Tree Ordinances

### CHAPTER 151 TREES AND GRASS

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

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.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.  
(Code of Iowa, Sec. 364.12[2c, d, & e])

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

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

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

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

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

151.07 CUTTING OR MOWING OF GRASS.

1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.

2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

**The State of Iowa is an Equal Opportunity Employer and provider of ADA services.**

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 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 Director Chuck Gipp at 515-281-5918.