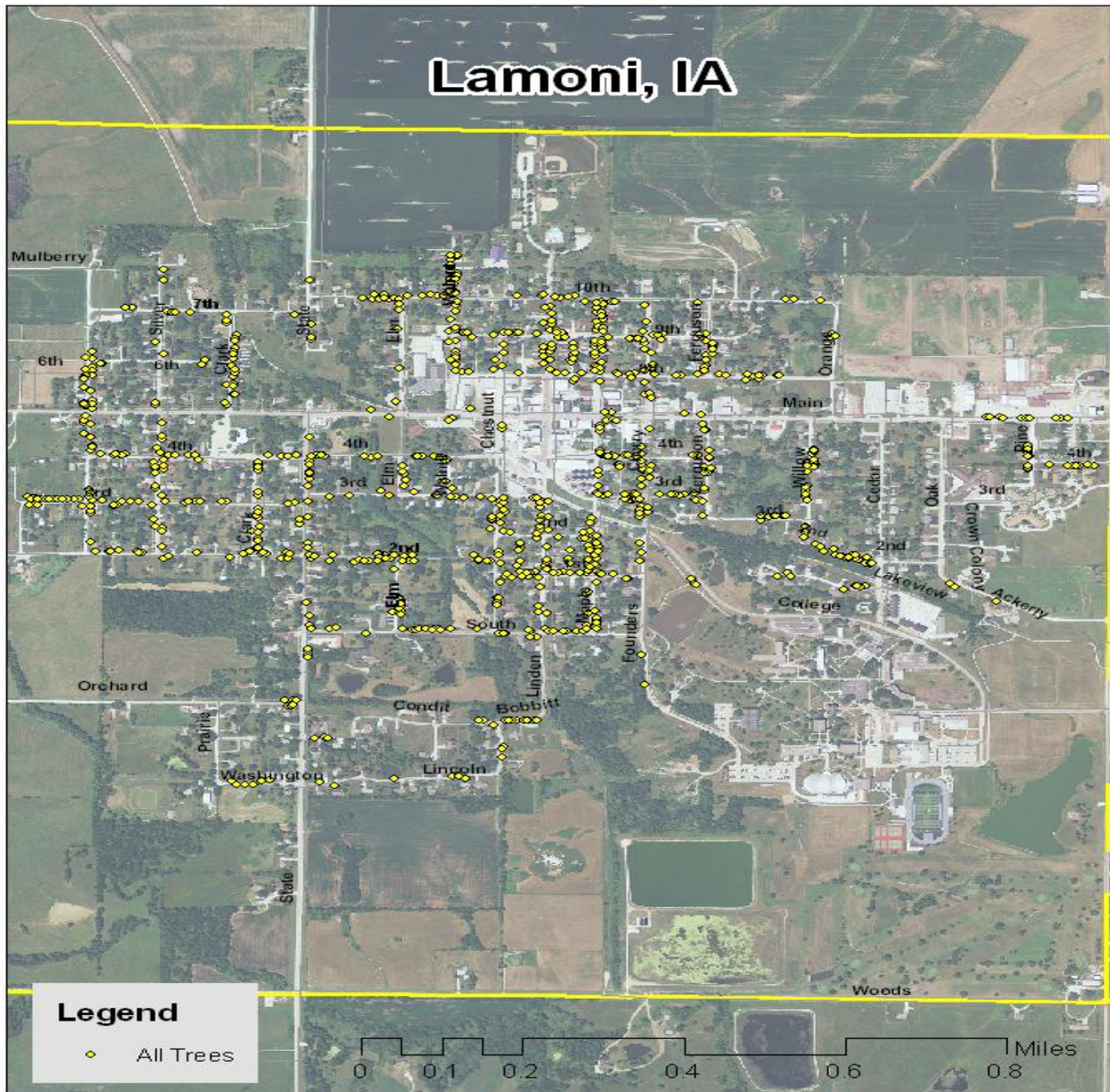


# LAMONI, IA



## 2013 Management Plan

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# Executive Summary

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## Overview

This plan was developed to assist the City of Lamoni 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 Lamoni'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 2012, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street trees. Below are some key findings of the 913 trees inventoried.

- Lamoni's trees provide \$141,560 of benefits annually, an average of \$155 a tree
- There are over 48 species of trees
- The top three genus are: Maple 16%, Ash 11%, and Walnut 10%
- 45% of trees are in need of some type of management
- 70 trees are recommended for removal or being evaluated further 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 70 trees recommended for removal/evaluation, three are "critical concern" trees and should be removed immediately (locations shown in Figure 4, Appendix B). 34 more trees are recommended for removal within the next 3 years. For more information, see "Hazardous Trees" page 7. [\\*City ownership of the trees recommended for removal should be verified prior to any removal\\*](#)
- 36 of the 98 ash trees are in need of follow up because they are displaying signs and symptoms that may be associated with EAB. Check ash trees with a visual survey yearly.
- 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, silver maple, cottonwood, poplar, box elder, Chinese elm, Siberian elm, evergreen, willow or black walnut. **Suggested "Acceptable Trees List" is attached with this plan.**
- With an estimated average tree removal cost of \$500 per tree, it could take \$49,000 or more to remove the 98 ash trees if EAB damage occurs. – Suggestion: request a budget increase to \$6,000 annually over the next 10 years and apply for grants to plant replacement trees.

## Introduction

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

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

## Inventory

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In 2012, a tree inventory was conducted that included 100% of the city owned trees on 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, and 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 913 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.

## **Annual Benefits**

### **Annual Energy Benefits**

Trees conserve energy by shading buildings and blocking winds. Lamoni's trees reduce energy related costs by approximately \$39,513 annually (Appendix A, Table 1). These savings are both in Electricity (188.3 MWh) and in Natural Gas (25,733 Therms).

### **Annual Stormwater Benefits**

Lamoni's trees intercept about 1,840,647 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$49,885 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 Lamoni, it is estimated that trees remove 2,375 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 \$5,599 (Appendix A, Table 3).

### **Annual Carbon Benefits**

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Lamoni, trees sequester about 412,399 lbs of carbon a year with an associated value of \$5,225 (Appendix A, Table 5). In addition, the trees store 6,597,310 lbs of carbon, with a yearly benefit of \$49,480 (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. Lamoni receives \$40,253 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, Lamoni's trees provide \$141,560 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 913 trees in Lamoni provide approximately \$155 annually (Appendix A, Table 7).

## **Forest Structure**

### **Species Distribution**

Lamoni has over 48 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	155	17%
Ash	98	11%
Walnut	90	10%
Oak	48	5%
Spruce	22	2%
Apple (Crab)	26	3%
Linden/Basswood	31	3%
Sycamore	39	4%
Hackberry	37	4%
Lilac	20	2%
Locust	29	3%
Cherry	12	1%
Pine	30	3%
Elm	34	4%
Juniper/redcedar	22	2%
Others	220	26%

### **Age Class**

Most of Lamoni's trees (46.5%) are between 12 and 24 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 18 inches in diameter at 4.5 ft.

### **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 Lamoni indicate that 87% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 73% of Lamoni'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 10% of the population. This 10% is an estimate of trees that need management follow up.

### **Management Needs**

The following outlines the specific management needs of the street trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	234	25.6%
Crown Raising	31	3.4%



Tree Staking	18	2%
Tree Removal	70	7.7%
Crown Reduction	37	4%

## Canopy Cover

The canopy cover of Lamoni is approximately 20 acres (Appendix A, Figure 4).

## Land Use and Location

The majority of Lamoni’s city 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	99.9%
Park/vacant/other	0.1%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

### Location

Planting strip	98%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	2%

## 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

Lamoni has 3 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 (Elm, Honeylocust) and 1 tree (Green Ash) over 30 inches in diameter at 4.5 ft. that should be addressed immediately. After all of the critical concern trees are addressed, there should be follow up on the trees recommended for removal within the next 3 years. There are a total of 34 (16 mature, 18 young trees) of these trees (see locations on map Appendix B, Figure 5). After that, there are 33 more trees that should be evaluated for possible removal within 5 years.

### Poor tree species

After the removal of the critical concern trees and those needing removal within 3 years, ash trees in poor health should be assessed for removal (Appendix B, Figures 1 -4). Of the 34 recommended removals within 3 years, 8 are ash trees. There are a total of 98 ash trees, and 36 of those have signs and symptoms that have been associated with EAB. In addition, there are 15 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 should 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 Lamoni.

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 most heavily planted with Maple, Ash, and Walnut (Appendix A, Figure 1). These three species should not be planted until these percentages 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, Siberian elm, evergreen, and willow. **All trees planted must meet the restrictions in city ordinance.**

### **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.



## Maintenance Plan with No Additional Funding -Proposed

Remove critical concern trees first, then mature trees recommended for immediate removal (1-3years). Then young trees recommended for immediate removal. Then ash in poor condition.

### Year 1

Removal: 3 designated critical concern trees

Planting and Replacement: none

Visual Survey for signs and symptoms of EAB

### Year 2

Removal: 4 mature green ash recommended for immediate removal.

Planting and Replacement: 4 trees in open locations from year one removals

Routine trimming: Contract to trim 60 of the city trees needing trimming.

Visual Survey for signs and symptoms of EAB

### Year 3

Removal: 8 trees - and any new critical concern trees and ash in poor health.

Planting and Replacement: 9 trees in open locations from previous removals

Routine trimming: Contract to trim 60 of the city trees needing trimming.

Visual Survey for signs and symptoms of EAB

### Year 4

Removal: 8 trees - and any new critical concern trees and ash in poor health

Planting and Replacement: 9 trees in open locations from previous removals

Routine trimming: Contract to trim 60 of the city trees

Visual Survey for signs and symptoms of EAB

### Year 5

Removal: 8 trees - and new critical concern trees and ash in poor health

Planting and Replacement: 9 trees in open locations from previous removals

Routine trimming: Contract to trim 60 of the city trees

Visual Survey for signs and symptoms of EAB

### Year 6

Removal: 6 trees - and any new critical concern trees and ash in poor health

Planting and Replacement: 7 trees in open locations from previous removals

Routine trimming: Contract to trim 60 of the city trees

Visual Survey for signs and symptoms of EAB

\*Reduction of ash over 6 years: Approximately 8 ash trees removed (approximately 9% of ash) following the 6 year removal above of the designated trees. Next, concentrate on removing ash trees, poor condition trees first. Note: EAB could potentially kill all ash within 4 years of its arrival.

# 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\***

## 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 should be replaced with a suitable diversity of non-ash species. Suitable species are listed in the “Acceptable Tree List” attached with this plan. All trees must meet the restrictions in any city ordinance.

## 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 should 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. An “Emerald Ash Borer Symptoms List” and an EAB Pest Alert are provided with this plan for your information. If you suspect that you may actually have EAB damage, the first step is to contact the ISU Plant and Insect Diagnostic Clinic at 515-294-0581.

## Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. This should be done in accordance with any existing or new city code. Example Code: “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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Budget information was not provided by the city. Consequently, assuming that the budget for tree maintenance is minimal, the following are some estimated costs associated with the recommended maintenance work. If a budget does not exist, a recommendation would be to shoot for setting it at \$2 per capita, which is a requirement for becoming a Tree City USA.

Tree removal costs average around \$500 per tree, depending on the size and numbers of trees. the estimated range would be \$350-\$1,000.

Trimming (including cleaning, raising, reducing) averages \$75 per tree and can range from \$70 to \$200 per tree. New planting averages about \$150 per tree (5' trees in 10 gallon containers are about \$75-\$100 plus the cost of watering).

### Purposed Budget Increase

EAB could potentially kill all ash trees in Lamoni within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased by \$9,000 per year. Additionally, it is recommended that Lamoni 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. For more information about grants please contact Emma Bruemmer, DNR State Urban Forester, at 515-281-5600 or by e-mail at [Emma.Bruemmer@dnr.iowa.gov](mailto:Emma.Bruemmer@dnr.iowa.gov)

## Works Cited

Census Bureau. 2000. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2010)

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, D.J. and J.F. 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**

**Lamoni**

## Annual Energy Benefits of Public Trees by Species

1/31/2013

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	30.3	2,302	3,952.1	3,873	6,175	(N/A)	11.8	15.6	57.18
Green ash	24.0	1,822	3,212.8	3,149	4,970	(N/A)	10.3	12.6	52.87
Black walnut	20.3	1,542	2,688.3	2,634	4,177	(N/A)	9.9	10.6	46.41
Eastern redbud	4.5	340	698.5	685	1,025	(N/A)	5.0	2.6	22.28
American sycamore	12.4	942	1,702.4	1,668	2,610	(N/A)	4.3	6.6	66.93
Northern hackberry	9.4	715	1,305.1	1,279	1,994	(N/A)	4.1	5.1	53.89
Sugar maple	7.4	559	969.6	950	1,509	(N/A)	3.9	3.8	41.93
Northern pin oak	9.9	754	1,441.9	1,413	2,168	(N/A)	3.9	5.5	60.21
Norway maple	6.5	490	885.0	867	1,358	(N/A)	3.2	3.4	46.82
Honeylocust	8.8	668	1,146.2	1,123	1,791	(N/A)	3.2	4.5	61.75
Broadleaf Deciduous	2.5	190	397.9	390	580	(N/A)	3.1	1.5	20.72
American basswood	6.8	513	986.7	967	1,480	(N/A)	3.0	3.8	54.82
Apple	1.7	126	250.9	246	372	(N/A)	2.9	0.9	14.30
Broadleaf Deciduous	3.3	254	481.7	472	726	(N/A)	2.7	1.8	29.04
Eastern red cedar	2.1	162	319.2	313	475	(N/A)	2.4	1.2	21.59
Siberian elm	6.5	495	894.6	877	1,372	(N/A)	2.4	3.5	62.36
Lilac	2.4	185	386.1	378	563	(N/A)	2.2	1.4	28.17
Mulberry	2.5	190	392.9	385	575	(N/A)	1.9	1.5	33.83
Spruce	1.6	121	207.2	203	324	(N/A)	1.9	0.8	19.07
Eastern white pine	1.5	111	192.6	189	300	(N/A)	1.8	0.8	18.75
Black maple	3.6	276	488.9	479	755	(N/A)	1.6	1.9	50.33
Scotch pine	1.4	104	174.0	171	275	(N/A)	1.5	0.7	19.61
Common chokecherry	0.5	40	84.0	82	122	(N/A)	1.3	0.3	10.19
American elm	2.7	202	349.8	343	545	(N/A)	1.3	1.4	45.43
Other street trees	15.7	1,191	2,124.2	2,082	3,272	(N/A)	10.5	8.3	34.09
Citywide total	188.3	14,295	25,732.7	25,218	39,513	(N/A)	100.0	100.0	43.28

**Table 2: Annual Stormwater Benefits**

**Lamoni**

## Annual Stormwater Benefits of Public Trees by Species

1/31/2013

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	395,039	10,706	(N/A)	11.8	21.5	99.13
Green ash	244,325	6,622	(N/A)	10.3	13.3	70.44
Black walnut	185,133	5,017	(N/A)	9.9	10.1	55.75
Eastern redbud	19,215	521	(N/A)	5.0	1.0	11.32
American sycamore	144,979	3,929	(N/A)	4.3	7.9	100.75
Northern hackberry	70,973	1,924	(N/A)	4.1	3.9	51.99
Sugar maple	57,891	1,569	(N/A)	3.9	3.2	43.58
Northern pin oak	99,815	2,705	(N/A)	3.9	5.4	75.14
Norway maple	49,385	1,338	(N/A)	3.2	2.7	46.15
Honeylocust	79,162	2,145	(N/A)	3.2	4.3	73.98
Broadleaf Deciduous	11,213	304	(N/A)	3.1	0.6	10.85
American basswood	73,130	1,982	(N/A)	3.0	4.0	73.41
Apple	5,827	158	(N/A)	2.9	0.3	6.07
Broadleaf Deciduous	29,592	802	(N/A)	2.7	1.6	32.08
Eastern red cedar	31,081	842	(N/A)	2.4	1.7	38.29
Siberian elm	62,900	1,705	(N/A)	2.4	3.4	77.49
Lilac	11,043	299	(N/A)	2.2	0.6	14.96
Mulberry	13,094	355	(N/A)	1.9	0.7	20.87
Spruce	19,658	533	(N/A)	1.9	1.1	31.34
Eastern white pine	18,120	491	(N/A)	1.8	1.0	30.69
Black maple	31,225	846	(N/A)	1.6	1.7	56.42
Scotch pine	15,881	430	(N/A)	1.5	0.9	30.74
Common chokecherry	1,826	49	(N/A)	1.3	0.1	4.12
American elm	21,618	586	(N/A)	1.3	1.2	48.82
Other street trees	148,522	4,025	(N/A)	10.5	8.1	41.93
Citywide total	1,840,647	49,885	(N/A)	100.0	100.0	54.64

**Table 3: Annual Air Quality Benefits**

**Lamoni**

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

1/31/2013

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total (\$)	Standard % of Total Error	Avg. Trees \$/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	66.0	11.2	32.9	2.9	357	142.7	20.9	20.0	137.2	894	-36.7	-137	397.2	1,113 (N/A)	11.8	10.31
Green ash	29.9	4.8	14.5	1.3	160	113.9	16.6	15.9	108.8	711	0.0	0	305.8	871 (N/A)	10.3	9.27
Black walnut	20.4	3.3	10.3	0.9	110	96.2	14.1	13.4	92.1	601	0.0	0	250.7	712 (N/A)	9.9	7.91
Eastern redbud	5.6	0.9	2.7	0.3	30	22.2	3.2	3.0	20.3	136	0.0	0	58.1	166 (N/A)	5.0	3.61
American sycamore	19.5	3.1	9.1	0.9	103	59.3	8.6	8.2	56.2	369	0.0	0	164.9	472 (N/A)	4.3	12.11
Northern hackberry	9.3	1.6	5.1	0.4	52	45.2	6.6	6.3	42.7	281	0.0	0	117.1	333 (N/A)	4.1	8.99
Sugar maple	6.2	1.1	3.5	0.3	35	34.8	5.1	4.9	33.4	218	-5.2	-19	83.9	233 (N/A)	3.9	6.47
Northern pin oak	21.2	3.7	10.3	0.9	114	48.3	7.0	6.6	45.1	299	-4.9	-18	138.2	395 (N/A)	3.9	10.97
Norway maple	9.0	1.6	4.6	0.4	49	30.9	4.5	4.3	29.3	193	-2.2	-8	82.3	233 (N/A)	3.2	8.04
Honeylocust	14.8	2.4	6.9	0.7	79	41.4	6.1	5.8	39.8	259	-10.7	-40	107.2	298 (N/A)	3.2	10.27
Broadleaf Deciduous	3.3	0.5	1.6	0.2	18	12.4	1.8	1.7	11.4	76	0.0	0	32.8	94 (N/A)	3.1	3.36
American basswood	9.7	1.7	4.8	0.4	53	32.9	4.7	4.5	30.7	203	-8.4	-31	81.1	225 (N/A)	3.0	8.32
Apple	1.4	0.2	0.7	0.1	7	8.1	1.2	1.1	7.5	50	0.0	0	20.3	57 (N/A)	2.8	2.21
Broadleaf Deciduous	5.9	1.0	2.9	0.3	32	16.2	2.3	2.2	15.2	100	-1.4	-5	44.7	127 (N/A)	2.7	5.09
Eastern red cedar	6.2	1.2	4.9	0.8	40	10.4	1.5	1.4	9.7	64	-17.1	-64	18.9	40 (N/A)	2.4	1.83
Siberian elm	9.3	1.6	4.7	0.4	51	31.1	4.5	4.3	29.6	194	0.0	0	85.6	245 (N/A)	2.4	11.12
Lilac	3.3	0.6	1.6	0.2	18	12.1	1.7	1.6	11.0	74	0.0	0	32.1	92 (N/A)	2.2	4.60
Mulberry	4.5	0.7	2.1	0.2	24	12.4	1.8	1.7	11.3	76	0.0	0	34.7	100 (N/A)	1.9	5.87
Spruce	2.1	0.4	1.8	0.3	14	7.5	1.1	1.1	7.2	47	-7.0	-26	14.5	35 (N/A)	1.9	2.05
Eastern white pine	1.9	0.4	1.7	0.2	13	6.9	1.0	1.0	6.6	43	-6.4	-24	13.3	32 (N/A)	1.8	2.01
Black maple	7.5	1.3	3.5	0.3	40	17.3	2.5	2.4	16.5	108	-2.5	-9	48.7	138 (N/A)	1.6	9.22
Scotch pine	1.7	0.3	1.5	0.2	11	6.4	0.9	0.9	6.2	40	-5.4	-20	12.8	31 (N/A)	1.5	2.24
Common chokecherry	0.4	0.1	0.2	0.0	2	2.6	0.4	0.4	2.4	16	0.0	0	6.4	18 (N/A)	1.3	1.51
American elm	4.1	0.7	2.1	0.2	22	12.6	1.8	1.8	12.1	79	0.0	0	35.3	101 (N/A)	1.3	8.41
Other street trees	20.0	3.4	11.0	1.1	111	74.6	10.9	10.4	71.1	465	-14.4	-54	188.0	523 (N/A)	10.5	5.45
Citywide total	283.0	47.6	144.9	13.8	1,544	898.5	130.9	124.8	853.4	5,599	-122.2	-458	2,374.7	6,685 (N/A)	100.0	7.32

**Table 4: Annual Carbon Stored**

**Lamoni**

**Stored CO2 Benefits of Public Trees by Species**

1/31/2013

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	1,585,060	11,888	(N/A)	11.8	24.0	110.07
Green ash	989,260	7,419	(N/A)	10.3	15.0	78.93
Black walnut	676,727	5,075	(N/A)	9.9	10.3	56.39
Eastern redbud	90,388	678	(N/A)	5.0	1.4	14.74
American	639,982	4,800	(N/A)	4.3	9.7	123.07
Northern	133,179	999	(N/A)	4.1	2.0	27.00
Sugar maple	175,180	1,314	(N/A)	3.9	2.7	36.50
Northern pin oak	349,786	2,623	(N/A)	3.9	5.3	72.87
Norway maple	148,614	1,115	(N/A)	3.2	2.3	38.43
Honeylocust	185,661	1,392	(N/A)	3.2	2.8	48.02
Broadleaf	53,920	404	(N/A)	3.1	0.8	14.44
American	357,864	2,684	(N/A)	3.0	5.4	99.41
Apple	22,972	172	(N/A)	2.9	0.4	6.63
Broadleaf	98,355	738	(N/A)	2.7	1.5	29.51
Eastern red cedar	20,121	151	(N/A)	2.4	0.3	6.86
Siberian elm	228,599	1,714	(N/A)	2.4	3.5	77.93
Lilac	53,720	403	(N/A)	2.2	0.8	20.14
Mulberry	70,746	531	(N/A)	1.9	1.1	31.21
Spruce	14,540	109	(N/A)	1.9	0.2	6.41
Eastern white pine	13,369	100	(N/A)	1.8	0.2	6.27
Black maple	81,361	610	(N/A)	1.6	1.2	40.68
Scotch pine	10,902	82	(N/A)	1.5	0.2	5.84
Common	6,691	50	(N/A)	1.3	0.1	4.18
American elm	90,210	677	(N/A)	1.3	1.4	56.38
Other street trees	226,843	3,751	(N/A)	10.5	7.6	39.07
Citywide total	6,597,310	49,480	(N/A)	100.0	100.0	54.19

**Table 5: Annual Carbon Sequestered**

**Lamoni**

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

1/31/2013

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	120,209	902	-7,608	-21	-57	50,871	382	163,450	1,226	(N/A)	11.8	23.5	11.35
Green ash	53,189	399	-4,748	-18	-36	40,258	302	88,680	665	(N/A)	10.3	12.7	7.08
Black walnut	44,461	333	-3,248	-18	-24	34,080	256	75,275	565	(N/A)	9.9	10.8	6.27
Eastern redbud	8,021	60	-434	-9	-3	7,522	56	15,100	113	(N/A)	5.0	2.2	2.46
American sycamore	28,725	215	-3,072	-8	-23	20,812	156	46,458	348	(N/A)	4.3	6.7	8.93
Northern hackberry	9,509	71	-639	-7	-5	15,800	119	24,662	185	(N/A)	4.1	3.5	5.00
Sugar maple	12,835	96	-841	-7	-6	12,358	93	24,345	183	(N/A)	3.9	3.5	5.07
Northern pin oak	11,549	87	-1,679	-7	-13	16,673	125	26,536	199	(N/A)	3.9	3.8	5.53
Norway maple	9,842	74	-713	-6	-5	10,838	81	19,960	150	(N/A)	3.2	2.9	5.16
Honeylocust	20,638	155	-891	-6	-7	14,753	111	34,494	259	(N/A)	3.2	5.0	8.92
Broadleaf Deciduous	3,745	28	-259	-5	-2	4,205	32	7,685	58	(N/A)	3.1	1.1	2.06
American basswood	21,390	160	-1,718	-5	-13	11,340	85	31,007	233	(N/A)	3.0	4.5	8.61
Apple	2,532	19	-110	-5	-1	2,782	21	5,199	39	(N/A)	2.9	0.8	1.50
Broadleaf Deciduous	3,572	27	-472	-5	-4	5,614	42	8,708	65	(N/A)	2.7	1.3	2.61
Eastern red cedar	799	6	-97	-4	-1	3,586	27	4,285	32	(N/A)	2.4	0.6	1.46
Siberian elm	12,051	90	-1,097	-4	-8	10,946	82	21,895	164	(N/A)	2.4	3.1	7.46
Lilac	3,126	23	-258	-4	-2	4,089	31	6,954	52	(N/A)	2.2	1.0	2.61
Mulberry	1,545	12	-340	-3	-3	4,201	32	5,403	41	(N/A)	1.9	0.8	2.38
Spruce	1,498	11	-70	-3	-1	2,677	20	4,102	31	(N/A)	1.9	0.6	1.81
Eastern white pine	1,383	10	-64	-3	-1	2,461	18	3,776	28	(N/A)	1.8	0.5	1.77
Black maple	4,275	32	-391	-3	-3	6,096	46	9,978	75	(N/A)	1.6	1.4	4.99
Scotch pine	1,240	9	-52	-3	0	2,298	17	3,483	26	(N/A)	1.5	0.5	1.87
Common chokecherry	825	6	-32	-2	0	884	7	1,674	13	(N/A)	1.3	0.2	1.05
American elm	3,144	24	-433	-2	-3	4,473	34	7,182	54	(N/A)	1.3	1.0	4.49
Other street trees	32,295	242	-2,400	-19	-18	26,311	197	56,186	421	(N/A)	10.5	8.1	4.39
Citywide total	412,399	3,093	-31,667	-178	-239	315,925	2,369	696,478	5,224	(N/A)	100.0	100.0	5.72

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

**Lamoni**

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

1/31/2013

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	9,655	(N/A)	11.8	24.0	89.40
Green ash	4,654	(N/A)	10.3	11.6	49.52
Black walnut	4,153	(N/A)	9.9	10.3	46.15
Eastern redbud	466	(N/A)	5.0	1.2	10.12
American sycamore	2,272	(N/A)	4.3	5.6	58.26
Northern hackberry	1,559	(N/A)	4.1	3.9	42.14
Sugar maple	1,500	(N/A)	3.9	3.7	41.67
Northern pin oak	1,072	(N/A)	3.9	2.7	29.77
Norway maple	982	(N/A)	3.2	2.4	33.85
Honeylocust	4,560	(N/A)	3.2	11.3	157.26
Broadleaf Deciduous	216	(N/A)	3.1	0.5	7.70
American basswood	1,554	(N/A)	3.0	3.9	57.56
Apple	143	(N/A)	2.9	0.4	5.49
Broadleaf Deciduous	393	(N/A)	2.7	1.0	15.74
Eastern red cedar	298	(N/A)	2.4	0.7	13.56
Siberian elm	917	(N/A)	2.4	2.3	41.68
Lilac	181	(N/A)	2.2	0.5	9.04
Mulberry	90	(N/A)	1.9	0.2	5.27
Spruce	420	(N/A)	1.9	1.0	24.73
Eastern white pine	388	(N/A)	1.8	1.0	24.26
Black maple	571	(N/A)	1.6	1.4	38.08
Scotch pine	351	(N/A)	1.5	0.9	25.08
Common chokecherry	45	(N/A)	1.3	0.1	3.76
American elm	455	(N/A)	1.3	1.1	37.89
Other street trees	3,358	(N/A)	10.5	8.3	34.98
Citywide total	40,253	(N/A)	100.0	100.0	44.09



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

**Lamoni**

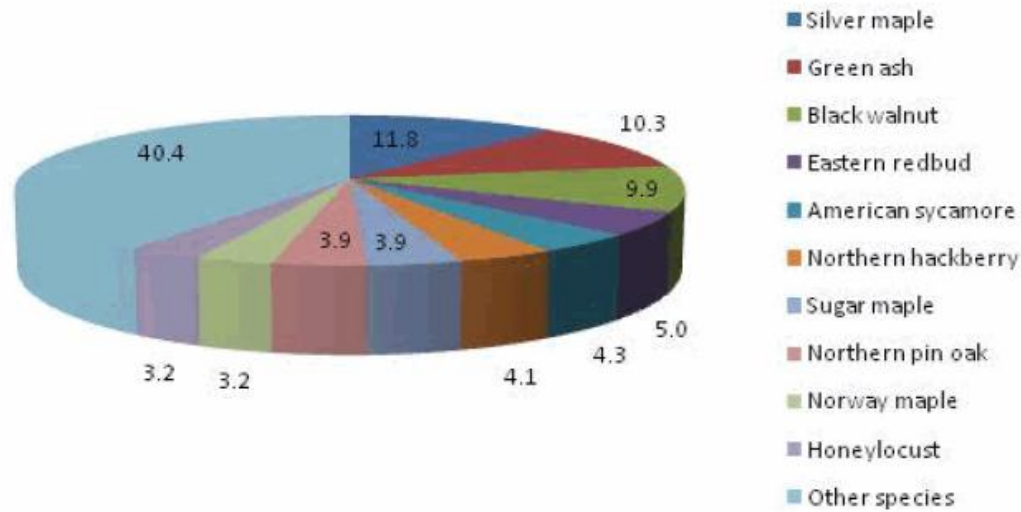
**Total Annual Benefits of Public Trees by Species (\$)**

1/31/201

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Silver maple	6,175	1,226	1,113	10,706	9,655	28,875	(±0)	20.4
Green ash	4,970	665	871	6,622	4,654	17,783	(±0)	12.6
Black walnut	4,177	565	712	5,017	4,153	14,623	(±0)	10.3
Eastern redbud	1,025	113	166	521	466	2,291	(±0)	1.6
American sycamore	2,610	348	472	3,929	2,272	9,632	(±0)	6.8
Northern hackberry	1,994	185	333	1,924	1,559	5,994	(±0)	4.2
Sugar maple	1,509	183	233	1,569	1,500	4,994	(±0)	3.5
Northern pin oak	2,168	199	395	2,705	1,072	6,538	(±0)	4.6
Norway maple	1,358	150	233	1,338	982	4,061	(±0)	2.9
Honeylocust	1,791	259	298	2,145	4,560	9,053	(±0)	6.4
Broadleaf Deciduous	580	58	94	304	216	1,251	(±0)	0.9
American basswood	1,480	233	225	1,982	1,554	5,473	(±0)	3.9
Apple	372	39	57	158	143	769	(±0)	0.5
Broadleaf Deciduous	726	65	127	802	393	2,114	(±0)	1.5
Eastern red cedar	475	32	40	842	298	1,688	(±0)	1.2
Siberian elm	1,372	164	245	1,705	917	4,402	(±0)	3.1
Lilac	563	52	92	299	181	1,188	(±0)	0.8
Mulberry	575	41	100	355	90	1,160	(±0)	0.8
Spruce	324	31	35	533	420	1,343	(±0)	0.9
Eastern white pine	300	28	32	491	388	1,240	(±0)	0.9
Black maple	755	75	138	846	571	2,386	(±0)	1.7
Scotch pine	275	26	31	430	351	1,114	(±0)	0.8
Common	122	13	18	49	45	248	(±0)	0.2
American elm	545	54	101	586	455	1,741	(±0)	1.2
Other street trees	3,272	421	523	4,025	3,358	11,600	(±0)	8.2
<b>Citywide Total</b>	<b>39,513</b>	<b>5,224</b>	<b>6,685</b>	<b>49,885</b>	<b>40,253</b>	<b>141,560</b>	<b>(±0)</b>	<b>100.0</b>

**Species Distribution of Public Trees (%)**

1/31/2013



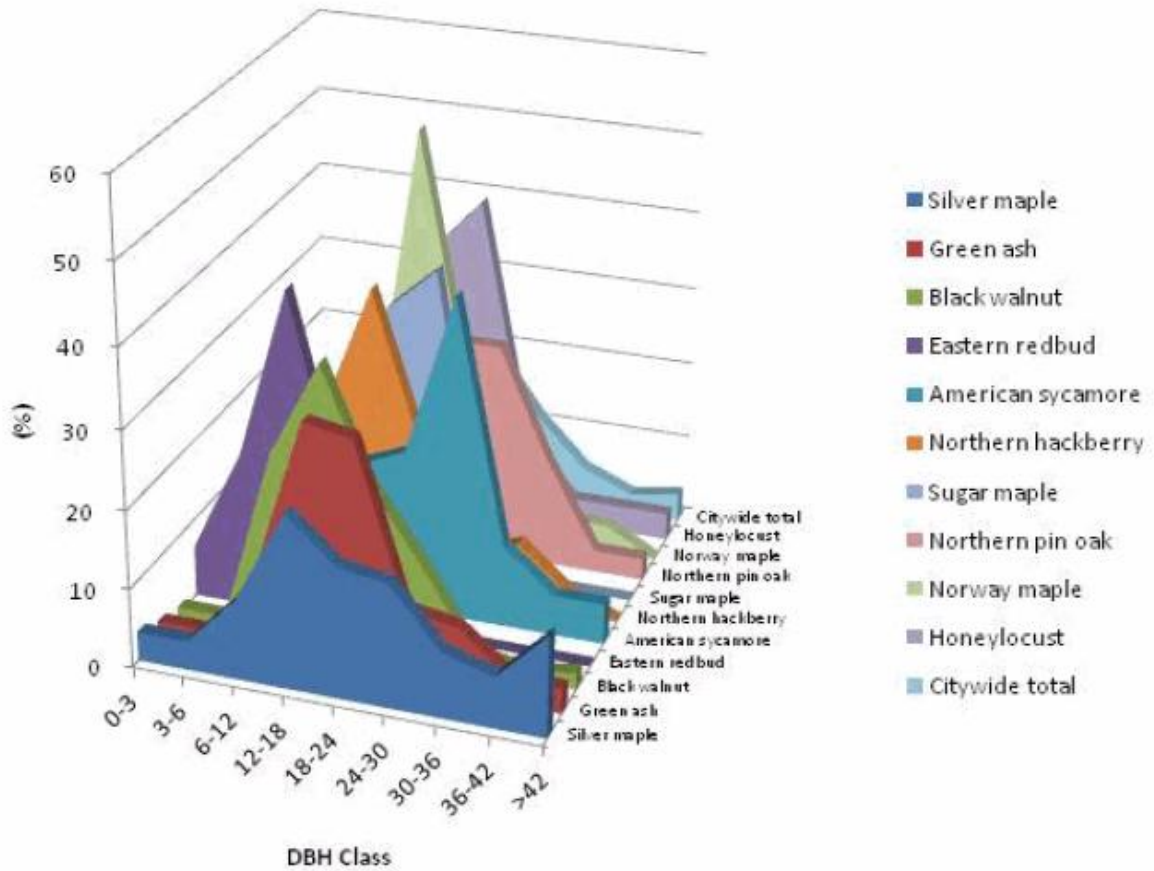
Species	Percent
Silver maple	11.8
Green ash	10.3
Black walnut	9.9
Eastern redbud	5.0
American sycamore	4.3
Northern hackberry	4.1
Sugar maple	3.9
Northern pin oak	3.9
Norway maple	3.2
Honeylocust	3.2
Other species	40.4
Total	100.0

Figure 1: Species Distribution

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

1/31/2013



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Silver maple	3.7	3.7	10.2	22.2	16.7	15.7	8.3	6.5	13.0
Green ash	2.1	2.1	10.6	30.9	29.8	9.6	8.5	3.2	3.2
Black walnut	1.1	1.1	23.3	35.6	21.1	12.2	2.2	1.1	2.2
Eastern redbud	6.5	19.6	41.3	17.4	15.2	0.0	0.0	0.0	0.0
American sycamore	0.0	0.0	0.0	17.9	20.5	41.0	10.3	5.1	5.1
Northern hackberry	0.0	5.4	21.6	37.8	18.9	5.4	8.1	2.7	0.0
Sugar maple	2.8	8.3	13.9	33.3	38.9	2.8	0.0	0.0	0.0
Northern pin oak	0.0	0.0	5.6	19.4	27.8	27.8	13.9	2.8	2.8
Norway maple	0.0	6.9	10.3	51.7	20.7	3.4	3.4	3.4	0.0
Honeylocust	0.0	0.0	3.4	34.5	41.4	10.3	3.4	3.4	3.4
Citywide total	4.2	7.4	19.5	26.8	19.7	11.2	5.0	2.5	3.6

Figure 2: Relative Age Class

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

1/31/2013

**Citywide total**

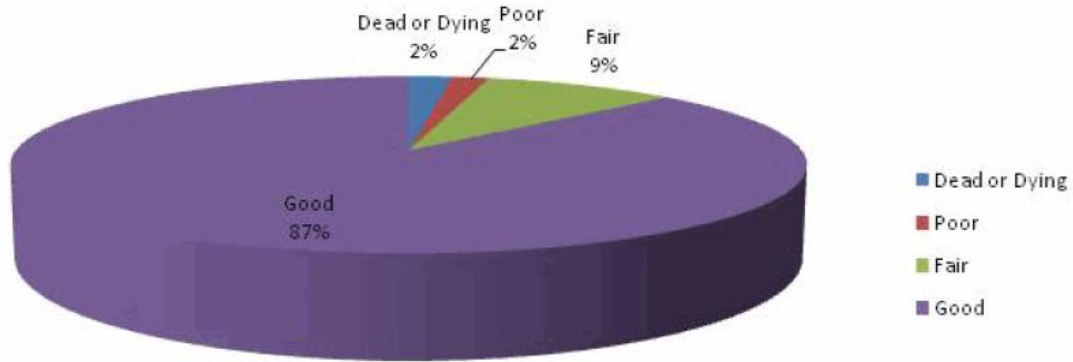


Figure 3: Foliage Condition

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

1/31/2013

**Citywide total**

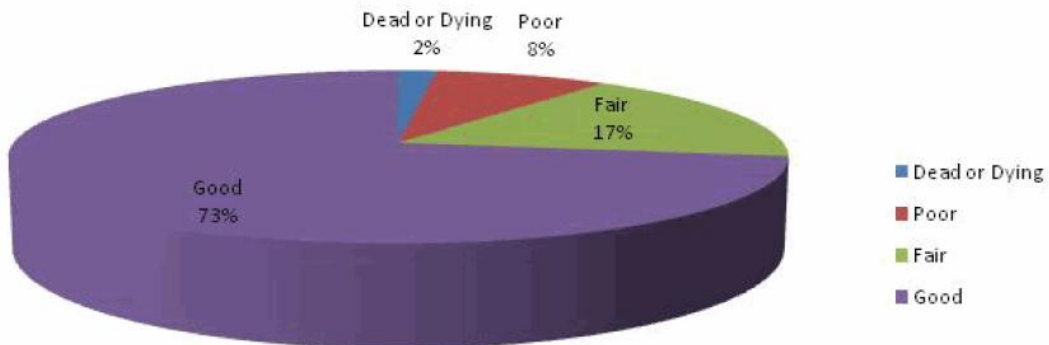
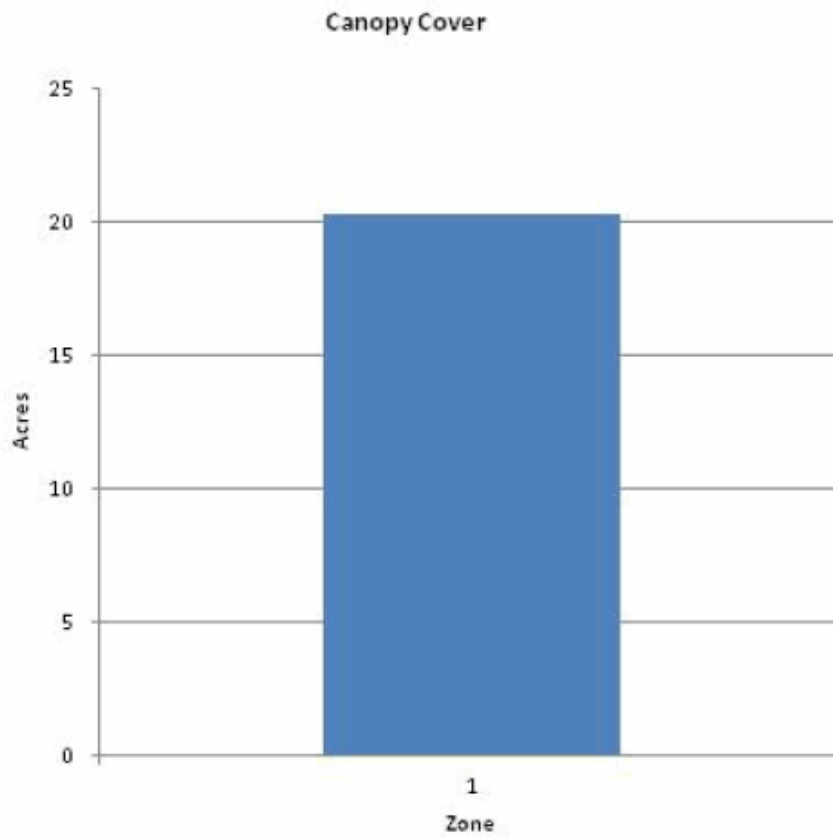


Figure 4: Wood Condition

**Lamoni**

**Canopy Cover of Public Trees (Acres)**

1/31/2013



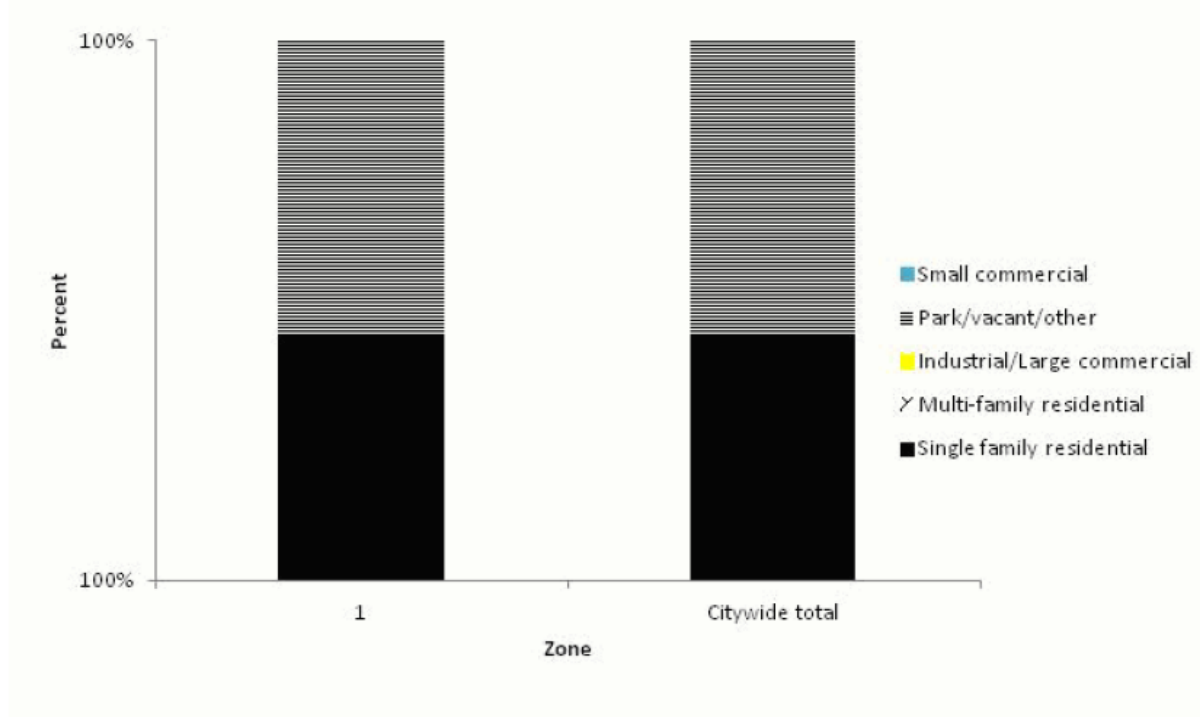
Zone	Acres	% of Total Canopy Cover
1	20	100.0
Citywide total	20	100.0

	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	20		

Figure 5: Canopy Cover in Acres

**Land Use of Public Trees by Zone (%)**

1/31/2013



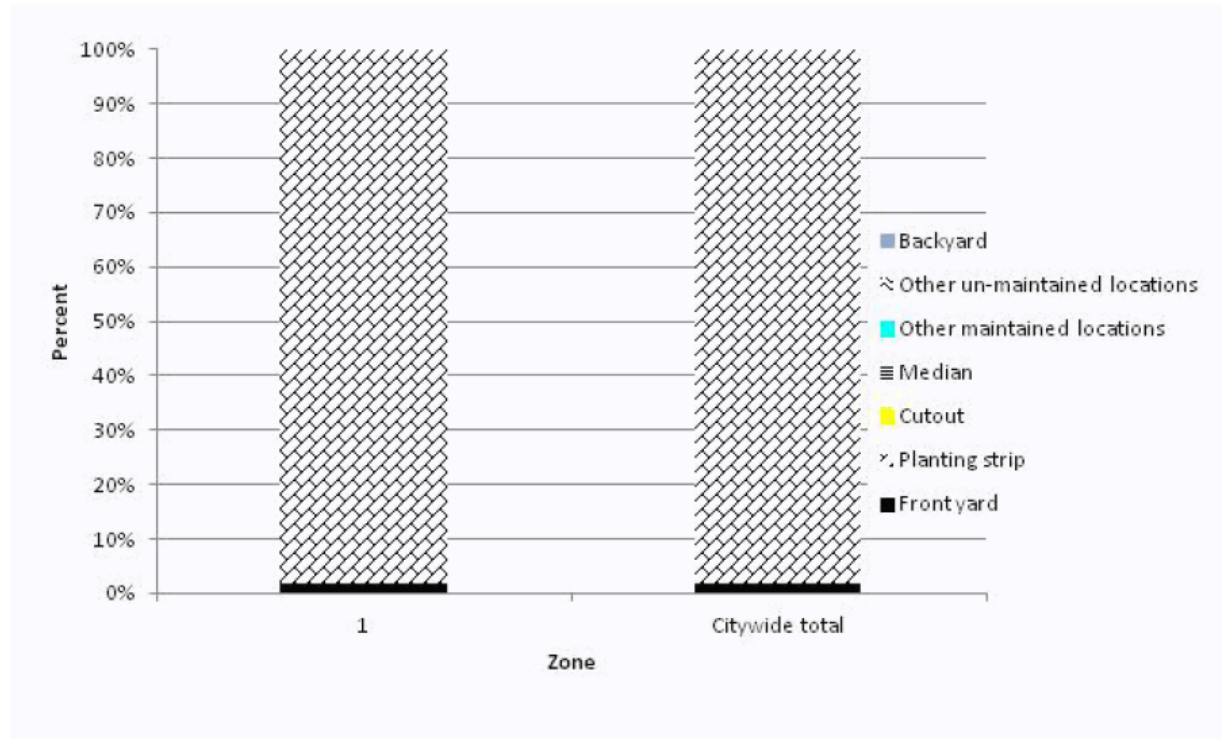
Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	99.9	0.0	0.0	0.1	0.0
Citywide total	99.9	0.0	0.0	0.1	0.0

Figure 6: Land Use of city/park trees

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**Location of Public Trees by Zone (%)**

1/31/2013



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	2.0	98.0	0.0	0.0	0.0	0.0	0.0
Citywide total	2.0	98.0	0.0	0.0	0.0	0.0	0.0

Figure 7: Location of city/park trees



## Appendix B: ArcGIS Mapping

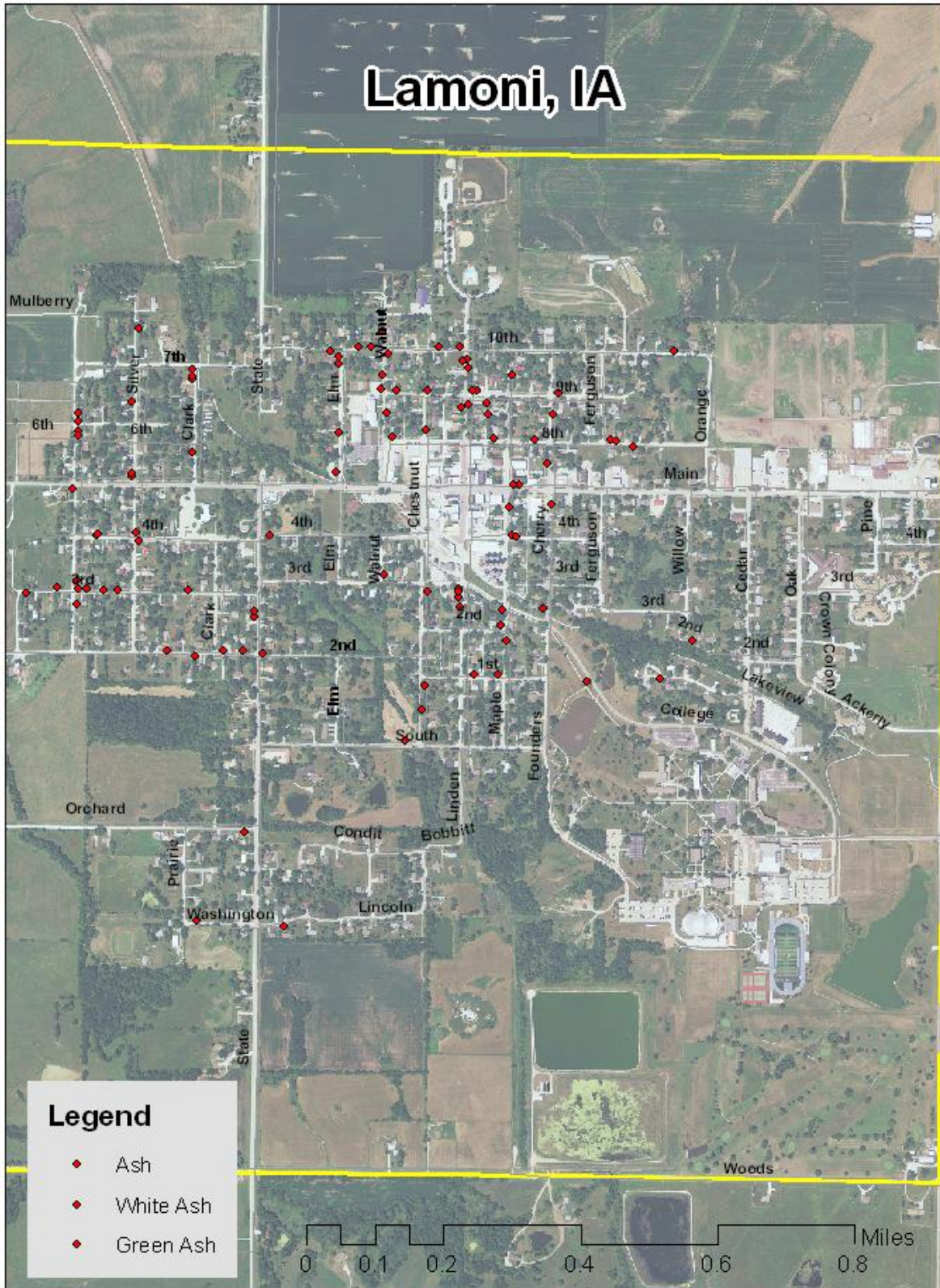


Figure 1: Location of Ash Trees



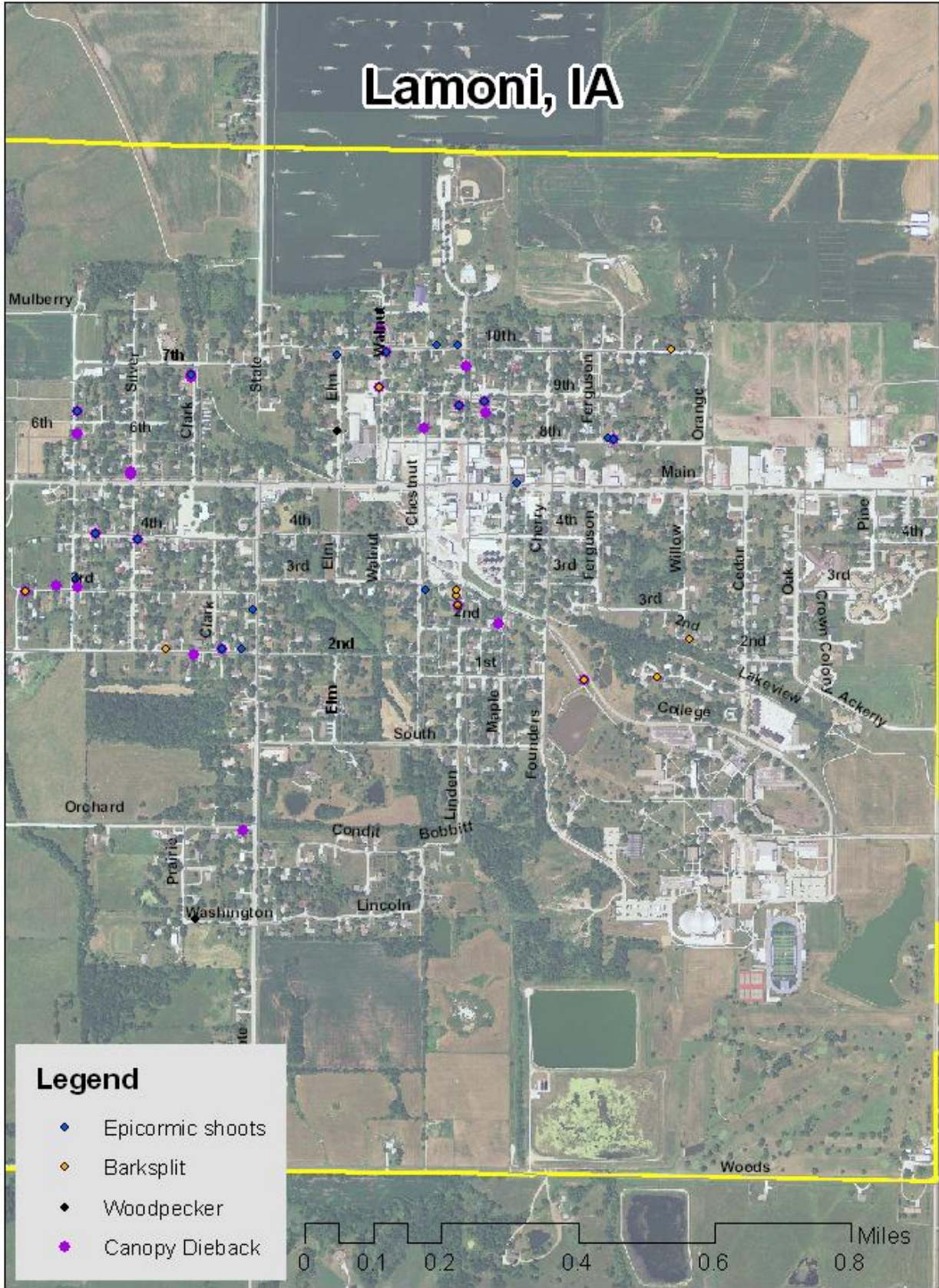


Figure 2: Location of EAB symptoms



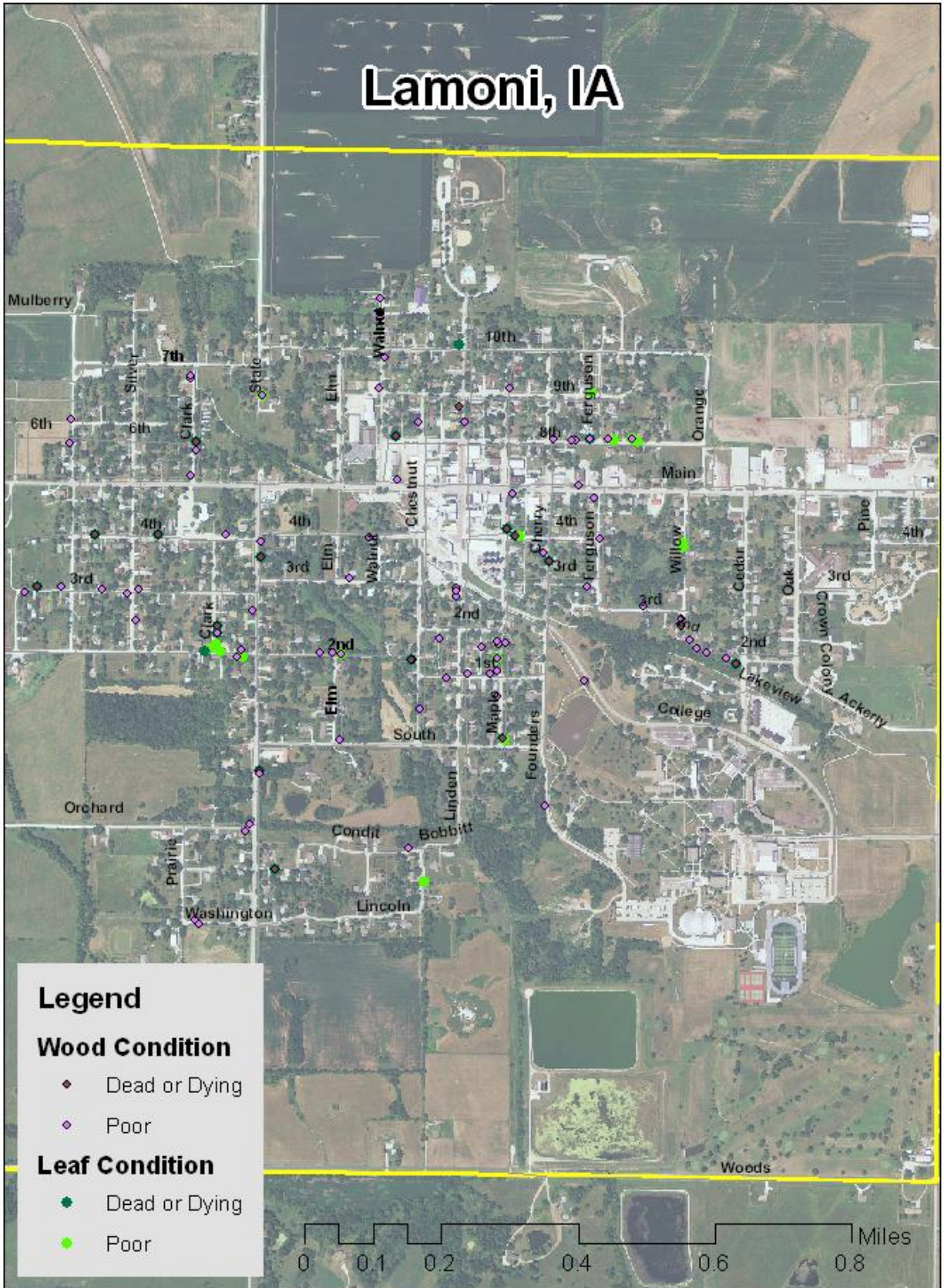


Figure 3: Location of Poor Condition Trees



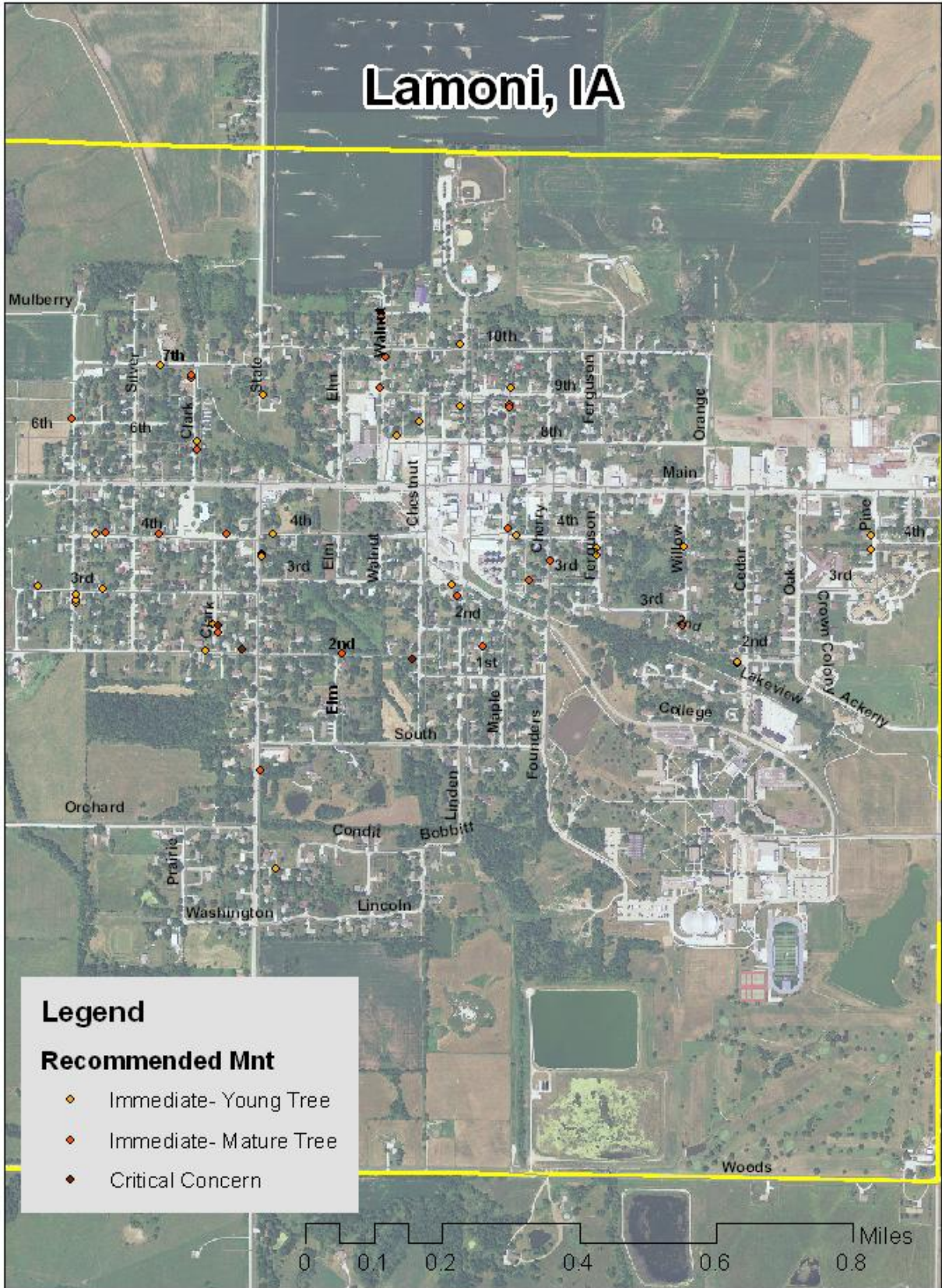


Figure 4: Location of Trees with Recommended Maintenance



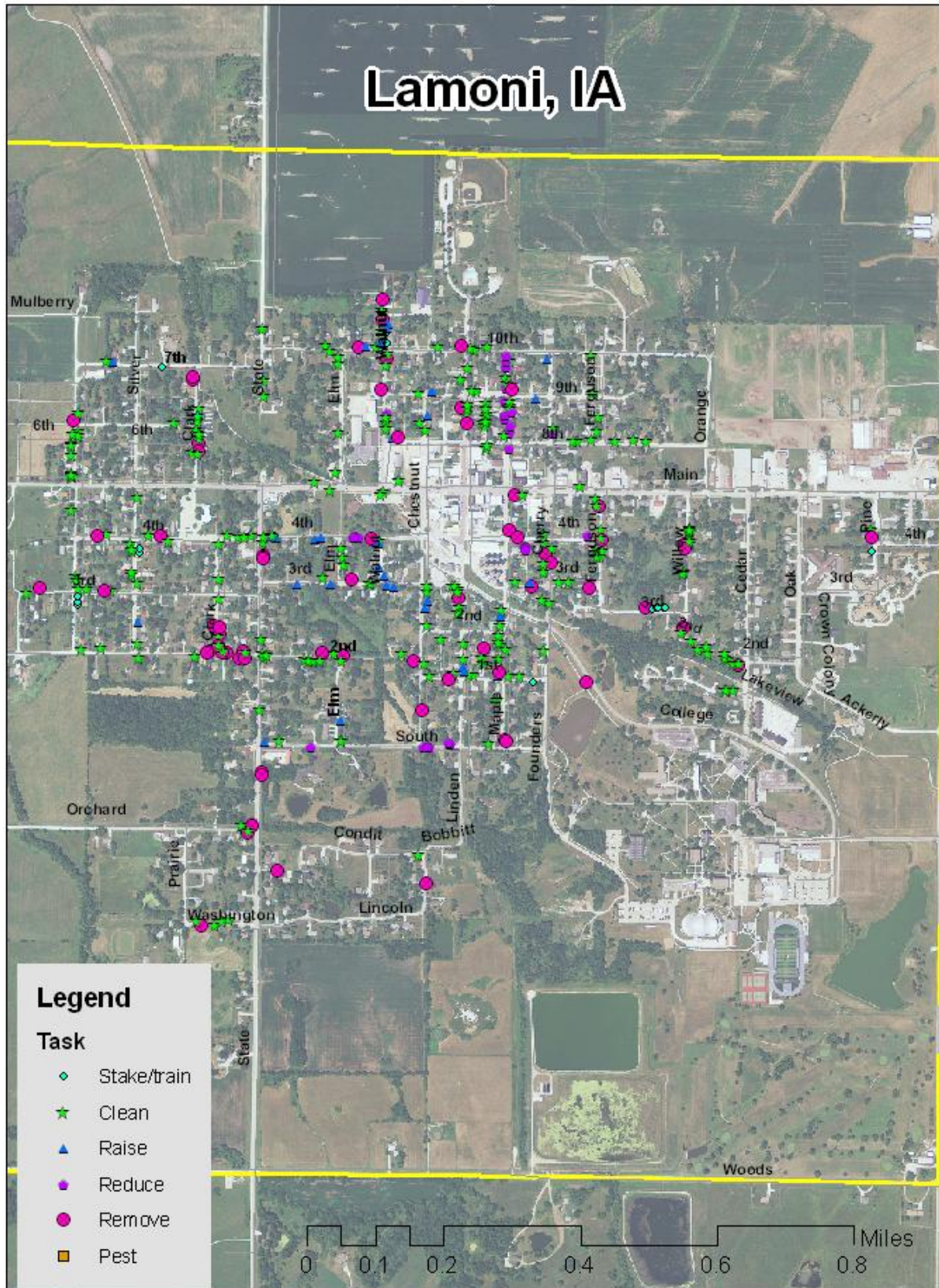


Figure 5: Maintenance Tasks \*City ownership of the trees recommended for removal should be verified prior to any removal\*

## Appendix C: Lamoni Tree Ordinances

**None provided by 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. 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 515-281-5918.