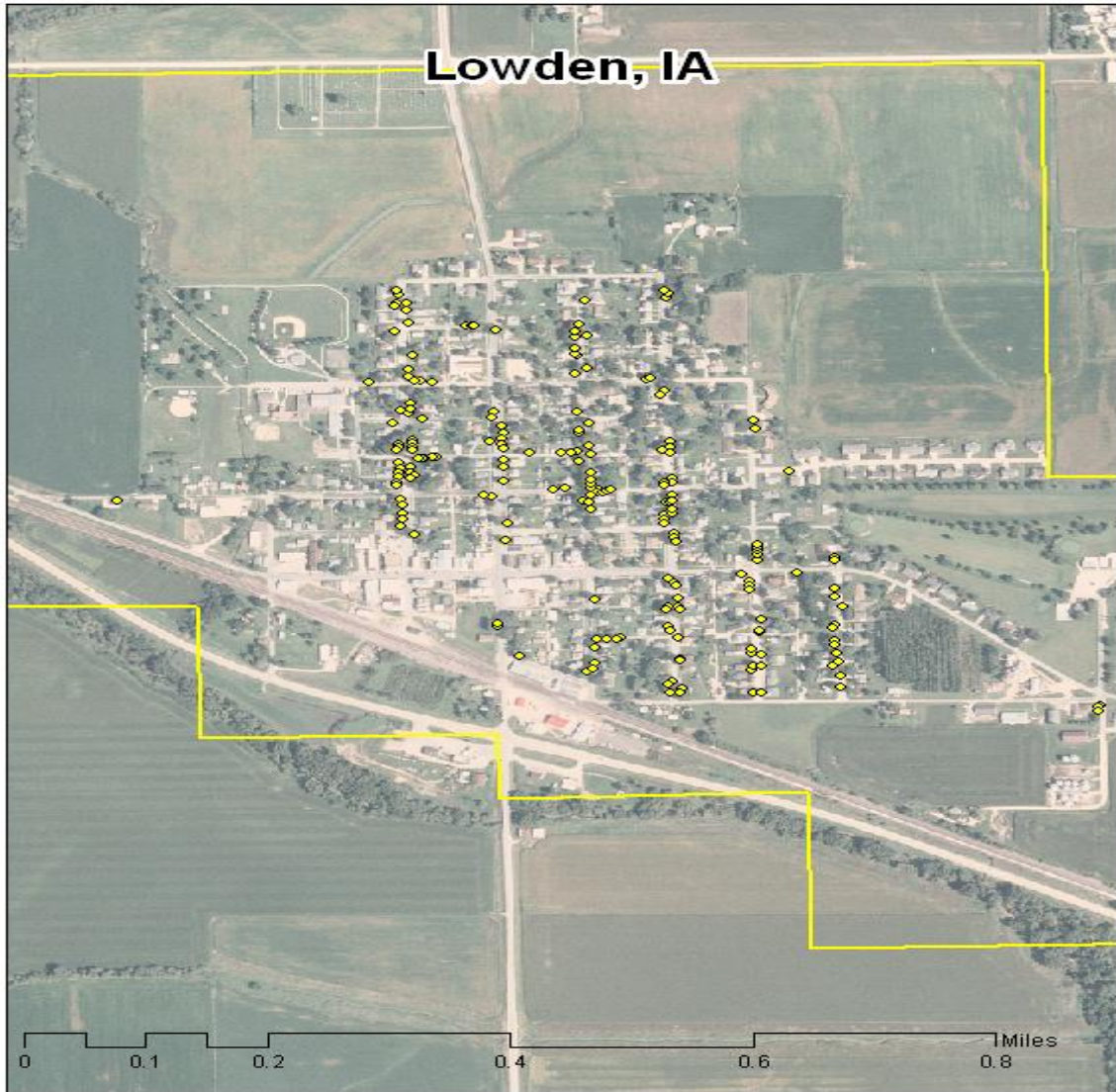


Lowden, IA



2010 Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Lowden 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 10.2% of Lowden'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 2010, 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 205 trees inventoried.

- Lowden's trees provide \$35,503 of benefits annually, an average of \$173 a tree
- There are over 27 species of trees
- The top three genus are: Norway Maple 17.6%, Hackberry 16.6%, and Sugar Maple 16.6%
- 22% of trees are in need of some type of management
- 8 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 8 trees needing removal, 2 trees are over 24 inches in diameter at 4.5 ft and should be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 9 of the 22 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB. The symptom is declining canopy, which may not be related to 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, Chinese elm, evergreen, willow, or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 9 or 10 years to remove ash – Suggestion: request a budget increase of \$1,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2010, 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, 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

The data collected for the 205 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. Lowden's trees reduce energy related costs by approximately \$9,873 annually (Appendix A, Table 1). These savings are both in Electricity (46.6 MWh) and in Natural Gas (6,468.3 Therms).

Annual Stormwater Benefits

Lowden's trees intercept about 473,287 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$12,827 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 Lowden, it is estimated that trees remove 595.4 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$1,680 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Lowden, trees sequester about 96,577 lbs of carbon a year with an associated yearly benefit of \$1,253 (Appendix A, Table 5). In addition, the trees store 1,566,814 lbs of carbon, with a total benefit of \$11,751 (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. Lowden receives \$9,870 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, Lowden's trees provide \$35,503 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 205 trees in Lowden provide approximately \$173 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Lowden has over 24 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Norway Maple	36	17.6%
Hackberry	34	16.6%
Sugar Maple	33	16.1%
Green Ash	21	10.2%
Silver Maple	18	8.8%
Red Maple	10	4.9%
Apple	8	3.9%
Callery Pear	6	2.9%
Pin Oak	5	2.4%
Siberian Elm	5	2.4%
Other species	29	14.2%

Age Class

Most of Lowden's trees (40%) 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. Lowden's size curve is slightly on the smaller side, showing a fairly large number of trees (13.7%) in the younger class (0-3" dbh).

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 Lowden indicate that 77% 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, 59% of Lowden'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 4% of the population. This 4% 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	24	12%
Crown Raising	2	1%
Tree Removal	8	4%
Crown Reduction	12	6%

Canopy Cover

The canopy cover of street trees in Lowden is approximately 5 acres (Appendix A, Figure 4). According to the 2000 census, Lowden occupies 646 acres. Thus the canopy cover on city land is about <1%.

Land Use and Location

The majority of Lowden'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%
Industrial/Large commercial	< 1%
Multifamily residential	<1%

Location

Front yard	98%
Back yard	2%

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

Lowden has an only 1 critical concern tree that was deemed to need immediate removal. This tree can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). Please refer to the six year maintenance plan at the end of this section. After the critical concern tree is addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are a total of 15 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 8 removals, 1 is an ash tree. There are a total of 22 ash trees, and 9 of those have signs and symptoms that have been associated with EAB. The symptom these ash are showing is canopy dieback, which might not be related to EAB. In addition, there are 12 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 Lowden.

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 (47%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut. All trees planted must meet the restrictions in city ordinance 12.16 (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: 4 largest critical concern trees

Planting and Replacement: 5 trees to be planted in open locations

Visual Survey for signs and symptoms of EAB

Year 2

Removal: 2 critical concern trees and 2 additional ash trees with poor health

Planting and Replacement: 5 trees in open locations from year one removals

Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 3 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 4 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 3 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 3 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 4 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 3 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 12 to 14 ash trees removed (approximately 60% of ash). It will take approximately 3 or 4 more years to remove all ash with the current budget. EAB could potentially kill all ash within 4 years of its arrival.

** To remove all ash trees within 6 years, the budget would need to be increased by \$1,000 a year.

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*](#)

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 quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed ash trees will be replaced. All trees will meet the restrictions in city ordinance 12.16 (Appendix C). The new plantings will be a diverse mix and should not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on 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. In the event that EAB does get to Lowden, it would be advisable that you have an addition to your City Code that states something to the effect of: "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

Current Budget

Total \$19,000 over 6 years (\$3,167/year)

FY 2011 Budget

Removal: \$2,400

Planting: \$500

Watering & Maintenance: \$500

FY 2012 Budget

Removal: \$2,400

Planting: \$500

Routine trimming: \$600

Watering & Maintenance: \$500

FY 2013 Budget

Removal: \$1,800

Planting: \$400

Watering & Maintenance: \$400

FY 2014 Budget

Removal: \$1,800

Planting: \$400

Routine trimming: \$600

Watering & Maintenance: \$400

FY 2015 Budget

Removal: \$1,800

Planting: \$400

Watering & Maintenance: \$400

FY 2016 Budget

Removal: \$1,800

Planting: \$400

Routine trimming: \$600

Watering & Maintenance: \$400

*Reduction of ash over 6 years: approximately 12 to 14 ash trees removed (approximately 60% of ash). **It will take approximately 10 years to remove all ash with the current budget.**

Purposed Budget Increase

EAB could potentially kill all ash trees in Lowden within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased by \$1,000 a year. Additionally, it is recommended that Lowden 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.

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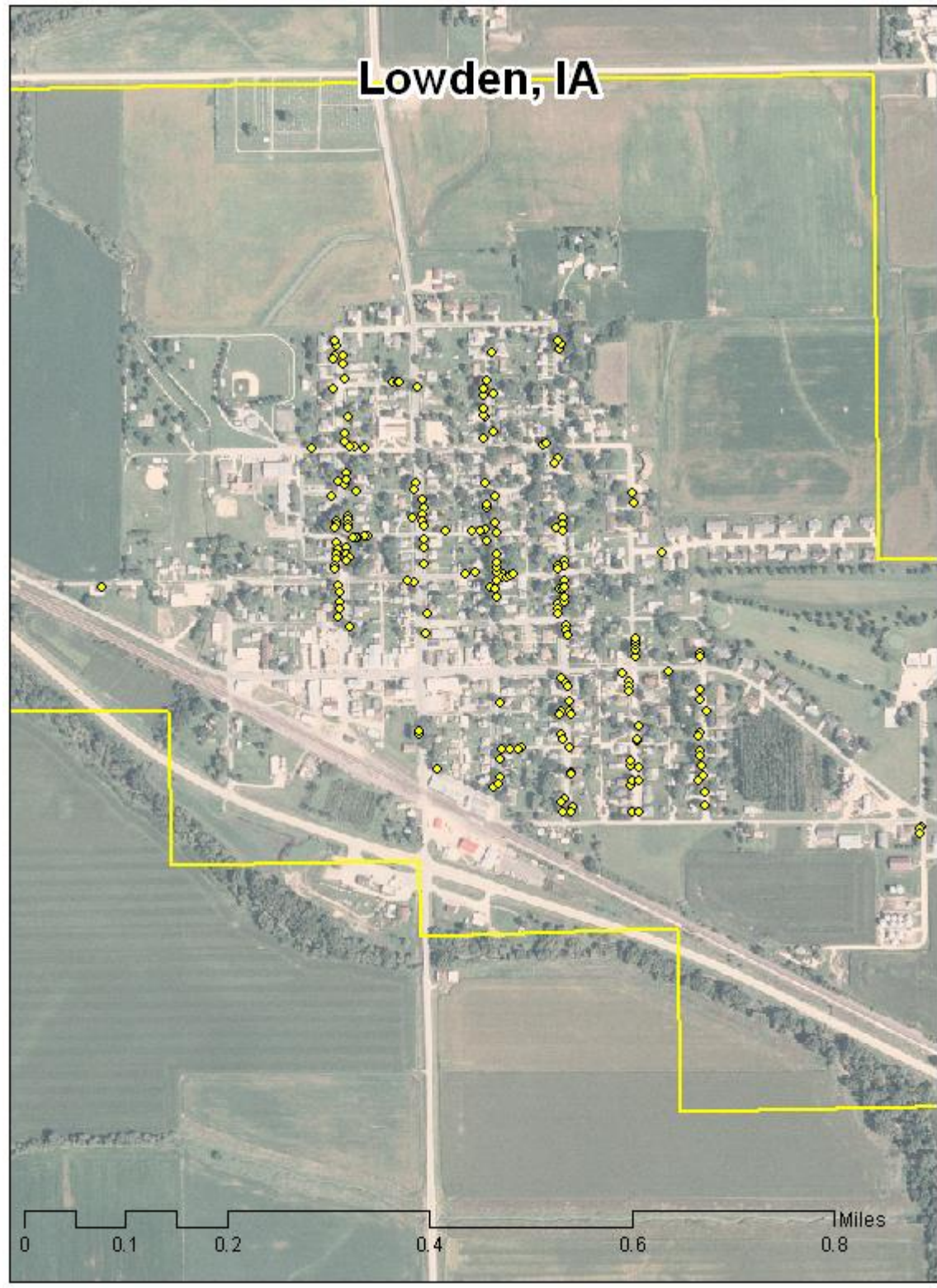
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Appendix A: i-Tree Data



Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

11/22/2010

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standar d Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway maple	8.2	626	1,186.9	1,163	1,789	(N/A)	17.6	18.1	49.69
Northern hackberry	12.0	907	1,693.0	1,659	2,566	(N/A)	16.6	26.0	75.48
Sugar maple	9.3	702	1,259.1	1,234	1,936	(N/A)	16.1	19.6	58.67
Green ash	4.2	316	571.3	560	875	(N/A)	10.2	8.9	41.69
Silver maple	4.9	368	629.6	617	985	(N/A)	8.8	10.0	54.74
Red maple	0.6	47	84.0	82	129	(N/A)	4.9	1.3	12.89
Apple	0.2	16	35.8	35	51	(N/A)	3.9	0.5	6.33
Callery pear	0.3	23	47.8	47	69	(N/A)	2.9	0.7	11.57
Pin oak	1.1	81	145.5	143	224	(N/A)	2.4	2.3	44.71
Siberian elm	1.1	84	149.7	147	231	(N/A)	2.4	2.3	46.15
Honeylocust	1.2	89	151.4	148	237	(N/A)	2.0	2.4	59.28
Northern pin oak	1.1	87	163.9	161	247	(N/A)	2.0	2.5	61.79
Blue spruce	0.1	7	14.6	14	21	(N/A)	1.5	0.2	6.94
American sycamore	1.0	79	147.4	144	224	(N/A)	1.5	2.3	74.61
American basswood	0.7	52	98.0	96	148	(N/A)	1.5	1.5	49.38
Other street trees	0.7	52	90.3	89	141	(N/A)	5.9	1.4	11.72
Citywide total	46.6	3,534	6,468.3	6,339	9,873	(N/A)	100.0	100.0	48.16

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

11/22/2010

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway maple	73,789	2,000	(N/A)	17.6	15.6	55.55
Northern hackberry	116,983	3,170	(N/A)	16.6	24.7	93.25
Sugar maple	97,591	2,645	(N/A)	16.1	20.6	80.15
Green ash	42,125	1,142	(N/A)	10.2	8.9	54.36
Silver maple	64,542	1,749	(N/A)	8.8	13.6	97.18
Red maple	3,550	96	(N/A)	4.9	0.8	9.62
Apple	696	19	(N/A)	3.9	0.2	2.36
Callery pear	1,399	38	(N/A)	2.9	0.3	6.32
Pin oak	12,148	329	(N/A)	2.4	2.6	65.85
Siberian elm	9,317	253	(N/A)	2.4	2.0	50.50
Honeylocust	8,924	242	(N/A)	2.0	1.9	60.46
Northern pin oak	11,416	309	(N/A)	2.0	2.4	77.35
Blue spruce	769	21	(N/A)	1.5	0.2	6.95
American sycamore	13,376	363	(N/A)	1.5	2.8	120.83
American basswood	9,897	268	(N/A)	1.5	2.1	89.41
Other street trees	6,764	183	(N/A)	5.9	1.4	15.28
Citywide total	473,287	12,827	(N/A)	100.0	100.0	62.57

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

11/22/2010

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total (\$)	Standard Error	% of Total Trees	Avg. \$/tree
	O ₃	NO ₂	PM ₁₀	SO ₂		NO ₂	PM ₁₀	VOC	SO ₂								
Norway maple	14.6	2.5	7.2	0.6	79	40.0	5.8	5.5	37.4	248	-3.5	-13	110.2	314 (N/A)	17.6	8.71	
Northern hackberry	18.4	3.2	9.3	0.8	100	57.7	8.4	8.0	54.2	358	0.0	0	159.9	458 (N/A)	16.6	13.47	
Sugar maple	12.4	2.1	6.3	0.6	68	44.1	6.4	6.1	41.9	275	-9.8	-37	110.1	305 (N/A)	16.1	9.26	
Green ash	4.8	0.8	2.4	0.2	26	19.9	2.9	2.8	18.8	124	0.0	0	52.4	149 (N/A)	10.2	7.11	
Silver maple	10.6	1.8	5.3	0.5	57	22.8	3.3	3.2	22.0	143	-5.7	-22	63.7	179 (N/A)	8.8	9.92	
Red maple	0.6	0.1	0.3	0.0	3	2.9	0.4	0.4	2.8	18	-0.2	-1	7.3	20 (N/A)	4.9	2.04	
Apple	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.5	7 (N/A)	3.9	0.87	
Callery pear	0.1	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	0.0	0	3.4	10 (N/A)	2.9	1.59	
Pin oak	2.1	0.4	1.1	0.1	12	5.1	0.7	0.7	4.8	32	-4.0	-15	11.1	29 (N/A)	2.4	5.71	
Siberian elm	1.2	0.2	0.6	0.1	6	5.3	0.8	0.7	5.0	33	0.0	0	13.8	39 (N/A)	2.4	7.85	
Honeylocust	1.6	0.3	0.8	0.1	9	5.5	0.8	0.8	5.3	34	-1.1	-4	14.0	39 (N/A)	2.0	9.76	
Northern pin oak	2.4	0.4	1.2	0.1	13	5.5	0.8	0.8	5.2	34	-0.6	-2	15.8	45 (N/A)	2.0	11.31	
Blue spruce	0.0	0.0	0.1	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.9	2 (N/A)	1.5	0.75	
American sycamore	1.8	0.3	0.8	0.1	9	5.0	0.7	0.7	4.7	31	0.0	0	14.2	41 (N/A)	1.5	13.55	
American basswood	1.6	0.3	0.7	0.1	8	3.3	0.5	0.5	3.1	21	-1.3	-5	8.7	24 (N/A)	1.5	8.05	
Other street trees	1.1	0.2	0.7	0.1	7	3.2	0.5	0.5	3.1	20	-2.0	-8	7.4	19 (N/A)	5.9	1.61	
Citywide total	73.4	12.5	36.9	3.3	399	223.2	32.4	30.9	211.1	1,388	-28.4	-106	595.4	1,680 (N/A)	100.0	8.20	

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

11/22/2010

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway maple	240,522	1,804	(N/A)	17.6	15.4	50.11
Northern	276,546	2,074	(N/A)	16.6	17.7	61.00
Sugar maple	352,391	2,643	(N/A)	16.1	22.5	80.09
Green ash	156,815	1,176	(N/A)	10.2	10.0	56.01
Silver maple	245,737	1,843	(N/A)	8.8	15.7	102.39
Red maple	7,027	53	(N/A)	4.9	0.5	5.27
Apple	2,227	17	(N/A)	3.9	0.1	2.09
Callery pear	2,193	16	(N/A)	2.9	0.1	2.74
Pin oak	55,455	416	(N/A)	2.4	3.5	83.18
Siberian elm	28,781	216	(N/A)	2.4	1.8	43.17
Honeylocust	19,560	147	(N/A)	2.0	1.3	36.67
Northern pin oak	40,130	301	(N/A)	2.0	2.6	75.24
Blue spruce	129	1	(N/A)	1.5	0.0	0.32
American	57,489	431	(N/A)	1.5	3.7	143.72
American	61,697	463	(N/A)	1.5	3.9	154.24
Other street trees	9,124	151	(N/A)	5.9	1.3	12.57
Citywide total	1,566,814	11,751	(N/A)	100.0	100.0	57.32

Table 5: Annual Carbon Sequestered

Annual CO₂ Benefits of Public Trees by Species

11/22/2010

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Norway maple	12,805	96	-1,155	-7	-9	13,828	104	25,471	191 (N/A)	17.6	15.2	5.31
Northern hackberry	15,298	115	-1,327	-7	-10	20,046	150	34,010	255 (N/A)	16.6	20.4	7.50
Sugar maple	19,855	149	-1,691	-6	-13	15,519	116	33,676	253 (N/A)	16.1	20.2	7.65
Green ash	9,695	73	-753	-4	-6	6,973	52	15,911	119 (N/A)	10.2	9.5	5.68
Silver maple	18,845	141	-1,180	-4	-9	8,140	61	25,802	194 (N/A)	8.8	15.4	10.75
Red maple	996	7	-34	-2	0	1,028	8	1,989	15 (N/A)	4.9	1.2	1.49
Apple	338	3	-11	-2	0	345	3	671	5 (N/A)	3.9	0.4	0.63
Callery pear	702	5	-11	-1	0	498	4	1,189	9 (N/A)	2.9	0.7	1.49
Pin oak	5,199	39	-266	-1	-2	1,790	13	6,722	50 (N/A)	2.4	4.0	10.08
Siberian elm	1,938	15	-138	-1	-1	1,857	14	3,657	27 (N/A)	2.4	2.2	5.48
Honeylocust	2,821	21	-94	-1	-1	1,962	15	4,689	35 (N/A)	2.0	2.8	8.79
Northern pin oak	1,226	9	-193	-1	-1	1,912	14	2,945	22 (N/A)	2.0	1.8	5.52
Blue spruce	36	0	-1	-1	0	145	1	180	1 (N/A)	1.5	0.1	0.45
American sycamore	2,673	20	-276	-1	-2	1,755	13	4,151	31 (N/A)	1.5	2.5	10.38
American basswood	3,174	24	-296	-1	-2	1,151	9	4,028	30 (N/A)	1.5	2.4	10.07
Other street trees	973	7	-97	-2	-1	1,152	9	2,027	15 (N/A)	5.9	1.2	1.27
Citywide total	96,577	724	-7,521	-40	-57	78,102	586	167,118	1,253 (N/A)	100.0	100.0	6.11

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

11/22/2010

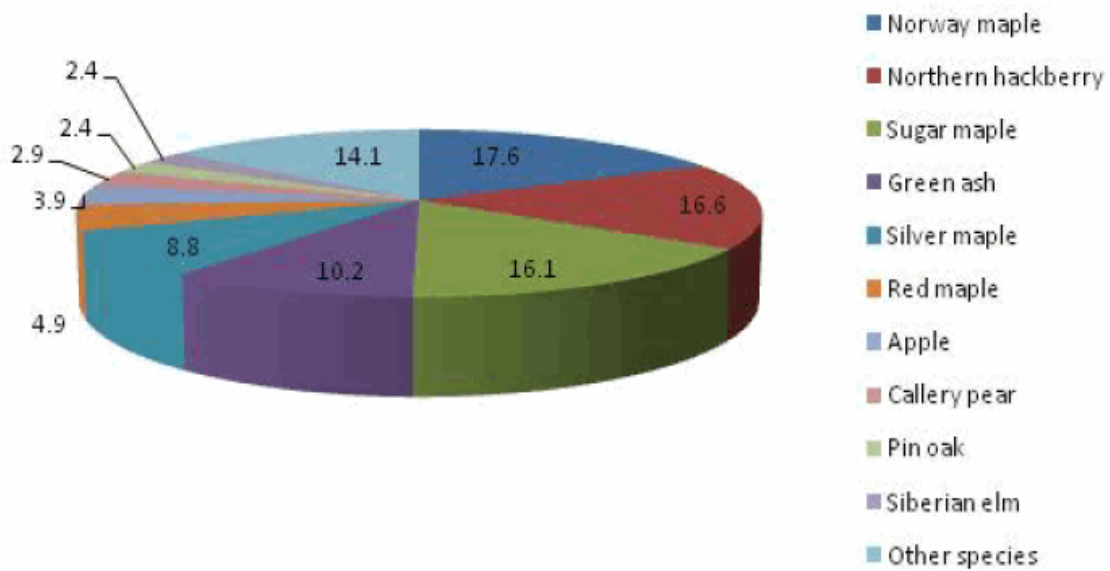
Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway maple	1,224	(N/A)	17.6	12.4	34.00
Northern hackberry	2,001	(N/A)	16.6	20.3	58.86
Sugar maple	2,118	(N/A)	16.1	21.5	64.18
Green ash	898	(N/A)	10.2	9.1	42.75
Silver maple	1,528	(N/A)	8.8	15.5	84.87
Red maple	156	(N/A)	4.9	1.6	15.56
Apple	17	(N/A)	3.9	0.2	2.13
Callery pear	91	(N/A)	2.9	0.9	15.11
Pin oak	391	(N/A)	2.4	4.0	78.26
Siberian elm	169	(N/A)	2.4	1.7	33.86
Honeylocust	595	(N/A)	2.0	6.0	148.65
Northern pin oak	114	(N/A)	2.0	1.2	28.42
Blue spruce	37	(N/A)	1.5	0.4	12.31
American sycamore	198	(N/A)	1.5	2.0	65.93
American basswood	203	(N/A)	1.5	2.1	67.51
Other street trees	131	(N/A)	5.9	1.3	10.94
Citywide total	9,870	(N/A)	100.0	100.0	48.14

Table 7: Summary of Benefits in Dollars

Total Annual Benefits of Public Trees by Species (\$)							
11/22/20							
Species	Energy	CO ₂	Air Quality	Stomwater	Aesthetic/Other	Total Standard (\$) Error	% of Total \$
Norway maple	1,789	191	314	2,000	1,224	5,518 (±0)	15.5
Northern hackberry	2,566	255	458	3,170	2,001	8,451 (±0)	23.8
Sugar maple	1,936	253	305	2,645	2,118	7,257 (±0)	20.4
Green ash	875	119	149	1,142	898	3,183 (±0)	9.0
Silver maple	985	194	179	1,749	1,528	4,634 (±0)	13.1
Red maple	129	15	20	96	156	416 (±0)	1.2
Apple	51	5	7	19	17	99 (±0)	0.3
Callery pear	69	9	10	38	91	216 (±0)	0.6
Pin oak	224	50	29	329	391	1,023 (±0)	2.9
Siberian elm	231	27	39	253	169	719 (±0)	2.0
Honeylocust	237	35	39	242	595	1,148 (±0)	3.2
Northern pin oak	247	22	45	309	114	738 (±0)	2.1
Blue spruce	21	1	2	21	37	82 (±0)	0.2
American sycamore	224	31	41	363	198	856 (±0)	2.4
American basswood	148	30	24	268	203	673 (±0)	1.9
Other street trees	141	15	19	183	131	490 (±0)	1.4
Citywide Total	9,873	1,253	1,680	12,827	9,870	35,503 (±0)	100.0

Species Distribution of Public Trees (%)

11/22/2010

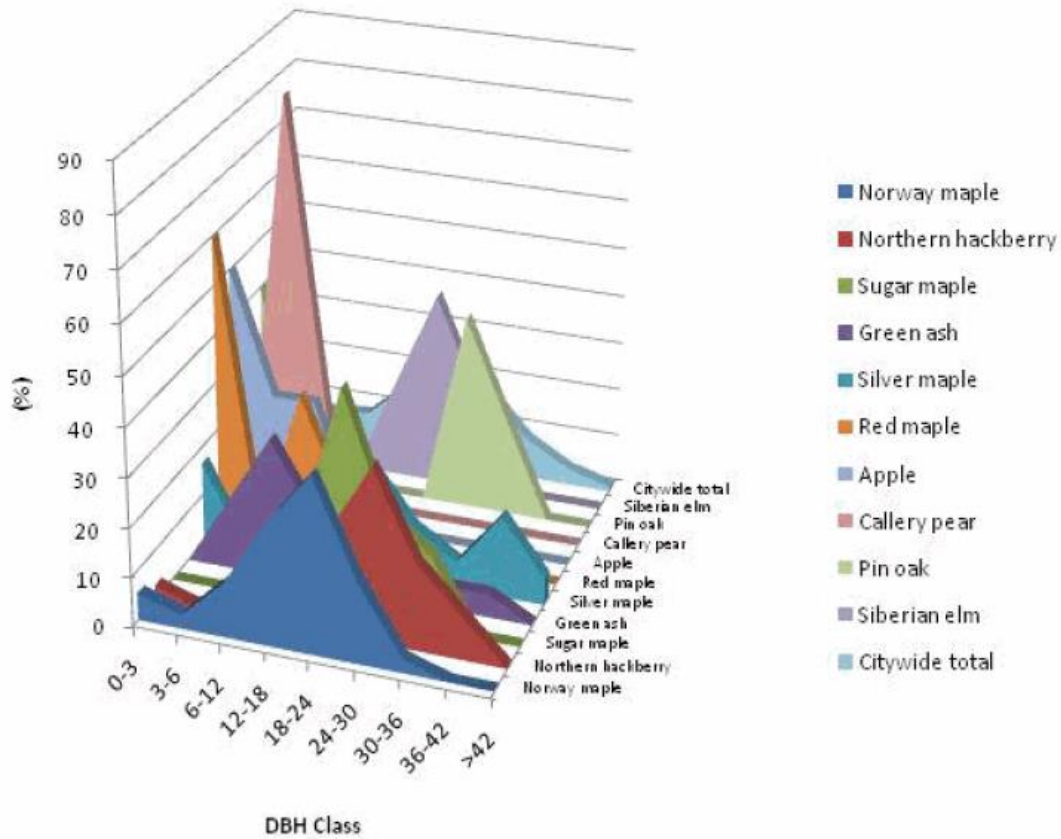


Species	Percent
Norway maple	17.6
Northern hackberry	16.6
Sugar maple	16.1
Green ash	10.2
Silver maple	8.8
Red maple	4.9
Apple	3.9
Callery pear	2.9
Pin oak	2.4
Siberian elm	2.4
Other species	14.1
Total	100.0

Figure 1: Species Distribution

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

11/22/2010



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	5.6	2.8	11.1	25.0	36.1	16.7	2.8	0.0	0.0
Northern hackberry	2.9	0.0	0.0	14.7	20.6	35.3	17.6	8.8	0.0
Sugar maple	0.0	0.0	3.0	15.2	45.5	21.2	15.2	0.0	0.0
Green ash	0.0	14.3	28.6	14.3	23.8	9.5	4.8	4.8	0.0
Silver maple	16.7	0.0	0.0	22.2	22.2	11.1	5.6	16.7	5.6
Red maple	60.0	0.0	30.0	10.0	0.0	0.0	0.0	0.0	0.0
Apple	50.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0
Callery pear	0.0	83.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Pin oak	40.0	0.0	0.0	0.0	0.0	40.0	20.0	0.0	0.0
Siberian elm	20.0	0.0	0.0	20.0	40.0	20.0	0.0	0.0	0.0
Citywide total	13.7	7.3	8.3	16.1	24.4	17.6	8.3	3.4	1.0

Figure 2: Relative Age Class

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

11/22/2010

Citywide total

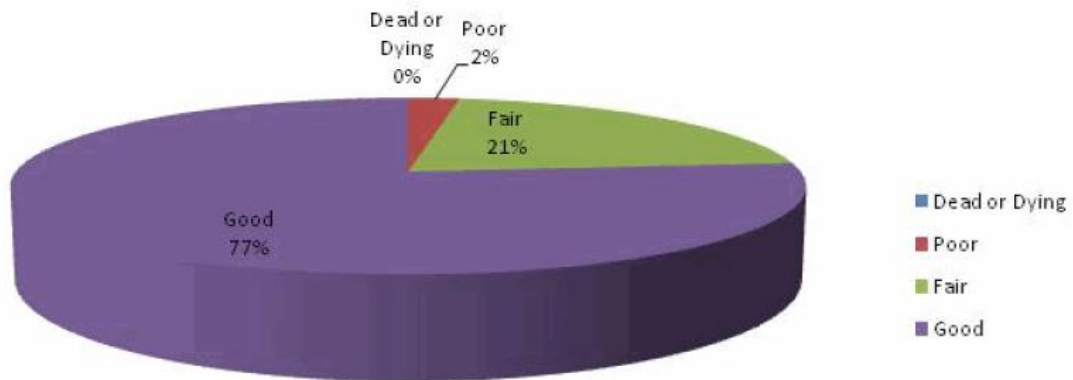


Figure 3: Foliage Condition

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

11/22/2010

Citywide total

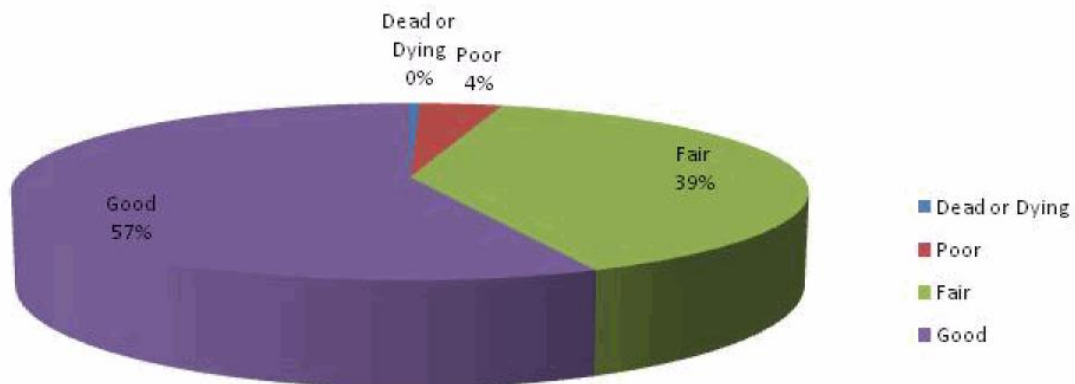
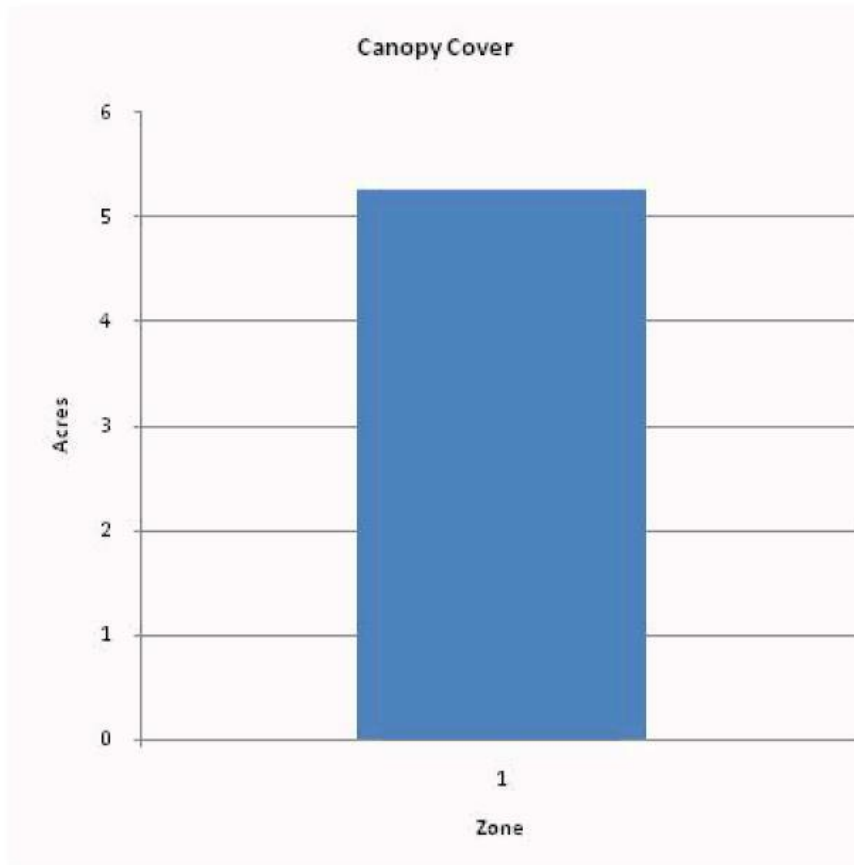


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

11/22/2010



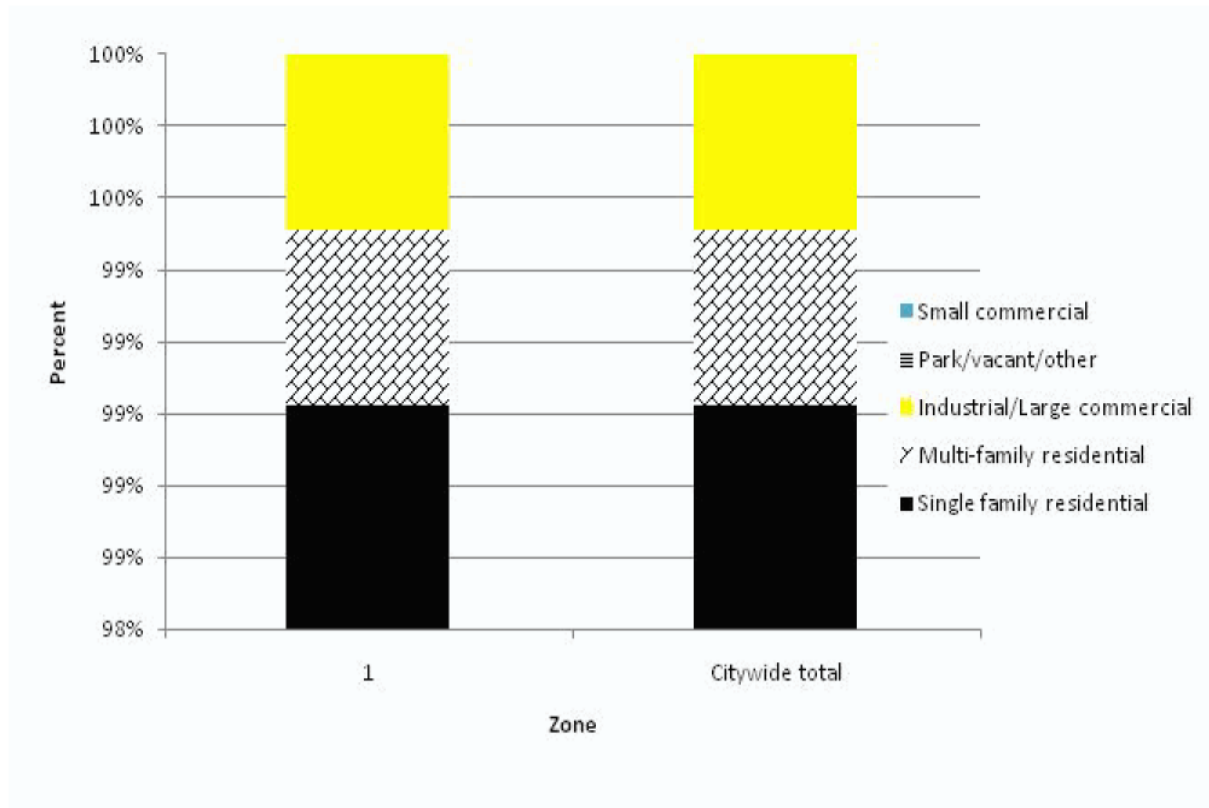
Zone	Acres	% of Total Canopy Cover
1	5	100.0
Citywide total	5	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	646		5		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

11/22/2010

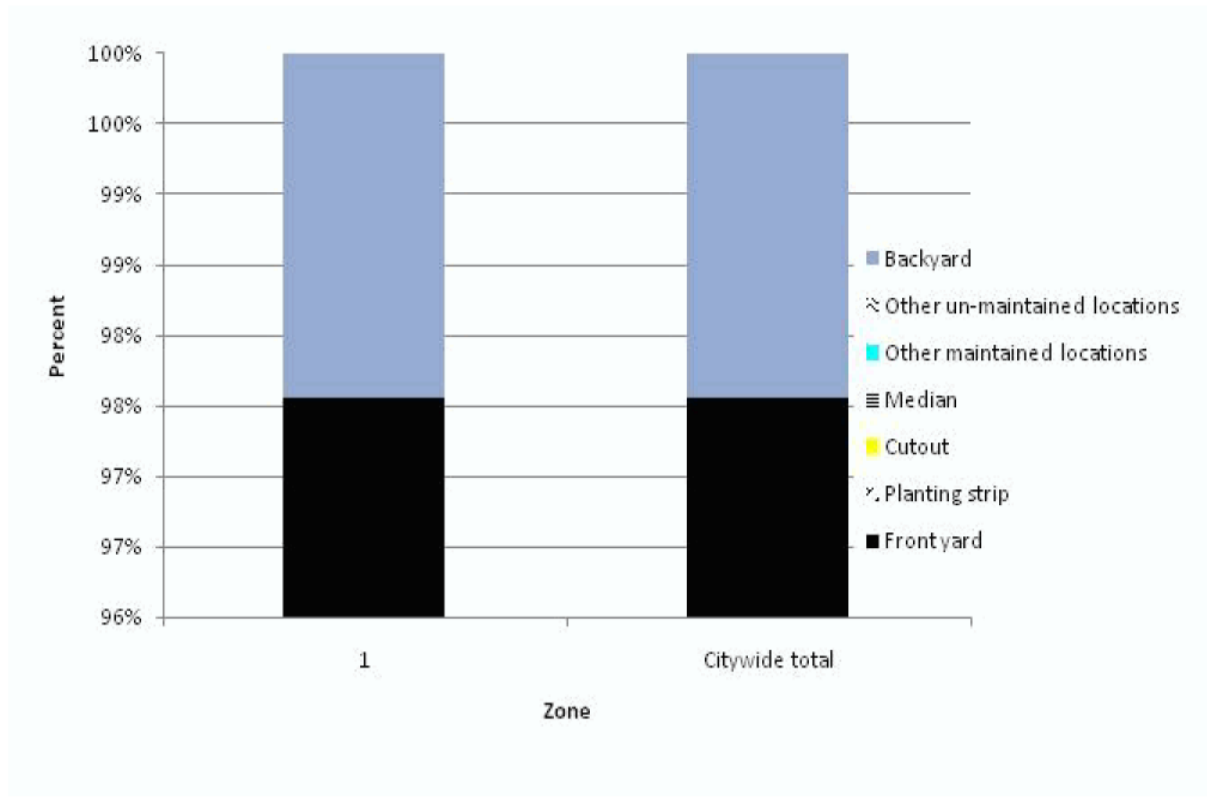


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	99.0	0.5	0.5	0.0	0.0
Citywide total	99.0	0.5	0.5	0.0	0.0

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

11/22/2010



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	97.6	0.0	0.0	0.0	0.0	0.0	2.4
Citywide total	97.6	0.0	0.0	0.0	0.0	0.0	2.4

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

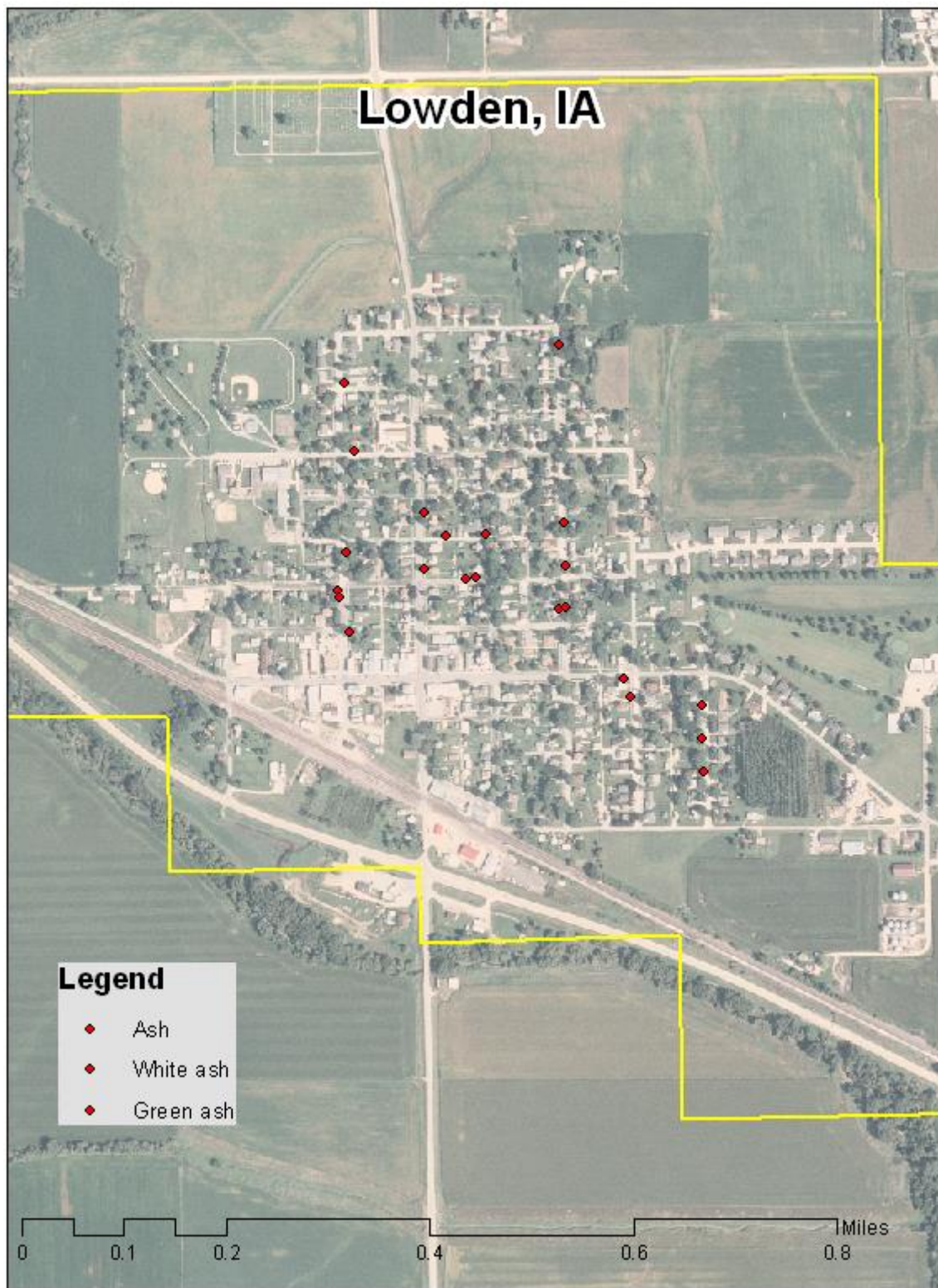


Figure 1: Location of Ash Trees



Figure 2: Location of EAB symptoms

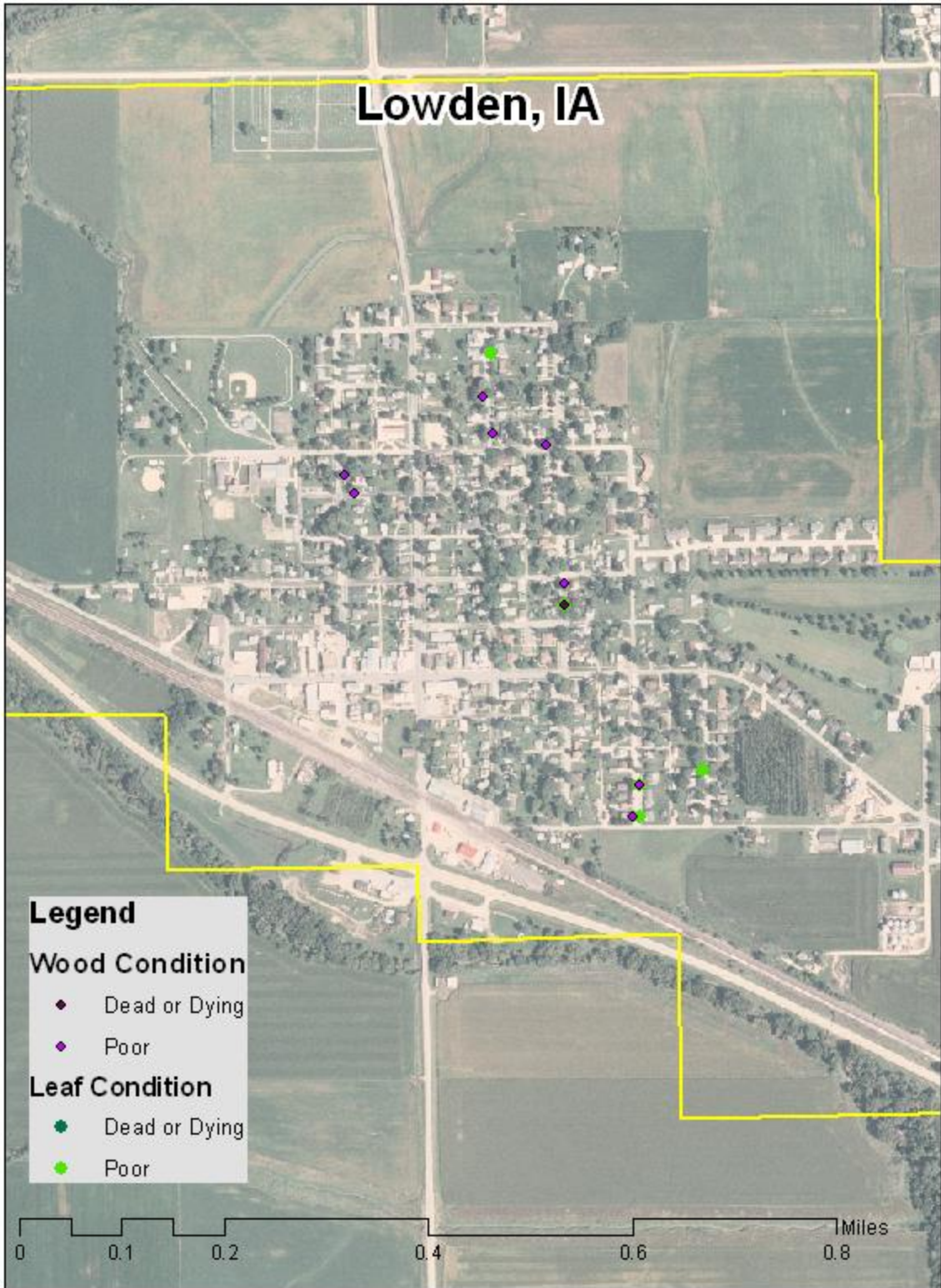


Figure 3: Location of Poor Condition Trees



Figure 4: Location of Trees with Recommended Maintenance

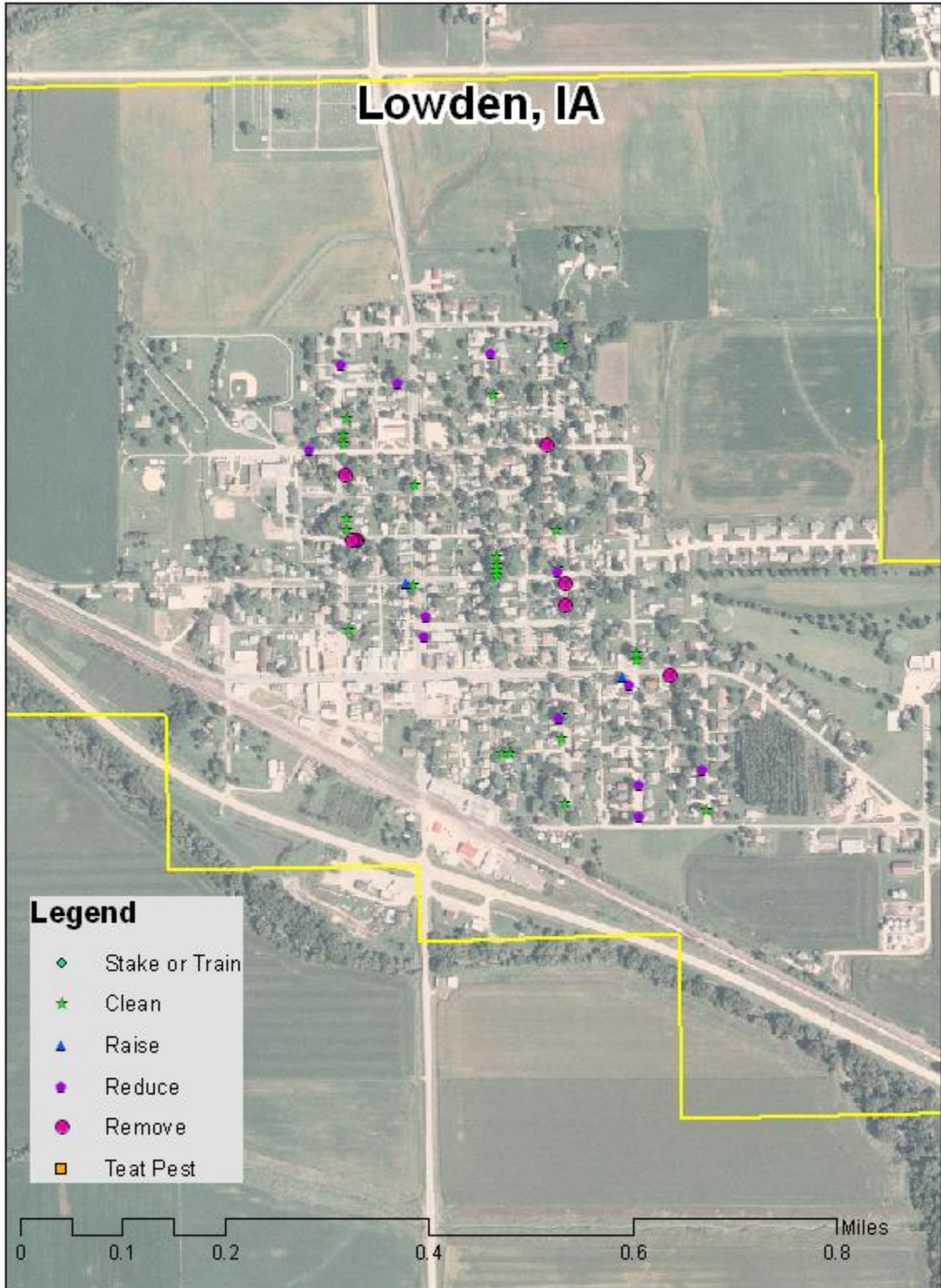


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Lowden Tree Ordinances

Chapter 12.16

STREET TREES

Sections:

- 12.16.010 Where planted--Removal when.
- 12.16.020 Trimming or cutting.

12.16.010 Where planted--Removal when. All trees hereafter planted in any street, avenue or highway shall be planted midway between the outer line of the sidewalk and the curb, where the curblineline is established, and where the curblineline is not established, on a line seven feet from the property line. All trees planted as of or after May 5, 1922 in any street, avenue or highway that interfere with the making of any improvements thereon, or with travel, or become dangerous, shall be removed, by order by the council, and any tree planted in any street, avenue or highway shall be planted upon such condition and subject to such removal. (Ord. 600 §1, 1922).

12.16.020 Trimming or cutting. It is unlawful to trim or cut in any manner any tree in any street, avenue, highway or public place unless such trimming or cutting is done under the personal supervision of the superintendent of public works or his representative, except that the owner, agent or occupant of any lot or parcel of land should keep the trees on and adjoining his property in the street, avenue or highway so trimmed that the overhanging branches are at least ten feet above the surface of the sidewalk or surface of the street and in all cases all trees shall be trimmed as high as the size and the shape of the tree will permit. (Ord. 601 §3, 1968: Ord. 600 §2, 1922).

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