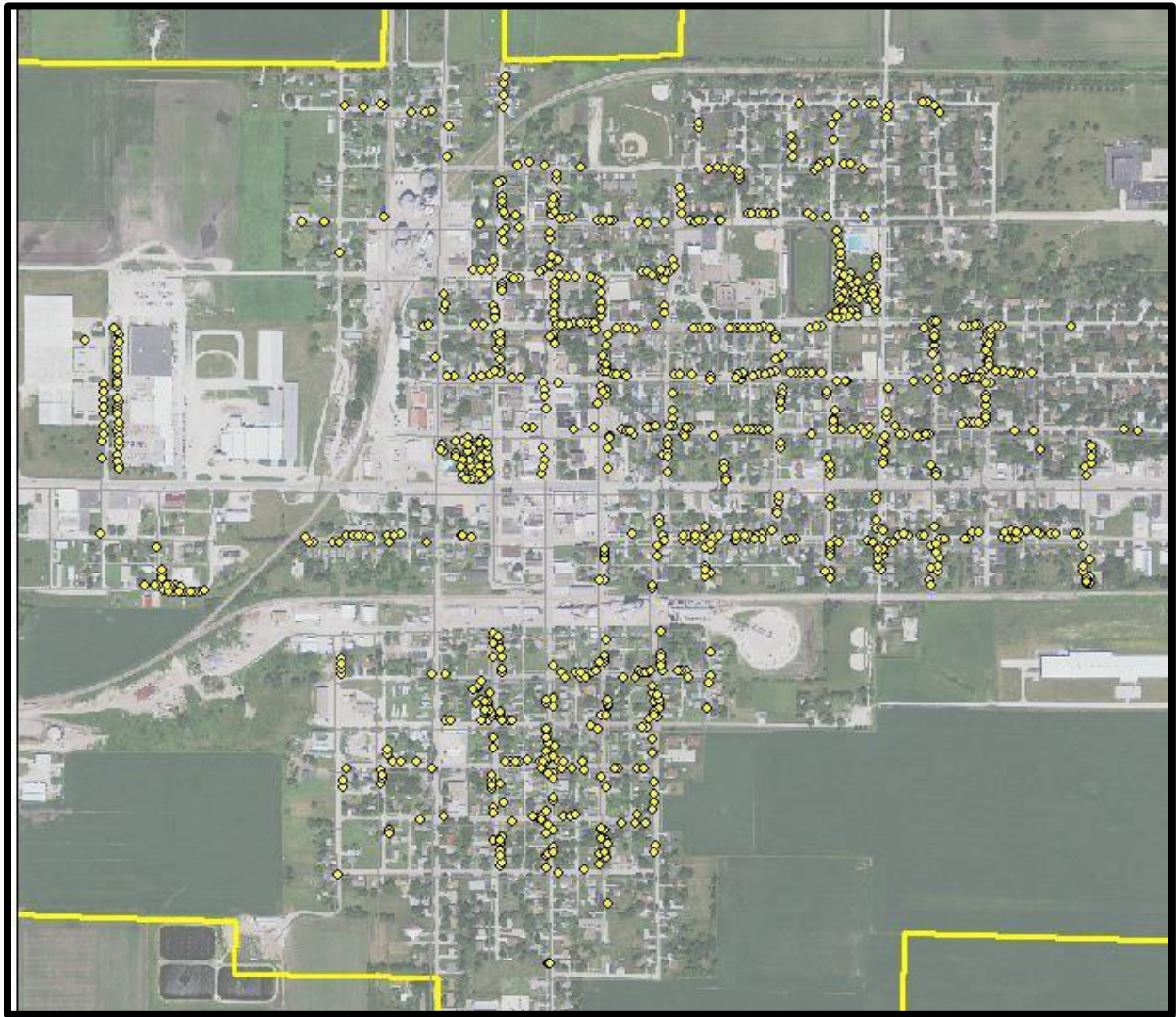


Community Tree Management Plan For Clarion, IA



Prepared by the Iowa DNR
Bureau of Forestry
2013



Table of Contents

Executive Summary	3
Overview.....	3
Inventory and Results.....	3
Recommendations	3
Introduction	4
Inventory Results.....	5
<i>Annual Benefits</i>	5
Annual Energy Benefits	5
Annual Stormwater Benefits	5
Annual Air Quality Benefits	5
Annual Carbon Benefits.....	5
Annual Aesthetics Benefits	5
Financial Summary of all Benefits	5
<i>Forest Structure</i>	6
Species Distribution	6
Size Class	6
Condition: Wood and Foliage	6
Canopy Cover.....	6
Land Use and Location.....	7
Management Needs	7
Recommendations.....	7
Risk Management.....	7
Pruning Cycle.....	7
Planting	8
Continual Monitoring	8
Proposed Work Schedule & Estimated Costs	8
Plan Prepared by	10
Works Cited	10
Appendix A: i-Tree Data.....	12
Appendix B: ArcGIS Mapping.....	22
Appendix C: Proposed Emerald Ash Borer	27
Ash Tree Removal.....	27
EAB Quarantines.....	27
Wood Disposal	27
Canopy Replacement.....	27
Postponed Work.....	28
Monitoring.....	28
Private Ash Trees	28

Executive Summary

Overview

This plan was developed to assist the City of Clarion with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management of this resource is critical to fully reaping these rewards. 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 (*Fraxinus spp.*). There is a strong possibility that 27% of Clarion's city-owned tree population (255 ash trees) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be spread out over time, mitigating the financial burden as well as public safety issues.

Inventory and Results

In June 2012, 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 954 trees inventoried.

- Clarion's trees provide \$159,372 of benefits annually, at an average of \$167 a tree
- There are at least 41 different species of trees in Clarion
- The top three genus are: Maple 40%, Ash 27%, and Hackberry 6%
- 25% of trees are in need of some type of maintenance (trimming, removal, etc.):
 - 14 trees are recommended for removal; some of these are critical concerns while others can be considered routine over the next 6 years
 - 222 trees need attention in the form of trimming or staking

Recommendations

The core recommendations are detailed in the *Recommendations* section. Some key ones include:

- Address the 14 trees recommended for removal according to their priority level: 1 is a "critical concern" tree which needs to be addressed immediately; 4 should be removed in the next 1-3 years; and 9 sometime in the next 6 years **City ownership of the trees recommended for removal should be verified prior to any removal**
- Schedule routine maintenance (trimming, etc.) for the 236 trees identified by the inventory
- Begin regularly monitoring 10 ash trees identified as displaying signs or symptoms associated with EAB
- Begin replacing trees in poor health and planting new ones with a diverse mix of species (other than maples & ash) that will buffer against major pests

Introduction

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

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

Inventory

In June 2012, a tree inventory was conducted that included all city-owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms 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 954 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. Clarion's trees reduce energy related costs by approximately \$44,829 annually (Appendix A, Table 1). These savings are both in Electricity (211 MWh) and in Natural Gas (29,392 Therms).

Annual Stormwater Benefits

Clarion's trees intercept about 1,912,375 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides \$51,829 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 Clarion, it is estimated that trees remove 2,648 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 \$7,451 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Clarion, trees sequester about 447,905 lbs of carbon a year with an associated value of \$3,359 (Appendix A, Table 5). In addition, the trees store 5,673,793 lbs of carbon, with a yearly benefit of \$42,553 (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. Clarion receives \$49,453 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, Clarion's trees provide \$159,372 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 954 trees in Clarion provide approximately \$167 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Clarion has over 41 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	382	40%
Ash	255	27%
Hackberry	62	6%
Linden	58	6%
Walnut	42	4%
Honeylocust	38	4%
Oak	18	2%
Blue spruce	15	2%
Crabapple	15	2%
Ginkgo	12	1%
All others	<10	<1%

Size Class

Most of Clarion’s trees (75%) are over 12 inches in diameter at 4.5 ft (Appendix A, Figure 2). This indicates an imbalance in the city’s tree population and suggests that as the larger, older trees decline and are removed, there is a lack of younger trees being planted to replace them. Having too many large trees and too few young ones increases the risk for catastrophic storm damage and a long “lag period” following major damage.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The results for Clarion indicate that 96% of the trees are in either good or fair health, while 4% of the trees have either foliage or structural wood in poor health or are considered dead or dying (Appendix A, Figures 3 & 4 and Appendix B, Figure 3).

The 6% of trees in poor health represent opportunity costs to the city where time and space are being sacrificed. Trees with poor trunks or tops should be promptly removed and replaced with new, healthy trees to diversify and improve the overall health and resiliency of Clarion’s urban tree population.

Canopy Cover

The amount of tree canopy cover over Clarion is approximately 22 acres (Appendix A, Figure 5). According to the U.S. Census, Clarion occupies 2,086 acres of land. Thus the canopy cover on city land is about 1%.

Land Use and Location

The majority of Clarion’s city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figures 6 & 7).

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, Figures 4 & 5).

Crown Cleaning	212	22%
Tree Removal	14	1%
Crown Reduction	7	<1%
Tree Staking/Training	3	<1%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist’s vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

Hazardous trees

Clarion has 1 critical concern tree that needs immediate removal and 4 more that should be removed within the next 3 years. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). After those are addressed, there should be follow up on the trees marked as needing removal but which are not considered critical concern. There are a total of 9 trees with these needs.

Poor condition trees

After the removal & replacement of the trees mentioned above, trees showing poor leaf or wood health should be scheduled for routine replacement (Appendix B, Figures 3 & 4), especially ash and maple trees that are in poor health. There were 38 individual trees identified in poor condition. ***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 there are three categories of maintenance issues identified in addition to tree removals: crown cleaning, staking/training, and crown reduction. Crown cleaning removes dead, diseased, and broken limbs. Staking/training is for recently planted young trees that need to be staked, pruned, or shaped for proper architecture to

prevent problems later on. Crown reduction is removing individual limbs to avoid interference with structures or utility wires.

A total of 222 trees were identified as needing one or more of these maintenance activities in the next 6 years. Beyond that, it is generally recommended that all trees be pruned on a routine schedule every five to ten years. Please refer to the six year maintenance plan for further information.

Planting

Theoretically, the City should be planting (and removing) about 7-12 trees per year in order to maintain the current size of Clarion's tree population and to spread the trees equally out among different ages (size classes). This assumes the typical lifespan of a tree in Clarion to be 80-140 years; if the trees are not living that long, the target will be higher (15-20 trees/yr). Most of the planting over the next 10-15 years can be done to replace the trees that are removed. 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 Clarion.

It is important to plant a diverse mix of differing species in the urban forest to maintain canopy health, since most insects and diseases target a single genus of trees (e.g., ash, maple, oak). Current diversity recommendations advise that a single genus not make up more than 20% of the urban forest and a single species (e.g. 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 the genus Maple, at 40% (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 for various reasons include: cottonwood, poplar, boxelder, Chinese elm, evergreens, willow, or black walnut, and any others identified in the City Code referring to trees.

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 couple of years 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.

Proposed Work Schedule & Estimated Costs

EAB could potentially kill all 255 ash trees in Clarion within 4 years of its arrival, with tree removal costs likely to exceed \$178,500. By budgeting for routine maintenance, replacement, and removals now, the city can be proactive and preventative rather than reactive when this pest arrives.

The following is a proposed 6-year work plan that would address the highest priority issues at this time. Estimated costs are based on \$700/tree average for removal, \$25/tree average for trimming*, and \$150/tree average for planting. *Individual homeowners are presumed to be responsible for light trimming and staking/training of young trees in the City right-of-way. For new tree plantings & replacements, it is recommended that Clarion apply for grants. 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.

<u>Year 1</u>	<u>Estimated Costs</u>
Removals: 7 of the 14 recommended trees	\$4900
Planting and replacements: 10 new trees	\$1500
Trimming: 37 of the 219 recommended trees	\$925
Staking & training: 3 of 3 recommended trees	
Survey trees showing EAB symptoms: 10 trees	
<u>Year 2</u>	
Removals: 7 of the 14 recommended trees	\$4900
Planting and replacements: 10 new trees	\$1500
Trimming: 37 of the 219 recommended trees	\$925
Survey trees showing EAB symptoms: 10 trees	
<u>Year 3</u>	
Planting and replacements: 10 new trees	\$1500
Trimming: 37 of the 219 recommended trees	\$925
Survey trees showing EAB symptoms: 10 trees	
<u>Year 4</u>	
Planting and replacements: 10 new trees	\$1500
Trimming: 37 of the 219 recommended trees	\$925
Survey trees showing EAB symptoms: 10 trees	
<u>Year 5</u>	
Planting and replacements: 10 new trees	\$1500
Trimming: 37 of the 219 recommended trees	\$925
Survey trees showing EAB symptoms: 10 trees	
<u>Year 6</u>	
Planting and replacements: 10 new trees	\$1500
Trimming: 34 of the 219 recommended trees	\$925
Survey trees showing EAB symptoms: 10 trees	
<u>Annually thereafter</u>	
Removals: 6-12/year avg. focusing on poor condition ash & maple	\$8400

Planting and replacements: 6-12/year avg.	\$1800
Routine trimming: 95 trees/year avg.	\$2375
Routine monitoring for EAB symptoms	

Plan Prepared by:

JOE HERRING District Forester

Iowa Department of Natural Resources

P 641-752-3352 | joe.herring@dnr.iowa.gov

Office address: 2608 S. 2nd St. | Marshalltown, IA 50158

WWW.IOWADNR.GOV

Leading Iowans in Caring for Our Natural Resources.

Maps and figures provided by Emma Bruemmer, Urban Forestry Coordinator

Works Cited

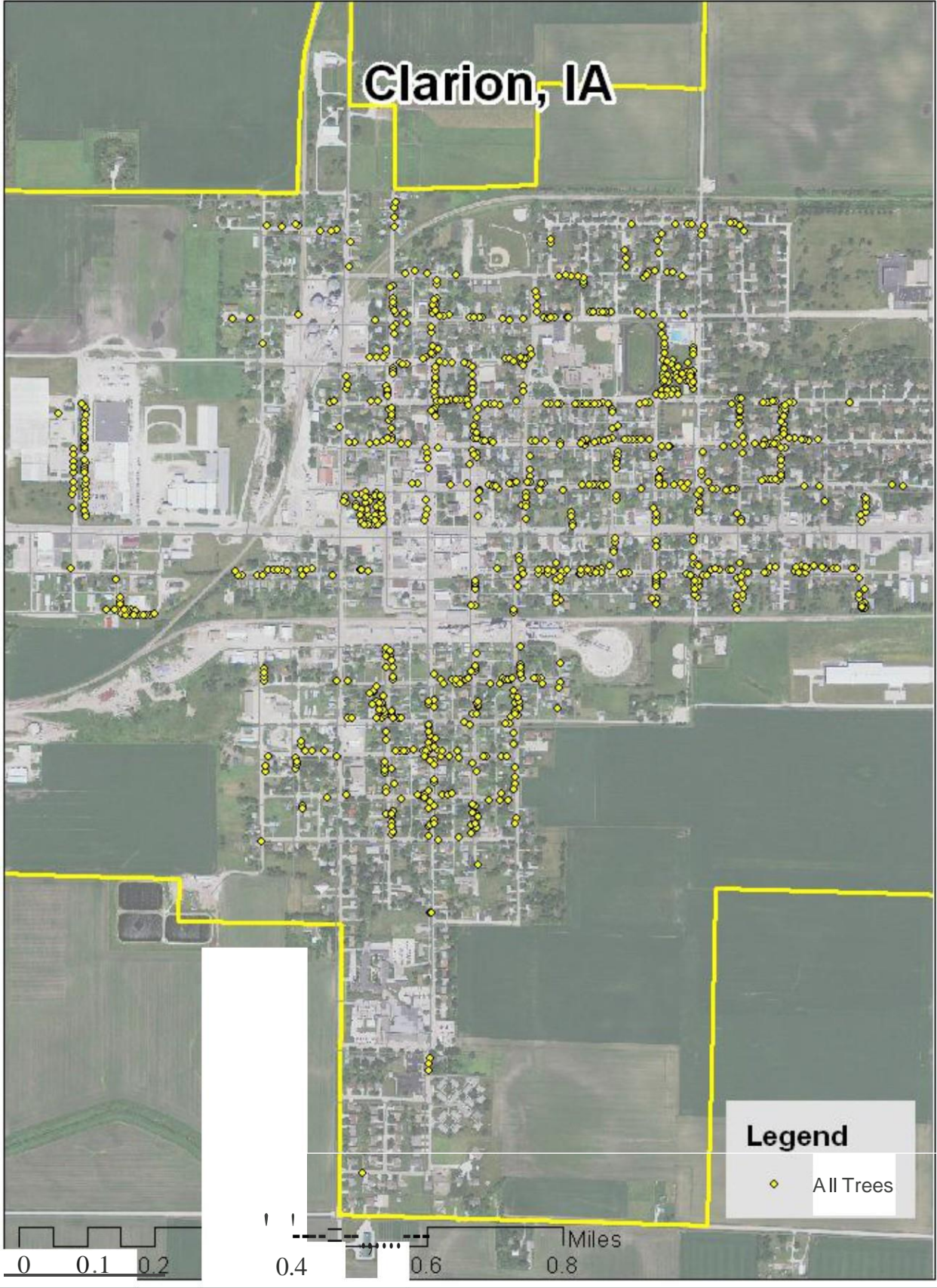
Census Bureau. 2000. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2010)

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

Clarion

Annual Energy Benefits of Public Trees by Species

12/18/2012

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	54.9	4,165	7,905.2	7,747	11,912	(N/A)	26.6	26.6	46.90
Norway maple	36.3	2,754	5,091.2	4,989	7,744	(N/A)	18.0	17.3	45.02
Silver maple	37.3	2,828	4,891.8	4,794	7,622	(N/A)	14.1	17.0	56.88
Northern hackberry	18.2	1,381	2,604.5	2,552	3,933	(N/A)	6.5	8.8	63.44
Black walnut	9.8	741	1,333.7	1,307	2,048	(N/A)	4.4	4.6	48.76
American basswood	10.0	762	1,459.4	1,430	2,193	(N/A)	4.3	4.9	53.48
Honeylocust	11.7	887	1,568.1	1,537	2,424	(N/A)	4.0	5.4	63.79
Red maple	1.4	105	208.3	204	309	(N/A)	3.0	0.7	10.67
Sugar maple	7.0	534	972.7	953	1,487	(N/A)	2.6	3.3	59.47
Black maple	4.0	301	515.6	505	806	(N/A)	2.0	1.8	42.44
Littleleaf linden	3.4	258	482.3	473	730	(N/A)	1.8	1.6	42.96
Apple	1.4	106	212.7	208	314	(N/A)	1.6	0.7	20.95
Blue spruce	1.7	130	212.8	209	339	(N/A)	1.6	0.8	22.57
Ginkgo	0.4	33	63.2	62	95	(N/A)	1.3	0.2	7.91
Other street trees	13.7	1,040	1,870.4	1,833	2,873	(N/A)	8.3	6.4	36.37
Citywide total	211.1	16,025	29,392.1	28,804	44,829	(N/A)	100.0	100.0	46.99

Table 2: Annual Stormwater Benefits

Clarion

Annual Stormwater Benefits of Public Trees by Species

12/18/2012

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	464,416	12,587	(N/A)	26.6	24.3	49.55
Norway maple	275,301	7,461	(N/A)	18.0	14.4	43.38
Silver maple	420,302	11,391	(N/A)	14.1	22.0	85.01
Northern hackberry	143,786	3,897	(N/A)	6.5	7.5	62.85
Black walnut	88,476	2,398	(N/A)	4.4	4.6	57.09
American basswood	86,798	2,352	(N/A)	4.3	4.5	57.38
Honeylocust	121,715	3,299	(N/A)	4.0	6.4	86.81
Red maple	7,465	202	(N/A)	3.0	0.4	6.98
Sugar maple	72,749	1,972	(N/A)	2.6	3.8	78.87
Black maple	28,674	777	(N/A)	2.0	1.5	40.90
Littleleaf linden	33,686	913	(N/A)	1.8	1.8	53.70
Apple	4,988	135	(N/A)	1.6	0.3	9.01
Blue spruce	20,797	564	(N/A)	1.6	1.1	37.58
Ginkgo	1,859	50	(N/A)	1.3	0.1	4.20
Other street trees	141,364	3,831	(N/A)	8.3	7.4	48.50
Citywide total	1,912,375	51,829	(N/A)	100.0	100.0	54.33

Table 3: Annual Air Quality Benefits

Clarion

Annual Air Quality Benefits of Public Trees by Species

12/18/2012

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								
Ash	88.5	15.3	44.4	3.9	481	266.0	38.5	36.6	249.0	1,648	-21.3	-80	720.7	2,048	(N/A)	26.6	8.06
Norway maple	48.8	8.4	25.0	2.2	266	174.7	25.3	24.1	164.7	1,085	-12.1	-45	461.1	1,306	(N/A)	18.0	7.60
Silver maple	59.0	10.0	30.7	2.6	323	175.7	25.7	24.6	168.7	1,099	-33.5	-125	463.5	1,297	(N/A)	14.0	9.68
Northern hackberry	18.8	3.3	10.3	0.8	105	88.0	12.7	12.1	82.5	546	0.0	0	228.6	650	(N/A)	6.5	10.49
Black walnut	8.8	1.4	4.6	0.4	48	46.6	6.8	6.5	44.3	290	0.0	0	119.4	338	(N/A)	4.4	8.06
American basswood	9.6	1.6	5.2	0.4	53	48.8	7.0	6.7	45.6	302	-8.9	-33	116.1	322	(N/A)	4.3	7.85
Honeylocust	23.4	3.9	10.8	1.1	124	55.4	8.1	7.7	52.9	346	-17.6	-66	145.6	404	(N/A)	4.0	10.63
Red maple	0.9	0.2	0.5	0.0	5	6.8	1.0	0.9	6.3	42	-0.4	-1	16.2	45	(N/A)	3.0	1.56
Sugar maple	9.0	1.5	4.6	0.4	49	33.6	4.9	4.7	31.8	209	-7.2	-27	83.4	232	(N/A)	2.6	9.27
Black maple	6.1	1.0	2.9	0.3	33	18.7	2.7	2.6	18.0	117	-2.2	-8	50.2	142	(N/A)	2.0	7.46
Littleleaf linden	5.6	1.0	2.8	0.2	30	16.4	2.4	2.3	15.4	102	-2.7	-10	43.3	122	(N/A)	1.8	7.17
Apple	1.2	0.2	0.6	0.1	7	6.9	1.0	0.9	6.3	42	0.0	0	17.2	49	(N/A)	1.6	3.25
Blue spruce	2.5	0.5	2.1	0.3	17	8.0	1.2	1.1	7.8	50	-7.4	-28	16.1	39	(N/A)	1.6	2.62
Ginkgo	0.1	0.0	0.1	0.0	1	2.1	0.3	0.3	2.0	13	-0.1	0	4.9	14	(N/A)	1.3	1.13
Other street trees	20.3	3.5	11.3	1.2	114	65.3	9.5	9.1	62.1	407	-20.8	-78	161.5	443	(N/A)	8.3	5.61
Citywide total	302.8	51.7	155.8	14.0	1,656	1,012.8	147.1	140.2	957.2	6,299	-134.0	-503	2,647.8	7,451	(N/A)	100.0	7.81

Table 4: Annual Carbon Stored

Clarion

Stored CO2 Benefits of Public Trees by Species

12/18/2012

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	1,462,737	10,971	(N/A)	26.6	25.8	43.19
Norway maple	805,437	6,041	(N/A)	18.0	14.2	35.12
Silver maple	1,250,588	9,379	(N/A)	14.1	22.0	70.00
Northern	260,166	1,951	(N/A)	6.5	4.6	31.47
Black walnut	284,579	2,134	(N/A)	4.4	5.0	50.82
American	342,079	2,566	(N/A)	4.3	6.0	62.58
Honeylocust	297,000	2,228	(N/A)	4.0	5.2	58.62
Red maple	13,015	98	(N/A)	3.0	0.2	3.37
Sugar maple	253,339	1,900	(N/A)	2.6	4.5	76.00
Black maple	68,479	514	(N/A)	2.0	1.2	27.03
Littleleaf linden	120,524	904	(N/A)	1.8	2.1	53.17
Apple	19,945	150	(N/A)	1.6	0.4	9.97
Blue spruce	14,271	107	(N/A)	1.6	0.3	7.14
Ginkgo	2,515	19	(N/A)	1.3	0.0	1.57
Other street trees	217,324	3,593	(N/A)	8.3	8.4	45.49
Citywide total	5,673,793	42,553	(N/A)	100.0	100.0	44.61

Table 5: Annual Carbon Sequestered

Clarion

Annual CO₂ Benefits of Public Trees by Species

12/18/2012

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	Standard % of Total Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	89,880	674	-7,021	-50	-53	92,040	690	174,849	1,311 (N/A)	26.6	22.6	5.16	
Norway maple	62,612	470	-3,866	-34	-29	60,865	456	119,577	897 (N/A)	18.0	15.4	5.21	
Silver maple	121,218	909	-6,003	-26	-45	62,506	469	177,695	1,333 (N/A)	14.1	22.9	9.95	
Northern hackberry	20,290	152	-1,249	-12	-9	30,516	229	49,544	372 (N/A)	6.5	6.4	5.99	
Black walnut	22,957	172	-1,366	-8	-10	16,378	123	37,960	285 (N/A)	4.4	4.9	6.78	
American basswood	24,199	181	-1,642	-8	-12	16,851	126	39,400	296 (N/A)	4.3	5.1	7.21	
Honeylocust	38,861	291	-1,426	-7	-11	19,606	147	57,034	428 (N/A)	4.0	7.4	11.26	
Red maple	1,976	15	-62	-6	-1	2,324	17	4,232	32 (N/A)	3.0	0.6	1.09	
Sugar maple	15,007	113	-1,216	-5	-9	11,791	88	25,576	192 (N/A)	2.6	3.3	7.67	
Black maple	8,716	65	-329	-4	-2	6,654	50	15,037	113 (N/A)	2.0	1.9	5.94	
Littleleaf linden	11,369	85	-579	-3	-4	5,693	43	16,480	124 (N/A)	1.8	2.1	7.27	
Apple	2,095	16	-96	-3	-1	2,339	18	4,335	33 (N/A)	1.6	0.6	2.17	
Blue spruce	1,204	9	-69	-3	-1	2,873	22	4,006	30 (N/A)	1.6	0.5	2.00	
Ginkgo	360	3	-12	-2	0	728	5	1,073	8 (N/A)	1.3	0.1	0.67	
Other street trees	27,161	204	-2,300	-15	-17	22,983	172	47,829	359 (N/A)	8.3	6.2	4.54	
Citywide total	447,905	3,359	-27,234	-186	-206	354,144	2,656	774,629	5,810 (N/A)	100.0	100.0	6.09	

Table 6: Annual Social and Aesthetic Benefits

Clarion

Annual Aesthetic/Other Benefits of Public Trees by Species

12/18/2012

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Ash	8,807	(N/A)	26.6	17.8	34.67
Norway maple	6,221	(N/A)	18.0	12.6	36.17
Silver maple	10,730	(N/A)	14.1	21.7	80.08
Northern hackberry	3,062	(N/A)	6.5	6.2	49.38
Black walnut	2,099	(N/A)	4.4	4.2	49.97
American basswood	1,931	(N/A)	4.3	3.9	47.11
Honeylocust	9,084	(N/A)	4.0	18.4	239.07
Red maple	351	(N/A)	3.0	0.7	12.09
Sugar maple	1,605	(N/A)	2.6	3.3	64.20
Black maple	1,172	(N/A)	2.0	2.4	61.70
Littleleaf linden	1,177	(N/A)	1.8	2.4	69.22
Apple	119	(N/A)	1.6	0.2	7.95
Blue spruce	366	(N/A)	1.6	0.7	24.40
Ginkgo	49	(N/A)	1.3	0.1	4.10
Other street trees	2,679	(N/A)	8.3	5.4	33.91
Citywide total	49,453	(N/A)	100.0	100.0	51.84

Table 7: Summary of Benefits in Dollars

Clarion

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

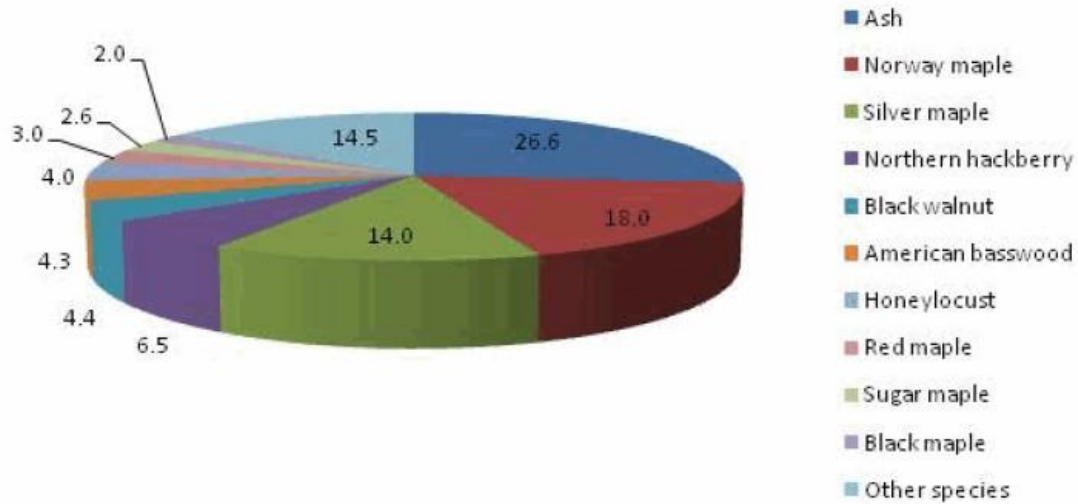
12/18/20

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Ash	11,912	1,311	2,048	12,587	8,807	36,665	(±0)	23.0
Norway maple	7,744	897	1,306	7,461	6,221	23,629	(±0)	14.8
Silver maple	7,622	1,333	1,297	11,391	10,730	32,373	(±0)	20.3
Northern hackberry	3,933	372	650	3,897	3,062	11,914	(±0)	7.5
Black walnut	2,048	285	338	2,398	2,099	7,168	(±0)	4.5
American basswood	2,193	295	322	2,352	1,931	7,094	(±0)	4.5
Honeylocust	2,424	428	404	3,299	9,084	15,639	(±0)	9.8
Red maple	309	32	45	202	351	939	(±0)	0.6
Sugar maple	1,487	192	232	1,972	1,605	5,487	(±0)	3.4
Black maple	806	113	142	777	1,172	3,010	(±0)	1.9
Littleleaf linden	730	124	122	913	1,177	3,065	(±0)	1.9
Apple	314	33	49	135	119	650	(±0)	0.4
Blue spruce	339	30	39	564	366	1,337	(±0)	0.8
Ginkgo	95	8	14	50	49	216	(±0)	0.1
Other street trees	2,873	359	443	3,831	2,679	10,185	(±0)	6.4
Citywide Total	44,829	5,810	7,451	51,829	49,453	159,372	(±0)	100.0

Clarion

Species Distribution of Public Trees (%)

12/18/2012



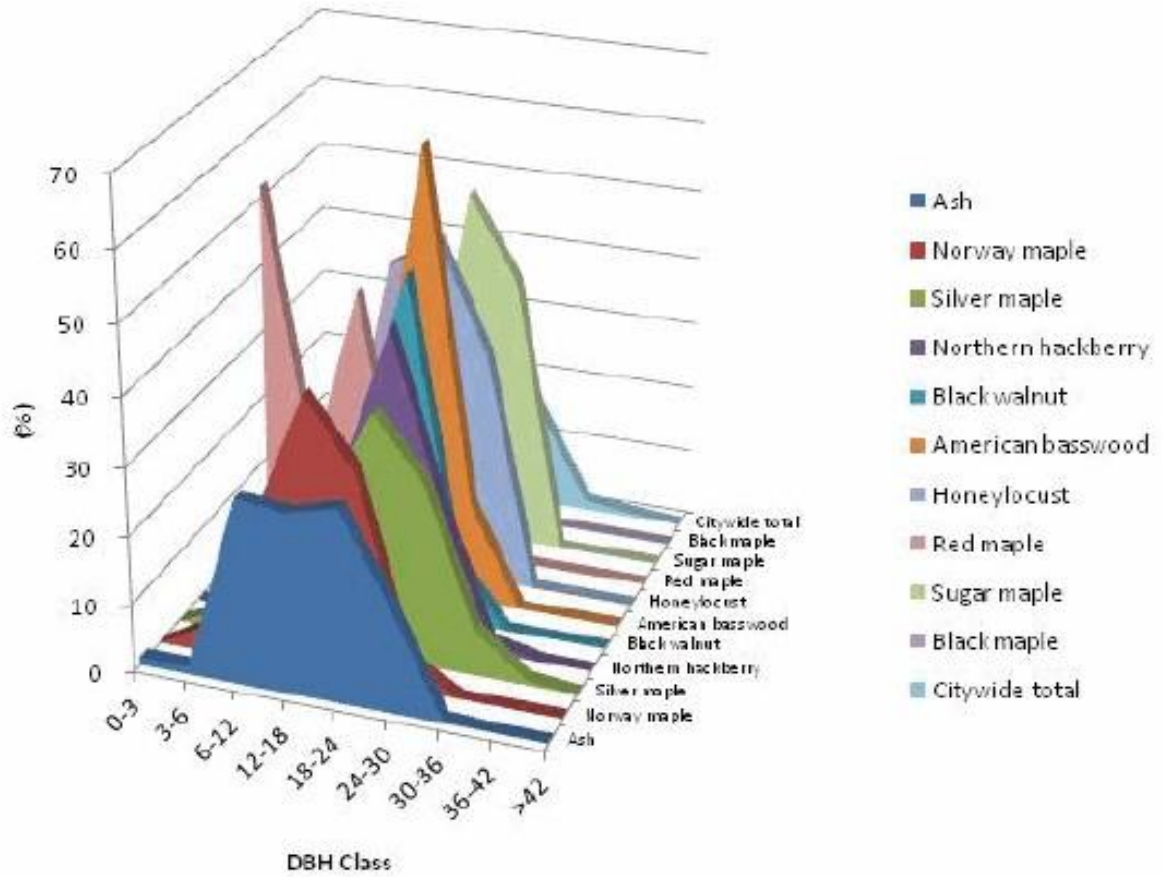
Species	Percent
Ash	26.6
Norway maple	18.0
Silver maple	14.0
Northern hackberry	6.5
Black walnut	4.4
American basswood	4.3
Honeylocust	4.0
Red maple	3.0
Sugar maple	2.6
Black maple	2.0
Other species	14.5
Total	100.0

Figure 1: Species Distribution

Clarion

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

12/18/2012



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Ash	1.2	1.2	27.2	26.4	28.3	15.4	0.4	0.0	0.0
Norway maple	0.0	4.1	21.5	40.1	30.2	4.1	0.0	0.0	0.0
Silver maple	0.0	3.0	4.5	22.4	35.8	26.9	6.7	0.7	0.0
Northern hackberry	0.0	0.0	9.7	22.6	45.2	21.0	1.6	0.0	0.0
Black walnut	2.4	4.8	7.1	26.2	50.0	9.5	0.0	0.0	0.0
American basswood	0.0	0.0	0.0	19.5	65.9	14.6	0.0	0.0	0.0
Honeylocust	0.0	0.0	10.5	5.3	50.0	34.2	0.0	0.0	0.0
Red maple	51.7	10.3	37.9	0.0	0.0	0.0	0.0	0.0	0.0
Sugar maple	0.0	0.0	0.0	8.0	52.0	40.0	0.0	0.0	0.0
Black maple	0.0	0.0	36.8	42.1	21.1	0.0	0.0	0.0	0.0
Citywide total	2.4	3.9	18.7	26.7	32.0	14.5	1.4	0.5	0.0

Figure 2: Relative Age Class

Clarion

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

12/18/2012

Citywide total

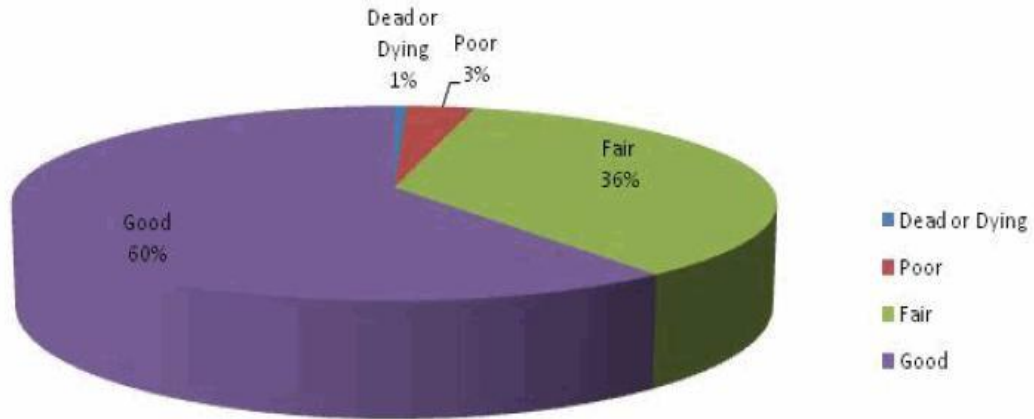


Figure 3: Foliage Condition

Clarion

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

12/18/2012

Citywide total

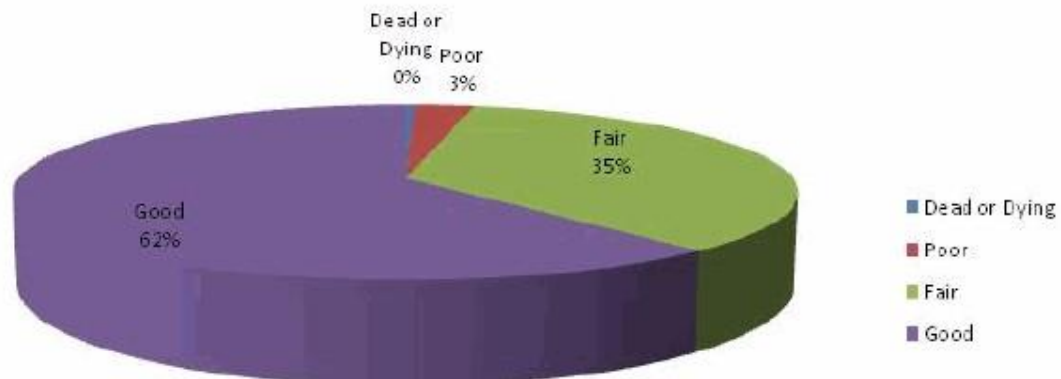
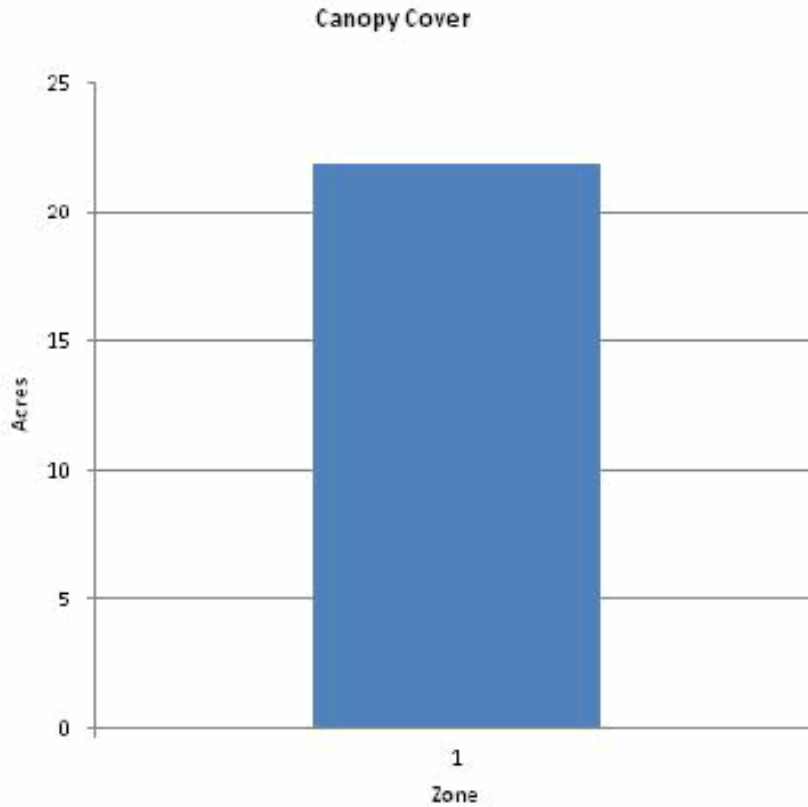


Figure 4: Wood Condition

Clarion

Canopy Cover of Public Trees (Acres)

12/18/2012



Zone	Acres	% of Total Canopy Cover
1	22	100.0
Citywide total	22	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	22		

Figure 5: Canopy Cover in Acres

Clarion

Land Use of Public Trees by Zone (%)

12/18/2012

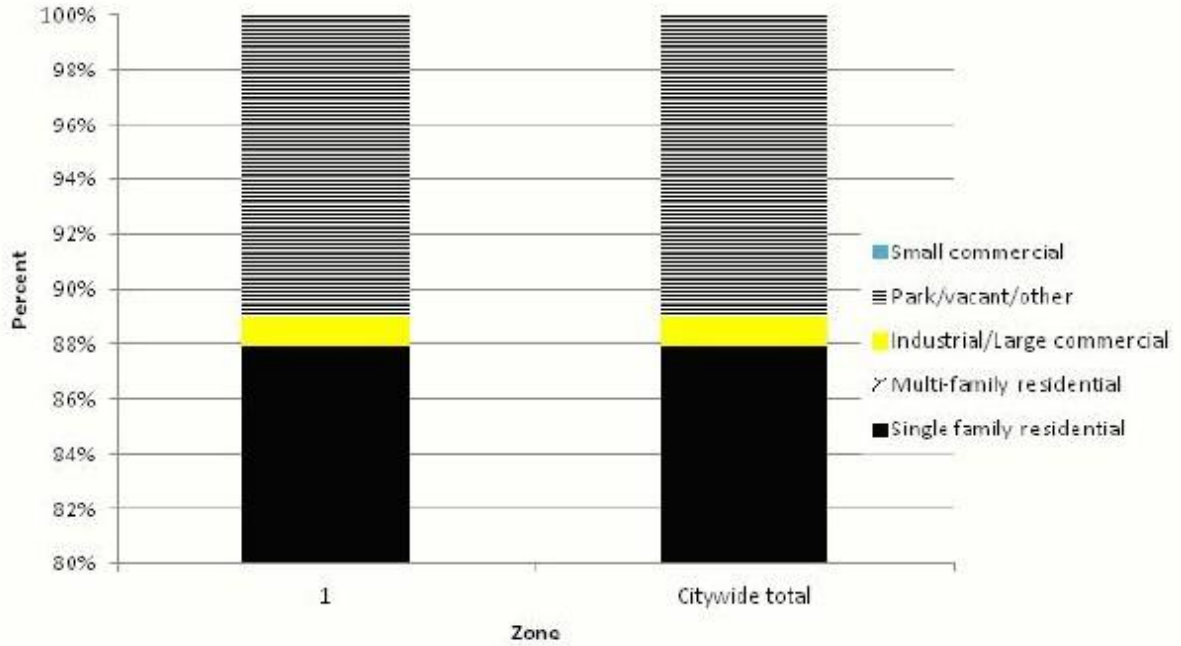
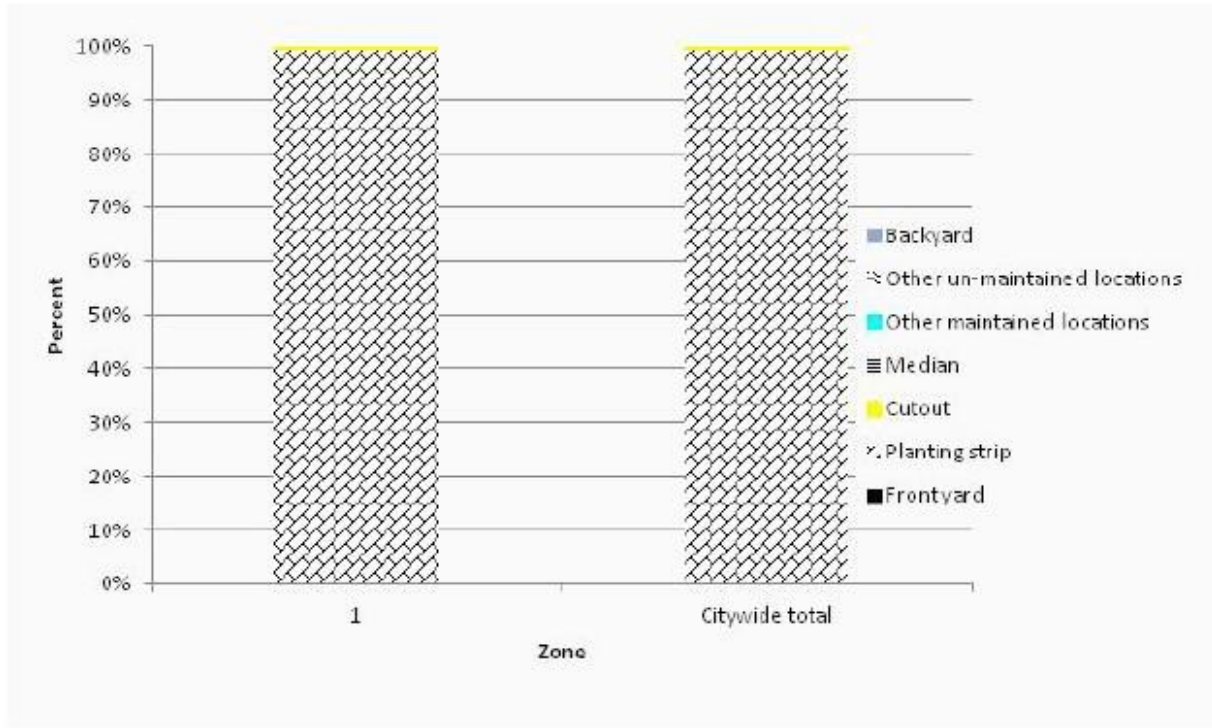


Figure 6: Land Use of city/park trees

Clarion

Location of Public Trees by Zone (%)

12/18/2012



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	0.0	99.3	0.7	0.0	0.0	0.0	0.0
Citywide total	0.0	99.3	0.7	0.0	0.0	0.0	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

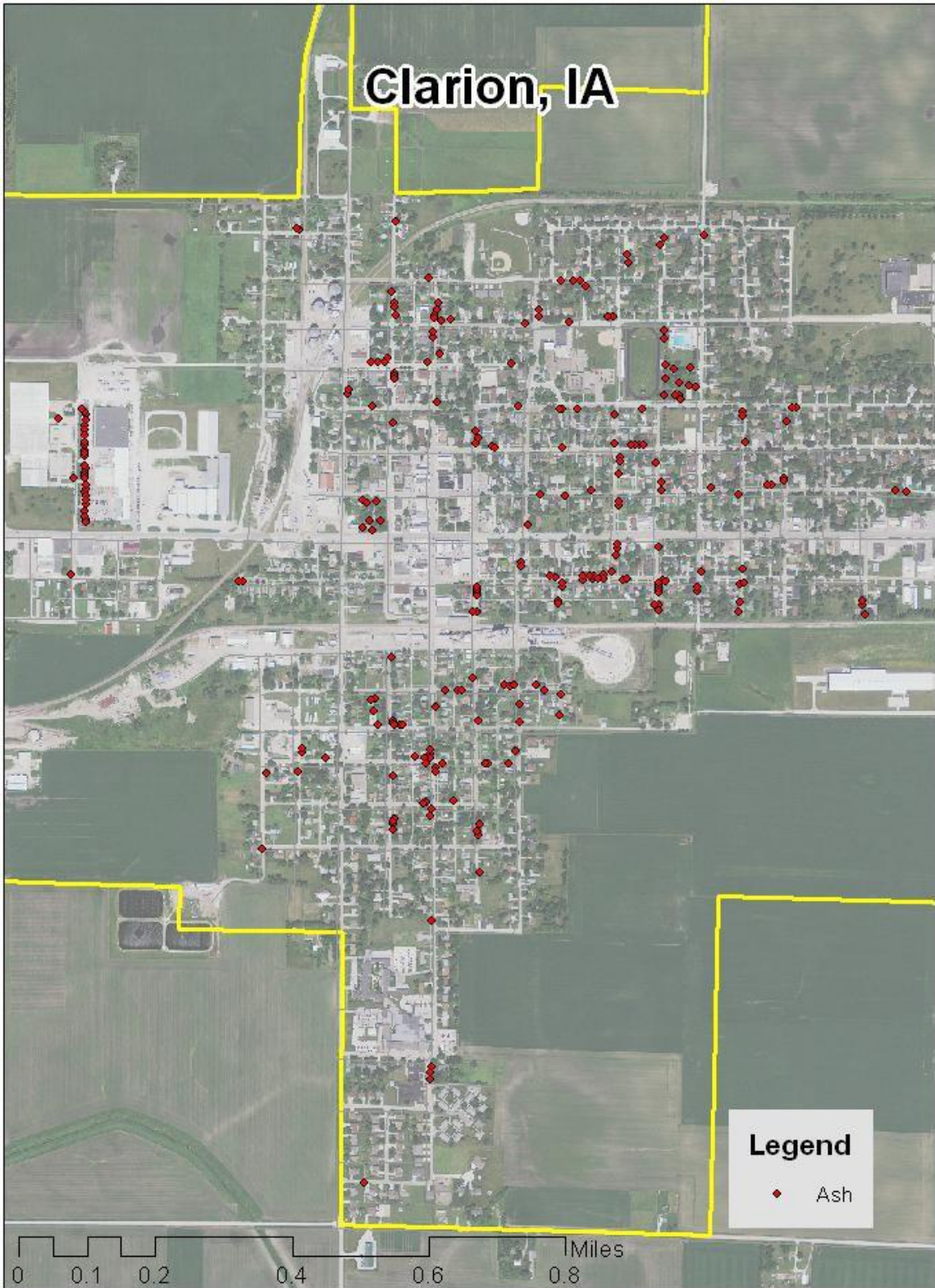


Figure 1: Location of Ash Trees

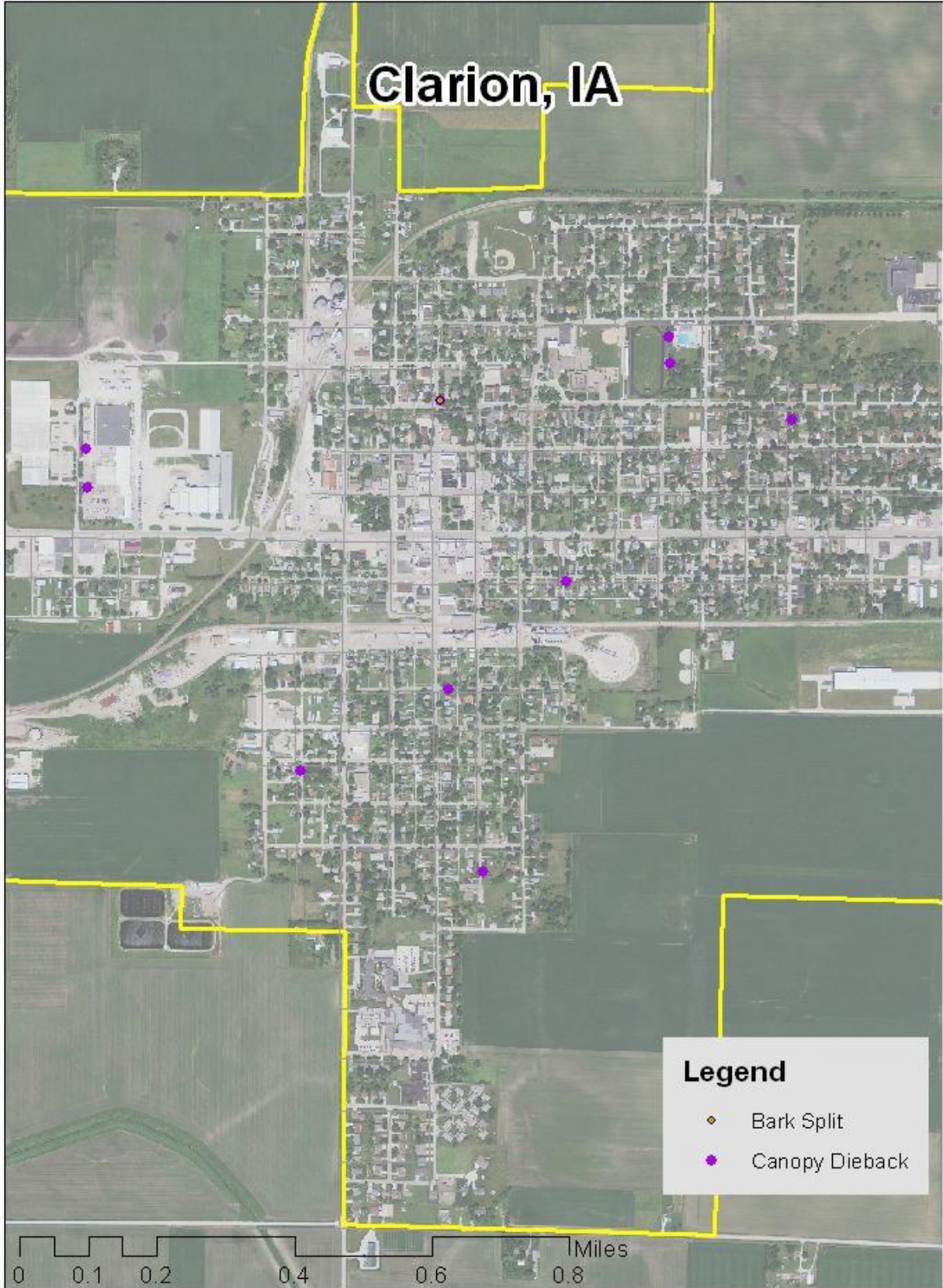


Figure 2: Location of EAB symptoms

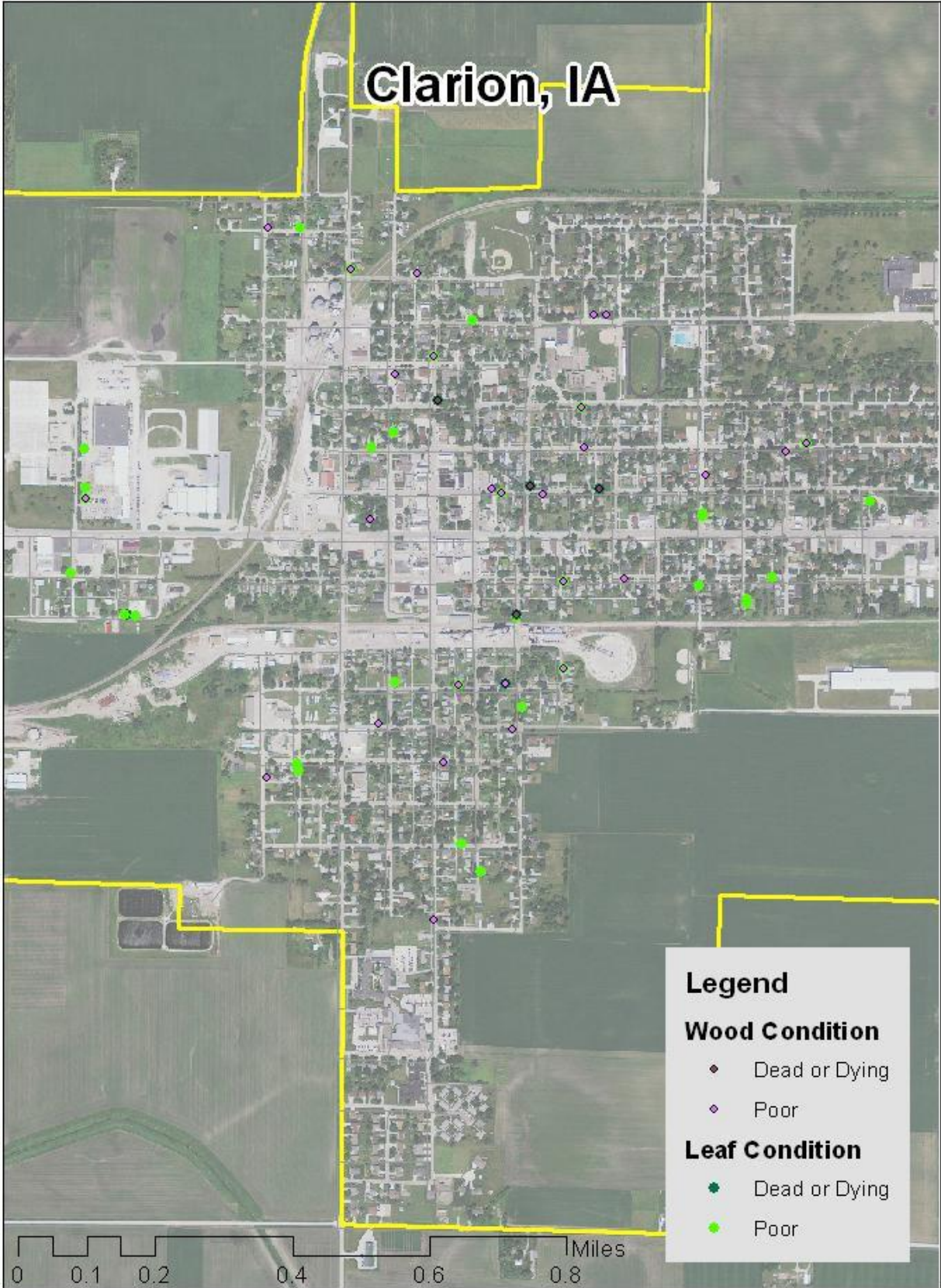


Figure 3: Location of Poor Condition Trees

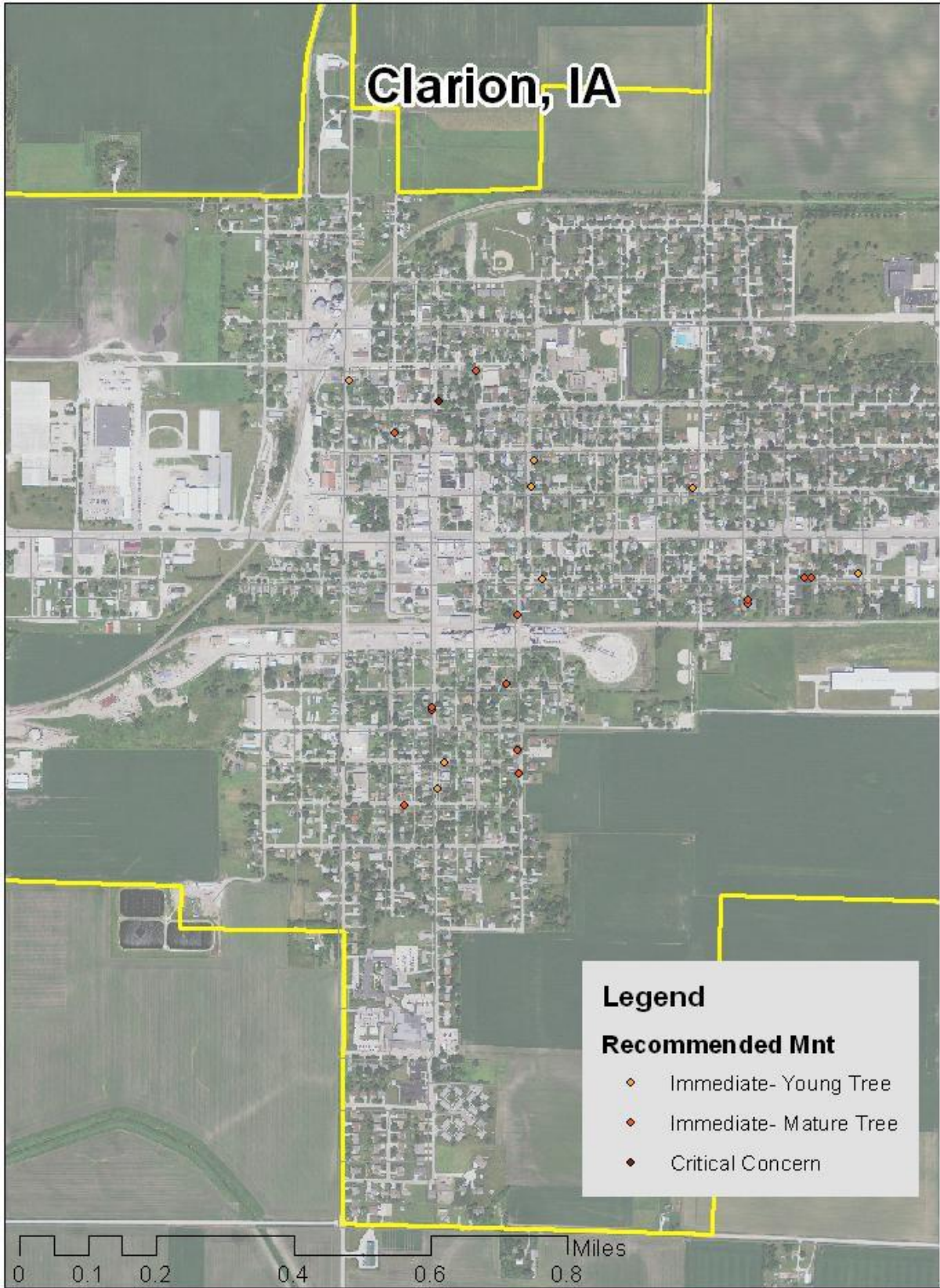


Figure 4: Location of Trees with Recommended Maintenance

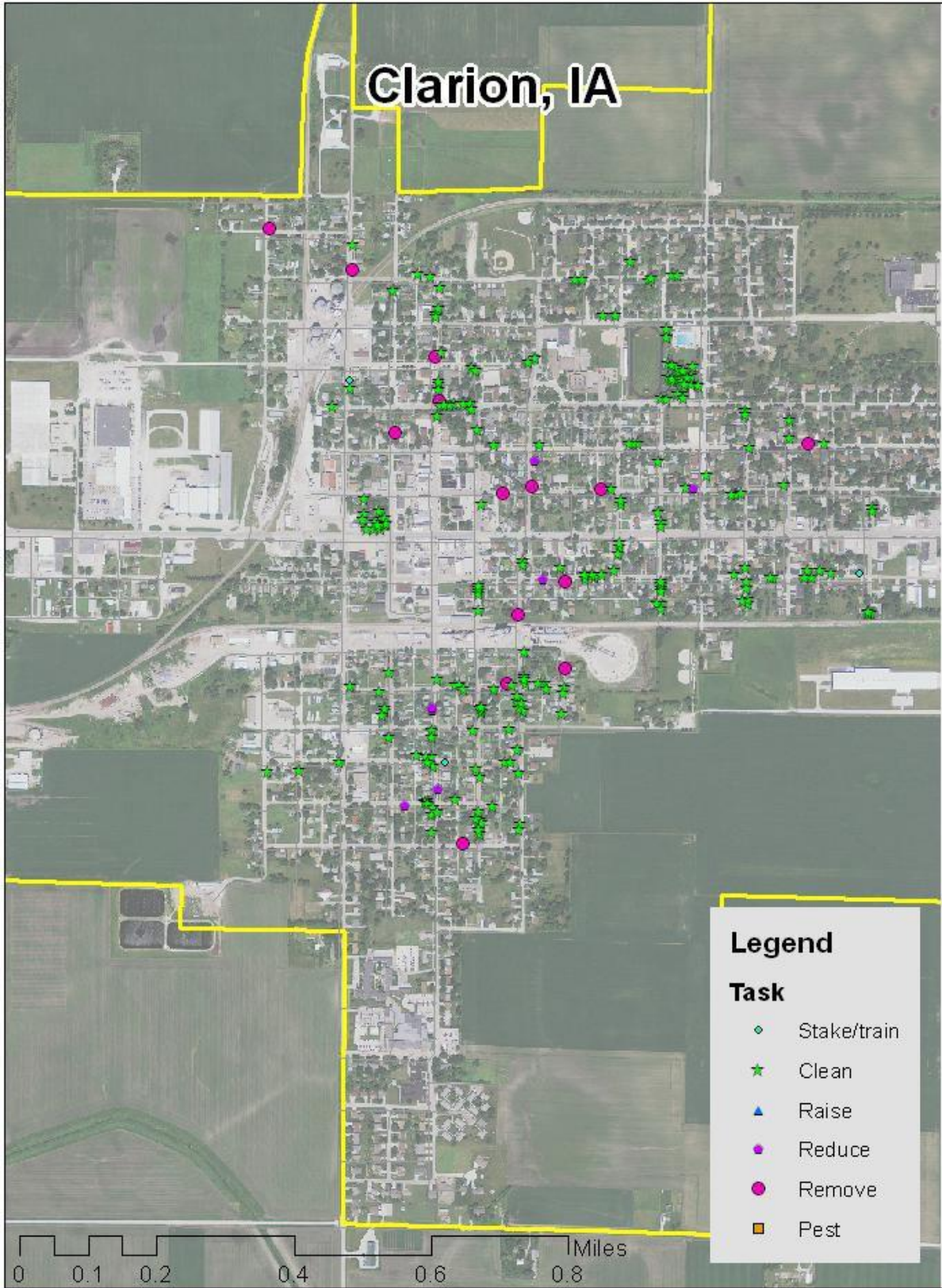


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Proposed Emerald Ash Borer Plan

Ash Tree Removal

Ash tree removal will be prioritized with dead, dying, hazardous trees to be removed first. Next will be all ash in poor condition and displaying signs and symptoms of EAB. *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. 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 guidelines in the City Code.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on trees 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.

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

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 9th St., Des Moines, IA 50319.

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-281-5918.