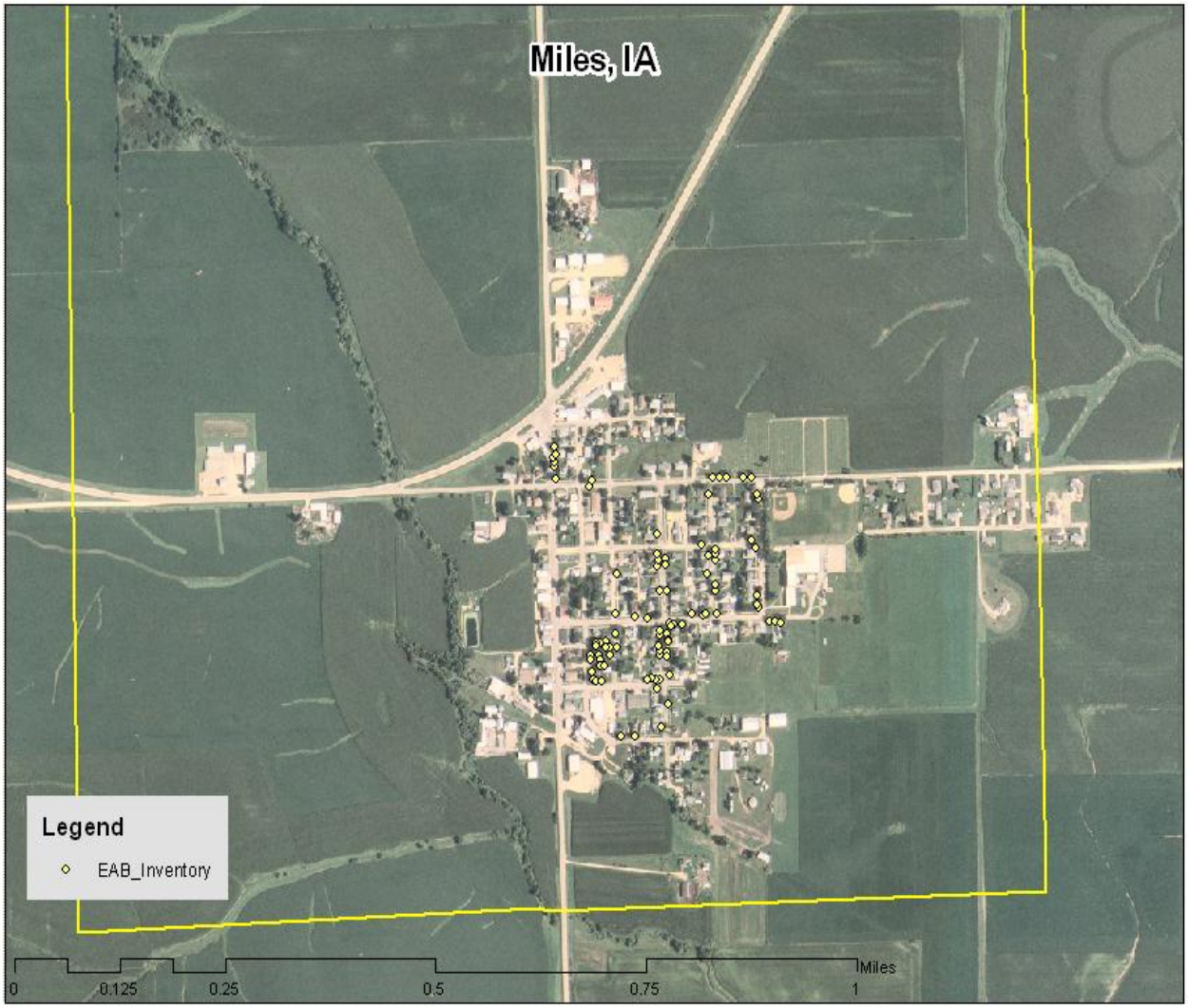
Miles, IA



2011 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Miles with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities 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 3% of Miles'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 92 trees inventoried.

- Miles's trees provide $2,571 of benefits annually, an average of $28 a tree
- There are over 14 species of trees
- The top three groups are: Maple 64%, hackberry 18%, and Siberian elm 7%
- 14% of trees are in need of some type of management
- 1 tree is 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.

- The 1 tree needing removal, is 16 inches in diameter. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 1 of the 3 ash trees are in need of follow up because they are displaying canopy die back which is a sign and symptom associated with EAB. It is not uncommon for ash trees to have canopy die back and sprouts on the tree, but the EAB is attracted to trees with these problems. The ash trees were examined and no EAB exit holes were found. Woodpecker feeding is an excellent way to look for EAB. Woodpeckers feed on emerald ash borer larvae located under the bark. Feeding is typically evident higher in the tree where the emerald ash borer prefers to attack first. Large numbers of larvae under the bark can lead to woodpecker damage that looks like strips of bark have been pulled off of the tree. This is called "flecking"
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Siberian elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly

Introduction

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

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

Inventory

In 2010, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms 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 92 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. Miles's trees reduce energy related costs by approximately $5,477 annually (Appendix A, Table 1). These savings are both in Electricity (26 MWh) and in Natural Gas (3,617 Therms).

Annual Stormwater Benefits

City of Miles's trees intercept about 255,256 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $6,918 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 Miles, it is estimated that trees remove 335 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $949 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Miles, trees sequester about 47,379 lbs of carbon a year with an associated value of $355 (Appendix A, Table 5). In addition, the trees store 86,217 lbs of carbon, with a yearly benefit of $647 (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. Miles receives $4,870 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, Miles's trees provide $2,571 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 92 trees in Miles provide approximately $28 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Miles has over 14 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by group is as follows:

Maple	58	64% (sugar, red, silver, Norway)
Ash	3	3% (green, white)
Hackberry	17	18%
Walnut	1	1%
Elm	6	7% (Siberian)
Honey Locust	1	1%
Eastern Red Cedar	2	2%
Ironwood	1	1%
Austrian Pine	2	2%
Other Large Evergreen	1	1%

Size Class

Most of Miles's trees (47%) are between 18 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For size, a Bell Curve is preferred and shows the highest amount of trees around 18 - 24 inches in diameter at 4.5 ft. Miles's size curve is in the middle, indicating an average size urban forest.

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 Miles indicate that 97% of the trees are in good health, with no foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 62% of Miles'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. Part of the estimated 4% of the trees is in need of some type of 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).

None needed	79	86%
Crown Cleaning	9	10%
Crown Raising	3	3%
Tree Staking	0	0%
Tree Removal	1	1%
Crown Reduction	0	0%

Canopy Cover

The canopy cover of Miles is approximately 3 acres (Appendix A, Figure 4). The average canopy cover over Miles's streets and sidewalks is 14%. There are some streets with 50% canopy cover.

Land Use and Location

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

Land Use	
Single family residential	80%
Parks	20%

Location	
Planting strip	80%
Parks	20%

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

Miles has 1 critical concern tree that need immediate removal. This tree 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. The 1 tree is between 12 and 18 inches in diameter at 4.5 ft. 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 mature trees intermediate concern. There are no trees with these needs. These trees should be evaluated within one year and maintenance work done.

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.

Pruning Practices

Below are some trees that have been pruned in a way that will make it difficult for these trees to respond correctly to the wounding. The good news is that this pruning can be easily corrected to allow for proper tree response.

Ash tree

Too Much Stub

Linden/Basswood

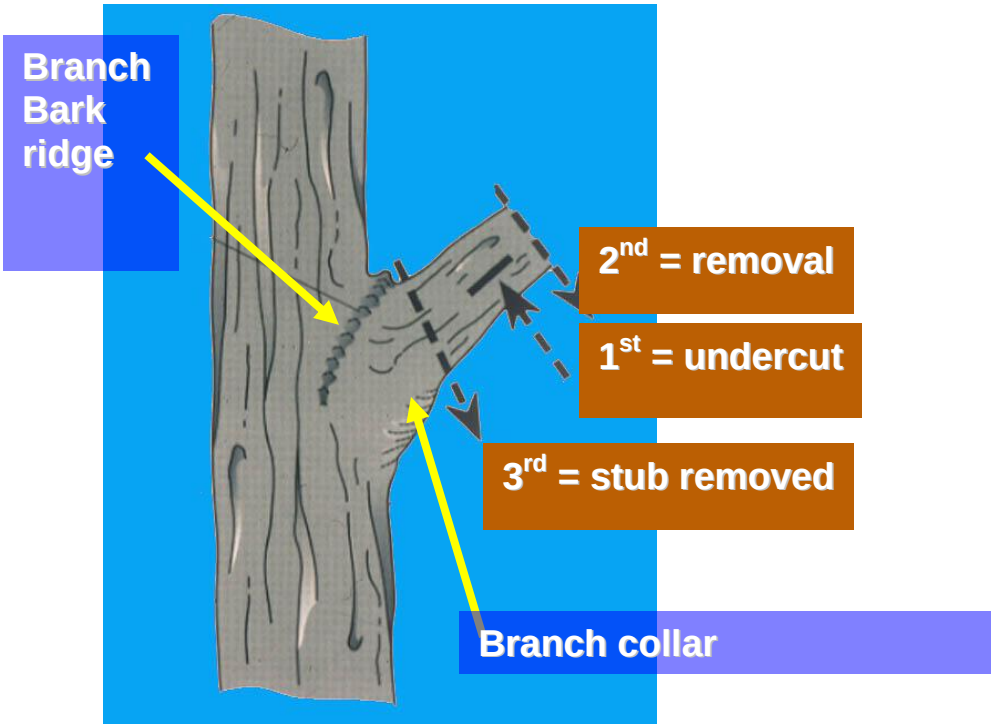
Consider the guidelines when pruning:

1. To avoid concerns related to the fungus that causes the disease oak wilt, all oak species should only be pruned between October 1 and February 28th.
2. All final cuts should be outside the branch collar.
3. Unless pruning broken oak branches between March 1 and September 30th pruning paints are not needed.

Branch collar

Proper Pruning

Improper Pruning



Proper Pruning Cut

Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1 to 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 urban forest in Miles.

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 (64%) (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 & Siberian elm, evergreen as street trees, willow or black walnut.

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

Year 1
- Removal: 1 critical concern tree
- Planting and Replacement: 1 tree to be planted in open locations
- Inspection and Maintenance Mature trees: 88 trees
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Year 2
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Year 3
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Year 4
- Removal: As needed
- Planting and Replacement: As needed
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Year 5
- Inspection and Maintenance Mature trees: 88 trees
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Year 6
- Routine trimming: As needed
- Visual Survey for signs and symptoms of EAB

Emerald Ash Borer Plan

Ash Tree Removal

I do not recommend removal of healthy ash trees until the EAB is present in your community. *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 quarantine.

Canopy Replacement

As budget permits, all removed trees should be replaced. The new plantings should be a diverse mix and should **not** include ash, maple, cottonwood, poplar, box elder, Chinese & Siberian elm, evergreen, willow or black walnut as street trees.

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.

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Appendix A: i-Tree Data

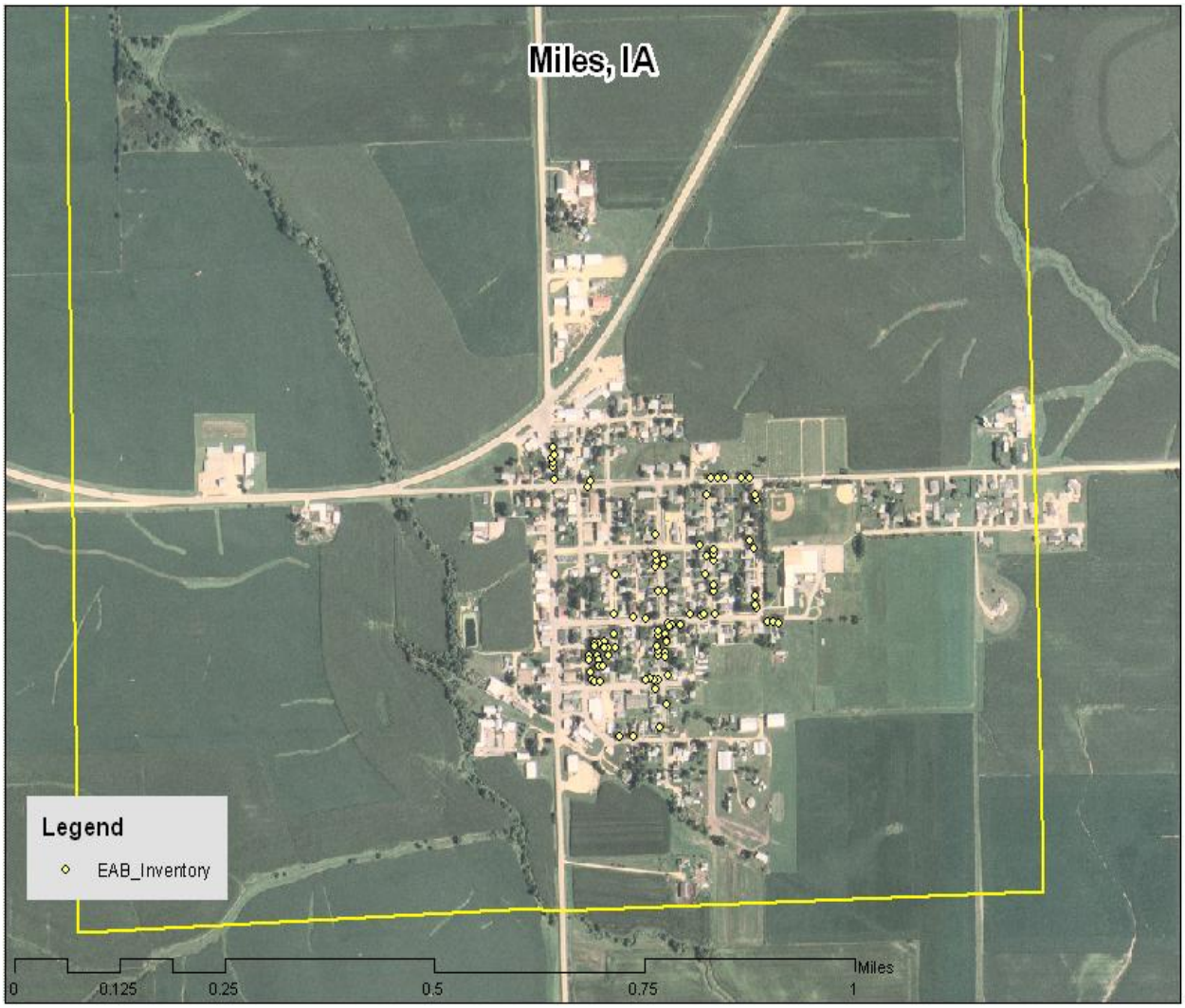


Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

8/9/2010

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	10.6	806	1,552.2	1,521	2,327	(N/A)	44.0	42.5	58.18
Northern hackberry	5.6	425	807.6	791	1,216	(N/A)	18.7	22.2	71.55
Silver maple	2.7	203	352.8	346	549	(N/A)	8.8	10.0	68.61
Sugar maple	2.1	156	286.8	281	437	(N/A)	7.7	8.0	62.43
Siberian elm	2.0	152	277.4	272	424	(N/A)	6.6	7.7	70.60
Red maple	0.5	39	60.8	60	99	(N/A)	3.3	1.8	32.98
Ash	0.9	69	134.4	132	200	(N/A)	3.3	3.7	66.79
Austrian pine	0.3	21	34.3	34	55	(N/A)	2.2	1.0	27.30
Conifer Evergreen Large	0.1	10	14.6	14	24	(N/A)	1.1	0.4	24.14
Honeylocust	0.4	28	47.4	46	74	(N/A)	1.1	1.4	74.28
Black walnut	0.0	0	0.5	0	1	(N/A)	1.1	0.0	0.66
Eastern red cedar	0.1	8	16.4	16	25	(N/A)	1.1	0.5	24.57
Eastern hophornbeam	0.2	15	31.6	31	46	(N/A)	1.1	0.8	46.14
Other street trees	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	25.5	1,932	3,617.1	3,545	5,477	(N/A)	100.0	100.0	60.18

Table 2: Annual Storm water Benefits

Annual Stormwater Benefits of Public Trees by Species

8/9/2010

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	100,060	2,712	(N/A)	44.0	39.2	67.80
Northern hackberry	49,324	1,337	(N/A)	18.7	19.3	78.63
Silver maple	36,216	982	(N/A)	8.8	14.2	122.69
Sugar maple	22,580	612	(N/A)	7.7	8.9	87.42
Siberian elm	20,292	550	(N/A)	6.6	8.0	91.66
Red maple	3,219	87	(N/A)	3.3	1.3	29.08
Ash	10,007	271	(N/A)	3.3	3.9	90.41
Austrian pine	4,507	122	(N/A)	2.2	1.8	61.08
Conifer Evergreen Large	1,539	42	(N/A)	1.1	0.6	41.70
Honeylocust	4,684	127	(N/A)	1.1	1.8	126.96
Black walnut	18	0	(N/A)	1.1	0.0	0.48
Eastern red cedar	1,634	44	(N/A)	1.1	0.6	44.30
Eastern hophornbeam	1,174	32	(N/A)	1.1	0.5	31.82
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	255,256	6,918	(N/A)	100.0	100.0	76.02

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

8/9/2010

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Norway maple	20.3	3.5	10.0	0.9	110	51.7	7.5	7.1	48.2	320	-4.8	-18	144.3	411	(N/A)	44.0	10.28
Northern hackberry	7.1	1.2	3.7	0.3	39	27.1	3.9	3.7	25.4	168	0.0	0	72.5	207	(N/A)	18.7	12.17
Silver maple	6.2	1.0	3.0	0.3	33	12.6	1.8	1.8	12.1	79	-3.3	-12	35.6	100	(N/A)	8.8	12.50
Sugar maple	2.9	0.5	1.5	0.1	16	9.8	1.4	1.4	9.3	61	-2.3	-9	24.6	68	(N/A)	7.7	9.77
Siberian elm	3.1	0.5	1.6	0.1	17	9.6	1.4	1.3	9.1	60	0.0	0	26.7	76	(N/A)	6.6	12.75
Red maple	0.6	0.1	0.3	0.0	3	2.4	0.4	0.3	2.3	15	-0.2	-1	6.3	18	(N/A)	3.3	5.88
Ash	2.2	0.4	1.1	0.1	12	4.4	0.6	0.6	4.1	27	-0.5	-2	13.0	37	(N/A)	3.3	12.44
Austrian pine	0.5	0.1	0.4	0.1	3	1.3	0.2	0.2	1.2	8	-1.9	-7	2.1	4	(N/A)	2.2	2.13
Conifer Evergreen Large	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	1.1	2.82
Honeylocust	0.9	0.2	0.4	0.0	5	1.7	0.3	0.2	1.7	11	-0.8	-3	4.7	13	(N/A)	1.1	12.87
Black walnut	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	1.1	0.08
Eastern red cedar	0.3	0.1	0.3	0.0	2	0.5	0.1	0.1	0.5	3	-0.9	-3	1.0	2	(N/A)	1.1	2.19
Eastern hophornbeam	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8	(N/A)	1.1	8.35
Other street trees	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.0	0.00
Citywide total	44.8	7.7	22.6	2.1	244	122.8	17.8	16.9	115.4	762	-15.2	-57	334.9	949	(N/A)	100.0	10.42

Table 4: Annual Carbon Stored

Annual CO_2 Benefits of Public Trees by Species

8/9/2010

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	16,794	126	-1,591	-8	-12	17,810	134	33,005	248	(N/A)	44.0	38.3	6.19
Northern hackberry	6,793	51	-487	-3	-4	9,389	70	15,691	118	(N/A)	18.7	18.2	6.92
Silver maple	10,790	81	-675	-2	-5	4,489	34	14,602	110	(N/A)	8.8	16.9	13.69
Sugar maple	4,598	34	-389	-1	-3	3,445	26	7,653	57	(N/A)	7.7	8.9	8.20
Siberian elm	3,840	29	-362	-1	-3	3,354	25	6,830	51	(N/A)	6.6	7.9	8.54
Red maple	969	7	-35	-1	0	868	7	1,802	14	(N/A)	3.3	2.1	4.51
Ash	1,210	9	-175	-1	-1	1,517	11	2,551	19	(N/A)	3.3	3.0	6.38
Austrian pine	303	2	-22	0	0	463	3	744	6	(N/A)	2.2	0.9	2.79
Conifer Evergreen	116	1	-6	0	0	216	2	326	2	(N/A)	1.1	0.4	2.45
Honeylocust	1,486	11	-59	0	0	615	5	2,042	15	(N/A)	1.1	2.4	15.31
Black walnut	3	0	0	0	0	4	0	7	0	(N/A)	1.1	0.0	0.05
Eastern red cedar	0	0	-5	0	0	187	1	181	1	(N/A)	1.1	0.2	1.36
Eastern hophornbeam	478	4	-32	0	0	335	3	781	6	(N/A)	1.1	0.9	5.86
Other street trees	0	0	0	0	0	0	0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	47,379	355	-3,837	-18	-29	42,693	320	86,217	647	(N/A)	100.0	100.0	7.11

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

8/9/2010

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	16,794	126	-1,591	-8	-12	17,810	134	33,005	248	(N/A)	44.0	38.3	6.19
Northern hackberry	6,793	51	-487	-3	-4	9,389	70	15,691	118	(N/A)	18.7	18.2	6.92
Silver maple	10,790	81	-675	-2	-5	4,489	34	14,602	110	(N/A)	8.8	16.9	13.69
Sugar maple	4,598	34	-389	-1	-3	3,445	26	7,653	57	(N/A)	7.7	8.9	8.20
Siberian elm	3,840	29	-362	-1	-3	3,354	25	6,830	51	(N/A)	6.6	7.9	8.54
Red maple	969	7	-35	-1	0	868	7	1,802	14	(N/A)	3.3	2.1	4.51
Ash	1,210	9	-175	-1	-1	1,517	11	2,551	19	(N/A)	3.3	3.0	6.38
Austrian pine	303	2	-22	0	0	463	3	744	6	(N/A)	2.2	0.9	2.79
Conifer Evergreen	116	1	-6	0	0	216	2	326	2	(N/A)	1.1	0.4	2.45
Honeylocust	1,486	11	-59	0	0	615	5	2,042	15	(N/A)	1.1	2.4	15.31
Black walnut	3	0	0	0	0	4	0	7	0	(N/A)	1.1	0.0	0.05
Eastern red cedar	0	0	-5	0	0	187	1	181	1	(N/A)	1.1	0.2	1.36
Eastern hophornbeam	478	4	-32	0	0	335	3	781	6	(N/A)	1.1	0.9	5.86
Other street trees	0	0	0	0	0	0	0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	47,379	355	-3,837	-18	-29	42,693	320	86,217	647	(N/A)	100.0	100.0	7.11

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

8/9/2010

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,554	(N/A)	44.0	31.9	38.85
Northern hackberry	946	(N/A)	18.7	19.4	55.63
Silver maple	841	(N/A)	8.8	17.3	105.18
Sugar maple	481	(N/A)	7.7	9.9	68.78
Siberian elm	275	(N/A)	6.6	5.6	45.77
Red maple	132	(N/A)	3.3	2.7	43.94
Ash	106	(N/A)	3.3	2.2	35.32
Austrian pine	79	(N/A)	2.2	1.6	39.70
Conifer Evergreen Large	32	(N/A)	1.1	0.7	32.32
Honeylocust	389	(N/A)	1.1	8.0	388.90
Black walnut	5	(N/A)	1.1	0.1	5.26
Eastern red cedar	0	(N/A)	1.1	0.0	0.00
Eastern hophornbeam	29	(N/A)	1.1	0.6	28.80
Other street trees	0	(±NaN)	0.0	0.0	0.00
Citywide total	4,870	(N/A)	100.0	100.0	53.51

Table 7: Summary of Benefits in Dollars

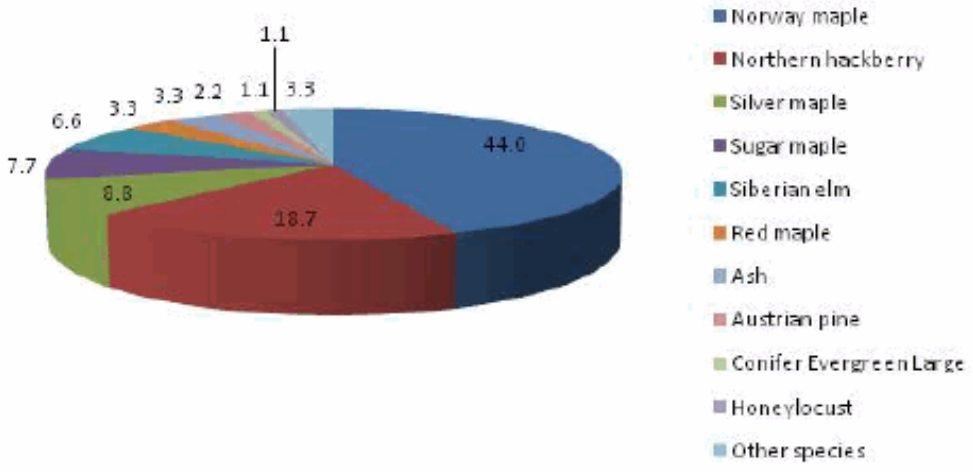
Annual Benefits of Public Trees by Species ($/tree)

8/10/2010

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Norway maple	58.18	6.19	10.28	67.80	38.85	181.29	(N/A)
Northern hackberry	71.55	6.92	12.17	78.63	55.63	224.91	(N/A)
Silver maple	68.61	13.69	12.50	122.69	105.18	322.67	(N/A)
Sugar maple	62.43	8.20	9.77	87.42	68.78	236.60	(N/A)
Siberian elm	70.60	8.54	12.75	91.66	45.77	229.32	(N/A)
Red maple	32.98	4.51	5.88	29.08	43.94	116.38	(N/A)
Ash	66.79	6.38	12.44	90.41	35.32	211.34	(N/A)
Austrian pine	27.30	2.79	2.13	61.08	39.70	133.00	(N/A)
Conifer Evergreen	24.14	2.45	2.82	41.70	32.32	103.42	(N/A)
Honeylocust	74.28	15.31	12.87	126.96	388.90	618.32	(N/A)
Black walnut	0.66	0.05	0.08	0.48	5.26	6.54	(N/A)
Eastern red cedar	24.57	1.36	2.19	44.30	0.00	72.41	(N/A)
Eastern	46.14	5.86	8.35	31.82	28.80	120.96	(N/A)
Other street trees	0.00	0.00	0.00	0.00	0.00	0.00	(N/A)

Species Distribution of Public Trees (%)

8/9/2010

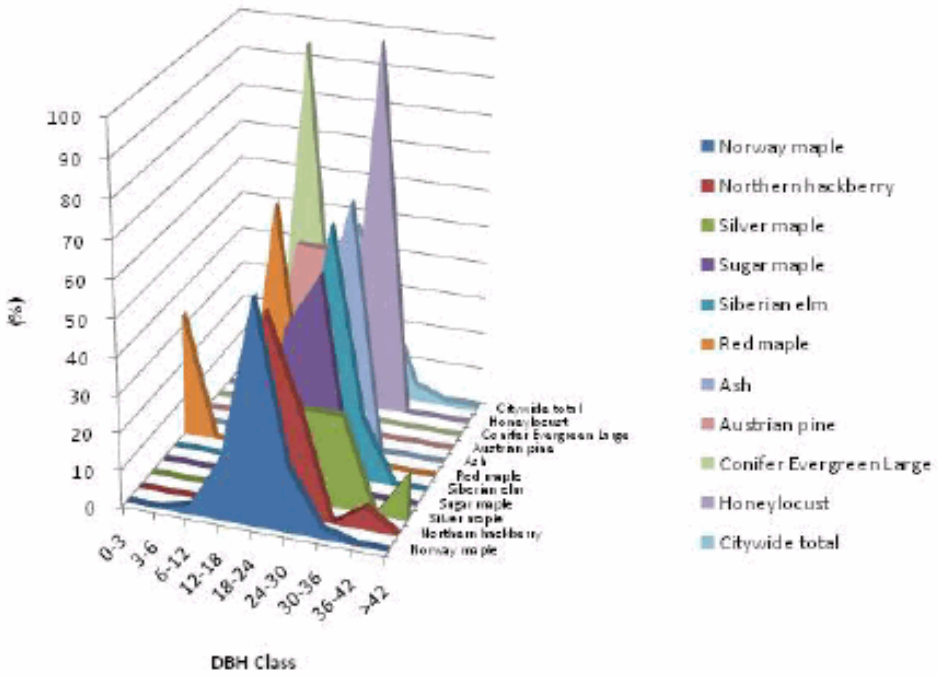


Species	Percent
Norway maple	44.0
Northern hackberry	18.7
Silver maple	8.8
Sugar maple	7.7
Siberian elm	6.6
Red maple	3.3
Ash	3.3
Austrian pine	2.2
Conifer Evergreen Large	1.1
Honeylocust	1.1
Other species	3.3
Total	100.0

Figure 1: Species Distribution

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

8/9/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	0.0	0.0	2.5	17.5	60.0	17.5	2.5	0.0	0.0
Northern hackberry	0.0	0.0	0.0	11.8	52.9	29.4	0.0	5.9	0.0
Silver maple	0.0	0.0	0.0	12.5	25.0	25.0	25.0	0.0	12.5
Sugar maple	0.0	0.0	0.0	0.0	42.9	57.1	0.0	0.0	0.0
Siberian elm	0.0	0.0	0.0	0.0	16.7	66.7	16.7	0.0	0.0
Red maple	33.3	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0
Ash	0.0	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0
Austrian pine	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Conifer Evergreen	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Honeylocust	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Citywide total	2.2	0.0	1.1	15.4	47.3	27.5	4.4	1.1	1.1

Figure 2: Relative Size Class

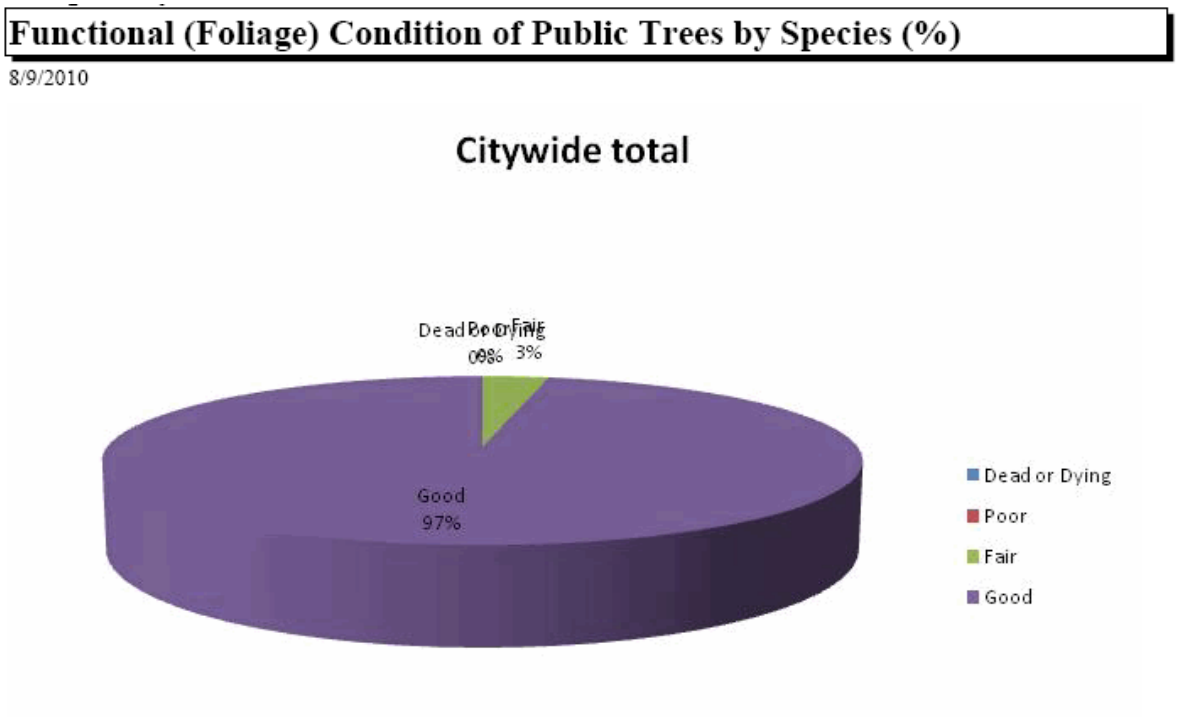


Figure 3: Foliage Condition

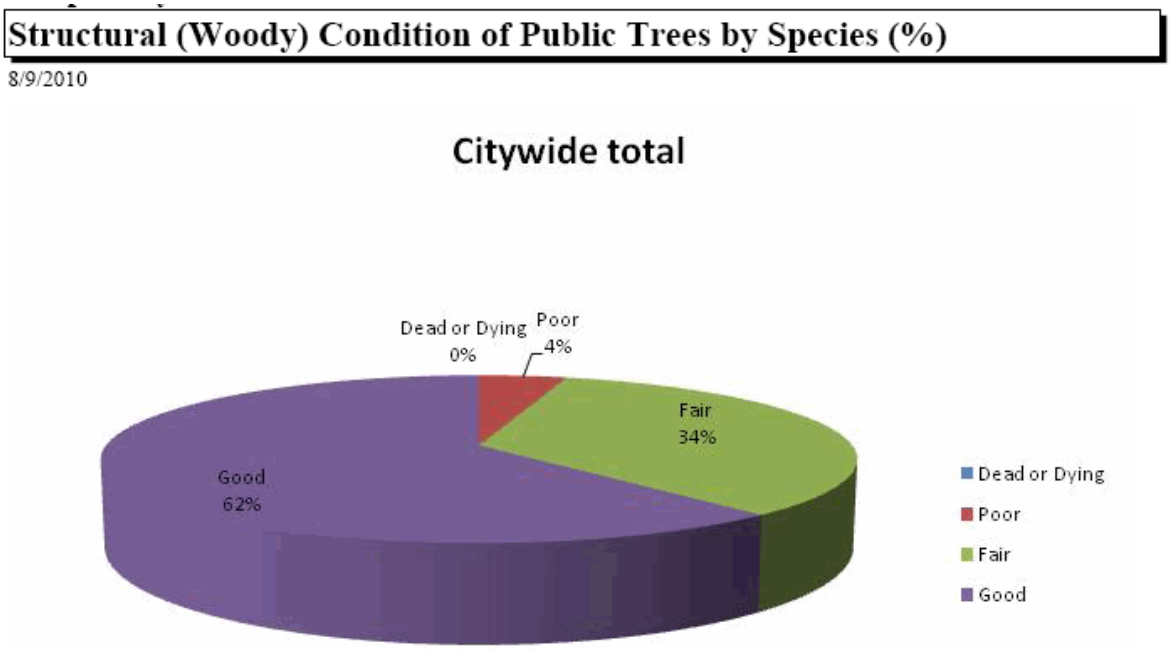
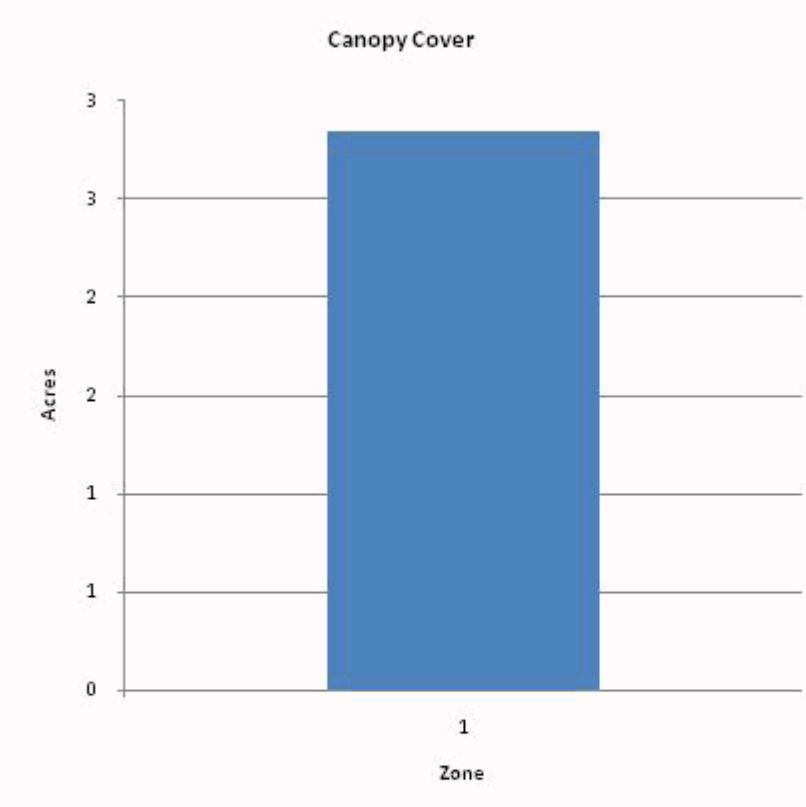


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

8/9/2010



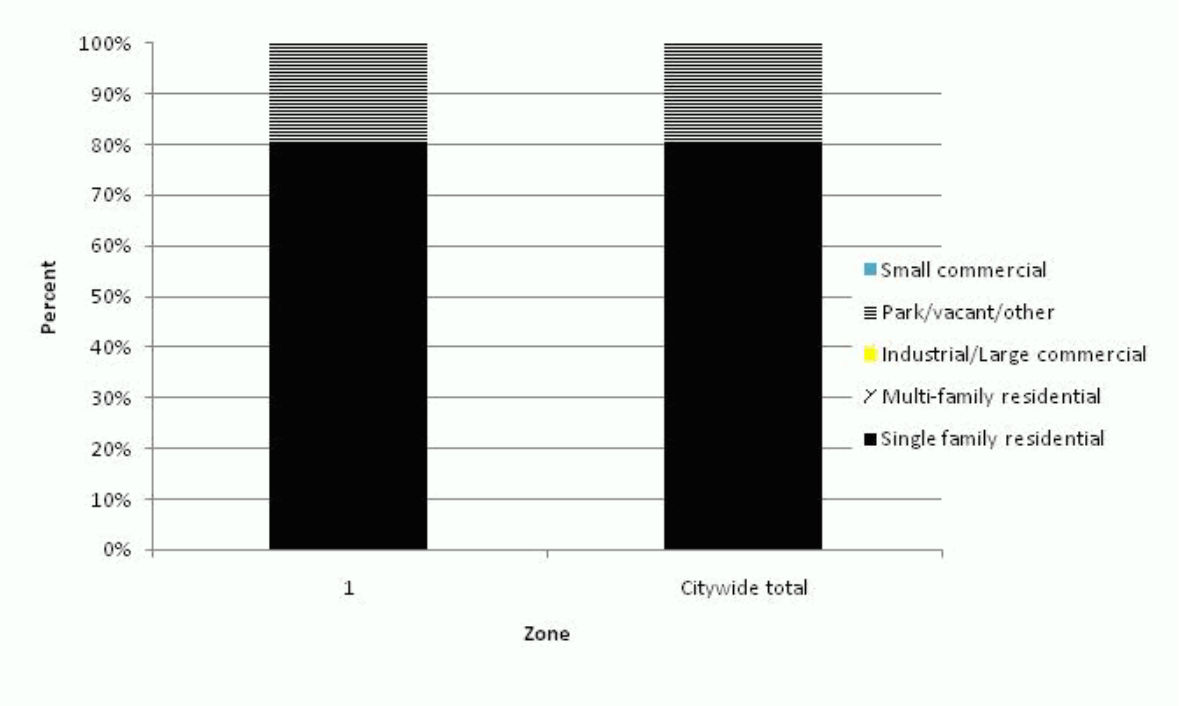
Zone	Acres	% of Total Canopy Cover
1	3	100.0
Citywide total	3	100.0

	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	3		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

8/9/2010

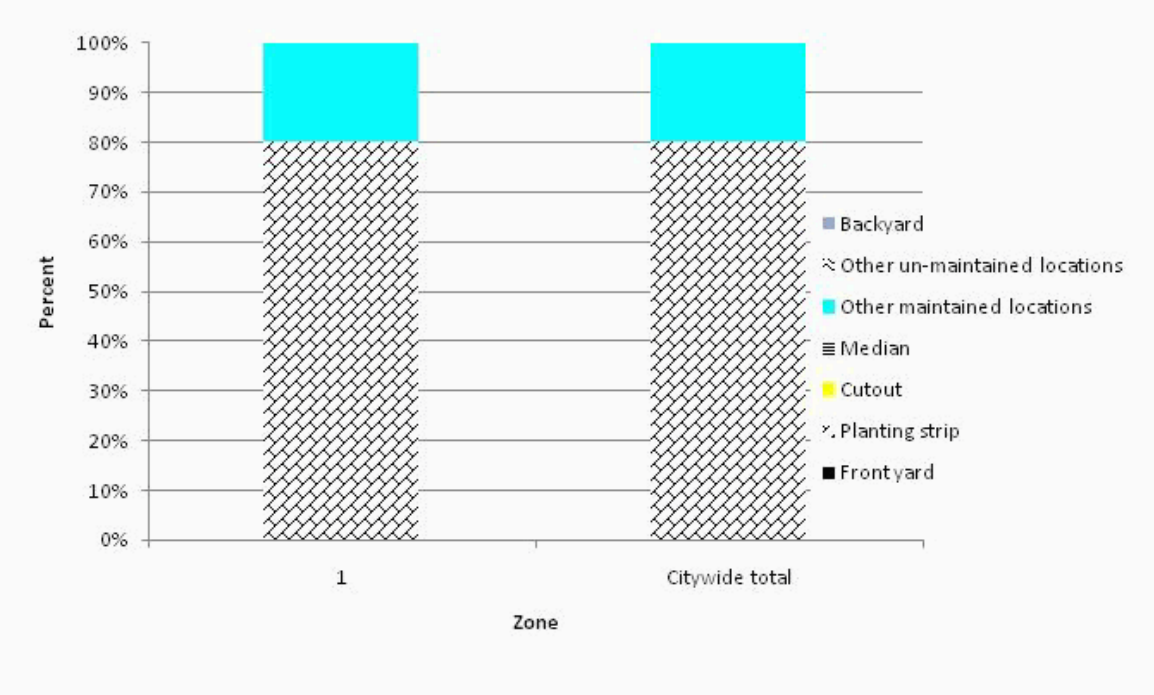


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	80.2	0.0	0.0	19.8	0.0
Citywide total	80.2	0.0	0.0	19.8	0.0

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

8/9/2010



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	0.0	80.2	0.0	0.0	19.8	0.0	0.0
Citywide total	0.0	80.2	0.0	0.0	19.8	0.0	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

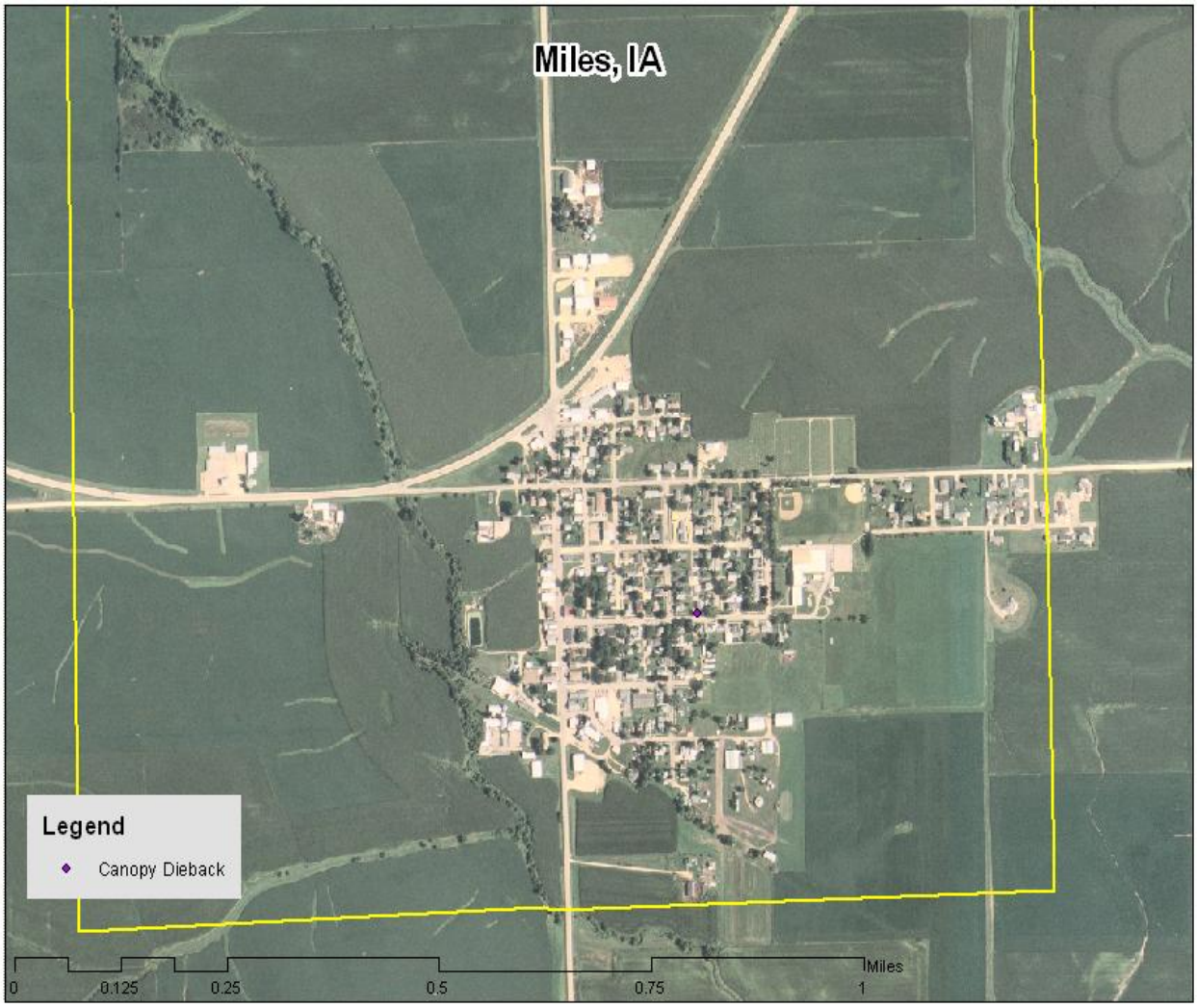


Figure 2: Location of EAB symptoms

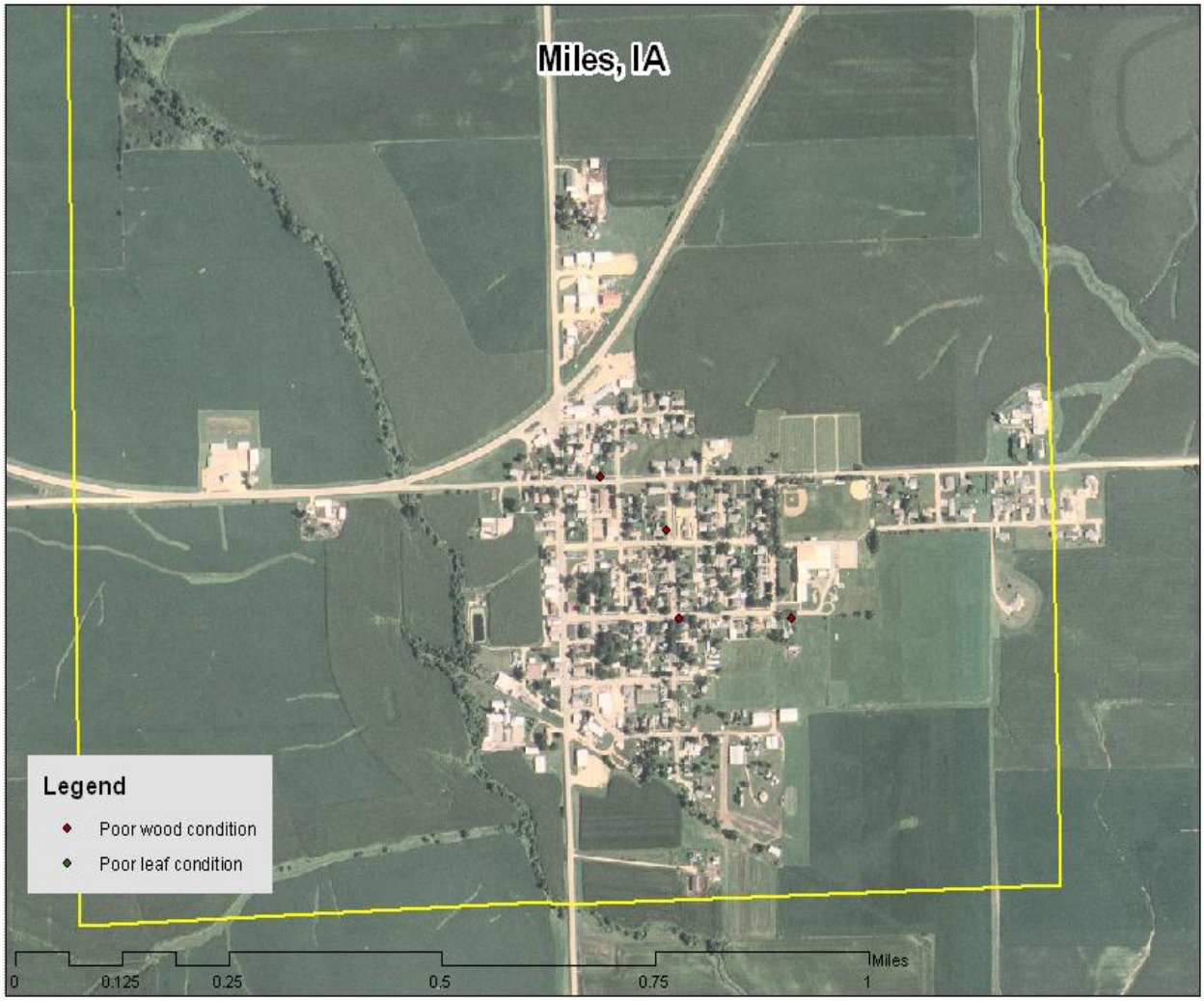


Figure 3: Location of Poor Condition Trees

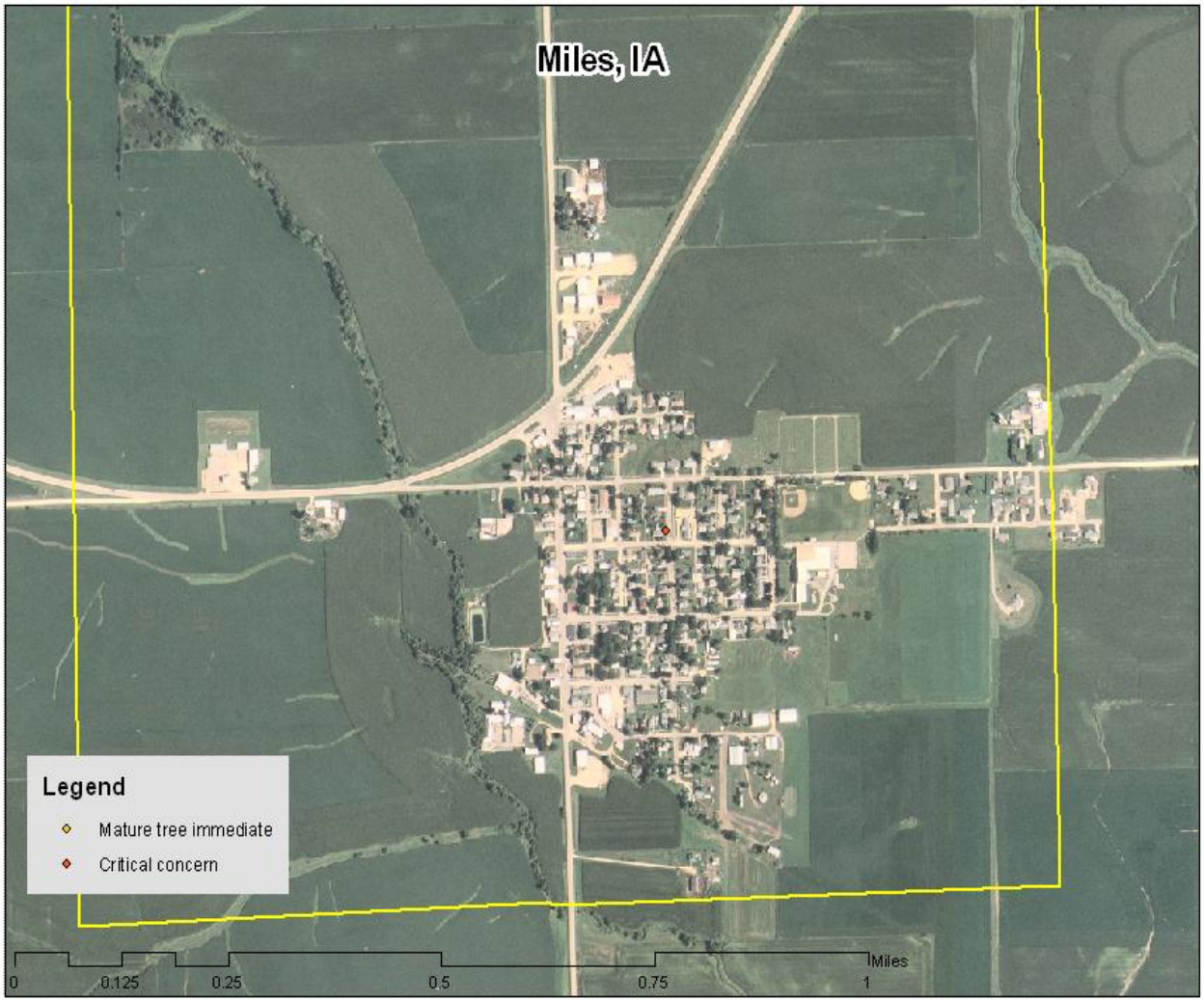


Figure 4: Location of Trees with Recommended Maintenance

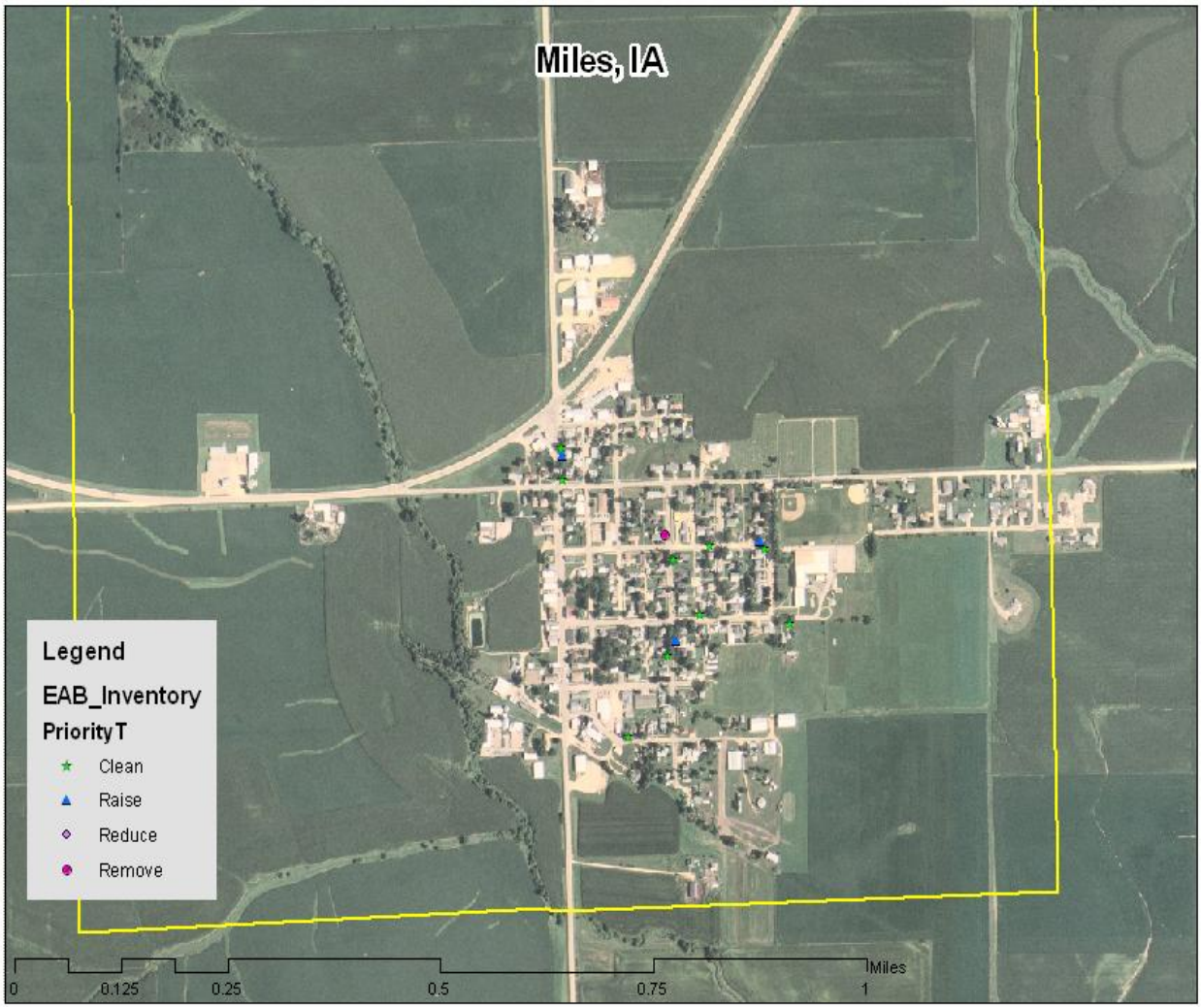


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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