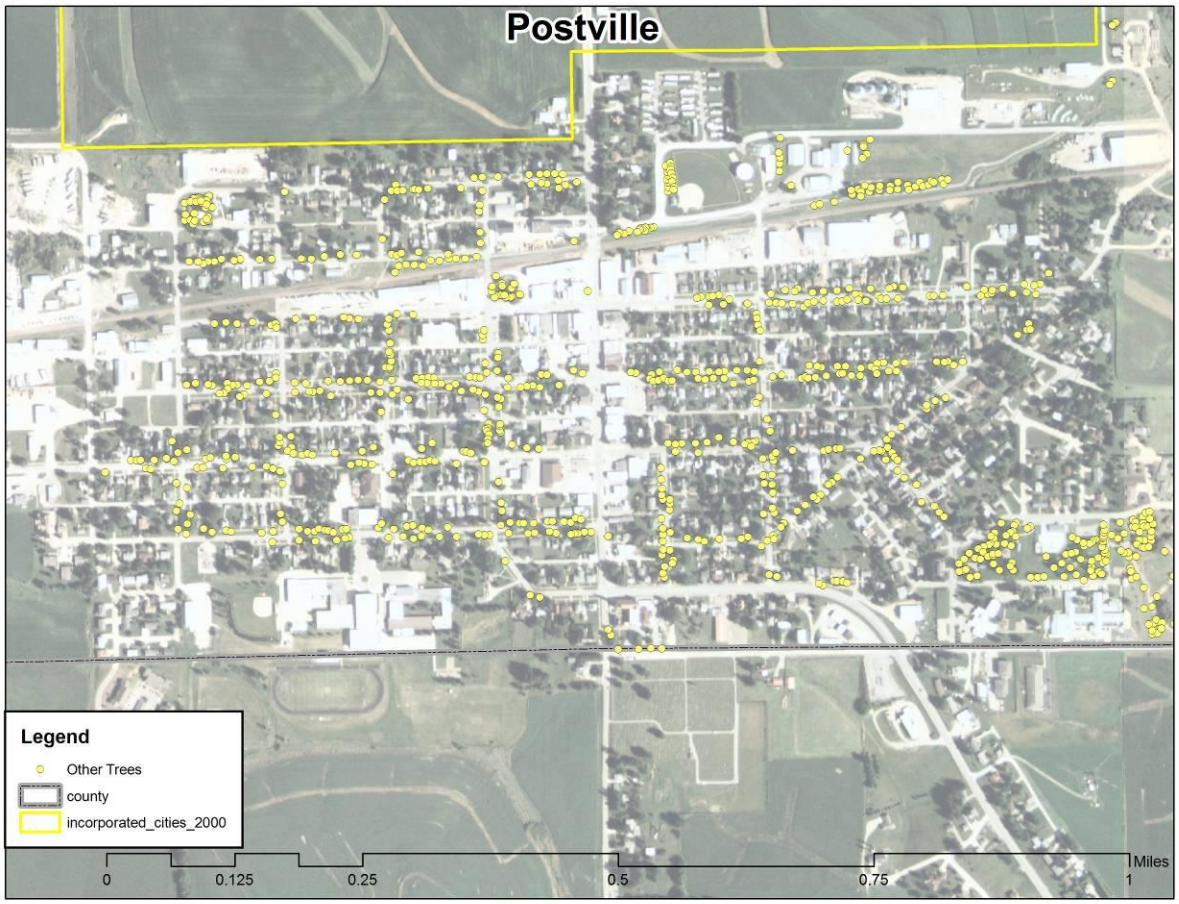
Morning Sun, IA



2010 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Morning Sun 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% of Morning Sun'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 191 trees inventoried.

- Morning Sun's trees provide $27,024 of benefits annually, an average of $141 a tree
- There are over 24 species of trees
- The top three genus are: Maple 42%, Ash 10%, and Pine 6%
- 49% 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, 3 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 6 of the 19 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 10 years to remove ash – Suggestion: request a budget increase to $3,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2010, a tree inventory was conducted that included 100% of the city owned street trees. 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 191 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. Morning Sun's trees reduce energy related costs by approximately $27,024 annually (Appendix A, Table 1). These savings are both in Electricity (35.5 MWh) and in Natural Gas (4808.9 Therms).

Annual Stormwater Benefits

Morning Sun's trees intercept about 348,045 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $9,433 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 Morning Sun, it is estimated that trees remove 436 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 $1,223 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Morning Sun, trees sequester about 133,599 lbs of carbon a year with an associated value of $1,002 (Appendix A, Table 4). In addition, the trees store 1,167,705 lbs of carbon, with a yearly benefit of $8,758 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Morning Sun receives $7,959 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, Morning Sun's trees provide $27,024 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 191 trees in Morning Sun provide approximately $141 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

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

Maple	82	42%
Ash	19	10%
Pine	13	6%
Spruce	9	5%
Catalpa	7	3%
Redbud	7	3%
Sycamore	7	3%
Elm	8	4%
Apple (Crab)	6	3%
Walnut	6	3%
Hackberry	4	2%
Cedar	4	2%
Magnolia	3	2%
Mulberry	3	2%
Sweetgum	2	1%
Tulip-tree	2	1%
Other species	9	8%

Age Class

Most of Morning Sun'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. Morning Sun's size curve shows another 41% between 0-12" which is on the smaller side, indicating a slightly younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Morning Sun indicate that 74% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 45% of Morning Sun'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 9% of the population. This 9% 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	22	11%
Crown Raising	8	4%
Tree Staking	0	0%
Tree Removal	8	4%
Crown Reduction	56	29%

Canopy Cover

The canopy cover of Morning Sun is approximately 4 acres (Appendix A, Figure 4). According to the 2000 census, Morning Sun occupies 512 acres. Thus the canopy cover on city land is about 1%.

Land Use and Location

The majority of Morning Sun'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	98.4%
Park/vacant/other	1%
Industrial/Large commercial	0%
Small commercial	<1%
Multifamily residential	0%

Location	
Backyard	6.8%
Other maintained locations	1.6%
Cutout (surrounded by pavement)	0%
Front yard	91.6%

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

Morning Sun has 0 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 3 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the largest immediate concern trees are addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are a total of 61 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 19 ash trees, and 6 of those have signs and symptoms that have been associated with EAB. *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 Morning Sun.

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 (45%) (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, as is recommended to be outlined in

section 151.02 of the city ordinance, Planting Restrictions (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan with <u>No Additional Funding</u>

Year 1

Removal: 2 largest immediate concern trees
Planting and Replacement: 3 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 1 immediate concern trees and 2 additional young trees with poor health
Planting and Replacement: 4 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: 2 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 3 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4

Removal: Removal of any new critical concern trees and ash in poor health
Planting and Replacement: 3 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: Removal of any new critical concern trees and ash in poor health
Planting and Replacement: 2 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: Removal of any new critical concern trees and ash in poor health
Planting and Replacement: 3 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 6 of 19 ash trees removed (approximately 32% of ash). It will take approximately 10 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 to $3,000 a year. If the budget were increased to $4,000 a year all ash could be removed in 4 years.

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 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 restrictions, recommended to be outlined in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will 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. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Budget

Current Budget
Total $9,000 over 6 years ($1,500/year)

FY 2011 Budget
Removal: $1,500
Planting:
Watering & Maintenance:

FY 2012 Budget
Removal: $750
Planting: $750
Routine trimming:
Watering & Maintenance:

FY 2013 Budget
Removal: $1,500
Planting:
Watering & Maintenance:

FY 2014 Budget
Removal: $750
Planting: $750
Routine trimming:
Watering & Maintenance:

FY 2015 Budget
Removal: $1,500
Planting:
Watering & Maintenance:

FY 2016 Budget
Removal: $0
Planting: $1,500
Routine trimming:
Watering & Maintenance:

*Reduction of ash over 6 years: approximately 6 of 19 ash trees removed (approximately 32% 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 Morning Sun within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $3,000 a year. If the budget were increased to $4,000 a year all ash could be removed within 4 years. Additionally, it is recommended that Morning Sun 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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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
Sugar maple	7.1	542	928.2	910	1,451	(N/A)	15.7	19.6	48.37
Silver maple	8.0	605	1,028.4	1,008	1,613	(N/A)	15.2	21.8	55.62
Norway maple	3.4	261	484.7	475	736	(N/A)	10.0	9.9	38.73
Green ash	4.4	331	604.2	592	923	(N/A)	10.0	12.5	48.58
Norway spruce	0.6	44	84.7	83	127	(N/A)	4.7	1.7	14.15
Elm	1.6	118	217.8	213	332	(N/A)	4.2	4.5	41.49
Catalpa	2.4	181	316.2	310	490	(N/A)	3.7	6.6	70.07
Eastern redbud	0.3	21	47.3	46	67	(N/A)	3.7	0.9	9.59
American sycamore	2.1	157	288.7	283	440	(N/A)	3.7	5.9	62.86
Conifer Evergreen	0.3	21	45.1	44	65	(N/A)	3.1	0.9	10.87
Black walnut	0.7	57	99.9	98	154	(N/A)	3.1	2.1	25.74
Apple	0.2	18	40.8	40	58	(N/A)	3.1	0.8	9.67
Eastern white pine	0.4	29	50.7	50	79	(N/A)	3.1	1.1	13.11
Northern hackberry	1.0	78	154.1	151	229	(N/A)	2.1	3.1	57.20
Eastern red cedar	0.2	15	29.3	29	43	(N/A)	2.1	0.6	10.82
Red maple	0.3	25	40.5	40	65	(N/A)	1.6	0.9	21.55
Southern magnolia	0.2	15	31.0	30	46	(N/A)	1.6	0.6	15.25
White mulberry	0.2	16	32.9	32	48	(N/A)	1.6	0.7	15.96
Sweetgum	0.6	43	73.8	72	115	(N/A)	1.1	1.6	57.57
Tulip tree	0.5	36	54.0	53	88	(N/A)	1.1	1.2	44.23
Other street trees	1.1	84	155.8	153	236	(N/A)	5.8	3.2	21.48
Citywide total	35.5	2,695	4,808.3	4,712	7,407	(N/A)	100.0	100.0	38.78

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
Sugar maple	63,165	1,712	(N/A)	15.7	18.2	57.06
Silver maple	93,661	2,538	(N/A)	15.2	26.9	87.53
Norway maple	23,859	647	(N/A)	10.0	6.9	34.03
Green ash	43,845	1,188	(N/A)	10.0	12.6	62.54
Norway spruce	6,480	176	(N/A)	4.7	1.9	19.51
Elm	17,767	482	(N/A)	4.2	5.1	60.19
Catalpa	29,230	792	(N/A)	3.7	8.4	113.17
Eastern redbud	946	26	(N/A)	3.7	0.3	3.66
American sycamore	22,612	613	(N/A)	3.7	6.5	87.55
Conifer Evergreen	3,036	82	(N/A)	3.1	0.9	13.71
Black walnut	5,615	152	(N/A)	3.1	1.6	25.36
Apple	804	22	(N/A)	3.1	0.2	3.63
Eastern white pine	4,311	117	(N/A)	3.1	1.2	19.47
Northern hackberry	7,911	214	(N/A)	2.1	2.3	53.60
Eastern red cedar	2,660	72	(N/A)	2.1	0.8	18.03
Red maple	1,878	51	(N/A)	1.6	0.5	16.97
Southern magnolia	1,509	41	(N/A)	1.6	0.4	13.63
White mulberry	1,189	32	(N/A)	1.6	0.3	10.74
Sweetgum	5,408	147	(N/A)	1.1	1.6	73.29
Tulip tree	2,931	79	(N/A)	1.1	0.8	39.72
Other street trees	9,228	250	(N/A)	5.8	2.7	22.74
Citywide total	348,045	9,433	(N/A)	100.0	100.0	49.39

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

11/22/2010

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
Sugar maple	7.5	1.3	3.9	0.3	41	33.6	4.9	4.7	32.3	210	-6.0	-23	82.5	229	(N/A)	15.7	7.63
Silver maple	13.8	2.3	7.1	0.6	75	37.4	5.5	5.2	36.1	235	-7.6	-29	100.5	281	(N/A)	15.2	9.70
Norway maple	3.9	0.7	2.1	0.2	21	16.6	2.4	2.3	15.6	103	-1.0	-4	42.6	121	(N/A)	9.9	6.34
Green ash	4.9	0.8	2.4	0.2	26	20.9	3.0	2.9	19.8	130	0.0	0	54.8	156	(N/A)	9.9	8.21
Norway spruce	0.6	0.1	0.6	0.1	4	2.8	0.4	0.4	2.6	18	-2.0	-8	5.6	14	(N/A)	4.7	1.57
Elm	2.7	0.4	1.2	0.1	14	7.5	1.1	1.0	7.1	47	0.0	0	21.1	61	(N/A)	4.2	7.58
Catalpa	4.4	0.7	2.0	0.2	23	11.3	1.6	1.6	10.8	70	0.0	0	32.7	94	(N/A)	3.7	13.41
Eastern redbud	0.1	0.0	0.1	0.0	1	1.4	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	3.7	1.32
American sycamore	2.7	0.4	1.3	0.1	14	9.9	1.4	1.4	9.4	62	0.0	0	26.7	76	(N/A)	3.7	10.87
Conifer Evergreen	0.2	0.0	0.3	0.0	2	1.4	0.2	0.2	1.3	8	-0.9	-3	2.7	7	(N/A)	3.1	1.14
Black walnut	0.4	0.1	0.3	0.0	2	3.5	0.5	0.5	3.4	22	0.0	0	8.7	24	(N/A)	3.1	4.08
Apple	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	7	0.0	0	2.8	8	(N/A)	3.1	1.32
Eastern white pine	0.4	0.1	0.4	0.1	3	1.8	0.3	0.3	1.7	11	-1.4	-5	3.6	9	(N/A)	3.1	1.46
Northern hackberry	1.0	0.2	0.5	0.0	5	5.0	0.7	0.7	4.6	31	0.0	0	12.8	36	(N/A)	2.1	9.10
Eastern red cedar	0.4	0.1	0.3	0.1	3	0.9	0.1	0.1	0.9	6	-1.4	-5	1.5	3	(N/A)	2.1	0.80
Red maple	0.3	0.1	0.2	0.0	2	1.5	0.2	0.2	1.5	10	-0.1	0	3.9	11	(N/A)	1.6	3.66
Southern magnolia	0.0	0.0	0.1	0.0	0	1.0	0.1	0.1	0.9	6	-0.4	-1	2.0	5	(N/A)	1.6	1.75
White mulberry	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	3.0	9	(N/A)	1.6	2.85
Sweetgum	0.6	0.1	0.3	0.0	3	2.7	0.4	0.4	2.6	17	0.0	0	7.0	20	(N/A)	1.0	9.95
Tulip tree	0.2	0.0	0.1	0.0	1	2.1	0.3	0.3	2.1	14	0.0	0	5.3	15	(N/A)	1.0	7.42
Other street trees	1.6	0.3	0.8	0.1	9	5.3	0.8	0.7	5.0	33	-1.6	-6	12.9	35	(N/A)	5.8	3.21
Citywide total	46.4	7.8	24.3	2.2	254	168.9	24.6	23.5	160.8	1,054	-22.6	-85	436.0	1,223	(N/A)	100.0	6.41

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
Sugar maple	212,795	1,596	(N/A)	15.7	18.2	53.20
Silver maple	296,323	2,222	(N/A)	15.2	25.4	76.64
Norway maple	65,446	491	(N/A)	10.0	5.6	25.83
Green ash	157,801	1,184	(N/A)	10.0	13.5	62.29
Norway spruce	3,700	28	(N/A)	4.7	0.3	3.08
Elm	90,937	682	(N/A)	4.2	7.8	85.25
Catalpa	149,613	1,122	(N/A)	3.7	12.8	160.30
Eastern redbud	3,107	23	(N/A)	3.7	0.3	3.33
American	86,534	649	(N/A)	3.7	7.4	92.71
Conifer Evergreen	981	7	(N/A)	3.1	0.1	1.23
Black walnut	14,569	109	(N/A)	3.1	1.3	18.21
Apple	2,527	19	(N/A)	3.1	0.2	3.16
Eastern white pine	2,712	20	(N/A)	3.1	0.2	3.39
Northern	12,852	96	(N/A)	2.1	1.1	24.10
Eastern red cedar	1,465	11	(N/A)	2.1	0.1	2.75
Red maple	4,061	30	(N/A)	1.6	0.4	10.15
Southern magnolia	1,041	8	(N/A)	1.6	0.1	2.60
White mulberry	6,770	51	(N/A)	1.6	0.6	16.93
Sweetgum	19,445	146	(N/A)	1.1	1.7	72.92
Tulip tree	7,344	55	(N/A)	1.1	0.6	27.54
Other street trees	12,556	208	(N/A)	5.8	2.4	18.87
Citywide total	1,167,705	8,758	(N/A)	100.0	100.0	45.85

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

11/22/2010

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	13,391	100	-1,021	-6	-8	11,969	90	24,333	183	(N/A)	15.7	18.2	6.08
Silver maple	26,855	201	-1,422	-6	-11	13,373	100	38,800	291	(N/A)	15.2	29.0	10.03
Norway maple	6,027	45	-314	-4	-2	5,766	43	11,476	86	(N/A)	10.0	8.6	4.53
Green ash	10,425	78	-757	-4	-6	7,312	55	16,976	127	(N/A)	10.0	12.7	6.70
Norway spruce	530	4	-18	-2	0	981	7	1,491	11	(N/A)	4.7	1.1	1.24
Elm	3,149	24	-436	-2	-3	2,619	20	5,330	40	(N/A)	4.2	4.0	5.00
Catalpa	4,908	37	-718	-1	-5	3,990	30	8,179	61	(N/A)	3.7	6.1	8.76
Eastern redbud	435	3	-15	-1	0	458	3	877	7	(N/A)	3.7	0.7	0.94
American sycamore	5,098	38	-415	-1	-3	3,472	26	8,153	61	(N/A)	3.7	6.1	8.73
Conifer Evergreen	152	1	-5	-1	0	464	3	610	5	(N/A)	3.1	0.5	0.76
Black walnut	1,671	13	-70	-1	-1	1,249	9	2,849	21	(N/A)	3.1	2.1	3.56
Apple	380	3	-12	-1	0	397	3	763	6	(N/A)	3.1	0.6	0.95
Eastern white pine	338	3	-13	-1	0	641	5	964	7	(N/A)	3.1	0.7	1.21
Northern hackberry	1,141	9	-62	-1	0	1,719	13	2,798	21	(N/A)	2.1	2.1	5.25
Eastern red cedar	109	1	-7	-1	0	322	2	423	3	(N/A)	2.1	0.3	0.79
Red maple	561	4	-19	-1	0	552	4	1,092	8	(N/A)	1.6	0.8	2.73
Southern magnolia	128	1	-5	-1	0	340	3	463	3	(N/A)	1.6	0.4	1.16
White mulberry	17	0	-32	-1	0	346	3	330	2	(N/A)	1.6	0.3	0.83
Sweetgum	1,302	10	-93	0	-1	945	7	2,154	16	(N/A)	1.1	1.6	8.08
Tulip tree	891	7	-35	0	0	786	6	1,641	12	(N/A)	1.1	1.2	6.15
Other street trees	2,185	16	-133	-2	-1	1,848	14	3,897	29	(N/A)	5.8	2.9	2.66
Citywide total	79,693	598	-5,605	-37	-42	59,548	447	133,599	1,002	(N/A)	100.0	100.0	5.25

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

11/22/2010

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	1,495	(N/A)	15.7	18.8	49.83
Silver maple	2,320	(N/A)	15.2	29.2	79.99
Norway maple	628	(N/A)	10.0	7.9	33.04
Green ash	925	(N/A)	10.0	11.6	48.70
Norway spruce	155	(N/A)	4.7	2.0	17.27
Elm	287	(N/A)	4.2	3.6	35.83
Catalpa	378	(N/A)	3.7	4.8	53.97
Eastern redbud	23	(N/A)	3.7	0.3	3.34
American sycamore	417	(N/A)	3.7	5.2	59.53
Conifer Evergreen	100	(N/A)	3.1	1.3	16.70
Black walnut	190	(N/A)	3.1	2.4	31.69
Apple	21	(N/A)	3.1	0.3	3.51
Eastern white pine	101	(N/A)	3.1	1.3	16.76
Northern hackberry	181	(N/A)	2.1	2.3	45.26
Eastern red cedar	62	(N/A)	2.1	0.8	15.44
Red maple	80	(N/A)	1.6	1.0	26.82
Southern magnolia	53	(N/A)	1.6	0.7	17.77
White mulberry	0	(N/A)	1.6	0.0	0.02
Sweetgum	111	(N/A)	1.1	1.4	55.72
Tulip tree	92	(N/A)	1.1	1.2	45.86
Other street trees	340	(N/A)	5.8	4.3	30.93
Citywide total	7,959	(N/A)	100.0	100.0	41.67

Table 7: Summary of Benefits in Dollars

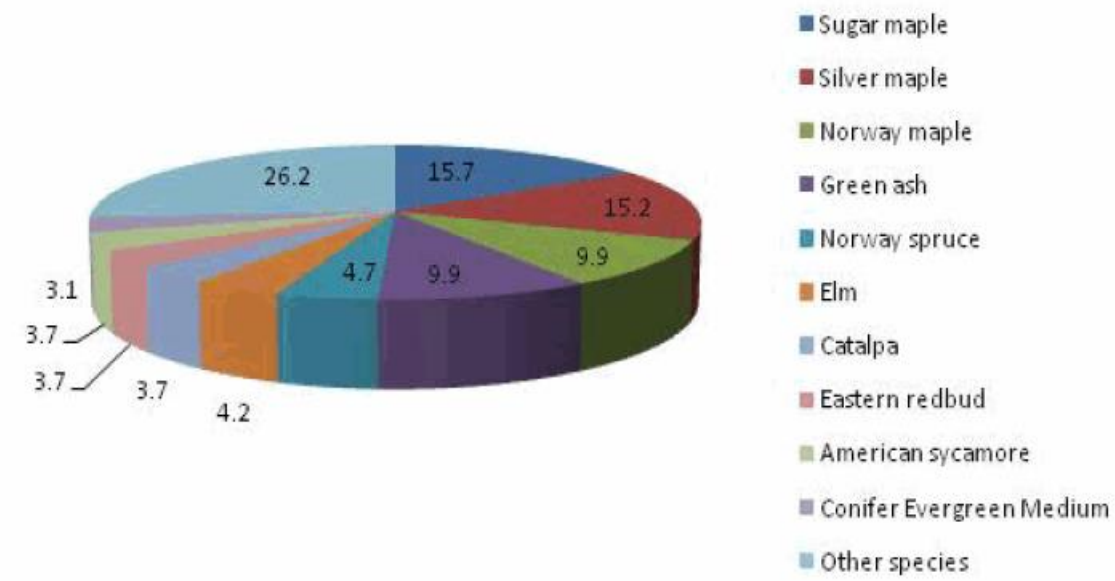
Total Annual Benefits of Public Trees by Species ($)

11/22/20

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Sugar maple	1,451	182	229	1,712	1,495	5,069	(±0)	18.8
Silver maple	1,613	291	281	2,538	2,320	7,043	(±0)	26.1
Norway maple	736	86	121	647	628	2,217	(±0)	8.2
Green ash	923	127	156	1,188	925	3,320	(±0)	12.3
Norway spruce	127	11	14	176	155	484	(±0)	1.8
Elm	332	40	61	482	287	1,201	(±0)	4.4
Catalpa	490	61	94	792	378	1,816	(±0)	6.7
Eastern redbud	67	7	9	26	23	132	(±0)	0.5
American sycamore	440	61	76	613	417	1,607	(±0)	5.9
Conifer Evergreen	65	5	7	82	100	259	(±0)	1.0
Black walnut	154	21	24	152	190	543	(±0)	2.0
Apple	58	6	8	22	21	114	(±0)	0.4
Eastern white pine	79	7	9	117	101	312	(±0)	1.2
Northern hackberry	229	21	36	214	181	682	(±0)	2.5
Eastern red cedar	43	3	3	72	62	184	(±0)	0.7
Red maple	65	8	11	51	80	215	(±0)	0.8
Southern magnolia	46	3	5	41	53	149	(±0)	0.6
White mulberry	48	2	9	32	0	91	(±0)	0.3
Sweetgum	115	16	20	147	111	409	(±0)	1.5
Tulip tree	88	12	15	79	92	287	(±0)	1.1
Other street trees	236	29	35	250	340	891	(±0)	3.3
Citywide Total	7,407	1,002	1,223	9,433	7,959	27,024	(±0)	100.0

Species Distribution of Public Trees (%)

11/22/2010

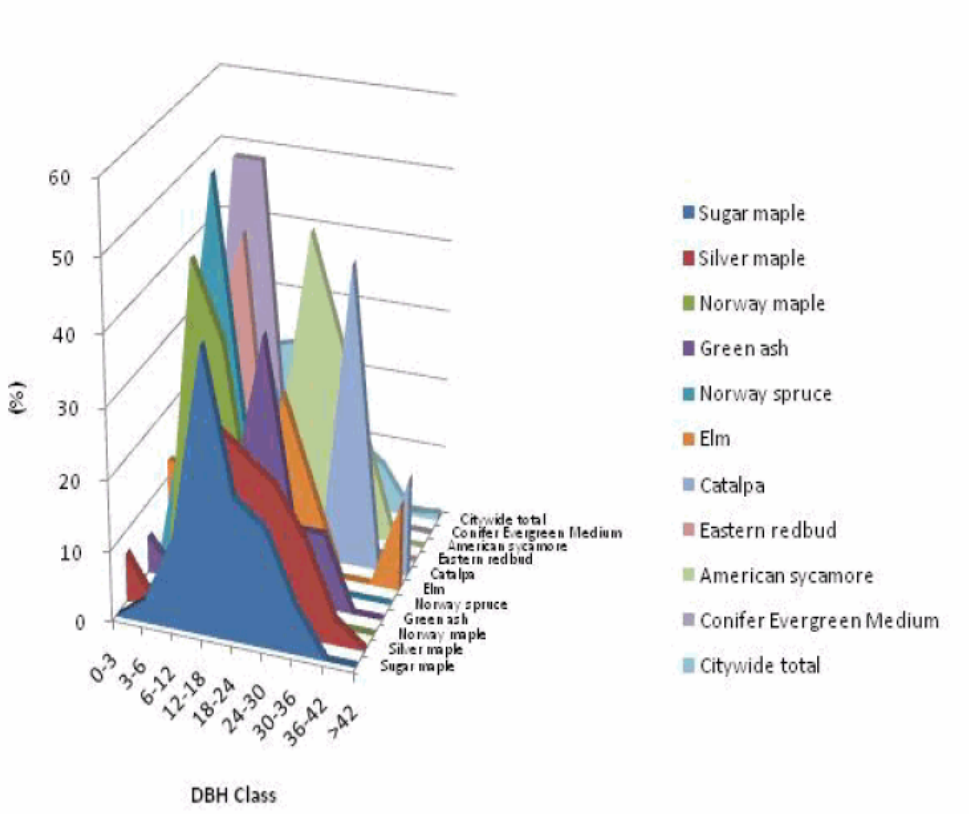


Species	Percent
Sugar maple	15.7
Silver maple	15.2
Norway maple	9.9
Green ash	9.9
Norway spruce	4.7
Elm	4.2
Catalpa	3.7
Eastern redbud	3.7
American sycamore	3.7
Conifer Evergreen	3.1
Other species	26.2
Total	100.0

Figure 1: Species Distribution

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

11/22/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Sugar maple	0.0	3.3	13.3	40.0	20.0	16.7	6.7	0.0	0.0
Silver maple	6.9	0.0	3.4	27.6	24.1	20.7	13.8	3.4	0.0
Norway maple	0.0	0.0	47.4	36.8	10.5	5.3	0.0	0.0	0.0
Green ash	5.3	0.0	21.1	15.8	36.8	10.5	10.5	0.0	0.0
Norway spruce	0.0	22.2	55.6	22.2	0.0	0.0	0.0	0.0	0.0
Elm	12.5	12.5	25.0	0.0	25.0	12.5	0.0	0.0	12.5
Catalpa	0.0	0.0	0.0	28.6	14.3	0.0	42.9	0.0	14.3
Eastern redbud	28.6	28.6	42.9	0.0	0.0	0.0	0.0	0.0	0.0
American sycamore	0.0	0.0	0.0	14.3	42.9	28.6	14.3	0.0	0.0
Conifer Evergreen	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Citywide total	5.2	14.1	22.0	23.0	17.3	9.9	6.8	0.5	1.0

Figure 2: Relative Age Class

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

11/22/2010

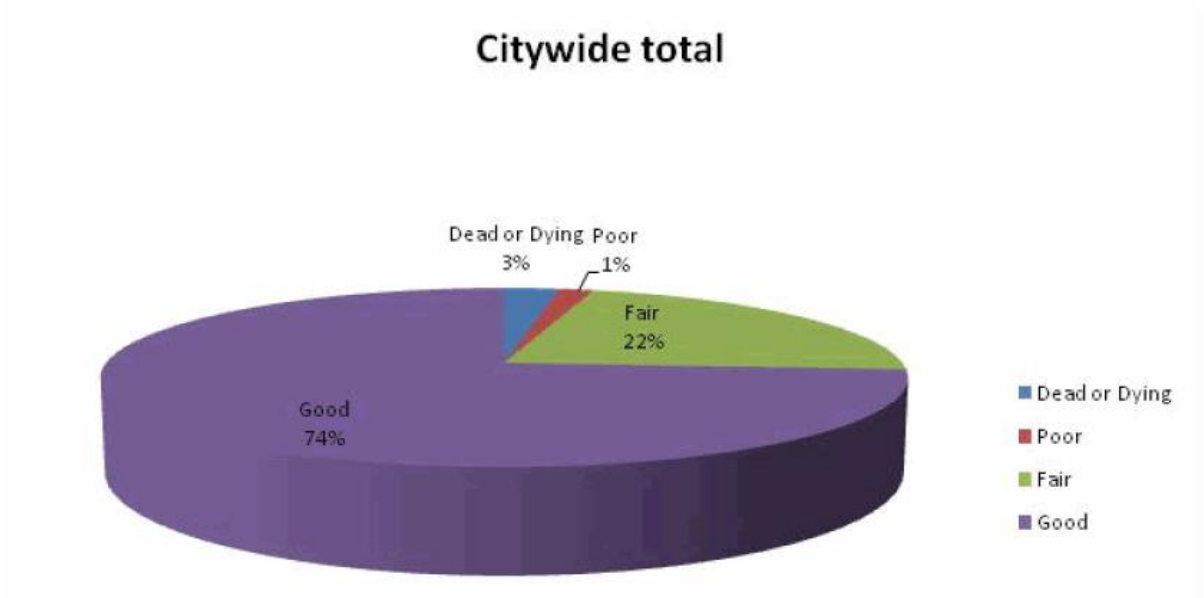


Figure 3: Foliage Condition

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

11/22/2010

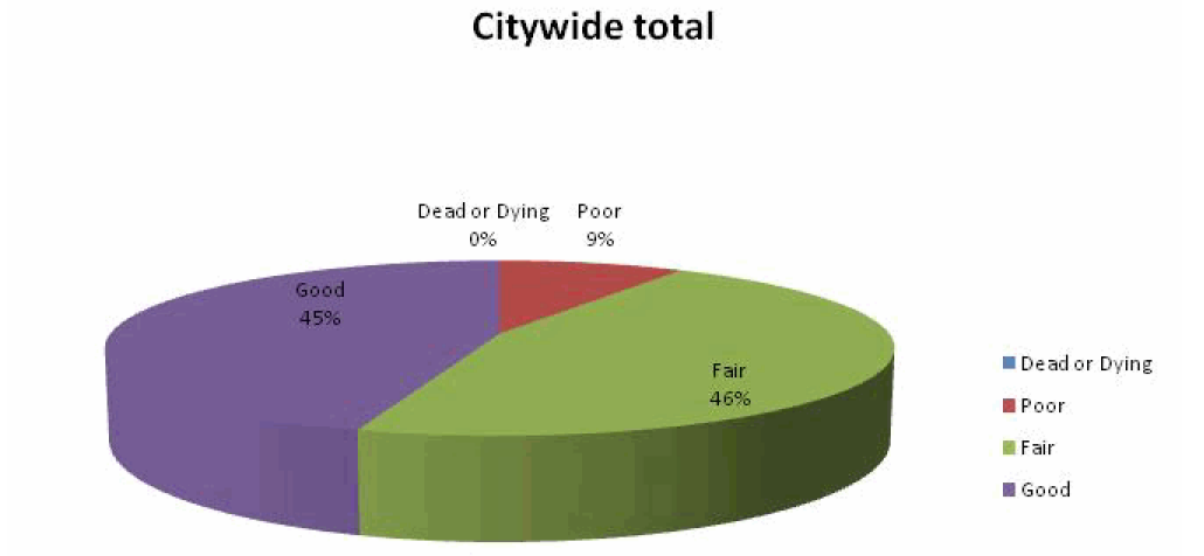
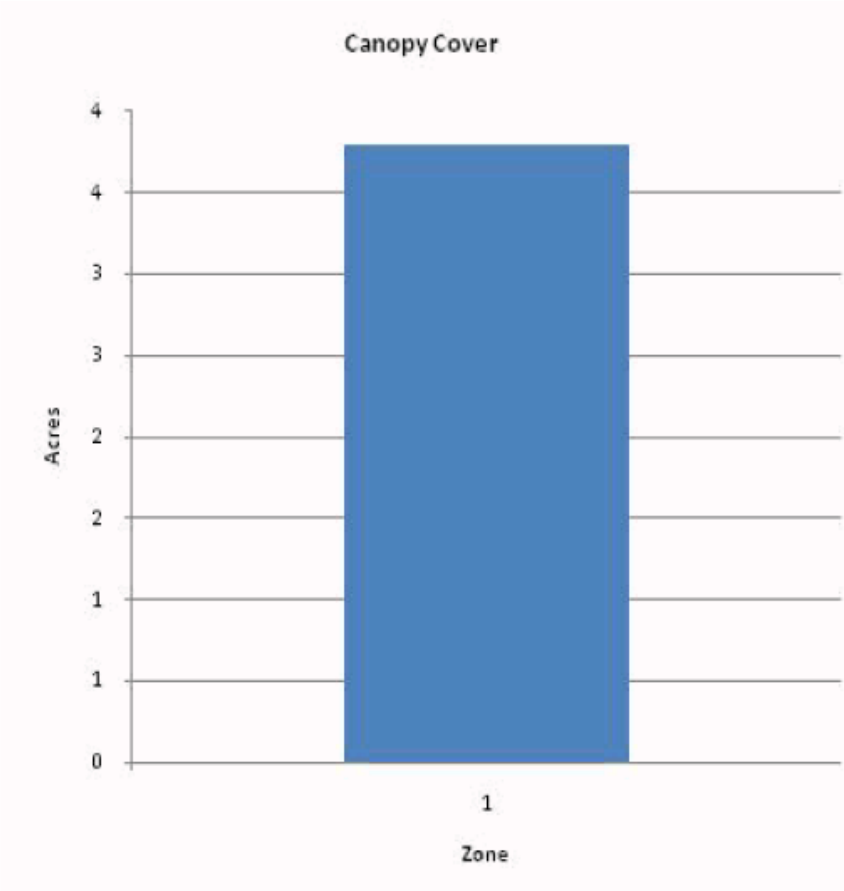


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

11/22/2010



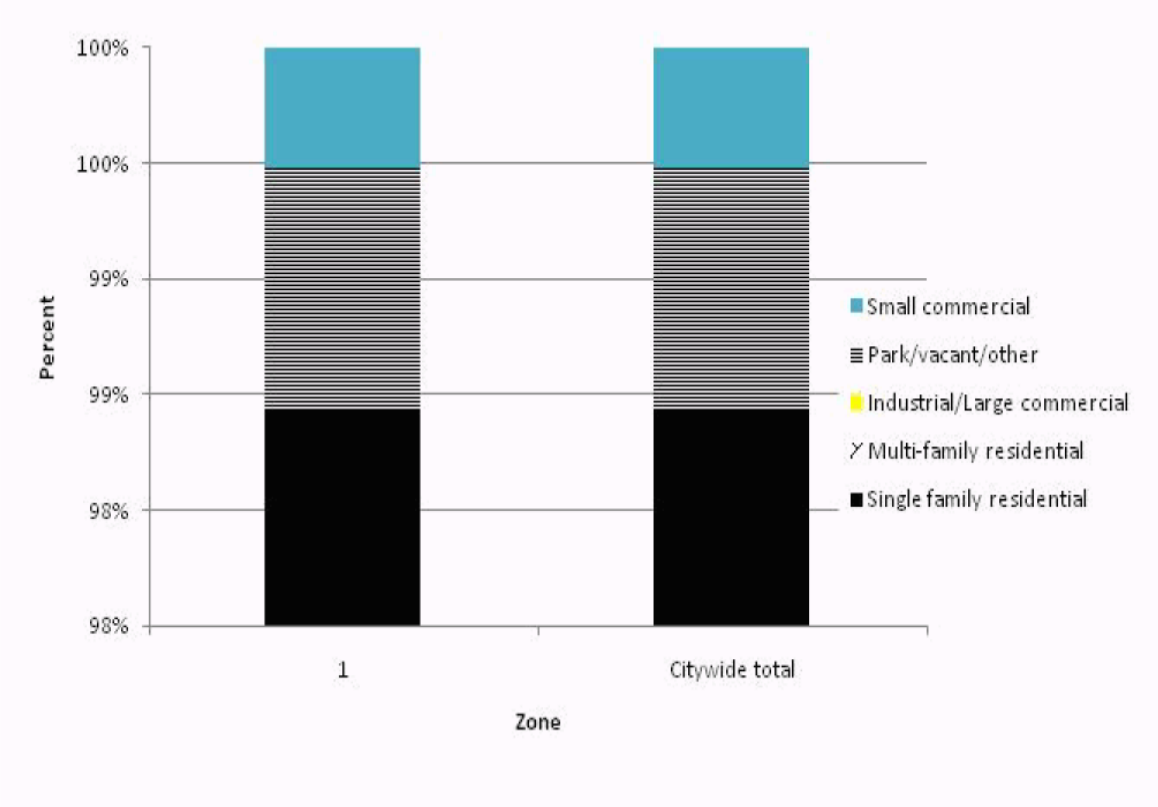
Zone	Acres	% of Total Canopy Cover
1	4	100.0
Citywide total	4	100.0

	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	4		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

11/22/2010

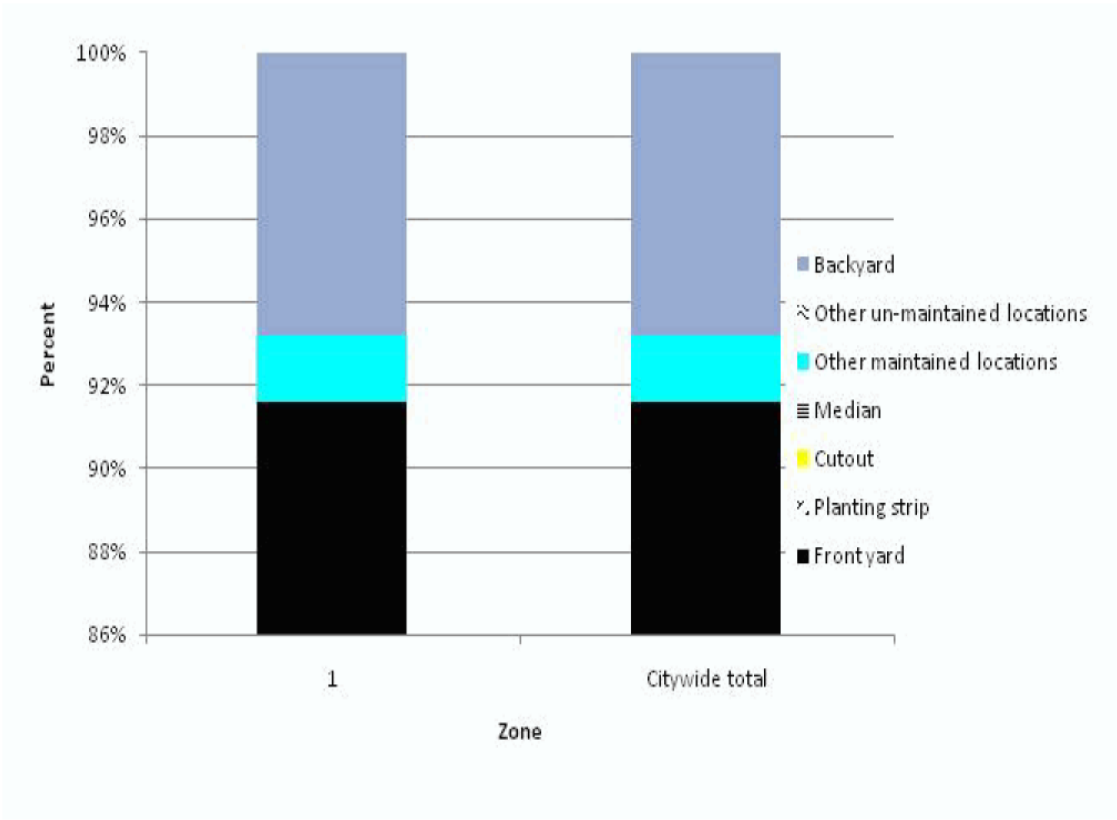


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	98.4	0.0	0.0	1.0	0.5
Citywide total	98.4	0.0	0.0	1.0	0.5

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	91.6	0.0	0.0	0.0	1.6	0.0	6.8
Citywide total	91.6	0.0	0.0	0.0	1.6	0.0	6.8

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

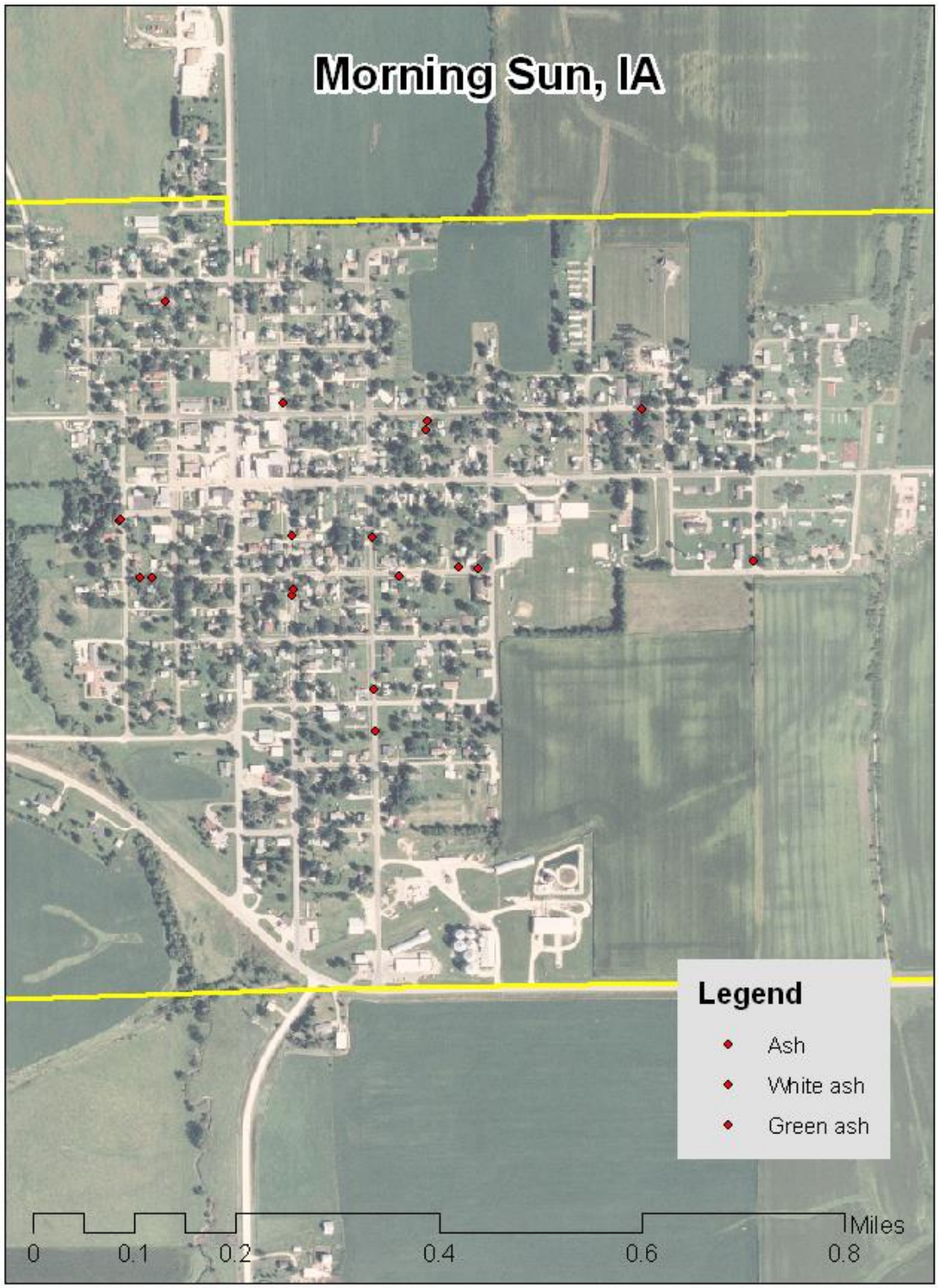


Figure 1: Location of Ash Trees

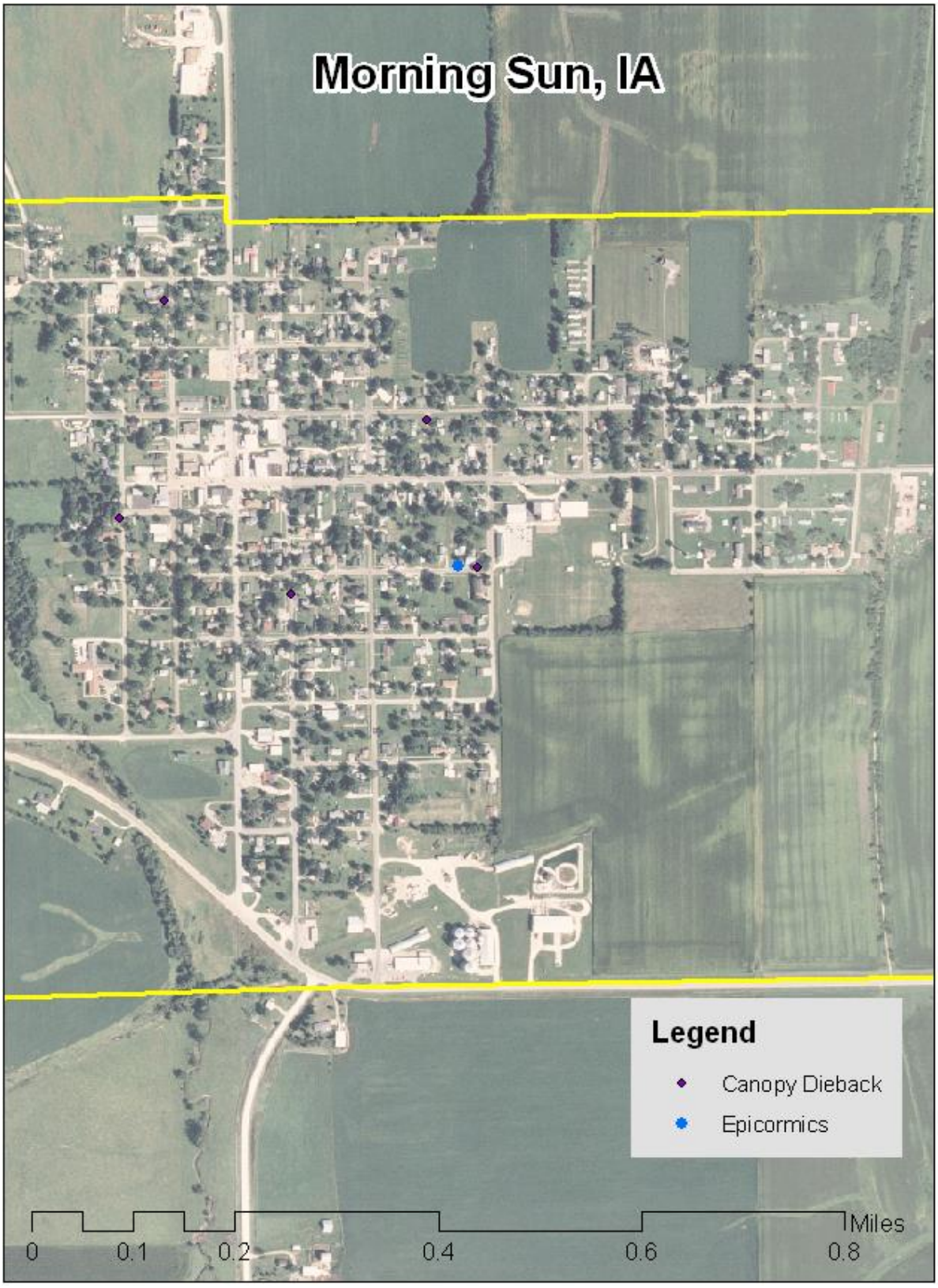


Figure 2: Location of EAB symptoms

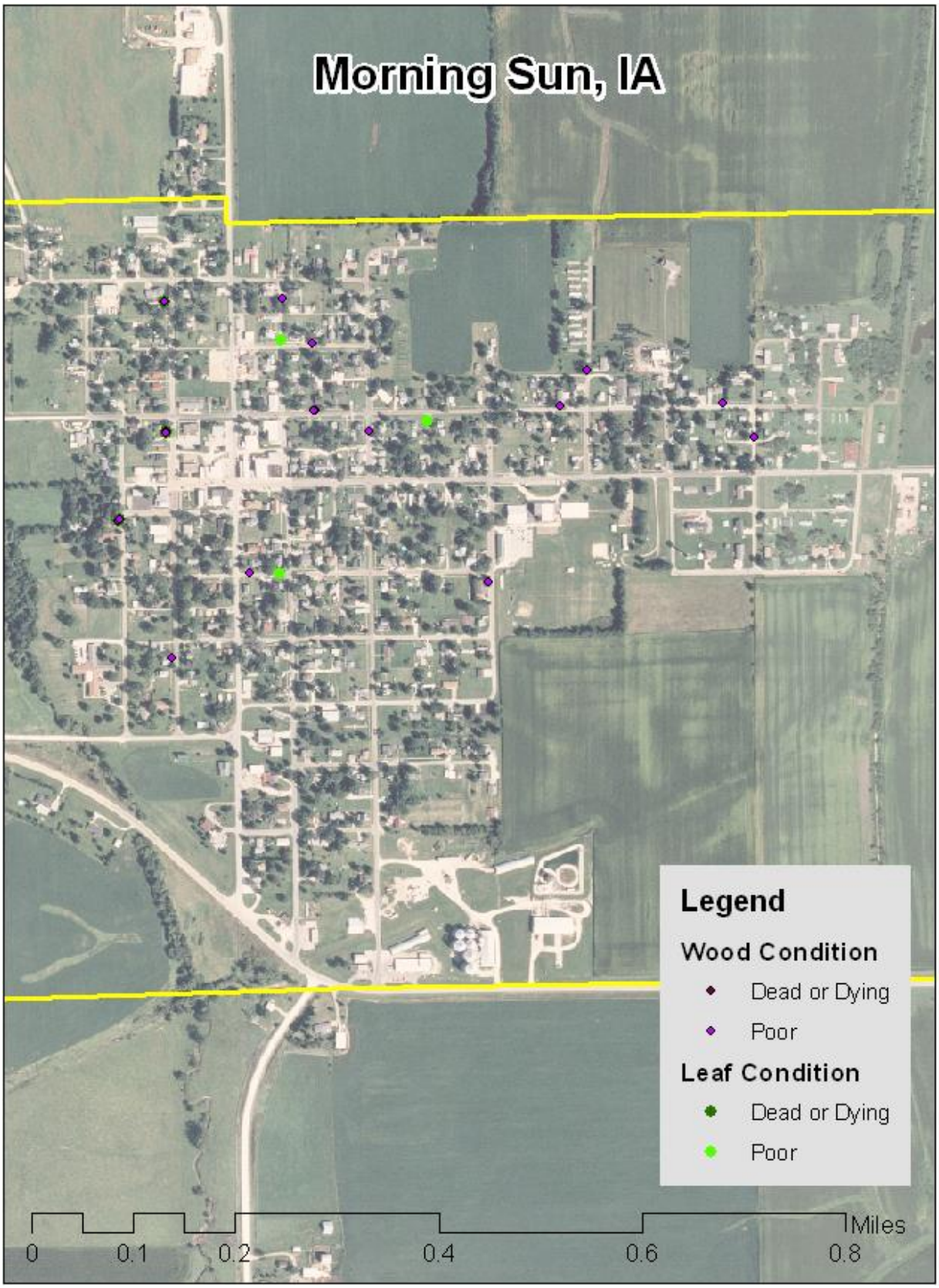


Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance*City ownership of the trees recommended for removal should be verified prior to any removal*

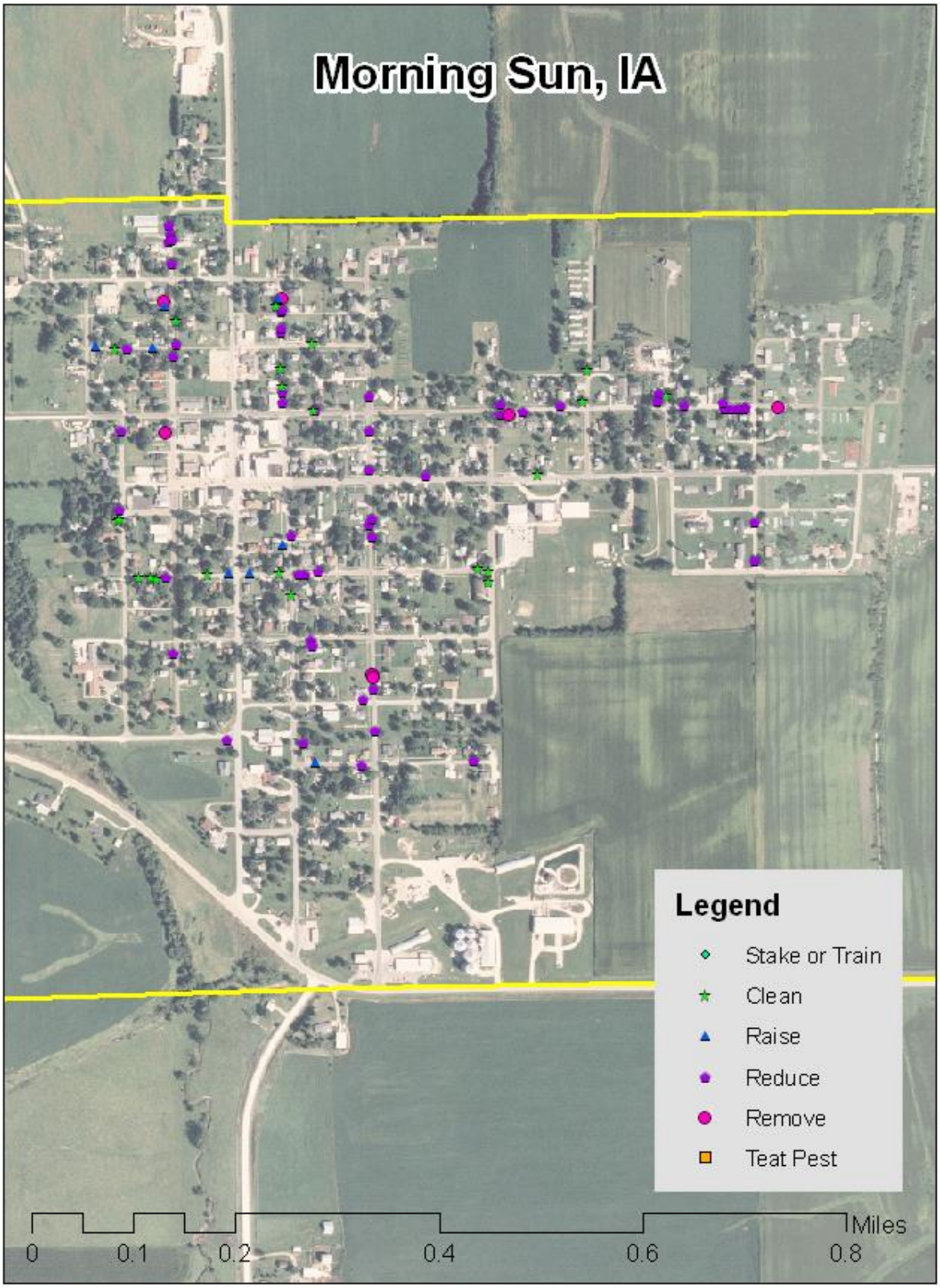


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Morning Sun Tree Ordinances

Morning Sun

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2c, d & e])

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

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

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

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

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that 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

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holder/property owner shall provide the City with notice at least twenty-four (24) hours prior to the time when inspection of backfill is desired.

8. Completion by the City. Should any excavation in any street or alley be discontinued or left open and unfinished for a period of twenty-four (24) hours after the approved completion date, or in the event the work is improperly done, the City has the right to finish or correct the excavation work and charge any expenses therefor to the permit holder/property owner.

9. Responsibility for Costs. All costs and expenses incident to the excavation shall be borne by the permit holder and/or property owner. The permit holder and owner shall indemnify the City from any loss or damage that may directly or indirectly be occasioned by such excavation.

10. Notification. At least forty-eight (48) hours prior to the commencement of the excavation, excluding Saturdays, Sundays and legal holidays, the person performing the excavation shall contact the Statewide Notification Center and provide the center with the information required under Section 480.4 of the Code of Iowa.

11. Permit Fee. A permit fee of ten dollars ($10.00) shall be payable at the time of filing the application with the City. A separate permit shall be required for each excavation.

12. Permit Issued. Upon approval of the application, filing of bond and insurance certificate, and payment of any required fees, a permit shall be issued.

13. Permit Exemption. Utility companies are exempt from the permit application requirement of this section. They shall, however, comply with all other pertinent provisions and shall post with the City a yearly bond in the amount of one thousand dollars ($1,000.00) to guarantee such compliance.

135.10 MAINTENANCE OF PARKING OR TERRACE. It shall be the responsibility of the abutting property owner to maintain all property outside the lot and property lines and inside the curb lines upon the public streets, except that the abutting property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. Maintenance includes timely mowing, trimming trees and shrubs and picking up litter.

(Code of Iowa, Sec. 364.12[2c])

135.11 FAILURE TO MAINTAIN PARKING OR TERRACE. If the abutting property owner does not perform an action required under the above section within a reasonable time, the City may perform the required action and assess the cost against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2e])

135.12 DUMPING OF SNOW. It is unlawful for any person to throw, push, or place or cause to be thrown, pushed or placed, any ice or snow from private property, sidewalks, or driveways onto the traveled way of a street or alley so as to obstruct gutters, or impede the passage of vehicles upon the street or alley or to create a hazardous condition therein; except where, in the cleaning of large commercial drives in the business district it is absolutely necessary to move the snow onto the street or alley temporarily, such accumulation shall be

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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 Director Richard Leopold at 515-281-5918.