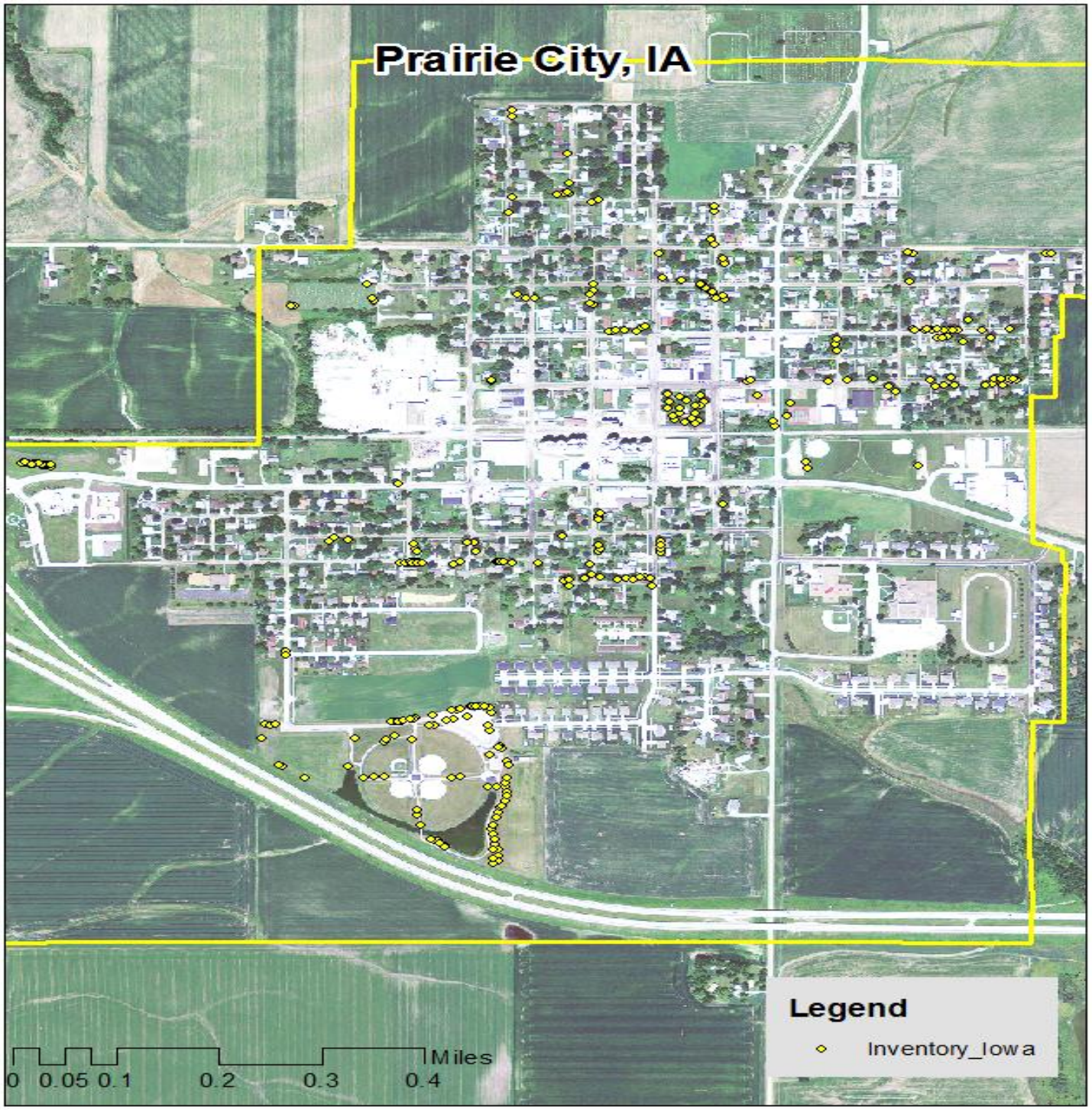
PRAIRIE CITY, IA



2014 Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Prairie City 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 5% of Prairie City'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 2013, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of city street trees. Below are some key findings of the 522 trees inventoried.

- Prairie City's trees provide $60,166 of benefits annually, an average of $115 a tree
- There are over 35 species of trees
- The top three genus are: Maple 27%, Spruce 24%, and Arborvitae 11%
- 25% of trees are in need of some type of management
- 26 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 26 trees needing removal, 9 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*
- 4 of the 26 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, evergreen, cottonwood, poplar, box elder, Siberian elm, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take several years to remove ash and other trees recommended for removal. Suggestion: request a budget increase to $6,880 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2013, 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 522 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Prairie City's trees reduce energy related costs by approximately $15,857 annually (Appendix A, Table 1). These savings are both in Electricity (74.6 MWh) and in Natural Gas (10,402.6 Therms).

Annual Stormwater Benefits

Prairie City's trees intercept about 861,658 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $23,353 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 Prairie City, it is estimated that trees remove 940 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 $2,610 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Prairie City, trees sequester about 276,253 lbs of carbon a year with an associated value of $2,072 (Appendix A, Table 5). In addition, the trees store 2,959,767 lbs of carbon, with a yearly benefit of $22,198 (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. Prairie City receives $16,273 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, Prairie City's trees provide $60,166 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 522 trees in Prairie City provide a little over $115 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Prairie City has over 35 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	140	27%
Spruce	123	24%
Arborvitae	55	11%
Oak	30	6%
Ash	26	5%
Hackberry	25	5%
Pear	17	3%
Apple (Crab)	16	3%
Linden/Basswood	15	3%
Pine	12	2%
Juniper	6	1%
Other broadleaf deciduous	57	11%

Age Class

Most of Prairie City's trees (50%) are between 0 and 6 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amounts of trees are in the 18 to 24 inch size category in diameter at 4.5 ft. Prairie City's size curve is on the smaller side, indicating a 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 Prairie City indicate that 87% of the trees are in good health, with only 5% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 73% of Prairie City's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 10% of the population. This 10% is an estimate of trees that need management follow up.

Management Needs

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

Crown Cleaning	92	18%
Tree Removal	26	5%
Crown Raising	8	1.5%
Crown Reduction	3	<1%

Canopy Cover

The canopy cover of Prairie City is approximately 8.7 acres (Appendix A, Figure 5). According to the 2000 census, Prairie City occupies 768 acres. Thus the canopy cover on city land is just over 1%.

Land Use and Location

The majority of Prairie City's city and park trees are in front yards and 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	51%
Park/vacant/other	49%
Small commercial	<1%

Location	
Planting strip	50%
Front yard	47%
Median	2%

Recommendations

Risk Management

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

Hazardous trees

Prairie City has 21 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 4 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 critical 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 37 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 26 removals, none are ash trees. There are a total of 26 ash trees, and 4 of those have signs and symptoms that have been associated with EAB. These trees should be monitored annually. *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 Prairie City.

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 (27%) and Spruce (24%) (Appendix A, Figure 1). Maple and Spruce 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: evergreens, cottonwood, poplar, box elder, Siberian elm, willow or black walnut, as outlined in section 151.02 of the sample city ordinance (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: 4 largest critical concern trees, plus 5 largest remaining recommended for removal
Planting and Replacement: 10 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Years 2 through 6

Removal: 8-9 each year - critical concern trees, those recommended for removal, and additional ash trees with poor health.
Planting and Replacement: 10-11 trees each year in open locations
Routine trimming: Contract to trim 1/3 of the city trees in Years 2, 4, and 6.
Visual Survey for signs and symptoms of EAB

EAB could potentially kill all ash within 4 years of its' arrival. Estimated cost for tree removal is $500 per tree (multiplied by 52 = $26,000). Estimated cost for replacement plantings is $150 per tree (multiplied by 62 = $9,300). Estimated trimming cost is $1,200 in years 2, 4, and 6 ($3,600 total) and watering and maintenance cost is estimated at $400 annually ($2,400 total). The grand total of estimated urban forestry costs equals $41,300. To remove all ash trees within 6 years, plant replacement trees, do the recommended trimming, plus routine watering and maintenance each year, the budget would need to be increased to about $6,880 a year. As stated earlier, the city is encouraged to apply for grants to help with the cost of replacement plantings.

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*

Treatment of Ash Trees

Chemical treatment can be effective, spreading removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

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 in sample city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, evergreens, cottonwood, poplar, box elder, Siberian elm, 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. Sample 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

Suggested Budget
Total $41,300 over 6 years (about $6,880/year on average)

FY 2014 Budget

Removal: $4,500
Planting: $1,500
Watering & Maintenance: $500

FY 2015-2019 Budget

Removal: $4,000 to $4,500 annually
Planting: $1,500 to $1,650 each year
Routine trimming: $1,200 in 2015, 2017, and 2019
Watering & Maintenance: $500 annually

Purposed Budget Increase

EAB could potentially kill all ash trees in Prairie City within 4 years of its arrival. To remove all ash trees and plant replacement trees within 6 years, the budget would need to be increased to $6,883 a year. Additionally, it is recommended that Prairie City 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

Prairie City

Annual Energy Benefits of Public Trees by Species

3/7/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	1.0	79	156.8	154	233	(N/A)	21.1	1.5	2.12
Northern white cedar	0.7	53	92.4	91	144	(N/A)	10.5	0.9	2.61
Silver maple	13.9	1,056	1,826.6	1,790	2,846	(N/A)	10.2	18.0	53.71
Sugar maple	9.3	706	1,270.2	1,245	1,951	(N/A)	7.9	12.3	47.58
Ash	8.0	607	1,185.7	1,162	1,769	(N/A)	5.0	11.2	68.03
Northern hackberry	9.8	742	1,396.9	1,369	2,111	(N/A)	4.8	13.3	84.44
Norway maple	4.9	368	692.9	679	1,047	(N/A)	3.3	6.6	61.62
Pear	0.4	29	65.8	64	93	(N/A)	3.3	0.6	5.48
Pin oak	5.6	422	760.1	745	1,167	(N/A)	3.3	7.4	68.67
Apple	0.3	23	46.2	45	68	(N/A)	3.1	0.4	4.28
Red maple	0.9	68	129.9	127	195	(N/A)	2.9	1.2	13.03
American basswood	3.4	255	500.1	490	745	(N/A)	2.3	4.7	62.11
Norway spruce	1.7	127	216.9	213	339	(N/A)	2.1	2.1	30.83
Eastern white pine	0.6	46	82.9	81	127	(N/A)	1.9	0.8	12.74
Maple	1.1	86	153.4	150	236	(N/A)	1.7	1.5	26.24
Broadleaf Deciduous	1.3	98	194.0	190	288	(N/A)	1.7	1.8	31.99
Broadleaf Deciduous	0.0	2	4.4	4	6	(N/A)	1.3	0.0	0.87
Catalpa	2.1	157	280.1	275	432	(N/A)	1.2	2.7	71.99
Eastern red cedar	0.7	51	98.7	97	147	(N/A)	1.2	0.9	24.57
Northern red oak	0.9	67	125.8	123	190	(N/A)	1.2	1.2	31.69
Other street trees	8.2	620	1,122.8	1,100	1,720	(N/A)	10.3	10.9	31.86
Citywide total	74.6	5,663	10,402.6	10,195	15,857	(N/A)	100.0	100.0	30.38

Table 2: Annual Stormwater Benefits

Prairie City

Annual Stormwater Benefits of Public Trees by Species

3/7/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	15,275	414	(N/A)	21.1	1.8	3.76
Northern white cedar	8,640	234	(N/A)	10.5	1.0	4.26
Silver maple	184,616	5,003	(N/A)	10.2	21.4	94.40
Sugar maple	99,790	2,704	(N/A)	7.9	11.6	65.96
Ash	90,156	2,443	(N/A)	5.0	10.5	93.98
Northern hackberry	101,938	2,763	(N/A)	4.8	11.8	110.51
Norway maple	48,359	1,311	(N/A)	3.3	5.6	77.10
Pear	1,277	35	(N/A)	3.3	0.2	2.04
Pin oak	61,109	1,656	(N/A)	3.3	7.1	97.42
Apple	1,035	28	(N/A)	3.1	0.1	1.75
Red maple	7,364	200	(N/A)	2.9	0.9	13.30
American basswood	35,151	953	(N/A)	2.3	4.1	79.39
Norway spruce	36,690	994	(N/A)	2.1	4.3	90.40
Eastern white pine	12,168	330	(N/A)	1.9	1.4	32.98
Maple	10,262	278	(N/A)	1.7	1.2	30.90
Broadleaf Deciduous	13,121	356	(N/A)	1.7	1.5	39.51
Broadleaf Deciduous	52	1	(N/A)	1.3	0.0	0.20
Catalpa	28,362	769	(N/A)	1.2	3.3	128.11
Eastern red cedar	9,807	266	(N/A)	1.2	1.1	44.30
Northern red oak	9,657	262	(N/A)	1.2	1.1	43.62
Other street trees	86,830	2,353	(N/A)	10.3	10.1	43.58
Citywide total	861,658	23,353	(N/A)	100.0	100.0	44.74

Table 3: Annual Air Quality Benefits

Prairie City

Annual Air Quality Benefits of Public Trees by Species

3/7/2014

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
Spruce	1.1	0.2	1.1	0.1	8	5.1	0.7	0.7	4.7	31	-6.1	-23	7.8	17	(N/A)	21.1	0.15
Northern white cedar	0.7	0.1	0.6	0.1	5	3.3	0.5	0.5	3.2	21	-3.1	-12	5.9	14	(N/A)	10.5	0.25
Silver maple	30.6	5.2	15.2	1.4	166	65.6	9.6	9.2	63.0	410	-16.4	-62	183.3	515	(N/A)	10.2	9.71
Sugar maple	13.2	2.2	6.6	0.6	72	44.3	6.5	6.2	42.1	276	-10.4	-39	111.4	309	(N/A)	7.9	7.54
Ash	20.2	3.5	9.7	0.9	109	39.0	5.6	5.3	36.3	241	-4.6	-17	116.0	333	(N/A)	5.0	12.79
Northern hackberry	16.6	2.9	8.3	0.7	90	47.3	6.8	6.5	44.3	293	0.0	0	133.4	383	(N/A)	4.8	15.32
Norway maple	10.3	1.8	5.0	0.5	56	23.5	3.4	3.2	22.0	146	-2.4	-9	67.3	192	(N/A)	3.3	11.31
Pear	0.2	0.0	0.1	0.0	1	1.9	0.3	0.3	1.7	12	0.0	0	4.5	13	(N/A)	3.3	0.75
Pin oak	10.5	1.8	5.4	0.5	58	26.5	3.9	3.7	25.2	165	-19.7	-74	57.9	149	(N/A)	3.3	8.79
Apple	0.3	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	0.0	0	3.7	11	(N/A)	3.1	0.66
Red maple	1.7	0.3	0.8	0.1	9	4.3	0.6	0.6	4.1	27	-0.6	-2	11.9	34	(N/A)	2.9	2.25
American basswood	4.5	0.8	2.2	0.2	24	16.4	2.4	2.3	15.3	101	-3.9	-15	40.1	111	(N/A)	2.3	9.26
Norway spruce	4.4	0.9	3.5	0.5	29	7.8	1.2	1.1	7.6	49	-21.1	-79	6.0	-1	(N/A)	2.1	-0.08
Eastern white pine	1.4	0.3	1.1	0.2	9	2.9	0.4	0.4	2.8	18	-5.6	-21	3.8	6	(N/A)	1.9	0.61
Maple	2.6	0.4	1.2	0.1	14	5.4	0.8	0.7	5.1	34	-0.8	-3	15.5	44	(N/A)	1.7	4.89
Broadleaf Deciduous	2.8	0.5	1.3	0.1	15	6.3	0.9	0.9	5.8	39	-0.6	-2	18.0	51	(N/A)	1.7	5.72
Broadleaf Deciduous	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	1.3	0.11
Catalpa	4.1	0.7	1.9	0.2	22	9.9	1.4	1.4	9.4	62	0.0	0	28.9	83	(N/A)	1.1	13.87
Eastern red cedar	2.1	0.4	1.6	0.3	13	3.2	0.5	0.4	3.0	20	-5.4	-20	6.1	13	(N/A)	1.1	2.19
Northern red oak	2.1	0.4	1.0	0.1	11	4.2	0.6	0.6	4.0	26	-3.0	-11	10.0	26	(N/A)	1.1	4.38
Other street trees	15.2	2.5	7.4	0.8	82	39.0	5.7	5.4	37.0	243	-4.9	-18	108.2	307	(N/A)	10.3	5.68
Citywide total	144.6	24.9	74.5	7.3	793	357.8	52.0	49.5	338.1	2,225	-108.5	-407	940.1	2,610	(N/A)	100.0	5.00

Table 4: Annual Carbon Stored

Prairie City

Stored CO2 Benefits of Public Trees by Species

3/7/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	9,796	73	(N/A)	21.1	0.3	0.67
Northern white	4,807	36	(N/A)	10.5	0.2	0.66
Silver maple	695,432	5,216	(N/A)	10.2	23.5	98.41
Sugar maple	377,786	2,833	(N/A)	7.9	12.8	69.11
Ash	333,275	2,500	(N/A)	5.0	11.3	96.14
Northern	249,415	1,871	(N/A)	4.8	8.4	74.82
Norway maple	170,478	1,279	(N/A)	3.3	5.8	75.21
Pear	4,139	31	(N/A)	3.3	0.1	1.83
Pin oak	273,576	2,052	(N/A)	3.3	9.2	120.70
Apple	4,138	31	(N/A)	3.1	0.1	1.94
Red maple	18,680	140	(N/A)	2.9	0.6	9.34
American	160,167	1,201	(N/A)	2.3	5.4	100.10
Norway spruce	53,970	405	(N/A)	2.1	1.8	36.80
Eastern white pine	13,386	100	(N/A)	1.9	0.5	10.04
Maple	27,544	207	(N/A)	1.7	0.9	22.95
Broadleaf	45,619	342	(N/A)	1.7	1.5	38.02
Broadleaf	96	1	(N/A)	1.3	0.0	0.10
Catalpa	138,363	1,038	(N/A)	1.2	4.7	172.95
Eastern red cedar	6,612	50	(N/A)	1.2	0.2	8.27
Northern red oak	46,767	351	(N/A)	1.2	1.6	58.46
Other street trees	147,745	2,443	(N/A)	10.3	11.0	45.24
Citywide total	2,959,767	22,198	(N/A)	100.0	100.0	42.53

Table 5: Annual Carbon Sequestered

Prairie City

Annual CO_2 Benefits of Public Trees by Species

3/7/2014

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
Spruce	1,079	8	-47	-21	-1	1,746	13	2,757	21	(N/A)	21.1	1.0	0.19
Northern white cedar	642	5	-23	-11	0	1,176	9	1,784	13	(N/A)	10.5	0.7	0.24
Silver maple	54,511	409	-3,338	-10	-25	23,345	175	74,508	559	(N/A)	10.2	27.0	10.54
Sugar maple	20,651	155	-1,813	-8	-14	15,605	117	34,434	258	(N/A)	7.9	12.5	6.30
Ash	5,780	43	-1,600	-5	-12	13,412	101	17,587	132	(N/A)	5.0	6.4	5.07
Northern hackberry	13,352	100	-1,197	-5	-9	16,399	123	28,550	214	(N/A)	4.8	10.3	8.56
Norway maple	6,670	50	-818	-3	-6	8,142	61	13,991	105	(N/A)	3.3	5.1	6.17
Pear	627	5	-20	-3	0	633	5	1,236	9	(N/A)	3.3	0.5	0.55
Pin oak	25,487	191	-1,313	-3	-10	9,336	70	33,507	251	(N/A)	3.3	12.1	14.78
Apple	503	4	-20	-3	0	511	4	991	7	(N/A)	3.1	0.4	0.46
Red maple	1,357	10	-90	-3	-1	1,507	11	2,771	21	(N/A)	2.9	1.0	1.39
American basswood	10,011	75	-769	-2	-6	5,640	42	14,879	112	(N/A)	2.3	5.4	9.30
Norway spruce	2,146	16	-259	-2	-2	2,798	21	4,682	35	(N/A)	2.1	1.7	3.19
Eastern white pine	771	6	-64	-2	0	1,022	8	1,727	13	(N/A)	1.9	0.6	1.29
Maple	497	4	-132	-2	-1	1,896	14	2,259	17	(N/A)	1.7	0.8	1.88
Broadleaf Deciduous	1,926	14	-219	-2	-2	2,162	16	3,867	29	(N/A)	1.7	1.4	3.22
Broadleaf Deciduous	61	0	0	-1	0	39	0	98	1	(N/A)	1.3	0.0	0.11
Catalpa	4,501	34	-664	-1	-5	3,479	26	7,314	55	(N/A)	1.2	2.7	9.14
Eastern red cedar	86	1	-32	-1	0	1,121	8	1,174	9	(N/A)	1.2	0.4	1.47
Northern red oak	897	7	-224	-1	-2	1,478	11	2,149	16	(N/A)	1.2	0.8	2.69
Other street trees	13,862	104	-1,563	-11	-12	13,699	103	25,987	195	(N/A)	10.3	9.4	3.61
Citywide total	165,415	1,241	-14,207	-102	-107	125,146	939	276,253	2,072	(N/A)	100.0	100.0	3.97

Table 6: Annual Social and Aesthetic Benefits

Prairie City

Annual Aesthetic/Other Benefits of Public Trees by Species

3/7/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	789	(N/A)	21.1	4.9	7.17
Northern white cedar	423	(N/A)	10.5	2.6	7.69
Silver maple	4,445	(N/A)	10.2	27.3	83.86
Sugar maple	2,157	(N/A)	7.9	13.3	52.60
Ash	510	(N/A)	5.0	3.1	19.62
Northern hackberry	1,656	(N/A)	4.8	10.2	66.24
Norway maple	608	(N/A)	3.3	3.7	35.77
Pear	30	(N/A)	3.3	0.2	1.77
Pin oak	2,004	(N/A)	3.3	12.3	117.89
Apple	22	(N/A)	3.1	0.1	1.40
Red maple	184	(N/A)	2.9	1.1	12.24
American basswood	752	(N/A)	2.3	4.6	62.70
Norway spruce	322	(N/A)	2.1	2.0	29.28
Eastern white pine	223	(N/A)	1.9	1.4	22.29
Maple	66	(N/A)	1.7	0.4	7.34
Broadleaf Deciduous	186	(N/A)	1.7	1.1	20.69
Broadleaf Deciduous	0	(N/A)	1.3	0.0	0.03
Catalpa	336	(N/A)	1.2	2.1	56.04
Eastern red cedar	27	(N/A)	1.2	0.2	4.56
Northern red oak	67	(N/A)	1.2	0.4	11.17
Other street trees	1,466	(N/A)	10.3	9.0	27.14
Citywide total	16,273	(N/A)	100.0	100.0	31.17

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of Public Trees by Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Spruce	233	21	17	414	789	$1,472.69	(±0)	2.45
Northern white cedar	144	13	14	234	423	$828.16	(±0)	1.38
Silver maple	2,846	559	515	5,003	4,445	$13,367.82	(±0)	22.22
Sugar maple	1,951	258	309	2,704	2,157	$7,379.12	(±0)	12.26
Ash	1,769	132	333	2,443	510	$5,186.79	(±0)	8.62
Northern hackberry	2,111	214	383	2,763	1,656	$7,126.92	(±0)	11.85
Norway maple	1,047	105	192	1,311	608	$3,263.43	(±0)	5.42
Pear	93	9	13	35	30	$179.87	(±0)	0.30
Pin oak	1,167	251	149	1,656	2,004	$5,228.35	(±0)	8.69
Apple	68	7	11	28	22	$136.90	(±0)	0.23
Red maple	195	21	34	200	184	$633.24	(±0)	1.05
American basswood	745	112	111	953	752	$2,673.03	(±0)	4.44
Norway spruce	339	35	-1	994	322	$1,689.87	(±0)	2.81
Eastern white pine	127	13	6	330	223	$699.14	(±0)	1.16
Maple	236	17	44	278	66	$641.32	(±0)	1.07
Broadleaf Deciduous Medium	288	29	51	356	186	$910.22	(±0)	1.51
Broadleaf Deciduous Small	6	1	1	1	0	$9.20	(±0)	0.02
Catalpa	432	55	83	769	336	$1,674.91	(±0)	2.78
Eastern red cedar	147	9	13	266	27	$462.49	(±0)	0.77
Northern red oak	190	16	26	262	67	$561.21	(±0)	0.93
Other street trees	1,720	195	307	2,353	1,466	$6,040.88	(±0)	10.04
Citywide total	15,857	2,072	2,610	23,353	16,273	$60,165.55	(±0)	100.00

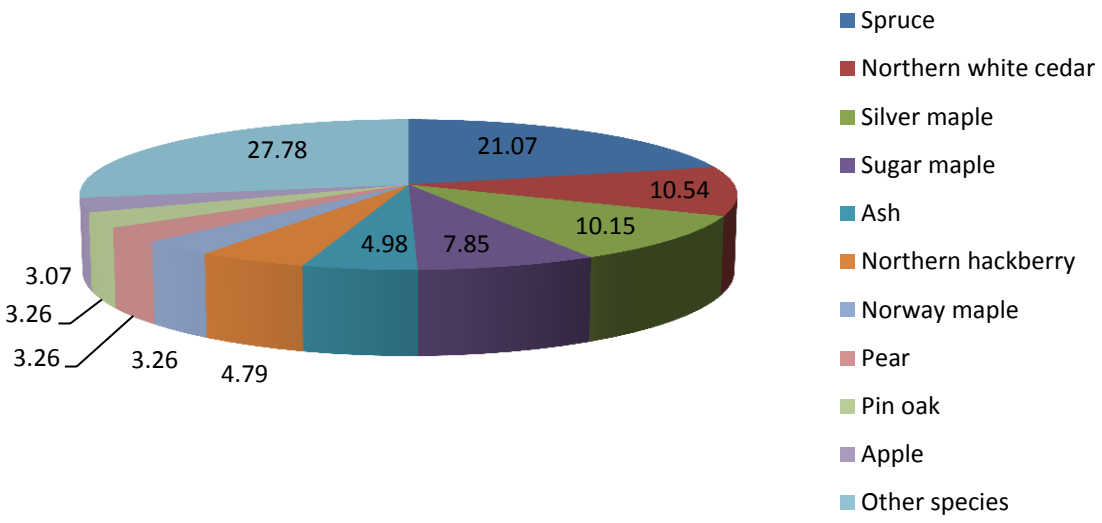

Figure 1: Species Distribution

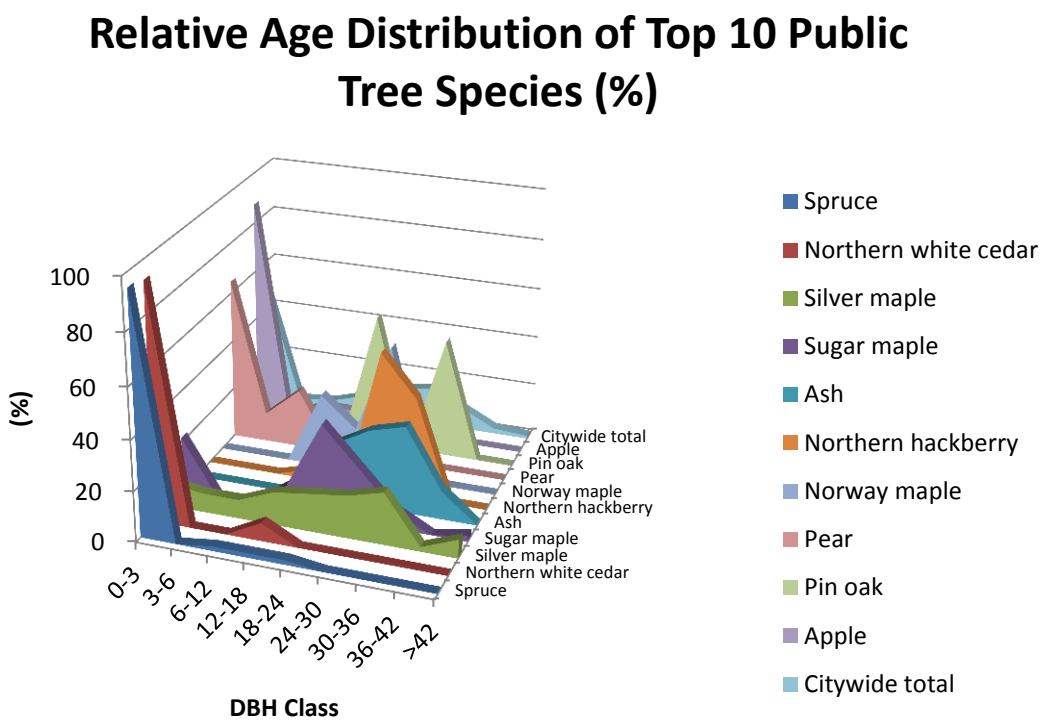

Figure 2: Relative Age Class

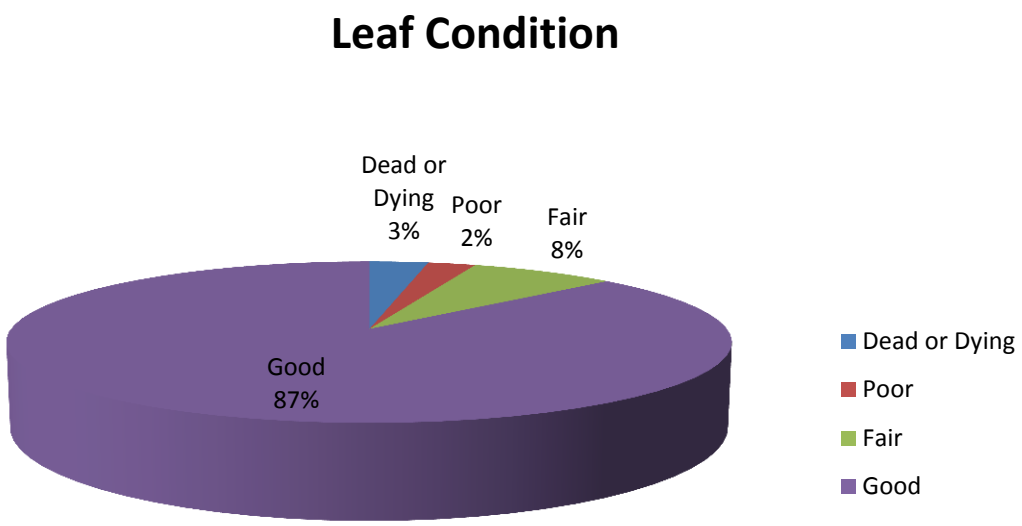

Figure 3: Foliage Condition

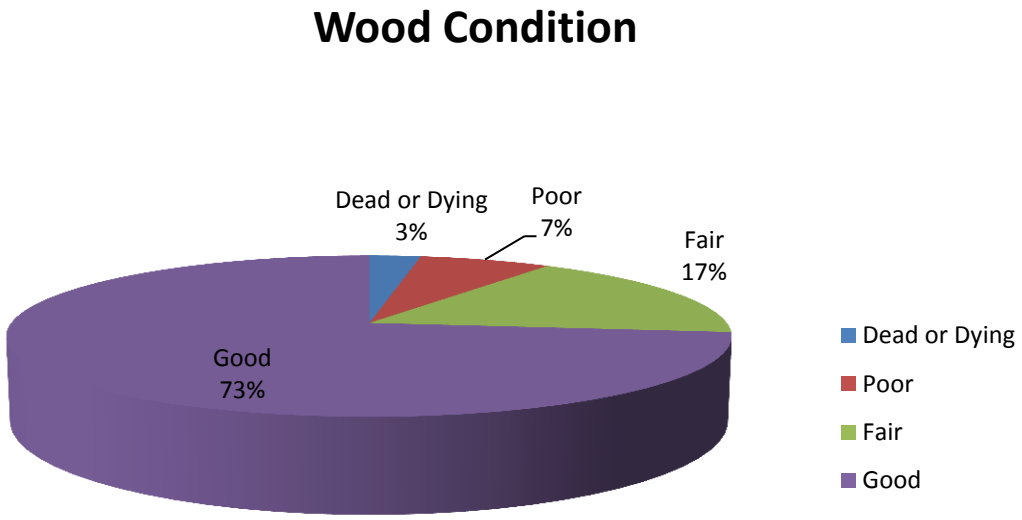

Figure 4: Wood Condition

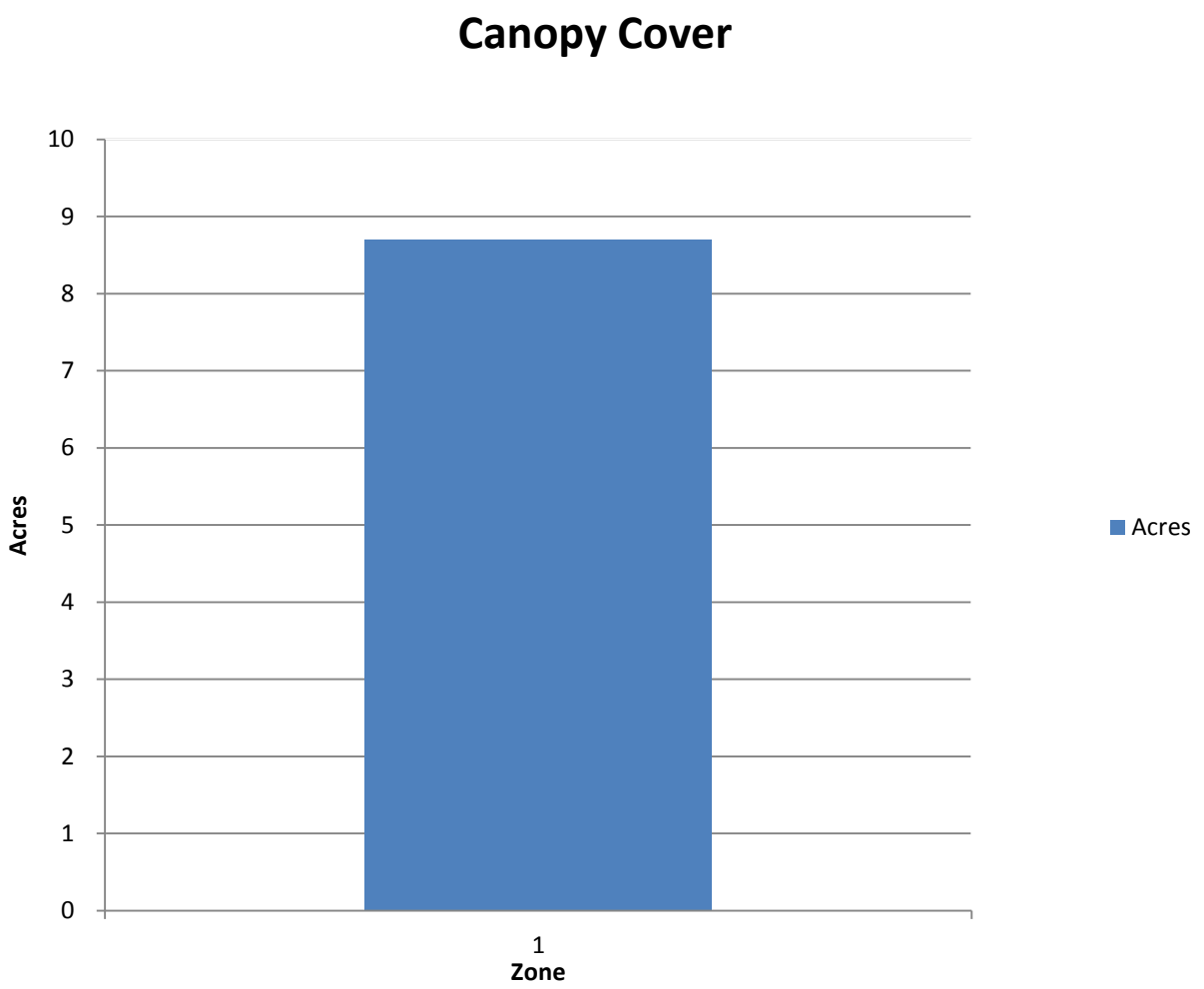

Figure 5: Canopy Cover in Acres

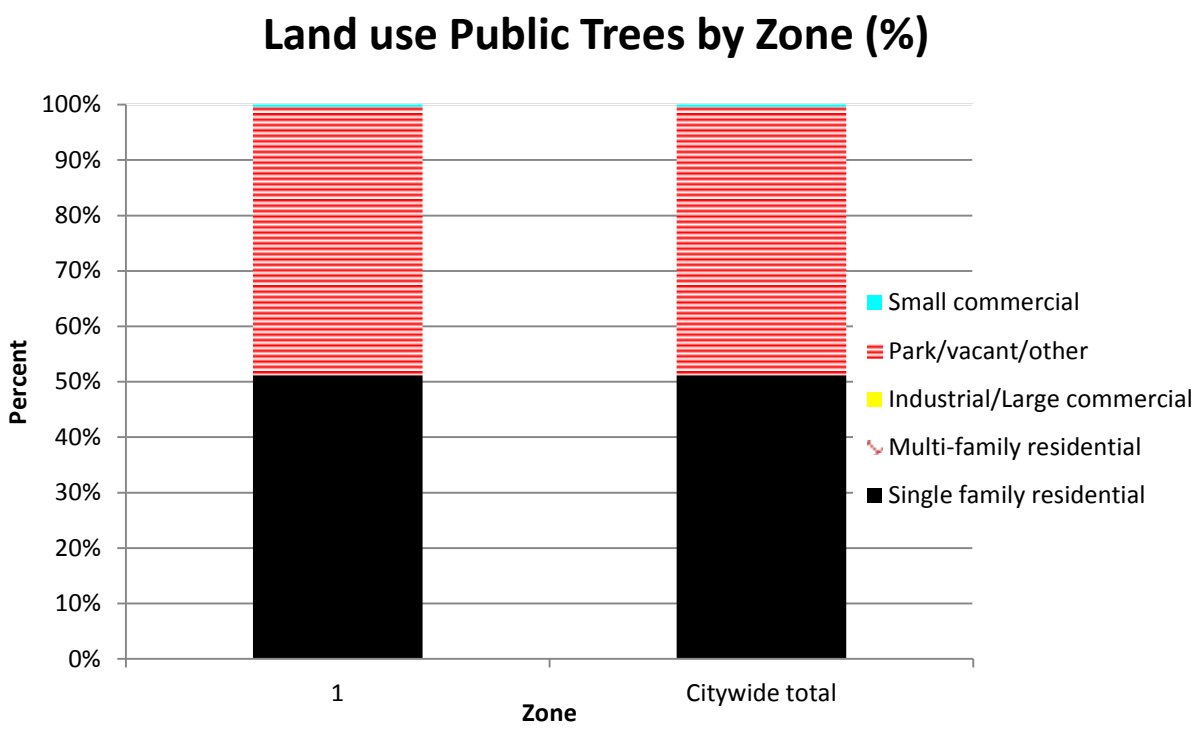

Figure 6: Land Use of city/park trees

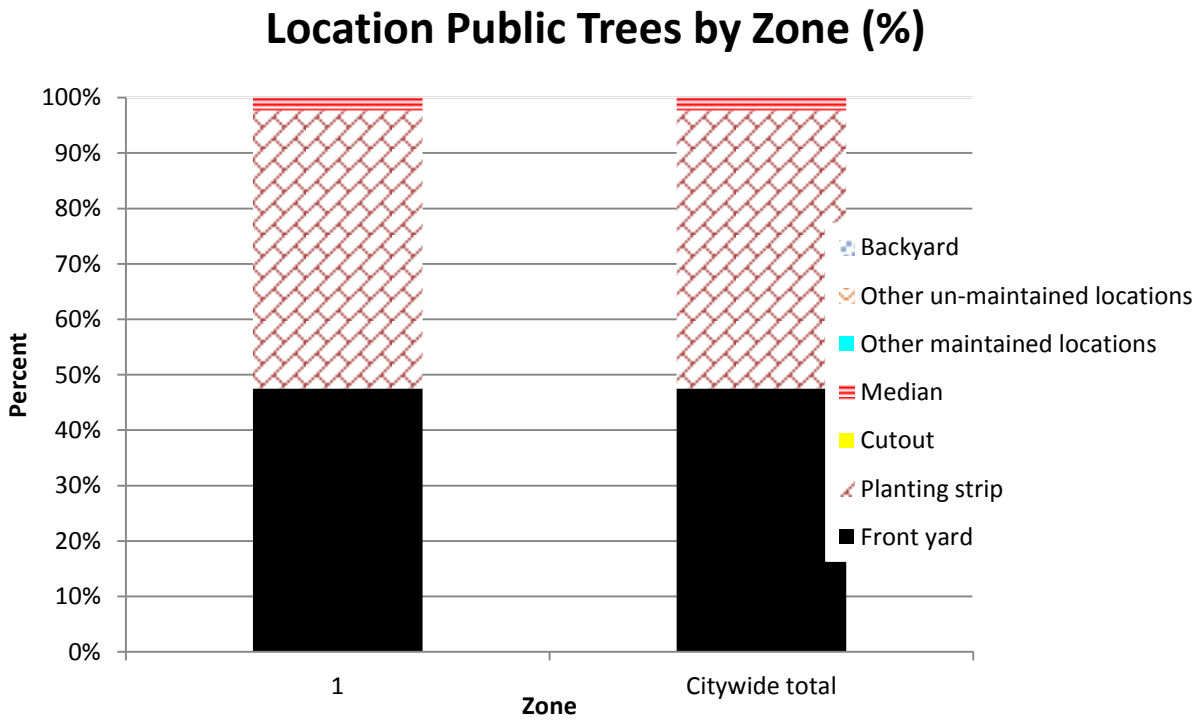

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

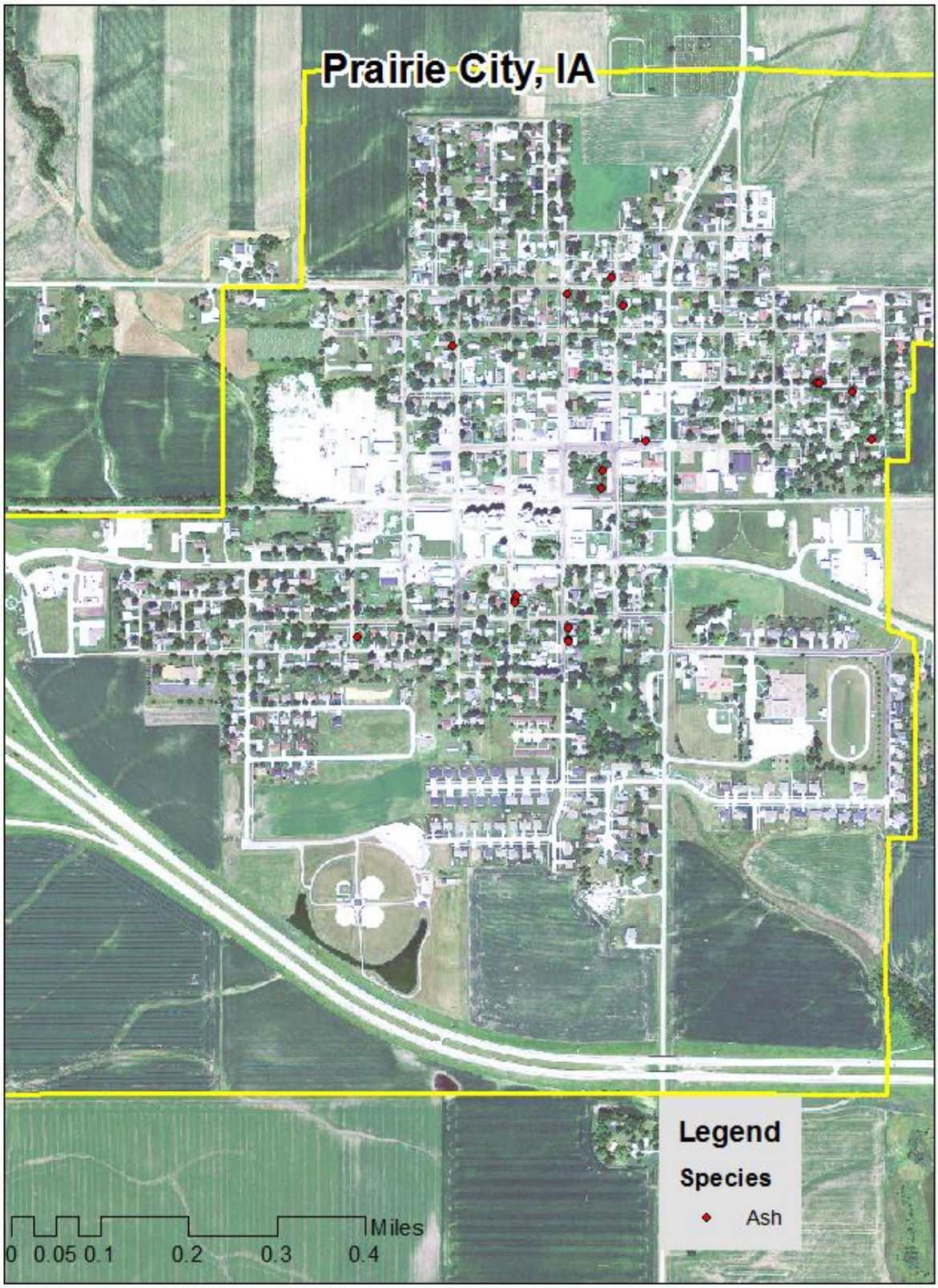

Figure 1: Location of Ash Trees

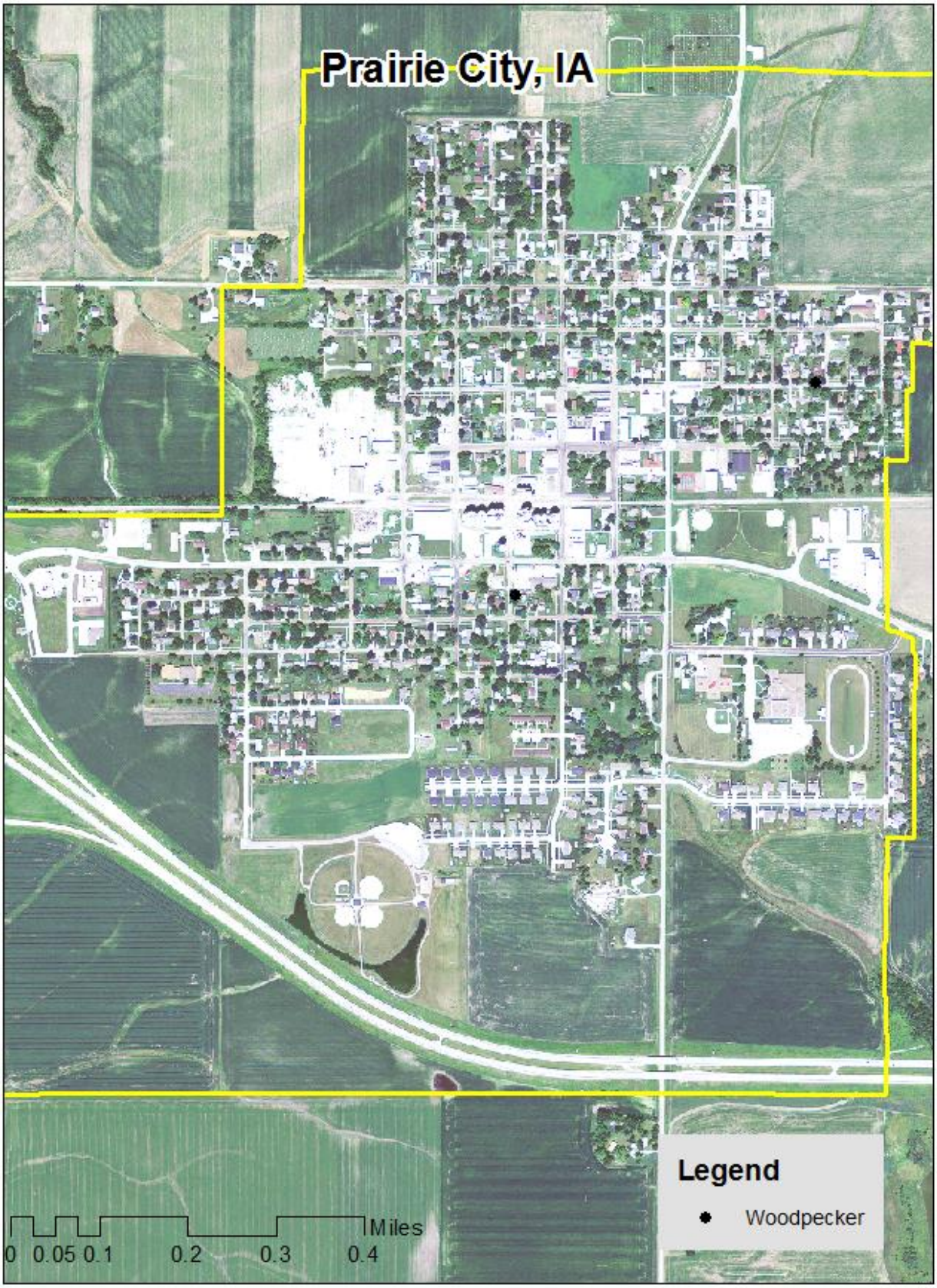

Figure 2: Location of EAB symptoms

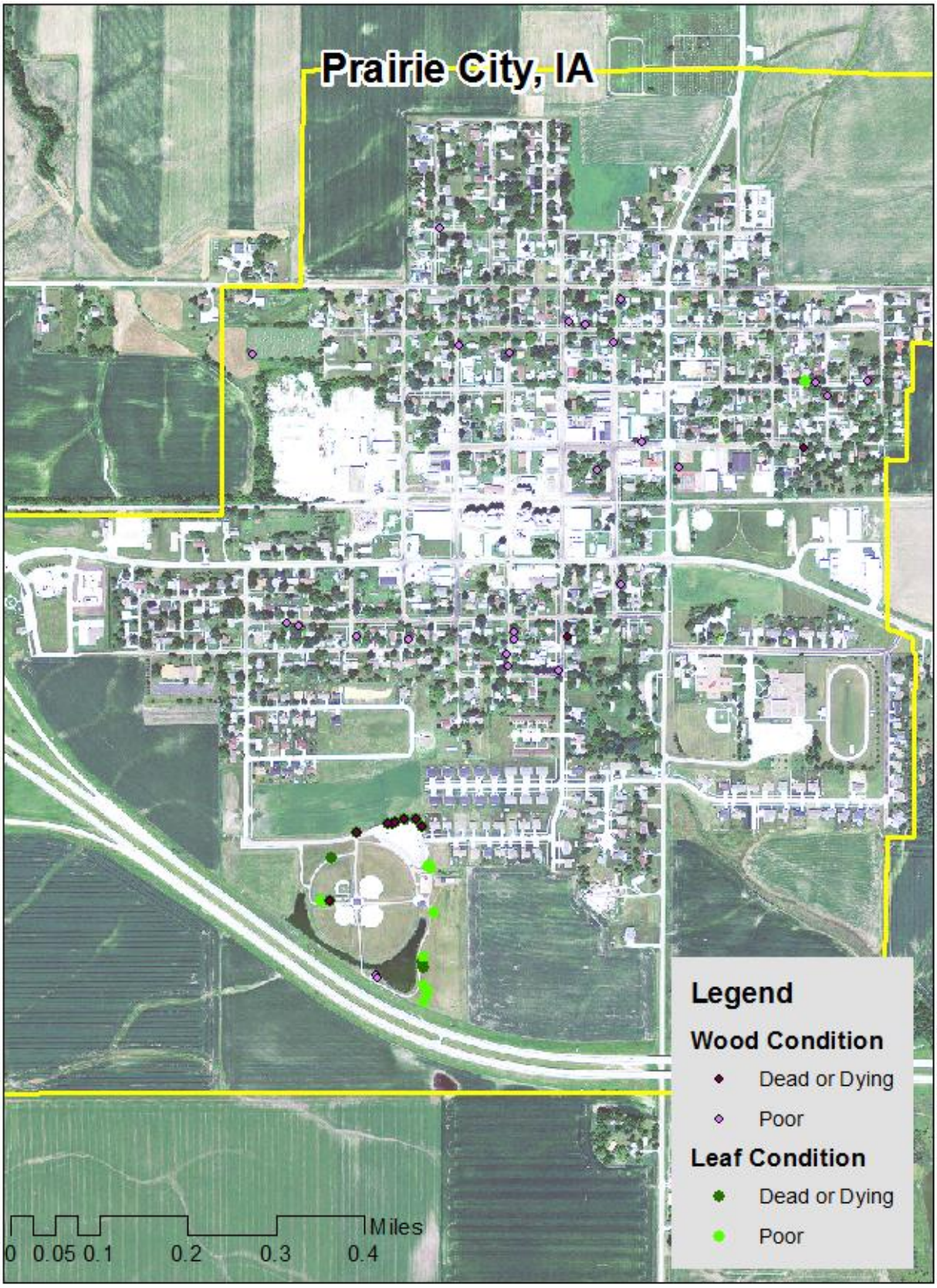

Figure 3: Location of Poor Condition Trees

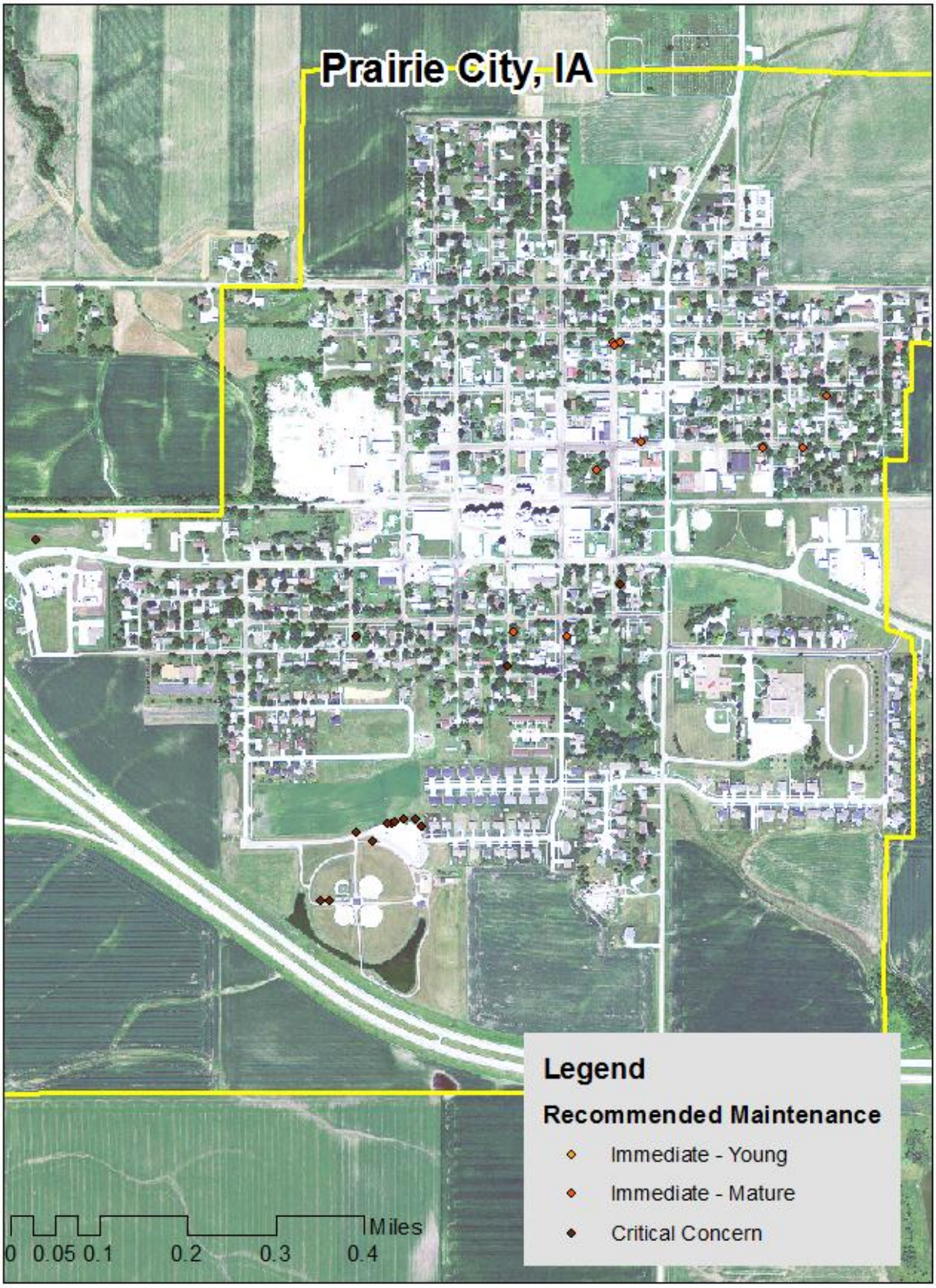

Figure 4: Location of Trees with Recommended Maintenance

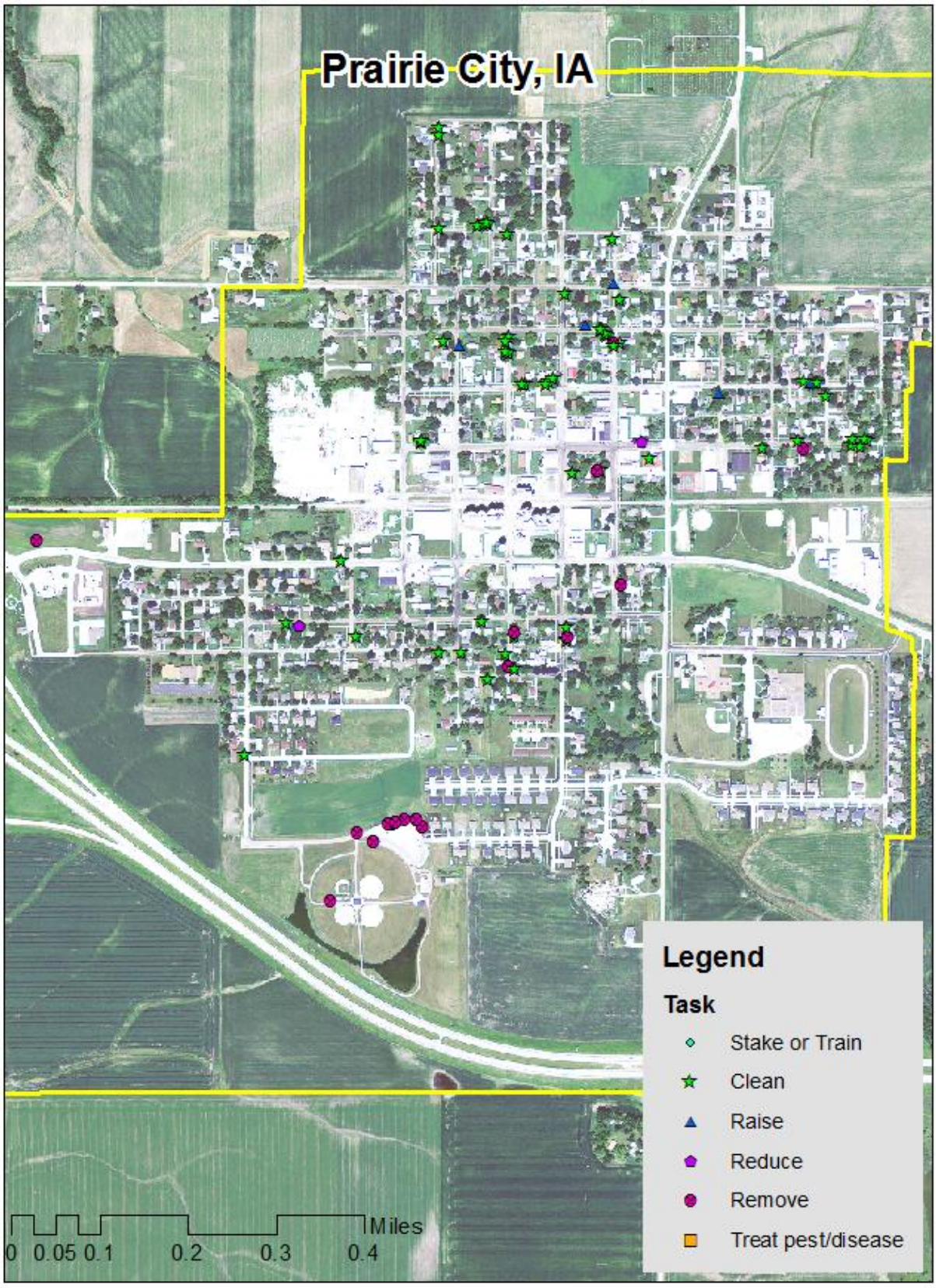

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Prairie City Tree Ordinances

CHAPTER 151
TREES AND GRASS

151.01 DEFINITION. For use in this chapter, "boulevard" 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 boulevard or street except in accordance with the following:
1. Alignment. All tress planted in any street shall be planted in the boulevard midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any boulevard which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.
3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

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 eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, 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 infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

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 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.
(Code of Iowa, Sec. 364.12[3b & h])

151.07 CUTTING OR MOWING OF GRASS.
1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.
2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.