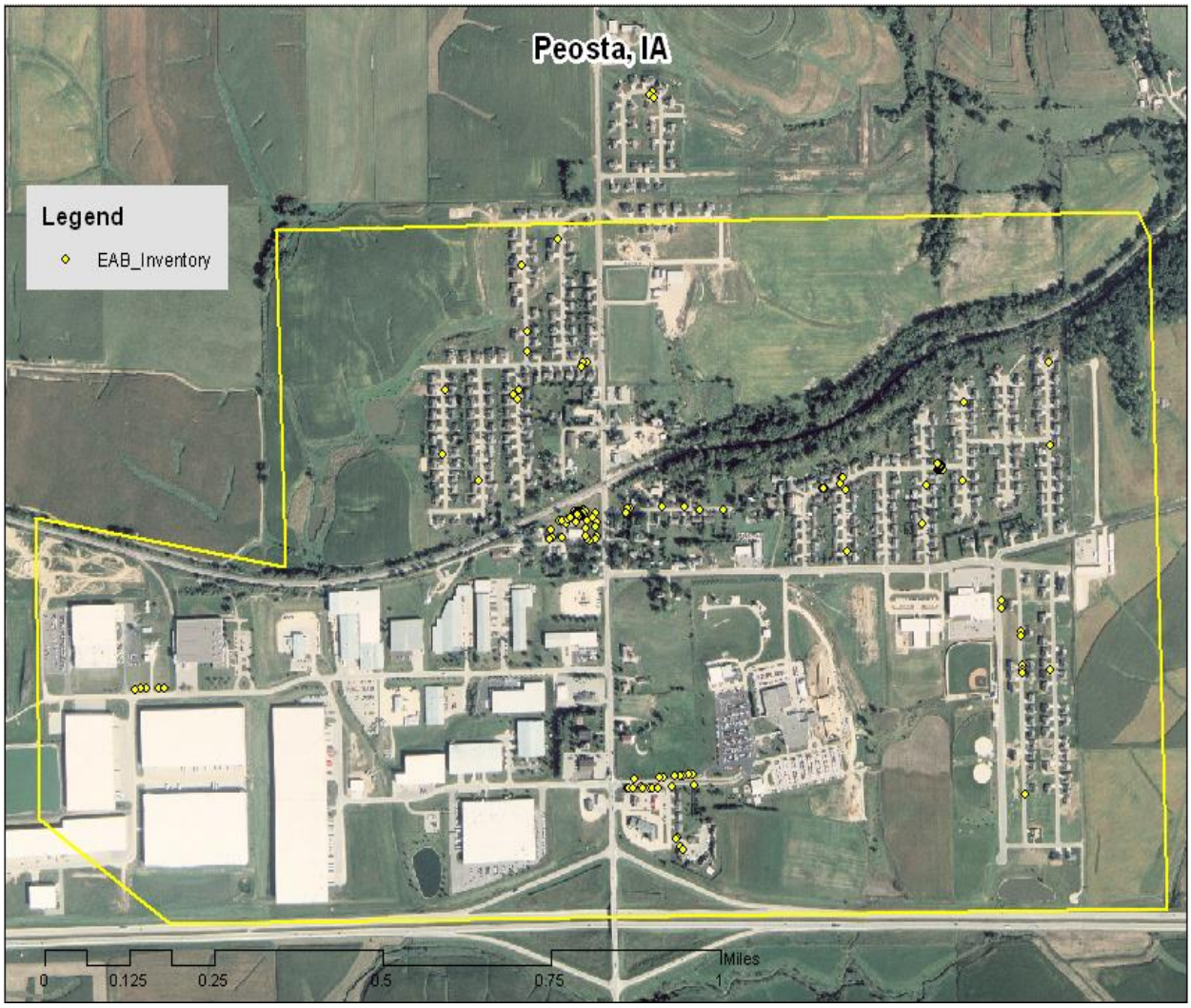
PEOSTA, IA



2010 Management Plan

Prepared by Bruce Blaire
Bureau of Forestry, Iowa DNR

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Peosta 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 new and emerging pest, emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia that kills all species of ash native to North America. There is a strong possibility that Peosta's 5 city-owned ash trees (4%) 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 several years mitigating public safety issues.

Inventory and Results

In the late summer of 2010, a street tree inventory was conducted using an integrated Global Positioning System (GPS) data collector. This involved a complete inventory of street trees within the City's Right-of-Way (10 feet from the curb) and park trees around the fire station. Below are some key findings of the 130 trees inventoried.

- Peosta's street trees provide roughly $6,007 of annual benefits, an average of $46 per tree.
- The top three species groups are: Maples 22%, Arborvitae 22% and Oak 10%.
- Approximately 28% of trees are in need of some type of management.
- For various reasons, 3 trees are recommended for removal.

Recommendations

The core recommendations are described in detail in the Recommendations Section of this plan. The Emerald Ash Borer section includes management recommendations, as well. Below are some key recommendations.

- There are a total of 5 ash trees. Check ash trees with a visual survey, yearly.
- All trees should be pruned on a routine schedule- one third of the city every other year. This is especially important when trees are young to insure they develop proper architecture.
- Plant a diverse mix of trees that *do not include the following*: ash, soft maple, autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar and tree-of-heaven.

Introduction

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

Trees are an important component of Peosta's infrastructure and are one of the greatest assets to the community. Through research it has been shown that trees provide a community with numerous public benefits including: improved air quality, storm water runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and creating a desirable place to live. It is essential that these benefits be maintained for the people of Peosta and future generations through sound urban forestry management.

Good urban forest management involves setting goals and developing management strategies to achieve these goals. An essential start to developing management strategies is to have a comprehensive public tree inventory. This inventory supplies information that can be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Peosta's urban forestry goals.

Inventory

In 2010, a tree inventory was conducted that included city owned street trees and park trees surrounding the fire station. The tree data was collected using a handheld global positioning system (GPS) receiver/data logger. This devise records geographic information system (GIS) coordinates with an accuracy of 3 meters. The data can then be used in a software program called ArcGIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information which can be continually updated and made available for anyone to use who has the ArcGIS software.

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

Trees growing within city easements (i.e. 10 foot from the street curb) (see Appendix 3 for Peosta's city ordinances relating to its urban trees) were tallied in the survey. To quantify the urban forest structure and its benefits, specific data is collected for each tree. This data includes: location, land use, tree species, diameter at 4.5 ft (DBH), 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 by the data loggers was downloaded and analyzed by software developed by the USDA Forest service called *Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM)*. This software is also part of the i-Tree suite. You can find more information about this software program at the following link: http://www.itreetools.org. The following is a summary of results from the i-Tree STRATUM analysis of Peosta's inventory data.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking wind. Peosta's trees reduce energy related costs by approximately $1,581 annually (Appendix A, Table 1). These savings are both in Electricity (7.5 MWh) and in Natural Gas (1,029 Therms).

Annual Storm water Benefits

Peosta's trees intercept about 51,350 gallons of rainfall and snow melt per year (Appendix A, Table 2). This interception provides $1,392 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 that emit volatile organic matter (e.g. ozone). In Peosta, it is estimated that trees remove 82.3 lbs. of air pollution (ozone (O_3), particulate matter less than 10 microns (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $225 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduces the amount of carbon in the atmosphere, mitigating climate change. Of the 130 trees inventoried, the amount of carbon stored amounts to approximately 84,266 total lbs of CO_2 (Appendix A, Table 4). Those trees are sequestering an additional 12,570 lbs of carbon per year (Appendix A, Table 5). The benefits these trees provide from summer shading and from reductions in household wind infiltration in the winter result in approximately 12,652 fewer lbs of CO_2 being released into the atmosphere during energy production (Appendix A Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. Our analysis has a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Peosta receives approximately $2,125 in annual social benefits from its street trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Peosta's trees provide a total of $6,007 worth of benefits annually. Benefits of individual trees vary based on size, species, health and location. On average, the 130 trees in Peosta's inventory provide approximately $46 per tree annually (Appendix A, Table 7).

Forest Structure

Species Distribution

There were over 26 different tree species surveyed. The distribution of trees by genus is as follows:

Genus	# of trees	% of total
Maple (*acer*)	28	21.5%
Northern White Cedar (*Thuja*) a.k.a. "Arborvitae"	28	21.5%
Oak (*quercus*)	13	10.0%
Apple (*malus*)	12	9.2%
Pine (*Pinus*)	9	6.9%
Other	9	6.9%
Elm (*ulmus*)	7	5.4%
Spruce (*picea*)	6	4.6%
Linden (*tilia*)	6	4.6%
Ash (*fraxius*)	5	3.8%
Honeylocust (*gleditsia*)	3	2.3%
Lilac (*syringa*)	2	1.5%
Birch (*betula*)	1	0.8%
Willow (*salix*)	1	0.8%

Age Classes

The table below summarizes distribution of surveyed trees by their diameter in inches when measured at 4.5 above the ground. Trees between 3 to 6 inches diameter are most abundant (39.2%). There were also many smaller trees in the 0 to 3 inch size range (26.9%). The size distribution indicates the obvious – Peosta has had a boom in growth over the past couple of decades, so most of the trees are younger. See Appendix A, Figure 2 for a breakdown of size distributions by species.

Size Classes (inches of diameter at 4.5 feet)	# of trees	% of trees
0 - 3	35	26.9%
3 - 6	51	39.2%
6 - 12	26	20.0%
12 - 18	18	13.8%

Condition: Foliage and Wood

Leaf condition is a good indicator of the overall health of urban trees. The foliage condition results for Peosta indicated that 59% of the trees were in good health, 36% in fair health and 5% in poor health. (Appendix A, Figure 3). The high proportion that were in fair and poor health category were likely a result of the many leaf diseases (especially anthracnose) associated with last summer's wet/warm weather. Another major factor in leaf health had to do with leaf-feeding damage from a Japanese beetle outbreak. These leaf ailments may be resolved naturally next summer if the climate conditions are more nominal.

The condition of the wood in urban trees is another important indicator of tree health. The wood forms the structural support system for the leaves and branches. Extensive decay in the main stem makes a tree structurally unsafe which leads to a tree becoming a safety hazard. In Peosta, 82% of the surveyed trees showed wood in good health, 17% showed fair health and only 1% showed poor health (Appendix A, Figure 4). The 1% in poor condition should be assessed more carefully and my need to be removed for the sake of public safety.

Management Needs

Each tree was assessed for any recommended maintenance needs. The following table lists the specific management needs and recommendations for the surveyed trees. Of the trees recommended for removal, none were judged to be of critical concern for public safety (See Appendix B, figure 5).

Priority Task	# of trees	% of trees
none	93	71.5%
stake/train	18	13.8%
clean	6	4.6%
raise	7	5.4%
reduce	3	2.3%
remove	3	2.3%

Land Use and Location

The majority of Peosta's surveyed trees are 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.

<u>Land Use</u>

Single family residential	48%
Park/vacant/other	48%
Multifamily residential	4%

<u>Location</u>

Other maintained locations	50%
Front yard	32%
Back yard	17%
Other unmaintained locations	1%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

Hazardous trees

Because most of Peosta's trees are still quite small, *none* of its trees recommended for removal were consider of "critical concern" and should, therefore, be removed immediate. A total of 3 trees were recommended for removal for one reason or another. Of those, I believe that one was a 0 – 3 inch diameter apple with poor wood condition and, therefore, could break off or topple over in storms or under ice and snow loads. There was also a volunteer Chinese elm obstructing the sight view of a street sign and one young spruce tree that was planted far too close to the street and would eventually be obstructing sight view, thus creating a potential public safety hazard.

Pruning Cycle

Proper pruning can extend the life and improve the overall health of trees, and can reduce public safety issues. In the Management Needs section of the survey, there are four maintenance issues to be addressed: 1) routine pruning, 2) crown cleaning, 3) crown raising and 4) 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 allowing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs that could interfere with structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Pruning should be done more frequently when a tree is very young to develop good stem architecture.

Maintenance Recommendation	# of trees	% of trees
young tree (routine)	81	62.3%
mature tree (routine)	45	34.6%
young tree (immediate)	3	2.3%
None	1	0.8%

Planting

Plantings over the next six years should replace the trees that are recommended for removal. It is recommended to plant two trees for every tree removed since survival rates are less for younger trees. It is not essential for all the new trees be planted in the same location as the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Peosta.

Since most insects and diseases target a particular genus (e.g. ash) or species (e.g. green ash), it is therefore important to always plant a diverse mix of species. Current diversity recommendations advise that any genus (e.g. maple, oak or ash) not make up more than 20% of the urban forest. Any single species (e.g. silver maple, sugar maple, white oak or bur oak) not make up more than 10% of the total urban forest. Presently, the forest is most heavily planted with Maple (22%) and Northern White Cedar (arborvitae) (22%) (Appendix A, Figure 1). Your city has plenty of these two genuses so other species should be encouraged. Ash trees have not been recommended since 2002 due to the threat of EAB. Other species to avoid because they can be public nuisances include: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, and willow.

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.

Emerald Ash Borer (EAB) Plan

Ash Tree Removal

It is nearly certain that all of Peosta's community-wide ash trees will eventually die when EAB arrives. Therefore, we highly recommend that Peosta develop an ash tree replacement plan to get ahead of this issue. See Appendix 2, Figure 1 for the locations of the ash trees. Additionally, strongly consider removing the tree with poor wood condition (Appendix 2, Figure 3).

EAB Quarantines

EAB is an extremely destructive plant pest and is responsible for the death of many millions of ash trees throughout the Eastern United States and Canada. 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 its spread beyond its known locations 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 urban 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 your budget permits, all removed ash trees should be replaced. All trees should meet the restrictions in your city's ordinance (Appendix C). The new plantings should be a diverse mix and should not include ash, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genuses 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 as trees are infested with Emerald Ash Borer. Trees that are on private property are part of Edgewood's urban forest. Private property owners should be given direction to the proper species to plant, spacing, and location. Edgewood has a city ordinance for trees. This ordinance dates back to the Dutch elm disease days and needs to be updated.

Budget

EAB could potentially kill all of the ash trees in Cascade within a decade after its arrival. It is recommended that the City apply for grants to fund replacement tree planting. 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. Remove the 3 trees recommended for removal (Appendix B, Figure 5). Remember to replant 2 trees for everyone removed. We also recommend that the City adopt a policy of allocating somewhere between $2 to $4 per capita per year into a forestry budget to be used for planting, removals and maintenance of Peosta's urban forest.

Recommended Budget

Budget a total of $2,500 over the next year.

FY 2012 Budget

Removal: $1500
Planting: $600
Routine trimming: $300
Watering & Maintenance: $100

Works Cited

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

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, D.J. and J.F. Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J.; McPherson, E. Gregory; Simpson, James R.; Vargas, Kelaine E.; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

8/13/2010

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	0.4	34	78.2	77	110	(N/A)	21.5	7.0	3.93
Apple	0.1	11	26.0	26	37	(N/A)	9.2	2.3	3.07
Silver maple	0.9	68	114.5	112	180	(N/A)	8.5	11.4	16.34
Eastern white pine	0.4	33	74.4	73	106	(N/A)	6.9	6.7	11.81
Northern red oak	1.1	80	132.5	130	210	(N/A)	6.2	13.3	26.20
Chinese elm	0.2	15	25.8	25	41	(N/A)	5.4	2.6	5.82
Red maple	0.3	20	38.1	37	57	(N/A)	4.6	3.6	9.50
Littleleaf linden	1.1	82	132.2	130	212	(N/A)	4.6	13.4	35.30
Maple	0.4	31	60.0	59	89	(N/A)	3.9	5.7	17.89
Blue spruce	0.4	34	61.0	60	93	(N/A)	3.9	5.9	18.68
Sugar maple	0.2	13	24.7	24	37	(N/A)	3.1	2.4	9.37
Conifer Evergreen Small	0.0	2	4.5	4	6	(N/A)	3.1	0.4	1.60
Green ash	0.4	29	48.1	47	77	(N/A)	3.1	4.8	19.13
Broadleaf Deciduous	0.0	2	5.0	5	7	(N/A)	2.3	0.5	2.38
Honeylocust	0.8	63	100.1	98	161	(N/A)	2.3	10.2	53.77
Norway maple	0.0	3	7.0	7	10	(N/A)	1.5	0.6	5.04
Swamp white oak	0.1	6	12.4	12	18	(N/A)	1.5	1.1	8.99
Pin oak	0.1	11	21.0	21	31	(N/A)	1.5	2.0	15.71
Lilac	0.0	2	4.4	4	6	(N/A)	1.5	0.4	3.13
Other street trees	0.4	33	59.0	58	91	(N/A)	5.4	5.8	13.04
Citywide total	7.5	572	1,028.8	1,008	1,581	(N/A)	100.0	100.0	12.16

Table 2: Annual Storm water Benefits

Annual Stormwater Benefits of Public Trees by Species

8/13/2010

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	4,317	117	(N/A)	21.5	8.4	4.18
Apple	469	13	(N/A)	9.2	0.9	1.06
Silver maple	6,503	176	(N/A)	8.5	12.7	16.02
Eastern white pine	4,594	125	(N/A)	6.9	9.0	13.83
Northern red oak	6,165	167	(N/A)	6.2	12.0	20.89
Chinese elm	1,201	33	(N/A)	5.4	2.3	4.65
Red maple	1,186	32	(N/A)	4.6	2.3	5.36
Littleleaf linden	6,758	183	(N/A)	4.6	13.2	30.53
Maple	2,150	58	(N/A)	3.9	4.2	11.66
Blue spruce	5,355	145	(N/A)	3.9	10.4	29.02
Sugar maple	838	23	(N/A)	3.1	1.6	5.68
Conifer Evergreen Small	257	7	(N/A)	3.1	0.5	1.74
Green ash	2,417	65	(N/A)	3.1	4.7	16.37
Broadleaf Deciduous	84	2	(N/A)	2.3	0.2	0.75
Honeylocust	4,670	127	(N/A)	2.3	9.1	42.19
Norway maple	175	5	(N/A)	1.5	0.3	2.37
Swamp white oak	325	9	(N/A)	1.5	0.6	4.41
Pin oak	740	20	(N/A)	1.5	1.4	10.03
Lilac	76	2	(N/A)	1.5	0.2	1.03
Other street trees	3,070	83	(N/A)	5.4	6.0	11.89
Citywide total	51,350	1,392	(N/A)	100.0	100.0	10.71

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

8/13/2010

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
Northern white cedar	0.1	0.0	0.2	0.0	1	2.3	0.3	0.3	2.0	14	-1.2	-4	4.1	11	(N/A)	21.5	0.38
Apple	0.1	0.0	0.0	0.0	0	0.8	0.1	0.1	0.7	5	0.0	0	1.7	5	(N/A)	9.2	0.41
Silver maple	0.4	0.1	0.3	0.0	2	4.2	0.6	0.6	4.0	26	-0.5	-2	9.7	27	(N/A)	8.5	2.44
Eastern white pine	0.4	0.1	0.4	0.0	3	2.2	0.3	0.3	2.0	14	-1.3	-5	4.4	11	(N/A)	6.9	1.27
Northern red oak	1.0	0.2	0.5	0.0	6	4.9	0.7	0.7	4.8	31	-1.4	-5	11.5	31	(N/A)	6.2	3.90
Chinese elm	0.0	0.0	0.0	0.0	0	0.9	0.1	0.1	0.9	6	0.0	0	2.2	6	(N/A)	5.4	0.87
Red maple	0.1	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	2.9	8	(N/A)	4.6	1.38
Littleleaf linden	0.8	0.1	0.5	0.0	5	5.0	0.7	0.7	4.9	32	-0.5	-2	12.4	35	(N/A)	4.6	5.78
Maple	0.3	0.0	0.2	0.0	1	2.0	0.3	0.3	1.8	12	-0.1	0	4.7	13	(N/A)	3.8	2.63
Blue spruce	0.6	0.1	0.5	0.1	4	2.1	0.3	0.3	2.0	13	-1.8	-7	4.2	10	(N/A)	3.8	2.08
Sugar maple	0.0	0.0	0.0	0.0	0	0.8	0.1	0.1	0.8	5	0.0	0	1.9	5	(N/A)	3.1	1.32
Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	-0.1	0	0.2	0	(N/A)	3.1	0.11
Green ash	0.1	0.0	0.1	0.0	1	1.8	0.3	0.3	1.8	11	0.0	0	4.3	12	(N/A)	3.1	3.04
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)	2.3	0.31
Honeylocust	0.8	0.1	0.4	0.0	4	3.9	0.6	0.5	3.8	24	-0.5	-2	9.6	27	(N/A)	2.3	8.90
Norway maple	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	1.5	0.67
Swamp white oak	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	2	(N/A)	1.5	1.21
Pin oak	0.0	0.0	0.0	0.0	0	0.7	0.1	0.1	0.6	4	-0.1	0	1.5	4	(N/A)	1.5	2.04
Lilac	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)	1.5	0.41
Other street trees	0.2	0.0	0.2	0.0	1	2.1	0.3	0.3	2.0	13	-0.3	-1	4.8	13	(N/A)	5.4	1.91
Citywide total	5.0	0.9	3.5	0.3	30	35.9	5.2	5.0	34.2	224	-7.8	-29	82.3	225	(N/A)	100.0	1.73

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

8/13/2010

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white	712	5	(N/A)	21.5	0.8	0.19
Apple	1,388	10	(N/A)	9.2	1.7	0.87
Silver maple	11,055	83	(N/A)	8.5	13.1	7.54
Eastern white pine	1,873	14	(N/A)	6.9	2.2	1.56
Northern red oak	16,802	126	(N/A)	6.2	19.9	15.75
Chinese elm	1,298	10	(N/A)	5.4	1.5	1.39
Red maple	1,991	15	(N/A)	4.6	2.4	2.49
Littleleaf linden	19,000	143	(N/A)	4.6	22.6	23.75
Maple	3,739	28	(N/A)	3.9	4.4	5.61
Blue spruce	3,089	23	(N/A)	3.9	3.7	4.63
Sugar maple	1,554	12	(N/A)	3.1	1.8	2.91
Conifer Evergreen	51	0	(N/A)	3.1	0.1	0.09
Green ash	5,077	38	(N/A)	3.1	6.0	9.52
Broadleaf	205	2	(N/A)	2.3	0.2	0.51
Honeylocust	9,111	68	(N/A)	2.3	10.8	22.78
Norway maple	235	2	(N/A)	1.5	0.3	0.88
Swamp white oak	437	3	(N/A)	1.5	0.5	1.64
Pin oak	1,211	9	(N/A)	1.5	1.4	4.54
Lilac	192	1	(N/A)	1.5	0.2	0.72
Other street trees	2,379	39	(N/A)	5.4	6.2	5.62
Citywide total	84,266	632	(N/A)	100.0	100.0	4.86

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

8/13/2010

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
Northern white cedar	359	3	-3	-5	0	741	6	1,092	8	(N/A)	21.5	4.3	0.29
Apple	268	2	-7	-2	0	249	2	508	4	(N/A)	9.2	2.0	0.32
Silver maple	2,022	15	-53	-2	0	1,492	11	3,459	26	(N/A)	8.5	13.7	2.36
Eastern white pine	404	3	-9	-2	0	736	6	1,130	8	(N/A)	6.9	4.5	0.94
Northern red oak	1,530	11	-81	-2	-1	1,763	13	3,211	24	(N/A)	6.2	12.7	3.01
Chinese elm	519	4	-6	-1	0	340	3	852	6	(N/A)	5.4	3.4	0.91
Red maple	323	2	-10	-1	0	434	3	746	6	(N/A)	4.6	3.0	0.93
Littleleaf linden	2,795	21	-91	-1	-1	1,818	14	4,520	34	(N/A)	4.6	17.9	5.65
Maple	573	4	-18	-1	0	677	5	1,232	9	(N/A)	3.9	4.9	1.85
Blue spruce	297	2	-15	-1	0	744	6	1,026	8	(N/A)	3.9	4.1	1.54
Sugar maple	281	2	-7	-1	0	292	2	565	4	(N/A)	3.1	2.2	1.06
Conifer Evergreen	15	0	0	-1	0	45	0	59	0	(N/A)	3.1	0.2	0.11
Green ash	802	6	-24	-1	0	649	5	1,426	11	(N/A)	3.1	5.7	2.67
Broadleaf Deciduous	55	0	-1	-1	0	48	0	102	1	(N/A)	2.3	0.4	0.26
Honeylocust	1,423	11	-44	-1	0	1,397	10	2,776	21	(N/A)	2.3	11.0	6.94
Norway maple	101	1	-1	0	0	72	1	171	1	(N/A)	1.5	0.7	0.64
Swamp white oak	191	1	-2	0	0	129	1	318	2	(N/A)	1.5	1.3	1.19
Pin oak	216	2	-6	0	0	241	2	450	3	(N/A)	1.5	1.8	1.69
Lilac	47	0	-1	0	0	43	0	88	1	(N/A)	1.5	0.4	0.33
Other street trees	776	6	-25	-1	0	740	6	1,489	11	(N/A)	5.4	5.9	1.60
Citywide total	12,999	97	-404	-25	-3	12,652	95	25,220	189	(N/A)	100.0	100.0	1.46

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

8/13/2010

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	181	(N/A)	21.5	8.5	6.45
Apple	11	(N/A)	9.2	0.5	0.90
Silver maple	306	(N/A)	8.5	14.4	27.83
Eastern white pine	122	(N/A)	6.9	5.7	13.51
Northern red oak	143	(N/A)	6.2	6.7	17.90
Chinese elm	103	(N/A)	5.4	4.9	14.73
Red maple	59	(N/A)	4.6	2.8	9.83
Littleleaf linden	307	(N/A)	4.6	14.4	51.11
Maple	104	(N/A)	3.9	4.9	20.82
Blue spruce	114	(N/A)	3.9	5.4	22.74
Sugar maple	36	(N/A)	3.1	1.7	9.10
Conifer Evergreen Small	26	(N/A)	3.1	1.2	6.55
Green ash	104	(N/A)	3.1	4.9	25.97
Broadleaf Deciduous	2	(N/A)	2.3	0.1	0.71
Honeylocust	308	(N/A)	2.3	14.5	102.70
Norway maple	16	(N/A)	1.5	0.7	7.81
Swamp white oak	26	(N/A)	1.5	1.2	12.89
Pin oak	31	(N/A)	1.5	1.5	15.53
Lilac	2	(N/A)	1.5	0.1	1.05
Other street trees	124	(N/A)	5.4	5.9	17.78
Citywide total	2,125	(N/A)	100.0	100.0	16.34

Table 7: Summary of Benefits in Dollars

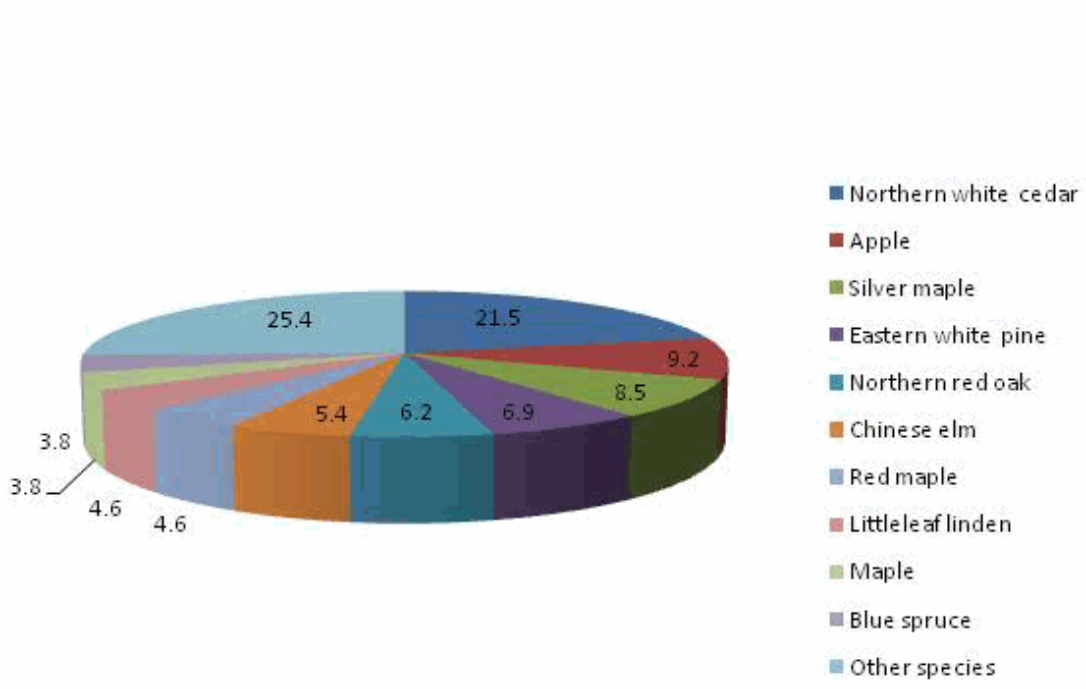
Annual Benefits of Public Trees by Species ($/tree)

8/13/2010

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Northern white	3.93	0.29	0.38	4.18	6.45	15.23	(N/A)
Apple	3.07	0.32	0.41	1.06	0.90	5.75	(N/A)
Silver maple	16.34	2.36	2.44	16.02	27.83	64.98	(N/A)
Eastern white pine	11.81	0.94	1.27	13.83	13.51	41.37	(N/A)
Northern red oak	26.20	3.01	3.90	20.89	17.90	71.90	(N/A)
Chinese elm	5.82	0.91	0.87	4.65	14.73	26.99	(N/A)
Red maple	9.50	0.93	1.38	5.36	9.83	27.00	(N/A)
Littleleaf linden	35.30	5.65	5.78	30.53	51.11	128.36	(N/A)
Maple	17.89	1.85	2.63	11.66	20.82	54.84	(N/A)
Blue spruce	18.68	1.54	2.08	29.02	22.74	74.06	(N/A)
Sugar maple	9.37	1.06	1.32	5.68	9.10	26.53	(N/A)
Conifer Evergreen	1.60	0.11	0.11	1.74	6.55	10.11	(N/A)
Green ash	19.13	2.67	3.04	16.37	25.97	67.18	(N/A)
Broadleaf	2.38	0.26	0.31	0.75	0.71	4.41	(N/A)
Honeylocust	53.77	6.94	8.90	42.19	102.70	214.51	(N/A)
Norway maple	5.04	0.64	0.67	2.37	7.81	16.54	(N/A)
Swamp white oak	8.99	1.19	1.21	4.41	12.89	28.68	(N/A)
Pin oak	15.71	1.69	2.04	10.03	15.53	45.01	(N/A)
Lilac	3.13	0.33	0.41	1.03	1.05	5.95	(N/A)
Other street trees	13.04	1.60	1.91	11.89	17.78	46.21	(N/A)

Species Distribution of Public Trees (%)

8/13/2010

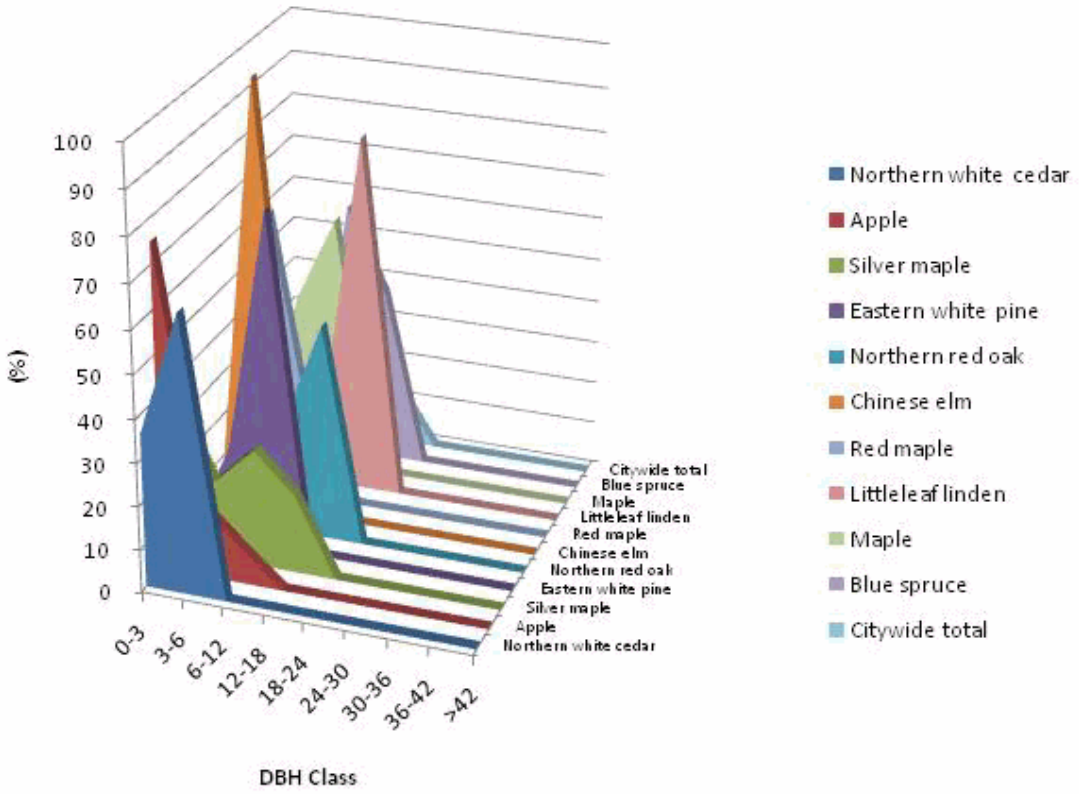


Species	Percent
Northern white cedar	21.5
Apple	9.2
Silver maple	8.5
Eastern white pine	6.9
Northern red oak	6.2
Chinese elm	5.4
Red maple	4.6
Littleleaf linden	4.6
Maple	3.8
Blue spruce	3.8
Other species	25.4
Total	100.0

Figure 1: Species Distribution

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

8/13/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Northern white cedar	35.7	64.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apple	75.0	16.7	8.3	0.0	0.0	0.0	0.0	0.0	0.0
Silver maple	36.4	18.2	27.3	18.2	0.0	0.0	0.0	0.0	0.0
Eastern white pine	0.0	22.2	77.8	0.0	0.0	0.0	0.0	0.0	0.0
Northern red oak	0.0	25.0	25.0	50.0	0.0	0.0	0.0	0.0	0.0
Chinese elm	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red maple	16.7	66.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Littleleaf linden	0.0	0.0	16.7	83.3	0.0	0.0	0.0	0.0	0.0
Maple	0.0	40.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0
Blue spruce	0.0	0.0	60.0	40.0	0.0	0.0	0.0	0.0	0.0
Citywide total	26.9	39.2	20.0	13.8	0.0	0.0	0.0	0.0	0.0

Figure 2: Relative Age Class

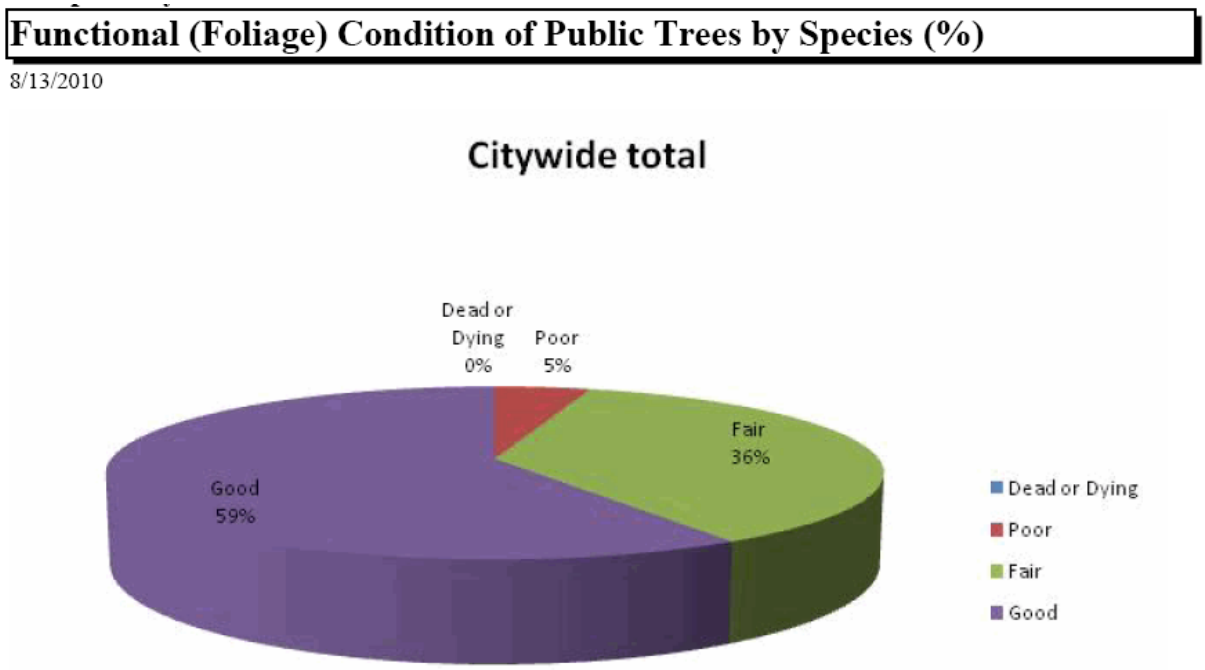


Figure 3: Foliage Condition

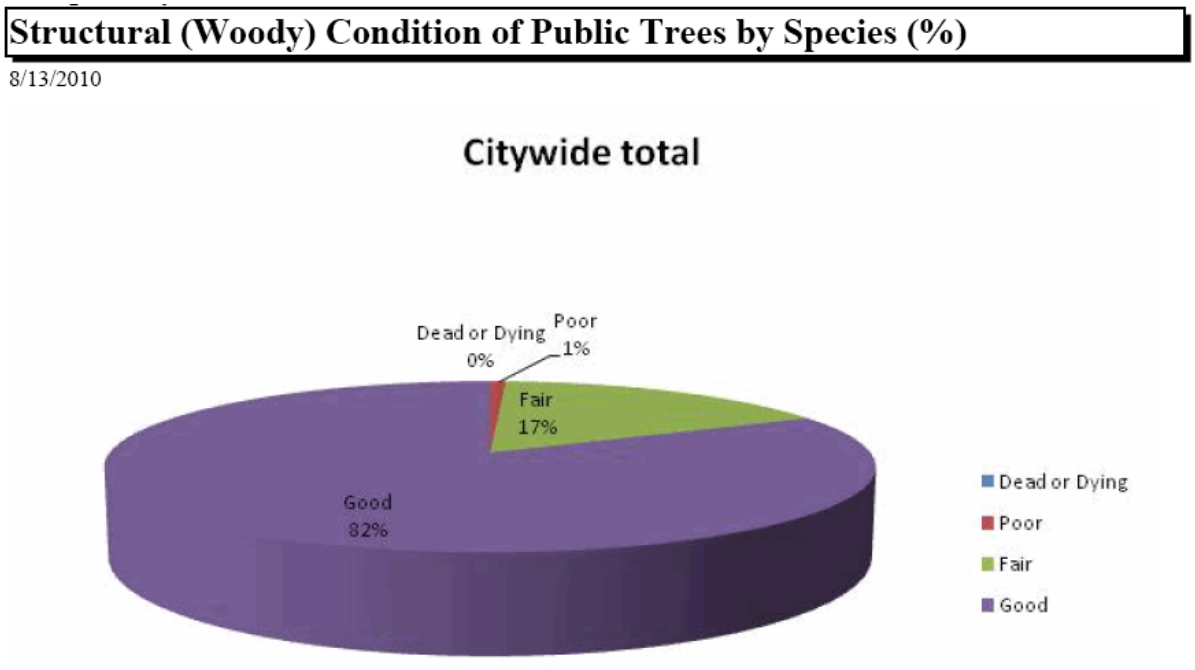
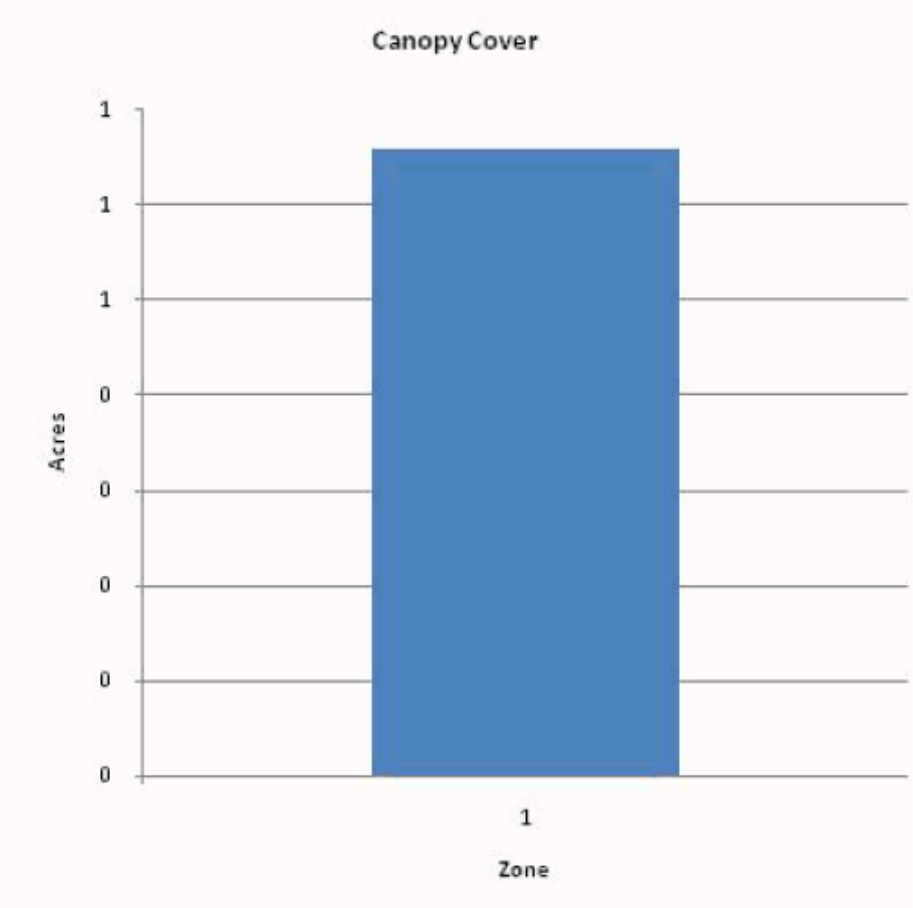


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

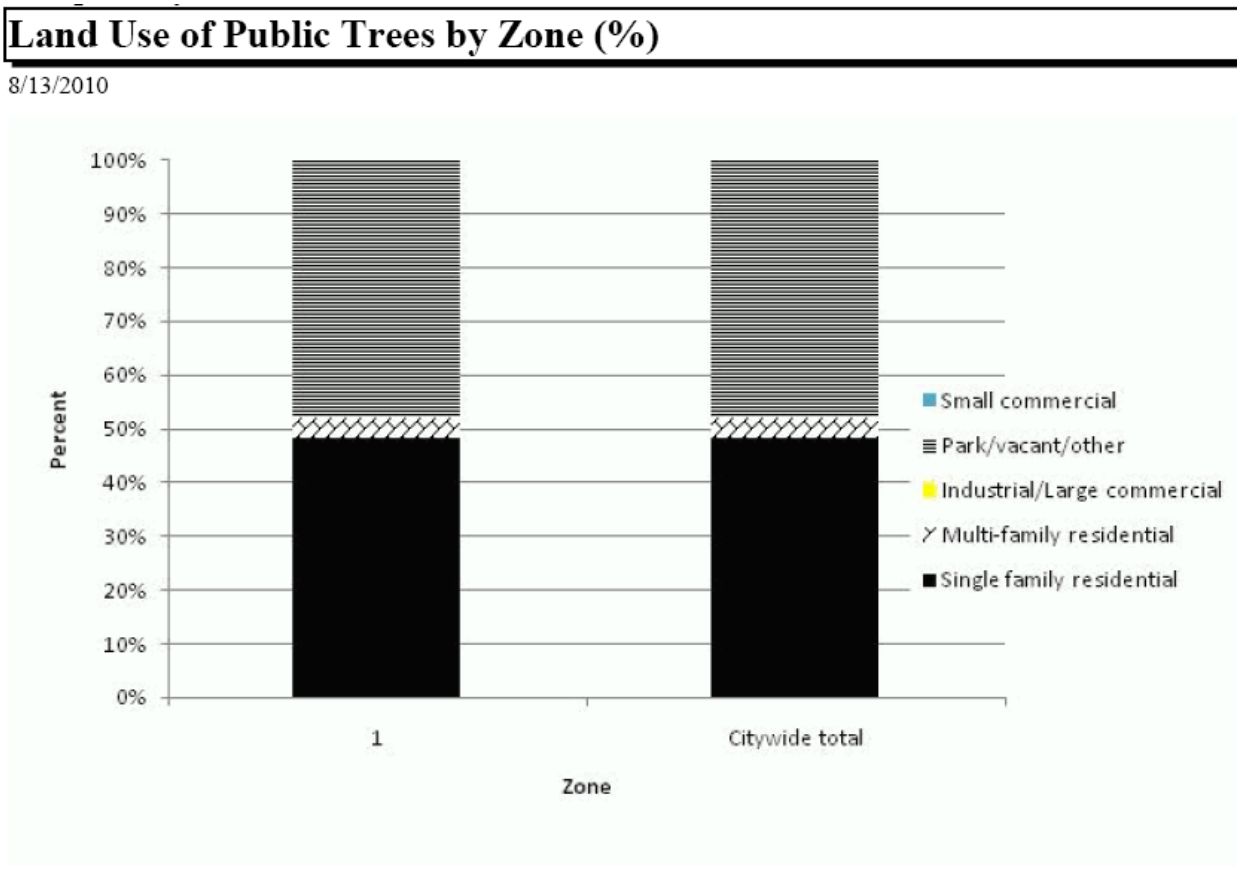
8/13/2010



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

Figure 5: Canopy Cover in Acres

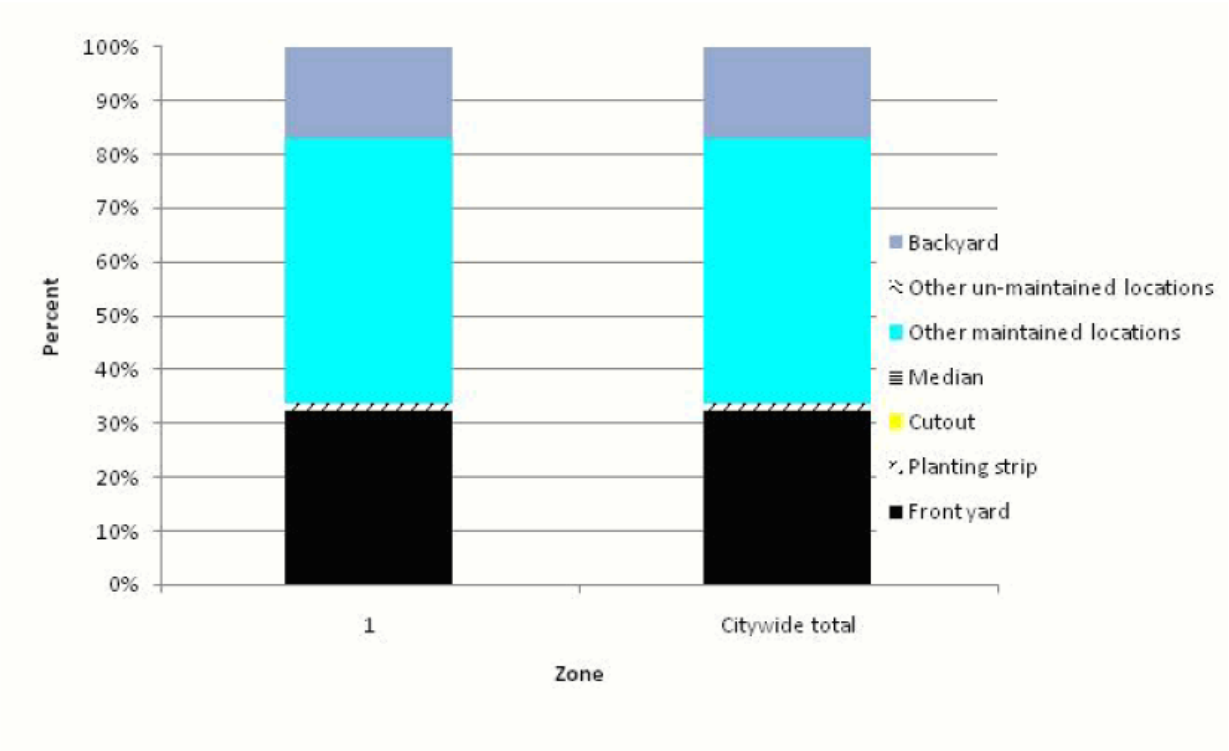


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	48.5	3.8	0.0	47.7	0.0
Citywide total	48.5	3.8	0.0	47.7	0.0

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

8/13/2010



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	32.3	1.5	0.0	0.0	49.2	0.0	16.9
Citywide total	32.3	1.5	0.0	0.0	49.2	0.0	16.9

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

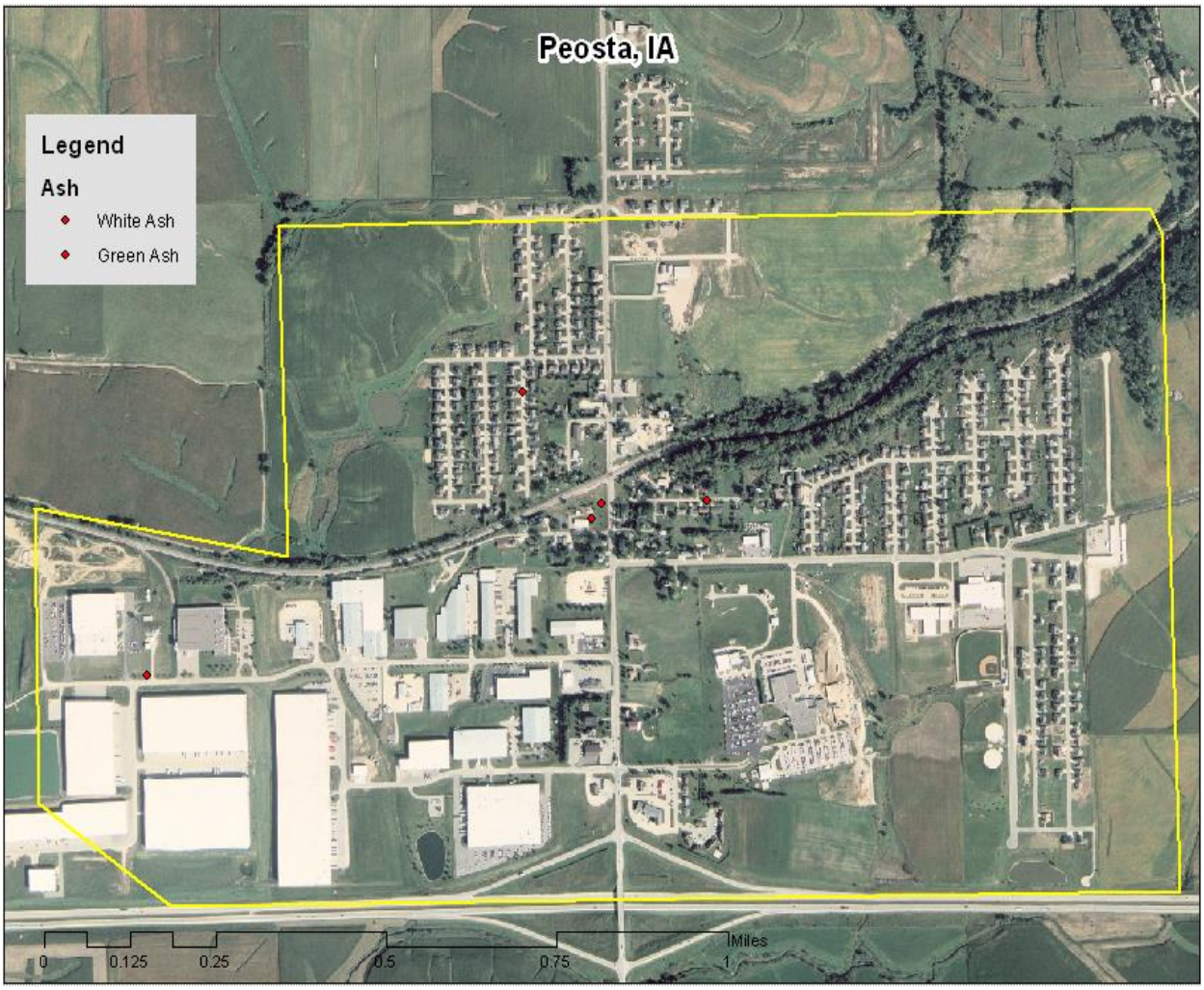


Figure 1: Location of Ash Trees

NO SYMPTOMS OF EAB

Figure 2: Location of EAB symptoms

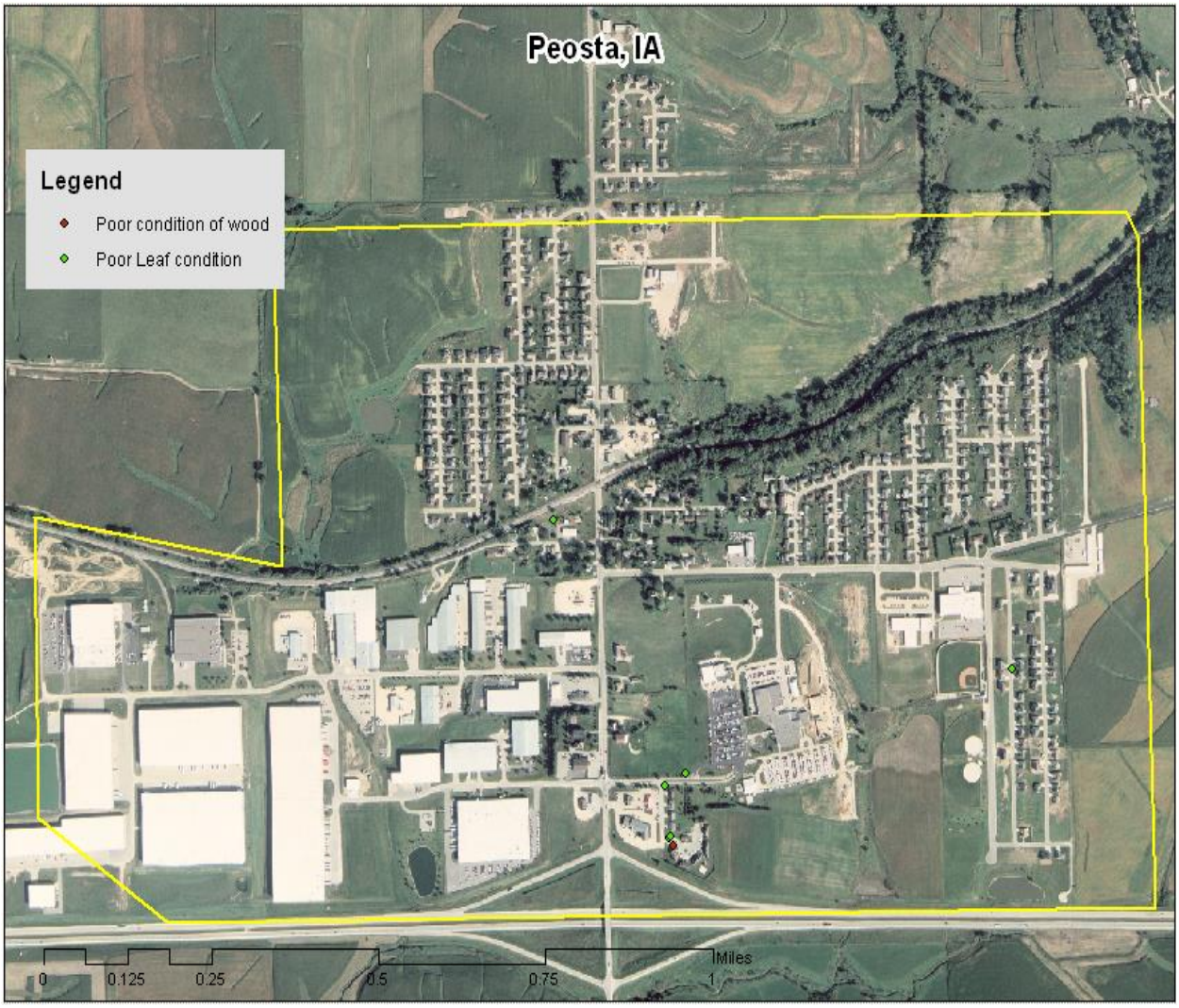


Figure 3: Location of Poor Condition Trees

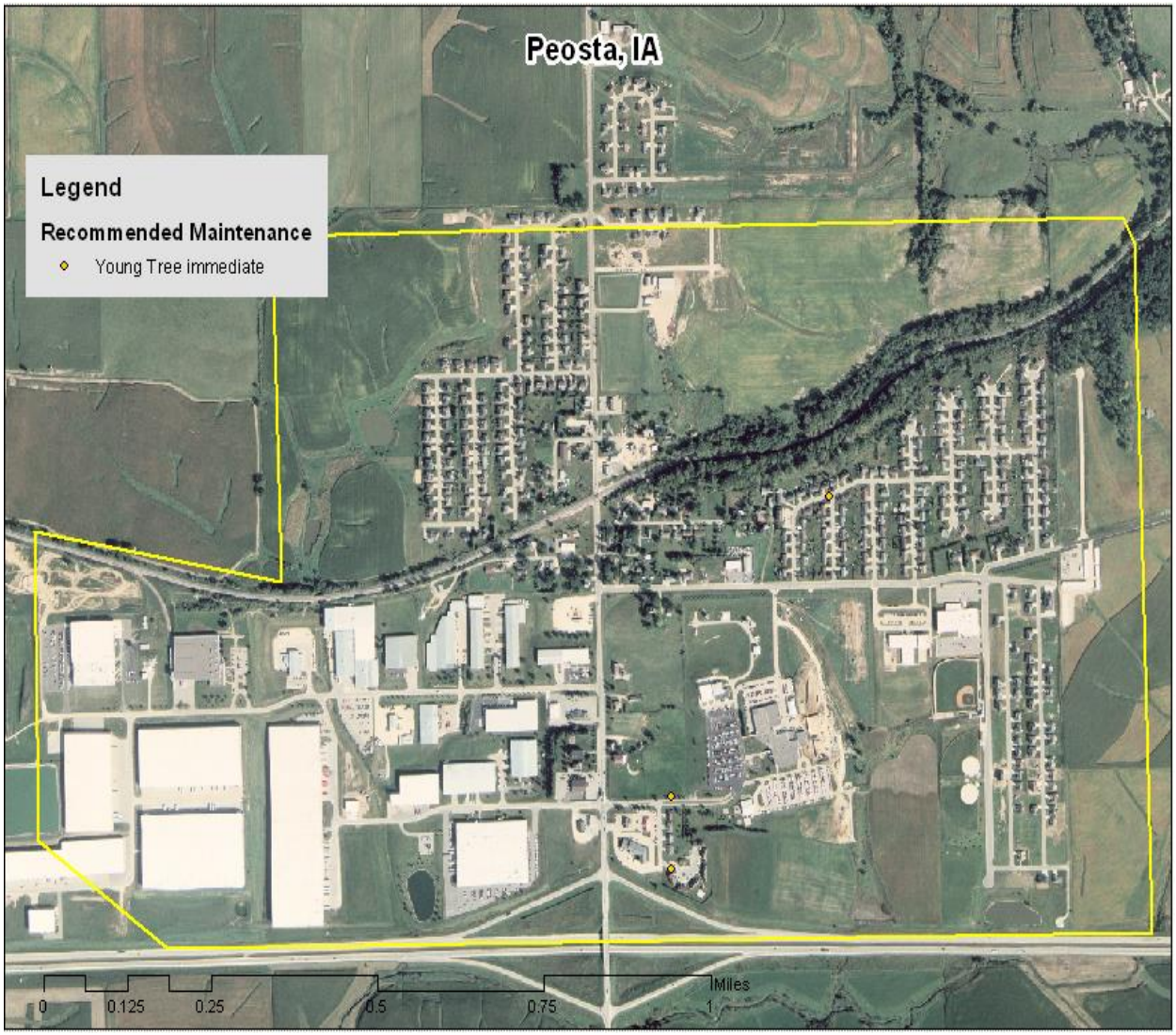


Figure 4: Location of Trees with Recommended Maintenance

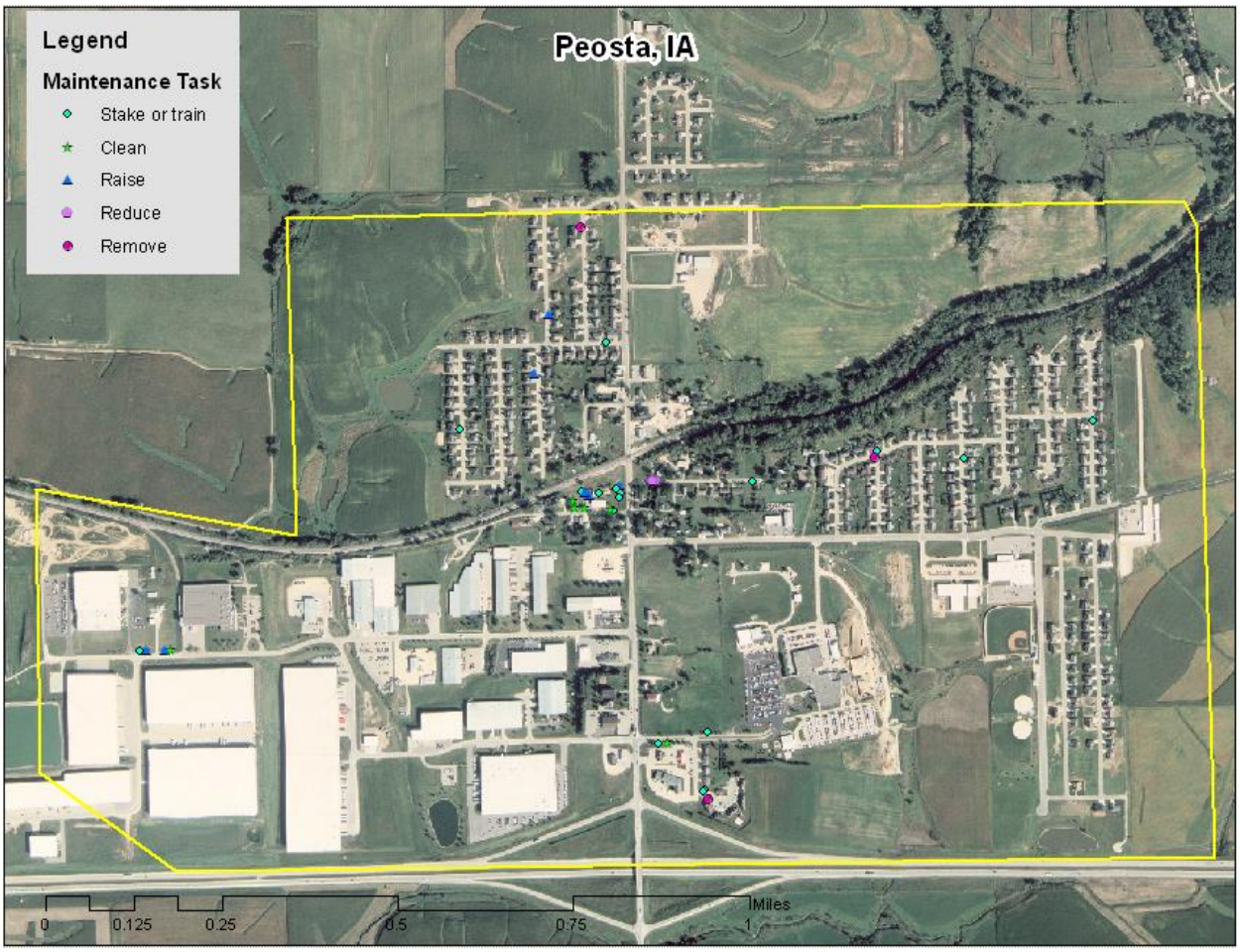


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Peosta Tree Ordinances

MINIMUM STANDARDS FOR THE DESIGN OF SUBDIVISIONS

6-7-11 MINIMUM STANDARDS. The following standards shall be considered the minimum standards necessary to protect the public health, safety, and general welfare.

11. Blocks.

a. No block may be more than one thousand three hundred twenty (1,320) feet or less than five hundred (500) feet in length between the center lines of intersecting streets, except where, in the opinion of the governing body, extraordinary conditions unquestionably justify a departure from these limits.

b. In blocks over seven hundred (700) feet in length, the governing body may require at or near the middle of the block a public way or easement of not less than ten (10) feet in width for use by pedestrians and/or as an easement for public utilities.

3-2-1 DEFINITIONS. For use in this Ordinance, the following terms are defined:

1. The term "nuisance" means whatever is injurious to health, indecent, or unreasonably offensive to the senses or an obstacle to the free use of property, so as essentially to unreasonably interfere with the comfortable enjoyment of life or property. The following are declared to be nuisances: (Code of Iowa, Sec. 657.1)

h. Cotton-bearing cottonwood trees and all other cotton-bearing poplar trees in the City.

m. Trees infected with Dutch elm disease. (Code of Iowa, Sec. 657.2(12))

3-2-3 OTHER CONDITIONS REGULATED. The following actions are required and may also be abated in the manner provided in this Ordinance:

1. The removal of diseased trees or dead wood, but not diseased trees and dead wood outside the lot and property lines and inside the curb lines upon the public street. (Code of Iowa, Sec. 364.12(3)(b))

7. The maintenance, by the property owner, of all property outside the lot and property lines and inside the curb lines upon public streets, including maintaining a fifteen (15) foot clearance above the street from trees extending over the streets, except as provided in Section 3-2-3(1). (Ord. 03-04, Passed September 9, 2003)

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

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

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