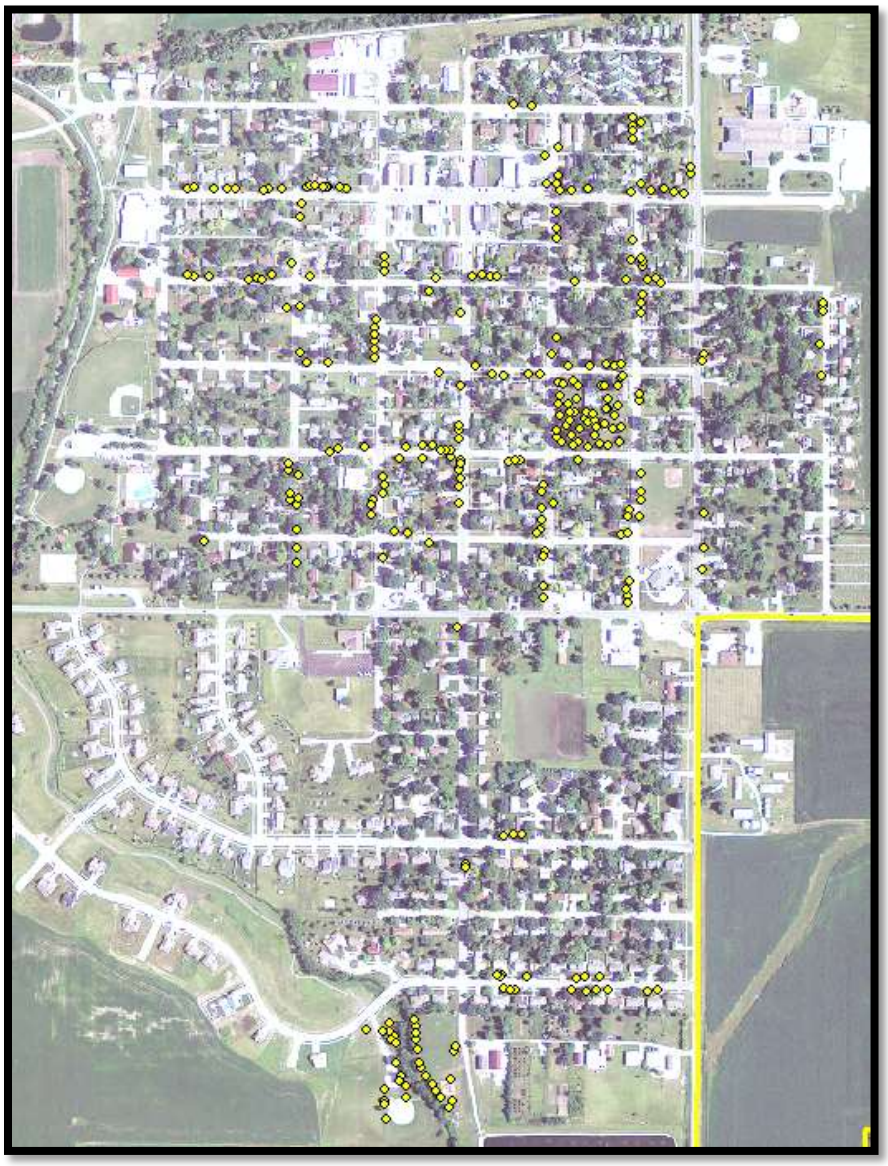
Community Tree Management Plan
For Slater, IA



Prepared by the Iowa DNR
Bureau of Forestry
2014

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Executive Summary

Overview

This plan was developed to assist the City of Slater with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management of this resource is critical to fully reaping these rewards. Management is especially important considering the serious threats posed by forest pests such as the Emerald Ash Borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees *(Fraxinus spp.)*. Ash trees presently comprise approximately 18% of Slater's city-owned tree population that will likely all die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be spread out over time, mitigating the financial burden as well as public safety issues.

Inventory and Results

In May 2013, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The survey was a complete inventory of street right-of-way trees as well as all trees in two city parks. Below are some key findings of the 282 trees inventoried.

- Slater's trees provide $38,262 of benefits annually, at an average of $136 a tree
- There are at least 32 different species of trees in Slater
- The top three genus are: Maple 30%, Ash 18%, and Crabapple 8%
- 27% of trees are in need of some type of maintenance (trimming, removal, etc.):
    - 17 trees are recommended for removal; some of these are critical concerns while others can be considered routine over the next 6 years
    - 60 trees need maintenance in the form of trimming

Recommendations

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

- Begin replacing old trees in poor health and planting new ones with a diverse mix of species (other than maples & ash) that will buffer against major pests
- Address the 17 trees recommended for removal according to their priority level: 2 are "critical concern" trees which need to be addressed immediately; 2 should be removed in the next 1-3 years; and the rest sometime in the next 6 years *City ownership of the trees recommended for removal should be verified prior to any removal*
- Schedule routine maintenance (trimming, etc.) for the 60 trees identified by the inventory

Introduction

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

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

Inventory

In May 2013, a tree inventory was conducted that included 100% of the city owned trees along city streets, including two parks (Southside Park and the main city park between 3rd and 4th Ave). 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 program 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 282 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. Slater's trees reduce energy related costs by approximately $11,143 annually (Appendix A, Table 1). These savings are both in Electricity (53 MWh) and in Natural Gas (7,289 Therms).

Annual Stormwater Benefits

Slater's trees intercept about 478,833 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides $12,977 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 mater (ozone). In Slater, it is estimated that trees remove 653 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 $1,834 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Slater, trees sequester about 108,712 lbs of carbon a year with an associated value of $815/yr (Appendix A, Table 5). The trees are storing a total of 1,432,899 lbs of carbon, with a total benefit of $10,747 (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. Slater receives $10,882 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, Slater's trees provide $38,262 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 282 trees in Slater provide approximately $136 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Slater has over 32 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	84	30%
Ash	51	18%
Crabapples	23	8%
Hackberry	18	6%
Sycamore	15	5%
Eastern red cedar	15	5%
All others	< 15 ea.	< 5% ea.

Size Class

Most of Slater's trees (61%) are over 12 inches in diameter at 4.5 ft (Appendix A, Figure 2). This indicates an imbalance in the city's tree population and suggests that as the larger, older trees decline and are removed, there is a lack of younger trees being planted to replace them. Having too many large trees and too few young ones increases the risk for catastrophic storm damage and a long "lag period" following major damage.

Condition: Wood and Foliage Health

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The survey results for Slater indicate that 88% of the trees are in either good or fair health, while 12% of the trees are in poor health or are considered dead or dying (Appendix A, Figures 3 & 4 and Appendix B, Figure 3).

The 12% of trees classified as poor, dead, or dying represent opportunity costs to the city where time and space are being sacrificed. Trees in poor health should be promptly removed and replaced with new, healthy trees to diversify and improve the overall health and resiliency of Slater's urban tree population.

Canopy Cover

The amount of tree canopy cover over Slater is approximately 5 acres (Appendix A, Figure 5). According to the U.S. Census, Slater occupies 806 acres of land. Thus the canopy cover on city land is about 1%.

Land Use and Location

The majority of Slater's trees are in city parks or in planting strips in single family residential neighborhoods (Appendix A, Figures 6 & 7).

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figures 4 & 5). Crown cleaning removes dead, diseased, and broken limbs. Crown reduction is removing individual limbs to avoid interference with nearby structures, utility wires, or other branches.

Crown Cleaning	45	16%
Tree Removal	17	6%
Crown Reduction	15	5%
Total	77	27%

Recommendations

Risk Management

Hazardous trees and branches 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 immediately.

Hazardous trees & branches: Critical concerns and Immediate needs

Slater has 4 "critical concern" trees that need immediate attention: 2 trees with hazardous branches that need crown cleaning and 2 hazardous trees that need taken down. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing "immediate" maintenance attention, meaning within the next three years. There are a total of 21 trees with these needs. Refer to the maps in Figures 3 and 4 of Appendix B to view the locations of these trees.

Routine maintenance trees

After the removal & replacement of the critical concern and immediate need trees, there are 52 trees needing "routine" maintenance within the next six years (Appendix B, Figures 3 & 4). Of this number, 40 need trimming and 12 are recommended for removal & replacement with something new.

After addressing the trees mentioned above, any remaining trees that are listed in "poor" health (either wood or foliage) should be targeted for replacement as time and resources allow.

Routine Pruning

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. It is generally recommended that all trees be inspected for pruning needs every five to ten years. This would equate to pruning roughly 30 trees per year in Slater.

Planting

Theoretically, the city should be planting (and removing) about 2-4 trees per year in order to sustain the tree population and to spread the trees equally out among different ages (size classes). This assumes the typical lifespan of a tree in Slater to be 80-140 years; if the trees are not living that long, the target will be higher (4-6 trees/yr). Most of the planting over the next 10-15 years can be done to replace the trees that are removed. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Slater.

It is important to plant a diverse mix of differing species in the urban forest to maintain canopy health, since most insects and diseases target a single genus of trees (e.g., ash, maple, oak). Current diversity recommendations advise that a single genus not make up more than 20% of the urban forest and a single species (e.g. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with the genus Maple, at 30% (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid for various reasons include: cottonwood, poplar, boxelder, Chinese elm, evergreens, willow, or black walnut, and any others identified in the city tree code.

A list containing generally acceptable and recommended trees for planting in Iowa is provided with this plan. Ensure each individual planting is tailored for the environmental conditions, available space, and other factors.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that all ash trees which are showing any signs or symptoms of EAB be checked annually with a visual survey for tree death and for additional symptoms (canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage). All other ash trees in the city which aren't exhibiting these symptoms should still be routinely monitored as time allows.

Proposed Work Schedule & Estimated Costs

EAB could potentially kill all 51 ash trees in Slater within 4 years of its arrival, with tree removal costs likely to exceed $35,000. By budgeting for routine maintenance, replacement, and removals now, the city can be proactive and preventative rather than reactive when this pest arrives.

The following is a proposed 6-year work plan that would address the highest priority issues at this time. Estimated costs are based on $700/tree average for removal, $75/tree average for

trimming*, and $150/tree average for planting. *Individual homeowners are presumed to be responsible for light trimming and staking/training of young trees in the City right-of-way. For new tree plantings & replacements, it is recommended that Slater apply for grants. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Year 1	Estimated Costs
Removals: 3 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Year 2	
Removals: 3 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Year 3	
Removals: 3 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Year 4	
Removals: 3 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Year 5	
Removals: 3 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Year 6	
Removals: 2 of the 17 recommended trees	$2100
Planting and replacements: 3 new trees	$450
Trimming: 10 of the 60 recommended trees	$750
Annually thereafter	
Removals: 2-4/year avg. focusing on poor condition ash & maple	$2100
Planting and replacements: 2-4/year avg.	$450
Routine trimming: 30 trees/year avg.	$2250
Routine monitoring for EAB symptoms	

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Maps and figures provided by Emma Bruemmer, Urban Forestry Coordinator. All data and information used for this report may be obtained by contacting the Iowa DNR Forestry Bureau.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Slater

Annual Energy Benefits of Public Trees by Species

3/14/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	11.5	873	1,619.4	1,587	2,460	(N/A)	18.1	22.1	48.23
Silver maple	11.3	855	1,424.6	1,396	2,251	(N/A)	14.5	20.2	54.90
Norway maple	4.1	308	548.5	538	846	(N/A)	8.2	7.6	36.78
Apple	1.7	126	273.6	268	394	(N/A)	8.2	3.5	17.15
Northern hackberry	5.4	409	771.5	756	1,165	(N/A)	6.4	10.5	64.72
Eastern red cedar	1.4	103	204.1	200	303	(N/A)	5.3	2.7	20.20
American sycamore	4.7	353	652.4	639	993	(N/A)	5.3	8.9	66.19
Black walnut	3.7	278	508.9	499	777	(N/A)	5.0	7.0	55.49
Red maple	1.0	73	135.7	133	206	(N/A)	4.6	1.9	15.87
Eastern redbud	1.0	73	166.8	163	237	(N/A)	4.6	2.1	18.19
Spruce	0.4	33	67.0	66	99	(N/A)	3.6	0.9	9.85
Northern red oak	0.7	52	91.5	90	142	(N/A)	2.5	1.3	20.30
Northern white cedar	0.4	27	51.4	50	78	(N/A)	1.8	0.7	15.55
American basswood	1.2	88	149.0	146	234	(N/A)	1.8	2.1	46.82
Black maple	0.8	58	90.2	88	147	(N/A)	1.1	1.3	48.95
Sugar maple	0.0	3	6.0	6	9	(N/A)	1.1	0.1	3.04
Honeylocust	0.8	61	110.0	108	169	(N/A)	1.1	1.5	56.34
Bur oak	0.3	22	41.2	40	62	(N/A)	1.1	0.6	20.64
Other street trees	2.7	203	376.8	369	572	(N/A)	6.0	5.1	33.67
Citywide total	52.7	4,000	7,288.5	7,143	11,143	(N/A)	100.0	100.0	39.51

Table 2: Annual Stormwater Benefits

Slater

Annual Stormwater Benefits of Public Trees by Species

3/14/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	95,880	2,599	(N/A)	18.1	20.0	50.95
Silver maple	128,736	3,489	(N/A)	14.5	26.9	85.10
Norway maple	25,685	696	(N/A)	8.2	5.4	30.27
Apple	5,908	160	(N/A)	8.2	1.2	6.96
Northern hackberry	42,859	1,162	(N/A)	6.4	9.0	64.53
Eastern red cedar	19,640	532	(N/A)	5.3	4.1	35.49
American sycamore	55,331	1,500	(N/A)	5.3	11.6	99.97
Black walnut	34,244	928	(N/A)	5.0	7.2	66.29
Red maple	5,314	144	(N/A)	4.6	1.1	11.08
Eastern redbud	3,438	93	(N/A)	4.6	0.7	7.17
Spruce	4,601	125	(N/A)	3.6	1.0	12.47
Northern red oak	4,010	109	(N/A)	2.5	0.8	15.53
Northern white cedar	6,576	178	(N/A)	1.8	1.4	35.65
American basswood	8,039	218	(N/A)	1.8	1.7	43.57
Black maple	4,811	130	(N/A)	1.1	1.0	43.46
Sugar maple	162	4	(N/A)	1.1	0.0	1.46
Honeylocust	8,217	223	(N/A)	1.1	1.7	74.23
Bur oak	1,823	49	(N/A)	1.1	0.4	16.47
Other street trees	23,557	638	(N/A)	6.0	4.9	37.56
Citywide total	478,833	12,977	(N/A)	100.0	100.0	46.02

Table 3: Annual Air Quality Benefits

Slater

Annual Air Quality Benefits of Public Trees by Species

3/14/2014

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
Ash	18.3	3.2	9.2	0.8	100	55.4	8.0	7.7	52.2	344	-4.4	-17	150.3	427	(N/A)	18.1	8.37
Silver maple	18.9	3.2	9.7	0.8	103	52.6	7.7	7.4	51.0	330	-10.8	-40	140.7	393	(N/A)	14.5	9.60
Norway maple	3.9	0.7	2.1	0.2	22	19.4	2.8	2.7	18.4	121	-1.0	-4	49.2	139	(N/A)	8.2	6.03
Apple	1.2	0.2	0.6	0.1	6	8.3	1.2	1.1	7.5	51	0.0	0	20.2	57	(N/A)	8.2	2.50
Northern hackberry	5.6	1.0	3.1	0.3	31	26.1	3.8	3.6	24.4	162	0.0	0	67.8	193	(N/A)	6.4	10.72
Eastern red cedar	3.7	0.7	3.0	0.5	24	6.6	1.0	0.9	6.1	41	-10.8	-40	11.8	25	(N/A)	5.3	1.66
American sycamore	7.1	1.1	3.3	0.3	38	22.4	3.2	3.1	21.1	139	0.0	0	61.7	177	(N/A)	5.3	11.77
Black walnut	3.5	0.6	1.8	0.2	19	17.6	2.6	2.4	16.6	109	0.0	0	45.1	128	(N/A)	5.0	9.15
Red maple	0.7	0.1	0.4	0.0	4	4.6	0.7	0.6	4.4	29	-0.3	-1	11.3	32	(N/A)	4.6	2.45
Eastern redbud	0.6	0.1	0.3	0.0	3	4.9	0.7	0.7	4.4	30	0.0	0	11.7	33	(N/A)	4.6	2.55
Spruce	0.4	0.1	0.4	0.0	3	2.1	0.3	0.3	2.0	13	-1.4	-5	4.2	11	(N/A)	3.5	1.06
Northern red oak	0.6	0.1	0.3	0.0	3	3.3	0.5	0.5	3.1	20	-0.9	-3	7.6	21	(N/A)	2.5	2.95
Northern white cedar	0.7	0.1	0.6	0.1	5	1.7	0.3	0.2	1.6	11	-2.9	-11	2.5	5	(N/A)	1.8	0.91
American basswood	0.8	0.1	0.5	0.0	5	5.5	0.8	0.8	5.3	34	-0.8	-3	13.0	36	(N/A)	1.8	7.17
Black maple	1.0	0.2	0.5	0.0	5	3.5	0.5	0.5	3.5	22	-0.4	-1	9.3	26	(N/A)	1.1	8.75
Sugar 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)	1.1	0.43
Honeylocust	1.6	0.3	0.7	0.1	8	3.8	0.6	0.5	3.7	24	-1.2	-4	10.0	28	(N/A)	1.1	9.26
Bur oak	0.1	0.0	0.1	0.0	0	1.4	0.2	0.2	1.3	9	0.0	0	3.2	9	(N/A)	1.1	2.99
Other street trees	3.1	0.5	1.6	0.1	17	12.9	1.9	1.8	12.1	80	-0.6	-2	33.3	94	(N/A)	6.0	5.55
Citywide total	71.8	12.3	38.3	3.6	397	252.3	36.7	35.0	238.9	1,570	-35.5	-133	653.4	1,834	(N/A)	100.0	6.50

Table 4: Annual Carbon Stored

Slater

Stored CO2 Benefits of Public Trees by Species

3/14/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	302,291	2,267	(N/A)	18.1	21.1	44.45
Silver maple	425,240	3,189	(N/A)	14.5	29.7	77.79
Norway maple	67,012	503	(N/A)	8.2	4.7	21.85
Apple	21,490	161	(N/A)	8.2	1.5	7.01
Northern	78,166	586	(N/A)	6.4	5.5	32.57
Eastern red cedar	12,406	93	(N/A)	5.3	0.9	6.20
American	230,137	1,726	(N/A)	5.3	16.1	115.07
Black walnut	111,365	835	(N/A)	5.0	7.8	59.66
Red maple	10,052	75	(N/A)	4.6	0.7	5.80
Eastern redbud	11,803	89	(N/A)	4.6	0.8	6.81
Spruce	2,169	16	(N/A)	3.6	0.2	1.63
Northern red oak	10,289	77	(N/A)	2.5	0.7	11.02
Northern white	6,800	51	(N/A)	1.8	0.5	10.20
American	29,619	222	(N/A)	1.8	2.1	44.43
Black maple	10,872	82	(N/A)	1.1	0.8	27.18
Sugar maple	252	2	(N/A)	1.1	0.0	0.63
Honeylocust	19,895	149	(N/A)	1.1	1.4	49.74
Bur oak	3,104	23	(N/A)	1.1	0.2	7.76
Other street trees	36,258	600	(N/A)	6.0	5.6	35.27
Citywide total	1,432,899	10,747	(N/A)	100.0	100.0	38.11

Table 5: Annual Carbon Sequestered

Slater

Annual CO_2 Benefits of Public Trees by Species

3/14/2014

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
Ash	17,436	131	-1,451	-10	-11	19,284	145	35,259	264	(N/A)	18.1	18.5	5.19
Silver maple	37,738	283	-2,041	-8	-15	18,891	142	54,580	409	(N/A)	14.5	28.7	9.98
Norway maple	6,984	52	-322	-4	-2	6,815	51	13,473	101	(N/A)	8.2	7.1	4.39
Apple	2,547	19	-103	-4	-1	2,789	21	5,229	39	(N/A)	8.2	2.8	1.71
Northern hackberry	6,034	45	-375	-4	-3	9,035	68	14,691	110	(N/A)	6.4	7.7	6.12
Eastern red cedar	371	3	-60	-3	0	2,278	17	2,586	19	(N/A)	5.3	1.4	1.29
American sycamore	11,330	85	-1,105	-3	-8	7,811	59	18,033	135	(N/A)	5.3	9.5	9.02
Black walnut	8,790	66	-535	-3	-4	6,145	46	14,397	108	(N/A)	5.0	7.6	7.71
Red maple	1,473	11	-48	-3	0	1,621	12	3,043	23	(N/A)	4.6	1.6	1.76
Eastern redbud	1,480	11	-57	-3	0	1,614	12	3,035	23	(N/A)	4.6	1.6	1.75
Spruce	381	3	-10	-2	0	727	5	1,096	8	(N/A)	3.6	0.6	0.82
Northern red oak	1,015	8	-49	-1	0	1,158	9	2,122	16	(N/A)	2.5	1.1	2.27
Northern white cedar	429	3	-33	-1	0	606	5	1,001	8	(N/A)	1.8	0.5	1.50
American basswood	2,189	16	-142	-1	-1	1,947	15	3,993	30	(N/A)	1.8	2.1	5.99
Black maple	1,450	11	-52	-1	0	1,293	10	2,689	20	(N/A)	1.1	1.4	6.72
Sugar maple	94	1	-1	-1	0	71	1	163	1	(N/A)	1.1	0.1	0.41
Honeylocust	2,624	20	-95	-1	-1	1,353	10	3,881	29	(N/A)	1.1	2.0	9.70
Bur oak	626	5	-15	-1	0	476	4	1,087	8	(N/A)	1.1	0.6	2.72
Other street trees	5,722	43	-384	-3	-3	4,489	34	9,824	74	(N/A)	6.0	5.2	4.33
Citywide total	108,712	815	-6,878	-55	-52	88,403	663	190,182	1,426	(N/A)	100.0	100.0	5.06

Table 6: Annual Social and Aesthetic Benefits

Slater

Annual Aesthetic/Other Benefits of Public Trees by Species

3/14/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Ash	1,706	(N/A)	18.1	15.7	33.45
Silver maple	3,263	(N/A)	14.5	30.0	79.59
Norway maple	737	(N/A)	8.2	6.8	32.04
Apple	144	(N/A)	8.2	1.3	6.25
Northern hackberry	905	(N/A)	6.4	8.3	50.27
Eastern red cedar	161	(N/A)	5.3	1.5	10.76
American sycamore	898	(N/A)	5.3	8.3	59.85
Black walnut	780	(N/A)	5.0	7.2	55.72
Red maple	244	(N/A)	4.6	2.3	18.79
Eastern redbud	83	(N/A)	4.6	0.8	6.40
Spruce	120	(N/A)	3.6	1.1	11.96
Northern red oak	100	(N/A)	2.5	0.9	14.28
Northern white cedar	115	(N/A)	1.8	1.1	22.93
American basswood	185	(N/A)	1.8	1.7	36.91
Black maple	198	(N/A)	1.1	1.8	65.89
Sugar maple	8	(N/A)	1.1	0.1	2.76
Honeylocust	615	(N/A)	1.1	5.7	205.00
Bur oak	86	(N/A)	1.1	0.8	28.56
Other street trees	535	(N/A)	6.0	4.9	31.46
Citywide total	10,882	(N/A)	100.0	100.0	38.59

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 $
Ash	2,460	264	427	2,599	1,706	$7,455.57	(±0)	19.49
Silver maple	2,251	409	393	3,489	3,263	$9,805.84	(±0)	25.63
Norway maple	846	101	139	696	737	$2,518.74	(±0)	6.58
Apple	394	39	57	160	144	$794.78	(±0)	2.08
Northern hackberry	1,165	110	193	1,162	905	$3,534.45	(±0)	9.24
Eastern red cedar	303	19	25	532	161	$1,041.14	(±0)	2.72
American sycamore	993	135	177	1,500	898	$3,701.82	(±0)	9.67
Black walnut	777	108	128	928	780	$2,721.04	(±0)	7.11
Red maple	206	23	32	144	244	$649.30	(±0)	1.70
Eastern redbud	237	23	33	93	83	$468.78	(±0)	1.23
Spruce	99	8	11	125	120	$361.61	(±0)	0.95
Northern red oak	142	16	21	109	100	$387.34	(±0)	1.01
Northern white cedar	78	8	5	178	115	$382.72	(±0)	1.00
American basswood	234	30	36	218	185	$702.28	(±0)	1.84
Black maple	147	20	26	130	198	$521.34	(±0)	1.36
Sugar maple	9	1	1	4	8	$24.29	(±0)	0.06
Honeylocust	169	29	28	223	615	$1,063.56	(±0)	2.78
Bur oak	62	8	9	49	86	$214.13	(±0)	0.56
Other street trees	572	74	94	638	535	$1,913.67	(±0)	5.00
Citywide total	11,143	1,426	1,834	12,977	10,882	$38,262.42	(±0)	100.00

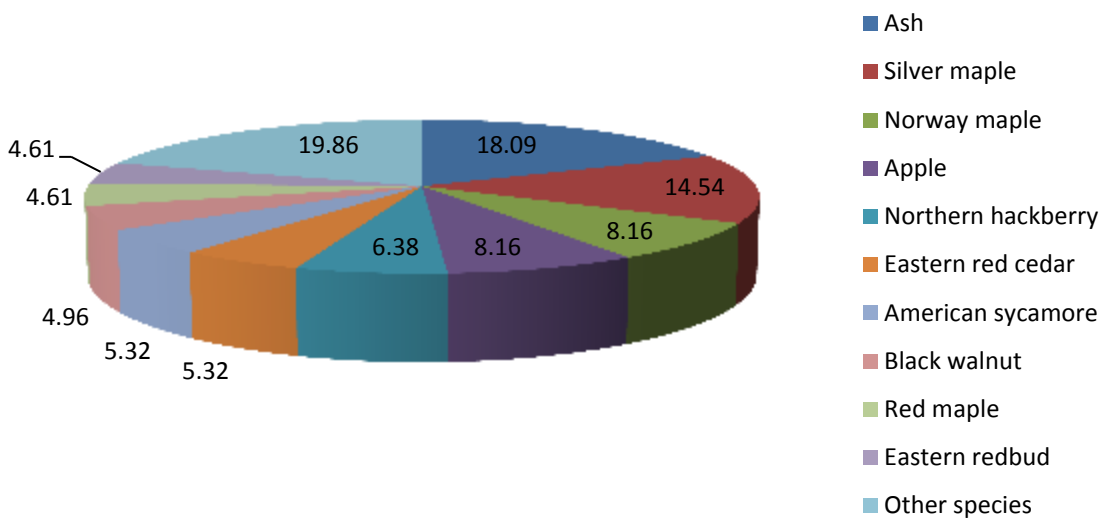

Figure 1: Species Distribution

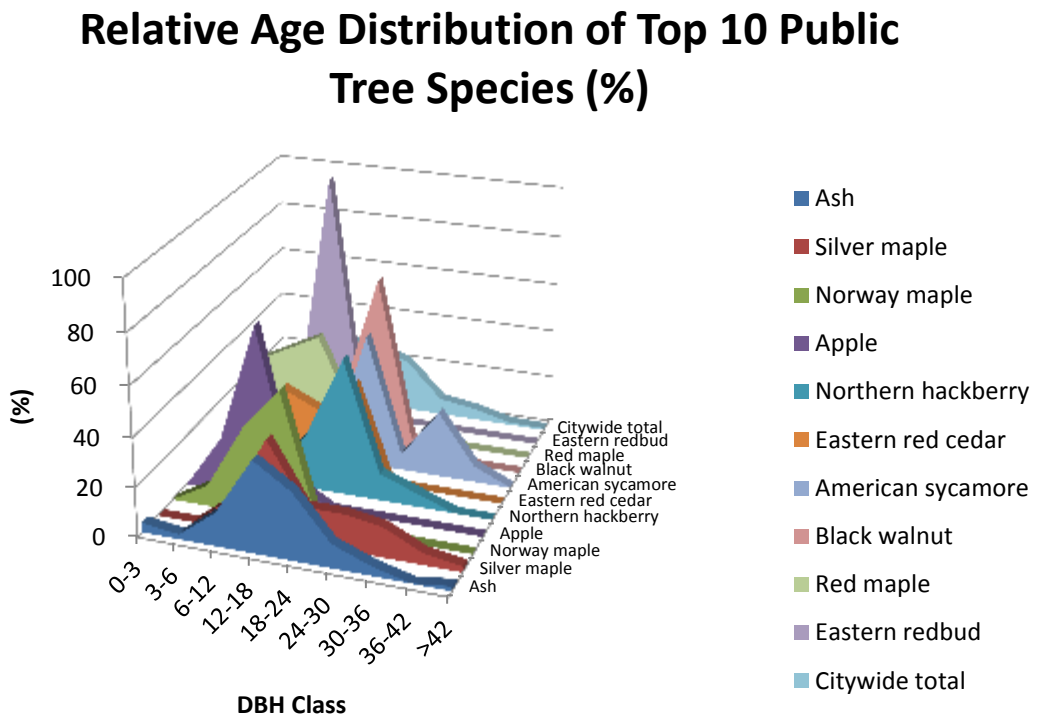

Figure 2: Relative Age Class

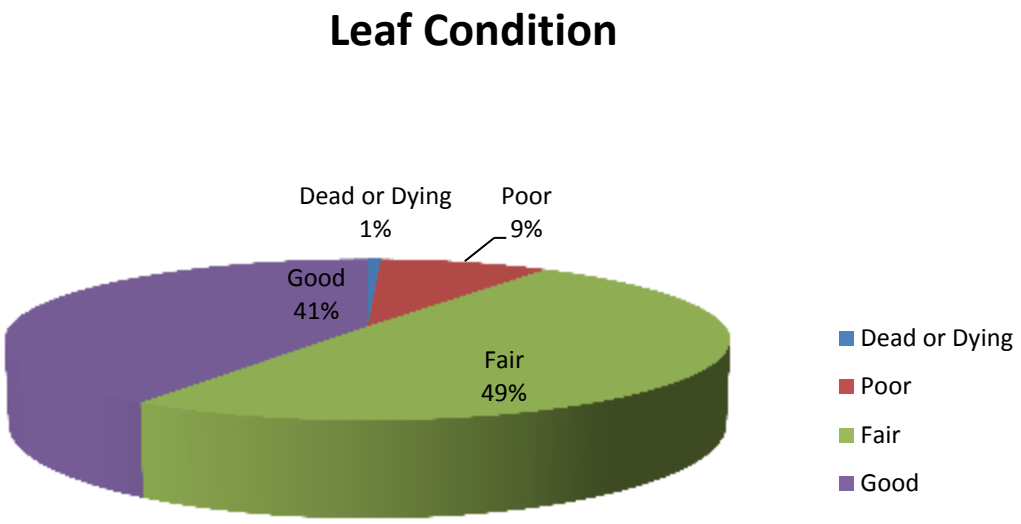

Figure 3: Foliage Condition

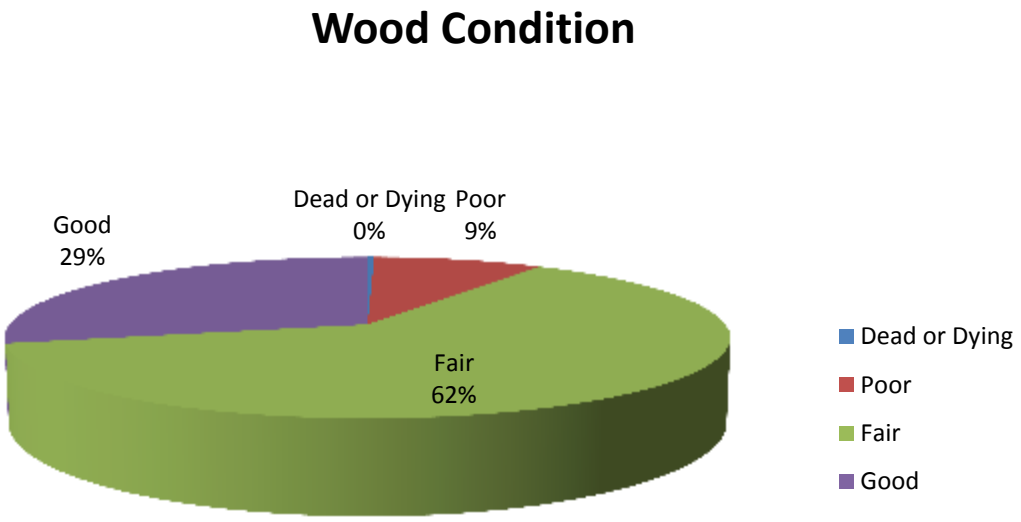

Figure 4: Wood Condition

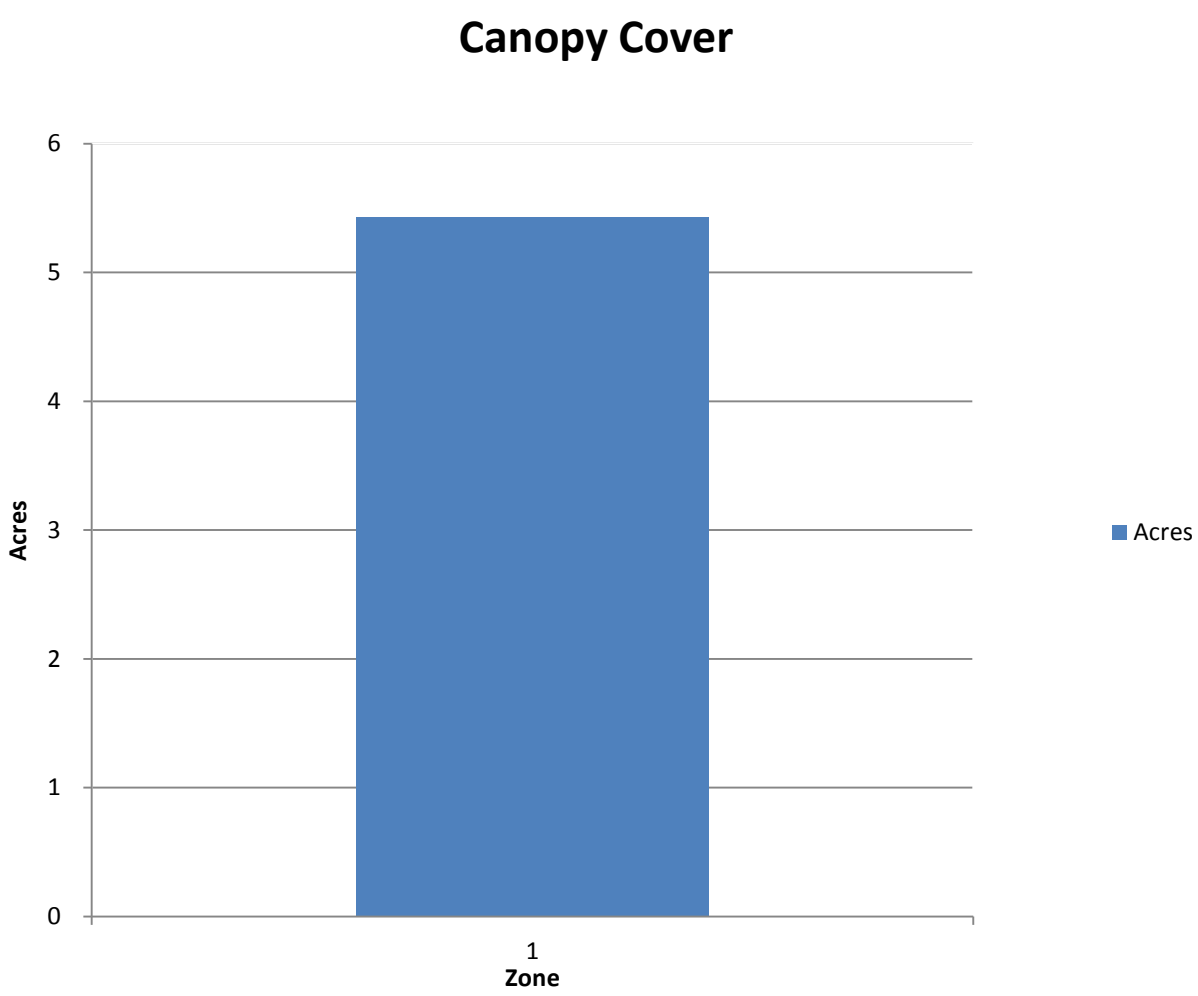

Figure 5: Canopy Cover in Acres

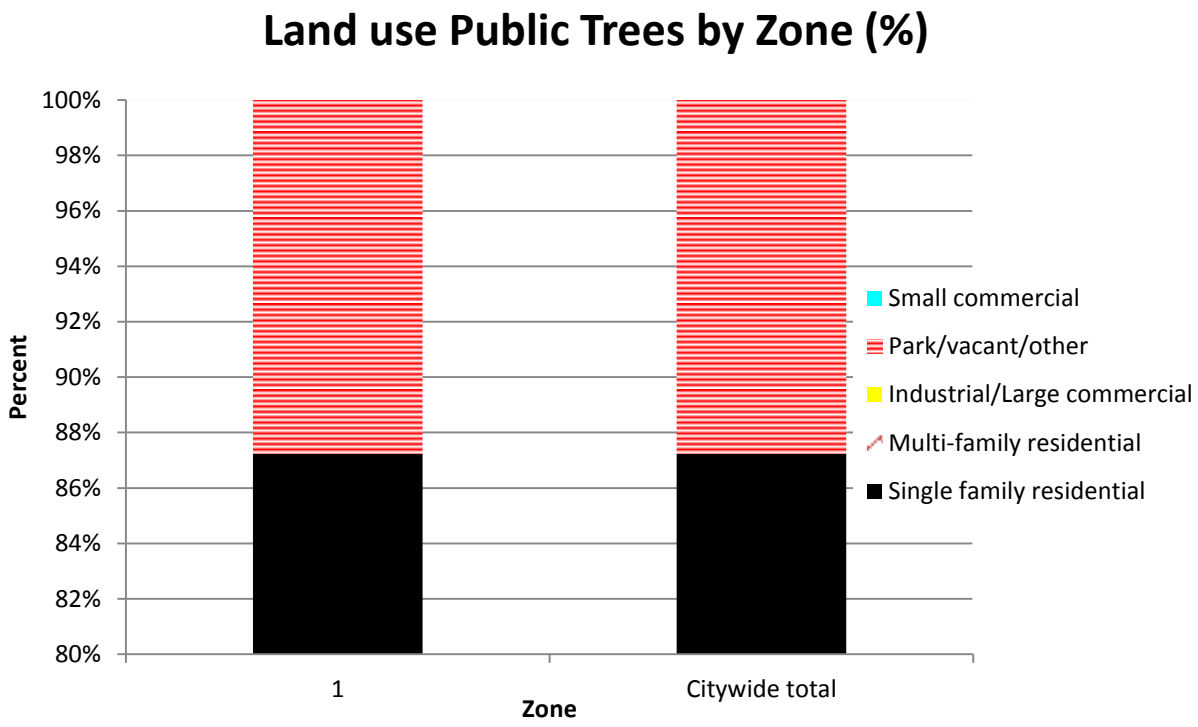

Figure 6: Land Use of city/park trees

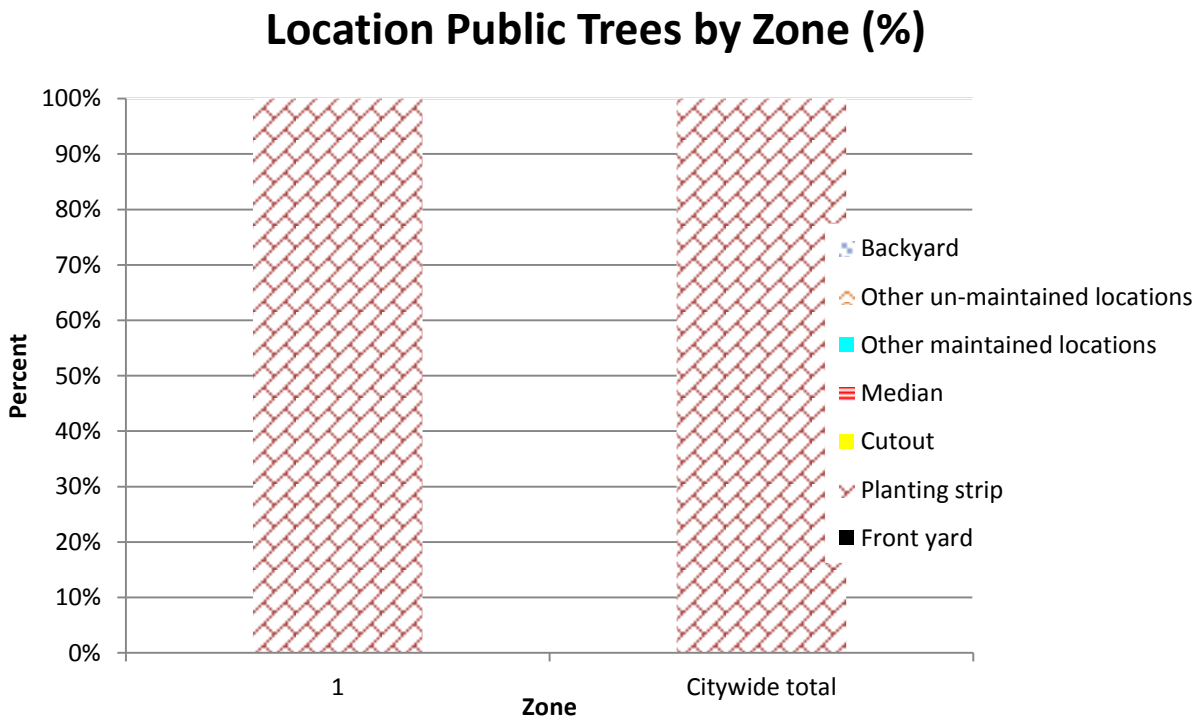

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

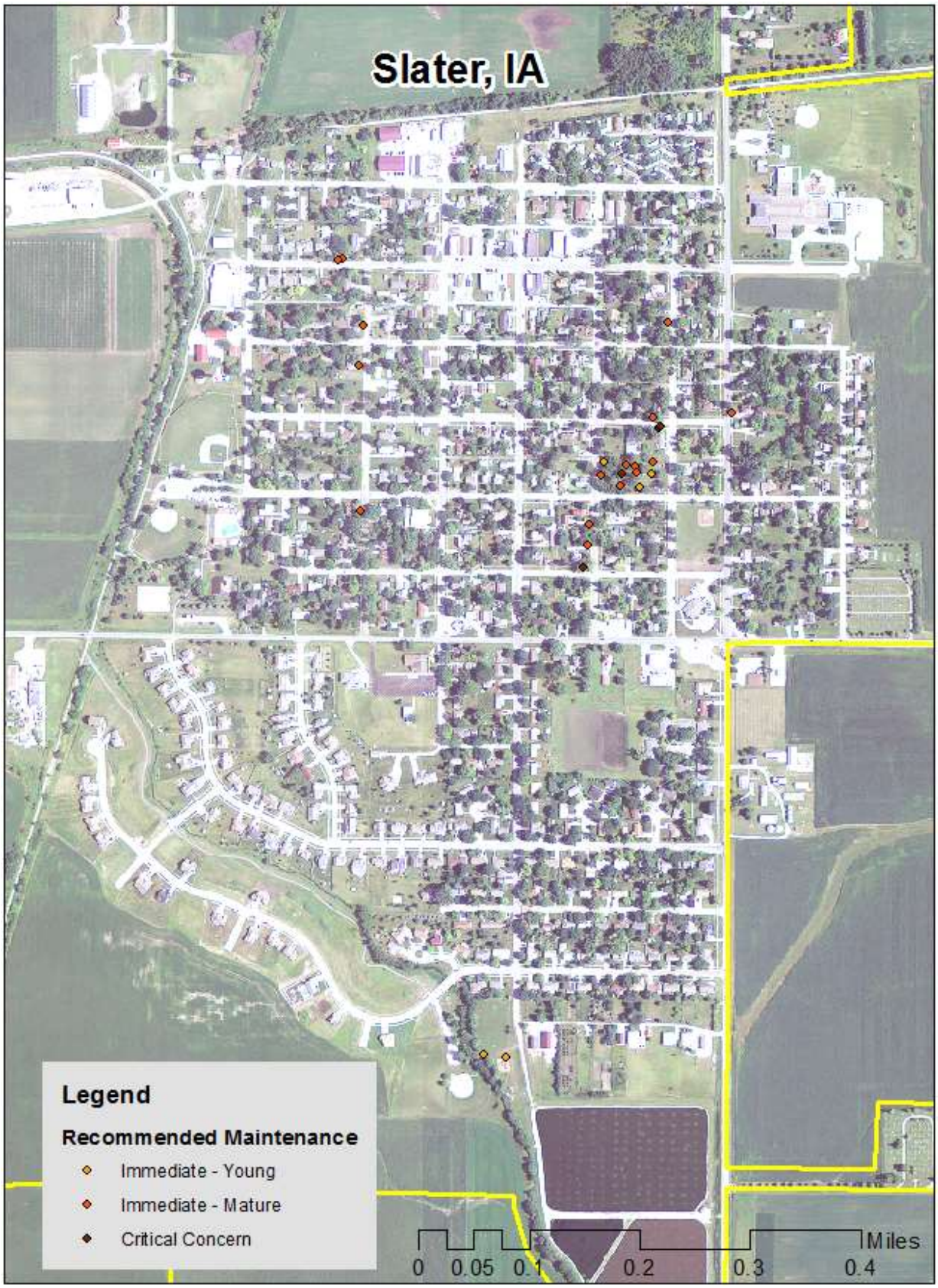

Figure 4: Location of Trees with Recommended Maintenance

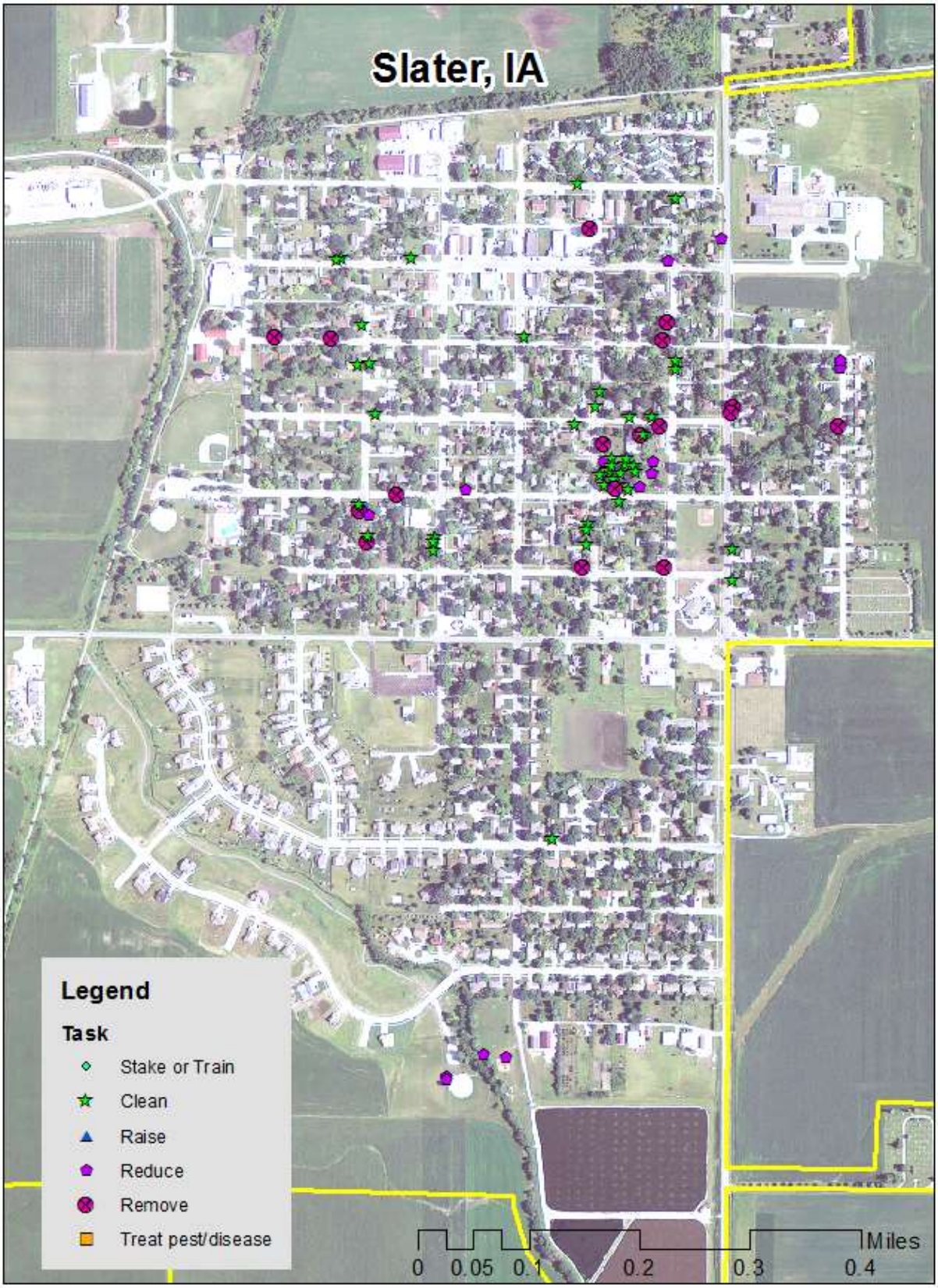

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Proposed Emerald Ash Borer Plan

Ash Tree Removal

Ash tree removal will be prioritized with dead, dying, hazardous trees to be removed first. Next will be all ash in poor condition and displaying signs and symptoms of EAB. *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:
- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed ash trees will be replaced. All trees will meet the guidelines in the City Code.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on trees other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB.

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