Keystone, IA

2014 Community Tree Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Keystone 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 17% (36 trees) of Keystone'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 street and park trees. Below are some key findings of the 212 trees inventoried.

- There are currently 36 ash trees on public property
- 69 % of the public ash trees (25) are 18 inches or greater in diameter
- Keystone's trees provide $36,936 of benefits annually, an average of $174 a tree
- There are approximately 29 species of trees
- ~50% of the trees surveyed are 18 inches in diameter or less, and the remaining 50% are 18 inches in diameter or greater
- The top three genus are: maple 52%, ash 17%, and oak 9%
- 27 % of trees are in need of some type of management
- 11 trees are recommended to be considered for removal
- 75% of the trees surveyed are along the streets

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 11 trees needing to be evaluated for removal, 7 of them are over 24 inches in diameter at 4.5 ft. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 6 of the 36 public ash trees are in need of an immediate follow up because they are displaying signs and symptoms associated with EAB. 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
- Plant a diverse mix of trees that does not include ash and maple
- Based on an estimate of $600 to $1,000 per tree the potential cost of removing the 36 public ash trees is between $21,600 and $36,000

Introduction

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

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

Inventory

In 2013, a tree inventory was conducted that included 100% of the city owned trees on the streets and the parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms of EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory_Results

The data collected for the 212 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. Keystone's trees reduce energy related costs by approximately $10,109 annually (Appendix A, Table 1). These savings are both in Electricity (47.9 MWh) and in Natural Gas (6,604.8 Therms).

Annual Stormwater Benefits

Keystone's trees intercept about 512,002 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $13,876 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 Keystone, it is estimated that trees remove 621.2 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 $1,751 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Keystone, trees sequester about 100,833 lbs of carbon a year with an associated value of $1,288 (Appendix A, Table 5). In addition, the trees store 1,960,453 lbs of carbon, with a yearly benefit of $14,703 (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. Keystone receives $9,912 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, Keystone's trees provide $36,936.22 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 212 trees in Keystone provide approximately $174 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Keystone has 29 different tree species along city streets and in the parks (Appendix A, Figure 1). The distribution of the most common trees by genus is as follows:

Maple	110	52%
Ash	36	17%
Oak	19	9%

Age Class

~50% of all trees surveyed are 18 inches in diameter or less, and the remaining 50% are 18 inches in diameter or greater. 69 % of the public ash trees (25) are 18 inches or greater in diameter.

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 Keystone indicate that 85% of the trees are in good health, with only 2% of the foliage in poor health (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 62% of Keystone'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 11% of the population.

Management Needs

The following outlines the specific management needs of the inventoried street and park trees by number of trees (Appendix B, Figure 5).

Crown Raising	34
Crown Cleaning	12
Tree Removal	11

Canopy Cover

The canopy cover of Keystone is approximately 5.5 acres (Appendix A, Figure 5).

Land Use and Location

Around 75% of Keystone's public trees are located along the streets (Appendix A, Figure 6 & Appendix A, Figure7).

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

Keystone has 11 trees that should be considered for removal. In the fall of 2013 you were sent a letter listing a number of trees that need to be evaluated for removal or pruning. *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. It is critical that any oak species are only pruned during the dormant season (November 1 through March 1).

Planting

If any trees are removed in the future it is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. 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 Keystone.

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 community tree cover has significant maple (52%) (Appendix A, Figure 1), so no new maple should be planted until the percentage decreases significantly. Also, ash trees have not been recommended since 2002, due to the threat of EAB.

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 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 trees in poor condition (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 is one option that some communities are considering to potentially help spread removal costs out over several years while allowing trees to continue to provide benefits. Treatment is not recommended if EAB is more than 15 miles away from the community. **There are a lot of factors that need to be considered before the community decides if it wants to utilize chemical treatments on public trees including environmental concerns related to the use of insecticides for this pest.** 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 Iowa Department of Agriculture and Land Stewardship (IDALS) is attempting to contain the beetle before it spreads beyond its known positions by regulating articles. Currently the entire State of Iowa is under a state and federal quarantine. See http://iowatreepests.com/eab_regulations.html for specifics on current quarantines.

The regulated articles under the quarantine include EAB at any living state; entire ash trees; firewood of any hardwood species; any cut or fallen material of the ash; non-heat treated ash lumber with either bark or sapwood attached; and hardwood wood or bark chips larger than one inch in two dimension.

The quarantine orders that the regulated articles cannot be moved out of the State of Iowa unless a permit the USDA Animal and Plant Health Inspection Service (APHIS) or if the article has been treated to exterminate any pests under the supervision of USDA and the Iowa Department of Agriculture and Land Stewardship.

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? 69 % of the public ash trees (25) are 18 inches or greater in diameter.

Canopy Replacement

As budget permits, all removed ash trees will hopefully be replaced. The new plantings will be a diverse mix and will not include ash or maple.

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. There are 36 public ash trees.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if the trees die and become hazardous. There is a statement in the current city tree ordinance that would allow the city to encourage the removal of trees of concern.

Budget

The average cost of removing ash trees is $600 to $1,000, meaning the overall cost of removing 36 ash trees is estimated at $21,600 and $36,000 currently. EAB could potentially kill all untreated ash within 4 to 8 years of its arrival to your community. This pest is in Mechanicsville, Waterloo, and Newton in this area. Based on recent findings in Iowa there is significant potential that this pest is in this area, but just has not been found yet. At this point 69% (25) of the public ash trees are 18 inches in diameter or greater which could increase the average cost of removal per tree.

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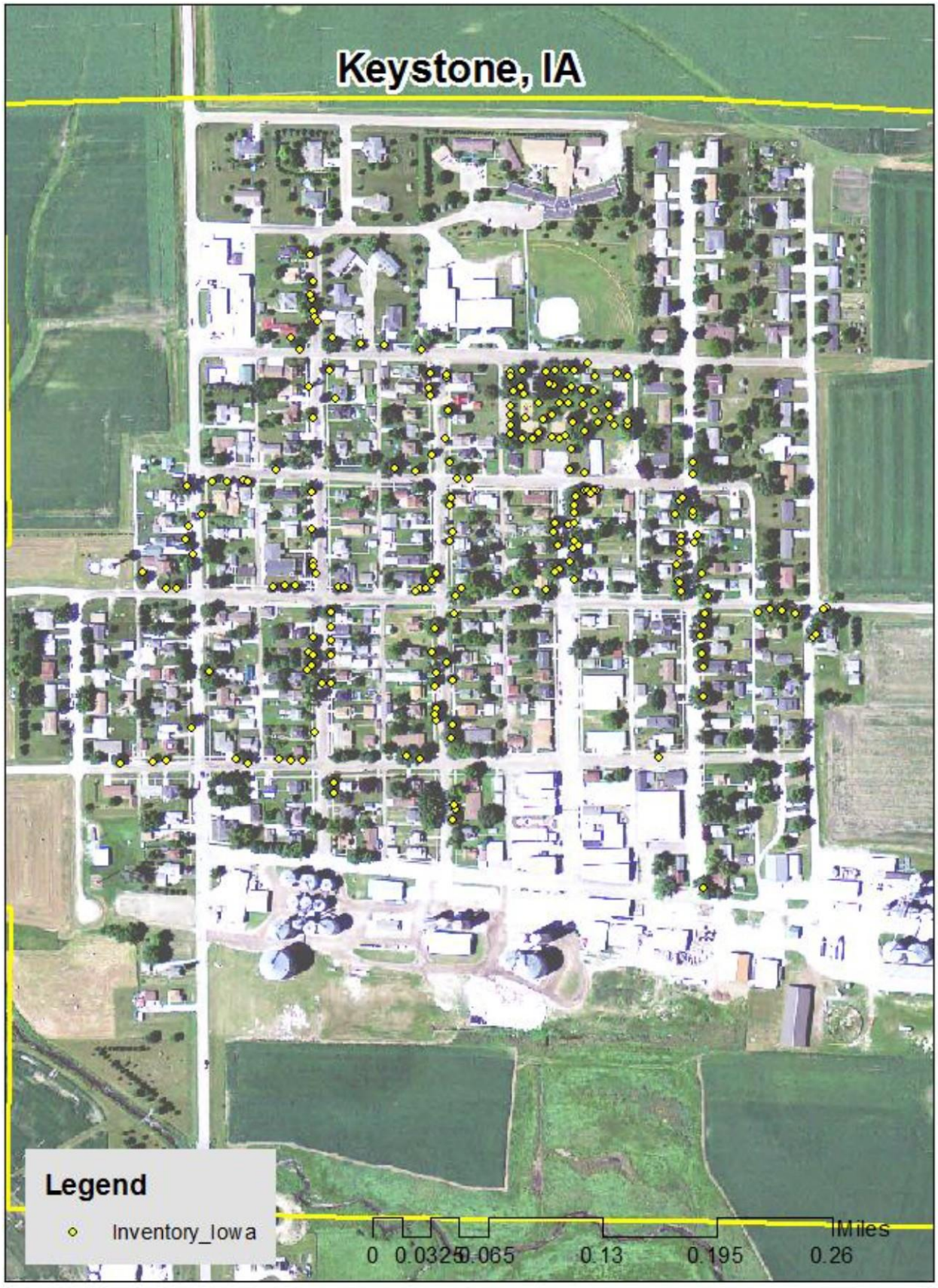
Keystone, IA
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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Keystone

Annual Energy Benefits of Public Trees by Species

3/5/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	11.5	870	1,653.9	1,621	2,490	(N/A)	22.2	24.6	52.99
Green ash	10.3	782	1,394.8	1,367	2,149	(N/A)	15.1	21.3	67.16
Sugar maple	6.2	469	829.5	813	1,282	(N/A)	9.0	12.7	67.45
Red maple	3.1	238	419.3	411	649	(N/A)	8.5	6.4	36.06
Silver maple	5.3	403	716.1	702	1,105	(N/A)	7.6	10.9	69.06
Northern red oak	1.6	123	227.6	223	346	(N/A)	5.7	3.4	28.81
Honeylocust	2.8	212	357.4	350	563	(N/A)	4.3	5.6	62.52
Apple	0.3	24	54.3	53	77	(N/A)	3.8	0.8	9.63
Maple	0.8	64	108.8	107	171	(N/A)	3.3	1.7	24.37
Eastern red cedar	0.4	28	58.5	57	86	(N/A)	3.3	0.9	12.22
Littleleaf linden	0.8	58	96.7	95	153	(N/A)	2.4	1.5	30.52
Pin oak	0.4	32	54.5	53	86	(N/A)	1.9	0.9	21.41
Black maple	0.9	65	119.7	117	182	(N/A)	1.4	1.8	60.68
American basswood	0.8	64	122.0	120	184	(N/A)	1.4	1.8	61.22
Other street trees	2.7	204	391.6	384	588	(N/A)	10.4	5.8	26.73
Citywide total	47.9	3,636	6,604.8	6,473	10,109	(N/A)	100.0	100.0	47.68

Table 2: Annual Stormwater Benefits

Keystone

Annual Stormwater Benefits of Public Trees by Species

3/5/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	107,694	2,919	(N/A)	22.2	21.0	62.10
Green ash	124,363	3,370	(N/A)	15.1	24.3	105.33
Sugar maple	79,992	2,168	(N/A)	9.0	15.6	114.10
Red maple	22,258	603	(N/A)	8.5	4.4	33.51
Silver maple	74,245	2,012	(N/A)	7.6	14.5	125.76
Northern red oak	14,642	397	(N/A)	5.7	2.9	33.07
Honeylocust	28,720	778	(N/A)	4.3	5.6	86.48
Apple	1,075	29	(N/A)	3.8	0.2	3.64
Maple	4,870	132	(N/A)	3.3	1.0	18.85
Eastern red cedar	5,114	139	(N/A)	3.3	1.0	19.80
Littleleaf linden	4,700	127	(N/A)	2.4	0.9	25.47
Pin oak	2,280	62	(N/A)	1.9	0.5	15.45
Black maple	8,600	233	(N/A)	1.4	1.7	77.70
American basswood	11,178	303	(N/A)	1.4	2.2	100.98
Other street trees	22,272	604	(N/A)	10.4	4.4	27.44
Citywide total	512,002	13,876	(N/A)	100.0	100.0	65.45

Table 3: Annual Air Quality Benefits

Keystone

Annual Air Quality Benefits of Public Trees by Species

3/5/2014

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Norway maple	22.1	3.8	10.8	1.0	119	55.6	8.0	7.6	52.0	344	-5.2	-19	155.8	444	(N/A)	22.2	9.45
Green ash	17.5	2.8	8.1	0.8	92	49.1	7.2	6.8	46.7	306	0.0	0	138.9	398	(N/A)	15.1	12.45
Sugar maple	11.3	1.9	5.5	0.5	61	29.3	4.3	4.1	28.0	183	-8.8	-33	76.1	211	(N/A)	9.0	11.10
Red maple	4.6	0.8	2.2	0.2	25	14.9	2.2	2.1	14.2	93	-1.6	-6	39.4	111	(N/A)	8.5	6.18
Silver maple	13.0	2.2	6.4	0.6	70	25.2	3.7	3.5	24.0	157	-7.0	-26	71.6	201	(N/A)	7.5	12.58
Northern red oak	2.9	0.5	1.5	0.1	16	7.8	1.1	1.1	7.3	48	-4.2	-16	18.1	48	(N/A)	5.7	4.03
Honeylocust	5.5	0.9	2.5	0.3	29	13.1	1.9	1.8	12.7	82	-4.3	-16	34.5	95	(N/A)	4.2	10.60
Apple	0.2	0.0	0.1	0.0	1	1.6	0.2	0.2	1.4	10	0.0	0	3.7	11	(N/A)	3.8	1.32
Maple	0.8	0.1	0.4	0.0	5	4.0	0.6	0.6	3.8	25	-0.3	-1	10.0	28	(N/A)	3.3	4.02
Eastern red cedar	0.7	0.1	0.6	0.1	4	1.8	0.3	0.2	1.7	11	-2.7	-10	2.7	5	(N/A)	3.3	0.78
Littleleaf linden	0.5	0.1	0.3	0.0	3	3.6	0.5	0.5	3.5	22	-0.3	-1	8.7	24	(N/A)	2.4	4.87
Pin oak	0.2	0.0	0.1	0.0	1	2.0	0.3	0.3	1.9	12	-0.5	-2	4.4	12	(N/A)	1.9	2.97
Black maple	2.2	0.4	1.0	0.1	12	4.1	0.6	0.6	3.9	25	-0.7	-3	12.1	35	(N/A)	1.4	11.54
American basswood	1.7	0.3	0.8	0.1	9	4.1	0.6	0.6	3.8	25	-1.4	-5	10.5	29	(N/A)	1.4	9.72
Other street trees	3.7	0.6	2.0	0.2	21	13.1	1.9	1.8	12.2	81	-1.0	-4	34.5	98	(N/A)	10.4	4.44
Citywide total	86.9	14.7	42.4	3.9	468	229.1	33.3	31.8	217.1	1,426	-38.0	-143	621.2	1,751	(N/A)	100.0	8.26

Table 4: Annual Carbon Stored

Keystone

Stored CO2 Benefits of Public Trees by Species

3/5/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	364,568	2,734	(N/A)	22.2	18.6	58.18
Green ash	582,255	4,367	(N/A)	15.1	29.7	136.47
Sugar maple	328,964	2,467	(N/A)	9.0	16.8	129.85
Red maple	51,880	389	(N/A)	8.5	2.7	21.62
Silver maple	305,235	2,289	(N/A)	7.6	15.6	143.08
Northern red oak	61,840	464	(N/A)	5.7	3.2	38.65
Honeylocust	71,244	534	(N/A)	4.3	3.6	59.37
Apple	3,449	26	(N/A)	3.8	0.2	3.23
Maple	10,105	76	(N/A)	3.3	0.5	10.83
Eastern red cedar	2,531	19	(N/A)	3.3	0.1	2.71
Littleleaf linden	12,834	96	(N/A)	2.4	0.7	19.25
Pin oak	4,993	37	(N/A)	1.9	0.3	9.36
Black maple	23,836	179	(N/A)	1.4	1.2	59.59
American	63,592	477	(N/A)	1.4	3.2	158.98
Other street trees	33,170	548	(N/A)	10.4	3.7	24.93
Citywide total	1,960,453	14,703	(N/A)	100.0	100.0	69.36

Table 5: Annual Carbon Sequestered

Keystone

Annual CO_2 Benefits of Public Trees by Species

3/5/2014

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
Norway maple	13,802	104	-1,750	-9	-13	19,217	144	31,260	234	(N/A)	22.2	18.2	4.99
Green ash	22,649	170	-2,795	-6	-21	17,284	130	37,132	278	(N/A)	15.1	21.6	8.70
Sugar maple	15,380	115	-1,579	-4	-12	10,357	78	24,155	181	(N/A)	9.0	14.1	9.53
Red maple	6,676	50	-249	-4	-2	5,262	39	11,686	88	(N/A)	8.5	6.8	4.87
Silver maple	22,537	169	-1,465	-3	-11	8,909	67	29,978	225	(N/A)	7.6	17.5	14.05
Northern red oak	1,687	13	-297	-2	-2	2,711	20	4,099	31	(N/A)	5.7	2.4	2.56
Honeylocust	3,110	23	-342	-2	-3	4,695	35	7,461	56	(N/A)	4.3	4.3	6.22
Apple	502	4	-17	-2	0	527	4	1,011	8	(N/A)	3.8	0.6	0.95
Maple	1,413	11	-49	-1	0	1,414	11	2,777	21	(N/A)	3.3	1.6	2.98
Eastern red cedar	256	2	-12	-1	0	623	5	865	6	(N/A)	3.3	0.5	0.93
Littleleaf linden	1,989	15	-62	-1	0	1,278	10	3,204	24	(N/A)	2.4	1.9	4.81
Pin oak	741	6	-24	-1	0	712	5	1,428	11	(N/A)	1.9	0.8	2.68
Black maple	1,847	14	-114	-1	-1	1,431	11	3,163	24	(N/A)	1.4	1.8	7.91
American basswood	3,425	26	-305	-1	-2	1,416	11	4,535	34	(N/A)	1.4	2.6	11.34
Other street trees	4,819	36	-351	-4	-3	4,517	34	8,980	67	(N/A)	10.4	5.2	3.06
Citywide total	100,833	756	-9,410	-41	-71	80,352	603	171,733	1,288	(N/A)	100.0	100.0	6.08

Table 6: Annual Social and Aesthetic Benefits

Keystone

Annual Aesthetic/Other Benefits of Public Trees by Species

3/5/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,337	(N/A)	22.2	13.5	28.45
Green ash	1,785	(N/A)	15.1	18.0	55.77
Sugar maple	1,529	(N/A)	9.0	15.4	80.50
Red maple	925	(N/A)	8.5	9.3	51.40
Silver maple	1,738	(N/A)	7.6	17.5	108.63
Northern red oak	151	(N/A)	5.7	1.5	12.55
Honeylocust	729	(N/A)	4.3	7.4	80.95
Apple	27	(N/A)	3.8	0.3	3.43
Maple	213	(N/A)	3.3	2.2	30.47
Eastern red cedar	134	(N/A)	3.3	1.4	19.11
Littleleaf linden	228	(N/A)	2.4	2.3	45.54
Pin oak	87	(N/A)	1.9	0.9	21.64
Black maple	218	(N/A)	1.4	2.2	72.72
American basswood	227	(N/A)	1.4	2.3	75.54
Other street trees	585	(N/A)	10.4	5.9	26.58
Citywide total	9,912	(N/A)	100.0	100.0	46.76

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 $
Norway maple	2,490	234	444	2,919	1,337	$7,424.64	(±0)	20.10
Green ash	2,149	278	398	3,370	1,785	$7,980.98	(±0)	21.61
Sugar maple	1,282	181	211	2,168	1,529	$5,371.10	(±0)	14.54
Red maple	649	88	111	603	925	$2,376.41	(±0)	6.43
Silver maple	1,105	225	201	2,012	1,738	$5,281.26	(±0)	14.30
Northern red oak	346	31	48	397	151	$972.28	(±0)	2.63
Honeylocust	563	56	95	778	729	$2,220.83	(±0)	6.01
Apple	77	8	11	29	27	$151.84	(±0)	0.41
Maple	171	21	28	132	213	$564.86	(±0)	1.53
Eastern red cedar	86	6	5	139	134	$369.86	(±0)	1.00
Littleleaf linden	153	24	24	127	228	$556.06	(±0)	1.51
Pin oak	86	11	12	62	87	$256.56	(±0)	0.69
Black maple	182	24	35	233	218	$691.63	(±0)	1.87
American basswood	184	34	29	303	227	$776.41	(±0)	2.10
Other street trees	588	67	98	604	585	$1,941.49	(±0)	5.26
Citywide total	10,109	1,288	1,751	13,876	9,912	$36,936.22	(±0)	100.00

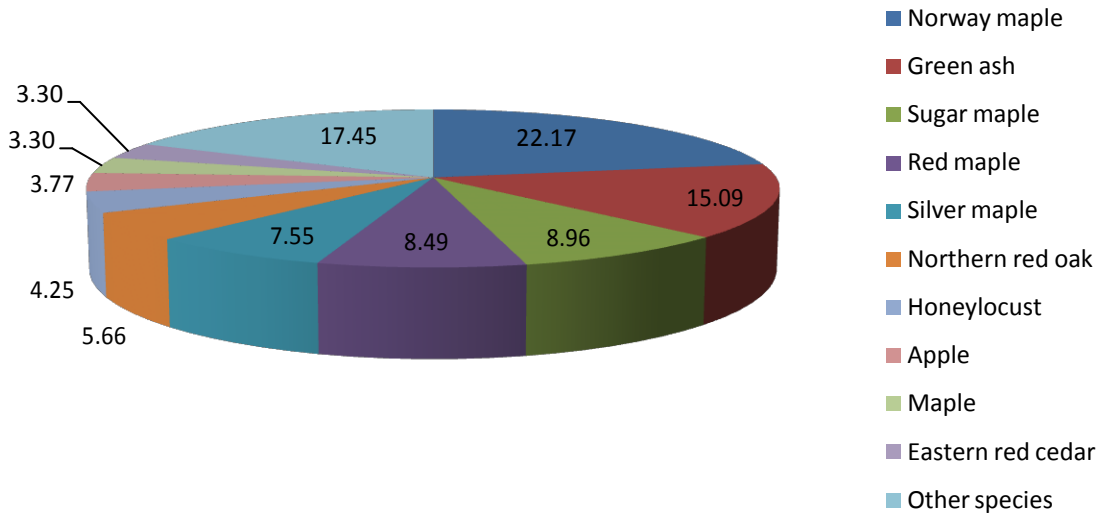

Figure 1: Species Distribution

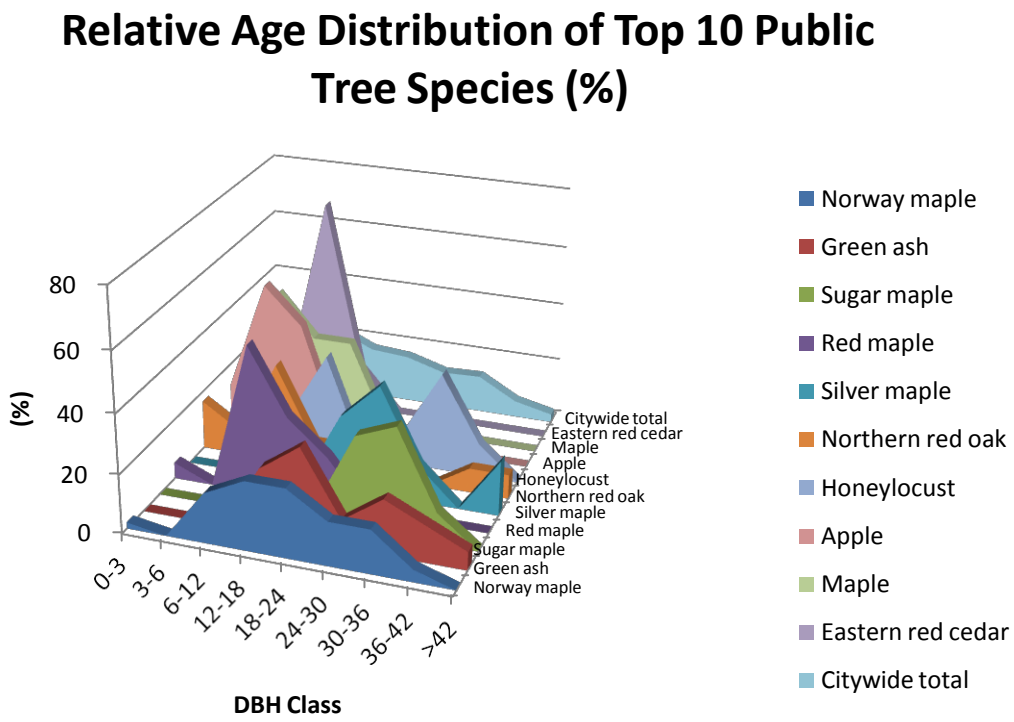

Figure 2: Relative Age Class

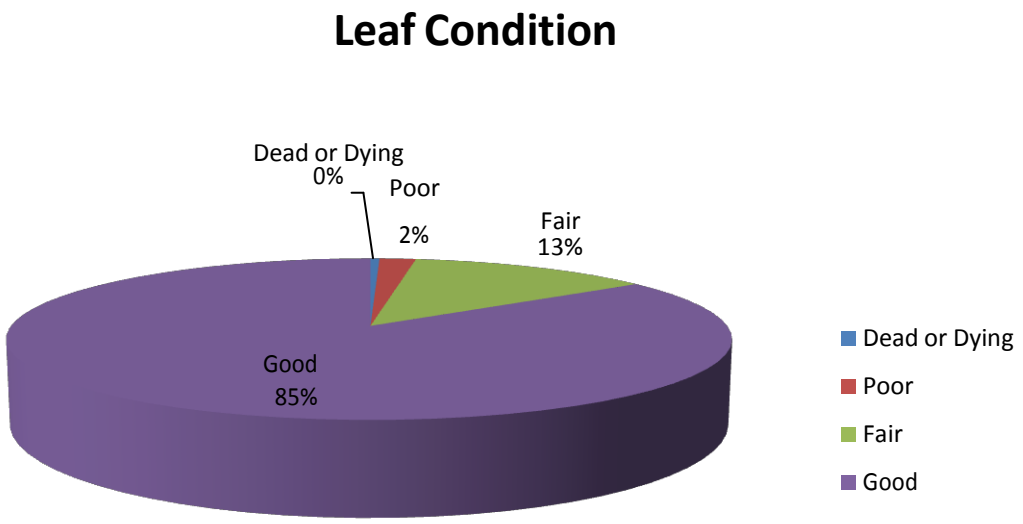

Figure 3: Foliage Condition

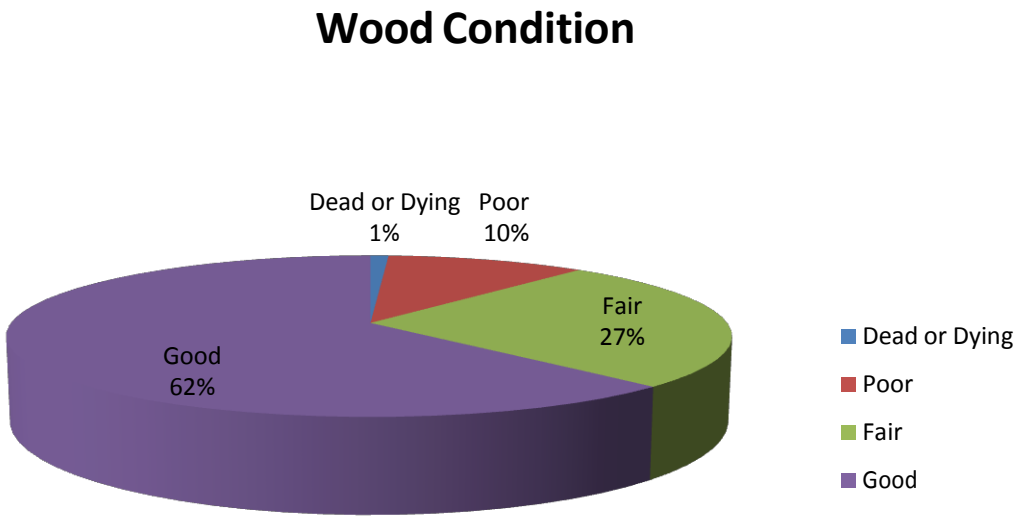

Figure 4: Wood Condition

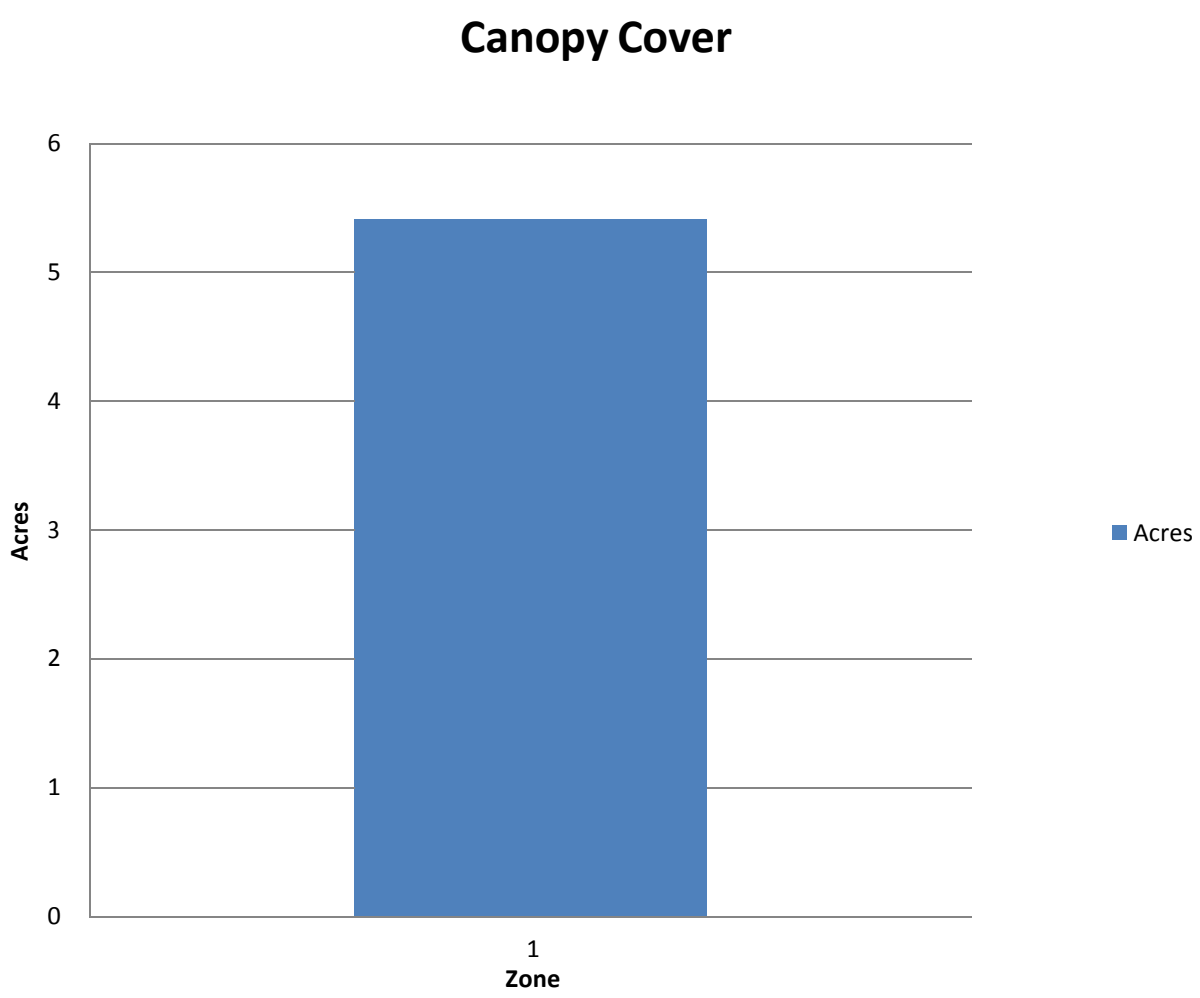

Figure 5: Canopy Cover in Acres

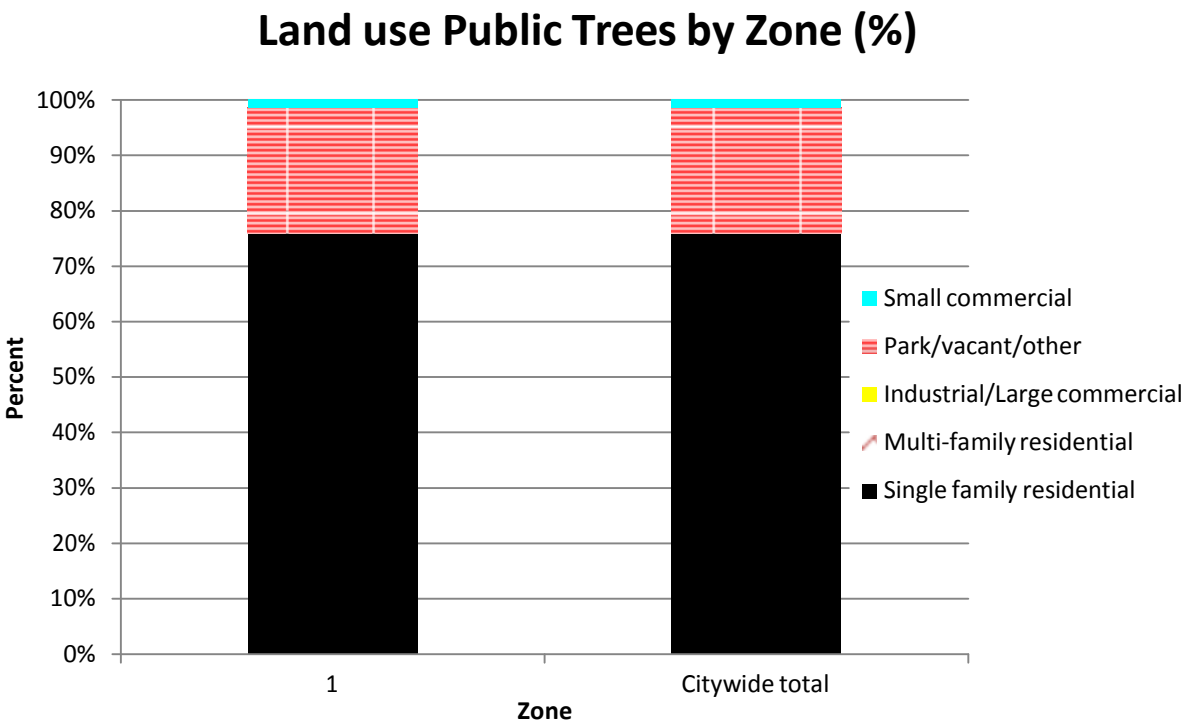

Figure 6: Land Use of city/park trees

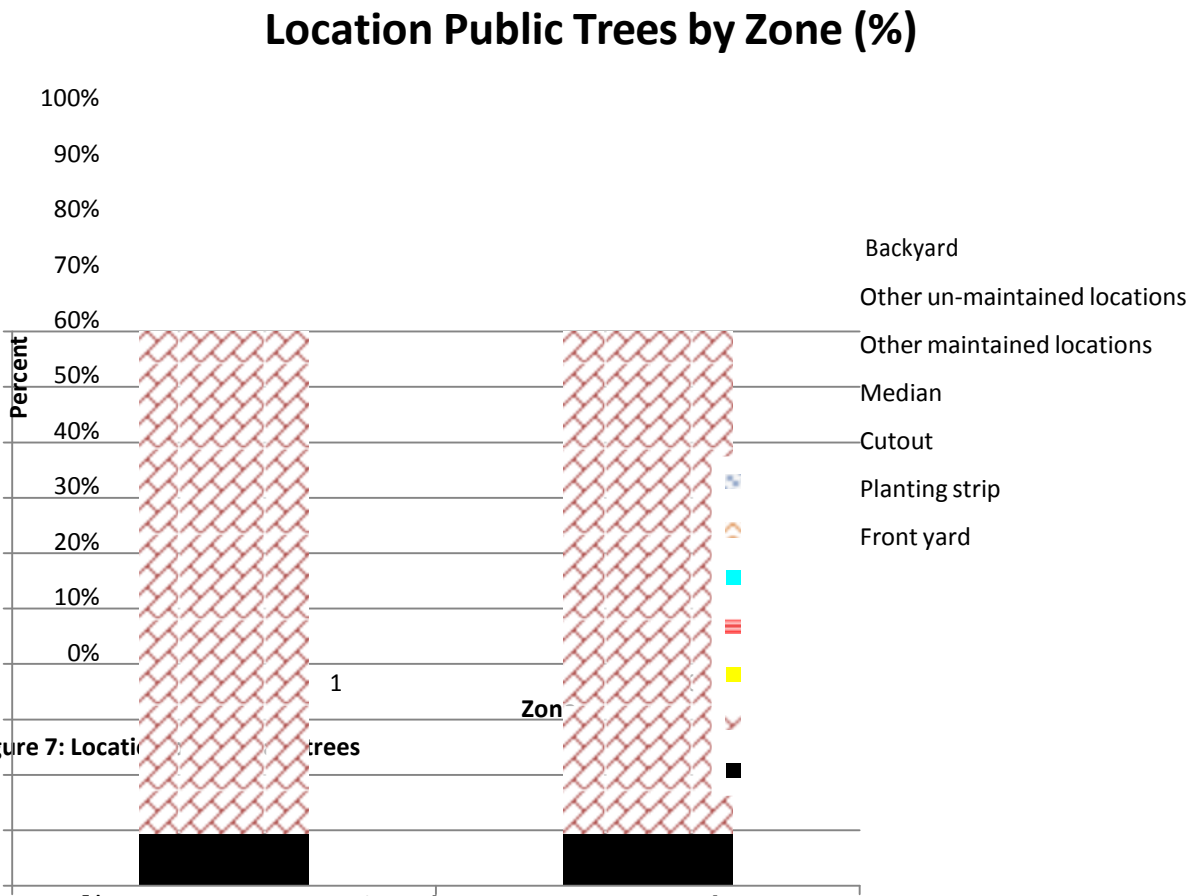

Figure 7: Locati trees

Appendix B: ArcGIS Mapping

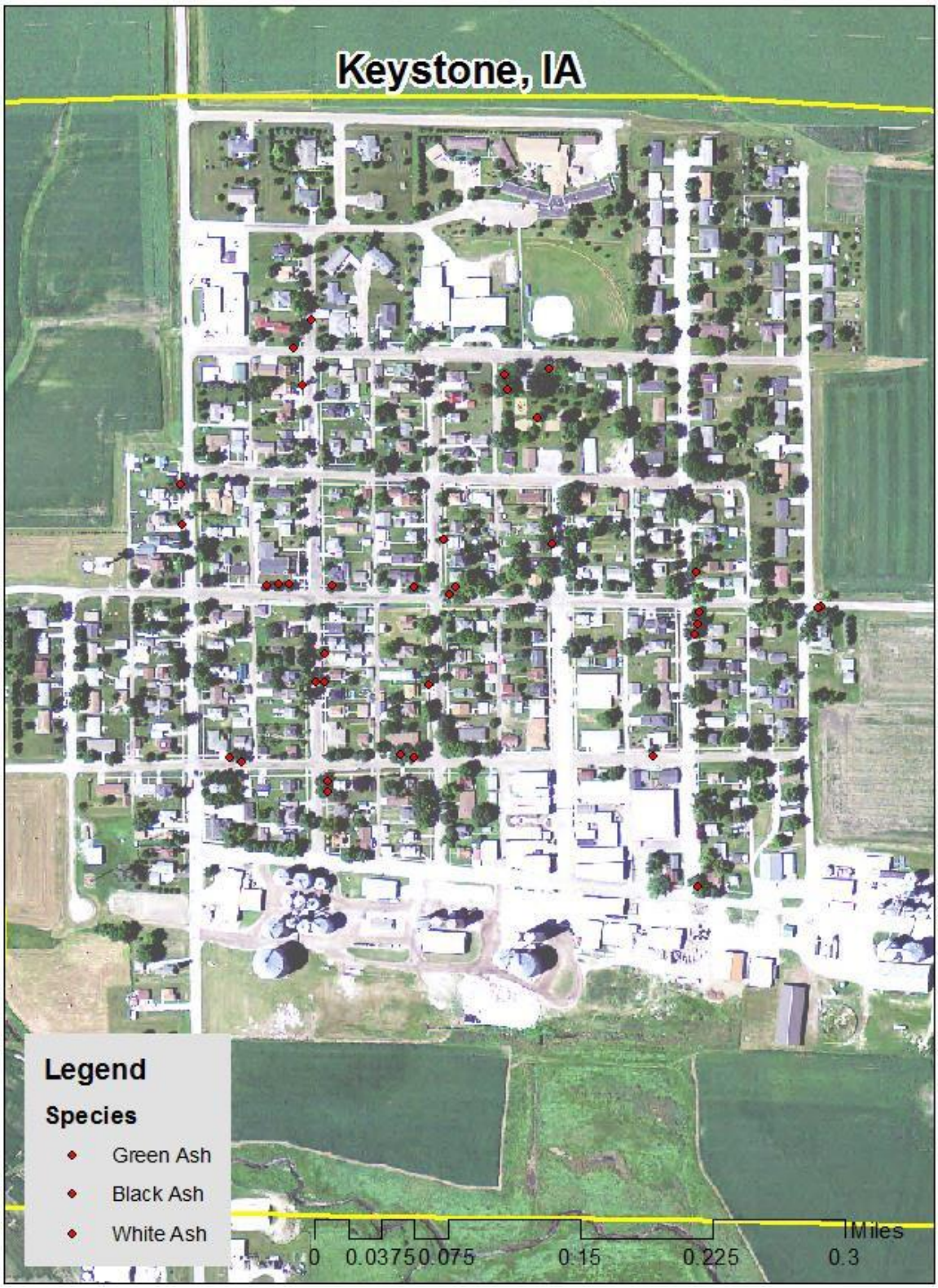

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

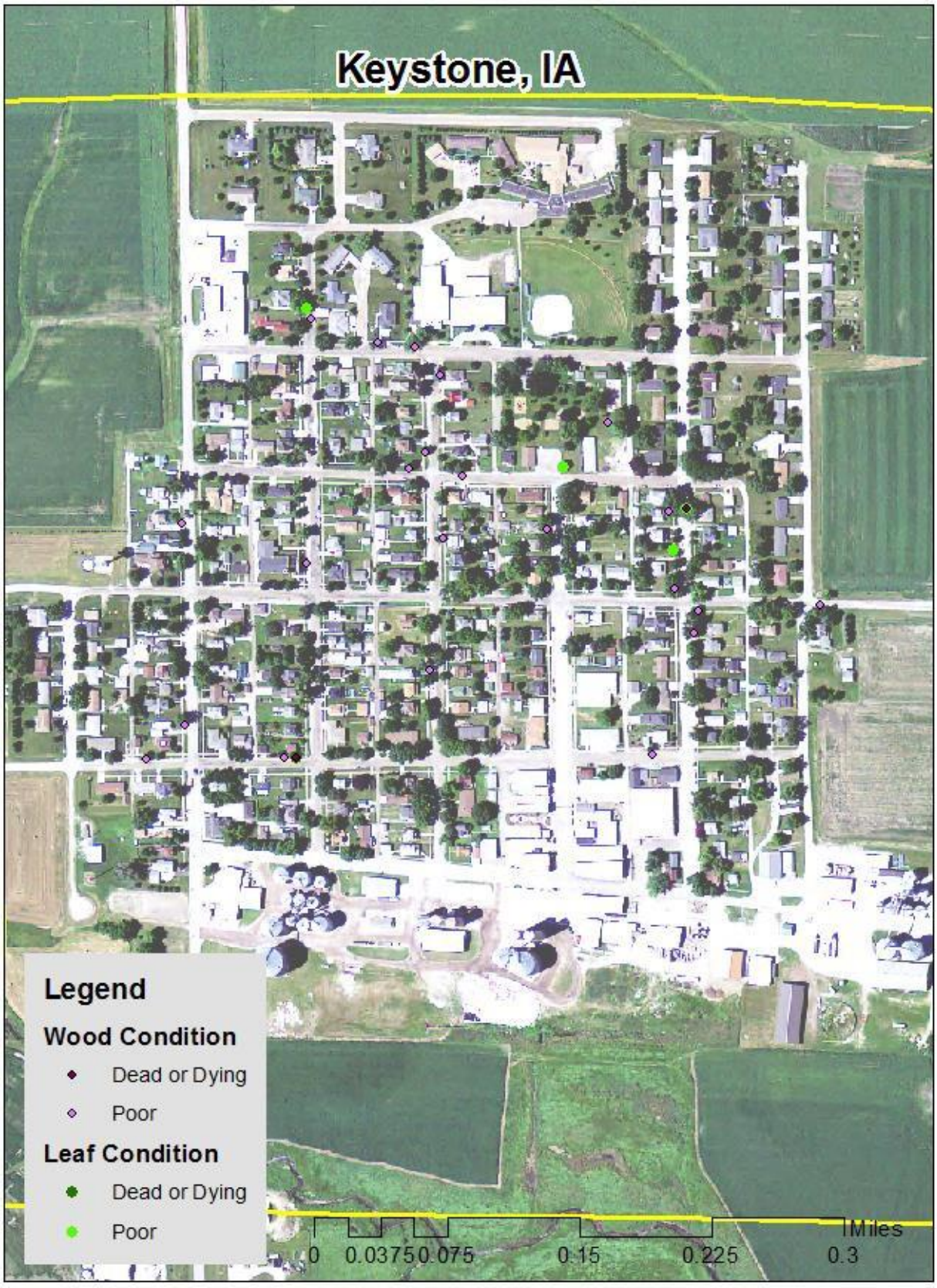

Figure 3: Location of Poor Condition Trees

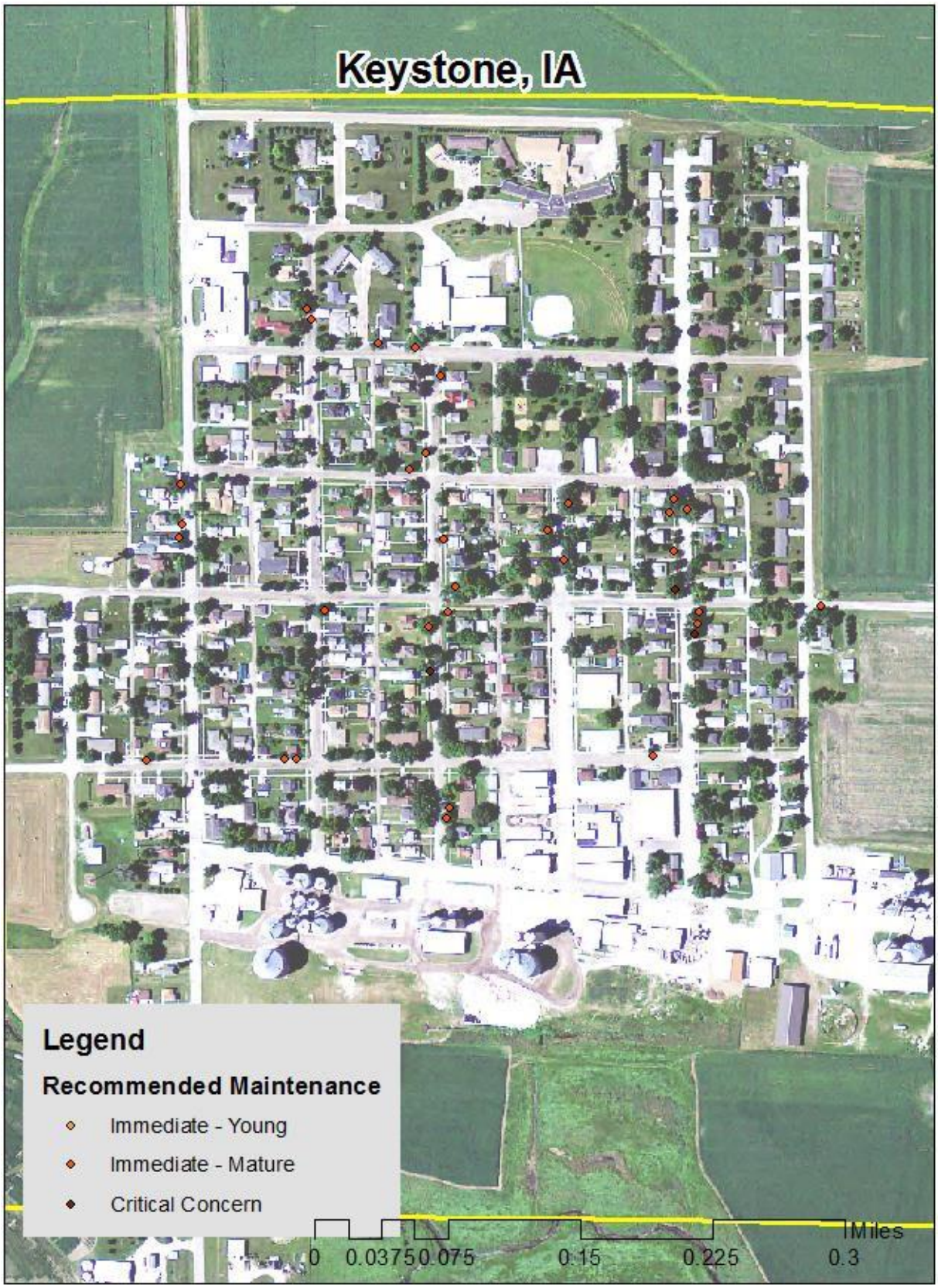

Figure 4: Location of Trees with Recommended Maintenance

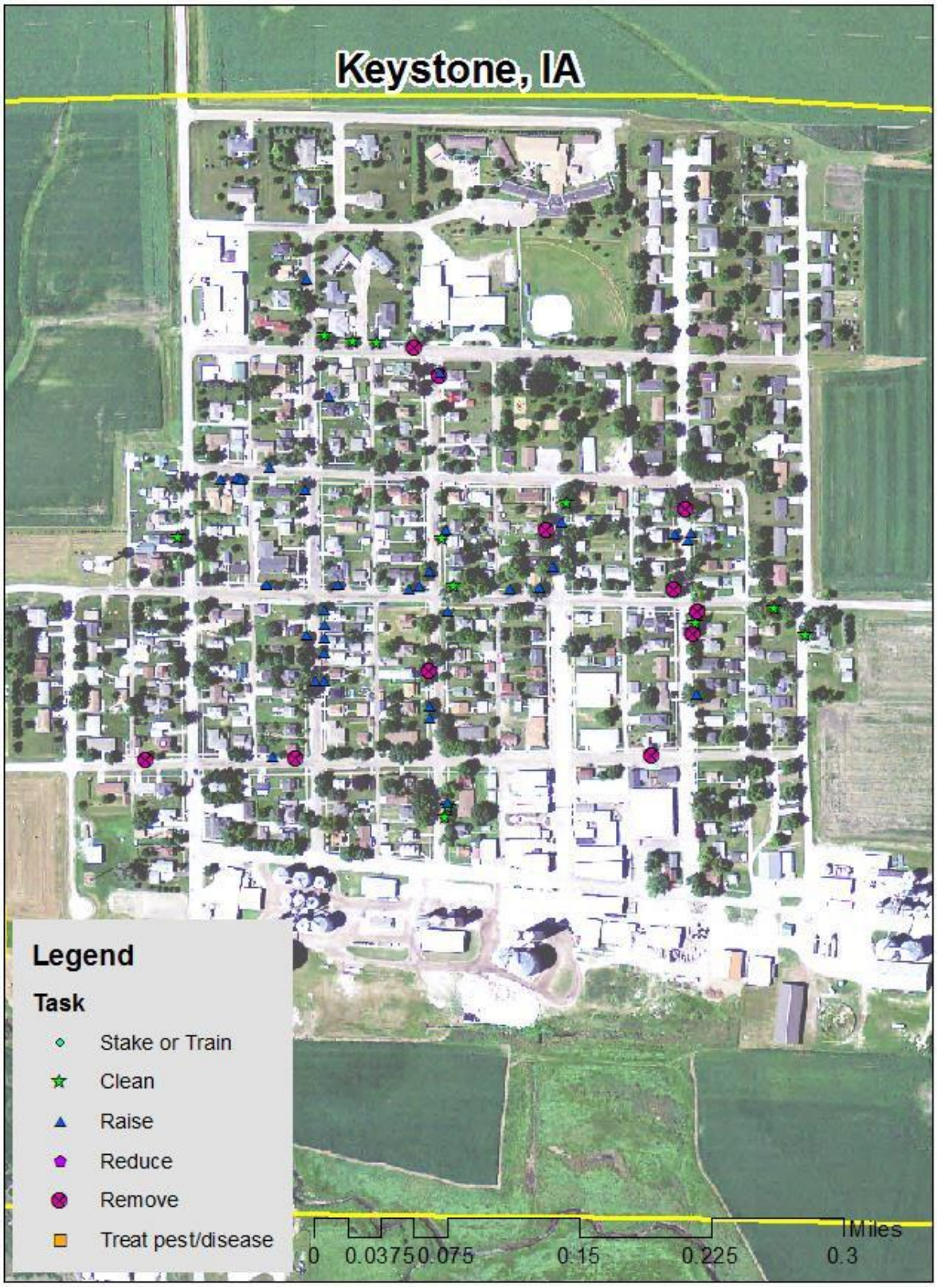

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal****

Appendix C: Keystone Tree Ordinances

TREES

150.01 PURPOSE. The purpose of this chapter is to beautify and preserve the appearance of the City by requiring street trees to be uniformly located and maintained.

150.02 DEFINITIONS. For use in this chapter, the following definitions are given.

1. "Park trees" are trees, shrubs, bushes and all other woody vegetation located in public parks and other public places.

2. "Street trees" are trees, shrubs, bushes and all other woody vegetation located on the parking.

150.03 PLANTING RESTRICTIONS.

1. The spacing of street trees will be in accordance with the three species size classes established by the Tree Board, and no tree may be planted closer together than the following:

   A. Small trees: 30 feet

   B. Medium trees: 40 feet

   C. Large trees: 50 feet

except in special plantings designed or approved in writing by a landscape architect.

2. The distance trees may be planted from curbs or curb lines and sidewalks will be in accordance with the three species size classes established by the Tree Board, and no trees may be planted closer to any curb or sidewalk than the following:

   A. Small trees: 2 feet

   B. Medium trees: 3 feet

   C. Large trees: 4 feet.

3. No trees shall be planted in the area adjacent to a street corner formed by the nearest intersecting curb lines and a straight line connecting said intersecting curb lines at a point of 35 feet distant along each curb line.

4. No street trees shall be planted closer than 10 feet to any fire hydrant.

5. No street trees, other than those species designated as small trees, may be planted under or within 10 lateral feet of any overhead utility wire or over or within 5 lateral feet of any underground water line, sewer line, transmission line or other utility line.

7. All street trees shall have comparatively straight trunks, well-developed leaders and top and root characteristics of the species or variety showing evidence of proper nursery pruning. All trees must be free of insect, disease, mechanical injuries and other objectionable features at the time of planting. To compensate for any serious loss of roots, the top of the tree should be reduced by thinning or cutting back as determined by the growth, characteristic of the tree species. The leader shall not be cut off in such trimming.

8. All trees now or hereafter planted in any street, avenue or highway that interfere with the making of any improvements thereon or with travel or become dangerous shall be removed by order of the Council. Any tree planted in any street, avenue or highway shall be planted upon such condition and subject to such removal.

150.04 TRIMMING RESTRICTIONS.

1. All dead and diseased wood shall be removed.

2. All limbs one inch in diameter or more must be precut to prevent splitting. All limbs or branches that might injure the tree or adjacent property, streets or sidewalks shall be lowered by ropes.

3. A crossed or rubbing branch shall be removed where practicable, but removal shall not leave large holes in the general outline of the tree. Crossed or rubbing branches may be cabled apart.

4. All cuts, old or new, one inch in diameter or more, shall be painted with an approved tree wound dressing. On old wounds, only exposed wood shall be painted.

5. Where there is a danger of transmitting disease by tools, said tools shall be disinfected with alcohol before use on another tree.

6. The owner of the abutting property shall be responsible for trimming of street trees on the adjacent parking and shall keep the street trees trimmed so that all branches will be at least 15 feet above the surface of the street and 8 feet above the sidewalks.

7. The owner of the abutting property shall, upon 20 days' notice in writing, remove all dead, diseased or dangerous trees, or broken or decayed limbs which constitute a danger to the public safety or property or constitute a nuisance.

8. It is unlawful to trim or cut in any manner any tree in the street, avenue, highway or public place, unless such trimming or cutting shall be done under the personal supervision of the Tree Board.

150.05 PUBLIC TREE CARE. The City has the right to plant, prune, maintain and remove trees, plants and shrubs within the lines of all streets, alleys, avenues, lanes, squares and public grounds, as may be necessary to insure public safety or to preserve or enhance the symmetry and beauty of such public grounds. The City may remove or cause or order to be removed any tree or part thereof which is in an unsafe condition or which by reason of its nature is injurious to sewers, electric power lines, gas lines, water lines or other public improvements, or is infected with any injurious fungus, insect or other pest in the same manner as provided in Section 150.07.

defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes, or certain trees under utility wires or other obstructions where other pruning practices are impractical, may be exempted from this section at the determination of the Tree Board. No topping shall occur without the prior consent of the Tree Board.

150.07 REMOVAL OF DEAD OR DISEASED TREES. The City has the right to cause the removal of any dead or diseased trees on private property within the City when such trees constitute a hazard to life and property, or harbor insects or diseases which constitute a potential threat to other trees within the City. The Tree Board will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within twenty (20) days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owner's property tax notice.

150.08 REMOVAL OF STUMPS. All stumps of street and park trees shall be removed below the surface of the ground so that the top of the stump does not project above the surface of the ground.

150.09 INTERFERENCE WITH TREE BOARD. It is unlawful for any person to prevent, delay or interfere with the Tree Board or any of its agents while engaging in and about the planting, cultivating, mulching, pruning, spraying or removing any street trees, park trees or trees on private grounds as authorized in this chapter.

TREE BOARD

24.01 Establishment of Board
24.02 Compensation
24.03 Duties and Responsibilities

24.01 ESTABLISHMENT OF BOARD. There is hereby established a Tree Board for the City, which consists of six members, appointed by the Mayor with the approval of the Council for staggered three-year terms. In the event a vacancy occurs, any replacement appointed to the Board shall be for the unexpired portion of the term.

24.02 COMPENSATION. Members of the Board shall serve without compensation.

24.03 DUTIES AND RESPONSIBILITIES. The duties and responsibilities of the Tree Board shall be as follows:

1. The Tree Board shall prepare a written plan for the care, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs in parks, along streets and in other public areas and to update the same on an annual basis. Such a plan as updated shall be presented to the Council on an annual basis for its consideration and upon their approval shall constitute the official Comprehensive Tree Plan for the City.

2. The Tree Board shall be responsible for administering the Comprehensive Tree Plan.

3. Upon request by the Mayor or Council, the Tree Board shall consider, investigate and report a recommendation as to any matter falling within their duties and responsibilities.

4. The Board shall establish three classes of trees: Small Trees, Medium Trees, Large Trees and shall designate at least six species of trees within each category. This list shall be known as the "Official Street Tree Species" for the City and shall be subject to approval by the Council.

CODE OF ORDINANCES, KEYSTONE, IOWA
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