Community Tree Management Plan For Hubbard, IA

Prepared by the Iowa DNR
Urban and Community Forestry Program
2019

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Hubbard with managing its public tree population, 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 that kills all species of ash trees *(Fraxinus spp.)*. There is a high likelihood that 17% of Hubbard's city-owned tree population (87 ash trees) will 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 2018, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete survey of street and park trees. Below are some key findings of the 500 trees inventoried.

- Hubbard's trees provide $74,560 of benefits to the community annually, at an average of nearly $150 a tree
- There are at least 41 different species of trees in Hubbard
- The top three genus are: Maple 48%, Ash 17%, and Crabapples 8%
- 198 trees (40% of the total population) are in need of some type of maintenance (trimming, removal, etc.):
    - 5 trees were flagged as "critical concerns" for having hazardous limbs or trunks that need dealt with
    - 32 trees are recommended for removal either for health reasons or because they're already dead

Recommendations

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

- Address the 5 trees flagged as "critical concern" trees as possible (Appendix B, Fig. 4). (Note: one additional tree marked as "critical concern" is a young tree that needs staking/training but is not considered hazardous.)
- Begin planting new trees using a diverse mix of species wherever space is available and to replace the 32 trees slated for removal
- Begin regularly monitoring the 17 ash trees identified as displaying signs or symptoms associated with EAB
- Address the 48 trees flagged for "immediate" maintenance needs within the next three years (Appendix B, Fig. 4)
- Schedule routine maintenance (trimming, etc.) for the remaining trees identified by the inventory (Appendix B) needing work sometime during the next six years

Introduction

This plan was developed to assist Hubbard with the management, budgeting and future planning of their community's 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 Hubbard, these costs can be extended over years and public safety issues from dead and dying trees mitigated.

Trees are an important component of any community'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 Hubbard and future generations through good urban forest management.

Good urban forest 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 Hubbard maximize the benefits and minimize the costs of the tree canopy.

Inventory

In May 2018, a tree inventory was conducted that included 100% of the city owned trees on both streets and 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 ArcGIS 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 associated with 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 500 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. Hubbard's trees reduce energy related costs by approximately $22,536 annually (Appendix A, Table 1). These savings are both in Electricity (106.1 MWh) and in Natural Gas (14,782 Therms).

Annual Stormwater Benefits

Hubbard's trees intercept about 1,009,425 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides $27,355 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 Hubbard, it is estimated that trees remove 1,374.6 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 $3,879 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Hubbard, trees sequester about 338,764 lbs of carbon each year with an associated value of $2,541 (Appendix A, Table 5). This equates to 3,459,173 lbs of carbon being stored in Hubbard's trees with total benefit of $25,944 (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. Hubbard receives $18,251 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, Hubbard's trees provide $74,560 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 500 trees in Hubbard provide approximately $149 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Hubbard has at least 41 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	242	48%
Ash	87	17%
Crabapples	41	8%
Oak	24	5%
Honey Locust	13	4%
All others	< 12 ea.	< 3% ea.

Size Class

Appendix A, Figure 2 depicts the size class distribution of Hubbard's tree population. 12% of the total trees are in the 1-6" diameter class; 42% are between 6-18"; and 46% are 18" and larger in diameter. This indicates a slight imbalance towards mature trees and suggests that more younger trees could be planted to help replace old trees as they die. 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 Hubbard indicate that 86% of the trees are in either good or fair health, while 14% of the trees are in poor health or are considered dead or dying (Appendix A, Figures 3 & 4 and Appendix B, Figure 3).

The 14% of trees classified as poor, dead, or dying represent opportunity costs to the city where time and space are being sacrificed growing poor trees. Trees in poor health should be promptly removed and replaced with new, healthy trees to diversify and improve the overall health and resiliency of Hubbard's urban tree population.

Canopy Cover

The amount of tree canopy cover over Hubbard is approximately 11 acres (Appendix A, Figure 5). According to the U.S. Census, Hubbard occupies 1.842 square miles of land. Thus the canopy cover on city land is just under 1%.

Land Use and Location

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

Management Needs

The following table outlines specific management needs of the street and park trees that were identified during the survey. (Appendix B, Figures 4 & 5).

Maintenance Type Needed	# of Trees	Pct. of Tree Population
Crown Cleaning	89	18%
Crown Reduction	34	7%
Tree Removal	32	6%
Crown Raising	27	5%
Tree Staking/Training	14	3%
Pest/Disease Treatment	2	<1%

Definitions: "Crown cleaning" removes dead, diseased, and broken limbs. *"Crown reduction"* involves shortening or removing individual limbs to avoid interference with nearby structures, utility wires, traffic flow, or other branches. "*Removal"* implies that the entire tree needs to be removed either for safety or tree health purposes. *"Raising"* removes lower branches from the tree trunk to eliminate obstructions or clearance issues. *"Staking/training"* refers to corrective staking or pruning on very young saplings to help develop proper form and prevent future problems. "*Pest/Disease Treatment"* would imply treating very high value or important landscape trees with preventative pesticides to protect their health.

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

Hubbard has 5 "critical concern" trees that are larger than 18" diameter which either need complete removal or trimming to mitigate risks.

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 16 trees with these needs that are larger than 12" diameter. Refer to the maps in Figures 3 and 4 of Appendix B to view the locations of these trees.

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 100 trees per year in Hubbard.

After the addressing the critical concern and immediate needs trees, there are 144 trees in Hubbard recommended for "routine" maintenance sometime within the next six years (Appendix B, Figures 3 & 4).

Planting

Theoretically, the city should be planting (and removing) about 5 trees per year in order to sustain the current tree population and to spread the trees equally out among different ages (size classes). This assumes the typical lifespan of a tree in Hubbard to be 80-140 years; if the trees are not living that long, or if the goal is to *increase* the tree population, the target will be higher (8-10 trees/yr). Most of the planting over the next 10-15 years can be done to replace Ash trees that are removed or killed by EAB when it arrives. 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 Hubbard.

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:

- No single species should comprise more than 10% of the total tree population in the community (e.g. silver maple, sugar maple, white oak, bur oak)
- No single genus should comprise more than 20% of the total tree population (e.g. oak, maple, ash, elm)

Presently, Hubbard's urban forest is heavily planted with the genus Maple, at 48% (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, 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 (Appendix D). 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 87 Ash trees in Hubbard within 4 years of its arrival, with tree removal costs likely to exceed $60,000. 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, $25/tree average for trimming*, $250/tree for pest treatments, 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 Hubbard apply for grants such as the Iowa DNR Trees For Kids program.

Year 1	Estimated Costs
Removals: 11 of the 32 recommended trees (critical concern and immediate needs)	$7700
Preventative Pest Treatment: 2 of 2 trees	$500
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Staking & training: 14 of 14 recommended trees	
Survey trees showing EAB symptoms: 17 trees	

Year 2	
Removals: 11 of the 32 recommended trees (critical concern and immediate needs)	$7700
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Survey trees showing EAB symptoms: 17 trees	

Year 3	
Removals: 10 of the 32 recommended trees (critical concern and immediate needs)	$7000
Preventative Pest Treatment: 2 of 2 trees	$500
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Survey trees showing EAB symptoms: 17 trees	

Year 4	
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Survey trees showing EAB symptoms: 17 trees	

Year 5	
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Preventative Pest Treatment: 2 of 2 trees	$500
Survey trees showing EAB symptoms: 17 trees	
Year 6	
Planting and replacements: 5 new trees	$750
Trimming: 25 of the 150 recommended trees	$625
Survey trees showing EAB symptoms: 17 trees	
Annually thereafter	
Removals: 5/year avg. focusing on poor condition ash & maple	$3500
Planting and replacements: 5/year avg.	$750
Routine trimming: 25 trees/year avg.	$625
Routine monitoring for EAB symptoms	

Plan Prepared by:

Inventory and report prepared by

Joe Herring, Iowa DNR District Forester
524 Lawler St
Iowa Falls, IA 50126
641-648-6304
joe.herring@dnr.iowa.gov

Maps and figures provided by Emma Hanigan, Iowa DNR Urban Forestry Coordinator.

All data and information used for this report may be obtained by contacting the Iowa DNR Forestry Bureau.

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

Hubbard

Annual Energy Benefits of Public Trees

12/4/2018

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	23.2	1,763	3,315.5	3,249	5,013	(N/A)	20.4	22.2	49.14
Ash	24.3	1,843	3,490.1	3,420	5,264	(N/A)	17.4	23.4	60.50
Sugar maple	14.6	1,110	1,918.6	1,880	2,990	(N/A)	11.4	13.3	52.46
Apple	3.0	225	463.4	454	679	(N/A)	8.2	3.0	16.57
Red maple	3.8	290	501.6	492	782	(N/A)	5.6	3.5	27.92
Black maple	6.2	473	867.9	851	1,323	(N/A)	4.4	5.9	60.15
Silver maple	5.9	449	786.9	771	1,220	(N/A)	4.2	5.4	58.08
Northern red oak	1.8	137	246.5	242	379	(N/A)	3.2	1.7	23.69
Honeylocust	3.9	295	506.7	497	792	(N/A)	2.6	3.5	60.89
Black walnut	3.2	242	422.6	414	656	(N/A)	2.4	2.9	54.67
Amur maple	0.9	68	147.7	145	213	(N/A)	2.4	0.9	17.72
American basswood	2.0	155	278.5	273	428	(N/A)	1.6	1.9	53.52
Littleleaf linden	1.6	124	239.3	235	359	(N/A)	1.6	1.6	44.87
American elm	1.8	137	230.5	226	362	(N/A)	1.4	1.6	51.78
Northern hackberry	2.1	160	289.5	284	444	(N/A)	1.2	2.0	73.99
Eastern white pine	0.9	68	118.1	116	184	(N/A)	1.2	0.8	30.70
Swamp white oak	0.7	55	98.9	97	151	(N/A)	1.0	0.7	30.30
Broadleaf Deciduous Mediu	0.4	32	59.5	58	90	(N/A)	1.0	0.4	18.06
Eastern redbud	0.2	19	42.3	41	60	(N/A)	0.8	0.3	15.00
Blue spruce	0.2	19	35.1	34	53	(N/A)	0.8	0.2	13.30
Callery pear	0.2	17	35.4	35	51	(N/A)	0.8	0.2	12.86
Lilac	0.1	5	11.4	11	16	(N/A)	0.6	0.1	5.40
Black poplar	1.1	83	152.7	150	233	(N/A)	0.6	1.0	77.62
River birch	0.8	58	108.6	106	164	(N/A)	0.6	0.7	54.72
Tulip tree	0.5	35	62.7	61	97	(N/A)	0.4	0.4	48.42
Broadleaf Deciduous Small	0.1	6	13.5	13	19	(N/A)	0.4	0.1	9.53
Northern white cedar	0.0	1	1.3	1	2	(N/A)	0.4	0.0	0.93
Norway spruce	0.2	14	24.1	24	38	(N/A)	0.4	0.2	18.86
Pin oak	0.6	46	84.4	83	129	(N/A)	0.4	0.6	64.44
Black cherry	0.1	11	25.7	25	36	(N/A)	0.4	0.2	18.19
Hickory	0.1	7	13.7	13	21	(N/A)	0.2	0.1	20.64
Spruce	0.1	4	9.5	9	14	(N/A)	0.2	0.1	13.58
Broadleaf Deciduous Large	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Mulberry	0.2	15	31.6	31	46	(N/A)	0.2	0.2	46.14
Quaking aspen	0.2	18	27.0	26	44	(N/A)	0.2	0.2	44.23
Pear	0.1	6	12.8	13	18	(N/A)	0.2	0.1	18.19
Mountain ash	0.2	14	24.7	24	38	(N/A)	0.2	0.2	38.13
Conifer Evergreen Large	0.1	4	9.5	9	14	(N/A)	0.2	0.1	13.58
Bur oak	0.1	7	13.7	13	21	(N/A)	0.2	0.1	20.64
Eastern cottonwood	0.4	33	59.0	58	91	(N/A)	0.2	0.4	91.02
Japanese tree lilac	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Total	106.1	8,050	14,781.6	14,486	22,536	(N/A)	100.0	100.0	45.07

Table 2: Annual Stormwater Benefits

Hubbard

Annual Stormwater Benefits of Public Trees

12/4/2018

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	201,376	5,457	(N/A)	20.4	19.9	53.50
Ash	241,731	6,551	(N/A)	17.4	23.9	75.30
Sugar maple	147,352	3,993	(N/A)	11.4	14.6	70.06
Apple	10,549	286	(N/A)	8.2	1.0	6.97
Red maple	23,786	645	(N/A)	5.6	2.4	23.02
Black maple	61,810	1,675	(N/A)	4.4	6.1	76.14
Silver maple	82,237	2,229	(N/A)	4.2	8.1	106.12
Northern red oak	15,900	431	(N/A)	3.2	1.6	26.93
Honeylocust	42,474	1,151	(N/A)	2.6	4.2	88.54
Black walnut	30,111	816	(N/A)	2.4	3.0	68.00
Amur maple	3,184	86	(N/A)	2.4	0.3	7.19
American basswood	18,401	499	(N/A)	1.6	1.8	62.33
Littleleaf linden	15,918	431	(N/A)	1.6	1.6	53.92
American elm	14,954	405	(N/A)	1.4	1.5	57.89
Northern hackberry	19,017	515	(N/A)	1.2	1.9	85.89
Eastern white pine	18,020	488	(N/A)	1.2	1.8	81.39
Swamp white oak	4,153	113	(N/A)	1.0	0.4	22.51
Broadleaf Deciduous Medium	2,333	63	(N/A)	1.0	0.2	12.64
Eastern redbud	862	23	(N/A)	0.8	0.1	5.84
Blue spruce	2,813	76	(N/A)	0.8	0.3	19.06
Callery pear	1,074	29	(N/A)	0.8	0.1	7.28
Lilac	206	6	(N/A)	0.6	0.0	1.86
Black poplar	15,125	410	(N/A)	0.6	1.5	136.63
River birch	6,368	173	(N/A)	0.6	0.6	57.52
Tulip tree	7,411	201	(N/A)	0.4	0.7	100.41
Broadleaf Deciduous Small	272	7	(N/A)	0.4	0.0	3.68
Northern white cedar	97	3	(N/A)	0.4	0.0	1.32
Norway spruce	2,134	58	(N/A)	0.4	0.2	28.92
Pin oak	5,987	162	(N/A)	0.4	0.6	81.13
Black cherry	529	14	(N/A)	0.4	0.1	7.17
Hickory	608	16	(N/A)	0.2	0.1	16.47
Spruce	596	16	(N/A)	0.2	0.1	16.14
Broadleaf Deciduous Large	18	0	(N/A)	0.2	0.0	0.48
Mulberry	1,174	32	(N/A)	0.2	0.1	31.82
Quaking aspen	1,466	40	(N/A)	0.2	0.1	39.72
Pear	264	7	(N/A)	0.2	0.0	7.17
Mountain ash	667	18	(N/A)	0.2	0.1	18.06
Conifer Evergreen Large	596	16	(N/A)	0.2	0.1	16.14
Bur oak	608	16	(N/A)	0.2	0.1	16.47
Eastern cottonwood	7,239	196	(N/A)	0.2	0.7	196.17
Japanese tree lilac	7	0	(N/A)	0.2	0.0	0.20
Citywide total	1,009,425	27,355	(N/A)	100.0	100.0	54.71

Table 3: Annual Air Quality Benefits

Hubbard

Annual Air Quality Benefits of Public Trees

12/4/2018

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	39.3	6.8	19.5	1.7	213	112.3	16.3	15.5	105.4	697	-9.4	-35	307.5	874 (N/A)	20.4	8.57
Ash	51.5	8.9	25.0	2.3	277	117.6	17.0	16.2	110.2	729	-11.9	-45	336.8	962 (N/A)	17.4	11.05
Sugar maple	18.8	3.2	9.6	0.8	102	69.0	10.1	9.6	66.3	432	-14.9	-56	172.5	478 (N/A)	11.4	8.39
Apple	2.4	0.4	1.2	0.1	13	14.7	2.1	2.0	13.4	90	0.0	0	36.3	103 (N/A)	8.2	2.52
Red maple	4.3	0.7	2.2	0.2	23	18.0	2.6	2.5	17.3	113	-1.6	-6	46.3	130 (N/A)	5.6	4.65
Black maple	16.1	2.7	7.4	0.7	85	29.8	4.3	4.1	28.2	186	-5.2	-20	88.1	251 (N/A)	4.4	11.41
Silver maple	14.0	2.4	6.9	0.6	76	27.9	4.1	3.9	26.7	175	-7.4	-28	79.2	222 (N/A)	4.2	10.59
Northern red oak	3.2	0.6	1.6	0.1	17	8.6	1.3	1.2	8.2	54	-4.6	-17	20.2	54 (N/A)	3.2	3.38
Honeylocust	8.2	1.4	3.8	0.4	43	18.3	2.7	2.6	17.6	115	-6.5	-24	48.3	134 (N/A)	2.6	10.28
Black walnut	3.3	0.5	1.7	0.1	18	15.1	2.2	2.1	14.5	94	0.0	0	39.5	112 (N/A)	2.4	9.35
Amur maple	0.6	0.1	0.3	0.0	3	4.5	0.6	0.6	4.1	27	0.0	0	10.9	31 (N/A)	2.4	2.57
American basswood	2.3	0.4	1.2	0.1	12	9.8	1.4	1.4	9.3	61	-2.0	-8	23.7	66 (N/A)	1.6	8.21
Littleleaf linden	2.5	0.4	1.3	0.1	14	8.0	1.2	1.1	7.4	49	-1.3	-5	20.7	58 (N/A)	1.6	7.29
American elm	5.0	0.8	2.3	0.2	27	8.5	1.2	1.2	8.2	53	0.0	0	27.4	80 (N/A)	1.4	11.36
Northern hackberry	3.3	0.6	1.7	0.1	18	10.1	1.5	1.4	9.6	63	0.0	0	28.3	81 (N/A)	1.2	13.52
Eastern white pine	2.1	0.4	1.7	0.3	14	4.2	0.6	0.6	4.1	27	-8.9	-33	5.1	7 (N/A)	1.2	1.17
Swamp white oak	0.6	0.1	0.3	0.0	3	3.4	0.5	0.5	3.3	21	-0.2	-1	8.5	24 (N/A)	1.0	4.80
Broadleaf Deciduous Medium	0.3	0.0	0.2	0.0	2	2.0	0.3	0.3	1.9	13	-0.1	0	5.0	14 (N/A)	1.0	2.79
Eastern redbud	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	0.0	0	2.9	8 (N/A)	0.8	2.09
Blue spruce	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.1	7	-0.9	-3	2.4	6 (N/A)	0.8	1.48
Callery pear	0.1	0.0	0.1	0.0	0	1.1	0.2	0.1	1.0	7	0.0	0	2.5	7 (N/A)	0.8	1.78
Lilac	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.8	2 (N/A)	0.6	0.71
Black poplar	2.1	0.3	1.0	0.1	11	5.3	0.8	0.7	5.0	33	0.0	0	15.3	44 (N/A)	0.6	14.66
River birch	1.2	0.2	0.6	0.1	7	3.7	0.5	0.5	3.4	23	-0.3	-1	9.9	28 (N/A)	0.6	9.41
Tulip tree	1.2	0.2	0.5	0.1	6	2.2	0.3	0.3	2.1	14	0.0	0	6.9	20 (N/A)	0.4	9.95
Broadleaf Deciduous Small	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3 (N/A)	0.4	1.33
Northern white cedar	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.4	0.05
Norway spruce	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.7	4 (N/A)	0.4	2.15
Pin oak	0.9	0.2	0.5	0.0	5	2.9	0.4	0.4	2.8	18	-1.8	-7	6.3	17 (N/A)	0.4	8.29
Black cherry	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5 (N/A)	0.4	2.55
Hickory	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.2	2.99
Spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1 (N/A)	0.2	1.48
Broadleaf Deciduous Large	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.2	0.08
Mulberry	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8 (N/A)	0.2	8.35
Quaking aspen	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7 (N/A)	0.2	7.42
Pear	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	0.2	2.55
Mountain ash	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7 (N/A)	0.2	6.56
Conifer Evergreen Large	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1 (N/A)	0.2	1.48
Bur oak	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.2	2.99
Eastern cottonwood	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19 (N/A)	0.2	19.04
Japanese tree lilac	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.2	0.11
Citywide total	186.1	31.8	92.2	8.5	1,007	508.9	73.9	70.4	480.8	3,164	-78.1	-293	1,374.6	3,879 (N/A)	100.0	7.76

Table 4: Annual Carbon Stored

Hubbard

Stored CO2 Benefits of Public Trees

12/4/2018

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	647,192	4,854	(N/A)	20.4	18.7	47.59
Ash	848,040	6,360	(N/A)	17.4	24.5	73.11
Sugar maple	543,038	4,073	(N/A)	11.4	15.7	71.45
Apple	40,923	307	(N/A)	8.2	1.2	7.49
Red maple	51,071	383	(N/A)	5.6	1.5	13.68
Black maple	170,475	1,279	(N/A)	4.4	4.9	58.12
Silver maple	320,081	2,401	(N/A)	4.2	9.3	114.31
Northern red oak	66,857	501	(N/A)	3.2	1.9	31.34
Honeylocust	106,757	801	(N/A)	2.6	3.1	61.59
Black walnut	108,364	813	(N/A)	2.4	3.1	67.73
Amur maple	11,564	87	(N/A)	2.4	0.3	7.23
American basswood	83,671	628	(N/A)	1.6	2.4	78.44
Littleleaf linden	53,928	404	(N/A)	1.6	1.6	50.56
American elm	97,512	731	(N/A)	1.4	2.8	104.48
Northern hackberry	52,528	394	(N/A)	1.2	1.5	65.66
Eastern white pine	22,032	165	(N/A)	1.2	0.6	27.54
Swamp white oak	9,668	73	(N/A)	1.0	0.3	14.50
Broadleaf Deciduous	5,179	39	(N/A)	1.0	0.1	7.77
Eastern redbud	2,902	22	(N/A)	0.8	0.1	5.44
Blue spruce	1,488	11	(N/A)	0.8	0.0	2.79
Callery pear	1,756	13	(N/A)	0.8	0.1	3.29
Lilac	533	4	(N/A)	0.6	0.0	1.33
Black poplar	70,804	531	(N/A)	0.6	2.0	177.01
River birch	19,515	146	(N/A)	0.6	0.6	48.79
Tulip tree	39,444	296	(N/A)	0.4	1.1	147.91
Broadleaf Deciduous	922	7	(N/A)	0.4	0.0	3.46
Northern white cedar	5	0	(N/A)	0.4	0.0	0.02
Norway spruce	1,427	11	(N/A)	0.4	0.0	5.35
Pin oak	23,457	176	(N/A)	0.4	0.7	87.96
Black cherry	1,816	14	(N/A)	0.4	0.1	6.81
Hickory	1,035	8	(N/A)	0.2	0.0	7.76
Spruce	257	2	(N/A)	0.2	0.0	1.93
Broadleaf Deciduous	12	0	(N/A)	0.2	0.0	0.09
Mulberry	6,743	51	(N/A)	0.2	0.2	50.57
Quaking aspen	3,672	28	(N/A)	0.2	0.1	27.54
Pear	908	7	(N/A)	0.2	0.0	6.81
Mountain ash	3,037	23	(N/A)	0.2	0.1	22.78
Conifer Evergreen La	257	2	(N/A)	0.2	0.0	1.93
Bur oak	1,035	8	(N/A)	0.2	0.0	7.76
Eastern cottonwood	39,259	294	(N/A)	0.2	1.1	294.44
Japanese tree lilac	14	0	(N/A)	0.2	0.0	0.10
Citywide total	3,459,173	25,944	(N/A)	100.0	100.0	51.89

Table 5: Annual Carbon Sequestered

Hubbard

Annual CO Benefits of Public Trees

12/4/2018

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	35,375	265	-3,109	-236	-25	38,972	292	71,002	533 (N/A)	20.4	21.0	5.22
Ash	23,642	177	-4,071	-271	-33	40,737	306	60,038	450 (N/A)	17.4	17.7	5.18
Sugar maple	30,119	226	-2,607	-151	-21	24,533	184	51,893	389 (N/A)	11.4	15.3	6.83
Apple	4,507	34	-197	-43	-2	4,974	37	9,241	69 (N/A)	8.2	2.7	1.69
Red maple	6,936	52	-245	-35	-2	6,412	48	13,067	98 (N/A)	5.6	3.9	3.50
Black maple	8,793	66	-818	-59	-7	10,447	78	18,363	138 (N/A)	4.4	5.4	6.26
Silver maple	24,286	182	-1,539	-66	-12	9,914	74	32,596	244 (N/A)	4.2	9.6	11.64
Northern red oak	1,925	14	-321	-23	-3	3,038	23	4,618	35 (N/A)	3.2	1.4	2.16
Honeylocust	4,524	34	-512	-29	-4	6,520	49	10,502	79 (N/A)	2.6	3.1	6.06
Black walnut	7,097	53	-520	-31	-4	5,347	40	11,893	89 (N/A)	2.4	3.5	7.43
Amur maple	1,368	10	-56	-14	-1	1,500	11	2,799	21 (N/A)	2.4	0.8	1.75
American basswood	5,323	40	-402	-22	-3	3,431	26	8,330	62 (N/A)	1.6	2.5	7.81
Littleleaf linden	5,473	41	-259	-20	-2	2,750	21	7,945	60 (N/A)	1.6	2.3	7.45
American elm	2,243	17	-468	-19	-4	3,019	23	4,774	36 (N/A)	1.4	1.4	5.12
Northern hackberry	2,497	19	-252	-20	-2	3,542	27	5,767	43 (N/A)	1.2	1.7	7.21
Eastern white pine	1,121	8	-106	-16	-1	1,513	11	2,512	19 (N/A)	1.2	0.7	3.14
Swamp white oak	1,315	10	-47	-7	0	1,206	9	2,468	19 (N/A)	1.0	0.7	3.70
Broadleaf Deciduous Medi	807	6	-26	-4	0	707	5	1,483	11 (N/A)	1.0	0.4	2.22
Eastern redbud	380	3	-14	-4	0	410	3	771	6 (N/A)	0.8	0.2	1.45
Blue spruce	153	1	-7	-4	0	416	3	558	4 (N/A)	0.8	0.2	1.05
Callery pear	511	4	-11	-3	0	369	3	867	7 (N/A)	0.8	0.3	1.63
Lilac	114	1	-3	-2	0	112	1	221	2 (N/A)	0.6	0.1	0.55
Black poplar	2,626	20	-340	-12	-3	1,839	14	4,113	31 (N/A)	0.6	1.2	10.28
River birch	1,326	10	-94	-7	-1	1,275	10	2,500	19 (N/A)	0.6	0.7	6.25
Tulip tree	986	7	-189	-6	-1	783	6	1,574	12 (N/A)	0.4	0.5	5.90
Broadleaf Deciduous Smal	123	1	-4	-1	0	130	1	246	2 (N/A)	0.4	0.1	0.92
Northern white cedar	7	0	0	0	0	12	0	19	0 (N/A)	0.4	0.0	0.07
Norway spruce	168	1	-7	-3	0	311	2	469	4 (N/A)	0.4	0.1	1.76
Pin oak	2,371	18	-113	-6	-1	1,020	8	3,272	25 (N/A)	0.4	1.0	12.27
Black cherry	228	2	-9	-2	0	248	2	465	3 (N/A)	0.4	0.1	1.74
Hickory	209	2	-5	-1	0	159	1	361	3 (N/A)	0.2	0.1	2.71
Spruce	53	0	-1	-1	0	94	1	145	1 (N/A)	0.2	0.0	1.08
Broadleaf Deciduous Larg	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Mulberry	0	0	-32	-4	0	335	3	299	2 (N/A)	0.2	0.1	2.24
Quaking aspen	445	3	-18	-2	0	393	3	819	6 (N/A)	0.2	0.2	6.14
Pear	114	1	-4	-1	0	124	1	232	2 (N/A)	0.2	0.1	1.74
Mountain ash	268	2	-15	-2	0	308	2	560	4 (N/A)	0.2	0.2	4.20
Conifer Evergreen Large	53	0	-1	-1	0	94	1	145	1 (N/A)	0.2	0.0	1.08
Bur oak	209	2	-5	-1	0	159	1	361	3 (N/A)	0.2	0.1	2.71
Eastern cottonwood	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.2	0.4	10.90
Japanese tree lilac	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Citywide total	178,616	1,340	-16,614	-1,135	-133	177,897	1,334	338,764	2,541 (N/A)	100.0	100.0	5.08

Table 6: Annual Social and Aesthetic Benefits

Hubbard

Annual Aesthetic/Other Benefits of Public Trees

12/4/2018

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	3,429	(N/A)	20.4	18.8	33.62
Ash	2,230	(N/A)	17.4	12.2	25.63
Sugar maple	3,231	(N/A)	11.4	17.7	56.69
Apple	253	(N/A)	8.2	1.4	6.17
Red maple	1,023	(N/A)	5.6	5.6	36.55
Black maple	1,048	(N/A)	4.4	5.7	47.62
Silver maple	1,934	(N/A)	4.2	10.6	92.11
Northern red oak	167	(N/A)	3.2	0.9	10.43
Honeylocust	1,078	(N/A)	2.6	5.9	82.90
Black walnut	634	(N/A)	2.4	3.5	52.81
Amur maple	77	(N/A)	2.4	0.4	6.43
American basswood	399	(N/A)	1.6	2.2	49.88
Littleleaf linden	575	(N/A)	1.6	3.2	71.90
American elm	299	(N/A)	1.4	1.6	42.76
Northern hackberry	340	(N/A)	1.2	1.9	56.63
Eastern white pine	247	(N/A)	1.2	1.4	41.15
Swamp white oak	144	(N/A)	1.0	0.8	28.73
Broadleaf Deciduous Medium	94	(N/A)	1.0	0.5	18.78
Eastern redbud	21	(N/A)	0.8	0.1	5.32
Blue spruce	71	(N/A)	0.8	0.4	17.73
Callery pear	65	(N/A)	0.8	0.4	16.22
Lilac	6	(N/A)	0.6	0.0	2.06
Black poplar	190	(N/A)	0.6	1.0	63.17
River birch	125	(N/A)	0.6	0.7	41.75
Tulip tree	73	(N/A)	0.4	0.4	36.54
Broadleaf Deciduous Small	6	(N/A)	0.4	0.0	3.22
Northern white cedar	12	(N/A)	0.4	0.1	5.76
Norway spruce	48	(N/A)	0.4	0.3	23.87
Pin oak	199	(N/A)	0.4	1.1	99.74
Black cherry	13	(N/A)	0.4	0.1	6.40
Hickory	29	(N/A)	0.2	0.2	28.56
Spruce	15	(N/A)	0.2	0.1	15.42
Broadleaf Deciduous Large	5	(N/A)	0.2	0.0	5.26
Mulberry	0	(N/A)	0.2	0.0	0.00
Quaking aspen	46	(N/A)	0.2	0.3	45.86
Pear	6	(N/A)	0.2	0.0	6.40
Mountain ash	15	(N/A)	0.2	0.1	15.48
Conifer Evergreen Large	15	(N/A)	0.2	0.1	15.42
Bur oak	29	(N/A)	0.2	0.2	28.56
Eastern cottonwood	58	(N/A)	0.2	0.3	58.34
Japanese tree lilac	0	(N/A)	0.2	0.0	0.03
Citywide total	18,251	(N/A)	100.0	100.0	36.50

Table 7: Summary of Benefits in Dollars

Hubbard

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

12/4/2018

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard E
Norway maple	49.14	5.22	8.57	53.50	33.62	150.06	(N/A)
Ash	60.50	5.18	11.05	75.30	25.63	177.66	(N/A)
Sugar maple	52.46	6.83	8.39	70.06	56.69	194.42	(N/A)
Apple	16.57	1.69	2.52	6.97	6.17	33.92	(N/A)
Red maple	27.92	3.50	4.65	23.02	36.55	95.64	(N/A)
Black maple	60.15	6.26	11.41	76.14	47.62	201.58	(N/A)
Silver maple	58.08	11.64	10.59	106.12	92.11	278.56	(N/A)
Northern red oak	23.69	2.16	3.38	26.93	10.43	66.59	(N/A)
Honeylocust	60.89	6.06	10.28	88.54	82.90	248.67	(N/A)
Black walnut	54.67	7.43	9.35	68.00	52.81	192.27	(N/A)
Amur maple	17.72	1.75	2.57	7.19	6.43	35.67	(N/A)
American basswood	53.52	7.81	8.21	62.33	49.88	181.76	(N/A)
Littleleaf linden	44.87	7.45	7.29	53.92	71.90	185.44	(N/A)
American elm	51.78	5.12	11.36	57.89	42.76	168.91	(N/A)
Northern hackberry	73.99	7.21	13.52	85.89	56.63	237.24	(N/A)
Eastern white pine	30.70	3.14	1.17	81.39	41.15	157.55	(N/A)
Swamp white oak	30.30	3.70	4.80	22.51	28.73	90.03	(N/A)
Broadleaf Deciduous M	18.06	2.22	2.79	12.64	18.78	54.50	(N/A)
Eastern redbud	15.00	1.45	2.09	5.84	5.32	29.69	(N/A)
Blue spruce	13.30	1.05	1.48	19.06	17.73	52.62	(N/A)
Callery pear	12.86	1.63	1.78	7.28	16.22	39.75	(N/A)
Lilac	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)
Black poplar	77.62	10.28	14.66	136.63	63.17	302.36	(N/A)
River birch	54.72	6.25	9.41	57.52	41.75	169.65	(N/A)
Tulip tree	48.42	5.90	9.95	100.41	36.54	201.23	(N/A)
Broadleaf Deciduous S	9.53	0.92	1.33	3.68	3.22	18.68	(N/A)
Northern white cedar	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)
Norway spruce	18.86	1.76	2.15	28.92	23.87	75.55	(N/A)
Pin oak	64.44	12.27	8.29	81.13	99.74	265.87	(N/A)
Black cherry	18.19	1.74	2.55	7.17	6.40	36.05	(N/A)
Hickory	20.64	2.71	2.99	16.47	28.56	71.37	(N/A)
Spruce	13.58	1.08	1.48	16.14	15.42	47.70	(N/A)
Broadleaf Deciduous I	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
Mulberry	46.14	2.24	8.35	31.82	0.00	88.55	(N/A)
Quaking aspen	44.23	6.14	7.42	39.72	45.86	143.36	(N/A)
Pear	18.19	1.74	2.55	7.17	6.40	36.05	(N/A)
Mountain ash	38.13	4.20	6.56	18.06	15.48	82.43	(N/A)
Conifer Evergreen Lar	13.58	1.08	1.48	16.14	15.42	47.70	(N/A)
Bur oak	20.64	2.71	2.99	16.47	28.56	71.37	(N/A)
Eastern cottonwood	91.02	10.90	19.04	196.17	58.34	375.47	(N/A)
Japanese tree lilac	0.87	0.10	0.11	0.20	0.03	1.31	(N/A)
Citywide Total	45.07	5.08	7.76	54.71	36.50	149.12	(N/A)

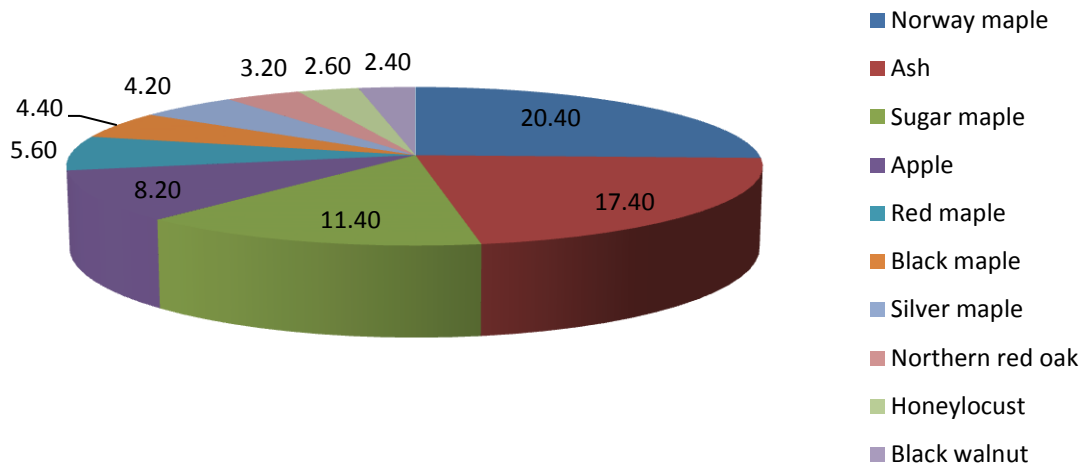

Figure 1: Species Distribution

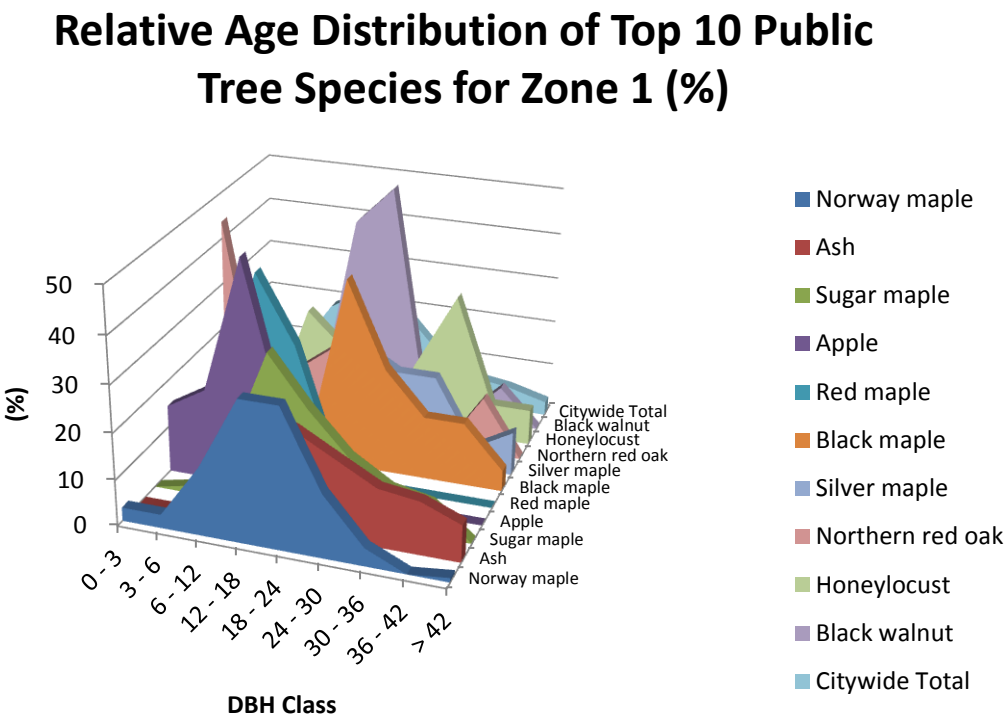

Figure 2: Relative Age Class

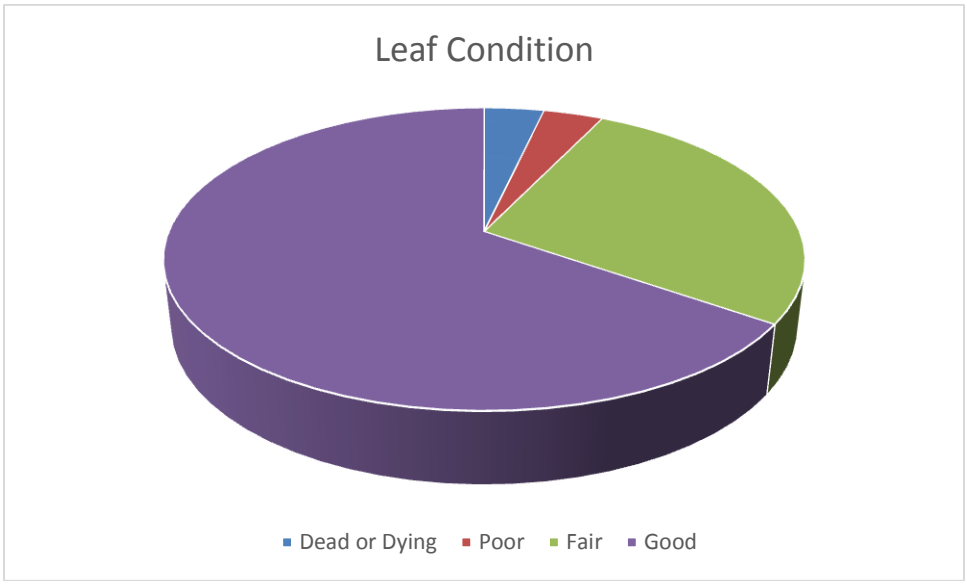

Figure 3: Foliage Condition

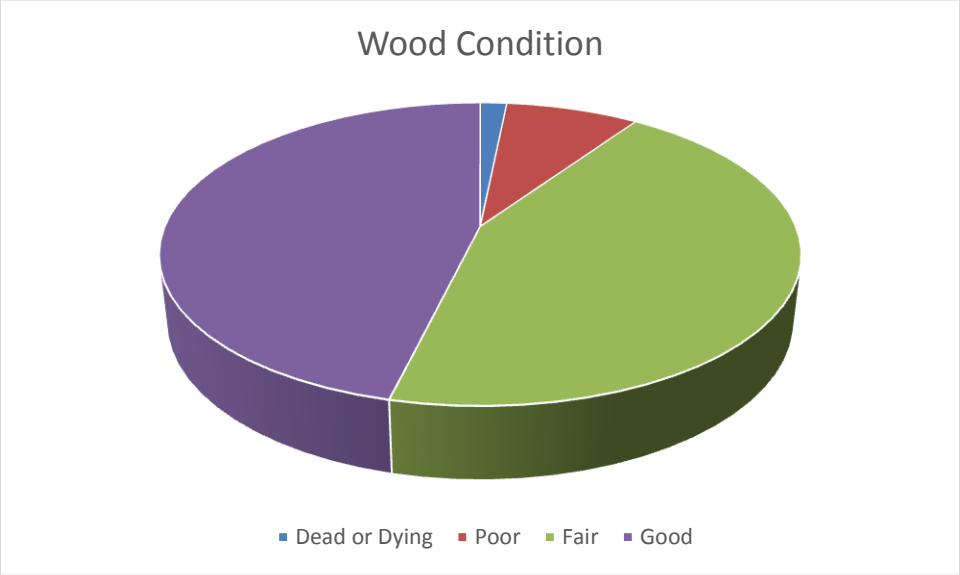

Figure 4: Wood Condition

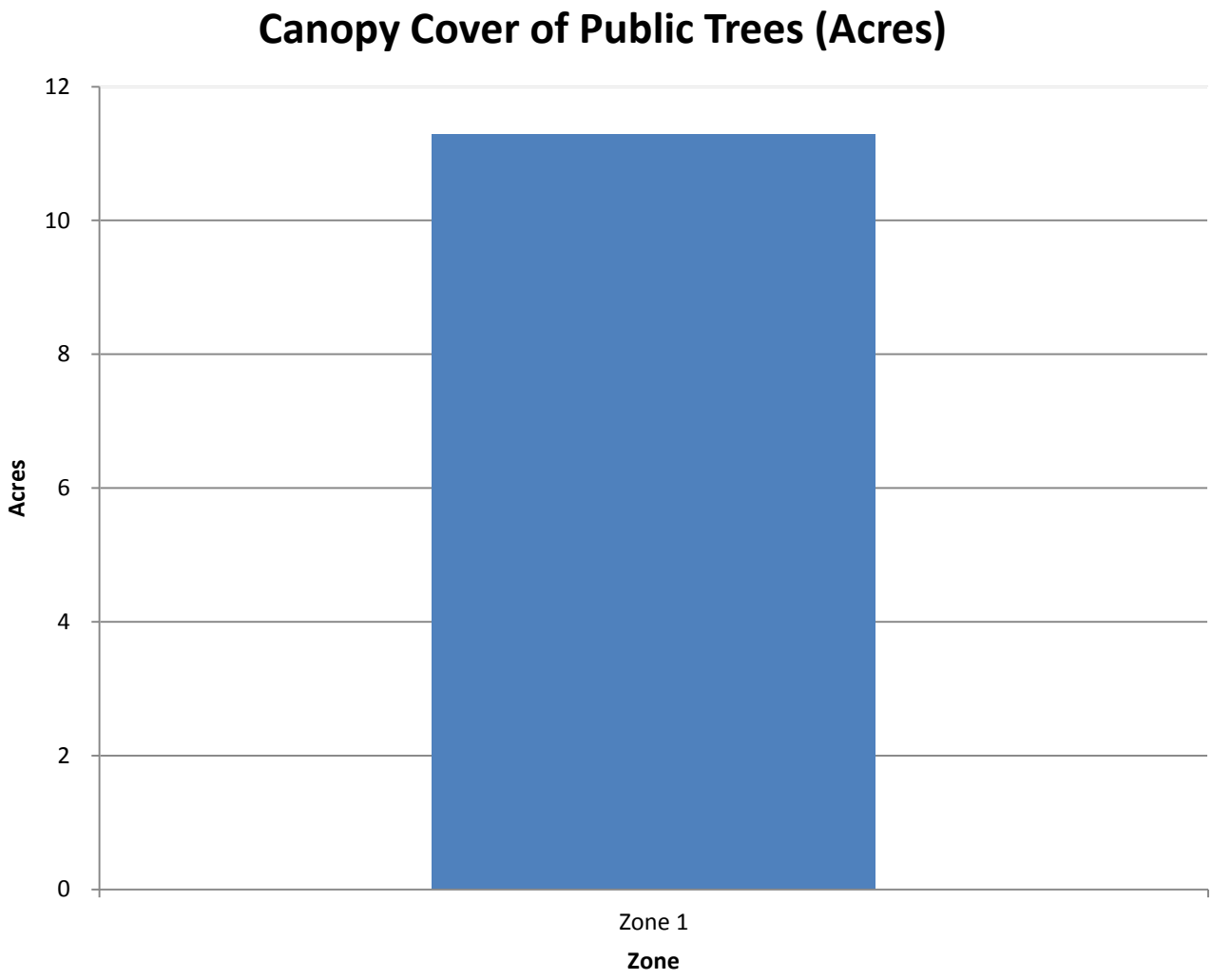

Figure 5: Canopy Cover in Acres

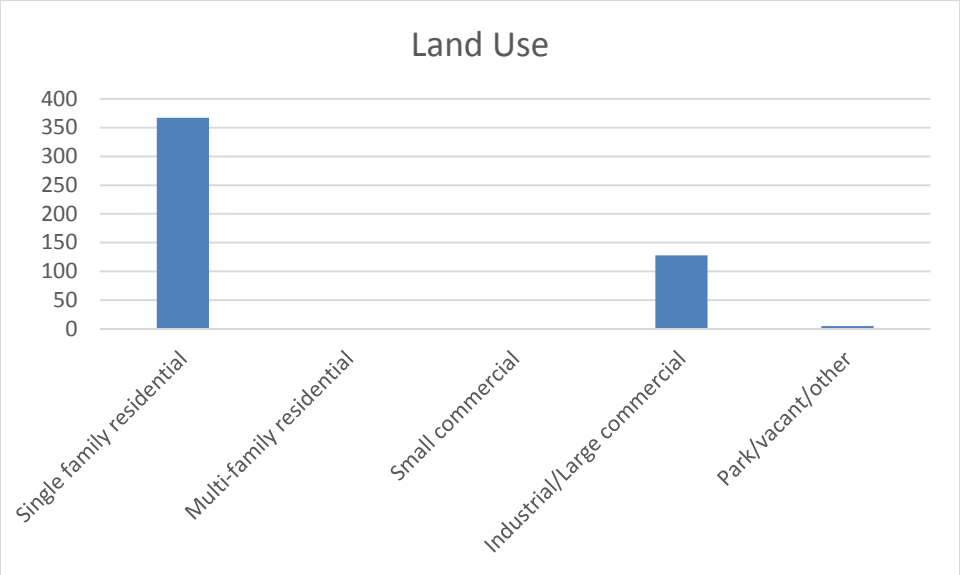

Figure 6: Land Use of city/park trees

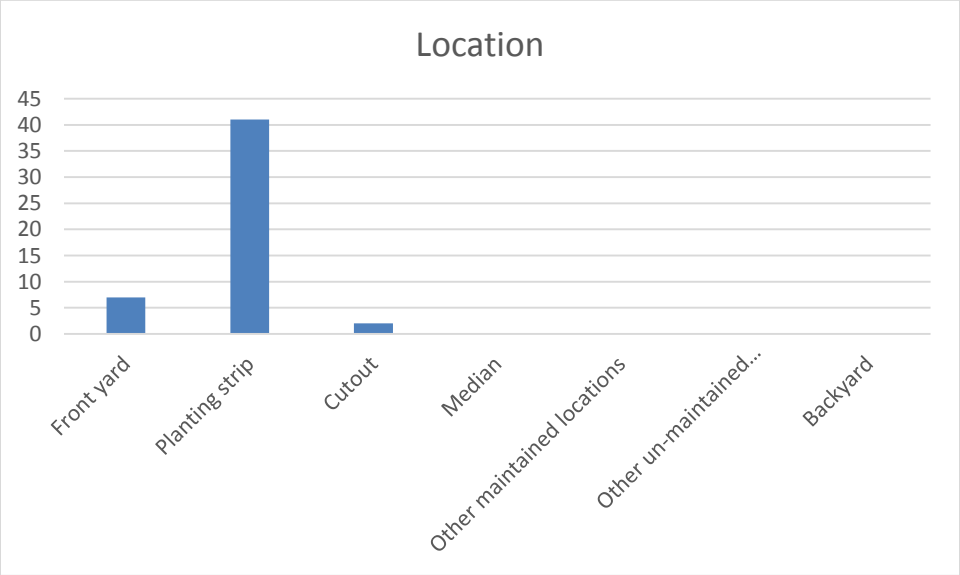

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

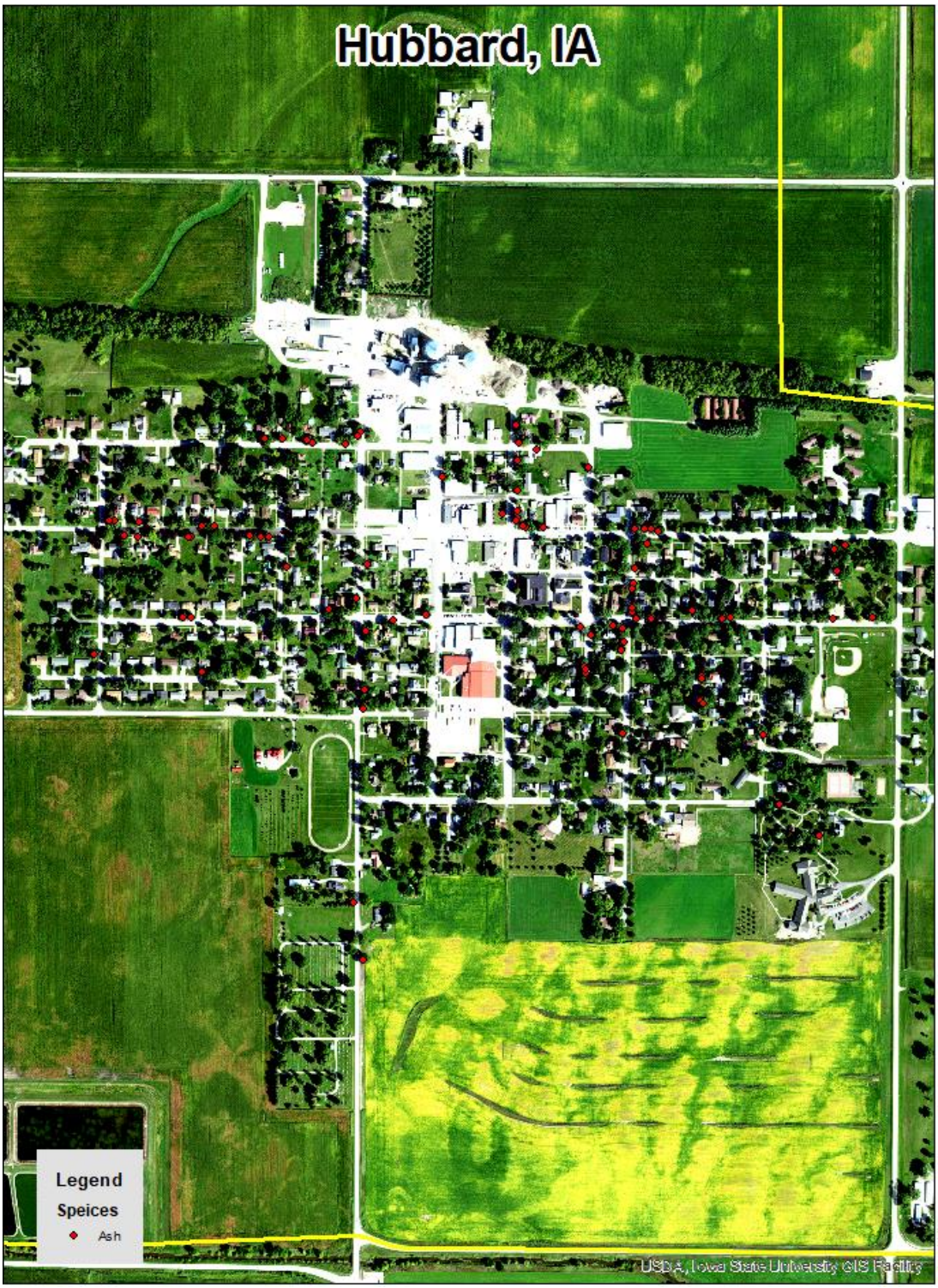

Figure 1: Location of Ash Trees

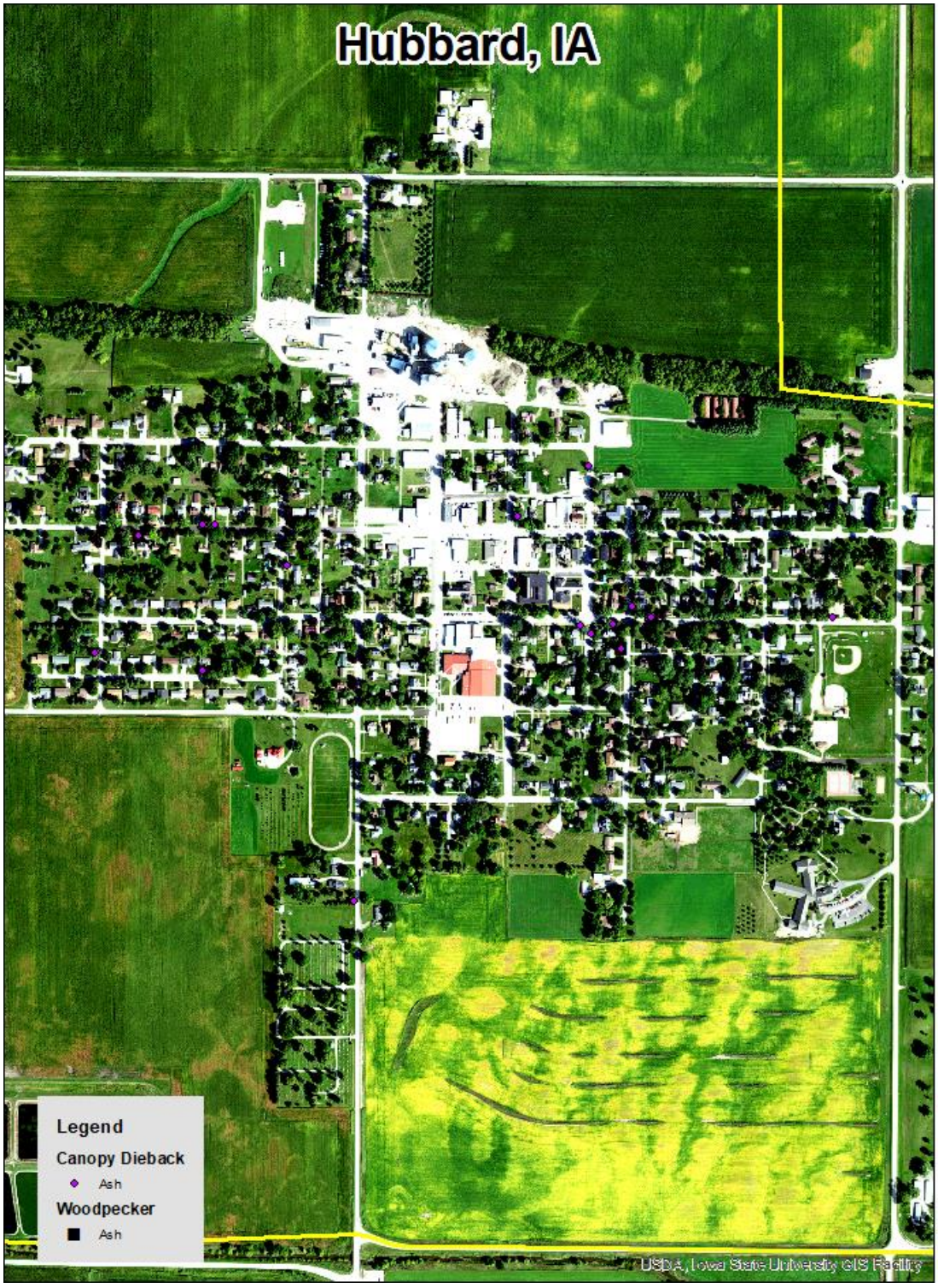

Figure 2: Location of EAB symptoms

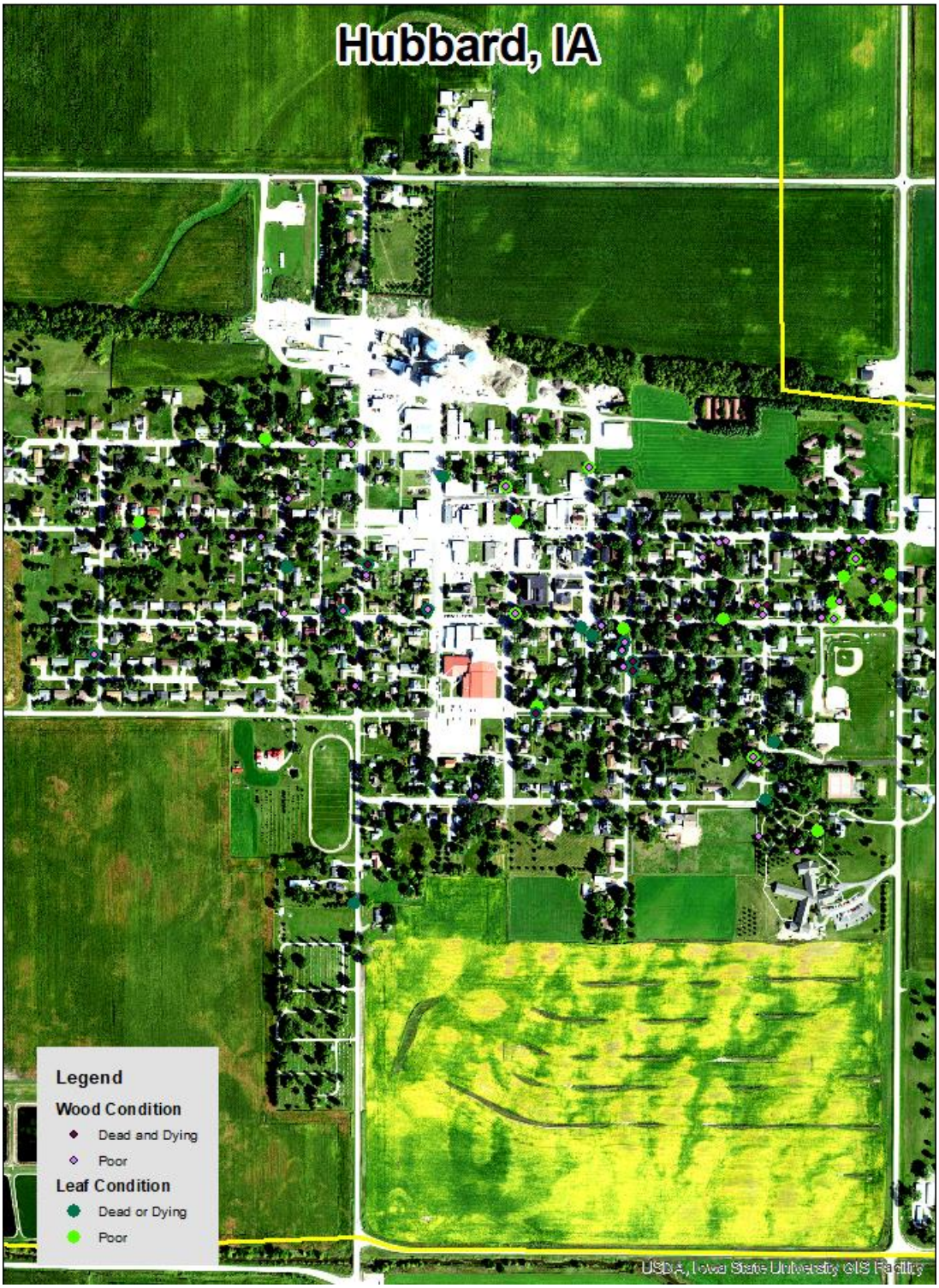

Figure 3: Location of Poor Condition Trees

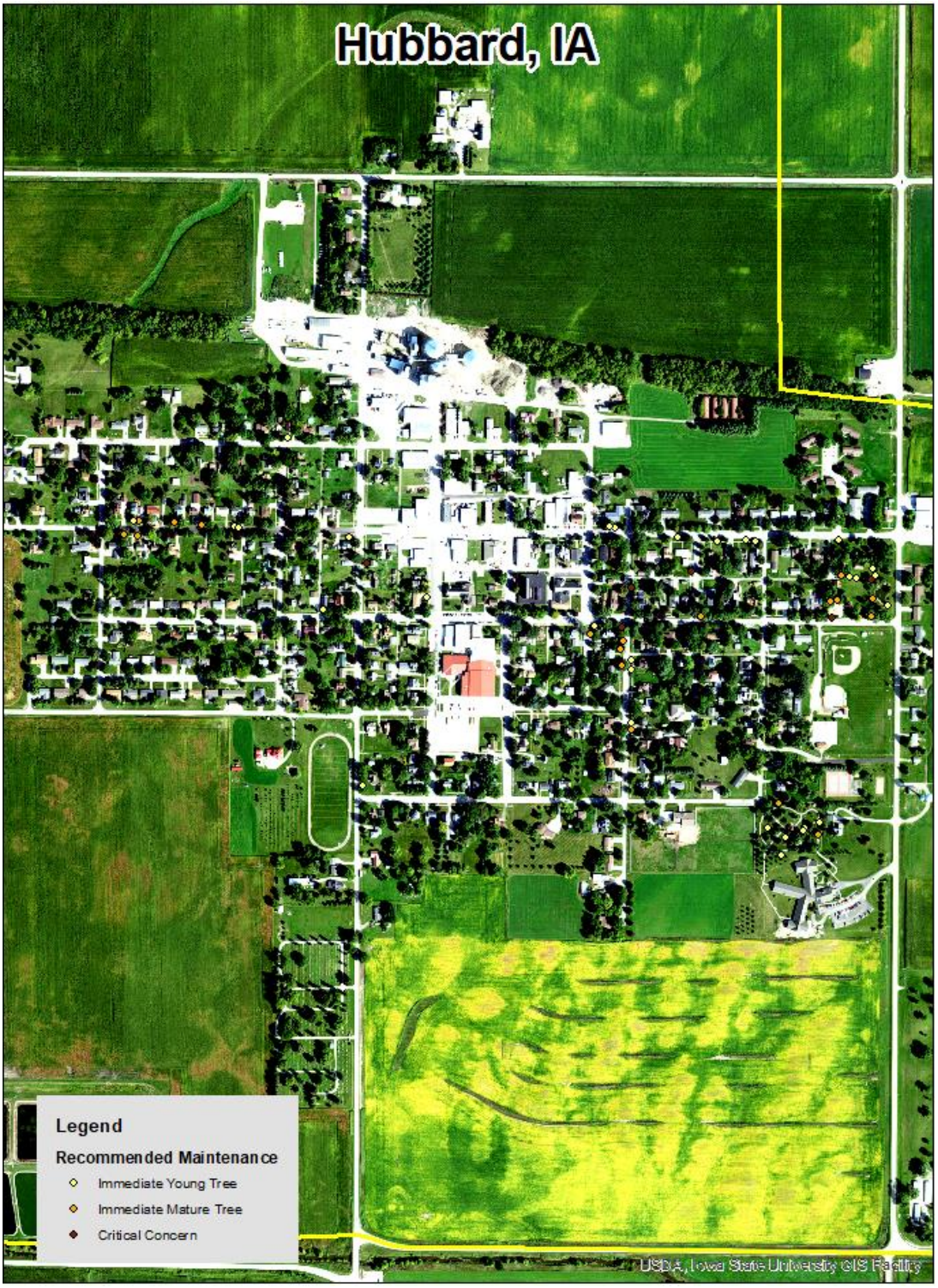

Figure 4: Location of Trees with Recommended Maintenance

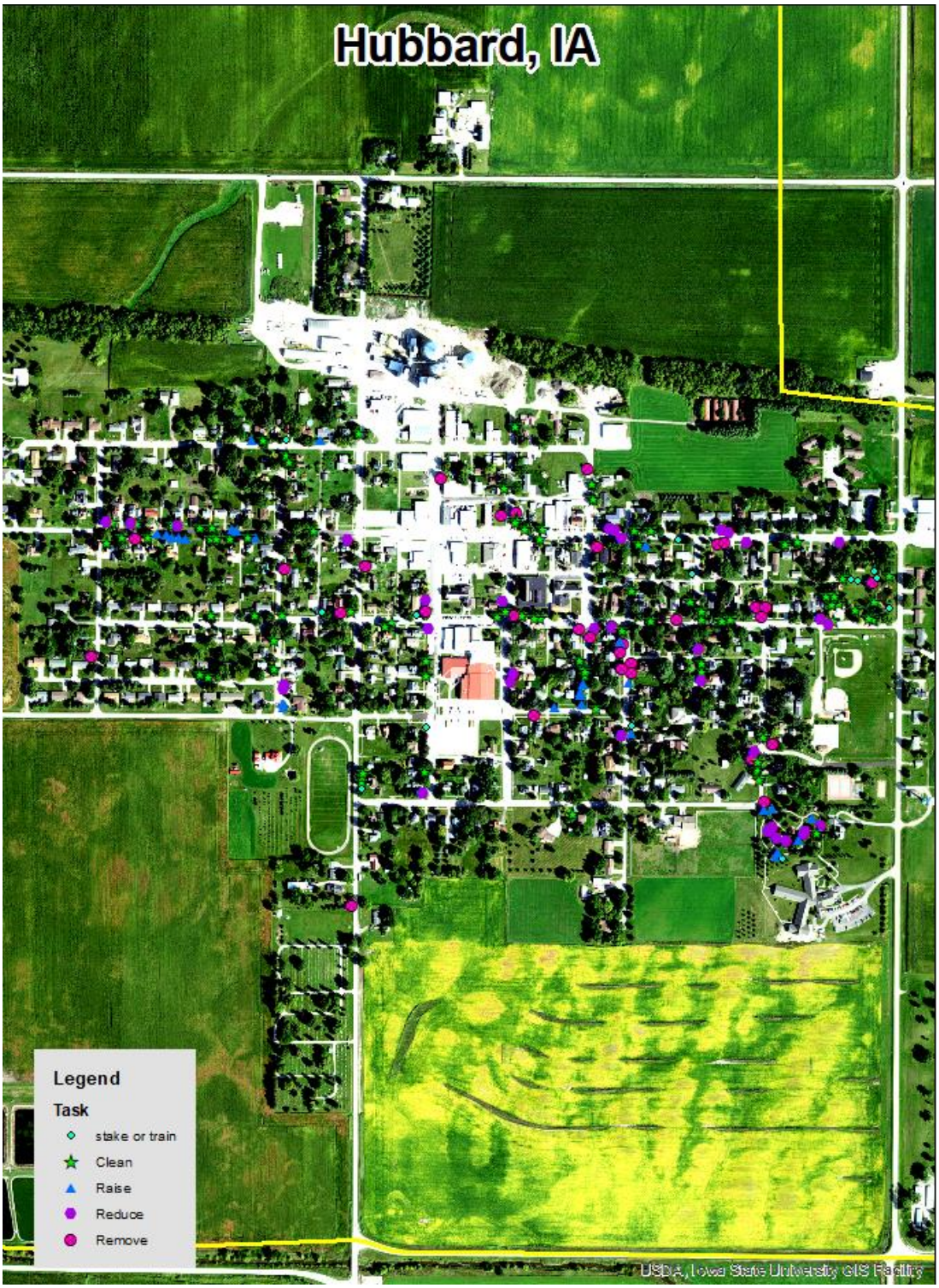

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal****

Appendix C: Proposed Emerald Ash Borer Plan

Ash Tree Removal

Ash trees that become infested with EAB will die within 4-8 years and can present very serious risks to life and property. Once branches or trees die, the tissue can become very brittle and unpredictable within 1-2 years, making removal more dangerous and expensive for tree services. Therefore, it is recommended that ash trees be removed immediately as soon as signs and symptoms of EAB are detected in those trees. Dead, dying, and hazardous ash trees should be prioritized for removal first to mitigate public safety and risk. Next should be all ash in poor condition and displaying early signs and symptoms of EAB. *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

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.

The entire State of Iowa is under a quarantine which prohibits the transport of regulated articles to areas outside the federal quarantine area. For a current quarantine map, please visit http://www.emeraldashborer.info/moving-firewood.php. County-to-county transport of regulated articles inside the State of Iowa is permitted, but discouraged.

Wood Disposal

Wood waste can be disposed of by typical means, such as chipping, composting, burning, etc. Cities and residents are encouraged to destroy ash materials promptly to prevent their spread to other neighboring communities and counties. Firewood from ash trees should be kept and used locally as much as possible.

Canopy Replacement

Replace all ash trees promptly with a diverse species mix as budgets allow. Encourage local residents to plant trees on their adjoining properties. All trees should 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 the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Treatment of Ash Trees

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property either before or upon arrival of EAB. Preventative treatments using insecticides are available to protect highly valuable ash trees but must be administered for the remainder of the tree's life. Treatments are formulated either for homeowner use or via professionally-applied trunk injections, depending on tree size, in accordance with ISU Extension bulletin PM-2084 (available online for free).

Appendix D: Recommended Species List

IOWA TREE LIST			
	*This is a statewide list; Species survivability may vary by location.		
	Common Name	**Scientific Name**	**Cultivars/ Selections**
SHADE TREES	Black Maple	*Acer nigrum*	
	Red Maple	*Acer rubrum*	Burgundy Belle, Red Sunset, Scarlet Jewel, Redpoint, Somerset
	Sugar Maple	*Acer saccharum*	Commemoration, Crescendo, Endowment, Fall Fiesta, Legacy, Green Mountain
	River Birch	*Betula nigra*	Heritage
	White-barked Birch	*Betula populifolia*	Whitespire Sr.
	American Elm	*Ulmus Americana*	Jefferson, Prairie Expedition (Lewis and Clark), Princeton
	Pecan	*Carya illinoinensis*	
	Shellbark Hickory	*Carya laciniosa*	
	Shagbark Hickory	*Carya ovata*	
	Hackberry	*Celtis occidentalis*	Chicagoland, Prairie Pride, Windy City
	Yellowwood	*Cladrastis kentuckea*	
	Turkish Filbert	*Corylus columa*	
	Ginkgo (male only)	*Ginkgo biloba*	Autumn Gold, Golden Colonnade, Halka, Magyar, Presidential Gold, Princeton Sentry
	Thornless Honeylocust	*Gleditsia triacanthos*	Northern Acclaim, Skyline, Shademaster
	Kentucky Coffeetree	*Gymnocladus dioicus*	
	Sweetgum	*Liquidambar styraciflua*	
	Tuliptree	*Liriodendron tulipifera*	
	Cucumbertree Magnolia	*Magnolia acuminata*	
	Blackgum	*Nyssa slyvatica*	
	London Planetree	*Platanus x acerfolia*	Bloodgood, Exclamation
	White Oak	*Quercus alba*	
	Swamp White Oak	*Quercus bicolor*	
	Scarlet Oak	*Quercus coccinea*	
	Shingle Oak	*Quercus imbricaria*	
	Bur Oak	*Quercus macrocarpa*	
	Chinkapin Oak	*Quercus muehlenbergii*	
	Pin Oak	*Quercus Palustris*	
	Northern Red Oak	*Quercus rubra*	
	American Linden	*Tilia americana*	Boulevard, Front Yard, Legend, American Sentry
	Silver Linden	*Tilia tomemtosa*	
	Littleleaf Linden	*Tilia Cordata*	Glenleven
LOW-GROWING TREES	Serviceberry	*Amelanchier spp.*	Autumn Brilliance, Cole's Select, Cumulus, Princess Diana, Strata
	American Hornbeam	*Carpinus caroliniana*	
	Eastern Redbud	*Cercis canadensis*	
	Pagoda Dogwood	*Cornus alternifolia*	
	Flowering Crabapple	*Malus spp.*	Adirondack, Cardinal, David, Donald Wyman, Doublooms, Floribunda, Golden Raindrops, Harvest Gold, Indian Magic, Louisa, Mary Potter, Purple Prince, Red Jewel, Royal Fountain, Royal Raindrops, Sugar Tyme
	American Hophornbeam	*Ostyra virginiana*	
	American Plum	*Prunus americana*	
	Japanese Tree Lilac	*Syringa reticulata*	Ivory Silk, Summer Snow
CONIFERS	White Fir	*Abies concolor*	
	Norway Spruce	*Picea abies*	
	White Spruce	*Picea glauca*	
	Black Hills Spruce	*Picea glauca var. densata*	
	Serbian Spruce	*Picea omorika*	
	White Pine	*Pinus strobus*	
	Arborvitae	*Thuja occidentalis*	
	Canadian Hemlock	*Tsuga canadensis*	
	Larch	*Larix decidua*	
	Bald Cypress	*Taxodium distichum*	

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.