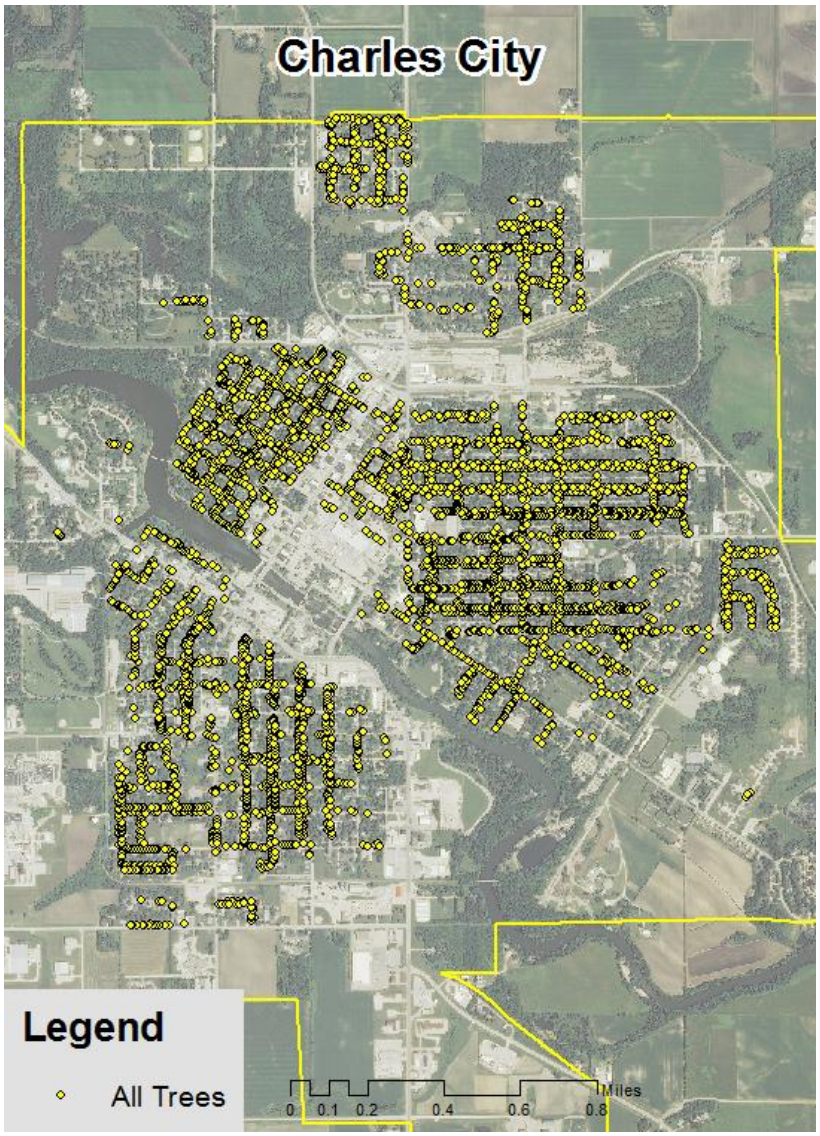
Charles City, IA



2015 Urban Forest Management Plan
Prepared by Matt Brewer
Bureau of Forestry, Iowa DNR

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Charles City with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 21% of Charles City's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. 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

A tree inventory was conducted by Emma Hanigan, Iowa DNR, 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 7,006 trees inventoried.

- Charles City's trees provide $1,159,125 of benefits annually, an average of $165 a tree
- There are over 64 species of trees
- The top three genera are: Maple 49%, Ash 21%, and Hackberry 9%
- 4% of trees are in need of some type of management
- 62 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 62 trees needing removal, 14 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 116 of the 1,448 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 15 years to remove ash – Suggestion: request a budget increase and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Charles City with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Charles City, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Charles City's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of Charles City and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Charles City's urban forestry goals.

Inventory

A tree inventory was conducted by Emma Hanigan, Iowa DNR, 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 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 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 7,006 city trees was entered into the USDA Forest Service program i-Tree Streets, part of the i-Tree suite. The following are results from the i-Tree Streets analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Charles City's trees reduce energy related costs by approximately $327,297 annually (Appendix A, Table 1). These savings are both in Electricity (1,582.9 MWh) and in Natural Gas (211,386.6 Therms).

Annual Stormwater Benefits

Charles City's trees intercept about 14,090,418 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $381,850 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 Charles City, it is estimated that trees remove 19,436.7 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 $54,628 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Charles City, trees sequester about 3,408,975 lbs of carbon a year with an associated value of $25,567 (Appendix A, Table 4). In addition, the trees store 43,732,976 lbs of carbon, with a yearly benefit of $327,997 (Appendix A, Table 5).

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. Charles City receives $351,561 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree Streets analysis, Charles City's trees provide $1,159,125 of benefits annually. Benefits of individual trees vary based on size, species, health

and location, but on average each of the 7,006 trees in Charles City provide approximately $165 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Charles City has over 64 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Maple	3,464	49%
Ash	1,448	21%
Hackberry	663	9%
Oak	402	6%
Linden/Basswood	343	5%
Honeylocust	144	2%
Apple/Crabapple	132	2%
Black Walnut	118	2%
Elm	43	1%
Spruce	40	1%
Aspen/Cottonwood/Poplar	30	<1%
Catalpa	26	<1%
Mountain Ash	17	<1%
Cherry/Plum	16	<1%
Eastern Red Cedar	15	<1%
Ohio Buckeye	13	<1%
Black Locust	12	<1%
Pine	10	<1%
Mulberry	9	<1%
Pear	8	<1%
Southern Magnolia	7	<1%
Hickory	6	<1%
Eastern Redbud	6	<1%
Ginkgo	6	<1%
Willow	4	<1%
Northern White Cedar	4	<1%
Birch	3	<1%
American Chestnut	2	<1%
Kentucky Coffeetree	2	<1%
Amur Corktree	2	<1%
American Sycamore	2	<1%
Mimosa	1	<1%
Dogwood	1	<1%

Eastern Hophornbeam	1	<1%
Other Medium Deciduous	2	<1%
Other Small Deciduous	2	<1%
Other Medium Evergreen	2	<1%

Age Class

Most of Charles City's trees (87%) are between 6 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Charles City's size curve includes a significant amount of trees that are in the middle stage of life, and consideration should be given to planting in order to provide the next generation of trees.

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 Charles City indicate that 86% of the trees are in good health, with only 1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Additionally, 38% of Charles City's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 4% of the population. This 4% is an estimate of trees that need management follow up.

Management Needs

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

Crown Cleaning	210	3%
Tree Removal	62	<1%
Crown Reduction	18	<1%
Tree Staking	3	<1%
Crown Raising	1	<1%

Canopy Cover

The total canopy with both private and public trees is 26%, 1,055 acres. The canopy cover included in the Charles City inventory includes approximately 163 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Charles City's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

Land Use	
Single family residential	98%
Small commercial	1%
Industrial/Large commercial	<1%
Multifamily residential	<1%
Park/vacant/other	<1%

Location	
Planting strip	83%
Front yard	17%
Median	<1%
Cutout (surrounded by pavement)	<1%

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

Charles City has 11 critical concern trees that need immediate removal, 2 that need crown reduction, and 15 that need crown cleaning. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 13 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 266 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 62 removals, 6 are ash trees. There are a total of 1,448 ash trees, and 116 of those have signs and symptoms that have been associated with EAB. In addition, there are 323 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction.

Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

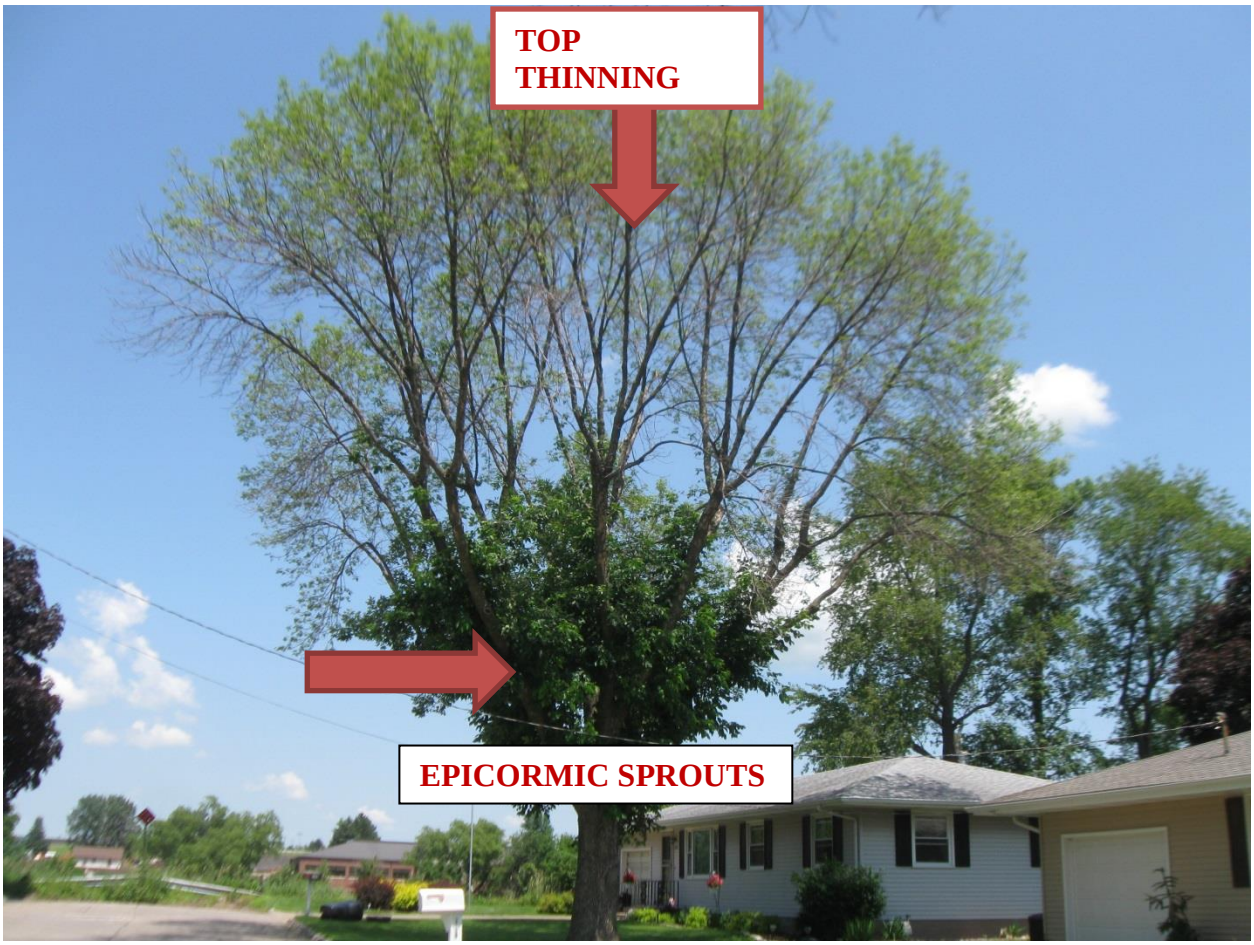
Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant at least 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same or greater number of trees helps ensure continuation of the benefits of the existing forest in Charles City.

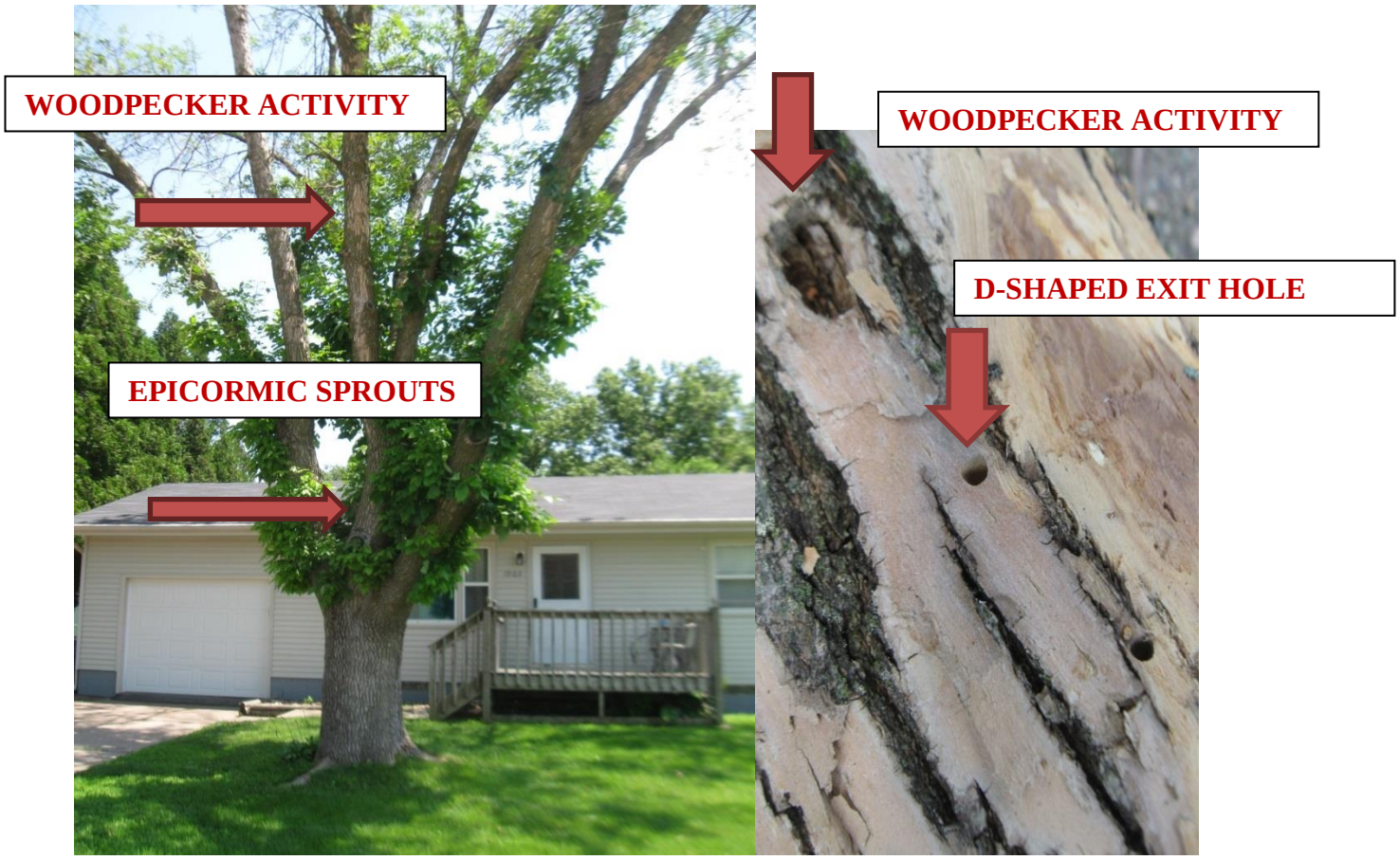
It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (49%) (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 because they are public nuisances include: any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring For EAB

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 decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage (See examples below). Once EAB arrives in Charles City, it could potentially kill all ash within 4 to 10 years of its arrival.



EAB infested tree in Muscatine with top thinning and many new green epicormic sprouts



EAB infested tree in Muscatine with sprouting, wood pecker activity, and D-shaped exit holes

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be an 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/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of 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.

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? The entire state of Iowa is under quarantine, so regulated articles may not be moved into non-quarantined states. For more information, please visit http://www.emeraldashborer.info/.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera 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. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”.

Six Year Maintenance Plan and Cost Estimates

Year 1 (FY 2016)

Remove 11 critical concern trees that need immediate attention	$4,400
Maintain 17 critical concern trees that need immediate attention (2 reduction, 15 cleaning)	$5,100
Remove 51 trees (marked for removal)	$20,400
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected), 736 trees in good condition, average 12–18" -$15 per inch, treated every two years, see note	avg. $225/tree
Visual Survey for signs and symptoms of EAB	

Year 2 (FY 2017)

Remove any new critical concern trees and ash in poor health	$400/tree
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected)	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 3 (FY 2018)

Remove any new critical concern trees and ash in poor health	$400/tree
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected)	
Visual Survey for signs and symptoms of EAB	

Year 4 (FY 2019)

Remove any new critical concern trees and ash in poor health	$400/tree
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected)	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 5 (FY 2020)

Remove any new critical concern trees and ash in poor health	$400/tree
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected)	
Visual Survey for signs and symptoms of EAB	

Year 6 (FY 2021)

Remove any new critical concern trees and ash in poor health	$400/tree
Plant and Maintain 75 trees in open locations (pursue grants)	$7,500
Ash tree treatment (if elected)	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

*****Reduction of ash in poor health will reduce exposure to Emerald Ash Borer over time. EAB could potentially kill all ash within 4 years of its arrival.
******Assuming a cost of $400 per tree for removal, the budget would need to be increased to $96,500 a year to remove all ash trees within 6 years.
*******Suggest a future (post ash removal and replacement) budget of at least $40,000. Currently, this amount would cover about 41% of what would be needed to remove EAB infested trees over a six year period. Suggest setting aside additional funds to prepare for the expected arrival of EAB. Planting could be at least partially dependent on receiving grant funds annually.

Proposed Budget Increase

EAB could potentially kill all ash trees in Charles City within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $96,500 a year. If the budget were increased to $44,600 a year all ash could be removed within 13 years. Additionally, it is recommended that Charles City apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For an example, if the average ash diameter is 20 inches and treatment costs $15 per inch, then treating 10 trees would cost about $3,000 (every other year treatment). This would be 10 trees selected for treatment, and Charles City would still need to find $400 per tree for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 every two years for treatment and leave five less trees for removal (for at least two more years). These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Charles City. It is suggested to consider increasing the budget to plan for this.

Works Cited

Census Bureau. 2010. http://censtats.census.gov/data/IA/1601964290.pdf (April, 2013)

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

Charles City

Annual Energy Benefits of Public Trees

3/20/2015

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	327.5	24,855	44,667.0	43,774	68,628	(N/A)	23.6	21.0	41.67
Green ash	293.4	22,270	37,748.7	36,994	59,264	(N/A)	19.7	18.1	43.04
Silver maple	236.1	17,919	30,732.7	30,118	48,037	(N/A)	11.7	14.7	58.72
Sugar maple	177.9	13,501	23,007.1	22,547	36,048	(N/A)	10.7	11.0	48.06
Northern hackberry	218.0	16,546	30,627.2	30,015	46,561	(N/A)	9.5	14.2	70.23
Pin oak	54.9	4,167	7,361.1	7,214	11,380	(N/A)	3.0	3.5	55.25
Littleleaf linden	34.4	2,610	4,656.0	4,563	7,173	(N/A)	2.8	2.2	37.36
American basswood	34.6	2,629	4,814.9	4,719	7,348	(N/A)	2.1	2.2	48.99
Honeylocust	41.2	3,127	5,300.2	5,194	8,321	(N/A)	2.1	2.5	57.79
Apple	7.7	581	1,213.7	1,189	1,771	(N/A)	1.9	0.5	13.42
Black walnut	25.9	1,969	3,442.9	3,374	5,343	(N/A)	1.7	1.6	45.28
Northern red oak	21.2	1,609	2,832.3	2,776	4,384	(N/A)	1.6	1.3	39.86
Black maple	22.4	1,698	2,901.8	2,844	4,542	(N/A)	1.4	1.4	47.81
Maple	2.3	175	345.6	339	514	(N/A)	1.0	0.2	7.44
Red maple	8.4	635	1,109.4	1,087	1,722	(N/A)	1.0	0.5	24.96
Bur oak	20.7	1,573	2,864.1	2,807	4,379	(N/A)	0.9	1.3	67.38
White ash	5.9	444	743.8	729	1,173	(N/A)	0.7	0.4	24.96
Catalpa	5.8	442	790.8	775	1,217	(N/A)	0.4	0.4	46.79
Spruce	2.3	177	301.8	296	473	(N/A)	0.3	0.1	20.56
Mountain ash	1.4	104	195.1	191	296	(N/A)	0.2	0.1	17.39
Black poplar	4.6	346	651.5	639	984	(N/A)	0.2	0.3	57.90
Eastern red cedar	1.4	103	204.1	200	303	(N/A)	0.2	0.1	20.20
American elm	2.1	157	277.6	272	429	(N/A)	0.2	0.1	30.65
Northern pin oak	3.1	237	443.3	434	672	(N/A)	0.2	0.2	47.97
Ohio buckeye	1.6	123	235.7	231	354	(N/A)	0.2	0.1	27.24
Elm	2.7	205	351.6	345	549	(N/A)	0.2	0.2	45.78
Black locust	3.3	250	479.0	469	719	(N/A)	0.2	0.2	59.93
Blue spruce	0.6	47	92.3	90	137	(N/A)	0.2	0.0	11.44
Amur maple	0.6	45	95.0	93	138	(N/A)	0.1	0.0	13.79
Chinese elm	1.8	140	244.4	240	380	(N/A)	0.1	0.1	37.96
Eastern white pine	0.9	67	116.2	114	181	(N/A)	0.1	0.1	20.15
Mulberry	1.1	83	178.4	175	258	(N/A)	0.1	0.1	28.69
Cherry plum	0.5	40	75.9	74	114	(N/A)	0.1	0.0	12.68
Cottonwood	2.8	213	389.5	382	595	(N/A)	0.1	0.2	74.35
Pear	0.2	17	38.9	38	55	(N/A)	0.1	0.0	6.90
Siberian elm	1.5	113	194.3	190	303	(N/A)	0.1	0.1	43.31
Southern magnolia	0.2	13	29.8	29	42	(N/A)	0.1	0.0	6.07
Eastern redbud	0.3	24	55.7	55	79	(N/A)	0.1	0.0	13.17
Ginkgo	1.3	98	165.8	163	260	(N/A)	0.1	0.1	43.34
Hickory	0.7	54	95.6	94	147	(N/A)	0.1	0.0	24.57
Swamp white oak	0.6	47	83.6	82	129	(N/A)	0.1	0.0	21.54
Black cherry	0.3	21	39.8	39	60	(N/A)	0.1	0.0	11.95
Quaking aspen	0.9	68	108.4	106	174	(N/A)	0.1	0.1	34.79
Northern white cedar	0.1	9	20.3	20	29	(N/A)	0.1	0.0	7.25
Boxelder	0.7	56	100.4	98	155	(N/A)	0.1	0.0	38.65
Willow	1.2	89	174.0	170	259	(N/A)	0.1	0.1	64.76
Black spruce	0.3	25	47.6	47	72	(N/A)	0.0	0.0	24.02
River birch	0.9	67	124.3	122	188	(N/A)	0.0	0.1	62.82
Broadleaf Deciduous Small	0.1	7	16.6	16	24	(N/A)	0.0	0.0	11.80
Norway spruce	0.2	16	28.6	28	44	(N/A)	0.0	0.0	21.89
Kentucky coffeetree	0.5	38	65.1	64	102	(N/A)	0.0	0.0	50.77
American sycamore	0.9	70	122.1	120	190	(N/A)	0.0	0.1	94.83
Amur corktree	0.3	21	35.7	35	56	(N/A)	0.0	0.0	27.88
Broadleaf Evergreen Mediur	0.5	35	48.4	47	83	(N/A)	0.0	0.0	41.29
Broadleaf Deciduous Mediu	0.5	36	59.0	58	94	(N/A)	0.0	0.0	46.78
American chestnut	0.8	59	107.4	105	164	(N/A)	0.0	0.1	82.02
Kwanzan cherry	0.1	11	25.7	25	36	(N/A)	0.0	0.0	18.19
Mimosa	0.0	2	3.8	4	5	(N/A)	0.0	0.0	5.40
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.0	0.0	24.14
White oak	0.0	0	0.5	0	1	(N/A)	0.0	0.0	0.66
Basswood	0.1	7	13.7	13	21	(N/A)	0.0	0.0	20.64
Eastern hophornbeam	0.2	14	24.7	24	38	(N/A)	0.0	0.0	38.13
Ash	0.3	24	47.4	46	71	(N/A)	0.0	0.0	70.84
Dogwood	0.0	2	3.8	4	5	(N/A)	0.0	0.0	5.40
Total	1,582.9	120,138	211,386.6	207,159	327,297	(N/A)	100.0	100.0	46.88

Table 2: Annual Stormwater Benefits

Charles City

Annual Stormwater Benefits of Public Trees

3/20/2015

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	2,330,205	63,149	(N/A)	23.6	16.5	38.34
Green ash	2,400,850	65,063	(N/A)	19.7	17.0	47.25
Silver maple	2,912,953	78,941	(N/A)	11.7	20.7	96.50
Sugar maple	1,572,780	42,622	(N/A)	10.7	11.2	56.83
Northern hackberry	1,930,103	52,306	(N/A)	9.5	13.7	78.89
Pin oak	510,971	13,847	(N/A)	3.0	3.6	67.22
Littleleaf linden	287,813	7,800	(N/A)	2.8	2.0	40.62
American basswood	298,884	8,100	(N/A)	2.1	2.1	54.00
Honeylocust	351,128	9,516	(N/A)	2.1	2.5	66.08
Apple	27,952	758	(N/A)	1.9	0.2	5.74
Black walnut	233,022	6,315	(N/A)	1.7	1.7	53.52
Northern red oak	186,487	5,054	(N/A)	1.6	1.3	45.94
Black maple	176,759	4,790	(N/A)	1.4	1.3	50.42
Maple	11,294	306	(N/A)	1.0	0.1	4.44
Red maple	50,945	1,381	(N/A)	1.0	0.4	20.01
Bur oak	281,910	7,640	(N/A)	0.9	2.0	117.53
White ash	39,998	1,084	(N/A)	0.7	0.3	23.06
Catalpa	63,095	1,710	(N/A)	0.4	0.4	65.76
Spruce	32,076	869	(N/A)	0.3	0.2	37.79
Mountain ash	4,901	133	(N/A)	0.2	0.0	7.81
Black poplar	50,459	1,367	(N/A)	0.2	0.4	80.44
Eastern red cedar	19,641	532	(N/A)	0.2	0.1	35.49
American elm	16,208	439	(N/A)	0.2	0.1	31.37
Northern pin oak	24,964	677	(N/A)	0.2	0.2	48.32
Ohio buckeye	9,240	250	(N/A)	0.2	0.1	19.26
Elm	24,682	669	(N/A)	0.2	0.2	55.74
Black locust	33,428	906	(N/A)	0.2	0.2	75.49
Blue spruce	7,533	204	(N/A)	0.2	0.1	17.01
Amur maple	2,068	56	(N/A)	0.1	0.0	5.60
Chinese elm	16,278	441	(N/A)	0.1	0.1	44.11
Eastern white pine	11,506	312	(N/A)	0.1	0.1	34.65
Mulberry	5,762	156	(N/A)	0.1	0.0	17.35
Cherry plum	1,814	49	(N/A)	0.1	0.0	5.46
Cottonwood	39,042	1,058	(N/A)	0.1	0.3	132.25
Pear	757	21	(N/A)	0.1	0.0	2.57
Siberian elm	12,529	340	(N/A)	0.1	0.1	48.50
Southern magnolia	1,015	27	(N/A)	0.1	0.0	3.93
Eastern redbud	1,134	31	(N/A)	0.1	0.0	5.12
Ginkgo	8,865	240	(N/A)	0.1	0.1	40.04
Hickory	4,505	122	(N/A)	0.1	0.0	20.35
Swamp white oak	3,591	97	(N/A)	0.1	0.0	16.22
Black cherry	941	26	(N/A)	0.1	0.0	5.10
Quaking aspen	5,612	152	(N/A)	0.1	0.0	30.42
Northern white cedar	1,289	35	(N/A)	0.1	0.0	8.73
Boxelder	6,642	180	(N/A)	0.1	0.0	45.00
Willow	12,487	338	(N/A)	0.1	0.1	84.60
Black spruce	5,493	149	(N/A)	0.0	0.0	49.62
River birch	8,938	242	(N/A)	0.0	0.1	80.74
Broadleaf Deciduous Small	333	9	(N/A)	0.0	0.0	4.51
Norway spruce	4,817	131	(N/A)	0.0	0.0	65.28
Kentucky coffeetree	4,056	110	(N/A)	0.0	0.0	54.96
American sycamore	14,478	392	(N/A)	0.0	0.1	196.17
Amur corktree	1,572	43	(N/A)	0.0	0.0	21.30
Broadleaf Evergreen Medium	3,551	96	(N/A)	0.0	0.0	48.11
Broadleaf Deciduous Medium	2,818	76	(N/A)	0.0	0.0	38.19
American chestnut	10,981	298	(N/A)	0.0	0.1	148.79
Kwanzan cherry	529	14	(N/A)	0.0	0.0	7.17
Mimosa	69	2	(N/A)	0.0	0.0	1.86
Scotch pine	1,539	42	(N/A)	0.0	0.0	41.70
White oak	18	0	(N/A)	0.0	0.0	0.48
Basswood	608	16	(N/A)	0.0	0.0	16.47
Eastern hophornbeam	667	18	(N/A)	0.0	0.0	18.06
Ash	3,764	102	(N/A)	0.0	0.0	102.01
Dogwood	69	2	(N/A)	0.0	0.0	1.86
Citywide total	14,090,418	381,850	(N/A)	100.0	100.0	54.70

Table 3: Annual Air Quality Benefits

Charles City

Annual Air Quality Benefits of Public Trees

3/20/2015

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	400.7	69.1	207.5	17.7	2,195	1,565.3	227.9	217.3	1,486.1	9,752	-100.8	-378	4,091.0	11,569 (N/A)	23.6	7.02
Green ash	228.9	36.6	122.1	10.3	1,255	1,379.3	202.4	193.4	1,330.0	8,647	0.0	0	3,503.0	9,901 (N/A)	19.7	7.19
Silver maple	447.7	75.9	226.5	19.8	2,433	1,110.3	162.8	155.4	1,068.4	6,954	-242.6	-910	3,024.3	8,478 (N/A)	11.7	10.36
Sugar maple	187.3	31.9	98.8	8.3	1,030	836.4	122.7	117.2	805.8	5,242	-151.6	-568	2,056.9	5,703 (N/A)	10.7	7.60
Northern hackberry	285.3	49.4	148.2	12.8	1,565	1,049.6	152.2	145.0	988.8	6,519	0.0	0	2,831.2	8,083 (N/A)	9.5	12.19
Pin oak	80.2	14.1	42.7	3.6	444	260.4	38.0	36.3	248.7	1,626	-153.6	-576	570.4	1,494 (N/A)	3.0	7.25
Littleleaf linden	43.7	7.5	22.4	1.9	239	164.1	23.9	22.8	156.1	1,023	-22.1	-83	420.3	1,179 (N/A)	2.8	6.14
American basswood	34.8	5.9	18.3	1.5	191	166.4	24.2	23.0	157.2	1,035	-31.6	-119	399.7	1,107 (N/A)	2.1	7.38
Honeylocust	64.7	10.7	30.3	2.9	344	193.4	28.4	27.1	186.6	1,213	-46.8	-176	497.3	1,381 (N/A)	2.1	9.59
Apple	6.4	1.1	3.3	0.3	35	38.0	5.4	5.2	34.7	233	0.0	0	94.3	268 (N/A)	1.9	2.03
Black walnut	24.0	3.8	12.4	1.1	130	122.9	18.0	17.1	117.6	768	0.0	0	316.8	898 (N/A)	1.7	7.61
Northern red oak	37.8	6.5	18.6	1.7	205	100.5	14.7	14.0	96.0	628	-53.6	-201	236.2	631 (N/A)	1.6	5.74
Black maple	40.9	7.0	19.2	1.8	218	105.3	15.4	14.7	101.3	660	-14.0	-52	291.6	825 (N/A)	1.4	8.68
Maple	1.2	0.2	0.8	0.1	7	11.2	1.6	1.5	10.4	69	-0.5	-2	26.5	74 (N/A)	1.0	1.08
Red maple	8.9	1.5	4.6	0.4	49	39.6	5.8	5.5	37.9	247	-3.4	-13	100.8	283 (N/A)	1.0	4.11
Bur oak	39.9	6.4	18.2	1.8	210	99.2	14.4	13.7	93.9	617	0.0	0	287.5	827 (N/A)	0.9	12.72
White ash	2.5	0.4	1.7	0.1	15	27.4	4.0	3.8	26.5	172	0.0	0	66.5	187 (N/A)	0.7	3.97
Catalpa	7.6	1.2	3.7	0.3	41	27.7	4.0	3.9	26.4	173	0.0	0	74.9	214 (N/A)	0.4	8.22
Spruce	3.5	0.7	3.0	0.4	23	11.0	1.6	1.5	10.6	69	-12.3	-46	20.0	46 (N/A)	0.3	1.99
Mountain ash	1.4	0.2	0.7	0.1	7	6.6	1.0	0.9	6.2	41	0.0	0	17.0	48 (N/A)	0.2	2.85
Black poplar	5.9	0.9	2.9	0.3	32	22.0	3.2	3.0	20.6	136	0.0	0	58.9	168 (N/A)	0.2	9.89
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)	0.2	1.66
American elm	1.3	0.2	0.8	0.1	8	9.8	1.4	1.4	9.4	61	0.0	0	24.4	69 (N/A)	0.2	4.93
Northern pin oak	4.6	0.8	2.3	0.2	25	15.1	2.2	2.1	14.2	94	-1.1	-4	40.3	114 (N/A)	0.2	8.17
Ohio buckeye	1.1	0.2	0.7	0.0	6	7.9	1.1	1.1	7.4	49	-0.3	-1	19.2	54 (N/A)	0.2	4.15
Elm	2.6	0.4	1.3	0.1	14	12.7	1.9	1.8	12.2	80	0.0	0	33.1	94 (N/A)	0.2	7.83
Black locust	7.2	1.2	3.5	0.3	39	16.0	2.3	2.2	14.9	99	-1.6	-6	45.9	131 (N/A)	0.2	10.94
Blue spruce	0.9	0.2	0.8	0.1	6	3.0	0.4	0.4	2.8	19	-2.5	-9	6.2	15 (N/A)	0.2	1.28
Amur maple	0.4	0.1	0.2	0.0	2	2.9	0.4	0.4	2.7	18	0.0	0	7.2	20 (N/A)	0.1	2.03
Chinese elm	1.6	0.3	0.8	0.1	9	8.7	1.3	1.2	8.4	55	0.0	0	22.4	63 (N/A)	0.1	6.35
Eastern white pine	1.2	0.2	1.1	0.2	8	4.2	0.6	0.6	4.0	26	-4.2	-16	7.9	19 (N/A)	0.1	2.07
Mulberry	1.9	0.3	0.9	0.1	10	5.5	0.8	0.7	5.0	34	0.0	0	15.2	44 (N/A)	0.1	4.85
Cherry plum	0.4	0.1	0.2	0.0	2	2.5	0.4	0.3	2.4	16	0.0	0	6.4	18 (N/A)	0.1	2.01
Cottonwood	5.6	0.9	2.5	0.2	29	13.5	2.0	1.9	12.7	84	0.0	0	39.2	113 (N/A)	0.1	14.12
Pear	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.0	7	0.0	0	2.7	8 (N/A)	0.1	0.94
Siberian elm	1.6	0.3	0.9	0.1	9	7.0	1.0	1.0	6.7	44	0.0	0	18.6	53 (N/A)	0.1	7.54
Southern magnolia	0.0	0.0	0.1	0.0	0	0.9	0.1	0.1	0.8	5	-0.2	-1	1.8	5 (N/A)	0.1	0.71
Eastern redbud	0.2	0.0	0.1	0.0	1	1.6	0.2	0.2	1.5	10	0.0	0	3.9	11 (N/A)	0.1	1.83
Ginkgo	2.4	0.4	1.2	0.1	13	6.0	0.9	0.8	5.8	38	-0.8	-3	17.0	48 (N/A)	0.1	8.01
Hickory	0.2	0.0	0.2	0.0	1	3.4	0.5	0.5	3.2	21	0.0	0	8.0	22 (N/A)	0.1	3.73
Swamp white oak	0.5	0.1	0.3	0.0	3	3.0	0.4	0.4	2.8	19	-0.1	-1	7.4	21 (N/A)	0.1	3.46
Black cherry	0.2	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9 (N/A)	0.1	1.88
Quaking aspen	0.4	0.1	0.2	0.0	2	4.1	0.6	0.6	4.0	26	0.0	0	10.1	28 (N/A)	0.1	5.65
Northern white cedar	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	4	-0.4	-1	1.2	3 (N/A)	0.1	0.76
Boxelder	0.7	0.1	0.4	0.0	4	3.5	0.5	0.5	3.4	22	-0.3	-1	8.8	25 (N/A)	0.1	6.18
Willow	2.7	0.5	1.3	0.1	15	5.7	0.8	0.8	5.3	35	-0.6	-2	16.6	47 (N/A)	0.1	11.87
Black spruce	0.9	0.2	0.7	0.1	6	1.6	0.2	0.2	1.5	10	-2.1	-8	3.4	8 (N/A)	0.0	2.67
River birch	1.9	0.3	0.9	0.1	10	4.2	0.6	0.6	4.0	26	-0.4	-2	12.3	35 (N/A)	0.0	11.69
Broadleaf Deciduous Small	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)	0.0	1.63
Norway spruce	0.6	0.1	0.5	0.1	4	1.0	0.1	0.1	0.9	6	-2.9	-11	0.5	-1 (N/A)	0.0	-0.51
Kentucky coffeetree	0.4	0.1	0.2	0.0	2	2.3	0.3	0.3	2.3	15	0.0	0	5.9	17 (N/A)	0.0	8.38
American sycamore	2.7	0.4	1.2	0.1	14	4.4	0.6	0.6	4.2	27	0.0	0	14.3	42 (N/A)	0.0	20.79
Amur corktree	0.2	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	-0.1	0	3.2	9 (N/A)	0.0	4.56
Broadleaf Evergreen Medium	0.2	0.0	0.3	0.0	2	2.1	0.3	0.3	2.1	13	-1.0	-4	4.3	11 (N/A)	0.0	5.49
Broadleaf Deciduous Medium	0.4	0.1	0.2	0.0	2	2.2	0.3	0.3	2.1	14	-0.1	0	5.6	16 (N/A)	0.0	7.92
American chestnut	1.6	0.3	0.7	0.1	8	3.7	0.5	0.5	3.5	23	0.0	0	10.9	31 (N/A)	0.0	15.71
Kwanzan 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)	0.0	2.55
Mimosa	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.71
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)	0.0	2.82
White oak	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)	0.0	0.08
Basswood	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)	0.0	2.99
Eastern hophornbeam	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)	0.0	6.56
Ash	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14 (N/A)	0.0	13.58
Dogwood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.71
Citywide total	2,005.5	340.0	1,034.5	90.2	10,958	7,511.1	1,097.1	1,046.8	7,174.9	46,908	-863.5	-3,238	19,436.7	54,628 (N/A)	100.0	7.83

Table 4: Annual Carbon Stored

Charles City

Stored CO2 Benefits of Public Trees

3/20/2015

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	6,682,174	50,116	(N/A)	23.6	15.3	30.43
Green ash	7,532,347	56,493	(N/A)	19.7	17.2	41.03
Silver maple	9,708,987	72,817	(N/A)	11.7	22.2	89.02
Sugar maple	5,356,637	40,175	(N/A)	10.7	12.2	53.57
Northern hackberry	4,180,618	31,355	(N/A)	9.5	9.6	47.29
Pin oak	2,028,826	15,216	(N/A)	3.0	4.6	73.87
Littleleaf linden	955,747	7,168	(N/A)	2.8	2.2	37.33
American basswood	1,268,142	9,511	(N/A)	2.1	2.9	63.41
Honeylocust	814,044	6,105	(N/A)	2.1	1.9	42.40
Apple	110,418	828	(N/A)	1.9	0.3	6.27
Black walnut	784,286	5,882	(N/A)	1.7	1.8	49.85
Northern red oak	782,324	5,867	(N/A)	1.6	1.8	53.34
Black maple	446,180	3,346	(N/A)	1.4	1.0	35.22
Maple	19,284	145	(N/A)	1.0	0.0	2.10
Red maple	107,830	809	(N/A)	1.0	0.2	11.72
Bur oak	1,310,298	9,827	(N/A)	0.9	3.0	151.19
White ash	81,656	612	(N/A)	0.7	0.2	13.03
Catalpa	249,422	1,871	(N/A)	0.4	0.6	71.95
Spruce	27,129	203	(N/A)	0.3	0.1	8.85
Mountain ash	20,983	157	(N/A)	0.2	0.0	9.26
Black poplar	190,202	1,427	(N/A)	0.2	0.4	83.91
Eastern red cedar	12,406	93	(N/A)	0.2	0.0	6.20
American elm	39,643	297	(N/A)	0.2	0.1	21.24
Northern pin oak	75,429	566	(N/A)	0.2	0.2	40.41
Ohio buckeye	20,115	151	(N/A)	0.2	0.0	11.60
Elm	86,560	649	(N/A)	0.2	0.2	54.10
Black locust	117,866	884	(N/A)	0.2	0.3	73.67
Blue spruce	6,682	50	(N/A)	0.2	0.0	4.18
Amur maple	7,558	57	(N/A)	0.1	0.0	5.67
Chinese elm	53,285	400	(N/A)	0.1	0.1	39.96
Eastern white pine	9,050	68	(N/A)	0.1	0.0	7.54
Mulberry	30,616	230	(N/A)	0.1	0.1	25.51
Cherry plum	7,319	55	(N/A)	0.1	0.0	6.10
Cottonwood	182,637	1,370	(N/A)	0.1	0.4	171.22
Pear	2,391	18	(N/A)	0.1	0.0	2.24
Siberian elm	40,771	306	(N/A)	0.1	0.1	43.68
Southern magnolia	502	4	(N/A)	0.1	0.0	0.54
Eastern redbud	3,823	29	(N/A)	0.1	0.0	4.78
Ginkgo	34,775	261	(N/A)	0.1	0.1	43.47
Hickory	8,844	66	(N/A)	0.1	0.0	11.06
Swamp white oak	8,601	65	(N/A)	0.1	0.0	10.75
Black cherry	3,748	28	(N/A)	0.1	0.0	5.62
Quaking aspen	13,085	98	(N/A)	0.1	0.0	19.63
Northern white cedar	518	4	(N/A)	0.1	0.0	0.97
Boxelder	20,615	155	(N/A)	0.1	0.0	38.65
Willow	44,451	333	(N/A)	0.1	0.1	83.35
Black spruce	7,598	57	(N/A)	0.0	0.0	18.99
River birch	32,184	241	(N/A)	0.0	0.1	80.46
Broadleaf Deciduous	1,086	8	(N/A)	0.0	0.0	4.07
Norway spruce	7,528	56	(N/A)	0.0	0.0	28.23
Kentucky coffeetree	12,130	91	(N/A)	0.0	0.0	45.49
American sycamore	95,241	714	(N/A)	0.0	0.2	357.15
Amur corktree	3,843	29	(N/A)	0.0	0.0	14.41
Broadleaf Evergreen !	3,701	28	(N/A)	0.0	0.0	13.88
Broadleaf Deciduous	7,248	54	(N/A)	0.0	0.0	27.18
American chestnut	51,886	389	(N/A)	0.0	0.1	194.57
Kwanzan cherry	1,816	14	(N/A)	0.0	0.0	6.81
Mimosa	178	1	(N/A)	0.0	0.0	1.33
Scotch pine	1,170	9	(N/A)	0.0	0.0	8.78
White oak	12	0	(N/A)	0.0	0.0	0.09
Basswood	1,035	8	(N/A)	0.0	0.0	7.76
Eastern hophornbeam	3,037	23	(N/A)	0.0	0.0	22.78
Ash	14,280	107	(N/A)	0.0	0.0	107.10
Dogwood	178	1	(N/A)	0.0	0.0	1.33
Citywide total	43,732,976	327,997	(N/A)	100.0	100.0	46.98

Table 5: Annual Carbon Sequestered

Charles City

Annual CO Benefits of Public Trees

3/20/2015

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	535,611	4,017	-32,120	-3,082	-264	549,280	4,120	1,049,688	7,873 (N/A)	23.6	18.0	4.78
Green ash	638,108	4,786	-36,155	-2,828	-292	492,159	3,691	1,091,283	8,185 (N/A)	19.7	18.7	5.94
Silver maple	835,012	6,263	-46,610	-2,424	-368	396,004	2,970	1,181,982	8,865 (N/A)	11.7	20.2	10.84
Sugar maple	333,706	2,503	-25,723	-1,769	-206	298,362	2,238	604,575	4,534 (N/A)	10.7	10.4	6.05
Northern hackberry	259,517	1,946	-20,067	-1,971	-165	365,666	2,742	603,144	4,524 (N/A)	9.5	10.3	6.82
Pin oak	203,599	1,527	-9,738	-551	-77	92,082	691	285,392	2,140 (N/A)	3.0	4.9	10.39
Littleleaf linden	104,531	784	-4,589	-390	-37	57,690	433	157,243	1,179 (N/A)	2.8	2.7	6.14
American basswood	84,084	631	-6,087	-375	-48	58,109	436	135,730	1,018 (N/A)	2.1	2.3	6.79
Honeylocust	110,626	830	-3,907	-316	-32	69,112	518	175,514	1,316 (N/A)	2.1	3.0	9.14
Apple	12,137	91	-532	-118	-5	12,848	96	24,335	183 (N/A)	1.9	0.4	1.38
Black walnut	58,804	441	-3,765	-259	-30	43,512	326	98,292	737 (N/A)	1.7	1.7	6.25
Northern red oak	29,035	218	-3,755	-255	-30	35,553	267	60,578	454 (N/A)	1.6	1.0	4.13
Black maple	38,388	288	-2,142	-195	-18	37,522	281	73,573	552 (N/A)	1.4	1.3	5.81
Maple	3,024	23	-95	-34	-1	3,865	29	6,761	51 (N/A)	1.0	0.1	0.73
Red maple	12,943	97	-518	-80	-4	14,039	105	26,384	198 (N/A)	1.0	0.5	2.87
Bur oak	49,960	375	-6,290	-228	-49	34,755	261	78,197	586 (N/A)	0.9	1.3	9.02
White ash	11,676	88	-394	-60	-3	9,820	74	21,041	158 (N/A)	0.7	0.4	3.36
Catalpa	13,826	104	-1,197	-62	-9	9,758	73	22,325	167 (N/A)	0.4	0.4	6.44
Spruce	2,330	17	-130	-40	-1	3,912	29	6,071	46 (N/A)	0.3	0.1	1.98
Mountain ash	2,058	15	-101	-18	-1	2,308	17	4,247	32 (N/A)	0.2	0.1	1.87
Black poplar	11,542	87	-913	-49	-7	7,640	57	18,221	137 (N/A)	0.2	0.3	8.04
Eastern red cedar	499	4	-60	-25	-1	2,278	17	2,693	20 (N/A)	0.2	0.0	1.35
American elm	2,460	18	-190	-23	-2	3,470	26	5,717	43 (N/A)	0.2	0.1	3.06
Northern pin oak	5,321	40	-362	-30	-3	5,241	39	10,170	76 (N/A)	0.2	0.2	5.45
Ohio buckeye	3,141	24	-98	-16	-1	2,721	20	5,747	43 (N/A)	0.2	0.1	3.32
Elm	6,051	45	-415	-27	-3	4,526	34	10,136	76 (N/A)	0.2	0.2	6.33
Black locust	4,626	35	-566	-34	-5	5,517	41	9,543	72 (N/A)	0.2	0.2	5.96
Blue spruce	426	3	-32	-12	0	1,034	8	1,417	11 (N/A)	0.2	0.0	0.89
Amur maple	913	7	-36	-10	0	991	7	1,858	14 (N/A)	0.1	0.0	1.39
Chinese elm	4,204	32	-256	-19	-2	3,095	23	7,024	53 (N/A)	0.1	0.1	5.27
Eastern white pine	860	6	-43	-15	0	1,490	11	2,291	17 (N/A)	0.1	0.0	1.91
Mulberry	464	3	-147	-19	-1	1,841	14	2,140	16 (N/A)	0.1	0.0	1.78
Cherry plum	801	6	-35	-8	0	877	7	1,635	12 (N/A)	0.1	0.0	1.36
Cottonwood	6,926	52	-877	-31	-7	4,709	35	10,727	80 (N/A)	0.1	0.2	10.06
Pear	368	3	-12	-5	0	377	3	728	5 (N/A)	0.1	0.0	0.68
Siberian elm	2,548	19	-196	-15	-2	2,491	19	4,828	36 (N/A)	0.1	0.1	5.17
Southern magnolia	65	0	-2	-2	0	294	2	354	3 (N/A)	0.1	0.0	0.38
Eastern redbud	502	4	-18	-5	0	539	4	1,018	8 (N/A)	0.1	0.0	1.27
Ginkgo	1,545	12	-167	-18	-1	2,155	16	3,515	26 (N/A)	0.1	0.1	4.39
Hickory	1,489	11	-42	-8	0	1,187	9	2,626	20 (N/A)	0.1	0.0	3.28
Swamp white oak	1,102	8	-42	-6	0	1,045	8	2,099	16 (N/A)	0.1	0.0	2.62
Black cherry	419	3	-18	-4	0	457	3	854	6 (N/A)	0.1	0.0	1.28
Quaking aspen	1,754	13	-63	-8	-1	1,496	11	3,179	24 (N/A)	0.1	0.1	4.77
Northern white cedar	112	1	-3	-3	0	201	2	308	2 (N/A)	0.1	0.0	0.58
Boxelder	1,988	15	-99	-9	-1	1,241	9	3,122	23 (N/A)	0.1	0.1	5.85
Willow	940	7	-213	-14	-2	1,957	15	2,670	20 (N/A)	0.1	0.0	5.01
Black spruce	159	1	-36	-7	0	561	4	677	5 (N/A)	0.0	0.0	1.69
River birch	1,126	8	-154	-9	-1	1,472	11	2,435	18 (N/A)	0.0	0.0	6.09
Broadleaf Deciduous Smal	152	1	-5	-2	0	161	1	306	2 (N/A)	0.0	0.0	1.15
Norway spruce	274	2	-36	-4	0	349	3	583	4 (N/A)	0.0	0.0	2.18
Kentucky coffeetree	1,105	8	-58	-5	0	834	6	1,876	14 (N/A)	0.0	0.0	7.04
American sycamore	1,391	10	-457	-11	-4	1,547	12	2,470	19 (N/A)	0.0	0.0	9.26
Amur corktree	482	4	-19	-3	0	460	3	919	7 (N/A)	0.0	0.0	3.45
Broadleaf Evergreen Medi	286	2	-18	-4	0	776	6	1,040	8 (N/A)	0.0	0.0	3.90
Broadleaf Deciduous Medi	772	6	-35	-4	0	790	6	1,523	11 (N/A)	0.0	0.0	5.71
American chestnut	1,919	14	-249	-9	-2	1,300	10	2,962	22 (N/A)	0.0	0.1	11.11
Kwanzan cherry	228	2	-9	-2	0	248	2	465	3 (N/A)	0.0	0.0	1.74
Mimosa	38	0	-1	-1	0	37	0	74	1 (N/A)	0.0	0.0	0.55
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	0.0	0.0	2.43
White oak	3	0	0	0	0	4	0	7	0 (N/A)	0.0	0.0	0.05
Basswood	209	2	-5	-1	0	159	1	361	3 (N/A)	0.0	0.0	2.71
Eastern hophornbeam	268	2	-15	-2	0	308	2	560	4 (N/A)	0.0	0.0	4.20
Ash	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.0	0.0	6.27
Dogwood	38	0	-1	-1	0	37	0	74	1 (N/A)	0.0	0.0	0.55
Citywide total	3,408,975	25,567	-209,994	-15,540	-1,692	2,655,027	19,913	5,838,468	43,789 (N/A)	100.0	100.0	6.27

Table 6: Annual Social and Aesthetic Benefits

Charles City

Annual Aesthetic/Other Benefits of Public Trees

3/20/2015

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	54,681	(N/A)	23.6	15.6	33.20
Green ash	61,920	(N/A)	19.7	17.6	44.97
Silver maple	70,796	(N/A)	11.7	20.1	86.55
Sugar maple	37,122	(N/A)	10.7	10.6	49.50
Northern hackberry	36,199	(N/A)	9.5	10.3	54.60
Pin oak	17,000	(N/A)	3.0	4.8	82.52
Littleleaf linden	11,188	(N/A)	2.8	3.2	58.27
American basswood	6,607	(N/A)	2.1	1.9	44.05
Honeylocust	25,709	(N/A)	2.1	7.3	178.53
Apple	675	(N/A)	1.9	0.2	5.11
Black walnut	5,500	(N/A)	1.7	1.6	46.61
Northern red oak	2,278	(N/A)	1.6	0.6	20.71
Black maple	5,054	(N/A)	1.4	1.4	53.20
Maple	535	(N/A)	1.0	0.2	7.75
Red maple	1,998	(N/A)	1.0	0.6	28.96
Bur oak	3,653	(N/A)	0.9	1.0	56.20
White ash	1,790	(N/A)	0.7	0.5	38.09
Catalpa	1,188	(N/A)	0.4	0.3	45.71
Spruce	641	(N/A)	0.3	0.2	27.85
Mountain ash	116	(N/A)	0.2	0.0	6.83
Black poplar	958	(N/A)	0.2	0.3	56.33
Eastern red cedar	202	(N/A)	0.2	0.1	13.50
American elm	401	(N/A)	0.2	0.1	28.66
Northern pin oak	521	(N/A)	0.2	0.1	37.23
Ohio buckeye	353	(N/A)	0.2	0.1	27.16
Elm	557	(N/A)	0.2	0.2	46.38
Black locust	422	(N/A)	0.2	0.1	35.20
Blue spruce	170	(N/A)	0.2	0.0	14.16
Amur maple	51	(N/A)	0.1	0.0	5.14
Chinese elm	404	(N/A)	0.1	0.1	40.35
Eastern white pine	238	(N/A)	0.1	0.1	26.45
Mulberry	26	(N/A)	0.1	0.0	2.85
Cherry plum	45	(N/A)	0.1	0.0	5.04
Cottonwood	495	(N/A)	0.1	0.1	61.84
Pear	19	(N/A)	0.1	0.0	2.38
Siberian elm	227	(N/A)	0.1	0.1	32.40
Southern magnolia	22	(N/A)	0.1	0.0	3.14
Eastern redbud	28	(N/A)	0.1	0.0	4.62
Ginkgo	116	(N/A)	0.1	0.0	19.32
Hickory	189	(N/A)	0.1	0.1	31.44
Swamp white oak	123	(N/A)	0.1	0.0	20.48
Black cherry	24	(N/A)	0.1	0.0	4.74
Quaking aspen	195	(N/A)	0.1	0.1	38.94
Northern white cedar	42	(N/A)	0.1	0.0	10.59
Boxelder	170	(N/A)	0.1	0.0	42.43
Willow	86	(N/A)	0.1	0.0	21.53
Black spruce	32	(N/A)	0.0	0.0	10.76
River birch	102	(N/A)	0.0	0.0	34.03
Broadleaf Deciduous Small	8	(N/A)	0.0	0.0	4.23
Norway spruce	33	(N/A)	0.0	0.0	16.54
Kentucky coffeetree	104	(N/A)	0.0	0.0	51.77
American sycamore	87	(N/A)	0.0	0.0	43.45
Amur corktree	52	(N/A)	0.0	0.0	26.02
Broadleaf Evergreen Medium	70	(N/A)	0.0	0.0	34.98
Broadleaf Deciduous Medium	78	(N/A)	0.0	0.0	39.16
American chestnut	133	(N/A)	0.0	0.0	66.60
Kwanzan cherry	13	(N/A)	0.0	0.0	6.40
Mimosa	2	(N/A)	0.0	0.0	2.06
Scotch pine	32	(N/A)	0.0	0.0	32.32
White oak	5	(N/A)	0.0	0.0	5.26
Basswood	29	(N/A)	0.0	0.0	28.56
Eastern hophornbeam	15	(N/A)	0.0	0.0	15.48
Ash	31	(N/A)	0.0	0.0	31.46
Dogwood	2	(N/A)	0.0	0.0	2.06
Citywide total	351,561	(N/A)	100.0	100.0	50.36

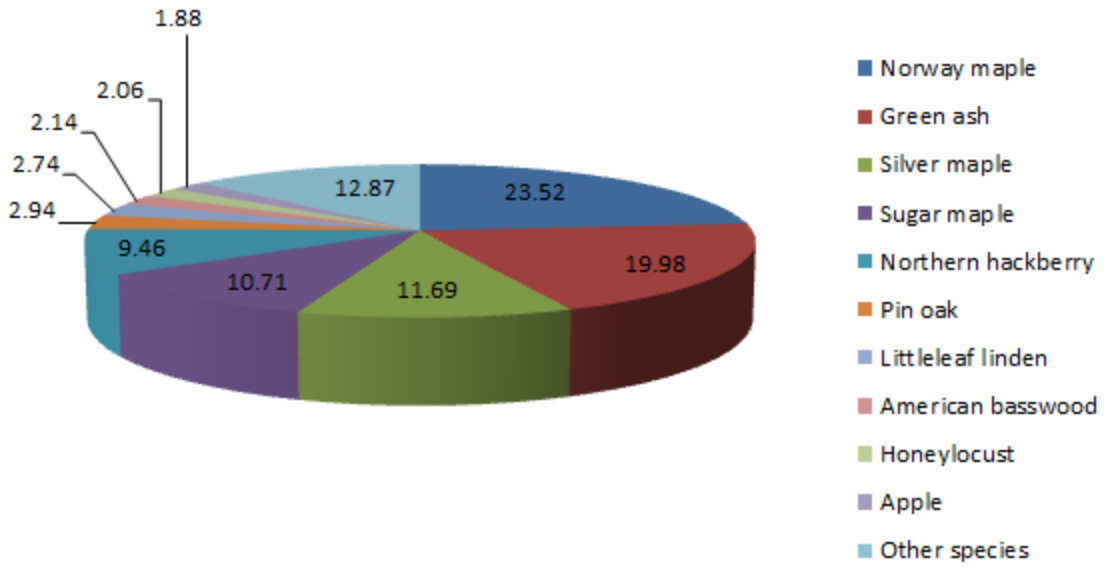
Table 7: Summary of Benefits in Dollars

Charles City

Total Annual Benefits of Public Trees by Species ($)

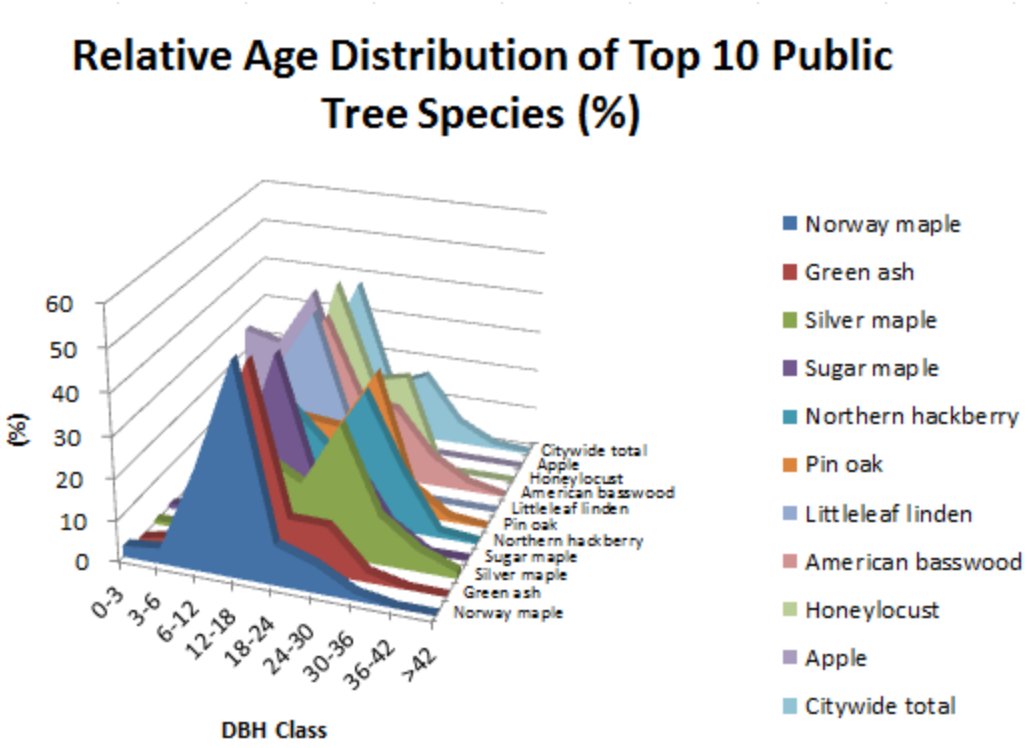
3/20/2015

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	68,628	7,873	11,569	63,149	54,681	205,899	(N/A)	17.8
Green ash	59,264	8,185	9,901	65,063	61,920	204,332	(N/A)	17.6
Silver maple	48,037	8,865	8,478	78,941	70,796	215,116	(N/A)	18.6
Sugar maple	36,048	4,534	5,703	42,622	37,122	126,029	(N/A)	10.9
Northern hackberry	46,561	4,524	8,083	52,306	36,199	147,672	(N/A)	12.7
Pin oak	11,380	2,140	1,494	13,847	17,000	45,861	(N/A)	4.0
Littleleaf linden	7,173	1,179	1,179	7,800	11,188	28,519	(N/A)	2.5
American basswood	7,348	1,018	1,107	8,100	6,607	24,180	(N/A)	2.1
Honeylocust	8,321	1,316	1,381	9,516	25,709	46,243	(N/A)	4.0
Apple	1,771	183	268	758	675	3,654	(N/A)	0.3
Black walnut	5,343	737	898	6,315	5,500	18,793	(N/A)	1.6
Northern red oak	4,384	454	631	5,054	2,278	12,802	(N/A)	1.1
Black maple	4,542	552	825	4,790	5,054	15,763	(N/A)	1.4
Maple	514	51	74	306	535	1,480	(N/A)	0.1
Red maple	1,722	198	283	1,381	1,998	5,583	(N/A)	0.5
Bur oak	4,379	586	827	7,640	3,653	17,086	(N/A)	1.5
White ash	1,173	158	187	1,084	1,790	4,392	(N/A)	0.4
Catalpa	1,217	167	214	1,710	1,188	4,496	(N/A)	0.4
Spruce	473	46	46	869	641	2,074	(N/A)	0.2
Mountain ash	296	32	48	133	116	625	(N/A)	0.1
Black poplar	984	137	168	1,367	958	3,614	(N/A)	0.3
Eastern red cedar	303	20	25	532	202	1,083	(N/A)	0.1
American elm	429	43	69	439	401	1,381	(N/A)	0.1
Northern pin oak	672	76	114	677	521	2,060	(N/A)	0.2
Ohio buckeye	354	43	54	250	353	1,055	(N/A)	0.1
Elm	549	76	94	669	557	1,945	(N/A)	0.2
Black locust	719	72	131	906	422	2,250	(N/A)	0.2
Blue spruce	137	11	15	204	170	537	(N/A)	0.0
Amur maple	138	14	20	56	51	280	(N/A)	0.0
Chinese elm	380	53	63	441	404	1,340	(N/A)	0.1
Eastern white pine	181	17	19	312	238	767	(N/A)	0.1
Mulberry	258	16	44	156	26	500	(N/A)	0.0
Cherry plum	114	12	18	49	45	239	(N/A)	0.0
Cottonwood	595	80	113	1,058	495	2,341	(N/A)	0.2
Pear	55	5	8	21	19	108	(N/A)	0.0
Siberian elm	303	36	53	340	227	958	(N/A)	0.1
Southern magnolia	42	3	5	27	22	100	(N/A)	0.0
Eastern redbud	79	8	11	31	28	156	(N/A)	0.0
Ginkgo	260	26	48	240	116	691	(N/A)	0.1
Hickory	147	20	22	122	189	500	(N/A)	0.0
Swamp white oak	129	16	21	97	123	386	(N/A)	0.0
Black cherry	60	6	9	26	24	125	(N/A)	0.0
Quaking aspen	174	24	28	152	195	573	(N/A)	0.0
Northern white cedar	29	2	3	35	42	112	(N/A)	0.0
Boxelder	155	23	25	180	170	552	(N/A)	0.0
Willow	259	20	47	338	86	751	(N/A)	0.1
Black spruce	72	5	8	149	32	266	(N/A)	0.0
River birch	188	18	35	242	102	586	(N/A)	0.1
Broadleaf Deciduous Sm	24	2	3	9	8	47	(N/A)	0.0
Norway spruce	44	4	-1	131	33	211	(N/A)	0.0
Kentucky coffeetree	102	14	17	110	104	346	(N/A)	0.0
American sycamore	190	19	42	392	87	729	(N/A)	0.1
Amur corktree	56	7	9	43	52	166	(N/A)	0.0
Broadleaf Evergreen Me	83	8	11	96	70	268	(N/A)	0.0
Broadleaf Deciduous M	94	11	16	76	78	276	(N/A)	0.0
American chestnut	164	22	31	298	133	648	(N/A)	0.1
Kwanzan cherry	36	3	5	14	13	72	(N/A)	0.0
Mimosa	5	1	1	2	2	11	(N/A)	0.0
Scotch pine	24	2	3	42	32	103	(N/A)	0.0
White oak	1	0	0	0	5	7	(N/A)	0.0
Basswood	21	3	3	16	29	71	(N/A)	0.0
Eastern hophornbeam	38	4	7	18	15	82	(N/A)	0.0
Ash	71	6	14	102	31	224	(N/A)	0.0
Dogwood	5	1	1	2	2	11	(N/A)	0.0
Citywide Total	327,297	43,789	54,628	381,850	351,561	1,159,125	(N/A)	100.0



Charles City	
Species Distribution of Public Trees (%)	
3/6/2015	
Species	Percent
Norway maple	23.52
Green ash	19.98
Silver maple	11.69
Sugar maple	10.71
Northern hackberry	9.46
Pin oak	2.94
Littleleaf linden	2.74
American basswood	2.14
Honeylocust	2.06
Apple	1.88
Other species	12.87
Total	100.00

Figure 1: Species Distribution



Charles City

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

3/6/2015

DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	2.73	3.76	24.88	50.79	9.65	6.61	1.58	0.00	0.00
Green ash	0.43	2.50	23.71	47.43	11.86	11.71	2.21	0.14	0.00
Silver maple	0.85	1.10	9.77	21.49	16.48	31.99	11.72	5.01	1.59
Sugar maple	0.93	2.13	14.67	42.40	13.87	19.60	6.00	0.13	0.27
Northern hackberry	0.00	0.15	5.13	27.00	18.10	32.73	15.08	1.36	0.45
Pin oak	0.00	2.91	15.05	20.39	19.42	33.98	7.28	0.97	0.00
Littleleaf linden	0.00	1.04	28.13	42.71	16.15	11.98	0.00	0.00	0.00
American basswood	0.00	0.00	14.67	38.67	19.33	18.00	7.33	2.00	0.00
Honeylocust	0.00	0.00	12.50	43.75	20.83	22.92	0.00	0.00	0.00
Apple	25.76	23.48	37.88	11.36	1.52	0.00	0.00	0.00	0.00
Citywide total	2.54	3.70	19.47	38.01	12.85	16.67	5.51	0.98	0.27

Figure 2: Relative Age Class

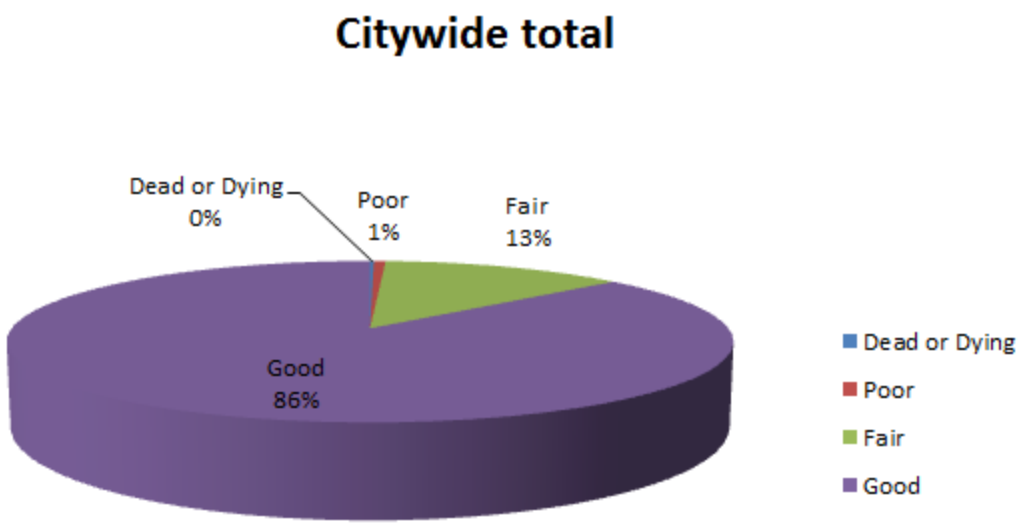


Figure 3: Foliage Condition

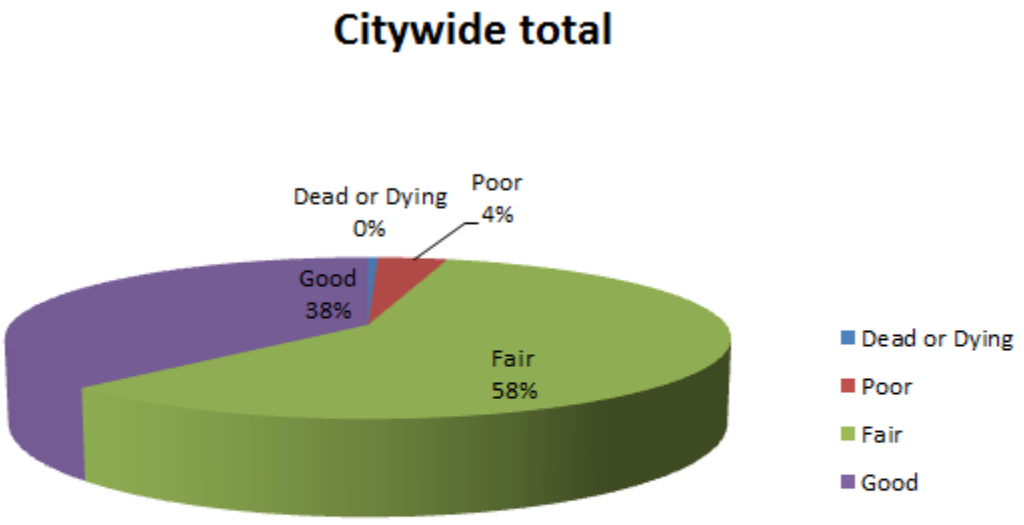
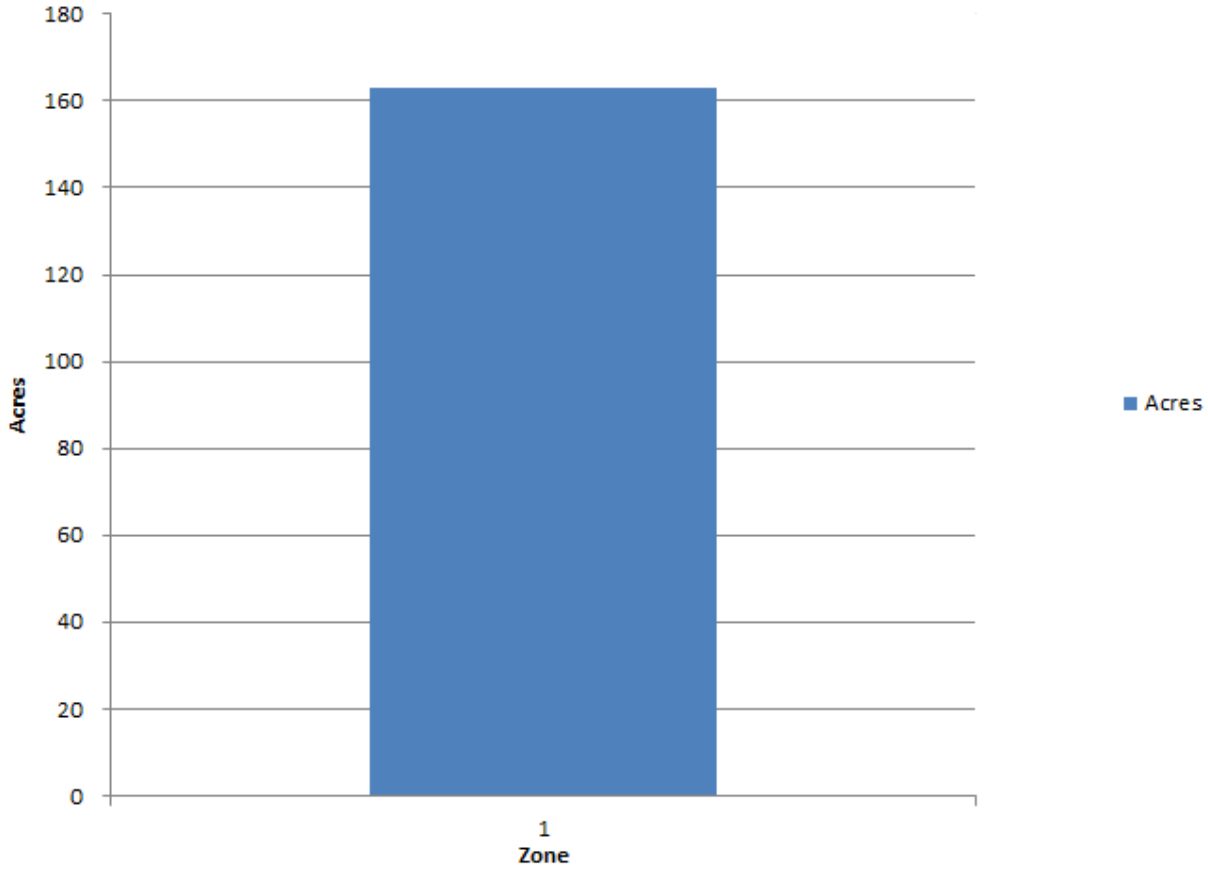
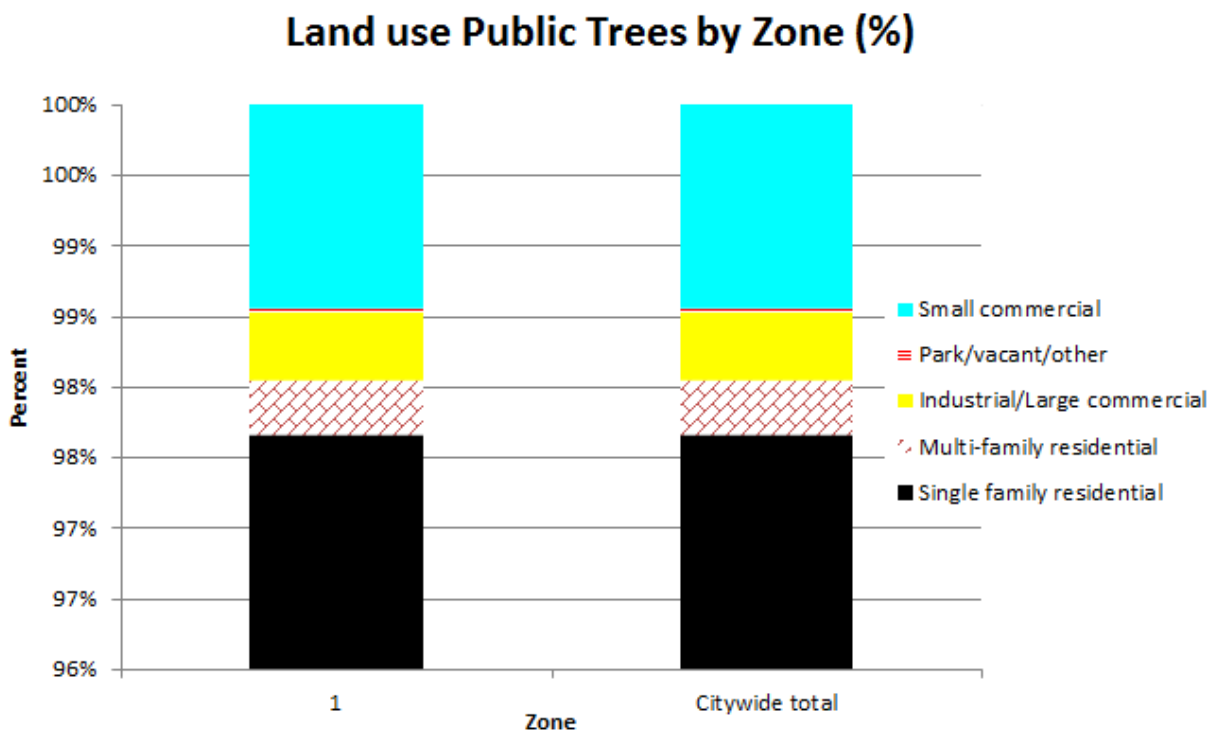


Figure 4: Wood Condition



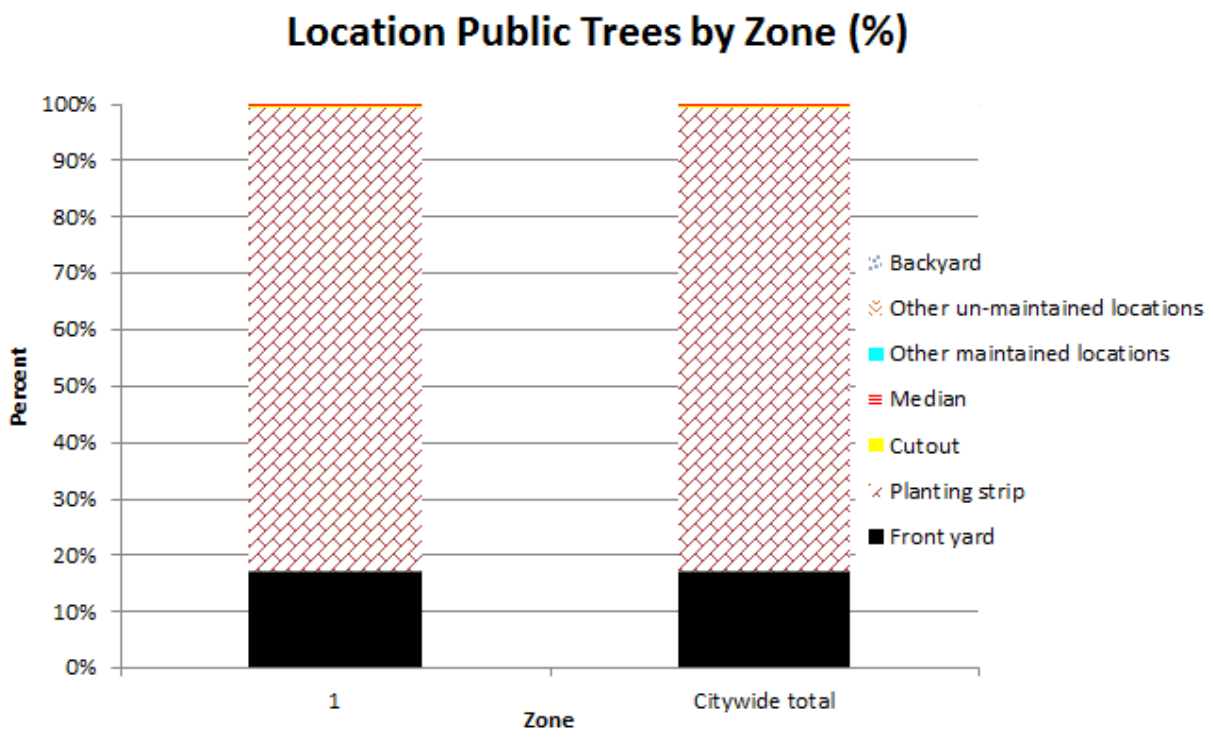
Zone	Acres	% of Total Canopy
1	163.15	100.00
Citywide total	163.15	100.00

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/Large commercial	Park/vacant/other	Small commercial
1	97.66	0.39	0.49	0.03	1.44
Citywide total	97.66	0.39	0.49	0.03	1.44

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	16.76	82.73	0.06	0.46	0.00	0.00	0.00
Citywide total	16.76	82.73	0.06	0.46	0.00	0.00	0.00

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

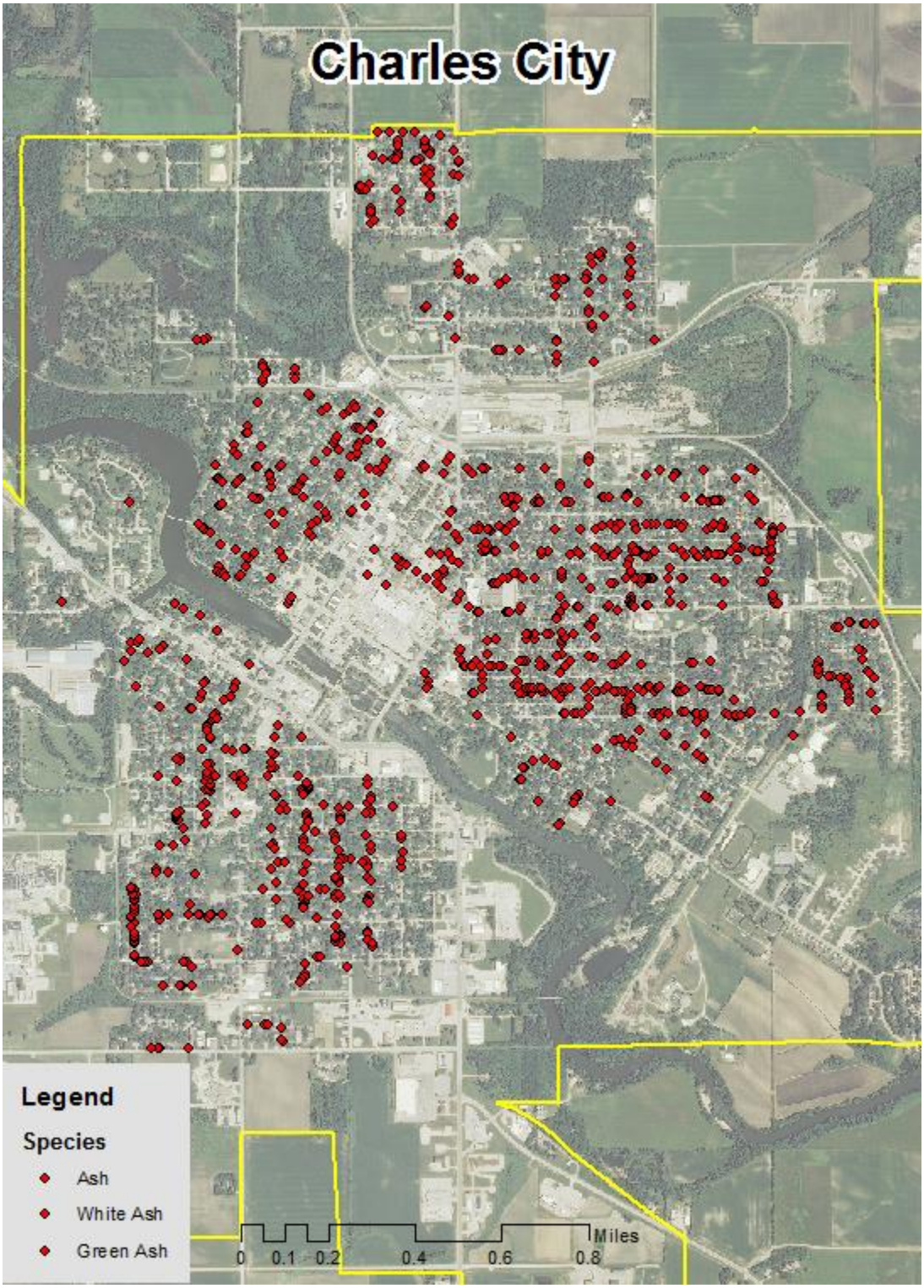


Figure 1: Location of Ash Trees

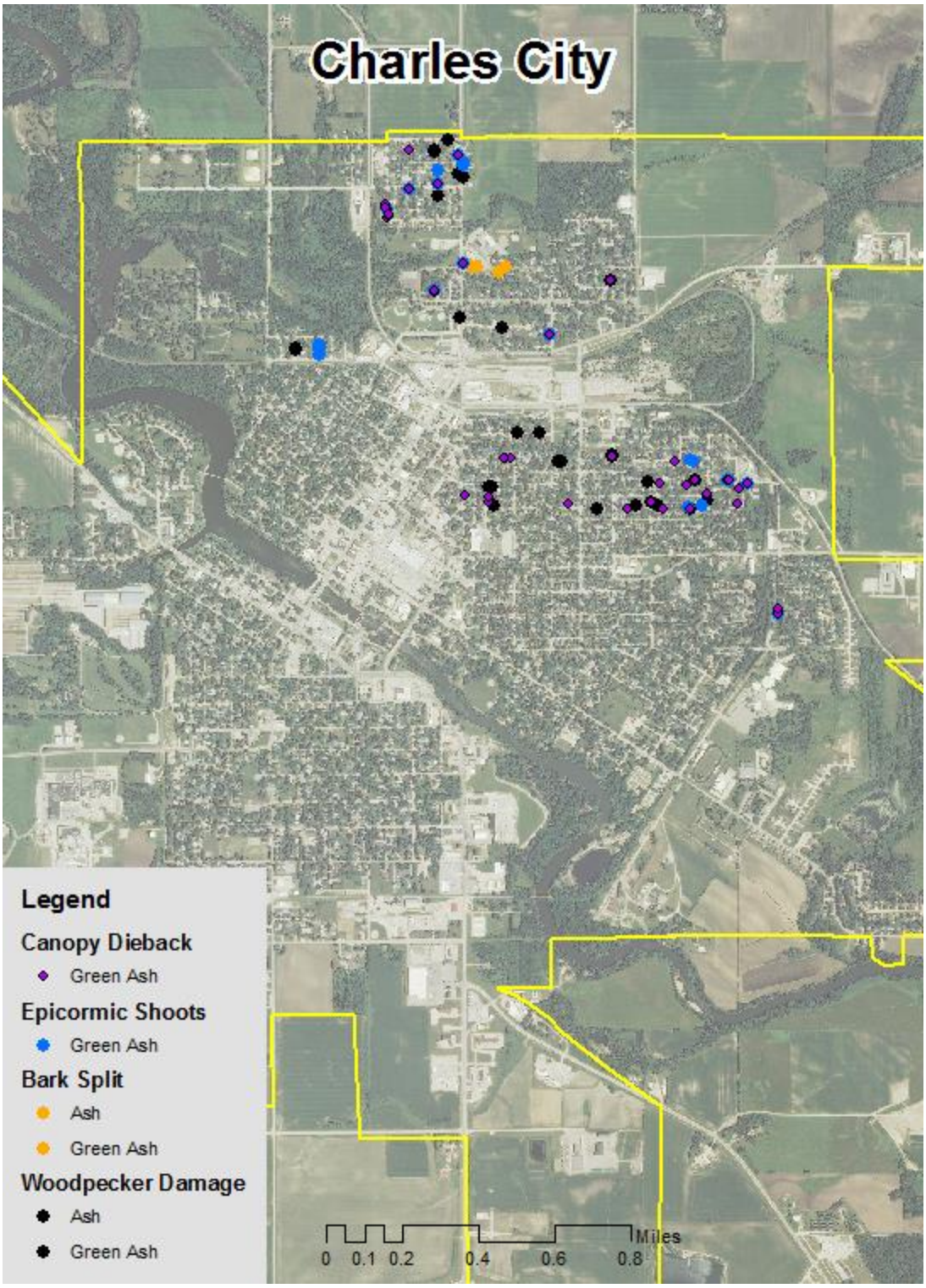


Figure 2: Location of EAB symptoms

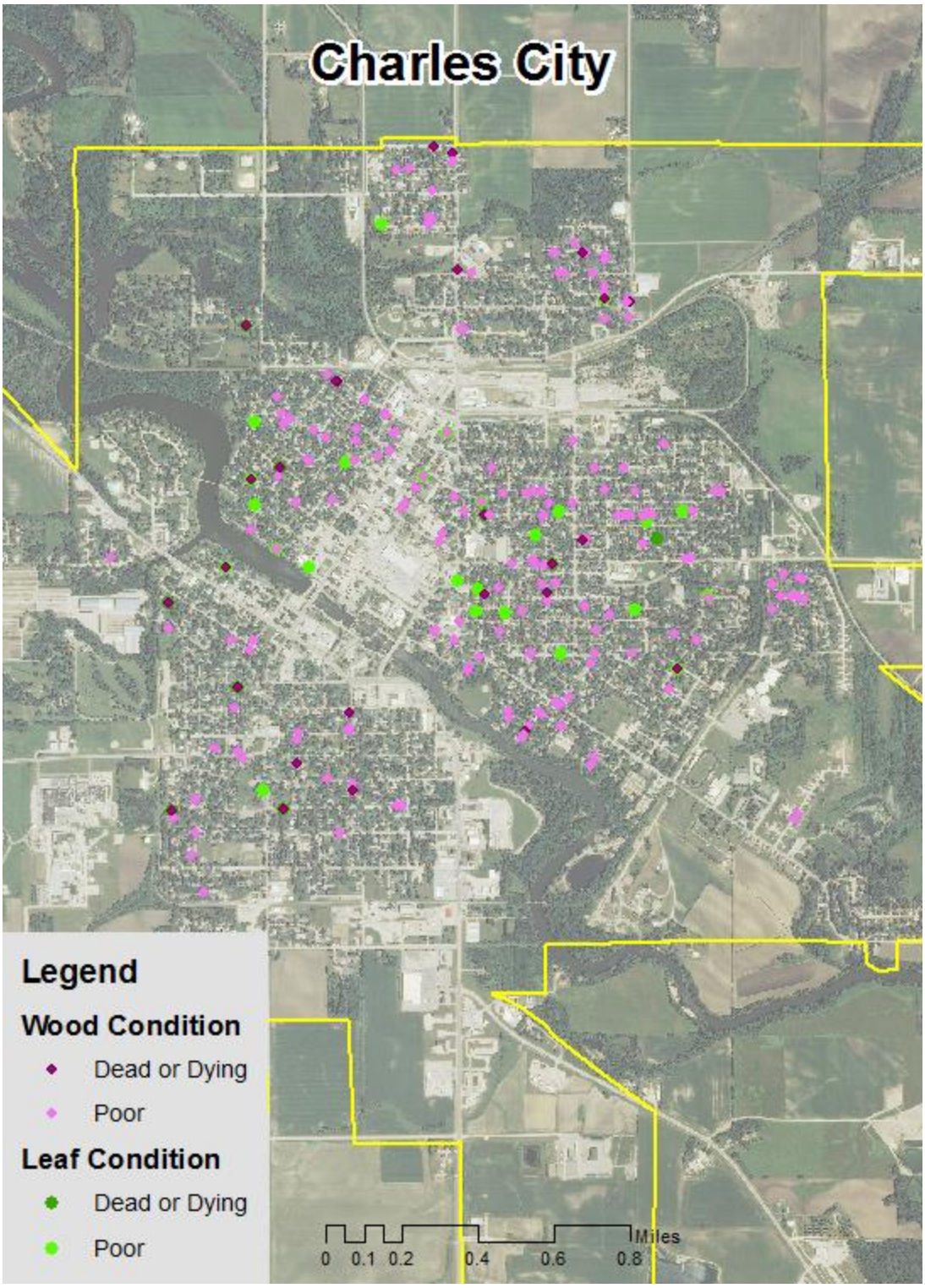


Figure 3: Location of Poor Condition Trees

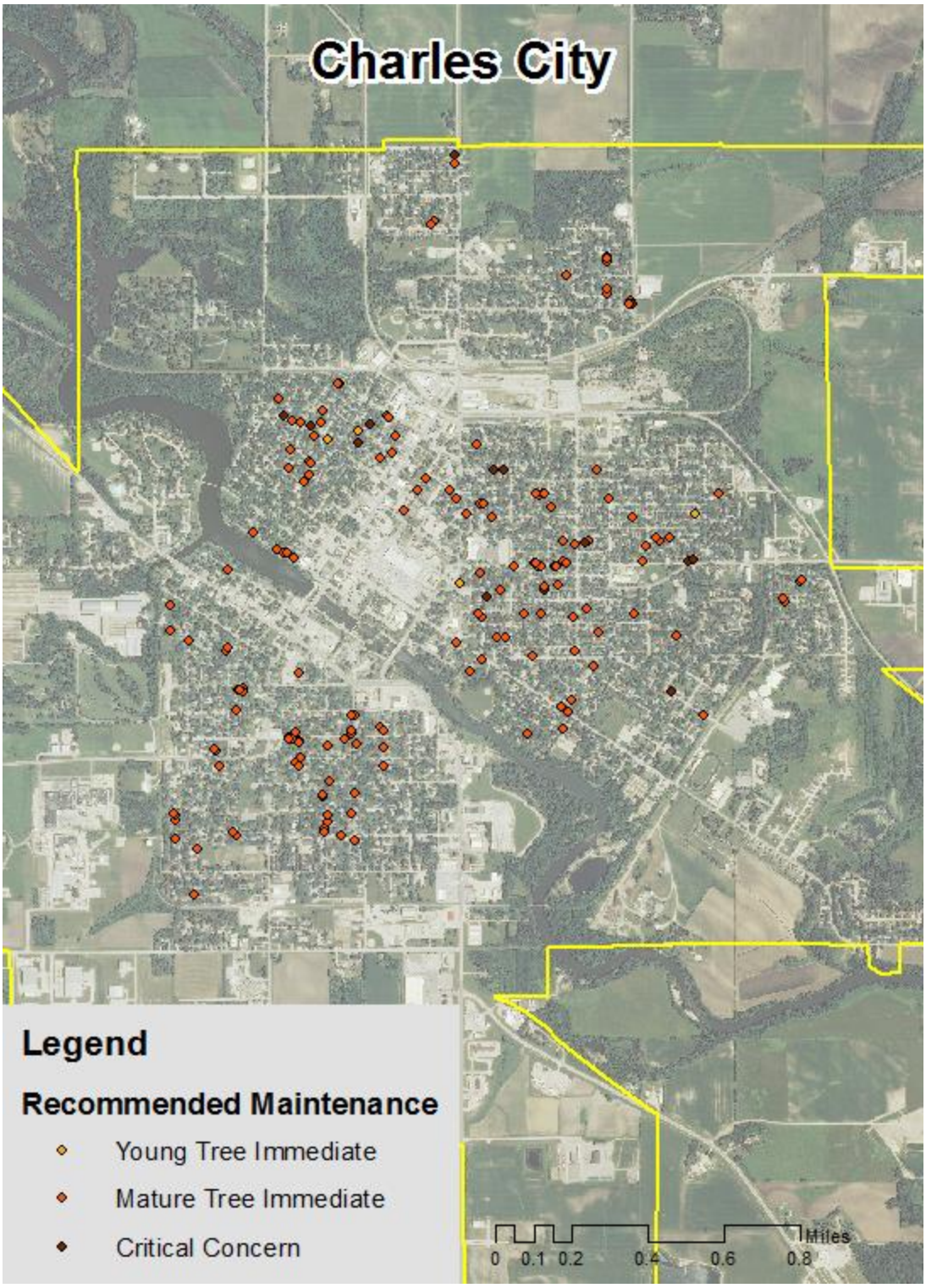


Figure 4: Location of Trees with Recommended Maintenance

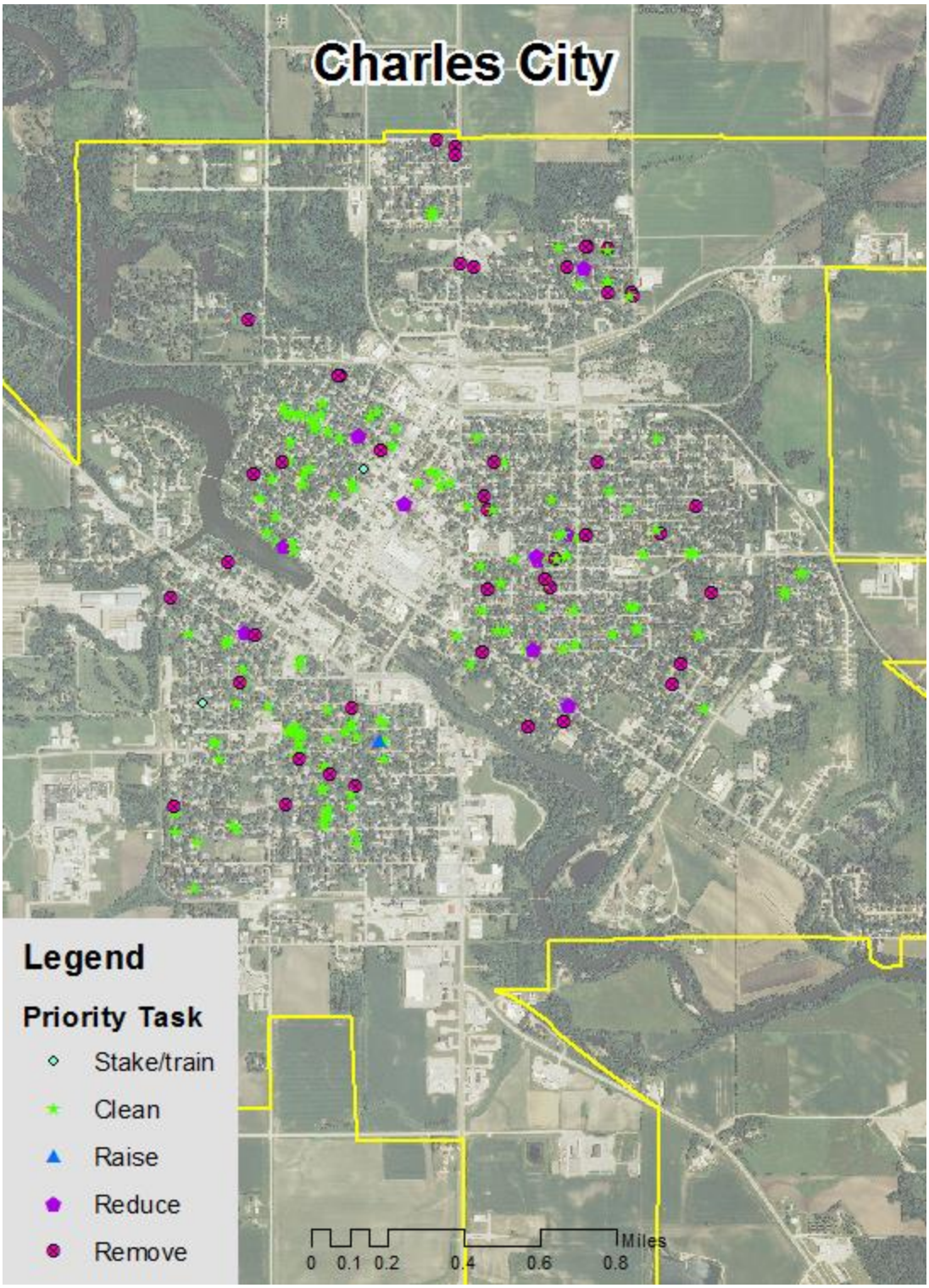


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Charles City Tree Ordinances

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line nine (9) feet from the property line.

2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than thirty (30) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES FOR SAFETY. The City may trim any tree located on the parking if the tree is creating a public hazard.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

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

[The next page is 791]

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.