State Center, IA

2016 Urban Forest Management Plan

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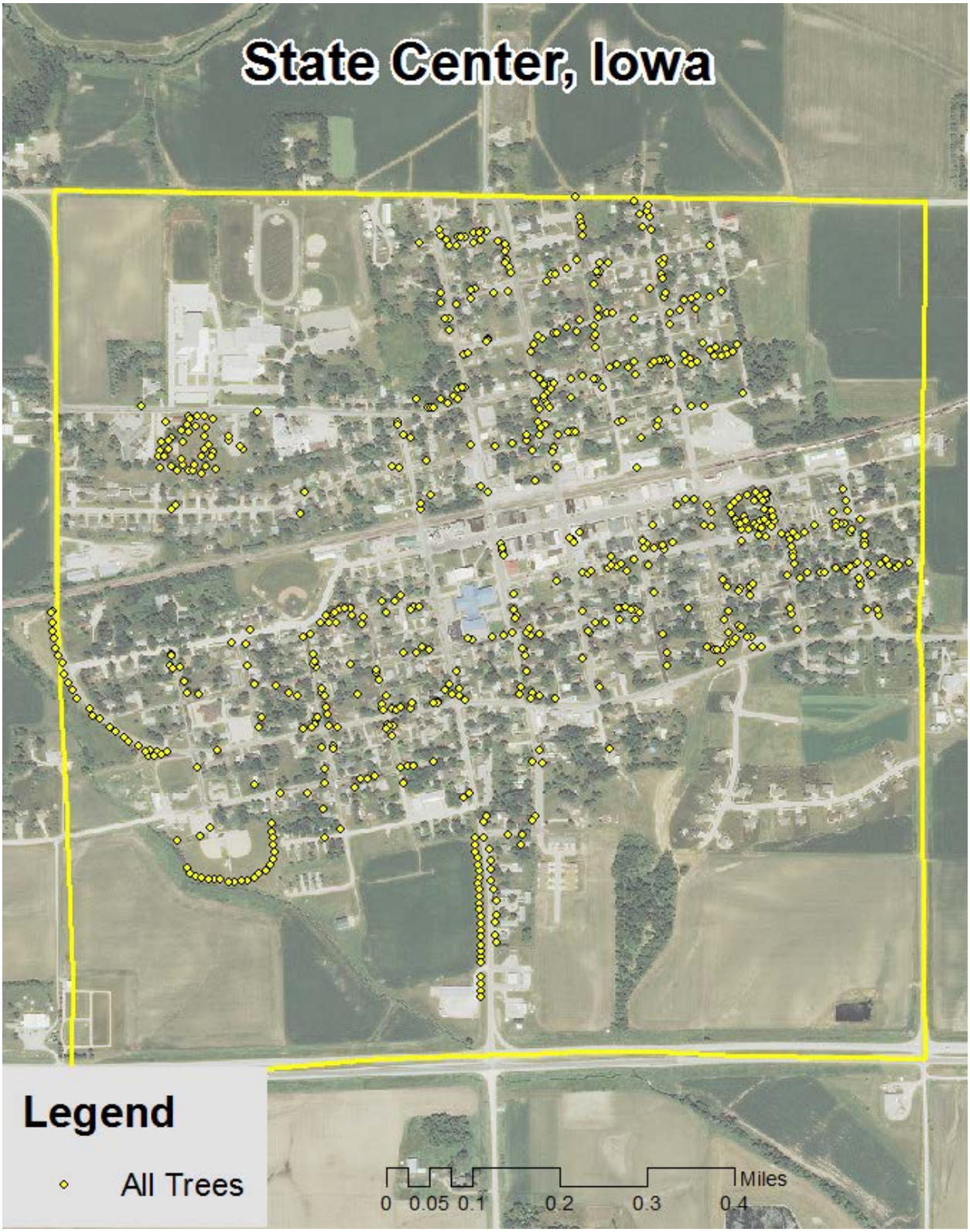

Trees inventoried in Fall 2015

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Executive Summary

Overview

This plan was developed to assist the City of State Center 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 13% of State Center'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

In 2015, a tree inventory was conducted by Matt Brewer, 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 642 trees inventoried.

- State Center's trees provide $111,180 of benefits annually, an average of $174 a tree
- There are over 44 species of trees
- The top three genera are: Maple 44%, Ash 13%, and Oak 12%
- 12% of trees are in need of some type of management
- 10 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 10 trees needing removal, 8 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*
- 3 of the 82 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, evergreens, poplars (including cottonwood), sycamore, silver maple, honeylocust, catalpa, pin oak, boxelder, birch, Russian olive, female ginkgo, willow, Oriental elms, red mulberry, white mulberry, crabapples (with exception of Spring Snow or male sterile varieties), and fruit-bearing trees (except for male sterile varieties)
- Check ash trees with a visual survey yearly
- Budget impacts from ash removal – Suggestion: request a budget increase to at least $12,300 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2015, a tree inventory was conducted by Matt Brewer, 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 642 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. State Center's trees reduce energy related costs by approximately $29,137 annually (Appendix A, Table 1). These savings are both in Electricity (138.2 MWh) and in Natural Gas (19,031.8 Therms).

Annual Stormwater Benefits

State Center's trees intercept about 1,624,909 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $44,035 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 State Center, it is estimated that trees remove 1,768.6 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 $4,957 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In State Center, trees sequester about 314,802 lbs of carbon a year with an associated value of $2,361 (Appendix A, Table 4). In addition, the trees store 6,180,094 lbs of carbon, with a yearly benefit of $46,351 (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. State Center receives $29,186 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, State Center's trees provide $111,180 of benefits annually. Benefits of individual trees vary based on size, species, health

and location, but on average each of the 642 trees in State Center provides approximately $174 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

State Center has over 44 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	283	44%
Ash	82	13%
Oak	80	12%
Spruce	33	5%
Apple/Crabapple	21	3%
Hackberry	17	3%
Linden/Basswood	13	2%
Black Walnut	12	2%
Pear	12	2%
Kentucky Coffeetree	11	2%
Pine	9	1%
Honeylocust	7	1%
American Sycamore	7	1%
Aspen/Cottonwood	6	1%
Birch	5	1%
Eastern Red Cedar	4	1%
Elm	4	1%
Eastern Redbud	3	<1%
Northern White Cedar	3	<1%
Hickory	2	<1%
Ginkgo	2	<1%
Willow	2	<1%
Ohio Buckeye	1	<1%
Other Small Deciduous	15	2%
Other Large Evergreen	5	1%
Other Large Deciduous	1	<1%
Other Medium Deciduous	1	<1%
Other Small Evergreen	1	<1%

Age Class

Almost half of State Center's trees (48%) are between 18 and 36 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that a large number of trees are in the smallest size categories (a downward slope) to prepare for natural mortality and to maintain canopy

cover. State Center will have an aging tree population as this 48% matures, and should consider new plantings (currently about 22% are under 6 inches in diameter) to develop 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 State Center indicate that 95% of the trees are in good health, with <1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Additionally, 69% of State Center'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 8% of the population. This 8% 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	64	10%
Tree Removal	10	2%

Canopy Cover

The total canopy with both private and public trees is 17% (108 acres). The canopy cover included in the State Center inventory includes approximately 16 acres (Appendix A, Figure 4).

Land Use and Location

The majority of State Center's city and park trees are in yard settings 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	74%
Park/vacant/other	19%
Small commercial	7%
Multifamily residential	<1%

Location	
Front yard	64%
Planting strip	36%

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

State Center has 2 critical concern trees, both of which need immediate 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 is 1 tree 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 74 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 10 removals, 0 are ash trees. There are a total of 82 ash trees, and 3 of those have signs and symptoms that have been associated with EAB. In addition, there are 13 ash 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.

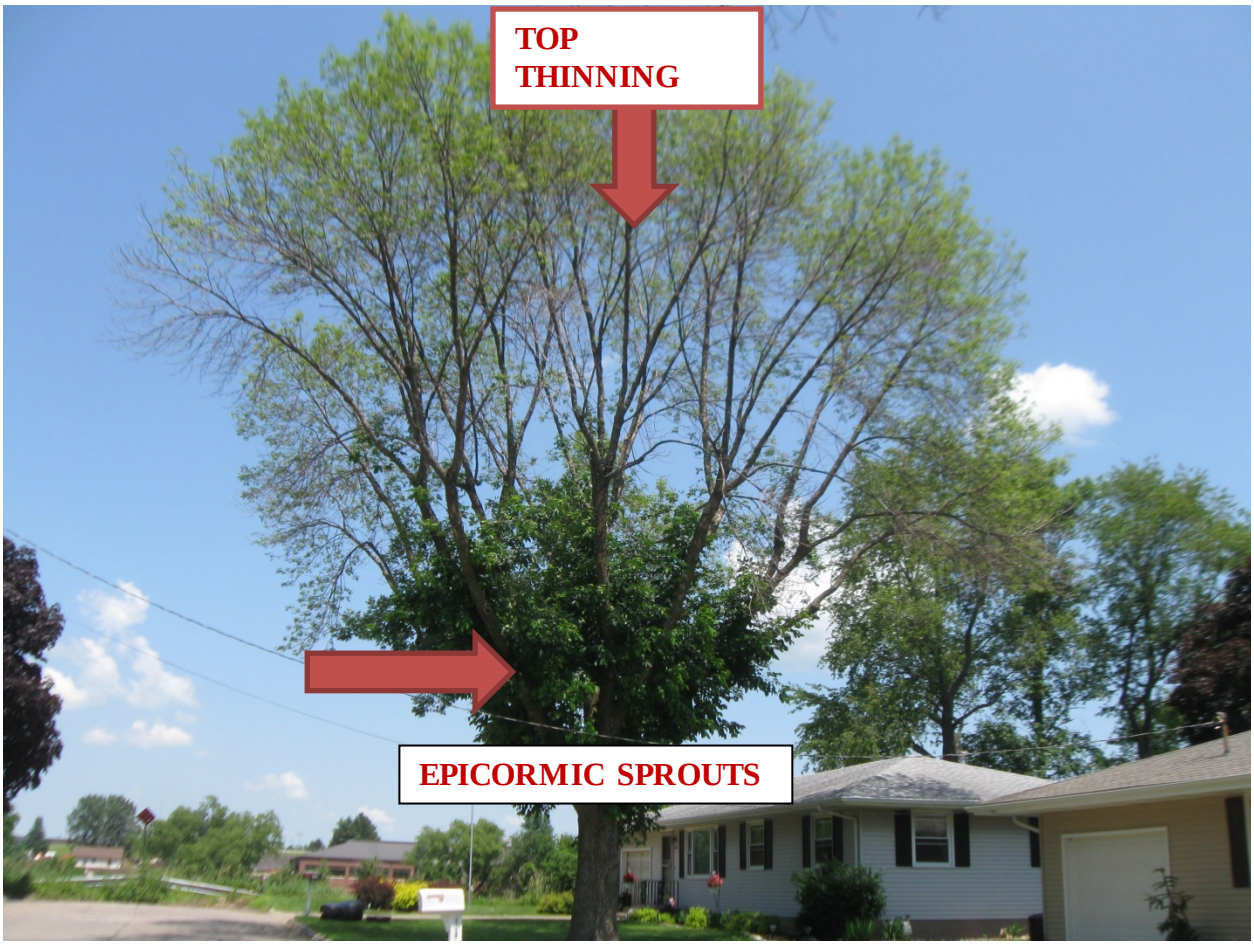
Planting

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 State Center.

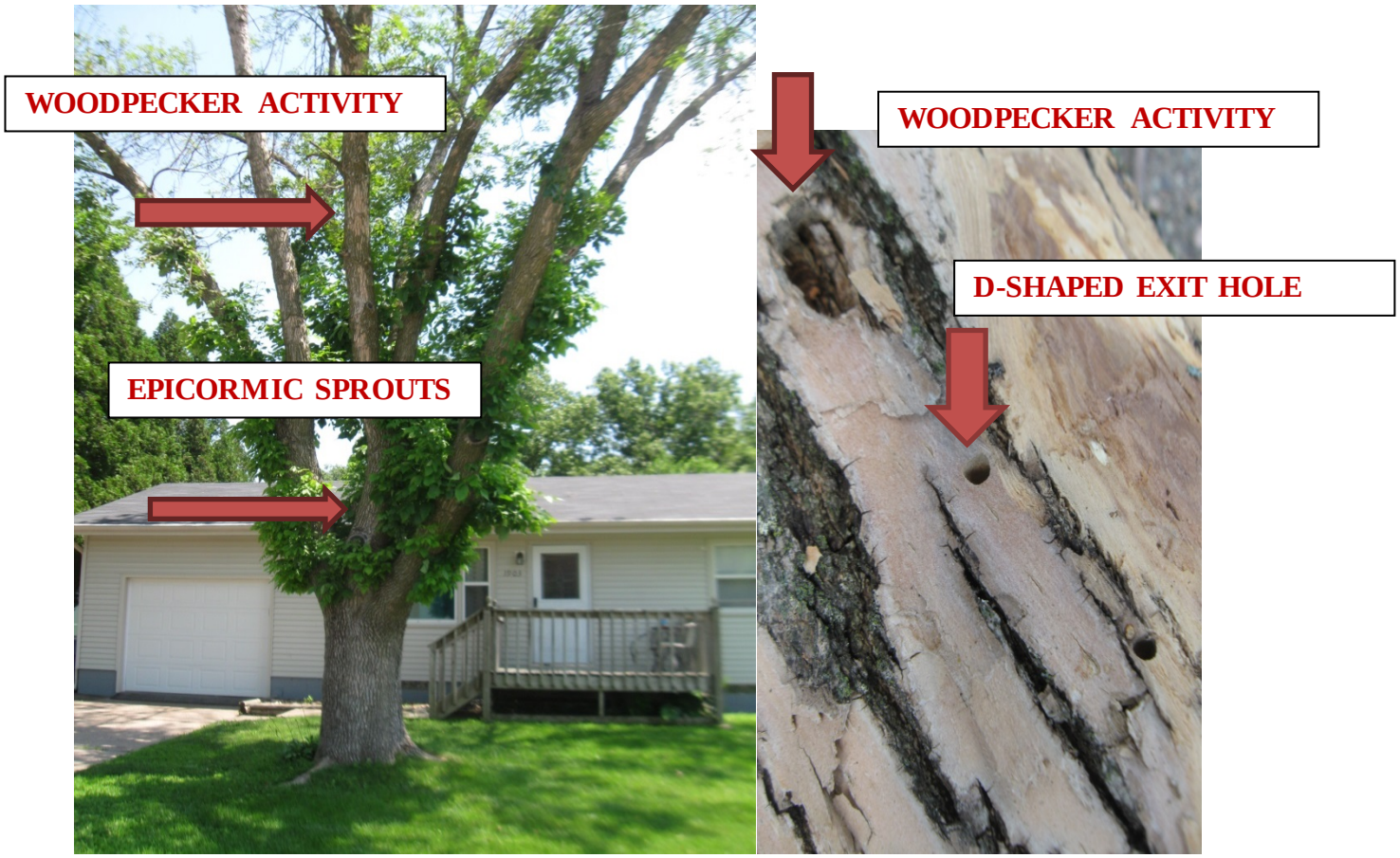
It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 10% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 5-10% of the total urban forest. Presently, the forest is heavily planted with maple (44%) (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: evergreens, poplars (including cottonwood), sycamore, silver maple, honeylocust, catalpa, pin oak, boxelder, birch, Russian olive, female ginkgo, willow, Oriental elms, red mulberry, white mulberry, crabapples (with exception of Spring Snow or male sterile varieties), and fruit-bearing trees (except for male sterile varieties), as outlined in section 151.06 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.06 (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 State Center, 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 151.06 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, evergreens, poplars (including cottonwood), sycamore, silver maple, honeylocust, catalpa, pin oak, boxelder, birch, Russian olive, female ginkgo, willow, Oriental elms, red mulberry, white mulberry, crabapples (with exception of Spring Snow or male sterile varieties), and fruit-bearing trees (except for male sterile varieties).

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 151.09 states “If the property owner does not perform an action required under this article within a reasonable time after written notice specifying the condition which creates the violation and specifies the time within the work must be done, the city may perform the required action and assess the property for collection in the same manner as a property tax.”.

Six Year Maintenance Plan and Cost Estimates

Year 1 (FY 2016)

Maintain 2 critical concern trees that need immediate attention (cleaning)	$600
Remove 5 trees (marked for removal)	$4,500
Plant and Maintain 10 trees in open locations (pursue grants)	$1,000
Ash tree treatment (if elected), 43 trees in good condition, average 18–24"	avg. $315/tree
-$15 per inch, treated every two years, see note	
*Or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 2 (FY 2017)

Remove 5 trees (marked for removal)	$4,500
Plant and Maintain 10 trees in open locations (pursue grants)	$1,000
Ash tree treatment (if elected) or saving for future ash removal	
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	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 4 (FY 2019)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
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	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 6 (FY 2021)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
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 4-15 years of its arrival.
******Assuming a cost of $900 per tree for removal, the budget would need to be increased to $12,300 a year to remove all ash trees within 6 years.
*******Suggest setting aside additional funds to prepare for the expected arrival of EAB. Planting would be at least partially dependent on receiving grant funds annually.

Proposed Budget Increase

EAB could potentially kill all ash trees in State Center within 4-15 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $12,300 a year. Additionally, it is recommended that State Center 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 State Center would still need to find $900 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 State Center. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees

1/7/2016

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	32.9	2,496	4,442.3	4,353	6,850	(N/A)	19.6	23.5	54.36
Green ash	26.0	1,973	3,574.1	3,503	5,475	(N/A)	11.8	18.8	72.04
Norway maple	17.1	1,298	2,494.4	2,444	3,742	(N/A)	10.9	12.8	53.46
Silver maple	16.7	1,270	2,177.6	2,134	3,404	(N/A)	8.1	11.7	65.47
Northern red oak	2.3	174	313.0	307	481	(N/A)	5.5	1.7	13.74
Spruce	2.4	185	348.9	342	527	(N/A)	4.8	1.8	17.00
Swamp white oak	0.4	31	67.6	66	97	(N/A)	3.7	0.3	4.06
Red maple	4.0	302	519.4	509	811	(N/A)	3.4	2.8	36.86
Apple	2.5	190	410.8	403	593	(N/A)	3.3	2.0	28.23
Northern hackberry	6.1	463	875.4	858	1,321	(N/A)	2.6	4.5	77.70
Broadleaf Deciduous Small	0.6	44	98.7	97	141	(N/A)	2.3	0.5	9.41
Black walnut	3.0	225	399.1	391	616	(N/A)	1.9	2.1	51.37
Pin oak	2.9	221	388.7	381	602	(N/A)	1.9	2.1	50.13
Maple	1.3	102	179.5	176	278	(N/A)	1.9	1.0	23.19
Pear	0.7	55	119.3	117	172	(N/A)	1.9	0.6	14.32
Kentucky coffeetree	0.1	4	8.3	8	12	(N/A)	1.7	0.0	1.12
Eastern white pine	1.1	84	142.0	139	223	(N/A)	1.2	0.8	27.91
Littleleaf linden	1.4	105	194.8	191	296	(N/A)	1.2	1.0	36.94
Honeylocust	2.1	162	281.9	276	438	(N/A)	1.1	1.5	62.57
American sycamore	0.8	59	109.3	107	167	(N/A)	1.1	0.6	23.79
White ash	1.1	85	139.8	137	222	(N/A)	0.9	0.8	37.02
Conifer Evergreen Large	0.9	67	118.1	116	183	(N/A)	0.8	0.6	36.63
Oak	1.9	147	257.6	252	399	(N/A)	0.8	1.4	79.86
Eastern red cedar	0.4	34	65.8	64	98	(N/A)	0.6	0.3	24.57
Bur oak	0.8	61	101.3	99	160	(N/A)	0.6	0.5	40.01
River birch	1.2	93	181.8	178	271	(N/A)	0.6	0.9	67.80
American basswood	1.5	111	211.0	207	318	(N/A)	0.6	1.1	79.48
Elm	0.8	61	111.5	109	171	(N/A)	0.6	0.6	42.63
Cottonwood	1.0	72	121.4	119	191	(N/A)	0.6	0.7	47.78
Eastern redbud	0.3	25	50.3	49	75	(N/A)	0.5	0.3	24.84
Northern white cedar	0.2	13	28.5	28	41	(N/A)	0.5	0.1	13.58
Eastern cottonwood	0.9	66	118.0	116	182	(N/A)	0.3	0.6	91.02
Hickory	0.2	14	27.5	27	41	(N/A)	0.3	0.1	20.64
Ginkgo	0.4	27	45.4	45	72	(N/A)	0.3	0.2	35.93
Blue spruce	0.2	12	20.0	20	31	(N/A)	0.3	0.1	15.73
Willow	0.1	11	23.0	23	33	(N/A)	0.3	0.1	16.73
Broadleaf Deciduous Mediu	0.3	24	47.4	46	71	(N/A)	0.2	0.2	70.84
Broadleaf Deciduous Large	0.3	25	46.9	46	71	(N/A)	0.2	0.2	70.91
Ohio buckeye	0.3	20	39.6	39	59	(N/A)	0.2	0.2	58.69
Paper birch	0.3	20	38.1	37	57	(N/A)	0.2	0.2	57.32
Basswood	0.3	25	46.9	46	71	(N/A)	0.2	0.2	70.91
Conifer Evergreen Small	0.0	1	2.5	2	4	(N/A)	0.2	0.0	3.62
Scotch pine	0.1	11	19.7	19	30	(N/A)	0.2	0.1	30.47
Amur maple	0.2	14	24.7	24	38	(N/A)	0.2	0.1	38.13
Total	138.2	10,486	19,031.8	18,651	29,137	(N/A)	100.0	100.0	45.38

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees

1/7/2016

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	400,984	10,867	(N/A)	19.6	24.7	86.24
Green ash	346,126	9,380	(N/A)	11.8	21.3	123.42
Norway maple	170,578	4,623	(N/A)	10.9	10.5	66.04
Silver maple	229,237	6,212	(N/A)	8.1	14.1	119.47
Northern red oak	17,262	468	(N/A)	5.5	1.1	13.37
Spruce	38,539	1,044	(N/A)	4.8	2.4	33.69
Swamp white oak	1,647	45	(N/A)	3.7	0.1	1.86
Red maple	30,640	830	(N/A)	3.4	1.9	37.74
Apple	12,635	342	(N/A)	3.3	0.8	16.30
Northern hackberry	63,203	1,713	(N/A)	2.6	3.9	100.75
Broadleaf Deciduous Small	2,490	67	(N/A)	2.3	0.2	4.50
Black walnut	28,031	760	(N/A)	1.9	1.7	63.30
Pin oak	32,812	889	(N/A)	1.9	2.0	74.10
Maple	10,151	275	(N/A)	1.9	0.6	22.92
Pear	3,426	93	(N/A)	1.9	0.2	7.74
Kentucky coffeetree	350	9	(N/A)	1.7	0.0	0.86
Eastern white pine	20,359	552	(N/A)	1.2	1.3	68.97
Littleleaf linden	12,378	335	(N/A)	1.2	0.8	41.93
Honeylocust	24,730	670	(N/A)	1.1	1.5	95.74
American sycamore	9,830	266	(N/A)	1.1	0.6	38.06
White ash	8,391	227	(N/A)	0.9	0.5	37.90
Conifer Evergreen Large	21,388	580	(N/A)	0.8	1.3	115.92
Oak	28,673	777	(N/A)	0.8	1.8	155.41
Eastern red cedar	6,538	177	(N/A)	0.6	0.4	44.30
Bur oak	6,892	187	(N/A)	0.6	0.4	46.69
River birch	13,772	373	(N/A)	0.6	0.8	93.31
American basswood	19,923	540	(N/A)	0.6	1.2	134.98
Elm	11,171	303	(N/A)	0.6	0.7	75.68
Cottonwood	9,029	245	(N/A)	0.6	0.6	61.17
Eastern redbud	1,196	32	(N/A)	0.5	0.1	10.80
Northern white cedar	1,787	48	(N/A)	0.5	0.1	16.14
Eastern cottonwood	14,478	392	(N/A)	0.3	0.9	196.17
Hickory	1,216	33	(N/A)	0.3	0.1	16.47
Ginkgo	1,957	53	(N/A)	0.3	0.1	26.52
Blue spruce	1,801	49	(N/A)	0.3	0.1	24.40
Willow	749	20	(N/A)	0.3	0.0	10.14
Broadleaf Deciduous Medium	3,764	102	(N/A)	0.2	0.2	102.01
Broadleaf Deciduous Large	3,943	107	(N/A)	0.2	0.2	106.85
Ohio buckeye	2,479	67	(N/A)	0.2	0.2	67.19
Paper birch	2,591	70	(N/A)	0.2	0.2	70.21
Basswood	3,943	107	(N/A)	0.2	0.2	106.85
Conifer Evergreen Small	183	5	(N/A)	0.2	0.0	4.97
Scotch pine	2,969	80	(N/A)	0.2	0.2	80.46
Amur maple	667	18	(N/A)	0.2	0.0	18.06
Citywide total	1,624,909	44,035	(N/A)	100.0	100.0	68.59

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees

1/7/2016

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								
Sugar maple	55.2	9.4	27.0	2.4	298	156.3	22.8	21.8	149.0	975	-42.9	-161	401.0	1,112	(N/A)	19.6	8.83
Green ash	49.9	8.0	22.7	2.2	262	124.3	18.1	17.2	117.8	774	0.0	0	360.2	1,036	(N/A)	11.8	13.63
Norway maple	36.1	6.2	17.6	1.6	195	83.1	12.0	11.4	77.6	514	-8.4	-31	237.3	678	(N/A)	10.9	9.68
Silver maple	37.7	6.4	18.7	1.7	204	78.7	11.5	11.0	75.7	493	-19.4	-73	221.9	624	(N/A)	8.1	11.99
Northern red oak	3.2	0.5	1.6	0.1	17	10.9	1.6	1.5	10.4	68	-4.5	-17	25.4	68	(N/A)	5.5	1.95
Spruce	4.2	0.8	3.6	0.5	28	11.8	1.7	1.6	11.1	73	-17.6	-66	17.7	35	(N/A)	4.8	1.13
Swamp white oak	0.1	0.0	0.1	0.0	0	2.1	0.3	0.3	1.9	13	0.0	0	4.6	13	(N/A)	3.7	0.54
Red maple	7.0	1.2	3.3	0.3	37	18.7	2.7	2.6	18.0	117	-2.4	-9	51.5	146	(N/A)	3.4	6.62
Apple	4.0	0.7	1.9	0.2	21	12.6	1.8	1.7	11.4	77	0.0	0	34.1	98	(N/A)	3.3	4.67
Northern hackberry	10.7	1.8	5.3	0.5	58	29.5	4.3	4.1	27.7	183	0.0	0	83.9	241	(N/A)	2.6	14.18
Broadleaf Deciduous Small	0.6	0.1	0.3	0.0	3	3.0	0.4	0.4	2.7	18	0.0	0	7.5	21	(N/A)	2.3	1.43
Black walnut	3.0	0.5	1.5	0.1	16	14.1	2.1	2.0	13.5	88	0.0	0	36.7	104	(N/A)	1.9	8.69
Pin oak	5.9	1.0	3.0	0.3	32	13.8	2.0	1.9	13.2	86	-10.9	-41	30.2	77	(N/A)	1.9	6.45
Maple	2.3	0.4	1.1	0.1	12	6.4	0.9	0.9	6.1	40	-0.8	-3	17.4	49	(N/A)	1.9	4.09
Pear	1.0	0.2	0.5	0.0	5	3.6	0.5	0.5	3.3	22	0.0	0	9.6	27	(N/A)	1.9	2.29
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.6	2	(N/A)	1.7	0.15
Eastern white pine	2.4	0.5	1.9	0.3	16	5.2	0.8	0.7	5.0	33	-10.3	-39	6.5	10	(N/A)	1.2	1.21
Littleleaf linden	1.9	0.3	1.0	0.1	11	6.6	1.0	0.9	6.3	41	-1.0	-4	17.1	48	(N/A)	1.2	6.02
Honeylocust	4.9	0.8	2.2	0.2	26	10.1	1.5	1.4	9.6	63	-3.8	-14	26.9	74	(N/A)	1.1	10.61
American sycamore	1.3	0.2	0.6	0.1	7	3.8	0.5	0.5	3.5	23	0.0	0	10.5	30	(N/A)	1.1	4.31
White ash	0.6	0.1	0.4	0.0	4	5.2	0.8	0.7	5.1	33	0.0	0	13.0	37	(N/A)	0.9	6.09
Conifer Evergreen Large	2.6	0.5	2.1	0.3	17	4.2	0.6	0.6	4.0	26	-12.8	-48	2.1	-5	(N/A)	0.8	-0.97
Oak	4.4	0.7	2.0	0.2	23	9.2	1.3	1.3	8.8	57	0.0	0	27.8	80	(N/A)	0.8	16.05
Eastern red cedar	1.4	0.3	1.1	0.2	9	2.2	0.3	0.3	2.0	13	-3.6	-14	4.1	9	(N/A)	0.6	2.19
Bur oak	0.7	0.1	0.4	0.0	4	3.7	0.6	0.5	3.6	24	0.0	0	9.7	27	(N/A)	0.6	6.85
River birch	3.1	0.5	1.5	0.1	17	6.0	0.9	0.8	5.6	37	-0.7	-3	17.8	51	(N/A)	0.6	12.73
American basswood	3.0	0.5	1.4	0.1	16	7.1	1.0	1.0	6.6	44	-2.5	-9	18.4	51	(N/A)	0.6	12.70
Elm	1.6	0.3	0.7	0.1	8	3.9	0.6	0.5	3.7	24	0.0	0	11.2	32	(N/A)	0.6	8.09
Cottonwood	1.0	0.2	0.5	0.0	6	4.5	0.7	0.6	4.3	28	0.0	0	11.8	34	(N/A)	0.6	8.39
Eastern redbud	0.3	0.0	0.2	0.0	2	1.6	0.2	0.2	1.5	10	0.0	0	4.1	12	(N/A)	0.5	3.88
Northern white cedar	0.2	0.0	0.2	0.0	1	0.9	0.1	0.1	0.8	5	-0.5	-2	1.7	4	(N/A)	0.5	1.48
Eastern cottonwood	2.3	0.4	1.0	0.1	12	4.2	0.6	0.6	4.0	26	0.0	0	13.1	38	(N/A)	0.3	19.04
Hickory	0.0	0.0	0.0	0.0	0	0.9	0.1	0.1	0.9	6	0.0	0	2.1	6	(N/A)	0.3	2.99
Ginkgo	0.4	0.1	0.2	0.0	2	1.7	0.2	0.2	1.6	11	-0.1	-1	4.4	12	(N/A)	0.3	6.18
Blue spruce	0.2	0.0	0.2	0.0	1	0.7	0.1	0.1	0.7	5	-0.6	-2	1.5	4	(N/A)	0.3	1.82
Willow	0.1	0.0	0.0	0.0	0	0.7	0.1	0.1	0.7	4	0.0	0	1.7	5	(N/A)	0.3	2.34
Broadleaf Deciduous Medium	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)	0.2	13.58
Broadleaf Deciduous Large	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.2	12.48
Ohio buckeye	0.5	0.1	0.2	0.0	3	1.3	0.2	0.2	1.2	8	-0.1	0	3.6	10	(N/A)	0.2	10.16
Paper birch	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	0.2	9.34
Basswood	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.2	12.48
Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	-0.1	0	0.1	0	(N/A)	0.2	0.20
Scotch pine	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1	(N/A)	0.2	1.45
Amur maple	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
Citywide total	256.3	43.4	127.4	12.3	1,388	660.3	96.1	91.6	625.9	4,111	-144.6	-542	1,768.6	4,957	(N/A)	100.0	7.72

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees

1/7/2016

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	1,588,570	11,914	(N/A)	19.6	25.7	94.56
Green ash	1,648,532	12,364	(N/A)	11.8	26.7	162.68
Norway maple	598,481	4,489	(N/A)	10.9	9.7	64.12
Silver maple	811,352	6,085	(N/A)	8.1	13.1	117.02
Northern red oak	65,051	488	(N/A)	5.5	1.1	13.94
Spruce	41,005	308	(N/A)	4.8	0.7	9.92
Swamp white oak	2,219	17	(N/A)	3.7	0.0	0.69
Red maple	76,771	576	(N/A)	3.4	1.2	26.17
Apple	65,014	488	(N/A)	3.3	1.1	23.22
Northern hackberry	165,045	1,238	(N/A)	2.6	2.7	72.81
Broadleaf Deciduous	11,004	83	(N/A)	2.3	0.2	5.50
Black walnut	96,763	726	(N/A)	1.9	1.6	60.48
Pin oak	155,824	1,169	(N/A)	1.9	2.5	97.39
Maple	25,164	189	(N/A)	1.9	0.4	15.73
Pear	16,724	125	(N/A)	1.9	0.3	10.45
Kentucky coffeetree	307	2	(N/A)	1.7	0.0	0.21
Eastern white pine	25,433	191	(N/A)	1.2	0.4	23.84
Littleleaf linden	41,939	315	(N/A)	1.2	0.7	39.32
Honeylocust	62,643	470	(N/A)	1.1	1.0	67.12
American sycamore	42,123	316	(N/A)	1.1	0.7	45.13
White ash	18,905	142	(N/A)	0.9	0.3	23.63
Conifer Evergreen La	33,304	250	(N/A)	0.8	0.5	49.96
Oak	147,391	1,105	(N/A)	0.8	2.4	221.09
Eastern red cedar	4,408	33	(N/A)	0.6	0.1	8.27
Bur oak	23,129	173	(N/A)	0.6	0.4	43.37
River birch	50,786	381	(N/A)	0.6	0.8	95.22
American basswood	112,471	844	(N/A)	0.6	1.8	210.88
Elm	52,084	391	(N/A)	0.6	0.8	97.66
Cottonwood	34,321	257	(N/A)	0.6	0.6	64.35
Eastern redbud	4,853	36	(N/A)	0.5	0.1	12.13
Northern white cedar	770	6	(N/A)	0.5	0.0	1.93
Eastern cottonwood	78,517	589	(N/A)	0.3	1.3	294.44
Hickory	2,069	16	(N/A)	0.3	0.0	7.76
Ginkgo	5,990	45	(N/A)	0.3	0.1	22.46
Blue spruce	1,161	9	(N/A)	0.3	0.0	4.35
Willow	1,319	10	(N/A)	0.3	0.0	4.95
Broadleaf Deciduous	14,280	107	(N/A)	0.2	0.2	107.10
Broadleaf Deciduous	15,773	118	(N/A)	0.2	0.3	118.30
Ohio buckeye	7,945	60	(N/A)	0.2	0.1	59.59
Paper birch	8,458	63	(N/A)	0.2	0.1	63.43
Basswood	15,773	118	(N/A)	0.2	0.3	118.30
Conifer Evergreen Sn	43	0	(N/A)	0.2	0.0	0.32
Scotch pine	3,343	25	(N/A)	0.2	0.1	25.07
Amur maple	3,037	23	(N/A)	0.2	0.0	22.78
Citywide total	6,180,094	46,351	(N/A)	100.0	100.0	72.20

Table 5: Annual Carbon Sequestered

Annual CO Benefits of Public Trees

1/7/2016

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
Sugar maple	78,662	590	-7,631	-366	-60	55,171	414	125,836	944 (N/A)	19.6	24.4	7.49
Green ash	60,569	454	-7,913	-285	-61	43,595	327	95,967	720 (N/A)	11.8	18.6	9.47
Norway maple	21,428	161	-2,874	-185	-23	28,677	215	47,045	353 (N/A)	10.9	9.1	5.04
Silver maple	64,602	485	-3,894	-178	-31	28,073	211	88,602	665 (N/A)	8.1	17.2	12.78
Northern red oak	2,512	19	-313	-30	-3	3,848	29	6,016	45 (N/A)	5.5	1.2	1.29
Spruce	2,641	20	-197	-47	-2	4,093	31	6,490	49 (N/A)	4.8	1.3	1.57
Swamp white oak	942	7	-18	-8	0	689	5	1,604	12 (N/A)	3.7	0.3	0.50
Red maple	7,677	58	-369	-36	-3	6,671	50	13,944	105 (N/A)	3.4	2.7	4.75
Apple	4,275	32	-312	-38	-3	4,205	32	8,130	61 (N/A)	3.3	1.6	2.90
Northern hackberry	8,131	61	-792	-60	-6	10,234	77	17,513	131 (N/A)	2.6	3.4	7.73
Broadleaf Deciduous Smal	1,109	8	-53	-11	0	982	7	2,027	15 (N/A)	2.3	0.4	1.01
Black walnut	6,946	52	-464	-30	-4	4,981	37	11,432	86 (N/A)	1.9	2.2	7.15
Pin oak	14,030	105	-748	-31	-6	4,878	37	18,128	136 (N/A)	1.9	3.5	11.33
Maple	2,218	17	-121	-13	-1	2,263	17	4,347	33 (N/A)	1.9	0.8	2.72
Pear	531	4	-80	-14	-1	1,215	9	1,652	12 (N/A)	1.9	0.3	1.03
Kentucky coffeetree	100	1	-2	-3	0	93	1	188	1 (N/A)	1.7	0.0	0.13
Eastern white pine	1,286	10	-122	-20	-1	1,859	14	3,003	23 (N/A)	1.2	0.6	2.82
Littleleaf linden	4,395	33	-201	-16	-2	2,312	17	6,490	49 (N/A)	1.2	1.3	6.08
Honeylocust	3,403	26	-301	-17	-2	3,574	27	6,659	50 (N/A)	1.1	1.3	7.13
American sycamore	1,973	15	-202	-10	-2	1,313	10	3,073	23 (N/A)	1.1	0.6	3.29
White ash	2,379	18	-91	-10	-1	1,883	14	4,160	31 (N/A)	0.9	0.8	5.20
Conifer Evergreen Large	443	3	-160	-19	-1	1,490	11	1,755	13 (N/A)	0.8	0.3	2.63
Oak	4,141	31	-707	-21	-5	3,246	24	6,658	50 (N/A)	0.8	1.3	9.99
Eastern red cedar	0	0	-21	-8	0	747	6	718	5 (N/A)	0.6	0.1	1.35
Bur oak	1,750	13	-111	-8	-1	1,342	10	2,974	22 (N/A)	0.6	0.6	5.58
River birch	1,210	9	-244	-14	-2	2,056	15	3,008	23 (N/A)	0.6	0.6	5.64
American basswood	6,035	45	-540	-18	-4	2,456	18	7,933	59 (N/A)	0.6	1.5	14.87
Elm	1,996	15	-250	-9	-2	1,353	10	3,090	23 (N/A)	0.6	0.6	5.79
Cottonwood	2,059	15	-165	-9	-1	1,595	12	3,479	26 (N/A)	0.6	0.7	6.52
Eastern redbud	495	4	-23	-4	0	557	4	1,025	8 (N/A)	0.5	0.2	2.56
Northern white cedar	158	1	-4	-4	0	283	2	434	3 (N/A)	0.5	0.1	1.08
Eastern cottonwood	1,824	14	-377	-10	-3	1,469	11	2,906	22 (N/A)	0.3	0.6	10.90
Hickory	418	3	-10	-2	0	318	2	723	5 (N/A)	0.3	0.1	2.71
Ginkgo	360	3	-29	-5	0	604	5	930	7 (N/A)	0.3	0.2	3.49
Blue spruce	103	1	-6	-3	0	261	2	356	3 (N/A)	0.3	0.1	1.33
Willow	320	2	-7	-2	0	240	2	551	4 (N/A)	0.3	0.1	2.07
Broadleaf Deciduous Medi	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.2	0.2	6.27
Broadleaf Deciduous Large	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.2	0.3	9.97
Ohio buckeye	470	4	-38	-3	0	440	3	869	7 (N/A)	0.2	0.2	6.52
Paper birch	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.2	0.2	7.93
Basswood	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.2	0.3	9.97
Conifer Evergreen Small	13	0	0	-1	0	26	0	39	0 (N/A)	0.2	0.0	0.29
Scotch pine	187	1	-16	-3	0	246	2	415	3 (N/A)	0.2	0.1	3.11
Amur maple	268	2	-15	-2	0	308	2	560	4 (N/A)	0.2	0.1	4.20
Citywide total	314,802	2,361	-29,682	-1,564	-234	231,731	1,738	515,287	3,865 (N/A)	100.0	100.0	6.02

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees

1/7/2016

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	7,954	(N/A)	19.6	27.3	63.13
Green ash	4,463	(N/A)	11.8	15.3	58.73
Norway maple	2,032	(N/A)	10.9	7.0	29.03
Silver maple	5,182	(N/A)	8.1	17.8	99.65
Northern red oak	258	(N/A)	5.5	0.9	7.38
Spruce	612	(N/A)	4.8	2.1	19.74
Swamp white oak	157	(N/A)	3.7	0.5	6.54
Red maple	1,008	(N/A)	3.4	3.5	45.83
Apple	252	(N/A)	3.3	0.9	11.99
Northern hackberry	1,038	(N/A)	2.6	3.6	61.07
Broadleaf Deciduous Small	61	(N/A)	2.3	0.2	4.05
Black walnut	618	(N/A)	1.9	2.1	51.52
Pin oak	1,066	(N/A)	1.9	3.7	88.80
Maple	300	(N/A)	1.9	1.0	24.99
Pear	29	(N/A)	1.9	0.1	2.44
Kentucky coffeetree	67	(N/A)	1.7	0.2	6.12
Eastern white pine	259	(N/A)	1.2	0.9	32.38
Littleleaf linden	473	(N/A)	1.2	1.6	59.10
Honeylocust	786	(N/A)	1.1	2.7	112.25
American sycamore	177	(N/A)	1.1	0.6	25.35
White ash	329	(N/A)	0.9	1.1	54.85
Conifer Evergreen Large	73	(N/A)	0.8	0.3	14.67
Oak	287	(N/A)	0.8	1.0	57.49
Eastern red cedar	0	(N/A)	0.6	0.0	0.00
Bur oak	163	(N/A)	0.6	0.6	40.64
River birch	106	(N/A)	0.6	0.4	26.49
American basswood	402	(N/A)	0.6	1.4	100.45
Elm	153	(N/A)	0.6	0.5	38.30
Cottonwood	187	(N/A)	0.6	0.6	46.72
Eastern redbud	28	(N/A)	0.5	0.1	9.43
Northern white cedar	46	(N/A)	0.5	0.2	15.42
Eastern cottonwood	117	(N/A)	0.3	0.4	58.34
Hickory	57	(N/A)	0.3	0.2	28.56
Ginkgo	30	(N/A)	0.3	0.1	14.77
Blue spruce	38	(N/A)	0.3	0.1	18.77
Willow	39	(N/A)	0.3	0.1	19.55
Broadleaf Deciduous Medium	31	(N/A)	0.2	0.1	31.46
Broadleaf Deciduous Large	66	(N/A)	0.2	0.2	65.59
Ohio buckeye	43	(N/A)	0.2	0.1	43.05
Paper birch	58	(N/A)	0.2	0.2	57.69
Basswood	66	(N/A)	0.2	0.2	65.59
Conifer Evergreen Small	13	(N/A)	0.2	0.0	13.37
Scotch pine	47	(N/A)	0.2	0.2	47.08
Amur maple	15	(N/A)	0.2	0.1	15.48
Citywide total	29,186	(N/A)	100.0	100.0	45.46

Table 7: Summary of Benefits in Dollars

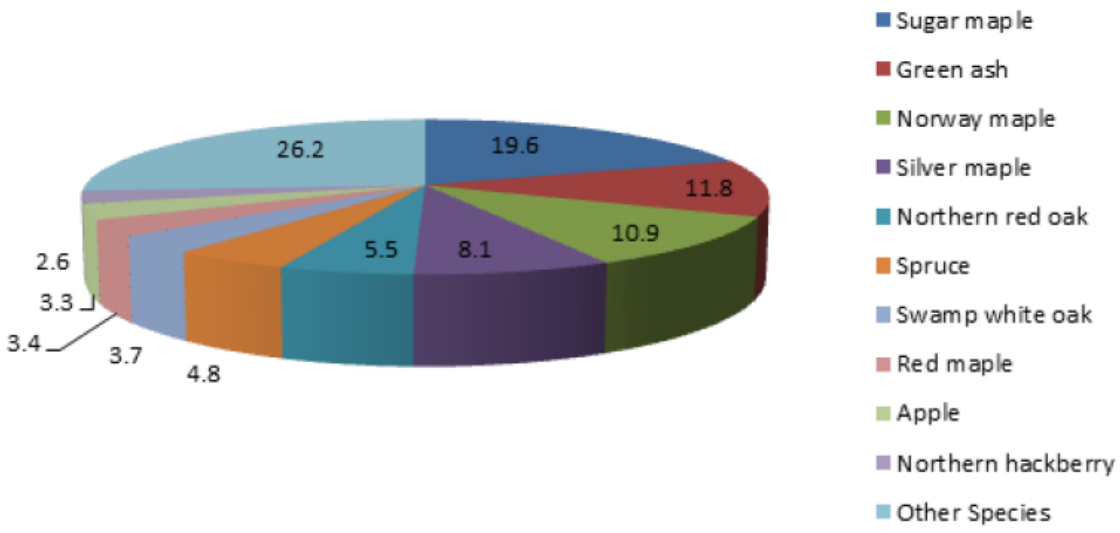
Total Annual Benefits of Public Trees by Species ($)

1/7/2016

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Sugar maple	6,850	944	1,112	10,867	7,954	27,726	(N/A)	24.9
Green ash	5,475	720	1,036	9,380	4,463	21,074	(N/A)	19.0
Norway maple	3,742	353	678	4,623	2,032	11,427	(N/A)	10.3
Silver maple	3,404	665	624	6,212	5,182	16,087	(N/A)	14.5
Northern red oak	481	45	68	468	258	1,320	(N/A)	1.2
Spruce	527	49	35	1,044	612	2,267	(N/A)	2.0
Swamp white oak	97	12	13	45	157	324	(N/A)	0.3
Red maple	811	105	146	830	1,008	2,900	(N/A)	2.6
Apple	593	61	98	342	252	1,346	(N/A)	1.2
Northern hackberry	1,321	131	241	1,713	1,038	4,444	(N/A)	4.0
Broadleaf Deciduous Sn	141	15	21	67	61	306	(N/A)	0.3
Black walnut	616	86	104	760	618	2,184	(N/A)	2.0
Pin oak	602	136	77	889	1,066	2,770	(N/A)	2.5
Maple	278	33	49	275	300	935	(N/A)	0.8
Pear	172	12	27	93	29	334	(N/A)	0.3
Kentucky coffeetree	12	1	2	9	67	92	(N/A)	0.1
Eastern white pine	223	23	10	552	259	1,066	(N/A)	1.0
Littleleaf linden	296	49	48	335	473	1,201	(N/A)	1.1
Honeylocust	438	50	74	670	786	2,018	(N/A)	1.8
American sycamore	167	23	30	266	177	664	(N/A)	0.6
White ash	222	31	37	227	329	846	(N/A)	0.8
Conifer Evergreen Large	183	13	-5	580	73	844	(N/A)	0.8
Oak	399	50	80	777	287	1,594	(N/A)	1.4
Eastern red cedar	98	5	9	177	0	290	(N/A)	0.3
Bur oak	160	22	27	187	163	559	(N/A)	0.5
River birch	271	23	51	373	106	824	(N/A)	0.7
American basswood	318	59	51	540	402	1,370	(N/A)	1.2
Elm	171	23	32	303	153	682	(N/A)	0.6
Cottonwood	191	26	34	245	187	682	(N/A)	0.6
Eastern redbud	75	8	12	32	28	155	(N/A)	0.1
Northern white cedar	41	3	4	48	46	143	(N/A)	0.1
Eastern cottonwood	182	22	38	392	117	751	(N/A)	0.7
Hickory	41	5	6	33	57	143	(N/A)	0.1
Ginkgo	72	7	12	53	30	174	(N/A)	0.2
Blue spruce	31	3	4	49	38	124	(N/A)	0.1
Willow	33	4	5	20	39	102	(N/A)	0.1
Broadleaf Deciduous M	71	6	14	102	31	224	(N/A)	0.2
Broadleaf Deciduous La	71	10	12	107	66	266	(N/A)	0.2
Ohio buckeye	59	7	10	67	43	186	(N/A)	0.2
Paper birch	57	8	9	70	58	202	(N/A)	0.2
Basswood	71	10	12	107	66	266	(N/A)	0.2
Conifer Evergreen Smal	4	0	0	5	13	22	(N/A)	0.0
Scotch pine	30	3	1	80	47	163	(N/A)	0.1
Amur maple	38	4	7	18	15	82	(N/A)	0.1
Citywide Total	29,137	3,865	4,957	44,035	29,186	111,180	(N/A)	100.0

Species Distribution of Public Trees

1/7/2016

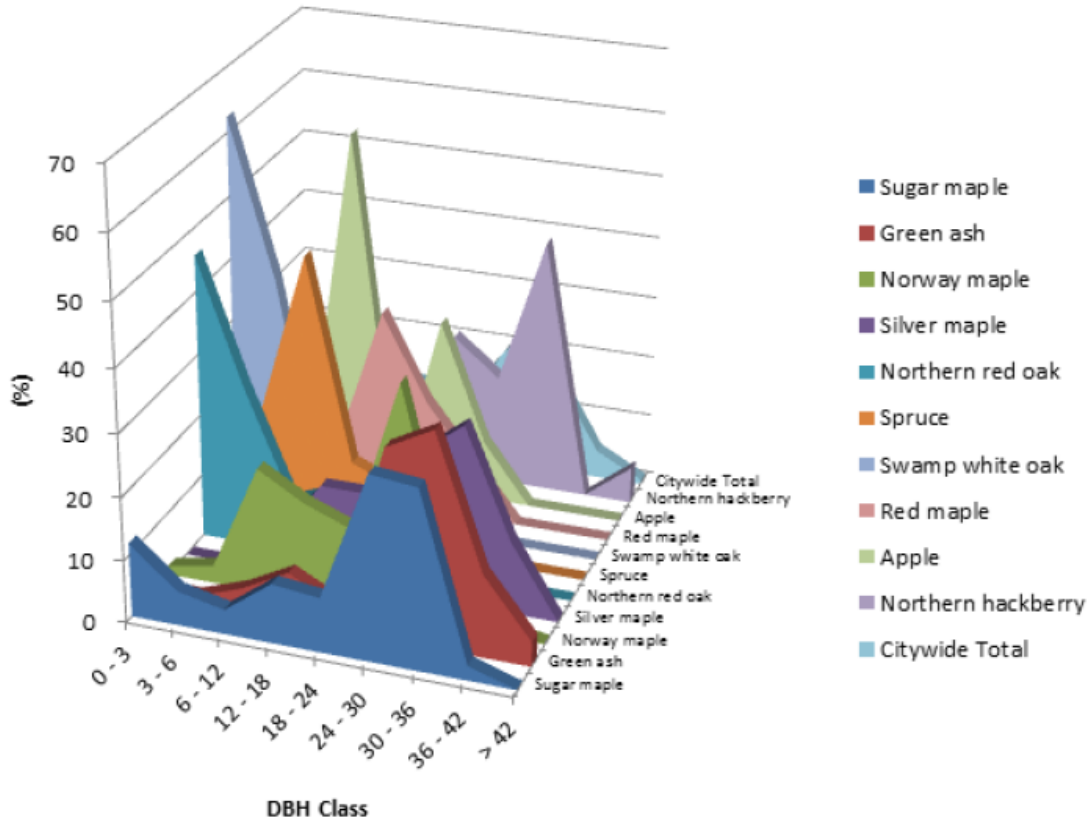


Species	Percent
Sugar maple	19.6
Green ash	11.8
Norway maple	10.9
Silver maple	8.1
Northern red oak	5.5
Spruce	4.8
Swamp white oak	3.7
Red maple	3.4
Apple	3.3
Northern hackberry	2.6
Other Species	26.2
Total	100.0

Figure 1: Species Distribution

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

1/7/2016



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Sugar maple	11.90	5.56	3.97	9.52	8.73	29.37	28.57	2.38	0.00
Green ash	1.32	1.32	3.95	7.89	3.95	30.26	34.21	13.16	3.95
Norway maple	1.43	2.86	20.00	15.71	12.86	37.14	8.57	1.43	0.00
Silver maple	0.00	0.00	5.77	15.38	15.38	23.08	28.85	11.54	0.00
Northern red oak	45.71	25.71	8.57	11.43	0.00	2.86	5.71	0.00	0.00
Spruce	3.23	19.35	45.16	12.90	9.68	9.68	0.00	0.00	0.00
Swamp white oak	62.50	37.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red maple	0.00	31.82	9.09	31.82	18.18	9.09	0.00	0.00	0.00
Apple	0.00	4.76	57.14	0.00	28.57	9.52	0.00	0.00	0.00
Northern hackberry	0.00	0.00	11.76	0.00	23.53	17.65	41.18	0.00	5.88
Citywide Total	11.99	10.12	13.08	11.68	10.44	20.72	16.82	4.52	0.62

Figure 2: Relative Age Class

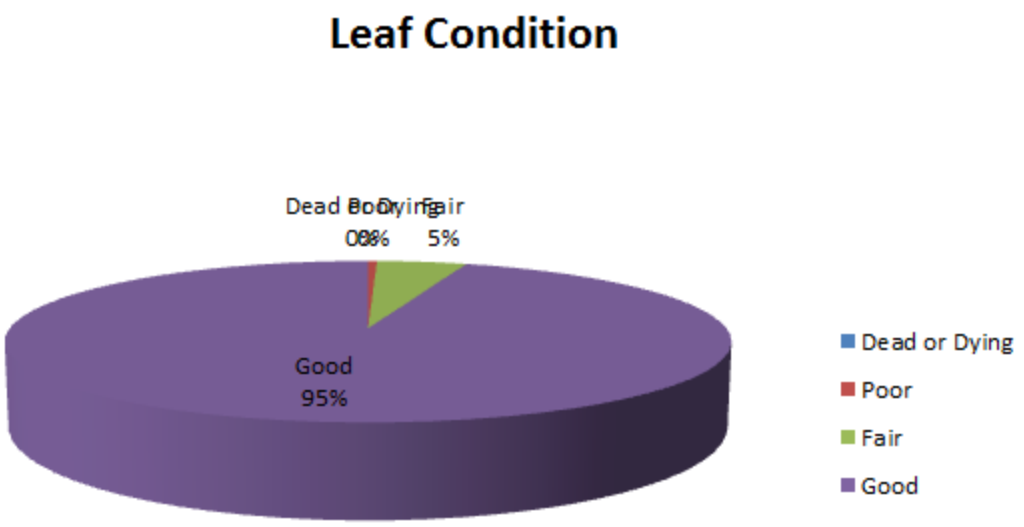


Figure 3: Foliage Condition

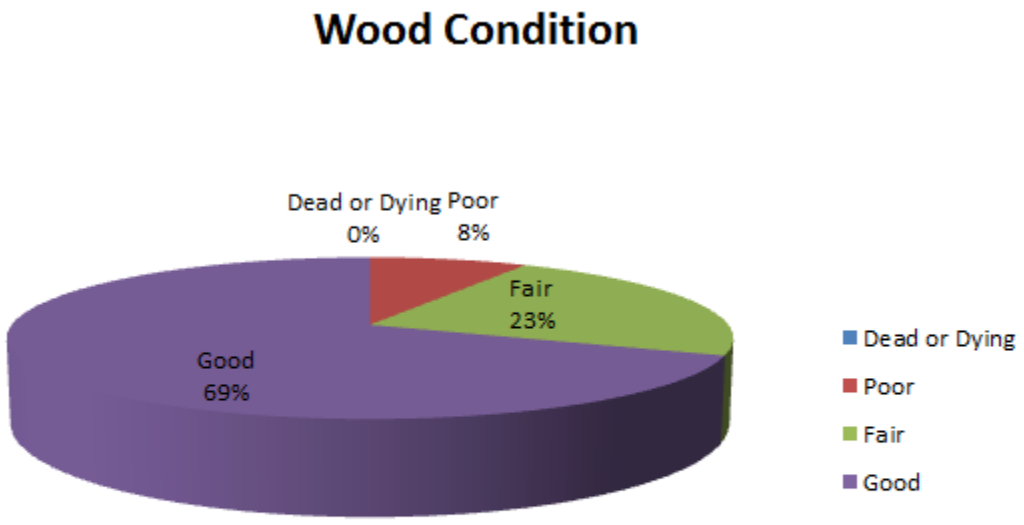
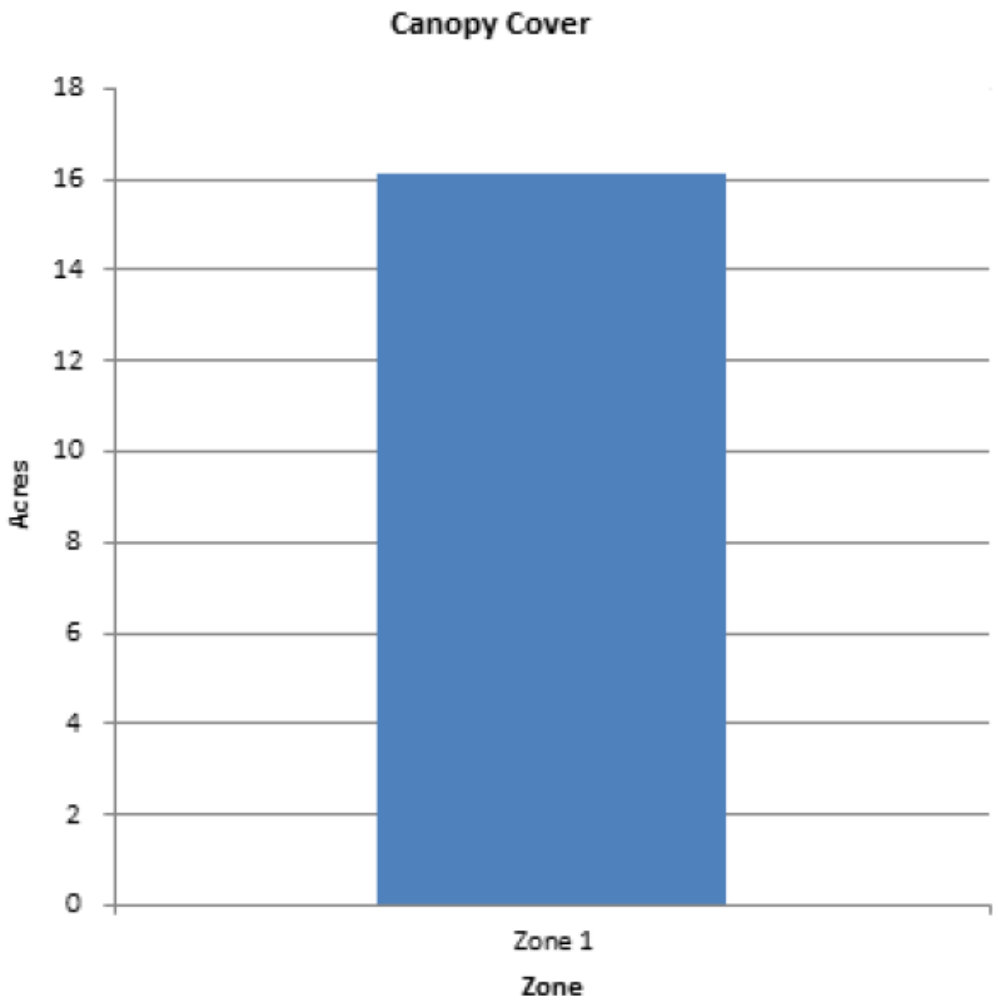


Figure 4: Wood Condition

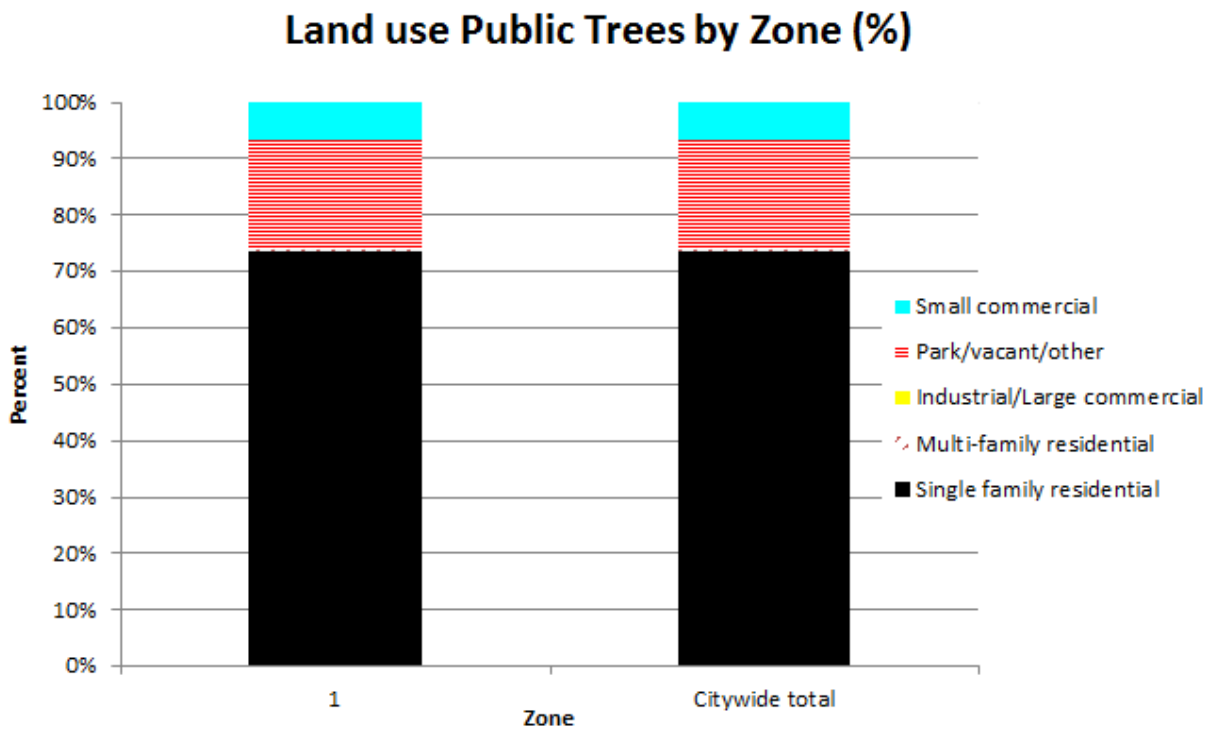
Canopy Cover of Public Trees (Acres)

1/7/2016



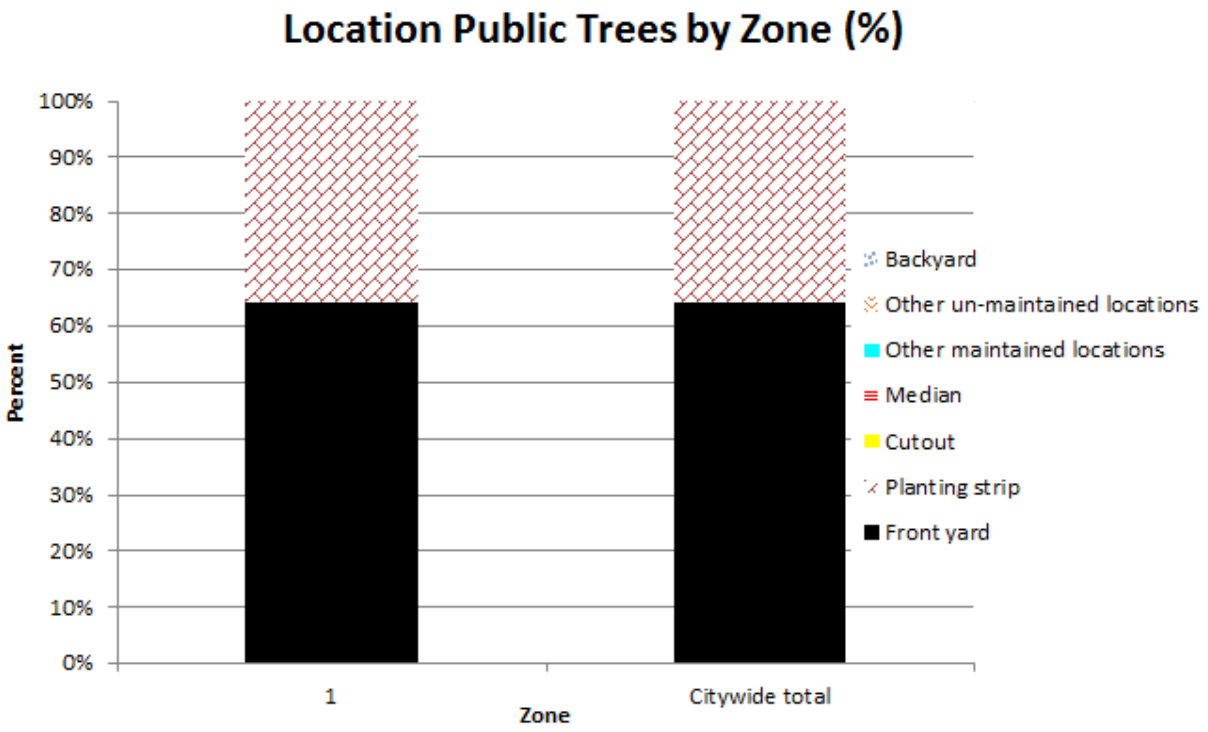
Zone	Acres	% of Total Canopy Cover
Zone 1	16	100.0
Citywide total	16	100.0

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/Large commercial	Park/vacant /other	Small commercial
1	73.52	0.31	0.00	19.47	6.70
Citywide total	73.52	0.31	0.00	19.47	6.70

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	64.02	35.98	0.00	0.00	0.00	0.00	0.00
Citywide total	64.02	35.98	0.00	0.00	0.00	0.00	0.00

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

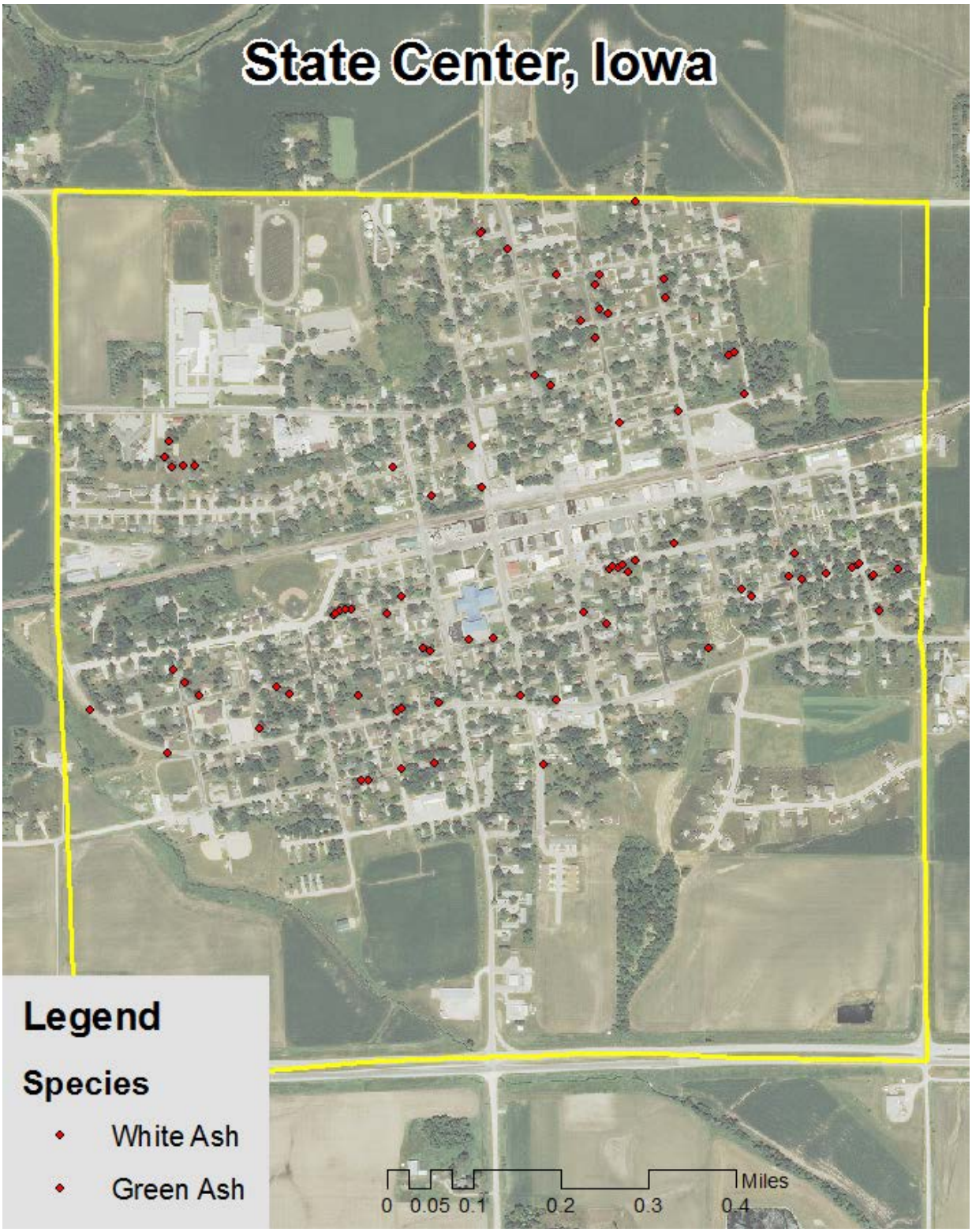


Figure 1: Location of Ash Trees

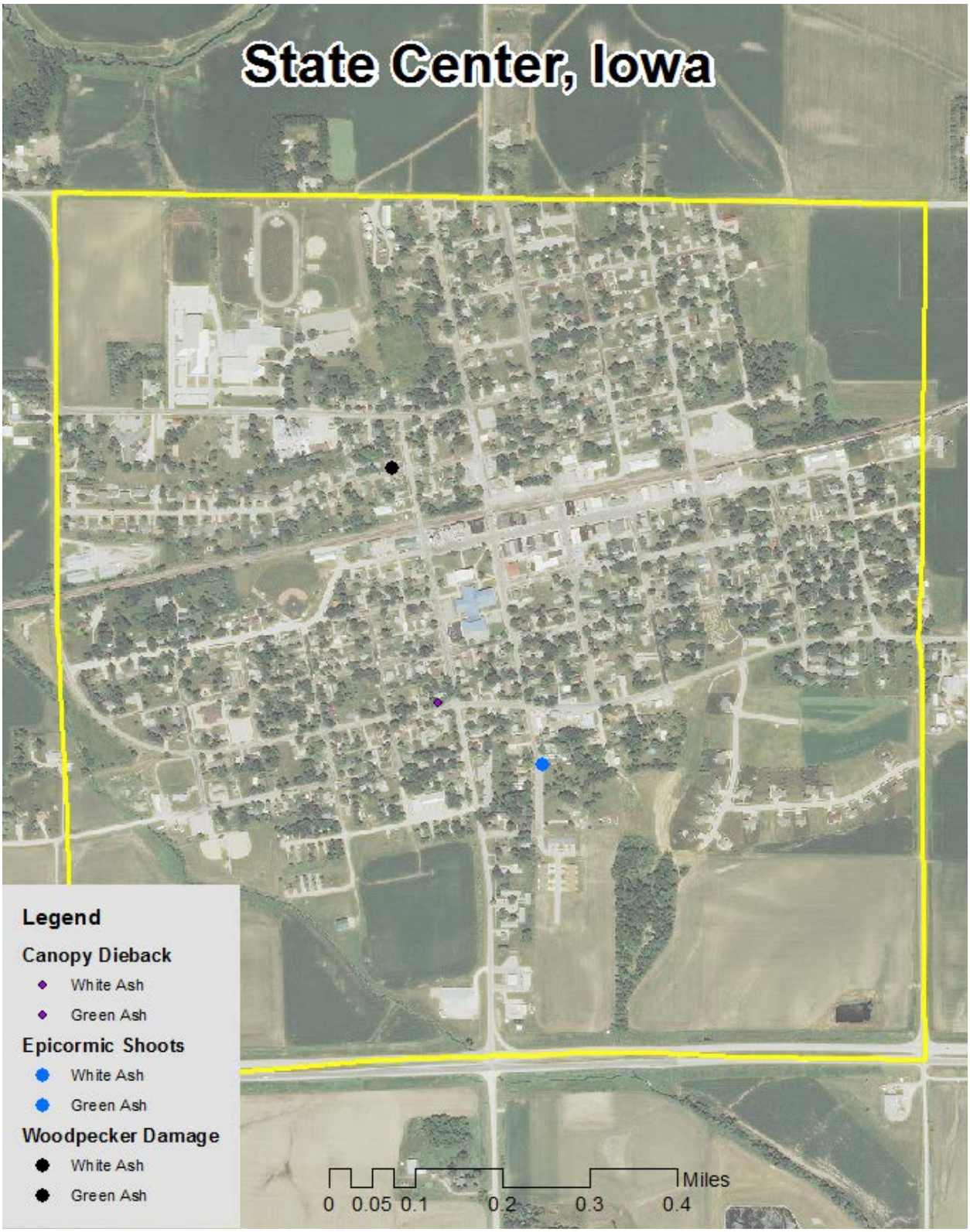


Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

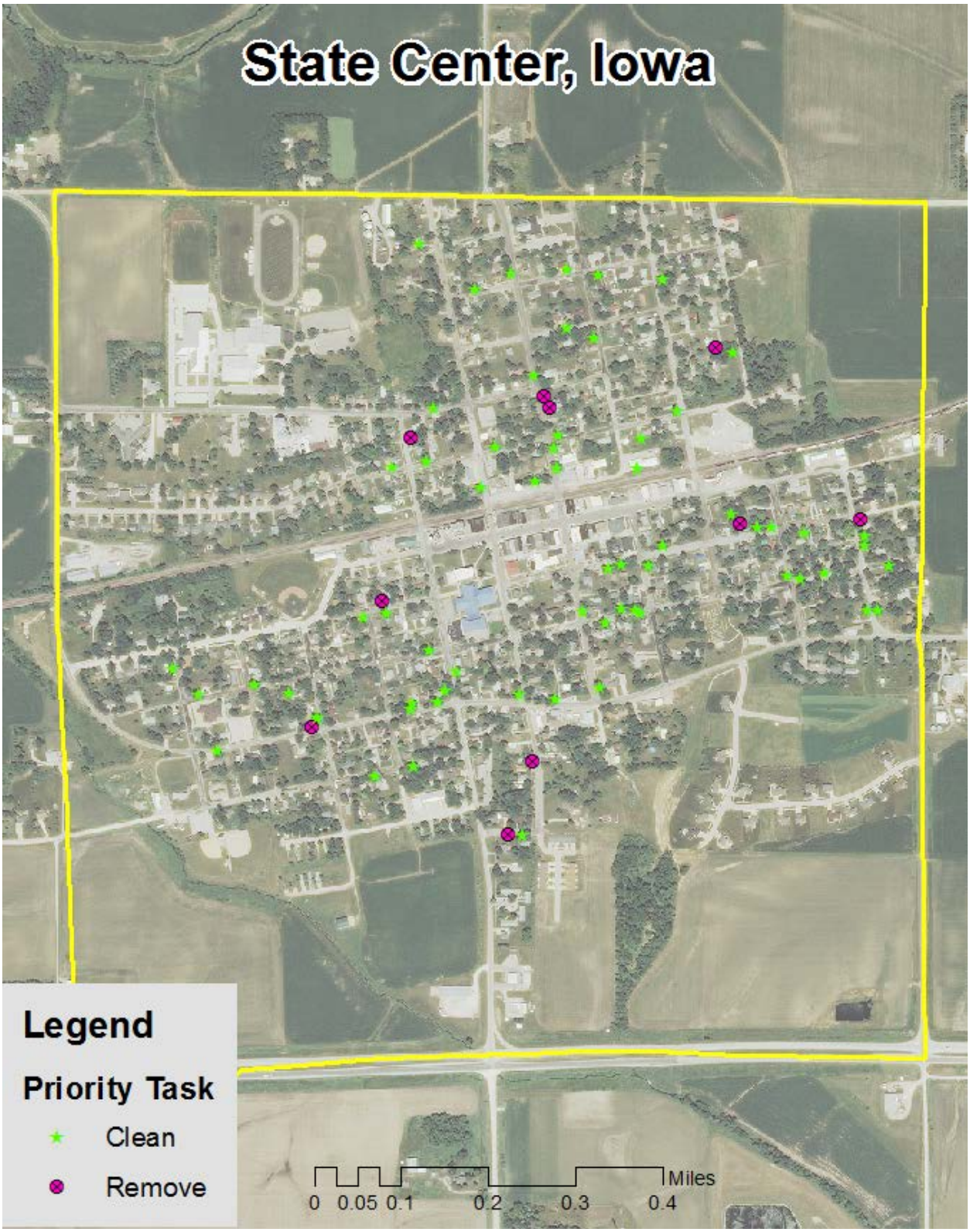


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: State Center Tree Ordinances

608

ORDINANCE NO. 268

AN ORDINANCE AMENDING CHAPTER 151 OF THE CODE OF ORDINANCES OF THE CITY OF STATE CENTER, IOWA, TO REQUIRE A PERMIT FOR THE PLANTING OF TREES, DEFINE PERMISSIBLE VARIETIES AND RESTRICT PLANTING, TRIMMING OR DAMAGING OF TREES UPON PUBLIC PROPERTY

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF STATE CENTER, IOWA:

Section 1. AMENDED CHAPTER 151. Chapter 151 of the Code of Ordinances for the City of State Center, Iowa is amended to read as follows:

151.01 DEFINITIONS. The following words, terms and ascribed to them in this section, Alley means a thoroughfare building.
Park includes any property owned in whole or in part by the city used in whole or in part for recreational purposes, wildlife purposes or other municipally owned public purpose related to recreation or wildlife, but does not include parkings or terraces or municipal parking lots.

Property owner means the contract purchaser if there is one of record, otherwise the record holder of legal title.

Public area includes parks and other lands owned or leased by the city and all terraces along all streets, highways, boulevards, and alleys.

Shrub means a woody plant with several stems and usually with a low mature height of eight feet or less.

Street intersection means the intersection of the public street right-of-way lines of the two intersecting streets. On streets that have sidewalks, this would be the intersection of the inside edges on the private property side of the sidewalks.

Terrace includes the city-owned street right-of-way or street easement area between the property line and the outside edge of any street, road or boulevard in the city, including the sidewalk if present.

Tree means any woody perennial plant of any age with a main trunk and many branches and includes living or dead trees whether standing or fallen.

151.02 PURPOSES. It is the policy of the city to regulate and control the planting, removal, pruning, and protection of trees and other vegetation within streets, highways, and alley rights-of-way and public park areas within the boundaries of the city; to eliminate and guard against dangerous conditions which may result in injury to persons using the public areas of the city; to prevent damage to any public sewer or water main, street, sidewalk or other public property; to protect trees located in public areas from undesirable and unsafe planting, removal, pruning and protection practices; and to guard all trees within the public areas of the city against the spread disease or pests.

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

1. Permit. Upon the issuance of a permit by the City Clerk on a form to be prescribed by that office and approved by the City Clerk or her designee, who shall be an officer or employee of the City.

2. Alignment and spacing. All trees planted along any street shall be planted in the parking midway between the outer line of the sidewalk and curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line, no closer than twenty (20) feet from any street intersections, or ten (10) feet from any driveways and, in where the closest structure is no closer than twenty-five (25) feet from the street, trees shall be planted on private property outside the terrace.

3. Easements or rights-of-way. It shall be unlawful to plant any tree or other woody plant material within any platted alley right-of-way, dedicated utility easement, or walkway area.

151.04 INJURING OR DAMAGING TREES. No person other than an authorized city employee in the performance of his duties, and no animal under any person's control shall in any public area of the city break, injure, mutilate, kill, destroy, cut carve, transplant or remove any tree or shrub; permit any fire to injure any portion of any tree or shrub; permit any toxic chemicals or materials to seep, drain, be emptied on, or otherwise enter into any tree or shrub; or injure the bark of any tree. During building operations, commercial promotions or public promotions, the builder of sponsor shall erect suitable protective barriers around public trees and shrubs to protect from potential injury. No rope, wire, sign or other material shall be fastened to, around, or through any tree or shrub in any public area, except in the event of emergency such as storms or accidents.

151.05 PUBLIC UTILITY WORK. Public utility work affecting trees or shrubs, including cutting, trimming, pruning approved growth inhibitors, shall be limited to the actual necessities or protection of the company, and such work shall be done in a professional manner and in accordance proper arboricultural standards. Trees growing on private land, but encroaching public way or utility easements, may be trimmed for the protection of the services of the company. Not less than forty-eight (48) hours before any digging is done in any terrace, a call shall be made to 800-292-8989 to advise and obtain the location of all underground utilities by the proper utility service company.

151.06 CERTAIN SPECIES PROHIBITED OR RECOMMENDED.

(a) It shall be unlawful to plant any of the following plant species on or adjacent street, terrace, avenue or highway in the city:

(1) All evergreen trees and shrub species except those with a mature height inches or less. ?
(2) All deciduous shrubs.
(3) All Poplars (Populus spp.), including but not restricted to Cottonwood, Poplar, Lombardy Poplar, and hybrids thereof.
(4) Sycamore (Platanus spp.) and all cultivars.
(5) Silver Maple (Acer saccharinum) and all cultivars.
(6) Honey Locust (Gleditsia triacanthos) and all cultivars.
(7) Catalpa (Catalpa speciosa).
(8) Pin Oak (Quercus palustris).
(9) Box Elder (Acer negundo).
(10) Birch (Betula spp.).

(11) Russian Olive (Elaeagnus angustfolia).
(12) Female Ginkgo (Ginkgo biloba).
(13) Willow (Salix spp.).
(14) Oriental Elms (Ulmuspumila and U parvfolia).
(15) Red Mulberry, White Mulberry (Morus rubra and Morus alba).
(16) Crab Apples, with exception of Spring Snow or male sterile varieties.

(b) The city council may issue a special decorative planting permit for planting evergreen and deciduous shrubs with a mature height greater than 12 inches within the terrace area for decorative purposes. Each request will be reviewed upon its own merits, and the proposed plantings at mature height shall not interfere with pedestrian and vehicular safety or the free use of the street or sidewalk.

(c) It shall also be unlawful to plant any tree species that bears fruit, except for male sterile varieties, on a city terrace or on private property in a location where the tree will overhang a sidewalk.

(d) Any plant species prohibited by this section, but in place on the effective date of Ordinance No. 14429, need not be removed by virtue of its mere existence unless interference with other sections of this chapter so requires.

(e) The following tree species are recommended for planting in public right-of-way areas in the city:

TERRACE AREA EIGHT FEET OR MORE IN WIDTH

Species	Spread (in feet)
Hackberry (Celtis occidentalis)	50
Basswood! Linden (Tilia spp.)	35 to 50
Kentucky Coffeetree (Gymnocladus dioicus)	40 to 50
White Oak (Quercus alba)	50 to 60
Bur Oak (Quercus macrocarpa)	50 to 60
Swamp White Oak (Quercus bicolor)	50
Northern Red Oak (Quercus rubra)	50
Sugar Maple (Acer saccharum)	40 to 50
Black Maple (Acer nigrum)	40 to 50
White Ash (Fraxinus americana) and cultivars	50
Male Ginkgo (Ginkgo biloba)	40 to 50

TERRACE AREA LESS THAN EIGHT FEET IN WIDTH
OR WHERE UTILITIES ARE LOCATED

Species	Spread (in feet)
Amur Maple-tree (Acer ginnala)	15 to 20
Japanese Tree Lilac (Syringa amurensisjaponica)	10
Tatarian Maple (Acer tataricum)	15
American Hophornbeam (Ostrya virgin iana)	25
Purple Leaf Plum (Prunus cerasfera)	15

Bradford Pear

Bradford Pear (Pyrus calleryana 'Bradford') 30

151.07 TRIMMING OF TREES ON PUBLIC PROPERTY.

(a) It shall be unlawful to trim or cut in any manner, any tree on any terrace, street, avenue, highway or other public place in the city without the receipt of a permit from the City Clerk, except that limbs or brauches not exceeding six inches in diameter may be trimmed from trees adjacent to the owner's property if done in a manner which conforms to arboricultural specifications and standards. Trees, limbs branches once removed, and any stumps remaining above ground level shall be promptly removed and the ground surface restored to its natural, level condition.

(b) The city shall be responsible for removing dead or diseased trees from within the city. The abutting property owner, agent, or occupant shall be responsible trimming and maintaining the trees on the terrace abutting their property. Trees trimmed that the overhanging branches shall be at least 15 feet above the surface at least ten feet above the surface of the sidewalk so as not to interfere with the street lighting or the free and safe use of the street and sidewalk by the public, taking into consideration tree maturity and size. Branches or limbs over six inches in diameter or trees on terrace only be removed by the city, a public service company, or a person or firm licensed and permitted by the City upon a permit issued by the City Clerk. No permit required of any public service company or city employee doing such work in the public service endeavors.

(c) The city may serve written notice to the abutting property owner or occupant to trim or otherwise maintain the trees on the abutting terrace or remove trees, other than dead or diseased trees, that are not in compliance with the provisions of this abutting property owner or occupant does not perform the required action within a reasonable time specified in the notice, the city may perform the required action and assess the costs against the abutting property owner.

(d) The city shall have the authority to trim or remove any tree, shrub, or other planted on any city terrace for noncompliance of this article. This work shall be done at city expense if written notice was not given to the abutting property owner or occupant.

151.08 TRIMMING OF TREES ON PRIVATE PROPERTY

(a) The property owner or occupant of any lot or parcel of land shall keep the trees on his property so trimmed that the overhanging branches shall be at least 15 feet above the surface of the street and at least eight feet above the surface of the sidewalk so as not to interfere with the street lighting or the free and safe use of the street and sidewalk by the public and shall be kept free of dead limbs and branches, taking into consideration the tree maturity and size.

(b) The city shall have the right to trim or prune any tree or shrub on private property without prior written notice when it overhangs public property and interferes with the proper spread street from a streetlight or interferes with visibility of any traffic control device or sign. The city may serve notice on the abutting property owner to remedy the violation or proceed on its own to perform the work and assess the cost to the property.

151.09 NOTICE AND ASSESSMENT OF COSTS TO PROPERTY OWNERS.

(a) If the property owner does not perform an action required under this article within a reasonable time after written notice specifying the condition which creates the violation and specifies the time within the work must be done, the city may perform the required action and

assess the property for collection in the same manner as a property tax. Notice may be by certified mail to the address shown for purposes of property taxes in the Office of the County Auditor, or to the occupant of the premises as shown by the records of such office, and shall state the time and date by which the work must be done. The notice shall also provide an opportunity to request a hearing before the City Council on not less than ten (10) days notice, unless the condition constitutes an emergency which threatens the health, safety or well-being of the public, in which case the city may perform any action which may be required under this article without prior written notice and assess the costs as provided in this section after providing written notice to the property owner and an opportunity to request a hearing before the City Council. All action taken by the city without notice to the property owner is done at city expense and shall not be assessed to the property owner.

151.10 RIGHT OF INSPECTION. The city shall have the right to come upon the private property of any person for the limited purpose of determining whether or not a violation of this ordinance exists, or to determine whether or not the requirements of a written notice served upon the property owner have been satisfied. Refusal by the owner or occupant to permit access to the property by the city shall be sufficient grounds to determine that a violation of this ordinance exists.

151.11 BARRICADES OR OTHER PROTECTIVE DEVICES.

When necessary for the protection of the public, guards, barricades or other protective devices warnings shall be maintained on any sidewalk, street or other public places where trees are being trimmed or removed. Barricades and other protective devices shall meet the standards set forth by the any permit or by direction of the public works department. Except in emergency, traffic on any street shall not be barricaded without first obtaining permission therefore from the public works department and notifying the fire department, police department, and the ambulance service of the closing and again when the street is reopened. (Ord. No. 14429, § 1, 6-14-1993)

151.12 PENALTIES. Violation of any section of this article shall be deemed to be a municipal infraction.

Section 3. REPEALER. All ordinances or part of ordinances in conflict with the provisions of this Ordinance are hereby repealed.

Section 4. SEVERABILITY. If any section, provision or part of this Ordinance shall be adjudged invalid, unconstitutional or unenforceable for any reason, such adjudication shall not affect the validity or enforcement of the remaining provisions.

Section 5. EFFECTIVE DATE. This Ordinance shall become effective from and after its final passage, approval and publication as provided by law, with the increase in compensation to take effect upon the next regular term of office.

[Iowa Code §380.6, 7(3)
§362.3
§372.13(8)]

Passed by the Council on this 16 day of March, 2005 and approved this 16 day of March, 2005

The City of State Center, Iowa

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 515-725-8200.