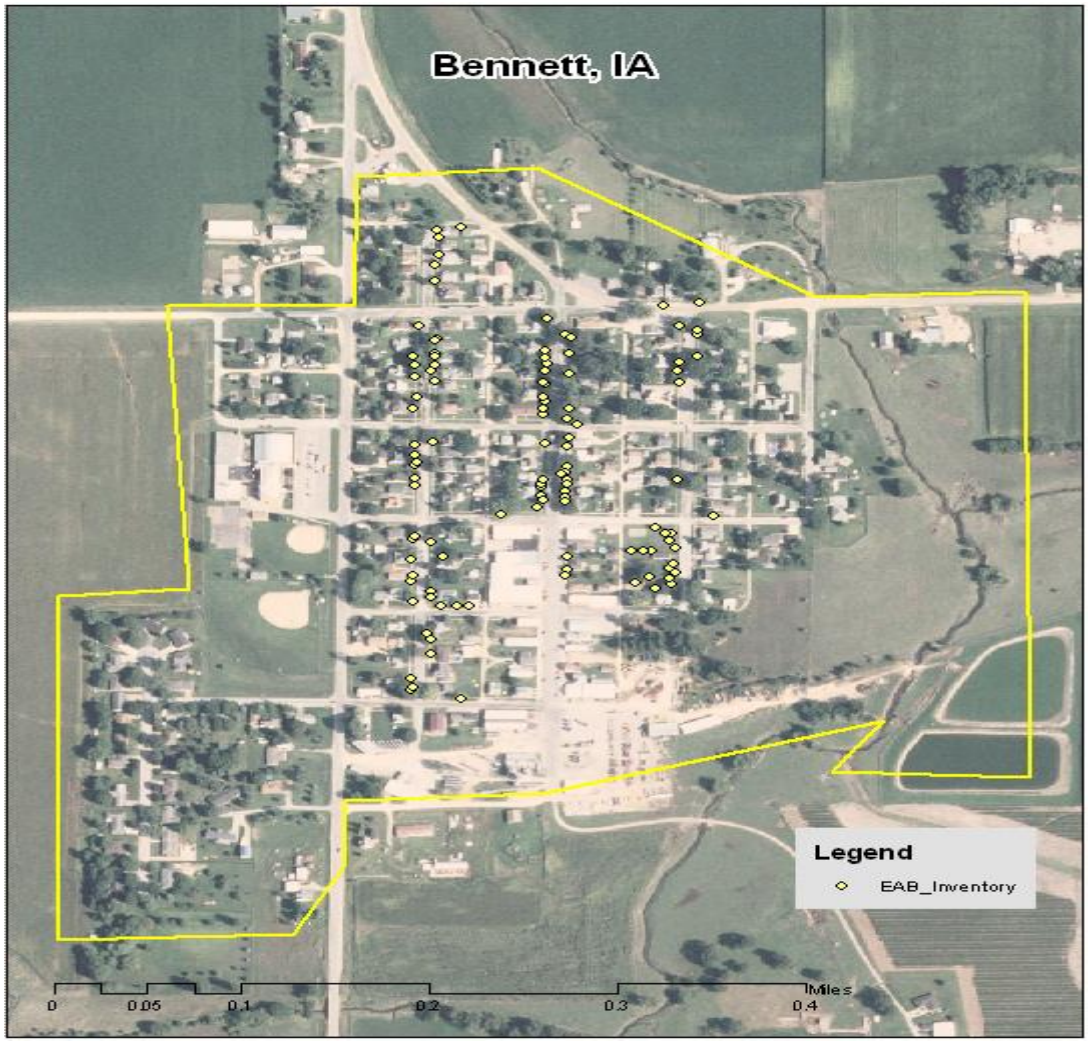
Bennett, IA



2010 Management Plan

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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Bennett with managing its urban forest, including budgeting and future planning. Trees provide many 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 that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 5.4% of Bennett's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues. Bennett has a low number of problem trees compared to most other communities, but the issues still need to be addressed.

Inventory and Results

In 2010, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 112 trees inventoried.

- Bennett's trees provide $18,277 of benefits annually, an average of $163 a tree
- There are over 20 species of trees
- The top three genus are: Maple 66%, Oak 10.7%, and Ash 5.4%
- 10% of trees are in need of some type of management
- 3 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 3 trees needing removal, 1 tree is over 24 inches in diameter at 4.5 ft and should be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 3 of the 6 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB. The symptom is declining canopy, which may not be related to EAB.
- 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, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the proposed budget it could take 6 years to remove ash – Suggestion: apply for grants to plant replacement trees and enlist volunteers for watering and maintenance.

Introduction

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

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

Inventory

In 2010, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 112 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Bennett's trees reduce energy related costs by approximately $5,066 annually (Appendix A, Table 1). These savings are both in Electricity (24.2 MWh) and in Natural Gas (3,295.1 Therms).

Annual Stormwater Benefits

Bennett's trees intercept about 258,043 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $6,993 of benefits to the city.

Annual Air Quality Benefits

Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic mater (ozone). In Bennett, it is estimated that trees remove 319.4 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 $903 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Bennett, trees sequester about 51,775 lbs of carbon a year with an associated value of $656 (Appendix A, Table 5). In addition, the trees store 1,029,547 lbs of carbon, with a TOTAL benefit of $7,722 (Appendix A, Table 4).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Bennett receives $4,659 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Bennett's trees provide $18,277 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 112 trees in Bennett provide approximately $163 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Bennett has over 20 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	74	66.0%
Oak	12	10.7%
Ash	6	5.4%
Other Trees	20	17.9%

Age Class

Most of Bennett's trees (44%) are between 6 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 18 inches in diameter at 4.5 ft. Bennett's size curve is a little on the smaller side, indicating a slightly younger than average stand.

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 Bennett indicate that 88% of the trees are in good health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 78% of Bennett'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 3% of the population. This 3% 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 5).

Tree Removal	3	2.7%

Canopy Cover

The canopy cover of Bennett is approximately 3 acres (Appendix A, Figure 5). According to the 2000 census, Bennett occupies 130 acres. Thus the canopy cover on city land is about 2.3%.

Land Use and Location

The majority of Bennett'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	84.8%
Park/vacant/other	15.2%

Location	
Planting strip	83.0%
Other maintained locations	15.2%
Front yard	1.8%

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

Bennett has 3 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 5). It is recommended to start with the large diameter critical concern trees first. There are 2 trees over 18 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 that do not include trimming.

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 3 removals, none are ash trees. There are a total of 6 ash trees, and 3 of those have signs and symptoms that have been associated with EAB. The symptom these ash are showing is canopy dieback, which might not be related to EAB. In addition, there are 5 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 3 years will replace the trees that are removed. It is recommended to plant 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 number of trees helps ensure continuation of the benefits of the existing forest in Bennett.

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 (66%) (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: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut. All trees planted should meet these restrictions.

Continual Monitoring

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

Proposed Six Year Maintenance Plan

Year 1

- Removal: 2 largest critical concern trees
- Planting and Replacement: 2 trees to be planted in open locations
- Visual Survey for signs and symptoms of EAB

Year 2

- Removal: 1 critical concern trees and 1 additional ash tree with poor health
- Planting and Replacement: 2 trees in open locations from year one removals
- Routine trimming: Trim 1/3 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 3

- Removal: 2 trees - removal of any new critical concern trees and ash in poor health
- Planting and Replacement: 2 trees to be planted in open locations and locations from previous removals
- Visual Survey for signs and symptoms of EAB

Year 4

- Removal: 1 tree - removal of any new critical concern tree or ash in poor health
- Planting and Replacement: 2 trees in open locations from previous removals

Routine trimming: Trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 1 tree - removal of any new critical concern trees or ash in poor health
Planting and Replacement: 2 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 1 tree - removal of any new critical concern tree or ash in poor health
Planting and Replacement: 2 trees in open locations from previous removals
Routine trimming: Trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 4 to 6 ash trees removed (approximately 66% to 100% of ash street trees). EAB could potentially kill all ash within 4 years of its arrival.

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*

EAB Quarantines

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

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

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

Wood Disposal

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

Canopy Replacement

As budget permits, all removed ash trees will be replaced. The new plantings will be a diverse mix and will not include ash, maple, 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 genus 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. Although Bennett has no City Code relating to trees, it is recommended that one is adopted similar to the example in Appendix C, 151.06, which states “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the 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.”

Budget

Proposed Budget
Total $6,600 over 6 years ($1,100/year)

FY 2011 Budget
Removal: $1,200
Planting: $200
Watering & Maintenance: City maintenance and volunteers

FY 2012 Budget
Removal: $1,200
Planting: $200
Routine trimming: City maintenance
Watering & Maintenance: City maintenance and volunteers

FY 2013 Budget
Removal: $1,200
Planting: $200
Watering & Maintenance: City maintenance and volunteers

FY 2014 Budget
Removal: $600
Planting: $200
Routine trimming: City maintenance
Watering & Maintenance: City maintenance and volunteers

FY 2015 Budget
Removal: $600
Planting: $200
Watering & Maintenance: City maintenance and volunteers

FY 2016 Budget
Removal: $600
Planting: $200
Routine trimming: City maintenance
Watering & Maintenance: City maintenance and volunteers

*Reduction of ash over 6 years: approximately 4 to 6 ash trees removed (approximately 66% to 100% of ash street trees).

Purposed Budget Increase

EAB could potentially kill all ash trees in Bennett within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to an average of $1,100 a year. Additionally, it is recommended that Bennett 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.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

8/12/2010

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	8.4	640	1,187.5	1,164	1,804	(N/A)	32.1	35.6	50.11
Silver maple	5.4	410	702.5	688	1,098	(N/A)	20.5	21.7	47.74
Sugar maple	1.6	122	215.6	211	334	(N/A)	8.0	6.6	37.06
Maple	0.3	20	38.1	37	57	(N/A)	5.4	1.1	9.50
Green ash	1.5	114	191.8	188	302	(N/A)	5.4	6.0	50.28
Northern red oak	0.9	68	119.7	117	185	(N/A)	5.4	3.7	30.84
Broadleaf Deciduous	0.4	32	67.4	66	98	(N/A)	3.6	1.9	24.47
Northern hackberry	1.5	117	205.4	201	318	(N/A)	2.7	6.3	106.07
Pin oak	0.6	42	77.7	76	118	(N/A)	2.7	2.3	39.29
Siberian elm	1.3	97	167.1	164	261	(N/A)	2.7	5.1	86.85
Eastern red cedar	0.2	17	32.9	32	49	(N/A)	1.8	1.0	24.57
Bur oak	0.9	70	122.1	120	190	(N/A)	1.8	3.7	94.83
American basswood	0.2	13	27.7	27	41	(N/A)	1.8	0.8	20.27
Other street trees	1.0	76	139.6	137	213	(N/A)	6.3	4.2	30.42
Citywide total	24.2	1,837	3,295.1	3,229	5,066	(N/A)	100.0	100.0	45.23

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

8/12/2010

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	75,106	2,036	(N/A)	32.1	29.1	56.54
Silver maple	70,060	1,899	(N/A)	20.5	27.2	82.55
Sugar maple	16,501	447	(N/A)	8.0	6.4	49.69
Maple	1,186	32	(N/A)	5.4	0.5	5.36
Green ash	14,833	402	(N/A)	5.4	5.8	67.00
Northern red oak	6,011	163	(N/A)	5.4	2.3	27.15
Broadleaf Deciduous	2,344	64	(N/A)	3.6	0.9	15.88
Northern hackberry	19,477	528	(N/A)	2.7	7.6	175.96
Pin oak	4,805	130	(N/A)	2.7	1.9	43.41
Siberian elm	16,613	450	(N/A)	2.7	6.4	150.08
Eastern red cedar	3,269	89	(N/A)	1.8	1.3	44.30
Bur oak	14,477	392	(N/A)	1.8	5.6	196.17
American basswood	947	26	(N/A)	1.8	0.4	12.83
Other street trees	12,414	336	(N/A)	6.3	4.8	48.06
Citywide total	258,043	6,993	(N/A)	100.0	100.0	62.44

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

8/12/2010

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	15.1	2.6	7.4	0.7	82	40.6	5.9	5.6	38.3	252	-3.6	-13	112.7	321	(N/A)	32.1	8.91
Silver maple	11.7	2.0	5.8	0.5	63	25.4	3.7	3.6	24.4	159	-6.7	-25	70.4	197	(N/A)	20.5	8.58
Sugar maple	2.5	0.4	1.2	0.1	14	7.6	1.1	1.1	7.3	48	-2.0	-7	19.4	54	(N/A)	8.0	5.98
Maple	0.1	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	2.9	8	(N/A)	5.4	1.38
Green ash	1.8	0.3	0.9	0.1	10	7.0	1.0	1.0	6.8	44	0.0	0	18.9	54	(N/A)	5.4	8.94
Northern red oak	1.0	0.2	0.5	0.0	6	4.2	0.6	0.6	4.0	26	-1.4	-5	9.9	27	(N/A)	5.4	4.46
Broadleaf Deciduous	0.2	0.0	0.2	0.0	1	2.1	0.3	0.3	1.9	13	-0.1	0	4.9	14	(N/A)	3.6	3.47
Northern hackberry	4.5	0.8	2.2	0.2	24	7.3	1.1	1.0	7.0	46	0.0	0	24.1	70	(N/A)	2.7	23.35
Pin oak	0.7	0.1	0.4	0.0	4	2.6	0.4	0.4	2.5	16	-1.3	-5	5.8	15	(N/A)	2.7	5.07
Siberian elm	3.4	0.6	1.6	0.1	18	6.0	0.9	0.8	5.8	38	0.0	0	19.2	56	(N/A)	2.7	18.58
Eastern red cedar	0.7	0.1	0.5	0.1	4	1.1	0.2	0.1	1.0	7	-1.8	-7	2.0	4	(N/A)	1.8	2.19
Bur oak	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)	1.8	20.79
American basswood	0.0	0.0	0.0	0.0	0	0.9	0.1	0.1	0.8	5	-0.1	0	1.9	5	(N/A)	1.8	2.71
Other street trees	1.7	0.3	0.9	0.1	9	4.8	0.7	0.7	4.5	30	-0.7	-2	12.9	37	(N/A)	6.3	5.22
Citywide total	46.2	7.9	22.9	2.1	250	115.4	16.8	16.0	109.7	719	-17.7	-66	319.4	903	(N/A)	100.0	8.06

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

4/18/2011

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	248,885	1,867	(N/A)	32.1	24.2	51.85
Silver maple	292,325	2,192	(N/A)	20.5	28.4	95.32
Sugar maple	76,407	573	(N/A)	8.0	7.4	63.67
Maple	1,991	15	(N/A)	5.4	0.2	2.49
Green ash	59,766	448	(N/A)	5.4	5.8	74.71
Northern red oak	18,482	139	(N/A)	5.4	1.8	23.10
Broadleaf	4,403	33	(N/A)	3.6	0.4	8.26
Northern	78,377	588	(N/A)	2.7	7.6	195.94
Pin oak	16,449	123	(N/A)	2.7	1.6	41.12
Siberian elm	82,863	621	(N/A)	2.7	8.1	207.16
Eastern red cedar	2,204	17	(N/A)	1.8	0.2	8.27
Bur oak	95,241	714	(N/A)	1.8	9.3	357.15
American	2,049	15	(N/A)	1.8	0.2	7.68
Other street trees	22,728	376	(N/A)	6.3	4.9	53.68
Citywide total	1,029,547	7,722	(N/A)	100.0	100.0	68.94

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

8/12/2010

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	10,475	79	-1,195	-7	-9	14,150	106	23,424	176	(N/A)	32.1	26.8	4.88
Silver maple	21,723	163	-1,403	-4	-11	9,050	68	29,365	220	(N/A)	20.5	33.6	9.58
Sugar maple	3,691	28	-367	-2	-3	2,701	20	6,024	45	(N/A)	8.0	6.9	5.02
Maple	323	2	-10	-1	0	434	3	746	6	(N/A)	5.4	0.9	0.93
Green ash	3,117	23	-287	-1	-2	2,513	19	5,342	40	(N/A)	5.4	6.1	6.68
Northern red oak	1,387	10	-89	-1	-1	1,496	11	2,793	21	(N/A)	5.4	3.2	3.49
Broadleaf Deciduous	896	7	-21	-1	0	703	5	1,577	12	(N/A)	3.6	1.8	2.96
Northern hackberry	2,199	16	-376	-1	-3	2,583	19	4,406	33	(N/A)	2.7	5.0	11.01
Pin oak	1,771	13	-79	-1	-1	923	7	2,615	20	(N/A)	2.7	3.0	6.54
Siberian elm	2,534	19	-398	-1	-3	2,140	16	4,275	32	(N/A)	2.7	4.9	10.69
Eastern red cedar	86	1	-11	0	0	374	3	448	3	(N/A)	1.8	0.5	1.68
Bur oak	1,391	10	-457	0	-3	1,547	12	2,481	19	(N/A)	1.8	2.8	9.30
American basswood	240	2	-10	0	0	296	2	526	4	(N/A)	1.8	0.6	1.97
Other street trees	1,943	15	-241	-1	-2	1,681	13	3,382	25	(N/A)	6.3	3.9	3.62
Citywide total	51,775	388	-4,942	-22	-37	40,593	304	87,404	656	(N/A)	100.0	100.0	5.85

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

8/12/2010

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,023	(N/A)	32.1	22.0	28.42
Silver maple	1,779	(N/A)	20.5	38.2	77.34
Sugar maple	383	(N/A)	8.0	8.2	42.51
Maple	59	(N/A)	5.4	1.3	9.83
Green ash	282	(N/A)	5.4	6.1	47.02
Northern red oak	124	(N/A)	5.4	2.7	20.73
Broadleaf Deciduous	105	(N/A)	3.6	2.3	26.22
Northern hackberry	241	(N/A)	2.7	5.2	80.30
Pin oak	167	(N/A)	2.7	3.6	55.65
Siberian elm	154	(N/A)	2.7	3.3	51.18
Eastern red cedar	27	(N/A)	1.8	0.6	13.68
Bur oak	87	(N/A)	1.8	1.9	43.45
American basswood	26	(N/A)	1.8	0.6	13.08
Other street trees	202	(N/A)	6.3	4.3	28.87
Citywide total	4,659	(N/A)	100.0	100.0	41.60

Table 7: Summary of Benefits in Dollars

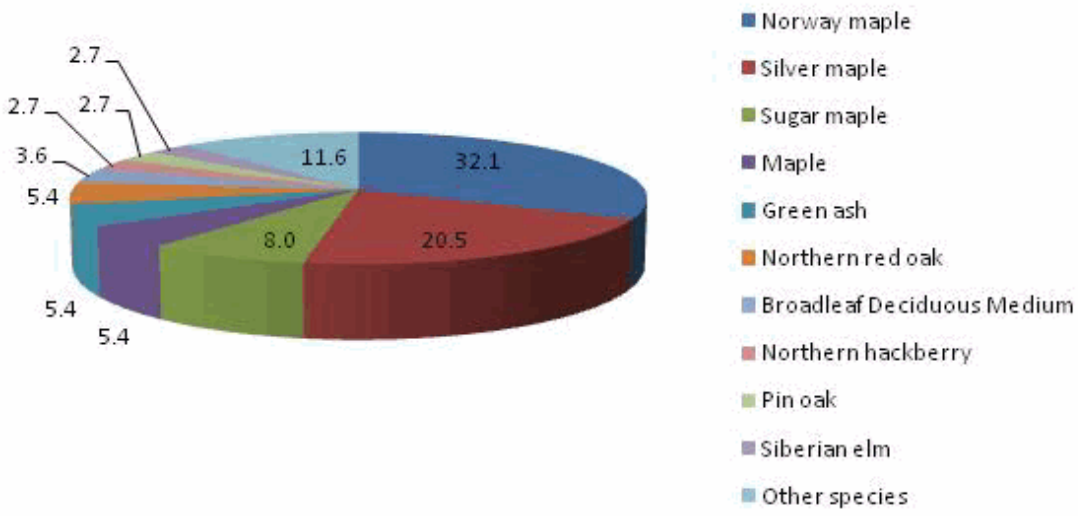
Total Annual Benefits of Public Trees by Species ($)

8/12/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	1,804	176	321	2,036	1,023	5,359	(±0)	29.3
Silver maple	1,098	220	197	1,899	1,779	5,193	(±0)	28.4
Sugar maple	334	45	54	447	383	1,262	(±0)	6.9
Maple	57	6	8	32	59	162	(±0)	0.9
Green ash	302	40	54	402	282	1,080	(±0)	5.9
Northern red oak	185	21	27	163	124	520	(±0)	2.8
Broadleaf Deciduous	98	12	14	64	105	292	(±0)	1.6
Northern hackberry	318	33	70	528	241	1,190	(±0)	6.5
Pin oak	118	20	15	130	167	450	(±0)	2.5
Siberian elm	261	32	56	450	154	952	(±0)	5.2
Eastern red cedar	49	3	4	89	27	173	(±0)	0.9
Bur oak	190	19	42	392	87	729	(±0)	4.0
American basswood	41	4	5	26	26	102	(±0)	0.6
Other street trees	213	25	37	336	202	813	(±0)	4.5
Citywide Total	5,066	656	903	6,993	4,659	18,277	(±0)	100.0

Species Distribution of Public Trees (%)

8/12/2010

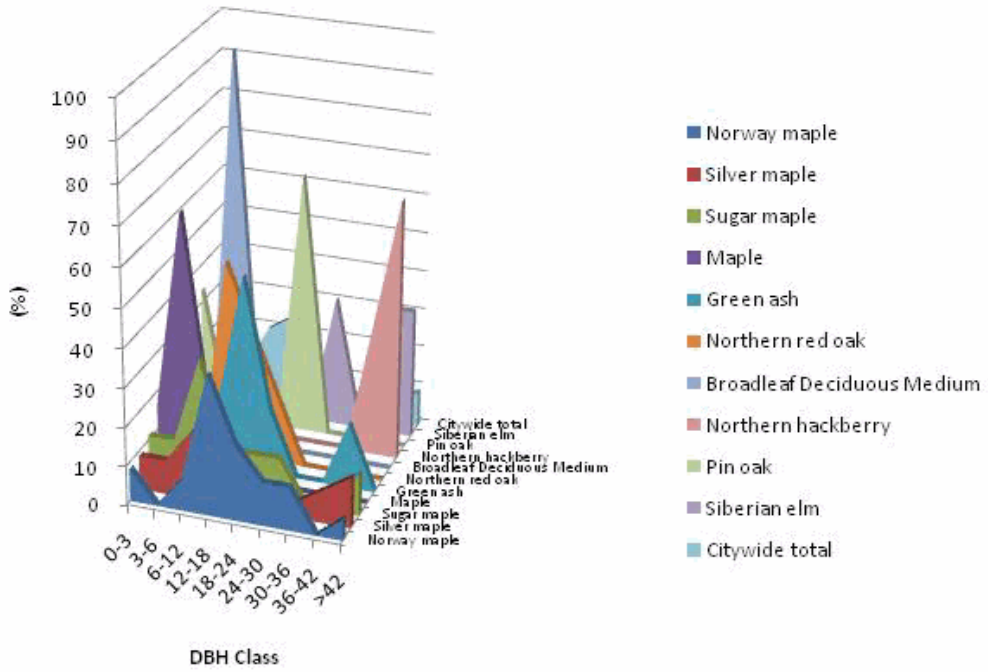


Species	Percent
Norway maple	32.1
Silver maple	20.5
Sugar maple	8.0
Maple	5.4
Green ash	5.4
Northern red oak	5.4
Broadleaf Deciduous	3.6
Northern hackberry	2.7
Pin oak	2.7
Siberian elm	2.7
Other species	11.6
Total	100.0

Figure 1: Species Distribution

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

8/12/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	8.3	0.0	8.3	36.1	19.4	11.1	11.1	0.0	5.6
Silver maple	8.7	8.7	17.4	21.7	13.0	4.3	4.3	8.7	13.0
Sugar maple	11.1	11.1	33.3	11.1	11.1	11.1	0.0	0.0	11.1
Maple	16.7	66.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Green ash	0.0	0.0	16.7	50.0	16.7	0.0	0.0	16.7	0.0
Northern red oak	0.0	0.0	50.0	33.3	16.7	0.0	0.0	0.0	0.0
Broadleaf Deciduous	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	66.7
Pin oak	33.3	0.0	0.0	0.0	66.7	0.0	0.0	0.0	0.0
Siberian elm	0.0	0.0	0.0	0.0	0.0	33.3	0.0	33.3	33.3
Citywide total	8.0	8.0	19.6	24.1	14.3	6.3	4.5	6.3	8.9

Figure 2: Relative Age Class

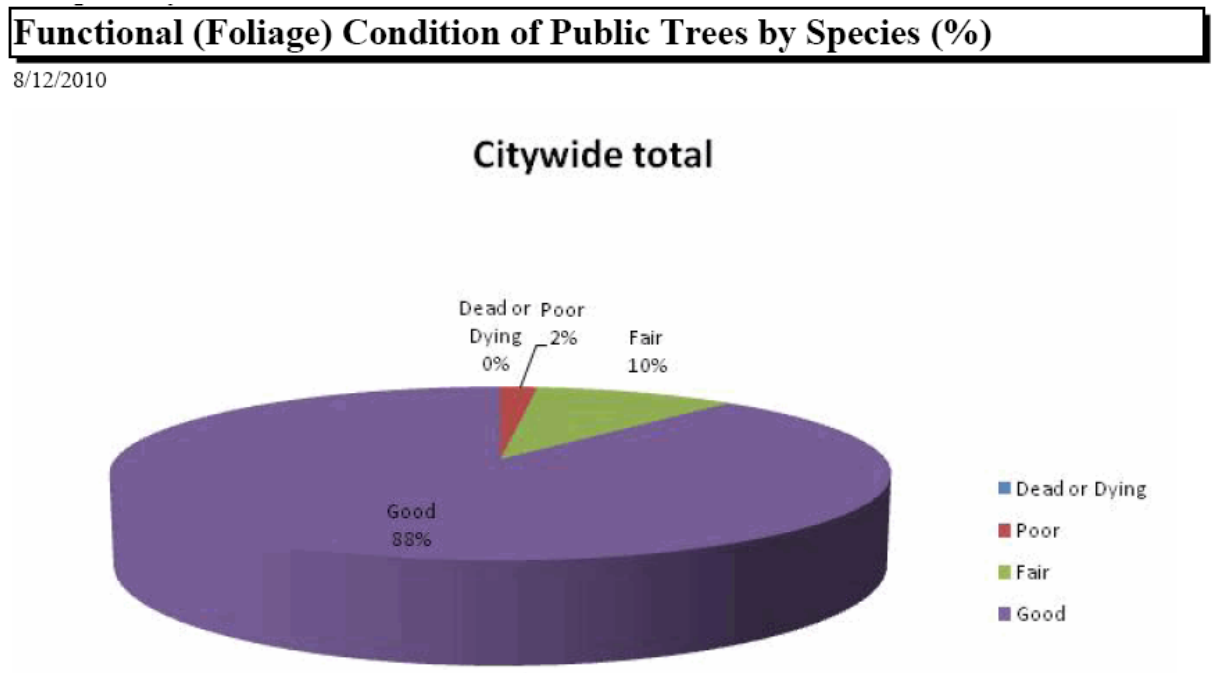


Figure 3: Foliage Condition

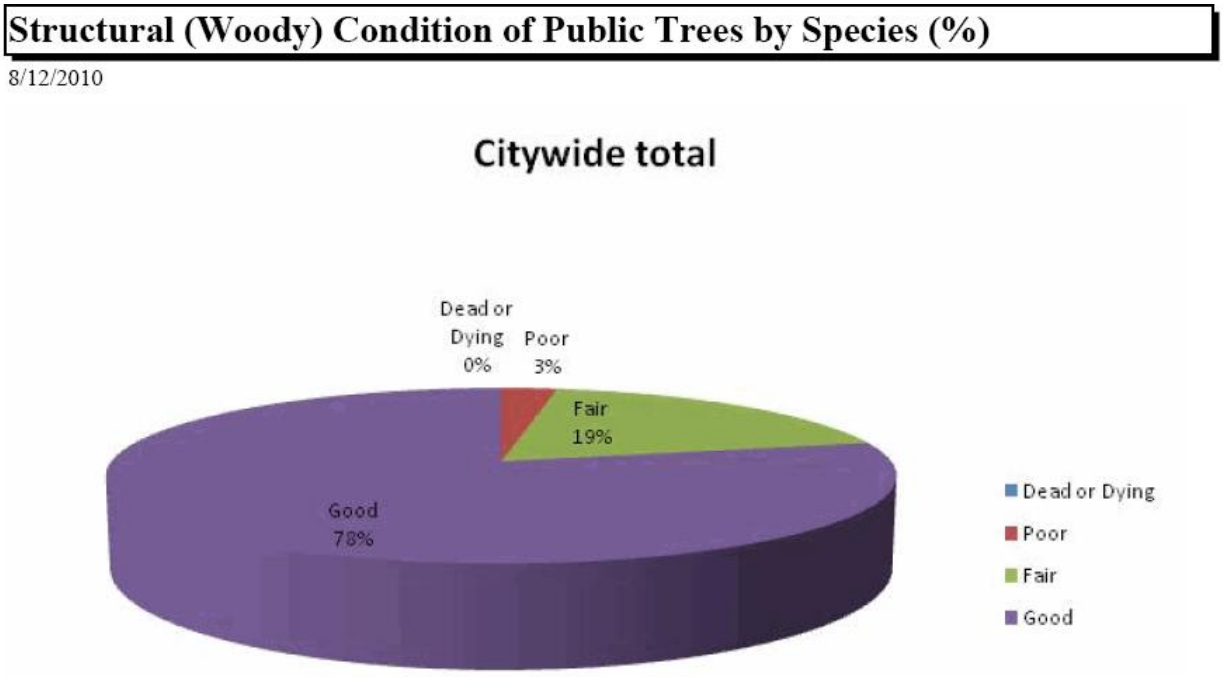
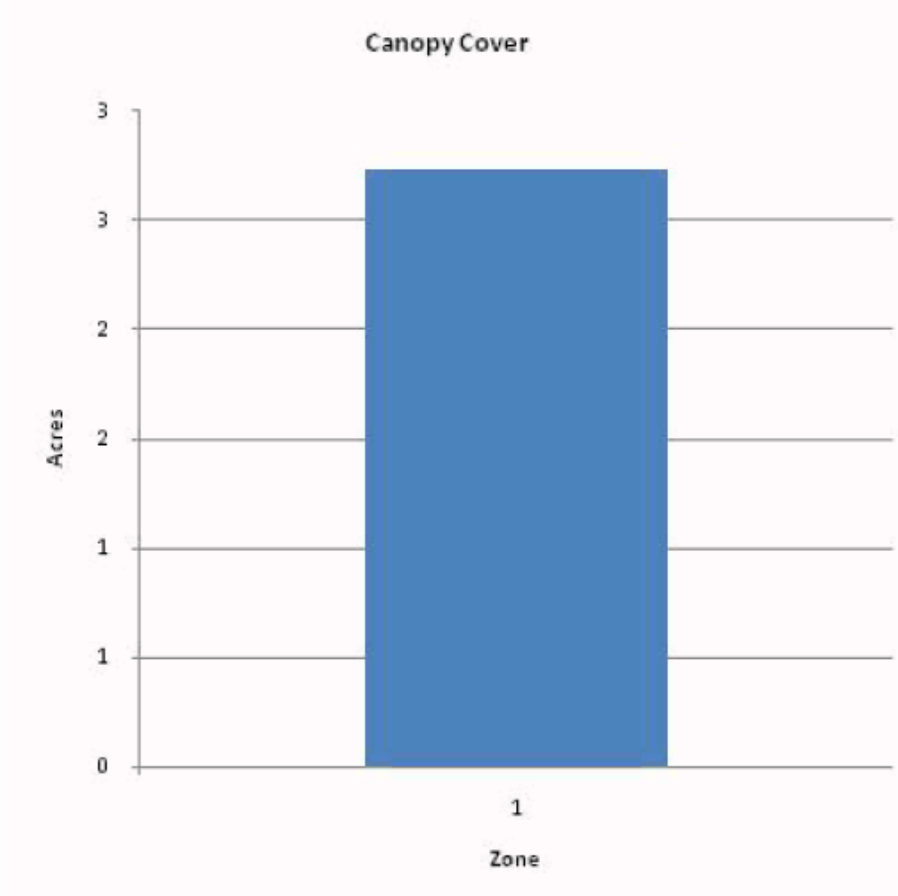


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

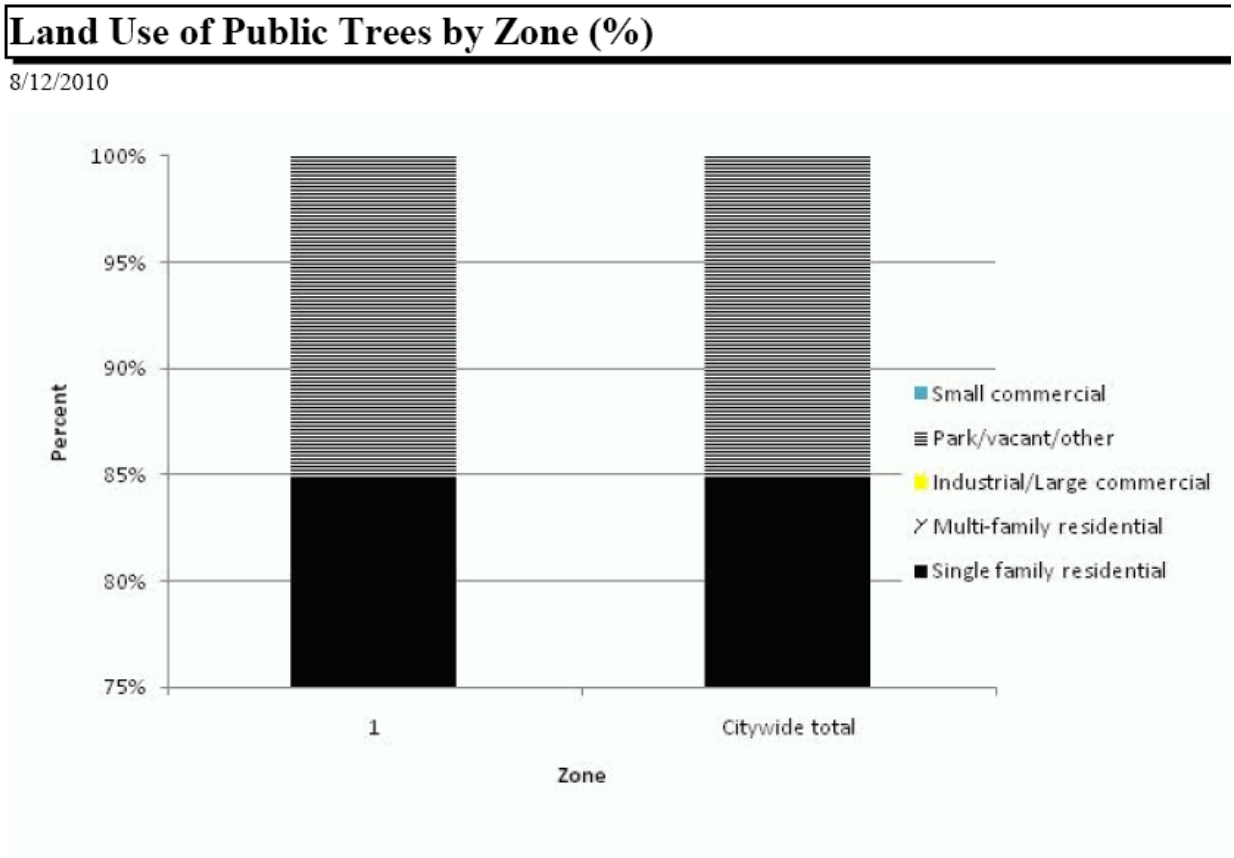
8/12/2010



Zone	Acres	% of Total Canopy Cover
1	3	100.0
Citywide total	3	100.0

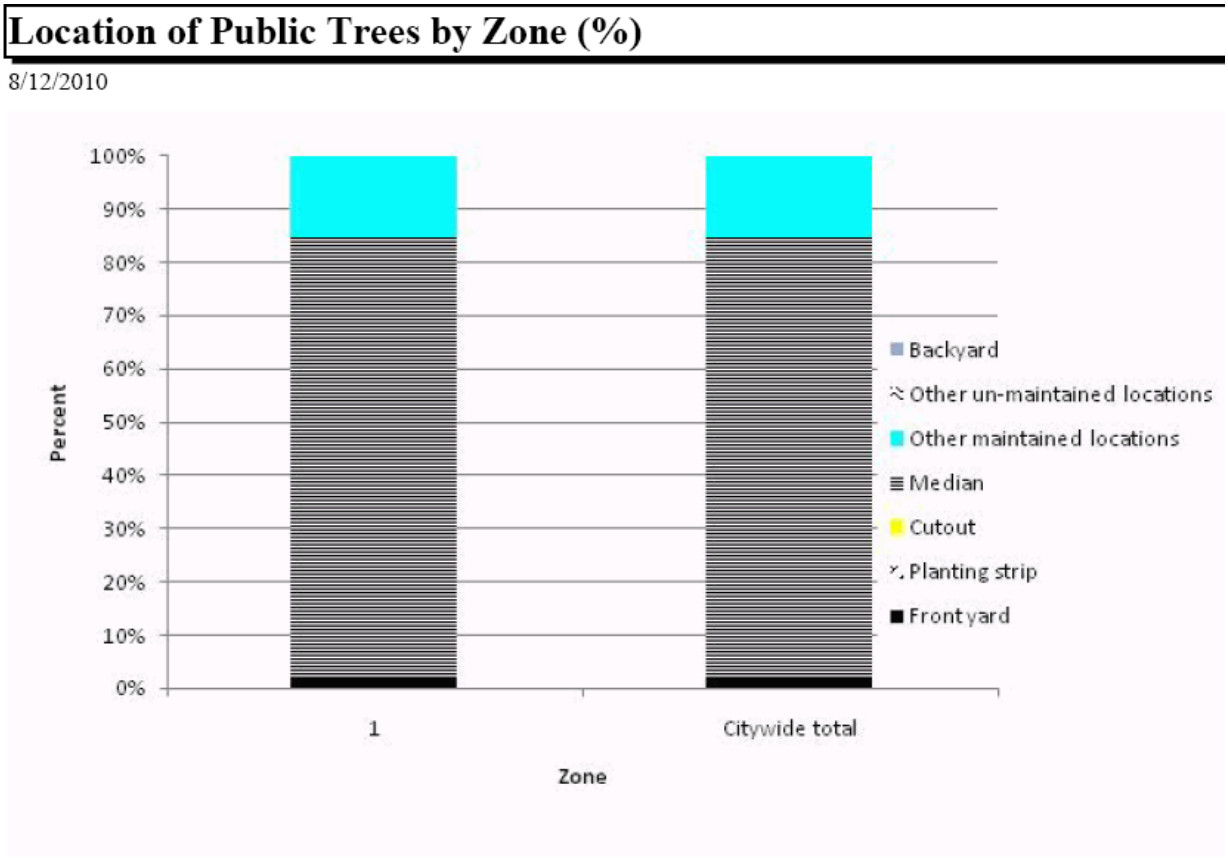
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	130 ac.		3	2.3%	

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	84.8	0.0	0.0	15.2	0.0
Citywide total	84.8	0.0	0.0	15.2	0.0

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	1.8	0.0	0.0	83.0	15.2	0.0	0.0
Citywide total	1.8	0.0	0.0	83.0	15.2	0.0	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

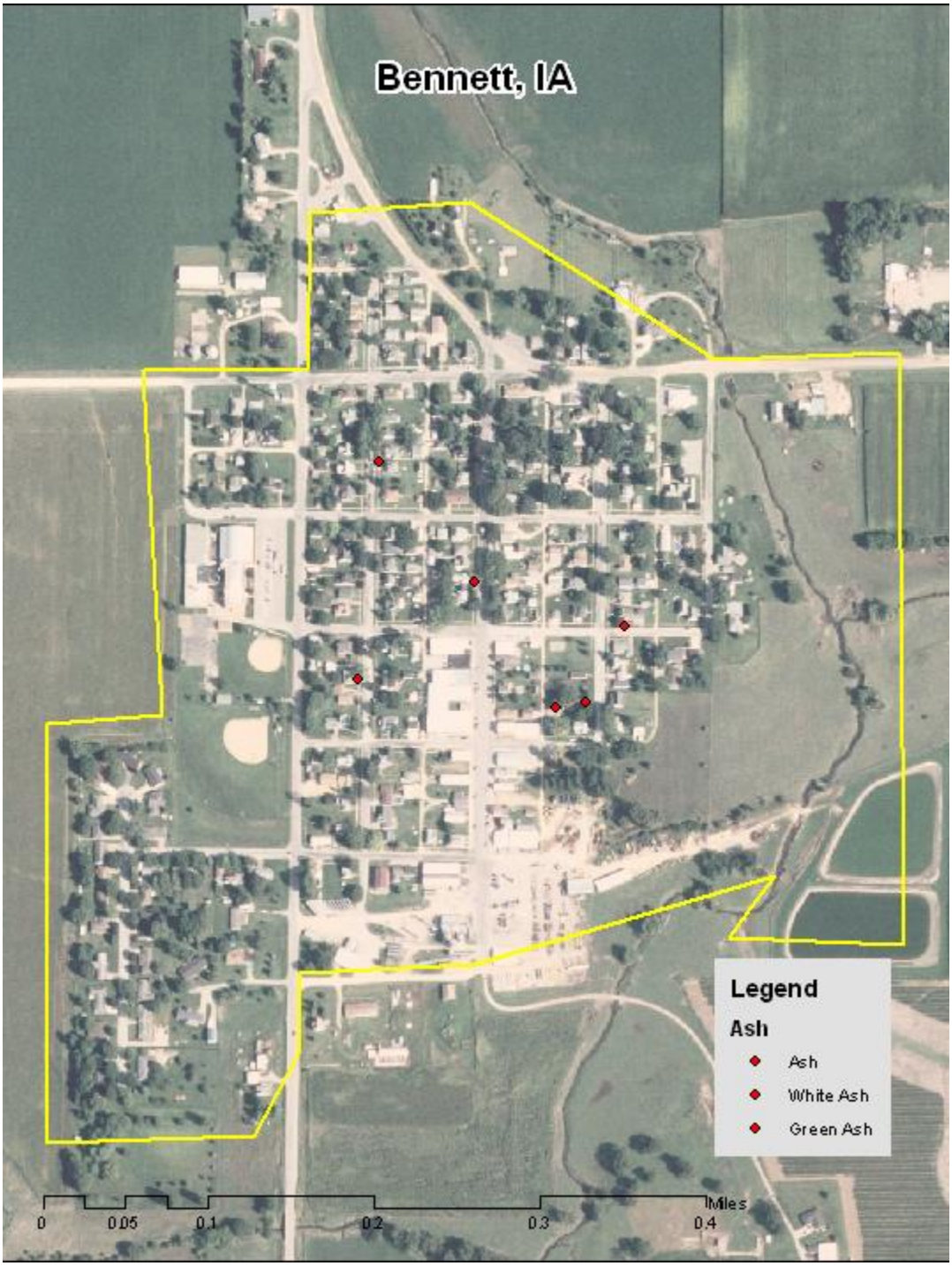


Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance*City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: SAMPLE Tree Ordinances

Although Bennett has no city ordinances referring to trees, the following is an example that could be adopted:

CHAPTER 151
TREES AND GRASS

151.01 Definition 151.05 Disease Control
151.02 Planting Restrictions 151.06 Inspection and Removal
151.03 Duty to Trim Trees 151.07 Cutting or Mowing of Grass
151.04 Trimming Trees to be Supervised

151.01 DEFINITION. For use in this chapter, "boulevard" 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 boulevard or street except in accordance with the following:
1. Alignment. All tress planted in any street shall be planted in the boulevard 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 ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any boulevard 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 twenty (20) 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 eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, 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 TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

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 infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:
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 the 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])

151.07 CUTTING OR MOWING OF GRASS.
1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.
2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

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 Director Richard Leopold at 515-281-5918.