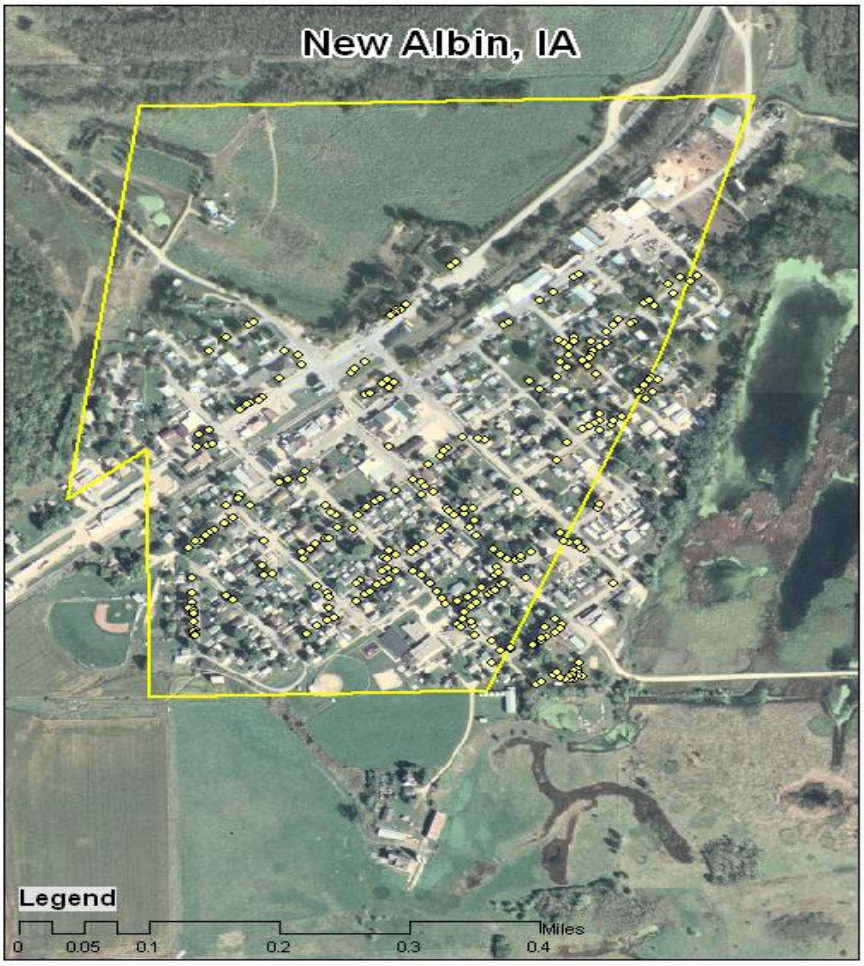
NEW ALBIN, IA



2010 Management Plan

Provided by Northeast Iowa R,C & D
Prepared by Beyer Forestry Services
In cooperation with the Iowa DNR Forestry Bureau

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of New Albin 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 9% of New Albin's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2009, 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 266 trees inventoried.

- New Albin's trees provide $51,856 of benefits annually, an average of $195 a tree
- There are over 28 species of trees
- The top three genus are: Maple 55%, Ash 9%, and Walnut 7%
- 32% 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 30 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*
- None of your ash trees are displaying signs and symptoms associated with 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, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.
- Check ash trees with a visual survey yearly

Introduction

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

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

Inventory

In 2009, 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 266 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. New Albin's trees reduce energy related costs by approximately $13,291 annually (Appendix A, Table 1). These savings are both in Electricity (63.5 MWh) and in Natural Gas (8,645.6 Therms).

Annual Stormwater Benefits

New Albin's trees intercept about 729,341 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $19,767 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 New Albin, it is estimated that trees remove 814 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 $2,284 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In New Albin trees sequester about 148,828 lbs of carbon a year with an associated value of $1,818 (Appendix A, Table 5). In addition, the trees store 2,691,461 lbs of carbon, with a yearly benefit of $20,186 (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. New Albin receives $14,697 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, New Albin's trees provide $51,856 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 266 trees in New Albin provide approximately $195 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

New Albin has over 28 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Species	Number of Trees	% of City Trees
Maple	147	55
Ash	23	9
Walnut	18	7
Oak	16	6
Spruce	15	6
Hackberry	10	4
Locust	8	3
Apple/Crabapple	5	2
Basswood/Linden	4	2
Birch	3	1
Cottonwood	3	1
Cedar	2	1
Mulberry	2	1
White Pine	1	<1
Elm	1	<1
Boxelder	1	<1
Other Broadleaf Species	7	3
Total	266	

Age Class

Most of New Albins's trees (39%) are between 12 and 24 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. New Albin's size curve is on the larger side, indicating an older 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 New Albin indicate that 89% 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, 82% of New Albin'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 7% of the population. This 7% 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	76	29%
Crown Raising	3	1%
Tree Removal	3	1%
Crown Reduction	3	1%

Canopy Cover

The canopy cover of New Albin is approximately 7acres (Appendix A, Figure 5). According to the 2000 census, New Albin occupies 128 acres. Thus the canopy cover on city land is about 5%.

Land Use and Location

The majority of New Albin'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	81%
Park/vacant/other	13%
Small commercial	4%
Industrial/Large commercial	1%
Multifamily residential	1%

Location	
Planting strip	73%
Other maintained locations	18%
Front yard	9%

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

New Albin 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 4). It is recommended to start with the large diameter critical concern trees first. There is 1 hackberry trees over 30 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. There are a total of 13 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). None of the immediate removal trees are ash trees. There are a total of 23 ash trees, and currently none of these have signs and symptoms that have been associated with EAB. However, the city has 9 ash trees over 18 inches in diameter, and 2 ash trees over 30 inches in diameter. *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 on page 11.

Planting

Most of the planting over the next 6 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 New Albin.

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 (55%) (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: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

Continual Monitoring

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

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all 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, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

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 as they are infested with Emerald Ash Borer. Private property owners should plant species that are recommended for the city owned property because the private property is a major portion of your urban forest.

It is recommended that New Albin develop a city tree ordinance to guide species, planting location, and maintenance of trees located in the city.

PROPOSED WORK SCHEDULE AND ESTIMATED COSTS_

Year 1

Remove 3 critical concern trees plus 5 ash trees	$1,200
Plant 10 trees in open locations	$1,500
Visual survey for signs and symptoms of Emerald Ash Borer	

Year 2

Remove 5 ash trees	$750
Plant 5 trees in open locations	$750
Prune 1/3 of city trees	$2,500
Maintenance of planted trees	$200
Visual survey for signs and symptoms of EAB	

Year 3

Remove 5 ash trees	$750
Plant 5 trees in open locations	$750
Maintenance of planted trees	$200
Visual survey for signs and symptoms of EAB	

Year 4

Remove 5 ash trees	$750
Plant 5 trees in open locations	$750
Prune 1/3 of city trees	$2,500
Maintenance of planted trees	$200
Visual survey for signs and symptoms of EAB	

Year 5

Remove 3 ash trees	$450
Plant 3 trees in open locations	$450
Maintenance of planted trees	$200
Visual survey for signs and symptoms of EAB	

Year 6

Prune 1/3 of city trees	$2,500
Maintenance of planted trees	$200

Purposed Budget Increase

EAB could potentially kill all ash trees in New Albin within 4 years of its arrival. To remove all ash trees within 6 years, replant trees to replace the ash, and properly care for the tree resource in New Albin, the city budget for trees should be $2,500 to $3,000 per year. It is recommended that New Albin 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.

Works Cited

Census Bureau. 2000. http://censtats.census.gov/data/IA/1601964290.pdf (April, 2010)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, D.J. and J.F. Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J.; McPherson, E. Gregory; Simpson, James R.; Vargas, Kelaine E.; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

7/7/2009

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	14.4	1,092	1,953.1	1,914	3,006	(N/A)	19.9	22.6	56.72
Norway maple	10.3	785	1,482.8	1,453	2,238	(N/A)	16.9	16.8	49.74
Silver maple	11.0	835	1,457.7	1,429	2,263	(N/A)	13.5	17.0	62.87
Green ash	4.6	347	601.9	590	937	(N/A)	7.1	7.1	49.33
Black walnut	5.0	380	661.6	648	1,029	(N/A)	6.8	7.7	57.15
Red maple	1.4	107	178.7	175	283	(N/A)	4.9	2.1	21.73
Northern hackberry	4.6	346	633.7	621	967	(N/A)	3.8	7.3	96.71
Norway spruce	1.1	80	138.7	136	216	(N/A)	3.8	1.6	21.57
Swamp white oak	2.2	166	324.9	318	485	(N/A)	3.0	3.7	60.60
Honeylocust	2.1	163	280.6	275	438	(N/A)	2.6	3.3	62.55
Planting Space	0.0	1	3.1	3	4	(N/A)	1.9	0.0	0.87
Apple	0.3	20	46.1	45	65	(N/A)	1.9	0.5	13.08
Northern red oak	0.7	54	96.9	95	149	(N/A)	1.9	1.1	29.83
White ash	0.6	47	83.0	81	128	(N/A)	1.5	1.0	32.01
Blue spruce	0.1	10	21.1	21	30	(N/A)	1.5	0.2	7.58
Paper birch	0.7	56	92.1	90	146	(N/A)	1.1	1.1	48.59
Eastern cottonwood	0.3	22	41.2	40	62	(N/A)	1.1	0.5	20.64
White oak	1.2	92	166.3	163	255	(N/A)	1.1	1.9	85.02
Other street trees	2.8	215	382.1	374	589	(N/A)	5.6	4.4	39.30
Citywide total	63.5	4,818	8,645.6	8,473	13,291	(N/A)	100.0	100.0	49.97

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

7/7/2009

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	159,485	4,322	(N/A)	19.9	21.9	81.55
Norway maple	93,548	2,535	(N/A)	16.9	12.8	56.34
Silver maple	168,262	4,560	(N/A)	13.5	23.1	126.67
Green ash	41,423	1,123	(N/A)	7.1	5.7	59.09
Black walnut	49,037	1,329	(N/A)	6.8	6.7	73.83
Red maple	8,486	230	(N/A)	4.9	1.2	17.69
Northern hackberry	57,383	1,555	(N/A)	3.8	7.9	155.52
Norway spruce	23,284	631	(N/A)	3.8	3.2	63.10
Swamp white oak	25,076	680	(N/A)	3.0	3.4	84.95
Honeylocust	26,347	714	(N/A)	2.6	3.6	102.01
Planting Space	37	1	(N/A)	1.9	0.0	0.20
Apple	931	25	(N/A)	1.9	0.1	5.04
Northern red oak	6,449	175	(N/A)	1.9	0.9	34.95
White ash	6,556	178	(N/A)	1.5	0.9	44.42
Blue spruce	1,306	35	(N/A)	1.5	0.2	8.85
Paper birch	5,521	150	(N/A)	1.1	0.8	49.88
Eastern cottonwood	1,823	49	(N/A)	1.1	0.3	16.47
White oak	18,219	494	(N/A)	1.1	2.5	164.59
Other street trees	36,168	980	(N/A)	5.6	5.0	65.35
Citywide total	729,341	19,767	(N/A)	100.0	100.0	74.31

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

7/7/2009

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Sugar maple	20.9	3.6	10.5	0.9	113	68.5	10.0	9.5	65.2	427	-16.5	-62	172.5	479	(N/A)	19.9	9.03
Norway maple	18.8	3.2	9.3	0.8	102	50.1	7.2	6.9	46.9	310	-4.4	-17	138.8	395	(N/A)	16.9	8.78
Silver maple	30.9	5.2	15.0	1.4	166	51.9	7.6	7.2	49.7	325	-16.4	-62	152.7	430	(N/A)	13.5	11.93
Green ash	4.4	0.7	2.2	0.2	24	21.6	3.2	3.0	20.8	135	0.0	0	56.1	159	(N/A)	7.1	8.37
Black walnut	5.6	0.9	2.8	0.3	30	23.7	3.5	3.3	22.7	148	0.0	0	62.7	178	(N/A)	6.8	9.90
Red maple	1.5	0.3	0.8	0.1	8	6.6	1.0	0.9	6.4	42	-0.6	-2	17.0	48	(N/A)	4.9	3.67
Northern hackberry	10.5	1.8	5.1	0.5	57	21.9	3.2	3.0	20.7	136	0.0	0	66.6	193	(N/A)	3.8	19.26
Norway spruce	2.8	0.6	2.2	0.3	18	5.0	0.7	0.7	4.8	31	-13.5	-51	3.6	-1	(N/A)	3.8	-0.13
Swamp white oak	5.7	1.0	2.7	0.3	30	10.7	1.5	1.5	9.9	66	-1.3	-5	32.0	92	(N/A)	3.0	11.47
Honeylocust	5.2	0.9	2.4	0.2	28	10.1	1.5	1.4	9.7	63	-4.2	-16	27.2	75	(N/A)	2.6	10.74
Planting Space	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.2	1	(N/A)	1.9	0.11
Apple	0.1	0.0	0.1	0.0	1	1.4	0.2	0.2	1.2	8	0.0	0	3.2	9	(N/A)	1.9	1.81
Northern red oak	1.3	0.2	0.6	0.1	7	3.4	0.5	0.5	3.2	21	-1.9	-7	8.0	21	(N/A)	1.9	4.26
White ash	1.0	0.2	0.5	0.0	5	2.9	0.4	0.4	2.8	18	0.0	0	8.1	23	(N/A)	1.5	5.83
Blue spruce	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.4	-1	1.3	3	(N/A)	1.5	0.80
Paper birch	0.5	0.1	0.3	0.0	3	3.4	0.5	0.5	3.3	21	0.0	0	8.6	24	(N/A)	1.1	8.06
Eastern cottonwood	0.1	0.0	0.1	0.0	0	1.4	0.2	0.2	1.3	9	0.0	0	3.2	9	(N/A)	1.1	2.99
White oak	2.7	0.4	1.2	0.1	14	5.8	0.8	0.8	5.5	36	0.0	0	17.5	50	(N/A)	1.1	16.82
Other street trees	6.0	1.0	3.3	0.4	33	13.5	2.0	1.9	12.8	84	-5.5	-21	35.2	97	(N/A)	5.6	6.44
Citywide total	118.1	20.1	59.0	5.6	641	302.6	44.1	42.0	287.6	1,886	-64.6	-242	814.4	2,284	(N/A)	100.0	8.59

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

7/7/2009

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	600,835	4,506	(N/A)	19.9	22.3	85.02
Norway maple	309,154	2,319	(N/A)	16.9	11.5	51.53
Silver maple	752,000	5,640	(N/A)	13.5	27.9	156.67
Green ash	142,426	1,068	(N/A)	7.1	5.3	56.22
Black walnut	181,328	1,360	(N/A)	6.8	6.7	75.55
Red maple	18,101	136	(N/A)	4.9	0.7	10.44
Northern	170,100	1,276	(N/A)	3.8	6.3	127.57
Norway spruce	34,520	259	(N/A)	3.8	1.3	25.89
Swamp white oak	93,643	702	(N/A)	3.0	3.5	87.79
Honeylocust	67,981	510	(N/A)	2.6	2.5	72.84
Planting Space	69	1	(N/A)	1.9	0.0	0.10
Apple	3,079	23	(N/A)	1.9	0.1	4.62
Northern red oak	27,251	204	(N/A)	1.9	1.0	40.88
White ash	17,854	134	(N/A)	1.5	0.7	33.48
Blue spruce	372	3	(N/A)	1.5	0.0	0.70
Paper birch	15,801	119	(N/A)	1.1	0.6	39.50
Eastern	3,104	23	(N/A)	1.1	0.1	7.76
White oak	91,145	684	(N/A)	1.1	3.4	227.86
Other street trees	73,800	1,220	(N/A)	5.6	6.1	81.35
Citywide total	2,691,461	20,186	(N/A)	100.0	100.0	75.89

Table 5: Annual Carbon Sequestered

Annual CO Benefits of Public Trees by Species

7/7/2009

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	32,127	241	-2,884	-10	-22	24,132	181	53,364	400	(N/A)	19.9	22.0	7.55
Norway maple	13,874	104	-1,484	-9	-11	17,354	130	29,735	223	(N/A)	16.9	12.3	4.96
Silver maple	51,010	383	-3,610	-7	-27	18,445	138	65,838	494	(N/A)	13.5	27.2	13.72
Green ash	10,264	77	-684	-4	-5	7,678	58	17,255	129	(N/A)	7.1	7.1	6.81
Black walnut	11,398	85	-870	-4	-7	8,404	63	18,928	142	(N/A)	6.8	7.8	7.89
Red maple	2,481	19	-87	-3	-1	2,374	18	4,766	36	(N/A)	4.9	2.0	2.75
Northern hackberry	6,629	50	-816	-2	-6	7,650	57	13,460	101	(N/A)	3.8	5.6	10.10
Norway spruce	588	4	-166	-2	-1	1,763	13	2,183	16	(N/A)	3.8	0.9	1.64
Swamp white oak	1,215	9	-449	-2	-3	3,679	28	4,443	33	(N/A)	3.0	1.8	4.17
Honeylocust	6,890	52	-326	-1	-2	3,600	27	10,163	76	(N/A)	2.6	4.2	10.89
Planting Space	43	0	0	-1	0	28	0	70	1	(N/A)	1.9	0.0	0.11
Apple	418	3	-15	-1	0	447	3	849	6	(N/A)	1.9	0.4	1.27
Northern red oak	1,093	8	-131	-1	-1	1,196	9	2,158	16	(N/A)	1.9	0.9	3.24
White ash	1,685	13	-86	-1	-1	1,032	8	2,631	20	(N/A)	1.5	1.1	4.93
Blue spruce	64	0	-2	-1	0	213	2	275	2	(N/A)	1.5	0.1	0.52
Paper birch	1,550	12	-76	-1	-1	1,227	9	2,701	20	(N/A)	1.1	1.1	6.75
Eastern cottonwood	626	5	-15	-1	0	476	4	1,087	8	(N/A)	1.1	0.5	2.72
White oak	2,831	21	-437	-1	-3	2,034	15	4,428	33	(N/A)	1.1	1.8	11.07
Other street trees	4,040	30	-781	-3	-6	4,751	36	8,007	60	(N/A)	5.6	3.3	4.00
Citywide total	148,828	1,116	-12,919	-52	-97	106,484	799	242,342	1,818	(N/A)	100.0	100.0	6.83

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

7/7/2009

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	3,352	(N/A)	19.9	22.8	63.24
Norway maple	1,346	(N/A)	16.9	9.2	29.91
Silver maple	3,812	(N/A)	13.5	25.9	105.90
Green ash	940	(N/A)	7.1	6.4	49.46
Black walnut	984	(N/A)	6.8	6.7	54.66
Red maple	361	(N/A)	4.9	2.5	27.73
Northern hackberry	755	(N/A)	3.8	5.1	75.53
Norway spruce	130	(N/A)	3.8	0.9	12.98
Swamp white oak	109	(N/A)	3.0	0.7	13.59
Honeylocust	1,751	(N/A)	2.6	11.9	250.08
Planting Space	0	(N/A)	1.9	0.0	0.03
Apple	23	(N/A)	1.9	0.2	4.66
Northern red oak	84	(N/A)	1.9	0.6	16.83
White ash	195	(N/A)	1.5	1.3	48.68
Blue spruce	51	(N/A)	1.5	0.4	12.69
Paper birch	149	(N/A)	1.1	1.0	49.80
Eastern cottonwood	86	(N/A)	1.1	0.6	28.56
White oak	192	(N/A)	1.1	1.3	63.85
Other street trees	378	(N/A)	5.6	2.6	25.23
Citywide total	14,697	(N/A)	100.0	100.0	55.25

Table 7: Summary of Benefits in Dollars

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

7/7/2009

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Sugar maple	56.72	7.55	9.03	81.55	63.24	218.09	(N/A)
Norway maple	49.74	4.96	8.78	56.34	29.91	149.74	(N/A)
Silver maple	62.87	13.72	11.93	126.67	105.90	321.09	(N/A)
Green ash	49.33	6.81	8.37	59.09	49.46	173.05	(N/A)
Black walnut	57.15	7.89	9.90	73.83	54.66	203.43	(N/A)
Red maple	21.73	2.75	3.67	17.69	27.73	73.58	(N/A)
Northern hackberry	96.71	10.10	19.26	155.52	75.53	357.12	(N/A)
Norway spruce	21.57	1.64	-0.13	63.10	12.98	99.15	(N/A)
Swamp white oak	60.60	4.17	11.47	84.95	13.59	174.78	(N/A)
Honeylocust	62.55	10.89	10.74	102.01	250.08	436.27	(N/A)
Planting Space	0.87	0.11	0.11	0.20	0.03	1.31	(N/A)
Apple	13.08	1.27	1.81	5.04	4.66	25.87	(N/A)
Northern red oak	29.83	3.24	4.26	34.95	16.83	89.10	(N/A)
White ash	32.01	4.93	5.83	44.42	48.68	135.87	(N/A)
Blue spruce	7.58	0.52	0.80	8.85	12.69	30.44	(N/A)
Paper birch	48.59	6.75	8.06	49.88	49.80	163.09	(N/A)
Eastern cottonwood	20.64	2.72	2.99	16.47	28.56	71.38	(N/A)
White oak	85.02	11.07	16.82	164.59	63.85	341.34	(N/A)
Other street trees	39.30	4.00	6.44	65.35	25.23	140.32	(N/A)

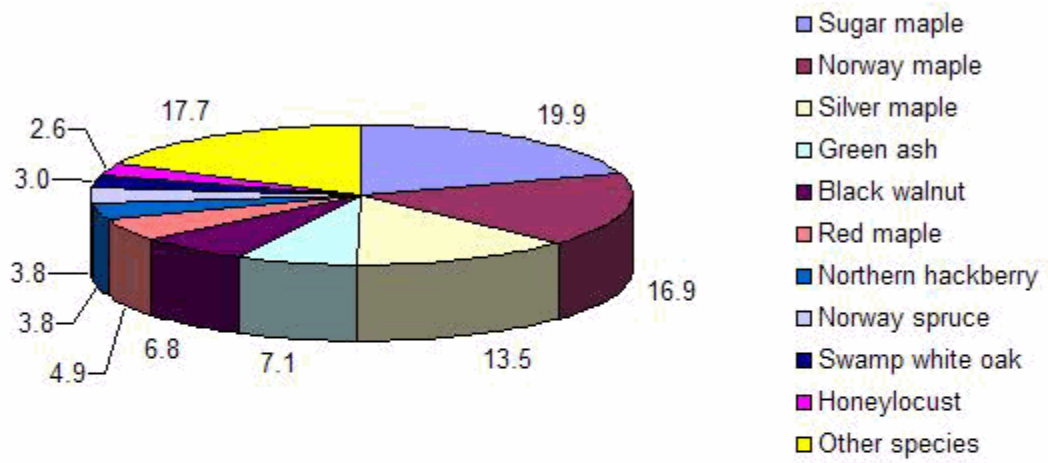
Total Annual Benefits of Public Trees by Species ($)

7/7/2009

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Sugar maple	3,006	400	479	4,322	3,352	11,559	(±0)	22.3
Norway maple	2,238	223	395	2,535	1,346	6,738	(±0)	13.0
Silver maple	2,263	494	430	4,560	3,812	11,559	(±0)	22.3
Green ash	937	129	159	1,123	940	3,288	(±0)	6.3
Black walnut	1,029	142	178	1,329	984	3,662	(±0)	7.1
Red maple	283	36	48	230	361	956	(±0)	1.8
Northern hackberry	967	101	193	1,555	755	3,571	(±0)	6.9
Norway spruce	216	16	-1	631	130	992	(±0)	1.9
Swamp white oak	485	33	92	680	109	1,398	(±0)	2.7
Honeylocust	438	76	75	714	1,751	3,054	(±0)	5.9
Planting Space	4	1	1	1	0	7	(±0)	0.0
Apple	65	6	9	25	23	129	(±0)	0.2
Northern red oak	149	16	21	175	84	446	(±0)	0.9
White ash	128	20	23	178	195	543	(±0)	1.0
Blue spruce	30	2	3	35	51	122	(±0)	0.2
Paper birch	146	20	24	150	149	489	(±0)	0.9
Eastern cottonwood	62	8	9	49	86	214	(±0)	0.4
White oak	255	33	50	494	192	1,024	(±0)	2.0
Other street trees	589	60	97	980	378	2,105	(±0)	4.1
Citywide Total	13,291	1,818	2,284	19,767	14,697	51,856	(±0)	100.0

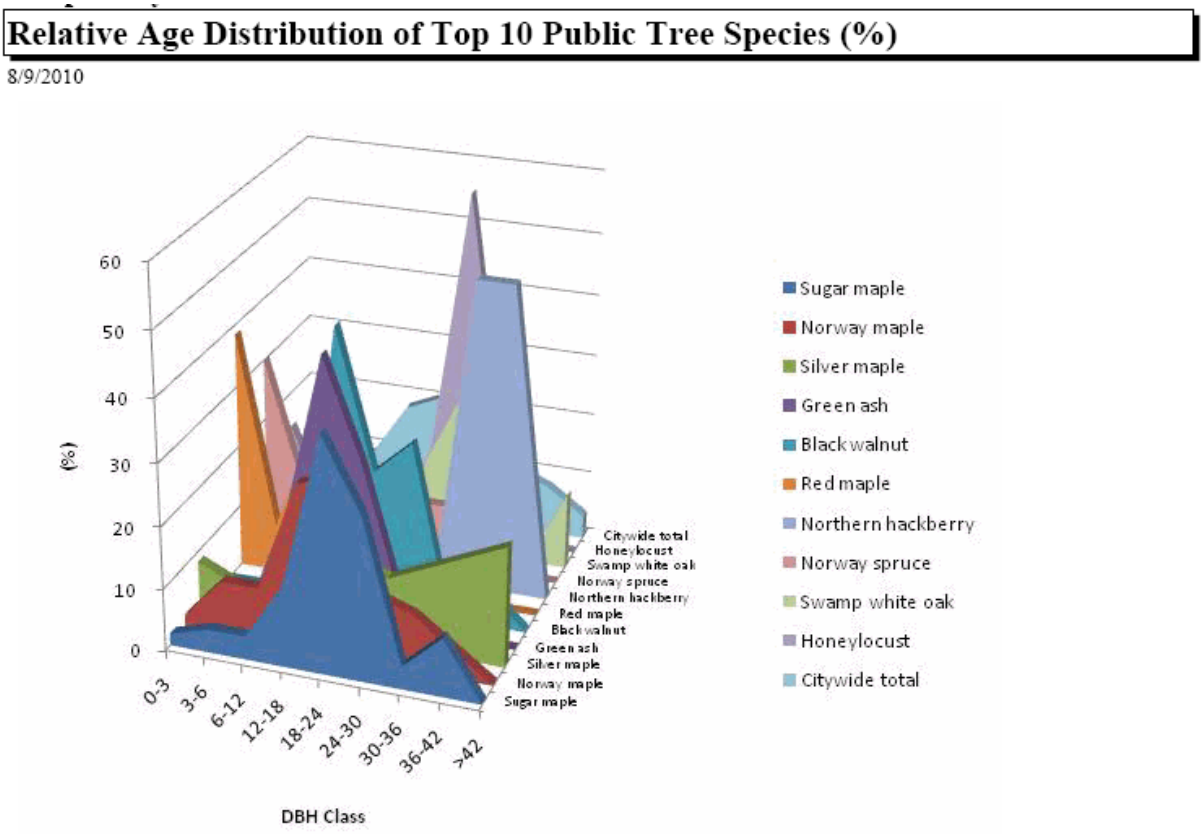
Species Distribution of Public Trees (%)

7/7/2009



Species	Percent
Sugar maple	19.9
Norway maple	16.9
Silver maple	13.5
Green ash	7.1
Black walnut	6.8
Red maple	4.9
Northern hackberry	3.8
Norway spruce	3.8
Swamp white oak	3.0
Honeylocust	2.6
Other species	17.7
Total	100.0

Figure 1: Species Distribution



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Sugar maple	1.9	3.8	3.8	13.2	37.7	26.4	3.8	9.4	0.0
Norway maple	2.2	8.9	8.9	26.7	28.9	11.1	8.9	4.4	0.0
Silver maple	8.3	5.6	5.6	5.6	13.9	11.1	13.9	16.7	19.4
Green ash	0.0	0.0	15.8	42.1	26.3	5.3	10.5	0.0	0.0
Black walnut	0.0	0.0	0.0	44.4	22.2	27.8	0.0	5.6	0.0
Red maple	38.5	7.7	23.1	30.8	0.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0
Norway spruce	30.0	10.0	0.0	10.0	10.0	10.0	30.0	0.0	0.0
Swamp white oak	12.5	0.0	0.0	0.0	12.5	25.0	37.5	0.0	12.5
Honeylocust	14.3	0.0	0.0	0.0	14.3	57.1	14.3	0.0	0.0
Citywide total	9.8	6.0	9.0	18.0	20.7	14.7	10.2	7.9	3.8

Figure 2: Relative Age Class

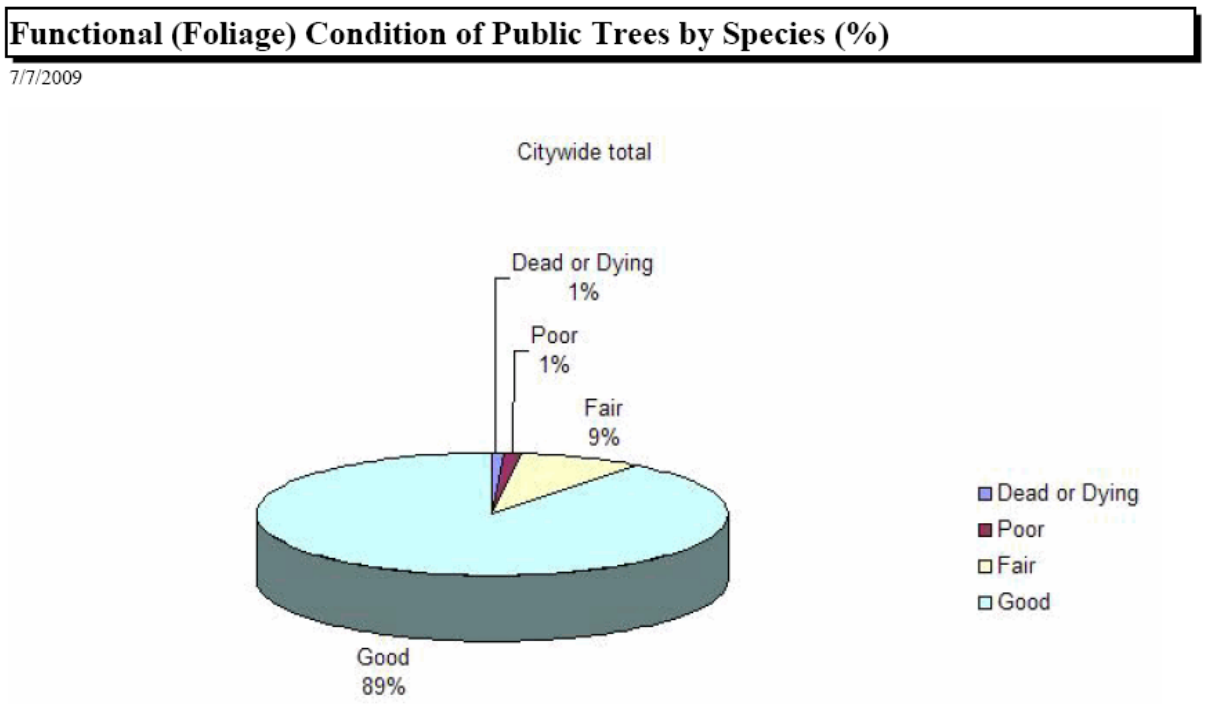


Figure 3: Foliage Condition

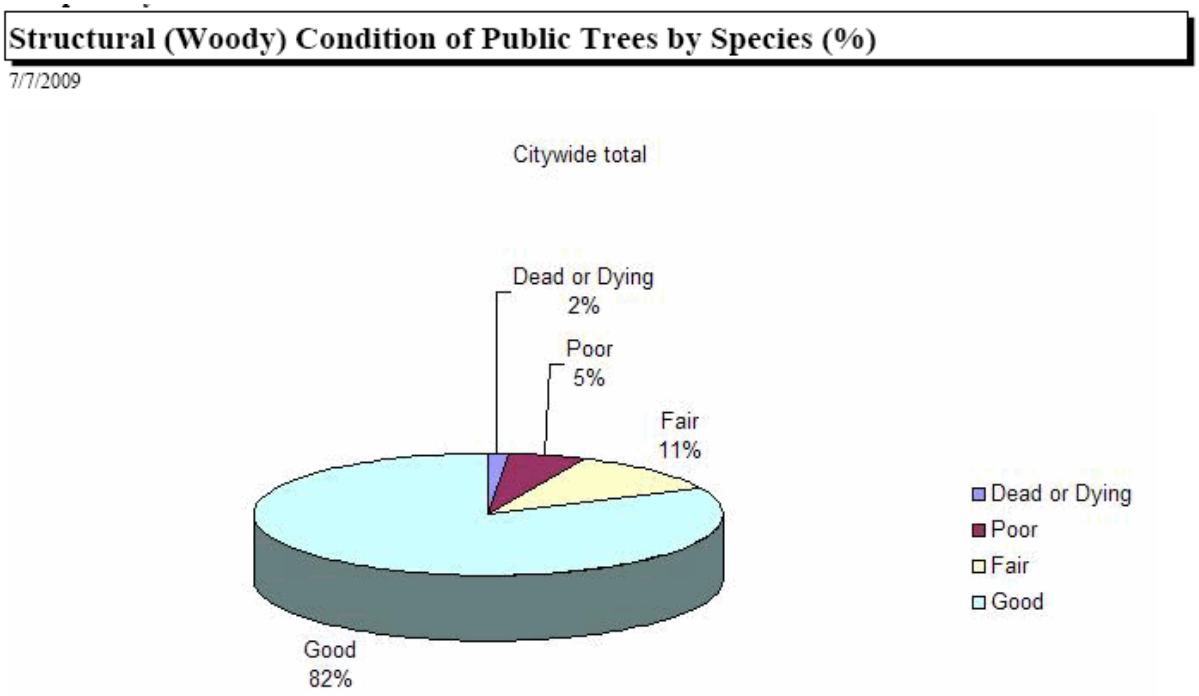
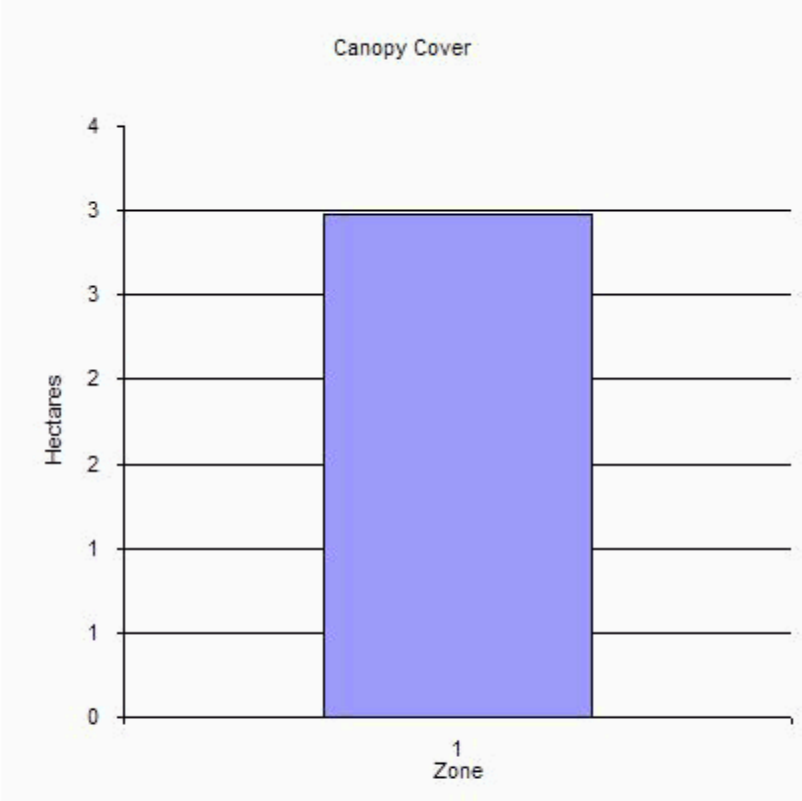


Figure 4: Wood Condition

Canopy Cover of Public Trees (Hectares)

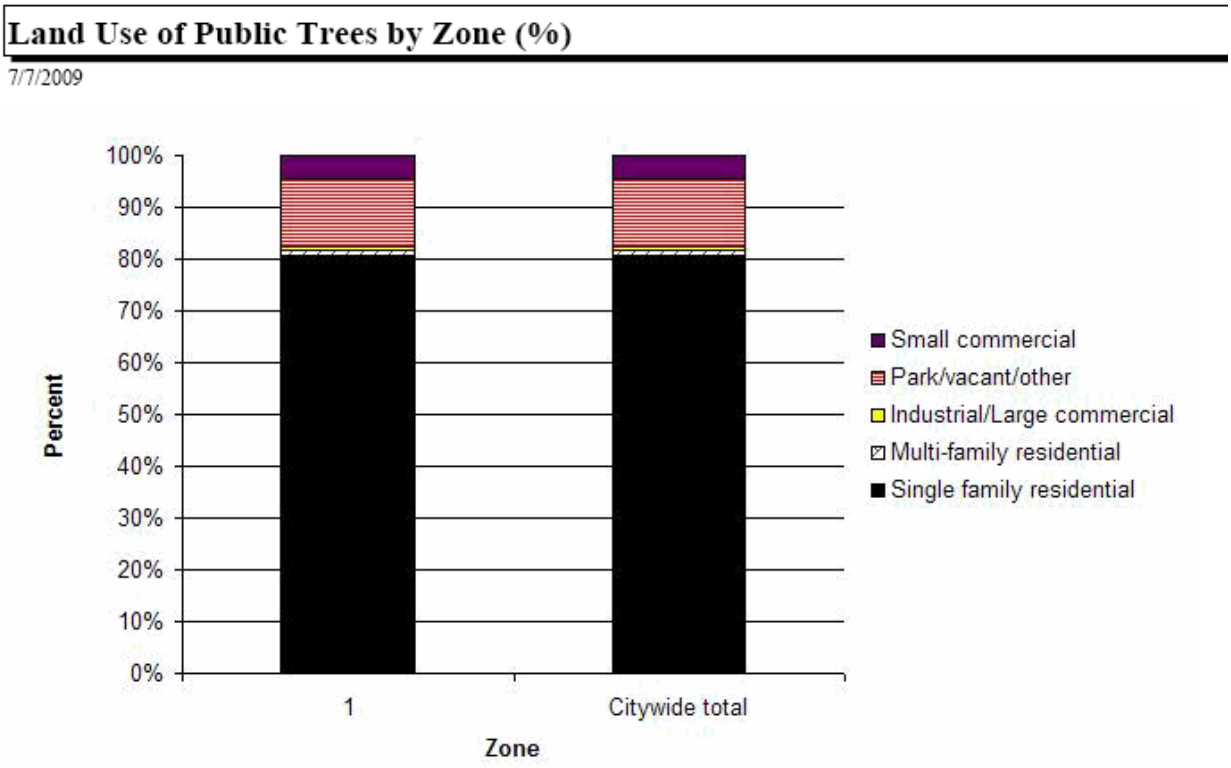
7/7/2009



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

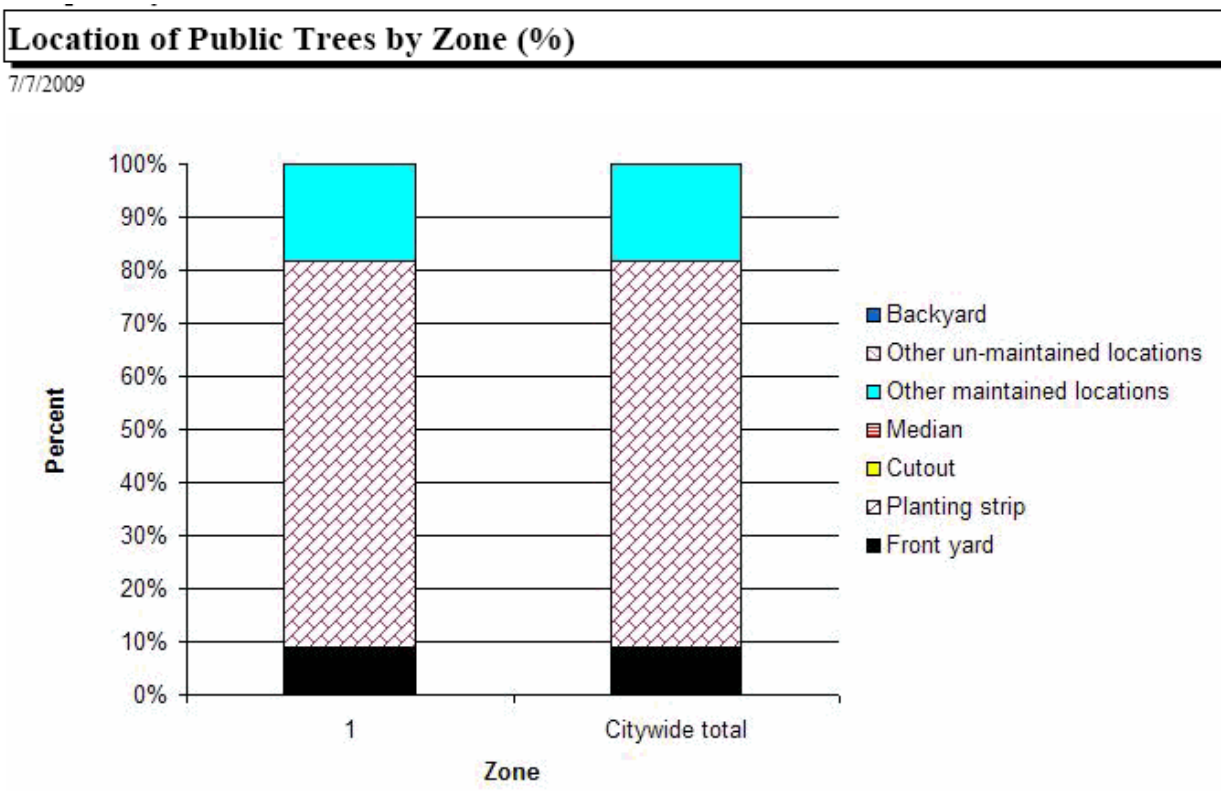
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	7		

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	80.7	1.1	0.7	13.1	4.4
Citywide total	80.7	1.1	0.7	13.1	4.4

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	9.1	72.6	0.0	0.0	18.2	0.0	0.0
Citywide total	9.1	72.6	0.0	0.0	18.2	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

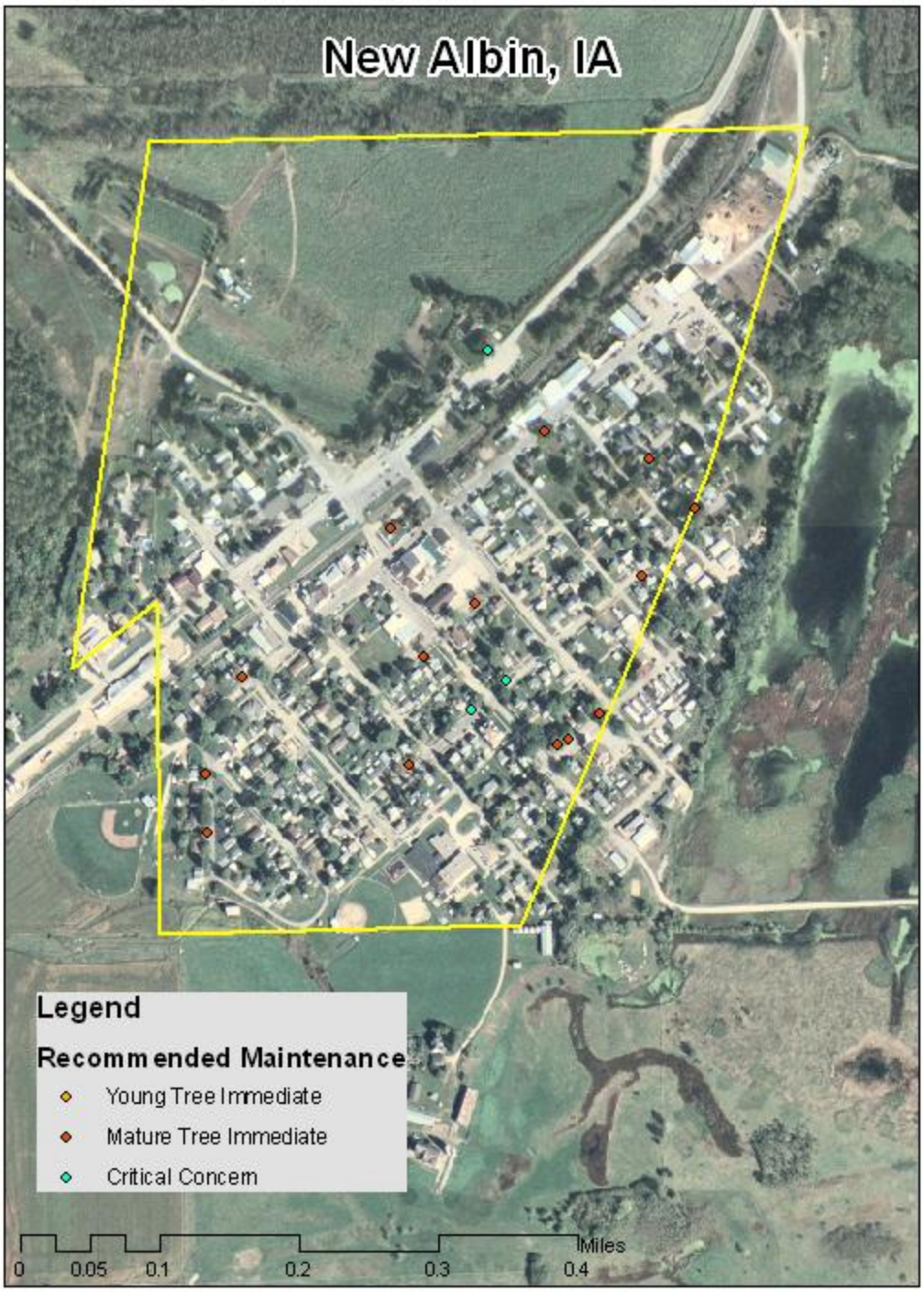


Figure 4: Location of Trees with Recommended Maintenance

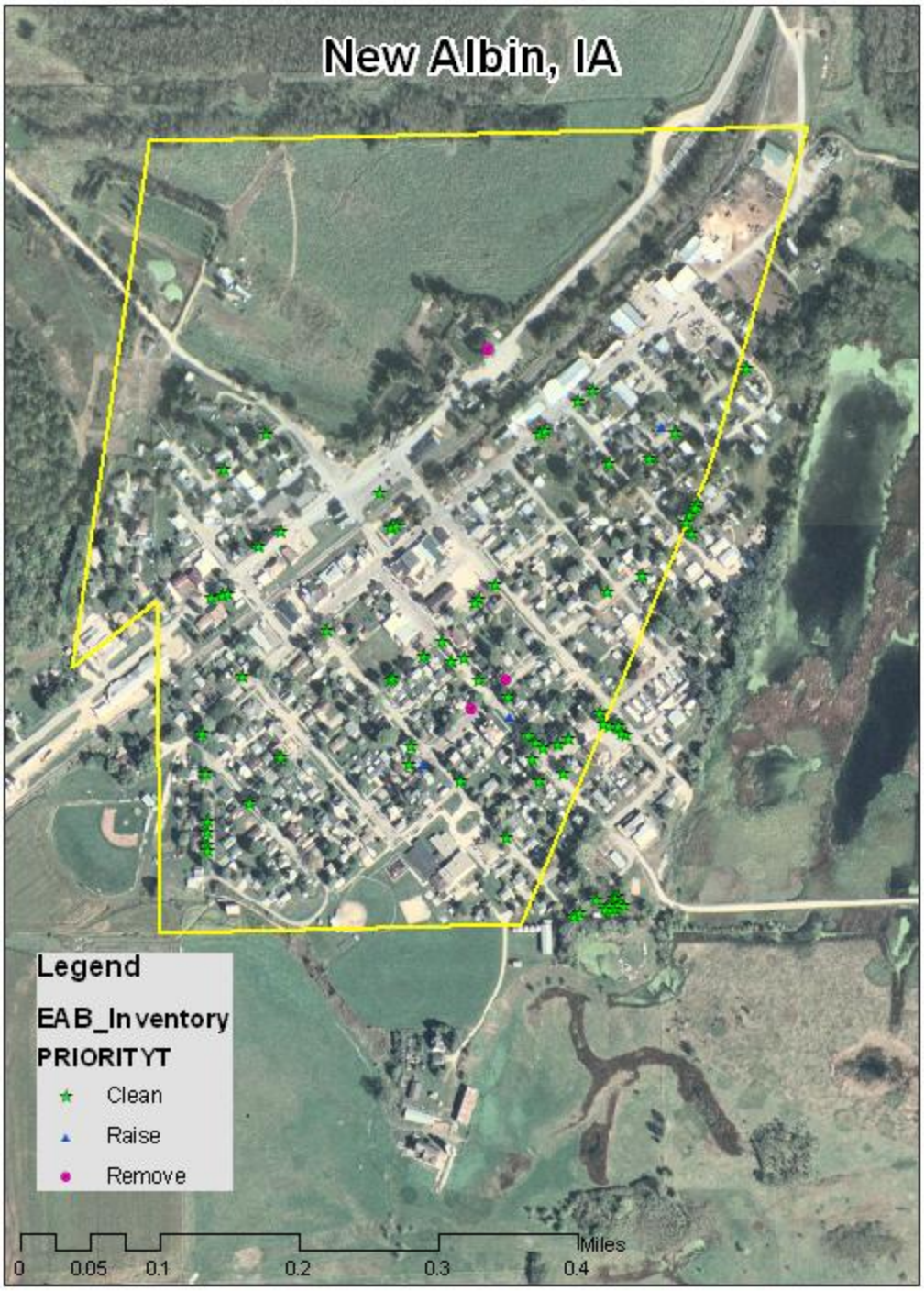


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

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.