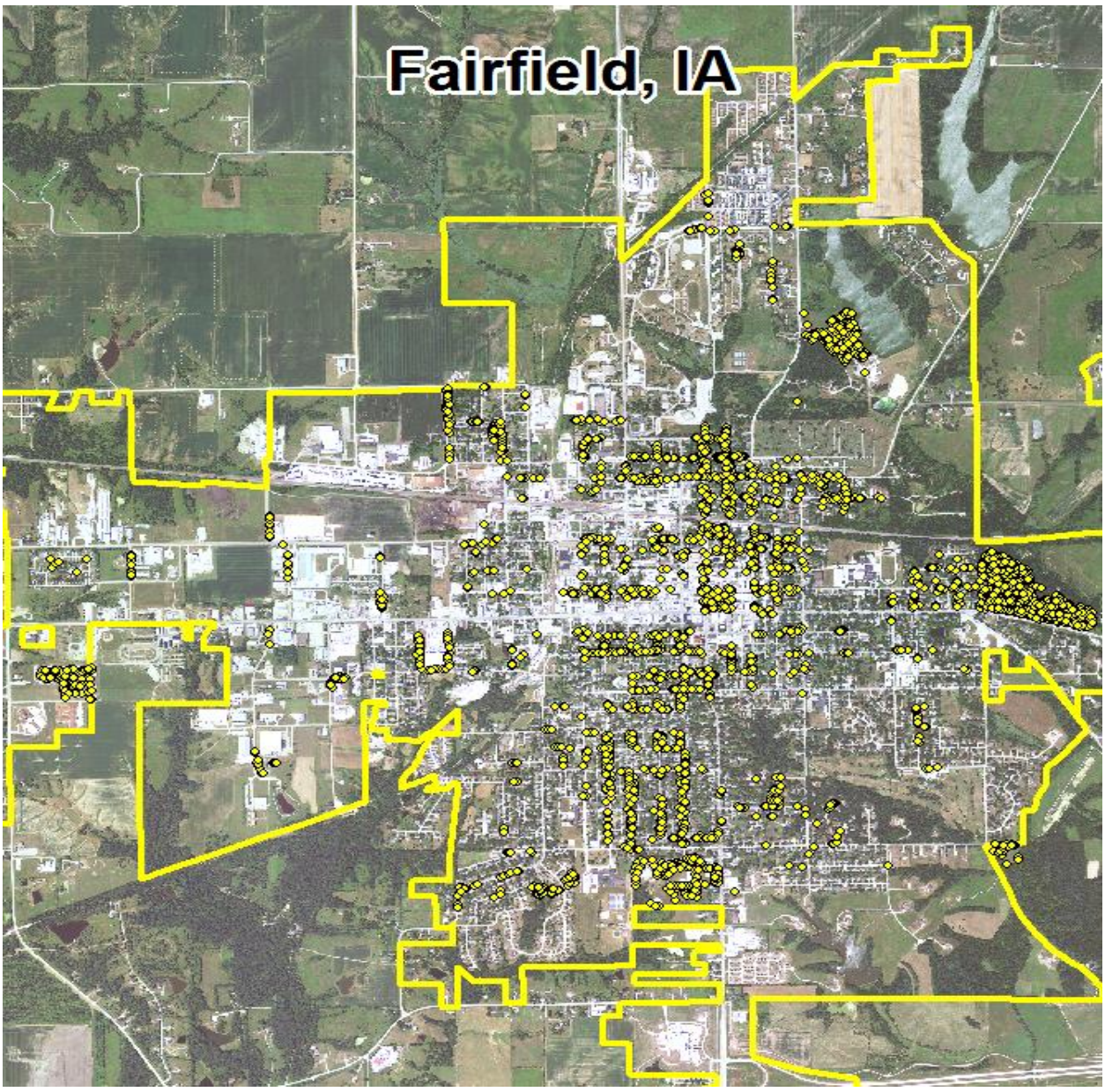
Fairfield, IA



2016 Urban Forest Management Plan
Prepared by Emma Hanigan/Ray Lehn
Bureau of Forestry, Iowa DNR

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Fairfield 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 12% of Fairfield's city owned trees (ash) will die, unless 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 2013, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street right-of-way trees. In 2015, an inventory of the trees in city parks was completed and added to the data base. Below are some key findings of the 3297 trees inventoried.

- Fairfield's trees provide $395,814 of benefits annually, an average of $120 a tree
- There are over 40 genera of trees
- The top four genera are: Maple 21%, Oak 20.2%, Ash 11.4%, and Apple 6.2%
  (Note: Inventory of street trees only was 31% maple and 5% oak. Addition of park trees changed total trees to 21% maple and 20.2% oak)
- 21.6% of trees are in need of some type of management
- 205 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 205 trees needing removal, 21 trees are over 24 inches in diameter, marked as critical and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*

  172 of the 376 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 in accordance with the List of Recommended Trees for Fairfield
- Check ash trees with a visual survey yearly

Introduction

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

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

Inventory

In 2013, a tree inventory was conducted that included most of the city owned trees on streets. In 2015, an inventory of the trees in city parks was completed and added to the data base. 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 3297 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 STREETS analysis. Findings

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Fairfield's trees reduce energy related costs by approximately $109,283 annually (Appendix A, Table 1). These savings are both in Electricity (518.7 MWh) and in Natural Gas (71,343.9 Therms).

Annual Stormwater Benefits

Fairfield's trees intercept about 5,382,274 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $145,860 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 Fairfield, it is estimated that trees remove 6,435.6 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 $17,994 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Fairfield, trees sequester about 1,190,089 lbs of carbon a year with an associated value of $8,926 (Appendix A, Table 5). In addition, the trees store 19,065,949 lbs of carbon, with a yearly benefit of $142,995 (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. Fairfield receives $114,483 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, Fairfield's trees provide $395,814 of benefits annually. Benefits of individual trees vary based on size, species, health

and location, but on average each of the 3,297 trees in Fairfield provide approximately $124 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Fairfield has over 40 different tree genera along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	691	21%
Oak	665	20.2%
Ash	376	11.4%
Apple (Crabapple)	206	6.2%
Pine	161	4.9%
Elm	120	3.6%
Redbud	104	3.2%
Walnut	75	2.3%
Honey Locust	69	2.1%
Linden/Basswood	69	2.1%
Spruce	66	2%
Pear	64	1.9%
Red Cedar	62	1.9%
Mulberry	56	1.7%
Hackberry	46	1.4%
Cottonwood/Poplar	40	1.2%
Lilac	38	1.2%
Catalpa	31	1%
Birch	29	<1%
Sycamore	28	< 1%
Hickory	22	<1%
Kentucky Coffeetree	20	<1%
Cherry	19	<1%
Tulip tree	19	<1%
Other	221	6.7%

Age Class

Most of Fairfield's trees (67%) are less than 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Fairfield's size curve is on the smaller side, indicating a younger than average stand and good preparation for mortality. Approximately 9% of trees are over 30 inches in diameter.

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 Fairfield indicate that 84% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 67% of Fairfield'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 6% of the population. This 6% 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).

Crown Cleaning	318	9.6%
Tree Removal	205	6.2%
Crown Reduction	133	4%
Crown Raising	33	1%
Stake/Train	14	<1%
Treat pest/disease	9	<1%

Canopy Cover

The total canopy cover with both private and public trees is approximately 28%, 1161 acres. The canopy cover included in the Fairfield inventory includes approximately 57 acres. (Appendix A, Figure 4). Fairfield has set a goal to increase canopy cover 1% over 30 years. To achieve this goal it is estimated that 100 additional trees a year would need to be planted on public and private lands.

Land Use and Location

The majority of Fairfield'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	53%
Park/vacant/other	43%
Small commercial	3%
Industrial/Large commercial	1%
Multifamily residential	1%

Location	
Planting strip	55%
Front yard	44%
Other	1%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc. should be removed.

Hazardous trees

Fairfield has 41 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 are 21 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance 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). There are a total of 376 ash trees, and 172 of those have signs and symptoms that have been associated with EAB. In addition, there are 182 other 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 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 Fairfield.

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 street tree portion of the urban forest is heavily planted with maple (31%). Maples should not be planted along streets until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Tree should be planted based on the List of Recommended Trees for Fairfield (Appendixes C & D).

Fairfield has set a goal to increase canopy cover 1% over 30 years. To achieve this goal it is estimated that 100 additional trees a year would need to be planted on public and private lands.

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 decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Maintenance Plan and estimated cost

These costs are estimates and will alter based on the completive bidding process, partnership with Alliant energy on removal and grants for tree planting. Additionally some of this work from the street tree inventory may have been addressed already- easing the budget over the next few years.

	Estimated
The following is recommended to be addressed within 1 year:	
35 Removals	$24,500
42 replacement plantings	$6,300
100 trees to be planted (on public or private lands) to meet canopy cover goal	$500
5 critical concern trees trimmed (as part of the 1/3 or town trimming)	$6,900
The following is recommended to be addressed within 2 years:	
100 Removals	$70,000
120 replacement plantings	$18,000
100 trees to be planted (on public or private lands) to meet canopy cover goal	$500
81 immediate trees trimmed (as part of the 1/3 or town trimming)	$6,900
The following is recommended to be addressed within 3 to 6 years:	
70 Removals	$49,000
84 replacement plantings	$12,600

100 trees to be planted (on public or private lands) to meet canopy cover goal	$500
398 trees trimmed (as part of the 1/3 or town trimming)	$6,900

Additionally there are ash trees not already marked for removal that will need to be removed over the next 1-6 years (if they are not treated)

342 Ash trees	$239,400
410 replacement plantings	$61,560

Without grants partnership and other cost saving measures is estimated that the cost of tree to Fairfield in the next 6 years will be **$84,176 annually**

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 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 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 trees will be replaced. All trees will meet the restrictions in city ordinance 11.08.050 (Appendix C) and the List of Recommended Trees for Fairfield.

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 11.08.104 states “Whenever the City is notified or becomes aware of a dead tree or broken or dead branch or limb in any private tree which is in imminent danger of falling and thereby injuring any individual or causing property damage to adjacent property, the Street Superintendent may declare the tree, branch or limb a hazard and order the property owner to remove the hazard in an expedient manner. If the property owner fails to remove the hazard, the Street Superintendent may cause the hazard to be removed. For purposes of removing the hazard, City crews or City agents shall be allowed on private property. Attempts should be made to notify the property owner before entering onto private property.”

Works Cited

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

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

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

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

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

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Fairfield

Annual Energy Benefits of Public Trees

2/1/2016

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	87.1	6,614	12,211.2	11,967	18,581	(N/A)	8.8	17.0	64.29
Silver maple	78.3	5,940	10,276.1	10,071	16,010	(N/A)	8.7	14.7	55.98
Apple	11.1	844	1,741.1	1,706	2,550	(N/A)	6.2	2.3	12.38
Green ash	30.3	2,297	3,943.0	3,864	6,161	(N/A)	6.0	5.6	31.12
Ash	27.4	2,083	3,866.0	3,789	5,872	(N/A)	4.8	5.4	36.93
Maple	23.5	1,782	3,164.7	3,101	4,883	(N/A)	4.5	4.5	33.00
Eastern white pine	15.5	1,173	2,027.8	1,987	3,160	(N/A)	3.5	2.9	27.24
Bur oak	22.7	1,723	3,125.8	3,063	4,786	(N/A)	3.3	4.4	44.32
Eastern redbud	5.6	424	864.6	847	1,272	(N/A)	3.2	1.2	12.23
Norway maple	18.4	1,397	2,607.2	2,555	3,952	(N/A)	3.1	3.6	39.13
Swamp white oak	6.3	482	955.7	937	1,418	(N/A)	2.5	1.3	16.89
Sugar maple	15.5	1,178	2,075.5	2,034	3,212	(N/A)	2.4	2.9	40.66
Black walnut	15.7	1,188	2,091.0	2,049	3,237	(N/A)	2.3	3.0	43.16
Pin oak	15.9	1,207	2,090.7	2,049	3,256	(N/A)	2.1	3.0	47.19
Honeylocust	10.6	806	1,439.7	1,411	2,217	(N/A)	2.1	2.0	32.13
Northern red oak	5.3	405	753.1	738	1,143	(N/A)	1.9	1.0	18.15
Eastern red cedar	4.0	306	611.1	599	905	(N/A)	1.9	0.8	14.60
Broadleaf Deciduous Small	0.7	54	123.9	121	176	(N/A)	1.7	0.2	3.08
Mulberry	3.0	229	466.4	457	686	(N/A)	1.5	0.6	14.00
Northern hackberry	10.5	797	1,504.3	1,474	2,271	(N/A)	1.4	2.1	49.37
Siberian elm	9.6	731	1,288.7	1,263	1,994	(N/A)	1.4	1.8	43.35
Red maple	5.3	404	708.5	694	1,099	(N/A)	1.4	1.0	23.89
Northern white cedar	0.7	55	116.3	114	169	(N/A)	1.3	0.2	3.93
Pear	0.9	69	153.8	151	219	(N/A)	1.2	0.2	5.77
American basswood	5.9	447	873.8	856	1,303	(N/A)	1.2	1.2	34.30
Northern pin oak	9.5	723	1,371.8	1,344	2,068	(N/A)	1.2	1.9	54.41
Lilac	0.5	41	92.3	90	131	(N/A)	0.9	0.1	4.23
Cottonwood	7.9	602	1,055.0	1,034	1,636	(N/A)	0.9	1.5	52.78
Chinese elm	7.7	584	1,063.7	1,042	1,626	(N/A)	0.9	1.5	52.45
American sycamore	8.4	641	1,156.8	1,134	1,775	(N/A)	0.8	1.6	63.39
Scotch pine	1.9	143	258.5	253	397	(N/A)	0.8	0.4	15.26
Callery pear	1.2	90	192.3	188	279	(N/A)	0.8	0.3	10.72
Broadleaf Deciduous Mediu	1.7	127	256.9	252	379	(N/A)	0.8	0.3	14.56
Blue spruce	1.7	129	246.2	241	370	(N/A)	0.8	0.3	14.81
River birch	4.2	321	571.6	560	881	(N/A)	0.8	0.8	35.24
American elm	4.1	309	503.0	493	802	(N/A)	0.8	0.7	32.08
Hickory	4.9	375	685.0	671	1,046	(N/A)	0.7	1.0	47.55
Littleleaf linden	1.4	106	192.4	189	295	(N/A)	0.7	0.3	13.39
Catalpa	4.4	337	568.4	557	894	(N/A)	0.7	0.8	40.62
Norway spruce	1.1	82	150.7	148	229	(N/A)	0.6	0.2	11.46
Kentucky coffeetree	0.3	24	47.0	46	70	(N/A)	0.6	0.1	3.49
Tulip tree	1.5	110	198.8	195	305	(N/A)	0.6	0.3	16.05
White ash	1.7	126	235.1	230	356	(N/A)	0.6	0.3	18.74
Spruce	1.1	84	161.3	158	243	(N/A)	0.6	0.2	12.76
Black cherry	1.2	92	184.8	181	273	(N/A)	0.5	0.2	16.05
Red pine	1.1	87	165.4	162	249	(N/A)	0.5	0.2	14.66
Ginkgo	1.8	133	226.1	222	355	(N/A)	0.5	0.3	22.18
Broadleaf Deciduous Large	1.9	145	254.8	250	395	(N/A)	0.5	0.4	24.69
Oak	3.4	262	469.0	460	721	(N/A)	0.4	0.7	51.53
Willow	0.9	71	126.3	124	195	(N/A)	0.3	0.2	19.51
Elm	0.3	24	45.5	45	68	(N/A)	0.3	0.1	6.84
Boxelder	1.1	86	154.9	152	238	(N/A)	0.3	0.2	23.76
Northern catalpa	0.9	69	122.9	120	190	(N/A)	0.3	0.2	21.07
Amur maple	1.0	73	148.9	146	219	(N/A)	0.3	0.2	24.31
Basswood	0.2	13	23.9	23	36	(N/A)	0.3	0.0	4.02
Black locust	0.8	62	124.0	122	183	(N/A)	0.2	0.2	22.89

White mulberry	0.5	41	84.3	83	124 (N/A)	0.2	0.1	17.73
Plum	0.1	5	10.7	11	15 (N/A)	0.2	0.0	2.16
Black maple	1.7	130	216.5	212	342 (N/A)	0.2	0.3	48.82
Japanese tree lilac	0.0	3	7.5	7	11 (N/A)	0.2	0.0	1.51
Southern magnolia	0.2	13	27.9	27	40 (N/A)	0.2	0.0	6.72
Quaking aspen	1.4	107	196.3	192	299 (N/A)	0.2	0.3	49.89
Ohio buckeye	0.4	33	66.6	65	99 (N/A)	0.2	0.1	19.72
Japanese maple	0.1	8	18.5	18	26 (N/A)	0.2	0.0	5.24
Sweetgum	1.0	75	141.5	139	214 (N/A)	0.2	0.2	42.81
Cherry plum	0.0	3	6.3	6	9 (N/A)	0.2	0.0	1.77
Conifer Evergreen Medium	0.2	12	26.4	26	38 (N/A)	0.1	0.0	9.55
Flowering dogwood	0.0	1	2.5	2	3 (N/A)	0.1	0.0	0.87
Birch	0.5	37	69.4	68	105 (N/A)	0.1	0.1	26.18
Broadleaf Evergreen Mediur	0.3	19	38.1	37	56 (N/A)	0.1	0.1	18.82
Conifer Evergreen Small	0.0	4	7.4	7	11 (N/A)	0.1	0.0	3.62
Alder	0.0	1	1.9	2	3 (N/A)	0.1	0.0	0.87
Eastern cottonwood	0.5	40	76.2	75	115 (N/A)	0.1	0.1	57.32
Conifer Evergreen Large	0.3	24	39.2	38	62 (N/A)	0.1	0.1	31.15
Austrian pine	0.2	14	25.4	25	39 (N/A)	0.1	0.0	19.66
Black spruce	0.0	3	6.1	6	9 (N/A)	0.1	0.0	4.29
Dogwood	0.0	2	4.4	4	6 (N/A)	0.1	0.0	3.13
Kwanzan cherry	0.0	0	0.6	1	1 (N/A)	0.0	0.0	0.87
Scarlet oak	0.5	37	63.1	62	99 (N/A)	0.0	0.1	98.63
Juniper	0.0	0	0.7	1	1 (N/A)	0.0	0.0	0.93
Common chokecherry	0.2	14	24.7	24	38 (N/A)	0.0	0.0	38.13
Black poplar	0.2	18	27.0	26	44 (N/A)	0.0	0.0	44.23
Sumac	0.0	2	3.8	4	5 (N/A)	0.0	0.0	5.40
Sweetbay	0.2	14	17.8	17	31 (N/A)	0.0	0.0	31.34
Total	518.7	39,366	71,343.9	69,917	109,283 (N/A)	100.0	100.0	33.15

Table 2: Annual Stormwater Benefits

Fairfield

Annual Stormwater Benefits of Public Trees

2/1/2016

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	1,053,103	28,539	(N/A)	8.8	19.6	98.75
Silver maple	983,959	26,665	(N/A)	8.7	18.3	93.24
Apple	40,039	1,085	(N/A)	6.2	0.7	5.27
Green ash	275,107	7,455	(N/A)	6.0	5.1	37.65
Ash	208,458	5,649	(N/A)	4.8	3.9	35.53
Maple	194,899	5,282	(N/A)	4.5	3.6	35.69
Eastern white pine	311,075	8,430	(N/A)	3.5	5.8	72.67
Bur oak	288,399	7,816	(N/A)	3.3	5.4	72.37
Eastern redbud	20,043	543	(N/A)	3.2	0.4	5.22
Norway maple	142,206	3,854	(N/A)	3.1	2.6	38.16
Swamp white oak	34,746	942	(N/A)	2.5	0.6	11.21
Sugar maple	149,600	4,054	(N/A)	2.4	2.8	51.32
Black walnut	139,061	3,769	(N/A)	2.3	2.6	50.25
Pin oak	170,938	4,632	(N/A)	2.1	3.2	67.14
Honeylocust	94,998	2,574	(N/A)	2.1	1.8	37.31
Northern red oak	44,452	1,205	(N/A)	1.9	0.8	19.12
Eastern red cedar	57,347	1,554	(N/A)	1.9	1.1	25.07
Broadleaf Deciduous Small	2,151	58	(N/A)	1.7	0.0	1.02
Mulberry	13,858	376	(N/A)	1.5	0.3	7.66
Northern hackberry	95,449	2,587	(N/A)	1.4	1.8	56.23
Siberian elm	86,776	2,352	(N/A)	1.4	1.6	51.12
Red maple	31,992	867	(N/A)	1.4	0.6	18.85
Northern white cedar	10,397	282	(N/A)	1.3	0.2	6.55
Pear	3,469	94	(N/A)	1.2	0.1	2.47
American basswood	59,723	1,619	(N/A)	1.2	1.1	42.59
Northern pin oak	91,685	2,485	(N/A)	1.2	1.7	65.39
Lilac	1,639	44	(N/A)	0.9	0.0	1.43
Cottonwood	75,171	2,037	(N/A)	0.9	1.4	65.71
Chinese elm	96,483	2,615	(N/A)	0.9	1.8	84.34
American sycamore	108,021	2,927	(N/A)	0.8	2.0	104.55
Scotch pine	25,023	678	(N/A)	0.8	0.5	26.08
Callery pear	6,111	166	(N/A)	0.8	0.1	6.37
Broadleaf Deciduous Medium	10,837	294	(N/A)	0.8	0.2	11.30
Blue spruce	20,738	562	(N/A)	0.8	0.4	22.48
River birch	27,639	749	(N/A)	0.8	0.5	29.96
American elm	27,293	740	(N/A)	0.8	0.5	29.59
Hickory	46,047	1,248	(N/A)	0.7	0.9	56.72
Littleleaf linden	9,875	268	(N/A)	0.7	0.2	12.16
Catalpa	53,384	1,447	(N/A)	0.7	1.0	65.76
Norway spruce	17,249	467	(N/A)	0.6	0.3	23.37
Kentucky coffeetree	2,930	79	(N/A)	0.6	0.1	3.97
Tulip tree	14,963	405	(N/A)	0.6	0.3	21.34
White ash	11,886	322	(N/A)	0.6	0.2	16.95
Spruce	19,856	538	(N/A)	0.6	0.4	28.32
Black cherry	4,727	128	(N/A)	0.5	0.1	7.54
Red pine	12,748	345	(N/A)	0.5	0.2	20.32
Ginkgo	10,031	272	(N/A)	0.5	0.2	16.99
Broadleaf Deciduous Large	13,930	377	(N/A)	0.5	0.3	23.59
Oak	36,957	1,002	(N/A)	0.4	0.7	71.54

Willow	5,338	145	(N/A)	0.3	0.1	14.47
Elm	2,905	79	(N/A)	0.3	0.1	7.87
Boxelder	9,794	265	(N/A)	0.3	0.2	26.54
Northern catalpa	11,768	319	(N/A)	0.3	0.2	35.44
Amur maple	3,898	106	(N/A)	0.3	0.1	11.74
Basswood	1,058	29	(N/A)	0.3	0.0	3.19
Black locust	7,342	199	(N/A)	0.2	0.1	24.87
White mulberry	2,380	64	(N/A)	0.2	0.0	9.21
Plum	175	5	(N/A)	0.2	0.0	0.68
Black maple	12,775	346	(N/A)	0.2	0.2	49.46
Japanese tree lilac	113	3	(N/A)	0.2	0.0	0.44
Southern magnolia	734	20	(N/A)	0.2	0.0	3.31
Quaking aspen	18,254	495	(N/A)	0.2	0.3	82.45
Ohio buckeye	4,387	119	(N/A)	0.2	0.1	23.78
Japanese maple	355	10	(N/A)	0.2	0.0	1.93
Sweetgum	11,865	322	(N/A)	0.2	0.2	64.31
Cherry plum	98	3	(N/A)	0.2	0.0	0.53
Conifer Evergreen Medium	1,805	49	(N/A)	0.1	0.0	12.23
Flowering dogwood	30	1	(N/A)	0.1	0.0	0.20
Birch	2,744	74	(N/A)	0.1	0.1	18.59
Broadleaf Evergreen Medium	2,030	55	(N/A)	0.1	0.0	18.34
Conifer Evergreen Small	550	15	(N/A)	0.1	0.0	4.97
Alder	22	1	(N/A)	0.1	0.0	0.20
Eastern cottonwood	5,181	140	(N/A)	0.1	0.1	70.21
Conifer Evergreen Large	6,143	166	(N/A)	0.1	0.1	83.24
Austrian pine	2,300	62	(N/A)	0.1	0.0	31.16
Black spruce	295	8	(N/A)	0.1	0.0	3.99
Dogwood	76	2	(N/A)	0.1	0.0	1.03
Kwanzan cherry	7	0	(N/A)	0.0	0.0	0.20
Scarlet oak	7,239	196	(N/A)	0.0	0.1	196.17
Juniper	24	1	(N/A)	0.0	0.0	0.66
Common chokecherry	667	18	(N/A)	0.0	0.0	18.06
Black poplar	1,466	40	(N/A)	0.0	0.0	39.72
Sumac	69	2	(N/A)	0.0	0.0	1.86
Sweetbay	913	25	(N/A)	0.0	0.0	24.73
Citywide total	5,382,274	145,860	(N/A)	100.0	100.0	44.24

Table 3: Annual Air Quality Benefits

Fairfield

Annual Air Quality Benefits of Public Trees

2/1/2016

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							
White oak	138.1	22.1	64.7	6.2	732	418.6	60.8	57.9	394.9	2,601	0.0	0	1,163.3	3,333 (N/A)	8.8	11.53
Silver maple	156.2	26.5	78.7	6.9	848	368.9	54.0	51.6	354.2	2,308	-87.0	-326	1,010.1	2,830 (N/A)	8.7	9.90
Apple	9.2	1.5	4.8	0.4	50	55.0	7.9	7.5	50.4	338	-0.1	0	136.5	388 (N/A)	6.2	1.88
Green ash	30.5	4.9	15.5	1.4	165	142.6	20.9	20.0	137.2	893	0.0	0	372.9	1,058 (N/A)	6.0	5.34
Ash	37.1	6.4	19.0	1.6	203	132.3	19.2	18.3	124.6	821	-9.2	-34	349.3	990 (N/A)	4.8	6.22
Maple	45.9	7.8	21.5	2.0	245	111.5	16.3	15.5	106.3	696	-15.5	-58	311.4	882 (N/A)	4.5	5.96
Eastern white pine	36.8	7.3	29.8	4.5	241	72.8	10.7	10.2	70.0	456	-164.6	-617	77.5	80 (N/A)	3.5	0.69
Bur oak	40.1	6.4	18.5	1.8	211	108.5	15.8	15.1	102.9	676	0.0	0	309.0	887 (N/A)	3.3	8.21
Eastern redbud	4.6	0.8	2.4	0.2	25	27.6	4.0	3.8	25.3	170	0.0	0	68.6	195 (N/A)	3.2	1.87
Norway maple	25.6	4.4	13.1	1.1	140	88.9	12.9	12.3	83.5	551	-6.3	-24	235.4	667 (N/A)	3.1	6.61
Swamp white oak	3.8	0.6	2.4	0.2	22	31.1	4.5	4.3	28.8	192	-1.2	-4	74.5	209 (N/A)	2.5	2.49
Sugar maple	18.4	3.1	9.5	0.8	101	73.6	10.8	10.3	70.3	460	-14.7	-55	182.0	505 (N/A)	2.4	6.39
Black walnut	14.4	2.3	7.5	0.6	78	74.3	10.8	10.4	70.9	464	0.0	0	191.3	542 (N/A)	2.3	7.23
Pin oak	30.1	5.3	15.5	1.4	165	75.1	11.0	10.5	72.0	470	-56.3	-211	164.7	424 (N/A)	2.1	6.14
Honeylocust	17.4	2.9	8.2	0.8	93	50.5	7.4	7.0	48.1	315	-12.8	-48	129.4	360 (N/A)	2.1	5.21
Northern red oak	8.5	1.5	4.3	0.4	46	25.6	3.7	3.5	24.2	159	-12.2	-46	59.6	160 (N/A)	1.9	2.54
Eastern red cedar	10.2	2.0	8.3	1.3	67	19.7	2.8	2.7	18.3	122	-31.2	-117	34.0	71 (N/A)	1.9	1.15
Broadleaf Deciduous Small	0.1	0.0	0.1	0.0	1	3.6	0.5	0.5	3.2	22	0.0	0	8.2	23 (N/A)	1.7	0.40
Mulberry	4.4	0.7	2.1	0.2	23	14.9	2.1	2.0	13.7	91	0.0	0	40.0	115 (N/A)	1.5	2.34
Northern hackberry	14.2	2.5	7.4	0.6	78	50.8	7.3	7.0	47.6	315	0.0	0	137.4	393 (N/A)	1.4	8.54
Siberian elm	12.0	2.0	6.2	0.5	66	45.7	6.7	6.4	43.6	285	0.0	0	123.2	351 (N/A)	1.4	7.63
Red maple	5.5	0.9	2.8	0.2	30	25.2	3.7	3.5	24.1	158	-2.1	-8	63.9	180 (N/A)	1.4	3.91
Northern white cedar	0.8	0.2	0.8	0.1	6	3.6	0.5	0.5	3.3	22	-4.1	-15	5.7	13 (N/A)	1.3	0.29
Pear	0.7	0.1	0.4	0.0	4	4.6	0.6	0.6	4.1	28	0.0	0	11.2	32 (N/A)	1.2	0.84
American basswood	7.5	1.3	3.8	0.3	41	28.8	4.1	3.9	26.7	178	-6.6	-25	70.0	194 (N/A)	1.2	5.11
Northern pin oak	19.1	3.3	9.3	0.8	103	46.2	6.7	6.4	43.2	286	-4.4	-17	130.6	372 (N/A)	1.2	9.80
Lilac	0.1	0.0	0.1	0.0	1	2.7	0.4	0.4	2.4	17	0.0	0	6.1	17 (N/A)	0.9	0.55
Cottonwood	8.2	1.3	4.1	0.4	44	37.6	5.5	5.2	36.0	235	0.0	0	98.3	279 (N/A)	0.9	9.01
Chinese elm	13.9	2.2	6.4	0.6	73	36.8	5.4	5.1	34.8	229	0.0	0	105.2	302 (N/A)	0.9	9.75
American sycamore	15.7	2.5	7.2	0.7	83	40.3	5.9	5.6	38.3	251	0.0	0	116.2	334 (N/A)	0.8	11.93
Scotch pine	2.6	0.5	2.3	0.3	17	9.0	1.3	1.3	8.6	56	-9.9	-37	15.9	36 (N/A)	0.8	1.40
Callery pear	0.5	0.1	0.4	0.0	3	6.0	0.8	0.8	5.4	36	-0.2	-1	13.8	39 (N/A)	0.8	1.49
Broadleaf Deciduous Medium	1.5	0.3	0.9	0.1	9	8.2	1.2	1.1	7.6	51	-0.4	-2	20.5	58 (N/A)	0.8	2.22
Blue spruce	2.3	0.4	2.0	0.3	15	8.2	1.2	1.1	7.7	51	-6.9	-26	16.3	40 (N/A)	0.8	1.61
River birch	4.4	0.8	2.3	0.2	24	20.2	2.9	2.8	19.2	126	-1.1	-4	51.6	146 (N/A)	0.8	5.83
American elm	3.4	0.6	1.9	0.2	19	19.0	2.8	2.7	18.5	119	0.0	0	49.0	138 (N/A)	0.8	5.54
Hickory	4.7	0.7	2.4	0.2	25	23.7	3.4	3.3	22.4	147	0.0	0	60.8	173 (N/A)	0.7	7.84
Littleleaf linden	1.3	0.2	0.7	0.1	7	6.7	1.0	0.9	6.3	42	-0.7	-3	16.6	46 (N/A)	0.7	2.11
Catalpa	8.8	1.4	4.0	0.4	46	20.8	3.1	2.9	20.1	131	0.0	0	61.5	177 (N/A)	0.7	8.04
Norway spruce	1.9	0.4	1.6	0.2	12	5.1	0.7	0.7	4.9	32	-7.8	-29	7.8	15 (N/A)	0.6	0.77
Kentucky coffeetree	0.3	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	0.0	0	3.8	11 (N/A)	0.6	0.55
Tulip tree	1.7	0.3	0.8	0.1	9	6.9	1.0	1.0	6.6	43	0.0	0	18.4	52 (N/A)	0.6	2.75
White ash	0.6	0.1	0.5	0.0	4	8.0	1.2	1.1	7.5	49	0.0	0	18.9	53 (N/A)	0.6	2.80
Spruce	2.2	0.4	1.9	0.3	15	5.4	0.8	0.7	5.0	33	-10.4	-39	6.3	9 (N/A)	0.6	0.47
Black cherry	1.3	0.2	0.6	0.1	7	5.9	0.9	0.8	5.5	37	0.0	0	15.2	43 (N/A)	0.5	2.55
Red pine	1.2	0.2	1.2	0.1	8	5.5	0.8	0.8	5.2	34	-4.0	-15	11.0	28 (N/A)	0.5	1.63
Ginkgo	2.3	0.4	1.1	0.1	12	8.2	1.2	1.2	8.0	52	-0.8	-3	21.7	61 (N/A)	0.5	3.83
Broadleaf Deciduous Large	1.0	0.2	0.6	0.0	6	9.1	1.3	1.3	8.7	57	0.0	0	22.2	62 (N/A)	0.5	3.90
Oak	4.5	0.7	2.2	0.2	24	16.4	2.4	2.3	15.6	102	0.0	0	44.3	126 (N/A)	0.4	9.02
Willow	0.7	0.1	0.4	0.0	4	4.5	0.7	0.6	4.3	28	-0.2	-1	11.1	31 (N/A)	0.3	3.13
Elm	0.3	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	0.0	0	3.8	11 (N/A)	0.3	1.09
Boxelder	1.0	0.2	0.5	0.0	6	5.4	0.8	0.7	5.1	34	-0.5	-2	13.3	37 (N/A)	0.3	3.73
Northern catalpa	2.1	0.3	0.9	0.1	11	4.3	0.6	0.6	4.1	27	0.0	0	13.1	38 (N/A)	0.3	4.22
Amur maple	1.1	0.2	0.5	0.0	6	4.7	0.7	0.6	4.3	29	0.0	0	12.2	35 (N/A)	0.3	3.88
Basswood	0.0	0.0	0.0	0.0	0	0.8	0.1	0.1	0.8	5	0.0	0	1.9	5 (N/A)	0.3	0.58
Black locust	1.4	0.2	0.7	0.1	8	4.0	0.6	0.5	3.7	25	-0.3	-1	10.9	31 (N/A)	0.2	3.89
White mulberry	0.7	0.1	0.3	0.0	4	2.7	0.4	0.4	2.5	17	0.0	0	7.1	20 (N/A)	0.2	2.90
Plum	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	0.0	0	0.7	2 (N/A)	0.2	0.28
Black maple	2.9	0.5	1.4	0.1	15	8.0	1.2	1.1	7.7	50	-1.0	-4	21.9	62 (N/A)	0.2	8.82
Japanese tree lilac	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1 (N/A)	0.2	0.19
Southern magnolia	0.0	0.0	0.1	0.0	0	0.9	0.1	0.1	0.8	5	-0.1	0	1.9	5 (N/A)	0.2	0.86
Quaking aspen	2.5	0.4	1.2	0.1	13	6.8	1.0	0.9	6.4	42	0.0	0	19.2	55 (N/A)	0.2	9.19
Ohio buckeye	0.9	0.2	0.5	0.0	5	2.2	0.3	0.3	2.0	13	-0.2	-1	6.1	17 (N/A)	0.2	3.49
Japanese maple	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.3	4 (N/A)	0.2	0.72
Sweetgum	1.5	0.2	0.7	0.1	8	4.8	0.7	0.7	4.5	30	0.0	0	13.1	38 (N/A)	0.2	7.52
Cherry plum	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1 (N/A)	0.2	0.23
Conifer Evergreen Medium	0.2	0.0	0.2	0.0	1	0.8	0.1	0.1	0.7	5	-0.5	-2	1.6	4 (N/A)	0.1	1.00
Flowering dogwood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	0.0	0	0.2	0 (N/A)	0.1	0.11
Birch	0.3	0.1	0.2	0.0	2	2.3	0.3	0.3	2.2	15	-0.1	0	5.7	16 (N/A)	0.1	4.02
Broadleaf Evergreen Medium	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	-0.5	-2	2.4	6 (N/A)	0.1	2.10

Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	-0.3	-1	0.3	1 (N/A)	0.1	0.20
Alder	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.0	0	0.0	0	0.1	0 (N/A)	0.1	0.11
Eastern cottonwood	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19 (N/A)	0.1	9.34
Conifer Evergreen Large	0.7	0.1	0.6	0.1	5	1.5	0.2	0.2	1.4	9	-3.4	-13	1.5	1 (N/A)	0.1	0.62
Austrian pine	0.3	0.1	0.2	0.0	2	0.9	0.1	0.1	0.9	6	-0.8	-3	1.8	4 (N/A)	0.1	2.21
Black spruce	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	-0.1	0	0.4	1 (N/A)	0.1	0.47
Dogwood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.1	0.41
Kwanzan cherry	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.0	0.11
Scarlet oak	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23 (N/A)	0.0	22.55
Juniper	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.0	0.09
Common chokecherry	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7 (N/A)	0.0	6.56
Black poplar	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7 (N/A)	0.0	7.42
Sumac	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.71
Sweetbay	0.2	0.0	0.2	0.0	1	0.8	0.1	0.1	0.8	5	0.0	0	2.3	7 (N/A)	0.0	6.61
Citywide total	794.9	134.1	412.0	40.1	4,356	2,478.2	360.7	343.8	2,350.3	15,432	-478.5	-1,794	6,435.6	17,994 (N/A)	100.0	5.46

Table 4: Annual Carbon Stored

Fairfield

Stored CO2 Benefits of Public Trees

2/1/2016

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	4,502,410	33,768	(N/A)	8.8	23.6	116.84
Silver maple	3,618,375	27,138	(N/A)	8.7	19.0	94.89
Apple	157,798	1,183	(N/A)	6.2	0.8	5.75
Green ash	1,032,732	7,745	(N/A)	6.0	5.4	39.12
Ash	619,488	4,646	(N/A)	4.8	3.2	29.22
Maple	500,555	3,754	(N/A)	4.5	2.6	25.37
Eastern white pine	412,520	3,094	(N/A)	3.5	2.2	26.67
Bur oak	1,329,151	9,969	(N/A)	3.3	7.0	92.30
Eastern redbud	79,403	596	(N/A)	3.2	0.4	5.73
Norway maple	426,204	3,197	(N/A)	3.1	2.2	31.65
Swamp white oak	70,878	532	(N/A)	2.5	0.4	6.33
Sugar maple	525,542	3,942	(N/A)	2.4	2.8	49.89
Black walnut	473,391	3,550	(N/A)	2.3	2.5	47.34
Pin oak	807,118	6,053	(N/A)	2.1	4.2	87.73
Honeylocust	220,901	1,657	(N/A)	2.1	1.2	24.01
Northern red oak	176,793	1,326	(N/A)	1.9	0.9	21.05
Eastern red cedar	34,335	258	(N/A)	1.9	0.2	4.15
Broadleaf Deciduous	5,616	42	(N/A)	1.7	0.0	0.74
Mulberry	69,572	522	(N/A)	1.5	0.4	10.65
Northern hackberry	213,048	1,598	(N/A)	1.4	1.1	34.74
Siberian elm	300,283	2,252	(N/A)	1.4	1.6	48.96
Red maple	66,906	502	(N/A)	1.4	0.4	10.91
Northern white cedar	7,322	55	(N/A)	1.3	0.0	1.28
Pear	13,691	103	(N/A)	1.2	0.1	2.70
American basswood	277,745	2,083	(N/A)	1.2	1.5	54.82
Northern pin oak	314,647	2,360	(N/A)	1.2	1.7	62.10
Lilac	4,199	31	(N/A)	0.9	0.0	1.02
Cottonwood	267,350	2,005	(N/A)	0.9	1.4	64.68
Chinese elm	464,834	3,486	(N/A)	0.9	2.4	112.46
American sycamore	523,097	3,923	(N/A)	0.8	2.7	140.12
Scotch pine	21,422	161	(N/A)	0.8	0.1	6.18
Callery pear	10,721	80	(N/A)	0.8	0.1	3.09
Broadleaf Deciduous	27,710	208	(N/A)	0.8	0.1	7.99
Blue spruce	12,082	91	(N/A)	0.8	0.1	3.62
River birch	73,317	550	(N/A)	0.8	0.4	21.99
American elm	89,017	668	(N/A)	0.8	0.5	26.71
Hickory	150,733	1,130	(N/A)	0.7	0.8	51.39
Littleleaf linden	31,026	233	(N/A)	0.7	0.2	10.58
Catalpa	303,178	2,274	(N/A)	0.7	1.6	103.36
Norway spruce	17,860	134	(N/A)	0.6	0.1	6.70
Kentucky coffeetree	8,689	65	(N/A)	0.6	0.0	3.26
Tulip tree	55,743	418	(N/A)	0.6	0.3	22.00
White ash	22,661	170	(N/A)	0.6	0.1	8.94
Spruce	25,311	190	(N/A)	0.6	0.1	9.99
Black cherry	20,758	156	(N/A)	0.5	0.1	9.16
Red pine	7,362	55	(N/A)	0.5	0.0	3.25
Ginkgo	32,261	242	(N/A)	0.5	0.2	15.12
Broadleaf Deciduous	34,892	262	(N/A)	0.5	0.2	16.36
Oak	146,703	1,100	(N/A)	0.4	0.8	78.59
Willow	12,679	95	(N/A)	0.3	0.1	9.51
Elm	8,740	66	(N/A)	0.3	0.0	6.56
Boxelder	29,824	224	(N/A)	0.3	0.2	22.37
Northern catalpa	72,360	543	(N/A)	0.3	0.4	60.30
Amur maple	17,534	132	(N/A)	0.3	0.1	14.61
Basswood	1,478	11	(N/A)	0.3	0.0	1.23

Black locust	24,015	180	(N/A)	0.2	0.1	22.51
White mulberry	11,399	85	(N/A)	0.2	0.1	12.21
Plum	425	3	(N/A)	0.2	0.0	0.45
Black maple	31,488	236	(N/A)	0.2	0.2	33.74
Japanese tree lilac	260	2	(N/A)	0.2	0.0	0.28
Southern magnolia	300	2	(N/A)	0.2	0.0	0.37
Quaking aspen	82,488	619	(N/A)	0.2	0.4	103.11
Ohio buckeye	15,431	116	(N/A)	0.2	0.1	23.15
Japanese maple	1,127	8	(N/A)	0.2	0.0	1.69
Sweetgum	47,343	355	(N/A)	0.2	0.2	71.01
Cherry plum	233	2	(N/A)	0.2	0.0	0.35
Conifer Evergreen M	613	5	(N/A)	0.1	0.0	1.15
Flowering dogwood	55	0	(N/A)	0.1	0.0	0.10
Birch	6,044	45	(N/A)	0.1	0.0	11.33
Broadleaf Evergreen I	1,452	11	(N/A)	0.1	0.0	3.63
Conifer Evergreen Sn	129	1	(N/A)	0.1	0.0	0.32
Alder	41	0	(N/A)	0.1	0.0	0.10
Eastern cottonwood	16,915	127	(N/A)	0.1	0.1	63.43
Conifer Evergreen La	8,661	65	(N/A)	0.1	0.0	32.48
Austrian pine	1,402	11	(N/A)	0.1	0.0	5.26
Black spruce	45	0	(N/A)	0.1	0.0	0.17
Dogwood	192	1	(N/A)	0.1	0.0	0.72
Kwanzan cherry	14	0	(N/A)	0.0	0.0	0.10
Scarlet oak	55,982	420	(N/A)	0.0	0.3	419.86
Juniper	3	0	(N/A)	0.0	0.0	0.02
Common chokecherry	3,037	23	(N/A)	0.0	0.0	22.78
Black poplar	3,672	28	(N/A)	0.0	0.0	27.54
Sumac	178	1	(N/A)	0.0	0.0	1.33
Sweetbay	3,037	23	(N/A)	0.0	0.0	22.78
Citywide total	19,065,949	142,995	(N/A)	100.0	100.0	43.37

Table 5: Annual Carbon Sequestered

Fairfield

Annual CO Benefits of Public Trees

2/1/2016

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
White oak	211,947	1,590	-21,612	-936	-7	0	0	189,400	1,420	(N/A)	8.8	17.3	4.92
Silver maple	294,055	2,205	-17,381	-828	-6	0	0	275,846	2,069	(N/A)	8.7	25.2	7.23
Apple	17,485	131	-760	-172	-1	0	0	16,553	124	(N/A)	6.2	1.5	0.60
Green ash	64,897	487	-4,957	-326	-2	0	0	59,614	447	(N/A)	6.0	5.5	2.26
Ash	42,189	316	-2,993	-280	-2	0	0	38,916	292	(N/A)	4.8	3.6	1.84
Maple	49,830	374	-2,405	-223	-2	0	0	47,202	354	(N/A)	4.5	4.3	2.39
Eastern white pine	18,008	135	-1,980	-286	-2	0	0	15,741	118	(N/A)	3.5	1.4	1.02
Bur oak	52,556	394	-6,381	-256	-2	0	0	45,920	344	(N/A)	3.3	4.2	3.19
Eastern redbud	8,798	66	-382	-87	-1	0	0	8,329	62	(N/A)	3.2	0.8	0.60
Norway maple	30,112	226	-2,052	-184	-1	0	0	27,876	209	(N/A)	3.1	2.6	2.07
Swamp white oak	12,876	97	-358	-72	-1	0	0	12,446	93	(N/A)	2.5	1.1	1.11
Sugar maple	31,346	235	-2,525	-164	-1	0	0	28,657	215	(N/A)	2.4	2.6	2.72
Black walnut	35,174	264	-2,272	-157	-1	0	0	32,744	246	(N/A)	2.3	3.0	3.27
Pin oak	60,857	456	-3,875	-169	-1	0	0	56,814	426	(N/A)	2.1	5.2	6.18
Honeylocust	24,297	182	-1,065	-91	-1	0	0	23,140	174	(N/A)	2.1	2.1	2.52
Northern red oak	5,331	40	-850	-71	-1	0	0	4,411	33	(N/A)	1.9	0.4	0.53
Eastern red cedar	1,789	13	-165	-82	-1	0	0	1,543	12	(N/A)	1.9	0.1	0.19
Broadleaf Deciduous Smal	1,302	10	-28	-21	0	0	0	1,252	9	(N/A)	1.7	0.1	0.16
Mulberry	3,960	30	-335	-48	0	0	0	3,577	27	(N/A)	1.5	0.3	0.55
Northern hackberry	12,462	93	-1,023	-100	-1	0	0	11,339	85	(N/A)	1.4	1.0	1.85
Siberian elm	17,128	128	-1,443	-102	-1	0	0	15,583	117	(N/A)	1.4	1.4	2.54
Red maple	9,245	69	-321	-52	0	0	0	8,872	67	(N/A)	1.4	0.8	1.45
Northern white cedar	737	6	-35	-19	0	0	0	682	5	(N/A)	1.3	0.1	0.12
Pear	1,677	13	-67	-20	0	0	0	1,591	12	(N/A)	1.2	0.1	0.31
American basswood	17,126	128	-1,334	-72	-1	0	0	15,721	118	(N/A)	1.2	1.4	3.10
Northern pin oak	12,148	91	-1,512	-102	-1	0	0	10,534	79	(N/A)	1.2	1.0	2.08
Lilac	942	7	-21	-15	0	0	0	907	7	(N/A)	0.9	0.1	0.22
Cottonwood	18,064	135	-1,283	-78	-1	0	0	16,702	125	(N/A)	0.9	1.5	4.04
Chinese elm	17,097	128	-2,231	-86	-1	0	0	14,779	111	(N/A)	0.9	1.4	3.58
American sycamore	18,879	142	-2,511	-92	-1	0	0	16,275	122	(N/A)	0.8	1.5	4.36
Scotch pine	1,835	14	-103	-35	0	0	0	1,698	13	(N/A)	0.8	0.2	0.49
Callery pear	2,611	20	-58	-16	0	0	0	2,537	19	(N/A)	0.8	0.2	0.73

Broadleaf Deciduous Medi	3,228	24	-140	-20	0	0	0	3,067	23 (N/A)	0.8	0.3	0.88
Blue spruce	1,144	9	-58	-30	0	0	0	1,056	8 (N/A)	0.8	0.1	0.32
River birch	7,368	55	-353	-39	0	0	0	6,976	52 (N/A)	0.8	0.6	2.09
American elm	4,519	34	-430	-41	0	0	0	4,049	30 (N/A)	0.8	0.4	1.21
Hickory	11,787	88	-724	-51	0	0	0	11,013	83 (N/A)	0.7	1.0	3.75
Littleleaf linden	4,018	30	-155	-20	0	0	0	3,843	29 (N/A)	0.7	0.4	1.31
Catalpa	7,647	57	-1,456	-49	0	0	0	6,143	46 (N/A)	0.7	0.6	2.09
Norway spruce	1,175	9	-86	-21	0	0	0	1,068	8 (N/A)	0.6	0.1	0.40
Kentucky coffeetree	709	5	-42	-6	0	0	0	660	5 (N/A)	0.6	0.1	0.25
Tulip tree	3,453	26	-268	-18	0	0	0	3,167	24 (N/A)	0.6	0.3	1.25
White ash	3,480	26	-111	-20	0	0	0	3,348	25 (N/A)	0.6	0.3	1.32
Spruce	1,275	10	-122	-22	0	0	0	1,131	8 (N/A)	0.6	0.1	0.45
Black cherry	2,020	15	-100	-18	0	0	0	1,902	14 (N/A)	0.5	0.2	0.84
Red pine	1,042	8	-35	-21	0	0	0	986	7 (N/A)	0.5	0.1	0.43
Ginkgo	1,829	14	-155	-25	0	0	0	1,649	12 (N/A)	0.5	0.2	0.77
Broadleaf Deciduous Large	4,207	32	-168	-21	0	0	0	4,019	30 (N/A)	0.5	0.4	1.88
Oak	7,958	60	-704	-36	0	0	0	7,217	54 (N/A)	0.4	0.7	3.87
Willow	1,685	13	-63	-9	0	0	0	1,612	12 (N/A)	0.3	0.1	1.21
Elm	755	6	-42	-5	0	0	0	707	5 (N/A)	0.3	0.1	0.53
Boxelder	2,879	22	-145	-14	0	0	0	2,720	20 (N/A)	0.3	0.2	2.04
Northern catalpa	1,569	12	-347	-12	0	0	0	1,209	9 (N/A)	0.3	0.1	1.01
Amur maple	1,621	12	-84	-13	0	0	0	1,524	11 (N/A)	0.3	0.1	1.27
Basswood	373	3	-7	-4	0	0	0	362	3 (N/A)	0.3	0.0	0.30
Black locust	992	7	-117	-10	0	0	0	864	6 (N/A)	0.2	0.1	0.81
White mulberry	1,012	8	-55	-8	0	0	0	949	7 (N/A)	0.2	0.1	1.02
Plum	119	1	-2	-2	0	0	0	115	1 (N/A)	0.2	0.0	0.12
Black maple	3,945	30	-151	-14	0	0	0	3,779	28 (N/A)	0.2	0.3	4.05
Japanese tree lilac	90	1	-2	-2	0	0	0	87	1 (N/A)	0.2	0.0	0.09
Southern magnolia	67	0	-1	-3	0	0	0	62	0 (N/A)	0.2	0.0	0.08
Quaking aspen	3,339	25	-396	-16	0	0	0	2,928	22 (N/A)	0.2	0.3	3.66
Ohio buckeye	610	5	-74	-5	0	0	0	531	4 (N/A)	0.2	0.0	0.80
Japanese maple	178	1	-6	-2	0	0	0	170	1 (N/A)	0.2	0.0	0.25
Sweetgum	2,576	19	-227	-11	0	0	0	2,338	18 (N/A)	0.2	0.2	3.51
Cherry plum	73	1	-1	-1	0	0	0	70	1 (N/A)	0.2	0.0	0.11
Conifer Evergreen Mediun	91	1	-3	-3	0	0	0	85	1 (N/A)	0.1	0.0	0.16
Flowering dogwood	35	0	0	-1	0	0	0	34	0 (N/A)	0.1	0.0	0.06
Birch	929	7	-30	-5	0	0	0	895	7 (N/A)	0.1	0.1	1.68
Broadleaf Evergreen Medi	169	1	-7	-4	0	0	0	158	1 (N/A)	0.1	0.0	0.40
Conifer Evergreen Small	40	0	-1	-2	0	0	0	38	0 (N/A)	0.1	0.0	0.09
Alder	26	0	0	-1	0	0	0	25	0 (N/A)	0.1	0.0	0.06
Eastern cottonwood	1,319	10	-81	-5	0	0	0	1,233	9 (N/A)	0.1	0.1	4.62
Conifer Evergreen Large	372	3	-42	-5	0	0	0	325	2 (N/A)	0.1	0.0	1.22
Austrian pine	129	1	-7	-3	0	0	0	119	1 (N/A)	0.1	0.0	0.45
Black spruce	14	0	0	-1	0	0	0	13	0 (N/A)	0.1	0.0	0.05
Dogwood	47	0	-1	-1	0	0	0	45	0 (N/A)	0.1	0.0	0.17
Kwanzan cherry	9	0	0	0	0	0	0	8	0 (N/A)	0.0	0.0	0.06
Scarlet oak	479	4	-269	-6	0	0	0	204	2 (N/A)	0.0	0.0	1.53
Juniper	1	0	0	0	0	0	0	0	0 (N/A)	0.0	0.0	0.00
Common chokecherry	268	2	-15	-2	0	0	0	251	2 (N/A)	0.0	0.0	1.88
Black poplar	445	3	-18	-2	0	0	0	426	3 (N/A)	0.0	0.0	3.19
Sumac	38	0	-1	-1	0	0	0	37	0 (N/A)	0.0	0.0	0.27
Sweetbay	183	1	-15	-2	0	0	0	167	1 (N/A)	0.0	0.0	1.25
Citywide total	1,190,089	8,926	-91,635	-5,873	-44	0	0	1,092,581	8,194 (N/A)	100.0	100.0	2.49

Table 6: Annual Social and Aesthetic Benefits

Fairfield

Annual Aesthetic/Other Benefits of Public Trees

2/1/2016

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	16,607	(N/A)	8.8	14.5	57.46
Silver maple	24,319	(N/A)	8.7	21.2	85.03
Apple	966	(N/A)	6.2	0.8	4.69
Green ash	6,664	(N/A)	6.0	5.8	33.66
Ash	4,384	(N/A)	4.8	3.8	27.57
Maple	6,387	(N/A)	4.5	5.6	43.16
Eastern white pine	3,495	(N/A)	3.5	3.1	30.13
Bur oak	4,288	(N/A)	3.3	3.7	39.70
Eastern redbud	489	(N/A)	3.2	0.4	4.70
Norway maple	3,072	(N/A)	3.1	2.7	30.42
Swamp white oak	1,540	(N/A)	2.5	1.3	18.33
Sugar maple	3,416	(N/A)	2.4	3.0	43.24
Black walnut	3,322	(N/A)	2.3	2.9	44.30
Pin oak	4,767	(N/A)	2.1	4.2	69.09
Honeylocust	5,305	(N/A)	2.1	4.6	76.88
Northern red oak	536	(N/A)	1.9	0.5	8.50
Eastern red cedar	880	(N/A)	1.9	0.8	14.20
Broadleaf Deciduous Small	57	(N/A)	1.7	0.0	1.00
Mulberry	219	(N/A)	1.5	0.2	4.48
Northern hackberry	1,817	(N/A)	1.4	1.6	39.51
Siberian elm	1,491	(N/A)	1.4	1.3	32.42
Red maple	1,400	(N/A)	1.4	1.2	30.43
Northern white cedar	346	(N/A)	1.3	0.3	8.06
Pear	86	(N/A)	1.2	0.1	2.27
American basswood	1,308	(N/A)	1.2	1.1	34.42
Northern pin oak	1,147	(N/A)	1.2	1.0	30.19
Lilac	48	(N/A)	0.9	0.0	1.54
Cottonwood	1,608	(N/A)	0.9	1.4	51.87
Chinese elm	1,389	(N/A)	0.9	1.2	44.81
American sycamore	1,445	(N/A)	0.8	1.3	51.60
Scotch pine	484	(N/A)	0.8	0.4	18.63
Callery pear	340	(N/A)	0.8	0.3	13.09
Broadleaf Deciduous Medium	392	(N/A)	0.8	0.3	15.08
Blue spruce	472	(N/A)	0.8	0.4	18.89
River birch	764	(N/A)	0.8	0.7	30.57
American elm	704	(N/A)	0.8	0.6	28.18
Hickory	1,077	(N/A)	0.7	0.9	48.93
Littleleaf linden	484	(N/A)	0.7	0.4	21.99
Catalpa	659	(N/A)	0.7	0.6	29.94
Norway spruce	321	(N/A)	0.6	0.3	16.04
Kentucky coffeetree	158	(N/A)	0.6	0.1	7.88
Tulip tree	376	(N/A)	0.6	0.3	19.78
White ash	588	(N/A)	0.6	0.5	30.97
Spruce	259	(N/A)	0.6	0.2	13.61
Black cherry	115	(N/A)	0.5	0.1	6.78
Red pine	304	(N/A)	0.5	0.3	17.88
Ginkgo	150	(N/A)	0.5	0.1	9.38
Broadleaf Deciduous Large	488	(N/A)	0.5	0.4	30.53

Oak	689 (N/A)	0.4	0.6	49.24
Willow	191 (N/A)	0.3	0.2	19.06
Elm	115 (N/A)	0.3	0.1	11.45
Boxelder	310 (N/A)	0.3	0.3	31.04
Northern catalpa	159 (N/A)	0.3	0.1	17.71
Amur maple	94 (N/A)	0.3	0.1	10.43
Basswood	90 (N/A)	0.3	0.1	9.96
Black locust	113 (N/A)	0.2	0.1	14.18
White mulberry	59 (N/A)	0.2	0.1	8.42
Plum	4 (N/A)	0.2	0.0	0.61
Black maple	512 (N/A)	0.2	0.4	73.08
Japanese tree lilac	2 (N/A)	0.2	0.0	0.32
Southern magnolia	38 (N/A)	0.2	0.0	6.31
Quaking aspen	270 (N/A)	0.2	0.2	44.96
Ohio buckeye	66 (N/A)	0.2	0.1	13.18
Japanese maple	9 (N/A)	0.2	0.0	1.71
Sweetgum	207 (N/A)	0.2	0.2	41.46
Cherry plum	2 (N/A)	0.2	0.0	0.44
Conifer Evergreen Medium	60 (N/A)	0.1	0.1	14.88
Flowering dogwood	0 (N/A)	0.1	0.0	0.03
Birch	104 (N/A)	0.1	0.1	26.12
Broadleaf Evergreen Medium	66 (N/A)	0.1	0.1	21.93
Conifer Evergreen Small	40 (N/A)	0.1	0.0	13.37
Alder	0 (N/A)	0.1	0.0	0.03
Eastern cottonwood	115 (N/A)	0.1	0.1	57.69
Conifer Evergreen Large	59 (N/A)	0.1	0.1	29.29
Austrian pine	46 (N/A)	0.1	0.0	23.16
Black spruce	17 (N/A)	0.1	0.0	8.67
Dogwood	2 (N/A)	0.1	0.0	1.05
Kwanzan cherry	0 (N/A)	0.0	0.0	0.03
Scarlet oak	29 (N/A)	0.0	0.0	28.57
Juniper	4 (N/A)	0.0	0.0	4.27
Common chokecherry	15 (N/A)	0.0	0.0	15.48
Black poplar	46 (N/A)	0.0	0.0	45.86
Sumac	2 (N/A)	0.0	0.0	2.06
Sweetbay	13 (N/A)	0.0	0.0	12.82
Citywide total	114,483 (N/A)	100.0	100.0	34.72

Table 7: Summary of Benefits in Dollars

Fairfield

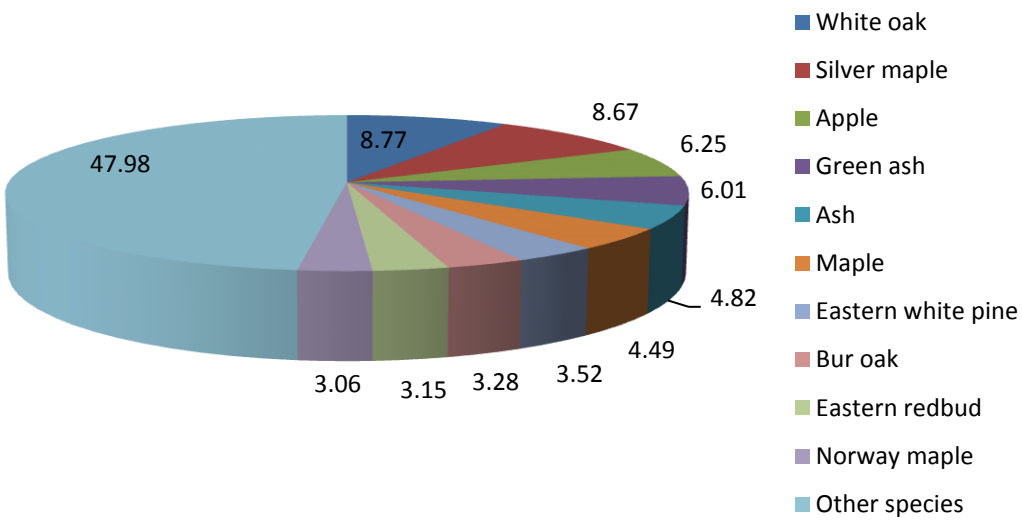
Total Annual Benefits of Public Trees by Species ($)

2/1/2016

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
White oak	18,581	1,420	3,333	28,539	16,607	68,480	(N/A)	17.3
Silver maple	16,010	2,069	2,830	26,665	24,319	71,894	(N/A)	18.2
Apple	2,550	124	388	1,085	966	5,113	(N/A)	1.3
Green ash	6,161	447	1,058	7,455	6,664	21,787	(N/A)	5.5
Ash	5,872	292	990	5,649	4,384	17,186	(N/A)	4.3
Maple	4,883	354	882	5,282	6,387	17,789	(N/A)	4.5
Eastern white pine	3,160	118	80	8,430	3,495	15,283	(N/A)	3.9
Bur oak	4,786	344	887	7,816	4,288	18,121	(N/A)	4.6
Eastern redbud	1,272	62	195	543	489	2,561	(N/A)	0.6
Norway maple	3,952	209	667	3,854	3,072	11,755	(N/A)	3.0
Swamp white oak	1,418	93	209	942	1,540	4,203	(N/A)	1.1
Sugar maple	3,212	215	505	4,054	3,416	11,402	(N/A)	2.9
Black walnut	3,237	246	542	3,769	3,322	11,116	(N/A)	2.8
Pin oak	3,256	426	424	4,632	4,767	13,506	(N/A)	3.4
Honeylocust	2,217	174	360	2,574	5,305	10,630	(N/A)	2.7
Northern red oak	1,143	33	160	1,205	536	3,077	(N/A)	0.8
Eastern red cedar	905	12	71	1,554	880	3,422	(N/A)	0.9
Broadleaf Deciduous Sn	176	9	23	58	57	323	(N/A)	0.1
Mulberry	686	27	115	376	219	1,422	(N/A)	0.4
Northern hackberry	2,271	85	393	2,587	1,817	7,153	(N/A)	1.8
Siberian elm	1,994	117	351	2,352	1,491	6,305	(N/A)	1.6
Red maple	1,099	67	180	867	1,400	3,612	(N/A)	0.9
Northern white cedar	169	5	13	282	346	815	(N/A)	0.2
Pear	219	12	32	94	86	443	(N/A)	0.1
American basswood	1,303	118	194	1,619	1,308	4,542	(N/A)	1.1
Northern pin oak	2,068	79	372	2,485	1,147	6,151	(N/A)	1.6
Lilac	131	7	17	44	48	247	(N/A)	0.1
Cottonwood	1,636	125	279	2,037	1,608	5,686	(N/A)	1.4
Chinese elm	1,626	111	302	2,615	1,389	6,043	(N/A)	1.5
American sycamore	1,775	122	334	2,927	1,445	6,603	(N/A)	1.7
Scotch pine	397	13	36	678	484	1,608	(N/A)	0.4
Callery pear	279	19	39	166	340	842	(N/A)	0.2
Broadleaf Deciduous M	379	23	58	294	392	1,145	(N/A)	0.3
Blue spruce	370	8	40	562	472	1,453	(N/A)	0.4
River birch	881	52	146	749	764	2,592	(N/A)	0.7
American elm	802	30	138	740	704	2,415	(N/A)	0.6
Hickory	1,046	83	173	1,248	1,077	3,626	(N/A)	0.9
Littleleaf linden	295	29	46	268	484	1,121	(N/A)	0.3
Catalpa	894	46	177	1,447	659	3,222	(N/A)	0.8
Norway spruce	229	8	15	467	321	1,041	(N/A)	0.3
Kentucky coffeetree	70	5	11	79	158	323	(N/A)	0.1
Tulip tree	305	24	52	405	376	1,162	(N/A)	0.3
White ash	356	25	53	322	588	1,345	(N/A)	0.3
Spruce	243	8	9	538	259	1,057	(N/A)	0.3
Black cherry	273	14	43	128	115	574	(N/A)	0.1
Red pine	249	7	28	345	304	934	(N/A)	0.2
Ginkgo	355	12	61	272	150	850	(N/A)	0.2
Broadleaf Deciduous La	395	30	62	377	488	1,354	(N/A)	0.3

Oak	721	54	126	1,002	689	2,593 (N/A)	0.7
Willow	195	12	31	145	191	574 (N/A)	0.1
Elm	68	5	11	79	115	278 (N/A)	0.1
Boxelder	238	20	37	265	310	871 (N/A)	0.2
Northern catalpa	190	9	38	319	159	715 (N/A)	0.2
Amur maple	219	11	35	106	94	465 (N/A)	0.1
Basswood	36	3	5	29	90	162 (N/A)	0.0
Black locust	183	6	31	199	113	533 (N/A)	0.1
White mulberry	124	7	20	64	59	275 (N/A)	0.1
Plum	15	1	2	5	4	27 (N/A)	0.0
Black maple	342	28	62	346	512	1,290 (N/A)	0.3
Japanese tree lilac	11	1	1	3	2	18 (N/A)	0.0
Southern magnolia	40	0	5	20	38	104 (N/A)	0.0
Quaking aspen	299	22	55	495	270	1,141 (N/A)	0.3
Ohio buckeye	99	4	17	119	66	305 (N/A)	0.1
Japanese maple	26	1	4	10	9	49 (N/A)	0.0
Sweetgum	214	18	38	322	207	798 (N/A)	0.2
Cherry plum	9	1	1	3	2	15 (N/A)	0.0
Conifer Evergreen Medi	38	1	4	49	60	151 (N/A)	0.0
Flowering dogwood	3	0	0	1	0	5 (N/A)	0.0
Birch	105	7	16	74	104	306 (N/A)	0.1
Broadleaf Evergreen Me	56	1	6	55	66	185 (N/A)	0.0
Conifer Evergreen Smal	11	0	1	15	40	67 (N/A)	0.0
Alder	3	0	0	1	0	4 (N/A)	0.0
Eastern cottonwood	115	9	19	140	115	398 (N/A)	0.1
Conifer Evergreen Large	62	2	1	166	59	291 (N/A)	0.1
Austrian pine	39	1	4	62	46	153 (N/A)	0.0
Black spruce	9	0	1	8	17	35 (N/A)	0.0
Dogwood	6	0	1	2	2	12 (N/A)	0.0
Kwanzan cherry	1	0	0	0	0	1 (N/A)	0.0
Scarlet oak	99	2	23	196	29	347 (N/A)	0.1
Juniper	1	0	0	1	4	6 (N/A)	0.0
Common chokecherry	38	2	7	18	15	80 (N/A)	0.0
Black poplar	44	3	7	40	46	140 (N/A)	0.0
Sumac	5	0	1	2	2	10 (N/A)	0.0
Sweetbay	31	1	7	25	13	77 (N/A)	0.0
Citywide Total	109,283	8,194	17,994	145,860	114,483	395,814 (N/A)	100.0

Figure 1: Species Distribution



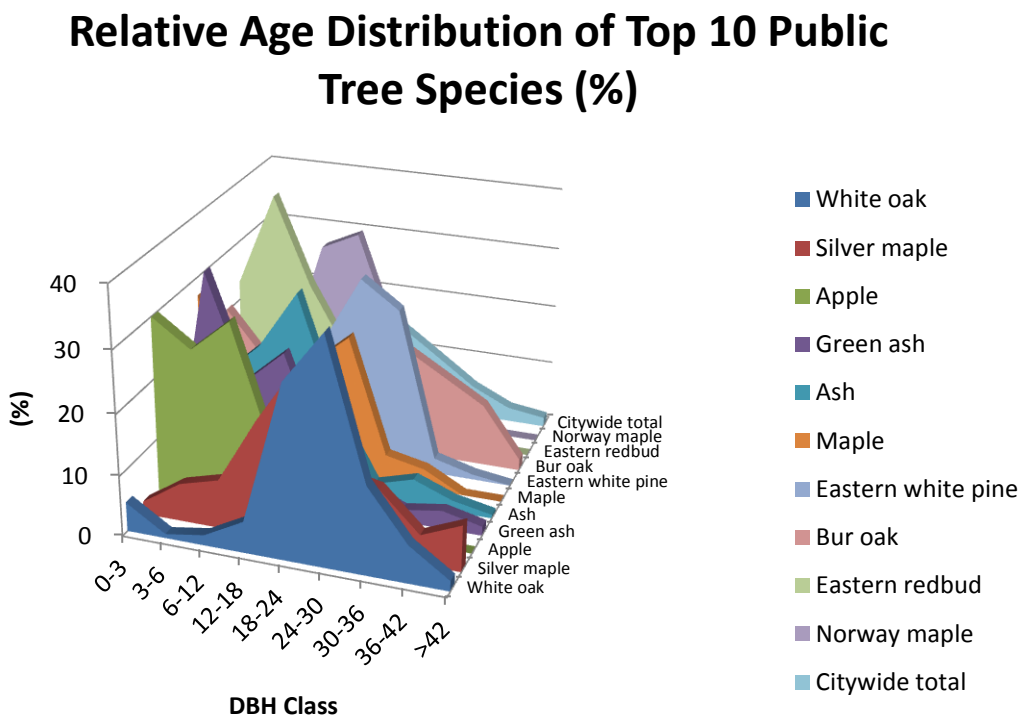


Figure 2: Relative Age Class

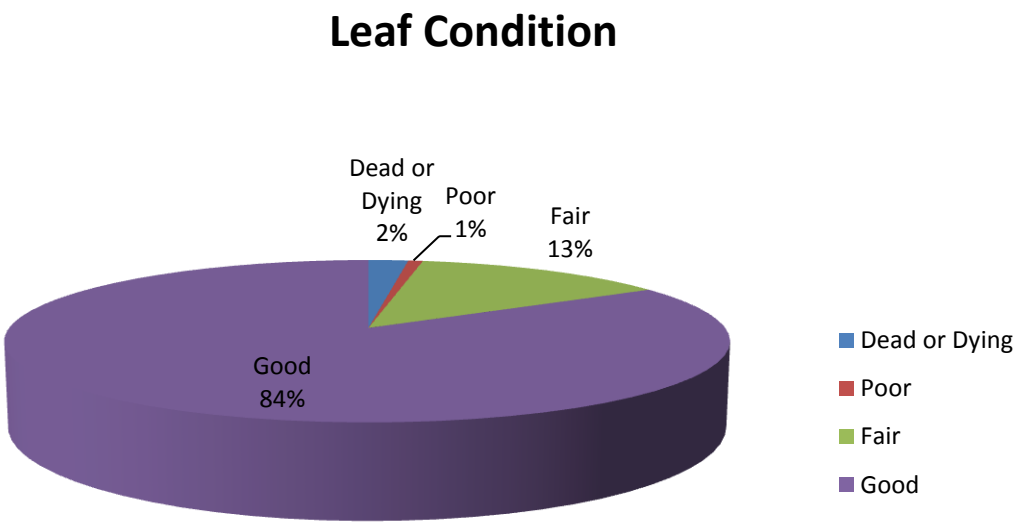


Figure 3: Foliage Condition

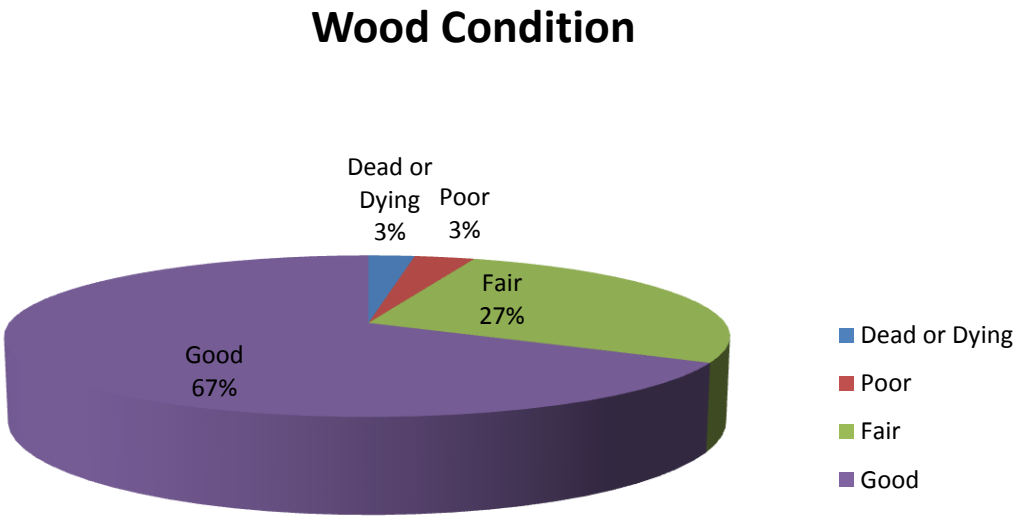


Figure 4: Wood Condition

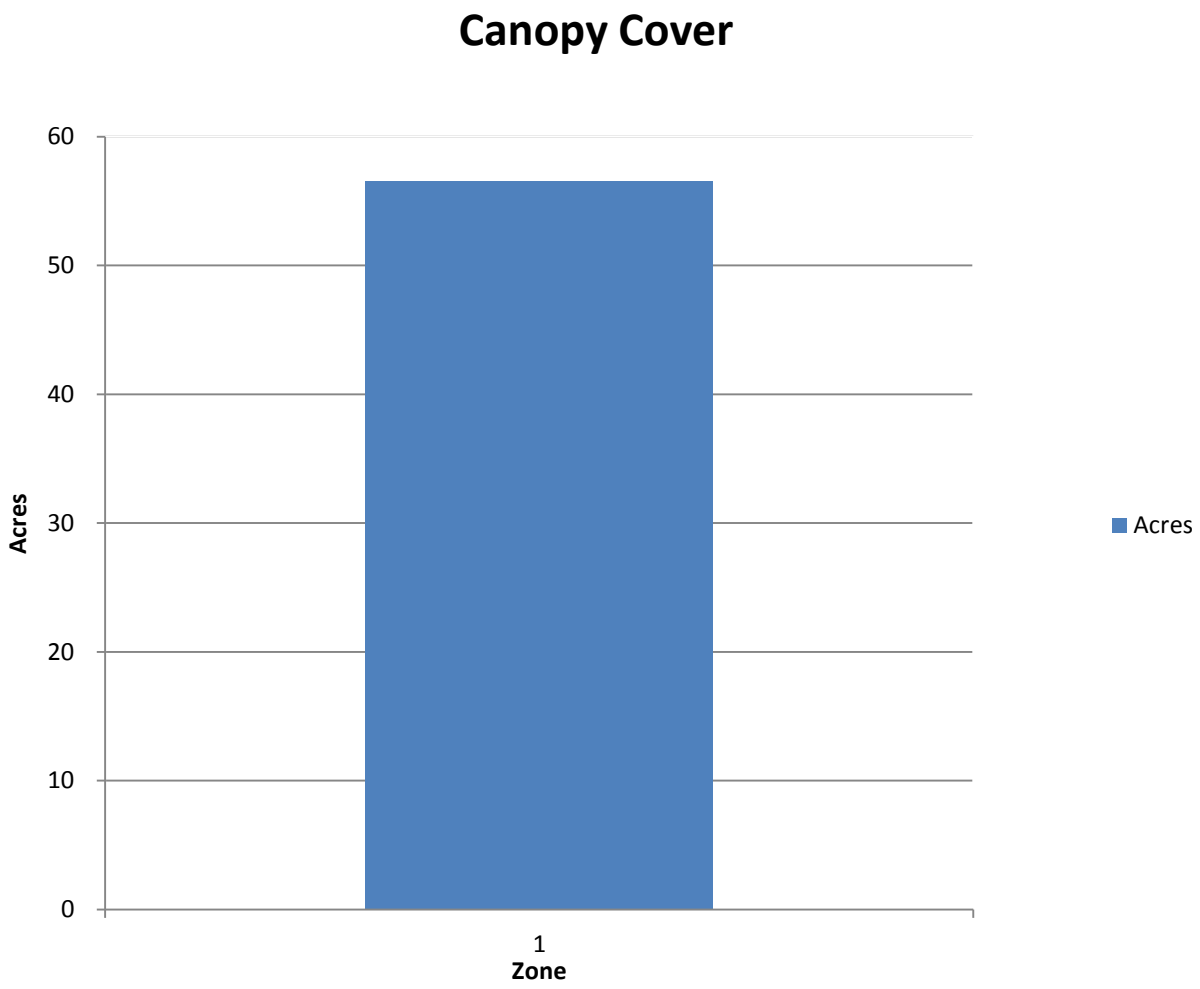


Figure 5: Canopy Cover in Acres

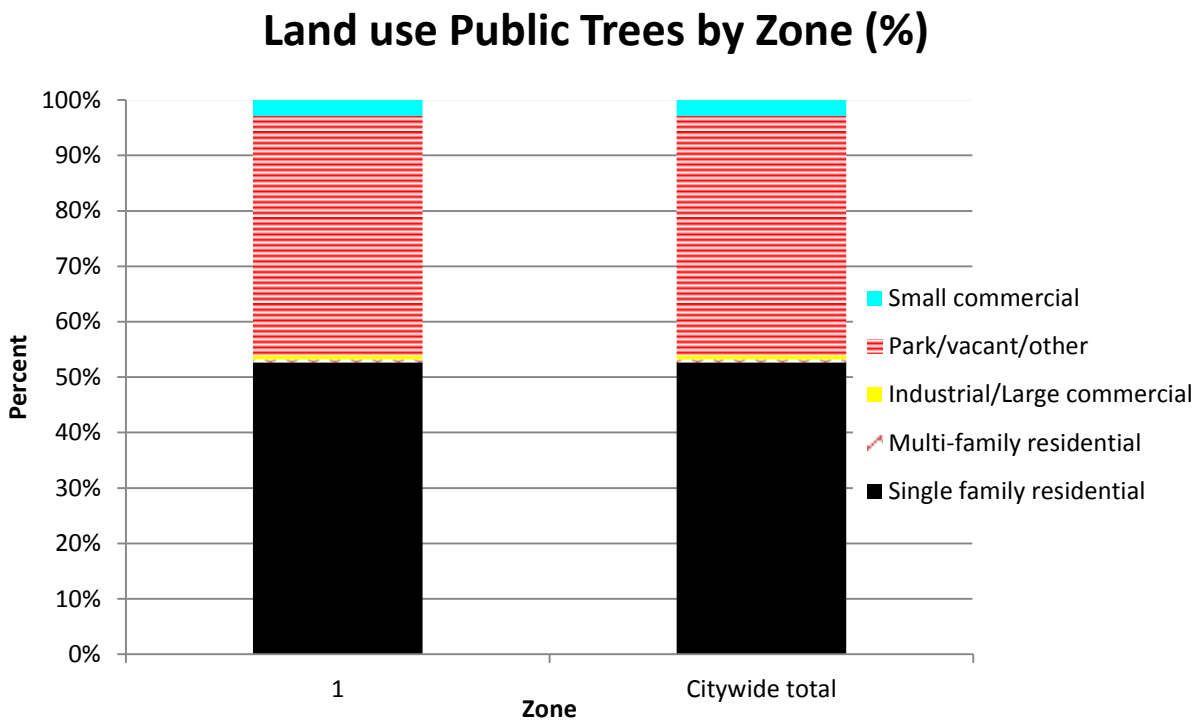


Figure 6: Land Use of city/park trees

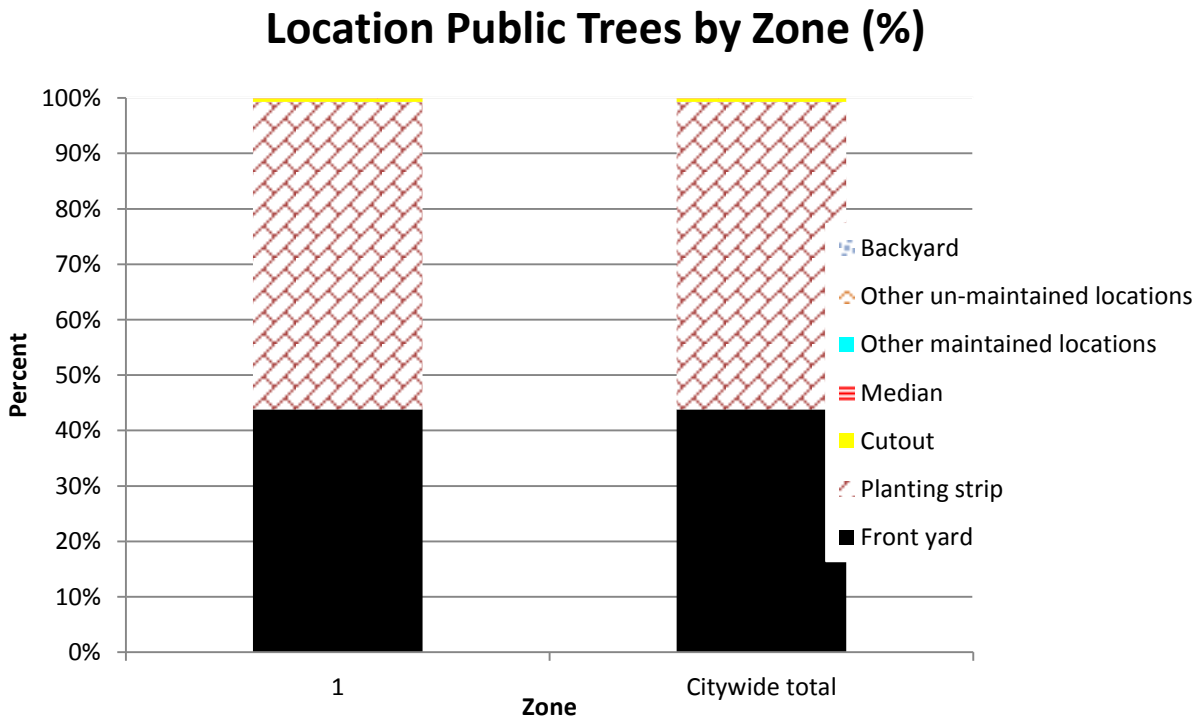


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

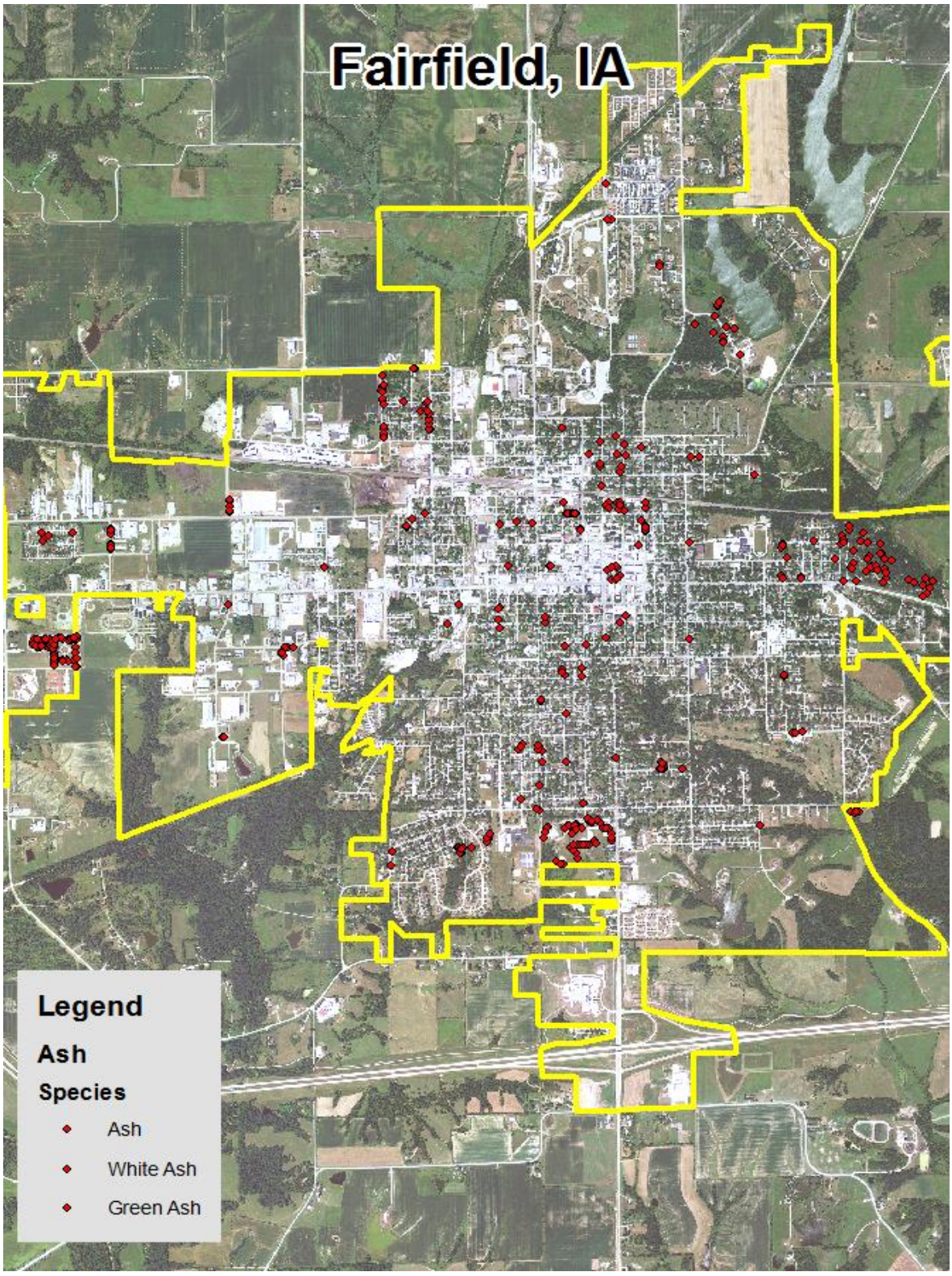


Figure 1: Location of Ash Trees

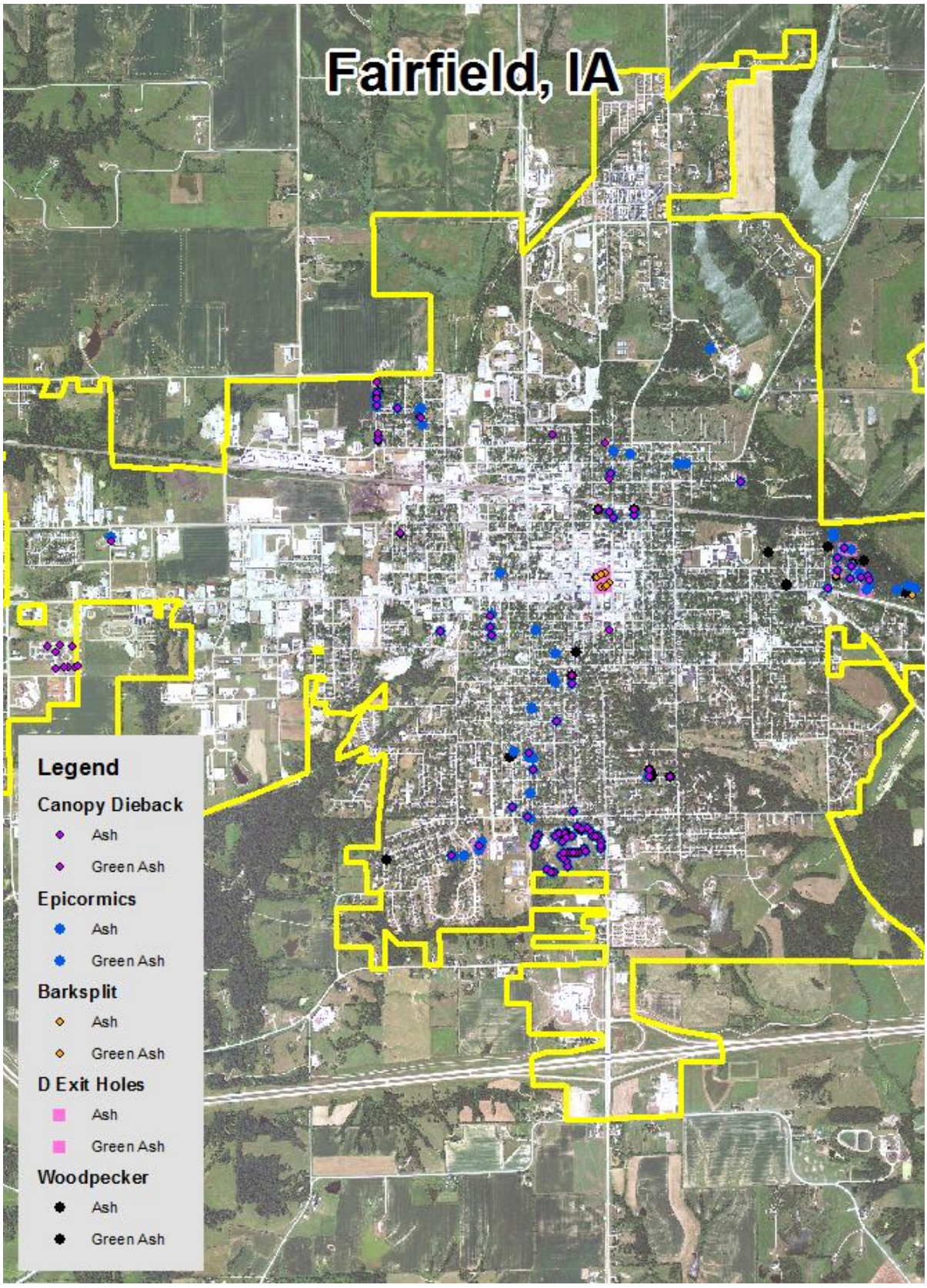


Figure 2: Location of EAB symptoms

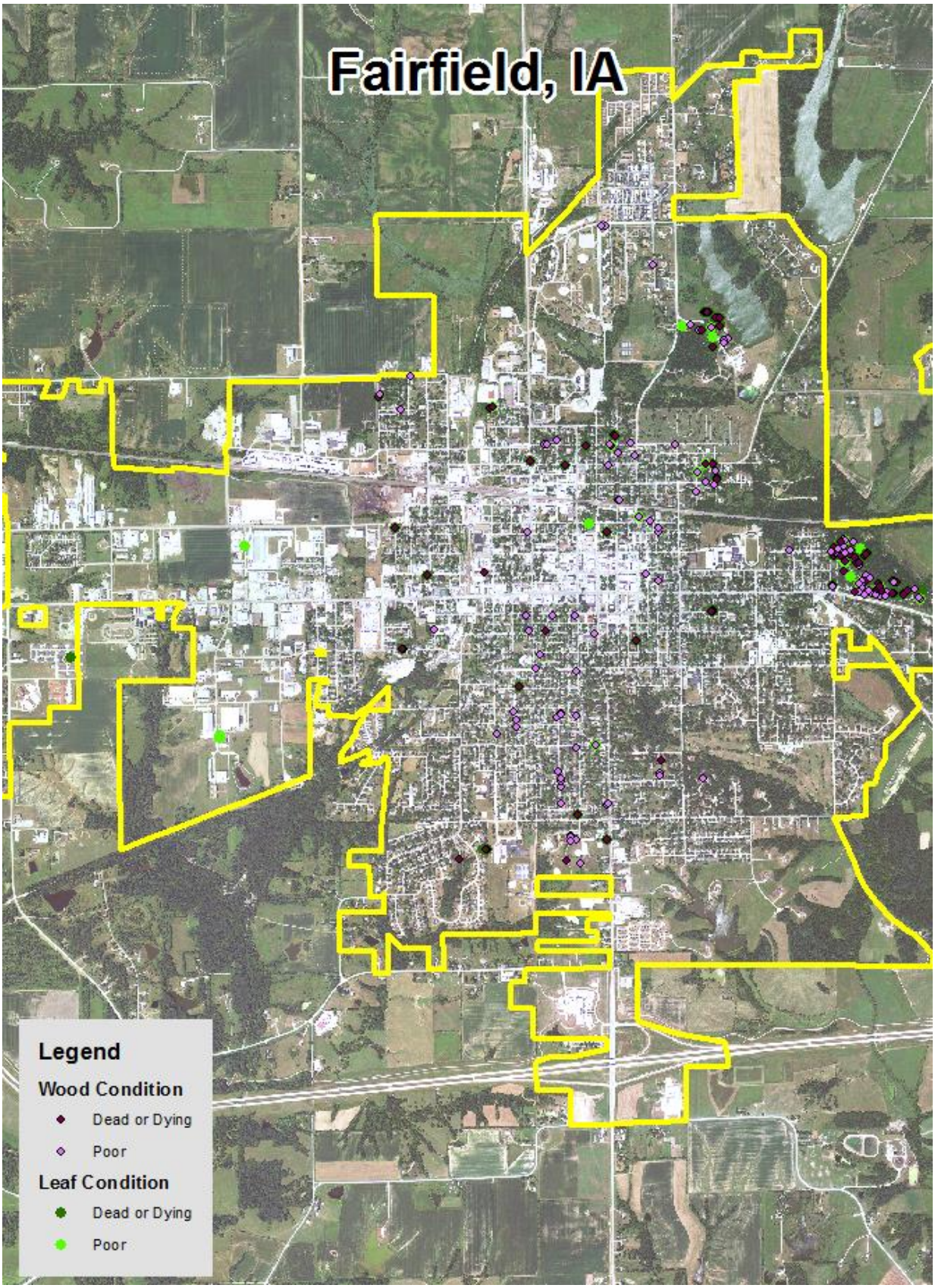


Figure 3: Location of Poor Condition Trees

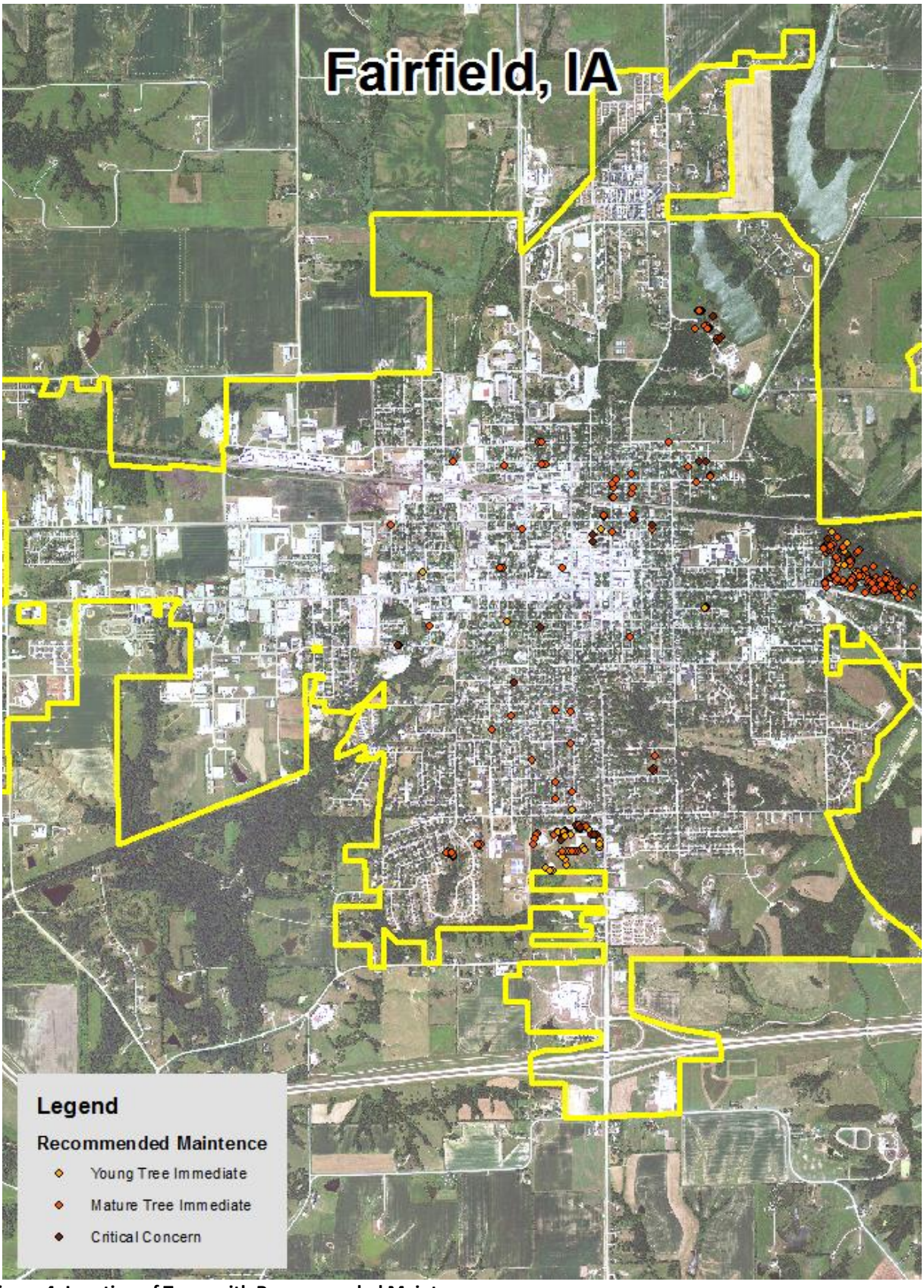


Figure 4: Location of Trees with Recommended Maintenance

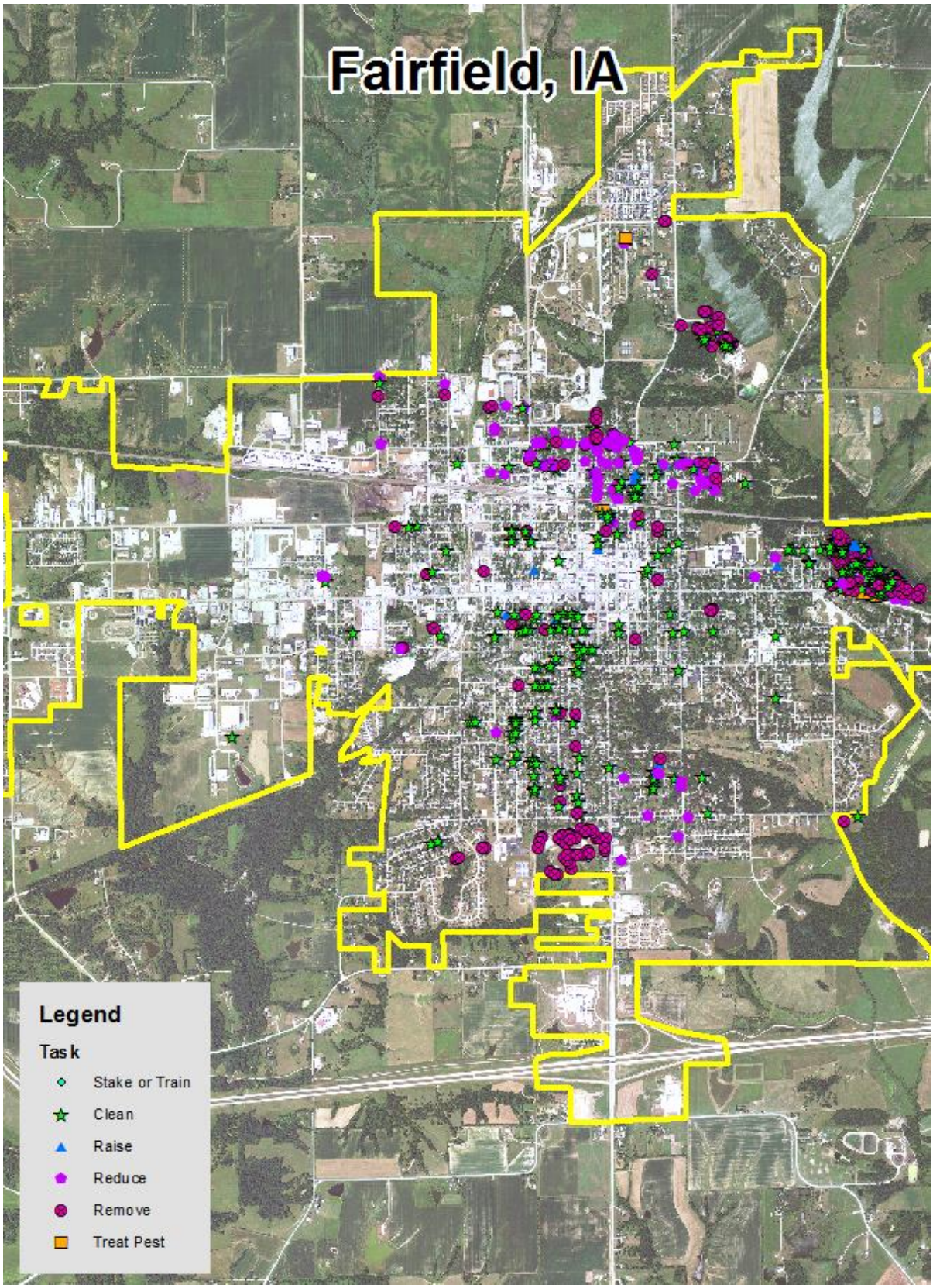


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Fairfield Tree Ordinances

TREE AND LANDSCAPING REGULATIONS*

Sections:

* Prior ordinance history: Ordinances 484, 626-11-2-626-11-5 and 850.

11.08.010 Purpose.
The purpose of this chapter is to protect and promote the public health and safety and to improve the aesthetic qualities of the community by regulating tree management and landscaping activities. The intent of the regulations is to reduce wind turbulence, heat and noise; to prevent erosion and reduce stormwater runoff; to protect private and public property and vehicular and pedestrian rights-of-way; and to promote aesthetic quality and otherwise create a pleasant community environment. (Ord. 861 § 2, 1995).

11.08.020 Scope.
These regulations include requirements and limitations for tree plantings adjacent to and within street rights-of-way in residential and manufacturing zoned districts. (Ord. 861 § 3, 1995).

11.08.030 Definitions.
As used in this chapter:
"Board" means the Fairfield tree enhancement board.
"May" means that the indicated action is permissive.

"Person" means any individual person, firm, partner-ship, corporation, trust or any other organized group of persons.
"Shall" means that the indicated action is mandatory.
"Street" means all that tract of land used, or in-tended to be used, for a public street lying between the property lines extended along each side thereof. (Ord. 861 §4, 1995).
Ordinance 11.08.030. Definitions: "Board" is deleted and "Committee" is substituted. Committee means the City of Fairfield ARBOR COMMITTEE. All references with Chapter 11 of the Fairfield Municipal Code to Fairfield Tree Enhancement Board are hereafter deleted and the name "ARBOR COMMITTEE" is substituted and inserted; more particularly at Chapter 11.08.030; chapter 11.08.040; Chapter 11.080.050; Chapter 11.08.100.

11.08.040 Fairfield tree enhancement board.
Effective the twenty-second day of February, 1993, the Fairfield tree enhancement board shall be created and shall be governed by the following guidelines and procedures.
(1) Members of the board shall serve without compensation.
(2) The Fairfield City Council shall establish a Fairfield tree enhancement board.
Said board shall consist of five members. Members shall be recommended by the mayor and appointed by the Fairfield city council for terms of three years.
(3) It shall be the responsibility of the board to study, investigate, counsel and develop a written plan for the care, preservation, trimming, planting, replanting, removal or disposition of trees and shrubs in public and private areas within the city. Such a plan will be presented to the city council and, upon its acceptance and approval, shall constitute the official comprehensive tree plan for the city of Fairfield, Iowa. The board shall review annually and update if needed the comprehensive city tree plan. The board, when requested by the city council, shall consider, investigate, make findings, report, and recommend upon any special matter of question within the scope of its work.
(4) The board shall choose its own officers, make its own rules and regulation, and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business.
(5) The board shall investigate, study and compile a list of trees suitable for planting and growth within the city of Fairfield. Such list shall be known as "List of Recommended Trees for Fairfield" and may be amended from time to time as necessary.
(Ord. 861 § 5, 1995).

11.08.050 Placement and location of trees.
All trees and shrubs shall hereafter be placed so as to avoid interference with overhead utility wires or underground cables, sewers or drains. All plantings within the public rights-of-way shall be of varieties that will pose a minimum of maintenance problems when mature. All plantings within the public rights-of-way shall be centered between the edge of the street and the sidewalk or property line. No trees shall be planted in areas where the distance between the street and the sidewalk or property line (where there is no sidewalk) is less than five feet. In areas where this distance is greater than five feet and less than eight feet, trees from the list of "small trees," as listed in the List of Recommended Trees for Fairfield may be planted. Where this distance is eight feet or greater, "small trees" and "large trees" may be planted. (Ord. 888 § 1, 1996: Ord. 861 § 6, 1995).

11.08.060 Species of trees limited.
Hereafter no tree from the list of Not Recommended List of Trees for Fairfield shall be planted, seeded or permitted to grow on any lands within the city of Fairfield. (Ord. 888 §1, 1996: Ord. 861 § 7, 1995).

11.08.070 Species of trees permitted.
The varieties of trees permitted by this title for planting in the city of Fairfield shall be compiled by the board. Said list shall contain a list of "small" trees which have a height at maturity of no more than thirty feet; a list of "large" trees which mature at greater than thirty feet; and a list of "not recommended" trees. Said list shall be titled "List of Recommended Trees for Fairfield," shall be kept on file in the office of the planning administrator, and shall be used to fulfill the requirements of this title. (Ord. 861 § 8, 1995).

11.08.075. Heritage Trees. Damage, Removal Conditions.

A. Heritage Trees. Any tree of the following genera or species shall be deemed Heritage Tree:

All trees in the genus Quercus (Oaks), Ulmus Americana (American Elm), Acer saccharum (Sugar Maple), all trees in the genus Carya (Hickory), all trees in the genus Juglans (Walnut), greater than or equal to 30" DBH (Diameter Breast High or"DBH": The diameter of a Tree measured at four and one- half feet (4-1/2') above the existing grade at the base of the Tree.)

B. Damage, Removal of Heritage Trees Permitted.

It shall be unlawful for any person to remove or damage any Heritage Tree prior to issuance by the City of a Tree Removal Permit therefor. Tree Removal Permits authorizing the removal of Heritage Trees under the provisions of this Section 11.08.075B. may be issued by the City for the following reasons:

(1) The Heritage Tree is dead or dying;
(2) The Heritage Tree is diseased;
(3) The Heritage Tree is damaged or injured to the extent that it is likely to die or become diseased, or that it constitutes a hazard to persons or property;
(4) Removal of the Heritage Tree is deemed appropriate by the City Administrator or his/her designee; and/or
(5) Removal of the Heritage Tree will avoid or alleviate an economic hardship or hardship of another nature on the lot or residence located on the lot.

C. <u>Exemption.</u>

Exempted from the above "permitting" requirements are trees determined to be part of Agriculture Activity or Silvicultual Activity sites, in active use, consistent with adjacent, or area land use of an agricultural, horticultural, or silvicultural commercial nature.

11.08.080 Manufacturing districts (M-1, M-2) requirements.
Whenever there is development of a vacant lot or a new use established, the requirements of this section shall be applicable to the entire lot.

(1) Large trees shall be planted at no less than one tree for every sixty feet of frontage, or no less than one small tree for every forty feet of frontage.
(2) No trees, hedges or other obstructions shall be planted or allowed to grow in any portion of the front or side yard area within twenty feet of the intersection of two right-of-way lines.
(3) Hereafter, no tree shall be planted within three feet of the front property line.
(4) Hereafter, one large tree shall be planted for every six required parking spaces, or one small tree shall be planted for every four required parking spaces. (Ord. 888 § 3, 1996; Ord. 861 § 9, 1995).

11.08.090 Residential districts (R-1, R-2, R-3, R-4, R-5) requirements. Whenever there is development on an undeveloped lot, the requirements of this section shall be applicable to the entire lot.
(1) Large trees shall be planted at no less than one tree for every sixty feet of frontage, or no less than one small tree for every forty feet of frontage.
(2) No trees, hedges or other obstructions shall be planted or allowed to grow in any portion of the front or side yard within twenty feet of the intersection of two right-of-way lines.
(3) Hereafter, no tree shall be planted within three feet of the front property line.
(Ord. 888 § 4, 1996; Ord. 861 § 10, 1995).

11.08.100 Permits. No person shall plant or remove any tree on any municipal-owned property, including street rights-of-way, without first filing an application and obtaining approval from the planning administrator. The applicant shall abide by the arboricultural specifications and standards of practice adopted by the board. The city shall have the authority to require posting of a bond adequate to fully repay the city for any and all costs attendant to the completion of the work covered in the permit. In addition, the applicant may be required to show adequate insurance coverage from potential damages during the execution of the work. (Ord. 888 § 5, 1996: Ord. 861 § 11, 1995).

11.08.104. Maintenance. Trees on Private Property. The property owner is responsible for the maintenance and care of any tree located on private property. Certain regulations apply to trees whose branches, limbs, roots or other parts extend into or over the street right-of-way. The property owner is responsible for ensuring private trees are trimmed to sufficient height to allow free passage of pedestrians and vehicular travel and so they will not obstruct or shade streetlights, traffic lights, signs or any traffic control devices or the view of any street intersection. Whenever the City is notified or becomes aware of a dead tree or broken or dead branch or limb in any private tree which is in imminent danger of falling and thereby injuring any individual or causing property damage to adjacent property, the Street Superintendent may declare the tree, branch or limb a hazard and order the property owner to remove the hazard in an expedient manner. If the property owner fails to remove the hazard, the Street Superintendent may cause the hazard to be removed. For purposes of removing the hazard, City crews or City agents shall be allowed on private property. Attempts should be made to notify the property owner before entering onto private property.

11.08.108 Protection: Protective Restrictions, Limitations.

A. No person shall:

(1) Damage, cut, carve, nail, bolt or set fire to any street tree;
(2) Attach any rope, chain or wire cable to any street tree;
(3) Attach advertising posters or any other contrivance to any street tree; or
(4) Allow any harmful gaseous, liquid, chemical or solid substance to come in contact with any street tree.

B. Tree topping. It is unlawful as a normal practice for any person or City department to top any street tree, park tree, or other tree on public property. Topping is defined as heading, stubbing, rounding, tipping or "dehorning" which means the drastic removal of large branches, severely cutting back limbs to stubs larger than three (3) inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes or certain trees under utility wires or other obstructions where other pruning practices are impractical may be exempted from this section at the determination of the Street Superintendent.

C. Ban on soil drench and granular insecticides: It is unlawful to use any soil drench, granular, or other topical application insecticides on trees within the City of Fairfield. These include but are not limited to topical insecticides containing Imidacloprid, Clothianidin, and Dinotefuran. Examples of products include: Bayer Advanced 12 month Tree & Shrub Insect Control, Bonide Annual Tree & Shrub Insect Control with Systemaxx, Compare N Save Systemic Tree & Shrub Insect Drench, Ferti-Lome Systemic Insect Spray, Gordon's Tree & Shrub Insect Killer, Green. Light Tree & Shrub Systemic Insect Killer, Ortho Bug B Gon Year-Long Shrub Insect Control Concentrate, Ortho Tree & Shrub Insect Killer Ready-Spray II , Optrol Insecticide, Bayer Advanced 12 month Tree & Shrub Protect & Feed Concentrate II, Green Light Tree & Shrub Insect Control with Safari 2G, Ortho Tree & Shrub Insect Control Granules, Bayer Advanced 12 month Tree & Shrub Protect & Feed RTU Granules II, and Ortho Tree & Shrub Insect Control RTU Granules.

(1) The protections, restrictions, and limitations of Chapter 11.08.108 are applicable within the boundaries of the City of Fairfield, Iowa to the extent:
   (a.) The same apply to commercial application. "Commercial" defined as in Iowa code Chapter 206.2 with reference to commercial activity.
   (b) The same are not pre-empted by, or in conflict with, Iowa Code Chapter 206.34 prohibiting or limiting certain local legislation.
   (c) They are not exempted as activity ordinarily permitted only in city land use areas zoned "agricultural", or similar activities ordinarily included in such exemption, such as commercial horticulture, nursery husbandry, silviculture, and specially defined forms of farming or agriculture.
   (d) They apply to and regulate all City of Fairfield property governed and within the scope of municipal Home Rule Ordinancing.

11.08.110. Removal of trees and shrubs. The city council may require the owner of any lands within city to remove and destroy any dead or diseased tree or parts of trees standing on the lands of such owner at the cost and expense of such owner, and the city council may also require such landowner to remove any tree, part of tree, or shrub, whether dead or diseased or not, standing in

a place in violation of the provisions set out in Section 11.08.050, also at the cost to such landowner.

11 08 120. Notice of landowner to remove trees, parts of trees and/or shrubs. A landowner, becomes liable for the cost and expense of removing a tree, part of tree or shrub only after a finding is made by the city council that such tree or part of tree or shrub is subject to removal under the provisions of Section 11.08.050, and orders the removal thereof at the cost and expense of such landowner, and service of a copy of the finding and removal order is made on the landowner. Such order shall set out with clarity the date fixed for the removal of such tree, part of tree or shrub, giving the landowner a reasonable time to remove same but not less than ten days from the time of service of such removal order. Such order shall be served on the landowner in the manner provided for service of original notices under the laws of the State of Iowa, and the city shall bear the cost of service of such removal order.

11.08.130 Appeal. The landowner who, having been served with notice as provided for in Section 11.08.120, believes that mistake has been made by the city council, or that the time fixed for removal is too short, may appear before the city coun-cil at its next meeting any time prior to the date fixed for the removal and show cause why such order should not be corrected, canceled or the time for removal extended. (Ord. 861 § 14, 1995).

11.08.140 Order of removal may be stayed.
Should no meeting of the city council be held between the time of service of the removal notice and the time fixed in said notice for removal of such tree, part of tree or shrub, the landowner may file notice in writing in the office of the city clerk demanding a hearing before the city council at its next meeting and ask that execution of the removal order be stayed until such hearing is held. At that time, such removal order shall be stayed until the next meeting of the city council. Should the landowner, either in person or through his agent or attorney, fail to appear at said next meeting of the city council, after being advised of the time and place of the meeting, the city council may reinstate the original re-moval order and the removal order may be executed by its original date. (Ord. 861 § 15, 1995).

11.08.150 Failure of landowner to remove.
If the landowner fails to remove the tree, part of tree or shrub as ordered, the city council may cause the same to be removed at the cost and expense of the land-owner in accordance with the provisions of Code of Iowa, Section 364.12, 1993; or the city council may proceed against the landowner under the penal provisions of this title, in which event, each day from the date fixed in the removal order for the removal of the tree, part of tree or shrub until the removal is accomplished shall constitute, and is declared to be, a separate and distinct violation of this title. (Ord. 861 § 16, 1995).

11.08.160 Supervision of parks and recreation department required. No person shall trim, fell or uproot any tree growing in any public park unless the work is done under the su-pervision of the director of parks and recreation or the parks superintendent. (Ord. 861 § 17, 1995).

11.08.170 Other remedies.

Nothing contained herein shall preclude the city from exercising the right to any and all remedies, either legal or equitable, provided for in such cases by the laws of the state of Iowa. (Ord. 861 § 18, 1995).

11.08.180 Penalties.

Any person violating any of the provisions of this chapter shall, upon conviction, be subject to a fine of not more than one hundred dollars or to a jail term not exceeding thirty days in the county jail. Each day a violation continues after notice shall be considered a separate offense or violation. (Ord. 861 § 19, 1995).

11.08.190 Severability.

If any section, provision or part of this chapter shall be adjudged to be invalid or unconstitutional, such adjudication shall not affect the validity of the ordinance codified in this chapter as a whole or any section, provision or part thereof not adjudged invalid or unconstitutional. (Ord. 861 § 20, 1995).

Appendix D: Recommended List of Tree Species

RECOMMENDED LIST OF TREE SPECIES FOR RIGHT OF WAY PLANTING
CITY OF FAIRFIELD

SMALL - LESS THAN 30 FEET IN HEIGHT AT MATURITY

- The following species may be planted in right-of-way areas that are 5' – 8' between the sidewalk and the curb and are recommended for areas under power lines.

American Hophornbeam	Eastern Wahoo	Pagoda Dogwood
American Hornbeam	Flowering Crabapple	Serviceberry
American Plum	Fringetree	Smoketree
Eastern Redbud	Japanese Tree Lilac	

LARGE – GREATER THAN 30 FEET IN HEIGHT AT MATURITY

- The following species may be planted in right-of-way areas that are 8' or greater between the sidewalk and the curb and where no power lines are present.

American Linden	Larch	Silver Linden
Bald Cypress	Littleleaf Linden	Swamp White Oak
Blackgum	London Planetree	Sweetgum
Bur Oak	Northern Red Oak	Thornless Honeylocust
Chinkapin Oak	Pin Oak	Tuliptree
Ginkgo (male only)	River Birch	White Oak
Hackberry	Scarlet Oak	White-barked Birch
Heritage Oak	Shingle Oak	Yellowwood
Kentucky Coffeetree	Shumard Oak	

NOT RECOMMENDED TREES

- The following tree species shall NOT be planted in right-of-way areas within the City of Fairfield.

American Elm	Chinese Elm	Red Mulberry
Ash	Cottonwood	Russian Olive
Black Locust	Cutleaf Weeping Birch	Siberian Elm
Black Walnut	Evergreen	Tree of Heaven
Box Elder	*Maple	White Mulberry
Catalpa	Poplar	Willow

* Maple trees are currently too large a percentage of total urban trees and will be allowed again in the future.

** No planting within 6’ of a fire hydrant.
** No trees may be planted in an area less than 5’ between sidewalk and curb.
** Plantings other than trees may not be allowed to grow over 2’ on a regular lot and 18” on a corner lot and must not interfere with pedestrian or vehicular traffic.
** No fruits or vegetables may be grown within the city right-of-way.

The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 9th St., Des Moines, IA 50319.

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-281-5918.