Buffalo, IA
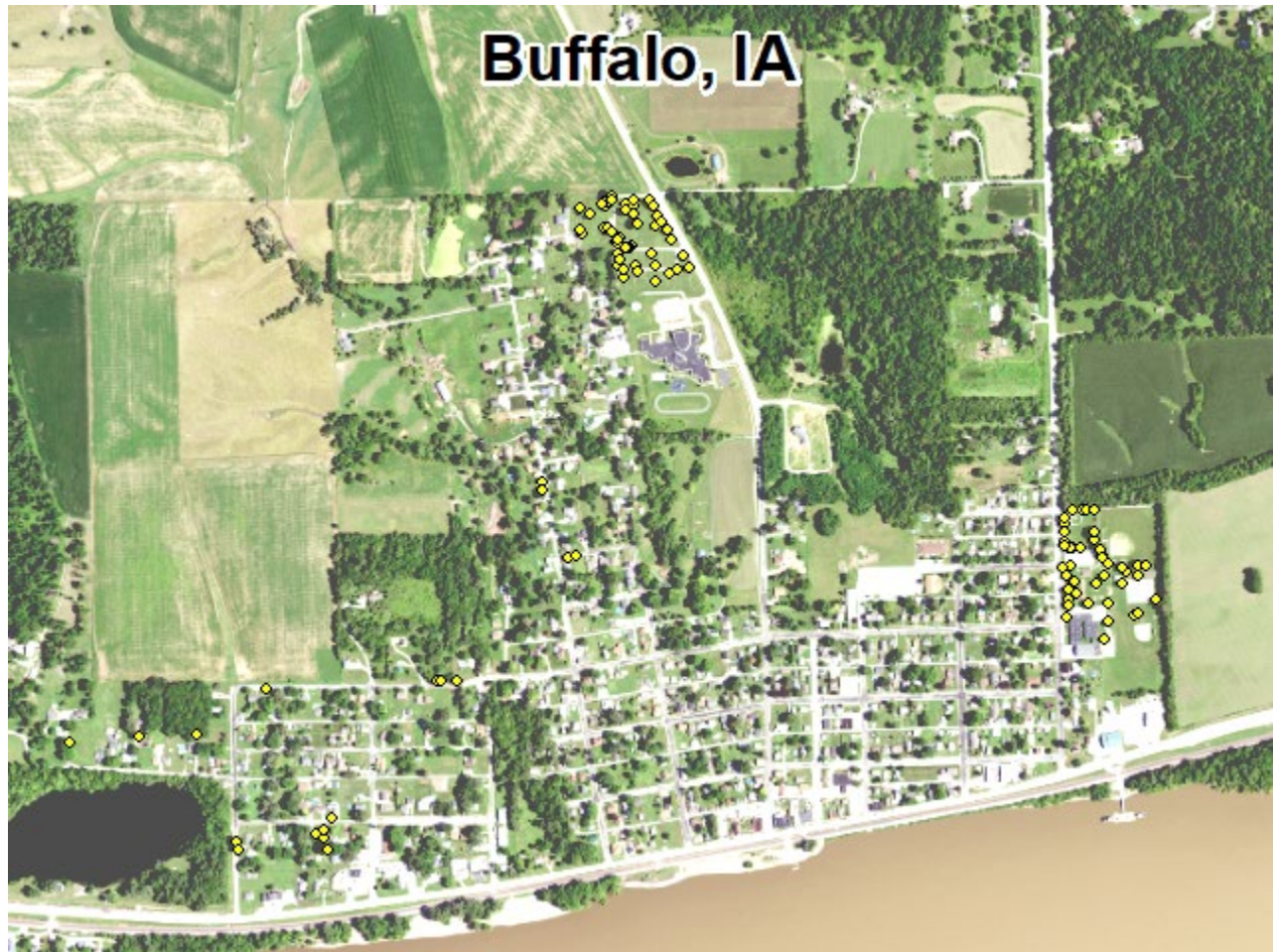

Buffalo, IA

2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Buffalo 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 23% of Buffalo's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2018, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 112 trees inventoried.

- Buffalo's trees provide $20,639 of benefits annually, an average of $184 a tree
- 20 species of trees were found in Buffalo
- The top three genera are: Ash 23%, Maple 21%, and Cedar 18%
- 62% of trees need some type of management other than routine maintenance.
- Due to a bad contract agreement, no data was collected on which trees are recommended for removal or where they are located. Additionally, no data was collected as to the maintenance priority of any given tree.

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.

- EAB was not recorded when the inventory was conducted. There are 26 ash trees within Allison and it is likely that some are currently displaying symptoms of EAB. It is recommended that a visual inspection of all ash trees be conducted annually.
- All trees should be pruned on a routine schedule- one sixth of the city every year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly

Introduction

This plan was developed to assist Buffalo 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 or treatment and replacement planting. With proper planning and management of the current canopy in Buffalo, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2018, 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 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 112 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Buffalo's trees reduce energy related costs by approximately $4,924 annually (Appendix A, Table 1). These savings are both in Electricity (23.8 MWh) and in Natural Gas (3,178.6 Therms).

Annual Stormwater Benefits

Buffalo's trees intercept about 322,725 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $8,746 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 Buffalo, it is estimated that trees remove 2892.9 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 $761 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Buffalo, trees sequester about 58,582 lbs of carbon a year with an associated value of $439 (Appendix A, Table 5). In addition, the trees store 1,129,718 lbs of carbon, with a yearly benefit of $8,473 (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. Buffalo receives $5,511 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STREETS analysis, Buffalo's trees provide $20,639 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 112 trees in Buffalo provide approximately $184 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Buffalo has 21 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Genus	Count	Percent
Ash	26	23
Maple	24	21
Cedar	21	19
Spruce	14	13
Oak	5	4
Pine	5	4
Honeylocust	5	4
Elm	3	3
Apple	2	2
TABA	2	2
White Mulberry	2	2
Sycamore	1	1
Walnut	1	1
PIGL	1	1

Age Class

Most of Buffalo's trees (43%) are between 6 and 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. Buffalo's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Buffalo indicate that 23% of the trees are in good health, with 16% of the foliage in poor health, or was indicated to be dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 23% of Buffalo'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 16% of the population. This 16% is an estimate of trees that need management follow up.

Management Needs

There were no specific management needs recorded for Allison trees. It is recommended that the trees that were listed as in need of immediate maintenance be prioritized.

Canopy Cover

The total canopy with both private and public trees is 38%, or 1557 acres. The canopy cover included in the Buffalo inventory includes 2.78 acres (Appendix A, Figure 4). The City's Canopy goal is to increase

canopy by 3%, in 30 years. To achieve this goal, it is estimated that 303 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Buffalo'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.

<u>Land Use</u>

Park/vacant/other	85%
Single family residential	13%
Small commercial	2%

<u>Location</u>

Other maintained locations	88%
Front yard	4%
Other unmaintained	4%
Planting strip	2%
Backyard	2%

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.

<u>Hazardous trees</u>

Detailed information was not collected on which trees are potentially hazardous or where they might be located.

<u>Poor tree species</u>

The data collectors did not collect appropriate data on this, however it was noted that 26 of the trees present within Buffalo are ash trees. While the collectors did not gather data on EAB, it is common though out the region and very likely affecting many of the ash trees in Buffalo. Visual inspections of ash trees should be conducted annually in order track their conditions. Treatment for EAB is an effective preventative measure that can be taken to prevent the death of healthy ash trees. It is not recommended to be used on ash trees already displaying two or more symptoms of EAB. Since data for EAB was not collected, we will present two separate scenarios regarding ash management versus removal. If all 26 ash trees in Buffalo are healthy and could be treated, it would cost an estimated $8,070 every two years, which is an average of $310.38 per tree. If all 26 ash trees in Buffalo are

suffering from EAB, it would cost an estimated $20,800 to remove, which is an average of $800 per tree. These scenarios represent two different extremes and while it is likely that many ash trees within Buffalo are displaying signs of EAB, it is also likely that many are not and would therefore be eligible for treatment. It is recommended that Buffalo treat many of its larger, healthier ash trees and begin removing dead or dying ash trees, as well as those found to be displaying 2 or more symptoms of EAB.

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 Buffalo.

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 (21%) (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 prohibited as stated by city ordinance 6-2.0103 include: cottonwood, poplar, box elder, Chinese elm, evergreen, and any fruit bearing tree. All trees planted must meet the restrictions in city ordinance 6-2.0103 (Appendix C).

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.

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

A regulated article under the USDA's quarantine includes any of the following items:
- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect 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 6-2.0103 (Appendix C). The new plantings should be a diverse mix and should not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on 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 if preventative treatments are not being used.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Buffalo

Annual Energy Benefits of Public Trees

6/12/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	6.4	482	820.1	804	1,286	(N/A)	22.0	26.1	53.57
Silver maple	6.4	487	839.2	822	1,309	(N/A)	16.5	26.6	72.75
Eastern red cedar	1.3	96	188.2	184	280	(N/A)	11.9	5.7	21.55
Blue spruce	1.0	73	126.0	124	197	(N/A)	8.3	4.0	21.85
Northern white cedar	0.9	66	121.5	119	185	(N/A)	7.3	3.8	23.16
Honeylocust	1.8	139	237.0	232	371	(N/A)	4.6	7.5	74.28
Norway spruce	0.9	70	123.0	121	191	(N/A)	4.6	3.9	38.17
Eastern white pine	0.7	53	93.5	92	145	(N/A)	3.7	2.9	36.25
Bur oak	1.6	120	215.0	211	330	(N/A)	3.7	6.7	82.60
Siberian elm	1.1	81	146.3	143	224	(N/A)	2.8	4.6	74.72
Maple	0.2	17	33.0	32	49	(N/A)	1.8	1.0	24.58
TABA	0.0	0	0.0	0	0	(N/A)	1.8	0.0	0.00
White mulberry	0.2	17	35.4	35	52	(N/A)	1.8	1.0	25.77
Norway maple	0.4	28	56.4	55	83	(N/A)	1.8	1.7	41.58
Apple	0.1	7	16.6	16	24	(N/A)	1.8	0.5	11.80
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.9	0.5	24.14
American sycamore	0.4	33	59.0	58	91	(N/A)	0.9	1.8	91.02
PIGL	0.0	0	0.0	0	0	(N/A)	0.9	0.0	0.00
Northern red oak	0.2	15	23.3	23	38	(N/A)	0.9	0.8	37.72
Black walnut	0.1	7	13.7	13	21	(N/A)	0.9	0.4	20.64
Red maple	0.1	8	16.5	16	25	(N/A)	0.9	0.5	24.58
Total	23.8	1,809	3,178.6	3,115	4,924	(N/A)	100.0	100.0	45.18

Table 2: Annual Stormwater Benefits

Buffalo

Annual Stormwater Benefits of Public Trees

6/12/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	60,962	1,652	(N/A)	22.0	18.9	68.84
Silver maple	99,122	2,686	(N/A)	16.5	30.7	149.23
Eastern red cedar	18,323	497	(N/A)	11.9	5.7	38.20
Blue spruce	12,300	333	(N/A)	8.3	3.8	37.04
Northern white cedar	16,099	436	(N/A)	7.3	5.0	54.54
Honeylocust	23,424	635	(N/A)	4.6	7.3	126.96
Norway spruce	23,023	624	(N/A)	4.6	7.1	124.79
Eastern white pine	16,783	455	(N/A)	3.7	5.2	113.71
Bur oak	24,307	659	(N/A)	3.7	7.5	164.68
Siberian elm	11,285	306	(N/A)	2.8	3.5	101.94
Maple	1,251	34	(N/A)	1.8	0.4	16.95
TABA	0	0	(N/A)	1.8	0.0	0.00
White mulberry	1,243	34	(N/A)	1.8	0.4	16.84
Norway maple	3,065	83	(N/A)	1.8	0.9	41.53
Apple	333	9	(N/A)	1.8	0.1	4.51
Scotch pine	1,539	42	(N/A)	0.9	0.5	41.70
American sycamore	7,239	196	(N/A)	0.9	2.2	196.17
PIGL	0	0	(N/A)	0.9	0.0	0.00
Northern red oak	1,193	32	(N/A)	0.9	0.4	32.34
Black walnut	608	16	(N/A)	0.9	0.2	16.47
Red maple	625	17	(N/A)	0.9	0.2	16.95
Citywide total	322,725	8,746	(N/A)	100.0	100.0	80.24

Table 3: Annual Air Quality Benefits

Buffalo

Annual Air Quality Benefits of Public Trees

6/12/2020

Species	Deposition (lb) O₃	NO₂	PM₁₀	SO₂	Total Depos. ($)	Avoided (lb) NO₂	PM₁₀	VOC	SO₂	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Green ash	7.4	1.2	3.6	0.3	40	29.9	4.4	4.2	28.8	187	0.0	0	79.8	227	(N/A)	22.0	9.46
Silver maple	18.9	3.2	9.1	0.8	102	30.2	4.4	4.2	29.0	189	-10.2	-38	89.8	252	(N/A)	16.5	14.03
Eastern red cedar	3.6	0.7	2.9	0.4	24	6.1	0.9	0.8	5.7	38	-10.1	-38	11.2	24	(N/A)	11.9	1.82
Blue spruce	1.5	0.3	1.3	0.2	10	4.5	0.7	0.6	4.4	28	-4.4	-16	9.1	22	(N/A)	8.3	2.46
Northern white cedar	1.9	0.4	1.5	0.2	12	4.2	0.6	0.6	3.9	26	-8.3	-31	5.0	7	(N/A)	7.3	0.88
Honeylocust	4.7	0.8	2.1	0.2	25	8.6	1.3	1.2	8.3	54	-3.8	-14	23.4	64	(N/A)	4.6	12.87
Norway spruce	2.8	0.6	2.2	0.3	18	4.4	0.6	0.6	4.2	27	-14.3	-54	1.5	-8	(N/A)	4.6	-1.58
Eastern white pine	2.0	0.4	1.6	0.3	13	3.3	0.5	0.5	3.2	21	-10.0	-37	1.8	-3	(N/A)	3.7	-0.82
Bur oak	3.7	0.6	1.7	0.2	20	7.5	1.1	1.0	7.1	47	0.0	0	23.0	66	(N/A)	3.7	16.61
Siberian elm	1.8	0.3	0.9	0.1	10	5.1	0.7	0.7	4.8	32	0.0	0	14.5	42	(N/A)	2.8	13.85
Maple	0.2	0.0	0.1	0.0	1	1.1	0.2	0.1	1.0	7	-0.1	0	2.6	7	(N/A)	1.8	3.64
TABA	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)	1.8	0.00
White mulberry	0.4	0.1	0.2	0.0	2	1.1	0.2	0.1	1.0	7	0.0	0	3.1	9	(N/A)	1.8	4.53
Norway maple	0.5	0.1	0.3	0.0	3	1.8	0.3	0.2	1.7	11	-0.1	-1	4.8	14	(N/A)	1.8	6.81
Apple	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	1.8	1.63
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	0.9	2.82
American sycamore	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19	(N/A)	0.9	19.04
PIGL	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)	0.9	0.00
Northern red oak	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.9	6	-0.3	-1	2.1	6	(N/A)	0.9	5.79
Black walnut	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.9	2.99
Red maple	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	0.9	3.64
Citywide total	51.4	8.9	28.5	3.2	289	112.9	16.5	15.7	108.0	705	-62.1	-233	282.9	761	(N/A)	100.0	6.98

Table 4: Annual Carbon Stored

Buffalo

Stored CO2 Benefits of Public Trees

6/12/2020

Species	Total Stored CO_2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	248,464	1,863	(N/A)	22.0	22.0	77.64
Silver maple	479,425	3,596	(N/A)	16.5	42.4	199.76
Eastern red cedar	11,852	89	(N/A)	11.9	1.0	6.84
Blue spruce	9,105	68	(N/A)	8.3	0.8	7.59
Northern white cedar	20,520	154	(N/A)	7.3	1.8	19.24
Honeylocust	61,224	459	(N/A)	4.6	5.4	91.84
Norway spruce	37,451	281	(N/A)	4.6	3.3	56.18
Eastern white pine	25,814	194	(N/A)	3.7	2.3	48.40
Bur oak	126,233	947	(N/A)	3.7	11.2	236.69
Siberian elm	44,218	332	(N/A)	2.8	3.9	110.54
Maple	2,201	17	(N/A)	1.8	0.2	8.26
TABA	0	0	(N/A)	1.8	0.0	0.00
White mulberry	6,921	52	(N/A)	1.8	0.6	25.95
Norway maple	9,046	68	(N/A)	1.8	0.8	33.92
Apple	1,086	8	(N/A)	1.8	0.1	4.07
Scotch pine	1,170	9	(N/A)	0.9	0.1	8.78
American sycamore	39,259	294	(N/A)	0.9	3.5	294.44
PIGL	0	0	(N/A)	0.9	0.0	0.00
Northern red oak	3,595	27	(N/A)	0.9	0.3	26.96
Black walnut	1,035	8	(N/A)	0.9	0.1	7.76
Red maple	1,101	8	(N/A)	0.9	0.1	8.26
Citywide total	1,129,718	8,473	(N/A)	100.0	100.0	77.73

Table 5: Annual Carbon Sequestered

Annual CO₂ Benefits of Public Trees

6/12/2020

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
Green ash	13,322	100	-1,193	-62	-9	10,652	80	22,718	170 (N/A)	22.0	24.5	7.10
Silver maple	31,188	234	-2,301	-76	-18	10,764	81	39,574	297 (N/A)	16.5	42.6	16.49
Eastern red cedar	291	2	-57	-23	-1	2,114	16	2,325	17 (N/A)	11.9	2.5	1.34
Blue spruce	716	5	-44	-16	0	1,615	12	2,272	17 (N/A)	8.3	2.4	1.89
Northern white cedar	513	4	-98	-19	-1	1,462	11	1,859	14 (N/A)	7.3	2.0	1.74
Honeylocust	2,972	22	-294	-14	-2	3,074	23	5,738	43 (N/A)	4.6	6.2	8.61
Norway spruce	1,024	8	-180	-19	-1	1,555	12	2,380	18 (N/A)	4.6	2.6	3.57
Eastern white pine	187	1	-124	-17	-1	1,179	9	1,226	9 (N/A)	3.7	1.3	2.30
Bur oak	3,396	25	-606	-18	-5	2,644	20	5,417	41 (N/A)	3.7	5.8	10.16
Siberian elm	2,076	16	-212	-11	-2	1,784	13	3,636	27 (N/A)	2.8	3.9	9.09
Maple	331	2	-11	-2	0	371	3	689	5 (N/A)	1.8	0.7	2.58
TABA	0	0	0	0	0	0	0	0	0 (N/A)	1.8	0.0	0.00
White mulberry	38	0	-33	-4	0	372	3	373	3 (N/A)	1.8	0.4	1.40
Norway maple	694	5	-43	-4	0	616	5	1,262	9 (N/A)	1.8	1.4	4.73
Apple	152	1	-5	-2	0	161	1	306	2 (N/A)	1.8	0.3	1.15
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	0.9	0.3	2.43
American sycamore	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.9	1.6	10.90
PIGL	0	0	0	0	0	0	0	0	0 (N/A)	0.9	0.0	0.00
Northern red oak	281	2	-17	-2	0	329	2	591	4 (N/A)	0.9	0.6	4.43
Black walnut	209	2	-5	-1	0	159	1	361	3 (N/A)	0.9	0.4	2.71
Red maple	165	1	-5	-1	0	186	1	344	3 (N/A)	0.9	0.4	2.58
Citywide total	58,582	439	-5,423	-298	-43	39,987	300	92,849	696 (N/A)	100.0	100.0	6.39

Table 6: Annual Social and Aesthetic Benefits

Buffalo

Annual Aesthetic/Other Benefits of Public Trees

6/12/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,188	(N/A)	22.0	21.6	49.52
Silver maple	2,235	(N/A)	16.5	40.6	124.17
Eastern red cedar	119	(N/A)	11.9	2.2	9.14
Blue spruce	209	(N/A)	8.3	3.8	23.26
Northern white cedar	141	(N/A)	7.3	2.6	17.64
Honeylocust	778	(N/A)	4.6	14.1	155.56
Norway spruce	105	(N/A)	4.6	1.9	21.00
Eastern white pine	47	(N/A)	3.7	0.9	11.77
Bur oak	233	(N/A)	3.7	4.2	58.18
Siberian elm	143	(N/A)	2.8	2.6	47.56
Maple	60	(N/A)	1.8	1.1	29.84
TABA	0	(N/A)	1.8	0.0	0.00
White mulberry	2	(N/A)	1.8	0.0	1.03
Norway maple	69	(N/A)	1.8	1.3	34.64
Apple	8	(N/A)	1.8	0.2	4.23
Scotch pine	32	(N/A)	0.9	0.6	32.32
American sycamore	58	(N/A)	0.9	1.1	58.34
PIGL	0	(N/A)	0.9	0.0	0.00
Northern red oak	24	(N/A)	0.9	0.4	24.08
Black walnut	29	(N/A)	0.9	0.5	28.56
Red maple	30	(N/A)	0.9	0.5	29.84
Citywide total	5,511	(N/A)	100.0	100.0	50.56

Table 7: Summary of Benefits in Dollars

Buffalo

Total Annual Benefits of Public Trees by Species ($)

6/12/2020

| Species	Energy	CO$_2$	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	1,286	170	227	1,652	1,188	4,524	(N/A)	21.9
Silver maple	1,309	297	252	2,686	2,235	6,780	(N/A)	32.9
Eastern red cedar	280	17	24	497	119	937	(N/A)	4.5
Blue spruce	197	17	22	333	209	778	(N/A)	3.8
Northern white cedar	185	14	7	436	141	784	(N/A)	3.8
Honeylocust	371	43	64	635	778	1,891	(N/A)	9.2
Norway spruce	191	18	-8	624	105	930	(N/A)	4.5
Eastern white pine	145	9	-3	455	47	653	(N/A)	3.2
Bur oak	330	41	66	659	233	1,329	(N/A)	6.4
Siberian elm	224	27	42	306	143	742	(N/A)	3.6
Maple	49	5	7	34	60	155	(N/A)	0.8
TABA	0	0	0	0	0	0	(N/A)	0.0
White mulberry	52	3	9	34	2	99	(N/A)	0.5
Norway maple	83	9	14	83	69	259	(N/A)	1.3
Apple	24	2	3	9	8	47	(N/A)	0.2
Scotch pine	24	2	3	42	32	103	(N/A)	0.5
American sycamore	91	11	19	196	58	375	(N/A)	1.8
PIGL	0	0	0	0	0	0	(N/A)	0.0
Northern red oak	38	4	6	32	24	104	(N/A)	0.5
Black walnut	21	3	3	16	29	71	(N/A)	0.3
Red maple	25	3	4	17	30	78	(N/A)	0.4
Citywide Total	4,924	696	761	8,746	5,511	20,639	(N/A)	100.0
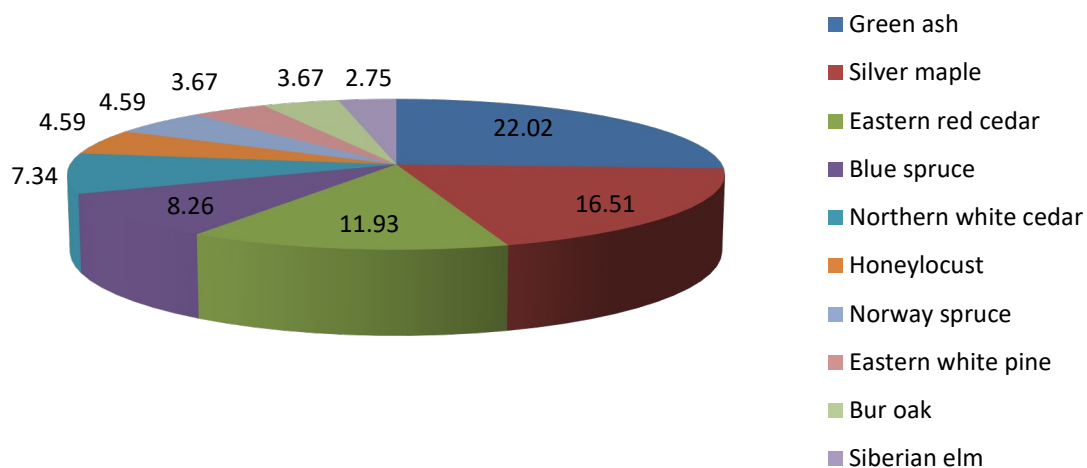
Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)
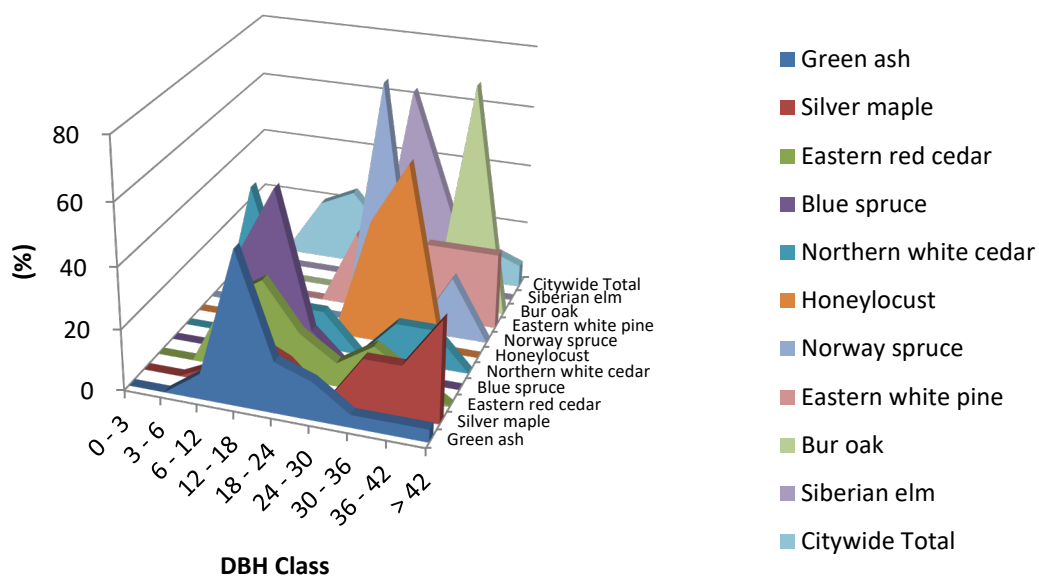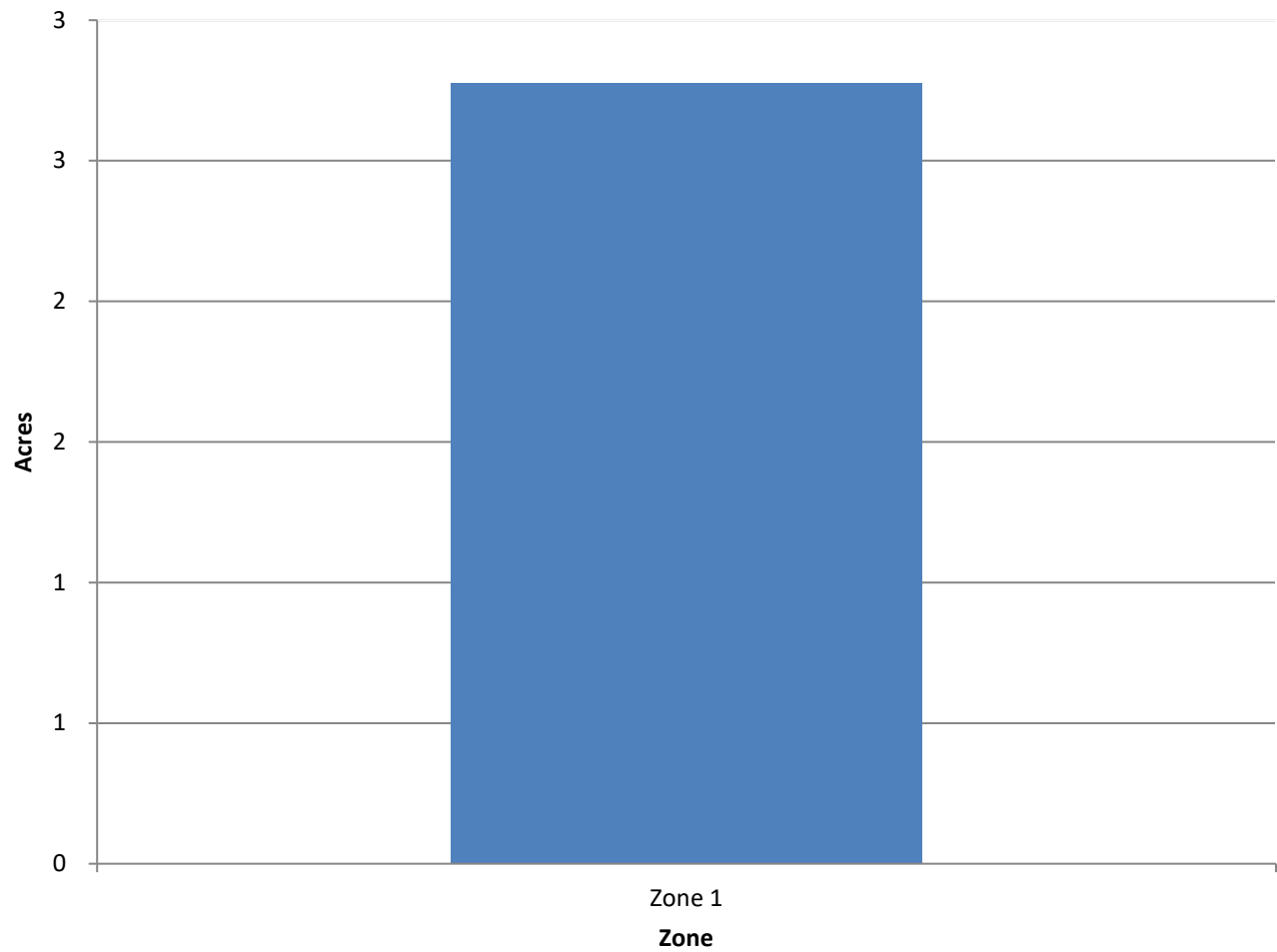
Figure 2: Relative Age Class
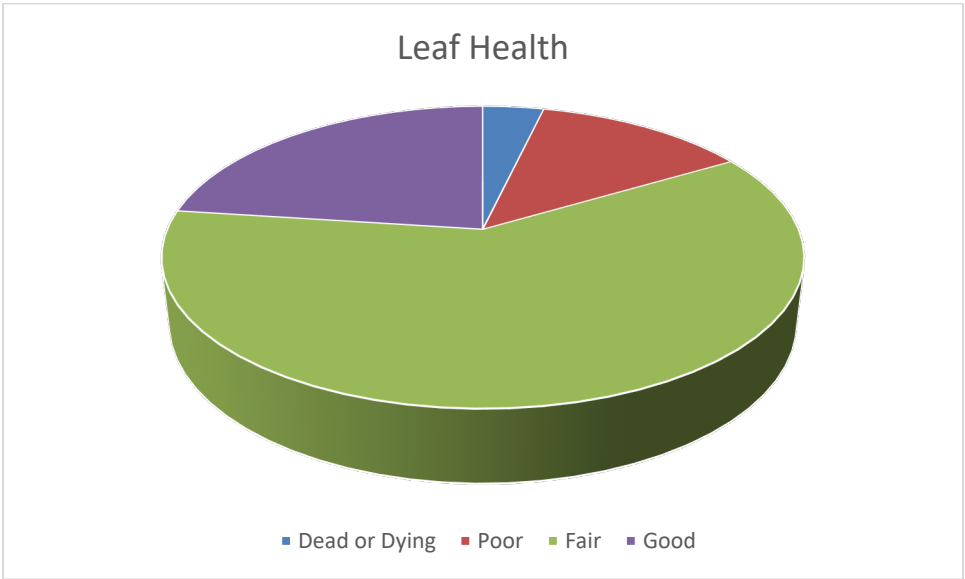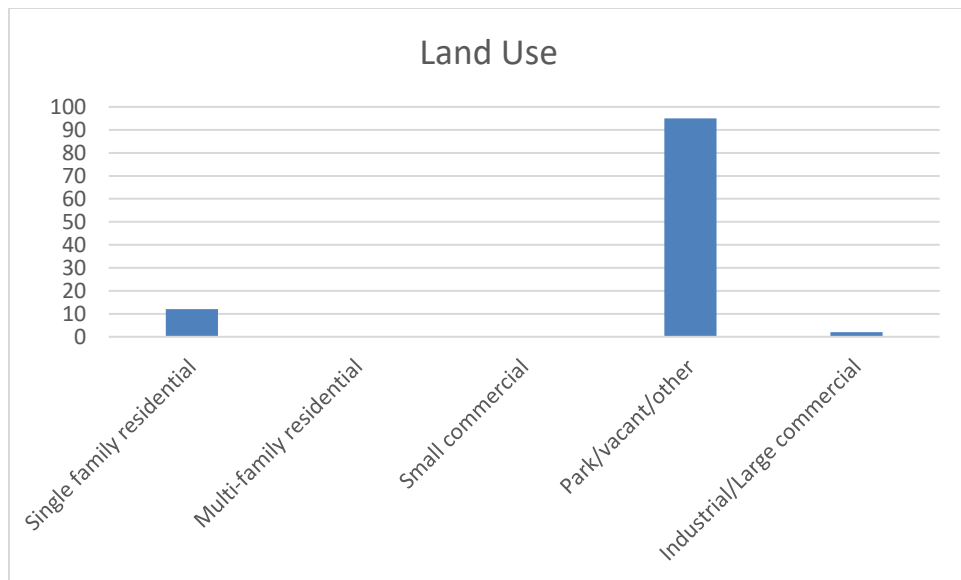

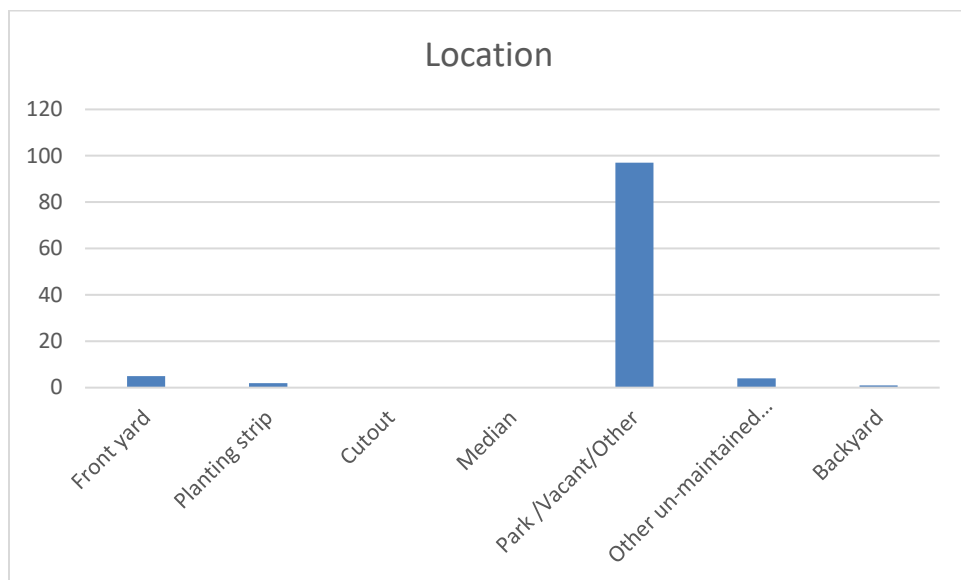**Figure 3: Foliage Condition**
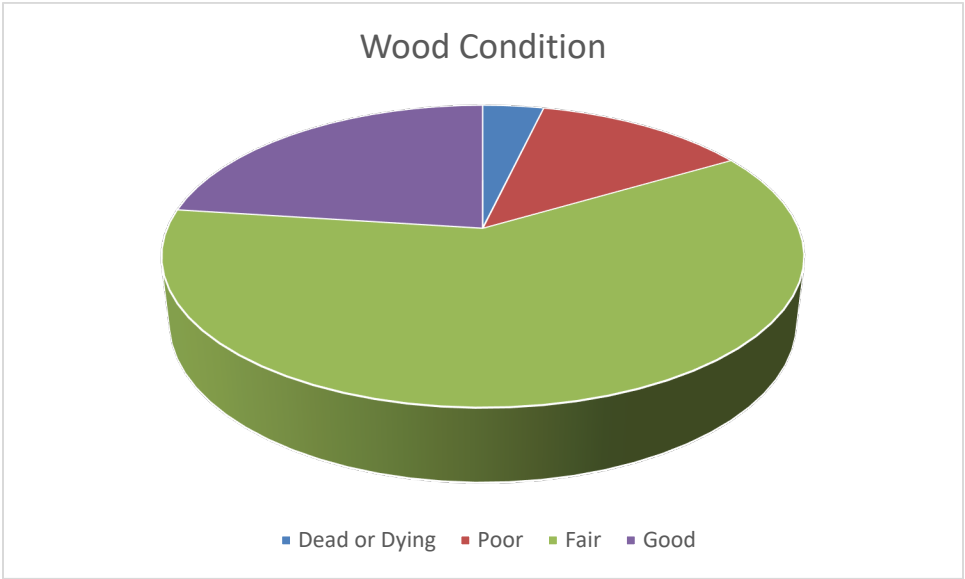
Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)
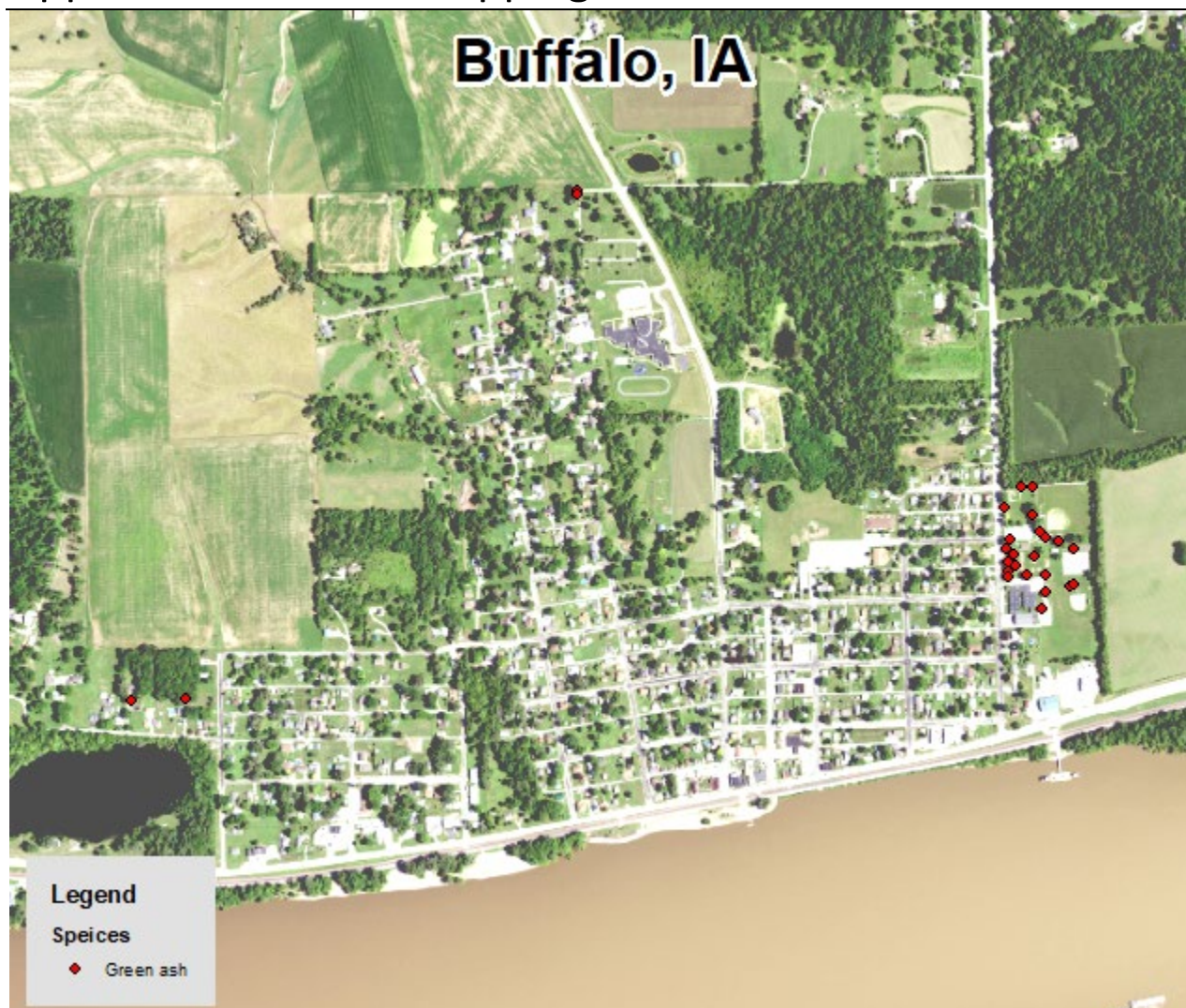

Figure 5: Canopy Cover in Acres
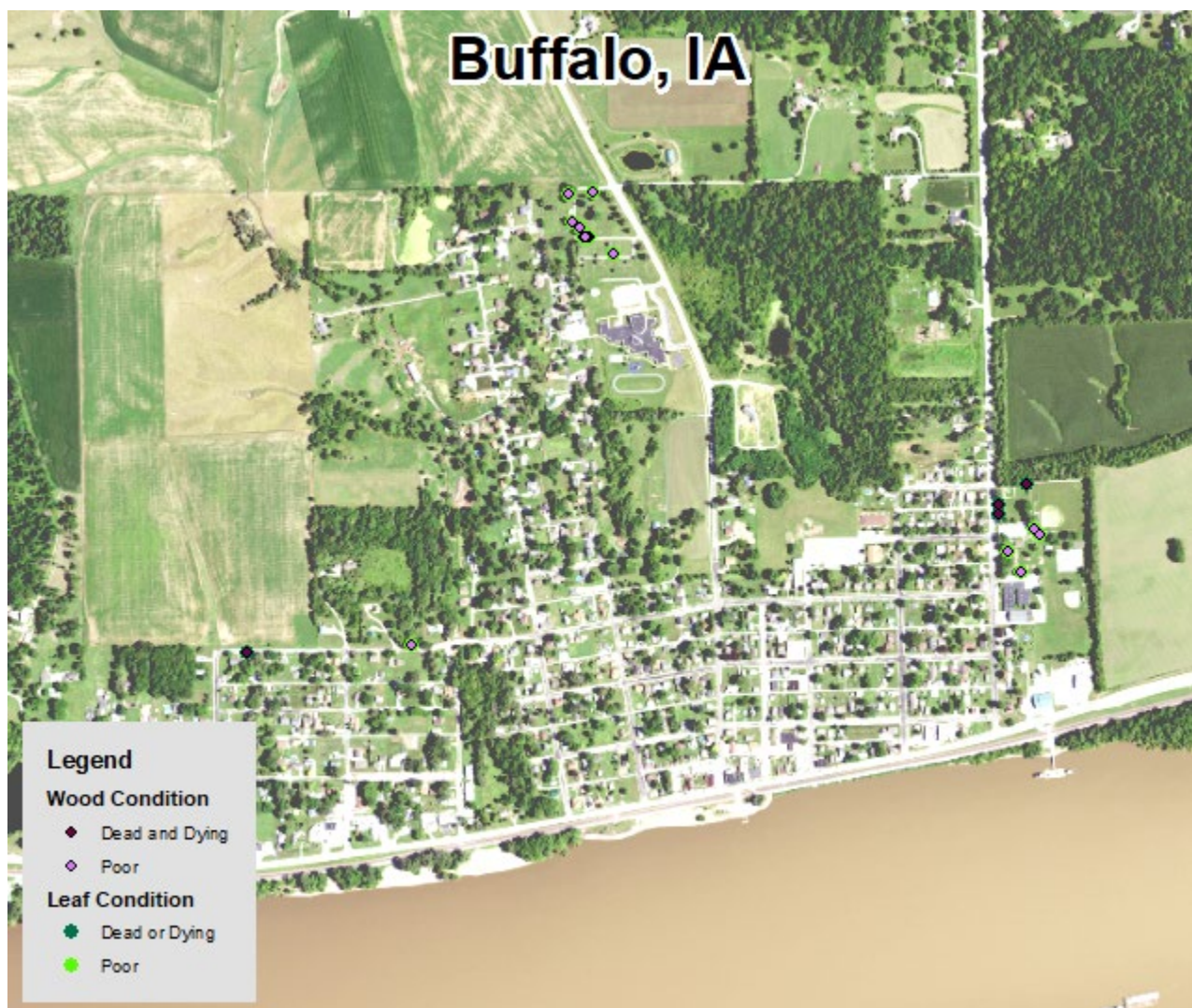
Figure 6: Land Use of city/park trees

Figure 7: Location of city/park trees

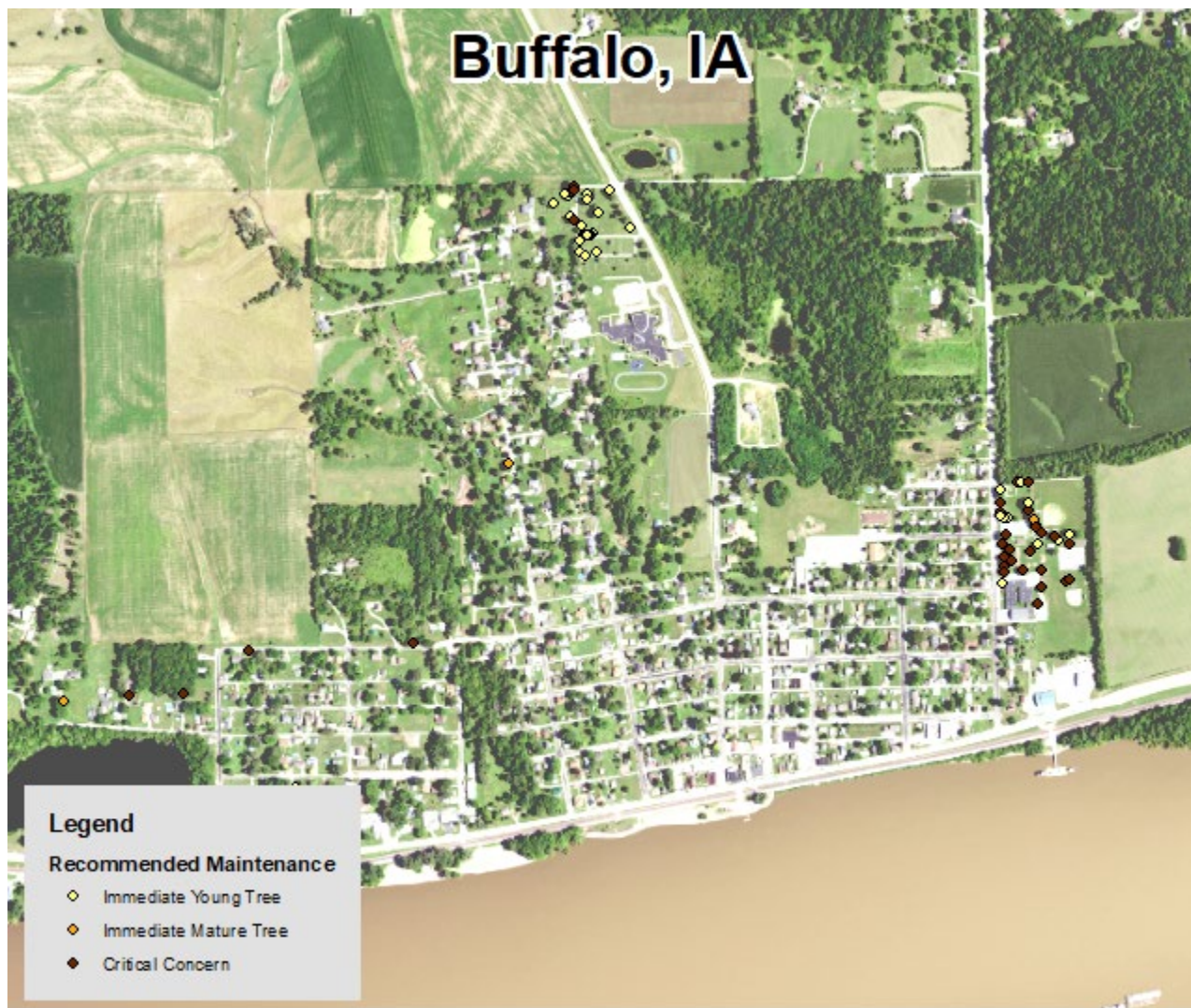# Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

Appendix C: Buffalo Tree Ordinances

CHAPTER 2 - TREES

ARTICLE 1 GENERAL PROVISIONS

6-2.0101   PURPOSE.
The purpose of this chapter is to beautify and pre- serve the appearance of the city by regulating and providing for the planting, care and removal of trees.

6-2.0102   DEFINITIONS.
For use in this chapter, the following terms are de- fined:

1.   "Parking": shall mean that part of the street, avenue or highway in the city not covered by sidewalk and lying between the lot line and the curb line; or, unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

2.   "Superintendent": shall mean the superintendent of streets.

6-2.0103   PLANTING RESTRICTIONS.
No tree shall be planted in any street or parking except in accordance with the following:

1.   Alignment. All trees hereafter planted in any street all be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line 10 feet from the property line.

2.   Spacing. Trees shall not be planted on this parking if it is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet to street intersections (property line extended) and ten (10) feet to driveways. If it is at all possible, trees should be planted inside the property lines and not between the sidewalk and the curb.

3.   Prohibited trees. No person shall hereinafter plant in any street, any fruit bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, or evergreens.

6-2.0104   DUTY TO TRIM TREES.
The owner or agent of the abutting property shall keep the trees on, or overhanging the street trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks.

(Code of Iowa, 1975, Sec. 364.12 [2c])

6-2.0105   ASSESSMENT.
If the abutting property owner fails to trim the trees as required in this chapter, the city may serve no-tice on the abutting property owner requiring him to do so within five (5) days. If he fails to trim the trees within that time, the city may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, 1975, Sec. 364.12 [2d and e])

6-2.0106   TRIMMING TREES TO BE SUPERVISED.
It shall be unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the city.

6-2.0107   REMOVAL OF TREES.
The superintendent shall remove, on the order of the council, any tree on the streets of the city which interferes with the making of improvements or with travel thereon. He shall additionally remove any trees on the street, not on private property, which have become dis- eased, or which constitute a danger to the public, or which may otherwise be declared a nuisance.
(Code of Iowa, 1975, Sec. 364.12 [2c] and 372.13 [4])

ARTICLE 2
DUTCH ELM DISEASE CONTROL

6-2.0201   TREES SUBJECT TO REMOVAL.
The council having determined that the health of the elm trees within the city is threatened by a fatal disease known as the Dutch elm disease hereby declares the follow- ing shall be removed:
(Code of Iowa, 1975, Sec. 364.12 [3b])

1.   Living or standing trees. Any living or standing elm tree or part thereof infected with the Dutch elm dis- ease fungus or which harbors any of the elm bark beetles, that is scolytus multistriatus (eichb.) or hylurgopinus rufipes (marsh.)

2.   Dead trees. Any dead elm tree or part thereof including logs, branches, stumps, firewood or other elm material from which the bark has not been removed and burned or sprayed with an effective elm bark beetle destroying insecticide.

6-2.0202   DUTY TO REMOVE.
No person, firm or corporation shall permit any tree or material as defined in Section 1 of this article to remain on the premises owned, controlled or occupied by him within the city.
(Code of Iowa, 1975, Sec. 364.12 [3b])

6-2.0203   INSPECTION.
The superintendent shall inspect or cause to be in- spected all premises and places within the city to deter- mine whether any condition as defined in Section 1 of this article exists thereon, and shall also

inspect or cause to be inspected any elm trees reported or suspected to be in- fected with the Dutch elm disease or any elm bark bearing material reported or suspected to be infected with the elm bark beetles.

6-2.0204   REMOVAL FROM CITY PROPERTY.
If the superintendent upon inspection or examination, in person or by some qualified person acting for him, shall determine that any condition as herein defined ex- ists in or upon any public street, alley, park or any pub- lic place, including the strip between the curb and the lot line of private property, within the city and that the danger of other elm trees within the city is imminent, he shall immediately cause it to be removed and burned or otherwise correct the same in such manner as to destroy or prevent as fully as possible the spread of Dutch elm dis- ease or the insect pests or vectors known to carry such disease fungus.

6-2.0205   REMOVAL FROM PRIVATE PROPERTY.
If the superintendent upon inspection or examination, of any person or by some qualified person acting for him, shall determine with reasonable certainty that any condition as herein defined exists in or upon private premises and that the danger to other elm trees within the city is imminent, he shall immediately notify by certified mail

the owner, occupant or person in charge of such property, to correct such condition within 14 days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt thereof, the council may cause the nuisance to be removed and the cost assessed against the property as provided in Article 2, Chapter 2 of Title III.
(Code of Iowa, 1975, Sec. 364.12 [b and h])

If the superintendent is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected with Dutch elm disease, he is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens.

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

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

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-725-8200.