New Providence, IA

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2020 Urban Forest Management Plan
Prepared by Iowa Department
of Natural Resources

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Executive Summary

Overview – Note: inventory was conducted prior to August 2020 Derecho
This plan was developed to assist the City of New Providence 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). 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 2019, 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 32 trees inventoried.

- New Providence's trees provide $3,856 of benefits annually, an average of $121 a tree
- There are at least 10 species of trees
- The top three genera are: Maple 31%, Oak 31%, Crabapple 19%
- 63% of trees are in need of some type of management
- 1 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.

- Plant a diverse mix of trees that do not include: ash, cottonwood, poplar, box elder, Chinese elm, or willow
- All trees should be pruned on a routine schedule- one third of the city every other year

Introduction

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

Trees are an important component of New Providence' infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of New Providence and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet New Providence's urban forestry goals.

Inventory

In 2019, 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 32 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. Fin

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. New Providence's trees reduce energy related costs by approximately $1,124 annually (Appendix A, Table 1). These savings are both in Electricity (5.4 MWh) and in Natural Gas (731 Therms).

Annual Stormwater Benefits

New Providence's trees intercept about 49,653 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $1,346 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 New Providence, it is estimated that trees remove 66 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 $184 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In New Providence, trees sequester about 18,470 lbs of carbon a year with an associated value of $139 (Appendix A, Table 5). In addition, the trees store 163,727 lbs of carbon, with a yearly benefit of $1,228 (Appendix A, Table 4).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. New Providence receives $1,064 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, New Providence's trees provide $3,856 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 32 trees in New Providence provide approximately $121 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

New Providence has over 10 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of top trees by genera is as follows:

Maple	10	31%
Oak	10	31%
Apple (crab)	6	19%
Ash	3	1%

Age Class

Most of New Providence's trees (60%) 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. New Providence'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 New Providence indicate that 97% 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, 91% of New Providence's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3).

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Needs:	No. trees
Crown Cleaning	11
Crown Raising	1
Tree Staking	4
Tree Removal	1
Crown Reduction	3

Canopy Cover

The total canopy with both private and public trees is 6%, or 37 acres. The canopy cover included in the New Providence inventory includes approximately 0.1 acres (Appendix A, Figure 4). A good goal to increase this percentage would be to plant 30 trees over the next six years.

Recommendations

Risk Management

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

Hazardous trees

New Providence has 3 trees that need immediate attention for mitigating large limbs. 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.

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 New Providence.

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. All trees planted must meet the restrictions in city ordinance 151.02 (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.

Six Year Maintenance Plan
Year 1
    Hazard branch mitigation: Attend to the 3 trees needing "immediate" crown cleaning
    Young tree maintenance: Attend to the 4 young trees needing immediate staking/training
    Planting and Replacement: 5 trees to be planted in open locations

Year 2
    Routine maintenance: Attend to the 13 trees needing "routine" maintenance activities
    Planting and Replacement: 5 trees in open locations from year one removals
    Routine trimming: Contract to trim 1/3 of the city trees

Year 3

Planting and Replacement: 5 trees in open locations from year one removals
Routine trimming: Contract to trim 1/3 of the city trees

Year 4
    Planting and Replacement: 5 trees in open locations from year one removals
    Routine trimming: Contract to trim 1/3 of the city trees

Year 5
    Planting and Replacement: 5 trees in open locations from year one removals
    Routine trimming: Contract to trim 1/3 of the city trees

Year 6
    Planting and Replacement: 5 trees in open locations from year one removals
    Routine trimming: Contract to trim 1/3 of the city trees

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 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on 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. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

New Providence

Annual Energy Benefits of Public Trees

4/7/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	1.1	86	150.1	147	233	(N/A)	28.1	20.7	25.88
Apple	0.2	12	28.2	28	40	(N/A)	18.8	3.5	6.64
Norway maple	1.2	89	174.0	170	259	(N/A)	12.5	23.0	64.76
Sugar maple	0.9	66	113.6	111	177	(N/A)	9.4	15.7	58.99
Silver maple	0.6	45	68.9	67	112	(N/A)	9.4	10.0	37.33
Green ash	0.9	69	113.0	111	179	(N/A)	9.4	16.0	59.83
American basswood	0.2	18	36.4	36	54	(N/A)	3.1	4.8	53.99
Mulberry	0.1	6	12.8	13	18	(N/A)	3.1	1.6	18.19
Northern red oak	0.1	7	14.2	14	21	(N/A)	3.1	1.9	21.11
Norway spruce	0.1	11	19.7	19	30	(N/A)	3.1	2.7	30.47
Total	5.4	408	730.7	716	1,124	(N/A)	100.0	100.0	35.13

Table 2: Annual Stormwater Benefits

New Providence

Annual Stormwater Benefits of Public Trees

4/7/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	7,186	195	(N/A)	28.1	14.5	21.64
Apple	559	15	(N/A)	18.8	1.1	2.52
Norway maple	12,487	338	(N/A)	12.5	25.1	84.60
Sugar maple	9,164	248	(N/A)	9.4	18.5	82.78
Silver maple	4,192	114	(N/A)	9.4	8.4	37.87
Green ash	10,170	276	(N/A)	9.4	20.5	91.87
American basswood	2,133	58	(N/A)	3.1	4.3	57.80
Mulberry	264	7	(N/A)	3.1	0.5	7.17
Northern red oak	529	14	(N/A)	3.1	1.1	14.33
Norway spruce	2,969	80	(N/A)	3.1	6.0	80.46
Citywide total	49,653	1,346	(N/A)	100.0	100.0	42.05

Table 3: Annual Air Quality Benefits

New Providence

Annual Air Quality Benefits of Public Trees

4/7/2020

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							
Bur oak	0.4	0.1	0.3	0.0	2	5.4	0.8	0.7	5.1	33	0.0	0	12.8	36 (N/A)	28.1	3.98
Apple	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.7	5	0.0	0	1.9	6 (N/A)	18.8	0.92
Norway maple	2.7	0.5	1.3	0.1	15	5.7	0.8	0.8	5.3	35	-0.6	-2	16.6	47 (N/A)	12.5	11.87
Sugar maple	1.2	0.2	0.6	0.1	7	4.1	0.6	0.6	3.9	26	-0.9	-4	10.3	28 (N/A)	9.4	9.50
Silver maple	0.3	0.1	0.2	0.0	2	2.7	0.4	0.4	2.7	17	-0.3	-1	6.4	18 (N/A)	9.4	5.93
Green ash	1.4	0.2	0.6	0.1	7	4.2	0.6	0.6	4.1	27	0.0	0	11.9	34 (N/A)	9.4	11.29
American basswood	0.2	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	7	-0.2	-1	2.8	8 (N/A)	3.1	7.78
Mulberry	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	3.1	2.55
Northern red oak	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	-0.1	0	1.1	3 (N/A)	3.1	2.89
Norway spruce	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1 (N/A)	3.1	1.45
Citywide total	6.8	1.1	3.6	0.3	37	25.6	3.7	3.6	24.4	160	-3.6	-13	65.5	184 (N/A)	100.0	5.74

Table 4: Annual Carbon Stored

New Providence

Stored CO2 Benefits of Public Trees

4/7/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	14,585	109	(N/A)	28.1	8.9	12.15
Apple	1,871	14	(N/A)	18.8	1.1	2.34
Norway maple	44,451	333	(N/A)	12.5	27.1	83.35
Sugar maple	34,375	258	(N/A)	9.4	21.0	85.94
Silver maple	8,349	63	(N/A)	9.4	5.1	20.87
Green ash	46,602	350	(N/A)	9.4	28.5	116.51
American basswood	8,218	62	(N/A)	3.1	5.0	61.63
Mulberry	908	7	(N/A)	3.1	0.6	6.81
Northern red oak	1,025	8	(N/A)	3.1	0.6	7.68
Norway spruce	3,343	25	(N/A)	3.1	2.0	25.07
Citywide total	163,727	1,228	(N/A)	100.0	100.0	38.37

Table 5: Annual Carbon Sequestered

New Providence

Annual CO₂ Benefits of Public Trees

4/7/2020

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
Bur oak	2,352	18	-70	-12	-1	1,897	14	4,167	31 (N/A)	28.1	22.6	3.47
Apple	262	2	-9	-3	0	271	2	521	4 (N/A)	18.8	2.8	0.65
Norway maple	1,680	13	-213	-12	-2	1,957	15	3,411	26 (N/A)	12.5	18.5	6.40
Sugar maple	1,835	14	-165	-9	-1	1,450	11	3,112	23 (N/A)	9.4	16.8	7.78
Silver maple	1,322	10	-40	-5	0	984	7	2,260	17 (N/A)	9.4	12.2	5.65
Green ash	1,803	14	-224	-9	-2	1,520	11	3,090	23 (N/A)	9.4	16.7	7.73
American basswood	597	4	-39	-3	0	405	3	960	7 (N/A)	3.1	5.2	7.20
Mulberry	114	1	-4	-1	0	124	1	232	2 (N/A)	3.1	1.3	1.74
Northern red oak	147	1	-5	-1	0	160	1	301	2 (N/A)	3.1	1.6	2.26
Norway spruce	187	1	-16	-3	0	246	2	415	3 (N/A)	3.1	2.2	3.11
Citywide total	10,300	77	-786	-59	-6	9,014	68	18,470	139 (N/A)	100.0	100.0	4.33

Table 6: Annual Social and Aesthetic Benefits

New Providence

Annual Aesthetic/Other Benefits of Public Trees

4/7/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	292	(N/A)	28.1	27.4	32.40
Apple	13	(N/A)	18.8	1.2	2.16
Norway maple	149	(N/A)	12.5	14.0	37.26
Sugar maple	195	(N/A)	9.4	18.3	65.06
Silver maple	148	(N/A)	9.4	13.9	49.42
Green ash	150	(N/A)	9.4	14.1	50.02
American basswood	48	(N/A)	3.1	4.5	47.53
Mulberry	6	(N/A)	3.1	0.6	6.40
Northern red oak	16	(N/A)	3.1	1.5	16.24
Norway spruce	47	(N/A)	3.1	4.4	47.08
Citywide total	1,064	(N/A)	100.0	100.0	33.26

Table 7: Summary of Benefits in Dollars

New Providence

Total Annual Benefits of Public Trees by Species ($)

4/7/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($) Standard Error	% of Total $
Bur oak	233	31	36	195	292	786 (N/A)	20.4
Apple	40	4	6	15	13	77 (N/A)	2.0
Norway maple	259	26	47	338	149	820 (N/A)	21.3
Sugar maple	177	23	28	248	195	672 (N/A)	17.4
Silver maple	112	17	18	114	148	409 (N/A)	10.6
Green ash	179	23	34	276	150	662 (N/A)	17.2
American basswood	54	7	8	58	48	174 (N/A)	4.5
Mulberry	18	2	3	7	6	36 (N/A)	0.9
Northern red oak	21	2	3	14	16	57 (N/A)	1.5
Norway spruce	30	3	1	80	47	163 (N/A)	4.2
Citywide Total	1,124	139	184	1,346	1,064	3,856 (N/A)	100.0
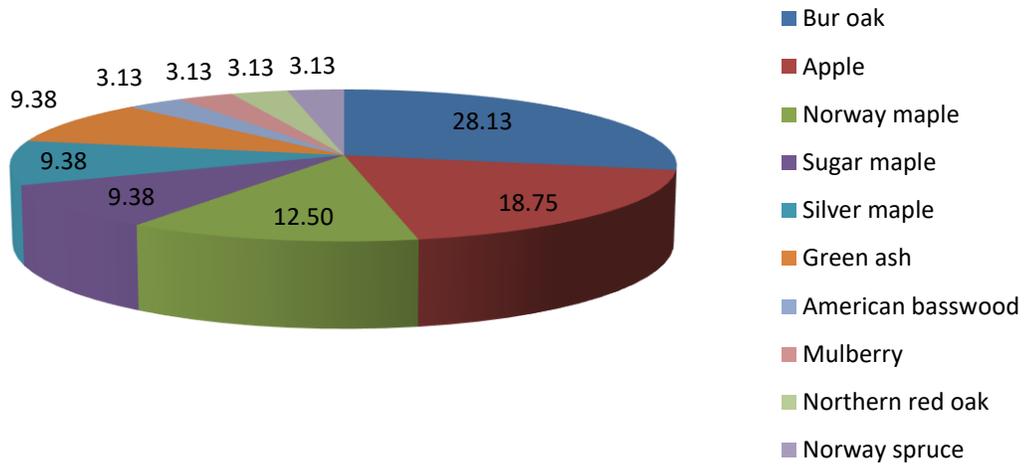
Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)
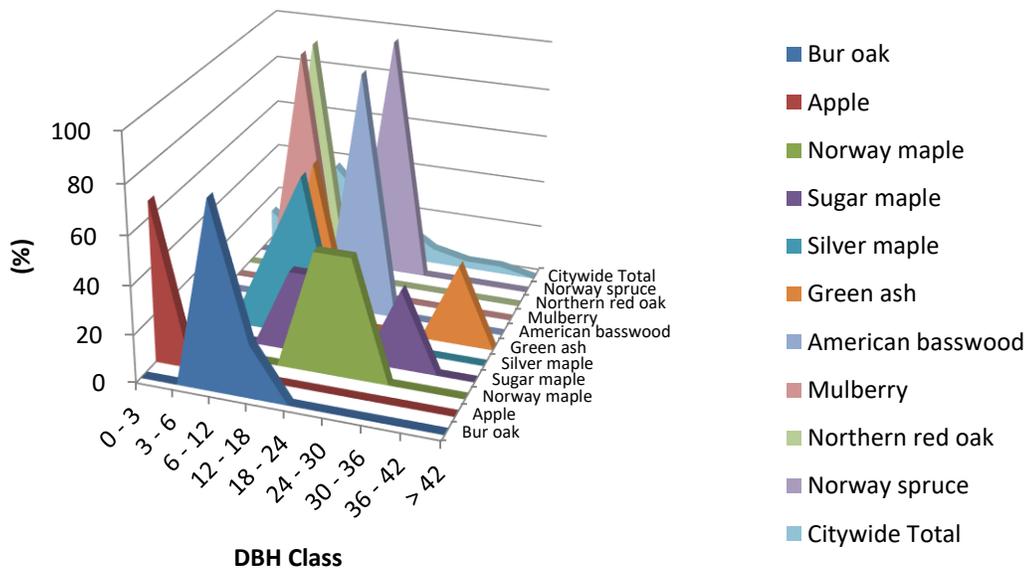
Figure 2: Relative Age Class
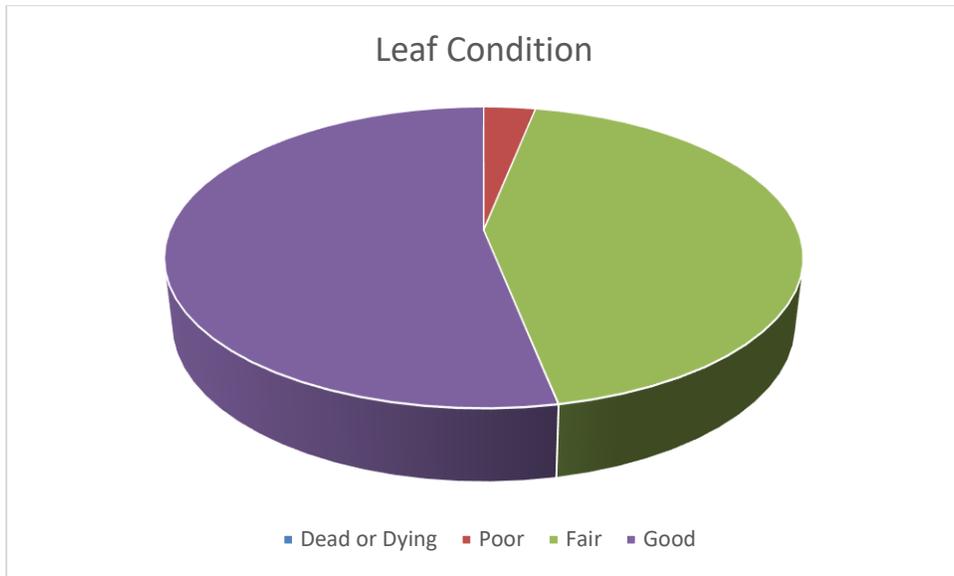
Figure 3: Foliage Condition

Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

Figure 5: Canopy Cover in Acres
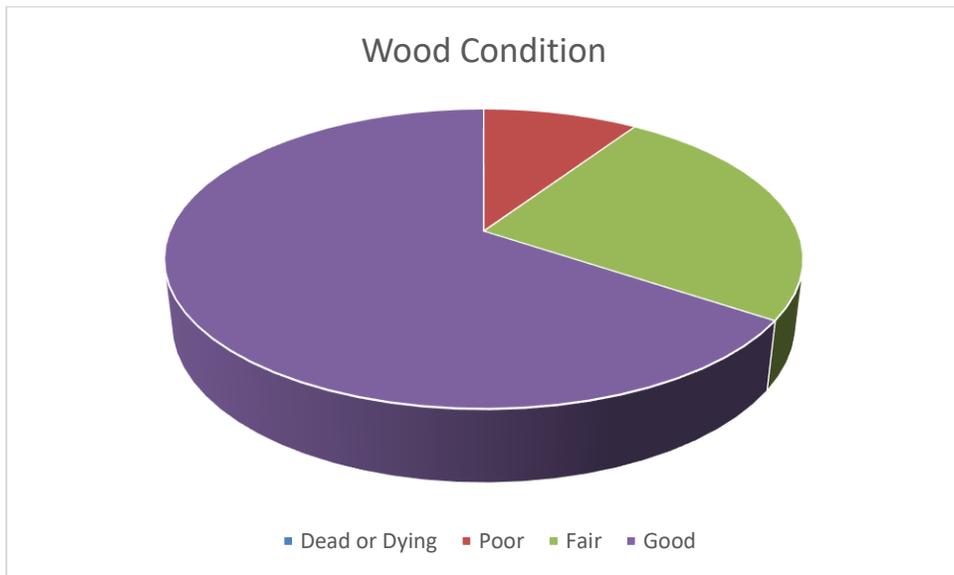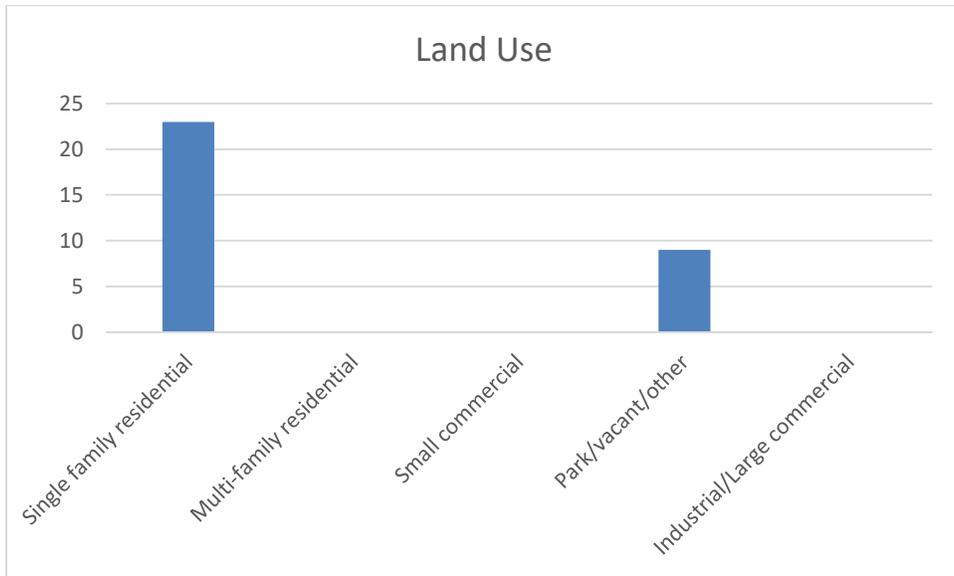
Figure 6: Land Use of city/park trees
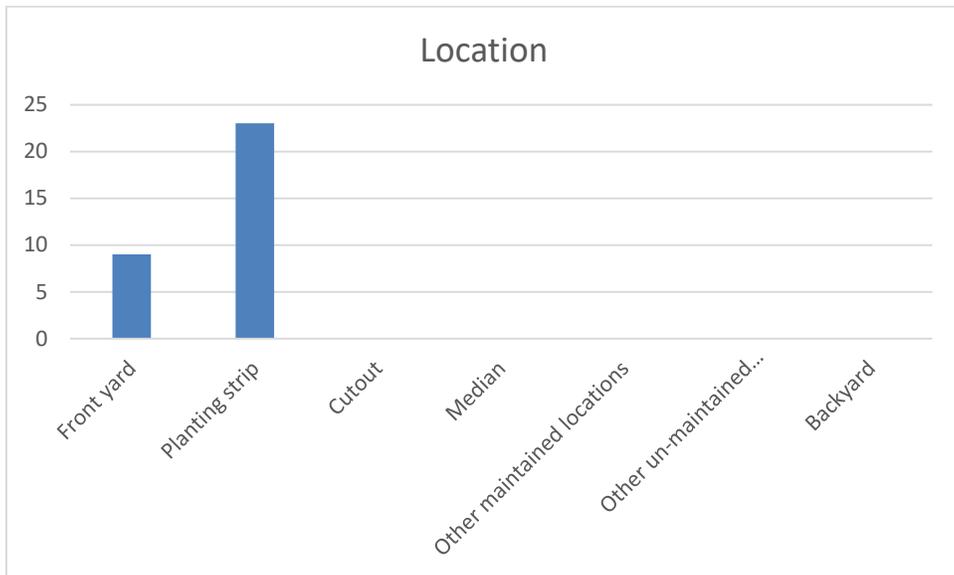
Figure 7: Location of city/park trees

Figure 1: Location of Ash Trees

No SIGNS
Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees
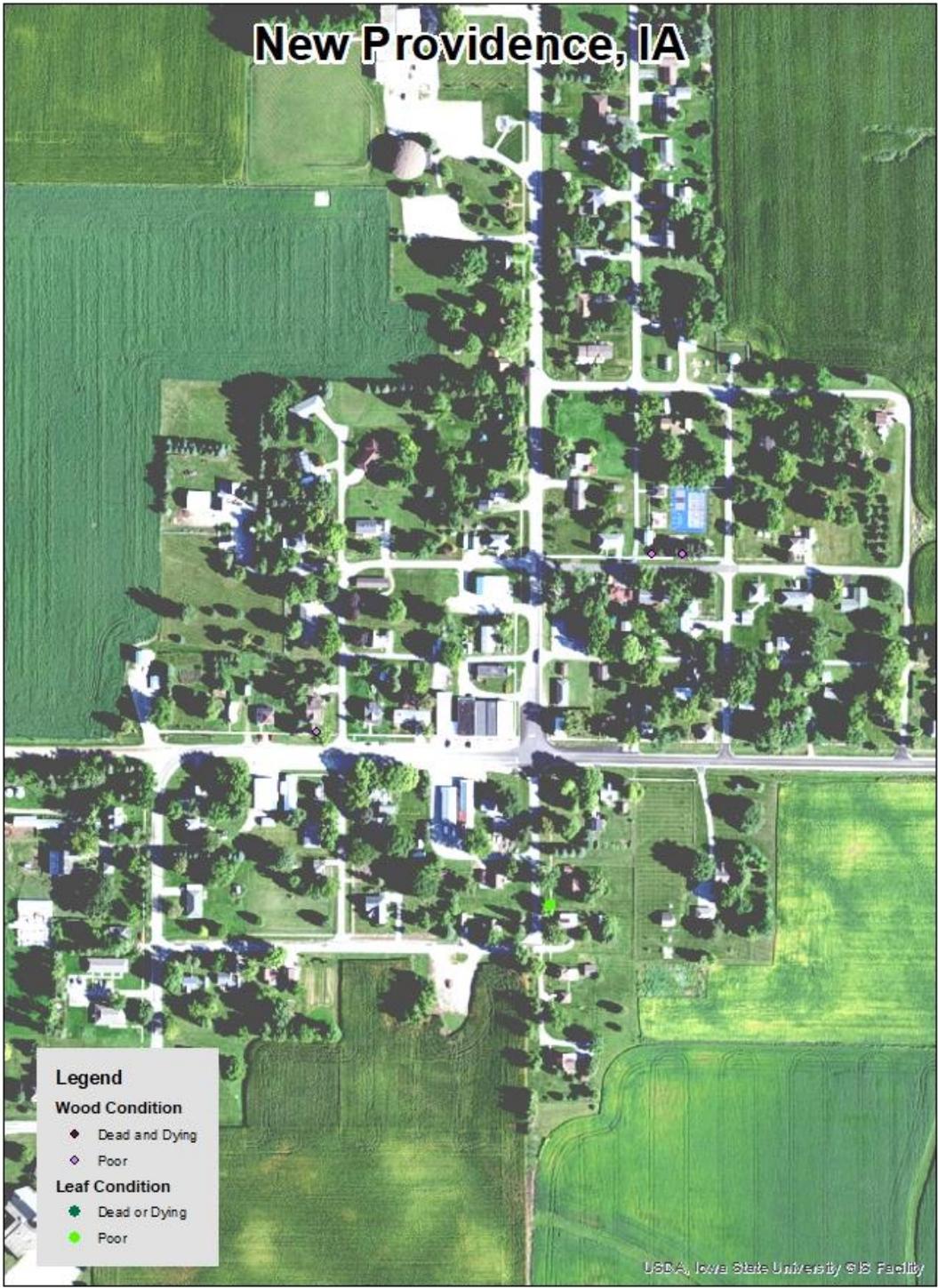
Figure 4: Location of Trees with Recommended Maintenance
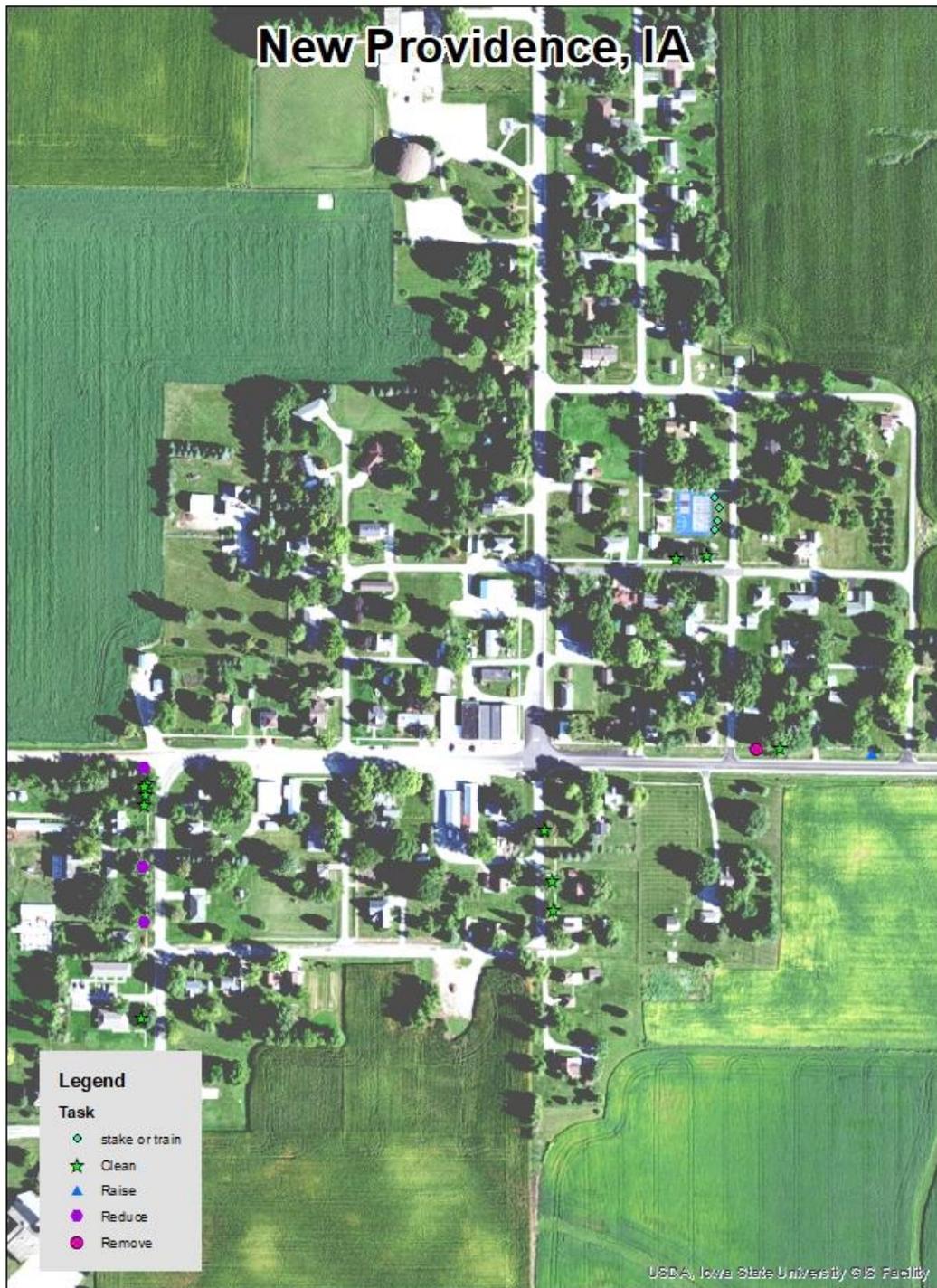
Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: New Providence Tree Ordinances