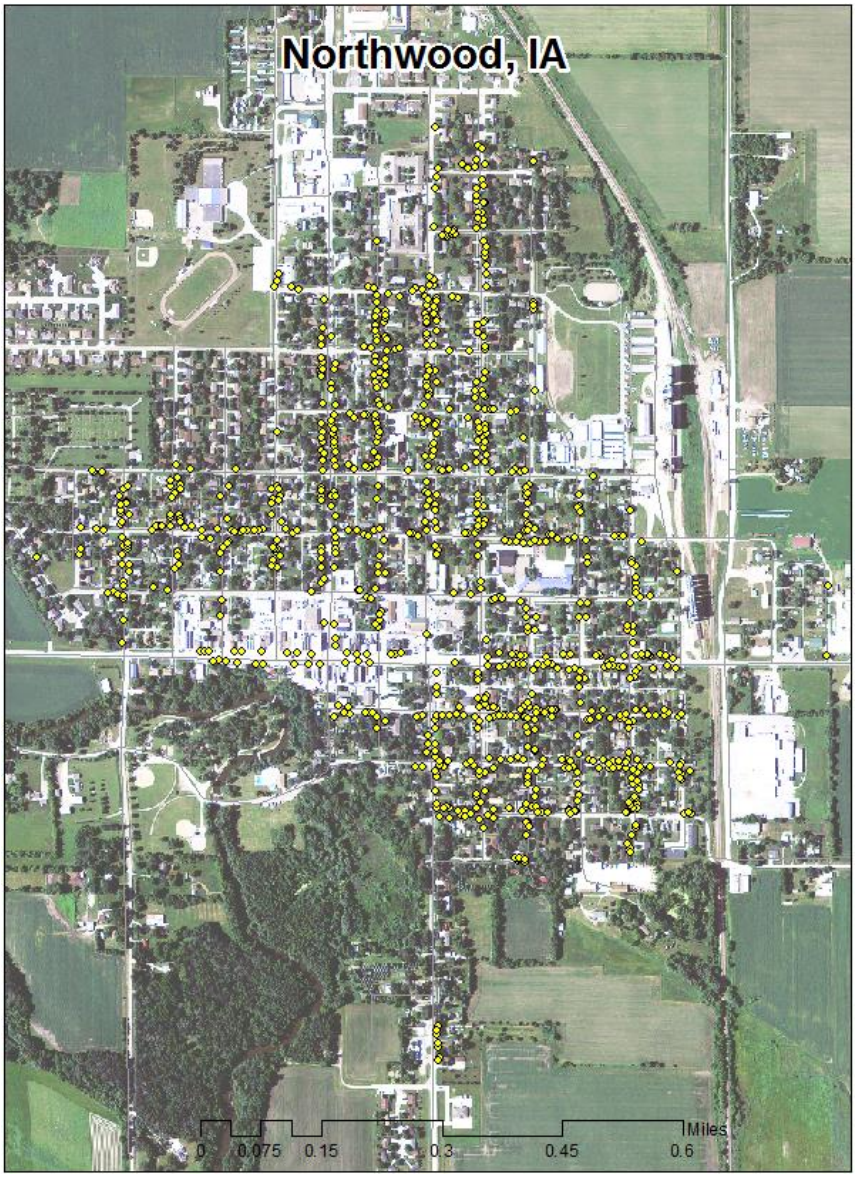
Northwood, IA



2013 Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Northwood 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 17% of Northwood's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2013, 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 861 trees inventoried.

- Northwood's trees provide $93,174 of benefits annually, an average of $108 a tree
- There are over 43 species of trees
- The top three genus are: Maple 55%, Ash 17%, and Apple 3%
- 33% of trees are in need of some type of management
- 46 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 46 trees needing removal, 21 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 30 of the 144 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 8 years just to remove ash – Suggestion: request a budget increase to $20,000 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Northwood with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Northwood, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2013, a tree inventory was conducted that included 100% of the city owned street trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 861 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis. Findings

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Northwood's trees reduce energy related costs by approximately $40,738 annually (Appendix A, Table 1). These savings are both in Electricity (193.9 MWh) and in Natural Gas (26,552.6 Therms).

Annual Stormwater Benefits

Northwood's trees intercept about 2,045,859 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $55,447 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 Northwood, it is estimated that trees remove 2,130 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 $5,766 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Northwood, trees sequester about 410,420 lbs of carbon a year with an associated value of $3,078 (Appendix A, Table 5). In addition, the trees store 6,998,255 lbs of carbon, with a yearly benefit of $52,487 (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. Northwood receives $22,464 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, Northwood's trees provide $93,174 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 861 trees in Northwood provide approximately $108 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Northwood has over 43 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	473	55%
Ash	144	17%
Apple (Crab)	26	3%
Honey locust	24	3%
Ginkgo	19	2%
Linden/Basswood	18	2%
Bur oak	14	2%
Black walnut	11	1%
Norway spruce	11	1%
Broadleaf Deciduous	10	1%
Japanese Tree Lilac	9	1%
Other street trees	103	12%

Age Class

Most of Northwood's trees (53%) are between 6 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amount of trees be in the smallest size category to prepare for natural mortality and to maintain canopy cover. Northwood'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 Northwood indicate that 95% of the trees are in good health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 78% of Northwood'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 10% of the population. This 8% is an estimate of trees that need management follow up.

Management Needs

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

Crown Cleaning	162	19%
Crown Raising	49	6%
Tree Removal	46	5%
Crown Reduction	28	3%

Canopy Cover

The canopy cover of Northwood is approximately 22 acres (Appendix A, Figure 4). According to the 2000 census, Northwood occupies 2,407 acres. Thus the canopy cover on city land is about <1%.

Land Use and Location

The majority of Northwood'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	100%
Park/vacant/other	0%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

Location	
Planting strip	100%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	0%

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

Northwood has 6 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 3 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. There are a total of 43 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 46 removals, 5 are ash trees. There are a total of 144 ash trees, and 20 of those have signs and symptoms that have been associated with EAB. *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 Northwood.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (55%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). 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 death 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 with No Additional Funding

Year 1
- Removal: 6 critical concern trees and 7 additional removal trees
- Planting and Replacement: 16 trees to be planted in open locations
- Visual Survey for signs and symptoms of EAB

Year 2
- Removal: 13 additional removal trees
- Planting and Replacement: 16 trees to be planted in open locations
- Routine trimming: Contract to trim 1/3 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 3
- Removal: 13 additional removal trees
- Planting and Replacement: 16 trees to be planted in open locations
- Visual Survey for signs and symptoms of EAB

Year 4
- Removal: 13 additional removal trees
- Planting and Replacement: 16 trees to be planted in open locations
- Routine trimming: Contract to trim 1/3 of the city trees
- Visual Survey for signs and symptoms of EAB

Year 5
- Removal: 13 of the poorest ash trees
- Planting and Replacement: 16 trees to be planted in open locations
- Visual Survey for signs and symptoms of EAB

Year 6
- Removal: 13 of the poorest ash trees
- Planting and Replacement: 16 trees to be planted in open locations
- Routine trimming: Contract to trim 1/3 of the city trees
- Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 31 ash trees removed (approximately 22% of ash). It will take approximately 16 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 years of its arrival.
** To remove all ash trees within 6 years, the budget would need to be increased to $20,000 a year. At $15,000 a year it will take 11 years to remove all the ash tree. This does not include any additional planting other that what has been laid out above.

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

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

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

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

Wood Disposal

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

Canopy Replacement

As budget permits, all removed ash trees will be replaced. 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 genus other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. 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."

Budget

Current Budget
Total $60,000 over 6 years ($10,000/year)

FY 2014 Budget
Removal: $6500
Planting: $1600
Watering & Maintenance: $900

FY 2015 Budget
Removal: $6500
Planting: $1600
Routine trimming: $2000
Watering & Maintenance: $900

FY 2016 Budget
Removal: $6500
Planting: $1600
Watering & Maintenance: $900

FY 2017 Budget
Removal: $6500
Planting: $1600
Routine trimming: $2000
Watering & Maintenance: $900

FY 2018 Budget
Removal: $6500
Planting: $1600
Watering & Maintenance: $900

FY 2019 Budget
Removal: $6500
Planting: $1600
Routine trimming: $2000
Watering & Maintenance: $900

*Reduction of ash over 6 years: approximately 31 ash trees removed (approximately 22% of ash). **It will take approximately 16 years to remove all ash with the current budget.**

Purposed Budget Increase

EAB could potentially kill all ash trees in Northwood within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $20,000 a year. Additionally, it is recommended that Northwood apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

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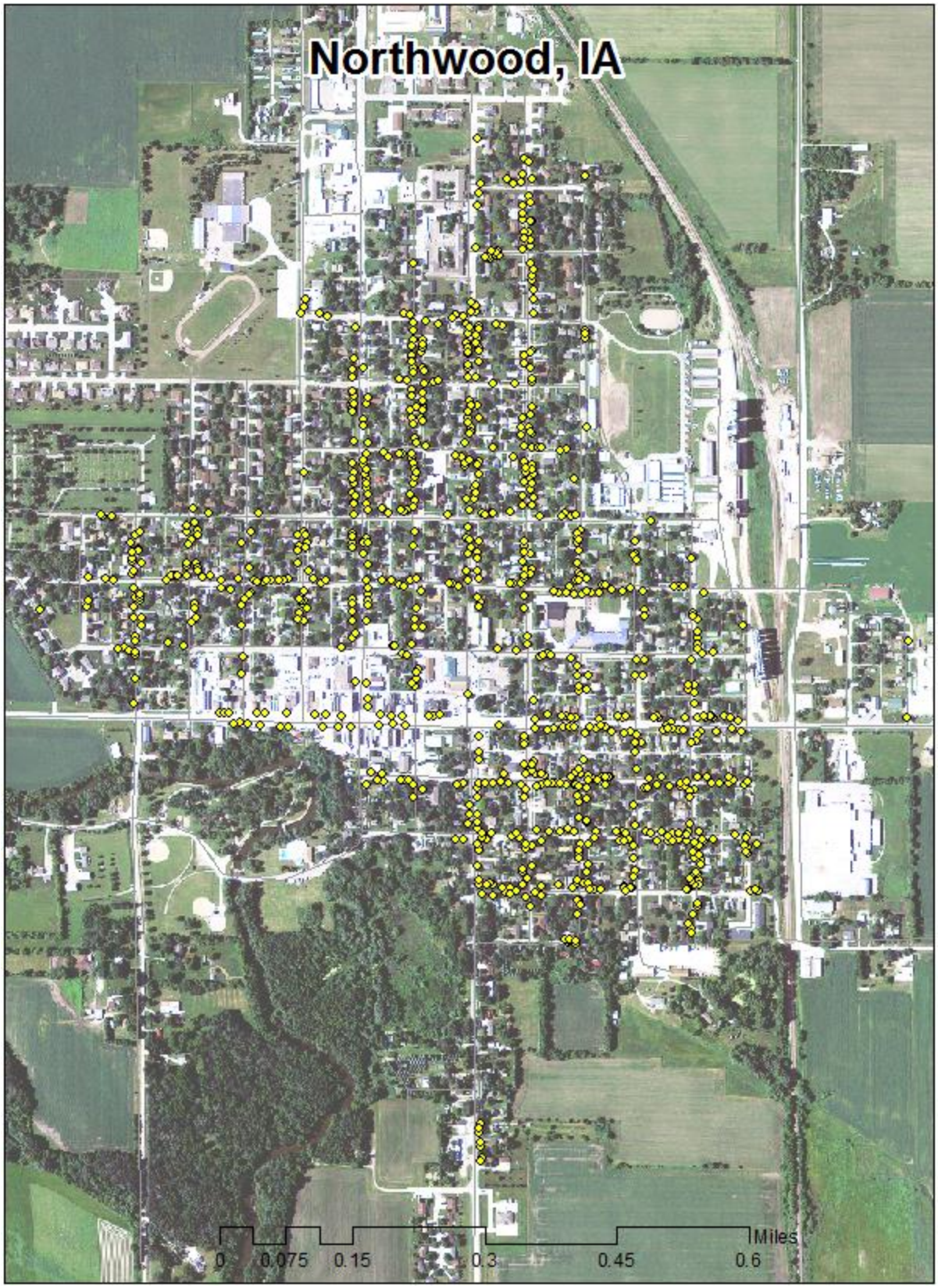
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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Northwood

Annual Energy Benefits of Public Trees by Species

9/16/2013

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	52.8	4,006	7,083.7	6,942	10,948	(N/A)	27.1	26.9	46.99
Ash	35.9	2,727	5,130.5	5,028	7,755	(N/A)	16.7	19.0	53.85
Silver maple	34.5	2,616	4,518.7	4,428	7,044	(N/A)	13.3	17.3	61.79
Norway maple	26.3	1,999	3,760.1	3,685	5,684	(N/A)	12.9	14.0	51.21
Apple	2.3	174	350.7	344	517	(N/A)	3.0	1.3	19.90
Honeylocust	6.7	512	896.9	879	1,391	(N/A)	2.8	3.4	57.96
Ginkgo	0.0	3	7.8	8	11	(N/A)	2.2	0.0	0.57
Littleleaf linden	3.2	240	437.5	429	668	(N/A)	2.1	1.6	37.14
Sugar maple	5.0	383	674.3	661	1,044	(N/A)	1.6	2.6	74.57
Bur oak	3.7	282	507.8	498	780	(N/A)	1.5	1.9	59.98
Black walnut	2.4	182	322.5	316	498	(N/A)	1.3	1.2	45.30
Norway spruce	1.9	146	250.6	246	392	(N/A)	1.3	1.0	35.62
Broadleaf Deciduous	0.0	3	6.2	6	9	(N/A)	1.2	0.0	0.87
Japanese tree lilac	0.2	14	33.2	33	47	(N/A)	1.1	0.1	5.22
Other street trees	18.8	1,428	2,572.1	2,521	3,949	(N/A)	12.0	9.7	38.34
Citywide total	193.9	14,716	26,552.6	26,022	40,738	(N/A)	100.0	100.0	47.37

Table 2: Annual Stormwater Benefits

Northwood

Annual Stormwater Benefits of Public Trees by Species

9/16/2013

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	448,891	12,166	(N/A)	27.1	21.9	52.21
Ash	337,061	9,135	(N/A)	16.7	16.5	63.44
Silver maple	517,573	14,027	(N/A)	13.3	25.3	123.05
Norway maple	238,355	6,460	(N/A)	12.9	11.7	58.20
Apple	8,643	234	(N/A)	3.0	0.4	9.01
Honeylocust	65,000	1,762	(N/A)	2.8	3.2	73.40
Ginkgo	135	4	(N/A)	2.2	0.0	0.19
Littleleaf linden	27,273	739	(N/A)	2.1	1.3	41.06
Sugar maple	71,089	1,927	(N/A)	1.6	3.5	137.62
Bur oak	53,641	1,454	(N/A)	1.5	2.6	111.83
Black walnut	23,750	644	(N/A)	1.3	1.2	58.52
Norway spruce	44,516	1,206	(N/A)	1.3	2.2	109.68
Broadleaf Deciduous	74	2	(N/A)	1.2	0.0	0.20
Japanese tree lilac	642	17	(N/A)	1.1	0.0	1.93
Other street trees	209,214	5,670	(N/A)	12.0	10.2	55.05
Citywide total	2,045,859	55,447	(N/A)	100.0	100.0	64.47

Table 3: Annual Air Quality Benefits

Northwood

Annual Air Quality Benefits of Public Trees by Species

9/16/2013

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Maple	107.5	18.3	50.2	4.8	573	250.4	36.6	34.9	239.1	1,564	-36.1	-135	705.7	2,001	(N/A)	27.1	8.59
Ash	69.5	12.0	34.1	3.1	375	173.7	25.1	23.9	163.0	1,077	-16.3	-61	488.3	1,392	(N/A)	16.7	9.67
Silver maple	91.3	15.5	44.5	4.0	491	162.3	23.8	22.7	155.9	1,016	-47.3	-177	472.7	1,330	(N/A)	13.3	11.66
Norway maple	48.0	8.3	23.7	2.1	260	127.4	18.4	17.6	119.5	790	-11.3	-42	353.7	1,007	(N/A)	12.9	9.07
Apple	2.2	0.4	1.1	0.1	12	11.3	1.6	1.5	10.4	69	0.0	0	28.6	81	(N/A)	3.0	3.13
Honeylocust	12.3	2.0	5.7	0.6	65	31.9	4.7	4.5	30.6	200	-9.1	-34	83.1	231	(N/A)	2.8	9.61
Ginkgo	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)	2.2	0.07
Littleleaf linden	4.2	0.7	2.1	0.2	23	15.2	2.2	2.1	14.3	94	-2.1	-8	38.9	109	(N/A)	2.1	6.06
Sugar maple	10.4	1.8	5.0	0.5	56	23.9	3.5	3.3	22.9	149	-8.0	-30	63.2	175	(N/A)	1.6	12.52
Bur oak	8.4	1.3	3.7	0.4	44	17.7	2.6	2.5	16.8	111	0.0	0	53.5	154	(N/A)	1.5	11.87
Black walnut	2.7	0.4	1.3	0.1	14	11.4	1.7	1.6	10.9	71	0.0	0	30.1	86	(N/A)	1.3	7.78
Norway spruce	5.4	1.1	4.3	0.7	35	9.1	1.3	1.3	8.7	57	-26.9	-101	5.0	-9	(N/A)	1.3	-0.78
Broadleaf Deciduous	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)	1.2	0.11
Japanese tree lilac	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.3	6	(N/A)	1.0	0.72
Other street trees	32.3	5.6	17.6	1.9	180	89.8	13.1	12.5	85.3	560	-31.1	-117	227.0	624	(N/A)	12.0	6.05
Citywide total	394.3	67.4	193.5	18.4	2,130	925.5	134.8	128.5	878.6	5,766	-188.2	-706	2,552.8	7,190	(N/A)	100.0	8.36

Table 4: Annual Carbon Stored

Northwood

Stored CO2 Benefits of Public Trees by Species

9/16/2013

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	1,166,262	8,747	(N/A)	27.1	16.7	37.54
Ash	1,149,214	8,619	(N/A)	16.7	16.4	59.85
Silver maple	2,105,393	15,790	(N/A)	13.3	30.1	138.51
Norway maple	793,186	5,949	(N/A)	12.9	11.3	53.59
Apple	36,613	275	(N/A)	3.0	0.5	10.56
Honeylocust	155,216	1,164	(N/A)	2.8	2.2	48.51
Ginkgo	86	1	(N/A)	2.2	0.0	0.03
Littleleaf linden	91,068	683	(N/A)	2.1	1.3	37.94
Sugar maple	304,785	2,286	(N/A)	1.6	4.4	163.28
Bur oak	280,556	2,104	(N/A)	1.5	4.0	161.86
Black walnut	86,652	650	(N/A)	1.3	1.2	59.08
Norway spruce	69,753	523	(N/A)	1.3	1.0	47.56
Broadleaf	138	1	(N/A)	1.2	0.0	0.10
Japanese tree lilac	2,076	16	(N/A)	1.1	0.0	1.73
Other street trees	343,485	5,679	(N/A)	12.0	10.8	55.14
Citywide total	6,998,255	52,487	(N/A)	100.0	100.0	61.03

Table 5: Annual Carbon Sequestered

Northwood

Annual CO_2 Benefits of Public Trees by Species

9/16/2013

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
Maple	83,769	628	-5,598	-45	-42	88,534	664	166,659	1,250	(N/A)	27.1	23.7	5.36
Ash	40,508	304	-5,516	-28	-42	60,261	452	95,225	714	(N/A)	16.7	13.6	4.96
Silver maple	149,817	1,124	-10,106	-22	-76	57,811	434	197,500	1,481	(N/A)	13.3	28.1	12.99
Norway maple	35,880	269	-3,807	-22	-29	44,184	331	76,235	572	(N/A)	12.9	10.9	5.15
Apple	3,629	27	-176	-5	-1	3,841	29	7,289	55	(N/A)	3.0	1.0	2.10
Honeylocust	20,668	155	-745	-5	-6	11,320	85	31,238	234	(N/A)	2.8	4.5	9.76
Ginkgo	42	0	0	-4	0	70	1	108	1	(N/A)	2.2	0.0	0.04
Littleleaf linden	8,701	65	-437	-4	-3	5,298	40	13,558	102	(N/A)	2.1	1.9	5.65
Sugar maple	13,347	100	-1,463	-3	-11	8,468	64	20,350	153	(N/A)	1.6	2.9	10.90
Bur oak	8,183	61	-1,347	-3	-10	6,234	47	13,068	98	(N/A)	1.5	1.9	7.54
Black walnut	5,614	42	-416	-2	-3	4,028	30	9,224	69	(N/A)	1.3	1.3	6.29
Norway spruce	999	7	-335	-2	-3	3,232	24	3,894	29	(N/A)	1.3	0.6	2.65
Broadleaf Deciduous	87	1	-1	-2	0	56	0	140	1	(N/A)	1.2	0.0	0.11
Japanese tree lilac	318	2	-10	-2	0	319	2	625	5	(N/A)	1.1	0.1	0.52
Other street trees	38,857	291	-3,635	-20	-27	31,569	237	66,772	501	(N/A)	12.0	9.5	4.86
Citywide total	410,420	3,078	-33,592	-168	-253	325,226	2,439	701,886	5,264	(N/A)	100.0	100.0	6.12

Table 6: Annual Social and Aesthetic Benefits

Northwood

Annual Aesthetic/Other Benefits of Public Trees by Species

9/16/2013

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	10,885	(N/A)	27.1	25.9	46.72
Ash	3,938	(N/A)	16.7	9.4	27.35
Silver maple	11,557	(N/A)	13.3	27.5	101.38
Norway maple	3,475	(N/A)	12.9	8.3	31.30
Apple	207	(N/A)	3.0	0.5	7.96
Honeylocust	4,768	(N/A)	2.8	11.4	198.69
Ginkgo	7	(N/A)	2.2	0.0	0.37
Littleleaf linden	950	(N/A)	2.1	2.3	52.76
Sugar maple	1,298	(N/A)	1.6	3.1	92.74
Bur oak	593	(N/A)	1.5	1.4	45.64
Black walnut	499	(N/A)	1.3	1.2	45.39
Norway spruce	143	(N/A)	1.3	0.3	13.04
Broadleaf Deciduous	0	(N/A)	1.2	0.0	0.03
Japanese tree lilac	15	(N/A)	1.1	0.0	1.67
Other street trees	3,645	(N/A)	12.0	8.7	35.39
Citywide total	41,982	(N/A)	100.0	100.0	48.82

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of Trees by Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	6,601.70	644.86	1,196.31	8,094.83	3,734.32	20,272.03	(±0)	21.76
Ash	6,762.03	551.23	1,253.80	8,798.74	2,503.55	19,869.35	(±0)	21.32
Silver maple	4,705.10	1,015.04	895.69	9,496.62	7,760.64	23,873.09	(±0)	25.62
Maple	2,116.07	250.95	385.76	2,288.52	2,244.11	7,285.41	(±0)	7.82
Basswood	1,764.37	230.45	339.33	3,179.63	1,393.44	6,907.22	(±0)	7.41
Honeylocust	608.51	89.44	103.39	876.63	1,761.32	3,439.29	(±0)	3.69
Black walnut	446.97	62.56	76.45	549.64	437.88	1,573.50	(±0)	1.69
Apple	148.80	16.05	24.34	66.94	59.02	315.15	(±0)	0.34
American basswood	300.62	42.04	44.56	342.42	279.33	1,008.98	(±0)	1.08
Sugar maple	381.36	50.50	59.92	545.14	422.87	1,459.79	(±0)	1.57
Boxelder	272.91	54.08	47.39	425.00	327.25	1,126.63	(±0)	1.21
Broadleaf Deciduous Small	39.80	3.97	5.39	14.61	14.63	78.41	(±0)	0.08
Other street trees	1,628.89	203.92	274.91	2,332.15	1,525.72	5,965.58	(±0)	6.40
Citywide total	25,777.13	3,215.11	4,707.23	37,010.86	22,464.09	93,174.44	(±0)	100.00

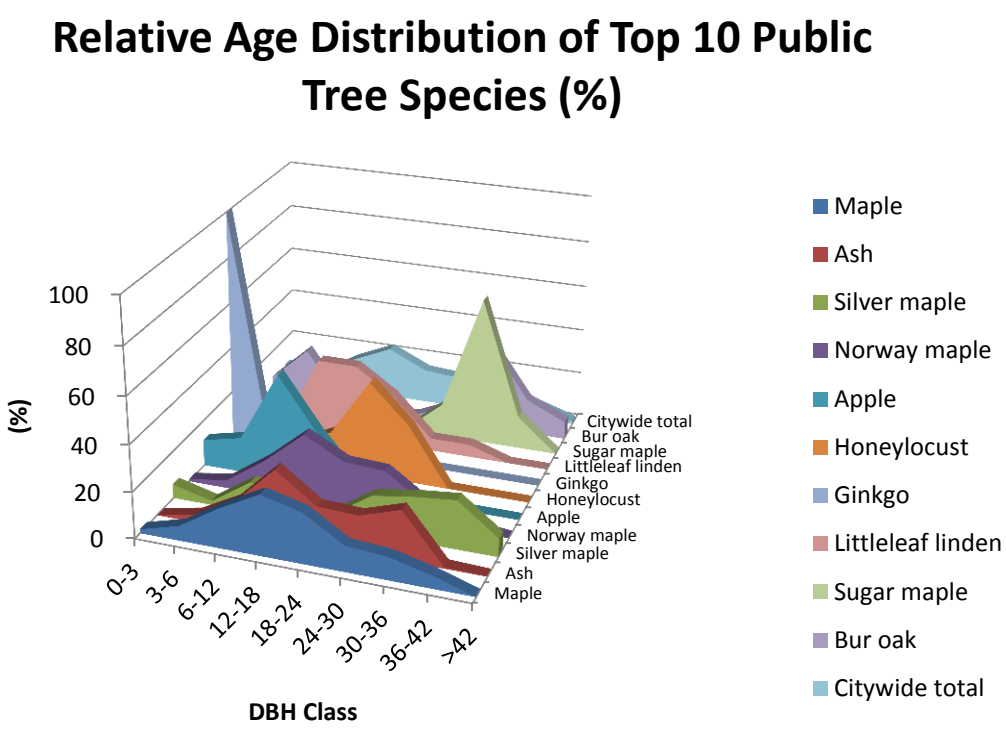

Figure 2: Relative Age Class

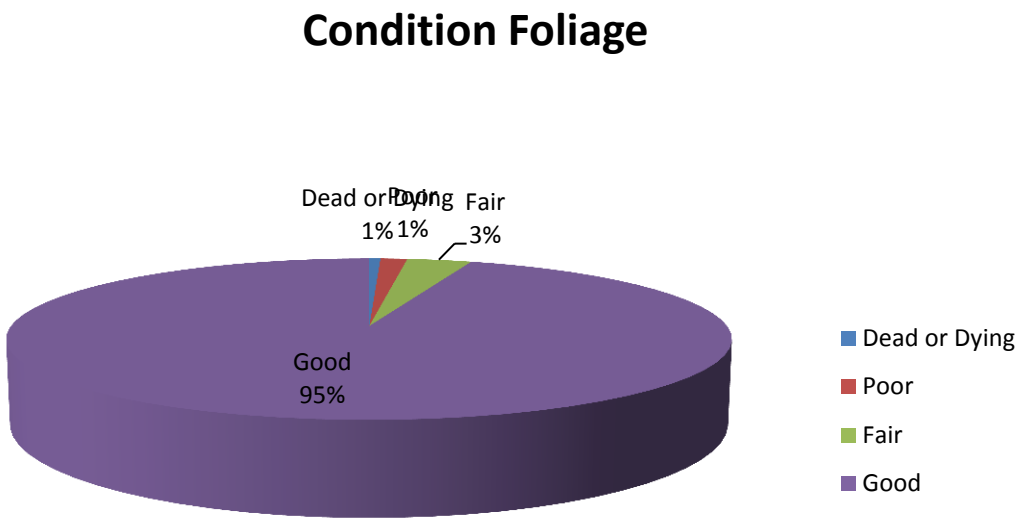

Figure 3: Foliage Condition

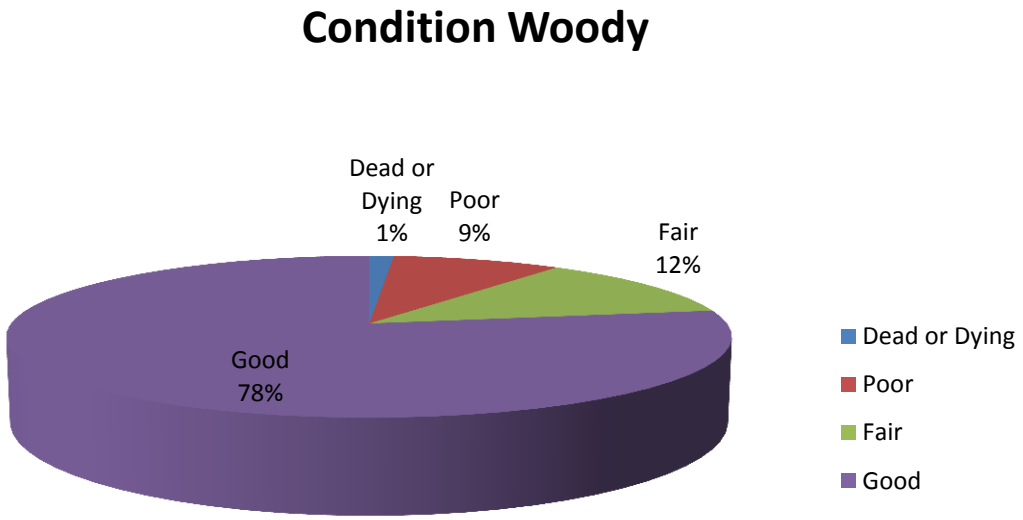

Figure 4: Wood Condition

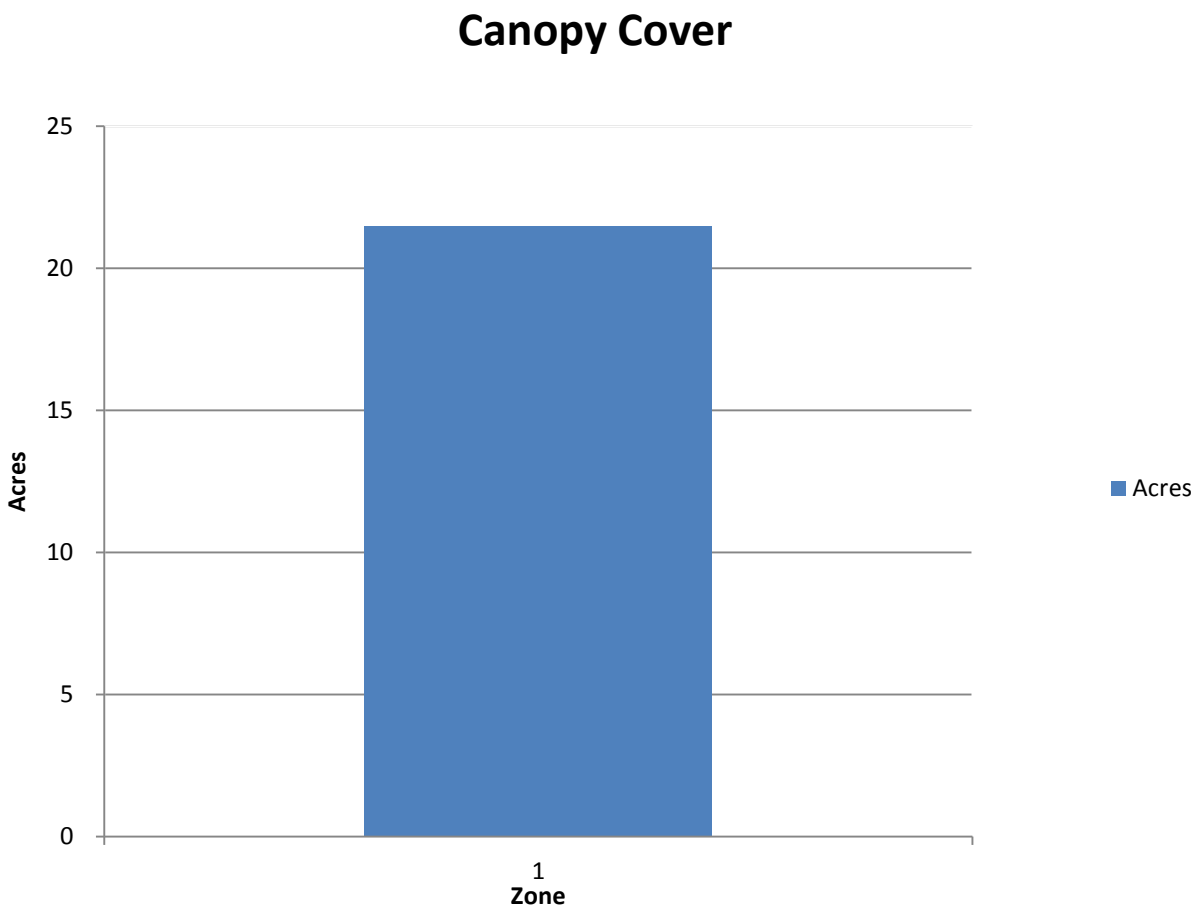

Figure 5: Canopy Cover in Acres

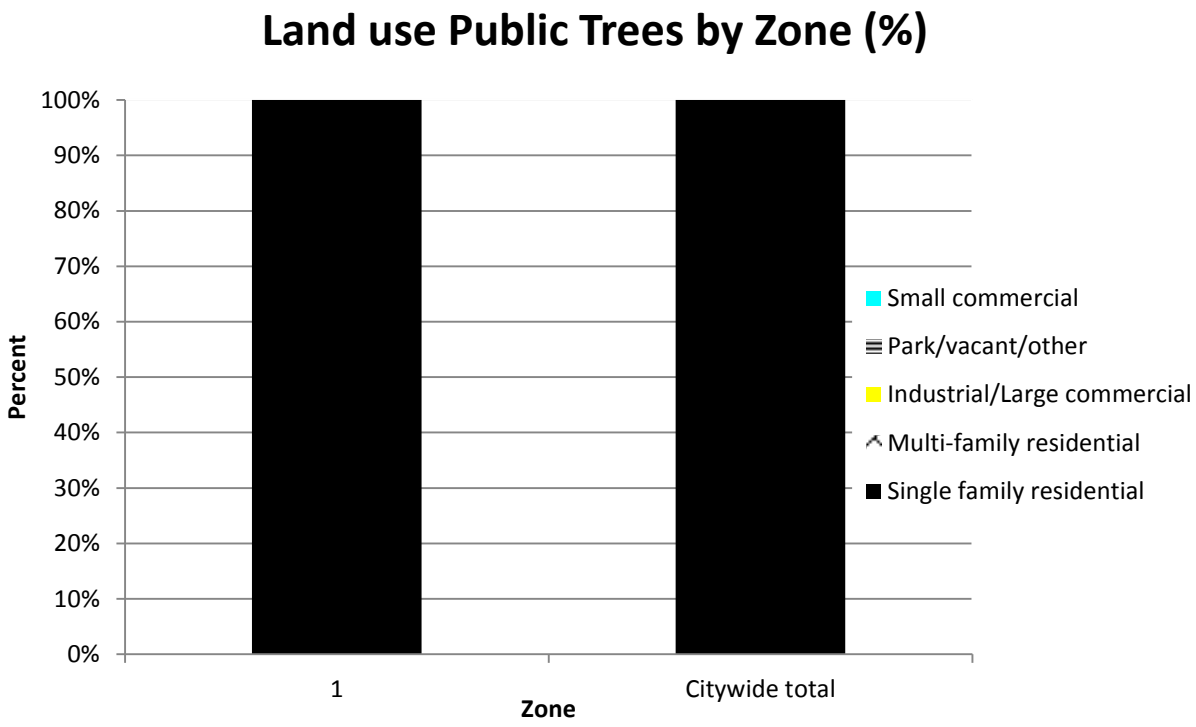

Figure 6: Land Use of city/park trees

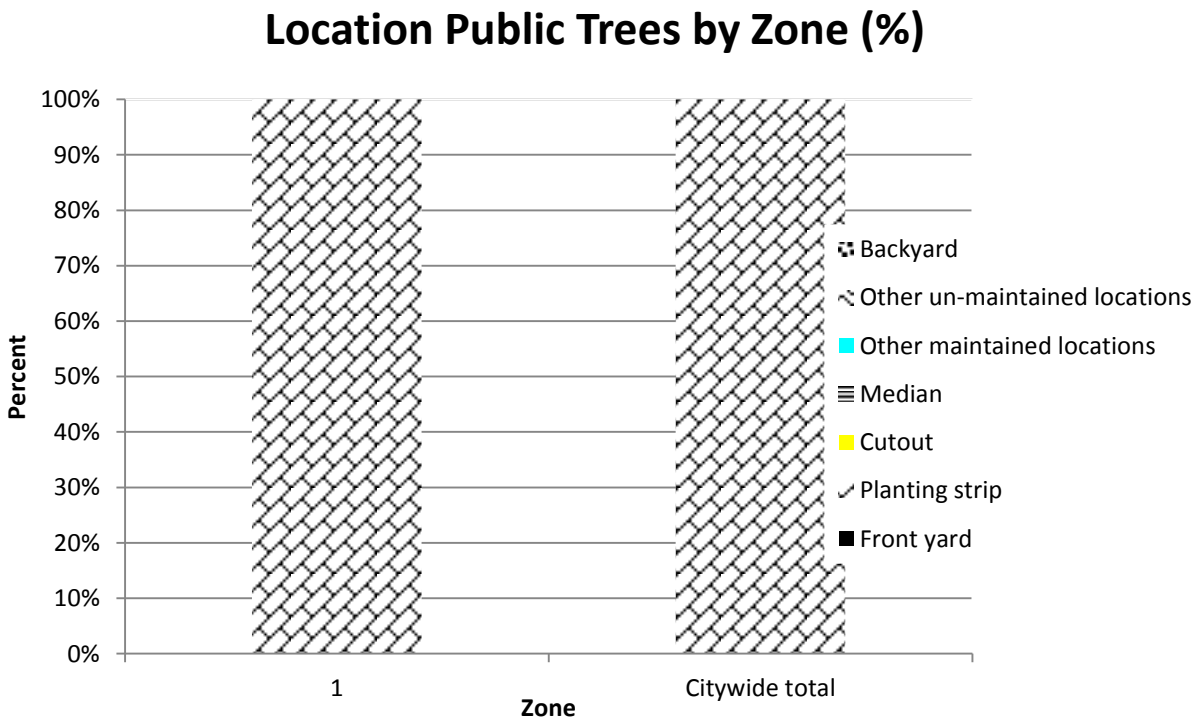

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

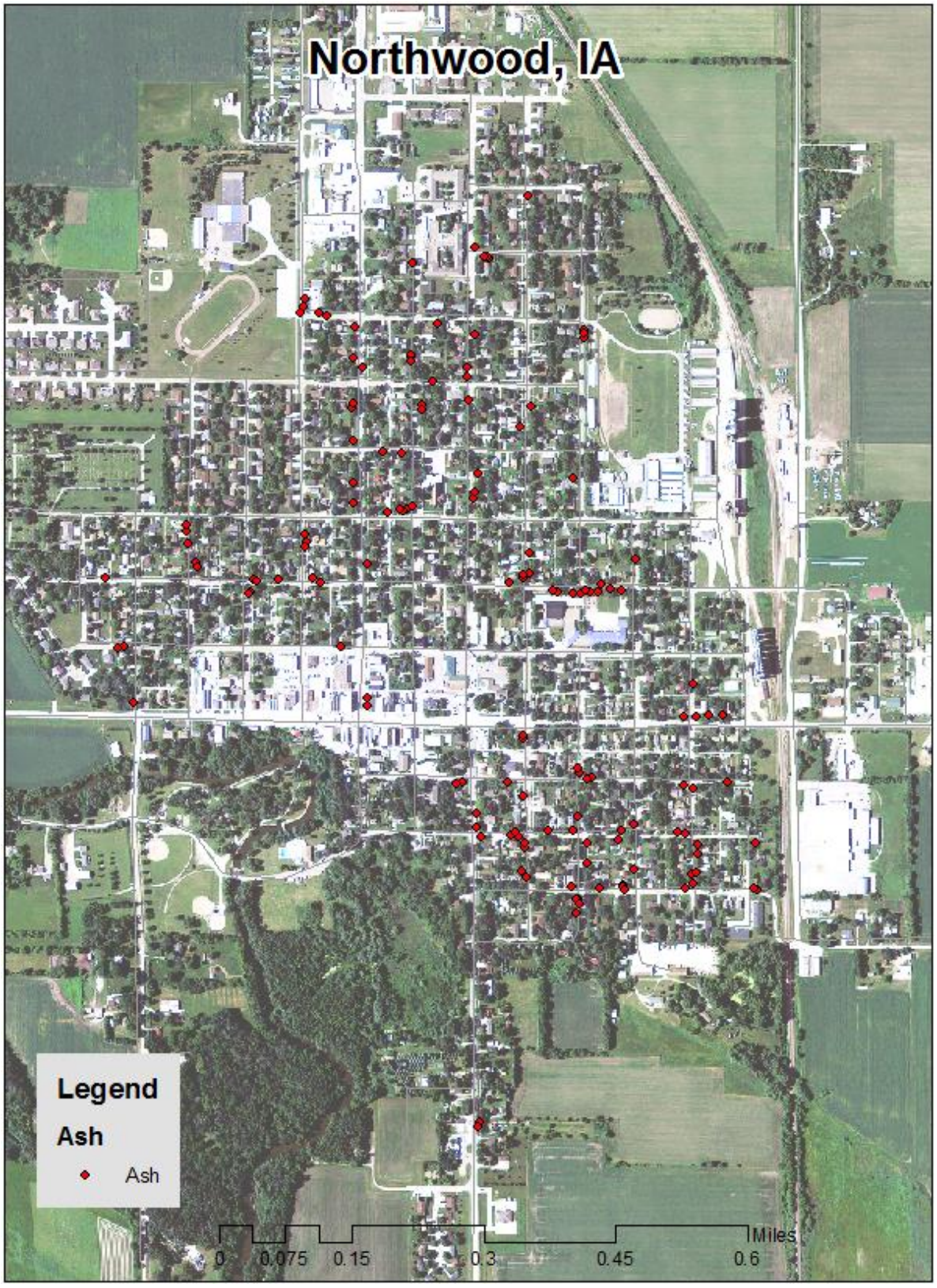

Figure 1: Location of Ash Trees

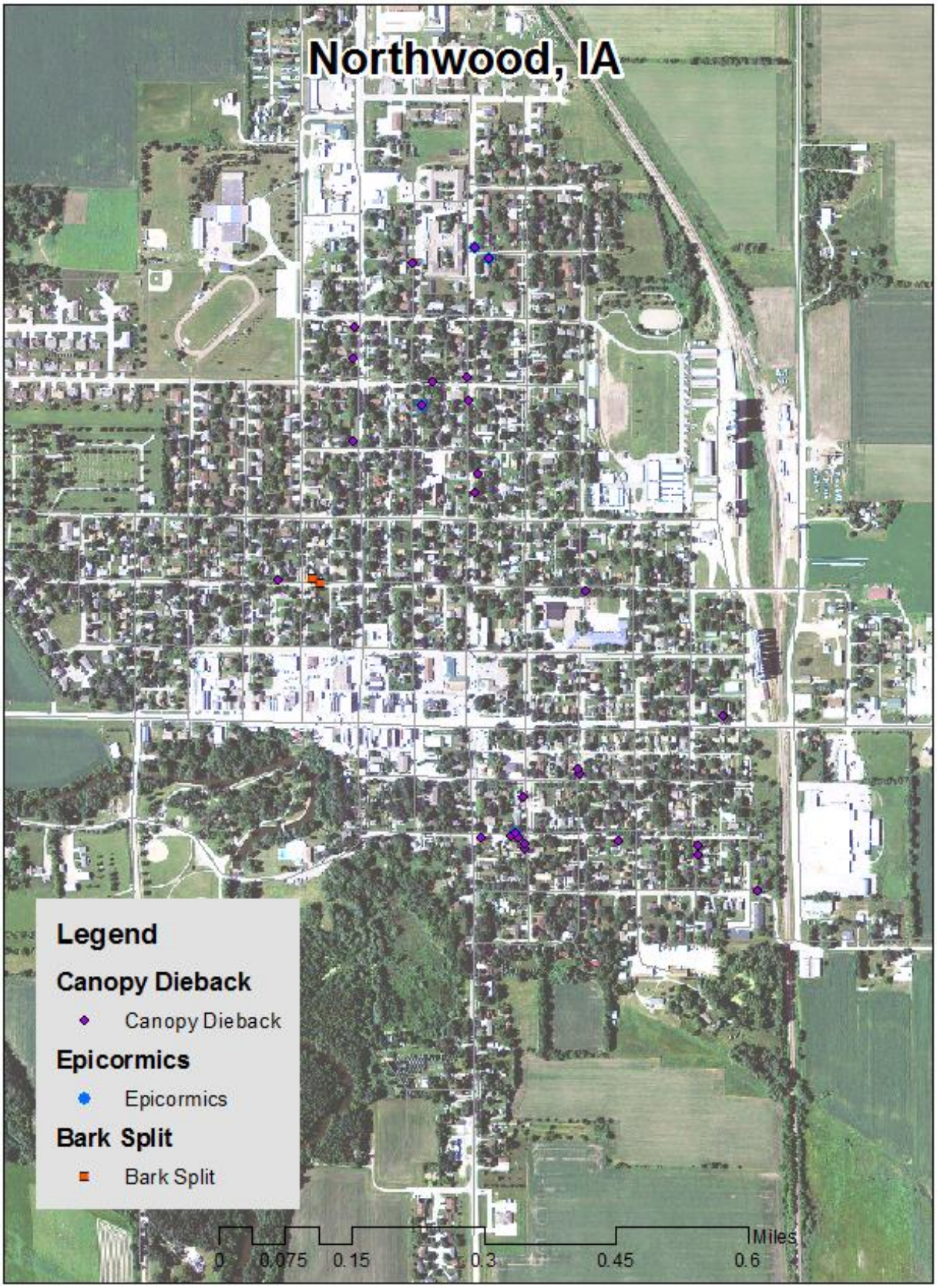

Figure 2: Location of EAB symptoms

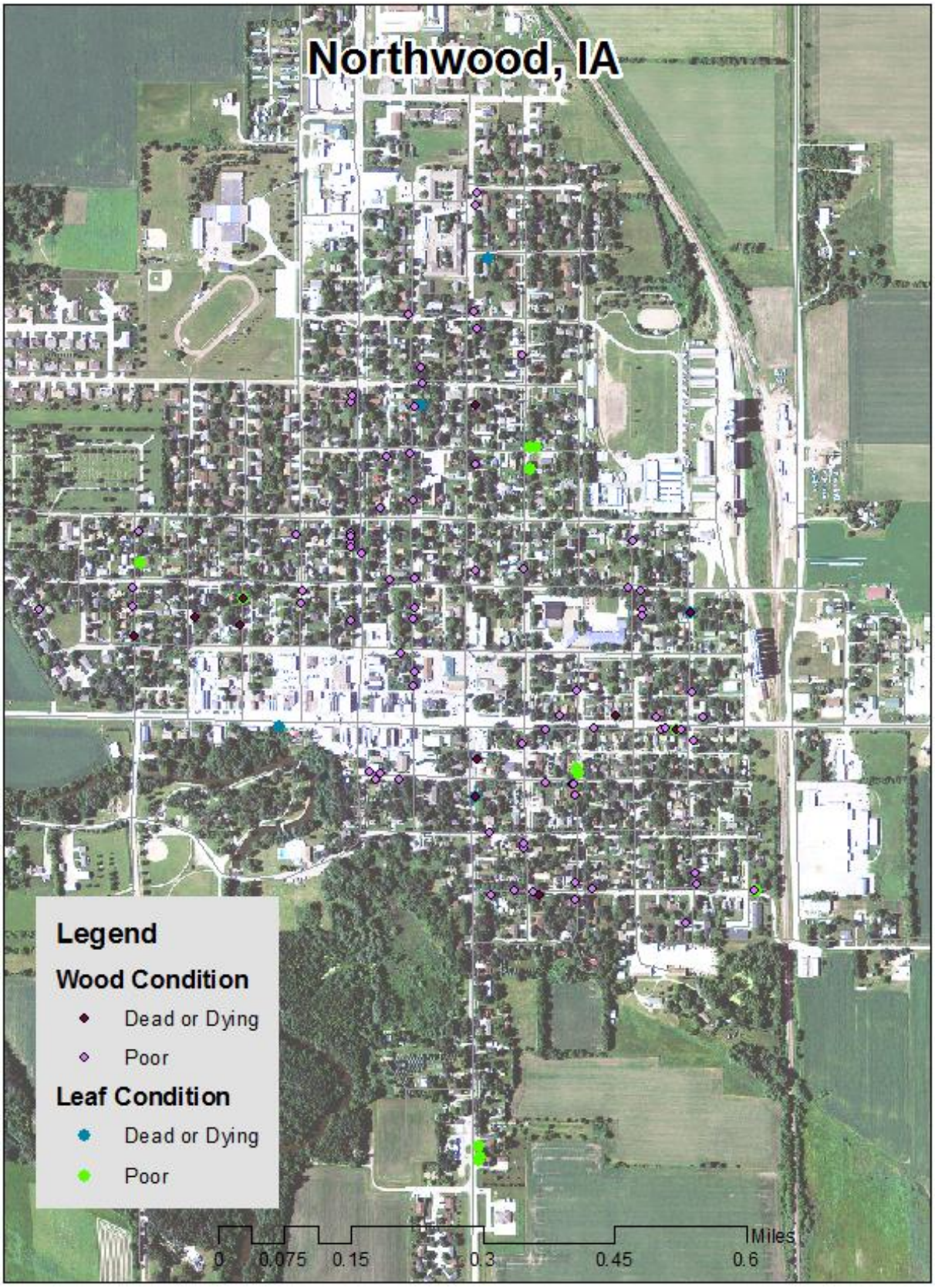

Figure 3: Location of Poor Condition Trees

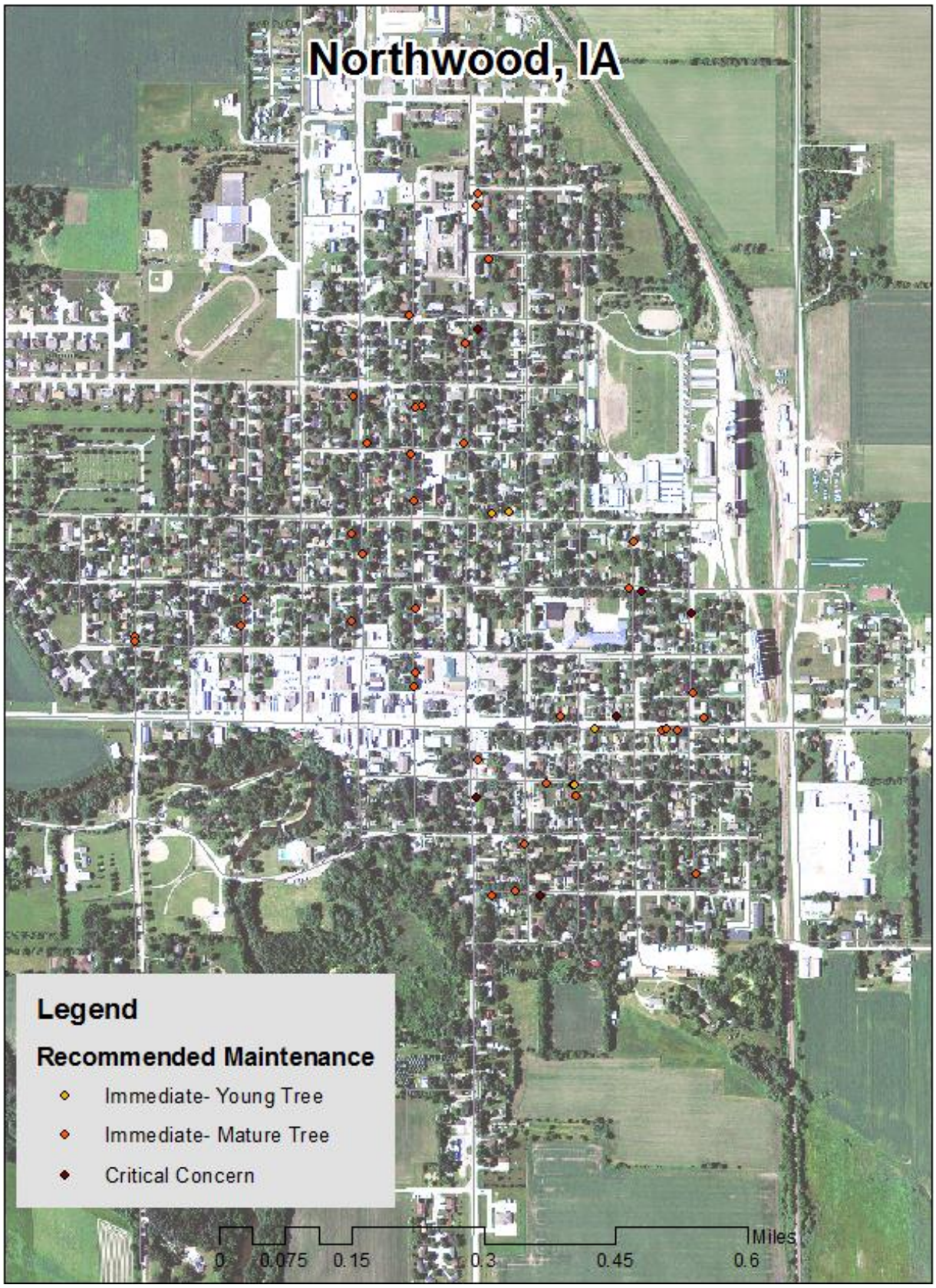

Figure 4: Location of Trees with Recommended Maintenance

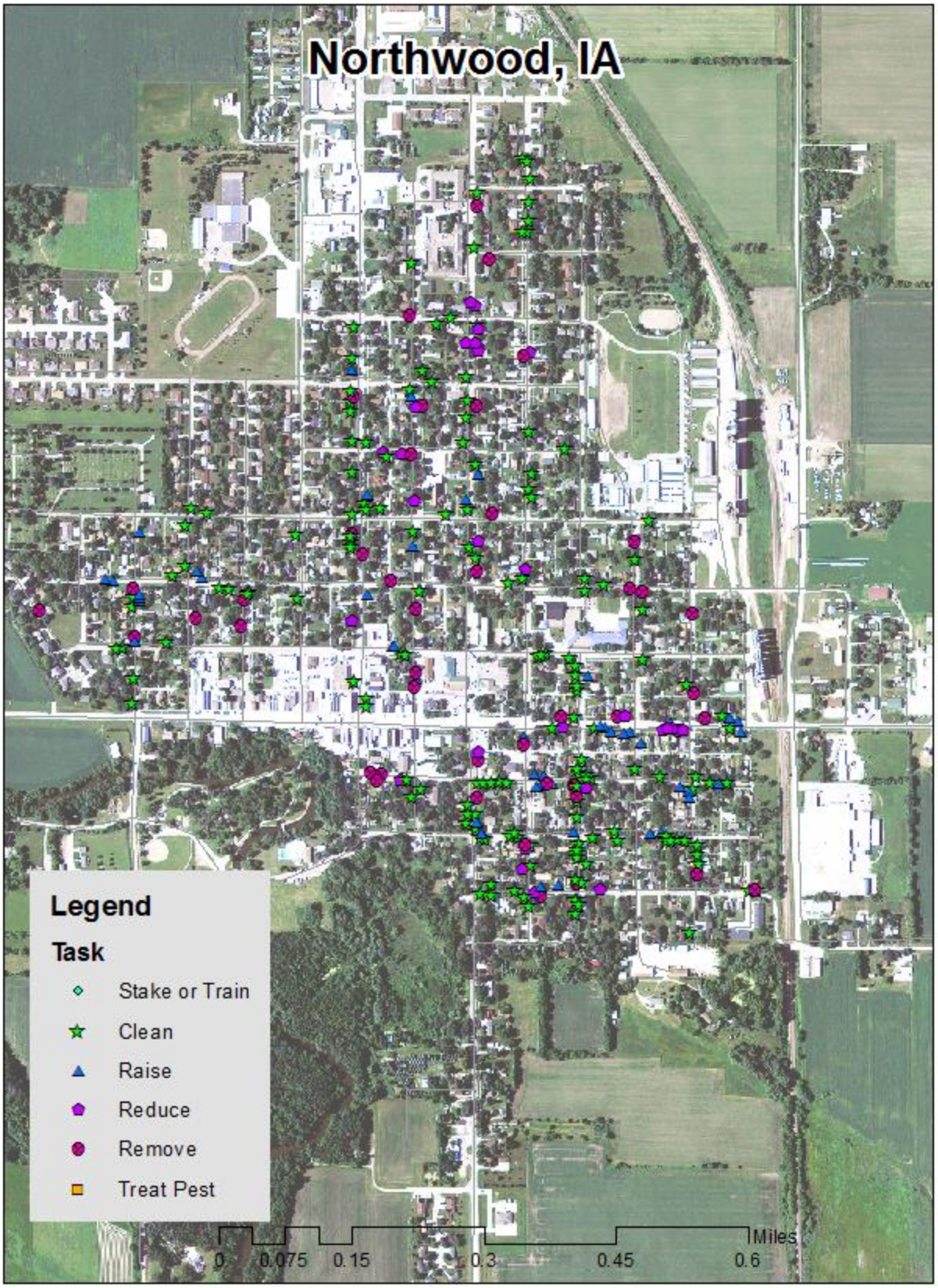

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Northwood Tree Ordinances

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue, or highway in the City not covered by sidewalk and lying between the lot line and the curb line or, on unpaved streets, that part of the street, avenue, or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

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

1. Alignment. All trees planted in any street shall 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 ten (10) feet from the property line.

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

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow, or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased, or damaged tree or shrub that may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

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