Solon, IA

2011 Community Street & Park Tree Management Plan

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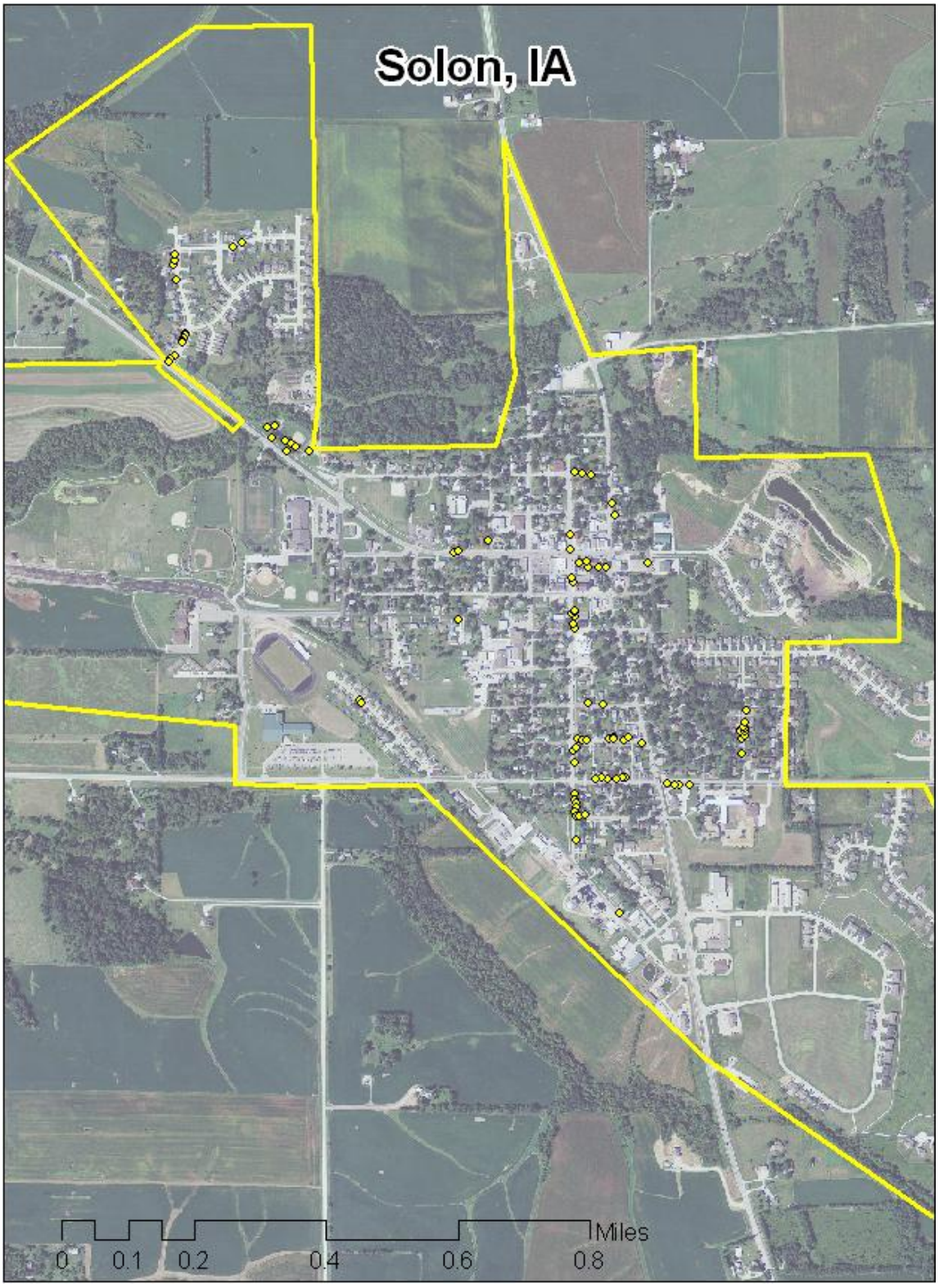
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Executive Summary

Overview

This plan was developed to assist the City of Solon 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) and gypsy moth. 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). **This pest was found in Iowa in the spring of 2010.** There is a strong possibility that ~10 % of Solon's city owned trees (ash-9) 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. Another concern is that 37% of Solon's city owned trees are some type of (maple-34), so if any type of insect or disease starts to threaten the health of maples in the community this could have a significant impact on the community tree population. Basically, 47% (43) of Solon's city owned trees are either a maple or an ash.

Inventory and Results

In the fall of 2010 a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees in the community. Below are some key findings of the 93 trees inventoried.

- Solon's trees provide $11,163 of benefits annually, an average of $120 a tree
- There are ~19 species of trees
- The top Five genus are: Maple 37%, Crabapple 16%, Callery Pear 12%, Hackberry 11%, and ash 10%
- 65% of trees are in need of some type of management, the majority of the management is pruning such as raising above streets and sidewalks for safety
- 5 trees are recommended for removal consideration and only 1 is ash

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 5 trees needing removal, 1 tree is 12 inches in diameter or less, 2 trees are between 12 and 18 inches, and 2 trees are over 18 inches in diameter at 4.5 ft. All of these trees should be evaluated as soon as possible to decide if they need to be removed and when. *City ownership of the trees recommended for removal should be verified prior to any removal*
- Only 1 of the 9 ash trees is in need of follow up, and this particular tree should be considered for removal.
- Attempt to prune all park trees on a routine schedule, and enforce the city tree ordinance to encourage pruning of trees between the street and sidewalk.

- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, boxelder, Chinese elm, willow, black walnut, or evergreen species as street trees. Evergreen species such as Norway spruce, Serbian spruce, white spruce, Eastern white pine, Eastern redcedar, concolor fir, or arborvitae can be considered for park plantings.
- Check ash trees with a visual survey yearly
- With the current budget it could take 1.8 years to remove the existing ash if they were to die

Introduction

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

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

Inventory

In the fall of 2010, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 93 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the I-Tree suite. The following are results from the I-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Solon's trees reduce energy related costs by approximately $3,288 annually (Appendix A, Table 1). These savings are both in Electricity (15.5 MWh) and in Natural Gas (2,151 Therms).

Annual Stormwater Benefits

Solon's trees intercept about 146,110 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $3,960 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 Solon, it is estimated that trees remove 197.7 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 $559 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Solon, trees sequester about 29,541 lbs of carbon a year with an associated value of $398 (Appendix A, Table 4). In addition, the trees store 514,746 lbs of carbon, with a yearly benefit of $3,861 (Appendix A, Table 5).

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. Solon receives $2,957 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, Solon's trees provide $11,163 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 93 trees in Solon provide approximately $120 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Solon has 19 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genus is as follows:

Maple	34	37% (Norway, Boxelder, Red, Silver, and Sugar)
Apple (Crabapple)	15	16%
Pear (Callery)	11	12%
Hackberry	10	11%
Ash	9	10% (Green & White)
Oak	5	5% or less for the rest below (Bur and Red)
Elm	3	(Siberian & Elm species)
American Basswood	2	
Eastern Redcedar	2	
Hickory	1	
Cottonwood	1	

Size Class

A little over half of Solon's public trees (50.5 %) are 12 inches and under in diameter at 4.5 ft (Appendix A, Figure 2). The remaining portion of the trees (35.5%) are between 12 and 24 inches, and (14%) are 24 inches and greater.

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 Solon indicate that 89% of the trees are in good health, with only 1% of the foliage in poor health (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 53% of Solon's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, or dead or dying is about 11% of the population.

Management Needs

- In (Appendix B, Figure 4) the specific management needs of the inventoried trees are identified. Management practices needed include crown cleaning, crown raising, crown reduction, and removal. The most common practice needed is crown raising above the street and sidewalks for safety clearance. City ordinance 151.03 DUTY TO TRIM TREES assigns that responsibility to adjacent property owners. There are 5 trees on the map listed for possible removal that should be evaluated as soon as possible to decide if they need to be removed and when. *City ownership of the trees recommended for removal should be verified prior to any removal* There are ~55 other trees on the map that need some work done within the next 3 years. The majority of the management is pruning such as raising branches above streets and sidewalks for safety.

Land Use and Location

The majority of Solon's city trees are in planting strips (75%) within single family residential neighborhoods (72 %), and the remaining trees (14%) are in the parks, (12.9%) small commercial areas, and (1.1 %) multi-family residential. (Appendix A, Figure 5 & Appendix A, Figure 6).

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 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

Solon has 5 trees that need to be considered for removal as soon as possible. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 5).

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

According to information provided to me by Solon, $5,000 has been budgeted for tree planting over the last two years. If some trees are removed in the next year consider replacing these trees at a minimum. It is recommended to plant 1 to 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 Solon.

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 15% 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 (37%) (Appendix A, Figure 1). Maples should not be planted on public property 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, boxelder, Chinese elm, evergreens as street trees, willow or black walnut, as outlined in section 151.02 of the city ordinance. All trees planted must meet the restrictions in city ordinance 151.02.

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. With many new potential tree health threats on the horizon attempt to monitor the health of all city owned trees on a regular basis.

Six Year Maintenance Plan with No Additional Funding

Year 1

Removal: 5 trees (@ estimate $600/tree) with the highest concern that have been identified
Planting and Replacement: 10 to 15 trees (@ $50 to $150/tree) planted in open locations
Visual Survey for signs and symptoms of EAB
Routine trimming: Prune a portion of park trees

Year 2

Removal: Removal of any new critical concern trees and ash in poor health as budget permits
Planting and Replacement: 5 to 15 trees planted in open locations
Visual Survey for signs and symptoms of EAB

Year 3
Removal: Removal of any new critical concern trees and ash in poor health as budget permits
Planting and Replacement: 5 to 15 trees planted in open locations
Routine trimming: Prune a portion of park trees
Visual Survey for signs and symptoms of EAB

Year 4
Removal: Removal of any new critical concern trees and ash in poor health as budget permits
Planting and Replacement: 5 to 15 trees planted in open locations
Visual Survey for signs and symptoms of EAB

Year 5
Removal: Removal of any new critical concern trees and ash in poor health as budget permits
Routine trimming: Prune a portion of park trees
Visual Survey for signs and symptoms of EAB

Year 6
Removal: Removal of any new critical concern trees and ash in poor health as budget permits
Planting and Replacement: 5 to 15 trees planted in open locations
Visual Survey for signs and symptoms of EAB

EAB could potentially kill all ash within 4 years of its arrival. It would take approximately 1.6 years to remove all ash (8) at $600/tree with the current budget ($3,000 removal).

Emerald Ash Borer Plan

Ash Tree Removal

There is only one ash tree at this point that needs to be evaluated for removal. After that tree removal will be prioritized with dead, dying, hazardous trees to be removed first. *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

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

A regulated article under the USDA's quarantine includes any of the following items:
- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash

• any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

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

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the ash 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 should be replaced. All trees will meet the restrictions in city ordinance 151.02. The new plantings will be a diverse mix and will not include ash, maple at this time, cottonwood, poplar, box elder, Chinese elm, evergreens along the streets, 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 151.05 and 151.06 states "**151.05 DISEASE CONTROL.** Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL.

The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that 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 fourteen (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

Over the last two years the tree budget has been:

Removal: $3,000
Planting: $5,000

EAB could potentially kill all ash within 4 to 10 years of its arrival. It would take approximately 1.6 years to remove all ash (8) at $600/tree with the current budget.

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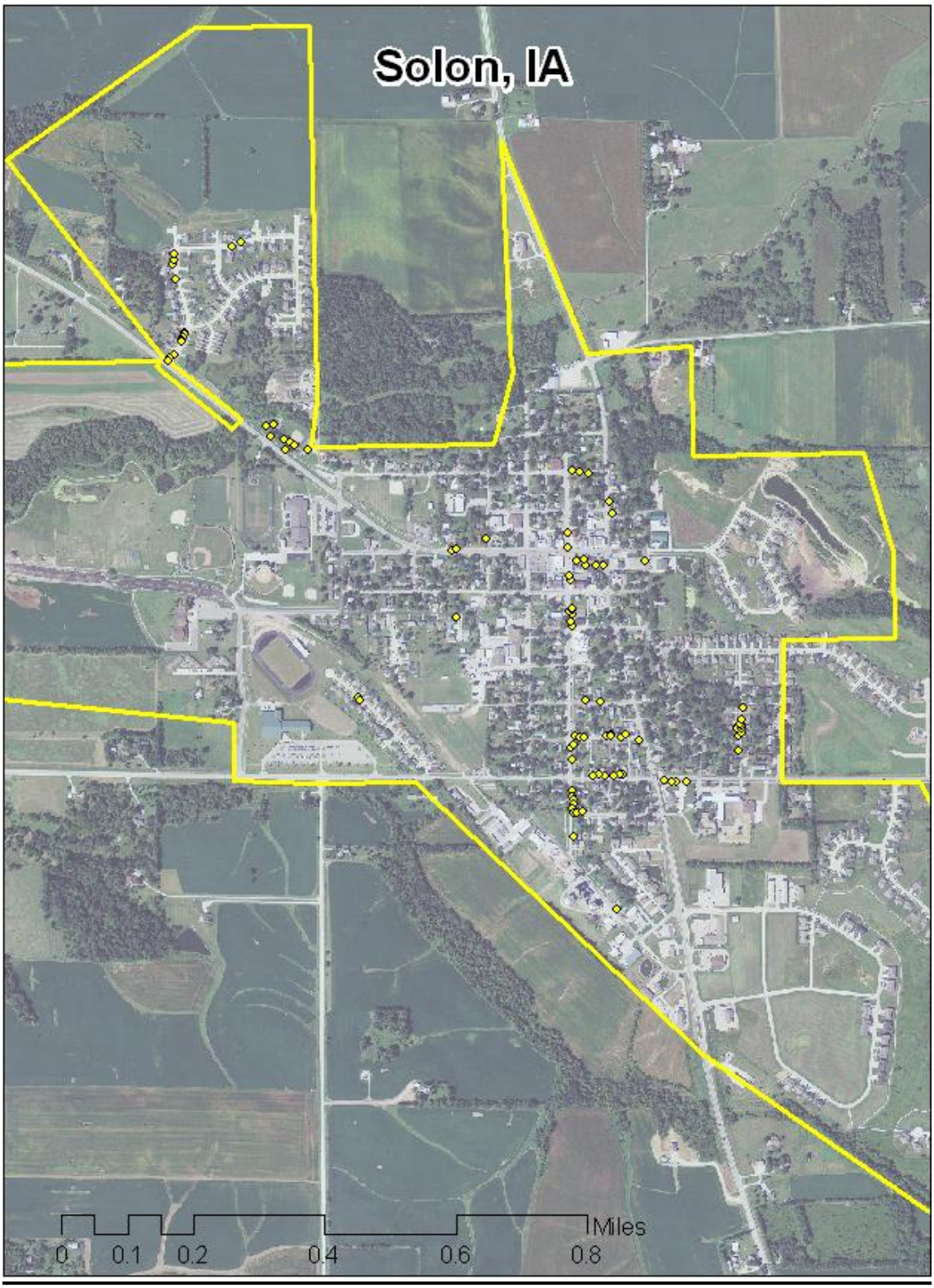


All trees inventoried during fall of 2010

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

12/6/2010

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	0.6	43	85.0	83	127	(N/A)	16.1	3.9	8.45
Callery pear	0.6	42	89.3	87	130	(N/A)	11.8	3.9	11.78
Norway maple	1.7	130	237.8	233	364	(N/A)	10.8	11.1	36.35
Northern hackberry	3.5	263	487.4	478	740	(N/A)	10.8	22.5	74.03
Sugar maple	1.8	140	242.4	238	377	(N/A)	8.6	11.5	47.14
Green ash	1.1	86	150.7	148	234	(N/A)	8.6	7.1	29.27
Maple	0.2	12	24.7	24	37	(N/A)	6.5	1.1	6.09
Silver maple	1.5	112	196.1	192	305	(N/A)	5.4	9.3	60.93
Boxelder	0.3	23	44.8	44	67	(N/A)	3.2	2.1	22.45
Bur oak	1.3	96	171.6	168	264	(N/A)	3.2	8.0	88.02
Red maple	0.1	9	17.2	17	26	(N/A)	2.2	0.8	12.80
Eastern red cedar	0.2	17	32.9	32	49	(N/A)	2.2	1.5	24.57
Northern red oak	0.2	18	28.7	28	46	(N/A)	2.2	1.4	22.98
American basswood	0.5	41	81.1	80	121	(N/A)	2.2	3.7	60.35
Siberian elm	0.8	63	108.8	107	170	(N/A)	2.2	5.2	84.75
Hickory	0.3	20	38.1	37	57	(N/A)	1.1	1.7	57.32
White ash	0.1	7	13.3	13	20	(N/A)	1.1	0.6	20.10
Cottonwood	0.5	37	63.1	62	99	(N/A)	1.1	3.0	98.63
Elm	0.3	20	38.1	37	57	(N/A)	1.1	1.7	57.32
Other street trees	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	15.5	1,180	2,151.2	2,108	3,288	(N/A)	100.0	100.0	35.36

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

12/6/2010

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	2,005	54	(N/A)	16.1	1.4	3.62
Callery pear	2,758	75	(N/A)	11.8	1.9	6.80
Norway maple	11,941	324	(N/A)	10.8	8.2	32.36
Northern hackberry	31,117	843	(N/A)	10.8	21.3	84.33
Sugar maple	14,512	393	(N/A)	8.6	9.9	49.16
Green ash	8,124	220	(N/A)	8.6	5.6	27.52
Maple	809	22	(N/A)	6.5	0.6	3.66
Silver maple	18,291	496	(N/A)	5.4	12.5	99.14
Boxelder	2,159	59	(N/A)	3.2	1.5	19.51
Bur oak	19,967	541	(N/A)	3.2	13.7	180.38
Red maple	637	17	(N/A)	2.2	0.4	8.63
Eastern red cedar	3,269	89	(N/A)	2.2	2.2	44.30
Northern red oak	1,361	37	(N/A)	2.2	0.9	18.44
American basswood	5,417	147	(N/A)	2.2	3.7	73.41
Siberian elm	10,710	290	(N/A)	2.2	7.3	145.12
Hickory	2,591	70	(N/A)	1.1	1.8	70.21
White ash	614	17	(N/A)	1.1	0.4	16.63
Cottonwood	7,238	196	(N/A)	1.1	5.0	196.17
Elm	2,591	70	(N/A)	1.1	1.8	70.21
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	146,110	3,960	(N/A)	100.0	100.0	42.58

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

12/6/2010

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
Apple	0.5	0.1	0.3	0.0	3	2.8	0.4	0.4	2.6	17	0.0	0	7.0	20	(N/A)	16.1	1.33
Callery pear	0.2	0.0	0.2	0.0	1	2.8	0.4	0.4	2.5	17	-0.1	0	6.4	18	(N/A)	11.8	1.63
Norway maple	2.0	0.3	1.0	0.1	11	8.2	1.2	1.1	7.8	51	-0.5	-2	21.3	60	(N/A)	10.8	6.03
Northern hackberry	5.1	0.9	2.6	0.2	28	16.7	2.4	2.3	15.7	103	0.0	0	45.9	131	(N/A)	10.8	13.12
Sugar maple	1.6	0.3	0.9	0.1	9	8.7	1.3	1.2	8.3	54	-1.3	-5	21.0	58	(N/A)	8.6	7.27
Green ash	0.6	0.1	0.4	0.0	3	5.4	0.8	0.8	5.2	34	0.0	0	13.2	37	(N/A)	8.6	4.63
Maple	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.7	5	0.0	0	1.9	5	(N/A)	6.5	0.88
Silver maple	2.7	0.5	1.4	0.1	15	7.0	1.0	1.0	6.7	44	-1.5	-6	18.8	53	(N/A)	5.4	10.56
Boxelder	0.2	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	-0.1	0	3.5	10	(N/A)	3.2	3.26
Bur oak	3.1	0.5	1.4	0.1	16	6.0	0.9	0.8	5.7	38	0.0	0	18.6	54	(N/A)	3.2	17.93
Red maple	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	2.2	1.88
Eastern red cedar	0.7	0.1	0.5	0.1	4	1.1	0.2	0.1	1.0	7	-1.8	-7	2.0	4	(N/A)	2.2	2.19
Northern red oak	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.3	-1	2.5	7	(N/A)	2.2	3.47
American basswood	0.7	0.1	0.3	0.0	4	2.7	0.4	0.4	2.5	16	-0.6	-2	6.4	18	(N/A)	2.2	8.90
Siberian elm	2.2	0.4	1.0	0.1	12	3.9	0.6	0.5	3.8	24	0.0	0	12.5	36	(N/A)	2.2	18.04
Hickory	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	1.1	9.34
White ash	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	0.0	0	1.0	3	(N/A)	1.1	2.91
Cottonwood	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23	(N/A)	1.1	22.55
Elm	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	1.1	9.34
Other street trees	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.0	0.00
Citywide total	21.9	3.7	11.2	1.0	120	74.4	10.8	10.3	70.5	463	-6.3	-24	197.7	559	(N/A)	100.0	6.01

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees by Species

12/6/2010

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	8,206	62	(N/A)	16.1	1.6	4.10
Callery pear	4,646	35	(N/A)	11.8	0.9	3.17
Norway maple	32,824	246	(N/A)	10.8	6.4	24.62
Northern	76,906	577	(N/A)	10.8	14.9	57.68
Sugar maple	43,754	328	(N/A)	8.6	8.5	41.02
Green ash	20,125	151	(N/A)	8.6	3.9	18.87
Maple	1,386	10	(N/A)	6.5	0.3	1.73
Silver maple	61,134	459	(N/A)	5.4	11.9	91.70
Boxelder	3,302	25	(N/A)	3.2	0.6	8.26
Bur oak	104,460	783	(N/A)	3.2	20.3	261.15
Red maple	1,118	8	(N/A)	2.2	0.2	4.19
Eastern red cedar	2,204	17	(N/A)	2.2	0.4	8.27
Northern red oak	3,782	28	(N/A)	2.2	0.7	14.18
American	23,457	176	(N/A)	2.2	4.6	87.96
Siberian elm	53,509	401	(N/A)	2.2	10.4	200.66
Hickory	8,458	63	(N/A)	1.1	1.6	63.43
White ash	1,035	8	(N/A)	1.1	0.2	7.76
Cottonwood	55,982	420	(N/A)	1.1	10.9	419.86
Elm	8,458	63	(N/A)	1.1	1.6	63.43
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	514,746	3,861	(N/A)	100.0	100.0	41.51

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

12/6/2010

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	888	7	-39	-3	0	959	7	1,804	14	(N/A)	16.1	3.4	0.90
Callery pear	1,256	9	-22	-2	0	929	7	2,161	16	(N/A)	11.8	4.1	1.47
Norway maple	3,033	23	-158	-2	-1	2,884	22	5,757	43	(N/A)	10.8	10.8	4.32
Northern hackberry	4,204	32	-369	-2	-3	5,803	44	9,636	72	(N/A)	10.8	18.1	7.23
Sugar maple	3,196	24	-210	-2	-2	3,086	23	6,070	46	(N/A)	8.6	11.4	5.69
Green ash	2,460	18	-97	-2	-1	1,911	14	4,272	32	(N/A)	8.6	8.0	4.01
Maple	215	2	-7	-1	0	273	2	481	4	(N/A)	6.5	0.9	0.60
Silver maple	5,291	40	-293	-1	-2	2,485	19	7,482	56	(N/A)	5.4	14.1	11.22
Boxelder	542	4	-16	-1	0	519	4	1,045	8	(N/A)	3.2	2.0	2.61
Bur oak	2,784	21	-501	-1	-4	2,119	16	4,401	33	(N/A)	3.2	8.3	11.00
Red maple	168	1	-5	0	0	192	1	355	3	(N/A)	2.2	0.7	1.33
Eastern red cedar	43	0	-11	0	0	374	3	406	3	(N/A)	2.2	0.8	1.52
Northern red oak	336	3	-18	0	0	393	3	711	5	(N/A)	2.2	1.3	2.67
American basswood	1,522	11	-113	0	-1	910	7	2,319	17	(N/A)	2.2	4.4	8.70
Siberian elm	1,623	12	-257	0	-2	1,390	10	2,756	21	(N/A)	2.2	5.2	10.33
Hickory	660	5	-41	0	0	441	3	1,060	8	(N/A)	1.1	2.0	7.95
White ash	182	1	-5	0	0	156	1	332	2	(N/A)	1.1	0.6	2.49
Cottonwood	479	4	-269	0	-2	813	6	1,023	8	(N/A)	1.1	1.9	7.67
Elm	660	5	-41	0	0	441	3	1,060	8	(N/A)	1.1	2.0	7.95
Other street trees	0	0	0	0	0	0	0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	29,541	222	-2,471	-18	-19	26,078	196	53,130	398	(N/A)	100.0	100.0	4.28

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

12/6/2010

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	46	(N/A)	16.1	1.6	3.08
Callery pear	161	(N/A)	11.8	5.5	14.68
Norway maple	311	(N/A)	10.8	10.5	31.08
Northern hackberry	571	(N/A)	10.8	19.3	57.14
Sugar maple	374	(N/A)	8.6	12.7	46.78
Green ash	278	(N/A)	8.6	9.4	34.79
Maple	37	(N/A)	6.5	1.3	6.21
Silver maple	443	(N/A)	5.4	15.0	88.65
Boxelder	81	(N/A)	3.2	2.8	27.10
Bur oak	183	(N/A)	3.2	6.2	61.09
Red maple	30	(N/A)	2.2	1.0	14.94
Eastern red cedar	14	(N/A)	2.2	0.5	6.84
Northern red oak	31	(N/A)	2.2	1.1	15.65
American basswood	117	(N/A)	2.2	4.0	58.63
Siberian elm	100	(N/A)	2.2	3.4	50.02
Hickory	58	(N/A)	1.1	2.0	57.69
White ash	33	(N/A)	1.1	1.1	33.42
Cottonwood	29	(N/A)	1.1	1.0	28.57
Elm	58	(N/A)	1.1	2.0	57.69
Other street trees	0	(±NaN)	0.0	0.0	0.00
Citywide total	2,957	(N/A)	100.0	100.0	31.80

Table 7: Summary of Benefits in Dollars

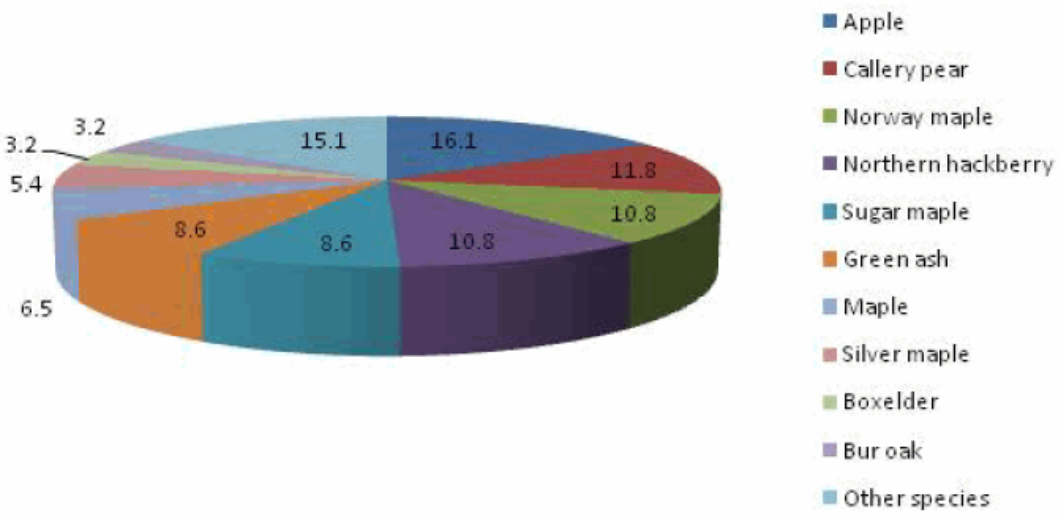
Total Annual Benefits of Public Trees by Species ($)

12/6/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Apple	127	14	20	54	46	261	(±0)	2.3
Callery pear	130	16	18	75	161	400	(±0)	3.6
Norway maple	364	43	60	324	311	1,101	(±0)	9.9
Northern hackberry	740	72	131	843	571	2,358	(±0)	21.1
Sugar maple	377	46	58	393	374	1,248	(±0)	11.2
Green ash	234	32	37	220	278	802	(±0)	7.2
Maple	37	4	5	22	37	105	(±0)	0.9
Silver maple	305	56	53	496	443	1,353	(±0)	12.1
Boxelder	67	8	10	59	81	225	(±0)	2.0
Bur oak	264	33	54	541	183	1,075	(±0)	9.6
Red maple	26	3	4	17	30	79	(±0)	0.7
Eastern red cedar	49	3	4	89	14	159	(±0)	1.4
Northern red oak	46	5	7	37	31	126	(±0)	1.1
American basswood	121	17	18	147	117	420	(±0)	3.8
Siberian elm	170	21	36	290	100	617	(±0)	5.5
Hickory	57	8	9	70	58	203	(±0)	1.8
White ash	20	2	3	17	33	76	(±0)	0.7
Cottonwood	99	8	23	196	29	354	(±0)	3.2
Elm	57	8	9	70	58	203	(±0)	1.8
Other street trees	0	0	0	0	0	0	(±0)	0.0
Citywide Total	3,288	398	559	3,960	2,957	11,163	(±0)	100.0

Species Distribution of Public Trees (%)

12/6/2010

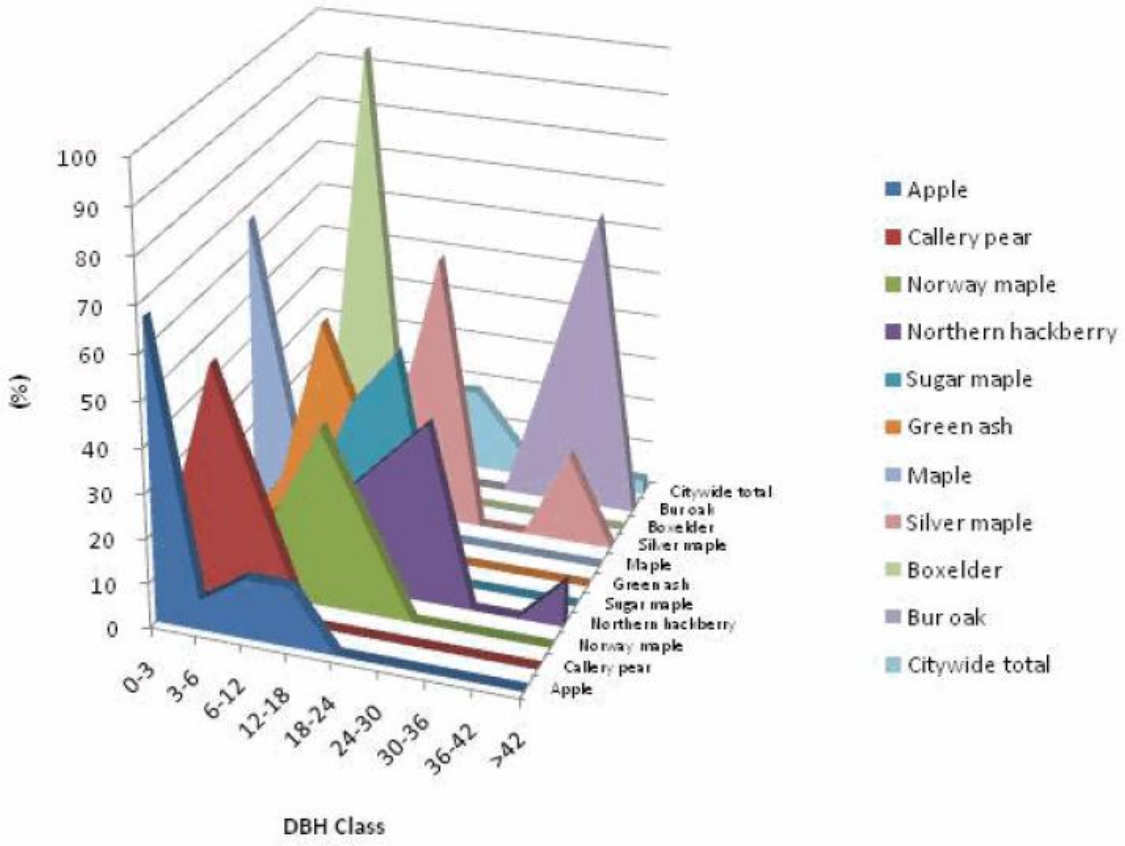


Species	Percent
Apple	16.1
Callery pear	11.8
Norway maple	10.8
Northern hackberry	10.8
Sugar maple	8.6
Green ash	8.6
Maple	6.5
Silver maple	5.4
Boxelder	3.2
Bur oak	3.2
Other species	15.1
Total	100.0

Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)

12/6/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Apple	66.7	6.7	13.3	13.3	0.0	0.0	0.0	0.0	0.0
Callery pear	18.2	54.5	27.3	0.0	0.0	0.0	0.0	0.0	0.0
Norway maple	10.0	10.0	20.0	40.0	20.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	20.0	30.0	40.0	0.0	0.0	10.0
Sugar maple	0.0	0.0	12.5	37.5	50.0	0.0	0.0	0.0	0.0
Green ash	0.0	12.5	50.0	25.0	12.5	0.0	0.0	0.0	0.0
Maple	66.7	16.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Silver maple	0.0	0.0	0.0	20.0	60.0	0.0	0.0	20.0	0.0
Boxelder	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Bur oak	0.0	0.0	0.0	0.0	0.0	0.0	33.3	66.7	0.0
Citywide total	19.4	11.8	19.4	17.2	18.3	6.5	1.1	3.2	3.2

Figure 2: Relative Age Class

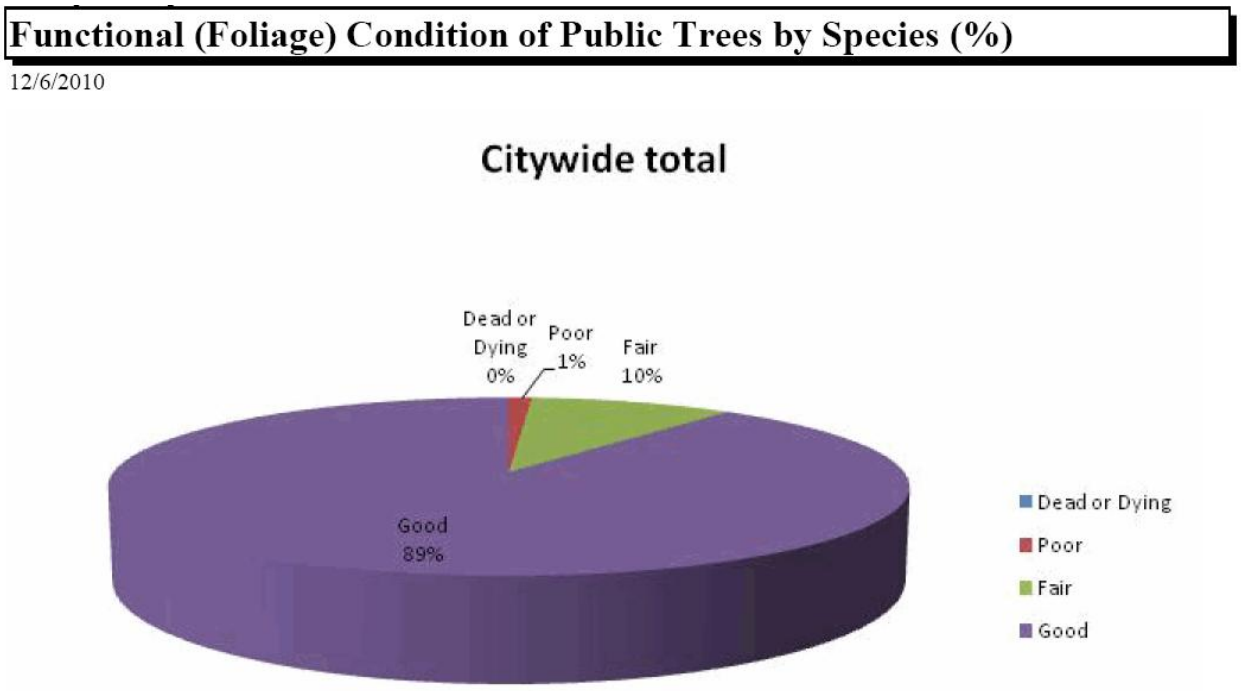


Figure 3: Foliage Condition

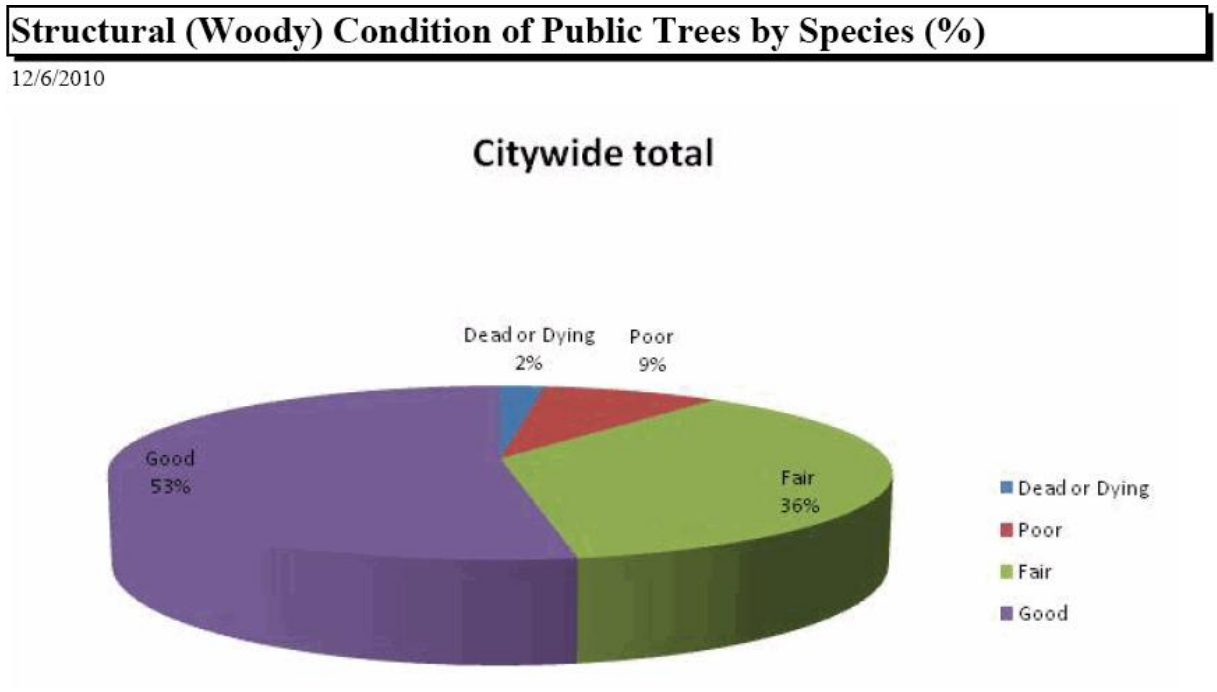
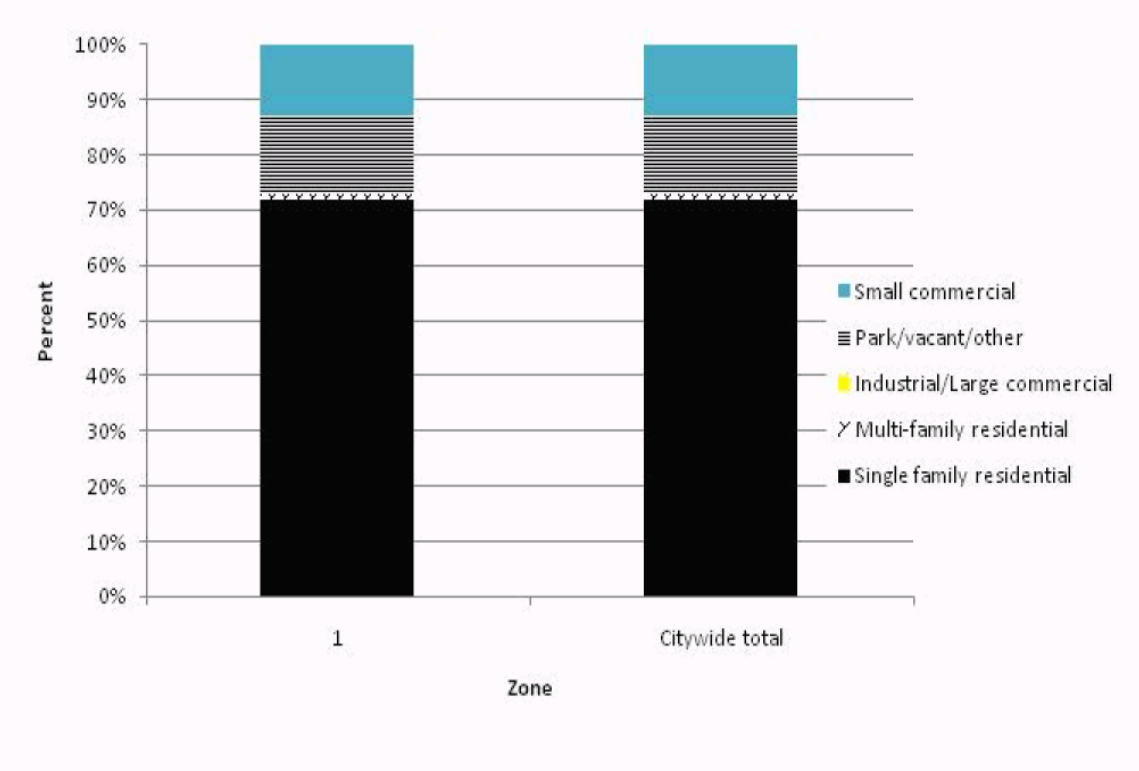


Figure 4: Wood Condition

Land Use of Public Trees by Zone (%)

12/6/2010

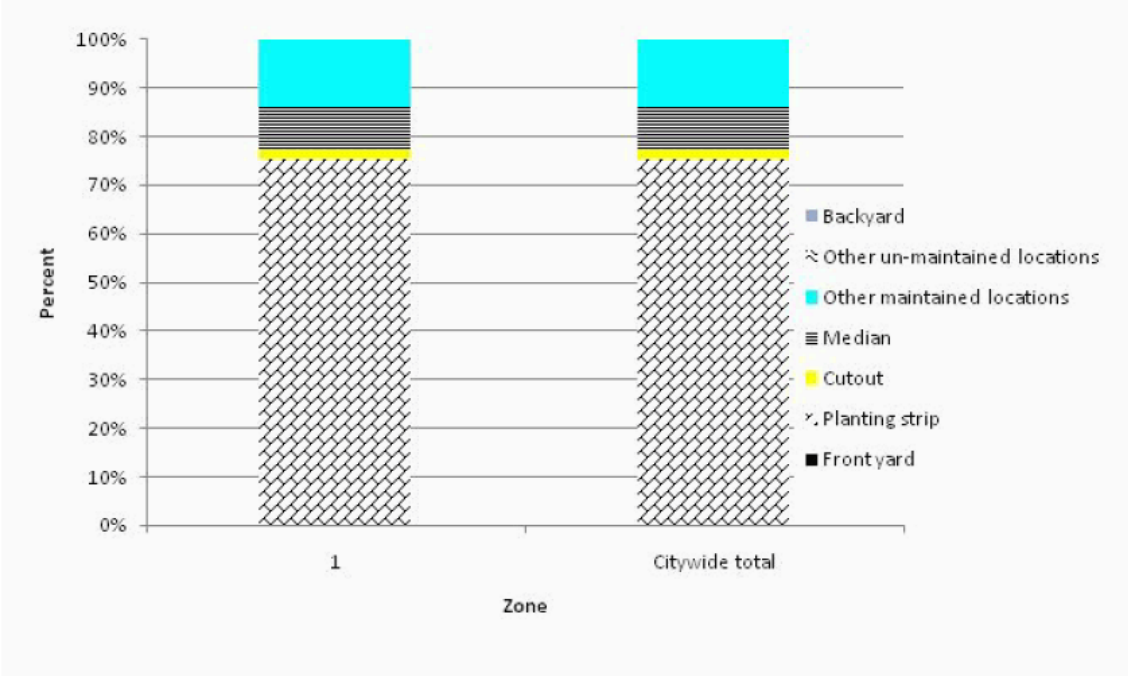


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	72.0	1.1	0.0	14.0	12.9
Citywide total	72.0	1.1	0.0	14.0	12.9

Figure 5: Land Use of city/park trees

Location of Public Trees by Zone (%)

12/6/2010



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	0.0	75.3	2.2	8.6	14.0	0.0	0.0
Citywide total	0.0	75.3	2.2	8.6	14.0	0.0	0.0

Figure 6: Location of city/park trees

Appendix B: ArcGIS Mapping

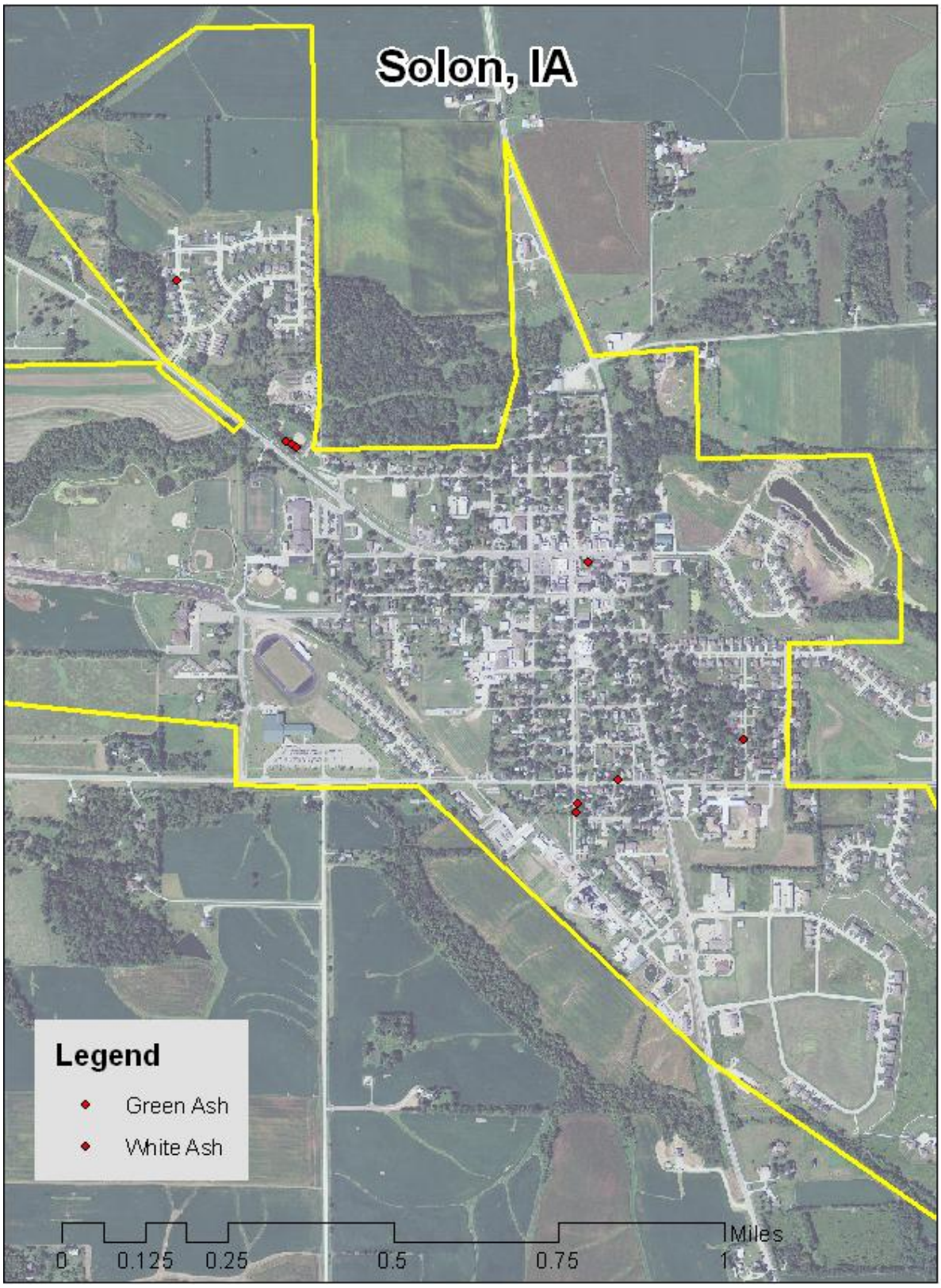


Figure 1: Location of Ash Trees

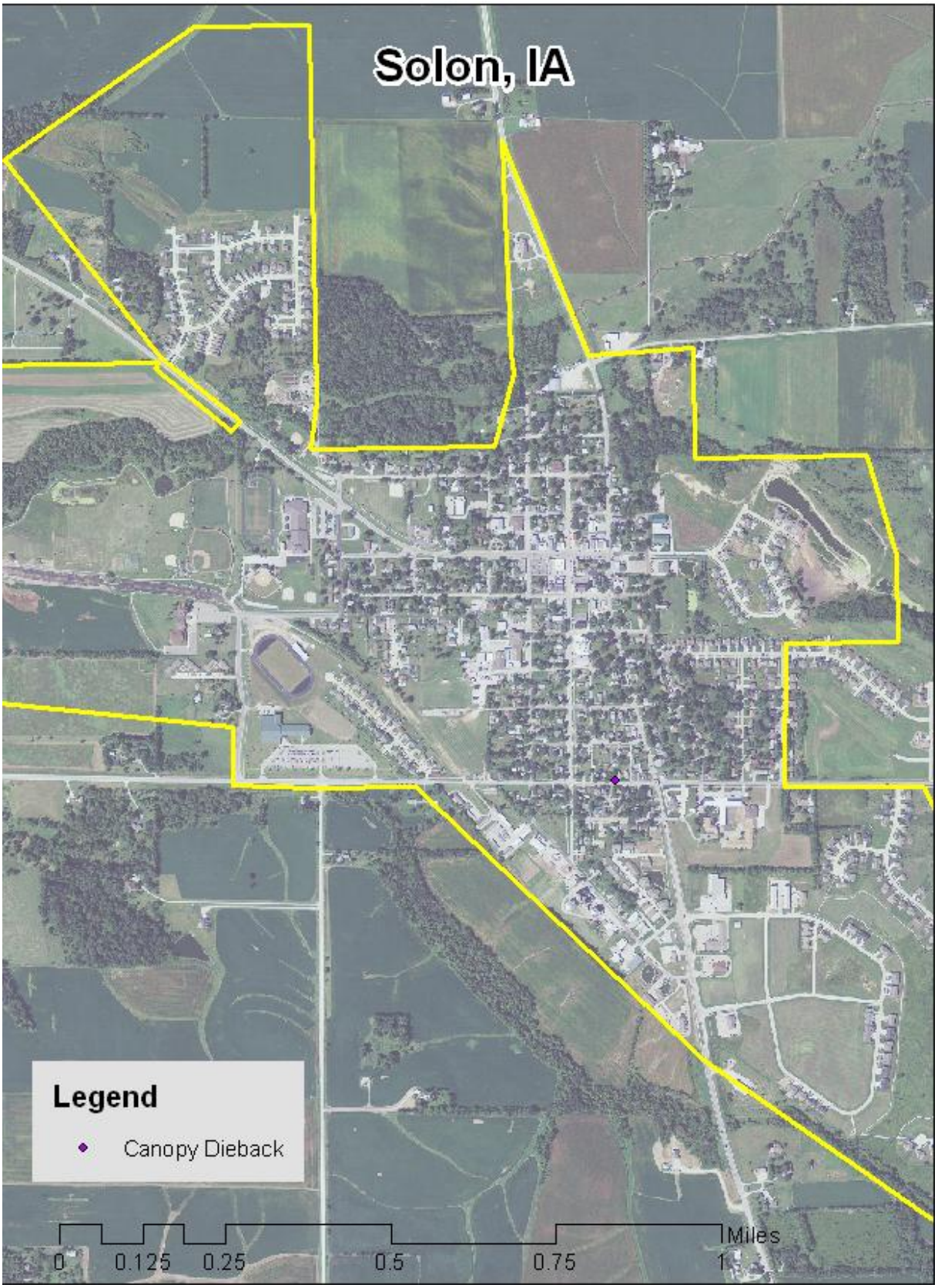


Figure 2: Location of EAB symptoms

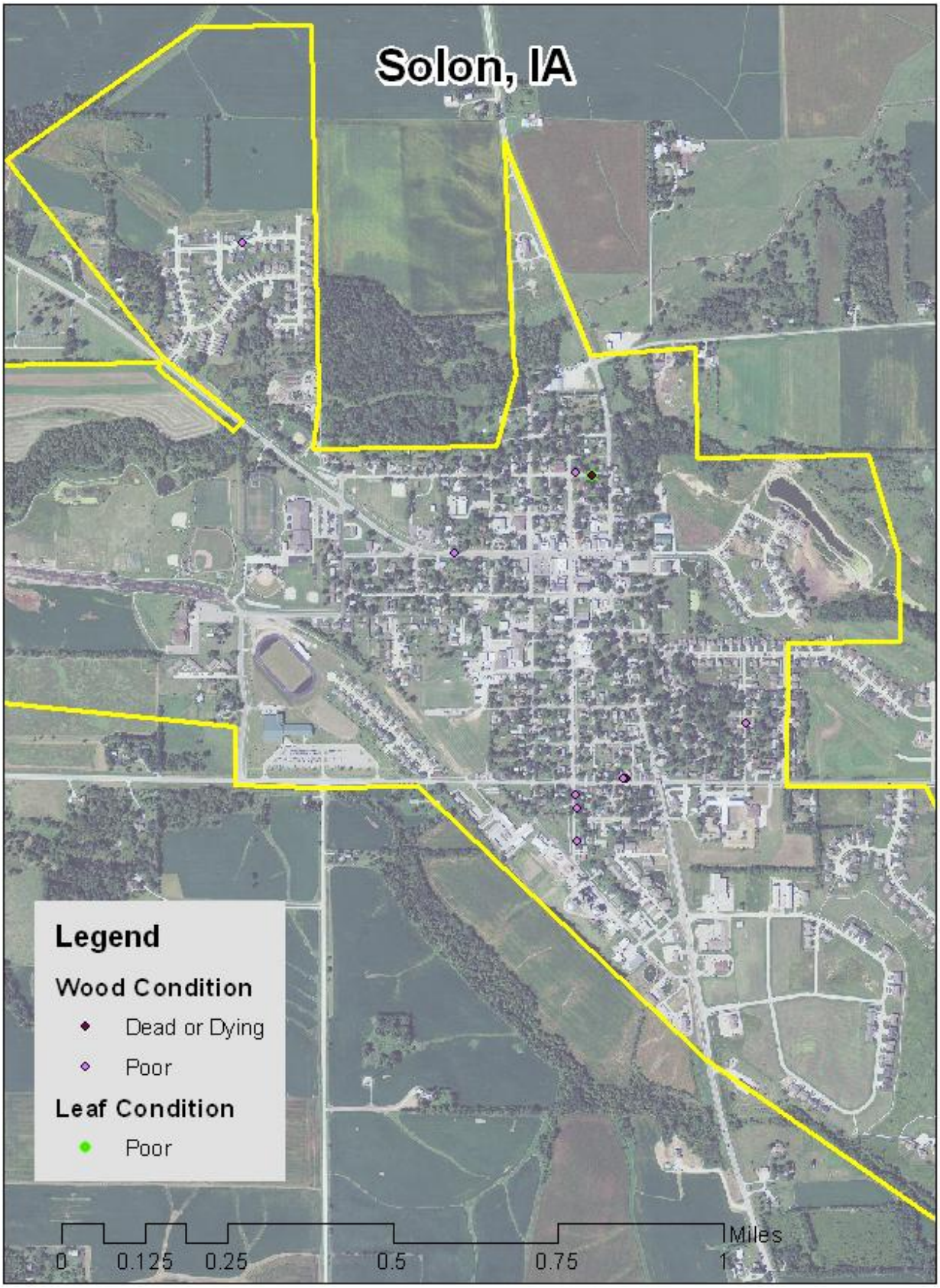


Figure 3: Location of Poor Condition Trees

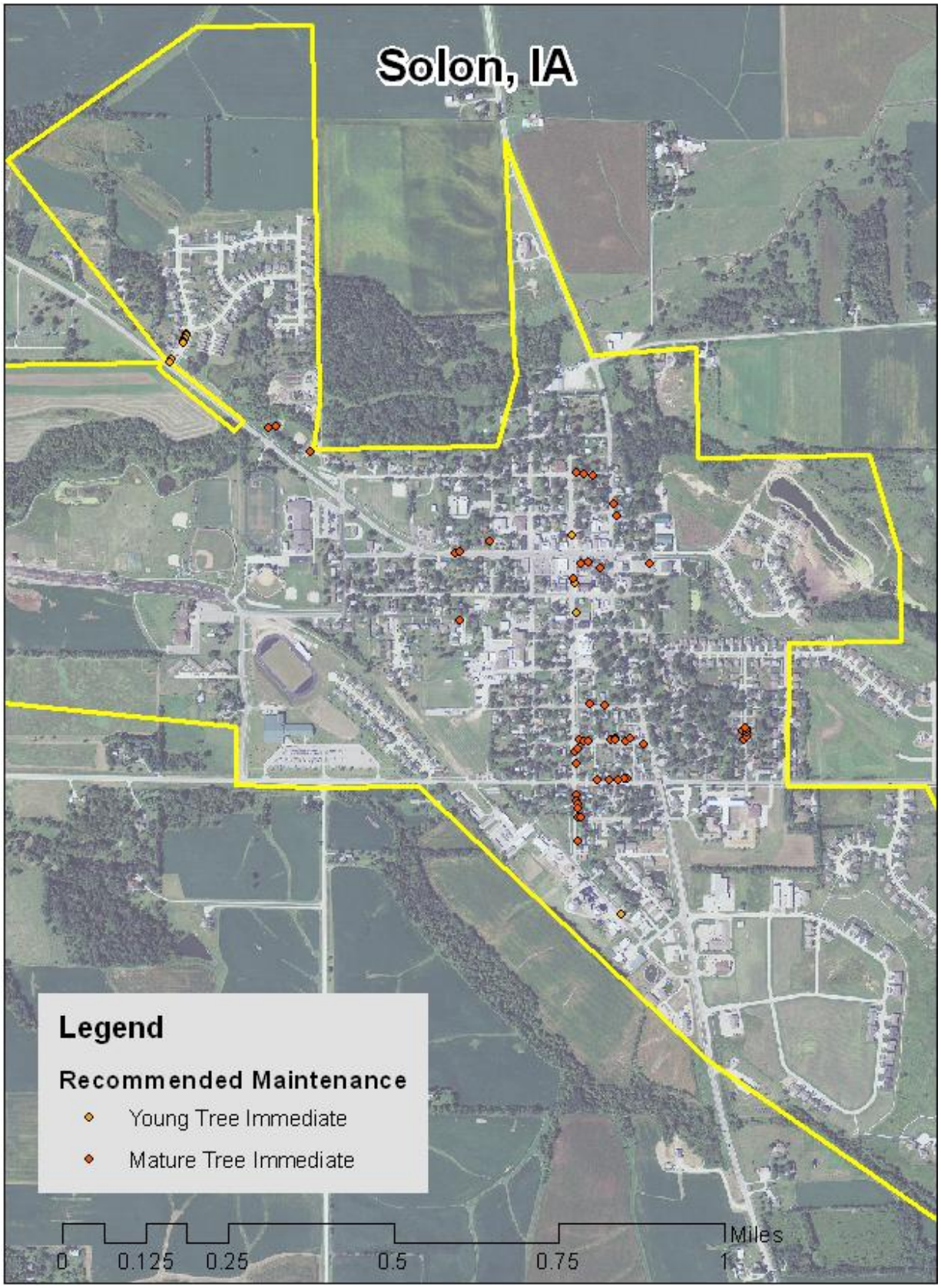


Figure 4: Location of Trees with Recommended Maintenance

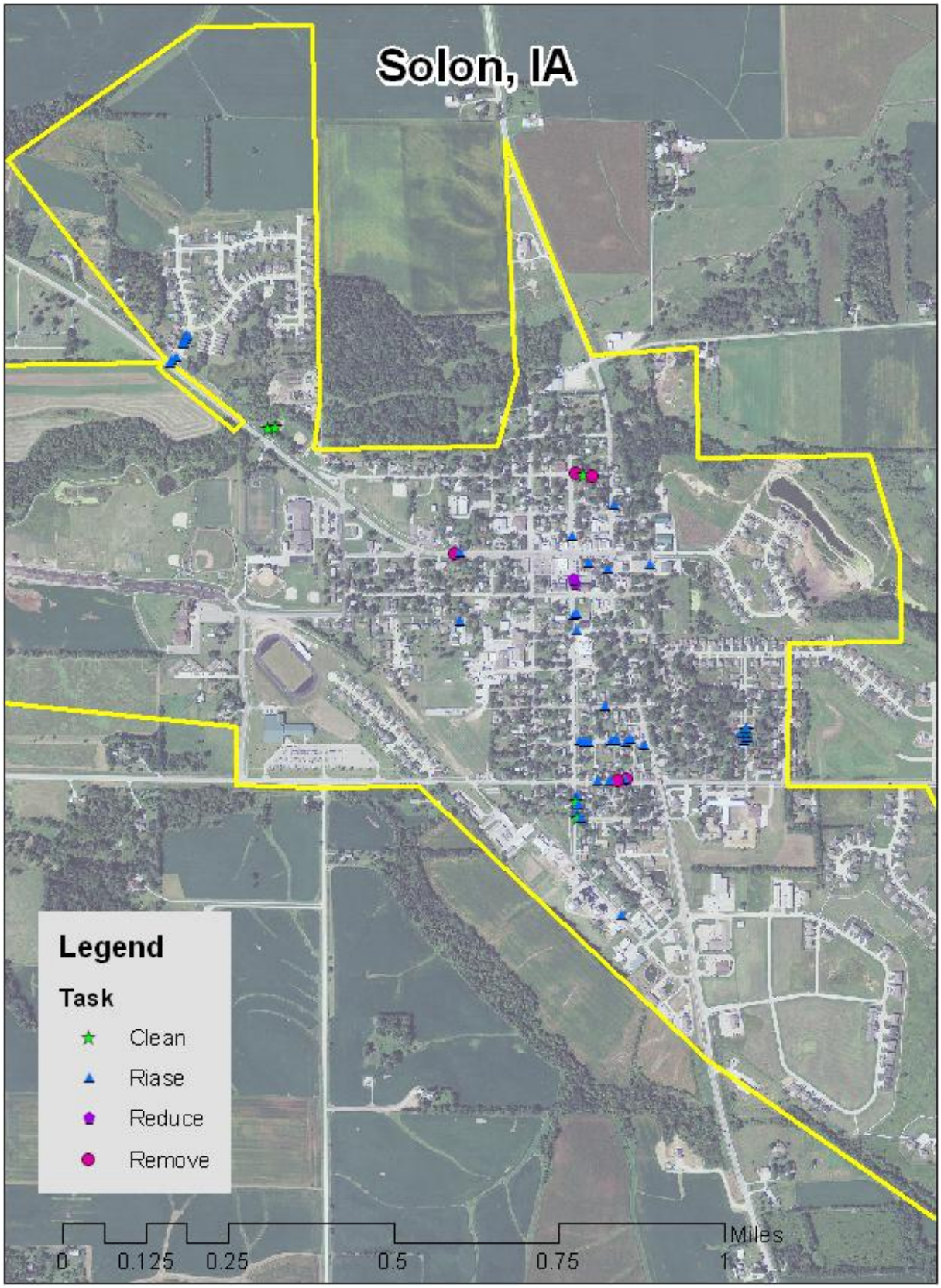


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Tree City USA

There has been some indication that Solon is interested in potentially becoming a Tree City U.S.A. To qualify as a Tree City USA community, a town or city must meet four standards established by The Arbor Day Foundation and the National Association of State Foresters.

1. A Tree Board or Department
2. A Tree Care Ordinance
3. A Community Forestry Program With an Annual Budget of at Least $2 Per Capita
4. An Arbor Day Observance and Proclamation

If your community is interested in more information on this program please contact Mark Vitosh, Iowa DNR District Forester at 319-351-8886 or Mark.Vitosh@dnr.iowa.gov.