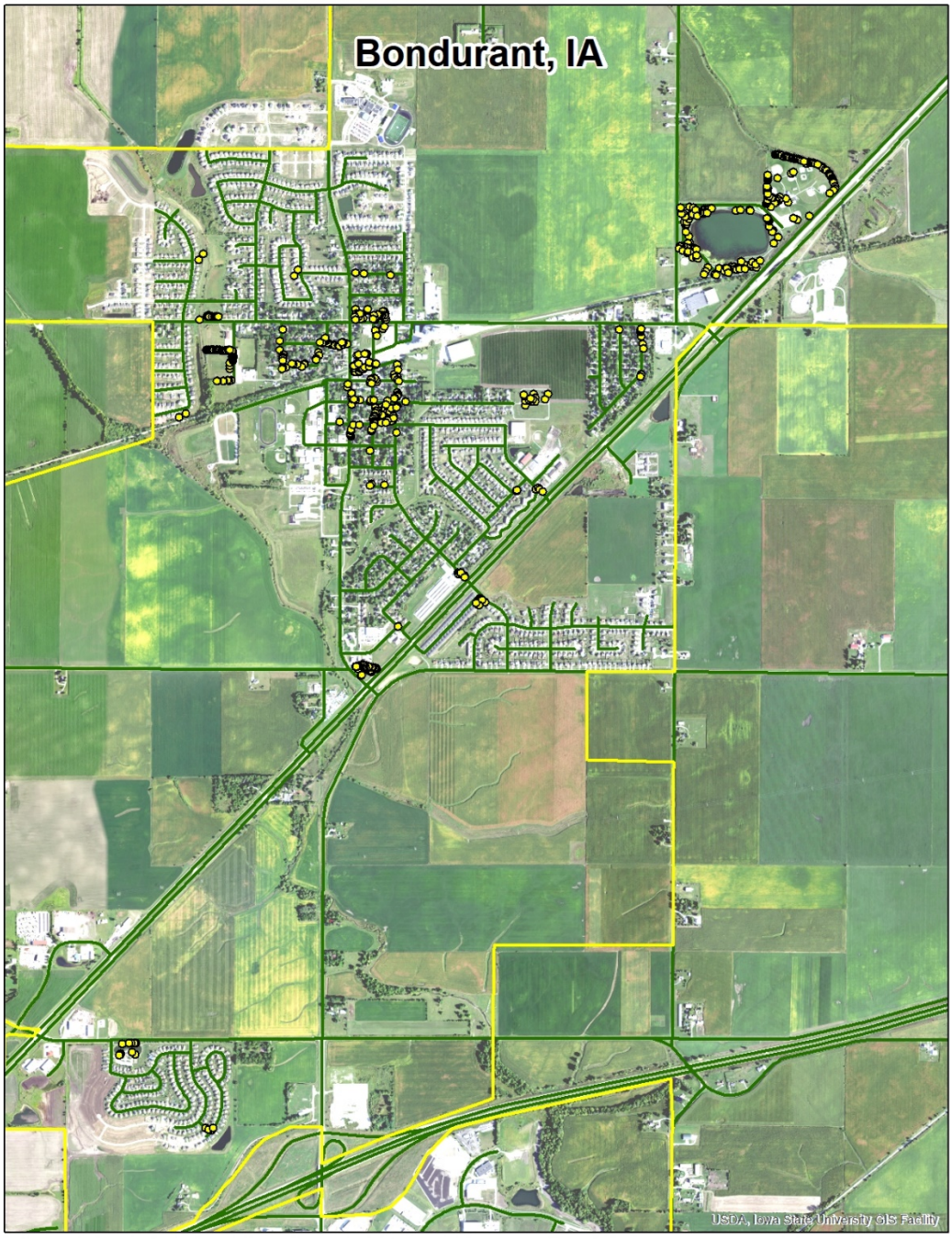
Bondurant, IA



2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Bondurant 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 9% of Bondurant's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2020, 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 541 trees inventoried.

- Bondurant's trees provide $52,302 of benefits annually, an average of $96.67 a tree
- There are over 52 species of trees from 29 different genera.
- The top three genera are: Maple 21%, Apple 11%, and Catalpa 9%
- 18% of trees are in need of some type of management
- 45 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 45 trees needing removal, 7 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*
- 28 of the 49 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly

Introduction

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

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

Inventory

In 2020, 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 541 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Bondurant's trees reduce energy related costs by approximately $14,747 annually (Appendix A, Table 1). These savings are both in Electricity (70.5 MWh) and in Natural Gas (9,588 Therms).

Annual Stormwater Benefits

Bondurant's trees intercept about 664,983gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $18,021 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 Bondurant, it is estimated that trees remove 853.1 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 $2,375 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Bondurant, trees sequester about 148,340 lbs of carbon a year with an associated value of $1,113 (Appendix A, Table 5). In addition, the trees store 2,028,994 lbs of carbon, with a yearly benefit of $15,217 (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. Bondurant receives $15,239 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, Bondurant's trees provide $52,302 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 541 trees in Bondurant provide approximately $96.68 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

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

Genus	Count	Percent
Maple	111	21%
Apple	61	11%
Catalpa	51	9%
Ash	49	9%
Oak	38	7%
Spruce	35	6%
Broadleaf Deciduous S/M/L	27	5%
Pine	27	5%
Elm	19	4%
Cedar	18	3%
Pear	17	3%
Sycamore	13	2%
Cottonwood	13	2%
Hackberry	9	2%
Birch	8	1%
Conifer Evergreen S/M/L	7	1%
Walnut	6	1%
Locust	6	1%
Basswood	6	1%
Willow	4	1%
Broadleaf Evergreen S/M/L	3	1%
Mulberry	3	1%
Alder	2	0%
Redbud	2	0%
Kentucky Coffeetree	2	0%
Cherry/Plum	1	0%
Lilac	1	0%
Aspen	1	0%
Sumac	1	0%

Age Class

Most of Bondurant's trees (43%) are between 6 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Bondurant'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 Bondurant indicate that 72% of the trees are in good health, with only 11% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 46% of Bondurant'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 14% of the population. This 14% 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	36	7%
Crown Raising	6	1%
Tree Staking	1	2%
Tree Removal	45	8%
Crown Reduction	2	<1%
Treat Pest/Disease	7	1%

Canopy Cover

The total canopy with both private and public trees is 4%, 227.64 acres. The canopy cover included in the Bondurant inventory includes approximately 7.29 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal, it is estimated that 392 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Bondurant'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	21%
Park/vacant/other	74%
Small commercial	3%
Multifamily residential	2%

Location	
Planting strip	25%
Front yard	75%

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

Bondurant has 7 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 2 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 immediate maintenance. There are a total of 18 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 45 removals, 10 are ash trees. There are a total of 49 ash trees, and 28 of those have at least 2 signs and symptoms that have been associated with EAB. In addition, there are 12 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Bondurant.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (21%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. At this time the ordiance does not allow planting in the right-of-way. The city should consider investing in street tree infrastructure. Trees in the city rights-of-way are an important tool to reduce stormwater infrastructure, lengthening the life of street pavement, slowing traffic, and much more. A city implemented program allows a more strategic and equitable access to these benefits.

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. Please refer to the example budget for the proposed maintenance schedule.

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. We encourage the ordinance restrictions be reviewed to provide equitable tree planting.

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 151.05 states "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."

Example Budget and Maintence Schedule

Current Budget

Total $78,000 over 6 years **($13,000/year)** this budget would include removal of all ash and other species marked for removal over the next 6 years. There are 7 ash trees that might be candidates for treatment and example of those changes are under the budget.

FY 2021 Budget

Removal: $10,500 (15)
Planting: $1,800 (18)
Young Tree Watering & Maintenance: $700
- Need changes or additional funds if treating healthy ash (7 good condition trees)

FY 2022 Budget

Removal: $9,100 (13)
Planting: $1,600 (16)
Routine trimming: $1,800
Young Tree Watering & Maintenance: $500

FY 2023 Budget

Removal: $10,500 (15)
Planting: $1,800 (18)
Young Tree Watering & Maintenance: $700
- Need changes or additional funds if treating healthy ash (7 good condition trees)

FY 2024 Budget

Removal: $9,100 (13)
Planting: $1,600 (16)
Routine trimming: $1,800
Young Tree Watering & Maintenance: $500

FY 2025 Budget

Removal: $10,500 (15)
Planting: $1,800 (18)
Young Tree Watering & Maintenance: $700
- Need changes or additional funds if treating healthy ash (7 good condition trees)

FY 2026 Budget

Removal: $9,100 (13)
Planting: $1,600 (16)
Routine trimming: $1,800
Young Tree Watering & Maintenance: $500

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at $15 per inch, there are only 7 treatable trees, it would cost approximately $2,100 for treatment every 2 years. The cost of removal of those 7 trees would be a one-time cost of $4,900.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Bondurant

Annual Energy Benefits of Public Trees

8/27/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	6.0	458	903.0	885	1,343	(N/A)	11.3	9.1	22.02
Catalpa	4.7	355	646.4	633	988	(N/A)	9.4	6.7	19.38
Green ash	8.0	608	1,059.9	1,039	1,646	(N/A)	7.4	11.2	41.16
Silver maple	9.6	729	1,265.4	1,240	1,969	(N/A)	6.3	13.4	57.92
Scotch pine	2.8	216	321.9	315	531	(N/A)	4.1	3.6	24.14
Swamp white oak	0.8	61	129.4	127	188	(N/A)	3.9	1.3	8.93
Spruce	1.1	86	163.5	160	246	(N/A)	3.9	1.7	11.74
Sugar maple	3.2	240	416.1	408	648	(N/A)	3.7	4.4	32.40
Pear	2.4	180	343.4	337	517	(N/A)	3.1	3.5	30.39
Elm	1.3	96	175.1	172	268	(N/A)	2.8	1.8	17.87
Northern white cedar	1.1	84	148.7	146	230	(N/A)	2.8	1.6	15.31
Red maple	1.1	87	161.9	159	246	(N/A)	2.8	1.7	16.37
American sycamore	3.0	225	359.9	353	578	(N/A)	2.4	3.9	44.43
Norway maple	2.6	199	363.1	356	555	(N/A)	2.4	3.8	42.66
Cottonwood	3.7	280	490.3	481	761	(N/A)	2.4	5.2	58.52
Blue spruce	0.4	28	55.6	55	82	(N/A)	2.2	0.6	6.85
Amur maple	0.4	32	69.1	68	99	(N/A)	2.0	0.7	9.03
Broadleaf Deciduous Large	1.1	81	145.9	143	224	(N/A)	1.8	1.5	22.41
White ash	1.8	136	201.7	198	333	(N/A)	1.7	2.3	37.05
Broadleaf Deciduous Mediu	0.4	34	71.5	70	104	(N/A)	1.7	0.7	11.52
Northern hackberry	3.0	231	414.5	406	637	(N/A)	1.7	4.3	70.79
Broadleaf Deciduous Small	0.0	3	8.2	8	11	(N/A)	1.5	0.1	1.43
River birch	0.4	28	60.0	59	87	(N/A)	1.5	0.6	10.89
Maple	0.3	19	37.3	37	56	(N/A)	1.5	0.4	7.00
Conifer Evergreen Large	0.5	35	71.6	70	106	(N/A)	1.3	0.7	15.09
Littleleaf linden	0.8	62	121.8	119	181	(N/A)	1.1	1.2	30.15
Honeylocust	1.1	83	147.7	145	227	(N/A)	1.1	1.5	37.89
Black walnut	1.3	102	189.7	186	288	(N/A)	1.1	2.0	47.94
Northern red oak	0.2	15	28.3	28	43	(N/A)	1.1	0.3	7.15
Black maple	1.0	79	142.9	140	219	(N/A)	0.9	1.5	43.89
Bur oak	0.8	58	88.4	87	144	(N/A)	0.9	1.0	28.86
Eastern white pine	0.5	41	62.5	61	102	(N/A)	0.9	0.7	20.43
Willow	1.0	77	151.3	148	225	(N/A)	0.7	1.5	56.21
Boxelder	0.7	53	86.6	85	138	(N/A)	0.7	0.9	34.58
Mulberry	0.5	36	76.1	75	110	(N/A)	0.6	0.7	36.82
Siberian elm	0.4	32	57.2	56	88	(N/A)	0.6	0.6	29.44
Northern pin oak	1.0	73	142.2	139	213	(N/A)	0.6	1.4	70.84
Eastern red cedar	0.3	25	49.3	48	74	(N/A)	0.6	0.5	24.57
Eastern redbud	0.1	6	13.5	13	19	(N/A)	0.4	0.1	9.53
Kentucky coffeetree	0.1	7	14.2	14	21	(N/A)	0.4	0.1	10.65
Broadleaf Evergreen Large	0.0	1	3.2	3	5	(N/A)	0.4	0.0	2.26
Black spruce	0.2	12	20.0	20	31	(N/A)	0.4	0.2	15.73
Alder	0.0	3	7.6	7	11	(N/A)	0.4	0.1	5.40
White oak	0.1	9	17.4	17	26	(N/A)	0.4	0.2	13.23
Black cherry	0.1	6	12.8	13	18	(N/A)	0.2	0.1	18.19
Sumac	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Chinese elm	0.1	7	13.7	13	21	(N/A)	0.2	0.1	20.64
Quaking aspen	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Pin oak	0.4	29	51.8	51	80	(N/A)	0.2	0.5	80.25
Broadleaf Evergreen Small	0.0	2	4.0	4	6	(N/A)	0.2	0.0	5.61
Japanese tree lilac	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Japanese maple	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Total	70.5	5,351	9,588.0	9,396	14,747	(N/A)	100.0	100.0	27.26

Table 2: Annual Stormwater Benefits

Bondurant

Annual Stormwater Benefits of Public Trees

8/27/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	24,807	672	(N/A)	11.3	3.7	11.02
Catalpa	29,762	807	(N/A)	9.4	4.5	15.81
Green ash	72,600	1,967	(N/A)	7.4	10.9	49.19
Silver maple	146,463	3,969	(N/A)	6.3	22.0	116.74
Scotch pine	33,850	917	(N/A)	4.1	5.1	41.70
Swamp white oak	3,906	106	(N/A)	3.9	0.6	5.04
Spruce	19,926	540	(N/A)	3.9	3.0	25.71
Sugar maple	25,850	701	(N/A)	3.7	3.9	35.03
Pear	9,024	245	(N/A)	3.1	1.4	14.39
Elm	18,588	504	(N/A)	2.8	2.8	33.58
Northern white cedar	26,431	716	(N/A)	2.8	4.0	47.75
Red maple	6,203	168	(N/A)	2.8	0.9	11.21
American sycamore	20,445	554	(N/A)	2.4	3.1	42.62
Norway maple	18,236	494	(N/A)	2.4	2.7	38.02
Cottonwood	38,702	1,049	(N/A)	2.4	5.8	80.68
Blue spruce	3,773	102	(N/A)	2.2	0.6	8.52
Amur maple	1,873	51	(N/A)	2.0	0.3	4.61
Broadleaf Deciduous Large	8,567	232	(N/A)	1.8	1.3	23.22
White ash	15,636	424	(N/A)	1.7	2.4	47.08
Broadleaf Deciduous Medium	2,283	62	(N/A)	1.7	0.3	6.87
Northern hackberry	31,036	841	(N/A)	1.7	4.7	93.45
Broadleaf Deciduous Small	121	3	(N/A)	1.5	0.0	0.41
River birch	1,847	50	(N/A)	1.5	0.3	6.26
Maple	973	26	(N/A)	1.5	0.1	3.29
Conifer Evergreen Large	5,112	139	(N/A)	1.3	0.8	19.79
Littleleaf linden	7,747	210	(N/A)	1.1	1.2	34.99
Honeylocust	5,623	152	(N/A)	1.1	0.8	25.40
Black walnut	16,157	438	(N/A)	1.1	2.4	72.97
Northern red oak	857	23	(N/A)	1.1	0.1	3.87
Black maple	8,588	233	(N/A)	0.9	1.3	46.55
Bur oak	4,740	128	(N/A)	0.9	0.7	25.69
Eastern white pine	6,367	173	(N/A)	0.9	1.0	34.51
Willow	10,594	287	(N/A)	0.7	1.6	71.77
Boxelder	5,088	138	(N/A)	0.7	0.8	34.47
Mulberry	2,613	71	(N/A)	0.6	0.4	23.60
Siberian elm	4,778	129	(N/A)	0.6	0.7	43.16
Northern pin oak	11,293	306	(N/A)	0.6	1.7	102.01
Eastern red cedar	4,904	133	(N/A)	0.6	0.7	44.30
Eastern redbud	272	7	(N/A)	0.4	0.0	3.68
Kentucky coffeetree	626	17	(N/A)	0.4	0.1	8.48
Broadleaf Evergreen Large	76	2	(N/A)	0.4	0.0	1.02
Black spruce	1,801	49	(N/A)	0.4	0.3	24.40
Alder	137	4	(N/A)	0.4	0.0	1.86
White oak	779	21	(N/A)	0.4	0.1	10.56
Black cherry	264	7	(N/A)	0.2	0.0	7.17
Sumac	7	0	(N/A)	0.2	0.0	0.20
Chinese elm	608	16	(N/A)	0.2	0.1	16.47
Quaking aspen	18	0	(N/A)	0.2	0.0	0.48
Pin oak	4,943	134	(N/A)	0.2	0.7	133.95
Broadleaf Evergreen Small	78	2	(N/A)	0.2	0.0	2.10
Japanese tree lilac	7	0	(N/A)	0.2	0.0	0.20
Japanese maple	7	0	(N/A)	0.2	0.0	0.20
Citywide total	664,983	18,021	(N/A)	100.0	100.0	33.31

Table 3: Annual Air Quality Benefits

Bondurant

Annual Air Quality Benefits of Public Trees

8/27/2020

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								
Apple	7.4	1.2	3.5	0.3	39	29.5	4.2	4.0	27.4	182	0.0	0	77.5	221	(N/A)	11.3	3.63
Catalpa	1.4	0.2	1.1	0.1	8	22.3	3.3	3.1	21.2	139	0.0	0	52.6	148	(N/A)	9.4	2.89
Green ash	7.6	1.2	3.9	0.3	41	37.9	5.5	5.3	36.3	237	0.0	0	98.0	278	(N/A)	7.4	6.95
Silver maple	25.4	4.3	12.4	1.1	137	45.3	6.6	6.3	43.4	283	-12.8	-48	132.1	372	(N/A)	6.3	10.94
Scotch pine	3.7	0.7	3.2	0.5	25	12.9	1.9	1.8	12.9	82	-12.0	-45	25.7	62	(N/A)	4.1	2.82
Swamp white oak	0.3	0.0	0.2	0.0	2	4.0	0.6	0.5	3.6	25	-0.1	0	9.2	26	(N/A)	3.9	1.23
Spruce	2.1	0.4	1.8	0.3	14	5.5	0.8	0.8	5.1	34	-9.9	-37	6.9	11	(N/A)	3.9	0.52
Sugar maple	2.9	0.5	1.6	0.1	16	14.9	2.2	2.1	14.3	93	-2.4	-9	36.2	101	(N/A)	3.7	5.03
Pear	2.6	0.4	1.3	0.1	14	11.5	1.7	1.6	10.8	71	0.0	0	29.9	85	(N/A)	3.1	5.01
Elm	2.7	0.4	1.2	0.1	14	6.1	0.9	0.8	5.8	38	0.0	0	18.1	52	(N/A)	2.8	3.48
Northern white cedar	3.2	0.6	2.5	0.4	21	5.2	0.8	0.7	5.0	33	-15.9	-59	2.6	-6	(N/A)	2.8	-0.40
Red maple	0.8	0.1	0.5	0.0	5	5.5	0.8	0.8	5.2	34	-0.3	-1	13.4	38	(N/A)	2.8	2.50
American sycamore	1.6	0.3	1.0	0.1	9	13.7	2.0	1.9	13.4	87	0.0	0	34.1	96	(N/A)	2.4	7.38
Norway maple	3.0	0.5	1.6	0.1	17	12.6	1.8	1.7	11.9	78	-0.8	-3	32.5	92	(N/A)	2.4	7.07
Cottonwood	4.7	0.7	2.3	0.2	25	17.5	2.6	2.4	16.7	109	0.0	0	47.1	134	(N/A)	2.4	10.33
Blue spruce	0.3	0.1	0.3	0.0	2	1.8	0.3	0.2	1.7	11	-1.2	-4	3.6	9	(N/A)	2.2	0.76
Amur maple	0.5	0.1	0.2	0.0	3	2.1	0.3	0.3	1.9	13	0.0	0	5.4	15	(N/A)	2.0	1.41
Broadleaf Deciduous Large	0.7	0.1	0.4	0.0	4	5.1	0.7	0.7	4.8	32	0.0	0	12.6	36	(N/A)	1.8	3.57
White ash	2.4	0.4	1.2	0.1	13	8.1	1.2	1.2	8.1	52	0.0	0	22.7	65	(N/A)	1.7	7.17
Broadleaf Deciduous Medium	0.2	0.0	0.1	0.0	1	2.2	0.3	0.3	2.0	14	-0.1	0	5.1	14	(N/A)	1.7	1.61
Northern hackberry	5.2	0.9	2.6	0.2	28	14.5	2.1	2.0	13.8	91	0.0	0	41.3	119	(N/A)	1.7	13.17
Broadleaf Deciduous Small	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)	1.5	0.18
River birch	0.1	0.0	0.1	0.0	1	1.9	0.3	0.3	1.7	11	-0.1	0	4.3	12	(N/A)	1.5	1.51
Maple	0.1	0.0	0.1	0.0	0	1.2	0.2	0.2	1.2	8	0.0	0	2.8	8	(N/A)	1.5	1.00
Conifer Evergreen Large	0.5	0.1	0.5	0.1	3	2.3	0.3	0.3	2.1	14	-1.5	-6	4.6	12	(N/A)	1.3	1.67
Littleleaf linden	1.2	0.2	0.6	0.1	7	4.0	0.6	0.5	3.7	25	-0.6	-2	10.3	29	(N/A)	1.1	4.81
Honeylocust	0.8	0.1	0.4	0.0	4	5.2	0.8	0.7	4.9	32	-0.5	-2	12.5	35	(N/A)	1.1	5.82
Black walnut	2.1	0.3	1.0	0.1	11	6.5	0.9	0.9	6.1	40	0.0	0	17.8	51	(N/A)	1.1	8.49
Northern red oak	0.1	0.0	0.1	0.0	0	1.0	0.1	0.1	0.9	6	-0.1	0	2.2	6	(N/A)	1.1	0.99
Black maple	2.0	0.3	0.9	0.1	11	5.0	0.7	0.7	4.7	31	-0.7	-3	13.8	39	(N/A)	0.9	7.82
Bur oak	0.3	0.1	0.2	0.0	2	3.5	0.5	0.5	3.4	22	0.0	0	8.6	24	(N/A)	0.9	4.80
Eastern white pine	0.7	0.1	0.6	0.1	5	2.5	0.4	0.4	2.4	16	-2.2	-8	4.9	12	(N/A)	0.9	2.37
Willow	2.3	0.4	1.1	0.1	12	4.9	0.7	0.7	4.6	30	-0.5	-2	14.3	41	(N/A)	0.7	10.20
Boxelder	0.5	0.1	0.3	0.0	3	3.3	0.5	0.5	3.2	21	-0.2	-1	8.0	22	(N/A)	0.7	5.60
Mulberry	0.9	0.2	0.4	0.0	5	2.4	0.3	0.3	2.1	14	0.0	0	6.7	19	(N/A)	0.6	6.41
Siberian elm	0.8	0.1	0.4	0.0	4	2.0	0.3	0.3	1.9	13	0.0	0	5.9	17	(N/A)	0.6	5.67
Northern pin oak	2.6	0.4	1.2	0.1	14	4.7	0.7	0.6	4.4	29	-0.6	-2	14.2	41	(N/A)	0.6	13.58
Eastern red cedar	1.0	0.2	0.8	0.1	7	1.6	0.2	0.2	1.5	10	-2.7	-10	3.1	7	(N/A)	0.6	2.19
Eastern redbud	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3	(N/A)	0.4	1.33
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.4	1.54
Broadleaf Evergreen Large	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.2	1	(N/A)	0.4	0.26
Black spruce	0.2	0.0	0.2	0.0	1	0.7	0.1	0.1	0.7	5	-0.6	-2	1.5	4	(N/A)	0.4	1.82
Alder	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	0.4	0.71
White oak	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.4	4	(N/A)	0.4	1.93
Black cherry	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)	0.2	2.55
Sumac	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)	0.2	0.11
Chinese elm	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.2	2.99
Quaking aspen	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)	0.2	0.08
Pin oak	0.9	0.2	0.5	0.0	5	1.8	0.3	0.3	1.8	12	-1.7	-6	4.0	10	(N/A)	0.2	10.20
Broadleaf Evergreen Small	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.2	0.75
Japanese tree lilac	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)	0.2	0.11
Japanese maple	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)	0.2	0.11
Citywide total	95.9	16.4	52.3	5.2	534	335.8	48.9	46.7	319.4	2,094	-67.5	-253	853.1	2,375	(N/A)	100.0	4.39

Table 4: Annual Carbon Stored

Bondurant

Stored CO2 Benefits of Public Trees

8/27/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	116,181	871	(N/A)	11.3	5.7	14.28
Catalpa	54,473	409	(N/A)	9.4	2.7	8.01
Green ash	248,321	1,862	(N/A)	7.4	12.2	46.56
Silver maple	557,675	4,183	(N/A)	6.3	27.5	123.02
Scotch pine	25,745	193	(N/A)	4.1	1.3	8.78
Swamp white oak	6,504	49	(N/A)	3.9	0.3	2.32
Spruce	23,411	176	(N/A)	3.9	1.2	8.36
Sugar maple	81,386	610	(N/A)	3.7	4.0	30.52
Pear	40,432	303	(N/A)	3.1	2.0	17.84
Elm	91,464	686	(N/A)	2.8	4.5	45.73
Northern white cedar	40,816	306	(N/A)	2.8	2.0	20.41
Red maple	11,573	87	(N/A)	2.8	0.6	5.79
American sycamore	54,668	410	(N/A)	2.4	2.7	31.54
Norway maple	49,983	375	(N/A)	2.4	2.5	28.84
Cottonwood	154,937	1,162	(N/A)	2.4	7.6	89.39
Blue spruce	1,628	12	(N/A)	2.2	0.1	1.02
Amur maple	8,759	66	(N/A)	2.0	0.4	5.97
Broadleaf Deciduous	23,410	176	(N/A)	1.8	1.2	17.56
White ash	42,221	317	(N/A)	1.7	2.1	35.18
Broadleaf Deciduous	4,008	30	(N/A)	1.7	0.2	3.34
Northern hackberry	81,195	609	(N/A)	1.7	4.0	67.66
Broadleaf Deciduous	274	2	(N/A)	1.5	0.0	0.26
River birch	3,109	23	(N/A)	1.5	0.2	2.91
Maple	1,546	12	(N/A)	1.5	0.1	1.45
Conifer Evergreen La	2,710	20	(N/A)	1.3	0.1	2.90
Littleleaf linden	26,052	195	(N/A)	1.1	1.3	32.56
Honeylocust	9,706	73	(N/A)	1.1	0.5	12.13
Black walnut	66,144	496	(N/A)	1.1	3.3	82.68
Northern red oak	945	7	(N/A)	1.1	0.0	1.18
Black maple	21,716	163	(N/A)	0.9	1.1	32.57
Bur oak	11,386	85	(N/A)	0.9	0.6	17.08
Eastern white pine	4,719	35	(N/A)	0.9	0.2	7.08
Willow	37,606	282	(N/A)	0.7	1.9	70.51
Boxelder	11,973	90	(N/A)	0.7	0.6	22.45
Mulberry	14,393	108	(N/A)	0.6	0.7	35.98
Siberian elm	19,920	149	(N/A)	0.6	1.0	49.80
Northern pin oak	42,840	321	(N/A)	0.6	2.1	107.10
Eastern red cedar	3,306	25	(N/A)	0.6	0.2	8.27
Eastern redbud	922	7	(N/A)	0.4	0.0	3.46
Kentucky coffeetree	1,047	8	(N/A)	0.4	0.1	3.93
Broadleaf Evergreen l	25	0	(N/A)	0.4	0.0	0.09
Black spruce	1,161	9	(N/A)	0.4	0.1	4.35
Alder	356	3	(N/A)	0.4	0.0	1.33
White oak	1,220	9	(N/A)	0.4	0.1	4.57
Black cherry	908	7	(N/A)	0.2	0.0	6.81
Sumac	14	0	(N/A)	0.2	0.0	0.10
Chinese elm	1,035	8	(N/A)	0.2	0.1	7.76
Quaking aspen	12	0	(N/A)	0.2	0.0	0.09
Pin oak	24,952	187	(N/A)	0.2	1.2	187.14
Broadleaf Evergreen S	178	1	(N/A)	0.2	0.0	1.33
Japanese tree lilac	14	0	(N/A)	0.2	0.0	0.10
Japanese maple	14	0	(N/A)	0.2	0.0	0.10
Citywide total	2,028,994	15,217	(N/A)	100.0	100.0	28.13

Table 5: Annual Carbon Sequestered

Bondurant

Annual CO 2 Benefits of Public Trees

8/27/2020

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
Apple	7,909	59	-558	-84	-5	10,126	76	17,393	130 (N/A)	11.3	6.8	2.14
Catalpa	10,105	76	-262	-56	-2	7,843	59	17,631	132 (N/A)	9.4	6.9	2.59
Green ash	18,009	135	-1,192	-80	-10	13,427	101	30,164	226 (N/A)	7.4	11.8	5.66
Silver maple	40,708	305	-2,677	-108	-21	16,114	121	54,037	405 (N/A)	6.3	21.1	11.92
Scotch pine	2,542	19	-124	-43	-1	4,763	36	7,138	54 (N/A)	4.1	2.8	2.43
Swamp white oak	1,800	13	-38	-12	0	1,342	10	3,092	23 (N/A)	3.9	1.2	1.10
Spruce	764	6	-112	-26	-1	1,904	14	2,530	19 (N/A)	3.9	1.0	0.90
Sugar maple	5,743	43	-393	-33	-3	5,309	40	10,626	80 (N/A)	3.7	4.2	3.98
Pear	3,684	28	-194	-28	-2	3,980	30	7,442	56 (N/A)	3.1	2.9	3.28
Elm	2,934	22	-439	-16	-3	2,131	16	4,610	35 (N/A)	2.8	1.8	2.30
Northern white cedar	1,243	9	-196	-24	-2	1,856	14	2,880	22 (N/A)	2.8	1.1	1.44
Red maple	1,713	13	-56	-13	-1	1,920	14	3,564	27 (N/A)	2.8	1.4	1.78
American sycamore	5,982	45	-262	-26	-2	4,970	37	10,663	80 (N/A)	2.4	4.2	6.15
Norway maple	4,621	35	-240	-25	-2	4,394	33	8,750	66 (N/A)	2.4	3.4	5.05
Cottonwood	8,206	62	-744	-37	-6	6,192	46	13,618	102 (N/A)	2.4	5.3	7.86
Blue spruce	198	1	-8	-7	0	613	5	796	6 (N/A)	2.2	0.3	0.50
Amur maple	368	3	-42	-9	0	699	5	1,016	8 (N/A)	2.0	0.4	0.69
Broadleaf Deciduous Large	2,482	19	-112	-12	-1	1,792	13	4,149	31 (N/A)	1.8	1.6	3.11
White ash	4,275	32	-204	-15	-2	3,002	23	7,058	53 (N/A)	1.7	2.8	5.88
Broadleaf Deciduous Medi	975	7	-21	-6	0	743	6	1,690	13 (N/A)	1.7	0.7	1.41
Northern hackberry	3,774	28	-390	-29	-3	5,104	38	8,459	63 (N/A)	1.7	3.3	7.05
Broadleaf Deciduous Smal	99	1	-2	-2	0	76	1	172	1 (N/A)	1.5	0.1	0.16
River birch	841	6	-18	-5	0	624	5	1,442	11 (N/A)	1.5	0.6	1.35
Maple	274	2	-7	-4	0	429	3	692	5 (N/A)	1.5	0.3	0.65
Conifer Evergreen Large	431	3	-13	-9	0	783	6	1,192	9 (N/A)	1.3	0.5	1.28
Littleleaf linden	2,710	20	-126	-11	-1	1,360	10	3,934	30 (N/A)	1.1	1.5	4.92
Honeylocust	1,754	13	-47	-9	0	1,825	14	3,524	26 (N/A)	1.1	1.4	4.41
Black walnut	3,410	26	-318	-15	-2	2,249	17	5,326	40 (N/A)	1.1	2.1	6.66
Northern red oak	281	2	-5	-3	0	335	3	608	5 (N/A)	1.1	0.2	0.76
Black maple	814	6	-104	-10	-1	1,756	13	2,456	18 (N/A)	0.9	1.0	3.68
Bur oak	1,484	11	-55	-7	0	1,276	10	2,699	20 (N/A)	0.9	1.1	4.05
Eastern white pine	480	4	-23	-8	0	904	7	1,353	10 (N/A)	0.9	0.5	2.03
Willow	1,434	11	-181	-11	-1	1,693	13	2,936	22 (N/A)	0.7	1.1	5.50
Boxelder	1,436	11	-57	-7	0	1,182	9	2,553	19 (N/A)	0.7	1.0	4.79
Mulberry	592	4	-69	-7	-1	794	6	1,310	10 (N/A)	0.6	0.5	3.27
Siberian elm	869	7	-96	-5	-1	713	5	1,480	11 (N/A)	0.6	0.6	3.70
Northern pin oak	0	0	-206	-13	-2	1,616	12	1,397	10 (N/A)	0.6	0.5	3.49
Eastern red cedar	0	0	-16	-6	0	561	4	539	4 (N/A)	0.6	0.2	1.35
Eastern redbud	123	1	-4	-1	0	130	1	246	2 (N/A)	0.4	0.1	0.92
Kentucky coffeetree	211	2	-5	-1	0	163	1	368	3 (N/A)	0.4	0.1	1.38
Broadleaf Evergreen Large	25	0	0	0	0	30	0	54	0 (N/A)	0.4	0.0	0.20
Black spruce	103	1	-6	-3	0	261	2	356	3 (N/A)	0.4	0.1	1.33
Alder	76	1	-2	-1	0	74	1	147	1 (N/A)	0.4	0.1	0.55
White oak	283	2	-6	-2	0	207	2	483	4 (N/A)	0.4	0.2	1.81
Black cherry	114	1	-4	-1	0	124	1	232	2 (N/A)	0.2	0.1	1.74
Sumac	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Chinese elm	209	2	-5	-1	0	159	1	361	3 (N/A)	0.2	0.1	2.71
Quaking aspen	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Pin oak	2,196	16	-120	-4	-1	652	5	2,723	20 (N/A)	0.2	1.1	20.43
Broadleaf Evergreen Small	27	0	-1	-1	0	38	0	64	0 (N/A)	0.2	0.0	0.48
Japanese tree lilac	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Japanese maple	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Citywide total	148,340	1,113	-9,760	-836	-79	118,259	887	256,003	1,920 (N/A)	100.0	100.0	3.55

Table 6: Annual Social and Aesthetic Benefits

Bondurant

Annual Aesthetic/Other Benefits of Public Trees

8/27/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	451	(N/A)	11.3	3.0	7.39
Catalpa	1,368	(N/A)	9.4	9.0	26.83
Green ash	1,693	(N/A)	7.4	11.1	42.32
Silver maple	3,193	(N/A)	6.3	21.0	93.92
Scotch pine	711	(N/A)	4.1	4.7	32.32
Swamp white oak	243	(N/A)	3.9	1.6	11.56
Spruce	235	(N/A)	3.9	1.5	11.18
Sugar maple	651	(N/A)	3.7	4.3	32.57
Pear	213	(N/A)	3.1	1.4	12.53
Elm	264	(N/A)	2.8	1.7	17.61
Northern white cedar	204	(N/A)	2.8	1.3	13.60
Red maple	289	(N/A)	2.8	1.9	19.25
American sycamore	602	(N/A)	2.4	4.0	46.35
Norway maple	469	(N/A)	2.4	3.1	36.08
Cottonwood	700	(N/A)	2.4	4.6	53.84
Blue spruce	133	(N/A)	2.2	0.9	11.09
Amur maple	19	(N/A)	2.0	0.1	1.71
Broadleaf Deciduous Large	283	(N/A)	1.8	1.9	28.25
White ash	511	(N/A)	1.7	3.4	56.81
Broadleaf Deciduous Medium	126	(N/A)	1.7	0.8	13.95
Northern hackberry	495	(N/A)	1.7	3.3	55.04
Broadleaf Deciduous Small	2	(N/A)	1.5	0.0	0.29
River birch	109	(N/A)	1.5	0.7	13.68
Maple	51	(N/A)	1.5	0.3	6.38
Conifer Evergreen Large	125	(N/A)	1.3	0.8	17.84
Littleleaf linden	297	(N/A)	1.1	1.9	49.45
Honeylocust	331	(N/A)	1.1	2.2	55.23
Black walnut	275	(N/A)	1.1	1.8	45.91
Northern red oak	38	(N/A)	1.1	0.2	6.26
Black maple	126	(N/A)	0.9	0.8	25.11
Bur oak	167	(N/A)	0.9	1.1	33.41
Eastern white pine	136	(N/A)	0.9	0.9	27.22
Willow	132	(N/A)	0.7	0.9	33.05
Boxelder	145	(N/A)	0.7	1.0	36.29
Mulberry	35	(N/A)	0.6	0.2	11.73
Siberian elm	76	(N/A)	0.6	0.5	25.44
Northern pin oak	0	(N/A)	0.6	0.0	0.00
Eastern red cedar	0	(N/A)	0.6	0.0	0.00
Eastern redbud	6	(N/A)	0.4	0.0	3.22
Kentucky coffeetree	34	(N/A)	0.4	0.2	16.91
Broadleaf Evergreen Large	17	(N/A)	0.4	0.1	8.32
Black spruce	38	(N/A)	0.4	0.2	18.77
Alder	4	(N/A)	0.4	0.0	2.06
White oak	43	(N/A)	0.4	0.3	21.64
Black cherry	6	(N/A)	0.2	0.0	6.40
Sumac	0	(N/A)	0.2	0.0	0.03
Chinese elm	29	(N/A)	0.2	0.2	28.56
Quaking aspen	5	(N/A)	0.2	0.0	5.26
Pin oak	157	(N/A)	0.2	1.0	157.02
Broadleaf Evergreen Small	1	(N/A)	0.2	0.0	0.99
Japanese tree lilac	0	(N/A)	0.2	0.0	0.03
Japanese maple	0	(N/A)	0.2	0.0	0.03
Citywide total	15,239	(N/A)	100.0	100.0	28.17

Table 7: Summary of Benefits in Dollars

Bondurant

Total Annual Benefits of Public Trees by Species ($)

8/27/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Apple	1,343	130	221	672	451	2,818	(N/A)	5.4
Catalpa	988	132	148	807	1,368	3,443	(N/A)	6.6
Green ash	1,646	226	278	1,967	1,693	5,811	(N/A)	11.1
Silver maple	1,969	405	372	3,969	3,193	9,909	(N/A)	18.9
Scotch pine	531	54	62	917	711	2,275	(N/A)	4.3
Swamp white oak	188	23	26	106	243	585	(N/A)	1.1
Spruce	246	19	11	540	235	1,051	(N/A)	2.0
Sugar maple	648	80	101	701	651	2,180	(N/A)	4.2
Pear	517	56	85	245	213	1,115	(N/A)	2.1
Elm	268	35	52	504	264	1,123	(N/A)	2.1
Northern white cedar	230	22	-6	716	204	1,166	(N/A)	2.2
Red maple	246	27	38	168	289	767	(N/A)	1.5
American sycamore	578	80	96	554	602	1,910	(N/A)	3.7
Norway maple	555	66	92	494	469	1,675	(N/A)	3.2
Cottonwood	761	102	134	1,049	700	2,746	(N/A)	5.3
Blue spruce	82	6	9	102	133	333	(N/A)	0.6
Amur maple	99	8	15	51	19	192	(N/A)	0.4
Broadleaf Deciduous La	224	31	36	232	283	806	(N/A)	1.5
White ash	333	53	65	424	511	1,386	(N/A)	2.6
Broadleaf Deciduous M	104	13	14	62	126	318	(N/A)	0.6
Northern hackberry	637	63	119	841	495	2,156	(N/A)	4.1
Broadleaf Deciduous Sn	11	1	1	3	2	20	(N/A)	0.0
River birch	87	11	12	50	109	269	(N/A)	0.5
Maple	56	5	8	26	51	147	(N/A)	0.3
Conifer Evergreen Large	106	9	12	139	125	390	(N/A)	0.7
Littleleaf linden	181	30	29	210	297	746	(N/A)	1.4
Honeylocust	227	26	35	152	331	772	(N/A)	1.5
Black walnut	288	40	51	438	275	1,092	(N/A)	2.1
Northern red oak	43	5	6	23	38	114	(N/A)	0.2
Black maple	219	18	39	233	126	635	(N/A)	1.2
Bur oak	144	20	24	128	167	484	(N/A)	0.9
Eastern white pine	102	10	12	173	136	433	(N/A)	0.8
Willow	225	22	41	287	132	707	(N/A)	1.4
Boxelder	138	19	22	138	145	463	(N/A)	0.9
Mulberry	110	10	19	71	35	246	(N/A)	0.5
Siberian elm	88	11	17	129	76	322	(N/A)	0.6
Northern pin oak	213	10	41	306	0	570	(N/A)	1.1
Eastern red cedar	74	4	7	133	0	217	(N/A)	0.4
Eastern redbud	19	2	3	7	6	37	(N/A)	0.1
Kentucky coffeetree	21	3	3	17	34	78	(N/A)	0.1
Broadleaf Evergreen La	5	0	1	2	17	24	(N/A)	0.0
Black spruce	31	3	4	49	38	124	(N/A)	0.2
Alder	11	1	1	4	4	21	(N/A)	0.0
White oak	26	4	4	21	43	98	(N/A)	0.2
Black cherry	18	2	3	7	6	36	(N/A)	0.1
Sumac	1	0	0	0	0	1	(N/A)	0.0
Chinese elm	21	3	3	16	29	71	(N/A)	0.1
Quaking aspen	1	0	0	0	5	7	(N/A)	0.0
Pin oak	80	20	10	134	157	402	(N/A)	0.8
Broadleaf Evergreen Sm	6	0	1	2	1	10	(N/A)	0.0
Japanese tree lilac	1	0	0	0	0	1	(N/A)	0.0
Japanese maple	1	0	0	0	0	1	(N/A)	0.0
Citywide Total	14,747	1,920	2,375	18,021	15,239	52,302	(N/A)	100.0

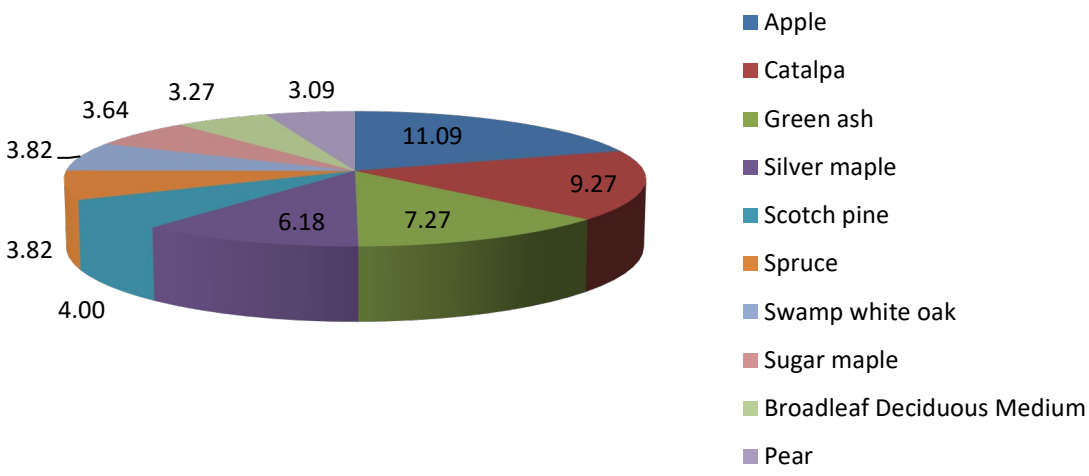

Figure 1: Species Distribution

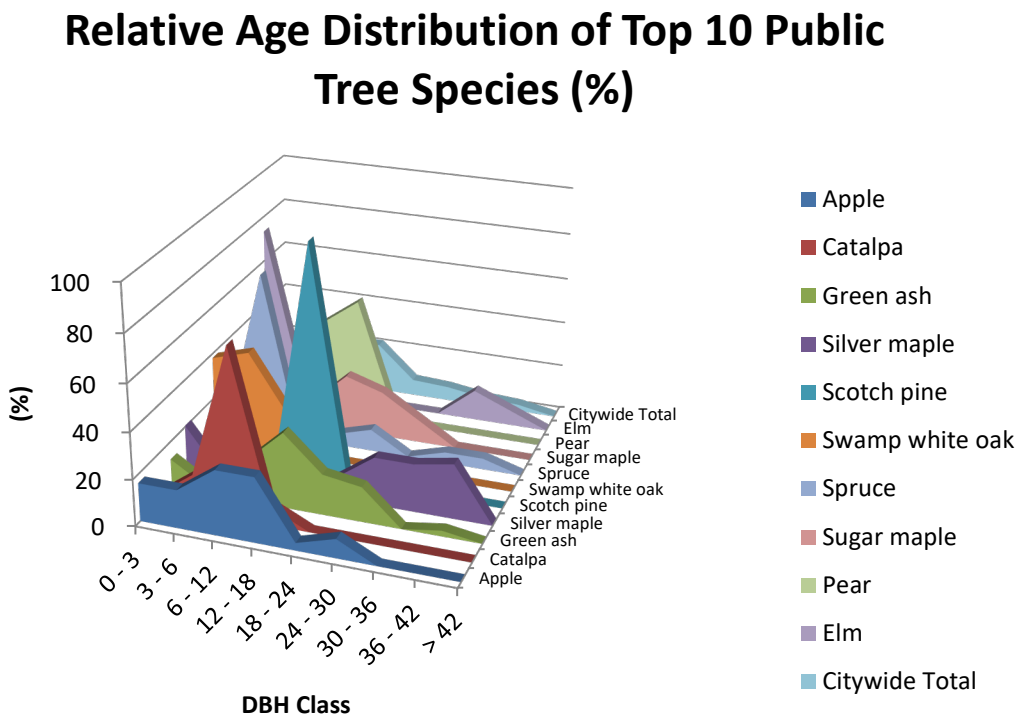

Figure 2: Relative Age Class

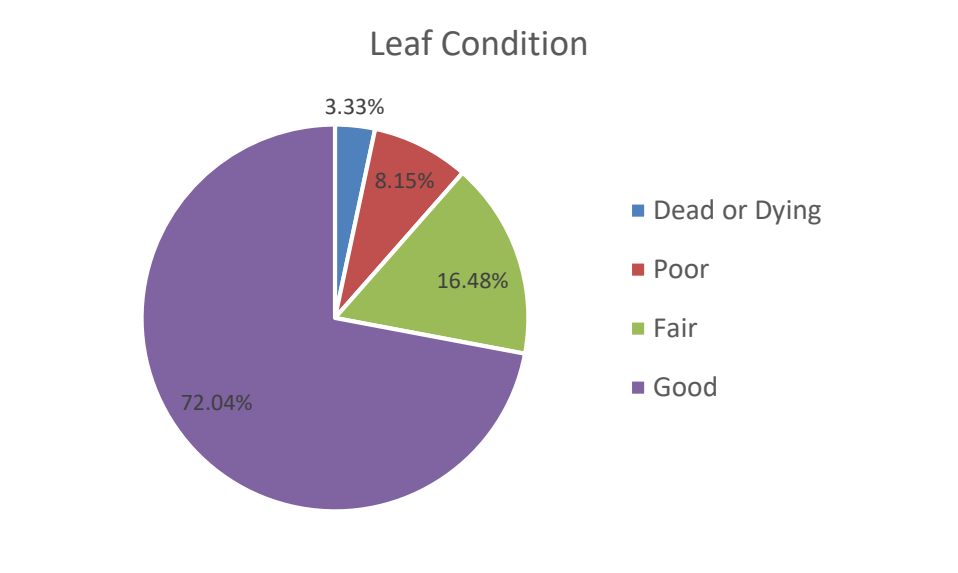

Figure 3: Foliage Condition

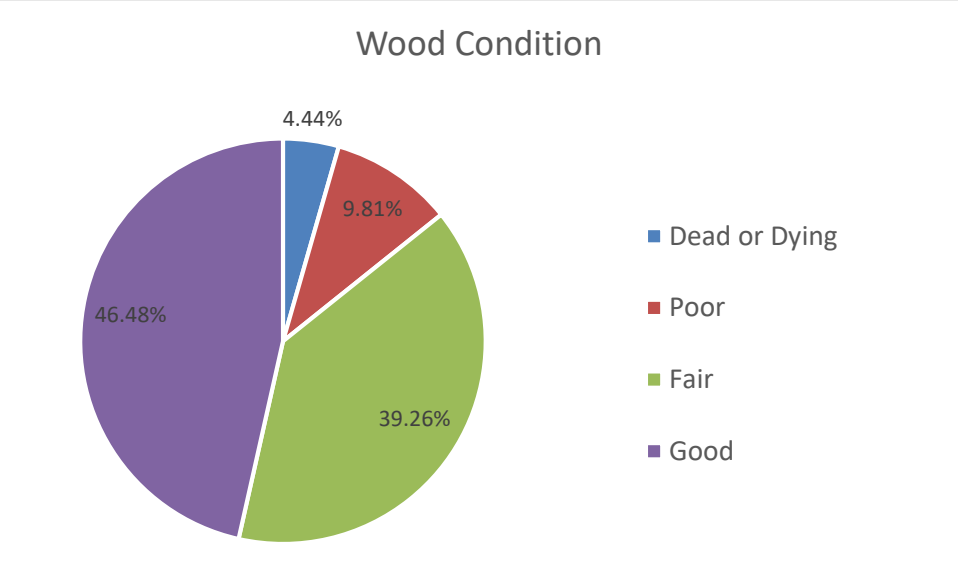

Figure 4: Wood Condition

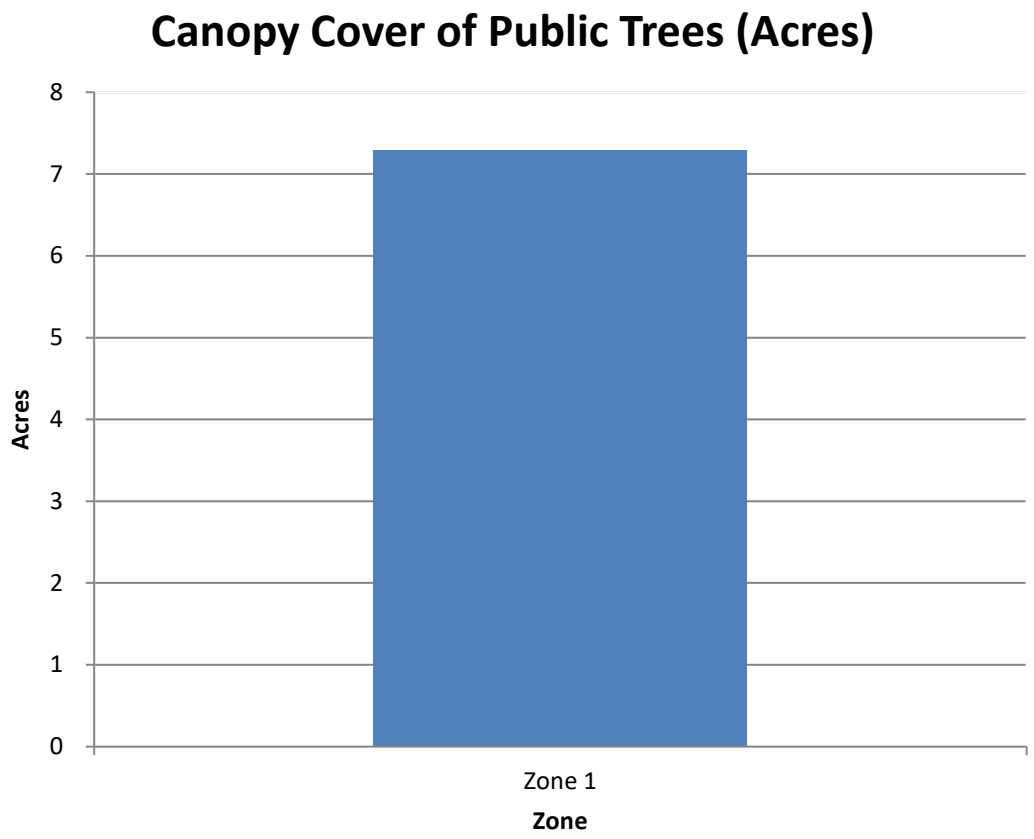

Figure 5: Canopy Cover in Acres

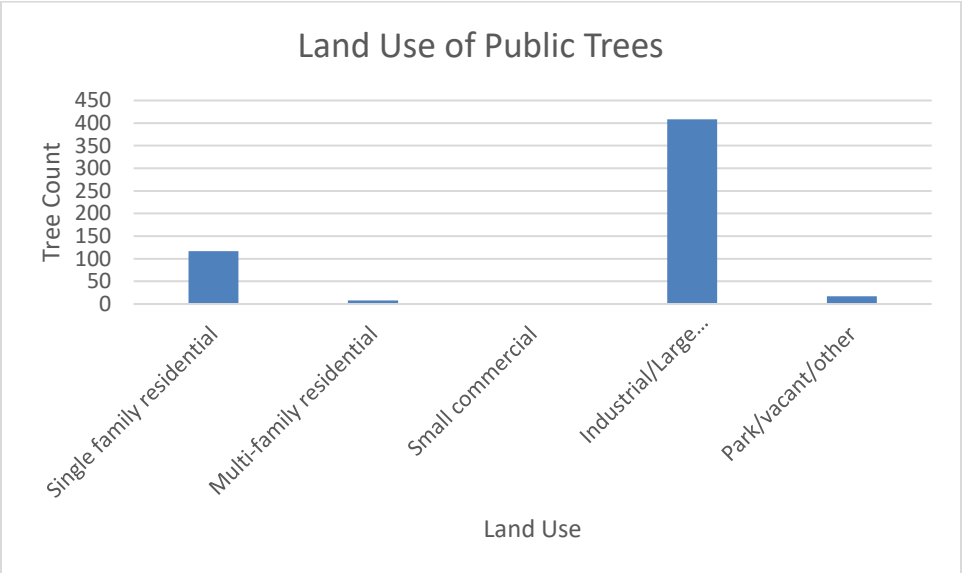

Figure 6: Land Use of city/park trees

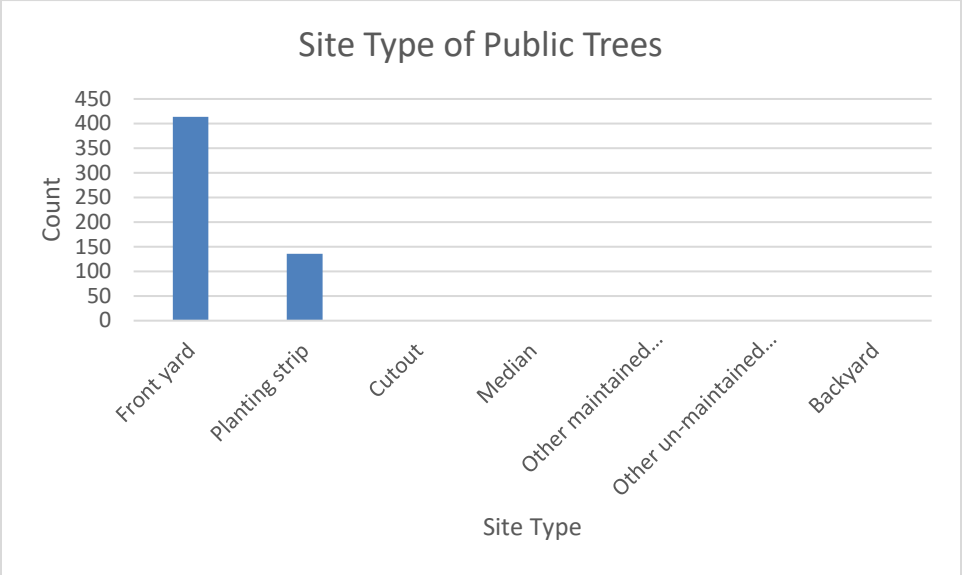

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

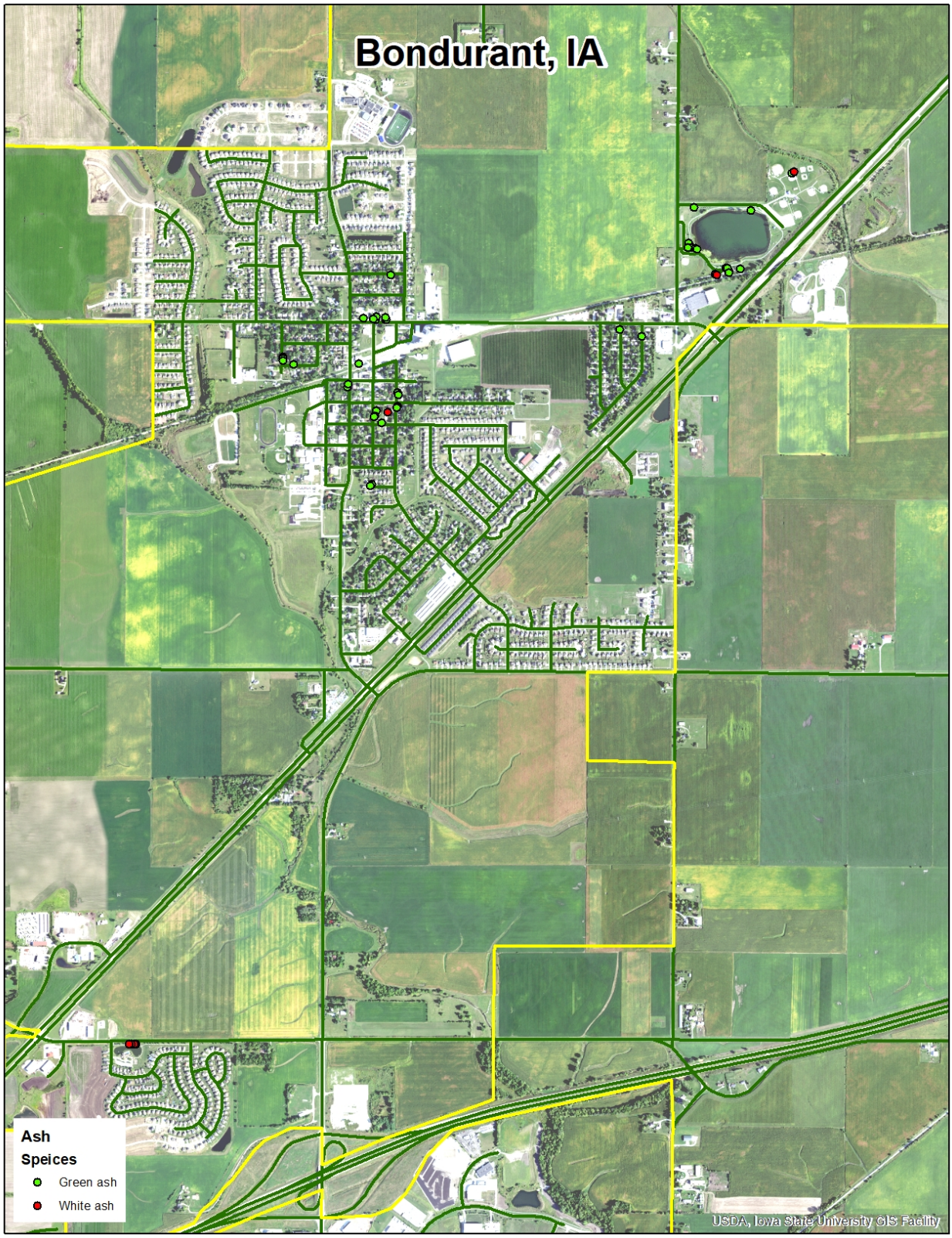

Figure 1: Location of Ash Trees

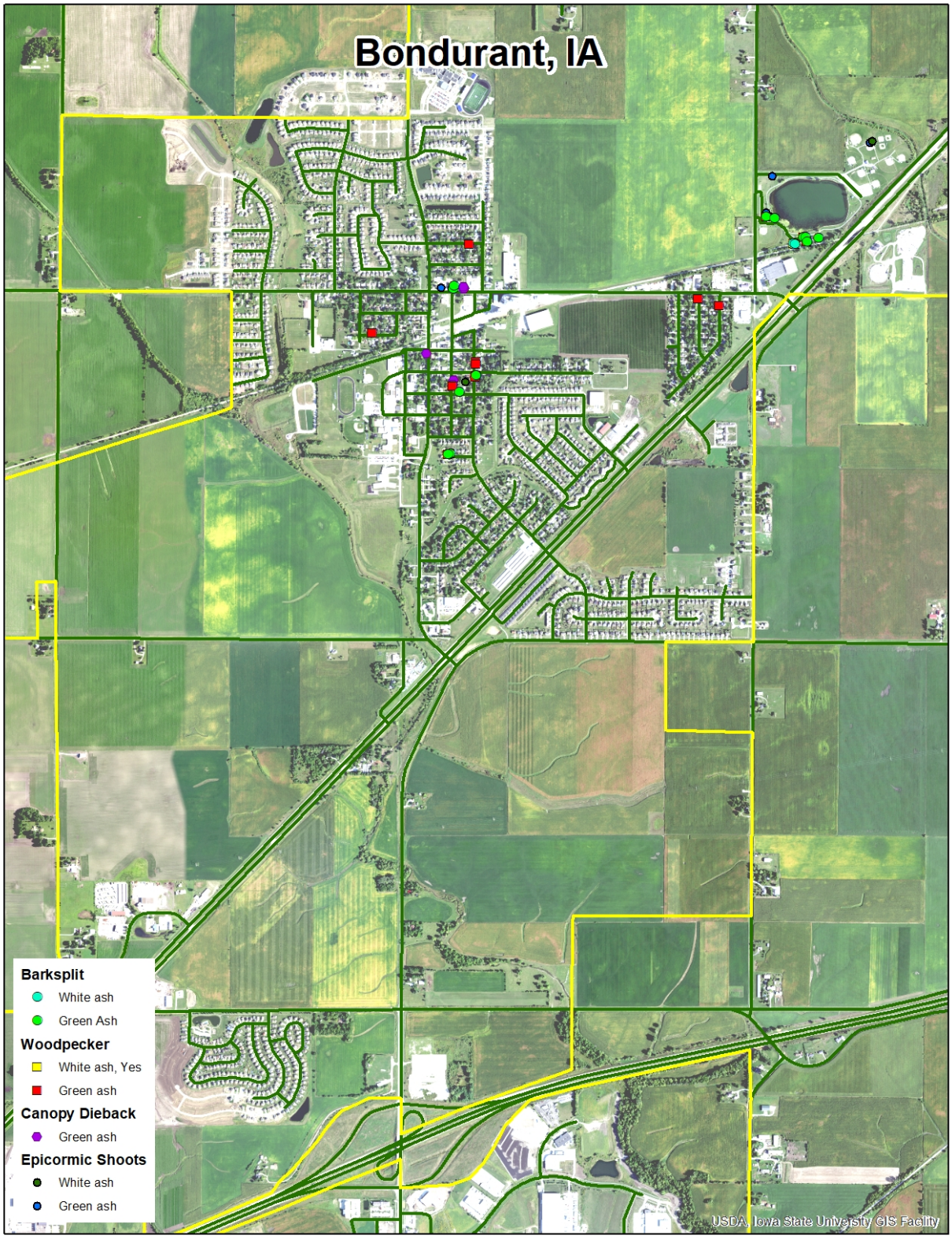

Figure 2: Location of EAB symptoms

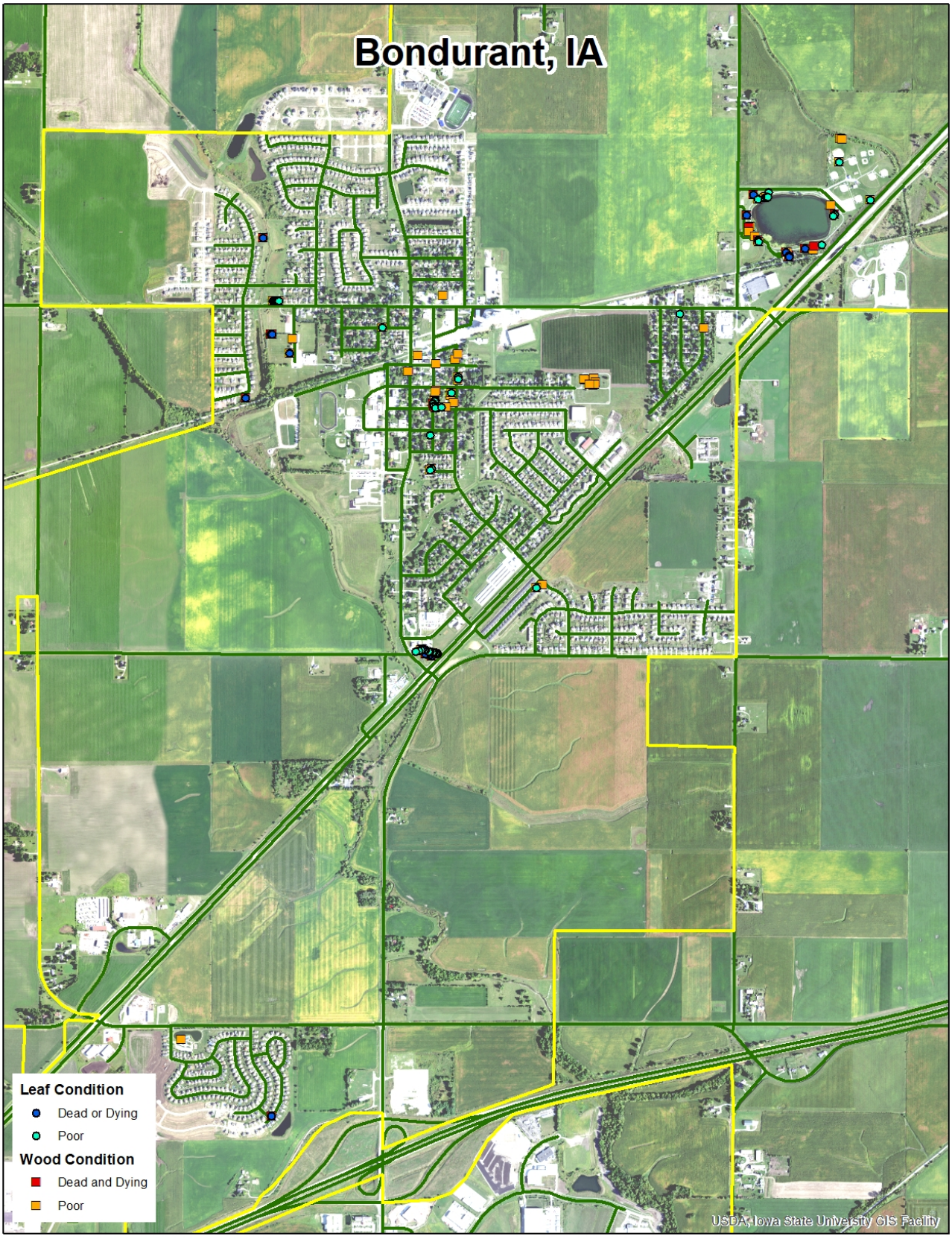

Figure 3: Location of Poor Condition Trees

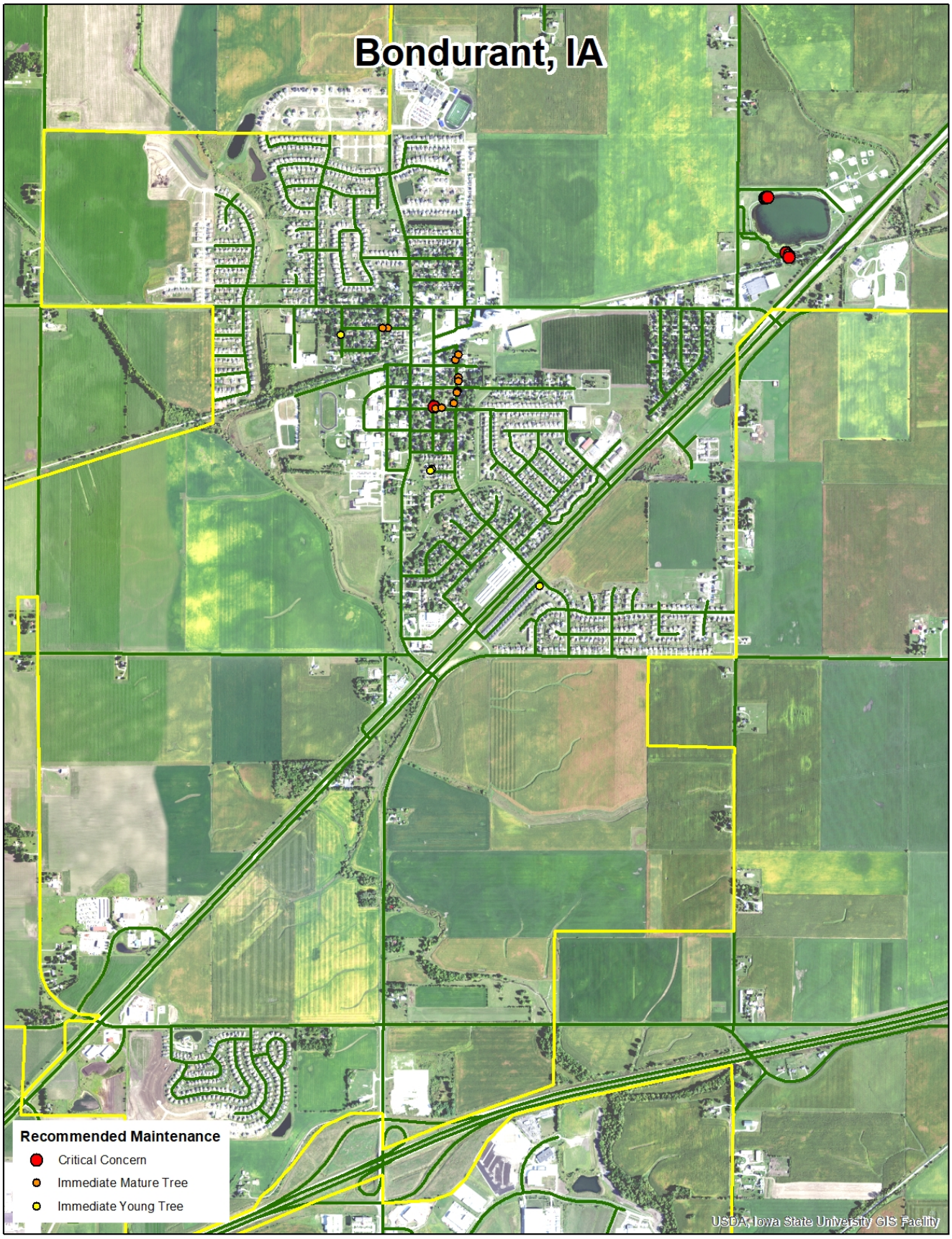

Figure 4: Location of Trees with Recommended Maintenance

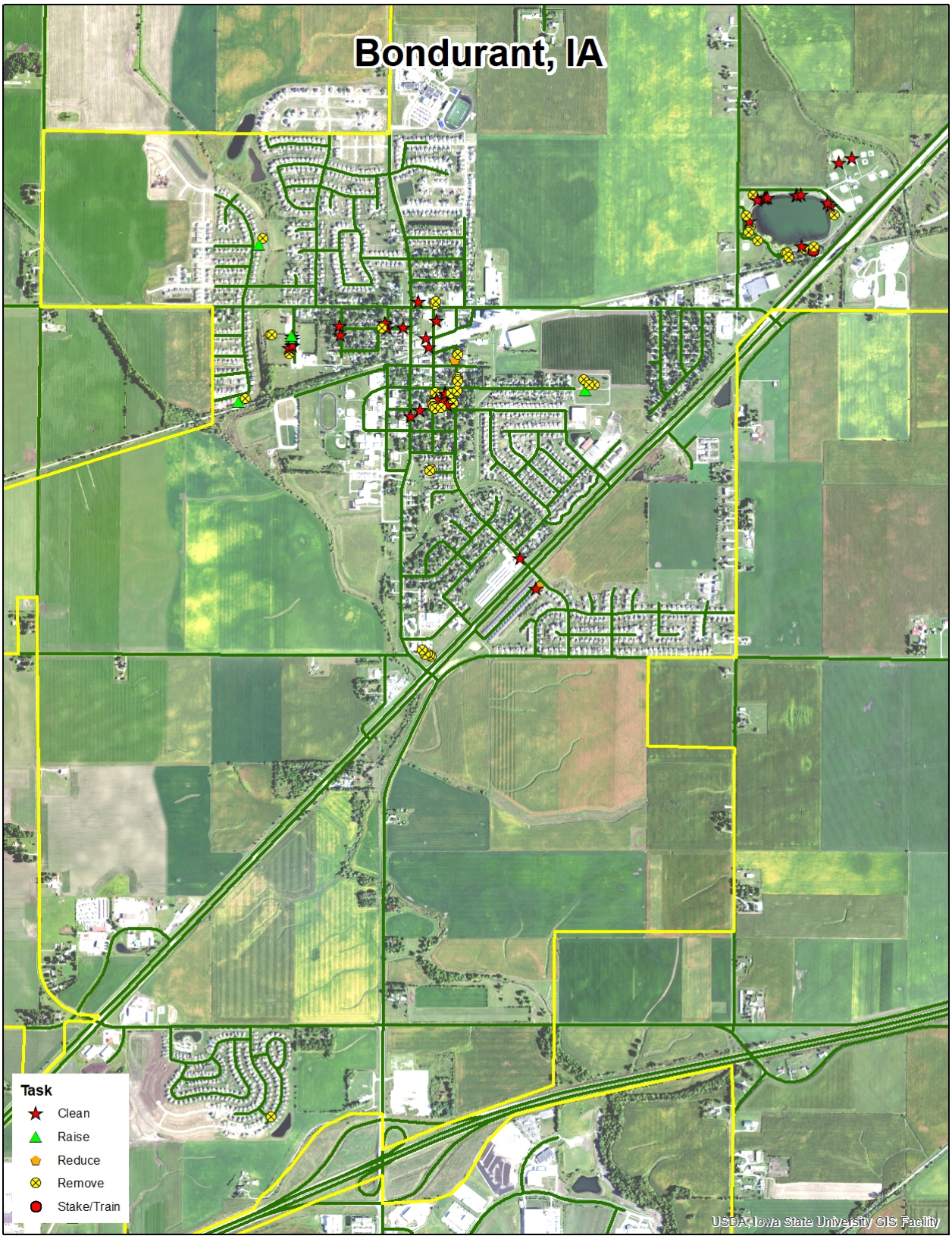

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Bondurant Tree Ordinances

CITY TREE BOARD

28.01 Purpose 28.04 Board Organization
28.02 City Tree Board 28.05 Compensation
28.03 Board Members 28.06 Powers and Duties

28.01 PURPOSE. It is the purpose of this chapter to provide for the establishment of a City Tree Board for the City, for the appointment of its Board members and to specify its powers and duties.

28.02 CITY TREE BOARD. There is hereby established the Bondurant City Tree Board.

28.03 BOARD MEMBERS. The City Tree Board shall consist of five (5) members, three (3) of whom shall be citizens and residents of the City and can include two (2) of whom that reside within the Bondurant-Farrar School district boundaries, to be appointed by Council.

28.04 BOARD ORGANIZATION. The term shall be four (4) years with one of the members appointed to the first Board shall be for only one year and the term of two members of the first Board shall be for two years. In the event that a vacancy shall occur during the term of any member, the successor shall be appointed by the Council for the unexpired portion of the term.

28.05 COMPENSATION. Members of the City Tree Board shall serve without compensation.

28.06 POWERS AND DUTIES. The City Tree Board shall have the following powers and duties.

1. The Board shall act as an advisory committee to the Park and Recreation Board. The Board shall have the responsibility to study, investigate, counsel, develop and update a written plan for the care, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs in parks and in other public areas. Such a plan will be presented to the Council and upon its acceptance and approval shall constitute the official comprehensive City Tree Plan for the City. The City Tree Board, when requested by the Park and Recreation Board, shall consider, investigate, make findings, report and recommend upon any special matter of question coming within the scope of its work.
2. The Board shall choose its own officers, make its own rules and regulations and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business.

(Ordinance No. 03-207)
(Ordinance No. 14-211)
(Ordinance No. 15-209)

28.07 MEETING ATTENDANCE. Board members are expected to attend all regular and special meetings of the Board. If a member has a valid reason for nonattendance, the member shall notify the Board chairperson or City Clerk before the meeting. A Board member will be asked to resign if at any time the member has three unexcused absences within a six-month period from a regular, special, or subcommittee meeting, or if total absences (whether excused or not) exceed forty percent (40%) of the total meetings in a calendar year. A review of attendance will be made at the end of each year.

TREES

151.01 Definition 151.04 Trimming Trees to be Supervised
151.02 Planting Prohibited 151.05 Disease Control
151.03 Duty to Trim Trees 151.06 Inspection and Removal

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 PROHIBITED. No person shall plant a tree in any street, street parking or public right-of-way.
(Ordinance No. 11-205)
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 fourteen (14) 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, 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 City Administrator 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:
1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.
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.
(Code of Iowa, Sec. 364.12[3b & h])

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

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

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