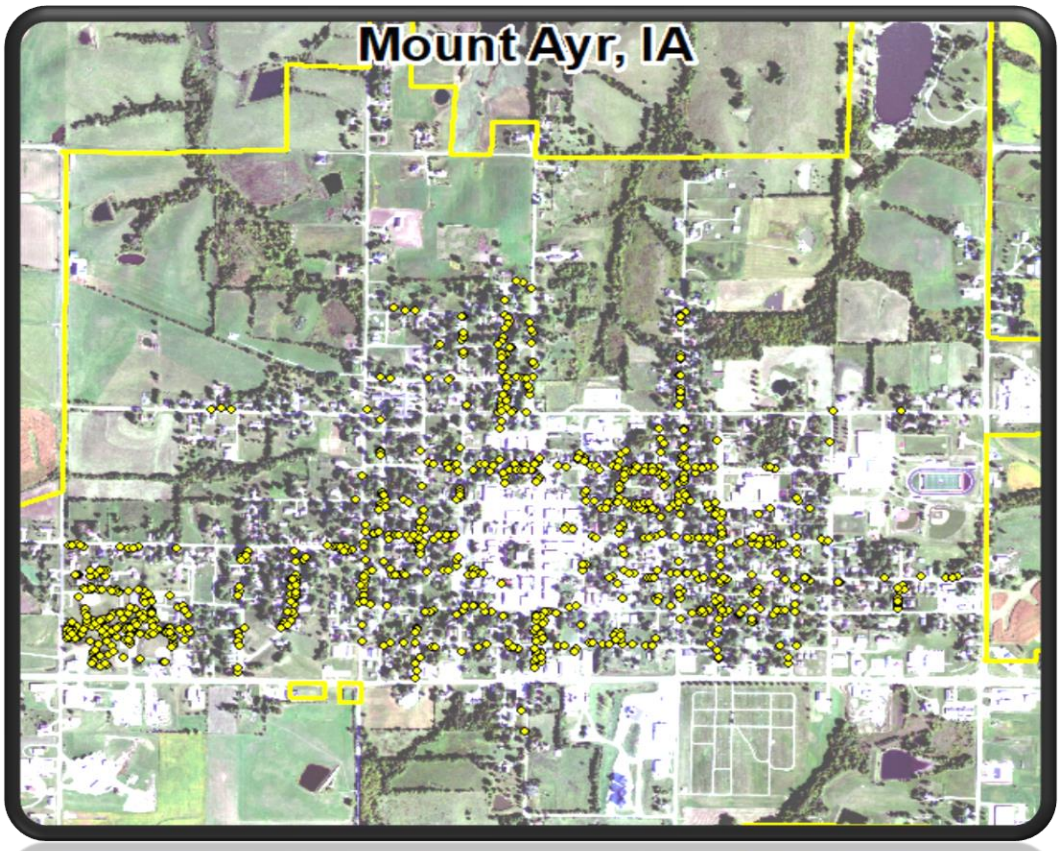
2022 Urban Forest Management Plan for the city of Mount Ayr



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Executive Summary

Overview

This plan was developed to assist the City of Mount Ayr 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 10% of Mount Ayr'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 2021, 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 841 trees inventoried.

- Mount Ayr's trees provide $184,703 of benefits annually, an average of $219.62 per tree
- There are over 53 species of trees
- The top three genera are: Maple 39.2%, Ash 10%, and Oak 8.2%
- 23.7% of trees are in need of some type of management
- 65 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 65 trees needing removal, 3 trees of critical concern and are over 24 inches in diameter at 4.5 ft and must be addressed immediately (these trees were classified as critical concern) *City ownership of the trees recommended for removal should be verified prior to any removal*
- 45 of the 84 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 does not include: ash, maple, cottonwood, poplar, willow, or non-native invasive trees (Bartlett Pear, Norway Maple, Amur Cork tree, Princess Tree, Siberian elm, etc).
- Check ash trees with a visual survey yearly
- With the current budget it could take 30 years just to remove ash – Suggestion: request a budget increase to $25,000 annually to cover potential EAB losses and normal tree losses and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2021, a tree inventory was conducted that included city owned trees in right of ways and in 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 841 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis. Fin

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Mount Ayr's trees reduce energy related costs by approximately $48,873 annually (Appendix A, Table 1). These savings are both in Electricity (219.2MWh) and in Natural Gas (29,831.8 Therms).

Annual Stormwater Benefits

Mount Ayr's trees intercept about 2,560,535 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $69,390 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 Mount Ayr, it is estimated that trees remove 2,832.4 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 $6,510 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere. In Mount Ayr, trees sequester about 615,297 lbs of carbon a year with an associated value of $4,615 (Appendix A, Table 5). In addition, the trees store 9,706,371 lbs of carbon, with a yearly benefit of $72,798 (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. Mount Ayr receives $54,496 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, Mount Ayr's trees provide $184,703 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 841 trees in Mount Ayr provide approximately $220 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Mount Ayr has over 53 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Age Class

Most of Mount Ayr's trees (33%) are between 18 and 30 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. Mount Ayr's size curve is on the larger side, indicating an older than 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 Mount Ayr indicate that 98% 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, 87% of Mount Ayr'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 13% of the population.

Species	Count	Percentage
Silver Maple	166	19.7%
Norway Maple	79	9.4%
Green ash	72	8.6%
Pin Oak	56	6.7%
Apple	45	5.4%
Hackberry	36	4.3%
Maple	31	3.7%
Sugar Maple	26	3.1%
Red Maple	26	3.1%
Siberian elm	25	3.0%
White Pine	25	3.0%
Ornamental Pear	23	2.7%
American Basswood	22	2.6%
Black Walnut	22	2.6%
Honey Locust	18	2.1%
Birch	17	2.0%
Scotch Pine	15	1.8%
Blue Spruce	15	1.8%
White Ash	11	1.3%
Mulberry	10	1.2%
Red Oak	7	0.8%
Red Bud	7	0.8%
Conifer Evergreen Medium	6	0.7%
Broadleaf Deciduous Medium	6	0.7%
Ohio Buckeye	6	0.7%

Little Leaf Linden	5	0.6%
Bur Oak	5	0.6%
Sycamore	5	0.6%
Spruce	5	0.6%
Tulip Tree	4	0.5%
Hickory	4	0.5%
Broadleaf Deciduous Small	4	0.5%
Willow	3	0.4%
Pear	3	0.4%
E. Red Cedar	3	0.4%
Kentucky Coffee Tree	3	0.4%
Elm	2	0.2%
Cottonwood	2	0.2%
Poplar	2	0.2%
Norway Spruce	2	0.2%
Sweetgum	2	0.2%
Catalpa	2	0.2%
Broadleaf Deciduous Large	2	0.2%
Black Maple	2	0.2%
American Elm	1	0.1%
Oak	1	0.1%
Cherry/plum	1	0.1%
Austrian Pine	1	0.1%
Southern Magnolia	1	0.1%
Gingko	1	0.1%
Ash	1	0.1%
Conifer Evergreen Small	1	0.1%
Other	1	0.1%
	841	

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	127	15%
Tree Removal	65	8%
Tree Reduction	5	<1%
Tree Raising	1	<1%
Pest/Disease Control	1	<1%

Canopy Cover

The total canopy cover, including both private and public trees is 13% (or 224 total acres). The canopy cover on city own properties included in the Mount Ayr inventory includes approximately 26.11 acres (Appendix A, Figure 4). New plantings and replacement plantings will be critical for just maintaining

the current canopy cover. While there are no programs to assist with tree removals, there are many programs available to assist communities with replacing public and private trees.

Land Use and Location

The majority of Mount Ayr's city and park trees are found 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	79%
Park/Vacant Lot	20%
Multifamily Residential	7%
Industrial/Large Commercial	4%

Location	
Planting strip	54%
Other maintained locations	46%

Changes in Forest Structure Since plan in 2015: Emerald Ash borer hit South Central and Southwest Iowa with a vengeance, staring around 2015 (after this inventory was completed). The increase in tree removals has to do with natural tree aging (and age-related structural risks), and also the tree decline and death associated with Emerald Ash Borer infestations. For instance, in 2015, only one ash tree showed signs of EAB, and now 45 trees (or about ½ of the total ash) showing symptoms of insect infestation. Fortunately, EAB has progressed more slowly in your area, as compared to your neighbors to the north and northwest.

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

Mount Ayr has 10 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 critical concern 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 removals are addressed, there should be follow up on the critical concern trees identified for cleaning (which there is 1). The next priority is to address all mature tree immediate and young tree immediate removals and maintenance tasks.

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 65 removals, 18 are ash trees. There are a total of 84 ash trees, and 45 of those have signs and symptoms that have been associated with EAB. In addition, there are 15 trees that are in poor or dead/dying 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.

Planting

Most of the planting over the next 6 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 Mount Ayr.

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 (39%) (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, Siberian elm, willow or black walnut (or other trees with large seeds for right of way use), 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 decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Budget and Emerald Ash Borer Plan

There are 84 ash trees that may require removal over the next five years, in addition to 65 trees that are slated for critical concern removal, immediate mature tree removal, and mature tree routine removals. The grand total of removals is 65 (18 of which are ash) which equals 41 trees. The total ash

trees (84) in combination with 41 removals equates to 125 total trees. If a tree service performs all the removals (and the removal work is not done by city staff), the cost to the city could be as much as $150,000 over the next 6 years (125 trees x $1,200 per tree). If city staff cannot remove trees, it is recommended that you solicit bids from tree services, in hope to get a quantity discount. The current tree budget is $5,000/year. This means, the removals would have to be spread out over 30 years unless the budget is increased. If the tree budget is increased to $25,000/year (at least in the short term), the ash and other tree removals could be covered within 6 years' time.

Six Year Maintenance Plan

FY 2023

Removal: 10 critical concern trees and at least 15 remaining mature tree immediate removals over 18" in diameter.
Planting and Replacement: 25 removals x 1.2 = up to 30 trees replaced
Routine Trimming: complete the 1 critical concern cleaning
Ongoing visual survey for signs and symptoms of EAB

FY 2024

Removal: Remove an additional 20 trees slated for mature tree immediate removal
Planting and Replacement: Replant at least 24 trees
Routine trimming: Prune ~ ½ of the 116 trees slated for mature tree immediate "cleaning"
Visual Survey for signs and symptoms of EAB

FY 2025

Removal: Remove the 12 remaining mature tree immediate trees, and also the 2 mature tree routine trees. Remove 2 young tree immediate trees. Remove 20 ash trees that are showing severe symptoms of EAB.
Planting and Replacement: replant 31 trees
Routine trimming: Prune remaining ~ ½ of the 116 trees slated for mature tree immediate "cleaning", and complete crown raises, and reductions on remaining 5 trees.
Visual Survey for signs and symptoms of EAB

FY 2026

Removal: Remove 4 young tree routine trees, and remove an additional 24 ash trees that are showing severe symptoms of EAB
Planting and Replacement: Replant 34 trees
Routine trimming: Complete trimming, raising, reductions, and staking on all remaining mature tree and young tree routine trees.
Visual Survey for signs and symptoms of EAB

FY 2027

Removal: Remove an additional 20 ash trees that are showing severe symptoms of EAB
Planting and Replacement: replant 24 trees
Visual Survey for signs and symptoms of EAB

FY 2028

Removal: Remove the final 20 ash trees (if dead)
Planting and Replacement: replant 24 trees

Visual Survey for signs and symptoms of EAB

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

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

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

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

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

Wood Disposal

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

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Siberian elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Tree Replacements and Prolonging Tree Life

If all ash trees die, in combination with the trees recommended for removal, Mounty Ayr will end up losing 125 trees. It is recommended that trees be replaced at a rate of 1.2 x the number of trees removed (which would equal 150 trees). While removal expenses are not covered by grants, tree planting and tree stock is often covered by grants for landowners and communities. 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.

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. Ash trees selected for ongoing treatments should be in excellent health, good structural form, and have more than 75% of their canopy intact. Actively dying trees with less than 75% of their canopy intact are not good candidates for injection treatment and should be considered for eventual removal. This is an alternative to the straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Mount Ayr. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Mount Ayr

Annual Energy Benefits of Public Trees

5/30/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	57.5	4,365	7,555.5	7,404	11,770	(N/A)	19.8	25.7	70.90
Norway maple	20.2	1,530	2,914.4	2,856	4,386	(N/A)	9.4	9.6	55.52
Green ash	22.8	1,731	3,133.2	3,071	4,801	(N/A)	8.6	10.5	66.69
Pin oak	19.9	1,513	2,671.8	2,618	4,131	(N/A)	6.7	9.0	73.77
Apple	3.8	285	575.4	564	849	(N/A)	5.4	1.9	18.86
Northern hackberry	13.1	997	1,857.3	1,820	2,817	(N/A)	4.3	6.1	78.26
Maple	4.8	364	655.5	642	1,006	(N/A)	3.7	2.2	32.45
Sugar maple	7.0	535	944.0	925	1,460	(N/A)	3.1	3.2	56.14
Red maple	5.1	389	652.1	639	1,028	(N/A)	3.1	2.2	39.54
Eastern white pine	3.0	231	380.4	373	604	(N/A)	3.0	1.3	24.16
Siberian elm	9.3	705	1,247.2	1,222	1,928	(N/A)	3.0	4.2	77.11
Callery pear	3.7	284	524.1	514	798	(N/A)	2.7	1.7	34.69
Black walnut	5.9	447	803.5	787	1,234	(N/A)	2.6	2.7	56.10
American basswood	6.9	526	1,007.9	988	1,514	(N/A)	2.6	3.3	68.82
Honeylocust	6.2	467	795.9	780	1,247	(N/A)	2.1	2.7	69.28
Birch	4.7	360	693.4	680	1,039	(N/A)	2.0	2.3	61.12
Scotch pine	1.5	114	188.7	185	299	(N/A)	1.8	0.7	19.91
Blue spruce	1.0	77	152.2	149	226	(N/A)	1.8	0.5	15.05
White ash	2.8	210	333.9	327	537	(N/A)	1.3	1.2	48.82
Mulberry	1.0	75	154.0	151	225	(N/A)	1.2	0.5	22.55
Northern red oak	0.8	62	113.1	111	173	(N/A)	0.8	0.4	24.68
Eastern redbud	0.9	71	145.8	143	214	(N/A)	0.8	0.5	30.54
Ohio buckeye	1.1	84	157.0	154	238	(N/A)	0.7	0.5	39.63
Broadleaf Deciduous Mediu	1.5	117	218.1	214	331	(N/A)	0.7	0.7	55.09
Conifer Evergreen Medium	0.6	48	81.1	80	128	(N/A)	0.7	0.3	21.27
American sycamore	1.8	138	252.8	248	385	(N/A)	0.6	0.8	77.08
Littleleaf linden	0.9	67	108.2	106	173	(N/A)	0.6	0.4	34.61
Bur oak	1.3	100	181.3	178	278	(N/A)	0.6	0.6	55.52
Spruce	0.4	34	54.1	53	87	(N/A)	0.6	0.2	17.38
Broadleaf Deciduous Small	0.2	12	26.9	26	38	(N/A)	0.5	0.1	9.53
Hickory	0.5	39	68.2	67	106	(N/A)	0.5	0.2	26.53
Tulip tree	0.9	71	108.0	106	177	(N/A)	0.5	0.4	44.23
Willow	0.7	52	103.8	102	154	(N/A)	0.4	0.3	51.33
Eastern red cedar	0.3	25	49.3	48	74	(N/A)	0.4	0.2	24.57
Pear	0.3	25	50.3	49	75	(N/A)	0.4	0.2	24.84
Kentucky coffeetree	1.0	74	138.6	136	210	(N/A)	0.4	0.5	70.08
Black maple	0.6	43	79.8	78	121	(N/A)	0.2	0.3	60.68
Cottonwood	0.4	30	54.1	53	83	(N/A)	0.2	0.2	41.34
Norway spruce	0.3	20	29.3	29	48	(N/A)	0.2	0.1	24.14
Eastern cottonwood	0.9	66	118.0	116	182	(N/A)	0.2	0.4	91.02
Elm	0.4	32	60.6	59	92	(N/A)	0.2	0.2	45.77
Catalpa	0.5	37	67.4	66	103	(N/A)	0.2	0.2	51.33
Broadleaf Deciduous Large	0.9	66	116.8	114	181	(N/A)	0.2	0.4	90.32
Sweetgum	0.3	25	40.7	40	65	(N/A)	0.2	0.1	32.43
Ash	0.3	24	47.4	46	71	(N/A)	0.1	0.2	70.84
Cherry plum	0.0	2	3.8	4	5	(N/A)	0.1	0.0	5.40
Ginkgo	0.2	13	18.9	19	31	(N/A)	0.1	0.1	31.46
Conifer Evergreen Small	0.0	1	2.5	2	4	(N/A)	0.1	0.0	3.62
American elm	0.5	40	67.0	66	106	(N/A)	0.1	0.2	105.59
Oak	0.0	0	0.5	0	1	(N/A)	0.1	0.0	0.66
Southern magnolia	0.1	6	12.7	12	19	(N/A)	0.1	0.0	18.82
Austrian pine	0.1	10	15.2	15	25	(N/A)	0.1	0.1	24.51
Total	219.2	16,638	29,831.8	29,235	45,873	(N/A)	100.0	100.0	54.61

Table 2: Annual Stormwater Benefits

Mount Ayr

Annual Stormwater Benefits of Public Trees

5/30/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	846,103	22,929	(N/A)	19.8	33.0	138.13
Norway maple	191,755	5,197	(N/A)	9.4	7.5	65.78
Green ash	282,183	7,647	(N/A)	8.6	11.0	106.21
Pin oak	238,986	6,477	(N/A)	6.7	9.3	115.65
Apple	13,846	375	(N/A)	5.4	0.5	8.34
Northern hackberry	144,945	3,928	(N/A)	4.3	5.7	109.11
Maple	39,608	1,073	(N/A)	3.7	1.5	34.62
Sugar maple	78,284	2,121	(N/A)	3.1	3.1	81.60
Red maple	33,462	907	(N/A)	3.1	1.3	34.88
Eastern white pine	45,604	1,236	(N/A)	3.0	1.8	49.44
Siberian elm	106,711	2,892	(N/A)	3.0	4.2	115.68
Callery pear	22,779	617	(N/A)	2.7	0.9	26.84
Black walnut	62,825	1,703	(N/A)	2.6	2.5	77.39
American basswood	84,072	2,278	(N/A)	2.6	3.3	103.56
Honeylocust	69,604	1,886	(N/A)	2.1	2.7	104.79
Birch	50,356	1,365	(N/A)	2.0	2.0	80.27
Scotch pine	17,421	472	(N/A)	1.8	0.7	31.47
Blue spruce	11,911	323	(N/A)	1.8	0.5	21.52
White ash	23,978	650	(N/A)	1.3	0.9	59.07
Mulberry	4,870	132	(N/A)	1.2	0.2	13.20
Northern red oak	6,145	167	(N/A)	0.8	0.2	23.79
Eastern redbud	4,725	128	(N/A)	0.8	0.2	18.29
Ohio buckeye	8,340	226	(N/A)	0.7	0.3	37.67
Broadleaf Deciduous Medium	14,697	398	(N/A)	0.7	0.6	66.38
Conifer Evergreen Medium	7,688	208	(N/A)	0.7	0.3	34.72
American sycamore	24,553	665	(N/A)	0.6	1.0	133.08
Littleleaf linden	5,499	149	(N/A)	0.6	0.2	29.80
Bur oak	13,902	377	(N/A)	0.6	0.5	75.35
Spruce	5,260	143	(N/A)	0.6	0.2	28.51
Broadleaf Deciduous Small	544	15	(N/A)	0.5	0.0	3.68
Hickory	3,289	89	(N/A)	0.5	0.1	22.28
Tulip tree	5,862	159	(N/A)	0.5	0.2	39.72
Willow	6,830	185	(N/A)	0.4	0.3	61.69
Eastern red cedar	4,904	133	(N/A)	0.4	0.2	44.30
Pear	1,196	32	(N/A)	0.4	0.0	10.80
Kentucky coffeetree	12,024	326	(N/A)	0.4	0.5	108.62
Black maple	5,734	155	(N/A)	0.2	0.2	77.70
Cottonwood	5,508	149	(N/A)	0.2	0.2	74.64
Norway spruce	3,077	83	(N/A)	0.2	0.1	41.70
Eastern cottonwood	14,478	392	(N/A)	0.2	0.6	196.17
Elm	4,551	123	(N/A)	0.2	0.2	61.66
Catalpa	6,098	165	(N/A)	0.2	0.2	82.63
Broadleaf Deciduous Large	12,729	345	(N/A)	0.2	0.5	172.48
Sweetgum	2,073	56	(N/A)	0.2	0.1	28.09
Ash	3,764	102	(N/A)	0.1	0.1	102.01
Cherry plum	69	2	(N/A)	0.1	0.0	1.86
Ginkgo	718	19	(N/A)	0.1	0.0	19.45
Conifer Evergreen Small	183	5	(N/A)	0.1	0.0	4.97
American elm	4,551	123	(N/A)	0.1	0.2	123.33
Oak	18	0	(N/A)	0.1	0.0	0.48
Southern magnolia	677	18	(N/A)	0.1	0.0	18.34
Austrian pine	1,544	42	(N/A)	0.1	0.1	41.85
Citywide total	2,560,535	69,390	(N/A)	100.0	100.0	82.61

Table 3: Annual Air Quality Benefits

Mount Ayr

Annual Air Quality Benefits of Public Trees

5/30/2022

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								
Silver maple	146.9	24.9	71.9	6.5	792	270.9	39.7	37.9	260.1	1,696	-74.9	-281	784.0	2,206	(N/A)	19.8	13.29
Norway maple	39.5	6.8	19.4	1.8	214	97.8	14.1	13.4	91.4	606	-9.2	-35	275.1	784	(N/A)	9.4	9.93
Green ash	38.1	6.1	17.7	1.7	202	109.0	15.9	15.1	103.3	679	0.0	0	307.0	880	(N/A)	8.6	12.23
Pin oak	43.8	7.7	22.2	2.0	239	94.6	13.8	13.2	90.3	590	-80.6	-302	206.9	527	(N/A)	6.7	9.42
Apple	3.5	0.6	1.7	0.2	19	18.5	2.6	2.5	17.0	114	0.0	0	46.6	132	(N/A)	5.4	2.94
Northern hackberry	25.5	4.4	12.6	1.1	138	63.4	9.2	8.7	59.6	393	0.0	0	184.5	531	(N/A)	4.3	14.76
Maple	9.3	1.6	4.4	0.4	49	22.8	3.3	3.2	21.7	142	-3.1	-12	63.5	180	(N/A)	3.7	5.81
Sugar maple	10.4	1.8	5.2	0.5	56	33.4	4.9	4.7	31.9	209	-8.2	-31	84.5	234	(N/A)	3.1	9.01
Red maple	6.5	1.1	3.2	0.3	35	24.0	3.5	3.4	23.2	151	-2.4	-9	62.9	177	(N/A)	3.1	6.80
Eastern white pine	5.1	1.0	4.3	0.6	34	14.2	2.1	2.0	13.8	89	-19.7	-74	23.5	49	(N/A)	3.0	1.98
Siberian elm	19.3	3.3	9.2	0.9	103	44.1	6.4	6.1	42.1	275	0.0	0	131.4	379	(N/A)	3.0	15.15
Callery pear	3.2	0.6	1.8	0.1	18	18.0	2.6	2.5	17.0	112	-0.9	-3	44.9	126	(N/A)	2.7	5.50
Black walnut	7.5	1.2	3.6	0.3	40	28.1	4.1	3.9	26.7	175	0.0	0	75.4	215	(N/A)	2.6	9.78
American basswood	11.9	2.0	5.8	0.5	64	33.7	4.9	4.6	31.5	209	-10.0	-37	84.9	235	(N/A)	2.6	10.69
Honeylocust	13.7	2.3	6.2	0.6	72	28.9	4.2	4.0	27.8	181	-10.7	-40	77.1	213	(N/A)	2.1	11.83
Birch	11.0	1.9	5.3	0.5	59	23.1	3.3	3.2	21.5	143	-2.5	-9	67.3	192	(N/A)	2.0	11.32
Scotch pine	1.8	0.4	1.6	0.2	12	7.0	1.0	1.0	6.8	44	-5.9	-22	13.9	34	(N/A)	1.8	2.28
Blue spruce	1.2	0.2	1.1	0.1	8	4.9	0.7	0.7	4.6	30	-3.8	-14	9.7	24	(N/A)	1.8	1.61
White ash	2.8	0.5	1.4	0.1	15	12.8	1.9	1.8	12.5	81	0.0	0	33.8	96	(N/A)	1.3	8.72
Mulberry	1.6	0.3	0.7	0.1	9	4.9	0.7	0.7	4.4	30	0.0	0	13.3	38	(N/A)	1.2	3.83
Northern red oak	1.1	0.2	0.6	0.0	6	3.9	0.6	0.5	3.7	24	-1.6	-6	9.0	24	(N/A)	0.8	3.49
Eastern redbud	1.6	0.3	0.7	0.1	8	4.6	0.7	0.6	4.2	28	0.0	0	12.8	37	(N/A)	0.8	5.26
Ohio buckeye	1.5	0.3	0.8	0.1	8	5.3	0.8	0.7	5.0	33	-0.4	-1	14.1	40	(N/A)	0.7	6.64
Broadleaf Deciduous Medium	3.1	0.5	1.5	0.1	17	7.4	1.1	1.0	7.0	46	-0.7	-3	21.1	60	(N/A)	0.7	10.01
Conifer Evergreen Medium	0.9	0.2	0.8	0.1	6	3.0	0.4	0.4	2.9	19	-2.7	-10	6.0	15	(N/A)	0.7	2.44
American sycamore	3.4	0.6	1.6	0.2	18	8.7	1.3	1.2	8.2	54	0.0	0	25.1	72	(N/A)	0.6	14.44
Littleleaf linden	0.7	0.1	0.4	0.0	4	4.1	0.6	0.6	4.0	26	-0.4	-1	10.1	28	(N/A)	0.6	5.65
Bur oak	1.6	0.3	0.8	0.1	9	6.3	0.9	0.9	6.0	39	0.0	0	16.8	48	(N/A)	0.6	9.57
Spruce	0.6	0.1	0.5	0.1	4	2.1	0.3	0.3	2.0	13	-1.8	-7	4.1	10	(N/A)	0.6	2.00
Broadleaf Deciduous Small	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)	0.5	1.33
Hickory	0.2	0.0	0.1	0.0	1	2.4	0.4	0.3	2.3	15	0.0	0	5.8	16	(N/A)	0.5	4.10
Tulip tree	0.4	0.1	0.3	0.0	2	4.3	0.6	0.6	4.2	27	0.0	0	10.6	30	(N/A)	0.5	7.42
Willow	1.4	0.2	0.7	0.1	8	3.4	0.5	0.5	3.1	21	-0.3	-1	9.5	27	(N/A)	0.4	9.07
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)	0.4	2.19
Pear	0.3	0.0	0.2	0.0	2	1.6	0.2	0.2	1.5	10	0.0	0	4.1	12	(N/A)	0.4	3.88
Kentucky coffeetree	1.6	0.2	0.7	0.1	8	4.7	0.7	0.7	4.4	29	0.0	0	13.1	38	(N/A)	0.4	12.51
Black maple	1.5	0.3	0.7	0.1	8	2.7	0.4	0.4	2.6	17	-0.5	-2	8.1	23	(N/A)	0.2	11.54
Cottonwood	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	0.2	7.90
Norway spruce	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.2	7	-1.1	-4	2.3	6	(N/A)	0.2	2.82
Eastern cottonwood	2.3	0.4	1.0	0.1	12	4.2	0.6	0.6	4.0	26	0.0	0	13.1	38	(N/A)	0.2	19.04
Elm	0.5	0.1	0.3	0.0	3	2.0	0.3	0.3	1.9	13	0.0	0	5.4	15	(N/A)	0.2	7.73
Catalpa	0.8	0.1	0.4	0.0	4	2.3	0.3	0.3	2.2	14	0.0	0	6.5	19	(N/A)	0.2	9.35
Broadleaf Deciduous Large	2.4	0.4	1.0	0.1	12	4.1	0.6	0.6	4.0	26	0.0	0	13.2	38	(N/A)	0.2	19.13
Sweetgum	0.1	0.0	0.1	0.0	1	1.5	0.2	0.2	1.5	10	0.0	0	3.7	10	(N/A)	0.2	5.21
Ash	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14	(N/A)	0.1	13.58
Cherry plum	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)	0.1	0.71
Ginkgo	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.8	5	0.0	0	1.9	5	(N/A)	0.1	5.44
Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	-0.1	0	0.1	0	(N/A)	0.1	0.20
American elm	1.5	0.3	0.7	0.1	8	2.5	0.4	0.3	2.4	15	0.0	0	8.1	23	(N/A)	0.1	23.47
Oak	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)	0.1	0.08
Southern magnolia	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2	(N/A)	0.1	2.10
Austrian pine	0.2	0.0	0.2	0.0	1	0.6	0.1	0.1	0.6	4	-0.6	-2	1.2	3	(N/A)	0.1	2.89
Citywide total	433.8	73.7	215.4	20.2	2,349	1,044.3	152.2	145.1	993.0	6,510	-245.3	-920	2,832.4	7,938	(N/A)	100.0	9.45

Table 4: Annual Carbon Stored

Mount Ayr

Stored CO2 Benefits of Public Trees

5/30/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	3,265,796	24,493	(N/A)	19.8	33.6	147.55
Norway maple	651,983	4,890	(N/A)	9.4	6.7	61.90
Green ash	1,253,860	9,404	(N/A)	8.6	12.9	130.61
Pin oak	1,164,123	8,731	(N/A)	6.7	12.0	155.91
Apple	57,105	428	(N/A)	5.4	0.6	9.52
Northern hackberry	404,440	3,033	(N/A)	4.3	4.2	84.26
Maple	101,671	763	(N/A)	3.7	1.0	24.60
Sugar maple	300,168	2,251	(N/A)	3.1	3.1	86.59
Red maple	75,112	563	(N/A)	3.1	0.8	21.67
Eastern white pine	46,018	345	(N/A)	3.0	0.5	13.81
Siberian elm	465,344	3,490	(N/A)	3.0	4.8	139.60
Callery pear	54,871	412	(N/A)	2.7	0.6	17.89
Black walnut	245,073	1,838	(N/A)	2.6	2.5	83.55
American basswood	440,449	3,303	(N/A)	2.6	4.5	150.15
Honeylocust	176,278	1,322	(N/A)	2.1	1.8	73.45
Birch	182,422	1,368	(N/A)	2.0	1.9	80.48
Scotch pine	12,072	91	(N/A)	1.8	0.1	6.04
Blue spruce	5,448	41	(N/A)	1.8	0.1	2.72
White ash	61,466	461	(N/A)	1.3	0.6	41.91
Mulberry	25,464	191	(N/A)	1.2	0.3	19.10
Northern red oak	22,281	167	(N/A)	0.8	0.2	23.87
Eastern redbud	25,095	188	(N/A)	0.8	0.3	26.89
Ohio buckeye	24,830	186	(N/A)	0.7	0.3	31.04
Broadleaf Deciduous T	51,189	384	(N/A)	0.7	0.5	63.99
Conifer Evergreen Me	5,041	38	(N/A)	0.7	0.1	6.30
American sycamore	112,230	842	(N/A)	0.6	1.2	168.35
Littleleaf linden	15,405	116	(N/A)	0.6	0.2	23.11
Bur oak	52,025	390	(N/A)	0.6	0.5	78.04
Spruce	3,770	28	(N/A)	0.6	0.0	5.65
Broadleaf Deciduous S	1,843	14	(N/A)	0.5	0.0	3.46
Hickory	6,775	51	(N/A)	0.5	0.1	12.70
Tulip tree	14,687	110	(N/A)	0.5	0.2	27.54
Willow	23,326	175	(N/A)	0.4	0.2	58.32
Eastern red cedar	3,306	25	(N/A)	0.4	0.0	8.27
Pear	4,853	36	(N/A)	0.4	0.0	12.13
Kentucky coffeetree	50,174	376	(N/A)	0.4	0.5	125.43
Black maple	15,891	119	(N/A)	0.2	0.2	59.59
Cottonwood	25,955	195	(N/A)	0.2	0.3	97.33
Norway spruce	2,340	18	(N/A)	0.2	0.0	8.78
Eastern cottonwood	78,517	589	(N/A)	0.2	0.8	294.44
Elm	16,807	126	(N/A)	0.2	0.2	63.03
Catalpa	26,978	202	(N/A)	0.2	0.3	101.17
Broadleaf Deciduous T	81,925	614	(N/A)	0.2	0.8	307.22
Sweetgum	4,706	35	(N/A)	0.2	0.0	17.65
Ash	14,280	107	(N/A)	0.1	0.1	107.10
Cherry plum	178	1	(N/A)	0.1	0.0	1.33
Ginkgo	1,787	13	(N/A)	0.1	0.0	13.40
Conifer Evergreen Sm	43	0	(N/A)	0.1	0.0	0.32
American elm	29,353	220	(N/A)	0.1	0.3	220.15
Oak	12	0	(N/A)	0.1	0.0	0.09
Southern magnolia	484	4	(N/A)	0.1	0.0	3.63
Austrian pine	1,118	8	(N/A)	0.1	0.0	8.39
Citywide total	9,706,371	72,798	(N/A)	100.0	100.0	86.66

Table 5: Annual Carbon Sequestered

Mount Ayr

Annual CO Benefits of Public Trees

5/30/2022

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
Silver maple	241,630	1,812	-15,676	-636	-122	96,469	724	321,788	2,413 (N/A)	19.8	34.5	14.54
Norway maple	27,520	206	-3,130	-212	-25	33,806	254	57,984	435 (N/A)	9.4	6.2	5.50
Green ash	53,839	404	-6,019	-244	-47	38,250	287	85,827	644 (N/A)	8.6	9.2	8.94
Pin oak	103,599	777	-5,588	-216	-44	33,435	251	131,230	984 (N/A)	6.7	14.1	17.58
Apple	5,846	44	-274	-52	-2	6,297	47	11,817	89 (N/A)	5.4	1.3	1.97
Northern hackberry	17,852	134	-1,941	-131	-16	22,040	165	37,820	284 (N/A)	4.3	4.0	7.88
Maple	8,692	65	-488	-47	-4	8,038	60	16,195	121 (N/A)	3.7	1.7	3.92
Sugar maple	15,659	117	-1,441	-76	-11	11,814	89	25,956	195 (N/A)	3.1	2.8	7.49
Red maple	9,946	75	-361	-44	-3	8,596	64	18,138	136 (N/A)	3.1	1.9	5.23
Eastern white pine	3,142	24	-221	-51	-2	5,110	38	7,981	60 (N/A)	3.0	0.9	2.39
Siberian elm	18,342	138	-2,234	-101	-18	15,590	117	31,597	237 (N/A)	3.0	3.4	9.48
Callery pear	6,855	51	-263	-35	-2	6,281	47	12,837	96 (N/A)	2.7	1.4	4.19
Black walnut	13,832	104	-1,176	-61	-9	9,871	74	22,467	169 (N/A)	2.6	2.4	7.66
American basswood	24,863	186	-2,114	-83	-16	11,632	87	34,299	257 (N/A)	2.6	3.7	11.69
Honeylocust	16,118	121	-846	-47	-7	10,320	77	25,546	192 (N/A)	2.1	2.7	10.64
Birch	5,860	44	-876	-51	-7	7,946	60	12,880	97 (N/A)	2.0	1.4	5.68
Scotch pine	1,356	10	-58	-25	-1	2,515	19	3,788	28 (N/A)	1.8	0.4	1.89
Blue spruce	630	5	-26	-18	0	1,691	13	2,277	17 (N/A)	1.8	0.2	1.14
White ash	6,490	49	-295	-23	-2	4,638	35	10,810	81 (N/A)	1.3	1.2	7.37
Mulberry	1,546	12	-122	-15	-1	1,647	12	3,055	23 (N/A)	1.2	0.3	2.29
Northern red oak	834	6	-107	-10	-1	1,370	10	2,086	16 (N/A)	0.8	0.2	2.24
Eastern redbud	983	7	-120	-14	-1	1,567	12	2,415	18 (N/A)	0.8	0.3	2.59
Ohio buckeye	1,814	14	-119	-11	-1	1,856	14	3,540	27 (N/A)	0.7	0.4	4.42
Broadleaf Deciduous Medi	1,736	13	-246	-16	-2	2,582	19	4,055	30 (N/A)	0.7	0.4	5.07
Conifer Evergreen Mediun	440	3	-24	-10	0	1,064	8	1,469	11 (N/A)	0.7	0.2	1.84
American sycamore	4,498	34	-539	-20	-4	3,041	23	6,981	52 (N/A)	0.6	0.7	10.47
Littleleaf linden	2,280	17	-74	-9	-1	1,481	11	3,678	28 (N/A)	0.6	0.4	5.52
Bur oak	3,225	24	-250	-14	-2	2,208	17	5,170	39 (N/A)	0.6	0.6	7.75
Spruce	403	3	-18	-7	0	750	6	1,127	8 (N/A)	0.6	0.1	1.69
Broadleaf Deciduous Smal	245	2	-9	-3	0	260	2	493	4 (N/A)	0.5	0.1	0.92
Hickory	1,072	8	-33	-5	0	869	7	1,903	14 (N/A)	0.5	0.2	3.57
Tulip tree	1,781	13	-70	-8	-1	1,571	12	3,275	25 (N/A)	0.5	0.4	6.14
Willow	694	5	-112	-8	-1	1,154	9	1,728	13 (N/A)	0.4	0.2	4.32
Eastern red cedar	0	0	-16	-6	0	561	4	539	4 (N/A)	0.4	0.1	1.35
Pear	495	4	-23	-4	0	557	4	1,025	8 (N/A)	0.4	0.1	2.56
Kentucky coffeetree	2,476	19	-241	-11	-2	1,644	12	3,868	29 (N/A)	0.4	0.4	9.67
Black maple	0	0	-76	-5	-1	954	7	872	7 (N/A)	0.2	0.1	3.27
Cottonwood	962	7	-125	-4	-1	654	5	1,487	11 (N/A)	0.2	0.2	5.58
Norway spruce	231	2	-11	-4	0	433	3	649	5 (N/A)	0.2	0.1	2.43
Eastern cottonwood	1,824	14	-377	-10	-3	1,469	11	2,906	22 (N/A)	0.2	0.3	10.90
Elm	1,066	8	-81	-5	-1	711	5	1,691	13 (N/A)	0.2	0.2	6.34
Catalpa	1,168	9	-129	-5	-1	809	6	1,842	14 (N/A)	0.2	0.2	6.91
Broadleaf Deciduous Larg	1,438	11	-393	-10	-3	1,463	11	2,498	19 (N/A)	0.2	0.3	9.37
Sweetgum	654	5	-23	-3	0	552	4	1,180	9 (N/A)	0.2	0.1	4.43
Ash	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.1	0.1	6.27
Cherry plum	38	0	-1	-1	0	37	0	74	1 (N/A)	0.1	0.0	0.55
Ginkgo	134	1	-9	-2	0	285	2	409	3 (N/A)	0.1	0.0	3.07
Conifer Evergreen Small	13	0	0	-1	0	26	0	39	0 (N/A)	0.1	0.0	0.29
American elm	655	5	-141	-5	-1	883	7	1,392	10 (N/A)	0.1	0.1	10.44
Oak	3	0	0	0	0	4	0	7	0 (N/A)	0.1	0.0	0.05
Southern magnolia	56	0	-2	-1	0	141	1	194	1 (N/A)	0.1	0.0	1.45
Austrian pine	91	1	-5	-2	0	213	2	296	2 (N/A)	0.1	0.0	2.22
Citywide total	615,297	4,615	-46,591	-2,385	-367	367,694	2,758	934,015	7,005 (N/A)	100.0	100.0	8.34

Table 6: Annual Social and Aesthetic Benefits

Mount Ayr

Annual Aesthetic/Other Benefits of Public Trees

5/30/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	18,583	(N/A)	19.8	34.1	111.94
Norway maple	2,601	(N/A)	9.4	4.8	32.93
Green ash	4,170	(N/A)	8.6	7.7	57.91
Pin oak	7,684	(N/A)	6.7	14.1	137.21
Apple	332	(N/A)	5.4	0.6	7.39
Northern hackberry	2,212	(N/A)	4.3	4.1	61.44
Maple	1,140	(N/A)	3.7	2.1	36.78
Sugar maple	1,637	(N/A)	3.1	3.0	62.98
Red maple	1,403	(N/A)	3.1	2.6	53.96
Eastern white pine	770	(N/A)	3.0	1.4	30.82
Siberian elm	1,202	(N/A)	3.0	2.2	48.06
Callery pear	736	(N/A)	2.7	1.4	32.02
Black walnut	1,174	(N/A)	2.6	2.2	53.35
American basswood	1,735	(N/A)	2.6	3.2	78.86
Honeylocust	4,003	(N/A)	2.1	7.3	222.40
Birch	531	(N/A)	2.0	1.0	31.26
Scotch pine	383	(N/A)	1.8	0.7	25.56
Blue spruce	307	(N/A)	1.8	0.6	20.47
White ash	773	(N/A)	1.3	1.4	70.28
Mulberry	90	(N/A)	1.2	0.2	9.01
Northern red oak	87	(N/A)	0.8	0.2	12.46
Eastern redbud	57	(N/A)	0.8	0.1	8.16
Ohio buckeye	188	(N/A)	0.7	0.3	31.41
Broadleaf Deciduous Medium	167	(N/A)	0.7	0.3	27.91
Conifer Evergreen Medium	143	(N/A)	0.7	0.3	23.85
American sycamore	324	(N/A)	0.6	0.6	64.82
Littleleaf linden	252	(N/A)	0.6	0.5	50.31
Bur oak	271	(N/A)	0.6	0.5	54.24
Spruce	118	(N/A)	0.6	0.2	23.63
Broadleaf Deciduous Small	13	(N/A)	0.5	0.0	3.22
Hickory	132	(N/A)	0.5	0.2	32.88
Tulip tree	183	(N/A)	0.5	0.3	45.86
Willow	69	(N/A)	0.4	0.1	23.09
Eastern red cedar	0	(N/A)	0.4	0.0	0.00
Pear	28	(N/A)	0.4	0.1	9.43
Kentucky coffeetree	190	(N/A)	0.4	0.3	63.29
Black maple	0	(N/A)	0.2	0.0	0.00
Cottonwood	72	(N/A)	0.2	0.1	35.93
Norway spruce	65	(N/A)	0.2	0.1	32.32
Eastern cottonwood	117	(N/A)	0.2	0.2	58.34
Elm	94	(N/A)	0.2	0.2	47.07
Catalpa	95	(N/A)	0.2	0.2	47.58
Broadleaf Deciduous Large	95	(N/A)	0.2	0.2	47.59
Sweetgum	74	(N/A)	0.2	0.1	37.21
Ash	31	(N/A)	0.1	0.1	31.46
Cherry plum	2	(N/A)	0.1	0.0	2.06
Ginkgo	12	(N/A)	0.1	0.0	12.07
Conifer Evergreen Small	13	(N/A)	0.1	0.0	13.37
American elm	82	(N/A)	0.1	0.2	82.32
Oak	5	(N/A)	0.1	0.0	5.26
Southern magnolia	22	(N/A)	0.1	0.0	21.93
Austrian pine	25	(N/A)	0.1	0.0	25.23
Citywide total	54,496	(N/A)	100.0	100.0	64.88

Table 7: Summary of Benefits in Dollars

Mount Ayr

Total Annual Benefits of Public Trees by Species ($)

5/30/2022

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Silver maple	11,770	2,413	2,206	22,929	18,583	57,901	(N/A)	31.3
Norway maple	4,386	435	784	5,197	2,601	13,403	(N/A)	7.3
Green ash	4,801	644	880	7,647	4,170	18,142	(N/A)	9.8
Pin oak	4,131	984	527	6,477	7,684	19,803	(N/A)	10.7
Apple	849	89	132	375	332	1,777	(N/A)	1.0
Northern hackberry	2,817	284	531	3,928	2,212	9,772	(N/A)	5.3
Maple	1,006	121	180	1,073	1,140	3,521	(N/A)	1.9
Sugar maple	1,460	195	234	2,121	1,637	5,647	(N/A)	3.1
Red maple	1,028	136	177	907	1,403	3,651	(N/A)	2.0
Eastern white pine	604	60	49	1,236	770	2,720	(N/A)	1.5
Siberian elm	1,928	237	379	2,892	1,202	6,637	(N/A)	3.6
Callery pear	798	96	126	617	736	2,374	(N/A)	1.3
Black walnut	1,234	169	215	1,703	1,174	4,494	(N/A)	2.4
American basswood	1,514	257	235	2,278	1,735	6,020	(N/A)	3.3
Honeylocust	1,247	192	213	1,886	4,003	7,541	(N/A)	4.1
Birch	1,039	97	192	1,365	531	3,224	(N/A)	1.7
Scotch pine	299	28	34	472	383	1,217	(N/A)	0.7
Blue spruce	226	17	24	323	307	897	(N/A)	0.5
White ash	537	81	96	650	773	2,137	(N/A)	1.2
Mulberry	225	23	38	132	90	509	(N/A)	0.3
Northern red oak	173	16	24	167	87	467	(N/A)	0.3
Eastern redbud	214	18	37	128	57	454	(N/A)	0.2
Ohio buckeye	238	27	40	226	188	719	(N/A)	0.4
Broadleaf Deciduous M	331	30	60	398	167	987	(N/A)	0.5
Conifer Evergreen Medi	128	11	15	208	143	505	(N/A)	0.3
American sycamore	385	52	72	665	324	1,499	(N/A)	0.8
Littleleaf linden	173	28	28	149	252	629	(N/A)	0.3
Bur oak	278	39	48	377	271	1,012	(N/A)	0.5
Spruce	87	8	10	143	118	366	(N/A)	0.2
Broadleaf Deciduous Sn	38	4	5	15	13	75	(N/A)	0.0
Hickory	106	14	16	89	132	357	(N/A)	0.2
Tulip tree	177	25	30	159	183	573	(N/A)	0.3
Willow	154	13	27	185	69	449	(N/A)	0.2
Eastern red cedar	74	4	7	133	0	217	(N/A)	0.1
Pear	75	8	12	32	28	155	(N/A)	0.1
Kentucky coffeetree	210	29	38	326	190	793	(N/A)	0.4
Black maple	121	7	23	155	0	306	(N/A)	0.2
Cottonwood	83	11	16	149	72	331	(N/A)	0.2
Norway spruce	48	5	6	83	65	207	(N/A)	0.1
Eastern cottonwood	182	22	38	392	117	751	(N/A)	0.4
Elm	92	13	15	123	94	337	(N/A)	0.2
Catalpa	103	14	19	165	95	396	(N/A)	0.2
Broadleaf Deciduous La	181	19	38	345	95	678	(N/A)	0.4
Sweetgum	65	9	10	56	74	215	(N/A)	0.1
Ash	71	6	14	102	31	224	(N/A)	0.1
Cherry plum	5	1	1	2	2	11	(N/A)	0.0
Ginkgo	31	3	5	19	12	71	(N/A)	0.0
Conifer Evergreen Smal	4	0	0	5	13	22	(N/A)	0.0
American elm	106	10	23	123	82	345	(N/A)	0.2
Oak	1	0	0	0	5	7	(N/A)	0.0
Southern magnolia	19	1	2	18	22	63	(N/A)	0.0
Austrian pine	25	2	3	42	25	97	(N/A)	0.1
Citywide Total	45,873	7,005	7,938	69,390	54,496	184,703	(N/A)	100.0

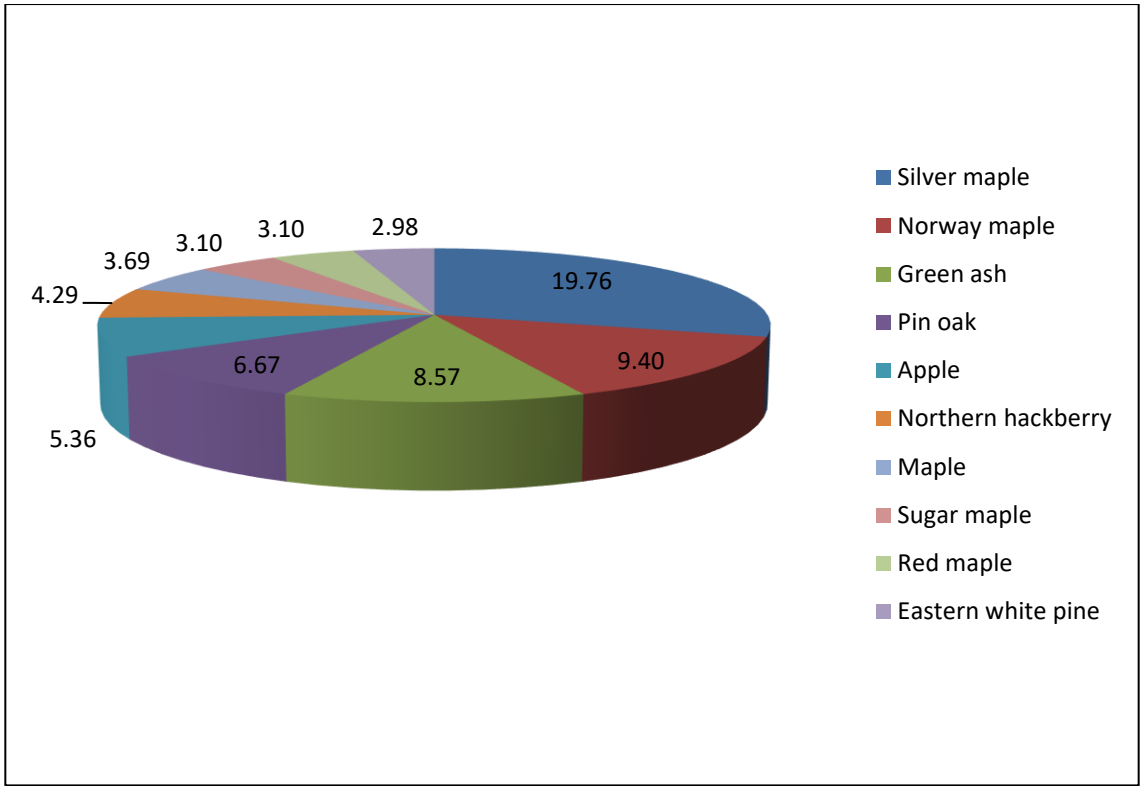

Figure 1: Species Distribution

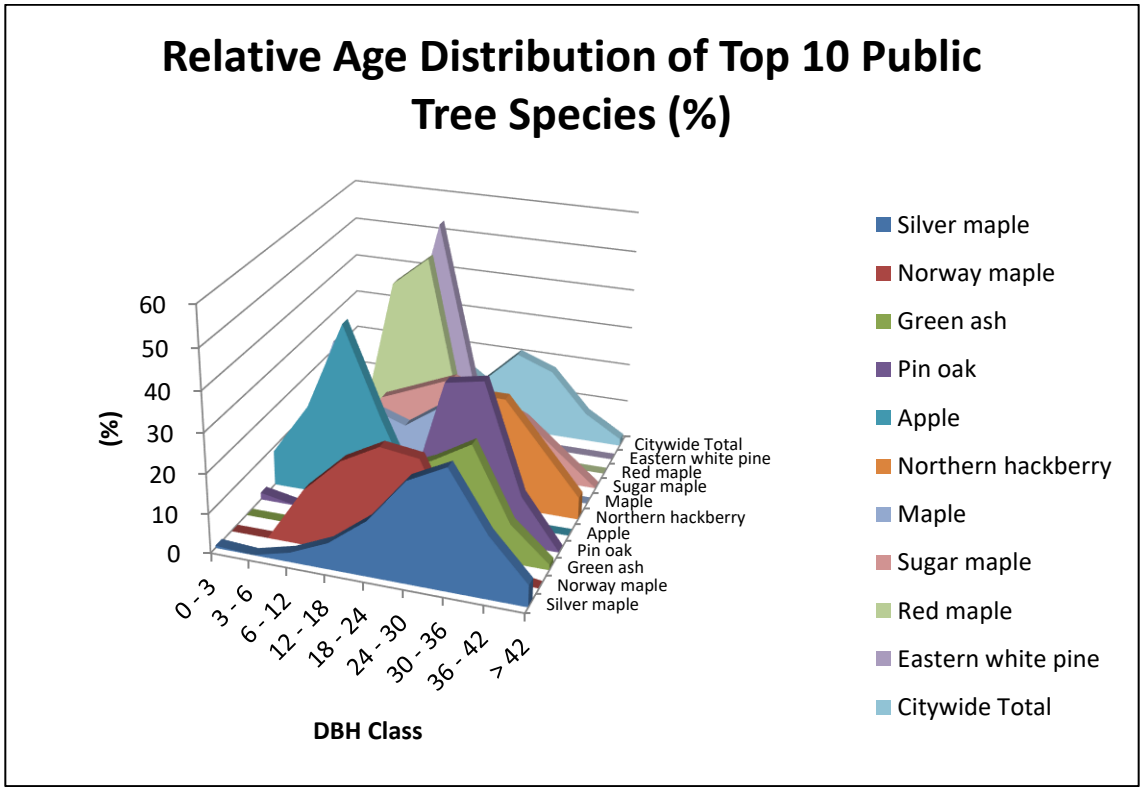

Figure 2: Relative Age Class

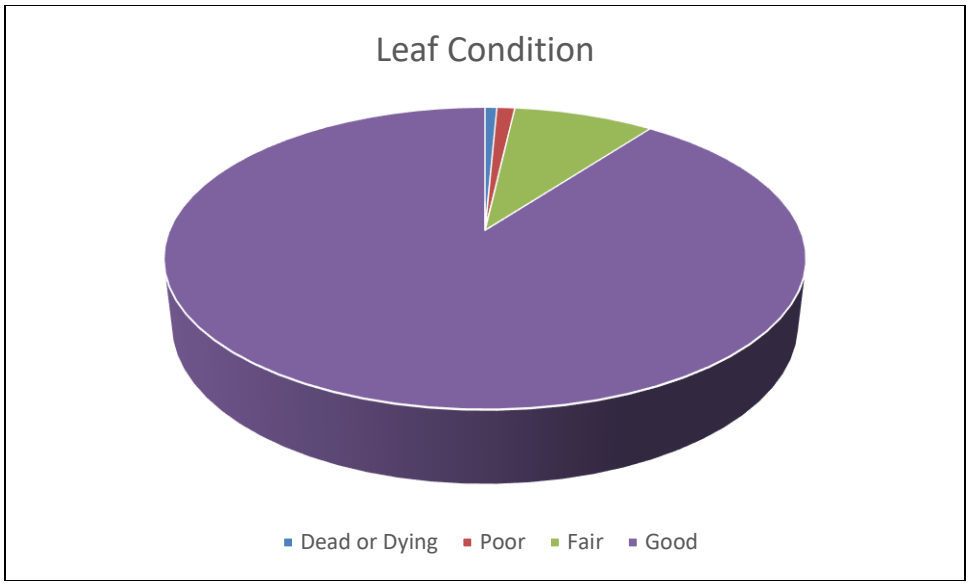

Figure 3: Foliage Condition

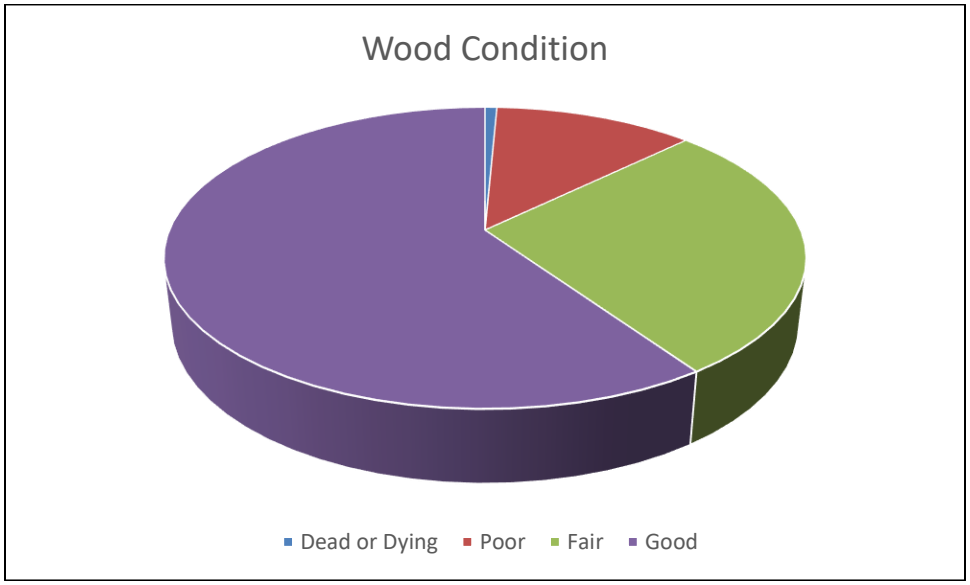

Figure 4: Wood Condition

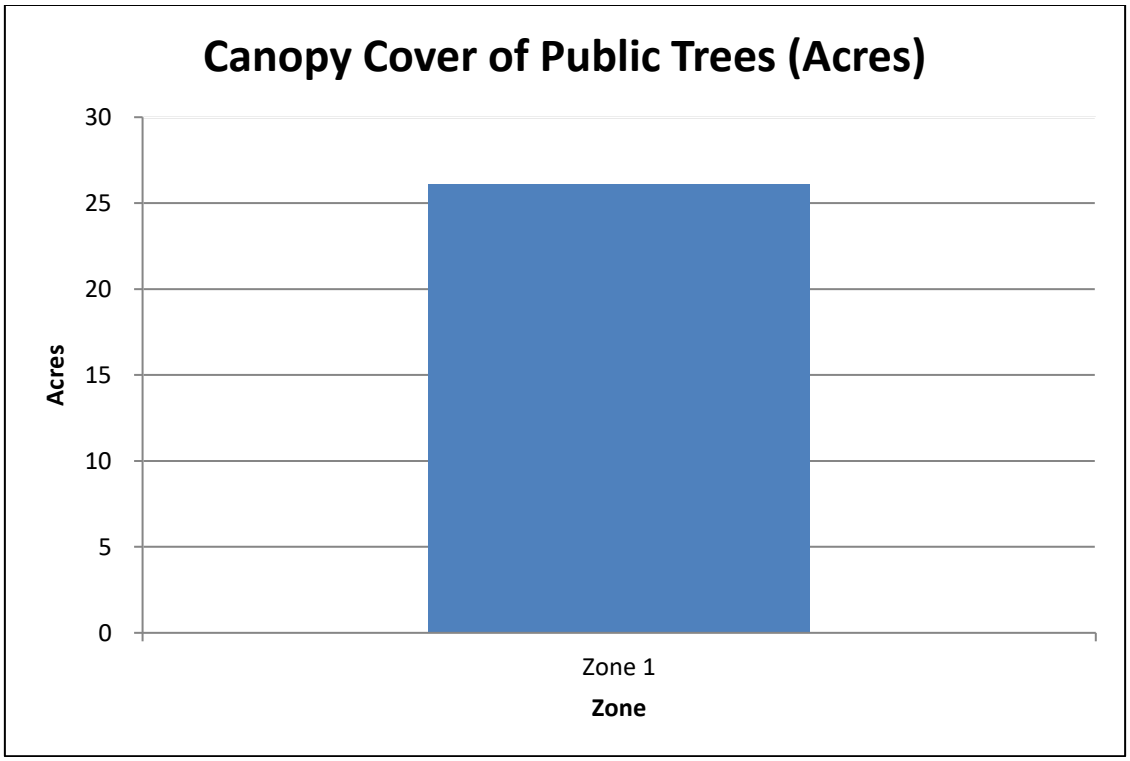

Figure 5: Canopy Cover in Acres

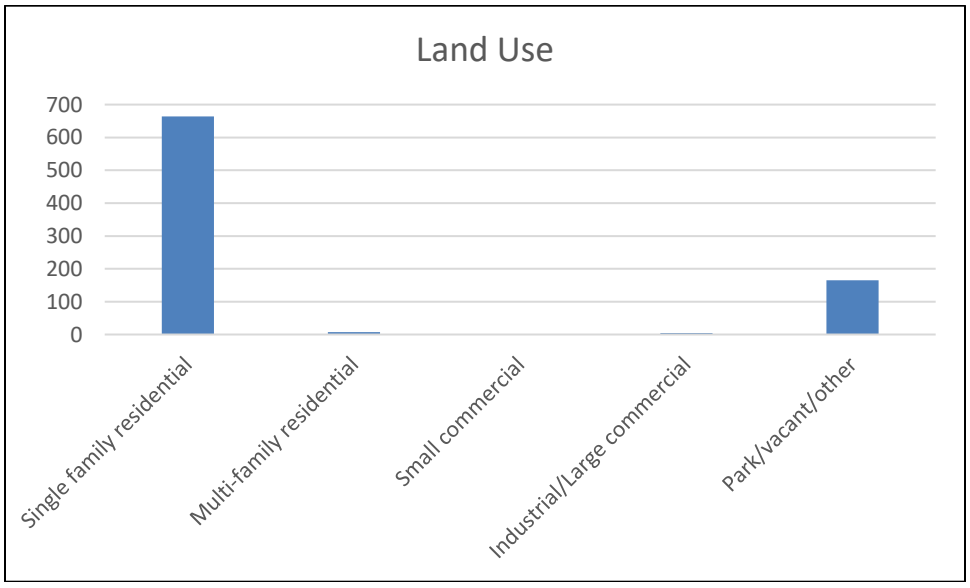

Figure 6: Land Use of city/park trees

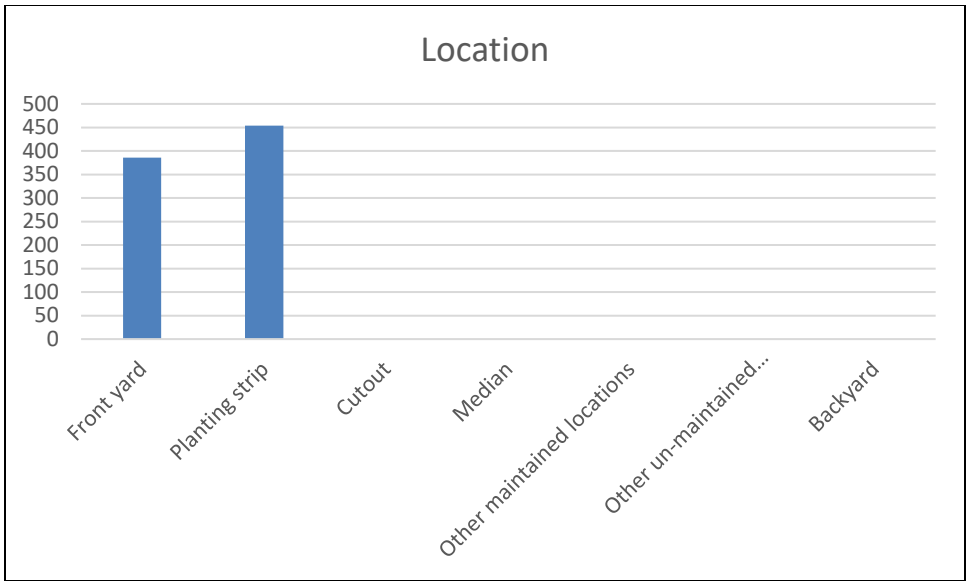

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

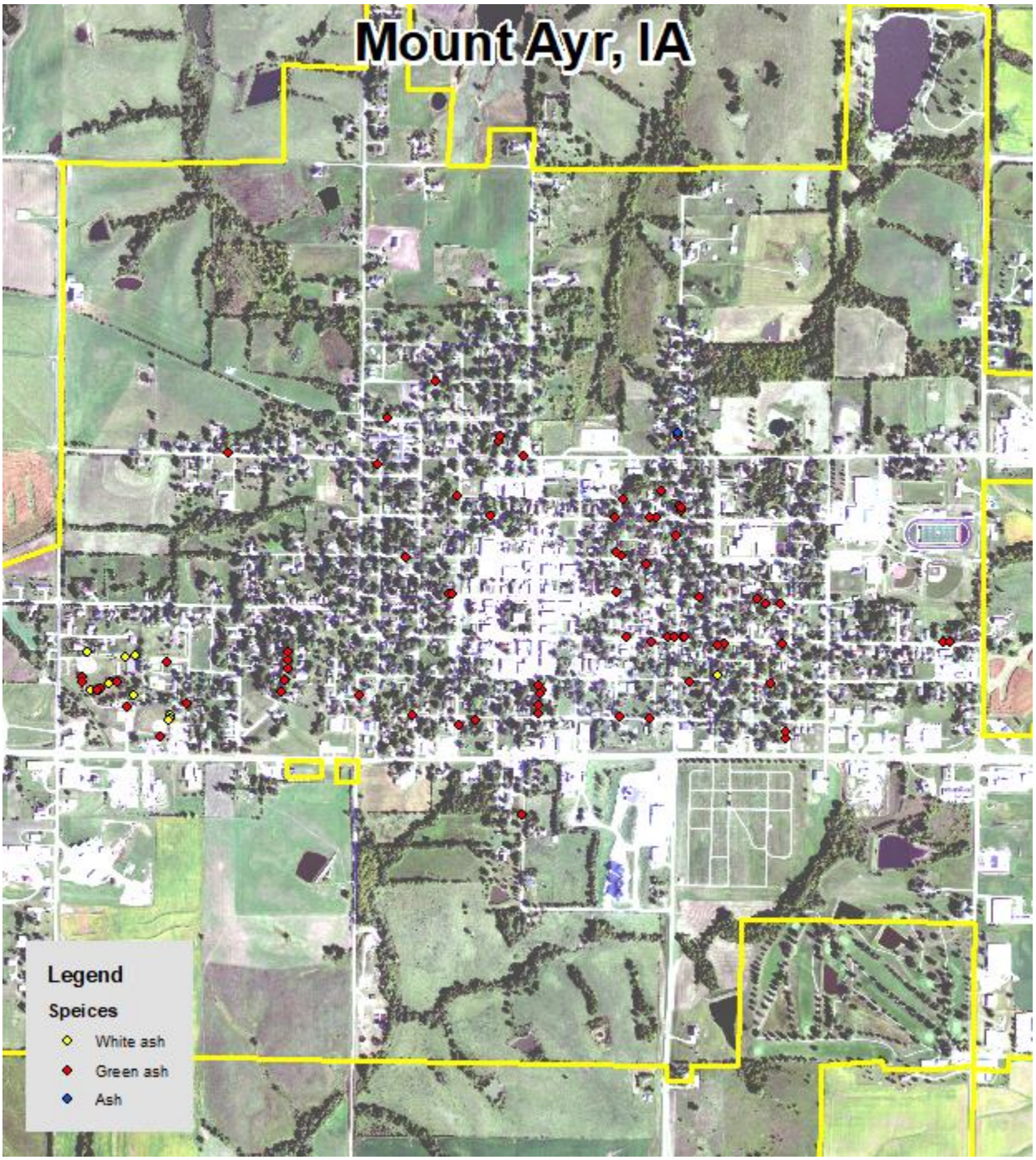

Figure 1: Location of Ash Trees

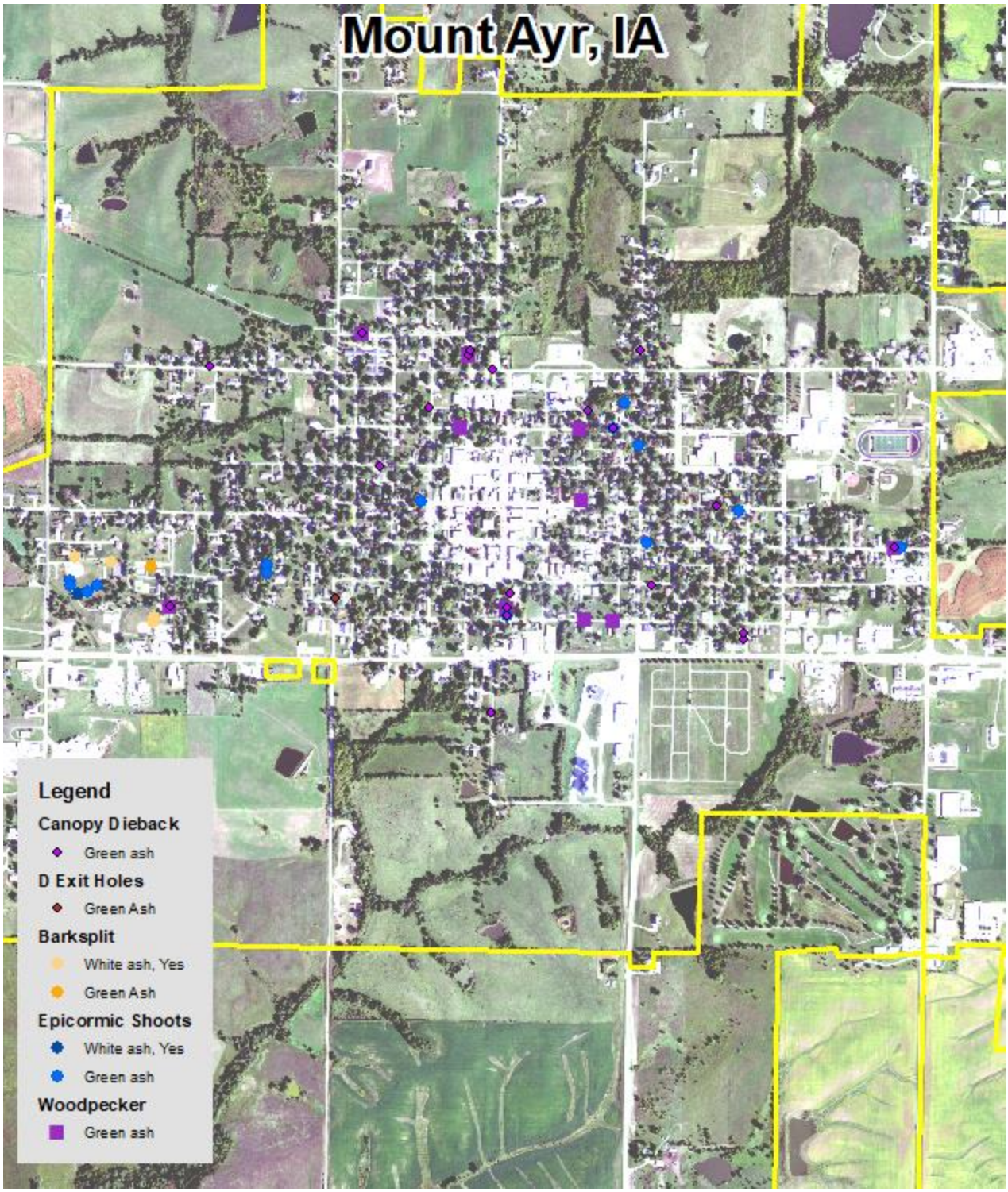

Figure 2: Location of EAB symptoms

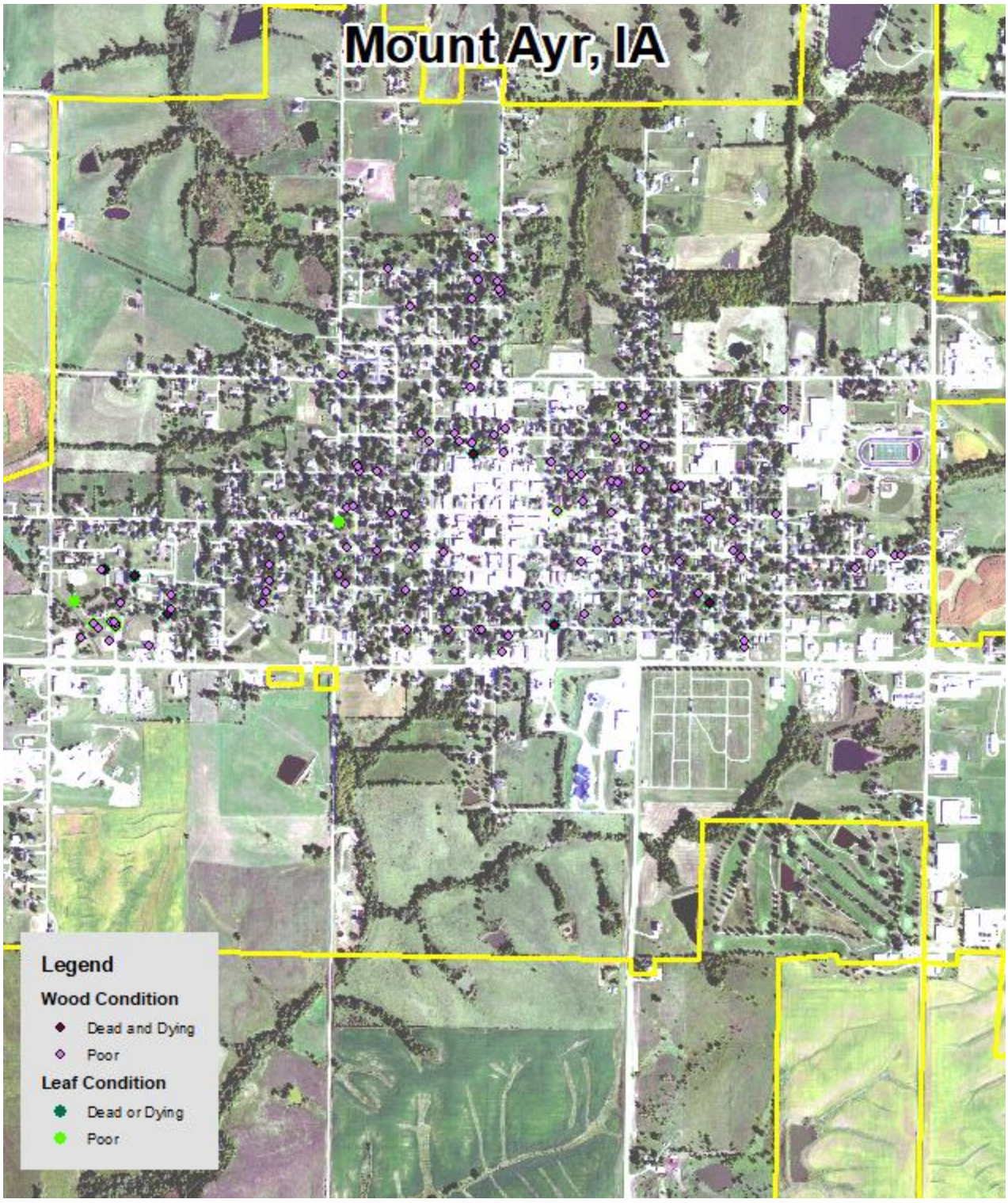

Figure 3: Location of Poor Condition Trees

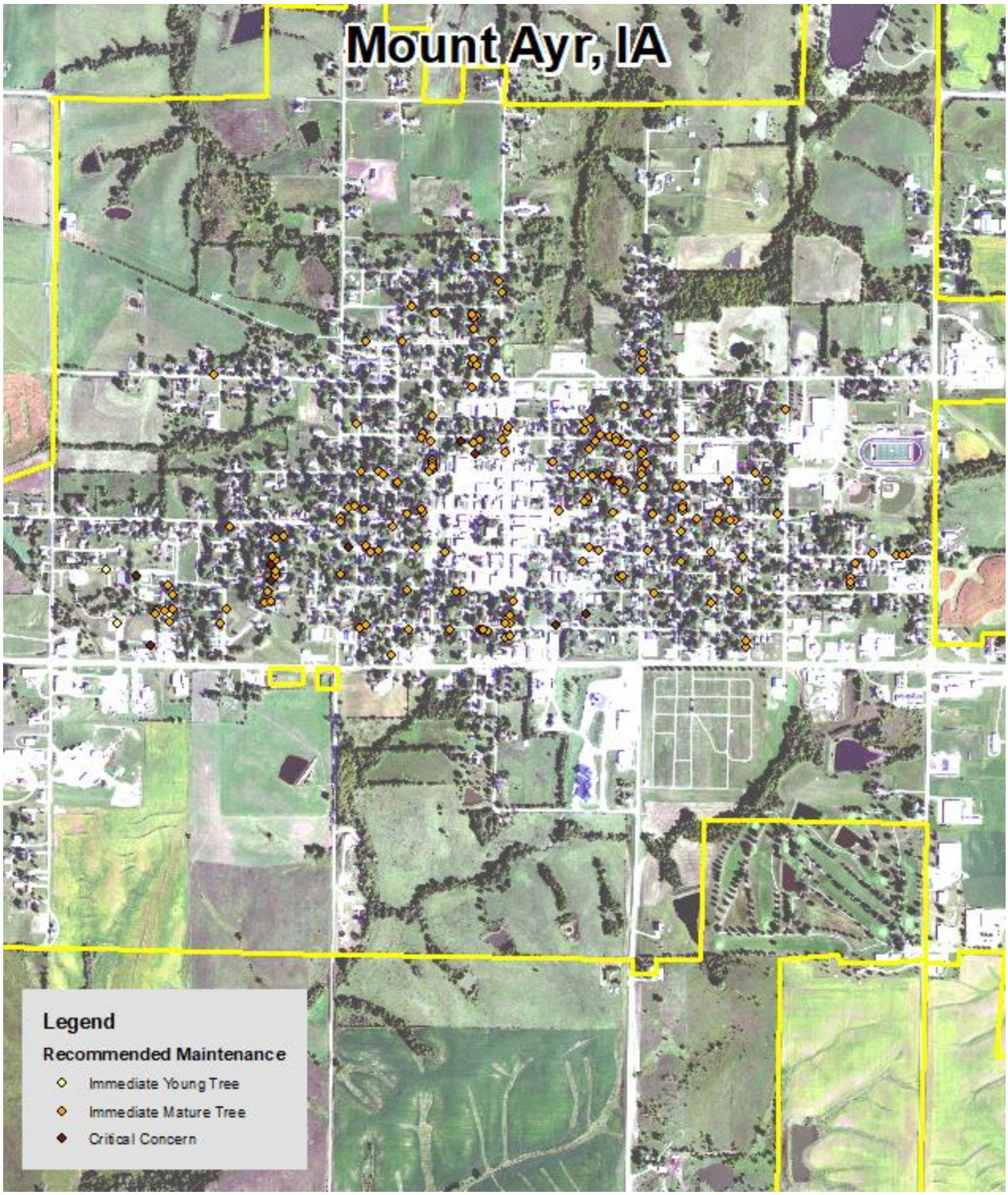

Figure 4: Location of Trees with Recommended Maintenance

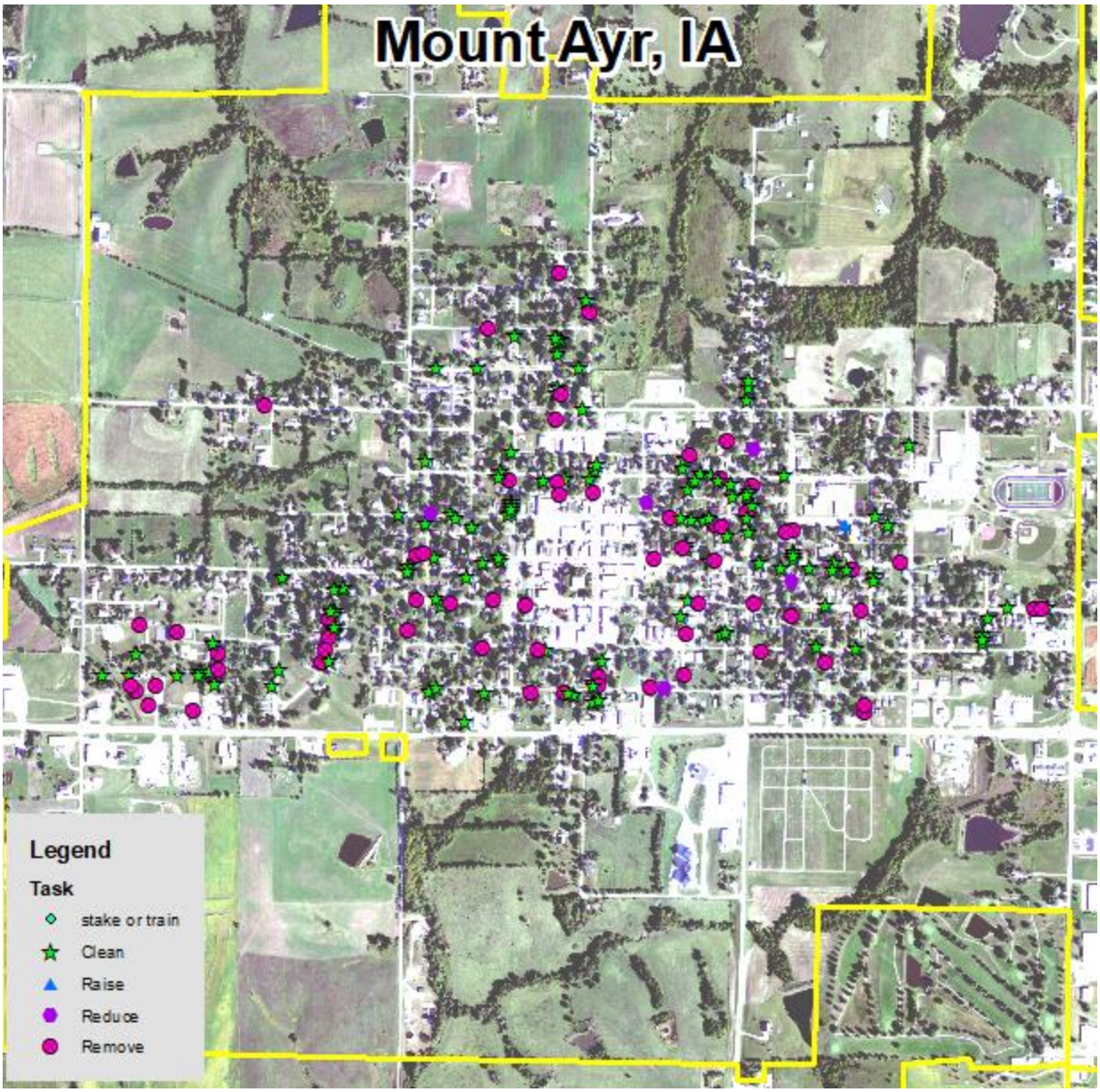

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Mount Ayr Tree Ordinances

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.