

Delmar, IA



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



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Executive Summary

Overview

This plan was developed to assist the City of Delmar with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 17% of Delmar'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 179 trees inventoried.

- Delmar's trees provide \$19,397 of benefits annually, an average of \$108.36 a tree
- There are over 21 species of trees from 12 different genera.
- The top three genera are: Maple 45%, Ash 17%, and Oak 15%
- 15% of trees are in need of some type of management
- 11 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 11 trees needing removal, 3 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*
- 1 of the 2 ash trees should be carefully examined, as it is displaying two or more symptoms that have been 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: cottonwoods
- Check ash trees with a visual survey yearly

Introduction

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

Trees are an important component of Delmar'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 Delmar 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 Delmar'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 179 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. Delmar's trees reduce energy related costs by approximately \$4,502 annually (Appendix A, Table 1). These savings are both in Electricity (21.9 MWh) and in Natural Gas (2,899.4 Therms).

Annual Stormwater Benefits

Delmar's trees intercept about 323,532 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$8,768 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 Delmar, it is estimated that trees remove 180.7 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$399 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Delmar, trees sequester about 27,627 lbs of carbon a year with an associated value of \$207 (Appendix A, Table 5). In addition, the trees store 426,896 lbs of carbon, with a yearly benefit of \$3,202 (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. Delmar receives \$5,264 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, Delmar's trees provide \$19,397 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 179 trees in Delmar provide approximately \$108.36 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Delmar has over 21 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Genus	Count	Percent
Spruce	116	64.80%
Maple	18	10.06%
Cedar	14	7.82%
Apple	11	6.15%
Oak	7	3.91%
Walnut	3	1.68%
Ash	2	1.12%
Basswood	2	1.12%
Hackberry	2	1.12%
Pine	2	1.12%
Cottonwood	1	0.56%
Pear	1	0.56%

Age Class

Most of Delmar’s trees (60%) are between 12 and 24 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. Delmar’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 Delmar indicate that 70% of the trees are in good health, with only 6% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 50% of Delmar’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 12% of the population. This 12% 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	14	8%
Tree Removal	11	6%
Crown Reduction	1	<1%

Canopy Cover

The total canopy with both private and public trees is 10%, 49.35 acres. The canopy cover included in the Delmar inventory includes approximately 2.03 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 35 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Delmar’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	8%
Park/vacant/other	92%

Location

Planting strip	6%
Front yard	94%

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

Delmar has 2 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. 1 of the critical concern trees is over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There is a total of 26 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 11 removals, 1 is an ash tree. There are a total of 2 ash trees, and 1 has signs and symptoms that have been associated with EAB. In addition, there are 22 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 Delmar.

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 spruce (65%) (Appendix A, Figure 1). Spruce trees should not continue to 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 cottonwoods as outlined in section 3-2-1 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.

Emerald Ash Borer Plan

Ash Tree Removal

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

Treatment of Ash Trees

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

EAB Quarantines

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

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

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

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

Wood Disposal

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

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 3-2-1 (Appendix C). The new plantings will be a diverse mix and will not include cottonwoods.

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.

Budget & Six Year Maintenance Plan

Current Budget

Total \$15,600 over 6 years (\$2,600/year)

FY 2020 Budget

Removal: 3 trees \$2,100
Planting: \$400
Watering & Maintenance: \$100

FY 2021 Budget

Removal: 1 tree \$700
Planting: \$200
Routine trimming: \$1,600
Watering & Maintenance: \$100

FY 2022 Budget

Removal: 3 trees \$2,100
Planting: \$400
Watering & Maintenance: \$100

FY 2023 Budget

Removal: 1 tree \$700
Planting: \$200
Routine trimming: \$1,600
Watering & Maintenance: \$100

FY 2024 Budget

Removal: 3 trees \$2,100
Planting: \$400
Watering & Maintenance: \$100

FY 2025 Budget

Removal: 1 tree \$700
Planting: \$200
Routine trimming: \$1,600
Watering & Maintenance: \$100

*Reduction of ash over 6 years: approximately 2 ash trees removed (approximately 100% of ash).

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Delmar

Annual Energy Benefits of Public Trees

8/6/2020

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway spruce	14.0	1,063	1,795.1	1,759	2,823	(N/A)	57.5	62.7	27.40
Apple	0.4	32	65.3	64	96	(N/A)	6.1	2.1	8.72
Spruce	0.8	64	107.0	105	169	(N/A)	6.1	3.8	15.35
Eastern red cedar	1.1	81	158.4	155	236	(N/A)	6.1	5.2	21.47
Norway maple	0.7	50	100.2	98	149	(N/A)	2.8	3.3	29.72
Northern red oak	0.5	40	66.2	65	105	(N/A)	2.2	2.3	26.20
Silver maple	0.6	43	78.5	77	120	(N/A)	2.2	2.7	29.97
Red maple	0.3	22	43.5	43	65	(N/A)	2.2	1.4	16.21
Black walnut	0.5	40	68.8	67	107	(N/A)	1.7	2.4	35.79
Northern white cedar	0.2	13	28.5	28	41	(N/A)	1.7	0.9	13.58
Northern pin oak	0.5	39	65.2	64	103	(N/A)	1.7	2.3	34.18
Northern hackberry	0.7	51	99.0	97	148	(N/A)	1.1	3.3	74.08
Green ash	0.6	43	73.8	72	115	(N/A)	1.1	2.6	57.57
Littleleaf linden	0.2	12	24.9	24	37	(N/A)	1.1	0.8	18.25
Blue spruce	0.2	14	25.4	25	39	(N/A)	1.1	0.9	19.66
Maple	0.1	5	10.4	10	16	(N/A)	1.1	0.3	7.85
Red pine	0.2	14	24.1	24	38	(N/A)	1.1	0.8	18.86
Sugar maple	0.1	10	19.4	19	29	(N/A)	1.1	0.7	14.67
Amur maple	0.0	2	3.8	4	5	(N/A)	0.6	0.1	5.40
Pear	0.0	2	3.8	4	5	(N/A)	0.6	0.1	5.40
Cottonwood	0.3	20	38.1	37	57	(N/A)	0.6	1.3	57.32
Total	21.9	1,661	2,899.4	2,841	4,502	(N/A)	100.0	100.0	25.15

Table 2: Annual Stormwater Benefits

Delmar

Annual Stormwater Benefits of Public Trees

8/6/2020

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway spruce	249,873	6,772	(N/A)	57.5	77.2	65.74
Apple	1,427	39	(N/A)	6.1	0.4	3.51
Spruce	9,790	265	(N/A)	6.1	3.0	24.12
Eastern red cedar	15,553	421	(N/A)	6.1	4.8	38.32
Norway maple	6,581	178	(N/A)	2.8	2.0	35.67
Northern red oak	3,083	84	(N/A)	2.2	1.0	20.89
Silver maple	6,201	168	(N/A)	2.2	1.9	42.01
Red maple	1,525	41	(N/A)	2.2	0.5	10.33
Black walnut	4,228	115	(N/A)	1.7	1.3	38.19
Northern white cedar	1,787	48	(N/A)	1.7	0.6	16.14
Northern pin oak	2,981	81	(N/A)	1.7	0.9	26.93
Northern hackberry	6,051	164	(N/A)	1.1	1.9	81.99
Green ash	5,409	147	(N/A)	1.1	1.7	73.29
Littleleaf linden	921	25	(N/A)	1.1	0.3	12.48
Blue spruce	2,300	62	(N/A)	1.1	0.7	31.16
Maple	275	7	(N/A)	1.1	0.1	3.72
Red pine	2,134	58	(N/A)	1.1	0.7	28.92
Sugar maple	687	19	(N/A)	1.1	0.2	9.30
Amur maple	69	2	(N/A)	0.6	0.0	1.86
Pear	69	2	(N/A)	0.6	0.0	1.86
Cottonwood	2,591	70	(N/A)	0.6	0.8	70.21
Citywide total	323,532	8,768	(N/A)	100.0	100.0	48.98

Table 3: Annual Air Quality Benefits

Delmar

Annual Air Quality Benefits of Public Trees

8/6/2020

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total Standard (\$)	Standard Error	% of Total Trees	Avg. \$/tree
	O ₃	NO ₂	PM ₁₀	SO ₂		NO ₂	PM ₁₀	VOC	SO ₂								
Norway spruce	28.9	5.7	23.7	3.6	191	65.6	9.6	9.2	63.5	412	-118.2	-443	91.8	159	(N/A)	57.5	1.55
Apple	0.3	0.0	0.2	0.0	2	2.1	0.3	0.3	1.9	13	0.0	0	5.0	14	(N/A)	6.1	1.30
Spruce	1.0	0.2	0.9	0.1	7	3.9	0.6	0.6	3.8	25	-3.3	-12	7.8	19	(N/A)	6.1	1.74
Eastern red cedar	3.2	0.6	2.5	0.4	21	5.2	0.7	0.7	4.8	32	-8.6	-32	9.6	20	(N/A)	6.1	1.86
Norway maple	1.4	0.2	0.7	0.1	7	3.3	0.5	0.4	3.0	20	-0.3	-1	9.2	26	(N/A)	2.8	5.26
Northern red oak	0.5	0.1	0.3	0.0	3	2.5	0.4	0.3	2.4	15	-0.7	-3	5.7	16	(N/A)	2.2	3.90
Silver maple	0.8	0.1	0.4	0.0	4	2.7	0.4	0.4	2.6	17	-0.5	-2	6.9	19	(N/A)	2.2	4.82
Red maple	0.2	0.0	0.1	0.0	1	1.4	0.2	0.2	1.3	9	-0.1	0	3.4	10	(N/A)	2.2	2.38
Black walnut	0.4	0.1	0.2	0.0	2	2.5	0.4	0.3	2.4	16	0.0	0	6.2	18	(N/A)	1.7	5.88
Northern white cedar	0.2	0.0	0.2	0.0	1	0.9	0.1	0.1	0.8	5	-0.5	-2	1.7	4	(N/A)	1.7	1.48
Northern pin oak	0.4	0.1	0.2	0.0	2	2.4	0.4	0.3	2.3	15	-0.1	0	6.1	17	(N/A)	1.7	5.68
Northern hackberry	0.9	0.1	0.5	0.0	5	3.3	0.5	0.5	3.1	20	0.0	0	8.8	25	(N/A)	1.1	12.53
Green ash	0.6	0.1	0.3	0.0	3	2.7	0.4	0.4	2.6	17	0.0	0	7.0	20	(N/A)	1.1	9.95
Littleleaf linden	0.1	0.0	0.1	0.0	0	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5	(N/A)	1.1	2.55
Blue spruce	0.3	0.1	0.2	0.0	2	0.9	0.1	0.1	0.9	6	-0.8	-3	1.8	4	(N/A)	1.1	2.21
Maple	0.0	0.0	0.0	0.0	0	0.3	0.1	0.0	0.3	2	0.0	0	0.8	2	(N/A)	1.1	1.12
Red pine	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.7	4	(N/A)	1.1	2.15
Sugar maple	0.0	0.0	0.0	0.0	0	0.7	0.1	0.1	0.6	4	0.0	0	1.5	4	(N/A)	1.1	2.07
Amur maple	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)	0.6	0.71
Pear	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)	0.6	0.71
Cottonwood	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	0.6	9.34
Citywide total	39.5	7.7	30.8	4.4	254	103.4	15.1	14.4	99.1	647	-133.8	-502	180.7	399	(N/A)	100.0	2.23

Table 4: Annual Carbon Stored

Delmar

Stored CO2 Benefits of Public Trees

8/6/2020

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway spruce	286,723	2,150	(N/A)	57.5	67.2	20.88
Apple	5,217	39	(N/A)	6.1	1.2	3.56
Spruce	6,664	50	(N/A)	6.1	1.6	4.54
Eastern red cedar	10,239	77	(N/A)	6.1	2.4	6.98
Norway maple	22,679	170	(N/A)	2.8	5.3	34.02
Northern red oak	8,401	63	(N/A)	2.2	2.0	15.75
Silver maple	16,700	125	(N/A)	2.2	3.9	31.31
Red maple	2,638	20	(N/A)	2.2	0.6	4.95
Black walnut	12,315	92	(N/A)	1.7	2.9	30.79
Northern white cedar	770	6	(N/A)	1.7	0.2	1.93
Northern pin oak	7,467	56	(N/A)	1.7	1.7	18.67
Northern hackberry	12,189	91	(N/A)	1.1	2.9	45.71
Green ash	19,445	146	(N/A)	1.1	4.6	72.92
Littleleaf linden	2,049	15	(N/A)	1.1	0.5	7.68
Blue spruce	1,402	11	(N/A)	1.1	0.3	5.26
Maple	437	3	(N/A)	1.1	0.1	1.64
Red pine	1,427	11	(N/A)	1.1	0.3	5.35
Sugar maple	1,319	10	(N/A)	1.1	0.3	4.95
Amur maple	178	1	(N/A)	0.6	0.0	1.33
Pear	178	1	(N/A)	0.6	0.0	1.33
Cottonwood	8,458	63	(N/A)	0.6	2.0	63.43
Citywide total	426,896	3,202	(N/A)	100.0	100.0	17.89

Table 5: Annual Carbon Sequestered

Delmar

Annual CO Benefits of Public Trees

8/6/2020

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard (\$)	% of Total Trees	% of Total \$	Avg \$/tre
Norway spruce	15,626	117	-1,376	-247	-12	23,503	176	37,505	281 (N/A)	57.5	60.6	2.72
Apple	664	5	-25	-8	0	704	5	1,336	10 (N/A)	6.1	2.2	0.91
Spruce	761	6	-32	-14	0	1,416	11	2,130	16 (N/A)	6.1	3.4	1.42
Eastern red cedar	439	3	-49	-19	-1	1,790	13	2,160	16 (N/A)	6.1	3.5	1.47
Norway maple	1,037	8	-110	-8	-1	1,115	8	2,034	15 (N/A)	2.8	3.3	3.05
Northern red oak	765	6	-40	-6	0	882	7	1,601	12 (N/A)	2.2	2.6	3.00
Silver maple	1,804	14	-81	-6	-1	949	7	2,666	20 (N/A)	2.2	4.3	5.00
Red maple	408	3	-13	-4	0	492	4	884	7 (N/A)	2.2	1.4	1.66
Black walnut	1,179	9	-59	-5	0	883	7	1,998	15 (N/A)	1.7	3.2	4.95
Northern white cedar	158	1	-4	-4	0	283	2	434	3 (N/A)	1.7	0.7	1.08
Northern pin oak	868	7	-37	-4	0	855	6	1,681	13 (N/A)	1.7	2.7	4.20
Northern hackberry	853	6	-59	-6	0	1,131	8	1,919	14 (N/A)	1.1	3.1	7.20
Green ash	1,302	10	-93	-5	-1	945	7	2,149	16 (N/A)	1.1	3.5	8.00
Littleleaf linden	447	3	-10	-2	0	267	2	702	5 (N/A)	1.1	1.1	2.63
Blue spruce	129	1	-7	-3	0	319	2	439	3 (N/A)	1.1	0.7	1.64
Maple	77	1	-2	-1	0	121	1	195	1 (N/A)	1.1	0.3	0.73
Red pine	168	1	-7	-3	0	311	2	469	4 (N/A)	1.1	0.8	1.76
Sugar maple	206	2	-7	-2	0	228	2	425	3 (N/A)	1.1	0.7	1.55
Amur maple	38	0	-1	-1	0	37	0	74	1 (N/A)	0.6	0.1	0.55
Pear	38	0	-1	-1	0	37	0	74	1 (N/A)	0.6	0.1	0.55
Cottonwood	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.6	1.7	7.92
Citywide total	27,627	207	-2,053	-352	-18	36,708	275	61,931	464 (N/A)	100.0	100.0	2.55

Table 6: Annual Social and Aesthetic Benefits

Delmar

Annual Aesthetic/Other Benefits of Public Trees

8/6/2020

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Norway spruce	3,654	(N/A)	57.5	69.4	35.47
Apple	36	(N/A)	6.1	0.7	3.31
Spruce	226	(N/A)	6.1	4.3	20.56
Eastern red cedar	158	(N/A)	6.1	3.0	14.35
Norway maple	103	(N/A)	2.8	2.0	20.60
Northern red oak	72	(N/A)	2.2	1.4	17.90
Silver maple	196	(N/A)	2.2	3.7	49.11
Red maple	74	(N/A)	2.2	1.4	18.56
Black walnut	118	(N/A)	1.7	2.2	39.43
Northern white cedar	46	(N/A)	1.7	0.9	15.42
Northern pin oak	91	(N/A)	1.7	1.7	30.40
Northern hackberry	116	(N/A)	1.1	2.2	57.91
Green ash	111	(N/A)	1.1	2.1	55.72
Littleleaf linden	62	(N/A)	1.1	1.2	31.20
Blue spruce	46	(N/A)	1.1	0.9	23.16
Maple	15	(N/A)	1.1	0.3	7.28
Red pine	48	(N/A)	1.1	0.9	23.87
Sugar maple	29	(N/A)	1.1	0.5	14.31
Amur maple	2	(N/A)	0.6	0.0	2.06
Pear	2	(N/A)	0.6	0.0	2.06
Cottonwood	58	(N/A)	0.6	1.1	57.69
Citywide total	5,264	(N/A)	100.0	100.0	29.41

Table 7: Summary of Benefits in Dollars

Delmar

Total Annual Benefits of Public Trees by Species (\$)

8/6/2020

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Norway spruce	2,823	281	159	6,772	3,654	13,688	(N/A)	70.6
Apple	96	10	14	39	36	195	(N/A)	1.0
Spruce	169	16	19	265	226	696	(N/A)	3.6
Eastern red cedar	236	16	20	421	158	852	(N/A)	4.4
Norway maple	149	15	26	178	103	472	(N/A)	2.4
Northern red oak	105	12	16	84	72	288	(N/A)	1.5
Silver maple	120	20	19	168	196	524	(N/A)	2.7
Red maple	65	7	10	41	74	197	(N/A)	1.0
Black walnut	107	15	18	115	118	373	(N/A)	1.9
Northern white cedar	41	3	4	48	46	143	(N/A)	0.7
Northern pin oak	103	13	17	81	91	304	(N/A)	1.6
Northern hackberry	148	14	25	164	116	467	(N/A)	2.4
Green ash	115	16	20	147	111	409	(N/A)	2.1
Littleleaf linden	37	5	5	25	62	134	(N/A)	0.7
Blue spruce	39	3	4	62	46	156	(N/A)	0.8
Maple	16	1	2	7	15	41	(N/A)	0.2
Red pine	38	4	4	58	48	151	(N/A)	0.8
Sugar maple	29	3	4	19	29	84	(N/A)	0.4
Amur maple	5	1	1	2	2	11	(N/A)	0.1
Pear	5	1	1	2	2	11	(N/A)	0.1
Cottonwood	57	8	9	70	58	202	(N/A)	1.0
Citywide Total	4,502	464	399	8,768	5,264	19,397	(N/A)	100.0

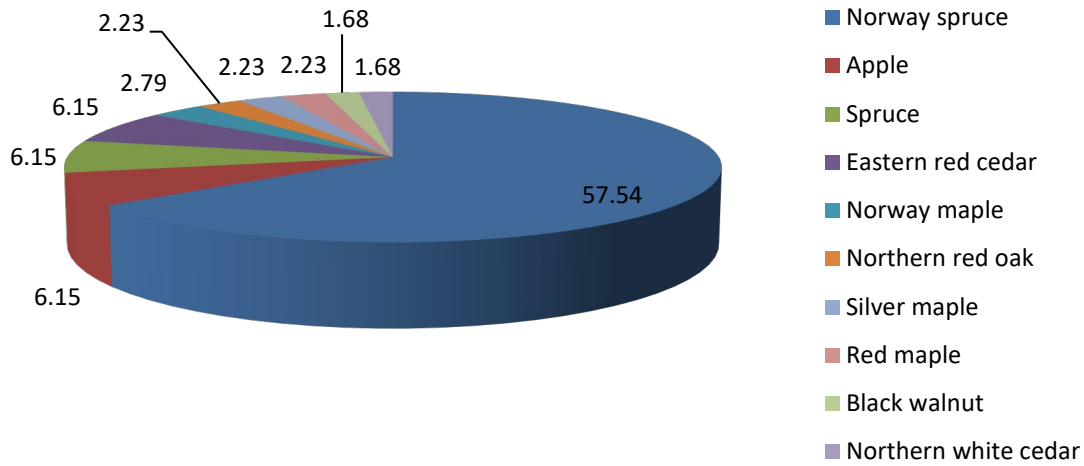


Figure 1: Species Distribution

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

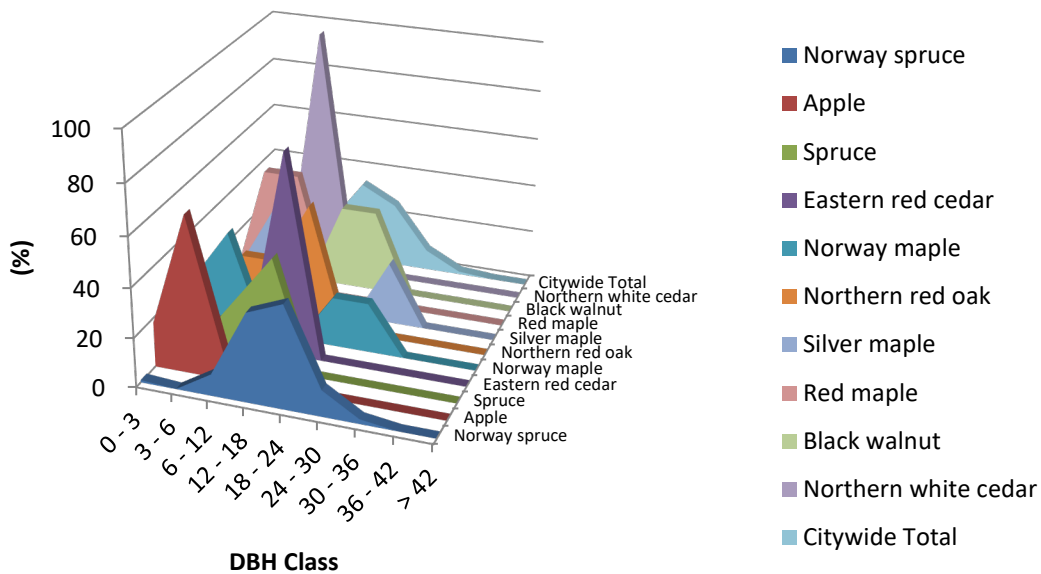


Figure 2: Relative Age Class

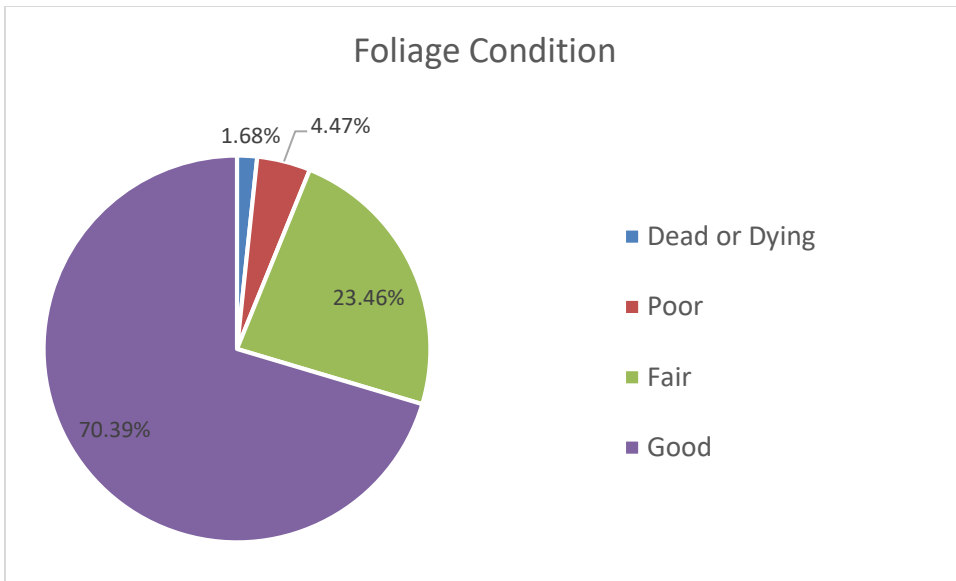


Figure 3: Foliage Condition

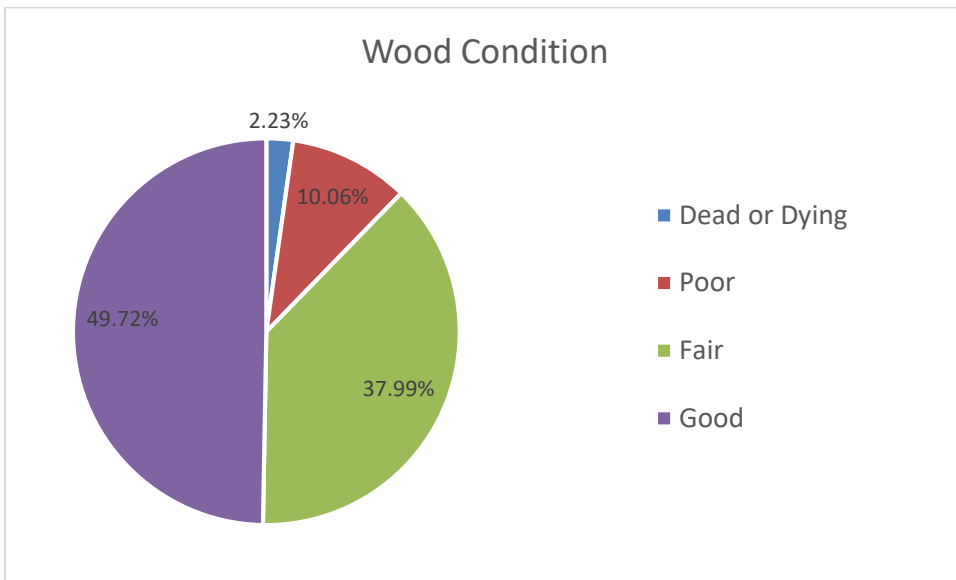


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

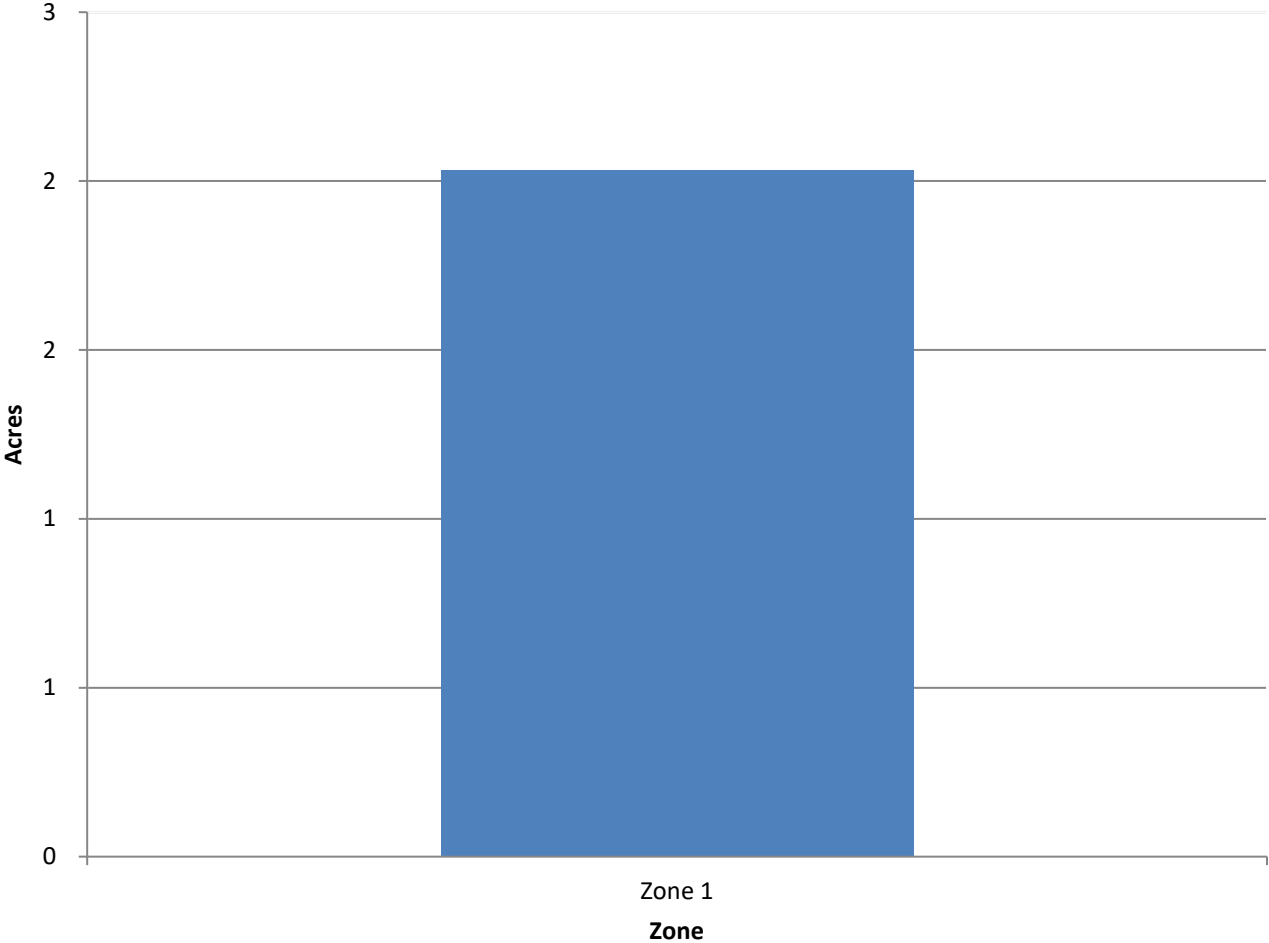


Figure 5: Canopy Cover in Acres

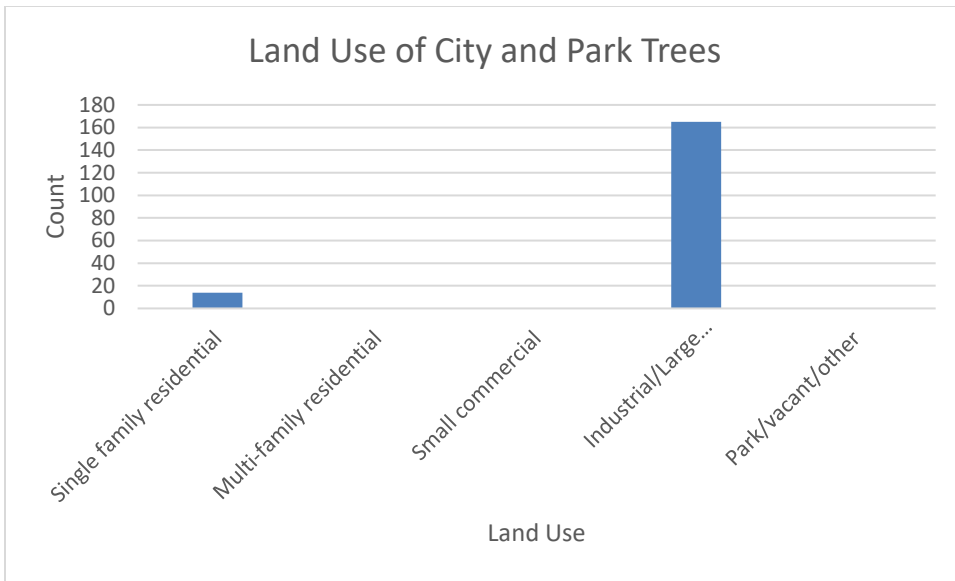


Figure 6: Land Use of city/park trees

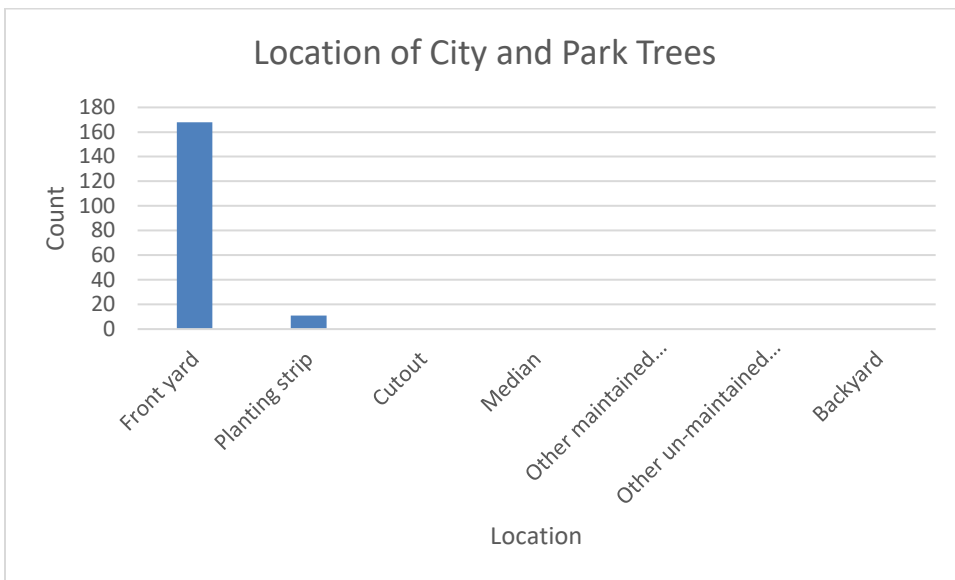


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping



Figure 1: Location of Ash Trees

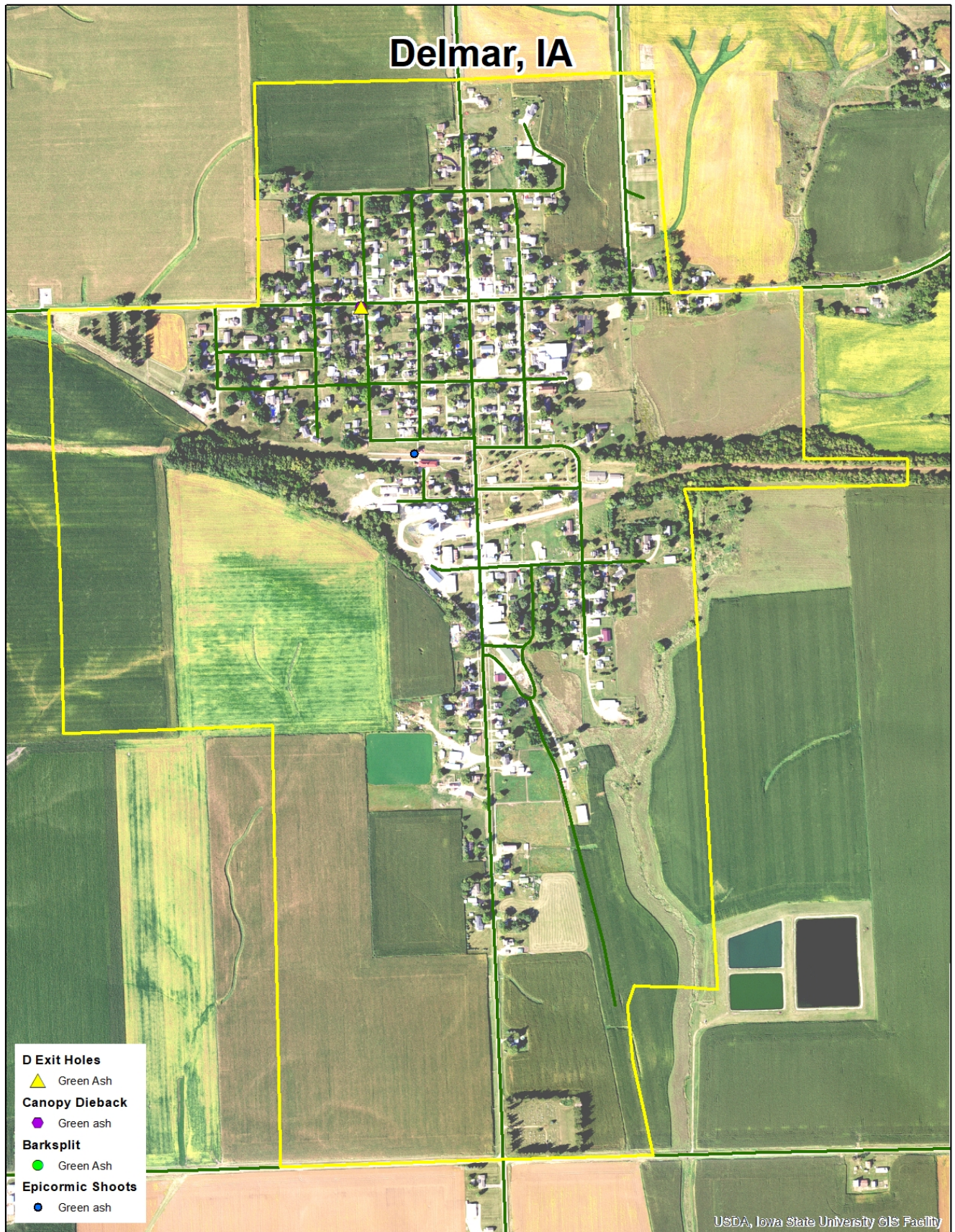


Figure 2: Location of EAB symptoms



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: Delmar Tree Ordinances

Nuisance Code

1. The term "nuisance" means whatever is injurious to health, indecent, or unreasonably offensive to the senses or an obstacle to the free use of property, so as essentially to unreasonably interfere with the comfortable enjoyment of life or property. The following are declared to be nuisances:

h. Cotton-bearing cottonwood trees and all other cotton-bearing poplar trees in the City.

m. Trees infected with Dutch elm disease. (Code of Iowa, Sec. 657.2(12))

3-2-3 OTHER CONDITIONS REGULATED. The following actions are required and may also be abated in the manner provided in this Ordinance:

1. The removal of diseased trees or dead wood, but not diseased trees and dead wood outside the lot and property lines and inside the curb lines upon the public street. (Code of Iowa, Sec. 364.12(3)(b))

7. The maintenance, by the property owner, of all property outside the lot and property lines and inside the curb lines upon public streets, including maintaining a fifteen (15) foot clearance above the street from trees extending over the streets, except as provided in Section 3-2-3(1).

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.