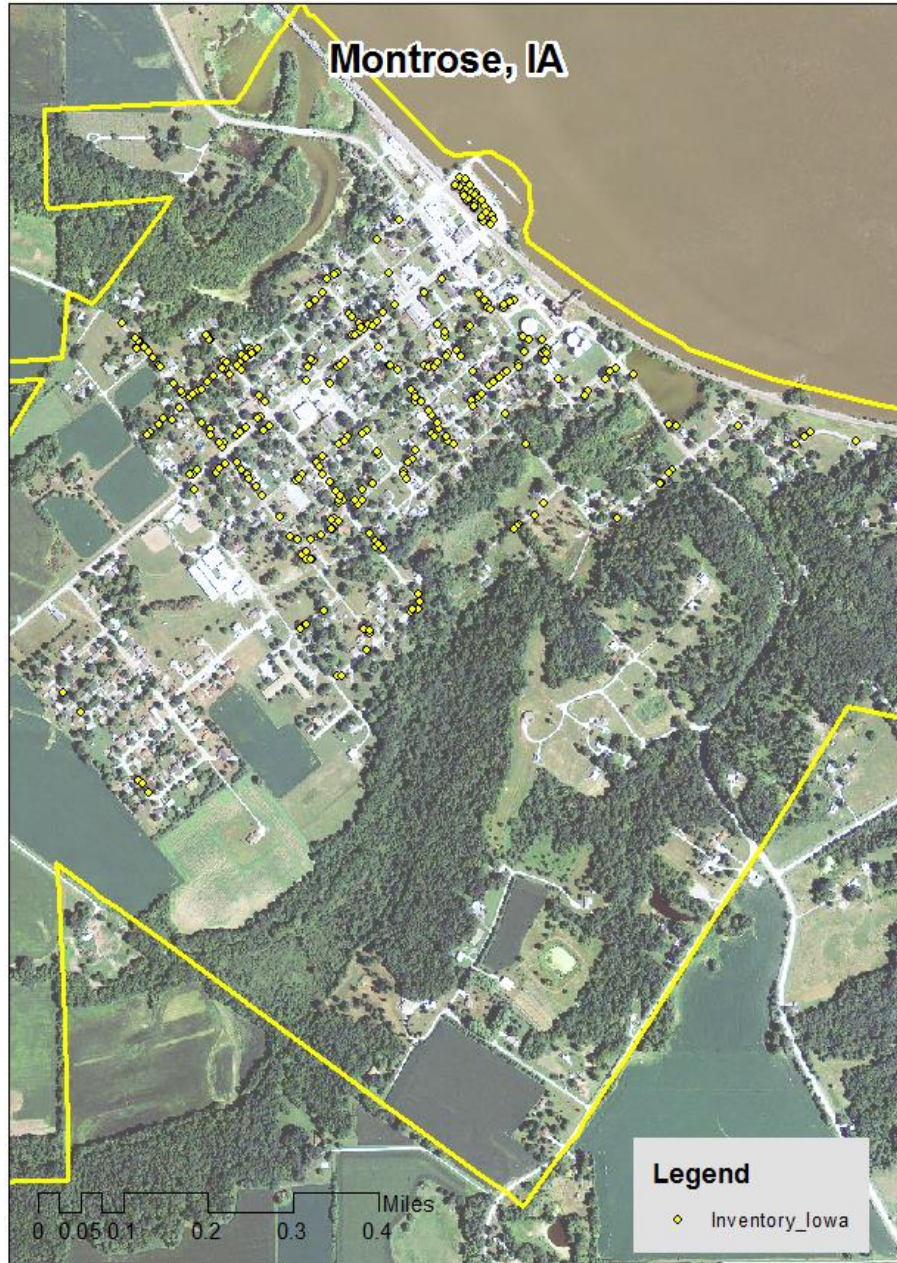


Montrose, IA



2014 Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Montrose with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities 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 6.4% of Montrose's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2013, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 311 trees inventoried.

- Montrose's trees provide \$60,905 of benefits annually, an average of \$195 a tree
- There are over 39 species of trees
- The top four genus are: Maple 44%, Elm 7.1%, Eastern Redbud 6.5% and Ash 6.5%
- 38% 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, 2 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*
- 6 of the 20 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 10-15 years to remove ash – Suggestion: request a budget increase to \$5,000 annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

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

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

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

Inventory Results

The data collected for the 311 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis. Findings

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Montrose's trees reduce energy related costs by approximately \$15,055 annually (Appendix A, Table 1). These savings are both in Electricity (72.2 MWh) and in Natural Gas (9,770 Therms).

Annual Stormwater Benefits

Montrose's trees intercept about 876,875 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$23,765 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 Montrose, it is estimated that trees remove 953.8 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 \$2,698 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Montrose, trees sequester about 307,512 lbs of carbon a year with an associated value of \$12,306 (Appendix A, Table 4). In addition, the trees store 3,743,740 lbs of carbon, with a yearly benefit of \$28,078 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Montrose receives \$17,080 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Montrose's trees provide \$60.905 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 311 trees in Montrose provide approximately \$195 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Montrose has over 39 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	139	43%
Chinese Elm	25	7.7%
Ash	20	6.4%
Redbud	20	6.4%
Walnut	19	6.1%
Callery Pear	11	3.5%
Oak	11	3.5%
Hackberry	7	2.2%
Poplar	6	1.9%
Cherry Plum	5	1.6%
Spruce	4	1.2%
Pine	4	1.2%
Mulberry	4	1.2%
Birch	4	1.2%
Tulip Poplar	3	1%
Sycamore	3	1%
Hickory	3	1%
Other	23	7.3%

Age Class

Most of Montrose's trees (34%) are between 12 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 18 inches in diameter at 4.5 ft. Montrose's size curve is on a good track with highest numbers at middle and smaller sizes, 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 Montrose indicate that 78% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). 48% of Montrose'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. This 13% 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	16	5.4%
Crown Raising	6	1.9%
Treat tree	2	<1%
Tree Removal	11	3.5%
Crown Reduction	85	27%

Canopy Cover

The canopy cover of Montrose is approximately 8.8 acres (Appendix A, Figure 4). According to the 2000 census, Montrose occupies 768 acres. Thus the canopy cover on city land is about 1%.

Land Use and Location

The majority of Montrose'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	80%
Park/vacant/other	17%
Industrial/Large commercial	<1%
Small commercial	1%
Multifamily residential	<1%

Location

Planting strip	88%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	12%

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

Montrose 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. There are 2 critical concern (1 removal and 1 reduction) 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 largest trees marked as needing maintenance that do not include routine trimming. 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 11 removals, 2 are ash trees. There are a total of 20 ash trees, and 5 of those have signs and symptoms that have been associated with EAB. In addition, there are 3 trees that are in poor wood health (all over 18" dbh). *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 Montrose.

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 (44%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box

elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

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

Six Year Maintenance Plan with No Additional Funding

Year 1

Removal: critical concern tree, 5 mature immediate removals
Planting and Replacement: 7 trees to be planted in open locations
Visual Survey for signs and symptoms of EAB

Year 2

Removal: any new critical concern trees and 2 young ash trees for removal
Planting and Replacement: 6 trees in open locations from year one removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: removal of any new critical concern trees and 3 elm (2 young and 1 mature)
Planting and Replacement: 7 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 4

Removal: removal of any new critical concern, ash in poor health and reduce large limbs
Planting and Replacement: 7 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 5

Removal: removal of any new critical concern trees, reduction of largest limbs
Planting and Replacement: 6 trees to be planted in open locations and locations from previous removals
Visual Survey for signs and symptoms of EAB

Year 6

Removal: removal of any new critical concern trees
Planting and Replacement: 7 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: 20 ash trees will need to be removed. It will take approximately 12 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 years of its arrival.

** To remove all ash trees within 4-5 years, the budget would need to be increased to \$5,000 a year.

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*

EAB Quarantines

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

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

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

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

Wood Disposal

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

Canopy Replacement

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

Postponed Work

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

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Budget

Current Budget

Total \$12,000 over 6 years (\$2,000/year)

FY 2015 Budget

Removal: \$1,600

Planting: Grants on public land, low cost tree/seedling programs

Watering & Maintenance: \$400

FY 2016 Budget

Removal: \$1,600

Planting: Grants on public land, low cost tree/seedling programs

Routine trimming: \$200

Watering & Maintenance: \$200

FY 2017 Budget

Removal: \$1,000

Planting: \$400

Watering & Maintenance: \$200

Routine trimming: \$400

FY 2018 Budget

Removal: \$2,000

Planting: Grants on public land, low cost tree/seedling programs

Routine trimming:

Watering & Maintenance:

FY 2019 Budget

Removal: \$1,000

Planting: \$500

Watering & Maintenance:

Routine Trimming: \$500

FY 2020 Budget

Removal: \$2,500

Planting: \$600

Routine trimming: \$1,700

Watering & Maintenance: \$500

*Reduction of ash over 4 years: approximately 5 ash trees removed (approximately 25% of ash).

It will take approximately 12 years to remove all ash with the current budget.

Purposed Budget Increase

EAB could potentially kill all ash trees in Montrose within 4 years of its arrival. To remove all ash trees within 4 years and still complete maintenance and removal on other tree species the budget would need to be increased to \$5,000 a year. If the budget were increased to \$7,000 a year all ash, in addition to the other species in need of maintenance or removal could be removed within 6 years. Additionally, it is recommended that Montrose apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for

community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Montrose

Annual Energy Benefits of Public Trees by Species

1/25/2014

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	29.2	2,215	3,843.3	3,766	5,982	(N/A)	31.8	39.7	60.42
Chinese elm	7.0	531	957.8	939	1,469	(N/A)	7.7	9.8	61.23
Sugar maple	6.4	486	859.3	842	1,328	(N/A)	6.8	8.8	63.24
Eastern redbud	1.1	80	174.9	171	251	(N/A)	6.4	1.7	12.57
Green ash	5.5	417	742.2	727	1,144	(N/A)	6.4	7.6	57.21
Black walnut	5.0	383	670.4	657	1,040	(N/A)	6.1	6.9	54.75
Norway maple	2.9	219	394.7	387	606	(N/A)	4.8	4.0	40.38
Callery pear	0.1	6	14.1	14	20	(N/A)	3.5	0.1	1.82
Northern hackberry	2.2	168	319.2	313	480	(N/A)	2.3	3.2	68.64
Northern pin oak	1.3	97	191.6	188	285	(N/A)	1.9	1.9	47.44
Broadleaf Deciduous	1.9	143	257.3	252	395	(N/A)	1.6	2.6	79.06
Cherry plum	0.1	7	15.8	15	22	(N/A)	1.6	0.2	4.50
Boxelder	0.8	62	110.3	108	170	(N/A)	1.3	1.1	42.46
Apple	0.2	15	33.3	33	47	(N/A)	1.3	0.3	11.80
Other street trees	8.6	652	1,185.9	1,162	1,814	(N/A)	16.4	12.1	35.58
Citywide total	72.2	5,480	9,770.1	9,575	15,055	(N/A)	100.0	100.0	48.41

Table 2: Annual Stormwater Benefits

Montrose

Annual Stormwater Benefits of Public Trees by Species

1/25/2014

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	396,076	10,734	(N/A)	31.8	45.2	108.43
Chinese elm	84,286	2,284	(N/A)	7.7	9.6	95.18
Sugar maple	81,834	2,218	(N/A)	6.8	9.3	105.61
Eastern redbud	3,672	100	(N/A)	6.4	0.4	4.98
Green ash	65,422	1,773	(N/A)	6.4	7.5	88.65
Black walnut	57,239	1,551	(N/A)	6.1	6.5	81.65
Norway maple	20,703	561	(N/A)	4.8	2.4	37.41
Callery pear	285	8	(N/A)	3.5	0.0	0.70
Northern hackberry	18,567	503	(N/A)	2.3	2.1	71.89
Northern pin oak	13,085	355	(N/A)	1.9	1.5	59.10
Broadleaf Deciduous	26,896	729	(N/A)	1.6	3.1	145.79
Cherry plum	282	8	(N/A)	1.6	0.0	1.53
Boxelder	8,432	229	(N/A)	1.3	1.0	57.13
Apple	666	18	(N/A)	1.3	0.1	4.51
Other street trees	99,430	2,695	(N/A)	16.4	11.3	52.84
Citywide total	876,875	23,765	(N/A)	100.0	100.0	76.41

Table 3: Annual Air Quality Benefits

Montrose

Annual Air Quality Benefits of Public Trees by Species

1/25/2014

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	66.8	11.3	33.1	3.0	361	137.7	20.2	19.2	132.1	861	-36.3	-136	387.0	1,086	(N/A)	31.8	10.97
Chinese elm	12.0	1.9	5.6	0.5	63	33.4	4.9	4.6	31.7	208	0.0	0	94.6	271	(N/A)	7.7	11.31
Sugar maple	12.0	2.0	5.8	0.5	64	30.4	4.4	4.2	29.0	190	-9.3	-35	79.1	219	(N/A)	6.8	10.43
Eastern redbud	0.7	0.1	0.4	0.0	4	5.3	0.8	0.7	4.8	32	0.0	0	12.7	36	(N/A)	6.4	1.80
Green ash	10.0	1.6	4.6	0.4	53	26.1	3.8	3.6	24.9	163	0.0	0	75.2	216	(N/A)	6.4	10.80
Black walnut	8.3	1.3	3.9	0.4	44	23.9	3.5	3.3	22.9	149	0.0	0	67.5	193	(N/A)	6.1	10.18
Norway maple	3.6	0.6	1.8	0.2	20	13.8	2.0	1.9	13.1	86	-0.9	-3	36.1	102	(N/A)	4.8	6.81
Callery pear	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	0.0	0	0.9	3	(N/A)	3.5	0.23
Northern hackberry	2.5	0.4	1.4	0.1	14	10.7	1.5	1.5	10.0	66	0.0	0	28.2	80	(N/A)	2.3	11.49
Northern pin oak	2.8	0.5	1.3	0.1	15	6.3	0.9	0.9	5.8	39	-0.6	-2	17.9	51	(N/A)	1.9	8.51
Broadleaf Deciduous	4.4	0.7	2.0	0.2	23	9.0	1.3	1.2	8.5	56	0.0	0	27.4	79	(N/A)	1.6	15.86
Cherry plum	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.0	3	(N/A)	1.6	0.59
Boxelder	1.1	0.2	0.5	0.0	6	3.9	0.6	0.5	3.7	24	-0.4	-1	10.1	28	(N/A)	1.3	7.09
Apple	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.3	7	(N/A)	1.3	1.63
Other street trees	15.5	2.5	7.5	0.7	83	41.1	6.0	5.7	38.9	256	-4.2	-16	113.8	323	(N/A)	16.4	6.34
Citywide total	139.8	23.3	68.0	6.3	751	343.4	50.1	47.8	327.0	2,142	-51.7	-194	953.8	2,698	(N/A)	100.0	8.68

Table 4: Annual Carbon Stored

Montrose

Stored CO2 Benefits of Public Trees by Species

1/25/2014

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	1,572,867	11,797	(N/A)	31.8	42.0	119.16
Chinese elm	400,912	3,007	(N/A)	7.7	10.7	125.29
Sugar maple	354,630	2,660	(N/A)	6.8	9.5	126.65
Eastern redbud	12,822	96	(N/A)	6.4	0.3	4.81
Green ash	342,037	2,565	(N/A)	6.4	9.1	128.26
Black walnut	280,827	2,106	(N/A)	6.1	7.5	110.85
Norway maple	58,705	440	(N/A)	4.8	1.6	29.35
Callery pear	387	3	(N/A)	3.5	0.0	0.26
Northern	35,897	269	(N/A)	2.3	1.0	38.46
Northern pin oak	45,568	342	(N/A)	1.9	1.2	56.96
Broadleaf	151,414	1,136	(N/A)	1.6	4.0	227.12
Cherry plum	725	5	(N/A)	1.6	0.0	1.09
Boxelder	35,476	266	(N/A)	1.3	1.0	66.52
Apple	2,171	16	(N/A)	1.3	0.1	4.07
Other street trees	203,800	3,370	(N/A)	16.4	12.0	66.07
Citywide total	3,743,740	28,078	(N/A)	100.0	100.0	90.28

Table 5: Annual Carbon Sequestered**Montrose****Annual CO₂ Benefits of Public Trees by Species**

1/25/2014

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	118,316	887	-7,550	-19	-57	48,957	367	159,704	1,198	(N/A)	31.8	51.9	12.10
Chinese elm	15,375	115	-1,924	-5	-14	11,729	88	25,175	189	(N/A)	7.7	8.2	7.87
Sugar maple	16,086	121	-1,702	-4	-13	10,740	81	25,119	188	(N/A)	6.8	8.2	8.97
Eastern redbud	1,643	12	-62	-4	0	1,766	13	3,343	25	(N/A)	6.4	1.1	1.25
Green ash	10,763	81	-1,642	-4	-12	9,209	69	18,327	137	(N/A)	6.4	6.0	6.87
Black walnut	10,274	77	-1,348	-4	-10	8,468	64	17,391	130	(N/A)	6.1	5.7	6.86
Norway maple	5,002	38	-282	-3	-2	4,837	36	9,554	72	(N/A)	4.8	3.1	4.78
Callery pear	150	1	-2	-2	0	136	1	282	2	(N/A)	3.5	0.1	0.19
Northern hackberry	2,587	19	-172	-1	-1	3,705	28	6,118	46	(N/A)	2.3	2.0	6.56
Northern pin oak	1,909	14	-219	-1	-2	2,140	16	3,830	29	(N/A)	1.9	1.3	4.79
Broadleaf Deciduous	3,622	27	-727	-1	-5	3,164	24	6,059	45	(N/A)	1.6	2.0	9.09
Cherry plum	160	1	-3	-1	0	154	1	310	2	(N/A)	1.6	0.1	0.47
Boxelder	2,748	21	-170	-1	-1	1,365	10	3,942	30	(N/A)	1.3	1.3	7.39
Apple	304	2	-10	-1	0	323	2	615	5	(N/A)	1.3	0.2	1.15
Other street trees	15,493	116	-2,157	-10	-16	14,416	108	27,742	208	(N/A)	16.4	9.0	4.08
Citywide total	204,432	1,533	-17,970	-61	-135	121,111	908	307,512	2,306	(N/A)	100.0	100.0	7.42

Table 6: Annual Social and Aesthetic Benefits**Montrose****Annual Aesthetic/Other Benefits of Public Trees by Species**

1/25/2014

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Silver maple	9,383	(N/A)	31.8	54.9	94.77
Chinese elm	1,235	(N/A)	7.7	7.2	51.45
Sugar maple	1,597	(N/A)	6.8	9.4	76.03
Eastern redbud	92	(N/A)	6.4	0.5	4.58
Green ash	894	(N/A)	6.4	5.2	44.72
Black walnut	869	(N/A)	6.1	5.1	45.73
Norway maple	501	(N/A)	4.8	2.9	33.40
Callery pear	40	(N/A)	3.5	0.2	3.66
Northern hackberry	374	(N/A)	2.3	2.2	53.36
Northern pin oak	178	(N/A)	1.9	1.0	29.66
Broadleaf Deciduous	261	(N/A)	1.6	1.5	52.12
Cherry plum	8	(N/A)	1.6	0.1	1.65
Boxelder	197	(N/A)	1.3	1.2	49.15
Apple	17	(N/A)	1.3	0.1	4.23
Other street trees	1,436	(N/A)	16.4	8.4	28.16
Citywide total	17,080	(N/A)	100.0	100.0	54.92

Table 7: Summary of Benefits in Dollars

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Silver maple	5982	1198	1086	10734	9383	\$28,382.64	(±0)	46.60
Chinese elm	1469	189	271	2284	1235	\$5,448.83	(±0)	8.95
Sugar maple	1328	188	219	2218	1597	\$5,549.94	(±0)	9.11
Eastern redbud	251	25	36	100	92	\$503.58	(±0)	0.83
Green ash	1144	137	216	1773	894	\$4,164.92	(±0)	6.84
Black walnut	1040	130	193	1551	869	\$3,784.01	(±0)	6.21
Norway maple	606	72	102	561	501	\$1,841.61	(±0)	3.02
Callery pear	20	2	3	8	40	\$72.66	(±0)	0.12
Northern hackberry	480	46	80	503	374	\$1,483.56	(±0)	2.44
Northern pin oak	285	29	51	355	178	\$897.03	(±0)	1.47
Broadleaf Deciduous Large	395	45	79	729	261	\$1,509.63	(±0)	2.48
Cherry plum	22	2	3	8	8	\$43.66	(±0)	0.07
Boxelder	170	30	28	229	197	\$652.92	(±0)	1.07
Apple	47	5	7	18	17	\$93.29	(±0)	0.15
Other street trees	1814	208	323	2695	1436	\$6,476.76	(±0)	10.63
Citywide total	15055	2306	2698	23765	17080	\$60,905.03	(±0)	100.00

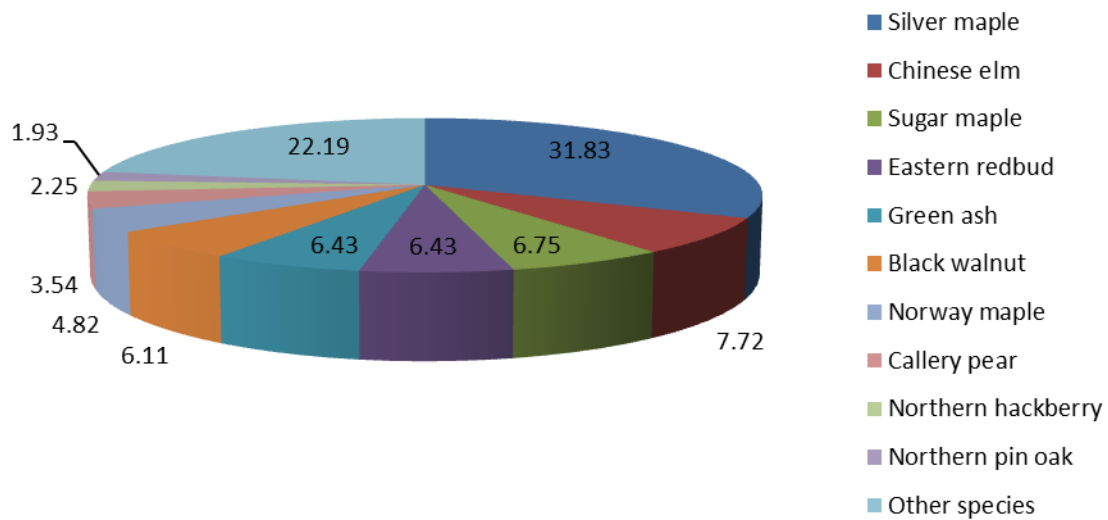


Figure 1: Species Distribution

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

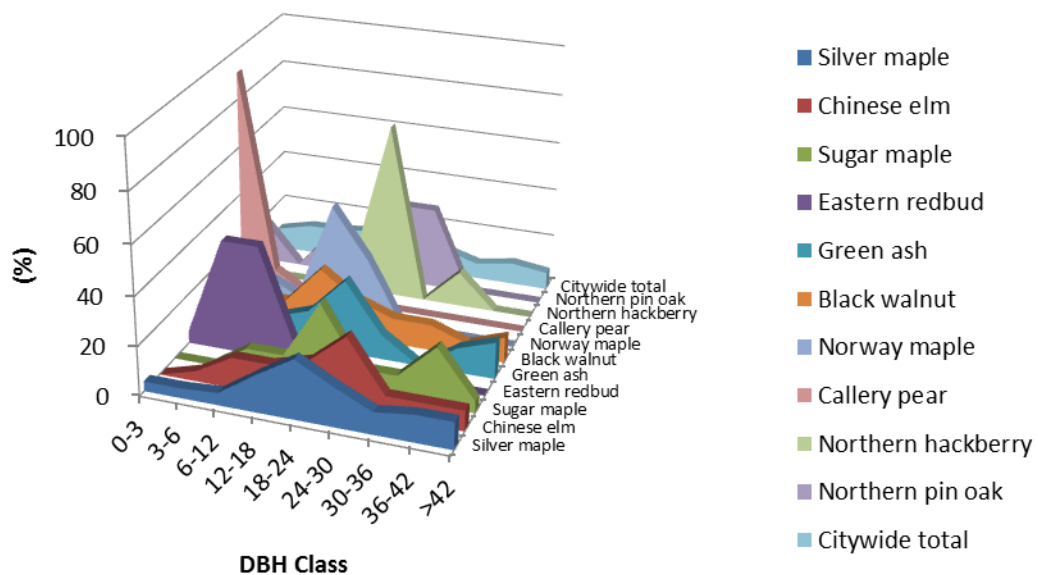


Figure 2: Relative Age Class

Leaf Condition

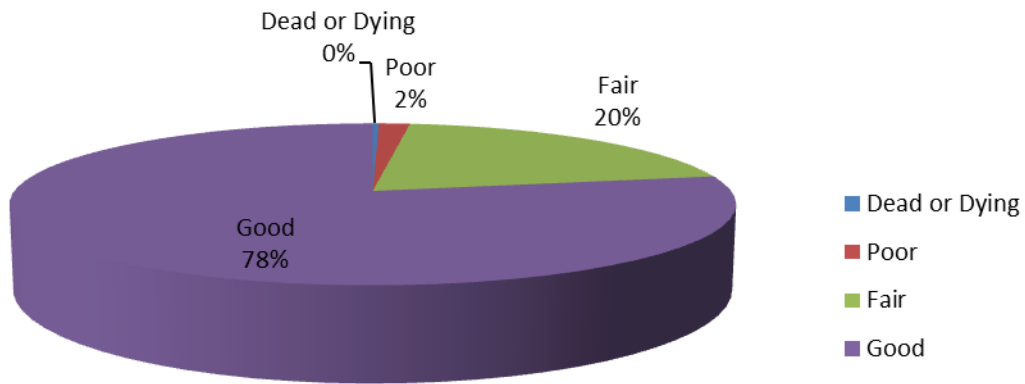


Figure 3: Foliage Condition

Wood Condition

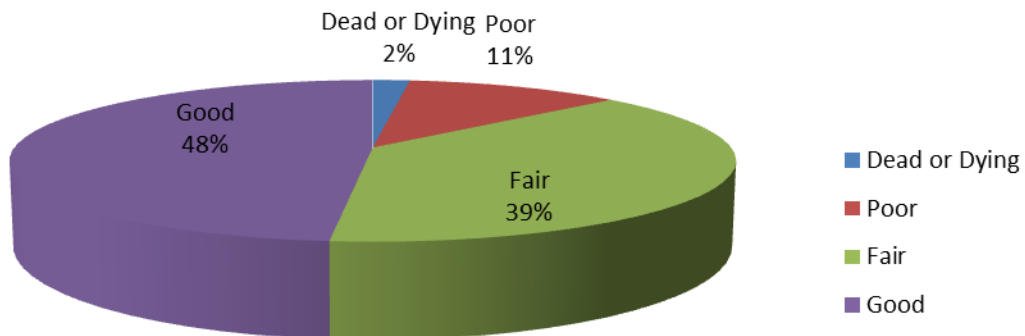


Figure 4: Wood Condition

Canopy Cover

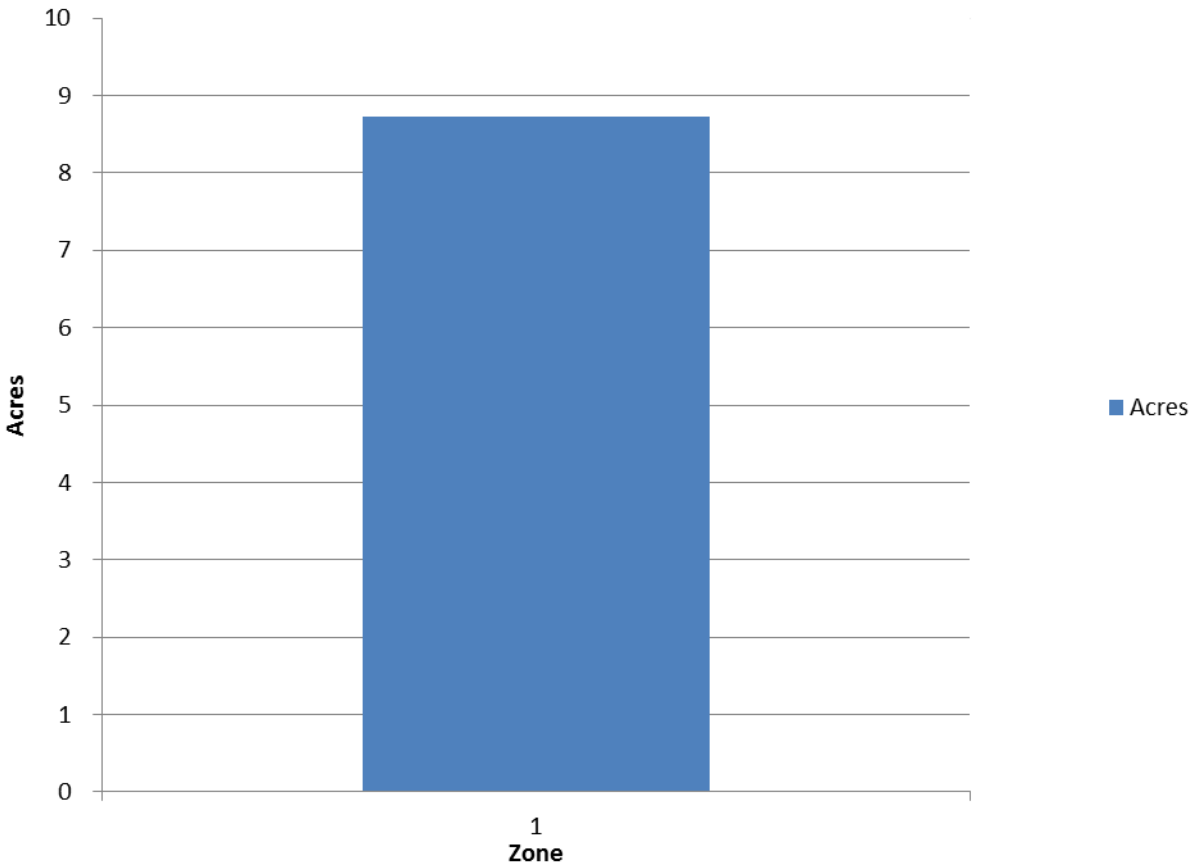


Figure 5: Canopy Cover in Acres

Land use Public Trees by Zone (%)

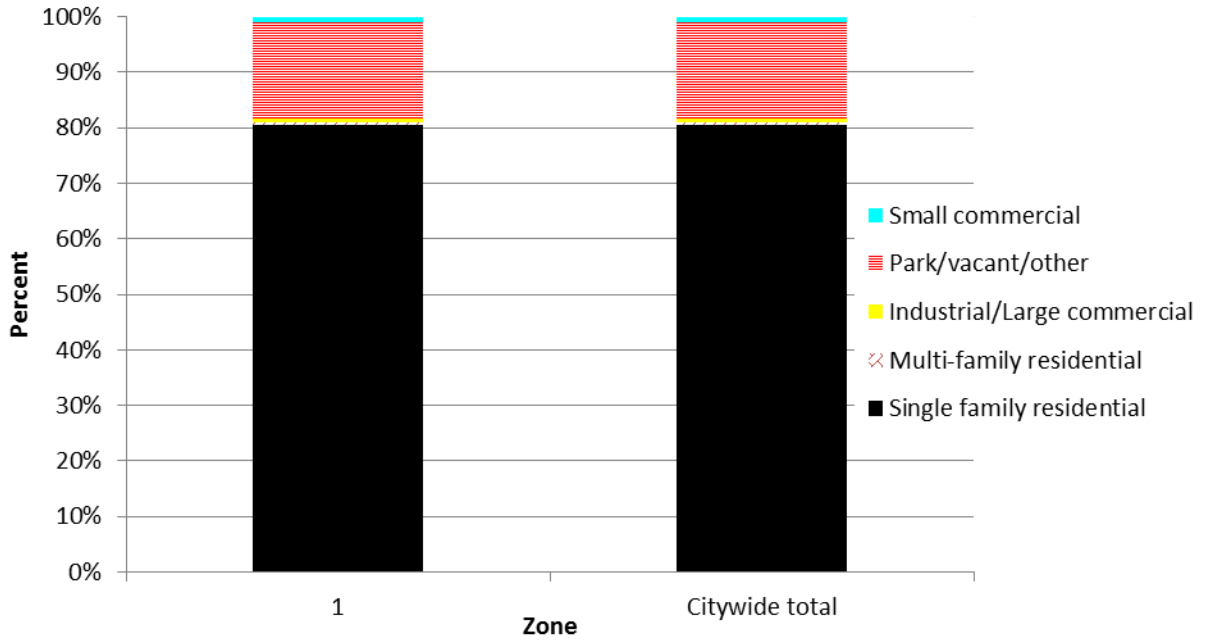


Figure 6: Land Use of city/park trees

Location Public Trees by Zone (%)

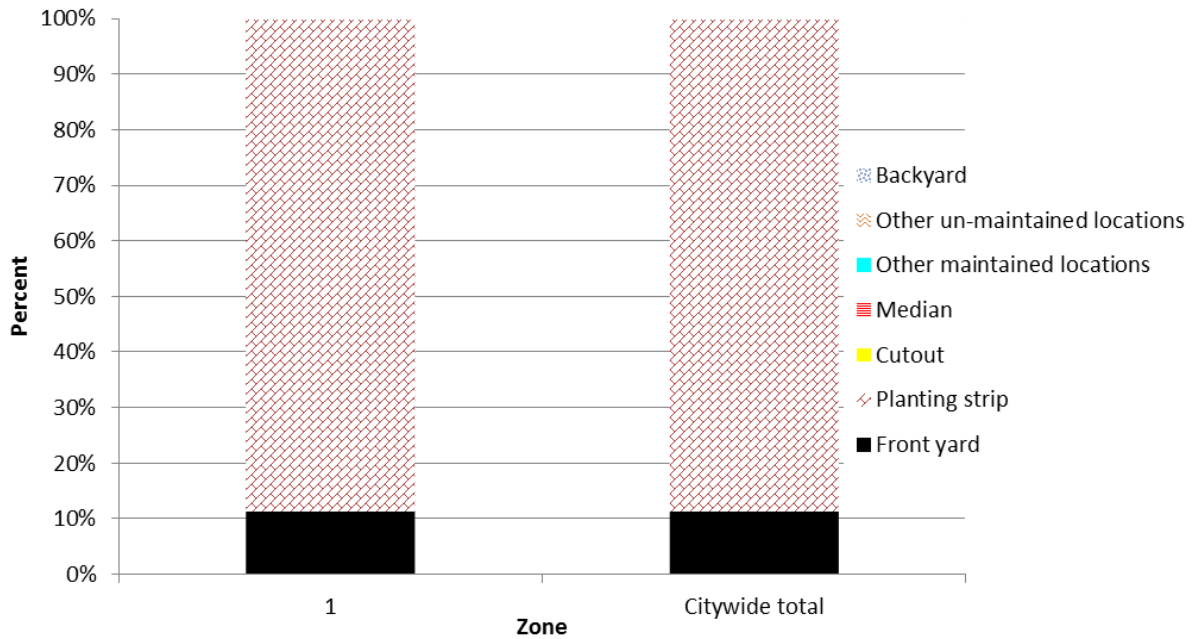


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping



Figure 1: Location of Ash Trees

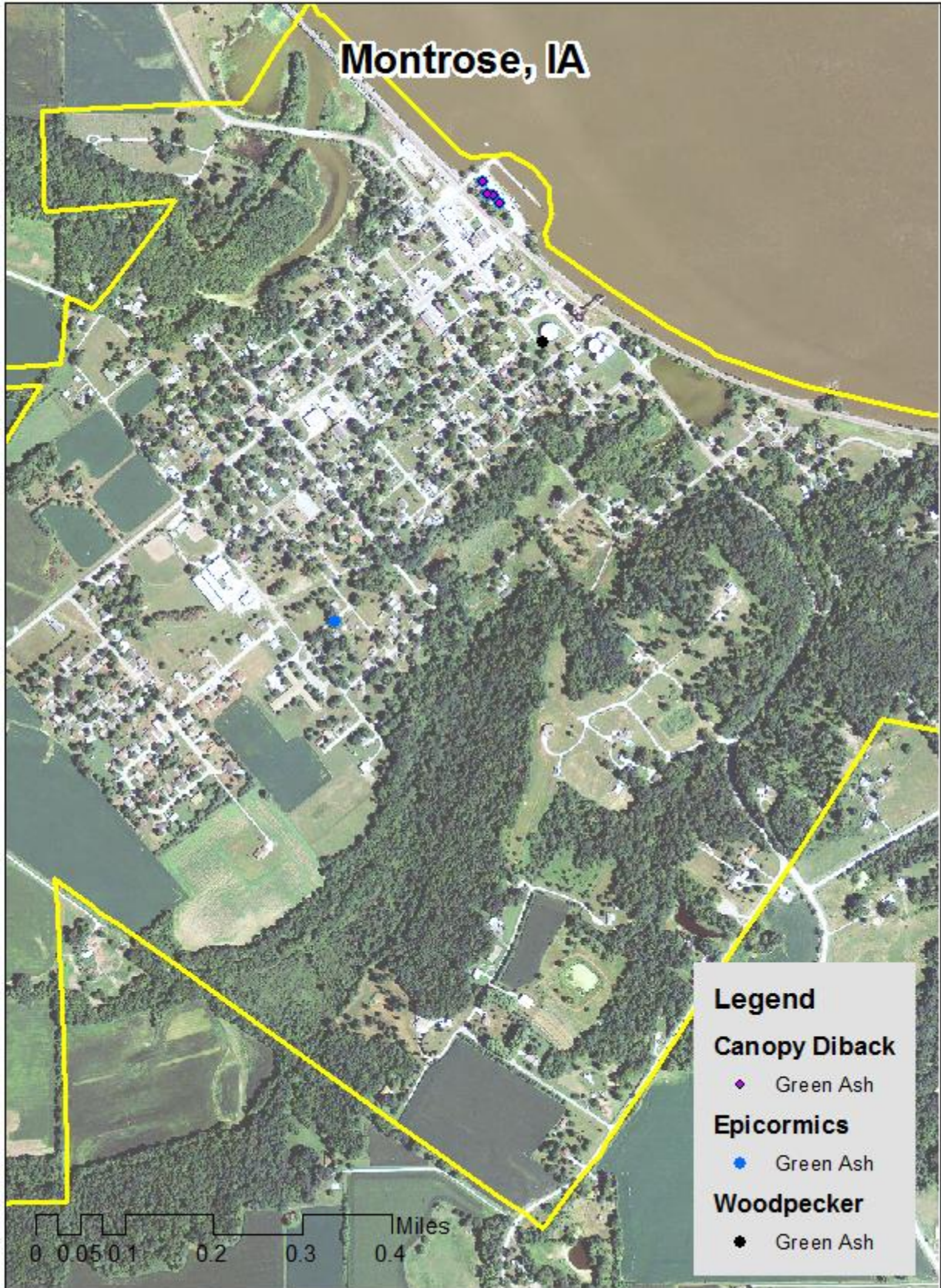


Figure 2: Location of EAB symptoms

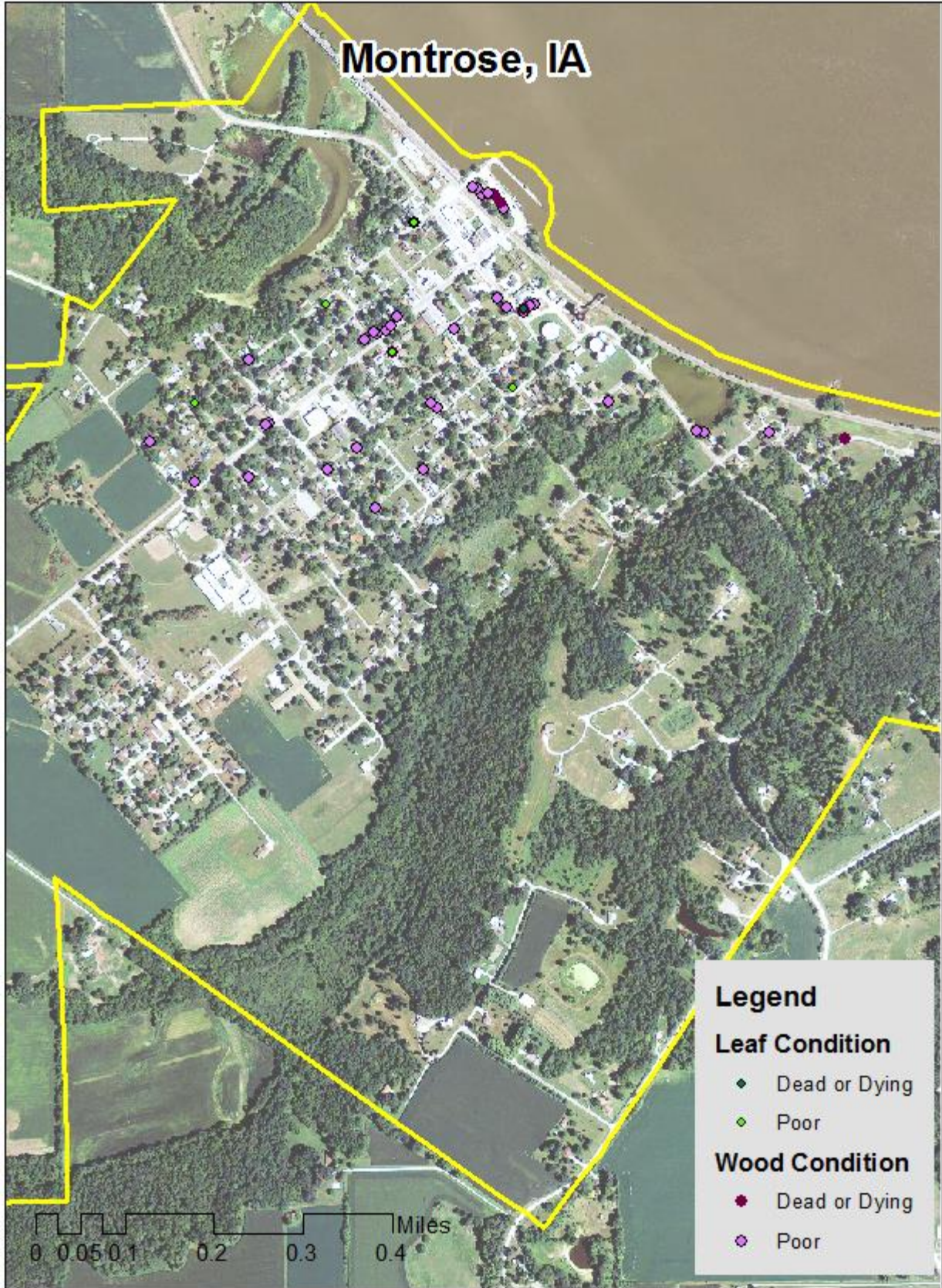


Figure 3: Location of Poor Condition Trees

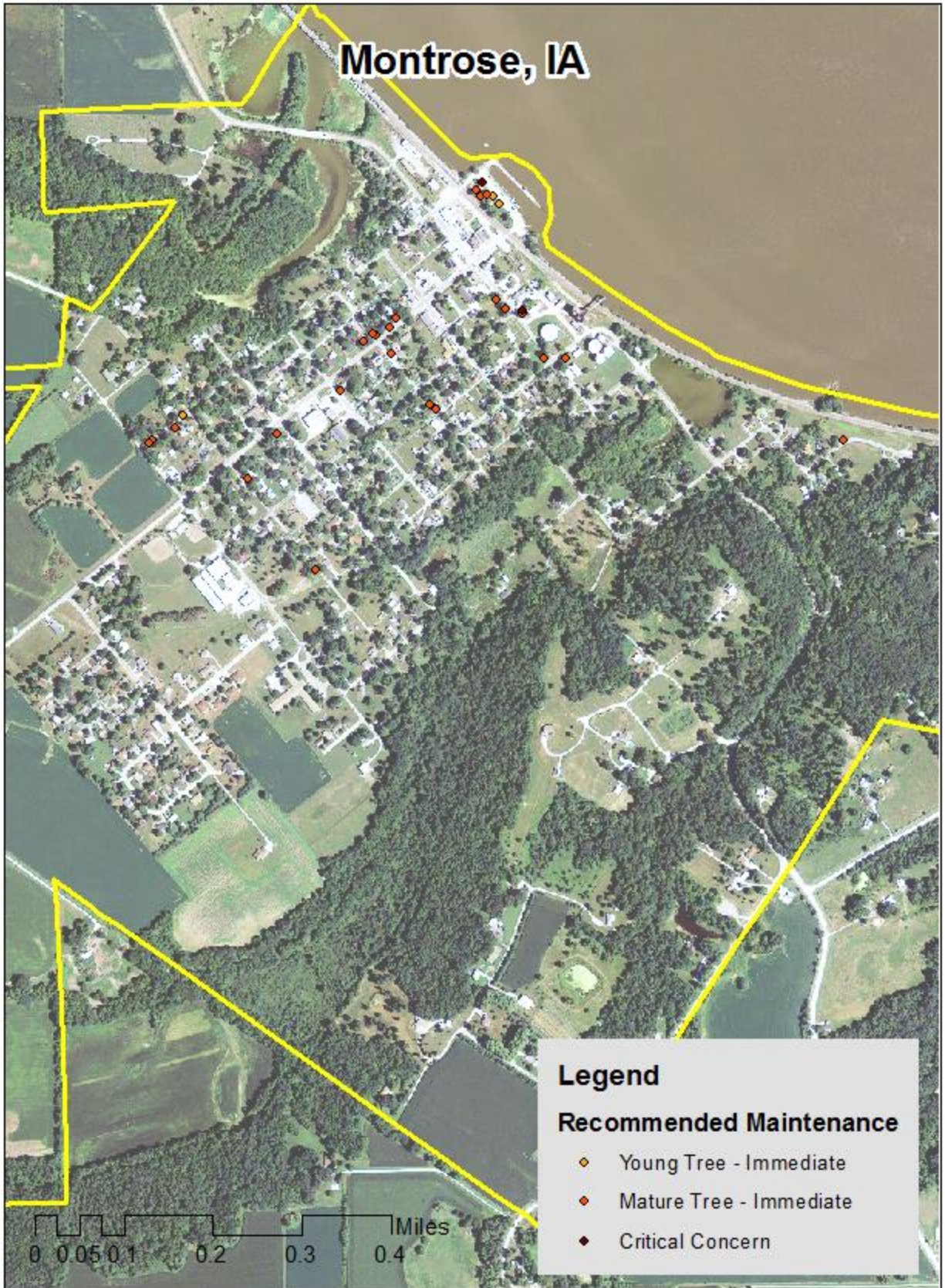


Figure 4: Location of Trees with Recommended Maintenance

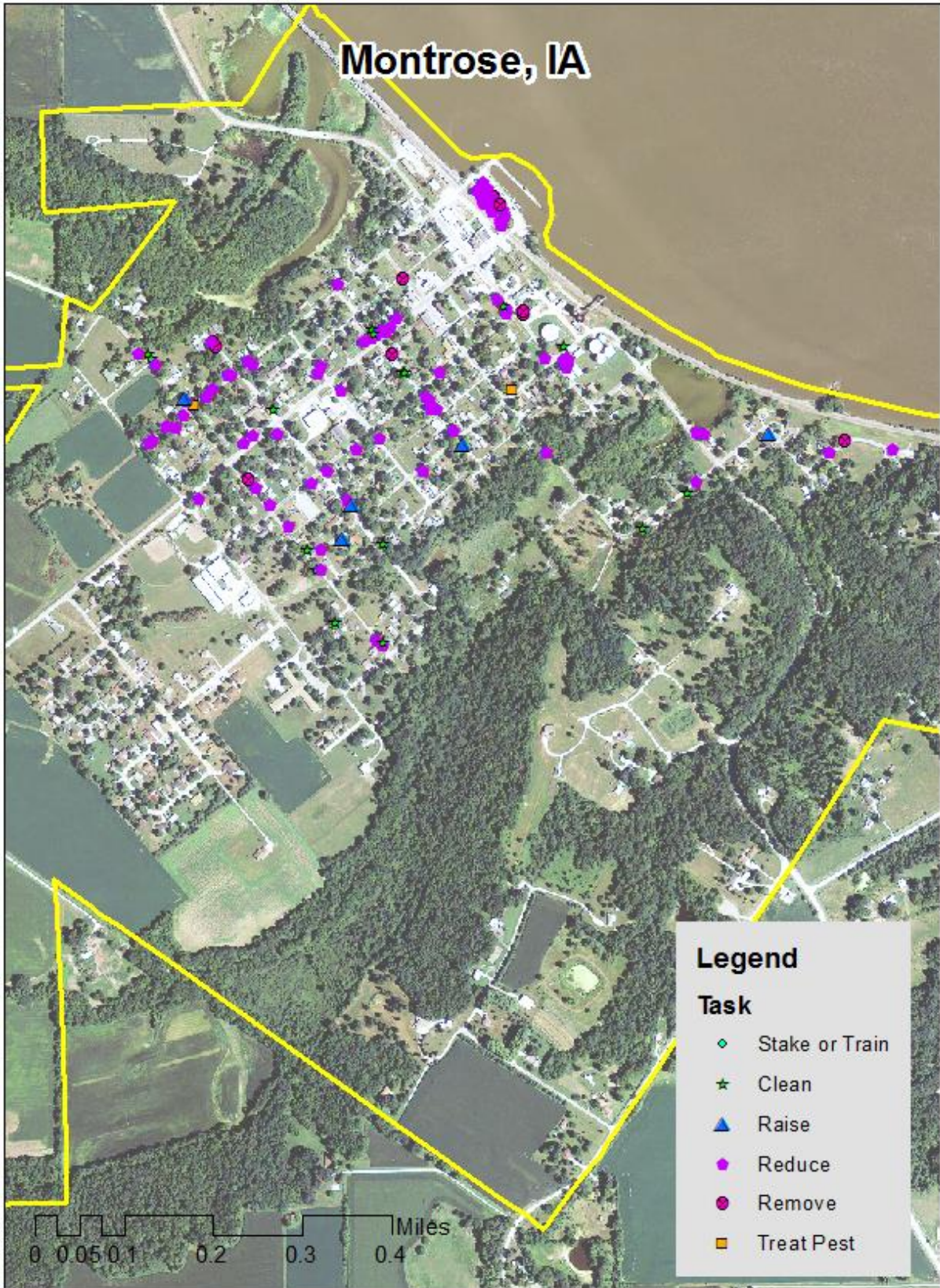


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Montrose Tree Ordinances

CHAPTER 151 TREES AND GRASS

151.01 Definition 151.05 Disease Control
151.02 Planting Restrictions 151.06 Inspection and Removal
151.03 Duty to Trim Trees 151.07 Cutting or Mowing of Grass
151.04 Trimming Trees to be Supervised

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

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

1. Alignment. All trees planted in any street shall be planted in the boulevard midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any boulevard which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.
3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12[2c, d, & e])

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

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

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:

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 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.

(Code of Iowa, Sec. 364.12[3b & h])

151.07 CUTTING OR MOWING OF GRASS.

1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.

2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

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 Director Richard Leopold at 515-281-5918.