

Community Tree Management Plan For Steamboat Rock, IA



Prepared by the Iowa DNR
Urban and Community Forestry Program
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Executive Summary

Overview

This plan was developed to assist the City of Steamboat Rock with managing its public tree population, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management of this resource is critical to fully reaping these rewards. Management is especially important considering the serious threats posed by emerging forest pests such as the Emerald Ash Borer (EAB), Gypsy Moth, Asian Long-horned Beetle, and more. With proper planning and management, the costs of removing dead and dying trees can be spread out over time, mitigating the financial burden as well as public safety issues.

Inventory and Results

In June 2018, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete survey of street and park trees. Below are some key findings of the 83 trees inventoried.

- Steamboat Rock’s trees provide \$13,362 of benefits annually, at an average of \$160 a tree
- There are at least 17 different species of trees in Steamboat Rock
- The top three genus are: Maple 39%, Oak 18%, and Crabapple 16%
- 46 trees (55% of the population) are in need of some type of maintenance:
 - 38 trees are recommended for some form of trimming (crown raising, cleaning, etc.)
 - 8 trees are recommended for removal either for safety or tree health reasons

Recommendations

The core recommendations are detailed in the *Recommendations* section. Some key ones include:

- Begin planting new trees using a diverse mix of species wherever space is available and replacing existing trees that are in poor health to diversify the tree population and buffer against tree pests
- Address the 46 trees recommended for maintenance according to their priority level: 14 are recommended for “immediate” needs, meaning sometime in the next three years; the other 32 can be deferred for up to six years *City ownership of the trees recommended for removal should be verified prior to any removal*
- Begin regularly monitoring the 7 ash trees for signs or symptoms associated with EAB

Introduction

This plan was developed to assist Steamboat Rock with the management, budgeting and future planning of their community's 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) and other exotic tree killing pests, 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 Steamboat Rock, these costs can be extended over years and public safety issues from dead and dying trees mitigated.

Trees are an important component of any community'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 Steamboat Rock and future generations through good urban forest management.

Good urban forest 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 Steamboat Rock maximize the benefits and minimize the costs of the tree canopy.

Inventory

In June 2018, a tree inventory was conducted of all municipally-owned trees on both streets and parks. Tree locations were recorded using a handheld Global Positioning System (GPS) receiver with an accuracy of 3 meters, which can be used as an active GIS data layer. Because the inventory is a digital document the data can be edited and 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 was 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, all ash trees were inspected for signs and symptoms of EAB. 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 83 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Steamboat Rock's trees reduce energy related costs by approximately \$3,898 annually (Appendix A, Table 1). These savings are both in Electricity (18.5 MWh) and in Natural Gas (2,544 Therms).

Annual Stormwater Benefits

Steamboat Rock's trees intercept about 191,967 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides \$5,202 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 Steamboat Rock, it is estimated that trees remove 240.7 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 \$681 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Steamboat Rock, trees sequester about 59,567 lbs of carbon each year with an associated value of \$447 (Appendix A, Table 5). This equates to 688,534 lbs of carbon being stored in Steamboat Rock's trees with total benefit of \$5,164 (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. Steamboat Rock receives \$3,134 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, Steamboat Rock's trees provide \$13,362 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 83 trees in Steamboat Rock provide approximately \$160 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Steamboat Rock has over 17 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genus is as follows:

Maple	33	39%
Oak	15	18%
Crabapple	13	16%
Ash	7	8%
Hackberry	3	4%
Walnut	3	4%
All others	< 3 ea.	< 3% ea.

Size Class

Most of Steamboat Rock's trees (71%) are over 12 inches in diameter at 4.5 ft (Appendix A, Figure 2). Just 9.6% of the trees are 6" in diameter or less. This indicates an imbalance in the city's tree population and suggests that as the larger, older trees decline and are removed, there is a lack of younger trees being planted to replace them. Having too many large trees and too few young ones increases the risk for catastrophic storm damage and a long "lag period" following major damage.

Condition: Wood and Foliage Health

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The survey results for Steamboat Rock indicate that 83% of the trees are in either good or fair health, while 17% of the trees are in poor health or are considered dead or dying (Appendix A, Figures 3 & 4 and Appendix B, Figure 3).

The 17% of trees classified as poor, dead, or dying represent opportunity costs to the city where time and space are being sacrificed. Trees in poor health should be promptly removed and replaced with new, healthy trees to diversify and improve the overall health and resiliency of Steamboat Rock's urban tree population.

Canopy Cover

The amount of tree canopy cover over Steamboat Rock is approximately 2 acres (Appendix A, Figure 5). According to the U.S. Census, Steamboat Rock occupies 352 acres of land. Thus the canopy cover on city land is less than 1%. This figure could be improved upon with more tree planting.

Land Use and Location

The majority of Steamboat Rock's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figures 6 & 7).

Management Needs

The following table outlines specific management needs of the street and park trees that were identified during the survey. (Appendix B, Figures 4 & 5).

<u>Maintenance Type Needed</u>	<u># of Trees</u>	<u>Pct. of Tree Population</u>
Crown Cleaning	18	22%
Crown Reduction	9	11%
Tree Removal	8	10%
Crown Raising	6	7%
Tree Staking/Training	5	6%
Pest/Disease Treatment	0	0

Definitions: "Crown cleaning" removes dead, diseased, and broken limbs. "Crown reduction" involves shortening or removing individual limbs to avoid interference with nearby structures, utility wires, traffic flow, or other branches. "Removal" implies that the entire tree needs to be removed either for safety or tree health purposes. "Raising" removes lower branches from the tree trunk to eliminate obstructions or clearance issues. "Staking/training" refers to corrective staking or pruning on very young saplings to help develop proper form and prevent future problems. "Pest/Disease Treatment" would imply treating very high value or important landscape trees with preventative pesticides to protect their health.

Recommendations

Risk Management

Hazardous trees and branches 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 immediately.

Hazardous trees & branches: Critical concerns

No "critical concern" trees that need immediate attention were identified during the inventory.

Immediate Needs (defer up to 3 years)

There were 14 trees marked as needing "immediate" maintenance attention, meaning within the next three years. They include 5 removals, 5 staking/training for young trees, and 4 trimmings. Refer to the maps in Figures 4 and 5 of Appendix B to view the locations of these trees.

Routine Maintenance (defer up to 6 years)

After addressing the immediate need trees discussed above, there are 32 trees recommended for "routine" maintenance within the next six years (Appendix B, Figures 4 & 5). Of this number, 29 need trimming and 3 are recommended for removal & replacement with something new.

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. It is generally recommended that all trees be inspected for pruning needs every five to ten years. This would equate to pruning roughly 10 trees per year in Steamboat Rock.

Planting

Theoretically, the city should be planting (and removing) about 10 trees per decade in order to sustain the current tree population and to spread the trees equally out among different ages (size classes). This assumes the typical lifespan of a tree in Steamboat Rock to be 80-140 years; if the trees are not living that long, or if the goal is to *increase* the tree population, the target will be higher (15-20 trees/decade). Some of the planting over the next 10-15 years can be done to replace the trees that are removed. 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 Steamboat Rock.

It is important to plant a diverse mix of differing *species* in the urban forest to maintain canopy health, since most insects and diseases target a single genus of trees (e.g., ash, maple, oak).

Current diversity recommendations advise that:

- No single species should comprise more than 10% of the total tree population in the community (e.g. silver maple, sugar maple, white oak, bur oak)
- No single genus should comprise more than 20% of the total tree population

Presently, Steamboat Rock's urban forest is heavily planted with the genus Maple, at 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 for various reasons include: cottonwood, poplar, boxelder, Chinese elm, evergreens, willow, or black walnut, and any others identified in the city tree code.

A list containing generally acceptable and recommended trees for planting in Iowa is provided with this plan (Appendix D). Ensure each individual planting is tailored for the environmental conditions, available space, and other factors.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that all ash trees which are showing any signs or symptoms of EAB be checked annually with a visual survey for tree death and for additional symptoms (canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage). All other ash trees in the city which aren't exhibiting these symptoms should still be routinely monitored as time allows.

Proposed Work Schedule & Estimated Costs

The trees in Steamboat Rock represent an important part of its overall infrastructure and quality of life for its residents. By budgeting for routine maintenance, replacement, and removals now, the city can be proactive and preventative rather than reactive when unexpected storms or tree pests arrive.

The following is a proposed 6-year work plan that would address the highest priority issues at this time. Estimated costs are based on \$700/tree average for removal, \$25/tree average for trimming*, and \$150/tree average for planting. *Individual homeowners are presumed to be responsible for light trimming and staking/training of young trees in the City right-of-way. For new tree plantings & replacements, it is recommended that Steamboat Rock apply for grants. 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.

<u>Year 1</u>	<u>Estimated Costs</u>
Removals: 5 of the 8 recommended trees	\$3500
Planting and replacements: 5 new trees	\$750
Trimming: 8 of the 38 recommended trees	\$200
Staking & training: 5 of 5 recommended trees	
 <u>Year 2</u>	
Removals: 3 of the 8 recommended trees	\$2100
Trimming: 6 of the 38 recommended trees	\$150
 <u>Year 3</u>	
Trimming: 6 of the 38 recommended trees	\$150
 <u>Year 4</u>	
Trimming: 6 of the 38 recommended trees	\$150
 <u>Year 5</u>	
Trimming: 6 of the 38 recommended trees	\$150
 <u>Year 6</u>	
Trimming: 6 of the 38 recommended trees	\$150
Planting and replacements: 5 new trees	\$750
 <u>Annually thereafter</u>	
Planting and replacements: 1/yr avg.	\$150
Routine trimming: 10 trees/year avg.	\$250
Routine monitoring for EAB symptoms	

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All data and information used for this report may be obtained by contacting the Iowa DNR Forestry Bureau.

Works Cited

Census Bureau. 2000. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2010)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, D.J. and J.F. Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J.; McPherson, E. Gregory; Simpson, James R.; Vargas, Kelaine E.; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Steamboat Rock

Annual Energy Benefits of Public Trees

1/10/2019

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Bur oak	3.8	287	505.4	495	782	(N/A)	18.1	20.1	52.12
Apple	1.1	86	175.2	172	258	(N/A)	15.7	6.6	19.84
Sugar maple	3.2	245	432.5	424	669	(N/A)	14.5	17.2	55.73
Black maple	2.1	159	295.8	290	449	(N/A)	9.6	11.5	56.17
Norway maple	1.4	107	191.2	187	295	(N/A)	8.4	7.6	42.11
Ash	2.1	157	308.4	302	459	(N/A)	8.4	11.8	65.63
Black walnut	0.8	58	103.2	101	159	(N/A)	3.6	4.1	52.96
Silver maple	1.0	76	133.1	130	206	(N/A)	3.6	5.3	68.65
Red maple	0.3	25	49.5	49	74	(N/A)	3.6	1.9	24.58
Northern hackberry	1.1	86	155.0	152	238	(N/A)	3.6	6.1	79.18
Conifer Evergreen Large	0.3	20	29.3	29	48	(N/A)	2.4	1.2	24.14
White ash	0.5	41	56.8	56	96	(N/A)	2.4	2.5	48.12
American elm	0.4	29	52.8	52	80	(N/A)	1.2	2.1	80.37
Scotch pine	0.1	10	14.6	14	24	(N/A)	1.2	0.6	24.14
Blue spruce	0.1	5	10.2	10	15	(N/A)	1.2	0.4	14.80
Northern red oak	0.1	7	14.2	14	21	(N/A)	1.2	0.5	21.11
Eastern red cedar	0.1	8	16.4	16	25	(N/A)	1.2	0.6	24.57
Total	18.5	1,405	2,543.6	2,493	3,898	(N/A)	100.0	100.0	46.96

Table 2: Annual Stormwater Benefit

Steamboat Rock

Annual Stormwater Benefits of Public Trees

1/10/2019

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Bur oak	54,139	1,467	(N/A)	18.1	28.2	97.81
Apple	4,057	110	(N/A)	15.7	2.1	8.46
Sugar maple	32,560	882	(N/A)	14.5	17.0	73.53
Black maple	20,694	561	(N/A)	9.6	10.8	70.10
Norway maple	9,288	252	(N/A)	8.4	4.8	35.96
Ash	22,495	610	(N/A)	8.4	11.7	87.09
Black walnut	6,647	180	(N/A)	3.6	3.5	60.04
Silver maple	13,405	363	(N/A)	3.6	7.0	121.09
Red maple	1,876	51	(N/A)	3.6	1.0	16.95
Northern hackberry	11,395	309	(N/A)	3.6	5.9	102.94
Conifer Evergreen Large	3,077	83	(N/A)	2.4	1.6	41.70
White ash	3,325	90	(N/A)	2.4	1.7	45.05
American elm	4,551	123	(N/A)	1.2	2.4	123.33
Scotch pine	1,539	42	(N/A)	1.2	0.8	41.70
Blue spruce	755	20	(N/A)	1.2	0.4	20.47
Northern red oak	529	14	(N/A)	1.2	0.3	14.33
Eastern red cedar	1,635	44	(N/A)	1.2	0.9	44.30
Citywide total	191,967	5,202	(N/A)	100.0	100.0	62.68

Table 3: Annual Air Quality Benefits

Steamboat Rock

Annual Air Quality Benefits of Public Trees

1/10/2019

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								
Bur oak	8.1	1.3	3.6	0.4	42	17.9	2.6	2.5	17.1	112	0.0	0	53.5	154	(N/A)	18.1	10.29
Apple	1.0	0.2	0.5	0.0	5	5.6	0.8	0.8	5.2	34	0.0	0	14.0	40	(N/A)	15.7	3.05
Sugar maple	4.1	0.7	2.1	0.2	22	15.3	2.2	2.1	14.6	96	-3.2	-12	38.1	106	(N/A)	14.5	8.81
Black maple	5.3	0.9	2.4	0.2	28	10.1	1.5	1.4	9.5	63	-1.7	-7	29.6	84	(N/A)	9.6	10.55
Norway maple	1.5	0.3	0.8	0.1	8	6.7	1.0	0.9	6.4	42	-0.4	-1	17.3	49	(N/A)	8.4	6.97
Ash	4.9	0.9	2.4	0.2	27	10.1	1.5	1.4	9.4	63	-1.1	-4	29.6	85	(N/A)	8.4	12.11
Black walnut	0.6	0.1	0.3	0.0	4	3.6	0.5	0.5	3.4	23	0.0	0	9.2	26	(N/A)	3.6	8.70
Silver maple	2.2	0.4	1.1	0.1	12	4.7	0.7	0.7	4.5	29	-1.1	-4	13.2	37	(N/A)	3.6	12.33
Red maple	0.2	0.0	0.1	0.0	1	1.6	0.2	0.2	1.5	10	-0.1	0	3.9	11	(N/A)	3.6	3.64
Northern hackberry	1.9	0.3	0.9	0.1	10	5.4	0.8	0.7	5.1	34	0.0	0	15.3	44	(N/A)	3.6	14.58
Conifer Evergreen Large	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)	2.4	2.82
White ash	0.2	0.0	0.1	0.0	1	2.4	0.4	0.3	2.4	15	0.0	0	5.9	17	(N/A)	2.4	8.32
American elm	0.5	0.1	0.3	0.0	3	1.8	0.3	0.3	1.7	11	0.0	0	4.9	14	(N/A)	1.2	14.10
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	1.2	2.82
Blue spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	2	(N/A)	1.2	1.53
Northern red oak	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	-0.1	0	1.1	3	(N/A)	1.2	2.89
Eastern red cedar	0.3	0.1	0.3	0.0	2	0.5	0.1	0.1	0.5	3	-0.9	-3	1.0	2	(N/A)	1.2	2.19
Citywide total	31.5	5.3	15.5	1.5	170	88.4	12.9	12.3	83.9	551	-10.6	-40	240.7	681	(N/A)	100.0	8.21

Table 4: Annual Carbon Stored

Steamboat Rock

Stored CO2 Benefits of Public Trees						
1/10/2019						
Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Bur oak	271,356	2,035	(N/A)	18.1	39.4	135.68
Apple	16,000	120	(N/A)	15.7	2.3	9.23
Sugar maple	115,735	868	(N/A)	14.5	16.8	72.33
Black maple	56,718	425	(N/A)	9.6	8.2	53.17
Norway maple	24,643	185	(N/A)	8.4	3.6	26.40
Ash	80,956	607	(N/A)	8.4	11.8	86.74
Black walnut	20,587	154	(N/A)	3.6	3.0	51.47
Silver maple	45,031	338	(N/A)	3.6	6.5	112.58
Red maple	3,302	25	(N/A)	3.6	0.5	8.26
Northern hackberry	28,694	215	(N/A)	3.6	4.2	71.74
Conifer Evergreen La	2,340	18	(N/A)	2.4	0.3	8.78
White ash	7,344	55	(N/A)	2.4	1.1	27.54
American elm	12,245	92	(N/A)	1.2	1.8	91.84
Scotch pine	1,170	9	(N/A)	1.2	0.2	8.78
Blue spruce	284	2	(N/A)	1.2	0.0	2.13
Northern red oak	1,025	8	(N/A)	1.2	0.1	7.68
Eastern red cedar	1,102	8	(N/A)	1.2	0.2	8.27
Citywide total	688,534	5,164	(N/A)	100.0	100.0	62.22

Table 5: Annual Carbon Sequestered

Steamboat Rock

Annual CO₂ Benefits of Public Trees

1/10/2019

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
Bur oak	8,240	62	-1,303	-42	-10	6,332	47	13,227	99 (N/A)	18.1	22.2	6.61
Apple	1,714	13	-77	-16	-1	1,906	14	3,527	26 (N/A)	15.7	5.9	2.04
Sugar maple	6,698	50	-556	-34	-4	5,414	41	11,522	86 (N/A)	14.5	19.3	7.20
Black maple	2,012	15	-272	-20	-2	3,524	26	5,244	39 (N/A)	9.6	8.8	4.92
Norway maple	2,462	18	-118	-13	-1	2,372	18	4,702	35 (N/A)	8.4	7.9	5.04
Ash	1,410	11	-389	-25	-3	3,474	26	4,470	34 (N/A)	8.4	7.5	4.79
Black walnut	1,765	13	-99	-7	-1	1,276	10	2,934	22 (N/A)	3.6	4.9	7.34
Silver maple	3,780	28	-216	-11	-2	1,669	13	5,222	39 (N/A)	3.6	8.8	13.06
Red maple	496	4	-16	-4	0	557	4	1,033	8 (N/A)	3.6	1.7	2.58
Northern hackberry	1,432	11	-138	-11	-1	1,893	14	3,177	24 (N/A)	3.6	5.3	7.94
Conifer Evergreen Large	231	2	-11	-4	0	433	3	649	5 (N/A)	2.4	1.1	2.43
White ash	987	7	-35	-4	0	898	7	1,846	14 (N/A)	2.4	3.1	6.92
American elm	454	3	-59	-4	0	632	5	1,023	8 (N/A)	1.2	1.7	7.68
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	1.2	0.5	2.43
Blue spruce	39	0	-1	-1	0	106	1	142	1 (N/A)	1.2	0.2	1.07
Northern red oak	147	1	-5	-1	0	160	1	301	2 (N/A)	1.2	0.5	2.26
Eastern red cedar	43	0	-5	-2	0	187	1	222	2 (N/A)	1.2	0.4	1.67
Citywide total	32,025	240	-3,305	-200	-26	31,048	233	59,567	447 (N/A)	100.0	100.0	5.38

**Table 6: Annual Social and Aesthetic Benefits
Steamboat Rock**

Annual Aesthetic/Other Benefits of Public Trees

1/10/2019

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Bur oak	609	(N/A)	18.1	19.4	40.57
Apple	97	(N/A)	15.7	3.1	7.50
Sugar maple	718	(N/A)	14.5	22.9	59.87
Black maple	248	(N/A)	9.6	7.9	31.00
Norway maple	252	(N/A)	8.4	8.0	36.02
Ash	129	(N/A)	8.4	4.1	18.45
Black walnut	161	(N/A)	3.6	5.1	53.74
Silver maple	305	(N/A)	3.6	9.7	101.72
Red maple	90	(N/A)	3.6	2.9	29.84
Northern hackberry	185	(N/A)	3.6	5.9	61.63
Conifer Evergreen Large	65	(N/A)	2.4	2.1	32.32
White ash	127	(N/A)	2.4	4.1	63.74
American elm	64	(N/A)	1.2	2.1	64.36
Scotch pine	32	(N/A)	1.2	1.0	32.32
Blue spruce	21	(N/A)	1.2	0.7	21.08
Northern red oak	16	(N/A)	1.2	0.5	16.24
Eastern red cedar	14	(N/A)	1.2	0.4	13.68
Citywide total	3,134	(N/A)	100.0	100.0	37.76

Table 7: Summary of Benefits in Dollars

Steamboat Rock

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

1/10/2019

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Bur oak	782	99	154	1,467	609	3,111	(N/A)	23.3
Apple	258	26	40	110	97	531	(N/A)	4.0
Sugar maple	669	86	106	882	718	2,462	(N/A)	18.4
Black maple	449	39	84	561	248	1,382	(N/A)	10.3
Norway maple	295	35	49	252	252	883	(N/A)	6.6
Ash	459	34	85	610	129	1,317	(N/A)	9.9
Black walnut	159	22	26	180	161	548	(N/A)	4.1
Silver maple	206	39	37	363	305	951	(N/A)	7.1
Red maple	74	8	11	51	90	233	(N/A)	1.7
Northern hackberry	238	24	44	309	185	799	(N/A)	6.0
Conifer Evergreen Large	48	5	6	83	65	207	(N/A)	1.5
White ash	96	14	17	90	127	344	(N/A)	2.6
American elm	80	8	14	123	64	290	(N/A)	2.2
Scotch pine	24	2	3	42	32	103	(N/A)	0.8
Blue spruce	15	1	2	20	21	59	(N/A)	0.4
Northern red oak	21	2	3	14	16	57	(N/A)	0.4
Eastern red cedar	25	2	2	44	14	86	(N/A)	0.6
Citywide Total	3,898	447	681	5,202	3,134	13,362	(N/A)	100.0

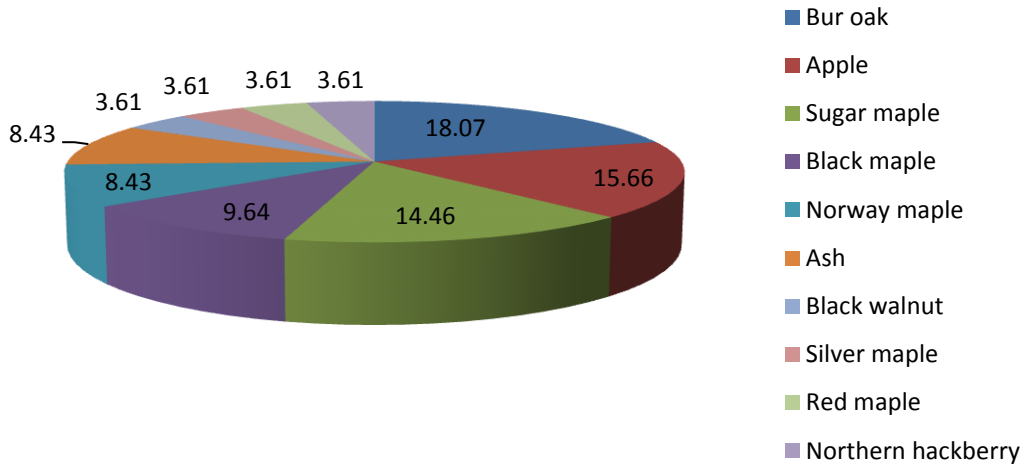


Figure 1: Species Distribution

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

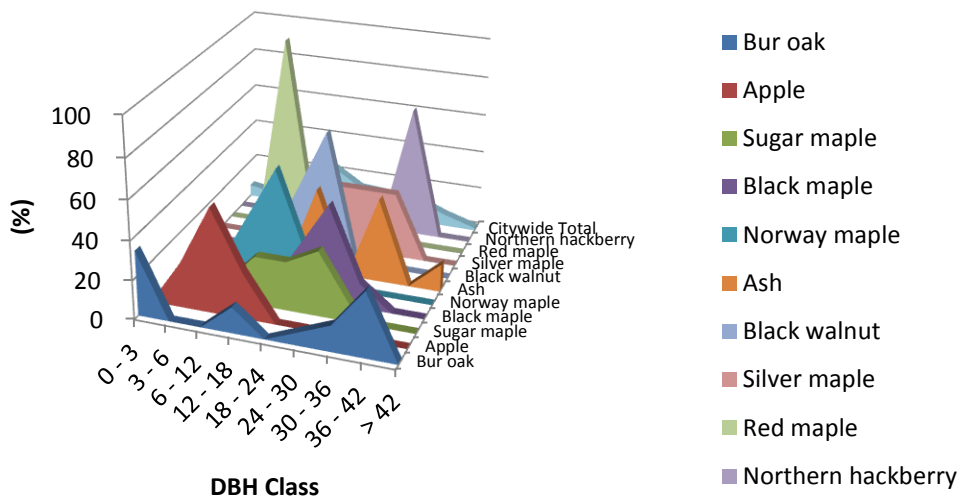


Figure 2: Size Class Distribution

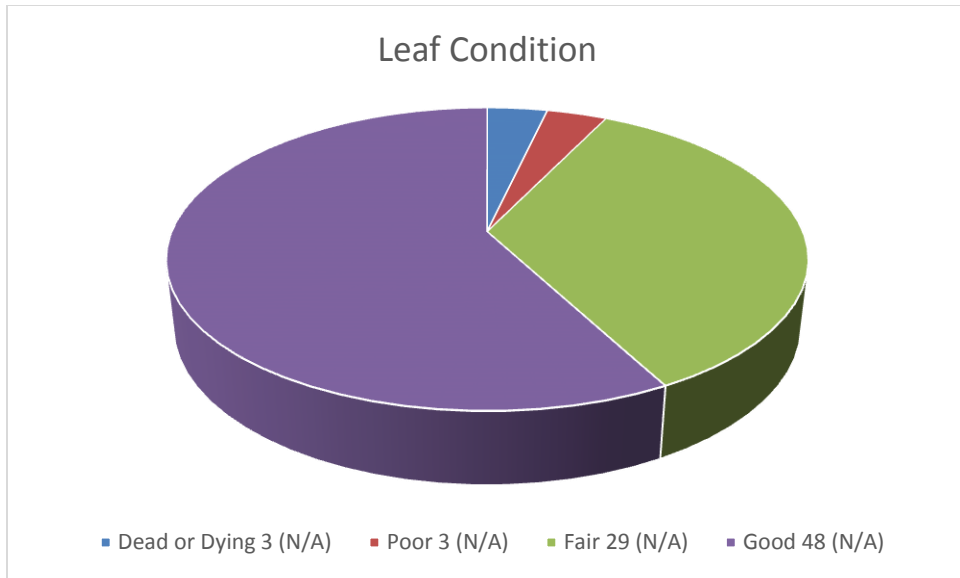


Figure 3: Foliage Condition

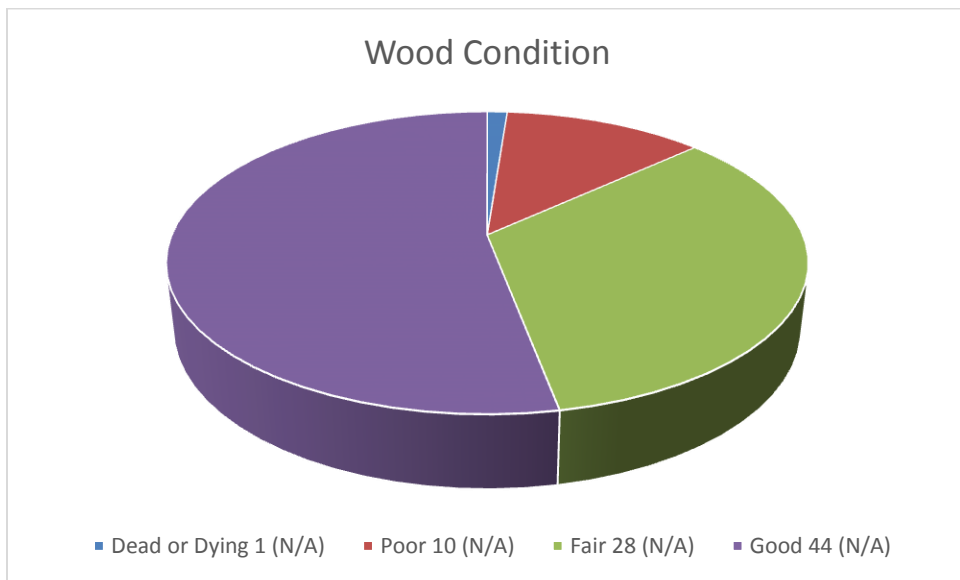


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

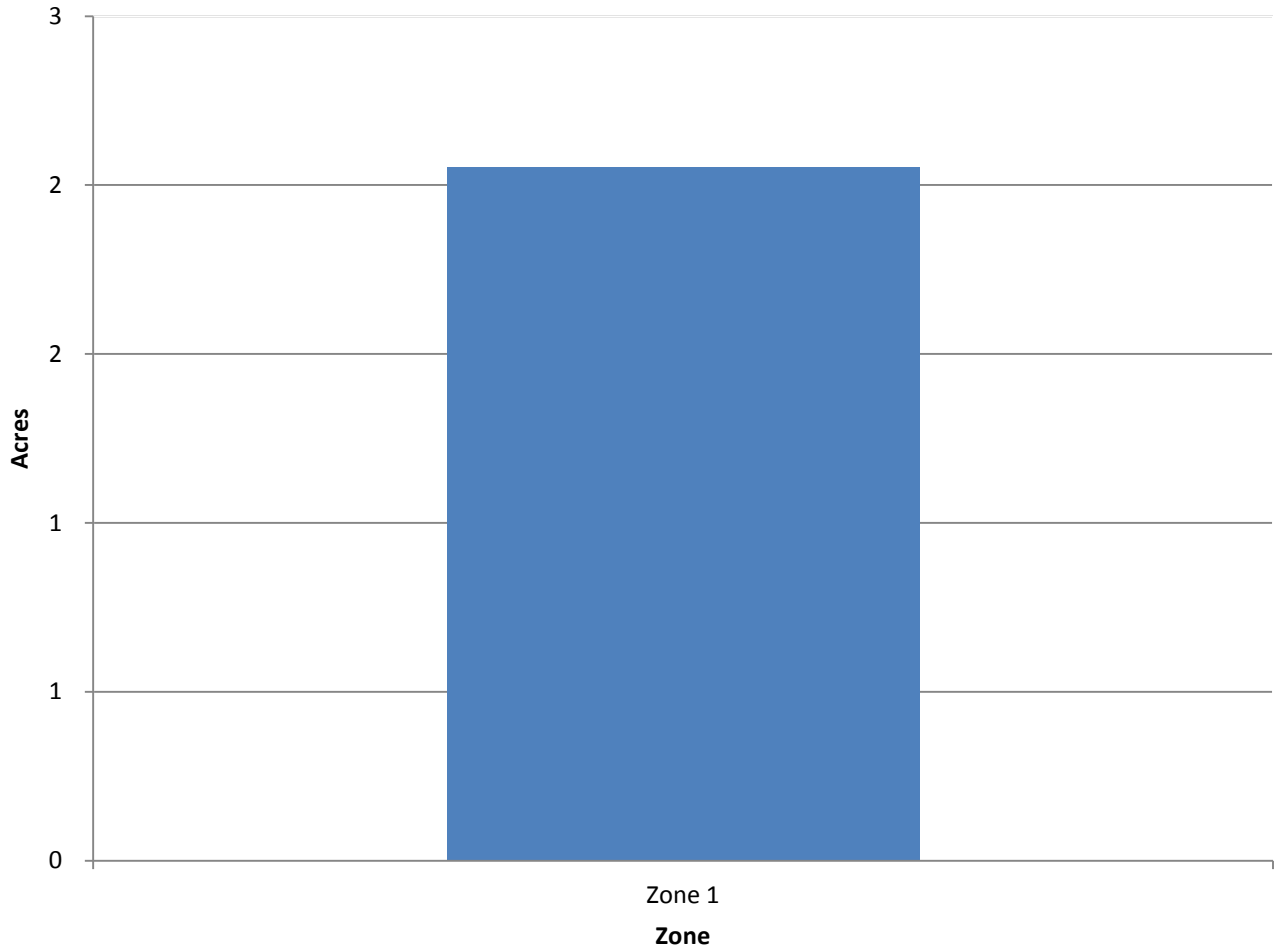


Figure 5: Canopy Cover in Acres

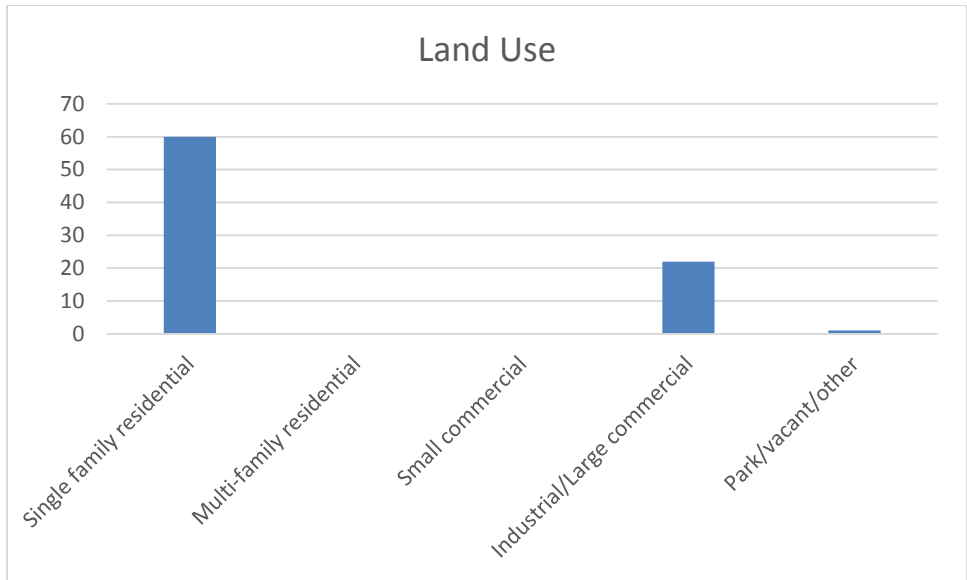


Figure 6: Land Use of city/park trees

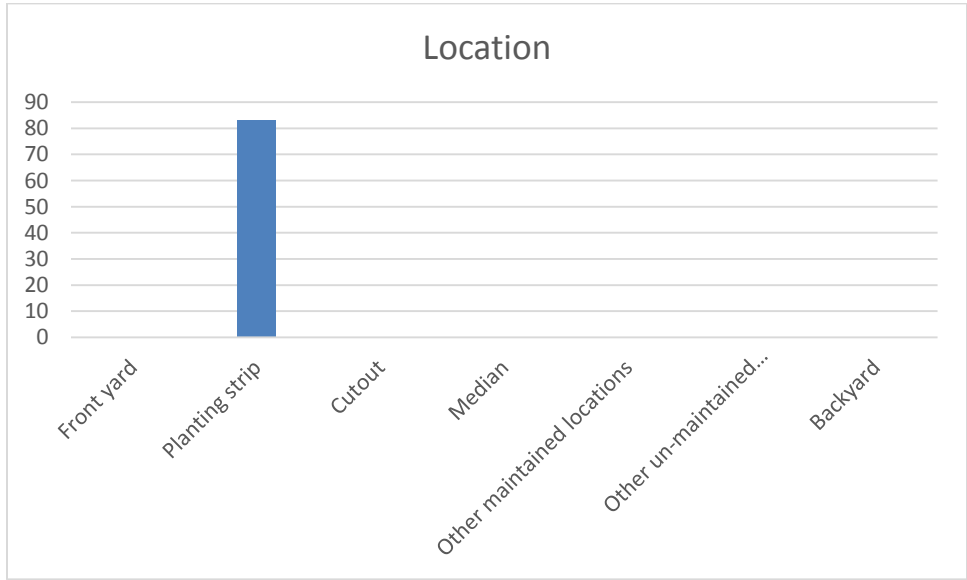


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping



Figure 1: Location of Ash Trees

[No Signs or Symptoms noted during inventory]
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: Proposed Emerald Ash Borer Plan

Ash Tree Removal

Ash trees that become infested with EAB will die within 6-8 years and can present very serious risks to life and property. Once branches or trees die, the tissue can become very brittle and unpredictable within 1-2 years, making removal more dangerous and expensive for tree services. Therefore, it is recommended that ash trees be removed immediately as soon as signs and symptoms of EAB are detected in those trees. Dead, dying, and hazardous ash trees should be prioritized for removal first to mitigate public safety and risk. Next should be all ash in poor condition and displaying early signs and symptoms of EAB. *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

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.

The entire State of Iowa is under a quarantine which prohibits the transport of regulated articles to areas outside the federal quarantine area. For a current quarantine map, please visit <http://www.emeraldashborer.info/moving-firewood.php>. County-to-county transport of regulated articles inside the State of Iowa is permitted, but discouraged.

Wood Disposal

Wood waste can be disposed of by typical means, such as chipping, composting, burning, etc. Cities and residents are encouraged to destroy ash materials promptly to prevent their spread to other neighboring communities and counties. Firewood from ash trees should be kept and used locally as much as possible.

Canopy Replacement

Replace all ash trees promptly with a diverse species mix as budgets allow. Encourage local residents to plant trees on their adjoining properties. All trees should meet the guidelines in the City Code.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on trees 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 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 either before or upon arrival of EAB. Preventative treatments using insecticides are available to protect highly valuable ash trees but must be administered for the remainder of the tree's life. Treatments are formulated either for homeowner use or via professionally-applied trunk injections, depending on tree size, in accordance with ISU Extension bulletin PM-2084 (available online for free).

Appendix D: Recommended Tree Planting List

IOWA TREE LIST			
*This is a statewide list; Species survivability may vary by location.			
	Common Name	Scientific Name	Cultivars/ Selections
SHADE TREES	Black Maple	<i>Acer nigrum</i>	
	Red Maple	<i>Acer rubrum</i>	Burgundy Belle, Red Sunset , Scarlet Jewel, Redpoint , Somerset
	Sugar Maple	<i>Acer saccharum</i>	Commemoration, Crescendo , Endowment , Fall Fiesta , Legacy , Green Mountain
	River Birch	<i>Betula nigra</i>	Heritage
	White-barked Birch	<i>Betula populifolia</i>	Whitespire Sr.
	American Elm	<i>Ulmus Americana</i>	Jefferson , Prairie Expedition (Lewis and Clark) , Princeton
	Pecan	<i>Carya illinoensis</i>	
	Shellbark Hickory	<i>Carya laciniosa</i>	
	Shagbark Hickory	<i>Carya ovata</i>	
	Hackberry	<i>Celtis occidentalis</i>	Chicagoland , Prairie Pride , Windy City
	Yellowwood	<i>Cladrastis kentuckea</i>	
	Turkish Filbert	<i>Corylus columa</i>	
	Ginkgo (male only)	<i>Ginkgo biloba</i>	Autumn Gold , Golden Colonnade , Halka , Magyar , Presidential Gold , Princeton Sentry
	Thornless Honeylocust	<i>Gleditsia triacanthos</i>	Northern Acclaim , Skyline , Shademaker
	Kentucky Coffeetree	<i>Gymnocladus dioicus</i>	
	Sweetgum	<i>Liquidambar styraciflua</i>	
	Tuliptree	<i>Liriodendron tulipifera</i>	
	Cucumbertree Magnolia	<i>Magnolia acuminata</i>	
	Blackgum	<i>Nyssa sylvatica</i>	
	London Planetree	<i>Platanus x acerfolia</i>	Bloodgood , Exclamation
	White Oak	<i>Quercus alba</i>	
	Swamp White Oak	<i>Quercus bicolor</i>	
	Scarlet Oak	<i>Quercus coccinea</i>	
	Shingle Oak	<i>Quercus imbricaria</i>	
	Bur Oak	<i>Quercus macrocarpa</i>	
	Chinkapin Oak	<i>Quercus muehlenbergii</i>	
	Pin Oak	<i>Quercus Palustris</i>	
	Northern Red Oak	<i>Quercus rubra</i>	
American Linden	<i>Tilia americana</i>	Boulevard , Front Yard, Legend, American Sentry	
Silver Linden	<i>Tilia tomentosa</i>		
Littleleaf Linden	<i>Tilia Cordata</i>	Glenleven	
LOW-GROWING TREES	Serviceberry	<i>Amelanchier spp.</i>	Autumn Brilliance , Cole's Select , Cumulus, Princess Diana , Strata
	American Hornbeam	<i>Carpinus caroliniana</i>	
	Eastern Redbud	<i>Cercis canadensis</i>	
	Pagoda Dogwood	<i>Cornus alternifolia</i>	
	Flowering Crabapple	<i>Malus spp.</i>	Adirondack , Cardinal , David , Donald Wyman , Doublooms , Floribunda , Golden Raindrops , Harvest Gold , Indian Magic , Louisa , Mary Potter , Purple Prince , Red Jewel , Royal Fountain , Royal Raindrops , Sugar Tyme
	American Hophornbeam	<i>Ostrya virginiana</i>	
	American Plum	<i>Prunus americana</i>	
Japanese Tree Lilac	<i>Syringa reticulata</i>	Ivory Silk , Summer Snow	
CONIFERS	White Fir	<i>Abies concolor</i>	
	Norway Spruce	<i>Picea abies</i>	
	White Spruce	<i>Picea glauca</i>	
	Black Hills Spruce	<i>Picea glauca var. densata</i>	
	Serbian Spruce	<i>Picea omorika</i>	
	White Pine	<i>Pinus strobus</i>	
	Arborvitae	<i>Thuja occidentalis</i>	
	Canadian Hemlock	<i>Tsuga canadensis</i>	
	Larch	<i>Larix decidua</i>	
	Bald Cypress	<i>Taxodium distichum</i>	

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If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-281-5918.