Okoboji, IA

2020 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Okoboji 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 31% of Okoboji'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 2018, 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 388 trees inventoried.

- Okoboji's trees provide $77,669 of benefits annually, an average of $200.18 a tree
- There were 20 species of trees inventoried from 13 different genera
- The top three genera are: Ash 31%, Oak 26%, and Maple 22%
- None of the trees were reported to need of any type of maintenance other than routine maintenance.
- No data was collected for which trees are recommended for removal or where they are located. Additionally, no data was collected as to the maintenance priority of any given tree.

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.

- EAB was not recorded when the inventory was conducted. There are 112 ash trees within Okoboji and it is likely that some are currently displaying symptoms of EAB. It is recommended that a visual inspection of all ash trees be conducted annually.
- All trees should be pruned on a routine schedule- one sixth of the city every year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly

Introduction

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

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

Inventory

In 2018, 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 388 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. Okoboji's trees reduce energy related costs by approximately $21,149 annually (Appendix A, Table 1). These savings are both in Electricity (100.3 MWh) and in Natural Gas (13,809.4 Therms).

Annual Stormwater Benefits

Okoboji's trees intercept about 1,123,489 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $30,447 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 Okoboji, it is estimated that trees remove 1,316.1 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $3,747 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Okoboji, trees sequester about 228,582 lbs of carbon a year with an associated value of $1,714 (Appendix A, Table 5). In addition, the trees store 4,753,417 lbs of carbon, with a yearly benefit of $35,651 (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. Okoboji receives $19,529 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, Okoboji's trees provide $77,669 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 388 trees in Okoboji provide approximately $200.18 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Okoboji has at least 20 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Genus	Count	Percent
Ash	121	31%
Oak	101	26%
Maple	85	22%
Elm	24	6%
Hackberry	17	4%
Spruce	12	3%
Boxelder	11	3%
Walnut	5	1%
Basswood	4	1%
Apple	3	1%
Locust	2	1%
SA alba	2	1%
Cottonwood	1	<1%

Age Class

Most of Okoboji's trees (48%) are between 18 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Okoboji has a slightly positive slope, indicating that there more trees in larger size categories than smaller categories, indicating that Okoboji has an older than average tree stand. Additionally, only 2% of the trees surveyed that had a diameter of between 0-3 inches, and only 5% of trees surveyed had a diameter of between 3-6 inches. This indicates that Okoboji does not have a very resilient canopy, as there are currently very few young trees to replace mature trees as they naturally die.

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 Okoboji indicate that 89% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 89% of Okoboji'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 4% of the population. This 4% is an estimate of trees that need management follow up.

Management Needs

There were no specific management needs recorded for Okoboji trees.

Canopy Cover

The total canopy with both private and public trees is 22%, 260.28 acres. The canopy cover included in the Okoboji inventory includes approximately 11.53 acres, which is <1% of the total land area of Okoboji (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 87 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Okoboji'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	Count	Percent
Park/Vacant/Other	260	67%
Single Family Res.	126	32%
Small Commercial	2	1%

Location	Count	Percent
Other Maintained	249	64%
Planting Strip	122	31%
Other un-maintained	11	3%
Cutout	6	2%

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

Detailed information was not collected on which trees are potentially hazardous or where they might be located.

Poor tree species

The data collectors did not collect appropriate data on this, however it was noted that 121 trees in Okoboji are ash trees, which is 31% of the total trees inventoried. While the collectors did not gather data on EAB, it is common though out the region and very likely affecting many of the ash trees in Okoboji. Visual inspections of ash trees should be conducted annually in order track their conditions. Treatment for EAB is an effective preventative measure that can be taken to prevent the death of healthy ash trees. It is not recommended to be used on ash trees already displaying two or more symptoms of EAB. Since data for EAB was not collected, we will present two separate scenarios regarding ash management versus removal. If all 121 ash trees in Okoboji are healthy and could be treated, it would cost an estimated $42,930 every two years, which is an average of $354.79 per tree. If all 121 ash trees in Okoboji are suffering from EAB, it would cost an estimated $96,800 to remove them, which is an average of $800 per tree. These scenarios represent two different extremes and while it is likely that many ash trees within Okoboji are displaying signs of EAB, it is also likely that many are not and would therefore be eligible for treatment. It is recommended that Okoboji treat many of its larger, healthier ash trees and begin removing dead or dying ash trees, as well as those found to be displaying 2 or more symptoms of EAB.

Pruning Cycle

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

Planting

Most of the planting over the next 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 Okoboji.

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 ash (31%) (Appendix A, Figure 1). 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 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 151.02 (Appendix C). The new plantings should be a diverse mix that will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow, black walnut, or any fruit-bearing tree.

Postponed Work

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

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states "If it is determined 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."

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Okoboji

Annual Energy Benefits of Public Trees

6/29/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	36.3	2,754	5,105.2	5,003	7,757	(N/A)	31.2	36.7	64.10
Bur oak	25.8	1,958	3,468.0	3,399	5,357	(N/A)	21.1	25.3	65.33
Norway maple	5.0	382	719.0	705	1,087	(N/A)	8.0	5.1	35.06
Silver maple	7.4	560	989.8	970	1,530	(N/A)	6.4	7.2	61.20
American elm	4.4	333	576.9	565	899	(N/A)	5.7	4.2	40.85
White oak	4.9	372	649.5	637	1,009	(N/A)	4.6	4.8	56.03
Northern hackberry	3.9	293	551.4	540	834	(N/A)	4.4	3.9	49.05
Red maple	1.7	131	232.7	228	359	(N/A)	3.4	1.7	27.63
Blue spruce	1.7	129	233.0	228	357	(N/A)	3.1	1.7	29.76
Black maple	2.3	178	283.9	278	456	(N/A)	3.1	2.2	38.04
Boxelder	2.8	209	383.6	376	585	(N/A)	2.8	2.8	53.22
Black walnut	1.0	79	150.5	148	227	(N/A)	1.3	1.1	45.37
Amur maple	0.3	22	51.3	50	73	(N/A)	1.0	0.3	18.19
American basswood	1.2	91	179.0	175	267	(N/A)	1.0	1.3	66.72
Apple	0.0	4	8.2	8	12	(N/A)	0.8	0.1	3.89
Siberian elm	0.7	51	93.1	91	142	(N/A)	0.5	0.7	71.03
SA ALBA	0.0	0	0.0	0	0	(N/A)	0.5	0.0	0.00
Black locust	0.5	40	79.1	78	117	(N/A)	0.5	0.6	58.69
Northern pin oak	0.1	8	16.9	17	24	(N/A)	0.3	0.1	24.47
Cottonwood	0.3	20	38.1	37	57	(N/A)	0.3	0.3	57.32
Total	100.3	7,616	13,809.4	13,533	21,149	(N/A)	100.0	100.0	54.51

Table 2: Annual Stormwater Benefits

Okoboji

Annual Stormwater Benefits of Public Trees

6/29/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	413,914	11,217	(N/A)	31.2	36.8	92.70
Bur oak	330,793	8,965	(N/A)	21.1	29.4	109.32
Norway maple	39,422	1,068	(N/A)	8.0	3.5	34.46
Silver maple	101,825	2,759	(N/A)	6.4	9.1	110.38
American elm	36,432	987	(N/A)	5.7	3.2	44.88
White oak	45,745	1,240	(N/A)	4.6	4.1	68.87
Northern hackberry	25,425	689	(N/A)	4.4	2.3	40.53
Red maple	10,088	273	(N/A)	3.4	0.9	21.03
Blue spruce	27,437	744	(N/A)	3.1	2.4	61.96
Black maple	14,356	389	(N/A)	3.1	1.3	32.42
Boxelder	38,518	1,044	(N/A)	2.8	3.4	94.89
Black walnut	10,340	280	(N/A)	1.3	0.9	56.04
Amur maple	1,058	29	(N/A)	1.0	0.1	7.17
American basswood	13,139	356	(N/A)	1.0	1.2	89.02
Apple	145	4	(N/A)	0.8	0.0	1.31
Siberian elm	6,718	182	(N/A)	0.5	0.6	91.03
SA ALBA	0	0	(N/A)	0.5	0.0	0.00
Black locust	4,959	134	(N/A)	0.5	0.4	67.19
Northern pin oak	586	16	(N/A)	0.3	0.1	15.88
Cottonwood	2,591	70	(N/A)	0.3	0.2	70.21
Citywide total	1,123,489	30,447	(N/A)	100.0	100.0	78.47

Table 3: Annual Air Quality Benefits

Okoboji

Annual Air Quality Benefits of Public Trees

6/29/2020

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Green ash	51.7	8.3	24.7	2.3	275	174.5	25.3	24.1	164.4	1,084	0.0	0	475.2	1,359	(N/A)	31.2	11.23
Bur oak	53.5	8.6	24.2	2.4	281	122.6	17.9	17.1	116.9	765	0.0	0	363.2	1,046	(N/A)	21.1	12.76
Norway maple	7.2	1.2	3.7	0.3	39	24.4	3.5	3.4	22.9	151	-1.8	-7	64.7	183	(N/A)	8.0	5.92
Silver maple	17.2	2.9	8.5	0.8	93	34.9	5.1	4.9	33.4	218	-9.0	-34	98.6	277	(N/A)	6.4	11.09
American elm	3.2	0.5	1.9	0.1	18	20.8	3.0	2.9	19.9	130	0.0	0	52.3	148	(N/A)	5.7	6.72
White oak	4.9	0.8	2.5	0.2	26	23.2	3.4	3.2	22.2	145	0.0	0	60.5	172	(N/A)	4.6	9.53
Northern hackberry	2.7	0.5	1.6	0.1	16	18.7	2.7	2.6	17.5	116	0.0	0	46.5	131	(N/A)	4.4	7.73
Red maple	1.6	0.3	0.9	0.1	9	8.2	1.2	1.1	7.8	51	-0.6	-2	20.5	58	(N/A)	3.4	4.43
Blue spruce	4.3	0.8	3.4	0.5	28	8.1	1.2	1.1	7.7	50	-10.5	-39	16.6	39	(N/A)	3.1	3.24
Black maple	2.8	0.5	1.3	0.1	15	10.9	1.6	1.5	10.6	69	-1.0	-4	28.3	80	(N/A)	3.1	6.63
Boxelder	5.8	0.9	2.6	0.3	30	13.2	1.9	1.8	12.5	82	-1.5	-6	37.4	107	(N/A)	2.8	9.70
Black walnut	1.1	0.2	0.6	0.0	6	5.1	0.7	0.7	4.7	31	0.0	0	13.1	37	(N/A)	1.3	7.43
Amur maple	0.2	0.0	0.1	0.0	1	1.5	0.2	0.2	1.3	9	0.0	0	3.6	10	(N/A)	1.0	2.55
American basswood	1.7	0.3	0.8	0.1	9	5.9	0.8	0.8	5.5	36	-1.5	-6	14.5	40	(N/A)	1.0	10.02
Apple	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	2	(N/A)	0.8	0.51
Siberian elm	1.0	0.2	0.5	0.0	6	3.2	0.5	0.4	3.0	20	0.0	0	8.9	25	(N/A)	0.5	12.72
SA ALBA	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.5	0.00
Black locust	1.0	0.2	0.5	0.0	5	2.6	0.4	0.4	2.4	16	-0.2	-1	7.1	20	(N/A)	0.5	10.16
Northern pin oak	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	0.3	3.47
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)	0.3	9.34
Citywide total	160.0	26.2	77.9	7.5	858	479.7	69.8	66.5	454.7	2,987	-26.2	-98	1,316.1	3,747	(N/A)	100.0	9.66

Table 4: Annual Carbon Stored

Okoboji

Stored CO2 Benefits of Public Trees

6/29/2020

Species	Total Stored CO_2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,678,034	12,585	(N/A)	31.2	35.3	104.01
Bur oak	1,823,703	13,678	(N/A)	21.1	38.4	166.80
Norway maple	120,674	905	(N/A)	8.0	2.5	29.20
Silver maple	381,317	2,860	(N/A)	6.4	8.0	114.40
American elm	89,767	673	(N/A)	5.7	1.9	30.60
White oak	157,842	1,184	(N/A)	4.6	3.3	65.77
Northern hackberry	35,803	269	(N/A)	4.4	0.8	15.80
Red maple	20,115	151	(N/A)	3.4	0.4	11.60
Blue spruce	33,313	250	(N/A)	3.1	0.7	20.82
Black maple	31,632	237	(N/A)	3.1	0.7	19.77
Boxelder	231,565	1,737	(N/A)	2.8	4.9	157.89
Black walnut	34,757	261	(N/A)	1.3	0.7	52.14
Amur maple	3,632	27	(N/A)	1.0	0.1	6.81
American basswood	60,956	457	(N/A)	1.0	1.3	114.29
Apple	369	3	(N/A)	0.8	0.0	0.92
Siberian elm	24,490	184	(N/A)	0.5	0.5	91.84
SA ALBA	0	0	(N/A)	0.5	0.0	0.00
Black locust	15,891	119	(N/A)	0.5	0.3	59.59
Northern pin oak	1,101	8	(N/A)	0.3	0.0	8.26
Cottonwood	8,458	63	(N/A)	0.3	0.2	63.43
Citywide total	4,753,417	35,651	(N/A)	100.0	100.0	91.88

Table 5: Annual Carbon Sequestered

Okoboji

Annual CO₂ Benefits of Public Trees

6/29/2020

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	88,471	664	-8,055	-384	-63	60,852	456	140,884	1,057 (N/A)	31.2	37.8	8.73
Bur oak	49,597	372	-8,754	-286	-68	43,277	325	83,834	629 (N/A)	21.1	22.5	7.67
Norway maple	8,226	62	-583	-51	-5	8,446	63	16,037	120 (N/A)	8.0	4.3	3.88
Silver maple	29,770	223	-1,830	-81	-14	12,376	93	40,234	302 (N/A)	6.4	10.8	12.07
American elm	4,939	37	-431	-43	-4	7,366	55	11,831	89 (N/A)	5.7	3.2	4.03
White oak	11,343	85	-758	-48	-6	8,222	62	18,760	141 (N/A)	4.6	5.0	7.82
Northern hackberry	3,594	27	-172	-33	-2	6,485	49	9,875	74 (N/A)	4.4	2.6	4.36
Red maple	2,849	21	-97	-16	-1	2,898	22	5,634	42 (N/A)	3.4	1.5	3.25
Blue spruce	1,735	13	-160	-33	-1	2,846	21	4,388	33 (N/A)	3.1	1.2	2.74
Black maple	4,274	32	-152	-19	-1	3,939	30	8,041	60 (N/A)	3.1	2.2	5.03
Boxelder	13,851	104	-1,112	-41	-9	4,629	35	17,327	130 (N/A)	2.8	4.6	11.81
Black walnut	2,594	19	-167	-11	-1	1,753	13	4,168	31 (N/A)	1.3	1.1	6.25
Amur maple	455	3	-17	-5	0	497	4	930	7 (N/A)	1.0	0.2	1.74
American basswood	3,698	28	-293	-14	-2	2,022	15	5,413	41 (N/A)	1.0	1.5	10.15
Apple	85	1	-2	-1	0	80	1	161	1 (N/A)	0.8	0.0	0.40
Siberian elm	1,279	10	-118	-7	-1	1,122	8	2,277	17 (N/A)	0.5	0.6	8.54
SA ALBA	0	0	0	0	0	0	0	0	0 (N/A)	0.5	0.0	0.00
Black locust	940	7	-76	-5	-1	880	7	1,738	13 (N/A)	0.5	0.5	6.52
Northern pin oak	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.1	2.95
Cottonwood	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.3	0.3	7.93
Citywide total	228,582	1,714	-22,821	-1,083	-179	168,306	1,262	372,985	2,797 (N/A)	100.0	100.0	7.21

Table 6: Annual Social and Aesthetic Benefits

Okoboji

Annual Aesthetic/Other Benefits of Public Trees

6/29/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	7,140	(N/A)	31.2	36.6	59.01
Bur oak	3,848	(N/A)	21.1	19.7	46.92
Norway maple	856	(N/A)	8.0	4.4	27.61
Silver maple	2,381	(N/A)	6.4	12.2	95.25
American elm	779	(N/A)	5.7	4.0	35.41
White oak	991	(N/A)	4.6	5.1	55.06
Northern hackberry	657	(N/A)	4.4	3.4	38.64
Red maple	451	(N/A)	3.4	2.3	34.69
Blue spruce	236	(N/A)	3.1	1.2	19.65
Black maple	601	(N/A)	3.1	3.1	50.11
Boxelder	780	(N/A)	2.8	4.0	70.95
Black walnut	238	(N/A)	1.3	1.2	47.62
Amur maple	26	(N/A)	1.0	0.1	6.40
American basswood	279	(N/A)	1.0	1.4	69.73
Apple	4	(N/A)	0.8	0.0	1.38
Siberian elm	92	(N/A)	0.5	0.5	46.00
SA ALBA	0	(N/A)	0.5	0.0	0.00
Black locust	86	(N/A)	0.5	0.4	43.05
Northern pin oak	26	(N/A)	0.3	0.1	26.22
Cottonwood	58	(N/A)	0.3	0.3	57.69
Citywide total	19,529	(N/A)	100.0	100.0	50.33

Table 7: Summary of Benefits in Dollars

Okoboji

Total Annual Benefits of Public Trees by Species ($)

6/29/2020

Species	Energy	CO$_2$	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	7,757	1,057	1,359	11,217	7,140	28,529	(N/A)	36.7
Bur oak	5,357	629	1,046	8,965	3,848	19,844	(N/A)	25.5
Norway maple	1,087	120	183	1,068	856	3,315	(N/A)	4.3
Silver maple	1,530	302	277	2,759	2,381	7,250	(N/A)	9.3
American elm	899	89	148	987	779	2,902	(N/A)	3.7
White oak	1,009	141	172	1,240	991	3,552	(N/A)	4.6
Northern hackberry	834	74	131	689	657	2,385	(N/A)	3.1
Red maple	359	42	58	273	451	1,183	(N/A)	1.5
Blue spruce	357	33	39	744	236	1,408	(N/A)	1.8
Black maple	456	60	80	389	601	1,587	(N/A)	2.0
Boxelder	585	130	107	1,044	780	2,646	(N/A)	3.4
Black walnut	227	31	37	280	238	814	(N/A)	1.0
Amur maple	73	7	10	29	26	144	(N/A)	0.2
American basswood	267	41	40	356	279	983	(N/A)	1.3
Apple	12	1	2	4	4	22	(N/A)	0.0
Siberian elm	142	17	25	182	92	459	(N/A)	0.6
SA ALBA	0	0	0	0	0	0	(N/A)	0.0
Black locust	117	13	20	134	86	371	(N/A)	0.5
Northern pin oak	24	3	3	16	26	73	(N/A)	0.1
Cottonwood	57	8	9	70	58	202	(N/A)	0.3
Citywide Total	21,149	2,797	3,747	30,447	19,529	77,669	(N/A)	100.0

Legend:
- Green ash
- Bur oak
- Norway maple
- Silver maple
- American elm
- White oak
- Northern hackberry
- Red maple
- Blue spruce
- Black maple

Values: 31.19, 21.13, 7.99, 6.44, 5.67, 4.64, 4.38, 3.35, 3.09, 3.09
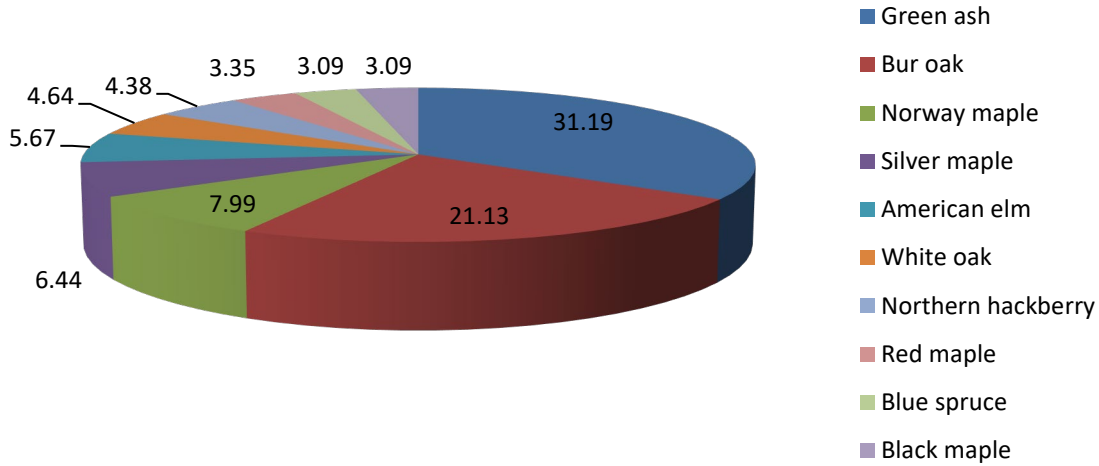
Figure 1: Species Distribution

Relative Age Distribution of Public Tree Species for All Zones (%)
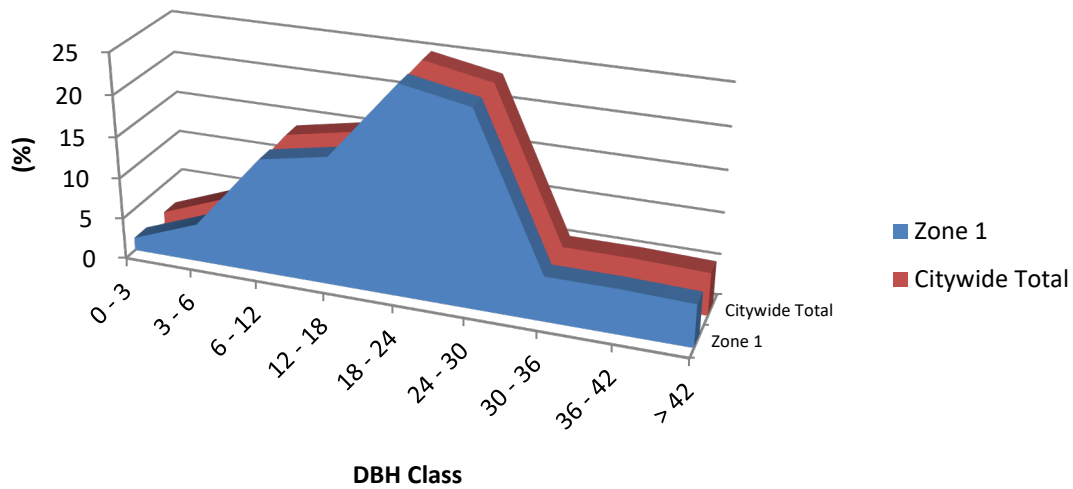

- Zone 1
- Citywide Total

DBH Class

Figure 2: Relative Age Class
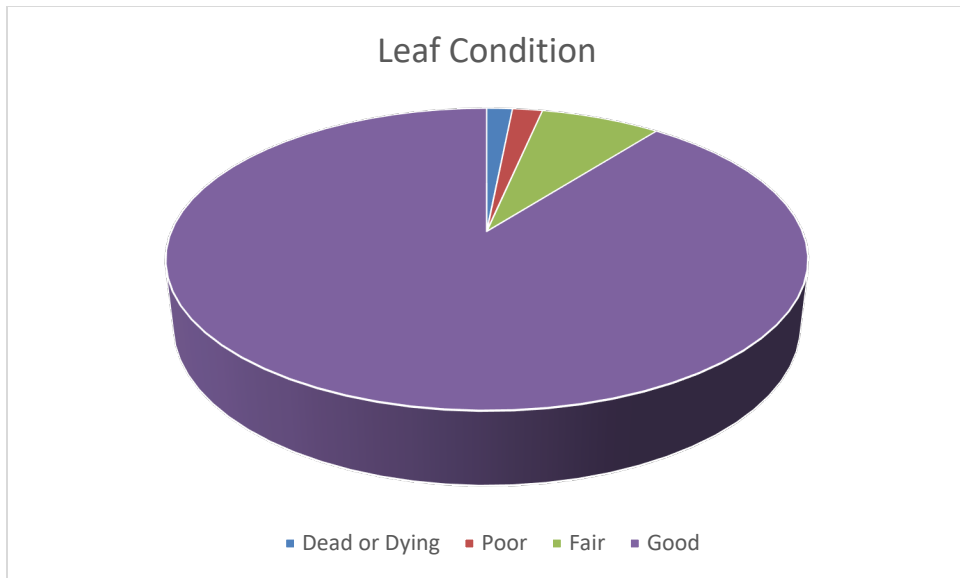
Figure 3: Foliage Condition
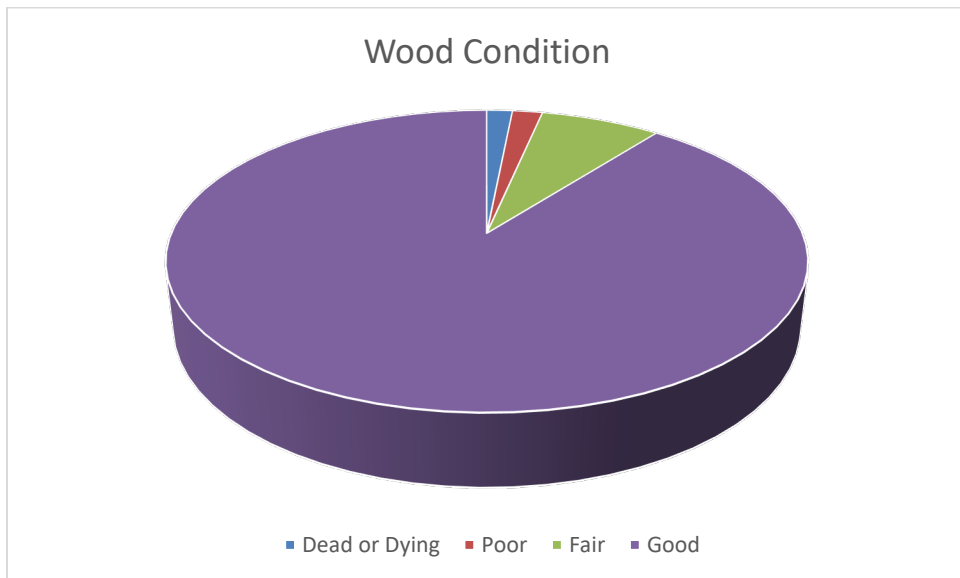
Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)
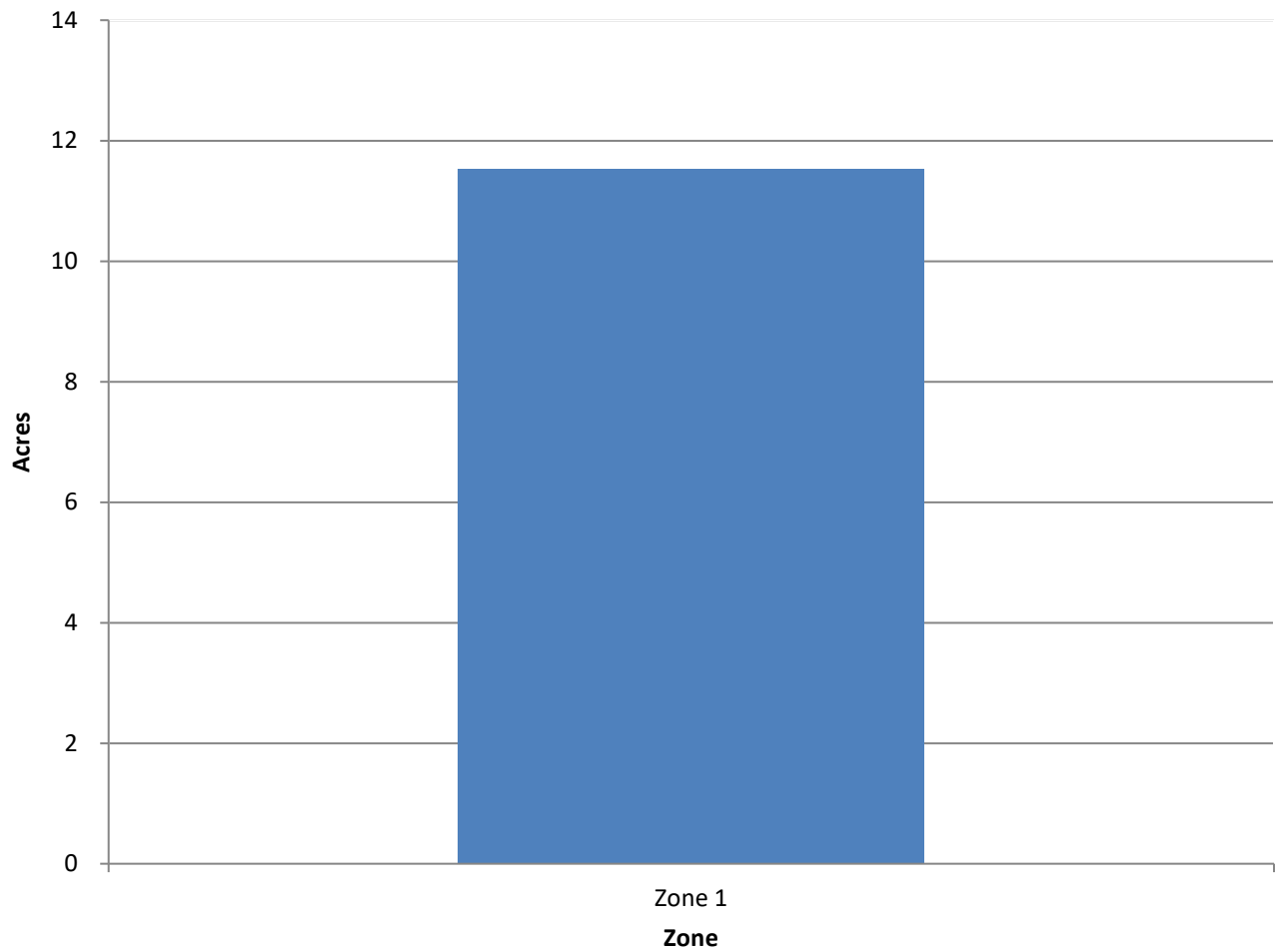
Figure 5: Canopy Cover in Acres
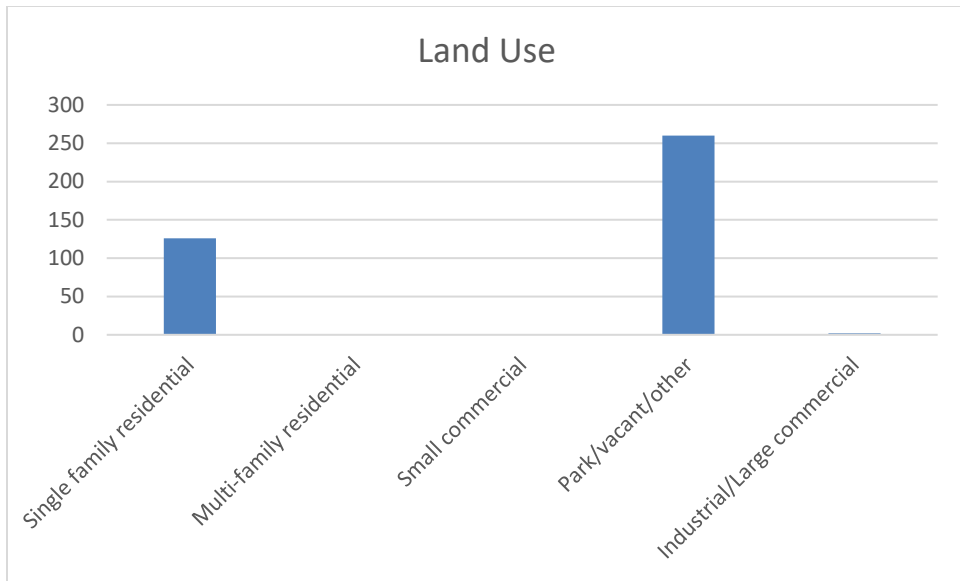
Figure 6: Land Use of city/park trees

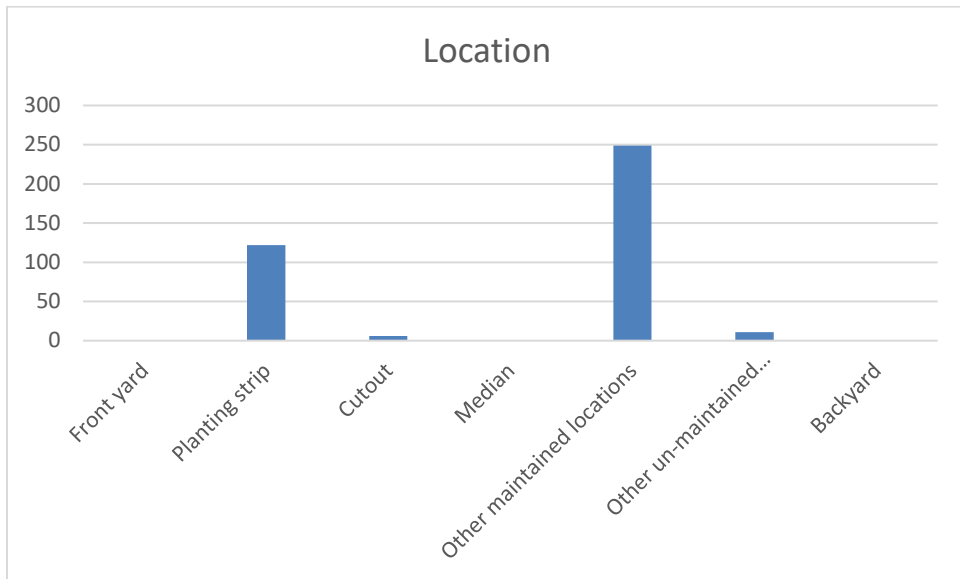
Figure 7: Location of city/park trees

Figure 1: Location of Ash Trees

Figure 3: Location of Poor Condition Trees

Appendix C: Okoboji Tree Ordinances

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CHAPTER 151

TREES

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

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:
1. Alignment. All trees planted in any street shall be planted in the parking 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 parking 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 fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within 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.

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(Code of Iowa, Sec. 364.12[2c, d & e])

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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 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])

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.