Nevada, IA:

2020 Urban Forest Management Plan

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Nevada in managing its urban forest, including budgeting and future planning. Trees bring numerous benefits to a community, and sound management helps leaders take advantage of these benefits. Management is especially important now considering the serious threats posed by forest pests like 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 except mountain ash. There is a strong possibility that 16 percent of Nevada's city-owned trees will die once EAB becomes established in the community, unless local leaders begin preventative treatment. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2020, JEO conducted a tree inventory 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 1,564 trees inventoried.

- Nevada trees provide $315,632 of benefits annually, an average of $201.81 per tree
- There are over 34 species of trees
- The top three genera are: maple 42%, ash 16%, and oak 7%
- 58 percent of trees need some type of management
- 233 trees should be removed

Recommendations

Below are some key recommendations, for further details see the Recommendation and Emerald Ash Borer Plan Sections:

- Out of the 85 in need of removal, 42 trees are over 24 inches in diameter at 4.5 feet and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 116 of the 253 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation.
- All trees should be pruned on a routine schedule: one third of the city every other year.
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.
- Check ash trees yearly with a visual survey.
- With the current budget it could take 3 years to remove only ash. The current budget is sufficient for tree management needs.

Introduction

INTRODUCTION

This plan was developed to assist Nevada with managing, budgeting, and future planning of their urban forest. Across the state, forestry budgets continue to decrease as a higher percentage of the budgets are devoted to 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, treatment, and replacement planting. With proper planning and management of the current canopy in Nevada, these costs can be spread out over the years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important part of Nevada's infrastructure and one of the city's greatest assets. The benefits of trees are immense. Trees improve air quality, intercept stormwater runoff, conserve energy, lower traffic speeds, increase property values, reduce crime, improve mental health, and create a desirable place to live, to name just a few. Good urban forestry management will maintain these important benefits for the people of Nevada and future generations.

Urban forestry management sets goals and develops management strategies to achieve them. To develop management strategies, a comprehensive public tree inventory must be conducted. The inventory informs maintenance, removal schedules, tree planting, and budgeting. Aligning management actions with the tree inventory results will help meet Nevada's urban forestry goals.

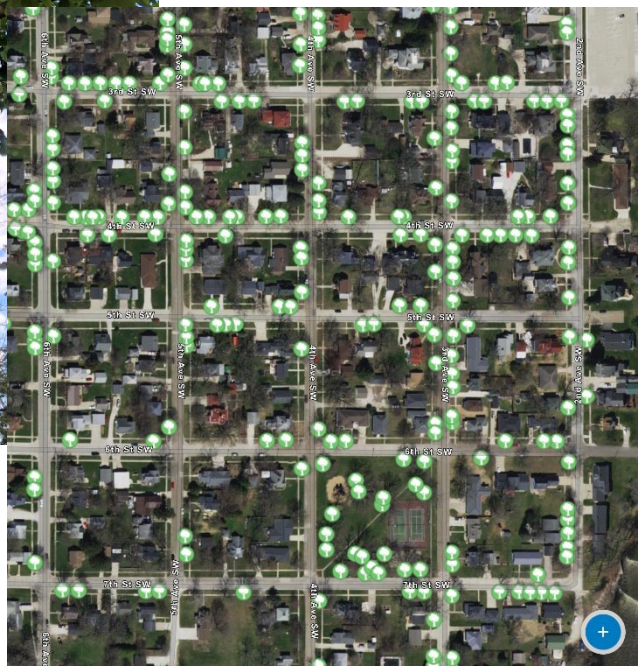
Assist Nevada with Managing its Urban Forest

Inform on the Benefits of a Healthy Urban Forest

Establish Preventative Treatment for Emerald Ash Borer

Develop Efficient City Tree Management Techniques

Mitigate Public Safety Issues



Inventory Results

INVENTORY

In 2020, JEO conducted a tree inventory that included 100 percent of the city-owned trees on both streets and parks. The team collected tree data 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 ArcGIS 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 data collectors' programming 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 feet, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, for all ash trees, the team notes signs and symptoms associated with EAB including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

INVENTORY RESULTS

JEO entered the data collected for the 1,564 city trees into the USDA Forest Service Program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. Following are results from the i-Tree STREETS analysis.

ANNUAL BENEFITS

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Nevada's trees reduce energy-related costs by approximately $83,007 annually (Appendix A, Table 1). These savings are both in electricity (396.4 MWh) and in natural gas (53,998.7 Therms).

Annual Stormwater Benefits

Nevada's trees intercept about 4,618,527 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $125,162 in benefit 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 lessens emissions of volatile organic matter (ozone). In Nevada, it is estimated that trees remove 5,274.5 pounds 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 $14,905 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Nevada, trees sequester about 914,891 pounds of carbon per year with an associated value of $6,862 (Appendix A, Table 5). In addition, the trees store 19,633,345 pounds of carbon, with a yearly benefit of $147,250 (Appendix A, Table 4).

Annual Aesthetics Benefits

The social benefits of trees are hard to capture. The i-Tree 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. Nevada receives $81,450 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, Nevada's trees provide $315,632 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,564 trees in Nevada provide approximately $201.81 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$83,007**	• Intercept **4,618,527 gallons** • Provides **$125,162** benefit	• Remove **5,274.5 lbs** of pollution • Net value of **$14,905**	• Sequester **914,891 lbs** • Value of **$6,862** • Store **19,633,345 lbs** • Value of **$147,250**	• **$81,450** in social benefits	• **$315,623** annual benefits • Each tree provides **$201.81** annually

FOREST STRUCTURE

Species Distribution

Nevada has over 34 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	662	42%
Ash	253	16%
Apple	113	7%
Oak	123	7%
Basswood/Linden	52	3%
Hackberry	53	3%
Locust	38	2%
Spruce	31	2%
Walnut	27	1.5%
Sycamore	23	1.5%
Birch	23	1.5%
Pine	21	1%
Elm	19	1%
Pear	16	1%
Willow	11	<1%
Amur maple	9	<1%
Cedar	7	<1%

Boxelder	2	<1%
Cherry	2	<1%
Kentucky Coffee	5	<1%
Cottonwood	2	<1%
Catalpa	3	<1%
Eastern redbud	5	<1%
Buckeye	2	<1%
Quaking Aspen	3	<1%
Yellowwood	3	<1%
Ginkgo	1	<1%
Hickory	5	<1%
Poplar	3	<1%
Amur corktree	4	<1%
Mulberry	6	<1%
Alder	1	<1%
Magnolia	1	<1%
Other Deciduous	33	2%

Age Class

Most of Nevada's trees (33 percent) are between 12 and 24 inches in diameter at 4.5 feet (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Nevada's size curve is on the medium side, indicating an average middle-aged stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Nevada indicate that 9 percent of the trees are in good health, with only 9 percent of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 42 percent of Nevada's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Three percent of the tree population's wood condition is in poor health, dead, or dying. This 15 percent 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).

Action	Number of Trees	Percentage
Crown Cleaning	616	39%
Tree Removal	233	15%
Crown Raising	221	14%
Crown Reduction	58	4%
Tree Staking	20	1%

Canopy Cover

The total canopy with both private and public trees is 465.95 acres or around 14 percent. The canopy cover included in the Nevada inventory includes approximately 47 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 16 percent in 30 years. To achieve this goal it is estimated that 58 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Nevada'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	Percentage
Single Family Residential	64%
Park/Vacant/Other	34%
Industrial/Large Commercial	1%
Multifamily Residential	1%
Small Commercial	1%

Recommendations

RECOMMENDATIONS

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead, dying, or have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorists' vision of pedestrians, vehicles, traffic signs and signals should be removed.

HAZARDOUS TREES

Nevada has 233 trees in need of immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 42 trees over 24 inches in diameter at 4.5 feet that should be addressed immediately. Please refer to the Schedule and Budget at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 915 trees with maintenance needs.

POOR TREE SPECIES

After removing the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 233 removals, 138 are ash trees. There are a total of 253 ash trees, and 116 of those have signs and symptoms that have been associated with EAB. In addition, there are 116 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising removes lower branches that are two inches in diameter or larger to provide clearance for pedestrians or vehicles. Crown reduction removes individual limbs from structures or utility wires. We recommend that all trees be pruned on a routine schedule every five to seven years. Please refer to the Schedule and Budget for further information.

Planting

Most of the planting over the next five years will replace the trees that are removed. We recommend planting 1.2 trees for every tree removed, since survival rates will not be 100 percent. 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 Nevada.

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 percent of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10 percent of the total urban forest. Presently, the forest is heavily planted with maple (42 percent) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. While the city currently has no existing City Code in reference to tree species restrictions, we encourage the city to work with the Iowa Department of Natural Resources to develop a plan moving forward. We encourage the new plantings to be a diverse mix and not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. We recommend 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 by first removing dead, dying, hazardous trees (Appendix B, Figure 4). Next will be all ash in poor condition that display EAB signs and symptoms (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 an effective tool for communities to spread removal costs out over several years while allowing trees to continue providing 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 normally disposed of if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. While the city currently has no existing City Code in reference to tree species restrictions, we encourage the city to work with the Iowa Department of Natural Resources to develop a plan moving forward. We encourage the new plantings to be a diverse mix and 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 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 EAB signs and symptoms including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists 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 ans the cost assessed against the property.”

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $65,000/Year – (Based off Reported Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 78 trees recommended for immediate removal	$54,600
Plant 69 trees in open locations	$10,350
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$64,950**

YEAR 2	Est. Cost
Remove 17 trees recommended for immediate removal	$11,900
Remove 53 ash in poor condition	$37,100
Plant 54 trees in open locations	$8,100
Prune 1/3 of city owned trees	$7,820
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$64,920**

YEAR 3	Est. Cost
Remove 78 ash in poor condition	$54,600
Plant 69 trees in open locations	$10,350
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$64,950**

YEAR 4	Est. Cost
Remove 7 ash in poor health	$4,900
Remove 58 remaining ash	$40,600
Plant 77 trees in open locations	$11,550
Prune 1/3 of city owned trees	$7,820
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$64,870**

YEAR 5	Est. Cost
Remove 57 remaining ash trees	$39,900
Plant 70 trees in open locations	$10,500
Prune 1/3 of city owned trees	$7,820
Additional removal, pruning, and maintenance	$6,780
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$65,000**

YEAR 6	Est. Cost
Additional removal, pruning, and maintenance	$57,180
Prune 1/3 of city owned trees	$7,820
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$65,000**

Estimated costs based on average costs of $700/tree for removal, $150/tree for planting and maintenance, and $15/tree for pruning.

Proposed Budget Increase

EAB could potentially kill all ash trees in Nevada within four years of its arrival. To remove all ash trees within six years, the current budget is sufficient. Additionally, we recommend that Nevada apply for grants to fund replacement trees and improvement of greenspaces. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option considered by many communities is treating selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removal all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at $15 per inch, about 216 trees could be treated per year (every other year treatment). Two hundred sixteen trees would be selected for treatment, and Nevada would still need to find $25,900 for removal. Alternatively, if there are 240 treatable trees, it would cost approximately $72,000 a year for treatment and leave $9,100 for removal. These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Nevada. We suggest considering an increased budget to plan for this.

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Appendices

APPENDIX A: i-TREE DATA

Annual Energy Benefits of Public Trees

2/1/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	65.3	4,954	8,961.8	8,783	13,736	(N/A)	12.7	16.5	69.03
Silver maple	63.1	4,787	8,362.3	8,195	12,982	(N/A)	11.6	15.6	71.72
Sugar maple	55.6	4,219	7,372.1	7,225	11,444	(N/A)	11.1	13.8	65.77
Norway maple	40.8	3,098	5,953.3	5,834	8,933	(N/A)	10.4	10.8	54.80
Apple	12.3	935	1,804.0	1,768	2,703	(N/A)	7.2	3.3	23.92
Red maple	18.1	1,372	2,440.1	2,391	3,763	(N/A)	5.9	4.5	40.91
Northern red oak	8.4	639	1,136.6	1,114	1,753	(N/A)	3.6	2.1	30.76
Northern hackberry	18.1	1,378	2,516.0	2,466	3,843	(N/A)	3.4	4.6	72.51
White ash	11.2	853	1,417.5	1,389	2,242	(N/A)	3.3	2.7	43.96
Black maple	11.3	855	1,516.9	1,487	2,342	(N/A)	2.9	2.8	50.91
Honeylocust	11.6	881	1,499.3	1,469	2,351	(N/A)	2.4	2.8	61.86
Littleleaf linden	5.2	394	720.8	706	1,100	(N/A)	2.3	1.3	30.57
Swamp white oak	5.4	412	765.6	750	1,162	(N/A)	1.8	1.4	41.51
Black walnut	9.8	744	1,318.4	1,292	2,036	(N/A)	1.7	2.5	75.41
American sycamore	9.6	725	1,255.0	1,230	1,955	(N/A)	1.5	2.4	85.01
Broadleaf Deciduous Small	0.4	28	56.8	56	84	(N/A)	1.4	0.1	3.80
Bur oak	3.5	265	471.2	462	727	(N/A)	1.4	0.9	33.03
Blue spruce	2.2	164	287.8	282	446	(N/A)	1.1	0.5	26.22
Eastern white pine	1.7	130	229.3	225	355	(N/A)	1.0	0.4	22.19
Pear	2.0	149	279.5	274	423	(N/A)	1.0	0.5	26.43
American basswood	4.7	358	677.4	664	1,022	(N/A)	1.0	1.2	63.86
Spruce	1.2	87	157.4	154	242	(N/A)	0.9	0.3	17.26
Willow	2.7	208	402.9	395	603	(N/A)	0.7	0.7	54.78
Birch	2.3	172	328.1	322	494	(N/A)	0.6	0.6	49.35
Pin oak	2.9	219	377.8	370	589	(N/A)	0.6	0.7	58.89
River birch	2.2	168	308.8	303	471	(N/A)	0.6	0.6	52.29
Amur maple	0.8	58	115.5	113	171	(N/A)	0.6	0.2	19.04
Broadleaf Deciduous Large	3.0	230	404.4	396	626	(N/A)	0.4	0.8	89.47
American elm	2.8	212	335.6	329	541	(N/A)	0.4	0.7	90.11
Maple	0.3	20	40.5	40	60	(N/A)	0.4	0.1	10.02
Eastern red cedar	0.6	46	90.1	88	134	(N/A)	0.4	0.2	22.39
Elm	0.4	32	59.2	58	90	(N/A)	0.4	0.1	15.08
Mulberry	1.2	90	182.8	179	269	(N/A)	0.4	0.3	44.80
Kentucky coffeetree	1.0	73	111.7	109	183	(N/A)	0.3	0.2	36.55
Siberian elm	1.8	140	238.1	233	373	(N/A)	0.3	0.4	74.67
Hickory	1.1	80	132.8	130	211	(N/A)	0.3	0.3	42.13
Scotch pine	0.7	52	83.3	82	133	(N/A)	0.3	0.2	26.67
Eastern redbud	0.5	41	78.8	77	118	(N/A)	0.3	0.1	23.61
Broadleaf Deciduous Mediu	0.9	68	135.6	133	201	(N/A)	0.3	0.2	50.13
Amur corktree	1.1	87	163.9	161	247	(N/A)	0.3	0.3	61.79
Paper birch	0.1	9	14.8	14	23	(N/A)	0.3	0.0	5.82
Oak	1.0	75	139.1	136	211	(N/A)	0.3	0.3	52.73
Ash	0.6	44	75.8	74	118	(N/A)	0.2	0.1	39.34
Black poplar	1.1	82	148.1	145	227	(N/A)	0.2	0.3	75.62
Yellowwood	0.0	1	2.4	2	3	(N/A)	0.2	0.0	1.10
Quaking aspen	0.4	27	51.0	50	77	(N/A)	0.2	0.1	25.79
Northern catalpa	1.0	74	126.2	124	197	(N/A)	0.1	0.2	98.63
Boxelder	0.6	46	83.5	82	128	(N/A)	0.1	0.2	63.97
Northern pin oak	0.6	49	94.8	93	142	(N/A)	0.1	0.2	70.84
Cottonwood	0.7	54	100.5	99	153	(N/A)	0.1	0.2	76.46
Chinese elm	0.9	66	116.8	114	181	(N/A)	0.1	0.2	90.32
White oak	0.2	18	27.5	27	45	(N/A)	0.1	0.1	22.44
Black cherry	0.3	21	44.5	44	64	(N/A)	0.1	0.1	32.17
Ohio buckeye	0.6	44	87.0	85	130	(N/A)	0.1	0.2	64.76
Southern magnolia	0.1	6	12.7	12	19	(N/A)	0.1	0.0	18.82
Northern white cedar	0.1	10	14.6	14	24	(N/A)	0.1	0.0	24.14

Annual Energy Benefits of Public Trees

2/1/2021

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Alder	0.2	14	24.7	24	38	(N/A)	0.1	0.0	38.13
Ginkgo	0.2	18	32.0	31	49	(N/A)	0.1	0.1	49.28
Catalpa	0.1	7	13.7	13	21	(N/A)	0.1	0.0	20.64
Total	396.4	30,088	53,998.7	52,919	83,007	(N/A)	100.0	100.0	53.07

Annual Stormwater Benefits of Public Trees

2/1/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	819,163	22,199	(N/A)	12.7	17.7	111.55
Silver maple	965,863	26,175	(N/A)	11.6	20.9	144.61
Sugar maple	719,240	19,491	(N/A)	11.1	15.6	112.02
Norway maple	404,735	10,968	(N/A)	10.4	8.8	67.29
Apple	47,349	1,283	(N/A)	7.2	1.0	11.36
Red maple	149,851	4,061	(N/A)	5.9	3.2	44.14
Northern red oak	69,966	1,896	(N/A)	3.6	1.5	33.26
Northern hackberry	184,535	5,001	(N/A)	3.4	4.0	94.36
White ash	100,778	2,731	(N/A)	3.3	2.2	53.55
Black maple	101,720	2,757	(N/A)	2.9	2.2	59.93
Honeylocust	128,728	3,489	(N/A)	2.4	2.8	91.80
Littleleaf linden	42,396	1,149	(N/A)	2.3	0.9	31.91
Swamp white oak	44,070	1,194	(N/A)	1.8	1.0	42.65
Black walnut	132,092	3,580	(N/A)	1.7	2.9	132.58
American sycamore	143,674	3,894	(N/A)	1.5	3.1	169.29
Broadleaf Deciduous Small	1,190	32	(N/A)	1.4	0.0	1.47
Bur oak	44,596	1,209	(N/A)	1.4	1.0	54.93
Blue spruce	32,821	889	(N/A)	1.1	0.7	52.32
Eastern white pine	34,704	940	(N/A)	1.0	0.8	58.78
Pear	7,513	204	(N/A)	1.0	0.2	12.73
American basswood	61,075	1,655	(N/A)	1.0	1.3	103.45
Spruce	20,529	556	(N/A)	0.9	0.4	39.74
Willow	28,267	766	(N/A)	0.7	0.6	69.64
Birch	21,689	588	(N/A)	0.6	0.5	58.78
Pin oak	28,043	760	(N/A)	0.6	0.6	76.00
River birch	18,710	507	(N/A)	0.6	0.4	56.34
Amur maple	3,188	86	(N/A)	0.6	0.1	9.60
Broadleaf Deciduous Large	46,024	1,247	(N/A)	0.4	1.0	178.18
American elm	20,986	569	(N/A)	0.4	0.5	94.79
Maple	1,423	39	(N/A)	0.4	0.0	6.43
Eastern red cedar	8,832	239	(N/A)	0.4	0.2	39.89
Elm	5,734	155	(N/A)	0.4	0.1	25.90
Mulberry	6,537	177	(N/A)	0.4	0.1	29.52
Kentucky coffeetree	6,034	164	(N/A)	0.3	0.1	32.70
Siberian elm	24,965	677	(N/A)	0.3	0.5	135.31
Hickory	7,595	206	(N/A)	0.3	0.2	41.17
Scotch pine	10,554	286	(N/A)	0.3	0.2	57.20
Eastern redbud	1,931	52	(N/A)	0.3	0.0	10.46
Broadleaf Deciduous Medium	8,024	217	(N/A)	0.3	0.2	54.36
Amur corktree	11,417	309	(N/A)	0.3	0.2	77.35
Paper birch	687	19	(N/A)	0.3	0.0	4.65
Oak	12,042	326	(N/A)	0.3	0.3	81.58
Ash	3,404	92	(N/A)	0.2	0.1	30.75
Black poplar	13,773	373	(N/A)	0.2	0.3	124.41
Yellowwood	37	1	(N/A)	0.2	0.0	0.33
Quaking aspen	4,132	112	(N/A)	0.2	0.1	37.33
Northern catalpa	14,478	392	(N/A)	0.1	0.3	196.17
Boxelder	9,231	250	(N/A)	0.1	0.2	125.08
Northern pin oak	7,529	204	(N/A)	0.1	0.2	102.01

Annual Stormwater Benefits of Public Trees

2/1/2021

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Cottonwood	9,433	256	(N/A)	0.1	0.2	127.82
Chinese elm	12,729	345	(N/A)	0.1	0.3	172.48
White oak	1,483	40	(N/A)	0.1	0.0	20.10
Black cherry	1,439	39	(N/A)	0.1	0.0	19.49
Ohio buckeye	6,244	169	(N/A)	0.1	0.1	84.60
Southern magnolia	677	18	(N/A)	0.1	0.0	18.34
Northern white cedar	1,539	42	(N/A)	0.1	0.0	41.70
Alder	667	18	(N/A)	0.1	0.0	18.06
Ginkgo	1,857	50	(N/A)	0.1	0.0	50.33
Catalpa	608	16	(N/A)	0.1	0.0	16.47
Citywide total	4,618,527	125,162	(N/A)	100.0	100.0	80.03

Annual Air Quality Benefits of Public Trees

2/1/2021

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	117.0	18.7	53.9	5.2	617	311.9	45.4	43.3	295.8	1,942	0.0	0	891.2	2,559	(N/A)	12.7	12.86
Silver maple	178.0	30.2	86.3	7.9	957	297.9	43.6	41.6	285.3	1,862	-93.6	-351	877.0	2,468	(N/A)	11.6	13.63
Sugar maple	110.5	18.8	52.9	4.9	592	263.0	38.5	36.7	251.7	1,644	-85.6	-321	691.3	1,915	(N/A)	11.1	11.01
Norway maple	85.3	14.7	41.6	3.8	460	198.5	28.7	27.3	185.2	1,228	-19.8	-74	565.1	1,614	(N/A)	10.4	9.90
Apple	13.5	2.2	6.5	0.6	72	59.9	8.6	8.2	55.9	370	-0.1	0	155.4	443	(N/A)	7.2	3.92
Red maple	35.1	6.0	16.5	1.6	187	85.9	12.5	12.0	81.9	536	-11.9	-45	239.5	679	(N/A)	5.9	7.38
Northern red oak	13.7	2.4	6.9	0.6	74	40.0	5.8	5.6	38.2	250	-19.4	-73	93.8	252	(N/A)	3.6	4.41
Northern hackberry	34.8	6.0	17.2	1.6	189	87.1	12.7	12.1	82.3	542	0.0	0	253.7	730	(N/A)	3.4	13.78
White ash	12.0	1.9	6.1	0.5	65	52.5	7.7	7.4	50.9	330	0.0	0	139.1	395	(N/A)	3.3	7.74
Black maple	25.4	4.3	11.7	1.1	135	53.5	7.8	7.4	51.0	334	-8.4	-31	153.9	437	(N/A)	2.9	9.50
Honeylocust	25.2	4.2	11.5	1.1	133	54.5	8.0	7.6	52.6	342	-19.7	-74	145.0	401	(N/A)	2.4	10.55
Littleleaf linden	6.2	1.1	3.2	0.3	34	24.9	3.6	3.5	23.6	155	-3.2	-12	63.2	177	(N/A)	2.3	4.92
Swamp white oak	8.2	1.4	4.1	0.4	45	26.2	3.8	3.6	24.6	162	-2.0	-7	70.4	200	(N/A)	1.8	7.13
Black walnut	22.2	3.6	9.9	1.0	116	46.6	6.8	6.5	44.4	291	0.0	0	141.0	407	(N/A)	1.7	15.08
American sycamore	29.7	4.7	12.9	1.3	154	45.2	6.6	6.3	43.3	282	0.0	0	150.0	437	(N/A)	1.5	18.99
Broadleaf Deciduous Small	0.2	0.0	0.1	0.0	1	1.8	0.3	0.2	1.7	11	0.0	0	4.4	12	(N/A)	1.4	0.56
Bur oak	7.1	1.1	3.2	0.3	37	16.6	2.4	2.3	15.8	104	0.0	0	48.9	141	(N/A)	1.4	6.40
Blue spruce	5.1	1.0	4.1	0.6	33	10.2	1.5	1.4	9.8	64	-12.4	-46	21.3	50	(N/A)	1.1	2.96
Eastern white pine	4.1	0.8	3.3	0.5	27	8.1	1.2	1.1	7.8	51	-18.4	-69	8.5	8	(N/A)	1.0	0.52
Pear	2.2	0.4	1.1	0.1	12	9.5	1.4	1.3	8.9	59	0.0	0	24.8	71	(N/A)	1.0	4.42
American basswood	9.1	1.6	4.3	0.4	49	22.8	3.3	3.1	21.4	142	-7.5	-28	58.6	162	(N/A)	1.0	10.13
Spruce	2.3	0.5	1.9	0.3	15	5.5	0.8	0.8	5.2	34	-10.2	-38	7.0	11	(N/A)	0.9	0.80
Willow	6.1	1.0	2.9	0.3	33	13.3	1.9	1.8	12.4	82	-1.4	-5	38.4	110	(N/A)	0.7	9.99
Birch	4.5	0.8	2.2	0.2	24	11.0	1.6	1.5	10.3	68	-1.1	-4	31.0	88	(N/A)	0.6	8.85
Pin oak	4.6	0.8	2.4	0.2	26	13.6	2.0	1.9	13.0	85	-8.8	-33	29.8	78	(N/A)	0.6	7.76
River birch	3.6	0.6	1.8	0.2	20	10.6	1.5	1.5	10.0	66	-0.9	-3	29.1	83	(N/A)	0.6	9.18
Amur maple	0.9	0.2	0.5	0.0	5	3.8	0.5	0.5	3.5	23	0.0	0	9.9	28	(N/A)	0.6	3.13
Broadleaf Deciduous Large	8.5	1.4	3.7	0.4	44	14.4	2.1	2.0	13.7	90	0.0	0	46.2	134	(N/A)	0.4	19.16
American elm	8.3	1.4	3.8	0.4	44	12.9	1.9	1.8	12.6	81	0.0	0	43.2	126	(N/A)	0.4	20.92
Maple	0.2	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	-0.1	0	3.1	9	(N/A)	0.4	1.46
Eastern red cedar	1.8	0.4	1.4	0.2	12	2.9	0.4	0.4	2.7	18	-4.9	-18	5.4	12	(N/A)	0.4	1.92
Elm	0.8	0.1	0.4	0.0	4	2.0	0.3	0.3	1.9	13	0.0	0	5.9	17	(N/A)	0.4	2.82
Mulberry	2.4	0.4	1.1	0.1	13	5.8	0.8	0.8	5.4	36	0.0	0	16.7	48	(N/A)	0.4	8.05
Kentucky coffeetree	0.4	0.1	0.3	0.0	3	4.4	0.7	0.6	4.4	28	0.0	0	10.9	31	(N/A)	0.3	6.11
Siberian elm	5.3	0.9	2.5	0.2	28	8.7	1.3	1.2	8.4	54	0.0	0	28.4	83	(N/A)	0.3	16.51
Hickory	0.6	0.1	0.4	0.0	3	5.0	0.7	0.7	4.8	31	0.0	0	12.3	35	(N/A)	0.3	6.92

Annual Air Quality Benefits of Public Trees

2/1/2021

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								
Scotch pine	1.2	0.2	1.0	0.1	8	3.2	0.5	0.4	3.1	20	-4.4	-16	5.3	11	(N/A)	0.3	2.27
Eastern redbud	0.5	0.1	0.3	0.0	3	2.6	0.4	0.4	2.4	16	0.0	0	6.7	19	(N/A)	0.3	3.78
Broadleaf Deciduous Medium	1.5	0.3	0.8	0.1	8	4.4	0.6	0.6	4.0	27	-0.4	-1	11.9	34	(N/A)	0.3	8.48
Amur corktree	2.4	0.4	1.2	0.1	13	5.5	0.8	0.8	5.2	34	-0.6	-2	15.8	45	(N/A)	0.3	11.31
Paper birch	0.0	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	0.87
Oak	1.6	0.2	0.7	0.1	8	4.7	0.7	0.7	4.5	29	0.0	0	13.1	38	(N/A)	0.3	9.40
Ash	0.5	0.1	0.3	0.0	3	2.7	0.4	0.4	2.6	17	-0.1	-1	6.9	19	(N/A)	0.2	6.43
Black poplar	2.3	0.4	1.1	0.1	12	5.1	0.7	0.7	4.9	32	0.0	0	15.4	44	(N/A)	0.2	14.79
Yellowwood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	0.0	0	0.1	0	(N/A)	0.2	0.14
Quaking aspen	0.5	0.1	0.2	0.0	3	1.7	0.3	0.2	1.6	11	0.0	0	4.7	13	(N/A)	0.2	4.48
Northern catalpa	3.2	0.5	1.4	0.1	16	4.6	0.7	0.6	4.4	29	0.0	0	15.5	45	(N/A)	0.1	22.55
Boxelder	1.4	0.2	0.6	0.1	7	2.9	0.4	0.4	2.7	18	-0.4	-1	8.5	24	(N/A)	0.1	12.08
Northern pin oak	1.7	0.3	0.8	0.1	9	3.1	0.5	0.4	2.9	19	-0.4	-1	9.5	27	(N/A)	0.1	13.58
Cottonwood	1.3	0.2	0.6	0.1	7	3.4	0.5	0.5	3.2	21	0.0	0	9.8	28	(N/A)	0.1	14.09
Chinese elm	2.4	0.4	1.0	0.1	12	4.1	0.6	0.6	4.0	26	0.0	0	13.2	38	(N/A)	0.1	19.13
White oak	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.7	8	(N/A)	0.1	3.75
Black cherry	0.5	0.1	0.2	0.0	3	1.4	0.2	0.2	1.2	8	0.0	0	3.8	11	(N/A)	0.1	5.45
Ohio buckeye	1.4	0.2	0.7	0.1	7	2.9	0.4	0.4	2.6	18	-0.3	-1	8.3	24	(N/A)	0.1	11.87
Southern magnolia	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2	(N/A)	0.1	2.10
Northern white cedar	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)	0.1	2.82
Alder	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7	(N/A)	0.1	6.56
Ginkgo	0.5	0.1	0.3	0.0	3	1.1	0.2	0.2	1.1	7	-0.2	-1	3.3	9	(N/A)	0.1	9.29
Catalpa	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.1	2.99
Citywide total	818.5	137.6	394.3	37.6	4,391	1,889.4	275.3	262.5	1,796.0	11,776	-336.6	-1,262	5,274.5	14,905	(N/A)	100.0	9.53

Nevada

Stored CO_2 Benefits of Public Trees

2/1/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	3,884,748	29,136	(N/A)	12.7	19.8	146.41
Silver maple	4,279,688	32,098	(N/A)	11.6	21.8	177.34
Sugar maple	3,289,144	24,669	(N/A)	11.1	16.8	141.77
Norway maple	1,405,518	10,541	(N/A)	10.4	7.2	64.67
Apple	212,033	1,590	(N/A)	7.2	1.1	14.07
Red maple	383,896	2,879	(N/A)	5.9	2.0	31.30
Northern red oak	276,504	2,074	(N/A)	3.6	1.4	36.38
Northern hackberry	564,507	4,234	(N/A)	3.4	2.9	79.88
White ash	257,206	1,929	(N/A)	3.3	1.3	37.82
Black maple	271,867	2,039	(N/A)	2.9	1.4	44.33
Honeylocust	324,579	2,434	(N/A)	2.4	1.7	64.06
Littleleaf linden	137,674	1,033	(N/A)	2.3	0.7	28.68
Swamp white oak	135,391	1,015	(N/A)	1.8	0.7	36.27
Black walnut	757,658	5,682	(N/A)	1.7	3.9	210.46
American sycamore	1,040,489	7,804	(N/A)	1.5	5.3	339.29
Broadleaf Deciduous	4,311	32	(N/A)	1.4	0.0	1.47
Bur oak	240,840	1,806	(N/A)	1.4	1.2	82.10
Blue spruce	39,635	297	(N/A)	1.1	0.2	17.49
Eastern white pine	46,049	345	(N/A)	1.0	0.2	21.59
Pear	34,311	257	(N/A)	1.0	0.2	16.08
American basswood	348,713	2,615	(N/A)	1.0	1.8	163.46
Spruce	24,713	185	(N/A)	0.9	0.1	13.24
Willow	99,978	750	(N/A)	0.7	0.5	68.17
Birch	74,734	561	(N/A)	0.6	0.4	56.05
Pin oak	121,291	910	(N/A)	0.6	0.6	90.97
River birch	60,048	450	(N/A)	0.6	0.3	50.04
Amur maple	15,016	113	(N/A)	0.6	0.1	12.51
Broadleaf Deciduous	294,179	2,206	(N/A)	0.4	1.5	315.19
American elm	159,221	1,194	(N/A)	0.4	0.8	199.03
Maple	2,470	19	(N/A)	0.4	0.0	3.09
Eastern red cedar	5,787	43	(N/A)	0.4	0.0	7.23
Elm	26,177	196	(N/A)	0.4	0.1	32.72
Mulberry	36,751	276	(N/A)	0.4	0.2	45.94
Kentucky coffeetree	14,873	112	(N/A)	0.3	0.1	22.31
Siberian elm	131,444	986	(N/A)	0.3	0.7	197.17
Hickory	20,508	154	(N/A)	0.3	0.1	30.76
Scotch pine	10,196	76	(N/A)	0.3	0.1	15.29
Eastern redbud	8,068	61	(N/A)	0.3	0.0	12.10
Broadleaf Deciduous	24,937	187	(N/A)	0.3	0.1	46.76
Amur corktree	40,130	301	(N/A)	0.3	0.2	75.24
Paper birch	742	6	(N/A)	0.3	0.0	1.39
Oak	50,186	376	(N/A)	0.3	0.3	94.10
Ash	8,349	63	(N/A)	0.2	0.0	20.87
Black poplar	80,212	602	(N/A)	0.2	0.4	200.53
Yellowwood	51	0	(N/A)	0.2	0.0	0.13
Quaking aspen	15,970	120	(N/A)	0.2	0.1	39.93
Northern catalpa	111,964	840	(N/A)	0.1	0.6	419.86
Boxelder	61,300	460	(N/A)	0.1	0.3	229.88
Northern pin oak	28,560	214	(N/A)	0.1	0.1	107.10
Cottonwood	41,716	313	(N/A)	0.1	0.2	156.43
Chinese elm	81,925	614	(N/A)	0.1	0.4	307.22
White oak	3,684	28	(N/A)	0.1	0.0	13.81
Black cherry	7,651	57	(N/A)	0.1	0.0	28.69
Ohio buckeye	22,225	167	(N/A)	0.1	0.1	83.35
Southern magnolia	484	4	(N/A)	0.1	0.0	3.63
Northern white cedar	1,170	9	(N/A)	0.1	0.0	8.78

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Stored CO_2 Benefits of Public Trees

2/1/2021

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Alder	3,037	23	(N/A)	0.1	0.0	22.78
Ginkgo	7,800	59	(N/A)	0.1	0.0	58.50
Catalpa	1,035	8	(N/A)	0.1	0.0	7.76
Citywide total	19,633,345	147,250	(N/A)	100.0	100.0	94.15

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Nevada

Annual CO_2 Benefits of Public Trees

2/1/2021

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	147,474	1,106	-18,647	-706	-145	109,473	821	237,594	1,782 (N/A)	12.7	16.0	8.95
Silver maple	291,377	2,185	-20,545	-730	-160	105,786	793	375,889	2,819 (N/A)	11.6	25.4	15.58
Sugar maple	143,657	1,077	-15,791	-630	-123	93,240	699	220,477	1,654 (N/A)	11.1	14.9	9.50
Norway maple	50,157	376	-6,752	-446	-54	68,472	514	111,432	836 (N/A)	10.4	7.5	5.13
Apple	19,141	144	-1,018	-159	-9	20,671	155	38,636	290 (N/A)	7.2	2.6	2.56
Red maple	26,463	198	-1,843	-169	-15	30,322	227	54,773	411 (N/A)	5.9	3.7	4.47
Northern red oak	11,720	88	-1,328	-102	-11	14,131	106	24,421	183 (N/A)	3.6	1.6	3.21
Northern hackberry	22,962	172	-2,710	-178	-22	30,443	228	50,516	379 (N/A)	3.4	3.4	7.15
White ash	25,310	190	-1,235	-100	-10	18,850	141	42,825	321 (N/A)	3.3	2.9	6.30
Black maple	9,260	69	-1,305	-104	-11	18,898	142	26,749	201 (N/A)	2.9	1.8	4.36
Honeylocust	15,508	116	-1,559	-89	-12	19,479	146	33,339	250 (N/A)	2.4	2.3	6.58
Littleleaf linden	15,766	118	-663	-62	-5	8,706	65	23,748	178 (N/A)	2.3	1.6	4.95
Swamp white oak	9,104	68	-651	-53	-5	9,102	68	17,501	131 (N/A)	1.8	1.2	4.69
Black walnut	18,466	138	-3,637	-110	-28	16,443	123	31,162	234 (N/A)	1.7	2.1	8.66
American sycamore	11,572	87	-4,994	-115	-38	16,028	120	22,490	169 (N/A)	1.5	1.5	7.33
Broadleaf Deciduous Smal	626	5	-21	-8	0	616	5	1,212	9 (N/A)	1.4	0.1	0.41
Bur oak	6,945	52	-1,156	-42	-9	5,855	44	11,603	87 (N/A)	1.4	0.8	3.96
Blue spruce	2,047	15	-190	-40	-2	3,618	27	5,435	41 (N/A)	1.1	0.4	2.40
Eastern white pine	1,862	14	-221	-34	-2	2,882	22	4,490	34 (N/A)	1.0	0.3	2.10
Pear	3,084	23	-165	-24	-1	3,292	25	6,188	46 (N/A)	1.0	0.4	2.90
American basswood	18,727	140	-1,674	-58	-13	7,911	59	24,906	187 (N/A)	1.0	1.7	11.67
Spruce	1,317	10	-119	-22	-1	1,932	14	3,108	23 (N/A)	0.9	0.2	1.66
Willow	2,395	18	-480	-32	-4	4,591	34	6,474	49 (N/A)	0.7	0.4	4.41
Birch	2,895	22	-359	-24	-3	3,801	29	6,312	47 (N/A)	0.6	0.4	4.73
Pin oak	11,433	86	-582	-29	-5	4,832	36	15,654	117 (N/A)	0.6	1.1	11.74
River birch	3,448	26	-288	-21	-2	3,713	28	6,851	51 (N/A)	0.6	0.5	5.71
Amur maple	1,335	10	-72	-11	-1	1,286	10	2,538	19 (N/A)	0.6	0.2	2.11
Broadleaf Deciduous Larg	4,833	36	-1,412	-35	-11	5,083	38	8,468	64 (N/A)	0.4	0.6	9.07
American elm	3,271	25	-764	-27	-6	4,680	35	7,160	54 (N/A)	0.4	0.5	8.95
Maple	378	3	-12	-4	0	452	3	814	6 (N/A)	0.4	0.1	1.02
Eastern red cedar	40	0	-28	-11	0	1,016	8	1,017	8 (N/A)	0.4	0.1	1.27
Elm	1,044	8	-126	-6	-1	716	5	1,629	12 (N/A)	0.4	0.1	2.04
Mulberry	2,181	16	-176	-16	-1	1,982	15	3,971	30 (N/A)	0.4	0.3	4.96

Annual CO_2 Benefits of Public Trees

Table 5 Continued

2/1/2021

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
Kentucky coffeetree	1,856	14	-71	-8	-1	1,620	12	3,396	25 (N/A)	0.3	0.2	5.09
Siberian elm	3,595	27	-631	-21	-5	3,093	23	6,036	45 (N/A)	0.3	0.4	9.05
Hickory	2,204	17	-98	-10	-1	1,779	13	3,875	29 (N/A)	0.3	0.3	5.81
Scotch pine	721	5	-49	-11	0	1,142	9	1,803	14 (N/A)	0.3	0.1	2.71
Eastern redbud	801	6	-39	-7	0	902	7	1,658	12 (N/A)	0.3	0.1	2.49
Broadleaf Deciduous Medi	1,634	12	-120	-9	-1	1,496	11	3,001	23 (N/A)	0.3	0.2	5.63
Amur corktree	1,596	12	-193	-12	-2	1,912	14	3,304	25 (N/A)	0.3	0.2	6.19
Paper birch	297	2	-4	-2	0	195	1	485	4 (N/A)	0.3	0.0	0.91
Oak	2,479	19	-241	-11	-2	1,648	12	3,875	29 (N/A)	0.3	0.3	7.27
Ash	996	7	-40	-5	0	966	7	1,917	14 (N/A)	0.2	0.1	4.79
Black poplar	1,995	15	-385	-12	-3	1,807	14	3,405	26 (N/A)	0.2	0.2	8.51
Yellowwood	16	0	0	-1	0	22	0	37	0 (N/A)	0.2	0.0	0.09
Quaking aspen	934	7	-77	-4	-1	605	5	1,458	11 (N/A)	0.2	0.1	3.64
Northern catalpa	958	7	-537	-12	-4	1,626	12	2,034	15 (N/A)	0.1	0.1	7.63
Boxelder	3,390	25	-294	-9	-2	1,018	8	4,104	31 (N/A)	0.1	0.3	15.39
Northern pin oak	0	0	-137	-9	-1	1,077	8	932	7 (N/A)	0.1	0.1	3.49
Cottonwood	1,816	14	-200	-8	-2	1,202	9	2,811	21 (N/A)	0.1	0.2	10.54
Chinese elm	1,438	11	-393	-10	-3	1,463	11	2,498	19 (N/A)	0.1	0.2	9.37
White oak	448	3	-18	-2	0	397	3	825	6 (N/A)	0.1	0.1	3.09
Black cherry	114	1	-37	-5	0	459	3	531	4 (N/A)	0.1	0.0	1.99
Ohio buckeye	840	6	-107	-6	-1	979	7	1,706	13 (N/A)	0.1	0.1	6.40
Southern magnolia	56	0	-2	-1	0	141	1	194	1 (N/A)	0.1	0.0	1.45
Northern white cedar	116	1	-6	-2	0	216	2	324	2 (N/A)	0.1	0.0	2.43
Alder	268	2	-15	-2	0	308	2	560	4 (N/A)	0.1	0.0	4.20
Ginkgo	319	2	-37	-4	0	396	3	674	5 (N/A)	0.1	0.0	5.06
Catalpa	209	2	-5	-1	0	159	1	361	3 (N/A)	0.1	0.0	2.71
Citywide total	914,891	6,862	-94,259	-4,379	-740	664,933	4,987	1,481,186	11,109 (N/A)	100.0	100.0	7.10

Annual Aesthetic/Other Benefits of Public Trees

2/1/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	11,321	(N/A)	12.7	13.9	56.89
Silver maple	21,544	(N/A)	11.6	26.5	119.03
Sugar maple	13,998	(N/A)	11.1	17.2	80.45
Norway maple	4,723	(N/A)	10.4	5.8	28.98
Apple	1,103	(N/A)	7.2	1.4	9.76
Red maple	3,544	(N/A)	5.9	4.4	38.53
Northern red oak	969	(N/A)	3.6	1.2	17.01
Northern hackberry	2,979	(N/A)	3.4	3.7	56.20
White ash	3,227	(N/A)	3.3	4.0	63.28
Black maple	1,206	(N/A)	2.9	1.5	26.21
Honeylocust	3,645	(N/A)	2.4	4.5	95.93
Littleleaf linden	1,748	(N/A)	2.3	2.1	48.54
Swamp white oak	892	(N/A)	1.8	1.1	31.86
Black walnut	1,354	(N/A)	1.7	1.7	50.16
American sycamore	738	(N/A)	1.5	0.9	32.08
Broadleaf Deciduous Small	28	(N/A)	1.4	0.0	1.29
Bur oak	610	(N/A)	1.4	0.7	27.74
Blue spruce	320	(N/A)	1.1	0.4	18.81
Eastern white pine	379	(N/A)	1.0	0.5	23.70
Pear	178	(N/A)	1.0	0.2	11.13
American basswood	1,256	(N/A)	1.0	1.5	78.49
Spruce	282	(N/A)	0.9	0.3	20.15
Willow	229	(N/A)	0.7	0.3	20.79
Birch	281	(N/A)	0.6	0.3	28.11
Pin oak	928	(N/A)	0.6	1.1	92.75
River birch	332	(N/A)	0.6	0.4	36.88
Amur maple	77	(N/A)	0.6	0.1	8.53
Broadleaf Deciduous Large	318	(N/A)	0.4	0.4	45.49
American elm	416	(N/A)	0.4	0.5	69.33
Maple	67	(N/A)	0.4	0.1	11.18
Eastern red cedar	21	(N/A)	0.4	0.0	3.56
Elm	102	(N/A)	0.4	0.1	17.06
Mulberry	131	(N/A)	0.4	0.2	21.78
Kentucky coffeetree	198	(N/A)	0.3	0.2	39.63
Siberian elm	224	(N/A)	0.3	0.3	44.82
Hickory	224	(N/A)	0.3	0.3	44.76
Scotch pine	191	(N/A)	0.3	0.2	38.22
Eastern redbud	46	(N/A)	0.3	0.1	9.17
Broadleaf Deciduous Medium	155	(N/A)	0.3	0.2	38.85
Amur corktree	145	(N/A)	0.3	0.2	36.28
Paper birch	59	(N/A)	0.3	0.1	14.73
Oak	195	(N/A)	0.3	0.2	48.79
Ash	105	(N/A)	0.2	0.1	34.85
Black poplar	152	(N/A)	0.2	0.2	50.62
Yellowwood	8	(N/A)	0.2	0.0	2.74
Quaking aspen	86	(N/A)	0.2	0.1	28.53
Northern catalpa	57	(N/A)	0.1	0.1	28.57
Boxelder	177	(N/A)	0.1	0.2	88.28

Annual Aesthetic/Other Benefits of Public Trees

2/1/2021

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern pin oak	0	(N/A)	0.1	0.0	0.00
Cottonwood	132	(N/A)	0.1	0.2	66.10
Chinese elm	95	(N/A)	0.1	0.1	47.59
White oak	51	(N/A)	0.1	0.1	25.56
Black cherry	6	(N/A)	0.1	0.0	3.20
Ohio buckeye	75	(N/A)	0.1	0.1	37.26
Southern magnolia	22	(N/A)	0.1	0.0	21.93
Northern white cedar	32	(N/A)	0.1	0.0	32.32
Alder	15	(N/A)	0.1	0.0	15.48
Ginkgo	23	(N/A)	0.1	0.0	22.94
Catalpa	29	(N/A)	0.1	0.0	28.56
Citywide total	81,450	(N/A)	100.0	100.0	52.08

Nevada

Table 7: Summary of Benefits in Dollars

Total Annual Benefits, Net Benefits, and Costs for Public Trees

2/1/2021

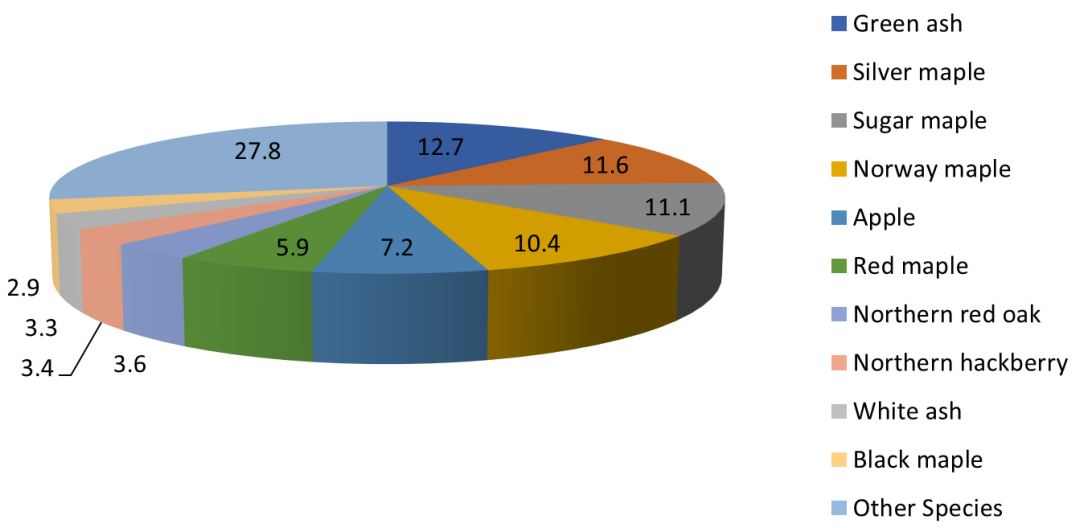
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	83,007	(N/A)	53.07	(N/A)	0.00	(N/A)
CO2	11,109	(N/A)	7.10	(N/A)	0.00	(N/A)
Air Quality	14,905	(N/A)	9.53	(N/A)	0.00	(N/A)
Stormwater	125,162	(N/A)	80.03	(N/A)	0.00	(N/A)
Aesthetic/Other	81,450	(N/A)	52.08	(N/A)	0.00	(N/A)
Total Benefits	315,632	(N/A)	201.81	(N/A)	0.00	(N/A)
Costs						
Planting	0		0.00		0.00	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	0		0.00		0.00	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	0		0.00		0.00	
Total Costs	0		0.00		0.00	
Net Benefits	315,632	(N/A)	201.81	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Nevada

Species Distribution of Public Trees

2/1/2021

Figure 1: Species Distribution



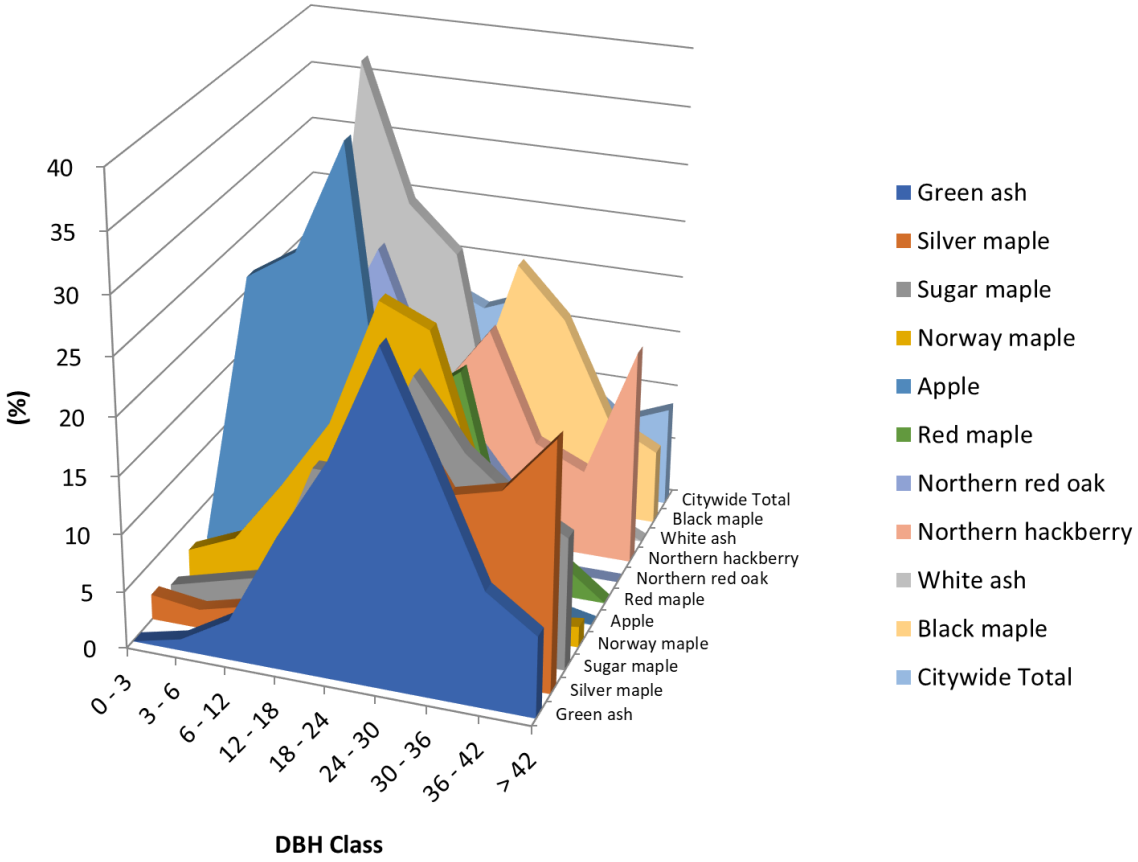
Species	Percent
Green ash	12.7
Silver maple	11.6
Sugar maple	11.1
Norway maple	10.4
Apple	7.2
Red maple	5.9
Northern red oak	3.6
Northern hackberry	3.4
White ash	3.3
Black maple	2.9
Other Species	27.8
Total	100.0

Nevada

Figure 2: Relative Age Class

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

2/1/2021



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Green ash	0.00	1.01	3.52	11.56	18.59	28.64	19.60	10.05	7.04
Silver maple	2.21	1.66	2.76	4.42	13.26	22.10	15.47	16.57	21.55
Sugar maple	1.15	2.30	3.45	13.79	13.79	22.99	17.24	13.79	11.49
Norway maple	2.45	4.29	9.82	15.95	26.99	25.15	12.27	1.23	1.84
Apple	1.77	25.66	28.32	38.05	5.31	0.00	0.00	0.88	0.00
Red maple	5.43	10.87	22.83	21.74	15.22	18.48	2.17	3.26	0.00
Northern red oak	14.04	10.53	17.54	26.32	15.79	10.53	5.26	0.00	0.00
Northern hackberry	1.89	3.77	11.32	15.09	13.21	18.87	9.43	7.55	18.87
White ash	0.00	1.96	39.22	27.45	23.53	3.92	1.96	1.96	0.00
Black maple	6.52	4.35	2.17	23.91	8.70	21.74	17.39	8.70	6.52
Citywide Total	5.18	7.03	10.81	17.58	15.73	17.39	10.36	7.10	8.82

Figure 3: Foliage Condition

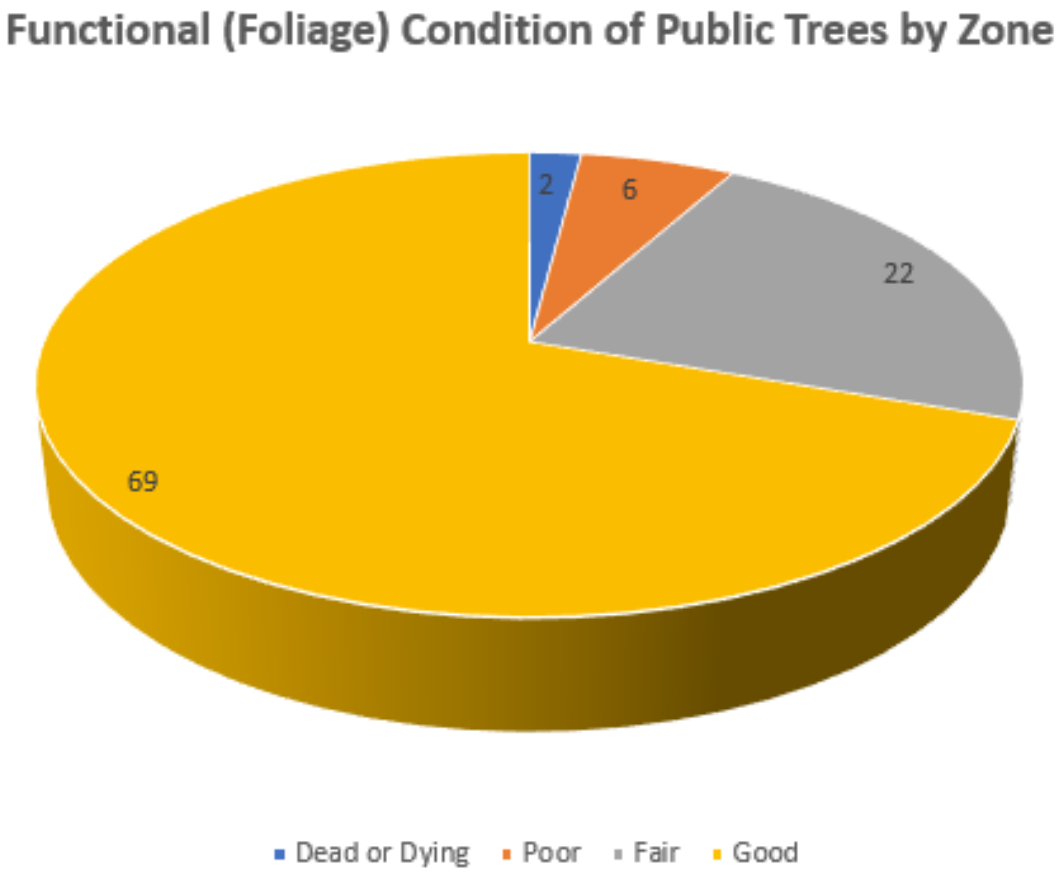


Figure 4: Wood Condition

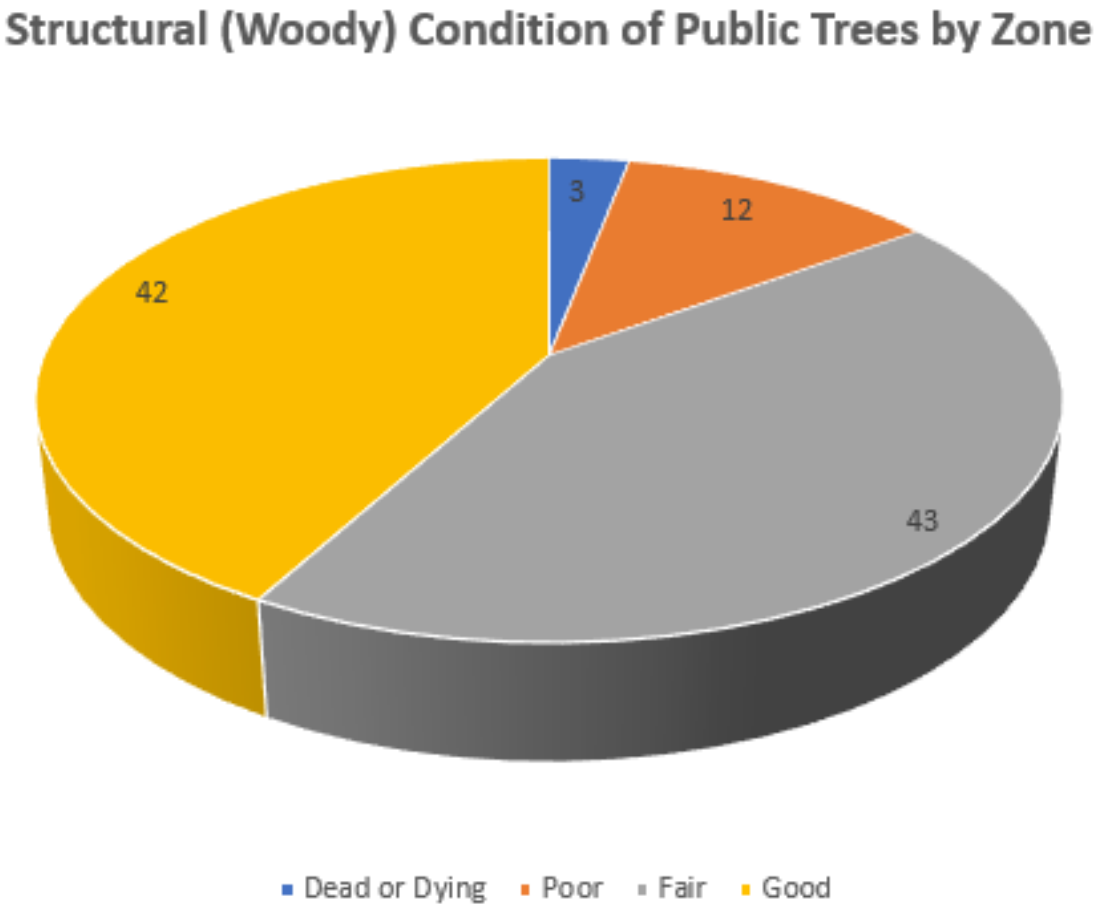
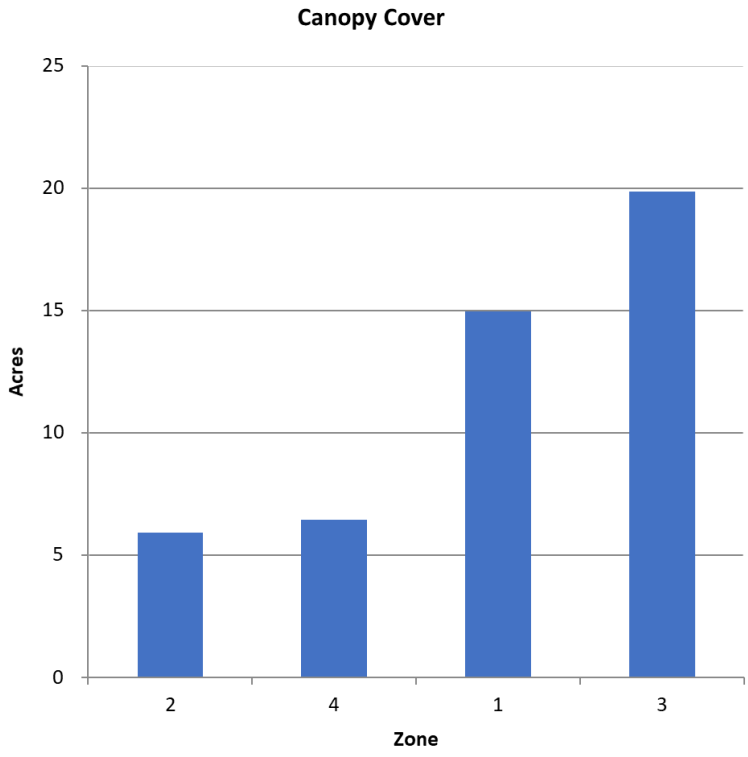


Figure 5: Canopy Cover in Acres

Nevada

Canopy Cover of Public Trees (Acres)

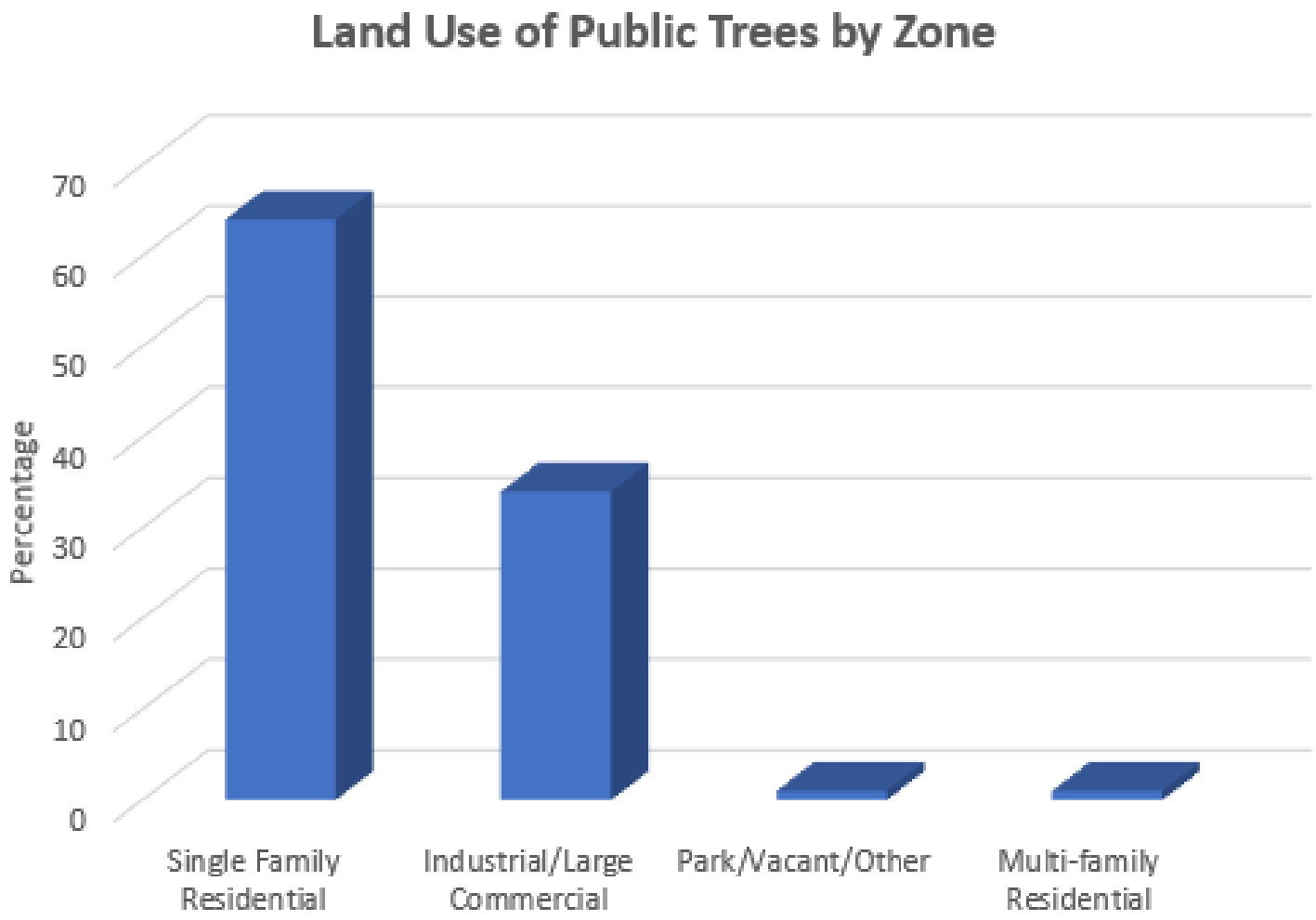
2/1/2021



Zone	Acres	% of Total Canopy Cover
2	6	12.5
4	6	13.7
1	15	31.7
3	20	42.1
Citywide total	47	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide Total	0	0	47	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

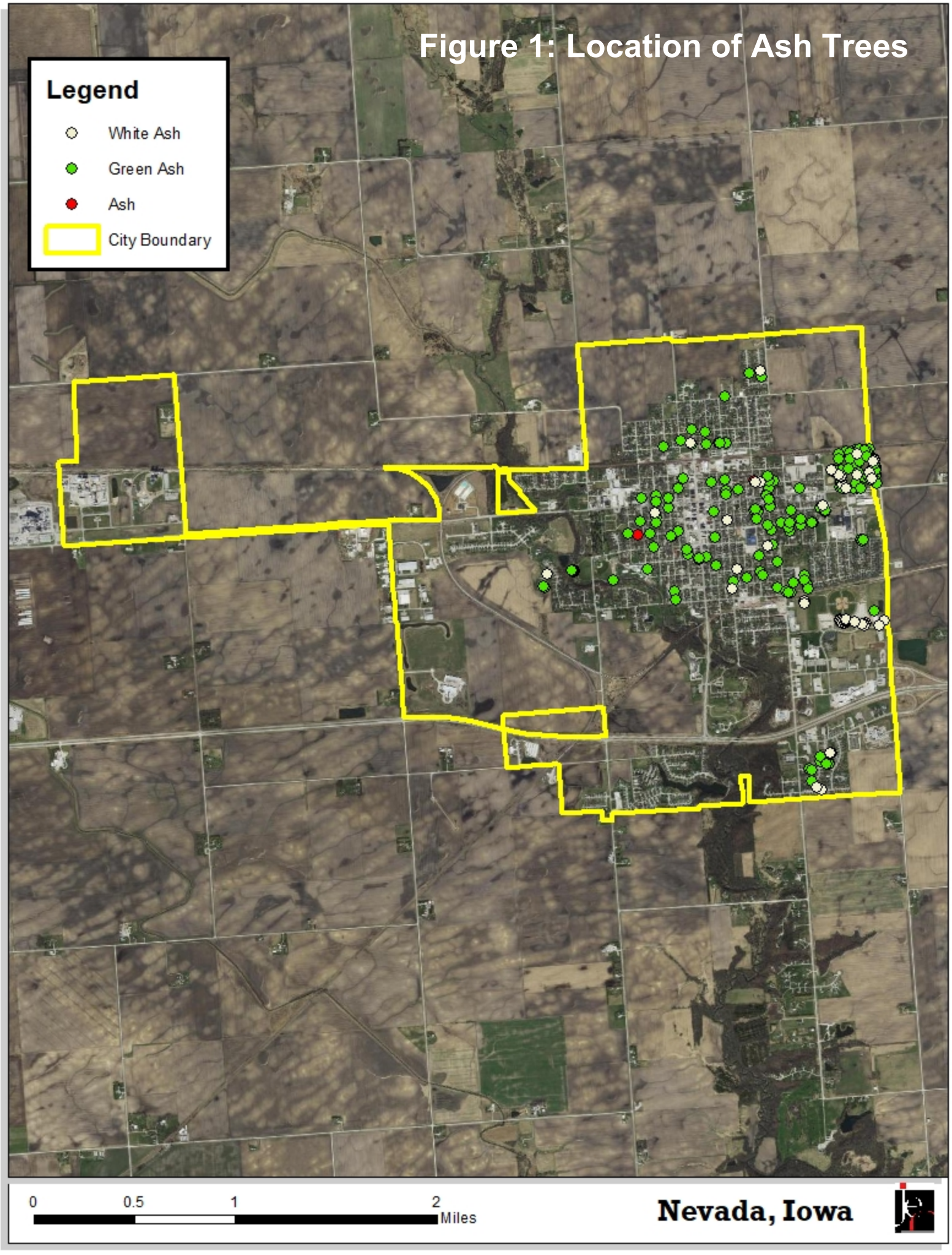


Figure 1: Location of Ash Trees
Legend
White Ash
Green Ash
Ash
City Boundary
0
0.5
1
2
Miles
Nevada, Iowa

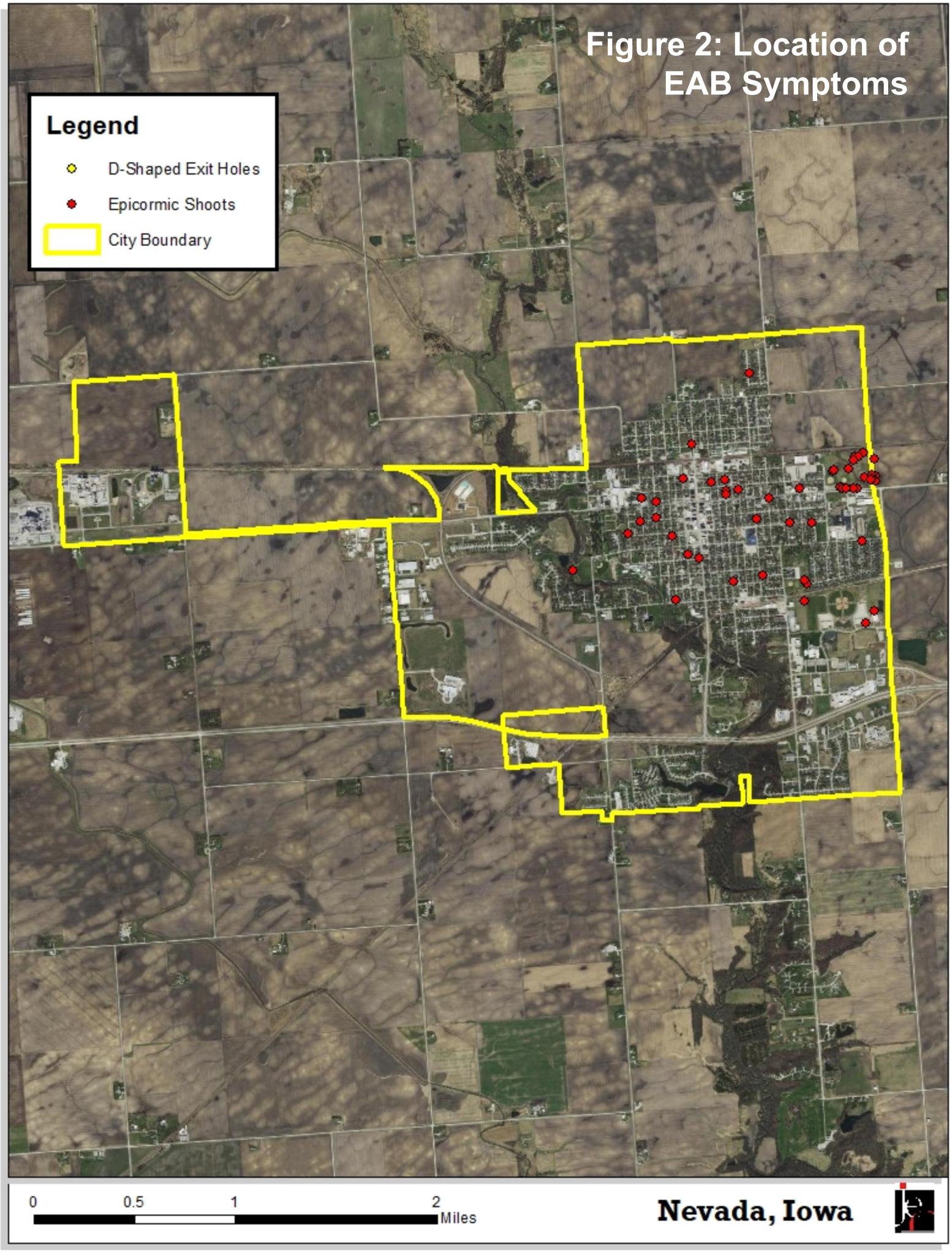


Figure 2: Location of EAB Symptoms
Legend
D-Shaped Exit Holes
Epicormic Shoots
City Boundary
0
0.5
1
2
Miles
Nevada, Iowa

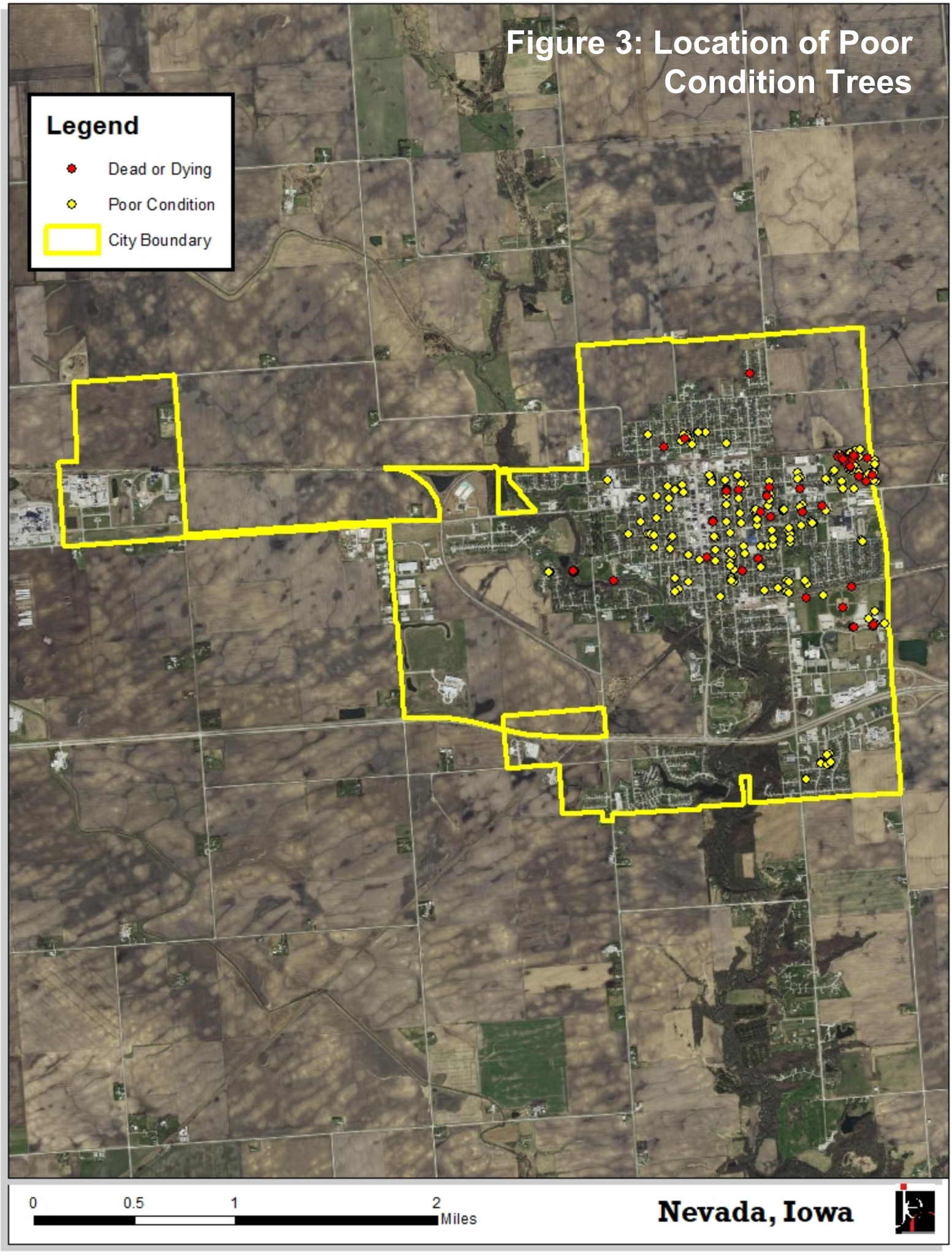
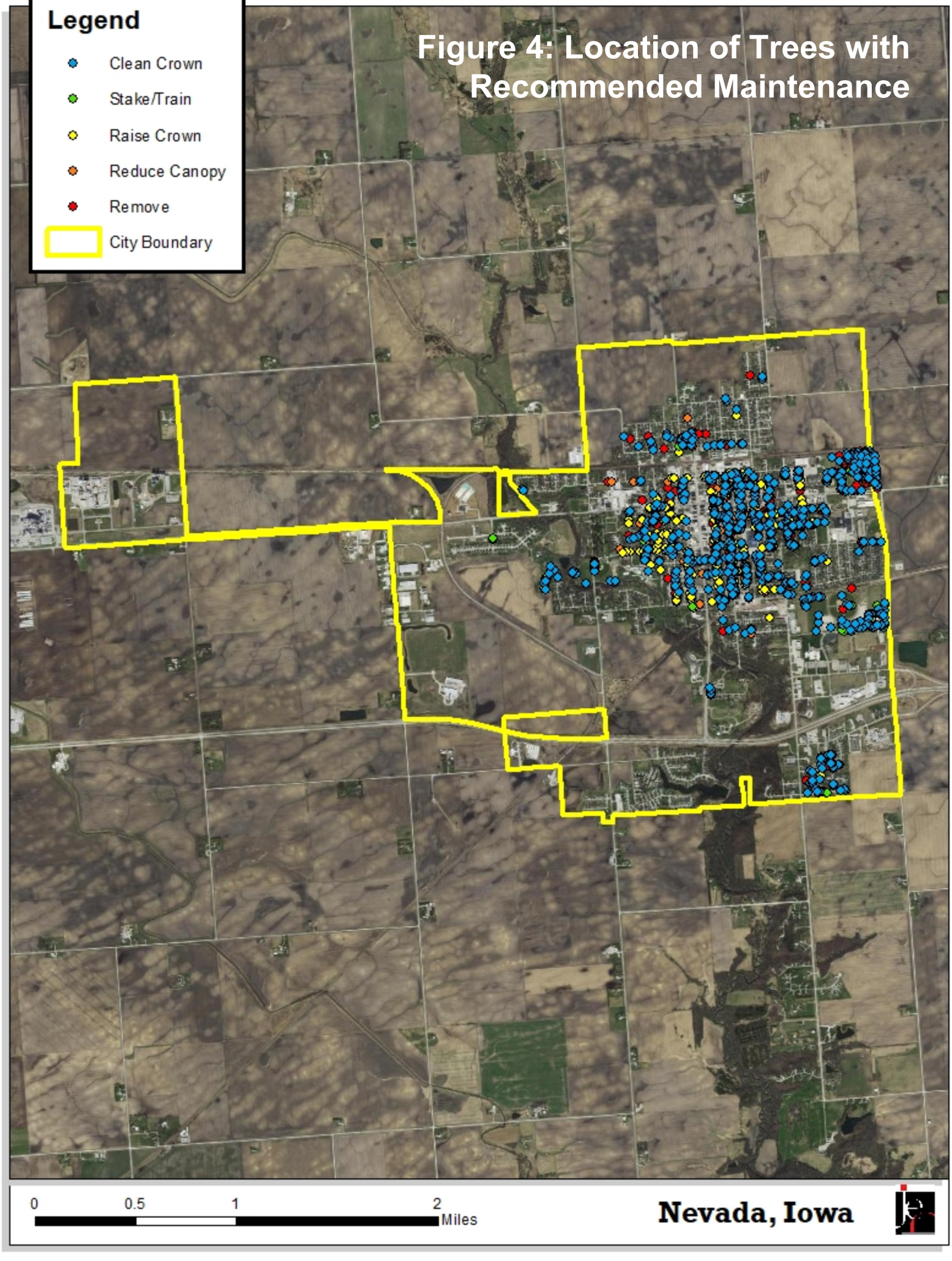


Figure 3: Location of Poor Condition Trees
Legend
Dead or Dying
Poor Condition
City Boundary
0
0.5
1
2
Miles
Nevada, Iowa


Legend
Clean Crown
Stake/Train
Raise Crown
Reduce Canopy
Remove
City Boundary
Figure 4: Location of Trees with Recommended Maintenance
0
0.5
1
2
Miles
Nevada, Iowa

APPENDIX C: NEVADA TREE ORDINANCES

151.01 DEFINITIONS.

For use in this chapter, the following terms are defined:

1. "Offensive vegetation" includes all noxious weeds as defined in Chapter 317 of the Code of Iowa and all other weeds which are not otherwise included in the definition contained in Chapter 317 but which are commonly held to be offensive to sight or smell. The term further includes all grasses not otherwise offensive which have reached a height of twelve inches or more, unless otherwise excluded by the following provisions of this subsection. The term further includes all dead trees on public or private property. Offensive vegetation does not include shrubbery, trees, flowers and other vegetation designed for aesthetic landscaping purposes, nor does the term include garden vegetables customarily grown for home use in a garden, provided the garden is regularly maintained and otherwise free from the type of offensive vegetation that this section seeks to eliminate.
2. "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 Statewide Urban Design and Specifications.

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.

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 dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

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.

151.07 GROWTH OF OFFENSIVE VEGETATION PROHIBITED.

The dense growth of offensive vegetation within the City is prohibited. This section does not apply to any lot or parcel of ground where cultivated, agricultural commodities are planted and harvested within the City, provided the lot or parcel is regularly maintained and otherwise free from the type of offensive vegetation that this section seeks to eliminate.

151.08 DUTY TO REMOVE OFFENSIVE VEGETATION.

The owners, agents or occupants of all lots and parcels of ground within the City limits shall cut or cause to be cut all offensive vegetation on their respective lots or parcels of ground not later than May 15, July 1 and August 15 of each year. In any case where the offensive vegetation is not cut within five (5) days after any date fixed above, it shall be the duty of the Zoning Enforcing Officer to enforce the provisions of this chapter. The provisions of this section also apply to all lands and lots abutting on any street or public way, to that portion of the property that lies between the property line of the property and the curb line, but only where curb and gutter have been installed.

151.09 NOTICE TO OWNER, AGENT OR OCCUPANT.

If the Zoning Enforcing Officer determines that Section 151.08 has been violated, the officer shall serve a written notice upon the owner, agent or occupant of the property, notifying the owner, agent or occupant that there exists a violation of this chapter and that unless the offensive vegetation is removed within five (5) days after the date of service of the notice, the City will proceed to remove the offensive vegetation and assess the costs against the owner. Notice is served by personally delivering the notice to the owner, agent or occupant, by leaving the notice with any adult resident at the location where the offense exists, or by mailing the notice to the owner, agent or occupant by certified mail, return receipt.

151.10 REMOVAL BY CITY; ASSESSMENT.

If the notice provided in Section 151.09 is not complied with, it shall be the duty of the Zoning Enforcing Officer to cause the offensive vegetation to be cut or otherwise destroyed. The Zoning Enforcing Officer shall make an itemized report to the Council of all work done, which report shall state the amount of expense incurred for each lot or parcel of ground; the number and description of each lot or parcel of ground upon which work has been done and the name of the owner, agent or occupant, if known, of each such parcel of land. The report shall be considered and acted upon as similar reports are acted upon when special assessments are to be made.

151.11 DUTY TO PAY.

It shall be the duty of the person against whose lot or parcel of land such assessment is made to pay to the City Clerk the amount of each assessment with ten percent (10%) interest thereon from date of the levy of the assessment, and in case such assessment or assessments remain unpaid by November 1 of each year, they shall Nevada, IA 2014 Urban Forest Management Plan 31 be certified by the Clerk to the County Treasurer, and shall be paid to and collected by the County Treasurer as ordinary taxes.