Appendix D
Peer City Review

Peer City reviews are conducted to compare city programs on a local and regional basis with the community conducting the research. A Peer City review answers the question, "What are other communities doing, and how do we compare?"

The local Peer City review below contains information provided by six Central and Western Montana communities. The Peer City survey was sent out to fifteen Montana communities participating in Montana Urban and Community Forestry Association. The regional information was obtained from the National Arbor Day Foundation using 2013 Tree City USA application data.

Montana Tree Program Survey

City	Anaconda		Billings		Great Falls		Helena		Missoula		Polson		Townsend	
Population	~9298		104K		58,000		~35,000		70,038		4600		2,000	
No. of Trees	1164 inventoried on public land		9200 Park trees no idea on street trees		36,000		~11,500+		24.423		2600		1,000	
Management Plan	Source	Year	Source	Year	Source	Year	Source	Year	Source	Year	Source	Year	Source	Year
	In-house		In-house	NO	In-house	ongoing	In-house		In-house	2014	In-house		In-house	2011
	Scott Makoutz	2012	Open Market	2015	Open Market		Open Market	2010	Open Market		Open Market		Open Market	
Ordinance		Year		Year		Year		Year		Year		Year	1990	Year
	Original Ordinance		Original Ordinance	1976	Original Ordinance	80's	Original Ordinance	1984	Original Ordinance	1953	Original Ordinance	1990	Original Ordinance	1990
	Last Update		Last Update	1976	Last Update	2014	working on it now	on going		1997	Last Update	2010	Last Update	
Budget	Source	Amount	Source	Amount	Source	Amount	Source	Amount	Source	Amount	Source	Amount	Source	Amount
	General Fund	$3,500	General Fund	160K	General Fund	343,000	General Fund		General Fund	284,224	General Fund	$2,500	General Fund	$10,000
	Special District		Special District	100K	Special District	342,000	Special District	226,649	Special District	120,964	Special District		Special District	
	Endowment		Endowment	$5k/yr	Endowment		Endowment		Endowment		Endowment		Endowment	
													Donations	$3,000
Staffing	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity	Hi-Lite All That Apply	Quantity
	Full Time		Full Time	2.5 including forester	Full Time	5.4	Full Time	2	Full Time	2	Full Time		Full Time	

Montana Tree Program Survey

City	Anaconda		Billings		Great Falls		Helena		Missoula		Polson		Townsend	
	Part Time		Part Time		Part Time		Part Time		Part Time	1	Part Time		Part Time Volunteers	0.5
	Seasonal		Seasonal	2- 6months	Seasonal	4	Seasonal	2	Seasonal	2	Seasonal		Seasonal	
	Volunteer	8												
Inventory	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year	Hi-Lite All That Apply	Year
	In-house		In-house		In-house	2005 ish	In-house	on going	In-house		In-house	2010	In-house	1990, 2006, 2011
	Open Market		Open Market	converted to TW 2013	Open Market		Open Market	2008	Open Market	2013	Open Market		Open Market	
	State Supplied	2011	State Supplied	2010 parks	State Supplied		State Supplied		State Supplied		State Supplied	2011	State Supplied	
Program Types	Type	Budget Percentage	Type	Budget Percentage	Type	Budget Percentage	Type	Budget Percentage	Type	Budget Percentage	Type	Budget Percentage	Type	Budget Percentage
	Cycle Prune	Grant funds	Cycle Prune	7yrs	Cycle Prune		Cycle Prune	40	Cycle Prune	0	Cycle Prune		Cycle Prune	25
	Sign and Signal Prune		Sign and Signal Prune	Street dept	Sign and Signal Prune		Sign and Signal Prune		Sign and Signal Prune		Sign and Signal Prune		Sign and Signal Prune	5
	Clearance Prune		Clearance Prune		Clearance Prune		Clearance Prune		Clearance Prune		Clearance Prune		Clearance Prune	20
	Sanitation Prune	Grant funds	Sanitation Prune		Sanitation Prune		Sanitation Prune		Sanitation Prune	18	Sanitation Prune		Sanitation Prune	
	Removals	100	Removals	25/yr	Removals		Removals	20	Removals	65	Removals	85	Removals	20
	Priority Disease Removals		Priority Disease Removals		Priority Disease Removals		Priority Disease Removals		Priority Disease Removals	2	Priority Disease Removals		Priority Disease Removals	
	Stump Removals		Stump Removals	25/yr	Stump Removals		Stump Removals	20	Stump Removals	10	Stump Removals		Stump Removals	10
	Tree Planting	Grant funds	Tree Planting	200/yr	Tree Planting		Tree Planting	20	Tree Planting	5	Tree Planting		Tree Planting	15
													Disease Control	5
Equipment	Type	Quantity	Type	Quantity	Type	Quantity	Type	Quantity	Type	Quantity	Type	Quantity	Type	Quantity
	Chip Truck		Chip Truck	1 ton with box	Chip Truck	2	Chip Truck	1	Chip Truck	1	Chip Truck		Chip Truck	
	Chipper		Chipper	1250	Chipper	2	Chipper	1	Chipper	1	Chipper		Chipper	
	Aerial Lift		Aerial Lift	IHC versalift	Aerial Lift	2	Aerial Lift	1	Aerial Lift	1	Aerial Lift		Aerial Lift	rented
	Climbing Truck		Climbing Truck		Climbing Truck		Climbing Truck	0	Climbing Truck	0	Climbing Truck		Climbing Truck	
	Stump Grinder		Stump Grinder	Yes	Stump Grinder	2	Stump Grinder	1	Stump Grinder	1	Stump Grinder		Stump Grinder	contracted

Montana Tree Program Survey

City	Anaconda		Billings		Great Falls		Helena		Missoula		Polson		Townsend	
	Backhoe		Backhoe		Backhoe		Backhoe	1	Backhoe	1	Backhoe	1	Backhoe	yes
	Self-load Log Truck		Self-load Log Truck	truck no hoist	Self-load Log Truck	1	Self-load Log Truck	0	Self-load Log Truck	1	Self-load Log Truck		Self-load Log Truck	
		None												
Contract Work	Type	Amount	Type	Amount	Type	Amount	Type	Amount	Type	Amount	Type	Amount	Type	Amount
	Stump Removal		Stump Removal		Stump Removal		Stump Removal		Stump Removal		Stump Removal		Stump Removal	$1,000
	Tree Removal		Tree Removal		Tree Removal	>50,000	Tree Removal		Tree Removal	60,000	Tree Removal	500	Tree Removal	$2,000
	Tree Planting		Tree Planting		Tree Planting		Tree Planting	$5,000/yr	Tree Planting		Tree Planting		Tree Planting	$1,500
	Pest Control		Pest Control	depends	Pest Control		Pest Control		Pest Control		Pest Control		Pest Control	
	Pruning		Pruning	40K/yr	Pruning		Pruning		Pruning		Pruning		Pruning	

Comparative Urban Forestry Programs in the Western Region

Community	Total Budget ($)	Population	$ per capita	Yrs as TCUSA*
Colorado Springs, CO	3,061,322.70	436,354	7.02	37
Boise, ID	1,526,477.00	205,314	7.43	36
Cheyenne, WY	1,270,800.00	61,537	20.65	32
Boulder, CO	808,839.10	97,385	8.31	30
Bismarck, ND	779,062.40	64,751	12.03	37
Spokane, WA	666,359.40	211,300	3.15	11
Rapid City, SD	449,539.00	67,956	6.62	34
Coeur d'Alene, ID	444,088.00	47,461	9.36	30
Missoula, MT	412,485.50	76,290	6.13	26
Laramie, WY	231,758.00	30,816	7.52	16
Kennewick, WA	205,446.50	76,410	2.69	14
Pasco, WA	149,136.45	65,600	2.27	7
Richland, WA	114,553.35	51,440	2.23	16

Based upon 2013 National Arbor Day Foundation data

* Tree City USA

INSTITUTE FOR
TOURISM&RECREATION RESEARCH
UNIVERSITY OF MONTANA

Missoula Urban Forest Interest Study 2014

Norma Polovitz Nickerson

7/15/2014

A random sample of Missoula residents completed a questionnaire regarding Missoula's public trees. Result show strong support for the urban forest in Missoula.

INSTITUTE FOR
TOURISM&RECREATION RESEARCH
UNIVERSITY OF MONTANA

Missoula Urban Forest Interest Study 2014

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Research Report 2014-9

July 11, 2014

i

Abstract

This study was conducted for the Urban Forest Division of the Missoula Parks and Recreation Department for use and guidance in the Urban Forest Master Plan. Online and mailback surveys were completed by a random sample of 407 Missoula residents in spring, 2014. Results show that Missoulians are profoundly supportive of public trees. Residents agree that their utilitarian purposes (e.g. shade, helping decrease pollution) are of value to the community. The aesthetic purposes tend to make their neighborhoods more enjoyable and Missoula a nicer place to live. Public trees provide a quality of life that Missoula residents appreciate. The majority of Missoula residents are willing to support the removal of hazardous trees, pruning, planting, and basic maintenance of public trees. While slightly less than half (47%) of Missoula residents would support increasing their taxes, 53% to 56% would support a separate revenue source for maintenance or planting of public trees.

Executive summary

Results of the Missoula urban forest study show that Missoula residents have a high regard for the value of trees, are willing to take personal responsibility for the trees, and possess a strong belief that the city has a responsibility to maintain the public trees.

- The top five aspects of why Missoula residents value the public trees are for their beauty (95%); making neighborhoods more enjoyable (93%); shade (92%); the ability of trees to improve air quality (91%), and; because it makes Missoula a nicer place to live (90%).
- When asked what they would do for Missoula's public trees, residents were in most agreement with watering the trees in front of their house (79%); encouraging adequate funding for maintenance of trees (76%), and; willingness to call the city about problem trees (72%).
- Residents see a need for the city to remove hazardous public trees (93%); prune trees to reduce future hazards (90%); replace dead/dying trees with young trees (88%), and; ensure new trees are planted and cared for properly (87%).
- Personal responsibility toward public trees decreased slightly in regards to funding. The support is high when it is simply requiring one to encourage funding (76%). As it gets more specific as to how to fund public trees, such as separate revenue sources (53%-56%) or higher taxes (47%), the number of residents, while still supportive, decreases.
- All respondents were very supportive of public trees, but those residents with boulevard trees in front of their home showed a slightly higher level of agreement to all but one statement.
- Many Missoulians suggested that the urban forest master plan focus on tree species diversity to discourage an insect or disease plague that could wipe out too many trees at one time and to emphasize native trees as much as possible.

Management Implications

The Missoula Urban Forest Master Plan needs to stress the maintenance of Missoula's public trees - removing hazardous trees, replacing dead and dying trees with young trees, and pruning trees. Focus needs to be on the variety of tree species when planting new trees as well as native species. The city of Missoula should study the implications of requiring all new development (residential and commercial) to build boulevards as well as planting and maintaining trees within the boulevard. Residents want Missoula to fund the maintenance of public trees but are cautious about developing separate revenue sources for the urban forest and even less likely to support a separate tax. This means that education about the physical and emotional benefits of trees as well as the cost of maintaining trees should be a section within the Urban Forest Management Plan. The Urban Forest Division could work with the MSU extension services on an education plan.

Table of Contents

List of Tables and Figures

Introduction

The Urban Forestry Division within the Missoula Parks and Recreation Department is in the process of writing a master plan for the urban forest. This report is based on a survey conducted to gauge the interest, attitudes and opinions toward Missoula's public trees – the urban forest. Understanding the opinions of the residents of Missoula is one step in completing the master plan.

Purpose

The purpose of this study was to assess the value held by Missoula residents of public trees in the city.

Methods

The population of study was all residents living within the Missoula, Montana city limits. Two methods of data collection were used:

1. A postcard mailing with instructions to go on-line to complete a survey, and;
2. A postage paid mail-back questionnaire.

The Missoula GIS Department staff randomly selected 2,000 residential addresses from the city's 9-1-1 database. To avoid the potential for duplication, all non-residential addresses were removed from the list prior to selection. The data set was divided into two address lists of 1,000 each.

Survey design

The questionnaire was designed after a literature review of similar studies (Appendix A). The questions were adopted from other studies and were written to represent four categories: value of trees; resident support for trees; community responsibility for public trees, and; the effect of trees on residents. Demographic questions and a few questions regarding what type of set up the respondents had in front of their residence (trees, sidewalk, boulevards) were also asked.

The questionnaire was reviewed by Missoula Parks and Recreation staff and the "Trees for Missoula" volunteer group. Minor additions and deletions were made. A pilot test of the survey was conducted on the "Nature Tourism and Outdoor Recreation" class of about 65 students at the University of Montana. Students were asked to complete the survey, and then a question-by-question discussion was held to validate the question design (making sure each question was interpreted as designed). Additional changes to wording were made before the final survey was ready for disbursement.

Postcard Method

The first method was the postcard mailing and online survey completion. This was an experiment to see if the less expensive method of only paying for postcard postage and encouraging people to get online to complete a survey could produce a valid number of completed questionnaires.

Postcards were mailed on April 18, 2014 to 1,000 residents (Appendix B). Each postcard had a hand written survey ID included on the card for the respondent to enter into the survey once they were online. This code provided a control to avoid duplications and ensure only responses from selected addresses. Only those with valid ID's were counted in the final data analysis. The postcard invitation did not have a cut-off date for participation. There were 106 responses from the on-line survey for a 10.6 percent response rate. This small response rate required the second method to be utilized.

Mail-back Survey Method

The second mailing of 1,000 surveys was sent out in three batches during the week of May 26, 2014. In this mailing, paper surveys were sent out to recipients. Each envelop contained a participation invitation letter from the Mayor (Appendix C), a paper survey and a stamped return envelope. Like the postcard survey, a survey ID was hand-written on each questionnaire. Surveys were returned by 301 respondents for a 30.1 percent response rate.

The mail-back survey asked that completed questionnaires be returned by June 16, 2014. Survey questionnaires were still arriving in the mail on July 9, 2014 therefore the cut-off for survey data entry was July 9, 2014.

In total, 407 completed and valid surveys were received for this study. An overall response rate of 20.3 percent was obtained from the 2,000 postcards and mail-back surveys.

Limitations

As in all studies, this study has some limitations. First, it is assumed that the people who responded are no different than those who did not respond. Second, in terms of the Missoula population, the U.S. Census reports that Missoula is 50.1 percent female and 49.9 percent male. This study had 57 percent female respondents, slightly higher than the Missoula population. Third, the questionnaire was sent to a random sample of 9-1-1 residences in Missoula. It is assumed that it is a complete database of households within the city limits.

Results

Results of the study are presented in three sections. Section 1 provides the descriptions of who completed the survey regarding demographic information as well as their residential description in terms of public trees. Section 2 provides the frequencies, percentages, and averages of:
- residents' value of trees;
- residents' commitment to trees in regards to support;
- the city's responsibility toward trees;
- the effect of trees on residents

Section 3 summarizes the written comments provided by Missoula residents related to the Urban Forest Master Plan and overall general comments.

Section 1: Demographics

Respondents to the survey were 57 percent female and 43 percent male. Eighty-one percent of respondents own their home. The average age of respondents was 52.25. The number of respondents by age category shows a fairly even distribution for the four decades between 30 and 70 years of age (Figure 1).
- 7%   = 20-29 years old
- 19%   = 30-39 years old
- 18%   = 40-49 years old
- 20%   = 50-59 years old
- 22%   = 60-69 years old
- 11%   = 70-79 years old
- 4%   = 80 year old and over

Figure 1: Age Category of Respondents

Age Categories - Number of Respondents
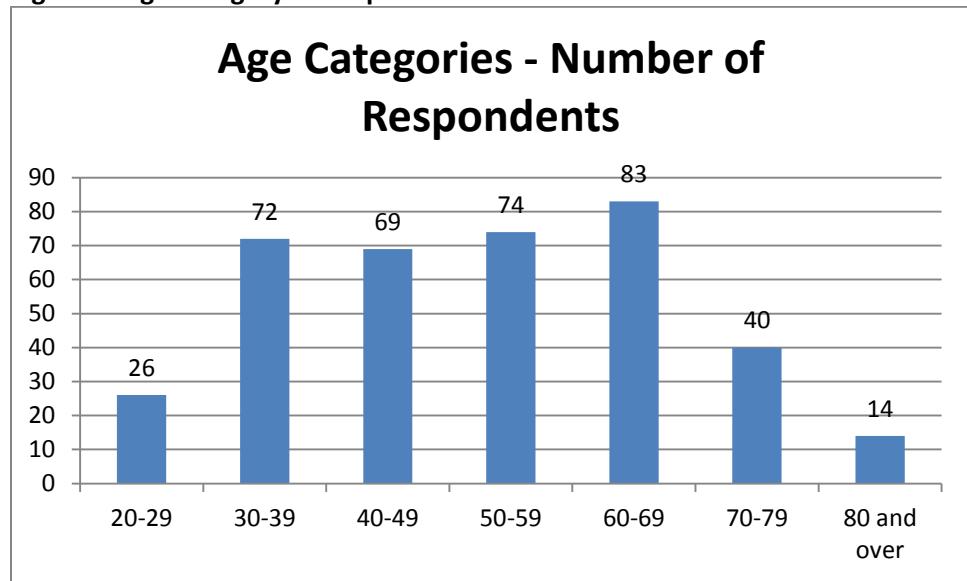
Respondents were most likely to live in the zip codes of 59802 or 59803 (Figure 2).

Figure 2: Zip Code of Respondents

Zip Code	N	Percent
None recorded	17	4%
59801	66	16%
59802	133	33%
59803	134	33%
59807	2	1%
59808	53	13%
Total	**407**	**100%**

3
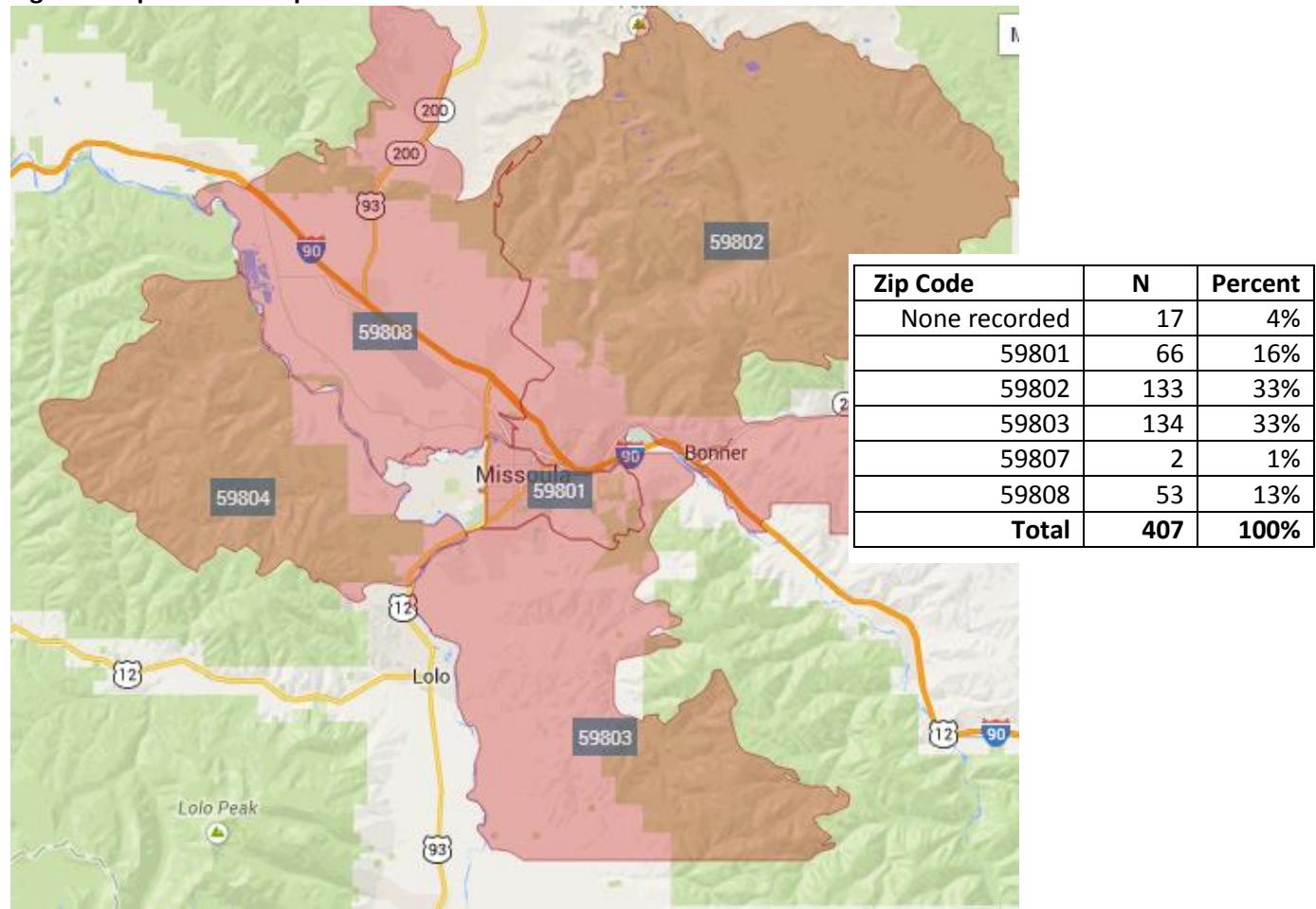
Respondents to the survey are highly educated. Only 20 percent have not graduated with at least a two year degree. Table 1 shows the highest number of respondents have a bachelor's degree (38%) followed by those with a master's degree (21%). The majority of respondents work full-time (54%) followed by 28 percent who are retired (Figure 3).

Table 1: Respondent Level of Education

Education Level	Frequency	Percent
Some high school	2	1%
High school diploma or equivalent GED	21	5%
Some college	55	14%
Associates degree	31	8%
Bachelor's degree	148	38%
Master's degree	81	21%
Doctorate	23	6%
Professional degree	27	7%
Total	**388**	**100%**

Figure 3: Employment of Respondents
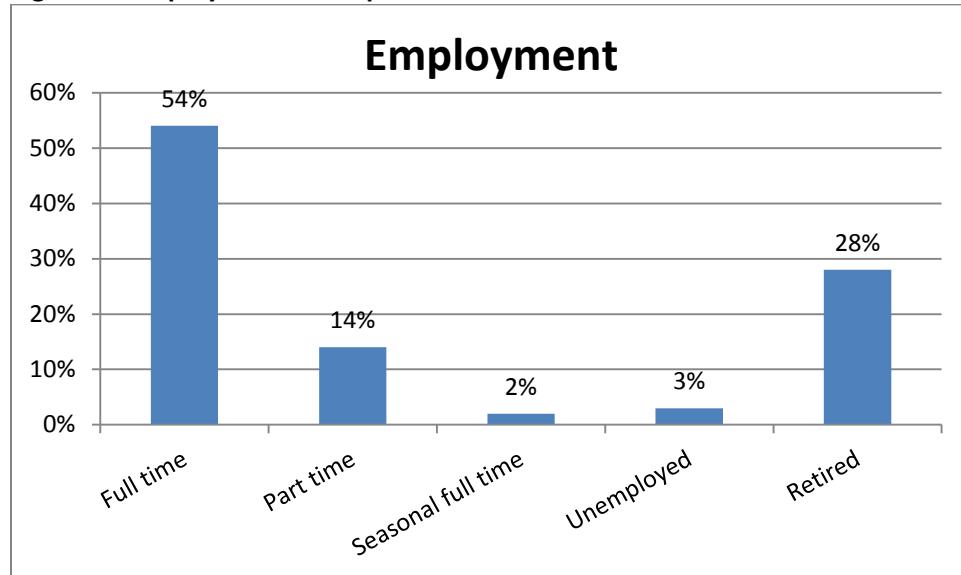
Finally, respondents are less likely to have trees in front of their residence. Only 30 percent have public trees while 70 percent do not. The response to the type of public area in front of their home is shown in Table 2.

4

Table 2: Sidewalks or Trees in Front of Home

In front of my residence, I have…	Yes	No	Don't know
a boulevard strip between my sidewalk and curb	139 (41%)	201 (59%)	3 (1%)
public trees in the boulevard strip between my sidewalk and curb	102 (30%)	233 (68%)	6 (2%)
a sidewalk next to the street (with or without curb)	151 (44%)	189 (55%)	2 (1%)
no sidewalk or public trees next to the street	101 (33%)	199 65%)	5 (2%)

Section 2: Attitudes and Opinions towards Trees in Missoula

Respondents were asked their level of agreement with 15 value statements about trees (Table 3). On a 5-point scale, with 1 being strongly disagree and 5 being strongly agree, it is clear that residents value trees when all means were above 3.0 on the scale. Missoula residents value the beauty that trees provide above all other statements followed by valuing the shade and making Missoula a nicer place to live.

Table 3: Value Statements of Missoula's Public Trees

I value Missoula's public trees because these trees…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
provide beauty	6 (2%)	2 (1%)	14 (4%)	112 (29%)	259 (66%)	4.57
provide shade	7 (2%)	3 (1%)	21 (5%)	141 (36%)	221 (56%)	4.44
make Missoula a nicer place to live	8 (2%)	6 (2%)	27 (7%)	123 (31%)	234 (59%)	4.43
contribute to reducing air pollution	11 (3%)	4 (1%)	33 (8%)	125 (32%)	222 (56%)	4.37
provide oxygen	11 (3%)	1 (<1%)	30 (8%)	156 (40%)	196 (50%)	4.33
make me happy	9 (2%)	12 (3%)	53 (13%)	111 (28%)	211 (53%)	4.27
keep streets and sidewalks cooler	8 (2%)	4 (1%)	44 (11%)	158 (40%)	182 (46%)	4.27
improve my quality of life	12 (3%)	13 (3%)	44 (11%)	122 (31%)	204 (52%)	4.25
encourage birds to live in my neighborhood	9 (2%)	4 (1%)	63 (16%)	125 (32%)	194 (49%)	4.24
help prevent soil erosion	11 (3%)	14 (4%)	46 (12%)	157 (40%)	165 (42%)	4.15
provide a benefit that outweighs their costs	12 (3%)	16 (4%)	67 (17%)	116 (29%)	183 (46%)	4.12
help manage storm water	9 (2%)	19 (5%)	69 (18%)	141 (36%)	157 (40%)	4.06
enhance my property value	12 (3%)	19 (5%)	91 (23%)	114 (29%)	154 (40%)	3.97
mask views I don't want to see	23 (6%)	41 (10%)	136 (34%)	92 (23%)	105 (26%)	3.54
make my neighborhood feel safer	23 (6%)	47 (12%)	162 (41%)	83 (21%)	79 (20%)	3.38

5

The next set of questions relate to residents' belief in their personal responsibility for public trees. Residents are willing to take care of trees and want them to be funded, but are slightly less enthusiastic about donating to causes for trees, reminding neighbors to water trees, and volunteering for "Trees for Missoula." However, the mean responses on the 5-point scale still show that the majority of residents agree with these responsibilities (Table 4).

Table 4: Resident Responsibility for Public Trees

I would do the following for Missoula's public trees…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
Take care of (water) the public trees planted in front of my house	17 (4%)	11 (3%)	51 (13%)	154 (39%)	158 (40%)	4.09
Encourage adequate funding for maintenance of these trees	19 (5%)	22 (6%)	52 (13%)	147 (37%)	154 (39%)	4.00
Call the city when I see a problem with a public tree	10 (3%)	20 (5%)	83 (21%)	182 (46%)	102 (26%)	3.87
Donate to causes that help maintain the public trees	24 (6%)	34 (9%)	127 (32%)	138 (35%)	71 (18%)	3.50
Remind my neighbor to water the public trees in front of their house	30 (8%)	60 (15%)	147 (37%)	94 (24%)	62 (16%)	3.25
Volunteer with "Trees For Missoula" (a local nonprofit organization)	35 (9%)	66 (17%)	174 (45%)	75 (19%)	41 (11%)	3.05

Respondents were asked their level of agreement with various statements regarding the extent to which the city should maintain the public trees. While all statements were agreed with by the vast majority of respondents, removing hazardous trees, replacing trees, and pruning trees had the highest means of all the statements indicating that the public is strongly in favor of the city keeping abreast of safety issues as they relate to public trees (Table 5).

The funding of public trees received some of the lower means within the survey. While respondents would like the city to fund Missoula's public trees, they are less enthusiastic about supporting a separate revenue source for tree maintenance or a separate revenue source for tree planting. With that said, however, the means were all above 3.0 on the 5-point scale indicating that support for funding is there. Looking at the individual agree responses, "providing separate revenue source for tree maintenance" had 56 percent in agreement and "providing separate revenue source for tree planting" had 53 percent in agreement (Table 5). When asked directly if they would support an increase in taxes to fund Missoula's public trees, 47 percent of respondents agreed (Table 5).

Table 6 displays the final set of questions which relate to how trees affect residents of Missoula. It is clear that trees make their life more enjoyable, provide desired shade, improve air quality, and have an aesthetic that encourages walking and shopping. Respondents want trees along city streets and are somewhat in favor of increasing their taxes for these trees (Table 6).

Table 5: Missoula City's Responsibility for Public Trees

| It is important to me that the city of Missoula…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
Removes hazardous public trees before they fall	4 (1%)	5 (1%)	17 (4%)	171 (43%)	199 (50%)	4.4
Replaces dead/dying public trees with young trees	5 (1%)	7 (2%)	33 (8%)	163 (41%)	186 (47%)	4.31
Prunes the public trees to reduce future hazards	4 (1%)	7 (2%)	27 (7%)	195 (49%	162 (41%)	4.28
Ensures that new public trees are planted and cared for properly	7 (2%)	8 (2%)	34 (9%)	166 (42%)	177 (45%)	4.27
Requires new developments to plant public street trees	15 (4%)	18 (5%)	50 (13%)	134 (34%)	175 (45%)	4.11
Funds Missoula's public trees	19 (5%)	18 (5%)	53 (14%)	154 (39%)	149 (38%)	4.01
Plants public trees between the sidewalk and street (where applicable)	16 (4%)	13 (3%)	84 (21%)	167 (42%)	114 (29%)	3.89
Provides a separate revenue source for public tree maintenance	33 (9%)	25 (6%)	115 (30%)	136 (35%)	81 (21%)	3.53
Provides a separate revenue source for public tree planting	32 (8%)	31 (8%)	117 (30%)	126 (32%)	83 (21%)	3.51

Table 6: The Effect of Trees on Respondents

To what extent do you agree with the following statements?	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
Trees make neighborhoods more enjoyable to me	3 (1%)	5 (1%)	18 (5%)	152 (39%)	212 (54%)	4.45
Trees are important because of their ability to improve air quality	6 (2%)	4 (1%)	26 (7%)	168 (43%)	185 (48%)	4.34
Shaded streets make my home cooler	7 (2%)	15 (4%)	61 (16%)	140 (37%)	161 (42%)	4.13
I am more likely to walk on a sidewalk lined with trees	11 (3%)	25 (7%)	98 (26%)	121 (32%)	129 (34%)	3.86
Trees around Missoula businesses make shopping more enjoyable	14 (4%)	25 (7%)	98 (26%)	144 (38%)	103 (27%)	3.77
Missoula's public trees are helpful in reducing my stress levels	20 (5%)	37 (10%)	120 (31%)	123 (32%)	88 (23%)	3.57
I am willing to increase my taxes to fund Missoula's public trees	55 (14%)	47 (12%)	105 (27%)	122 (31%)	62 (16%)	3.23
I would be OK if Missoula did not have trees along city streets	170 (44%)	131 (34%)	55 (14%)	20 (5%)	11 (3%)	1.89

A final analysis of the questions related to Missoula's public trees is provided in Figure 4. The data in this figure is split between respondents with boulevard trees and those without boulevard trees. It was deemed necessary to compare these two groups since one group (those with boulevard trees) might have a closer tie to Missoula's public trees.

One third of the respondents to the survey had boulevard trees, while two thirds did not have public trees in front of their homes. As displayed in Figure 4, it is obvious (means for both groups are above 3.0 on the 5-point scale) that all residents, whether or not they have trees adjacent to their property, are in favor of public trees, enjoy the aesthetics of the trees, and want the city to fund public trees.

A further look at Figure 4 reveals that residents with boulevard trees in front of their property are slightly more supportive on 37 out of the 38 questions. Only the question, "I value Missoula's public trees because these trees mask view I don't want to see" is higher for residents without boulevard trees. This suggests that an increase in appreciation of public trees and support of public trees can be heightened by placing trees in front of homes (if boulevards exist). The converse holds true as well. By reducing the number of public trees, support for public trees may also decrease.

8

Figure 4: Mean Response Comparison between Missoula Residents with Boulevard Trees and those without Boulevard Trees

Legend:
- Residents with boulevard trees
- Residents without boulevard trees

Categories (left to right):
- Provide beauty
- Trees make neighborhoods more enjoyable to me
- Removes hazardous public trees before they fall
- Take care of (water) the public trees
- Provide shade
- Make Missoula a nicer place to live
- Replaces dead/dying public trees with young trees
- Contribute to reducing air pollution
- Trees are important because of their ability to improve…
- Prunes the public trees to reduce future hazards
- Make me happy
- Keep streets and sidewalks cooler
- Improve my quality of life
- Provide oxygen
- Ensures that new public trees are planted and cared for…
- Encourage birds to live in my neighborhood
- Requires new developments to plant public street trees
- Shaded streets make my home cooler
- Provide a benefit that outweighs their costs
- Help prevent soil erosion
- Encourage adequate funding for maintenance of these…
- Funds Missoula's public trees
- Plants public trees between the sidewalk and street…
- Enhance my property value
- Help manage storm water
- I am more likely to walk on a sidewalk lined with trees
- Call the city when I see a problem with a public tree
- Trees around Missoula businesses make shopping…
- Provides a separate revenue source for public tree…
- Missoula's public trees are helpful in reducing my…
- Provides a separate revenue source for public tree…
- Donate to causes that help maintain the public trees
- Remind my neighbor to water the public trees
- Mask views I don't want to see
- Make my neighborhood feel safer
- I would be willing to increase my taxes to fund…
- Volunteer with "Trees For Missoula" (a local nonprofit…
- I would be OK if Missoula did not have trees along city…

9

Section 3: Open Ended Comments

Two open-ended questions at the end of the survey asked respondents what they would suggest be included in Missoula's master plan for public trees followed by a question asking them to provide any additional comments. Comments about the master plan were provided by 168 (41%) of all respondents. Additional comments were provided by 79 respondents (19%). Each open ended question was read thoroughly, and then assigned categories based on the comment. All comments are provided in full, unedited format in Appendices D and E.

Master Plan Suggestions

Review of the suggestions provided for the master plan lead to six overall themes and a total of fourteen comment categories (Figure 5).

The largest category was 'tree maintenance' with three additional subcategories added to the main theme. Representative quotes from each category are provided.

Tree Maintenance

- "I would include actually removing and replacing trees in some instances. Weeds growing at the base of the trees might also be addressed as well. "
- "Continuous maintenance of all public trees to make sure that they are benefiting all the people living and working in Missoula."

Tree placement

- "Careful selection of replacement species."
- "Prioritizing neighborhoods that are in particular need of beautifying - low income neighborhoods also."

Public Safety

- "Include all aspects- not just downtown. Many untrimmed trees are traffic danger due to visibility."

Sidewalks

- "Sidewalks do not need to be linear with a boulevard, because at times it is more appropriate to put the sidewalk with a curb next to the street, or winding around existing trees, particularly on side streets which are rarely if ever plowed anyway."

Species Diversity/Disease Control

- "Plant trees that need the least amount of water or lower amounts of water."
- "Plant a variety of species to prevent aging trees all at the same time."
- "Maintaining + replacing older trees that are becoming a hazard. Spraying trees to prevent unwanted insects. Plant a variety of trees. In my area it's all poplar. UGH!"
- "It's such a buzz word these days, but... Diversity. Diversity of species should be a priority."

Native Trees

- "More native plants and xeriscapes."
- "Plant evergreens- don't have to pick up leaves!"
- "Include an effort to plant a variety of trees, but focusing on those native to the region."

Wildlife Habitat

- "Plant more Nature trees + species good for wildlife (berry producers)."

Funding Concerns
- "Use existing funds to care for public trees/ new developments responsible for their trees. Put trees on private not public land. Property taxes already very high."
- "Adequate pruning. A 'catch up' fund to get up to date with the maintenance. It has been neglected for too long!!"
- "I think donations + fundraisers are good ideas."

No Taxes
- "I will not vote for a separate tax just for trees. City of Missoula is out of control! Love trees but come-on a separate dept +tax."
- "No tax increase! General fund only! Trim fat!

Yes Taxes
- "Increase taxes or have a special tax for trees. Everyone should contribute, not just those with trees. It is a similar problem we have with sidewalks. I believe we all need to improving our city."

Love Trees – Quality of Life
- "That trees be part of the 'Garden City' and that funds be provided to both purchase and maintain trees that make Missoula the beautiful place it is."
- "Being aware of the different types of trees that may actually cause structural damage to sidewalks. I love the atmosphere of trees and they are vital, however they need to keep year round especially in our urban areas."

Private Land Trees
- "Require new subdivisions to provide for planting trees and put covenants requirements for maintaining trees."

Public Education
- "Multiple sessions for public information sharing, discussion and input by all parties - with advance notice so we can attend!"
- "Education of property owners as to their obligation to water boulevard trees and the benefits of doing so."

Miscellaneous
- "Thank you for doing this survey and please make this happen - use volunteers a lot."
- "I think it is important to have a master plan for public trees but it must be reasonable. Funding sources must be included and replacement plans also."
- "The plan should have some specific goal like the total number of trees we'd like to have in the city, or the number of new trees that need to be planted, or the percentage of tree covered public area we'd like to reach in the city limits. Having some sort of goal like this would help gain support from residents and help in efforts to promote the plan and eventually pass tax increases to fund its implementation. The idea is similar to the UM group '1,000 New Gardens'. Having the tangible and measurable goal of planting 1000 new gardens in Missoula is a great mission for people to get behind and support, as well as to measure progress."

11

Figure 5: Master Plan Comment Categories

Tree Maintenance
(n=49)

Species Diversity/
Disease Control
(n=38)

Funding concerns
(n=30)

Love Trees, QOL,
(n=12)

Public Education
(n=18

Misc.
(n=22)

Tree Placement
(n=20)

Native Trees
(n=19)

No Taxes
(n=8)

Private Land Trees
(n=11)

Public Safety
(n=9)

Wildlife Habitat
(n=3)

Yes Taxes
(n=3)

Sidewalks
(n=7)
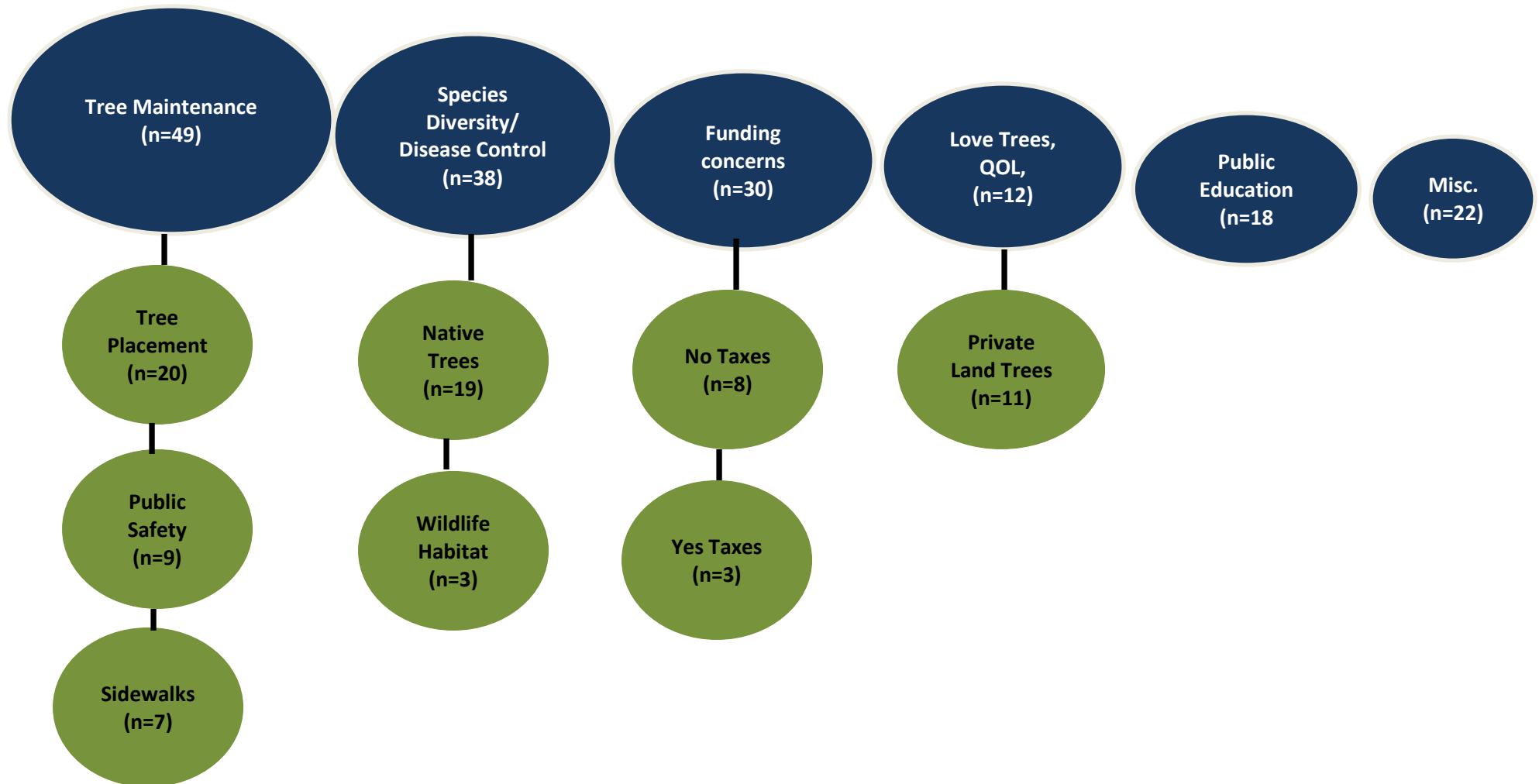
Additional Comments

There were 79 respondents who wrote in the 'additional' comments section. With this smaller number and the wide variety of responses, it was not beneficial to categorize the comments. A review of the comments seems to fall within the following topics:

- Thanks for the survey.
- Keep the trees. Trees are good for Missoula and our quality of life.
- Maintenance.
- Funding – some say no more taxes, others say let's have a tax.
- Suggestions on what/how to deal with trees.

The full list of comments from this section can be found in Appendix E.

Conclusions & Recommendations

This study was conducted to get a representative understanding of how Missoula residents value trees and their propensity to support public tree maintenance and upkeep.

The summary statistics show that Missoulians are fundamentally supportive of public trees. Residents agree that their utilitarian purposes (e.g. shade, helping decrease pollution) are of value to the community. The aesthetic purposes tend to make their neighborhoods more enjoyable and Missoula a nicer place to live. Public trees provide a quality of life that Missoula residents appreciate. Because of these reasons, it appears that residents of Missoula are willing to support the removal of trees (for safety reasons), pruning, planting, and basic maintenance of public trees.

It is recommended that the Urban Forest Division continue to put effort into the maintenance of Missoula's public trees. Removing hazardous trees before they fall received the highest mean score of the questions related to the city's responsibility in regard to trees. This was followed by replacing dead and dying trees with young trees, then pruning trees. All of these maintenance issues had only 12 people or less disagreeing with them, so the strength in agreement is very high.

Funding public trees is equally important, but how that funding occurs is less clear. For example, the five statements related to funding show an interesting pattern from 76 percent of residents agreeing that they would encourage adequate funding for maintenance to 47 percent who say they are willing to increase their taxes to fund Missoula's public trees. The support is high when it is simply requiring one to 'encourage funding.' As it gets more specific as to how to fund (e.g. separate revenue sources or higher taxes), the number of residents, while still supportive, decreases. Figure 6 summarizes the 'agree,' 'neutral,' and 'disagree' response levels for each of the five funding related questions.

Finding funding sources for city responsibilities is always a difficult prospect. We all know there are many deserving fingers in the small pot of money. It is recommended that the Urban Forest Division focus on both the utilitarian and aesthetic needs for public trees when discussing funding issues. These include, but are not limited to, the following talking points:

- Trees help moderate the "heat island" effect. With summer temperatures increasing, the forward thinking of planting new trees and maintaining the old trees is needed even more.
- Trees help control our carbon dioxide levels which contribute to 'greenhouse gas' pollution. Missoula can work towards offsetting the input we all have when driving our personal automobiles.

- Trees make Missoulians happy and Missoula a nice place to live. These quality of life aspects are noticed by economic developers and job creators. It becomes easier to convince others to live in a place that is happy and cared for by its citizens and city.

Figure 6: Support for Funding of Public Trees
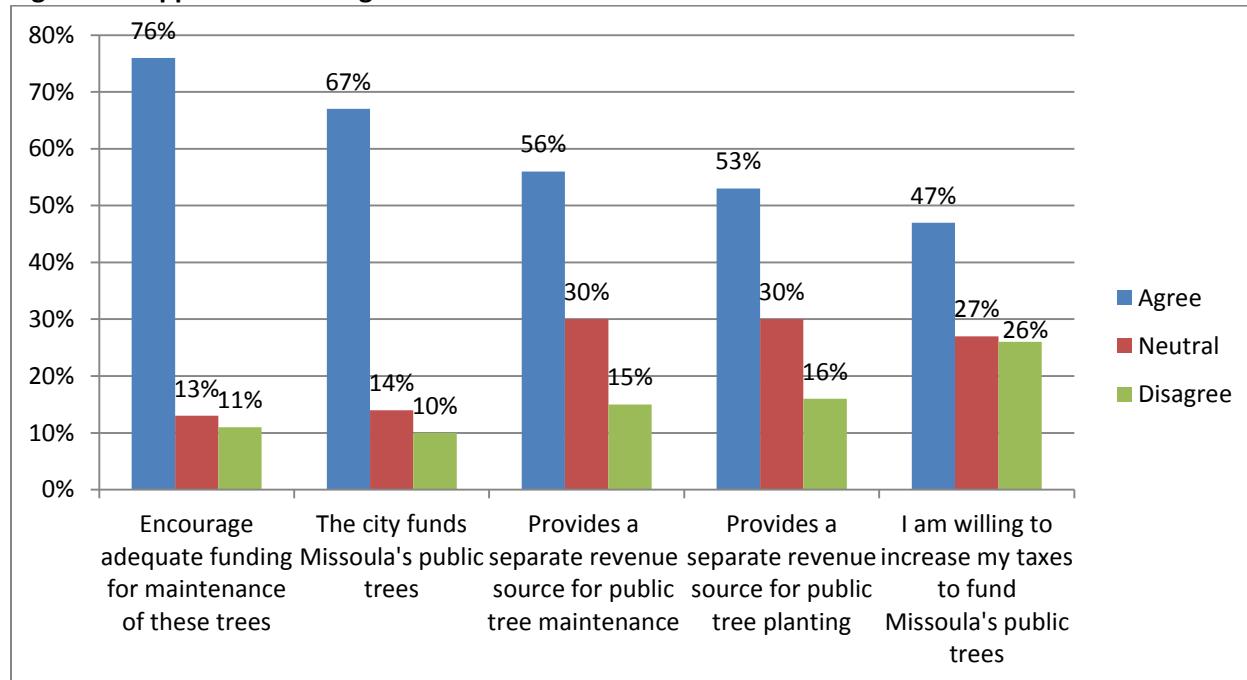
The majority of respondents (79%) agreed that new developments should be required to plant trees. This is one way to offset city funding of new trees and is highly supported by residents.

Finally, an interesting outcome emerged from the written suggestions for what should be included in the urban forest master plan. The importance of tree maintenance received the highest number of comments followed by the need for tree species diversity including a plea for more native trees and trees that require less watering. Tree diversity and native trees were not specifically asked about in the questionnaire, therefore the repeated occurrence of these comments shows how very important it is to many people in Missoula.

It is recommended that the Urban Forest Division focus on tree diversity, and to that end, provide an education through media outlets and pamphlets on what is native to the Missoula area so residents are supportive of the type of tree planted in front of their home, as well as providing information on trees they should be planting on their private property. Working with MSU extension may provide avenues for education to residents about native trees.

In summary, the data show strong support for public trees. Missoula has always been proud of the 'Garden City' title. Planting and maintaining Missoula's urban forest will allow the city to keep that title for decades to come.

Appendix A – Survey Instrument

This is a questionnaire regarding Missoula's public trees – the urban forest. Trees have been planted in Missoula since the early 1900s lining the street boulevards and throughout the parks. Maintenance activities, such as planting, watering, pruning and removal are funded through the Missoula Park District and the City General Fund. The purpose of this survey is to gain a pulse on the community's attitudes toward long term maintenance, planting, pruning, and removal of Missoula's public street, park and greenway trees. This questionnaire is being sent to a small, but scientifically valid, random sample of Missoula residents. Your response to this study, therefore, is important to the city of Missoula for planning Missoula's current and future urban forest.

If you enter your survey online, please enter this code: _____

In front of my residence, I have…	Yes	No	Don't know
A boulevard strip between my sidewalk and curb	❏	❏	❏
Public tree(s) in the boulevard strip between my sidewalk and curb	❏	❏	❏
A sidewalk next to the street (with or without curb)	❏	❏	❏
No sidewalk or public trees next to the street	❏	❏	❏

I value Missoula's public trees because these trees…	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Provide beauty	❏	❏	❏	❏	❏
Enhance my property value	❏	❏	❏	❏	❏
Provide shade	❏	❏	❏	❏	❏
Encourage birds to live in my neighborhood	❏	❏	❏	❏	❏
Contribute to reducing air pollution	❏	❏	❏	❏	❏
Improve my quality of life	❏	❏	❏	❏	❏
Make Missoula a nicer place to live	❏	❏	❏	❏	❏
Make me happy	❏	❏	❏	❏	❏
Provide a benefit that outweighs their costs	❏	❏	❏	❏	❏
Help prevent soil erosion	❏	❏	❏	❏	❏
Help manage storm water	❏	❏	❏	❏	❏
Keep streets and sidewalks cooler	❏	❏	❏	❏	❏
Mask views I don't want to see	❏	❏	❏	❏	❏
Make my neighborhood feel safer	❏	❏	❏	❏	❏
Provide oxygen	❏	❏	❏	❏	❏

I would do the following for Missoula's public trees…	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Encourage adequate funding for maintenance of these trees	❏	❏	❏	❏	❏
Take care of (water) the public trees planted in front of my house	❏	❏	❏	❏	❏
Remind my neighbor to water the public trees in front of their house	❏	❏	❏	❏	❏
Call the city when I see a problem with a public tree	❏	❏	❏	❏	❏
Donate to causes that help maintain the public trees	❏	❏	❏	❏	❏
Volunteer with "Trees For Missoula" (a local nonprofit organization)	❏	❏	❏	❏	❏

15

It is important to me that the city of Missoula…

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Prunes the public trees to reduce future hazards	❏	❏	❏	❏	❏
Removes hazardous public trees before they fall	❏	❏	❏	❏	❏
Replaces dead/dying public trees with young trees	❏	❏	❏	❏	❏
Ensures that new public trees are planted and cared for properly	❏	❏	❏	❏	❏
Funds Missoula's public trees	❏	❏	❏	❏	❏
Requires new developments to plant public street trees	❏	❏	❏	❏	❏
Provides a separate revenue source for public tree maintenance	❏	❏	❏	❏	❏
Provides a separate revenue source for public tree planting	❏	❏	❏	❏	❏
Plants public trees between the sidewalk and street (where applicable)	❏	❏	❏	❏	❏

To what extent do you agree with the following statements…

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Trees make neighborhoods more enjoyable to me	❏	❏	❏	❏	❏
Trees are important because of their ability to improve air quality	❏	❏	❏	❏	❏
I am more likely to walk on a sidewalk lined with trees	❏	❏	❏	❏	❏
l would be OK if Missoula did not have trees along city streets	❏	❏	❏	❏	❏
Shaded streets make my house cooler	❏	❏	❏	❏	❏
Missoula's public trees are helpful in reducing my stress levels	❏	❏	❏	❏	❏
I am willing to increase my taxes to fund Missoula's public trees	❏	❏	❏	❏	❏
Trees around Missoula businesses make shopping more enjoyable	❏	❏	❏	❏	❏

Are you a...   Male   Female

In what year were you born?   _____

What is your current zip code? _____

Are you currently a…   Homeowner   Renter

What is your CURRENT employment status? (circle only one)

Full time   Part time   Seasonal full time   Seasonal part time   Unemployed   Retired

What is your highest completed level of education? (circle one)

Some high school   Some college   Bachelor's degree   Doctorate

High school diploma or (GED)   Associates degree   Master's degree   Professional degree

What would you suggest should be included in Missoula's Master Plan for public trees?

16

Appendix B – Postcard mailed for on-line survey completion

Front

Missoula Parks and Recreation Department

What is the value of trees in Missoula?

Public Interest Survey

http://MissoulaTrees.surveyanalytics.com
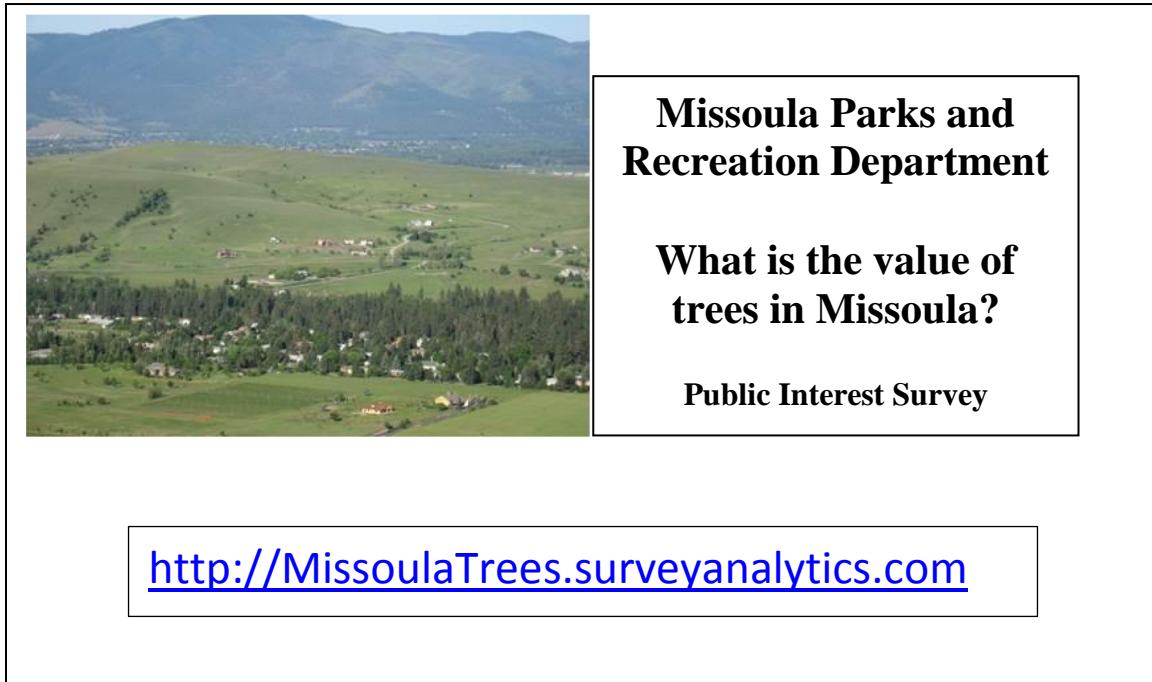
Back

Missoula's Trees – What do you think?

The Parks and Recreation Department is conducting a survey to determine citizen interest and areas of concern regarding Missoula's trees. **You are one** of a small random sample selected to participate in the survey. Please help! Go to the survey online at http://MissoulaTrees.surveyanalytics.com. Use the code below to access the survey.

(*Code inserted here)

If a paper version of the survey is needed, call City Forester Chris Boza at 552-6270.
***Respondents have a chance to win a free 30-Punch Pass to Splash Montana or Currents.

(Address here)

17

435 RYMAN MISSOULA, MONTANA 59802-4297 (406) 552-6001

May 27, 2014

Re: Urban Forestry Survey

Dear Missoula Citizen:

All of us who live in Missoula love our urban forest and want to protect our trees' health and longevity. In addition, Missoula's street trees, which number more than 20,000, are worth an estimated $70 million.

At the City of Missoula, we take our responsibility for the urban forest seriously. You are among a randomly selected sample of residents receiving this survey to help shape a new Urban Forest Master Plan. The plan will detail the recommendations and resources needed to proactively manage Missoula's urban forest for the next protecting the trees lining city streets and trails and growing in city parks. We need your help to make the master planning process the best it can be.

As a thank-you for your time and survey answers, you have an opportunity to enter a drawing for a 30-swim punch card to Splash Montana or Currents Aquatics Center.

Help us continue to be good stewards of our green infrastructure today and in the future.

Sincerely,

John Engen
Mayor

> ### *The Urban Forestry Division wants to hear from YOU!*
>
> Please complete and return the survey in the enclosed stamped envelope.
>
> If you prefer to respond to the survey online, please visit www.missoulaparks.org. Please use the code on the enclosed survey.
>
> ***PLEASE RESPOND BY JUNE 13, 2014***

18

Appendix D – Master Plan open ended comments

All comments are listed here without editing.

Trees and landscaping in Big Box retail parking lots.
Some way to maintain an effective assault on beetles harming and killing fir trees and Ponderosas pines in Missoula and its park areas and open space
We need a variety of trees suitable to Missoula.
I LOVE trees and believe in their power, but recognize the extent of work they require. Master plan must incorporate native trees that require limited watering, think of native plants as well as trees. Perhaps small subsidies for owners to buy trees to encourage/promote that they (the owner, not the city) will take maintain and take care of them.
More trees!
Plant as many trees as possible.
colorfull hearty trees
Trees improve the quality of Missoula's life. My only request is that trees aren't planted in a position where they block the view of traffic when turning (i.e. so you can't see if traffic is coming when you turn). I suggest we plant as many trees as possible, for research shows that contact with green nature has substantial health (both physical and emotional) benefits. Trees make life better for me, my students, my family, and my neighbors.
Multiple sessions for public information sharing, discussion and input by all parties - with advance notice so we can attend!
a separate district for funding...based on taxing areas where pub trees are planted   None up on south hill
I would like native trees to be used as much as possible. Maple trees are invading some of Missoula's natural parks (e.g., Greeenough), and Siberian elms are growing like weeds in some neighborhoods. I would include actually removing and replacing trees in some instances.   Weeds growing at the base of the trees might also be addressed as well.
diversity of species to avoid massive losses from diseases and insects. no monocultures. if sidewalks are required of homeowners, the the city must plant trees.
Careful consideration of tree types. No cottonwoods or maples. Beech, oak, willows, elms, quakies, etc all seem good choices. Maples are beautiful, but rip up other city assets with roots.
Concise, clear, information sessions in the community about the benefit (to all) of having trees and green spaces in a town or city.
MORE OF THEM - I am shocked there are not more trees in the 'Garden City.'
more trees, care for existing trees, and maintenance.   Missoula has amazing green space for a city of its size and that should be encouraged and continue their dedication for green space for the future...
Use native species whenever possible.
Aggressive replacement/removal of Norway Maple and Siberian Elm. Careful selection of replacement species.
thank you for doing this survey and please make this happen - use volunteers a lot
Continuous maintenance of all public trees to make sure that they are benefiting all the people living and working in Missoula.
I think it makes more sense to have 'side of the road' trees than anything on a median strip. Also, care needs to be taken with planting trees that are likely to push up sidewalks (or build sidewalks that discourage tree roots interference). http://www.mrsc.org/artdocmisc/m58mannmade.pdf Sidewalks that have pushed up sections may be completely unusable to people using power wheelchairs.
plant them, plant them, plant them... trees make everything better.
Emphasis on native trees to a certain extent
I think it is important to have a master plan for public trees but it must be reasonable. Funding sources must be included and replacement plans also. Obviously have more native trees is a preference but in some cases that may not be as reasonable. And trying to maintain older/bigger trees is important too.

Include species that are appropriate for our climate.
Include a maintenance plan.
Identify priority areas for tree planting or replacement.
Consider the use of native trees in boulevards where possible.

Sidewalks, as they are added to old neighborhoods, should respect existing parking and vegetation, which includes but is not limited to mature trees as is now stated in the city plan. Sidewalks do not need to be linear with a boulevard, because at times it is more appropriate to put the sidewalk with a curb next to the street, or winding around existing trees, particularly on side streets which are rarely if ever plowed anyway.
The plan should have some specific goal like the total number of trees we'd like to have in the city, or the number of new trees that need to be planted, or the percentage of tree covered public area we'd like to reach in the city limits. Having some sort of goal like this would help gain support from residents and help in efforts to promote the plan and eventually pass tax increases to fund its implementation. The idea is similar to the UM group '1,000 New Gardens'. Having the tangible and measurable goal of planting 1000 new gardens in Missoula is a great mission for people to get behind and support, as well as to measure progress.
Strive for the greatest yet practical diversification.
City should do what they say they are doing like watering, pruning, and replacement of trees. They don't water or prune the trees in the downtown area. Trees are on city property so they should be responsible at NO cost to the property owner. This cost is already in the Street Maintenance cost to the property owners downtown.
That the home owner be allowed to take care of their trees in front of their home using a qualified contractor approved by the city.
Adequate maintenance of trees. Plant low-growing trees under power lines. Start replanting Mount Jumbo, Mount Sentinel.
maintenance and replanting of trees
That trees be part of the 'Garden City' and that funds be provided to both purchase and maintain trees that make Missoula the beautiful place it is.
Native trees for water conservation
Birches and Black Walnuts, other fruit and nut trees
Don't create blind spots for traffic .
Asking home owners if they really want a new tree planted and no money for city if they could help with cost. Limit home owner over doing boulevard with growth that over hangers and they don't take care of
A small portion of city taxes should be put into a dedicated tree fund. A wider variety of trees should be planted (species preference by site, as applicable). Possibly plant fewer trees that grow larger on wide boulevards. Consider planting some high value trees that can be managed as a source of merchantable wood to fund the urban tree program. Maintain an inventory of city trees. Engage high school and university students (e.g., EVST and forestry) in helping with the inventory.
Consideration of working with a company that harvests or stores mature trees to be moved to key areas of town
replace and diversify
Continue to care for trees we already have, replace old/dead trees w/ more locally sustainable varieties (more drought tolerant). Make it part of new zoning that drought tolerant trees are planted in new housing developments, both apartments and houses.
Increase taxes or have a special tax for trees. Everyone should contribute, not just those with trees. It is a similar problem we have with sidewalks. I believe we all need to improving our city.
Consideration for native trees and low-water trees. Prioritizing neighborhoods that are in particular need of beautifying - low income neighborhoods also.
Public trees be supported across Missoula's neighborhoods, including the North and West Sides that have been ignored while the trees in the university area, # streets, and slant streets continue to get priority attention.
The southside neighborhoods are sorely in need of public trees. I feel that all the attention for tree life is on the downtown areas or the U area.   The southside is a step child of the city as far as parks, trees, urban development.
Norway Maples.
Put cherry trees on boulavards under power lines. They would attract lots of birds in July.
Only qualified professionals should be tending the trees not random city employees who know nothing or care nothing about the trees.

I see no reason why taxes should increase to care for the public trees. Budgeting on the part of the city should include a figure to maintain the trees. The answer is not always to increase taxes.
Monitoring of newly planted trees for maintainence problems (watering, injuries) until established.
mandatory tree planting for all commercial and residential development. Trees to be added to existing commercial/residential structures when major improvements are preformed.
Community involvement regarding choices.....
I have noticed that many trees planted by the city do not survive their early years, mostly due to the hot dry summers we are experiencing - the water bladders are helping, but not always enough. Part of the Master Plan should include follow-up on these young trees to assure survival. Currently, I am seeing a net loss of trees in Missoula.
Adequate funding; more native trees, but ones that can withstand the stress of being next to streets
plant native trees
All new subdivisions should plant trees.
Pruning as needed.
Planting of the right trees for Missoula, such as ones that are adapted to the climate and will not become invasive. An alternative to Norway maple should be investigated and its planting eliminated if an appropriate alternative is found. Can native trees be planted: ponderosa pine, alder, mountain maple, or larch?
If possible when removing trees, to haul them to a mill site or find an alternative use for them. (Not sure what the current policy is)
Additional planting where possible
No idea.
Creation of special task district
more natives or quasi-native naturalized varieties. more conifers. more diversity. shrubs too! less deciduous, esp. norway maples. yuck! don't like 'em. less sod, more xeriscaping & mulch.
A list of the benefits and drawbacks of different kinds of trees. I would like to see more native, water-wise, long-lived tree species planted if that's a viable option.
I'm not sure what Missoula's master plan for trees is. I think trees make the city more inviting; but I don't believe the city should be spending money on trees in residential areas. When I bought my house there were trees in the Boulevard area already. One died and I have replaced it. Not every home has trees in front of it and maybe that should be a personal choice.
It's probably already included, but I think it's important to plant trees other than maples, which are beautiful but whose seedlings become a nuisance.
NO 'plan' needed-
Include volunteers, parolees, homeless, students and anyone else in maintaining trees to save more money and/or provide a chance to give back as well as acquire work experience.
1) Include snags where possible (cavity builders) 2 Encourage litter/duff (natural of course)- for ground feeding blinds
Responsible spending= better spacing with new plantings, fewer new plantings; let home owners plant their own trees. More is not better.
To the extent possible, most of the trees be native to the Missoula area.
Chainsaws
More trees to treat wastewater before it goes back into creeks + rivers. More true hardwood variety.
No more planted medians.
Use of Federal grant money.
Funding
No cottonwoods, think about what falls from the trees. Keep sidewalks clear of low hanging branches.

21

Include all aspects- not just downtown. Many untrimmed trees are traffic danger due to visibility.
Don't study the 'plan' to defer + waste $ that should go towards maintaining + planting trees where they are needed.
Continued maintenance- my son died 14 years ago and a tree was donated to sky view park.- The tree died + the plaque was stolen- would like all replaced please- Thank you
Unlike sidewalk changes, if the city owns the tree, the city should care for the tree, otherwise put it in the hands of the homeowner to own the trees.
Plant trees that need the least amount of water or lower amounts of water-
Better budgeting by the city to include these costs in current funds. Nice , but not necessary to city management.
Public trees in parks & boulevard strips. Update the aging urban canopy, particularly surrounding SPH, nest side, Lowell school district. Cost lowering might include volunteers planting trees provided by the city of Missoula.
Provide business to local landscaping businesses.
A wide variety of tree types.
Education of property owners as to their obligation to water boulevard trees and the benefits of doing so.
A percentage of budget if needed.
Focus on native trees.
Public awareness of this issue and of any decisions made. Opportunity to be involved in the process.
Funding to provide for proper care- Maintain as insect and disease free as possible-
Answers to city problem trees!
Federal funding for trees
Deciduous- broad head trees. More trees downtown (where applicable).
Pay more attention to planning and taking care of existing plants an suck an stop w/ useless turn about an clustering an ruining traffic streets
Public school events and field trips to educate and help plant trees.
Garden boxes when trees are not possible- I want to see more public garden spaces for every to enjoy and fruit trees! Add fruit trees to the mix.
Arborist on call to assist homeowners with problems. City maintenance do public tree work instead of outsourcing.
Have a great variety of trees!
Don't separate trees into a special accounting category. They are part of the great mix in funds clumped into beaches and parks, the recreation funds. Use that appropriation to fund it.
Responsibility of businesses, including rental agencies and the properties they maintain, to ensure tree planing/care as part of their licensing.
Not really anything cuz you already have it covered.
Coordinated 'Arbor Day' activities.
Find funding aside from raising my taxes. You don't need as many as we have. They are overcrowding + roots cause problem. Thin them out!
Wise use of tax revenues allocated to parks and city trees, less manicured grass, more native plants and trees for less watering and maintenance.
For homeowners including out-of-state owners to be required to H2O and care for the trees in front of their house (something better than required shoveling- doesn't happen with rentals). Educate/discourage about Siberian Elm and Norway Maple.
Plant more trees, make sure property owners (or someone) keep these trees wetted. Stop cutting the Norway Maples in Greenough Park.
Plant replacement trees of same type as those being replaced. Mayor Engen need to tighten up on his spending. No new tax. We do not need to create more gov positions.
Prune to make sure trees don't obstruct street parking or walking on sidewalks!
Long-term plan for maintenance expenses.
Use the general funds, for which we are already heavily taxed. Encourage individuals, and require developers to plant trees appropriately. Pray for rain.

Being aware of the different types of trees that may actually cause structural damage to sidewalks. I love the atmosphere of trees and they are vital, however they need to keep year round especially in our urban areas.
1. A meaningful + effective plan that addresses all neighborhoods in Missoula in a timely + effective manner. 2. I think it would be meaningful to have the urban forester be visible in the neighborhoods. I also think it would be nice if the neighborhoods got access to equipment that the city owns to assist with care of these trees. Ex. The chipper in neighborhoods for a weekend to chip debris.
Where there is damage to sidewalks because of tree roots, the city should fix and not pass on costs to owner. Sidewalks need to be maintained for safety, especially in older sections of Missoula.
A way to incentivize neighborhoods to be accountable for their trees.
Roadways visual, not obstructed by trees or shrubs.
Require new developments to plant trees and maintain them.
Get rid of dead trees, maintain + care for existing trees.
More Linden trees.
Plant a variety of species to prevent aging trees all at the same time
Maybe more water wise trees, than maples. We have some p. pines or tamarack in our neighborhood and they are so lovely.
Build trees into cost of projects + annual budget. I will not vote for a separate tax just for trees. City of Missoula is out of control! Love trees but come-on a separate dept +tax
Maintain the Blvds. up Miller Ck. There are trees broken + down after our icy winter. We watched thru the thaw process of planting the pretty effect it made in our neighborhood, just keep it up.
They need to take care of dead trees. I called over a year ago and still haven't had anyone come look at the dead tree that is about to fall over in front of my house (623 Howell St.).
Plant more Nature trees + species good for wildlife (berry producers).
Make sure than new trees have their trunks protected from the deer. Some of the new trees on Miller Creek have already been rubbed by the bucks last fall.
Any time there is a transfer of ownership by property in an area with trees or where public trees could be planted, a city forester should meet with new prop owner to educate on care of trees + advise on planting new trees!
Keep trees out of boulevards- we need to maintain free streets they can cost us tons of money and 90% of them look bad or are dead. A waste of good water. Also stop tell people you will pick up leaves in the Fall what a mess and costly.
Maintain older trees in the downtown/University areas. Leave replacement decisions and associated costs to individual neighborhoods/homeowners. Take into consideration developing more natural landscapes that minimize/reduce watering.
Interpretive/ educational information for residents and children teaching the values of trees.
No additional taxes direct or indirect.
Trim and prune if obstructing.
Plant trees, but once they are planted, maintain them.
Take care of the trees after planted, including grass and area around trees.
Plant more Oak trees!
Funding and enforcement of waterings.
Tree species selected considering both purpose and safety- shade, strength of limbs, blowdown, potential, litter. Trees in parks, playgrounds, greenways and boulevards have different 'specs.'
Include incentives for landowners and developers to protect and enhance public trees- Do not worry about push back- regs are ok- it enhances property values! Aim for native species first- but contemplate other robust spp. that don't use as much water and are adaptable to climate changes.
Remove them all!
Have the jail work program help with labor to care for the trees.
Keep them off boulevards.
Trim them away from intersections to avoid blind spots + around stop signs.
Include an effort to plant a variety of trees, but focusing on those native to the region

Lot of trees. Especially trees that keep their green foliage.
Planting, pruning, disease control.
Some public input into types of trees planted- including public education re: pros + cons of different types.
Fruit trees- shade/oxygen/food!! Give the fruit to the Poverello Center.
Plant evergreens- don't have to pick up leaves!
More native plants and xeriscapes.
I think donations + fundraisers are good ideas.
Use the cities potential power to get better pricing for homeowner's that would plant trees in city- controlled areas. There has to be discount potential so that 1.5' trees don't cost $200+/ each to plant.
A realistic sustainable approach especially in terms of requirements, costs and funding sources.
Do nothing more than done- nobody wants morel taxes!!!
Maintaining + replacing older trees that are becoming a hazard. Spraying trees to prevent unwanted insects. Plant a variety of trees. In my area it's all poplar. UGH!
Nothing should be required for citizens, it should be voluntary.
Require new subdivisions to provide for planting trees and put covenants requirements for maintaining trees.
Resident awareness.
No tax increase! General fund only! Trim fat!
Keep including your city tree trimming crew and support them more. They do a great job not to mention several well paying jobs.
No new taxes. Use existing funds to care for public trees/ new developments responsible for their trees. Put trees on private not public land. property taxes already very high.
Adequate pruning. A 'catch up' fund to get up to date with the maintenance. It has been neglected for too long!!
Make sure that the trees are maintained in public areas. (example: Linda Vista Roundabout)
Make sure that grass is cut on boulevard strips or have reminders: someone call to ask property/business to do it.
Public access to tree-maps so public could identify species of trees. This would increase awareness and feeling of ownership.
It's such a buzz word these days, but... Diversity. Diversity of species should be a priority. Also, because the city seems to be non responsive to citizen's concerns regarding tree health, removal, pruning, maybe the city could reimburse a percentage of homeowner's expenses relative to trees on the city boulevard.
This 'Master Plan' needs to be short and to the point. With a comem sense way.
Return planting maple trees!
Do not plant green ash. Do not plant any tree from Poplar family or genus populous. Educate residents about how to maintain healthy trees. City forester has to become more visible. Have special fund raisers to raise awareness + money. How about a 'run for trees' or a 'trees are neat campaign.' Get into the news and make some noise. How about an 'adopt a tree campaign'. Every responsible adult could adopt a tree or block of trees. I am just doing a little brainstorming. here, but you get the idea. How about 'Trees Are the Answer' to all of lifes more complicated questions.

24

Appendix E – Open ended general comments

All comments are listed here without editing.

Trees truly have more value than we can imagine. Trees make our lives more fulfilling and enriching. Although I don't have public trees on my block, myself and neighbors have several in our yards. Our trees have much more value than those insipid parking meters.
More trees please!!
Thank you!
Thank you for asking! I love Missoula's mix of urban amenities such as parks and paths, bike paths and trails - as well as the preservation of wild spaces and places for wildlife habitation. I live near the new Riverside Park (by the Osprey stadium) and I love it!!
center islands are to difficult to get residents to maintain. plant those with water wise and drought resistant plantings. if homeowners are required to water street trees, then maybe a very small tax could be leveled at all home owners or rental owners without such trees to help support the streets we all use.
One of Missoula's best qualities is the great amount of trees and green space. We should do all we can to maintain the esthetic and environmental benefits that trees bring to the Garden City.
I currently live on the Foothills above the 'bowl' - NO TREES UP HERE AND IT SUCKS!!
Additional tree thinning is needed on Mt Jumbo and along Rattlesnake Creek to lower the risk of uncontrolable wildfire. There may be other places as well.
I think you are doing a good job with a overwhelming task. I'm happy to see some different tree species get planted. Keep up the good work!
Thank you again
the city removed to huge trees from my neighbors lawn by the street, they were beautiful. they replanted two trees and one died quickly. i wish they would replant that tree. thanks for the survey~ go trees! :)
Instead of cutting cottonwoods down in public parks, such as Greenough when they are considered a 'hazard', consider leaving a main trunk to provide habitat. We are losing mature cottonwood canopy throughout the city on streams and the river. When removing maples or other trees for whatever reason in parks such as Greenough, followup with additional planting and weed control. Develop a habitat restoration plan for natural park areas that includes tree planting-this is distinct from landscaping along boulevards.
I support having a tree population that is native to this area, with as much variety as possible with this stipulation. There also needs to be some way to address the problem that many homeowners here live out of state and rent their homes. They need to be aware that it is there responsibility to see to it that the tree is taken care of. Renters are often not made aware if they are expected to care for a tree and not educated on how to do so.
Create a community nursery/forest whose operations are integrated into the public school system.
Object to having all the same kind of trees ---in NY City they had to remove many trees when the Asian beetle came in so we should NOT have all the same kind of trees. Tree leaves clog my roof drains downtown and cost me about $1,000 per year to have them cleaned out. DWARF TRees should be considered OR flowering bushes.
Trees are beneficial but higher taxes are a detriment to living in Missoula
Missoula is the 'Garden City' and the trees contribute a lot to make it that way.
I think that trees provide a valuable service to humanity and that they should be treated with respect.
I live in Missoula because it is NOT an urban environment . Urban and crime free are never in the same sentence for a reason .so to that effect I say yes lets keep the trees .
I think the urban forest adds value to our city that is hard to quantify. There are places where there may be too many trees, such as in the university area. Maybe determine a tree density that is not quite as dense (50%-75% of current?). I do worry that we (city and citizens) use a lot of water to grow trees in an area the doesn't have sufficient precip to support them. To balance the desire for trees with the need to water them maybe plant fewer trees overall and, if possible, select species that require less water. If homeowners want to grow more trees on their property (vs. on city property) for shade they are welcome to.
I like the watering plastic bags around new trees for slow release
consistency in policy
Thanks for taking care of the trees in Missoula. They truly do make it the Garden City!

25

I have tried to contact the city arborist with questions re: my trees and cannot get a reply. That is frustrating as we really want to take good care of our trees, which seem to be in need of pruning badly.
I have never seen a public tree planted or pruned in either the north or west side neighborhoods (I have seen them cut down). Being poor does not mean one doesn't enjoy trees.
Reallocate present city funds to cover expenses for trees rather than increasing sids or property taxes. Property taxes and sids bear too great a proportion of public taxation already.
Labeling Norway Maples as 'invasive' and 'undesireable' is just 'modern correctness' and denies the valuable contribution the species made to our reputation as the Garden City and a great place to live. Are we ALL not 'invasive species'? I would argue that these very trees are a major reason the University district is the most desirable neighborhood in town.
Proper trees should be planted so the roots don't break the sidewalk. Again educated choices.
We DON'T need the city to initiate a new Tree District, to go along with the Street Maintenance District and Public Safety District. If the City needs money to fulfill its basic obligations, it should quit implementing so many tax increment districts, which cannibalize tax revenue which would otherwise go to the general fund.
I really value and want trees throughout the city....
I really don't have anything against maples, or other non native trees, as long as they can withstand the stress of being street trees. With global warming it may be necessary for the city to spend more to water street trees
I am totally OK with pine trees. Not every newly planted tree has to be a leafy deciduous.
If trees are diseased they should be removed. If the homeowner doesn't do it then the city should step in as they do when sidewalks aren't cleaned.
I LOVE trees! 20-something years ago, I planted three of them in the boulevard outside my house with the help of the city's cost-share program. I was really grateful for that program, which made it affordable to plant them. Today those trees-two burr oaks and an ash-- are big and healthy, and provide shade, bird habitat, and beauty.
1) Of course I like trees. Doesn't everyone? 2) Of course the city maintenance department should remove dead trees or dead limbs to serve public safety. However, since it is already measured that Missoula city taxes are the highest for any city in the state of Montana, I suggest that planting any new trees go near the bottom of any priority budget list for city services. 3) In my neighborhood, all of the trees are privately owned, and each homeowner cares for his own. If a property owner elsewhere in the city appreciates a nearby 'public' tree and wishes to water it, fine. In the 'public' tree dies from a lack of water and has to be removed, the adjacent property owner should be allowed to either plant another tree or not, as he or she decides. The city of Missoula has already spent unrevealed sums to plant trees around town. It's been done. Please do NOT add ANOTHER PLAN for the city government to increase city citizen's taxes AGAIN.
Our taxes are already the highest in the state. Cut some cost.
No trees in the boulevard because when the street needs to be enlarges the trees have to come out. Put them where they can live out a lifetime. Also trees, especially evergreens in roundabouts + boulevards make it difficult to see causing hazardous driving conditions.
Sidewalks up Hillview.
Keep planting.
T.L.C.
Our neighbors across from 180 Parkview Way have trees that are too large and block our view. The city should deal with this. Our property value has gone down because they have reduced our view.
Basic responsibility by property owners is really best simple, low cost solutions depending on neighborhoods. Most of the public trees have served well. You have a park district (tax) already for this!
This survey is incredibly biased and poor constructed.
I am happy with the care of my neighborhood trees- (The HipStrip)- What I know. The city plans are acceptable and supportive.
I provide residents with watering bags wrapped around trees that they could fill instead of running sprinklers.
It should be in-between.
Keep in mind trees have a life expectancy. Plan around the expectancy + budget for it.
We plan to leave Missoula soon because we can no longer afford the tax burden.
Consider working class people and retired folks living on your precious sidewalks under your newly planted public trees because they can no longer afford the property taxes. Compose a survey asking trees because they can no longer

afford their property taxes. Compose a survey asking how people feel about that. Let us all learn to live within our means. Save money on stupid questioners like this one.

Neutral.

You are taxing blue collar people who own property out of Missoula. Buy water company, free bus rides, attract transients + panhandlers, whats wrong with year round fiscal responsibility?

N/A

The city of Missoula has had trees for many years. The city already gets tax money to maintain them as well as the streets etc.. The city needs to live within the budget they have and not want to create a tax district to fund everything that happens here or wanting something new!

In 'old Missoula' the trees are dying and being replace constantly so our urban forest is very important to my husband and me.

Owners need to be responsible for trees on their lane. City should be able to ...... accountability.

Will the master plan include open space trees such as on Mount Jumbo? I live near the Mount Jumbo trailhead and the trees in front of my house need to be cut down. I am concerned about the fire hazard and an open meadow becoming a mature forest.

We need 1/2 the trees we have. Do not plant a nasty tree in front of my house. They are not cared for + I have already landscaped the boulevard.

I disagree with Missoula's undiscriminantly cutting all of the non-native trees in our parks. Why not remove the old, decaying trees as they die? Remove, also non-native saplings they sprout.

Neutral.

Seems to me that parks + rec do a good job. Why do we need a master plan? As a whole I think Missoulian's are good stewards and take pride in their trees, landscape, lawns etc..

I personally think planting new trees, tending to them as naturally as possible (let nature take its course).

Take care of all the trees that are already in the city. We need them!

Trees along Miller Creek look awful because they aren't cared for.

Please enter me in the drawing for a 30- swim punch. Mac York. Phone: 257-3864.

P.S. 27 years Evans Ave.. New 8+ years- ..... with the Rattlesnake- beautifully treed grounds.

Impossible to mow around tall weeds and grass around watering. Circle looks like crap. No-body keeps the new ones trimmed and roots (tree) eventually ruin sidewalks- trunk 3.5' from sidewalk and curb.

I live up the south hills. Value a view more than shaw. Wish my neighbor would cut down his obstructing trees.

The last thing this city needs in more government spending and taxing.

The city needs to quit taxing residents/ property owners into high debt. It is ridiculous. I planted my own trees and take care of them. The city never paid a dime for maintenance of them.

The city does not take care of the existing parkways. Never weeded! Money .... plants died.

I don't like newer housing areas where streets are narrow to allow for trees between sidewalk and street. This is a potential danger.

I am sure it is very expensive + care for our trees. How about teaming up with the University to make it a learning opportunity and ask for citizen volunteers.

No

I grow + plant my own trees. I also water them regularly + prune + maintain their health. The city should grow seedlings + ask residents to plant + maintain them. 'The city is out of control on assessments + taxes.'

The development I live in has trees in their planning- they belong to the owner for maintenance and care. Their questionnaire is all about public trees.

Thank you for asking.

The mayor is stealing all the thunder with his 'buy the water' system BS. And the county attorney with his suit of DOJ. I don't ever hear anything from the city forester. You have to get ingot he frey and mix it up a little. We all know that trees are pretty cool and they make our lives worth living. However, as a taxpayer I want to know Government is doing everything it can to get by without taxing me more. I am pretty sick of paying taxes but would be willing to donate to a campaign targeting improvement of the urban forest. I just got this survey on June 18th. I was in Alaska from June 2-17th.

The trees will be fine without you.

This survey, I believe, if we are honest, can be boiled down to 1. Are trees important to you? and 2. are you willing to pay for maintaining these trees. The rest of the questions a silly.

MISSOULA PUBLIC TREE INVENTORY REPORT

MISSOULA PARKS AND RECREATION

September 30, 2013

Missoula Parks and Recreation Department
Operations Division
100 Hickory Street
Missoula, MT 59801
(406) 552-6277
www.missoulaparks.org

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

In 2012, the City of Missoula Department of Parks and Recreation, Urban Forestry Division (UF), received a grant from the Montana Department of Natural Resources and Conservation (DNRC), with funding from the U.S. Forest Service, to conduct a citywide tree resource assessment.

The inventory of Missoula's right-of-way (ROW) trees was conducted in the summer of 2013 by Arborists and Research Specialists from the City's Urban Forestry Division with a coalition of volunteers from the Trees for Missoula (TFM) non-profit. The City of Missoula encompasses about 27.51 square miles and contains residential, commercial, agricultural, and industrial developments. Approximately 74.23% of the public streets in Missoula were inventoried. Using the ArcGIS software suite and TreeWorks extension, a database was created that provides geographic information and tree-specific data. This database contains records of 20,545 trees, 305 stumps, and 234 planting sites.

The total appraised value of the City of Missoula's urban forest is approximately $70.7 million.

GLOSSARY

Arboriculture: The art, science and technology of cultivating and maintaining trees, shrubs and other woody plants.

Citizen Service Requests (CSRs): Customer service reports generated by citizen callers pertaining to questions about tree health and maintenance requests.

Chapter 12.32 Missoula Municipal Code: the City of Missoula Ordinance Number 3043 describing tree, shrub, planting, pruning, and maintenance standards and regulations designed to protect the health, safety, and welfare of the public and the tree resource.

Chlorosis: A nutritional deficiency resulting in a yellowing of leaves due to a lack of chlorophyll.

Diameter at Breast Height (DBH): the standard method of measuring the trunk diameter of a tree at 4.5 feet above ground.

Geographic Information System (GIS): A system of computer hardware and software designed for the analysis, storage and mapping of geographic data. Data are stored as points, lines, polygons, raster images (pictures, aerial photographs, or 3D surfaces) and tables.

Global Positioning System (GPS): A system of satellites and ground units used together to determine terrestrial location and elevation. The GPS receiver is able to communicate with satellites to determine precise spatial information for the user.

Hazard: imminent threat to the public and to infrastructure.

i-Tree: a public domain software suite developed by the U.S. Forest Service that offers tools for assessing, analyzing, and strengthening management of urban forests. i-Tree Canopy and i-Tree Streets were used to estimate Missoula's canopy cover and to quantify benefits of street trees.

Montana Department of Natural Resources and Conservation (DNRC): the agency that provides leadership in managing Montana's water, soil, forest, and rangeland resources. Grant funding for the Missoula public tree inventory was awarded by the DNRC.

Park Tree: all trees on city owned or leased land other than trees that are in the public right-of-way.

Position Dilution of Precision (PDOP): A relative figure used with GPS navigation to compare the error in user position and the error in satellite position. The lower the value, such as 1-3, means more precise data.

Public Right of Way (ROW): the width between the dedicated boundaries of all public streets, roads, boulevards, and alleys. This includes all sidewalks and public parking strips located within such boundaries.

Senescence: the natural aging process of the tree organism.

Street/Boulevard Tree: any tree which exists in an area of public right-of-way between the edge of the public roadway, whether curbed or not, and the private property line.

Topping: the cutting back to a stub or non-lateral branch within the tree's crown to such a degree that removes the normal tree canopy and disfigures the tree.

Trees for Missoula (TFM): A non-profit organization based in Missoula dedicated to the advocating of Missoula's urban forest.

Urban Canopy Cover (UTC): the area covered by leaves, branches, and tree stems when viewed from aerial photographs, satellite imagery, or ground sampling.

Urban Ecology: A subfield of ecology which deals with the interaction between organisms in an urban or urbanized community, and their interaction with that community. In this perspective, the city itself is viewed as an ecosystem.

Urban Forestry: The art, science, and technology of planning and managing trees, greenspaces and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits that trees provide society.

Urban Forestry Division (UF): Missoula's Urban Forestry Division is dedicated to maintaining, enhancing, and expanding the urban forest through tree planting, pruning, and hazard removals.

1. INTRODUCTION

1.1 Urban Forestry in Missoula

The City of Missoula's Department of Parks and Recreation Urban Forestry division is committed to providing responsible stewardship of over 25,000 right-of-way (ROW) trees and 5,500 City park trees. Urban Forestry provides for the establishment and maximization of healthy tree canopy coverage to provide a wide range of benefits including air quality, shade, carbon sequestration, enhanced property values, and habitat for wildlife.

Primary goals of Missoula's Urban Forestry program are to assure public safety and to maximize and sustain the benefits produced by the forest resource. Additional goals include improvement of community wide aesthetics, minimization of infrastructure conflict and implementation of green infrastructure concepts, public outreach, and facilitation of recreation and leisure activities. Trees that are properly planted and maintained appreciate in value over time, thereby providing a significant public service. Collectively, the tree and shrub resource in Missoula improves the quality of life for residents and visitors.

The Urban Forestry Division, excluding the Greenways and Horticulture branch, has an established budget of over $353,000 to manage the publicly-owned forest resource. The staff includes a full-time Urban Forester, one full-time Lead Arborist, two ten-month seasonal Arborist Technicians, and several seasonal staff. Services include tree planting, pruning, hazard tree removal, stump grinding, inspections, monitoring, storm damage repair, and education. In 2012, the Division planted 105 trees, pruned 550 trees, and removed 123 dead or hazardous trees.

A variety of activities and projects are offered through the Forestry Division. The Memorial Tree program commemorates individuals by planting trees with memorial plaques in city parks. Second, homeowners may request the planting of boulevard trees by the Forestry Division through participation in the Cost Share program. Third, the Christmas Evergreen program collects cut trees after the holiday and recycles these into mulch, thereby generating a productive resource that reduces landfill waste. Last, the Run for the Trees fundraiser held each spring raises awareness and support for Missoula's urban forest.

For 25 years, Missoula has been recognized as a "Tree City USA" community. Achieving this designation entails meeting urban forestry management standards set by the Arbor Day Foundation in cooperation with the National Association of State Foresters and U.S. Forest Service. This includes "establishment and utilization of a tree board or commission, a tree care ordinance, an operating budget for the forestry program of at least $2 per capita, and celebration of Arbor Day" (Arbor Day Foundation, 2013).

1.2 Demonstrated Need

In order to appropriately manage Missoula's urban forest, the properties, condition, and extent of the resource must first be evaluated. A current forest assessment, accomplished through a complete public tree inventory, provides a comprehensive and statistically reliable accounting of

the urban forest. This enables managers to make efficient decisions as well as plan for effective long-term management.

Prior to 2013, the City of Missoula's Urban Forestry Division spearheaded three inventories of publicly-owned street trees. The first citywide inventory was launched in 1973, which provided the Division with operating information for 20 years. Between 1993 and 1996, a subsequent inventory catalogued and digitized the size, species composition, condition, maintenance requirements, and work history of approximately 11,000 trees.

In 2003, the Missoula tree inventory was expanded to include areas not previously inventoried and those recently annexed by the city. With funding awarded by the Montana Department of Natural Resources and Conservation (DNRC) via the U.S. Forest Service, a contractor was hired to re-inventory 12,868 trees and planting sites (10,468 and 2,400, respectively) within city-owned boulevards and right-of-way areas. The 1993 and 2003 inventories covered an area encompassing approximately 41.26% of Missoula's public streets.

Effective management of the urban forest cannot be achieved when data is known from only a small portion of the City. Additionally, annexation and land acquisition continues to increase the total land area of Missoula, thereby extending the responsibility of the Urban Forestry Division to manage public trees. To this end, the Urban Forestry Division applied for and was awarded a DNRC Program Development Grant in 2012 to conduct an updated tree inventory. Grant funds had previously been awarded to purchase the tree management software TreeWorks, an ArcGIS extension developed by the Kenerson Group, and to convert the 2003 inventory database to the TreeWorks format. The Trees for Missoula (TFM) non-profit donated global positioning system (GPS) handheld equipment to record digital coordinates of each tree. Combined, these resources enabled an accurate and efficient accounting of the urban forest.

The 2013 census, the fourth citywide tree resource assessment, is a proactive approach to provide forestry staff and the public with current and complete information pertaining to the urban forest. This will assist in abating hazards to the public and to the city from a liability standpoint, while minimizing potential pest and disease risk to the forest resource. At multiple scales, (i.e., by tree, species, neighborhood, ward, and city), the tree inventory can suggest the value and role that Missoula's urban forest plays in its community. The 2013 tree census will improve the Urban Forestry Division's capacity to plan for and manage the future of Missoula's urban forest.

1.3 Census Objectives

Missoula's 2013 urban forest assessment is guided by the following goals:

1. Determine the extent of the public forest
2. Determine the age, diameter class, condition, and maintenance of the forest
3. Determine the areas in greatest need of maintenance
4. Anticipate where trees are nearing the end of their lifespan and will need to be replaced in the near future
5. Inform property owners and tax payers as to the economic, environmental, and personal benefits of trees

The Missoula tree census may serve as a model for other cities in Montana to follow in order to reach their own urban forestry goals.

1.4 Site Description

Situated in mountainous western Montana, Missoula County lies approximately 115 miles west of Helena, Montana's capital city. The county seat is the City of Missoula, located at an elevation of 3200 feet. Missoula is located on the banks of the Clark Fork and Bitterroot Rivers and at the convergence of five mountain ranges. The City has four distinct seasons with an average temperature of 44.6° Fahrenheit (ranging from an average of 22.8°F in January to 67.5°F in July) and 13.61 inches of precipitation (Western Regional Climate Center, 2012).

The 2012 USDA Plant Hardiness Zone map, which defines regions by annual average minimum temperatures that can support certain trees and plants, classifies Missoula within Zone 5b (USDA Agricultural Research Service, 2012). The City of Missoula follows planting guidelines for Zone 4a due to late and early freezes, and isolated extreme freezing events, which are not usually associated with Zone 5.

Over 68,000 individuals inhabit the City of Missoula, for a population density of 2,427.6 people per square mile (U.S. Census Bureau, 2010). The total land area of the City is approximately 27.51 square miles; public streets comprise 311.78 linear miles.

Missoulians have a long history of supporting trees as a functional resource and an integral part of what make Missoula a great place to live and work. Known as the "Garden City", Missoula received its name due to the abundant gardens and fruit trees planted near the turn of the last century. As Missoula was developed, fruit trees gave way to streets with residences and businesses. In the late 1890s to early 1900s, early settlers to Missoula paid to have trees moved across the continent from the East Coast via train and planted along the new city streets. In the present day, Missoula enjoys a legacy of iconic trees throughout many of its older neighborhoods, streets, parks, and trails. Norway maples (*Acer platanoides*) comprise an estimated 33.4% of this population. This even-aged monoculture has begun to decline due to natural senescence, periods of drought, and ongoing development in the City.

2. CENSUS METHOLODOLOGY

2.1 Preparation

Substantial planning and preparation was required to implement the tree inventory for the City of Missoula. Grant funding was secured from the DNRC in order to purchase the TreeWorks tree management software, translate the 2003 inventory database into this ArcGIS extension software, and fund two Research Specialists. Consultations with University of Montana faculty and DNRC staff were instrumental in the project's design.

City of Missoula Arborists identified inventory zones based on criteria including residential neighborhoods and population density. Boundary lines were delineated on a City map at major streets, intersections, and railroad tracks. Next, maps were compiled from GIS shapefiles downloaded from the City of Missoula's Geographic Information System (GIS) server. Inventory polygons were drawn in ArcGIS and used to chart completion progress throughout the duration of the project. At the outset, nine census zones radiating from the center of the City were created. Additional zones were identified as the census progressed – 42 zones were inventoried by three teams in 14 weeks.

The Trees for Missoula (TFM) non-profit was a key partner throughout the duration of the tree census project. TFM seeks to support and promote a healthy urban forest through advocacy, volunteerism, education, and outreach (TFM, 2013). Accordingly, TFM recruited volunteers to increase public awareness of the tree census objectives and the community forest. These volunteers were essential for providing matching funds for the DNRC grant. Volunteers participated in a training session prior to the commencement of the inventory. This training familiarized volunteers with informational resources that would accompany each census team for the purpose of educating the public.

TFM collaborated with Parks and Recreation to acquire one Trimble® GeoExplorer 6000 series handheld computer and three Trimble® Juno 5B series handheld computers for the community tree inventory. Each handheld computer was loaded with the mobile component of the TreeWorks and ArcPad programs. A half-day in the field was allocated for Urban Forestry staff to practice entering tree and management data into TreeWorks.

2.2 Inventory Protocols

The City street tree inventory was conducted for 14 weeks between June and September, 2013. All trees were inventoried in the public right-of-ways (ROW) within each of the 42 zones. ROWs were determined by referencing a City of Missoula-Sanitary and Storm Sewers map. This map was overlain on aerial images, allowing for the measurement of street widths and the differentiation between public and private trees. Park trees located along boulevards were included in the inventory; interior park trees will be inventoried at a later date.

Three census teams collected spatial and tree-specific data for inclusion in the City's tree inventory database, in addition to updating the information collected during the 2003 tree inventory. Each of the three teams was led by a City of Missoula Arborist – two of these were paired with a Research Specialist. The third Arborist was responsible for logging data as well as assessing each tree. TFM volunteers accompanied the inventory for half or full day shifts. Each team was equipped with a handheld computer, a Diameter at Breast Height (DBH) tape, and a folder of information compiled by TFM. A measuring wheel proved to be useful in zones absent of boulevards delineating ROWs.

In each zone, census teams walked the length of public streets. A U-shaped walking path ensured that trees on side streets were assessed. Upon locating a public tree, its latitude and longitude coordinates would be computed and recorded by global positioning satellites. To maximize precision, this required consideration of the number of visible satellites, satellite stability, and

Position Dilution of Precision (PDOP). A lower PDOP value indicated a more accurate GPS location based on satellite position – the goal was a PDOP value of three feet or less.

Arborists or volunteers measured the DBH of each tree; height, spread, and age were not assessed due to time constraints. Arborists then identified tree species, defects, condition, risk, maintenance tasks, and maintenance priorities. Research Specialists entered tree data and address-specific attributes (for example, lot location, utility concerns, irrigation systems) into the TreeWorks mobile interface. Where applicable, tree stumps in need of removal and potential planting sites were recorded. TFM volunteers engaged interested residents and business owners, provided information on the project, and assisted in data collection.

2.3 ArcGIS and TreeWorks Software Integration

The ArcGIS software suite enables data to be stored, queried, analyzed, manipulated, and visualized spatially. The tree inventory data is stored in a separate database managed by the TreeWorks system. Prior to each inventory session, data pertinent to specific zones were downloaded to the handhelds. TreeWorks enables this data to be synced to the master database. Data points were checked back in to the master TreeWorks database daily, and displayed on a map compiled from City of Missoula shapefiles. Research Specialists managed this database and the check-in/check-out process.

TreeWorks enables users to query and review any tree in the inventory database. This is particularly useful for public relations and responding to specific questions from citizen callers. TreeWorks can also generate summary statistics from the inventory data, query specific attributes (such as tasks and safety risks), create work orders, calculate tree appraisals, and expedite response to Citizen Service Requests (CSRs). In sum, this computerized system promotes work efficiency and reliability.

3. RESULTS

3.1 Census Summary

Between June and September 2013, the public tree inventory was conducted along approximately 74.23% of Missoula's city streets and boulevards (Figure 1). This inventory assessed 20,545 trees located in the City's right-of-way. The average condition for inventoried trees is between poor to fair condition (a rating of 64.61). The average DBH is 11.8 inches.

Volunteers from the Trees for Missoula (TFM) non-profit were a valuable resource for acquiring information on tree diameters, addresses, and other site-specific attributes. Volunteers also provided information to homeowners and passersby, thereby maintaining survey continuity. A total of 24 volunteers contributed over 600 hours toward the inventory and toward grant matching funds.

The ratio of the City's population to *inventoried* street trees is about 3:1. Citywide, the tree canopy is estimated to cover 9.6% of Missoula's total land area (Table 10).
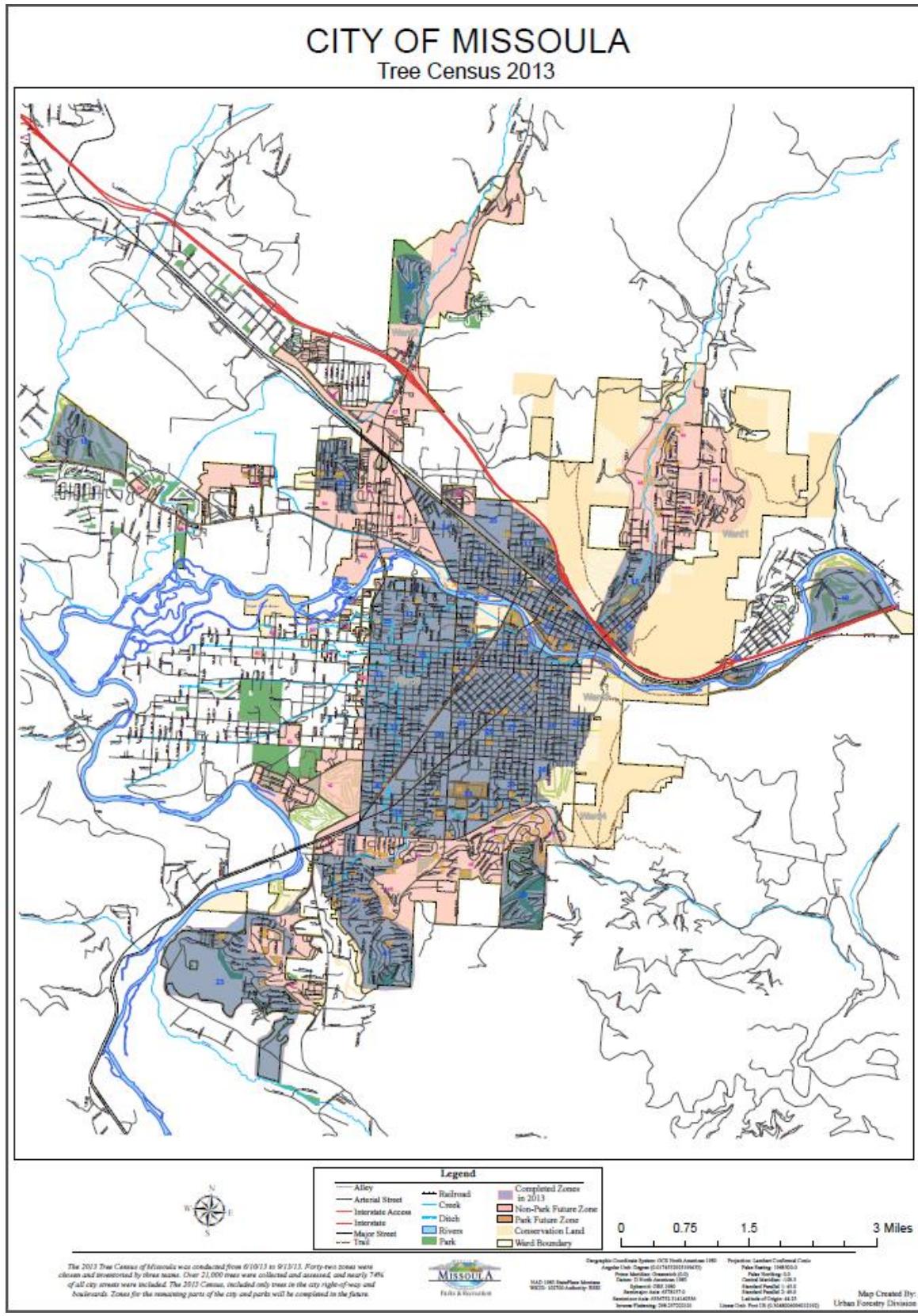
Figure 1: Area of 2013 Tree Census

3.1.1 Population Totals. The completed tree resource assessment included 20,545 public trees, 305 stumps, and 234 planting sites located within the city's ROW.

3.1.2 Species Composition and Diversity. Norway maples (*Acer platanoides*) accounted for 33.4% of the total street tree population (Figure 2, Table 1). This total includes the Crimson King, Schwedler, and Emerald Queen cultivars (numbers 14, 19, and 91 in the order of total abundance, Appendix A). Previous estimates, including the 2003 Missoula tree census, suggested this species comprised about 60% of the public tree resource. Relative composition has declined due to city annexation, new developments, an expanded tree census area, and tree removals commensurate with natural senescence.

Maple species, taken in whole, comprise 43.6% of the total inventoried tree population. Species of the ash (*Fraxinus*) genus cover 12.1% of Missoula's inventoried trees. Collectively, the maple and ash genus comprise 55.7% of the surveyed urban forest. The five most abundant species in Missoula (Figure 1), with respective cultivars included, make up 55.9% of Missoula's canopy. The remaining 44.1% of species in Missoula are fairly diverse – a goal of UF per Chapter 12.32 of Missoula's Municipal Code.

Clusters of monocultures exist in certain neighborhoods and zones (Appendix B, pg. 26). For example, 73.4% of Missoula's downtown trees are Honeylocusts (*Gleditsia triacanthos*). Similarly, the majority of ROW trees in the University District are Norway maples. Since biodiversity may lead to stability, monoculture neighborhoods should be monitored closely for disturbance.

Norway maple	30.7%
Green ash	7.7%
Siberian elm	5.2%
Honeylocust	4.4%
Red maple	3.5%
Others	48.5%
Total:	100.0%
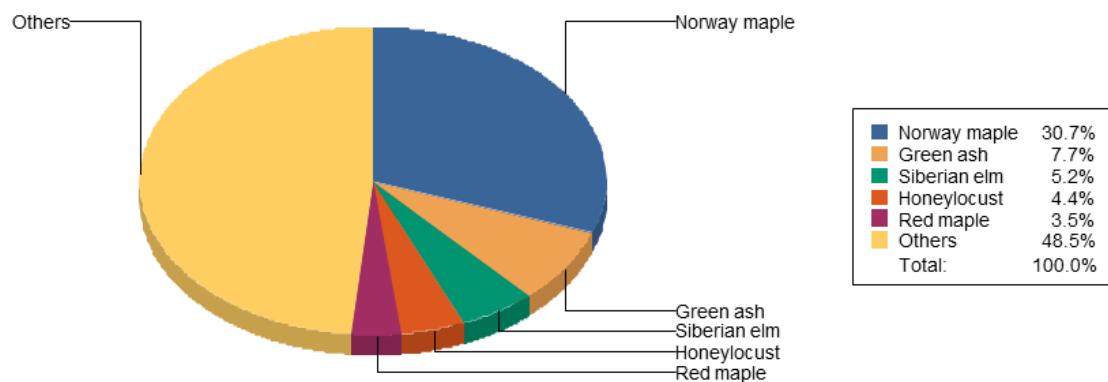
Figure 2: Population Distribution of Missoula's Most Abundant Tree Species

Table 1: Top 20 Tree Species in Missoula, including Cultivars, by Percent and Count

	Top 20 Species	
Species	**Percent**	**Count**
Norway maple	30.7%	6,304
Green ash	7.7%	1,573
Siberian elm	5.2%	1,070
Honeylocust	4.4%	901
Red maple	3.5%	729
Colorado blue spruce	3.2%	654
Crabapple species	2.6%	527
Quaking aspen	2.2%	450
American linden	2.0%	404
Spring Snow crabapple	1.8%	362
Boxelder maple	1.7%	357
Silver maple	1.6%	323
Canada Red chokecherry	1.5%	318
Crimson King Norway maple	1.5%	301
Littleleaf linden	1.5%	298
White ash	1.4%	288
Sugar maple	1.4%	281
Patmore Green ash	1.3%	274
Schwedler Norway maple	1.2%	240
Cherry species	1.1%	229
Others	22.7%	4,662
Total		**20,545**

3.1.3 DBH Size Class. The average DBH size class for all public trees inventoried in the City is 11.8 inches. Since DBH is a good indicator of age, the data indicate that there is a lack of diversity in both age and size of Missoula's urban forest. The majority of trees are 12 inches or under; few are over 30 inches, which is considered a large tree for Missoula.

Clusters of even-aged trees are particularly salient in areas such as the University District and new developments (Appendix B, pg. 27 & 28). An ideal forest structure would contain trees evenly distributed across all size classes. Similar to species diversity, age diversity is important because it promotes forest stand stability, resistance to disturbance (such as irruptive pest outbreaks, disease, and climatic variability), and resilience after a disturbance. This diversity reduces the likelihood of losing an even-aged cohort in a short time period.
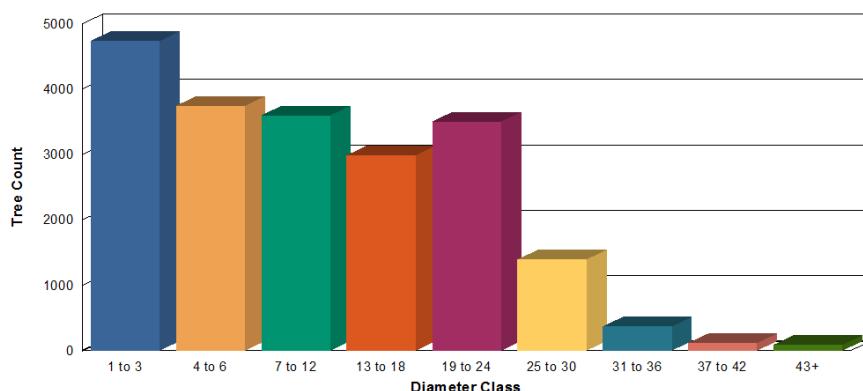
Figure 3: Diameter at Breast Height (DBH) Distribution of Inventoried Trees

Table 2: Distribution of Diameter Classes by Percent and Count

Diameter Class	Percent	Count
1 to 3 in.	23.1%	4,737
4 to 6 in.	18.2%	3,746
7 to 12 in.	17.5%	3,600
13 to 18 in.	14.5%	2,989
19 to 24 in.	17.1%	3,504
25 to 30 in.	6.8%	1,395
31 to 36 in.	1.8%	370
37 to 42 in.	0.6%	115
43+ in.	0.4%	89
Total		20,545

3.1.4 Tree Condition Ratings. Trees were assigned a condition rating from 0 (dead) – 100% (excellent). These conditions were defined as follows:

- Excellent (90+): Tree structure is appropriate to species type and physiology, with few if any structural defects.
- Good (80-89): Few structural defects, not topped, no dieback, and minimal deadwood. Structural defects, i.e. deadwood, can be solved through pruning.
- Fair (70-79): Tree is in accordance with natural senescence, not topped, and may have some structural defects that may not be fixable through pruning.
- Poor (50-69): Tree has had numerous structural or cultural defects – pruning will not improve the condition rating. Tree is topped, with minor dieback at 30-50%.
- Very poor (30-49): Tree has major dieback, multiple hazards, and is less than 50% alive. Very poor trees tend to be removals or approaching removal territory.
- Dead (0-29): 10% or less live woody tissue. Tree should be removed.

The average condition of trees in this inventory is 64.6 (Appendix B, pg. 29 & 30). This corresponds with a fair to poor rating, yet is much closer fair. In general, trees with a smaller DBH have a better average condition, since any structural defects they may have can be abated with pruning. Tree training, proper care, and maintenance are key to a healthy future.

Excellent	2.6%
Good	28.2%
Fair	37.5%
Poor	21.5%
Very Poor	9.0%
Dead	1.2%
Total:	100.0%
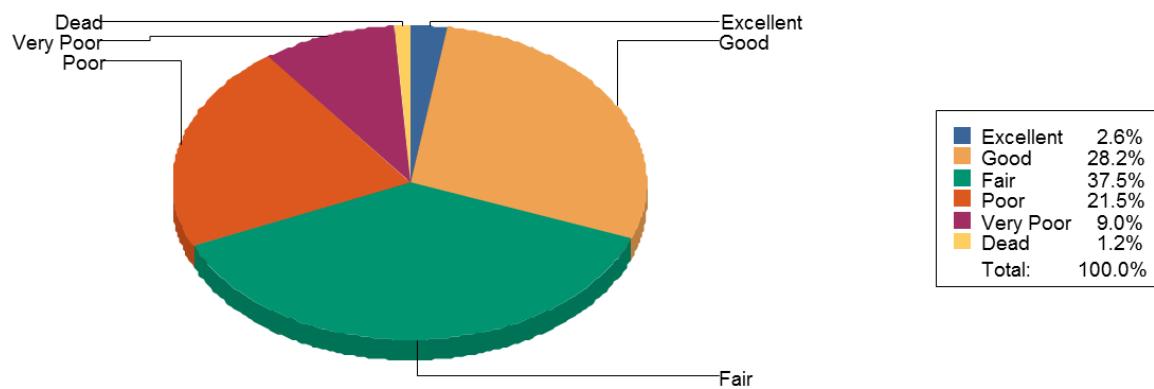
Figure 4: Condition Distribution of Inventoried Trees

Table 3: Condition Distribution by Percent and Count

Condition	Percent	Count
Excellent	2.6%	536
Good	28.2%	5,788
Fair	37.5%	7,697
Poor	21.5%	4,426
Very Poor	9.0%	1,855
Dead	1.2%	243
Total		**20,545**

3.1.5 Tree Risk Distribution. Tree risk is defined as the likelihood of failure of a whole tree or its parts. Tree failure can result from broken stems, limbs, or a loss of support from root systems (Tree Care Industry Association, Inc., 2011). A risk assessment was performed on each tree in this inventory. It is important to note that a hazard rating does not affect a tree's condition rating.

94.6% of Missoula's inventoried public trees have very low risk. This vast majority poses minimal hazard to people or property. For trees that have low risk to whole or part, pruning of hangers or removal of dead limbs may easily reduce the risk rating. Trees that have moderate, high, or extreme risk have been placed on a priority list for maintenance or removal by either City of Missoula Arborists or private contractors.

Very Low	94.6%
Tree - Low	2.2%
Part - Low	2.1%
Part - Moderate	0.6%
Tree - Moderate	0.2%
Part - High	0.1%
Tree - High	0.1%
Yes	0.0%
Part - Extreme	0.0%
Total:	100.0%
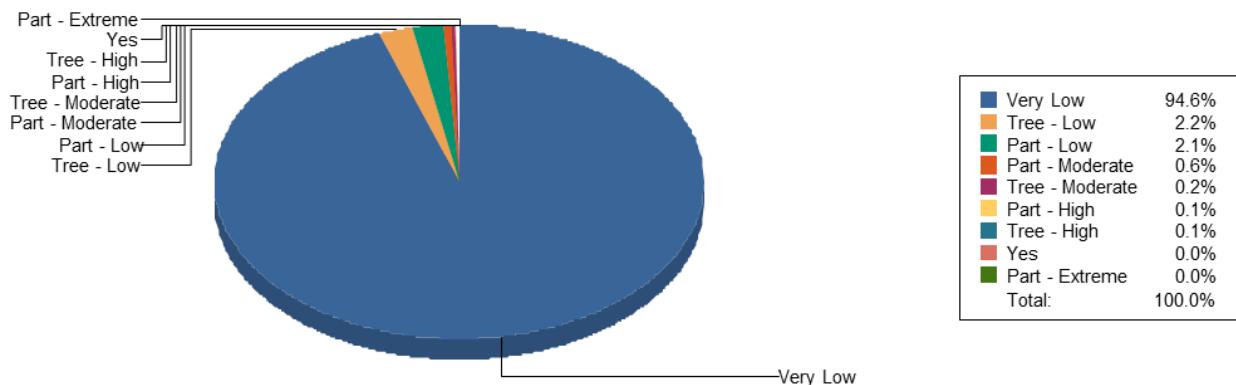
Figure 5: Tree Risk Distribution

Table 4: Tree Risk Distribution by Percent and Count

Tree Risk	Percent	Count
Very Low	94.6%	19,439
Tree - Low	2.2%	460
Part - Low	2.1%	435
Part - Moderate	0.6%	117
Tree - Moderate	0.2%	48
Part - High	0.1%	22
Tree - High	0.1%	17
Yes	0.0%	5
Part - Extreme	0.0%	2
Total		**20,545**

3.1.6 Biotic Defects. Tree defects are categorized as originating from either a biotic, structural, or cultural source. Multiple trees in this inventory have more than one defect, which in turn determines condition rating. Trees in excellent condition are generally devoid of defects.

The presence and visible effects of insects accounted for 71.6% of the top 5 identified biotic defects (this list includes aphids, poplar borer, and insect families defined by their practice of eating the leaves they roll around themselves for protection). This baseline data can be used to monitor changes in the composition, abundance, and effects of insect populations over time. This is important because severe pest outbreaks have the potential to lead to defoliation, branch dieback, and tree stress. Stressed trees may be more susceptible to attack by other pests and disease. Monitoring is particularly important in anticipation of the spread of highly destructive pests such as the Emerald Ash Borer beetle, which has yet to reach Montana's borders.

Wildlife damage was detected on 11.8% of inventoried trees. Herbivory and damage to tree bark by ungulates accounted for much of this damage. Damage from squirrels was identified by flattened tree limbs due to the stripping of bark to get to the vascular cambium for sustenance. Beaver damage was the third most common defect attributed to wildlife.

Iron chlorosis is associated with 6.6% of Missoula's inventoried trees. A chlorotic tree is unable to uptake nutrients, in part attributed to factors such as salt damage, soil pH, and soil compaction. This nutrient deficiency results in the yellowing of leaves due to a lack of chlorophyll. In more severe cases, leaf edges may scorch and turn brown. Chlorosis reduces health and condition, and may eventually cause individual limbs or trees to perish.

Aphids	66.9%
Wildlife Damage	11.8%
Iron Chlorosis	6.6%
Poplar Borer	2.9%
Leaf Rollers	1.8%
Others	10.0%
Total:	100.0%
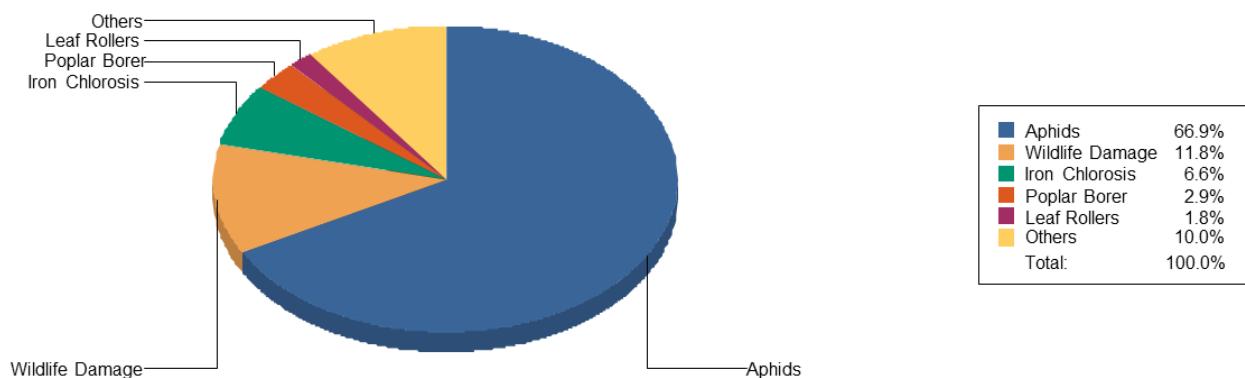
Figure 6: Biotic Defect Distribution of Inventoried Trees

Table 5: Biotic Defect Detail by Percent and Count

Defect	Percent	Count
Aphids	66.9%	1,873
Wildlife Damage	11.8%	330
Iron Chlorosis	6.6%	185
Poplar Borer	2.9%	82
Leaf Rollers	1.8%	50
Slime Flux	1.6%	45
Borer	1.3%	35
Fireblight	1.2%	34
Scale	1.2%	34
Ants	1.1%	32
Cytospora Canker	0.6%	18
Cedar Apple Rust	0.5%	15
Bronze Birch Borer	0.5%	14
Canker	0.5%	13
Conk/Fungus Fruit	0.4%	12
Leaf Miners	0.3%	7
Sooty Mold	0.3%	7
Beetles	0.1%	4
Armillaria	0.1%	2
Gypsy Moth	0.1%	2
Others	0.2%	5
Total		**2,799**

3.1.7 Structural Defects. Structural defects describe features or deformities in either a whole tree or its parts that may result in weak structure. In more severe cases, structural defects can lead to tree failure (Tree Care Industry Association, Inc., 2011).

Deadwood describes naturally occurring death of tissue dispersed evenly throughout a tree (23.8%, Figure 7, Table 6). Minor dieback is deadwood in a concentrated area, which usually leads back to one larger parent stem (10.0%). Major dieback describes this occurrence in multiple concentrated areas and multiple parent stems (7.8%).

Trunk scars describe lesions in the tree's bark layer which expose living tissue and create an opening for pathogens. In Missoula, trunk scars most commonly originate from damage caused by storms, ungulates, and vehicles. Branch architecture becomes a defect when the tree has not received crown training for proper growth. Visible indicators include fused and crossing branches as well as sucker growth.
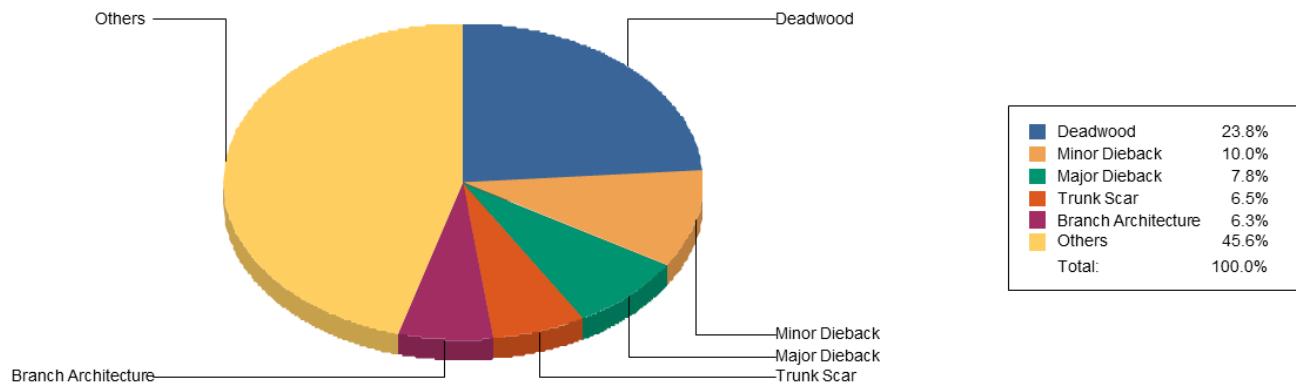
Figure 7: Structural Defect Distribution of Inventoried Trees

Table 6: Structural Defect Detail by Percent and Count

Defect	Percent	Count
Deadwood	23.8%	5,656
Minor Dieback	10.0%	2,372
Major Dieback	7.8%	1,855
Trunk Scar	6.5%	1,533
Branch Architecture	6.3%	1,501
Co-dominant Stems	6.3%	1,490
Included Bark	5.4%	1,285
Branch Cavity	4.8%	1,129
Frost Crack	3.7%	875
Trunk Decay	3.2%	748
Trunk Cavity	2.6%	625
Storm Damage	2.2%	512
Sucker Growth	1.9%	452
Declining	1.7%	392
Dead Top	1.6%	380
Multi-limb Decay	1.3%	316
Branch Decay	1.3%	309
Branch Scar	1.1%	267
Sunscald	0.9%	217
Co-dominant Trunk	0.8%	182
Others	6.9%	1,634
Total		**23,730**

3.1.8 Cultural Defects. In this tree inventory, cultural defects describe misguided attempts to plant trees or provide tree care. Topping and improper pruning account for 30.2% and 10.1% of the top five cultural defects. A topped tree has been disfigured due to the cutting back of its crown to a stub or non-lateral branch. This method has been practiced based on the conception that topping will promote growth and prevent tree danger by reducing height. In reality, topping results in a hazardous tree with splayed growth. UF created an "anti-topping" program in the early 1990s to increase public education and discourage further use of this method.

Improper pruning includes the practice of topping trees. In this inventory, improper prunes also describe flush cuts and cuts leaving behind stubs. A proper cut should follow the branch collar, without cutting into this tissue between the main stem and the branch.

Planting defects were also prevalent in this inventory. Trees planted too close (10.7%) could in part be described by "volunteer sprouts", or seedlings sprouting near the parent tree. Otherwise, this defect describes inadequate spacing for intentional plantings. Under current municipal codes, a small tree requires a boulevard width of three feet and spacing of at least 20 feet between trees. For medium trees, boulevard widths should be seven feet or wider with 30 foot spacing. Large trees require boulevard widths of at least 10 feet with 40 foot spacing between trees. A tree planted too deep lacks an exposed root collar, which suffocates the roots.

The fifth most common cultural defect is a lack of water stress, which results in leaf scorch. Drought stress is a common issue in Missoula.

Topped	30.2%	
Planted too Close	10.7%	
Improperly Pruned	10.1%	
Planted too Deep	9.3%	
Lack of Water Stress	7.6%	
Others	32.1%	
Total:	100.0%	
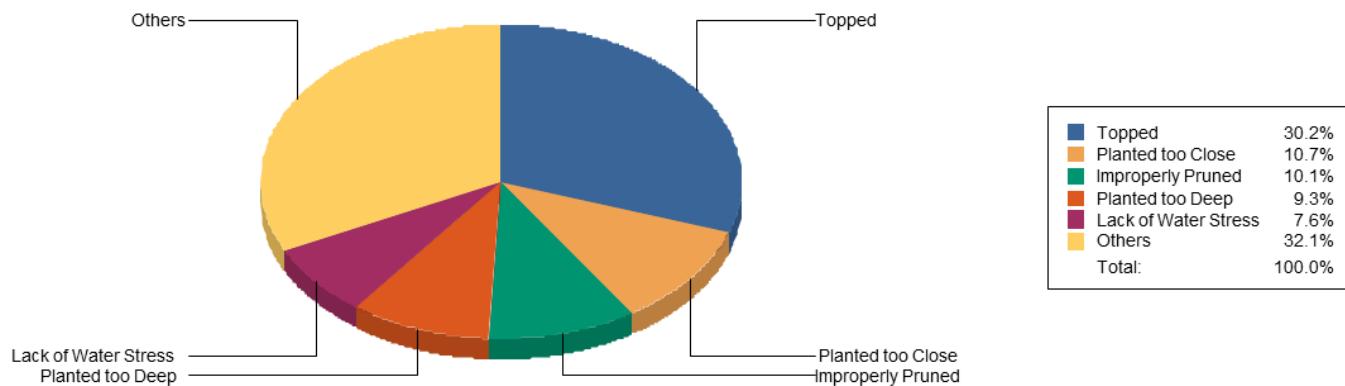
Figure 8: Cultural Defect Distribution of Inventoried Trees

Table 7: Cultural Defect Detail by Percent and Count

Defect	Percent	Count
Topped	30.2%	2,102
Planted too Close	10.7%	745
Improperly Pruned	10.1%	705
Planted too Deep	9.3%	649
Lack of Water Stress	7.6%	532
Mower/Trimmer	6.4%	446
Improper Location	5.2%	360
Foreign Object	4.9%	343
Construction Damage	3.5%	241
Heat Stress	2.8%	194
Pruning Stub	2.2%	152
Lion's Tailed	1.2%	85
Sidewalk Damage	1.1%	77
Swing in Tree	0.8%	54
Salt Damage	0.7%	49
Line of Sight	0.5%	35
Hit by Vehicle	0.5%	34
Pesticide Damage	0.5%	32
Compacted Soil	0.4%	29
Grade Filled > 2 in.	0.3%	23
Others	1.2%	83
Total		**6,970**

3.1.9 Maintenance Tasks. 73.9% of Missoula's inventoried public trees are in need of pruning. Pruning tasks were differentiated as crown cleaning, crown training, and crown raising (Appendix B, pg. 31). Crown cleaning improves the health and lifespan of trees by removing deadwood, dieback and other structural defects. Crown training of small, young trees removes potential structural risk and promotes healthy growth. Crown raising entails removing lower limbs for building clearance or line of sight obstructions.

The 18.6% of trees that did not require maintenance were either too small to prune, were in fair to excellent condition, or conversely had declined past the point of intervention and would soon become removals. Tree removals and stumps removals comprised 5.5% and 1.3% of the inventoried population, respectively. Replanting of trees does not necessarily follow tree or stump removal, as planting is contingent in part on supply, homeowner preference, available growing space, and utility and/or line of sight conflicts.

In Table 8, the "enlarge" task refers to the need to modify tree grates so as to accommodate the diameter of the planted tree.
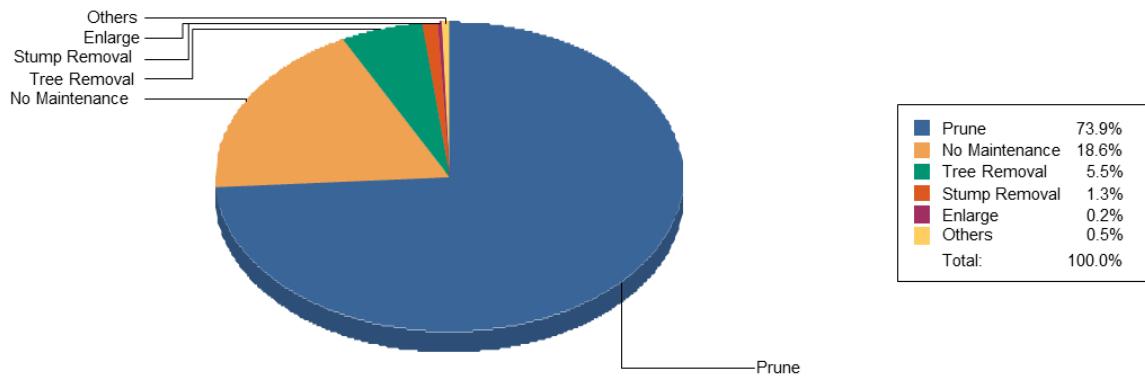
Figure 9: Distribution of Maintenance Tasks Required for Inventoried Trees

Table 8: Distribution of Required Maintenance Tasks by Count and Percent

Task	Count	Percent
Prune	16,884	73.9%
No Maintenance	4,253	18.6%
Tree Removal	1,248	5.5%
Stump Removal	305	1.3%
Enlarge	49	0.2%
Water	32	0.1%
Plant	27	0.1%
Remove Hardware	26	0.1%
Assess	23	0.1%
Level	5	0.0%
Install	3	0.0%
Replace	3	0.0%
Treat	1	0.0%
Total	**22,859**	

3.1.10 Value/appraisals: TreeWorks applies the following equation to each tree to appraise the overall value of Missoula's urban forest:

Species Rating
(as decimal value between 0-1)
X
Condition Value
(as decimal value between 0-1)
X
Location Rating
(as decimal value between 0-1)
X
{([Trunk Area – Replacement Trunk Area] x Tree Cost per Inch) + Replacement Cost}
&
Trees > 30" DBH will Appreciate at a Lesser Rate
Trunk Area = πr^2
Replacement Trunk Area = πr^2 where r = 1.5
Tree Cost per Inch = $72 for Coniferous; $60 for Deciduous
Replacement Cost = $480

Figure 10: TreeWorks Formula for Calculating Appraisal Values of Missoula's Urban Forest

A limitation of this appraisal applies to the location rating variable. In this census, a constant value of 75% was maintained for each tree, which was the pre-specified default. Since this rating was not customized, the appraisal values are likely an overestimation of the true value of the inventoried urban forest (Appendix B, pg. 32 & 33).

Most of UF's resources are allocated toward pruning hazards and reducing liability of older trees. These trees tend to be in poor condition with unfixable defects. Small tree training, on the other hand, can fix structural defects and maintain the good health of these trees as they age. By improving tree condition, appraisal values are raised, therefore increasing the overall value of the urban forest.

Table 9: Appraised Values of Missoula's Urban Forest

Total Number of Trees in Report:	20,545
Total Appraised Value:	$70,730,720
Total Mean Appraised Value:	$3,443
Median Appraised Value:	$1,220
Minimum Appraised Value:	$0
Maximum Appraised Value:	$52,000
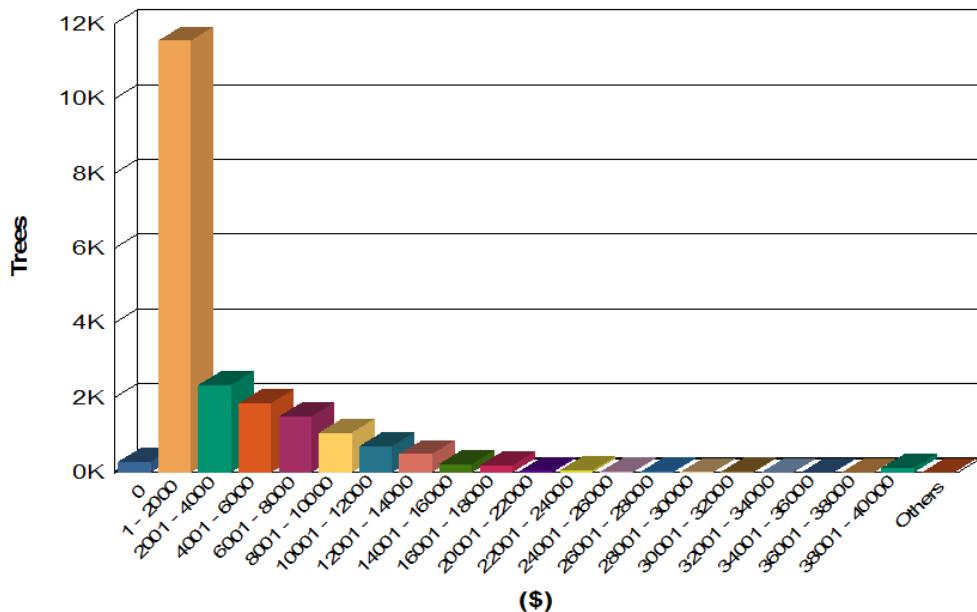
Figure 11: Distribution of Appraised Values for Missoula's Urban Forest

3.2 i-Tree Studies

As the City of Missoula continues to experience human population growth and development, the community forest's extent and structure similarly will be affected. Using i-Tree Canopy and i-Tree Streets, analyses were performed to assess current canopy cover and quantify benefits that trees bring to the City. i-Tree is a public domain software suite developed by the U.S. Forest

Service that offers tools for assessing, analyzing, and strengthening management of urban forests (www.itreetools.org). Baseline results could be used to plan for future management, to identify trends as development progresses, and to communicate the value of the urban forest to the public.

3.2.1 i-Tree Canopy

Urban Canopy Cover (UTC) refers to the area covered by leaves, branches, and tree stems when viewed from aerial photographs, satellite imagery, or ground sampling. i-Tree Canopy was used to evaluate existing canopy cover throughout Missoula city limits. This free photographic interpretation tool generates random points onto Google Maps ™ images. Each point is then classified by the user into a pre-specified cover class. i-Tree processes each pixel of the aerial photograph and categorizes the pixel based on the classification of each point to generate overall cover results. These results can be used to benchmark loss or gain of canopy cover, and to determine tree planting objectives.

In this analysis, 1000 points were randomly generated within the City of Missoula, an area spanning 27.51 mi^2. Public and private trees were not differentiated. In Table 10, *non-tree vegetation* includes shrubs, herbaceous vegetation, and grasslands. *Bare soil* is used to describe pervious sites such as gravel and construction sites with exposed soil. Points classified as *impervious other* include those landing on tennis courts and track fields.

Table 10: Estimated Percent Cover and Land Area of Cover Classes in Missoula

Cover Class	% Cover (± SE*)	Land Cover** (mi^2 ± SE)
Tree	9.60 ±0.93	2.79 ±0.27
Non-tree vegetation	37.8 ±1.53	11.0 ±0.45
Turf grass	19.0 ±1.24	5.52 ±0.36
Bare Soil	6.80 ±0.80	1.97 ±0.23
Water	1.10 ±0.33	0.32 ±0.10
Impervious road	16.7 ±1.18	4.85 ±0.34
Impervious building	8.80 ±0.90	2.56 ±0.26
Impervious other	0.20 ±0.14	0.06 ±0.04
* SE = standard error, or statistical estimate of uncertainty **Total land area of the City of Missoula = 27.51 mi^2		

3.2.2 i-Tree Streets

i-Tree Streets was used to assess and quantify annual environmental benefits of Missoula's urban forest. The model considers annual expenditures in order to estimate net benefits provided by the public tree resource.

i-Tree Streets allows the user to customize specific data fields based on the desired analyses. Species, DBH, land use, and utility data from the 2013 inventory were imported into the i-Tree Streets program. For the City of Missoula, specifications were entered as to the total municipal budget, population, total land area, total linear miles of streets, average sidewalk width, and average street width. The annual budget for the Urban Forestry Division was delineated into expenditures for planting, pruning, tree and stump removal, irrigation, program administration, CSRs, and other costs.

Estimated annual benefits of Missoula's inventoried street trees are reported in terms of energy, stormwater, air quality, carbon dioxide, aesthetic values, and replacement values. Summary reports can be found in Appendix C.

4. URBAN FORESTRY MANAGEMENT RECOMMENDATIONS AND STRATEGIES

The 2013 street tree inventory enables an understanding of the current condition of Missoula's dynamic urban forest. The baseline data generated from this census can be used to forecast trends, anticipate maintenance needs, develop planting decisions, and create budgets. The intent is to help inform the UF plan as to what is needed for the long-term sustainability, protection, restoration, and management of the tree resource, thereby ensuring its longevity for future generations.

One of the most immediate benefits from this inventory is that 118 priority tree removals were identified. Those posing high risk from whole or part were also flagged. These trees have already been placed on a contract list and will be removed from the population shortly. The tree census expedited this process, alerting UF of risk sooner than likely would have been noticed and reported otherwise. Public safety is a leading priority for Missoula Parks and Recreation and indeed, any public agency. The tree inventory has and can continue to reduce potential risks to citizens, private property, public property, and right-of-ways.

In addition to risk reduction, the tree inventory can be used to increase efficiency and effective allocation of resources. For example, maintenance assessments were made for each tree in the inventory. Each task received a priority rating, on a five-level scale from routine to low, medium, high priority or immediate action. The TreeWorks database can be used to determine and schedule where priority maintenance is required. Similarly, the database can be used to cross-reference service requests from citizens, therefore limiting driving mileage and staff time for evaluating each request.

The 2013 tree census helped to identify several trends and subsequently shape the following recommendations:

> ➤ *Continue to allocate resources toward the Missoula tree inventory.* Missoula's urban forest is not static, and neither should be its public tree inventory. At present, the tree inventory covers an area equivalent to about 74.23% of Missoula's public streets. Additional zones have been identified and delineated in ArcGIS that would bring the inventory total closer to 100%. These areas include park interiors, less populated residential districts, and industrial zones with few trees. Continuous assessment and

completion of inventory zones could occur over the course of several years, even if only a few hours were dedicated each month. Each time any maintenance task or tree planting is completed, the database should be updated to reflect these changes.

➢ *Reduce lag time between public tree inventories.* Tree inventories in Missoula have been conducted in 1973, 1993, 2003, and 2013. The current inventory represents the most complete assessment yet of the urban forest. However, even with the TreeWorks resource, this inventory will not provide a true reflection of the state of the urban forest in a decade – the inventory lag time for the last 20 years. City annexation, urban development, planting/pruning actions by citizens, insect infestations, volunteer tree sprouts, and a changing climate are among many factors that will continue to affect the structure and stability of the urban forest. A lag period of 10 years between complete tree assessments is not sufficient to keep pace with the complex forest and its inter-relations with public infrastructure, people, and environment.

➢ *Increase pruning cycle to every 5-7 years.* With three Certified Arborists on staff at the City of Missoula's UF Division, the current pruning cycle is estimated to be about every 47 years. Charged with maintaining over 20,500 street trees and 5,500 park trees, this inevitably leads to a reactive approach focused on reducing hazards and risk. An increased capacity for preventative maintenance would reduce storm damage risks from wind, heavy wet snow, and hanging limbs. It could also reduce risk from non-storm emergencies, such as conflicts with overhead and underground utilities, line of sight obstructions for signage and traffic lights, heaved sidewalks, and building clearance. Life expectancy and maintenance needs vary between species, with management ultimately affecting stability. Increased monetary and human resources could help improve and perpetuate the health, longevity, and aesthetics of Missoula's urban forest.

➢ *Dedicate an UF crew to small tree training*. The 2013 tree inventory revealed that Missoula Municipal Code 12.32 is not being adhered to in terms of new planting sites. That is, newly planted trees are not being pruned for structure as they should. When the tree is small, Certified Arborists are able to make structural pruning cuts that improve the health of the tree as well as overall structural strength. Defects can be removed that would otherwise create unfixable hazards as the tree ages. The benefits are immediate and cost less the sooner action is taken.

➢ *Increase species diversity and age.* Species in the maple and ash genus currently represent 55.7% of Missoula's urban forest. A stable and diverse tree population on the whole is better equipped to be resistant and resilient to biological pressures, such as insect and disease threats. As the aging tree population in Missoula is removed, it should be replaced with a population diverse in both species and age. Replacement of boulevard trees adjacent to private properties is already a priority for Urban Forestry, as these trees improve property values and aesthetics while reducing energy consumption. Missoula Municipal Code 12.32 states that 10-15% tree diversity needs to be maintained. UF and City Development Services, in particular, should improve communication regarding species and age class diversity of tree plantings in subdivisions as well as planting specifications, such as proper planting depth (ANSI z.133 Planting Specifications).

> *Increase public support and encourage participatory planning.* The TFM non-profit and Missoula Parks and Recreation collaborated successfully to plan and implement the tree inventory. TFM is guided in part by a mission to use education and outreach to garner support and donations on behalf of Missoula's urban forest. Further support for mutual objectives could be raised through the dissemination of summary data and GIS maps from this tree inventory. This could be accomplished through press releases, public presentations, and information pages on the TFM website. Further, as census data is used to create a plan for the future of the urban forest, Missoula citizens could be encouraged to submit public comment. A public attitudes survey toward the forest could also be administered, including the collection of "visions" that residents may have for its future. The hope is that the publicity generated from the 2013 census will increase membership for TFM, and therefore support of the community tree resource.

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Appendix A: Species Detail Distribution

Species Detail

Report universe: All ☒   Subset ☐

Rank	Percent	Common Name	Botanic Name	Average Condition	Diameter	Tree Count
1	30.7%	maple, norway	acer platanoides	59	18	6,304
2	7.7%	ash, green	fraxinus pennsylvanica	66	6	1,573
3	5.2%	elm, siberian	ulmus pumila	59	18	1,070
4	4.4%	honeylocust	gleditsia triacanthos	72	7	901
5	3.5%	maple, red	acer rubrum	68	4	729
6	3.2%	spruce, colorado	picea pungens	71	12	654
7	2.6%	crabapple species	malus species	71	5	527
8	2.2%	aspen, quaking	populus tremuloides	62	7	450
9	2.0%	linden, american	tilia americana	71	7	404
10	1.8%	crabapple spring snow	malus species spring snow	74	5	362
11	1.7%	maple, boxelder	acer negundo	51	19	357
12	1.6%	maple, silver	acer saccharinum	55	23	323
13	1.5%	chokecherry, common canada red	prunus virginiana canada red	75	4	318
14	1.5%	maple, norway crimson king	acer platanoides crimson kng	69	5	301
15	1.5%	linden, littleleaf	tilia cordata	68	6	298
16	1.4%	ash, white	fraxinus americana	72	5	288
17	1.4%	maple, sugar	acer saccharum	64	16	281
18	1.3%	ash, green patmore	fraxinus pennsylvanica patmr	68	6	274
19	1.2%	maple, norway schwedler	acer platanoides schwedler	66	13	240
20	1.1%	cherry	prunus cerasus	69	5	229
21	1.1%	maple, freeman	acer freemanii	67	5	219
22	1.0%	pine, ponderosa	pinus ponderosa	79	12	209
23	1.0%	oak, bur	quercus macrocarpa	76	5	205
24	1.0%	apple	malus species apple	74	7	196
25	0.9%	ash, white autumn purple	fraxinus americana autmn prp	74	5	181
26	0.9%	douglas fir	pseudotsuga menziesii	74	17	178
27	0.8%	plum species	prunus species	71	6	165
28	0.7%	hawthorn	crataegus species	68	5	154
29	0.7%	pine, austrian	pinus nigra	73	14	153
30	0.6%	mountain ash, american	sorbus americana	64	11	129
31	0.6%	mountainash, showy	sorbus decora	69	11	127
32	0.6%	locust, black	robinia pseudoacacia	60	23	122
33	0.5%	poplar, lombardy	populus nigra	59	17	108
34	0.5%	hackberry, common	celtis occidentalis	64	3	104
35	0.5%	horsechestnut	aesculus hippocastanum	69	13	94
36	0.4%	spruce, engelmann	picea engelmannii	66	14	91
37	0.4%	pine, scotch	pinus sylvestris	74	11	90
38	0.4%	ash species	fraxinus species	59	6	89

9/30/2013   cityofmissoula   Page 1 of 4

Appendix F pg 28

Rank	Percent	Common Name	Botanic Name	Average Condition	Diameter	Tree Count
39	0.4%	lilac, japanese tree	syringa reticulata	62	3	85
40	0.4%	maple, tatarian	acer tataricum	70	4	85
41	0.4%	oak, swamp white	quercus bicolor	71	3	83
42	0.4%	pear	pyrus species	75	5	78
43	0.4%	siouxland poplar	deltoides siouxland	66	12	77
44	0.4%	cottonwood, black	populus trichocarpa	53	26	74
45	0.3%	northern red oak	quercus rubra	70	4	62
46	0.3%	arborvitae, eastern	thuja occidentalis	76	8	60
47	0.3%	ash, black	fraxinus nigra	29	3	59
48	0.3%	birch, european white	betula pendula	61	12	56
49	0.3%	birch, paper	betula papyrifera	69	9	54
50	0.3%	unknown	unknown	59	6	54
51	0.3%	chokecherry, common shubert	prunus virginiana shubert	71	7	53
52	0.3%	juniper	juniperus species	72	9	53
53	0.2%	apricot	prunus armeniaca	71	7	47
54	0.2%	pine, mugo	pinus mugo	70	14	47
55	0.2%	serviceberry, canadian	amelanchier canadensis	68	3	45
56	0.2%	kentucky coffeetree	gymnocladus dioicus	74	4	36
57	0.2%	birch, river	betula nigra heritage	72	4	34
58	0.2%	spruce species	picea species	69	13	32
59	0.2%	larch, western	larix occidentalis	74	7	31
60	0.1%	mountain ash, european	sorbus aucuparia	59	11	29
61	0.1%	elm, american	ulmus americana	70	5	28
62	0.1%	walnut, black	juglans nigra	63	11	27
63	0.1%	peach	prunus persica	73	3	26
64	0.1%	maple, red autumn blaze	acer rubrum autumn blaze	68	3	24
65	0.1%	elm species	ulmus species	66	3	23
66	0.1%	honeylocust shademaster	gleditsia triacanthos shadem	70	4	23
67	0.1%	maple species	acer species	57	2	23
68	0.1%	willow	salix species	54	21	22
69	0.1%	willow, golden	salix alba	56	25	22
70	0.1%	pine, lodgepole	pinus contorta	75	6	21
71	0.1%	cedar, western red	thuja plicata	61	16	20
72	0.1%	oak species	quercus species	58	5	20
73	0.1%	olive, russian	elaeagnus angustifolia	73	10	20
74	0.1%	pear, ussurian	pyrus ussuriensis	70	4	20
75	0.1%	linden, littleleaf greenspire	tilia cordata greenspire	74	2	19
76	0.1%	maple, sugar green mountain	acer saccharum green mountn	71	8	18
77	0.1%	serviceberry, downy	amelanchier arborea	67	3	17
78	0.1%	maple, amur	acer ginnala	71	5	16
79	0.1%	mountain ash, oak leaf	sorbus quercifolia	81	3	16
80	0.1%	oak, english	quercus robur	69	6	16
81	0.1%	spruce, norway	picea abies	76	16	16
82	0.1%	ash, white autumn blaze	fraxinus americana autmn blz	75	9	15
83	0.1%	aspen, bigtooth	populus grandidentata	53	4	14

Rank	Percent	Common Name	Botanic Name	Average Condition	Diameter	Tree Count
84	0.1%	catalpa, northern	catalpa speciosa	74	4	13
85	0.1%	oak, pin	quercus palustris	58	3	13
86	0.1%	hornbeam species	carpinus species	61	5	12
87	0.1%	london planetree	platanus acerifolia	58	2	12
88	0.1%	buckeye, ohio	aesculus glabra	80	3	11
89	0.1%	plum, cherry thundercloud	prunus cerasifera thundercld	70	2	11
90	0.0%	fir, subalpine	abies lasiocarpa	78	11	10
91	0.0%	maple, norway emerald queen	acer platanoides emrld queen	67	5	10
92	0.0%	oak, scarlet	quercus coccinea	71	17	10
93	0.0%	pear, flowering chanticlear	pyrus calleryana chanticlear	73	2	10
94	0.0%	poplar, white	populus alba	60	19	10
95	0.0%	bristlecone pine	aristata	77	4	9
96	0.0%	crabapple prairie fire	malus species prairie fire	71	2	9
97	0.0%	ginkgo	gingko biloba	72	2	9
98	0.0%	juniper, common	juniperus communis	70	16	8
99	0.0%	lilac, japanese tree ivory silk	syringa reticulata ivry silk	66	2	8
100	0.0%	cottonwood, eastern	populus deltoides	34	20	7
101	0.0%	fir species	abies species	83	11	7
102	0.0%	redbud, eastern	cercis canadensis	70	2	7
103	0.0%	ash, european	fraxinus excelsior	73	1	6
104	0.0%	chokecherry, amur	prunus maacki	70	3	6
105	0.0%	crabapple thunderchild	malus species thunderchild	73	6	6
106	0.0%	fir, white	abies concolor	87	7	6
107	0.0%	linden, american redmond	tilia americana redmond	60	9	6
108	0.0%	oak, white	quercus alba	60	6	6
109	0.0%	pine, limber	pinus flexilis	73	14	6
110	0.0%	ash, green marshall seedless	fraxinus pennsylvanica marsh	46	21	5
111	0.0%	dogwood	cornus species	82	2	5
112	0.0%	juniper, rocky mountain	juniperus scopulorum	80	19	5
113	0.0%	lilac	syringa species	76	19	5
114	0.0%	maple, japanese	acer palmatum	78	1	5
115	0.0%	sumac	rhus species	76	7	5
116	0.0%	tuliptree	liriodendron tulipifera	86	2	5
117	0.0%	willow, weeping	salix babylonica	50	14	5
118	0.0%	beech, american	fagus grandifolia	80	5	4
119	0.0%	fir, grand	abies grandis	78	12	4
120	0.0%	maple, sycamore	acer pseudoplatanus	58	18	4
121	0.0%	oak, northern pin	quercus ellipsoides	75	16	4
122	0.0%	sweetgum, american	liquidambar styraciflua	73	2	4
123	0.0%	ash, white royal purple	fraxinus americana royal prp	37	3	3
124	0.0%	birch, yellow	betula alleghaniensis	63	9	3
125	0.0%	hophornbeam	ostrya virginiana	60	2	3
126	0.0%	maple, red autumn flame	acer rubrum autumn flame	43	2	3
127	0.0%	maple, silver cutleaf	acer saccharinum cutleaf	43	7	3
128	0.0%	pear, flowering autumn blaze	pyrus calleryana autumn blz	77	2	3

Rank	Percent	Common Name	Botanic Name	Average Condition	Diameter	Tree Count
129	0.0%	pine, white	pinus strobus	53	6	3
130	0.0%	serviceberry, apple autumn bril.	amelanchier grandiflora autm	77	2	3
131	0.0%	alder, european black	alnus glutinosa	75	22	2
132	0.0%	honeylocust skyline	gleditsia triacanthos skylin	75	2	2
133	0.0%	honeylocust sunburst	gleditsia triacanthos sunbur	80	4	2
134	0.0%	mapl, red northwood	acer rubrum northwd	75	2	2
135	0.0%	maple, paperbark	acer griseum	75	2	2
136	0.0%	maple, red october glory	acer rubrum october glory	80	1	2
137	0.0%	pine, western white	pinus monticola	50	1	2
138	0.0%	serviceberry, apple	amelanchier grandiflora	75	6	2
139	0.0%	ash, black fall gold	fraxinus nigra fall gold	30	10	1
140	0.0%	ash, white autumn applause	fraxinus americana autmn app	70	5	1
141	0.0%	bosnian pine	heldrechii	90	8	1
142	0.0%	cherry, black	prunus serotina	80	16	1
143	0.0%	cherry, weeping higan	prunus subhirtella pendula	50	1	1
144	0.0%	hawthorn, english	crataegus laevigata	50	4	1
145	0.0%	hawthorn, cockspur	crataegus crus-galli	50	14	1
146	0.0%	hickory	carya species	80	1	1
147	0.0%	honeysuckle	lonicera species	50	23	1
148	0.0%	hornbeam, american	carpinus caroliniana	80	2	1
149	0.0%	larch, european	larix decidua	70	1	1
150	0.0%	london planetree bloodgood	platanus acerifolia bloodgd	80	2	1
151	0.0%	maackia, amur	maackia amurensis	80	4	1
152	0.0%	maple, sycamore spathei	acer pseudoplatanus spathei	70	17	1
153	0.0%	mountain ash, european blackhaw	sorbus aucuparia blackhawk	70	1	1
154	0.0%	mulberry	morus species	80	7	1
155	0.0%	oak, black	quercus velutina	90	6	1
156	0.0%	pine, jack	pinus banksiana	90	8	1
157	0.0%	spruce, dwarf alberta (white)	picea glauca dwarf alberta	80	1	1
158	0.0%	willow, black	salix nigra	70	33	1
Totals				**65**	**12**	**20,545**

September 2013   25   **MISSOULA PARKS AND RECREATION**

Appendix F pg 31

Appendix B: Results Maps

Citywide Species Distribution

Legend

	Colorado blue spruce	Larch species
Norway maple	White ash	Broadleaf Deciduous Large
Green ash	Aspen species	Broadleaf Deciduous Medium
Siberian elm	American linden	Broadleaf Deciduous Small
Apple species	Boxelder maple	Coniferous Evergreen Large
Honeylocust	Silver maple	Coniferous Evergreen Medium
Plum species	Littleleaf linden	Coniferous Evergreen Small
Red maple	Sugar maple	Unknown species

Appendix F pg 32

Citywide Diameter Distribution

Legend

- 0 - 4 in.
- 5 - 8 in.
- 9 - 12 in.
- 13 - 18 in.
- 19 - 25 in.
- 26 - 30 in.
- 31 - 35 in.
- 36 - 93 in.

Tree Diameter Hotspots

Legend

- Smallest Diameter
- Smaller Diameter
- Small Diameter
- Low-Medium Diameter
- High-Medium Diameter
- Large Diameter
- Larger Diameter
- Largest Diameter

This map shows different diameters of the trees throughout the City. The different colors represent trees with similar diameters compared to other trees in their surroundings.

Citywide Condition Distribution

Legend
- Dead
- Very Poor
- Poor
- Fair
- Good
- Excellent

Tree Condition Value Hotspots

Legend

- Lowest Condition Values
- Low Condition Values
- Low-Medium Condition Values
- High-Medium Condition Values
- High Condition Values
- Highest Condition Values

This map shows different condition values of the trees throughout the City. The different colors represent trees with similar condition values compared to other trees in their surroundings.

Citywide Maintenance Needs

Legend

Removal Tasks:

▲ Stumps (305)

🟥 Trees (1,206)

Pruning Tasks:

🟤 Crown Raise (1,096)

🔵 Crown Train (6,737)

🟢 Crown Clean (7,182)

Citywide Tree Appraisal Value Distribution

Legend
- $0 - $170
- $171 - $470
- $471 - $1,370
- $1,371 - $3,760
- $3,761 - $7,600
- $7,601 - $52,000

Tree Appraisal Value Hotspots

Legend

- • Lowest Appraisal Values
- • Low Appraisal Values
- • Low-Medium Appraisal Values
- • High-Medium Appraisal Values
- • High Appraisal Values
- • Highest Appraisal Values

This map shows different appraisal values of the trees throughout the City. The different colors represent trees with similar appraisal values compared to other trees in their surroundings.

Appendix C: i-Tree Streets Benefit Lists

Missoula

Annual Energy Benefits of Public Trees By Species

9/30/2013

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	882.9	56,151	79,764.4	72,314	128,465	(N/A)	32.3	46.9	19.42
Green ash	83.5	5,311	9,030.9	8,187	13,499	(N/A)	9.0	4.9	7.29
Crabapple	21.2	1,349	2,415.4	2,190	3,539	(N/A)	5.4	1.3	3.22
Siberian elm	210.7	13,402	18,430.3	16,709	30,111	(N/A)	5.2	11.0	28.14
Honeylocust	50.1	3,189	5,660.1	5,131	8,320	(N/A)	4.5	3.0	8.97
Red maple	20.5	1,303	2,270.6	2,059	3,361	(N/A)	3.7	1.2	4.42
Blue spruce	42.9	2,729	4,959.3	4,496	7,225	(N/A)	3.2	2.6	11.05
White ash	28.0	1,779	3,526.9	3,197	4,977	(N/A)	2.4	1.8	10.20
Quaking aspen	22.6	1,439	2,578.4	2,338	3,777	(N/A)	2.2	1.4	8.39
American basswood	20.7	1,317	2,331.5	2,114	3,430	(N/A)	2.0	1.3	8.37
Common chokecherry	6.2	396	728.5	660	1,057	(N/A)	1.8	0.4	2.85
Boxelder	63.9	4,063	5,413.9	4,908	8,971	(N/A)	1.7	3.3	25.13
Silver maple	68.6	4,366	5,420.5	4,914	9,280	(N/A)	1.6	3.4	28.47
Littleleaf linden	11.4	724	1,240.0	1,124	1,849	(N/A)	1.6	0.7	5.83
Sugar maple	43.2	2,746	3,564.5	3,232	5,978	(N/A)	1.5	2.2	19.99
Schwedler Norway maple	24.1	1,531	2,364.6	2,144	3,675	(N/A)	1.2	1.3	15.31
Cherry plum	4.1	261	466.9	423	684	(N/A)	1.2	0.3	2.85
Freeman maple	6.8	432	756.0	685	1,118	(N/A)	1.1	0.4	5.10
Ponderosa pine	16.3	1,035	1,852.6	1,680	2,715	(N/A)	1.0	1.0	12.99
Bur oak	6.1	387	677.9	615	1,001	(N/A)	1.0	0.4	4.88
OTHER STREET TREES	201.2	12,794	19,796.1	17,947	30,741	(N/A)	16.5	11.2	9.10
Citywide total	1,835.0	116,705	173,249.4	157,068	273,772	(N/A)	100.0	100.0	13.36

Missoula

Annual Stormwater Benefits of Public Trees by Species

9/30/2013

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	14,040,988	151,653	(N/A)	32.3	43.5	22.93
Green ash	1,160,167	12,531	(N/A)	9.0	3.6	6.77
Crabapple	163,516	1,766	(N/A)	5.4	0.5	1.61
Siberian elm	5,656,257	61,092	(N/A)	5.2	17.5	57.10
Honeylocust	773,421	8,354	(N/A)	4.5	2.4	9.00
Red maple	274,105	2,961	(N/A)	3.7	0.9	3.90
Blue spruce	1,563,520	16,887	(N/A)	3.2	4.8	25.82
White ash	311,060	3,360	(N/A)	2.4	1.0	6.88
Quaking aspen	309,894	3,347	(N/A)	2.2	1.0	7.44
American basswood	255,121	2,756	(N/A)	2.0	0.8	6.72
Common chokecherry	48,652	525	(N/A)	1.8	0.2	1.42
Boxelder	876,426	9,466	(N/A)	1.7	2.7	26.52
Silver maple	1,019,995	11,017	(N/A)	1.6	3.2	33.79
Littleleaf linden	188,840	2,040	(N/A)	1.6	0.6	6.43
Sugar maple	715,558	7,729	(N/A)	1.5	2.2	25.85
Schwedler Norway maple	370,361	4,000	(N/A)	1.2	1.2	16.67
Cherry plum	30,216	326	(N/A)	1.2	0.1	1.36
Freeman maple	94,939	1,025	(N/A)	1.1	0.3	4.68
Ponderosa pine	393,959	4,255	(N/A)	1.0	1.2	20.36
Bur oak	81,525	881	(N/A)	1.0	0.3	4.30
OTHER STREET TREES	3,944,788	42,607	(N/A)	16.5	12.2	12.61
Citywide total	32,273,310	348,576	(N/A)	100.0	100.0	17.01

Missoula

Annual Air Quality Benefits of Public Trees by Species

9/30/2013

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total Standard ($) Error	% of Total Trees	Avg. $/tree
	O₃	NO₂	PM₁₀	SO₂		NO₂	PM₁₀	VOC	SO₂							
Norway maple	3,161.0	770.5	837.9	354.7	11,648	2,163.0	458.7	430.1	2,674.3	9,960	-1,775.9	-4,635	9,074.5	16,973 (N/A)	32.3	2.57
Green ash	96.5	23.9	27.5	10.3	357	213.8	44.3	41.4	255.3	972	0.0	0	712.9	1,329 (N/A)	9.0	0.72
Crabapple	80.0	20.0	22.3	10.0	298	54.2	11.1	10.3	63.1	244	-1.0	-3	269.9	540 (N/A)	5.4	0.49
Siberian elm	608.6	150.5	159.0	70.8	2,250	505.8	107.7	101.0	629.2	2,334	0.0	0	2,332.7	4,584 (N/A)	5.2	4.28
Honeylocust	62.2	15.5	18.1	6.7	230	129.1	26.5	24.7	151.8	584	-151.3	-395	283.3	419 (N/A)	4.5	0.45
Red maple	13.7	3.4	4.2	1.4	51	52.2	10.7	10.0	61.7	236	0.0	0	157.4	287 (N/A)	3.7	0.38
Blue spruce	106.3	26.5	28.3	13.3	395	111.4	22.7	21.2	129.4	502	-597.3	-1,559	-138.3	-662 (N/A)	3.2	-1.01
White ash	15.6	3.9	4.8	1.6	58	74.4	14.9	13.9	84.6	332	0.0	0	213.6	390 (N/A)	2.4	0.80
Quaking aspen	32.1	7.8	9.1	3.6	118	58.3	11.9	11.1	68.2	263	-41.3	-108	160.7	274 (N/A)	2.2	0.61
American basswood	39.3	11.4	13.4	5.1	152	52.9	10.8	10.1	61.8	239	-61.1	-159	143.7	231 (N/A)	2.0	0.56
Common chokecherry	21.1	5.3	6.0	2.6	79	15.9	3.2	3.0	18.3	71	-0.3	-1	75.1	149 (N/A)	1.8	0.40
Boxelder	238.3	58.8	58.9	25.7	877	154.0	32.9	30.9	192.3	712	0.0	0	791.7	1,589 (N/A)	1.7	4.45
Silver maple	248.0	61.2	62.0	26.7	913	162.9	35.1	33.0	206.3	757	-165.3	-431	670.0	1,239 (N/A)	1.6	3.80
Littleleaf linden	39.3	11.3	13.0	5.1	152	29.0	6.0	5.6	34.4	132	-26.7	-70	117.0	214 (N/A)	1.5	0.67
Sugar maple	180.8	44.7	46.9	21.0	668	103.6	22.2	20.9	130.4	480	-178.4	-466	392.2	683 (N/A)	1.5	2.28
Schwedler Norway maple	65.2	15.9	17.8	7.3	241	60.0	12.6	11.8	72.9	275	-45.2	-118	218.4	397 (N/A)	1.2	1.66
Cherry plum	14.3	3.6	4.0	1.8	53	10.4	2.1	2.0	12.0	47	-0.2	0	50.0	100 (N/A)	1.2	0.42
Freeman maple	4.9	1.2	1.5	0.5	18	17.6	3.6	3.4	20.9	80	0.0	0	53.6	98 (N/A)	1.1	0.45
Ponderosa pine	32.5	8.0	8.4	3.8	120	41.1	8.4	7.8	48.0	186	-155.3	-405	2.8	-100 (N/A)	1.0	-0.48
Bur oak	18.7	5.4	6.4	2.4	72	15.6	3.2	3.0	18.3	70	-70.8	-185	2.1	-42 (N/A)	1.0	-0.21
OTHER STREET TREES	700.8	174.7	181.1	81.1	2,594	497.6	104.1	97.4	602.3	2,274	-736.2	-1,921	1,703.0	2,946 (N/A)	16.5	0.87
Citywide total	5,779.3	1,423.5	1,530.4	655.6	21,344	4,522.6	952.8	892.7	5,535.3	20,749	-4,006.2	-10,456	17,286.2	31,637 (N/A)	100.0	1.54

Appendix F pg 42

Missoula

Annual CO₂ Benefits of Public Trees by Species

9/30/2013

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
Norway maple	1,588,857	11,916	-221,502	-93,722	-2,364	1,950,939	14,632	3,224,572	24,184 (N/A)	32.3	47.2	3.66
Green ash	184,342	1,383	-7,977	-9,967	-135	184,538	1,384	350,936	2,632 (N/A)	9.0	5.1	1.42
Crabapple	62,334	468	-3,221	-4,872	-61	46,880	352	101,121	758 (N/A)	5.4	1.5	0.69
Siberian elm	364,264	2,732	-41,988	-15,675	-432	465,636	3,492	772,237	5,792 (N/A)	5.2	11.3	5.41
Honeylocust	93,345	700	-3,475	-5,348	-66	110,801	831	195,323	1,465 (N/A)	4.5	2.9	1.58
Red maple	46,267	347	-1,468	-2,787	-32	45,255	339	87,268	655 (N/A)	3.7	1.3	0.86
Blue spruce	70,164	526	-9,013	-6,303	-115	94,804	711	149,651	1,122 (N/A)	3.2	2.2	1.72
White ash	45,830	344	-1,412	-2,291	-28	61,825	464	103,952	780 (N/A)	2.4	1.5	1.60
Quaking aspen	44,675	335	-3,035	-2,571	-42	50,010	375	89,080	668 (N/A)	2.2	1.3	1.48
American basswood	28,884	217	-2,324	-2,320	-35	45,749	343	69,989	525 (N/A)	2.0	1.0	1.28
Common chokecherry	19,091	143	-893	-1,504	-18	13,760	103	30,454	228 (N/A)	1.8	0.5	0.62
Boxelder	114,871	862	-16,178	-5,489	-162	141,155	1,059	234,360	1,758 (N/A)	1.7	3.4	4.92
Silver maple	154,719	1,160	-20,199	-5,721	-194	151,698	1,138	280,497	2,104 (N/A)	1.6	4.1	6.45
Littleleaf linden	14,231	107	-1,137	-1,531	-20	25,166	189	36,729	275 (N/A)	1.6	0.5	0.87
Sugar maple	93,551	702	-8,563	-3,672	-92	95,415	716	176,731	1,325 (N/A)	1.5	2.6	4.43
Schwedler Norway maple	46,854	351	-4,738	-2,599	-55	53,205	399	92,722	695 (N/A)	1.2	1.4	2.90
Cherry plum	12,058	90	-589	-941	-11	9,056	68	19,584	147 (N/A)	1.2	0.3	0.61
Freeman maple	15,577	117	-523	-924	-11	15,022	113	29,152	219 (N/A)	1.1	0.4	1.00
Ponderosa pine	10,740	81	-1,757	-2,058	-29	35,967	270	42,892	322 (N/A)	1.0	0.6	1.54
Bur oak	13,078	98	-706	-894	-12	13,433	101	24,912	187 (N/A)	1.0	0.4	0.91
OTHER STREET TREES	347,945	2,610	-42,566	-25,038	-507	444,528	3,334	724,870	5,437 (N/A)	16.5	10.6	1.61
Citywide total	3,371,679	25,288	-393,262	-196,227	-4,421	4,054,842	30,411	6,837,032	51,278 (N/A)	100.0	100.0	2.50

Appendix F pg 43

Missoula

Stored CO2 Benefits of Public Trees by Species

9/30/2013

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	46,140,544	346,054	(N/A)	32.3	56.4	52.32
Green ash	1,658,826	12,441	(N/A)	9.0	2.0	6.72
Crabapple	663,441	4,976	(N/A)	5.4	0.8	4.52
Siberian elm	8,711,002	65,333	(N/A)	5.2	10.6	61.06
Honeylocust	721,016	5,408	(N/A)	4.5	0.9	5.83
Red maple	301,058	2,258	(N/A)	3.7	0.4	2.97
Blue spruce	1,875,115	14,063	(N/A)	3.2	2.3	21.50
White ash	292,251	2,192	(N/A)	2.4	0.4	4.49
Quaking aspen	629,363	4,720	(N/A)	2.2	0.8	10.49
American basswood	482,649	3,620	(N/A)	2.0	0.6	8.83
Common chokecherry	183,055	1,373	(N/A)	1.8	0.2	3.70
Boxelder	3,370,264	25,277	(N/A)	1.7	4.1	70.80
Silver maple	4,207,785	31,558	(N/A)	1.6	5.1	96.80
Littleleaf linden	235,531	1,766	(N/A)	1.6	0.3	5.57
Sugar maple	1,783,063	13,373	(N/A)	1.5	2.2	44.73
Schwedler Norway m	986,788	7,401	(N/A)	1.2	1.2	30.84
Cherry plum	120,606	905	(N/A)	1.2	0.2	3.77
Freeman maple	108,235	812	(N/A)	1.1	0.1	3.71
Ponderosa pine	365,948	2,745	(N/A)	1.0	0.5	13.13
Bur oak	145,414	1,091	(N/A)	1.0	0.2	5.32
OTHER STREET TR	4,014,347	66,376	(N/A)	16.5	10.8	19.64
Citywide total	81,832,063	613,740	(N/A)	100.0	100.0	29.95

Missoula

Annual Aesthetic/Other Benefits of Public Trees by Species

9/30/2013

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	540,883	(N/A)	32.3	32.9	81.78
Green ash	173,389	(N/A)	9.0	10.5	93.62
Crabapple	36,631	(N/A)	5.4	2.2	33.30
Siberian elm	174,770	(N/A)	5.2	10.6	163.34
Honeylocust	92,443	(N/A)	4.5	5.6	99.62
Red maple	52,900	(N/A)	3.7	3.2	69.61
Blue spruce	38,046	(N/A)	3.2	2.3	58.17
White ash	59,875	(N/A)	2.4	3.6	122.69
Quaking aspen	32,441	(N/A)	2.2	2.0	72.09
American basswood	31,493	(N/A)	2.0	1.9	76.81
Common chokecherry	11,789	(N/A)	1.8	0.7	31.78
Boxelder	42,998	(N/A)	1.7	2.6	120.44
Silver maple	46,614	(N/A)	1.6	2.8	142.99
Littleleaf linden	20,744	(N/A)	1.6	1.3	65.44
Sugar maple	20,396	(N/A)	1.5	1.2	68.21
Schwedler Norway maple	18,826	(N/A)	1.2	1.1	78.44
Cherry plum	7,694	(N/A)	1.2	0.5	32.06
Freeman maple	17,272	(N/A)	1.1	1.1	78.87
Ponderosa pine	11,719	(N/A)	1.0	0.7	56.07
Bur oak	9,660	(N/A)	1.0	0.6	47.12
OTHER STREET TREES	205,991	(N/A)	16.5	12.5	60.94
Citywide total	1,646,573	(N/A)	100.0	100.0	80.36

Missoula

Annual Benefits of Public Trees by Species ($/tree)

9/30/2013

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($) Standard Error
Norway maple	19.42	3.66	2.57	22.93	81.78	130.35 (N/A)
Green ash	7.29	1.42	0.72	6.77	93.62	109.82 (N/A)
Crabapple	3.22	0.69	0.49	1.61	33.30	39.30 (N/A)
Siberian elm	28.14	5.41	4.28	57.10	163.34	258.27 (N/A)
Honeylocust	8.97	1.58	0.45	9.00	99.62	119.61 (N/A)
Red maple	4.42	0.86	0.38	3.90	69.61	79.16 (N/A)
Blue spruce	11.05	1.72	-1.01	25.82	58.17	95.75 (N/A)
White ash	10.20	1.60	0.80	6.88	122.69	142.17 (N/A)
Quaking aspen	8.39	1.48	0.61	7.44	72.09	90.01 (N/A)
American basswood	8.37	1.28	0.56	6.72	76.81	93.74 (N/A)
Common chokecherry	2.85	0.62	0.40	1.42	31.78	37.06 (N/A)
Boxelder	25.13	4.92	4.45	26.52	120.44	181.46 (N/A)
Silver maple	28.47	6.45	3.80	33.79	142.99	215.50 (N/A)
Littleleaf linden	5.83	0.87	0.67	6.43	65.44	79.25 (N/A)
Sugar maple	19.99	4.43	2.28	25.85	68.21	120.77 (N/A)
Schwedler Norway ma	15.31	2.90	1.66	16.67	78.44	114.97 (N/A)
Cherry plum	2.85	0.61	0.42	1.36	32.06	37.29 (N/A)
Freeman maple	5.10	1.00	0.45	4.68	78.87	90.10 (N/A)
Ponderosa pine	12.99	1.54	-0.48	20.36	56.07	90.48 (N/A)
Bur oak	4.88	0.91	-0.21	4.30	47.12	57.01 (N/A)
OTHER STREET TRI	9.10	1.61	0.87	12.61	60.94	85.12 (N/A)

Missoula

Importance Values for Public Most Abundant Trees

9/30/2013

Species	Number of Trees	% of Total Trees	Leaf Area (ft²)	% of Total Leaf Area	Canopy Cover (ft²)	% of Total Canopy Cover	Importance Value
Norway maple	6,614	32.3	33,190,195	48.8	7,806,647	51.0	44.0
Green ash	1,852	9.0	2,579,555	3.8	713,468	4.7	5.8
Crabapple	1,100	5.4	621,116	0.9	291,477	1.9	2.7
Siberian elm	1,070	5.2	8,481,736	12.5	1,432,982	9.4	9.0
Honeylocust	928	4.5	1,553,816	2.3	467,059	3.1	3.3
Red maple	760	3.7	570,909	0.8	171,905	1.1	1.9
Blue spruce	654	3.2	1,587,603	2.3	245,193	1.6	2.4
White ash	488	2.4	871,742	1.3	169,501	1.1	1.6
Quaking aspen	450	2.2	744,395	1.1	172,050	1.1	1.5
American basswood	410	2.0	722,916	1.1	106,198	0.7	1.3
Common chokecherry	371	1.8	178,653	0.3	86,946	0.6	0.9
Boxelder	357	1.7	2,558,785	3.8	500,699	3.3	2.9
Silver maple	326	1.6	2,894,859	4.3	556,271	3.6	3.2
Littleleaf linden	317	1.5	379,756	0.6	81,919	0.5	0.9
Sugar maple	299	1.5	1,657,550	2.4	396,851	2.6	2.2
Schwedler Norway maple	240	1.2	842,662	1.2	206,174	1.3	1.3
Cherry plum	240	1.2	115,832	0.2	54,368	0.4	0.6
Freeman maple	219	1.1	198,220	0.3	59,523	0.4	0.6
Ponderosa pine	209	1.0	627,630	0.9	71,290	0.5	0.8
Bur oak	205	1.0	191,601	0.3	49,647	0.3	0.5
OTHER TREES	3,380	16.5	7,472,084	11.0	1,655,041	10.8	12.8
Total	20,489	100.0	68,041,615	100.0	15,295,209	100.0	100.0

Missoula

Replacement Value for Public Trees by Species

9/30/2013

Species	0-3	3-6	6-12	12-18	DBH Class (in) 18-24	24-30	30-36	36-42	>42	Total Standard Error	% of Total
Norway maple	49,365	235,356	929,491	4,890,554	16,416,041	10,899,752	2,266,286	635,282	129,705	36,451,832 (±0)	55.94
Green ash	31,480	389,532	762,010	182,275	121,328	81,044	0	0	0	1,567,669 (±0)	2.41
Crabapple	64,883	229,841	434,273	257,761	122,469	56,591	13,267	24,551	0	1,203,635 (±0)	1.85
Siberian elm	14,623	45,886	196,073	442,245	744,412	1,433,068	1,168,859	739,438	420,076	5,204,681 (±0)	7.99
Honeylocust	27,512	111,670	712,384	209,363	27,930	0	0	0	0	1,088,859 (±0)	1.67
Red maple	59,386	182,770	173,000	40,515	10,663	9,331	0	0	0	475,666 (±0)	0.73
Blue spruce	20,378	46,294	150,050	415,180	585,647	823,462	414,921	174,627	85,153	2,715,712 (±0)	4.17
White ash	18,542	98,515	269,155	27,386	17,651	0	0	0	0	431,249 (±0)	0.66
Quaking aspen	15,029	43,272	131,372	98,436	53,815	44,035	0	11,416	38,261	435,637 (±0)	0.67
American basswood	29,602	67,713	172,022	66,327	126,025	110,720	37,125	21,194	0	630,728 (±0)	0.97
Common chokecherry	26,998	72,559	158,693	39,412	30,070	12,781	21,230	0	0	361,744 (±0)	0.56
Boxelder	1,585	9,143	44,620	124,657	228,647	334,137	185,535	151,313	56,992	1,136,629 (±0)	1.74
Silver maple	2,850	8,788	43,461	69,495	156,148	407,649	438,252	201,179	205,522	1,533,344 (±0)	2.35
Littleleaf linden	22,915	55,979	95,537	10,592	101,527	65,661	63,154	0	0	415,365 (±0)	0.64
Sugar maple	8,594	19,657	52,493	72,029	513,108	354,842	73,908	0	0	1,094,631 (±0)	1.68
Schwedler Norway maple	2,050	16,512	84,251	267,174	480,384	101,634	18,530	0	0	970,565 (±0)	1.49
Cherry plum	17,586	45,588	69,289	47,526	33,411	0	0	0	0	213,400 (+0)	0.33
Freeman maple	9,564	63,862	60,457	9,763	0	4,073	0	0	0	147,719 (+0)	0.23
Ponderosa pine	3,663	15,955	62,210	110,464	168,044	193,008	136,717	22,422	0	712,482 (+0)	1.09
Bur oak	17,536	39,090	96,814	51,259	14,307	39,601	0	0	0	258,608 (±0)	0.40
Douglas fir	2,405	3,046	46,721	117,476	225,119	350,284	266,923	72,929	0	1,084,902 (±0)	1.67
Plum	10,247	20,302	73,088	83,461	46,775	54,776	0	0	0	288,649 (±0)	0.44
Hawthorn	13,650	28,755	34,458	32,982	63,491	0	0	0	0	173,336 (±0)	0.27
Austrian pine	552	2,160	49,775	248,628	185,165	55,132	0	0	0	541,412 (±0)	0.83
American mountain ash	2,872	9,118	57,129	85,727	178,136	63,893	19,010	0	0	415,885 (±0)	0.64
Showy mountain ash	4,777	8,680	54,898	127,432	104,655	20,081	18,574	0	58,781	397,877 (±0)	0.61
Black locust	426	3,037	15,462	26,491	104,952	224,989	142,075	124,653	110,818	752,903 (±0)	1.16
Pear	12,148	24,567	40,987	17,200	0	0	0	0	0	94,902 (±0)	0.15
Black poplar	811	4,548	29,074	23,893	63,949	35,610	77,584	0	43,069	278,538 (±0)	0.43
Northern hackberry	14,822	9,145	12,578	7,696	6,848	12,789	0	0	0	63,878 (±0)	0.10
Horsechestnut	4,681	7,125	19,355	66,507	150,666	71,322	117,609	40,986	0	478,250 (±0)	0.73
Engelmann spruce	299	1,873	24,489	60,334	79,193	75,405	20,945	0	0	262,537 (±0)	0.40
Scotch pine	1,542	7,582	34,677	70,697	61,882	28,589	14,887	0	24,553	244,408 (+0)	0.38
Ash	2,345	14,666	33,853	8,303	0	0	0	0	0	59,167 (+0)	0.09
Tatar maple	7,245	19,958	18,156	27,355	6,422	0	0	0	0	79,136 (±0)	0.12
Japanese tree lilac	8,908	16,870	10,510	0	0	0	0	0	0	36,288 (±0)	0.06

1

Species	0-3	3-6	6-12	12-18	DBH Class (in) 18-24	24-30	30-36	36-42	>42	Total Standard Error	% of Total
Eastern cottonwood	1,634	3,618	27,180	65,239	49,871	16,935	0	6,925	41,235	212,637 (±0)	0.33
Swamp white oak	11,219	14,526	38,814	0	0	0	0	0	0	64,560 (±0)	0.10
Black cottonwood	0	3,360	13,509	14,234	33,495	55,642	47,752	39,243	224,214	431,449 (±0)	0.66
Serviceberry	10,152	9,329	3,494	5,178	9,949	0	0	0	0	38,102 (±0)	0.06
Northern red oak	2,464	6,000	22,584	3,371	0	0	0	0	0	34,419 (±0)	0.05
Black ash	1,883	6,138	3,906	0	0	0	0	0	0	11,927 (±0)	0.02
Northern white cedar	0	5,511	63,179	7,284	21,109	11,552	0	0	0	111,634 (±0)	0.17
European white birch	939	3,153	28,202	26,978	31,230	10,506	22,034	14,381	0	137,725 (±0)	0.21
Paper birch	3,042	6,800	10,525	25,233	11,166	28,066	26,708	0	0	111,540 (±0)	0.17
Juniper	117	5,353	16,638	14,169	27,163	7,737	0	0	0	71,177 (±0)	0.11
Sweet mountain pine	0	1,288	17,117	20,945	34,840	14,507	10,066	12,996	0	111,759 (±0)	0.17
Apricot	1,649	8,024	22,093	23,749	30,060	0	0	0	0	85,575 (+0)	0.13
Kentucky coffeetree	4,619	4,014	15,535	0	6,958	0	0	0	0	31,128 (±0)	0.05
River birch	3,898	3,877	7,849	3,605	0	0	0	0	0	19,229 (±0)	0.03
Spruce	1,563	1,874	6,510	5,535	29,029	50,804	24,507	0	0	119,823 (±0)	0.18
Western larch	1,127	3,980	13,228	13,007	9,041	13,202	0	0	0	53,585 (±0)	0.08
European mountain ash	910	3,647	6,472	16,798	30,060	9,128	0	0	27,431	94,445 (±0)	0.14
American elm	3,829	2,622	2,455	8,714	5,783	0	0	0	0	23,404 (±0)	0.04
Black walnut	814	2,044	8,364	17,854	26,523	11,925	0	8,553	0	76,077 (±0)	0.12
Peach	3,412	4,741	1,339	0	0	0	0	0	0	9,492 (±0)	0.01
Maple	3,802	1,486	0	0	0	0	0	0	0	5,288 (±0)	0.01
Elm	3,037	3,015	1,228	0	0	9,428	0	0	0	16,708 (±0)	0.03
Willow	0	1,042	3,459	6,079	7,768	6,719	0	4,801	32,157	62,025 (±0)	0.10
White willow	408	332	1,499	3,316	6,214	8,399	45,492	11,203	17,865	94,728 (±0)	0.15
Lodgepole pine	1,046	2,966	6,389	8,680	0	0	0	0	0	19,082 (±0)	0.03
Russian olive	0	3,282	13,836	8,689	11,134	23,732	0	0	0	60,672 (+0)	0.09
Oak	1,762	1,784	6,595	3,733	8,111	0	0	0	0	21,985 (+0)	0.03
Western redcedar	146	490	7,502	10,406	20,091	33,004	19,659	0	0	91,298 (+0)	0.14
Amur maple	923	2,795	3,099	4,019	7,722	0	0	0	0	18,558 (±0)	0.03
Norway spruce	0	0	7,245	13,465	13,331	30,028	18,266	0	0	82,334 (±0)	0.13
English oak	1,523	2,430	5,491	0	0	18,329	0	0	0	27,773 (±0)	0.04
Oak leaf mountain ash	2,019	3,647	1,785	0	0	0	0	0	0	7,451 (±0)	0.01
Bigtooth aspen	626	1,313	7,587	0	0	0	0	0	0	9,526 (±0)	0.01
Northern catalpa	2,438	1,610	0	0	4,788	0	0	0	0	8,835 (±0)	0.01
Pin oak	1,725	1,163	3,191	0	0	0	0	0	0	6,080 (±0)	0.01
Lilac	1,479	640	1,911	4,309	17,707	0	22,476	0	0	48,521 (±0)	0.07
Hornbeam species	232	4,258	3,416	0	0	0	0	0	0	7,906 (±0)	0.01
London planetree	1,670	1,421	0	0	0	0	0	0	0	3,091 (±0)	0.00
Ohio buckeye	1,548	3,276	1,822	0	0	0	0	0	0	6,645 (±0)	0.01
Subalpine fir	0	1,041	6,713	9,885	8,036	0	0	0	0	25,675 (±0)	0.04
White poplar	0	1,022	2,068	0	0	0	9,751	18,370	14,356	45,566 (±0)	0.07

2

Species	0-3	3-6	6-12	12-18	DBH Class (in) 18-24	24-30	30-36	36-42	>42	Total Standard Error	% of Total
Scarlet oak	0	2,016	1,702	0	10,139	31,442	19,200	0	0	64,500 (±0)	0.10
Ginkgo	1,858	1,410	0	0	0	0	0	0	0	3,268 (±0)	0.01
Bristlecone pine	518	885	1,915	0	0	0	0	0	0	3,318 (±0)	0.01
Fir	682	1,240	0	0	17,814	16,430	0	0	0	36,166 (±0)	0.06
Common juniper	0	282	0	8,625	8,267	6,770	0	0	0	23,944 (±0)	0.04
Eastern redbud	1,393	0	0	0	0	0	0	0	0	1,393 (±0)	0.00
White fir	179	1,611	1,631	0	9,401	0	0	0	0	12,822 (±0)	0.02
European ash	1,563	0	0	0	0	0	0	0	0	1,563 (±0)	0.00
Limber pine	0	509	1,571	10,728	0	11,282	0	0	0	24,090 (±0)	0.04
Amur chokecherry	0	3,064	0	0	0	0	0	0	0	3,064 (±0)	0.00
White oak	0	969	3,418	0	0	0	0	0	0	4,387 (±0)	0.01
Japanese maple	1,509	0	0	0	0	0	0	0	0	1,509 (+0)	0.00
Dogwood	891	1,252	0	0	0	0	0	0	0	2,143 (±0)	0.00
Rocky mountain juniper	0	0	838	5,236	4,724	0	0	14,853	0	25,651 (±0)	0.04
Tulip tree	1,295	679	0	0	0	0	0	0	0	1,974 (±0)	0.00
Sumac	455	584	1,562	0	7,793	0	0	0	0	10,394 (±0)	0.02
Weeping willow	0	0	1,139	5,733	10,918	0	0	0	0	17,790 (±0)	0.03
Grand fir	0	0	2,764	4,682	8,036	0	0	0	0	15,483 (±0)	0.02
Sycamore maple	0	0	0	7,453	10,918	0	0	0	0	18,371 (±0)	0.03
American beech	0	1,551	1,302	0	0	0	0	0	0	2,853 (±0)	0.00
Sweetgum	746	517	0	0	0	0	0	0	0	1,263 (±0)	0.00
Northern pin oak	0	0	1,302	2,768	11,165	0	0	0	0	15,235 (±0)	0.02
Yellow birch	0	0	4,727	0	0	0	0	0	0	4,727 (±0)	0.01
Eastern hophornbeam	387	655	0	0	0	0	0	0	0	1,042 (±0)	0.00
Eastern white pine	122	0	2,160	0	0	0	0	0	0	2,281 (±0)	0.00
Paperbark maple	580	0	0	0	0	0	0	0	0	580 (+0)	0.00
European alder	0	0	0	4,587	0	12,481	0	0	0	17,068 (+0)	0.03
Western white pine	204	0	0	0	0	0	0	0	0	204 (+0)	0.00
Sycamore maple "Spaeth	0	0	0	2,547	0	0	0	0	0	2,547 (±0)	0.00
Hickory	284	0	0	0	0	0	0	0	0	284 (±0)	0.00
American hornbeam	227	0	0	0	0	0	0	0	0	227 (±0)	0.00
European larch	271	0	0	0	0	0	0	0	0	271 (±0)	0.00
Honeysuckle	0	0	0	0	5,567	0	0	0	0	5,567 (±0)	0.01
Amur maackia	0	584	0	0	0	0	0	0	0	584 (±0)	0.00
Mulberry	0	0	1,822	0	0	0	0	0	0	1,822 (±0)	0.00
Pine	0	0	1,513	0	0	0	0	0	0	1,513 (±0)	0.00
Jack pine	0	0	1,513	0	0	0	0	0	0	1,513 (±0)	0.00
London planetree "bloody	284	0	0	0	0	0	0	0	0	284 (±0)	0.00
Black cherry	0	0	0	3,163	0	0	0	0	0	3,163 (±0)	0.00
Higan cherry	142	0	0	0	0	0	0	0	0	142 (±0)	0.00
Black oak	0	0	1,465	0	0	0	0	0	0	1,465 (±0)	0.00

3

Species	0-3	3-6	6-12	12-18	DBH Class (in) 18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Citywide total	623,123	2,136,464	5,699,036	8,836,589	21,797,802	16,402,307	5,781,300	2,351,315	1,530,187	65,158,123	(±0)	100.00

4

Missoula   Page 1 of 1

Population Summary of Public Trees

9/30/2013

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Broadleaf Deciduous Large (BDL)										
Norway maple	203	430	637	1,518	2,624	1,031	137	28	6	6,614
Green ash	148	876	702	82	31	13	0	0	0	1,852
Siberian elm	66	118	181	169	158	190	110	52	26	1,070
Honeylocust	126	222	515	61	4	0	0	0	0	928
Red maple	234	368	141	14	2	1	0	0	0	760
White ash	91	195	190	9	3	0	0	0	0	488
American basswood	114	127	110	21	23	12	2	1	0	410
Boxelder	6	25	58	72	75	72	28	16	5	357
Silver maple	15	21	44	32	48	76	53	20	17	326
Littleleaf linden	106	114	66	4	17	6	4	0	0	317
Sugar maple	33	38	39	32	107	44	6	0	0	299
Schwedler Norway maple	11	33	52	68	66	9	1	0	0	240
Freeman maple	35	127	52	4	0	1	0	0	0	219
BDL OTHER	448	321	306	119	94	77	41	19	39	1,464
Total	1,636	3,015	3,093	2,205	3,252	1,532	382	136	93	15,344 (±NaN)
Broadleaf Deciduous Medium (BDM)										
Quaking aspen	101	139	144	45	13	5	0	1	2	450
BDM OTHER	72	64	44	22	22	7	7	2	0	240
Total	173	203	188	67	35	12	7	3	2	690 (±NaN)
Broadleaf Deciduous Small (BDS)										
Crabapple	333	416	266	62	17	4	1	1	0	1,100
Common chokecherry	132	129	93	11	4	1	1	0	0	371
Cherry plum	90	90	44	12	4	0	0	0	0	240
BDS OTHER	358	272	196	111	73	15	3	0	3	1,031
Total	913	907	599	196	98	20	5	1	3	2,742 (±NaN)
Broadleaf Evergreen Large (BEL)										
BEL OTHER	0	0	3	0	0	0	0	0	0	3
Total	0	0	3	0	0	0	0	0	0	3 (±NaN)
Broadleaf Evergreen Medium (BEM)										
BEM OTHER	0	0	1	0	0	0	0	0	0	1
Total	0	0	1	0	0	0	0	0	0	1 (±NaN)
Broadleaf Evergreen Small (BES)										
BES OTHER	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0 (±NaN)
Conifer Evergreen Large (CEL)										
Blue spruce	142	112	107	112	79	69	23	7	3	654
Ponderosa pine	28	40	49	35	28	19	9	1	0	209
CEL OTHER	37	47	138	81	69	59	23	3	0	457
Total	207	199	294	228	176	147	55	11	3	1,320 (±NaN)
Conifer Evergreen Medium (CEM)										
CEM OTHER	21	30	71	97	38	8	1	0	1	267
Total	21	30	71	97	38	8	1	0	1	267 (±NaN)
Conifer Evergreen Small (CES)										
CES OTHER	5	25	43	23	19	4	1	2	0	122
Total	5	25	43	23	19	4	1	2	0	122 (±NaN)
UNMATCHED										
UNMATCHED OTHER	31	9	8	2	3	1	0	0	1	55
Total	31	9	8	2	3	1	0	0	1	55 (±NaN)
Grand Total	2,986	4,388	4,300	2,818	3,621	1,724	451	153	103	20,544 (±0)

Appendix F pg 52

Appendix G
Treeworks Report Tables

Treeworks inventory software has the capability to create many different reports at multiple levels through various sorting procedures. The sorting procedures and reports can be very detailed, down to a particular site, or global, including the entire city. The tables in this appendix are global and provide a summary of all public trees in the inventory.

Appendix G includes the following tables:

- Summary Appraised Value
- Summary Condition Distribution
- Summary Cultural Defect Distribution
- Summary Diameter Distribution
- Summary Growspace Distribution
- Summary Species Distribution
- Summary Structural Defect Distribution

Appraised Value

Report universe: All X   Subset

Total Number of Trees in Report:	**24,376**
Total Appraised Value:	**$86,337,870**
Total Mean Appraised Value:	**$3,542**
Median Appraised Value:	**$1,170**
Minimum Appraised Value:	**$0**
Maximum Appraised Value:	**$59,200**
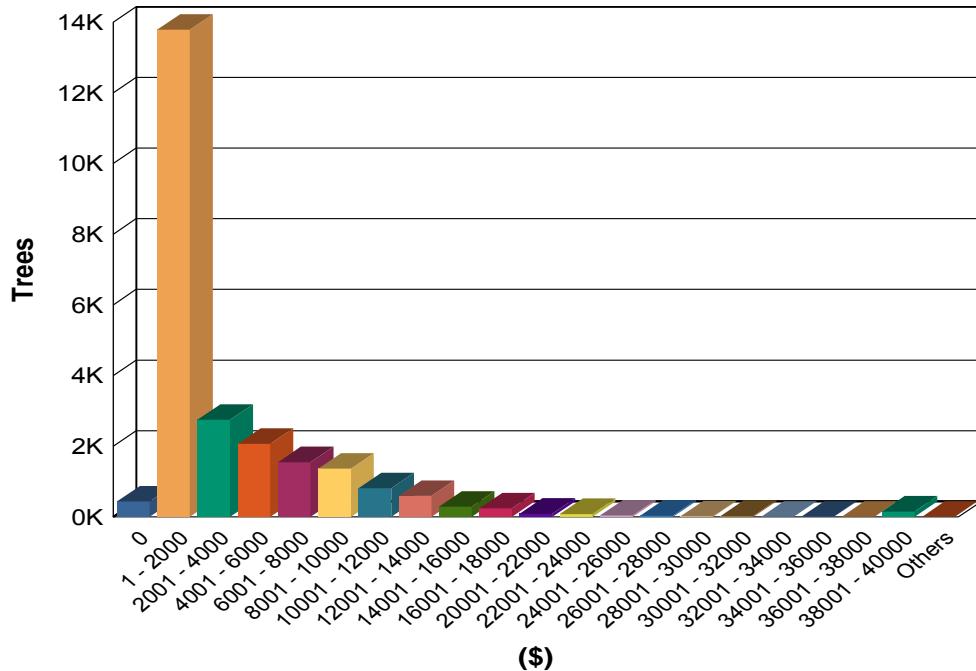
City-wide Appraised Value

Condition Distribution

Condition	Percent	Count
Excellent	3.1%	747
Good	28.7%	6,991
Fair	37.3%	9,085
Poor	21.5%	5,235
Very Poor	8.3%	2,019
Dead	1.2%	299
Total		24,376

City-wide Condition Distribution

Cultural Defect Distribution

	topped	26.2%
	planted 2 close	13.7%
	improper prune	10.2%
	planted to deep	9.1%
	mower/trimmer	8.0%
	Others	32.7%
	Total:	100.0%

Defect	Percent	Count
topped	26.2%	2,083
planted 2 close	13.7%	1,089
improper prune	10.2%	815
planted to deep	9.1%	727
mower/trimmer	8.0%	640
lackofwater stess	7.2%	575
improper location	5.5%	436
foreign object	4.6%	366
constructn damage	3.0%	242
heat stress	2.4%	194
pruning stub	1.9%	152
compacted soil	1.3%	107
lions tailed	1.1%	85
sidewalk damage	1.1%	84
swing	0.7%	54
salt damage	0.6%	49
pesticide damg	0.5%	37
line of sight	0.4%	35
hit by vehicle	0.4%	34
grade filled >2in	0.4%	32
Others	1.5%	117
Total		**7,953**

City-wide Cultural Defect Distribution

Diameter Distribution

Report universe: All   X   Subse
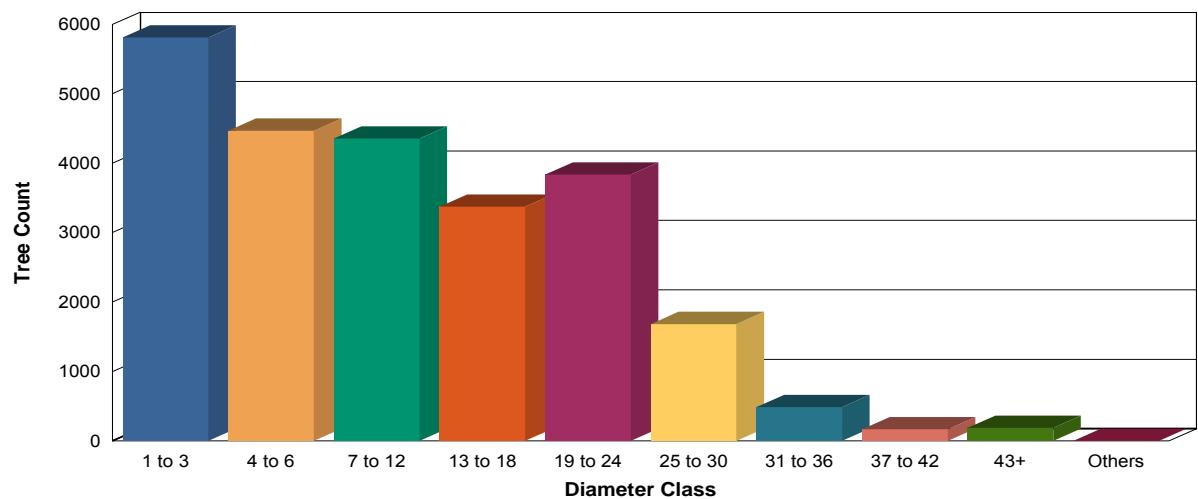
Diameter Class	Percent	Count
1 to 3	**23.8%**	**5,813**
4 to 6	**18.3%**	**4,468**
7 to 12	**17.9%**	**4,355**
13 to 18	**13.8%**	**3,374**
19 to 24	**15.7%**	**3,835**
25 to 30	**6.9%**	**1,683**
31 to 36	**2.0%**	**488**
37 to 42	**0.7%**	**169**
43+	**0.8%**	**190**
Others	**0.0%**	**1**
Total		**24,376**

City-wide Diameter Distribution

Growspace Distribution

Legend:
open		37.8%
10-15		19.7%
03-07		14.7%
07-10		10.6%
15 plus ft		7.2%
Others		10.0%
Total:		100.0%

Condition	Percent	Count
open	37.8%	9,203
10-15	19.7%	4,803
03-07	14.7%	3,589
07-10	10.6%	2,575
15 plus ft	7.2%	1,759
open irregular	4.0%	975
4x4 tree grate	2.7%	659
unknown	1.0%	232
01-03	0.6%	148
4x4 open	0.5%	127
3x3 open	0.4%	88
4x4 pavers	0.3%	67
3x3 tree grate	0.2%	40
raised bed	0.2%	38
15-20	0.1%	29
5x5 tree grate	0.1%	23
3x3 pavers	0.0%	11
5x5 open	0.0%	10
Total		**24,376**

City-wide Growspace Distribution

Species Distribution

■ maple, norway	26.8%
■ ash, green	8.1%
■ elm, siberian	5.6%
■ honeylocust	4.1%
■ mapl, red	3.3%
■ Others	52.1%
Total:	100.0%

Top 20 Species

Species	Percent	Count
maple, norway	26.8%	6,520
ash, green	8.1%	1,967
elm, siberian	5.6%	1,359
honeylocust	4.1%	1,003
mapl, red	3.3%	812
spruce, colorado	2.8%	672
pine, ponderosa	2.5%	620
crabapple spp	2.4%	581
aspen, quaking	2.1%	504
linden, american	1.9%	470
crabappl spr snow	1.7%	421
mapl, freeman	1.7%	414
linden,littleleaf	1.6%	394
mapl, boxelder	1.6%	391
chokchry,canad rd	1.6%	378
cottonwood, black	1.4%	342
maple, silver	1.3%	320
mapl, sugar	1.2%	301
mapl,nwy crmsn kg	1.2%	301
ash,white	1.2%	290
Others_	25.8%	6,271
Total		**24,331**

City-wide Species Distribution

Structural Defect Distribution

Defect	Percent	Count
deadwood	21.7%	6,547
branch architectr	11.2%	3,380
dieback-minor	8.3%	2,501
co-dominant stems	7.1%	2,141
scar - trunk	7.0%	2,115
dieback-major	6.2%	1,856
included bark	6.0%	1,807
cavity - branch	3.6%	1,091
sucker growth	3.0%	916
crack - frost	3.0%	890
decay - trunk	2.7%	815
cavity - trunk	2.1%	624
storm damage	1.8%	541
dead top	1.5%	445
declining	1.5%	443
co-dominate trunk	1.3%	391
scar - branch	1.2%	357
decay - multlimbs	1.1%	345
decay - branch	1.1%	317
lean >5degrees	1.0%	291
Others	7.7%	2,322
Total		**30,135**

City-wide Structural Defect Distribution

Condition Distribution
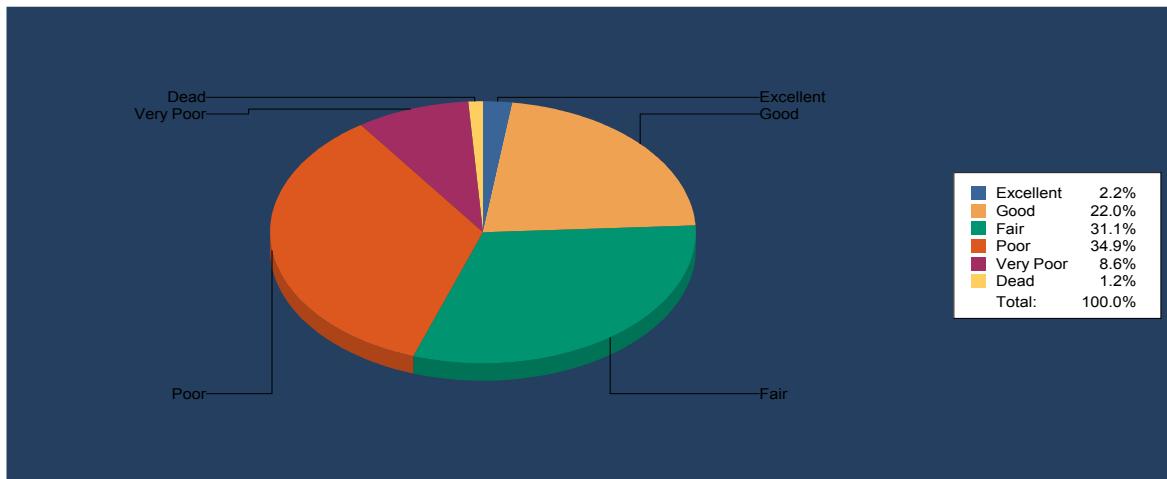
Condition	Percent	Count
Excellent	2.2%	24
Good	22.0%	239
Fair	31.1%	337
Poor	34.9%	378
Very Poor	8.6%	93
Dead	1.2%	13
Total		1,084

Condition distribution under multiple utility lines with primary electric lines

Diameter Distribution
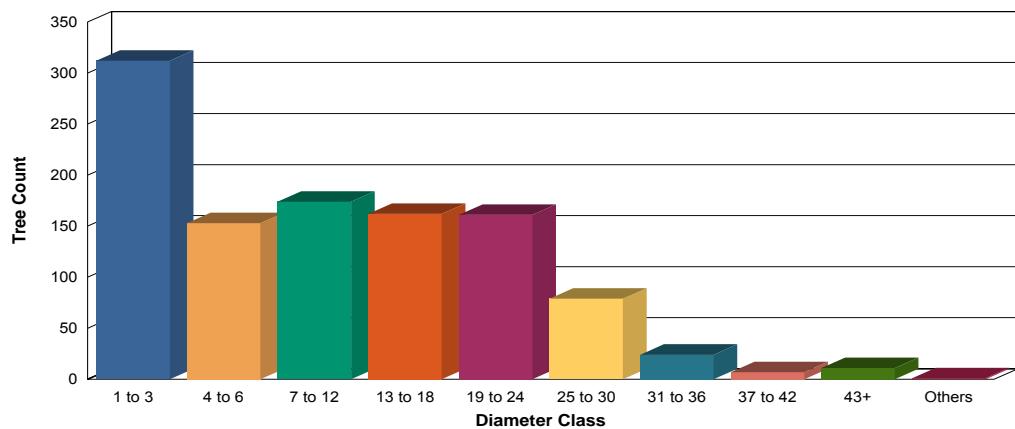
Diameter Class	Percent	Count
1 to 3	**28.8%**	**312**
4 to 6	**14.1%**	**153**
7 to 12	**16.1%**	**174**
13 to 18	**14.9%**	**162**
19 to 24	**14.9%**	**161**
25 to 30	**7.3%**	**79**
31 to 36	**2.2%**	**24**
37 to 42	**0.6%**	**7**
43+	**1.0%**	**11**
Others	**0.1%**	**1**
Total		**1,084**

Diameter distribution under multiple utility lines with primary electric lines

Species Distribution

■	maple, norway	23.6%
■	honeylocust	12.0%
■	spruce, colorado	11.7%
■	crabapple spp	6.2%
■	mapl, boxelder	4.9%
■	Others	41.6%
	Total:	100.0%
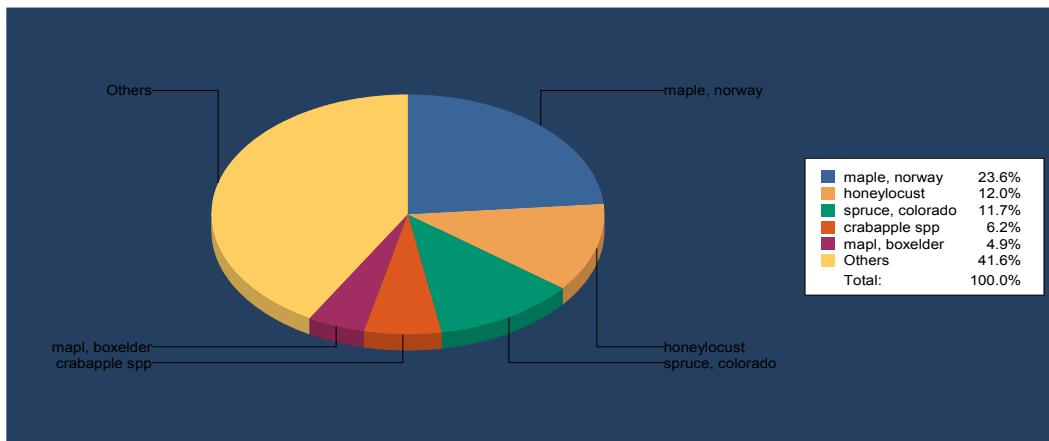
Top 20 Species

Species	Percent	Count
maple, norway	23.6%	255
honeylocust	12.0%	130
spruce, colorado	11.7%	127
crabapple spp	6.2%	67
mapl, boxelder	4.9%	53
elm, siberian	4.6%	50
crabappl spr snow	4.3%	47
pine, ponderosa	2.3%	25
aspen, quaking	1.8%	19
chokchry,canad rd	1.8%	19
maple, silver	1.7%	18
douglas fir	1.6%	17
mapl, red	1.5%	16
spruce spp	1.4%	15
lilac,jap tree	1.1%	12
ash, green	1.0%	11
linden,littleleaf	1.0%	11
maple, norway 'sc	0.9%	10
serviceberry,can	0.9%	10
mapl, freeman	0.8%	9
Others_	14.9%	161
Total		**1,082**

Species distribution under multiple utility lines with primary electric lines

Condition Distribution

Excellent	3.2%	
Good	27.0%	
Fair	35.5%	
Poor	19.1%	
Very Poor	14.2%	
Dead	1.0%	
Total:	100.0%	
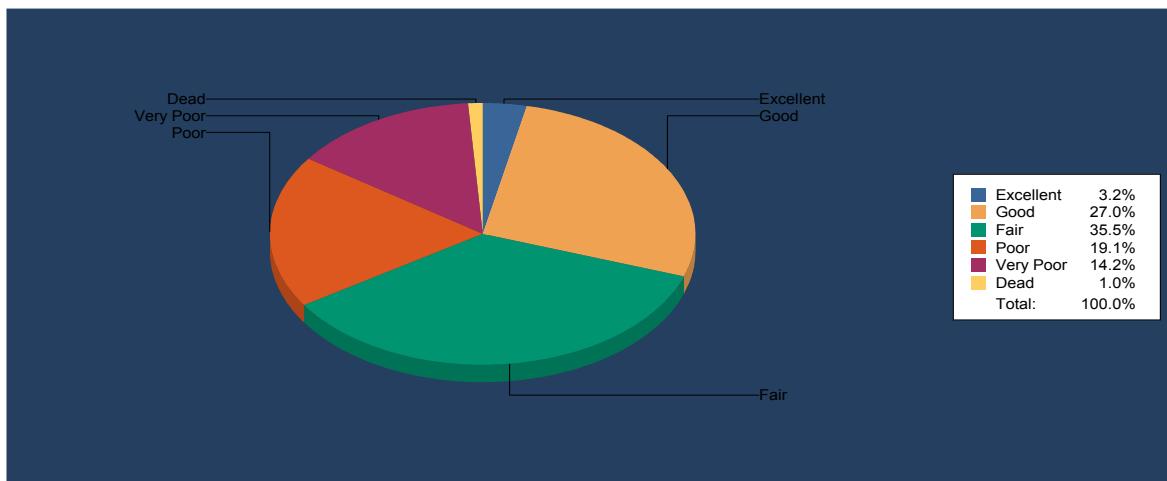
Condition	Percent	Count
Excellent	3.2%	32
Good	27.0%	268
Fair	35.5%	352
Poor	19.1%	189
Very Poor	14.2%	141
Dead	1.0%	10
Total		992

Condition distribution under primary electric lines

Diameter Distribution
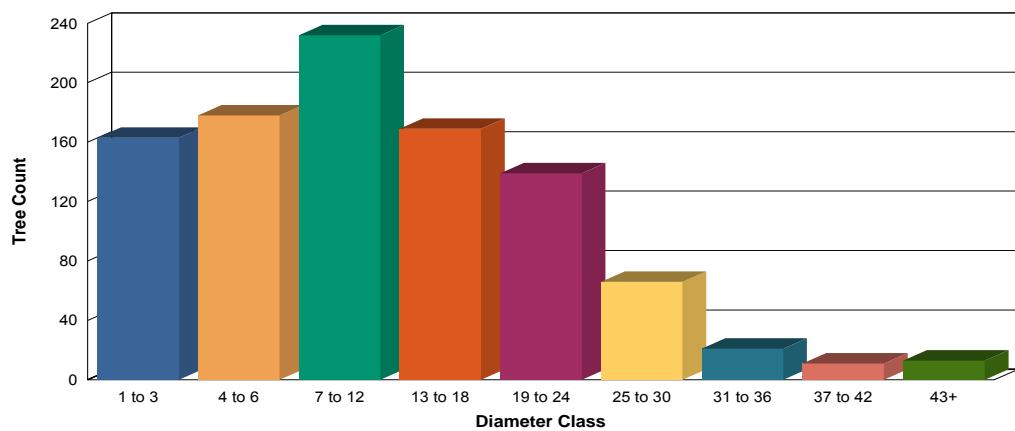
Diameter Class	Percent	Count
1 to 3	16.4%	163
4 to 6	17.9%	178
7 to 12	23.4%	232
13 to 18	17.0%	169
19 to 24	14.0%	139
25 to 30	6.7%	66
31 to 36	2.1%	21
37 to 42	1.1%	11
43+	1.3%	13
Total		992

Diameter distribution under primary electric lines

Species Distribution

maple, norway	26.8%	
ash, green	8.1%	
elm, siberian	5.6%	
honeylocust	4.1%	
mapl, red	3.3%	
Others	52.1%	
Total:	100.0%	

Top 20 Species

Species	Percent	Count
maple, norway	26.8%	6,520
ash, green	8.1%	1,967
elm, siberian	5.6%	1,359
honeylocust	4.1%	1,003
mapl, red	3.3%	812
spruce, colorado	2.8%	672
pine, ponderosa	2.5%	620
crabapple spp	2.4%	581
aspen, quaking	2.1%	504
linden, american	1.9%	470
crabappl spr snow	1.7%	421
mapl, freeman	1.7%	414
linden,littleleaf	1.6%	394
mapl, boxelder	1.6%	391
chokchry,canad rd	1.6%	378
cottonwood, black	1.4%	342
maple, silver	1.3%	320
mapl, sugar	1.2%	301
mapl,nwy crmsn kg	1.2%	301
ash,white	1.2%	290
Others_	25.8%	6,271
Total		**24,331**

Species distribution under primary electric lines

Appendix H

Soil Survey Data

Soils in Missoula range from ancient glacial to urban in nature. The characteristics of each soil type have a direct bearing on its ability to grow trees. This appendix identifies the soil types within, or directly adjacent to, the city limits. Soil types in the outlying county areas surrounding Missoula are not included in this appendix. Maps and complete soil profiles available upon request.

Included in this index are:

- 🌺 Soil Summary
- 🌺 Sample Soil Profile

Table Appendix H-1 Summary of Missoula Soil Types			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7	Argixerolls-Haploxerolls complex, 0 to 4 percent slopes	790.8	5.5%
8	Argixerolls-Haploxerolls complex, 4 to 15 percent slopes	1,404.8	9.9%
9	Argixerolls-Haploxerolls complex, 15 to 30 percent slopes	607.1	4.3%
10	Argixerolls-Haploxerolls complex, 30 to 60 percent slopes	52.7	0.4%
16	Bigarm gravelly loam, 0 to 4 percent slopes	348.0	2.4%
17	Bigarm gravelly loam, 4 to 15 percent slopes	80.2	0.6%
18	Bigarm gravelly loam, 15 to 30 percent slopes	125.4	0.9%
19	Bigarm gravelly loam, 30 to 60 percent slopes	208.6	1.5%
20	Bigarm-Rock outcrop complex, 30 to 60 percent slopes	126.3	0.9%
21	Riverside gravelly sandy loam, 8 to 15 percent slopes	68.4	0.5%
22	Riverside gravelly sandy loam, 15 to 30 percent slopes	175.3	1.2%
34	Desmet loam, 0 to 2 percent slopes	278.9	2.0%
44	Grantsdale loam, 0 to 2 percent slopes	373.7	2.6%
45	Grassvalley silty clay loam, 0 to 4 percent slopes	170.4	1.2%
46	Grassvalley silty clay loam, 4 to 8 percent slopes	156.1	1.1%
47	Grassvalley silty clay loam, 8 to 15 percent slopes	57.7	0.4%
53	Hollandlake gravelly loam, 4 to 30 percent slopes	126.3	0.9%
72	Moiese gravelly loam, 0 to 2 percent slopes	1,983.2	13.9%
73	Orthents, 0 to 4 percent slopes	526.5	3.7%
88	Pits, gravel	154.7	1.1%
93	Riverwash	23.9	0.2%
105	Totelake gravelly loam, 2 to 8 percent slopes	296.0	2.1%
114	Urban land	5,727.2	40.2%
133	Winkler gravelly loam, cool, 30 to 60 percent slopes	8.4	0.1%
135	Winkler, cool-Rock outcrop complex, 50 to 80 percent slopes	4.5	0.0%
136	Xerofluvents, 0 to 2 percent slopes	233.6	1.6%
138	Water	145.8	1.0%
Totals for Area of Interest		14,254.1	100.0%

This is a sample soil profile for the Missoula area. The information contained in the soil profile is used by staff to assist in the selection of appropriate trees within Missoula.

Missoula County Area, Montana
7—Argixerolls-Haploxerolls complex, 0 to 4 percent slopes
Map Unit Setting
- *National map unit symbol:* 4wd7
- *Elevation:* 2,600 to 6,200 feet
- *Mean annual precipitation:* 10 to 19 inches
- *Mean annual air temperature:* 39 to 45 degrees F
- *Frost-free period:* 70 to 120 days
- *Farmland classification:* Farmland of local importance

Map Unit Composition
- *Argixerolls and similar soils:* 50 percent
- *Haploxerolls and similar soils:* 40 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Argixerolls
  Properties and qualities
- *Slope:* 0 to 4 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None

Description of Haploxerolls
  Properties and qualities
- *Slope:* 0 to 4 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None

Minor Components
  Cobbly surface layers
- *Percent of map unit:* 8 percent
- *Ecological site:* Silty (si) 15-19" p.z. (R044XW184MT)

  Poorly drained soils
- *Percent of map unit:* 2 percent
- *Landform:* Drainageways
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Ecological site:* Wet meadow (wm) 10-14" p.z. (R044XW127MT)

Missoula County Area, Montana
8—Argixerolls-Haploxerolls complex, 4 to 15 percent slopes
Map Unit Setting
- *National map unit symbol:* 4wdl
- *Elevation:* 2,600 to 5,500 feet
- *Mean annual precipitation:* 14 to 19 inches
- *Mean annual air temperature:* 41 to 45 degrees F
- *Frost-free period:* 90 to 120 days
- *Farmland classification:* Farmland of local importance

Map Unit Composition
- *Argixerolls and similar soils:* 50 percent
- *Haploxerolls and similar soils:* 40 percent

- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Argixerolls
Properties and qualities
- *Slope:* 4 to 15 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None

Description of Haploxerolls
Properties and qualities
- *Slope:* 4 to 15 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None

Minor Components
Cobbly surface layers
- *Percent of map unit:* 7 percent
- *Ecological site:* Silty (si) 15-19" p.z. (R044XW184MT)

Stony surface layers
- *Percent of map unit:* 3 percent
- *Ecological site:* Silty (si) 15-19" p.z. (R044XW184MT)

Appendix I
Citizen Preference Analysis

During the stakeholder and citizen workshops on January 26 and 29, 2015, attendees were given the opportunity to express their preferences for tree management goals, maintenance spending and funding options. The results of the preference exercises are shown below.

For Goals and Funding Preferences, each attendee was given three red dots. The attendees were instructed to put the dots in the appropriate columns to mark their preferences. For expenditures, each attendee was $520 dollars to spend on their preferences; green dots were worth $100, yellow dots were worth $50 and blue dots were worth $20. The attendees were instructed to spend their money based upon their preferences.

Stakeholder Meeting Results – January 26, 2015

GOAL PREFERENCES			
Management	High Priority	Medium Priority	Low Priority
Establish Work Priorities	2		
Maintain Accurate Inventory		1	
Structural Pruning			
Establish Canopy Goals			
Establish Tree Diversity	1	1	
Aggressive Planting			
Appropriate Tree Stock			
Consistent Maintenance	2	1	
Incorporate Infrastructure Planning	2		
Consistent Enforcement	1	1	
Foster Community Involvement			
Education and Outreach		2	
Investigate Stable Funds			
Manage Into Future	1		
Pest Management			

EXPENDITURE PREFERENCES

Urban Forestry Activities	High Priority	Medium Priority	Low Priority
Planting	500		
Formative Pruning	100	70	20
Structural Pruning		220	
Removals	300	120	
Stump Grinding			40
Risk Management		100	20
Enforcement		80	
Continuous Inventory		100	20
Public Education	200	160	
Pest Management	200	150	
Tree Nursery	100	70	

FUNDING PREFERENCES

Funding Sources	High Priority	Medium Priority	Low Priority
Existing Park District			
New Park District	3		
Sell Carbon Credits		1	
Create Watering Incentive		3	
Create Endowment Fund		1	
Incorporate into Street Maintenance District			
Enact a Once-Cent Gas Tax	1	1	
Bicycle Tab Tax		1	1
Utility Tax			
Northwestern Energy Tree Replacement	3		

Citizen Workshop Results – January 29, 2015

GOAL PREFERENCES

Management	High Priority	Medium Priority	Low Priority
Establish Work Priorities			
Maintain Accurate Inventory	1	1	

GOAL PREFERENCES

Management	High Priority	Medium Priority	Low Priority
Structural Pruning			
Establish Canopy Goals	1		
Establish Tree Diversity	7		
Aggressive Planting	5	1	
Appropriate Tree Stock	3		
Consistent Maintenance	3		
Incorporate Infrastructure Planning			
Consistent Enforcement	4		
Foster Community Involvement			
Education and Outreach		1	
Investigate Stable Funds	3		
Manage Into Future	3		
Pest Management			

EXPENDITURE PREFERENCES

Urban Forestry Activity	High Priority	Medium Priority	Low Priority
Planting	1170	40	
Formative Pruning	150	100	
Structural Pruning	370	70	
Removals	410	70	
Stump Grinding	250	100	
Risk Management	270	20	
Enforcement	590	170	20
Continuous Inventory	350		20
Public Education	740	120	
Pest Management	200		20
Tree Nursery	270	70	

FUNDING PREFERENCES

Funding Source	High Priority	Medium Priority	Low Priority
Existing Park District	2		
New Park District	3		
Sell Carbon Credits			

FUNDING PREFERENCES

Funding Source	High Priority	Medium Priority	Low Priority
Create Watering Incentive	**7**		
Create Endowment Fund	**4**		
Incorporate into Street Maintenance District	**10**		
Enact a Once-Cent Gas Tax	**4**		
Bicycle Tab Tax			
Utility Tax	**2**		
Transient Occupancy Taxes			
Sales Tax	**1**		
Annual Neighborhood Arbor Day Fund Raising Event			

Goal Preferences Summary and Ranking

Priority	Goal	High	Medium	Low	High	Medium	Low	Sum
1	Establish Tree Diversity	**1**	**1**		**7**			9
2	Aggressive Planting				**5**	**1**		6
3	Consistent Maintenance	**2**	**1**		**3**			6
4	Consistent Enforcement	**1**	**1**		**4**			6
5	Manage Into Future	**1**			**3**			4
6	Investigate Stable Funds				**3**			3
7	Appropriate Tree Stock				**3**			3
8	Education and Outreach		**2**			**1**		3
9	Maintain Accurate Inventory		**1**		**1**	**1**		3
10	Establish Work Priorities	**2**						2
11	Incorporate Infrastructure Planning	**2**						2
12	Establish Canopy Goals				**1**			1
13	Structural Pruning							0
14	Foster Community Involvement							0
15	Pest Management							0