A Plan for Heber's Municipal Trees

August 2005

by
Brian Wiebler and
Tiffin Brough
TreeUtah

Table of Contents

Introduction to the Plan 6

1. What do We Have? 7

Overview of Procedures
- Data Collection 7
- Analysis with STRATUM 7

STRATUM Forest Structure Reports
- Population Summery 8
- Relative age Distribution 11
- Condition 16
- Relative Performance Index 18
- Maintenance Recommendations 19
- Maintenance Task 21
- Conflicts 23
- Canopy Cover 24
- Vandalism 24

2. What do We Want? 25

Benefits of Trees
- Saving Energy 25
- Reducing Atmospheric Carbon Dioxide 26
- Improving Air Quality 27
- Reducing Stormwater Runoff and Hydrology 29
- Aesthetics and Other Benefits 30

Costs of Trees
- Planting and Maintaining Trees 32
- Conflicts with Urban Infrastructure 32
- Wood Salvage, Recycling and Disposal 34

Findings from Public Outreach
- Level of Support for Proposed Goals 34
- Level of Support for City Ordinances 35
- Level of Satisfaction with Current Tree Service 36
- Level of Volunteer Interest 36
- Level of Financial Support 37
- Suggested Tree Projects 37
- List of Potential Volunteers 38

Table of Contents

3. How do We Get What We Want? 39

General Guidelines for Selecting and Placing Trees

- Residential Yard Trees 39
  - Maximizing Energy Savings from Shading
  - Planting Windbreaks for Heating Savings
  - Selecting Yard Trees to Maximize Benefits
- Trees in Public Places 42
  - Locating and Selecting Trees to Maximize Climatic Benefits
  - Locating and Selecting Trees to Maximize Stormwater Runoff Reduction Benefits
- General Guidelines to Maximize Long-Term Benefits 45

Local Committee Recommendations

- Recommendation 1 46
- Recommendation 2 46
- Recommendation 3 47
- Recommendation 4 48

References 47

Appendix 51

Data Collection Maps
Public Response Form
Project Idea Maps
Powerpoint Presentation
Outreach Poster

Photos

Photos

Introduction to the Plan

During the summer of 2005 TreeUtah launched a pilot program, the Strategic Planning Program for Municipal Trees, to help bring new science based tree management concepts to small Utah communities. With financial support from the National Tree Trust, TreeUtah developed a three step planning process with the objective of "increasing a municipality's capacity to manage trees as a population to help increase environmental and social benefits derived from the trees while reducing long-term costs."

The Strategic Planning Program for Municipal Trees includes three steps; 1) determining the current state of the community's trees (referred to as the "community forest"), 2) determining what the community wants from its community forest, and 3) determining how to get what the community wants.

This report includes information on how we set out to answer the questions posed in each of the three steps of the planning process and the results of our inquiry. We hope this information will be directly beneficial to those who manage trees in this community. However, we also hope that the planning process will help draw attention to the many environmental and social benefits of trees. We believe that when people have an understanding of the numerous benefits trees provide to their community they will demand the capacity of their municipal tree program be increased.

Chapter 1:

What do We Have?

The first step in our strategic planning process is to determine what the current state of the community forest is. It is important to understand the current condition of the tree population so we can determine if corrective measures are needed and to document improvements in the future.

Overview of Procedures

❖ Data Collection

Originally TreeUtah and the City of Heber were planning to conduct a sample inventory of street trees in the city. A sample inventory utilizes statistics to estimate the characteristics of the total street tree population based on data collected from randomly selected segments of the total population. However, after reviewing the goals of the city's current tree program it was decided that a full inventory of the Main Street Project, City Park, and the City Cemetery would provide more useful information (see Appendix for Data Collection Maps). In the future, if the City decides to begin actively managing street trees throughout town, a sample inventory should be used to estimate the tree population characteristics.

Data for the full inventory of the Main Street Project, City Park, and the City Cemetery was collected with handheld computers running the tree inventory software "i-Tree." Thirteen different data fields were populated for each tree inventoried. For a full list of data fields and their definitions, please see "Data Fields for the i-Tree Inventory System in the Appendix.

❖ Analysis with STRATUM

Data from the inventory was analyzed with the Street Tree Resource Analysis Tool for Urban-Forest Managers (STRATUM). STRATUM was designed by the Center for Urban Forest Management at the University of California at Davis as an easy to use computer-based tool that enables any community to conduct a street tree assessment in order to foster community support for their program, secure funding, and provide baseline data to effectively manage their community forest resource. Results from the STRATUM analysis for resource structure and management needs are provided in the next section. Future versions of STRATUM will be capable of calculating the environmental and social benefits of the trees and then placing an annual monetary value on those benefits. This monetary value can then be used to conduct cost benefit analysis on tree programs. For more information on STRATUM visit http://cufr.ucdavis.edu/stratum.asp

STRATUM Forest Structure Reports

Results from the STRATUM analysis for resource structure and management needs are included below.

❖ Population Summaries

Population Summary of PublicTrees for Zone Main Street

	DBH Class(in)									
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Broadleaf Deciduous Large (BDL)										
NORWAY MAPLE	25	3	0	0	0	0	0	0	0	28
HAWTHORN	8	3	0	0	0	0	0	0	0	11
ASH	5	3	0	0	0	0	0	0	0	8
MOUNTAIN ASH	5	0	0	0	0	0	0	0	0	5
Maple	3	0	0	0	0	0	0	0	0	3
BDL OTHER	3	0	0	0	0	0	0	0	0	3
Total	**49**	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**58**
Broadleaf Deciduous Medium (BDM)										
PEAR	29	5	0	0	0	0	0	0	0	34
BDM OTHER	1	0	0	0	0	0	0	0	0	1
Total	**30**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**35**
Broadleaf Deciduous Small (BDS)										
APPLE	40	0	0	0	0	0	0	0	0	40
PLUM or CHERRY	11	0	0	0	0	0	0	0	0	11
Redbud, Western	7	0	0	0	0	0	0	0	0	7
COMMON CHOKECHERI	5	0	0	0	0	0	0	0	0	5
Linden, Little-leaf	5	0	0	0	0	0	0	0	0	5
BDS OTHER	0	0	0	0	0	0	0	0	0	0
Total	**68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**68**
Zone Main Street Total	**147**	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**161**

Population Summary of PublicTrees for Zone City Park

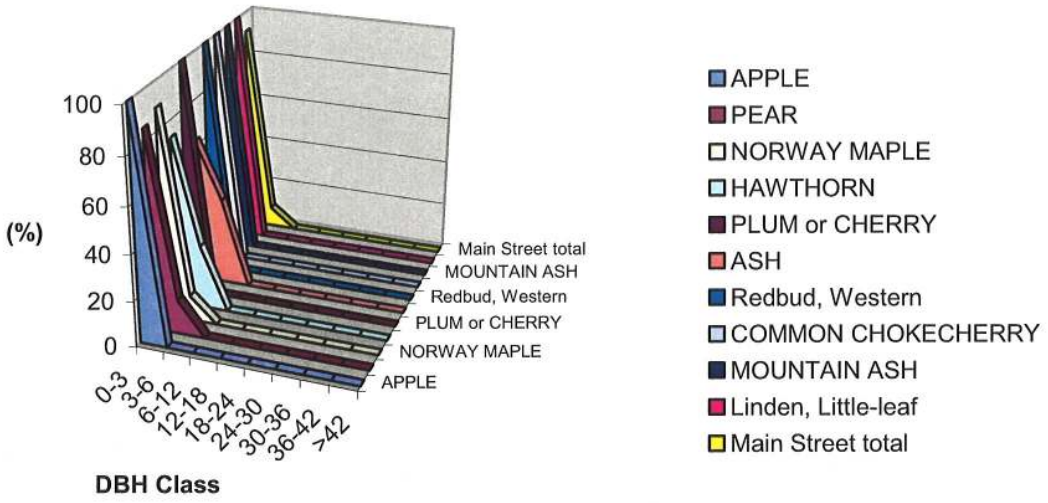
Species	DBH Class(in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Broadleaf Deciduous Large (BDL)										
HAWTHORN	3	9	1	0	0	0	0	0	0	13
GREEN ASH	2	3	0	0	1	0	0	0	0	6
NORWAY MAPLE	1	2	1	0	1	0	0	0	0	5
COTTONWOOD	0	0	2	0	0	0	0	0	0	2
SILVER MAPLE	0	0	1	0	0	0	0	0	0	1
MOUNTAIN ASH	1	0	0	0	0	0	0	0	0	1
BDL OTHER	0	0	0	0	0	0	0	0	0	0
Total	**7**	**14**	**5**	**0**	**2**	**0**	**0**	**0**	**0**	**28**
Broadleaf Deciduous Medium (BDM)										
Locust, Honey	0	0	1	1	4	3	1	0	0	10
Birch, River	0	0	0	0	1	0	0	0	0	1
BDM OTHER	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**1**	**1**	**5**	**3**	**1**	**0**	**0**	**11**
Broadleaf Deciduous Small (BDS)										
QUAKING ASPEN	0	1	2	0	0	0	0	0	0	3
EASTERN SERVICE BERRY	2	0	0	0	0	0	0	0	0	2
Linden, Little-leaf	1	0	0	0	0	0	0	0	0	1
BDS OTHER	0	0	0	0	0	0	0	0	0	0
Total	**3**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**6**
Conifer Evergreen Large (CEL)										
Spruce, Blue	0	0	6	6	0	0	0	0	0	12
SCOTCH PINE	0	0	2	0	0	0	0	0	0	2
CEL OTHER	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**8**	**6**	**0**	**0**	**0**	**0**	**0**	**14**
Conifer Evergreen Medium (CEM)										
Pine, Austrian Black	0	0	4	1	0	0	0	0	0	5
CEM OTHER	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**5**
Zone City Park Total	**10**	**15**	**20**	**8**	**7**	**3**	**1**	**0**	**0**	**64**

Population Summary of PublicTrees for Zone City Cemetery

	DBH Class(in)									
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Broadleaf Deciduous Large (BDL)										
NORWAY MAPLE	6	0	0	0	0	0	0	0	0	6
ASH	5	0	0	0	0	0	0	0	0	5
KENTUCKY COFFEETREE	5	0	0	0	0	0	0	0	0	5
HAWTHORN	3	0	0	0	0	0	0	0	0	3
WILLOW	0	0	0	1	0	0	0	1	0	2
GREEN ASH	1	0	0	0	0	0	0	0	0	1
ELM	1	0	0	0	0	0	0	0	0	1
BDL OTHER	0	0	0	0	0	0	0	0	0	0
Total	**##**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**23**
Broadleaf Deciduous Medium (BDM)										
Ginkgo, Female	7	0	0	0	0	0	0	0	0	7
Tree Of Heaven	0	0	3	0	0	1	0	0	0	4
BDM OTHER	0	0	0	0	0	0	0	0	0	0
Total	**7**	**0**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**11**
Broadleaf Deciduous Small (BDS)										
QUAKING ASPEN	0	0	0	1	0	0	0	0	0	1
BDS OTHER	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Conifer Evergreen Large (CEL)										
Spruce, Blue	4	6	9	0	1	2	8	3	3	36
NORWAY SPRUCE	0	0	0	0	0	2	2	2	0	6
JUNIPER	0	0	0	0	1	3	0	0	1	5
CEL OTHER	0	0	0	0	0	0	0	0	0	0
Total	**4**	**6**	**9**	**0**	**2**	**7**	**10**	**5**	**4**	**47**
Conifer Evergreen Medium (CEM)										
Pine, Austrian Black	0	0	1	0	0	0	0	1	0	2
CEM OTHER	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**
Zone City Cemetery Total	**##**	**6**	**13**	**2**	**2**	**8**	**10**	**7**	**4**	**84**

❖ Relative Age Distribution

Relative Age Distribution of Top 10 Public Tree Species for Zone Main Street (%)

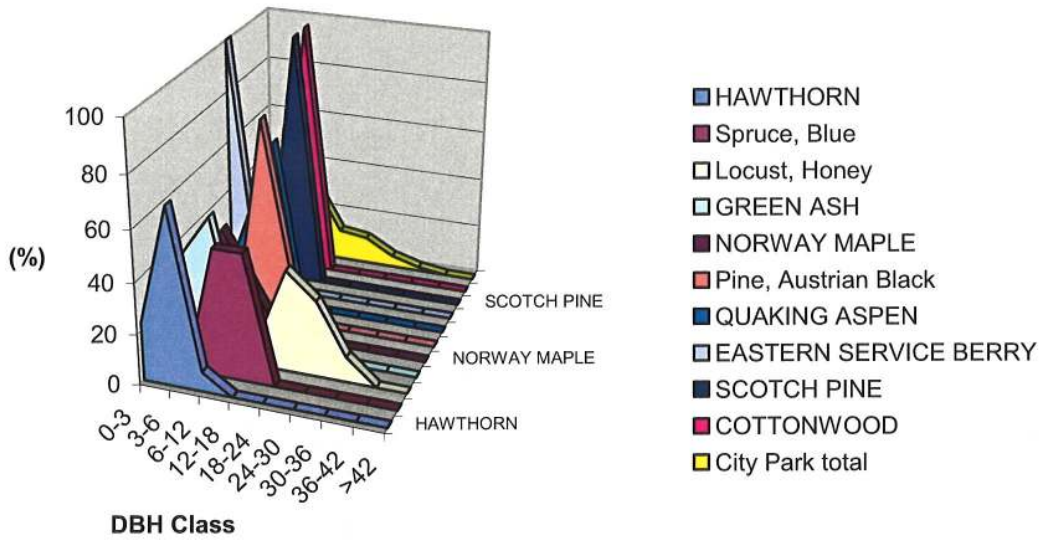


Relative Age Distribution of Top 10 Public Tree Species for Zone Main Street (%)

DBH class (in)

Species Name	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
APPLE	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PEAR	85.29	14.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NORWAY MAPLE	89.29	10.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAWTHORN	72.73	27.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PLUM or CHERRY	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ASH	62.50	37.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Redbud, Western	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COMMON CHOKECHERRY	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MOUNTAIN ASH	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Linden, Little-leaf	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Main Street total	91.30	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Relative Age Distribution of Top 10 Public Tree Species for Zone City Park (%)

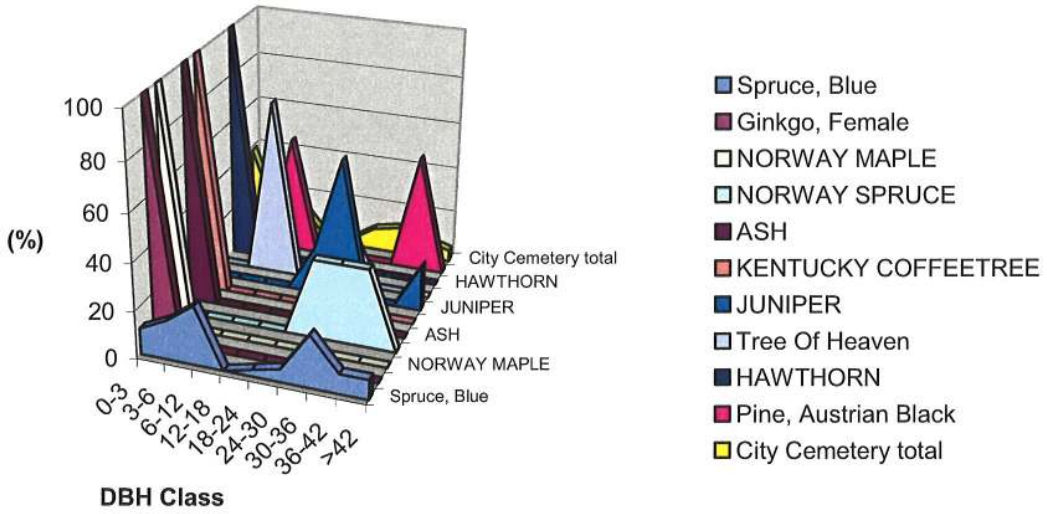


Relative Age Distribution of Top 10 Public Tree Species for Zone City Park (%)

DBH class (in)

Species Name	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
HAWTHORN	23.08	69.23	7.69	0.00	0.00	0.00	0.00	0.00	0.00
Spruce, Blue	0.00	0.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00
Locust, Honey	0.00	0.00	10.00	10.00	40.00	30.00	10.00	0.00	0.00
GREEN ASH	33.33	50.00	0.00	0.00	16.67	0.00	0.00	0.00	0.00
NORWAY MAPLE	20.00	40.00	20.00	0.00	20.00	0.00	0.00	0.00	0.00
Pine, Austrian Black	0.00	0.00	80.00	20.00	0.00	0.00	0.00	0.00	0.00
QUAKING ASPEN	0.00	33.33	66.67	0.00	0.00	0.00	0.00	0.00	0.00
EASTERN SERVICE BERRY	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCOTCH PINE	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
COTTONWOOD	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
City Park total	15.63	23.44	31.25	12.50	10.94	4.69	1.56	0.00	0.00

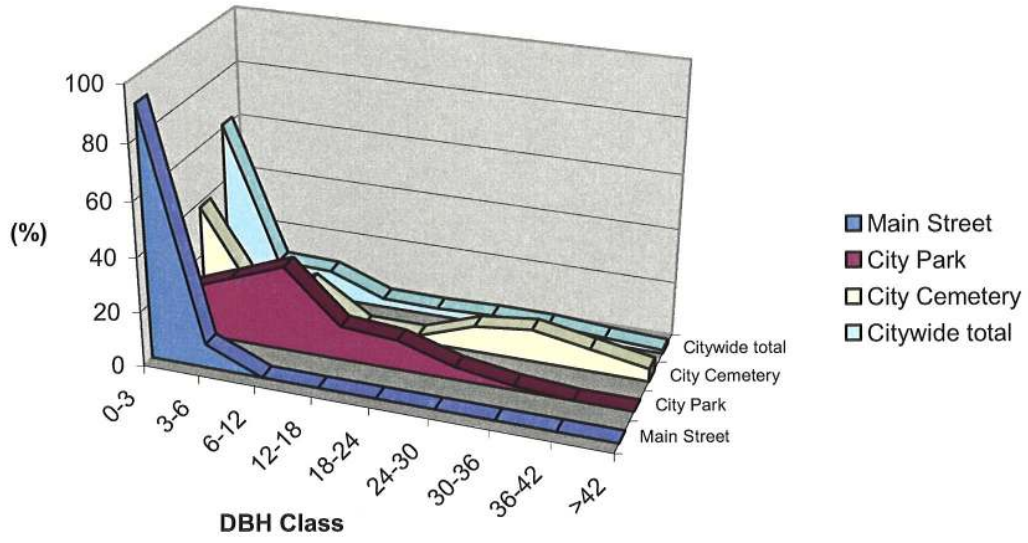
Relative Age Distribution of Top 10 Public Tree Species for Zone City Cemetery (%)



Relative Age Distribution of Top 10 Public Tree Species for Zone City Cemetery (%)
DBH class (in)

Species Name	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Spruce, Blue	11.11	16.67	25.00	0.00	2.78	5.56	22.22	8.33	8.33
Ginkgo, Female	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NORWAY MAPLE	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NORWAY SPRUCE	0.00	0.00	0.00	0.00	0.00	33.33	33.33	33.33	0.00
ASH	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KENTUCKY COFFEETREE	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JUNIPER	0.00	0.00	0.00	0.00	20.00	60.00	0.00	0.00	20.00
Tree Of Heaven	0.00	0.00	75.00	0.00	0.00	25.00	0.00	0.00	0.00
HAWTHORN	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pine, Austrian Black	0.00	0.00	50.00	0.00	0.00	0.00	0.00	50.00	0.00
City Cemetery total	38.10	7.14	15.48	2.38	2.38	9.52	11.90	8.33	4.76

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

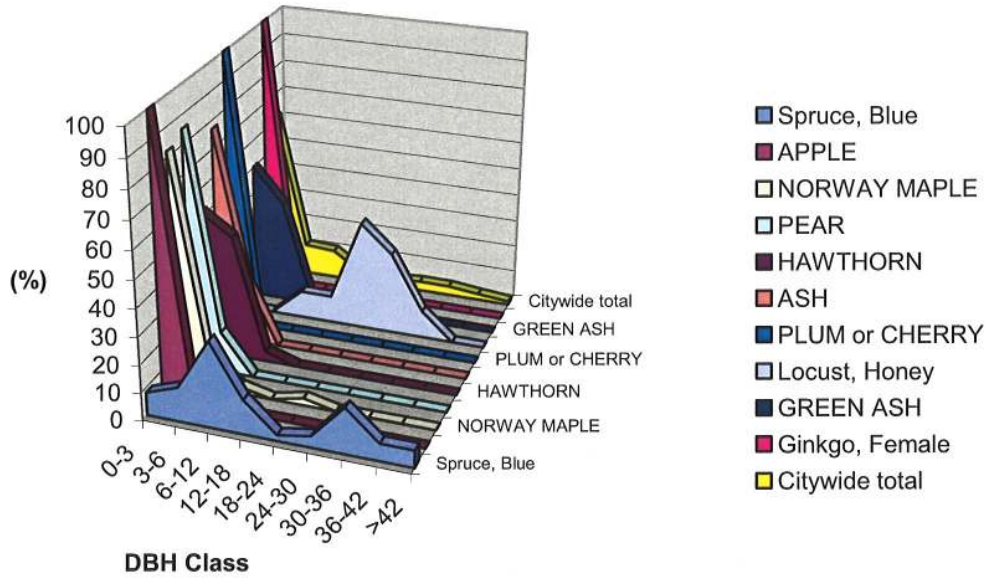


Relative Age Distribution of Public Tree Species for All Zones (%)

DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Main Street	91.30	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Park	15.63	23.44	31.25	12.50	10.94	4.69	1.56	0.00	0.00
City Cemetery	38.10	7.14	15.48	2.38	2.38	9.52	11.90	8.33	4.76
Citywide total	61.17	11.33	10.68	3.24	2.91	3.56	3.56	2.27	1.29

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

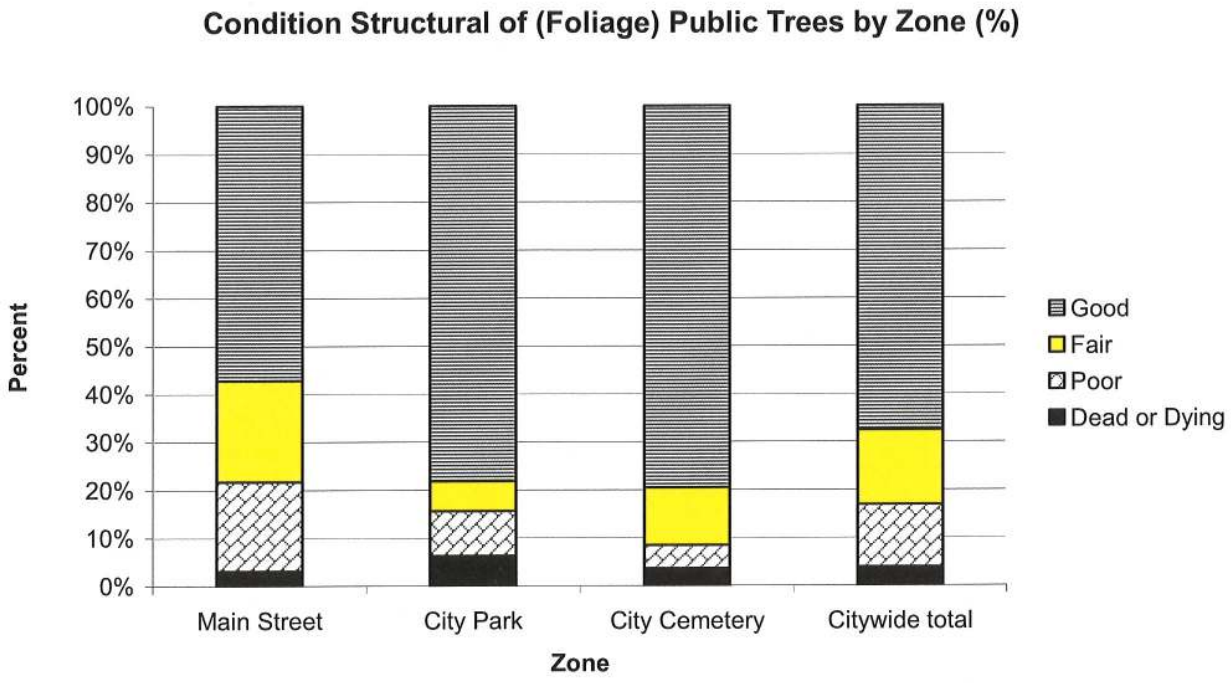


Relative Age Distribution of Top 10 Public Tree Species (%)
8/9/2005

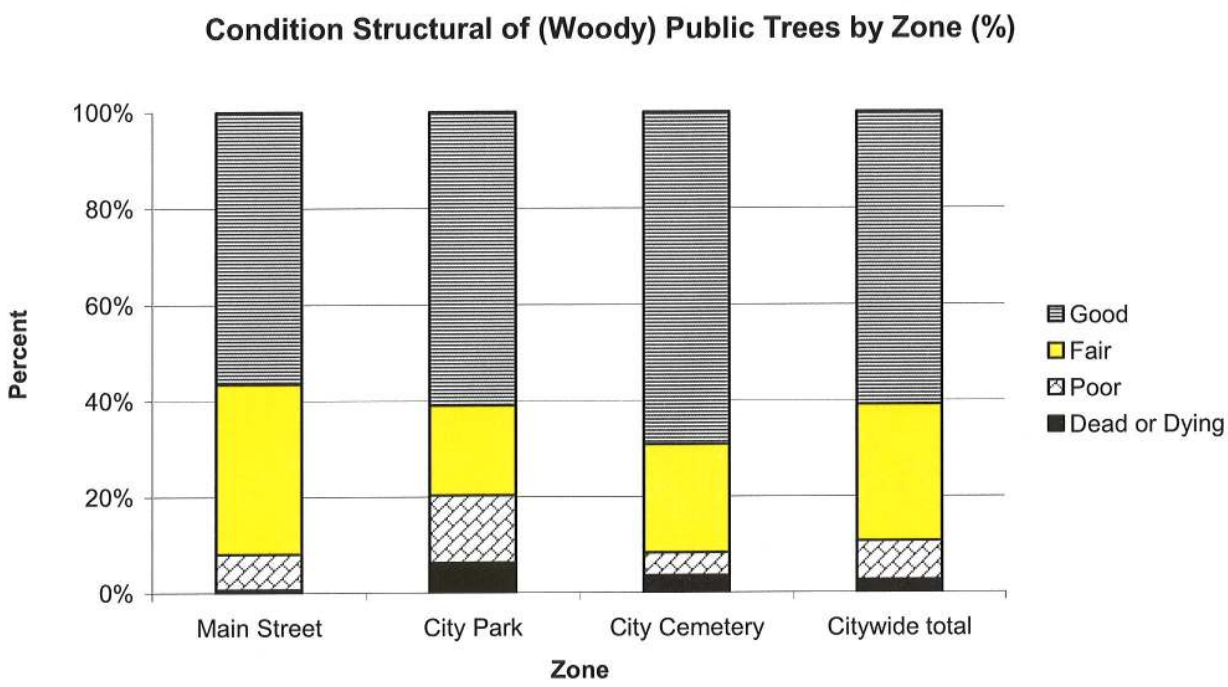
DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Spruce, Blue	8.33	12.50	31.25	12.50	2.08	4.17	16.67	6.25	6.25
APPLE	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NORWAY MAPLE	82.05	12.82	2.56	0.00	2.56	0.00	0.00	0.00	0.00
PEAR	85.29	14.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAWTHORN	51.85	44.44	3.70	0.00	0.00	0.00	0.00	0.00	0.00
ASH	76.92	23.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PLUM or CHERRY	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Locust, Honey	0.00	0.00	10.00	10.00	40.00	30.00	10.00	0.00	0.00
GREEN ASH	50.00	37.50	0.00	0.00	12.50	0.00	0.00	0.00	0.00
Ginkgo, Female	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Citywide total	61.17	11.33	10.68	3.24	2.91	3.56	3.56	2.27	1.29

❖ Condition



Zone Segment	Dead or Dying	Poor	Fair	Good
Main Street	3.11	18.63	21.12	57.14
City Park	6.25	9.38	6.25	78.13
City Cemetery	3.61	4.82	12.05	79.52
Citywide total	3.90	12.99	15.58	67.53



Zone Segment	Dead or Dying	Poor	Fair	Good
Main Street	0.62	7.45	35.40	56.52
City Park	6.25	14.06	18.75	60.94
City Cemetery	3.57	4.76	22.62	69.05
Citywide total	2.59	8.09	28.48	60.84

❖ Relative Performance Index

Relative Performance Index for Selected Trees

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees Total	% of Total Population
Spruce, Blue	2.11	2.08	3.17	93.68	**1.15**	48	15.58
APPLE	5.00	2.50	27.50	67.50	**1.05**	40	12.99
NORWAY MAPLE	7.69	19.23	33.33	39.74	**0.83**	39	12.66
PEAR	0.00	11.76	25.00	63.24	**1.02**	34	11.04
HAWTHORN	3.70	16.67	27.78	51.85	**0.92**	27	8.77
ASH	0.00	15.38	38.46	46.15	**0.93**	13	4.22
PLUM or CHERRY	9.09	9.09	27.27	54.55	**0.92**	11	3.57
Locust, Honey	0.00	10.00	15.00	75.00	**1.07**	10	3.25
GREEN ASH	0.00	18.75	37.50	62.50	**0.98**	8	2.60
Ginkgo, Female	0.00	18.75	37.50	62.50	**0.98**	8	2.60
Redbud, Western	0.00	28.57	28.57	42.86	**0.87**	7	2.27
Pine, Austrian Black	0.00	0.00	0.00	100.00	**1.21**	7	2.27
NORWAY SPRUCE	0.00	0.00	33.33	83.33	**1.14**	6	1.95
MOUNTAIN ASH	0.00	16.67	25.00	66.67	**1.04**	6	1.95
Linden, Little-leaf	0.00	16.67	16.67	83.33	**1.11**	6	1.95
KENTUCKY COFFEETREE	0.00	0.00	60.00	70.00	**1.09**	5	1.62
JUNIPER	0.00	0.00	40.00	80.00	**1.13**	5	1.62
COMMON CHOKECHERR\	0.00	20.00	40.00	50.00	**0.97**	5	1.62
Tree Of Heaven	25.00	0.00	75.00	0.00	**0.61**	4	1.30
QUAKING ASPEN	25.00	75.00	0.00	0.00	**0.30**	4	1.30
Citywide total	800.00	2,500.00	8,800.00	18,800.00	1.00	308	100.32

❖ Maintenance Recommendations

Maintenance Recommended Summary for Public Trees (None)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	15	0	0	0	0	0	0	0	0	15
City Park	1	1	14	4	0	0	0	0	0	20
City Cemetery	3	4	7	1	0	2	3	2	1	23
Citywide Total	19	5	21	5	0	2	3	2	1	58

Maintenance Recommended Summary for Public Trees (Small tree (routine))

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	115	14	0	0	0	0	0	0	0	129
City Park	8	11	3	1	1	0	0	0	0	24
City Cemetery	25	1	1	0	0	0	0	0	0	27
Citywide Total	148	26	4	1	1	0	0	0	0	180

Maintenance Recommended Summary for Public Trees (Samll tree (immediate))

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	17	0	0	0	0	0	0	0	0	17
City Park	0	1	1	0	0	0	0	0	0	2
City Cemetery	4	1	5	0	0	0	0	0	0	10
Citywide Total	21	2	6	0	0	0	0	0	0	29

Maintenance Recommended Summary for Public Trees (Large tree (routine))

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	0	0	0	0	0	0	0	0	0	0
City Park	0	0	1	1	5	1	1	0	0	9
City Cemetery	0	0	0	0	2	5	7	5	3	22
Citywide Total	0	0	1	1	7	6	8	5	3	31

Maintenance Recommended Summary for Public Trees (Large tree (immediate))

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	0	0	0	0	0	0	0	0	0	0
City Park	0	0	0	0	1	0	0	0	0	1
City Cemetery	0	0	0	1	0	1	0	0	0	2
Citywide Total	0	0	0	1	1	1	0	0	0	3

Maintenance Recommended Summary for Public Trees (Critical concern (public safety))

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	0	0	0	0	0	0	0	0	0	0
City Park	1	2	1	2	0	2	0	0	0	8
City Cemetery	0	0	0	0	0	0	0	0	0	0
Citywide Total	1	2	1	2	0	2	0	0	0	8

Summary Maintenance Recommended Need for Public Trees

Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	19	5	21	5	0	2	3	2	1	58	19
Small tree (routine)	148	26	4	1	1	0	0	0	0	180	58
Small tree (immediate)	21	2	6	0	0	0	0	0	0	29	9
Large tree (routine)	0	0	1	1	7	6	8	5	3	31	10
Large tree (immediate)	0	0	0	1	1	1	0	0	0	3	1
Critical concern (public s	1	2	1	2	0	2	0	0	0	8	3
Citywide total	189	35	33	10	9	11	11	7	4	309	100

❖ Maintenance Task

Maintenance Tasks Summary for Public Trees (None)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	16	1	0	0	0	0	0	0	0	17
City Park	1	1	14	4	0	0	0	0	0	20
City Cemetery	6	5	7	1	0	3	4	3	2	31
Citywide Total	23	7	21	5	0	3	4	3	2	68

Maintenance Tasks Summary for Public Trees (Stake/Train)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	57	3	0	0	0	0	0	0	0	60
City Park	3	1	1	0	1	0	0	0	0	6
City Cemetery	15	1	2	0	0	0	0	0	0	18
Citywide Total	64	3	3	0	1	0	0	0	0	71

Maintenance Tasks Summary for Public Trees (Clean)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	70	10	0	0	0	0	0	0	0	80
City Park	5	10	1	2	6	3	1	0	0	28
City Cemetery	9	0	0	1	2	3	6	4	2	27
Citywide Total	84	20	1	3	8	6	7	4	2	135

Maintenance Tasks Summary for Public Trees (Raise)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	0	0	0	0	0	0	0	0	0	0
City Park	0	0	2	1	0	0	0	0	0	6
City Cemetery	0	0	1	0	0	1	0	0	0	2
Citywide Total	11	2	3	1	0	1	0	0	0	18

Maintenance Tasks Summary for Public Trees (Reduce)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	0	0	0	0	0	0	0	0	0	0
City Park	0	0	0	0	0	0	0	0	0	0
City Cemetery	0	0	0	0	0	0	0	0	0	0
Citywide Total	0	0	0	0	0	0	0	0	0	0

Maintenance Tasks Summary for Public Trees (Remove)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Main Street	4	0	0	0	0	0	0	0	0	4
City Park	1	3	2	1	0	0	0	0	0	7
City Cemetery	2	0	3	0	0	1	0	0	0	6
Citywide Total	7	3	5	1	0	1	0	0	0	17

Summary Maintenance Tasks Need for Public Trees

Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	23	7	21	5	0	3	4	3	2	68	22.01
Stake/Train	64	3	3	0	1	0	0	0	0	71	22.98
Clean	84	20	1	3	8	6	7	4	2	135	43.69
Raise	11	2	3	1	0	1	0	0	0	18	5.83
Reduce	0	0	0	0	0	0	0	0	0	0	0.00
Remove	7	3	5	1	0	1	0	0	0	17	5.50
Citywide total	189	35	33	10	9	11	11	7	4	309	100.00

❖ Conflicts

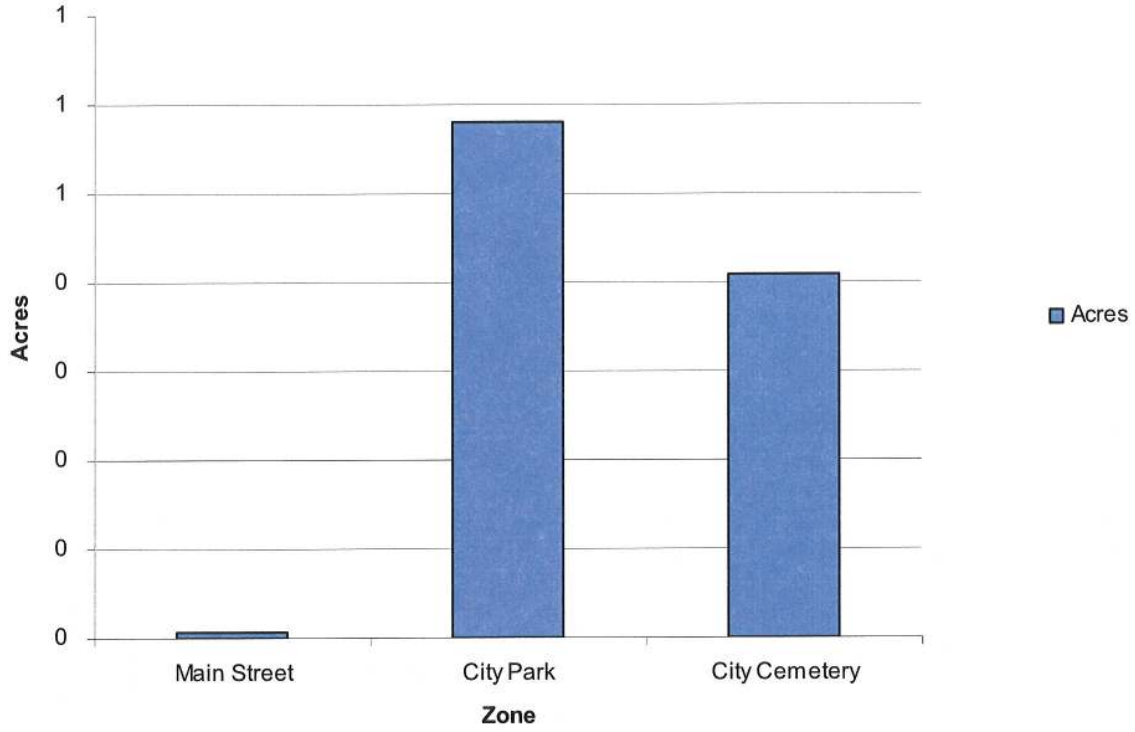
Overhead Utility LinesConflicts for Most Common Public Species

Species	No lines	Present and not conflicting	Present and conflict
Spruce, Blue	47	0	0
APPLE	40	0	0
NORWAY MAPLE	39	0	0
PEAR	33	0	0
HAWTHORN	27	0	0
ASH	13	0	0
PLUM or CHERRY	11	0	0
Locust, Honey	6	3	1
GREEN ASH	7	1	0
Ginkgo, Female	8	0	0
Redbud, Western	7	0	0
Pine, Austrian Black	7	0	0
NORWAY SPRUCE	6	0	0
MOUNTAIN ASH	6	0	0
Linden, Little-leaf	6	0	0
JUNIPER	5	0	0
COMMON CHOKECHERRY	5	0	0
Tree Of Heaven	4	0	0
KENTUCKY COFFEETREE	4	0	0
QUAKING ASPEN	4	0	0
Citywide total	285	4	1

Sidewalk HeaveConflicts for Most Common Public Species

Species	None	Low	Medium	>High
Spruce, Blue	47	0	0	0
APPLE	40	0	0	0
NORWAY MAPLE	39	0	0	0
PEAR	33	0	0	0
HAWTHORN	27	0	0	0
ASH	13	0	0	0
PLUM or CHERRY	11	0	0	0
Locust, Honey	8	2	0	0
GREEN ASH	8	0	0	0
Ginkgo, Female	8	0	0	0
Redbud, Western	7	0	0	0
Pine, Austrian Black	7	0	0	0
NORWAY SPRUCE	6	0	0	0
MOUNTAIN ASH	6	0	0	0
Linden, Little-leaf	6	0	0	0
JUNIPER	5	0	0	0
COMMON CHOKECHERRY	5	0	0	0
Tree Of Heaven	4	0	0	0
KENTUCKY COFFEETREE	4	0	0	0
QUAKING ASPEN	4	0	0	0
Citywide total	288	2	0	0

❖ Canopy Cover of Public Trees



Canopy Cover of Public Trees (Acres)

Zone	Acres	% of Total Canopy
Main Street	0.01	0.74
City Park	0.58	58.22
City Cemetery	0.41	41.04
Citywide total	1.00	100.00

❖ Vandalism

Vandalism on Main Street

	Trees	% Trees
NO	131	85.6
Yes	22	14.4

Chapter 2:

What do We Want?

Our program is based on the idea that, in general, people do want the environmental and social benefits that trees can provide. However, if people are not aware of these benefits they may not be very supportive of the city tree program. To aid in this education process this chapter presents information on the benefits of trees and costs of maintaining them. This information is taken from the "Northern Mountain and Prairie Community Tree Guide: Benefits, Costs and Strategic Planting" (McPherson et al. 2003). For more information on this publication please visit http://cufr.ucdavis.edu

In an effort to gain information about what this community was specifically interested in seeing happen with their trees and tree program TreeUtah distributed a "Public Response Form" (see Appendix for Public Response Form). Results form this non-scientific poll of interested citizens is included in this chapter.

Benefits of Trees

❖ Saving Energy

How trees save energy

Trees modify climate and conserve building energy use in three principal ways:

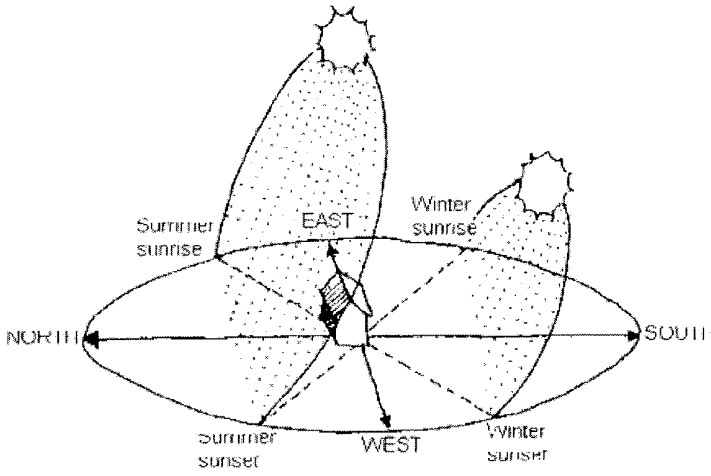
- Shading — reduces the amount of radiant energy absorbed and stored by built surfaces.
- Transpiration — converts liquid water to water vapor and thus cools by using solar energy that would otherwise result in heating of the air.
- Wind speed reduction — reduces the infiltration of outside air into interior spaces and conductive heat loss, especially where thermal conductivity is relatively high (e.g., glass windows) (Simpson 1998).

Trees and other greenspace within individual building sites may lower air temperatures 5°F (3°C) compared to outside the greenspace. At the larger scale of urban climate (6 miles [10 km] square), temperature differences of more than 9°F (5°C) have been observed between city centers and more vegetated suburban areas (Akbari et al. 1992). These "hot spots" in cities are called urban heat islands.

Trees moderate temperatures

For individual buildings, strategically placed trees can increase energy efficiency in the summer and winter. Solar angles are important when the summer sun is low in the east and west for several hours each day. Tree shade to protect east — and especially west — walls help keep buildings cool. In the winter, solar access on the southern side of buildings can warm interior spaces (Diagram 1). Even deciduous trees that shade south and east-facing walls during winter can increase heating costs.

Diagram 1: Paths of the sun at winter and summer solstices (from Sand 1991).



Rates at which outside air infiltrates into a building can increase substantially with wind speed. In cold windy weather, the entire volume of air in a poorly sealed home may change two to three times per hour. Even in newer or tightly sealed homes, the entire volume of air may change every two to three hours. Windbreaks reduce wind speed and resulting air infiltration by up to 50%, translating into potential annual heating savings of 10-12% (Heisler 1986). Reductions in wind speed reduce heat transfer through conductive materials as well. Cool winter winds, blowing against windows, can contribute significantly to the heating load of homes and buildings by increasing the temperature gradient between inside and outside temperatures. Windbreaks reduce air infiltration and conductive heat loss from buildings.

Trees can save substantial $

Trees provide greater energy savings in the Northern Mountain and Prairie region than in milder climate regions because of the cold winters and hot summers. A computer simulation of annual cooling savings for an energy efficient home in Denver indicated that the typical household with air conditioning spent about $400 each year for heating and $125 for cooling. Wind protection from two 25-ft tall (7.5 m) trees — on the west side of the house — was estimated to save $15 each year for heating, a 4% reduction (3.5 MBtu) (McPherson et al. 1993). Shade and lower air temperatures from the same two trees during summer reduced annual cooling costs by about $30 (24%). The total $45 savings represented a 9% reduction in annual heating and cooling costs.

Retrofit for more savings

In the Northern Mountain and Prairie region, there is ample opportunity to "retrofit" communities with more sustainable landscapes through strategic tree planting and stewardship of existing trees. Strategically located tree plantings could reduce annual heating and cooling costs by 20-25% for typical households.

❖ Reducing Atmospheric Carbon Dioxide

Trees reduce CO2

Urban forests can reduce atmospheric CO2 in two ways:

- Trees directly sequester CO2 as woody and foliar biomass while they grow.
- Trees near buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with electric power production.

Activities that release CO2

On the other hand, vehicles, chain saws, chippers, and other equipment release CO2 during the process of planting and maintaining trees. And eventually, all trees die and most of the CO2 that has accumulated in their woody biomass is released into the atmosphere through decomposition.

Typically, CO2 released due to tree planting, maintenance, and other program-related activities is about 2-8% of annual CO2 reductions obtained through sequestration and avoided power plant emissions (McPherson and Simpson 1999). To provide a complete picture of atmospheric CO2 reductions from tree planting it is important to consider CO2 released into the atmosphere through tree planting and care activities, as well as decomposition of wood from pruned or dead trees.

Avoided CO2 emissions

Regional variations in climate and the mix of fuels that produce energy to heat and cool buildings influence potential CO2 emission reductions. The average emission rate for the Northern Mountain and Prairie region is approximately 2.0 lbs (0.9 kg) CO2/kWh. Due to the large amount of coal in the mix of fuels used to generate the power, this emission rate is higher than in some other regions. For example, the two-state average for Oregon and Washington is much lower, 0.27 lbs (0.12 kg) CO2/kWh because hydroelectric power predominates. The Northern Mountain and Prairie region's relatively high CO2 emission rate accentuates CO2 benefits from reduced energy demand relative to other regions with lower emission rates.

Financial value of CO2 reduction

One of the most comprehensive studies of atmospheric CO2 reduction by an urban forest found that Sacramento, California's six million trees removed approximately 335 thousand tons (304,000 metric tonnes) of atmospheric CO2 annually, with an implied value of $3.3 million (McPherson 1998). Avoided power plant emissions (83,300 tons [75,600 tonnes]) accounted for 32% of the amount reduced (262,300 tons [238,000 tonnes]). The amount of CO2 reduction by Sacramento's urban forest offset 1.8% of total CO2 emitted annually as a byproduct of human consumption. This savings could have been substantially increased through strategic planting and long-term stewardship that maximized future energy savings from new tree plantings.

CO2 reduction through community forestry

Since 1990, Trees Forever, an Iowa-based nonprofit, has planted trees for energy savings and atmospheric carbon dioxide reduction with utility sponsorships. Over one-million landscape-sized trees have been planted in 400 communities with the help of 120,000 volunteers. These trees are estimated to offset CO2 emissions by 50,000 tons (45,359 metric tonnes) annually. Based on an Iowa State University study, survival rates are an amazing 91%, indicating a highly trained and committed volunteer force (Ramsay 2002).

❖ Improving Air Quality

Trees improve air quality

Urban trees provide air quality benefits in four main ways:

- Absorbing gaseous pollutants (e.g., ozone, nitrogen oxides, and sulfur dioxide) through leaf surfaces.
- Intercepting particulate matter (e.g., dust, ash, pollen, smoke).

- Releasing oxygen through photosynthesis.
- Transpiring water and shading surfaces, which lowers local air temperatures, thereby reducing ozone levels.

Trees affect ozone formation

In the absence of the cooling effects of trees, higher air temperatures contribute to ozone formation. Most trees emit various biogenic volatile organic compounds (BVOCs) such as isoprenes and monoterpenes that can contribute to ozone formation. The ozone-forming potential of different tree species varies considerably. A computer simulation study for the Los Angeles basin found that increased tree planting of low BVOC emitting tree species would reduce ozone concentrations and exposure to ozone, while planting of medium- and high-emitters would increase overall ozone concentrations (Taha 1996). The contribution of BVOC emissions from trees to ozone formation in Northern Mountain and Prairie communities has not been studied.

Areas with poor air quality

Although many communities in the Northern Mountain and Prairie region do not experience poor air quality, several areas have exceeded U.S. Environmental Protection Agency (EPA) standards and continue to experience periods of poor air quality. These include metro Fairbanks and Anchorage, Alaska; California's Owens Valley; the western metro Denver area and several mountain communities in Colorado; Northern Idaho; Northwest Montana as well as the Butte and Billings areas; Nevada's central Steptoe Valley; south-central Oregon; Yakima county in Washington; and the Sheridan, Wyoming area. Tree planting is one practical strategy for communities in these areas to meet and sustain mandated air quality standards.

Trees effectively reduce ozone and particulate matter concentrations

American Forest's (2001) study of the Colorado Front Range area found that the existing 6% tree canopy cover removed 1,080 tons (980 metric tonnes) of air pollutants valued at $5.3 million. A similar analysis for the Willamette/ Lower Columbia Region reported that existing tree cover (24%) removed 89,000 tons (80,740 tonnes) of pollutants annually with a value of $419 million (American Forests 2001b). Trees were most effective in removing ozone (O3), nitrogen dioxide (NO2), and particulate matter (PM10).

Other studies highlight recent research aimed at quantifying air quality benefits of urban trees. The annual value of pollutant uptake by a typical medium- sized tree in coastal southern California was estimated at approximately $20, and $12 in the San Joaquin Valley (McPherson et al. 1999a, 2000).

What about hydrocarbons?

Trees in a Davis, CA parking lot were found to benefit air quality by reducing air temperatures 1-3°F (0.5-1.5°C) (Scott et al. 1999). By shading asphalt surfaces and parked vehicles, the trees reduced hydrocarbon emissions from gasoline that evaporates out of leaky fuel tanks and worn hoses. These evaporative emissions are a principal component of smog, and parked vehicles are a primary source. In Chicago, the U.S. EPA adapted these research findings to the local climate and developed a method for easily estimating evaporative emission reductions from parking lot tree plantings. EPA grant applicants can use this approach to quantify pollutant reductions from parking lot tree planting projects.

❖ Reducing Stormwater Runoff and Hydrology

Trees protect water and soil resources

Urban stormwater runoff is a major source of pollution entering riparian areas. With increased recognition of the importance of non-point source runoff, stormwater management requirements have become increasingly stringent and costly. A healthy urban forest can reduce the amount of runoff and pollutant loading in receiving waters in four ways:

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows,
- Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and reduce overland flow,
- Tree canopies reduce soil erosion by diminishing the impact of raindrops on barren surfaces.
- Transpiration through tree leaves reduces soil moisture, increasing the soil's capacity to store rainfall.

Trees reduce runoff

Studies that have simulated urban forest effects on stormwater report annual runoff reductions of 2-7%. Annual interception of rainfall by Sacramento's urban forest for the urbanized area was only about 2% due to the winter rainfall pattern and predominance of non-evergreen species (Xiao et al. 1998). However, average interception on land with tree canopy cover ranged from 6-13% (150 gal [20 m3] per tree), close to values reported for rural forests. A typical medium-sized tree in coastal southern California was estimated to intercept 2,380 gal (9 m3) ($5) annually (McPherson et al. 2000). Broadleaf evergreens and conifers intercept more rainfall than deciduous species where winter rainfall patterns prevail.

In the Colorado Front Range, existing tree cover was estimated to reduce runoff by 52.9 million ft3 (1.5 million m3), valued at $3.2 million annually (American Forests 2001).

In the Willamette/Lower Columbia region, existing canopy (24%) reduced runoff by 8.5 billion ft3 (240.7 million m3). The annualized value of this benefit was $140 million (American Forests 2001).

Urban forests can dispose of waste water

Urban forests can provide other hydrologic benefits, too. For example, irrigated tree plantations or nurseries can be a safe and productive means of wastewater treatment. Reused wastewater can recharge aquifers, reduce stormwater treatment loads, and create income through sales of nursery or wood products. Recycling urban wastewater into greenspace areas can be an economical means of treatment and disposal, while at the same time providing other environmental benefits.

Shade yields less water use at power plants

Power plants consume water in the process of producing electricity. For example, coal-fired plants use about 0.6 gal (2.3 L) per kWh of electricity provided. Trees that reduce the demand for electricity, therefore, also reduce water consumed at the power plant (McPherson et al. 1993). Precious surface water resources are preserved and thermal pollution of rivers reduced.

❖ Aesthetics and Other Benefits

Beautification

Trees provide a host of aesthetic, social, economic, and health benefits that should be included in any benefit-cost analysis. One of the most frequently cited reasons that people plant trees is for beautification. Trees add color, texture, line, and form to the landscape. In this way, trees soften the hard geometry that dominates built environments. Research on the aesthetic quality of residential streets has shown that street trees are the single strongest positive influence on scenic quality (Schroeder and Cannon 1983).

Retail settings

Consumer surveys have found that preference ratings increase with the presence of trees in the commercial streetscape. In contrast to areas without trees, shoppers indicated that they shop more often and longer in well-landscaped business districts, and were willing to pay more for goods and services (Wolf 1999).

Public safety

Research in public housing complexes found that outdoor spaces with trees were used significantly more often than spaces without trees. By facilitating interactions among residents, trees can contribute to reduced levels of domestic violence, as well as foster safer and more sociable neighborhood environments (Sullivan and Kuo 1996).

Property values

Well-maintained trees increase the "curb appeal" of properties. Research comparing sales prices of residential properties with different tree resources suggests that people are willing to pay 3-7% more for properties with ample tree resources versus few or no trees. One of the most comprehensive studies of the influence of trees on residential property values was based on actual sales prices and found that each large front-yard tree was associated with about a 1% increase in sales price (Anderson and Cordell 1988). A much greater value of 9% ($15,000) was determined in a U.S. Tax Court case for the loss of a large black oak on a property valued at $164,500 (Neely 1988). Depending on average home sales prices, the value of this benefit can contribute significantly to cities' property tax revenues.

Social and psychological benefits

Scientific studies confirm our intuition that trees in cities provide social and psychological benefits. Humans derive substantial pleasure from trees, whether it is inspiration from their beauty, a spiritual connection, or a sense of meaning (Dwyer et al. 1992; Lewis 1996). Following natural disasters people often report a sense of loss if the urban forest in their community has been damaged (Hull 1992). Views of trees and nature from homes and offices provide restorative experiences that ease mental fatigue and help people to concentrate (Kaplan & Kaplan 1989). Desk-workers with a view of nature report lower rates of sickness and greater satisfaction with their jobs compared to those having no visual connection to nature (Kaplan 1992). Trees provide important settings for recreation and relaxation in and near cities. The act of planting trees can have social value, as bonds between people and local groups often result.

Human health benefits

The presence of trees in cities provides public health benefits and improves well-being of those who live, work and recreate in cities.

Physical and emotional stress has both short-term and long-term effects. Prolonged stress can compromise the human immune system. A series of studies on human stress caused by general urban conditions and city driving show that views of nature reduce stress response of both body and mind (Parsons et al. 1998). Urban green also appears to have an "immunization effect," in that people show less stress response if they have had a recent view of trees and vegetation. Hospitalized patients with views of nature and time spent outdoors need less medication, sleep better, and have a better outlook than patients without connections to nature (Ulrich 1985). Trees reduce exposure to ultraviolet light, thereby lowering the risk of harmful effects from skin cancer and cataracts (Tretheway and Manthe 1999).

Noise reduction

Certain environmental benefits from trees are more difficult to quantify than those previously described, but can be just as important. Noise can reach unhealthy levels in cities. Trucks, trains, and planes can produce noise that exceeds 100 decibels, twice the level at which noise becomes a health risk. Thick strips of vegetation in conjunction with landforms or solid barriers can reduce highway noise by 6-15 decibels. Plants absorb more high frequency noise than low frequency, which is advantageous to humans since higher frequencies are most distressing to people (Miller 1997).

Wildlife

Numerous types of wildlife inhabit cities and are generally highly valued by residents. For example, older parks, cemeteries, and botanical gardens often contain a rich assemblage of wildlife. Remnant woodlands and riparian habitats within cities can connect a city to its surrounding bioregion. Wetlands, greenways (linear parks), and other greenspace resources can provide habitats that conserve biodiversity (Platt et al. 1994).

Jobs and environmental education

Urban forestry can provide jobs for both skilled and unskilled labor. Public service programs and grassroots-led urban and community forestry programs provide horticultural training to volunteers across the U.S. Also, urban and community forestry provides educational opportunities for residents who want to learn about nature through first-hand experience (McPherson and Mathis 1999). Local nonprofit tree groups, along with municipal volunteer programs, often provide educational material, work with area schools, and hands-on training in the care of trees.

Shade can defer street maintenance

Tree shade on streets can help offset pavement management costs by protecting paving from weathering. The asphalt paving on streets contains stone aggregate in an oil binder. Tree shade lowers the street surface temperature and reduces the heating and volatilization of the oil. As a result, the aggregate remains protected for a longer period by the oil binder. When unprotected, vehicles loosen the aggregate and much like sandpaper, the loose aggregate grinds down the pavement (Brusca 1998). Because most weathering of asphalt-concrete pavement occurs during the first 5-10 years, when new street tree plantings provide little shade, this benefit mainly applies when older streets are resurfaced (Figure 4 on page 15).

Costs of Trees

❖ Planting and Maintaining Trees

Cities spend about $6.40 per tree

The environmental, social, and economic benefits of urban and community forests come with a price. A national survey reported that communities in the Northern Mountain and Prairie region spent an average of about $6.40 per tree, annually, for street and park tree management (Tschantz and Sacamano 1994). This amount was relatively high, with three regions spending more than this and six regions spending less. Generally, the single largest expenditure was for tree pruning, followed by tree removal/disposal, and tree planting.

More trees are removed than planted

Frequently, trees in new residential subdivisions are planted by developers, while cities/counties and volunteer groups plant trees on existing streets and parklands. In many cities, tree planting has not kept pace with removals. Moreover, limited growing space in cities is responsible for increased planting of smaller, shorter-lived trees that provide fewer benefits compared to larger trees.

Residential costs vary widely

Annual expenditures for tree management on private property have not been well-documented. Costs vary considerably, ranging from some commercial/residential properties that receive regular professional landscape service to others that are virtually "wild" and without maintenance. An analysis of data for Sacramento suggested that households typically spent about $5-$10 annually per tree for pruning and pest and disease control (McPherson et al. 1993, Summit and McPherson 1998).

Irrigation costs

Due to the region's warm and arid summer climate, newly planted trees require irrigation for three to five years. Installation of drip or bubbler irrigation can increase planting costs by $100 or more per tree. Once planted, trees typically require 200-400 gal (0.8-1.6 m3) per year during the establishment period. Assuming a water price of $1.40/Ccf in Fort Collins, annual irrigation water costs are initially less than $1/tree. However, as trees mature their water use can increase with an associated increase in annual costs. Trees planted in lawn areas with existing irrigation may require supplemental irrigation. Trees that are native to the Northern Mountain and Prairie region may not require supplemental irrigation after an establishment period.

❖ Conflicts with Urban Infrastructure

Tree roots and sidewalks can conflict

Like other cities across the U.S., communities in the Northern Mountain and Prairie region are spending millions of dollars each year to manage conflicts between trees and powerlines, sidewalks, sewers, and other elements of the urban infrastructure. In California, for example, a 1998 survey showed that cities spent an average of $2.36 per capita on sidewalk, curb and gutter repair, tree removal and replacement, prevention methods, and legal/liability costs (McPherson 2000). Some cities spent as little as $0.75 while others spent $6.98 per resident. These figures were for street trees only and did not include repair costs for damaged sewer lines, building foundations, parking lots, and various other

hardscape elements. When these additional expenditures were included, the total cost of root-sidewalk conflicts was well over $100 million per year in California alone.

In the Northern Mountain and Prairie region, dwindling budgets are increasing the sidewalk repair backlog and forcing cities to shift the costs of sidewalk repair to residents. This shift especially impacts residents in older areas, where large trees have outgrown small sites and infrastructure has deteriorated.

Costs of conflicts

The consequences of efforts to control these costs are having alarming effects on urban forests (Bernhardt and Swiecki 1993, Thompson and Ahern 2000):

- Cities are continuing to "downsize" their urban forests by planting smaller-stature trees. Although small trees are appropriate under powerlines and in small planting sites, they are less effective than large trees at providing shade, absorbing air pollutants, and intercepting rainfall.
- Sidewalk damage was the second most common reason that street and park trees were removed. Thousands of healthy urban trees are lost each year and their benefits forgone because of this problem.
- 25% of cities surveyed were removing more trees than they were planting. Residents forced to pay for sidewalk repairs may not want replacement trees.

Collectively, this is a lose-lose situation. Cost-effective strategies to retain benefits from large street trees while reducing costs associated with infrastructure conflicts are described in Strategies to Reduce Infrastructure Damage by Tree Roots (Costello et al. 2000). Matching the growth characteristics of trees to conditions at the planting site is one strategy.

Tree roots can damage old sewer lines that are cracked or otherwise susceptible to invasion. Sewer repair companies estimate that sewer damage is minor until trees and sewers are over 30 years old, and roots from trees in yards are usually more of a problem than roots from trees in planter strips along streets. The latter assertion may be due to the fact that sewers are closer to the root zone as they enter houses than at the street. Repair costs typically range from $100 for rodding to $1,000 or more for excavation and replacement.

Cleaning up after trees

Most communities sweep their streets regularly to reduce surface-runoff pollution entering local waterways. Street trees drop leaves, flowers, fruit, and branches year round that constitute a significant portion of debris collected from city streets. When leaves fall and winter rains begin, leaf litter from trees can clog sewers, dry wells, and other elements of flood control systems. Costs include additional labor needed to remove leaves, and property damage caused by localized flooding. Clean-up costs also occur after windstorms. Although these natural crises are infrequent, they can result in large expenditures.

Large trees under powerlines are costly

Conflicts between trees and powerlines are reflected in electric rates. Large trees under powerlines require more frequent pruning than better-suited trees. Frequent crown reduction reduces the benefits these trees could otherwise provide. Moreover, increased costs for pruning are passed on to ratepayers.

❖ Wood Salvage, Recycling and Disposal

Hauling and recycling waste wood are primary costs

In our survey, most Northern Mountain and Prairie cities are recycling green waste from urban trees as mulch, compost, and firewood. In some cases, the net costs of waste wood disposal are less than 1% of total tree care costs as cities and contractors strive to break-even (hauling and recycling costs are nearly offset by revenues from purchases of mulch, milled lumber, and firewood). Hauling waste wood and grinding are the primary costs. However, in many cities recycling waste wood is not economical. The costs of grinding wood into mulch can exceed the costs of hauling and burning.

Greenwaste recycling can save $

The city of Colorado Springs trades firewood from its removed trees to a local nursery for new trees (McGannon 2002). Each year about 30 cords of wood are traded for 20-30 shade trees (2-3" caliper), each worth $200. The nursery sells the firewood during winter and the city plants leftover trees the following spring. Both partners benefit from this arrangement.

Findings from Public Outreach

TreeUtah conducted public outreach to educate citizens about trees and to collect information from them about their level of support for various tree related concepts and to gather their input on future tree projects. Our outreach included talking to citizens during the tree inventory, including them in the tree inventory, displaying posters around town with information on tree benefits and an invitation to a tree meeting, hosting an open public meeting, doing a PowerPoint presentation, and dispersing our Public Response Form to anyone that was interested. Results from our Public Response Form are included below (see Appendix for a copy of the Public Response Form). This was a non-scientific poll and is not intended to be a representative population. The results presented are intended to help the City gage public support for various ideas and to create a record of new project ideas.

❖ Level of Support for Proposed Goals

1. Do you support the proposed 'General Goal' and 'Guiding Principles' listed below?

General Goal:
To maintain and increase the long-term sustainability of the City's trees.

Don't Support= 0%
Support as Proposed= 91.7%
Support with Refinements= 8.3%

Proposed Principals for City Land:
A. Increase environmental benefits, by striving to plant more trees that grow to a larger size in locations that don't have utilities conflicts.

Don't Support= 0%
Support as Proposed= 83.3%

Support with Refinements= 16.7%
Comments: We need to plant more trees close to streets and sidewalks to shade them

B. Reduce risk of tree disease and insect infestations, by aiming for a mix of tree species with a target of no one species being greater than 10% of the city tree population.
Don't Support= 0%
Support as Proposed= 83.3%
Support with Refinements= 16.7%

C. Plan for a mix of tree ages and gradual tree replacement, recognizing that trees will eventually die.
Don't Support= 8.3%
Support as Proposed= 58.3%
Support with Refinements= 33.3%

D. Focus on planting long-lived tree species that will benefit the community long into the future.
Don't Support= 0%
Support as Proposed= 91.7%
Support with Refinements= 8.3%

E. Focus on planting tree species that require less water.
Don't Support= 0%
Support as Proposed= 83.3%
Support with Refinements= 16.7%

F. Develop scheduled pruning for existing and newly planted trees.
Don't Support= 0%
Support as Proposed= 83.3%
Support with Refinements= 16.7%

❖ Level of Support for City Ordinances

2. Do you support the development of City ordinances to protect and manage trees?

A. Regulations to require the planting of at least one street tree per 30 feet of road frontage for all new commercial and residential developments.
Don't Support= 8.3%
Support as Proposed= 66.7%
Support with Refinements= 25%
Comments: They need to plant and maintain the trees (or at least pay to maintain)

B. Requirements for replacing any trees that are removed due to development.
Don't Support= 0%
Support as Proposed= 66.7%
Support with Refinements= 25%

C. Option for contributing to a 'tree fund' in lieu of replacing trees removed due to development.

Don't Support= 16.7%
Support as Proposed= 41.7%
Support with Refinements= 33.3%

Comments: No tree fund, they should just replace the trees

D. Extra protection for 'significant trees' such as a designated heritage tree or special wildlife area.

Don't Support= 0%
Support as Proposed= 83.3%
Support with Refinements= 16.7%

E. Developing a volunteer City Tree Board to help guide and promote tree management and planting.

Don't Support= 8.3%
Support as Proposed= 66.7%
Support with Refinements= 16.7%

F. City sponsored tree education events to teach the public about tree selection, planting and care.

Don't Support= 0%
Support as Proposed= 91.7%
Support with Refinements= 8.3%

❖ Level of Satisfaction with Current Tree Service

3. How satisfied are you with the current level of tree planting and maintenance by City crews?

Very satisfied= 25%
Somewhat satisfied= 50%
Not satisfied= 8.3%

Comments: Make sure you are planting the right trees for this area, need to improve pruning on young trees, need to have a program that removes dead trees and immediately plants a new tree in it's place

❖ Level of Volunteer Interest

4. Would you, your family, or your business be interested in acting as a volunteer to support trees in your community?

A. Would participate on a City Tree Board

No= 33.3%
Yes= 50%
Yes with Conditions= 8.3%

B. Would provide a charitable donation for a tree project

No= 16.7%

Yes= 58.3%
Yes with Conditions= 25%

C. Would plant and maintain a tree provided by the City
No= 33.3%
Yes= 66.7%
Yes with Conditions= 0%

D. Would organize my block to plant and maintain City trees on our street
No= 41.7%
Yes= 41.7%
Yes with Conditions= 8.3%

E. Would adopt, plant and maintain the trees on another street within guidelines set by the City
No= 41.7%
Yes= 25%
Yes with Conditions= 33%

❖ Level of Financial Support

5. Would you, your family, or your business pay a tax or other fee increase in support of street trees and their maintenance?
$0 / year= 25%
$10 / year= 50%
$20 / year= 8%
$30 / year= 8%
$40 / year= 0%
$50 / year= 8%
Comments: Our youth and scouts are always looking for service projects. Have each school set a goal to plant a tree for each classroom or grade.

❖ Suggested Tree Projects

a) Plant more trees on Main (farther North and South of the city center)
b) Plant more trees in all of the parks (especially park on Main Street and Timp Meadows) to increase the shady areas (See Map in Appendix)
c) Continue gradually planting more trees at the Cemetery to make sure there are trees there when the big old ones die (See Map in Appendix)
d) Figure out a way to get more trees planted in the new developments
e) Plant trees that are longer-lived (less cottonwood, willow, poplar, pear)
f) Encourage people to plant more native and water-wise trees by creating a demonstration area in one of the parks
g) Take out most of the center turning lane on Main Street and create a large tree filled median. The trees in the median would help create a canopy that could, in time, shade the Main Street area and make it more comfortable for shoppers and other visitors to spend time there. Currently the Main Street is too wide to ever have the trees on each side meet in the middle to create a canopy. The median could be

tapered down near intersections to maintain a small turning lane for traffic (See Map in Appendix)

h) Think about opportunities for "green corridors" that may benefit people and wildlife by providing a nice connection between existing parks or natural areas.
i) Do a large planting project on Center Street, especially on the way in and out of town toward Midway business district
j) Plant trees on the outer edges of the baseball fields.
k) Create a program were the City (or other partners) pays a portion of the cost for trees that private citizens are interested in planting along the street by their house.

❖ List of Potential Volunteers

Morgan Mendenhall (USU Extension Office)
55 South 500 East
Heber City, UT 84032
657-3233

Shirl McMayon (Mountain ReLeaf)
P.O. Box 682953
Park City, UT 84068

Suzanne Hansen
470 Ridge Dr.
Heber City, UT 84032

Paul E. Sims

Lambert Deegan

Chapter3:

How do We Get What We Want?

In this chapter we will provide general guidelines for maximizing the benefits that trees provide and specific recommendations from TreeUtah and the local committee who assisted us. We hope these recommendations will help the city and its citizens achieve their long-term tree goals.

General Guidelines for Selecting and Placing Trees

❖ Residential Yard Trees

- ***Maximizing Energy Savings from Shading***

Where should shade trees be planted? The right tree in the right place can save energy and reduce tree are costs. In midsummer, the sun shines on the east side of a building in the morning, passes over the roof near midday, and then shines on the west side in the afternoon. Electricity use is highest during the afternoon when temperatures are warmest and incoming sunshine is greatest. Therefore, the west side of a home is the most important side to shade. Evergreens on the west side can provide both summer shade and winter wind protection.

Depending on building orientation and window placement, sun shining through windows can heat a home quickly during the morning hours. The east side is the second most important side to shade when considering the net impact of tree shade on cooling and heating costs (Diagram 2). Deciduous trees on the east side provide summer shade and more winter solar heat gain than evergreens.

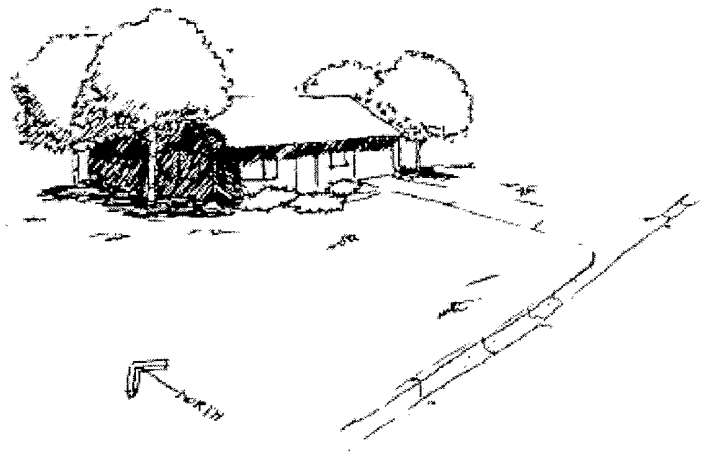
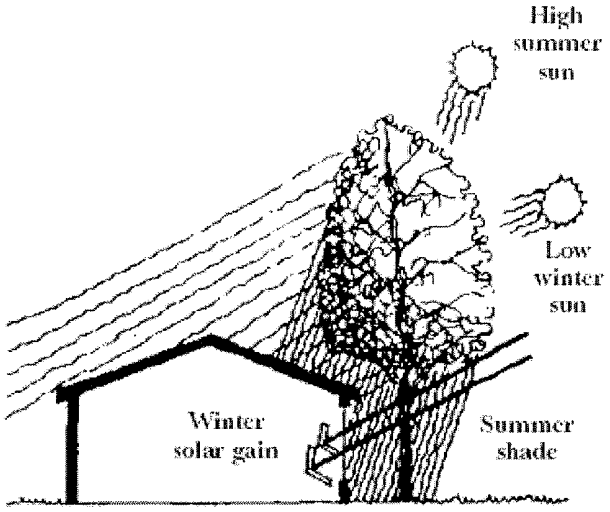


Diagram 2: Locate trees to shade west and east windows (from Sand 1993).

Use solar friendly trees. Trees located to shade south walls can block winter sunshine and increase heating costs, because during winter the sun is lower in the sky and shines on the south side of homes (Diagram 3). The warmth the sun provides is an asset, so do not plant evergreen trees that will block southern exposures and solar collectors. Use solar friendly trees to the south because the bare branches of these deciduous trees allow most sunlight to strike the building (some solar unfriendly deciduous trees can reduce sunlight striking the south side of buildings by 50%). Examples of solar friendly trees include most species and cultivars of maple (Acer spp.) and ash (Fraxinus spp.).

To maximize summer shade and minimize winter shade, locate trees about 10-20 ft (3-6 m) south of the home. As trees grow taller, prune lower branches to allow more sun to reach the building if this will not weaken the tree's structure (Diagram 4).



(Left) Diagram 3: Select solar friendly trees for south exposures and locate close enough to provide winter solar access and summer shade (from Sand 1991).

(Below) Diagram 4: Trees south of home before and after pruning. Lower branches are pruned up to increase heat gain from winter sun (from Sand 1993).

Roots, branches and buildings don't mix. Although the closer a tree is to the home the more shade it provides, the roots of trees that are too close can damage the foundation. Branches that impinge on the building can make it difficult to maintain exterior walls and windows. Keep trees at least 5-10 ft (1.5-3 m) from the home to avoid these conflicts, but within 30-50 ft (9-15 m) to effectively shade windows and walls.

Patios, driveways and air conditioners need shade. Paved patios and driveways can become heat sinks that warm the home during the day. Shade trees can make them cooler and more comfortable spaces. If a home is equipped with an air conditioner, shading can reduce its energy use — but do not plant vegetation so close that it will obstruct the flow of air around the unit.

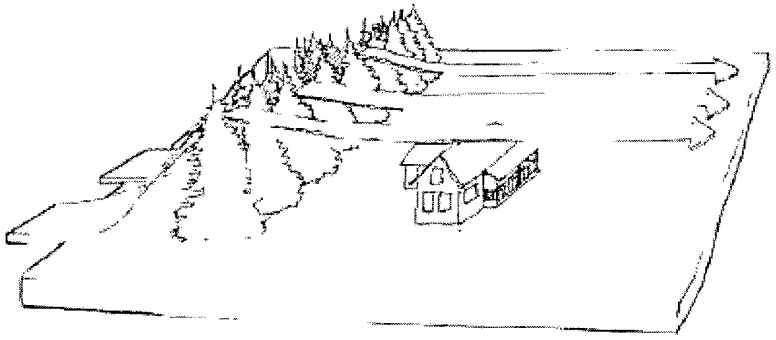
Avoid power, sewer, and water lines. Plant only suitable trees under overhead powerlines and do not plant directly above underground water and sewer lines. Contact your local utility company before planting to determine where underground lines are located and which tree species should not be planted under powerlines.

- ***Planting Windbreaks for Heating Savings***

With the long winter heating season in the Northern Mountain and Prairie region, additional energy savings can be obtained in situations where lot sizes are large enough to plant evergreen windbreaks. A tree's size and porosity can make it ideal at blocking wind, thereby reducing the impacts of cold winter weather and drying effects of summer winds.

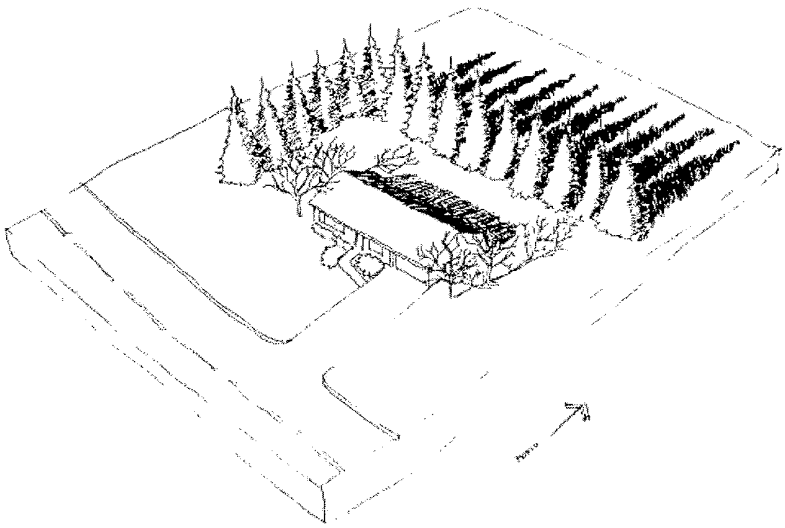
Locating windbreaks. Locate rows of trees perpendicular to the prevailing wind (Diagram 5), usually the north and west side of homes in this region. Remember that snow collects behind a windbreak. This can be a problem if the driveway is located between the trees and the home.

Digram 5: Evergreens guide wind over the building (from Sand, 1993).



Design the windbreak row to be longer than the building being sheltered because the wind speed increases at the edge of the windbreak. Ideally, the windbreak is planted upwind about 25-50 ft (7-15 m) from the building and consists of dense evergreens that will grow to twice the height of the building they shelter (Heisler 1986; Sand 1991). Avoid locating windbreaks that will block sunlight to south and east walls (Diagram 6). Trees should be spaced close enough to form a dense screen, but not so close that they will block sunlight to each other, causing lower branches to self-prune. Most conifers can be spaced about 6 ft (2 m) on center. If there is room for two or more rows, then space rows 10-12 ft (3-4 m) apart.

Diagram 6: Mid-winter shadows from a well-located windbreak and shade trees do not block solar radiation on the south-facing wall (from Sand 1993).



Plant dense evergreens. Evergreens are preferred over deciduous trees for windbreaks because they provide better wind protection. The ideal windbreak tree is fast growing, visually dense, has strong branch attachments, and has stiff branches that do not self-prune. Large windbreak trees for communities in the Northern Mountain and Prairie region include Colorado and Black Hills spruce (P. pungens and P. glauca var. densata), and Austrian and ponderosa pine (Pinus nigra and P. ponderosa). Good windbreak species for smaller sites include Eastern red cedar (Juniperus virginiana) and Rocky Mountain juniper (J. scopulorum).

In urban settings where vegetation is not a fire hazard, evergreens planted close to the home create dead airspaces that reduce air infiltration and heat loss. Allow shrubs to form thick hedges, especially along north, west, and east walls.

Consider using shrubs, trees, and fences to create sun pockets on the south side of the home. A southfacing patio that is protected from the wind can be used during sunny, cool but comfortable winter days.

- ***Selecting Yard Trees to Maximize Benefits***

The ideal shade tree has a fairly dense, round crown with limbs broad enough to partially shade the roof. Given the same placement, a large tree will provide more building shade than a small tree. Deciduous trees allow sun to shine through leafless branches in winter. Plant small trees where nearby buildings or powerlines limit aboveground space. Columnar or upright trees are appropriate in narrow side yards. Because the best location for shade trees is relatively close to the west and east sides of buildings, the most suitable trees will be strong and capable of resisting storm damage, disease, and pests (Sand 1994). Examples of trees not to select for placement near buildings include cottonwoods (Populus spp.) because of their invasive roots, weak wood, and large size, and ginkgos (Ginkgo biloba) because of their sparse shade and slow growth.

Picking the right tree. When selecting trees, match the tree's water requirements with those of surrounding plants. For instance, select low water-use species for planting in areas that receive little irrigation. Also, match the tree's maintenance requirements with the amount of care and the type of use different areas in the landscape receive. For instance, tree species that drop fruit that can be a slip-and-fall problem should not be planted near paved areas that are frequently used by pedestrians. Check with your local landscape professional before selecting trees to make sure that they are well suited to the site's soil and climatic conditions.

❖ Trees in Public Places

- ***Locating and Selecting Trees to Maximize Climate Benefits***

Large trees shade more

In common areas, along streets, in parking lots, and commercial areas locate trees to maximize shade on paving and parked vehicles. Shade trees reduce heat that is stored or reflected by paved surfaces. By cooling streets and parking areas, they reduce emissions of evaporative hydrocarbons from parked cars that are involved in smog formation (Scott et al. 1998). Large trees can shade more area than smaller trees, but should be used only where space permits. Remember that a tree needs space for both branches and roots.

For CO2 reduction, select trees well-suited to the site

Because trees in common areas and other public places may not shelter buildings from sun and wind, CO2 reductions are primarily due to sequestration. Fast-growing trees sequester more CO2 initially than slow-growing trees, but this advantage can be lost if the fast-growing trees die at younger ages. Large growing trees have the capacity to

store more CO2 than smaller growing trees. To maximize CO2 sequestration, select tree species that are well-suited to the site where they will be planted. Trees that are not well-adapted will grow slowly, show symptoms of stress, or die at an early age. Unhealthy trees do little to reduce atmospheric CO2, and can be unsightly liabilities in the landscape.

How to maximize trees as CO2 sinks

Parks and other public landscapes serve multiple purposes. Some of the guidelines listed below may help you maximize their ability to serve as CO2 sinks:

- Provide as much pervious surface as possible (including use of porous concrete near trees) so that trees grow vigorously and store more CO2.
- Maximize use of woody plants, especially trees, since they store more CO2 than do herbaceous plants and grass.
- Increase tree-stocking levels where feasible, and immediately replace dead trees to compensate for CO2 lost through tree and stump removal.
- Create a diversity of habitats, with trees of different ages and species, to promote a continuous canopy cover.
- Select species that are adapted to local climate, soils, and other growing conditions. Adapted plants should thrive in the long run and will avoid CO2 emissions stemming from high maintenance needs.
- Group species with similar landscape maintenance requirements together and consider how irrigation, pruning, fertilization, weed, pest, and disease control can be done most efficiently.
- Where feasible, reduce CO2 released through landscape management by using push mowers (not gas or electric), hand saws (not chain saws), pruners (not gas/electric shears), brooms, and rakes (not leaf blowers), and employing local landscape professionals who do not have to travel far to work sites.
- Consider the project's life-span when making species selection. Fast-growing species will sequester more CO2 initially than slow-growing species, but may not live as long.
- Provide a suitable soil environment for the trees in plazas, parking lots, and other difficult sites to maximize initial CO2 sequestration and longevity. Encourage use of structural soils where appropriate.

- ***Locating and Selecting Trees to Maximize Stormwater Runoff Reduction Benefits***

Strategies to control stormwater runoff through urban forestry include:

- Match trees to rainfall patterns so that they are in-leaf when precipitation is greatest.
- Select species with architectural features that maximize interception, such as large leaf surface area and rough surfaces that store water. Conifers intercept more rainfall than similar sized deciduous trees.
- Plant low-water use species and natives that, once established, require little supplemental irrigation.
- Plant more trees in appropriate areas.
- Improve the maintenance of existing trees.
- Plant species with rapid growth rates where appropriate.

Pay attention to infrastructure

Before planting contact your local utility company to locate

underground water, sewer, gas, and telecommunication lines. Note the location of powerlines, streetlights, and traffic signs, and select tree species that will not conflict with these aspects of the city's infrastructure. Keep trees at least 30 ft (10 m) away from street intersections to ensure visibility. Avoid planting shallow rooting species near sidewalks, curbs, and paving. Tree roots can heave pavement if planted too close to sidewalks and patios. Generally, avoid planting within 3 ft (1 m) of pavement, and remember that trunk flare at the base of large trees can displace soil and paving for a considerable distance.

Select only small-growing trees (<25 ft tall [8 m]) for locations under overhead powerlines, and do not plant directly above underground water and sewer lines (Diagram 7). Avoid locating trees where they will block illumination from streetlights or views of street signs in parking lots, commercial areas, and along streets.

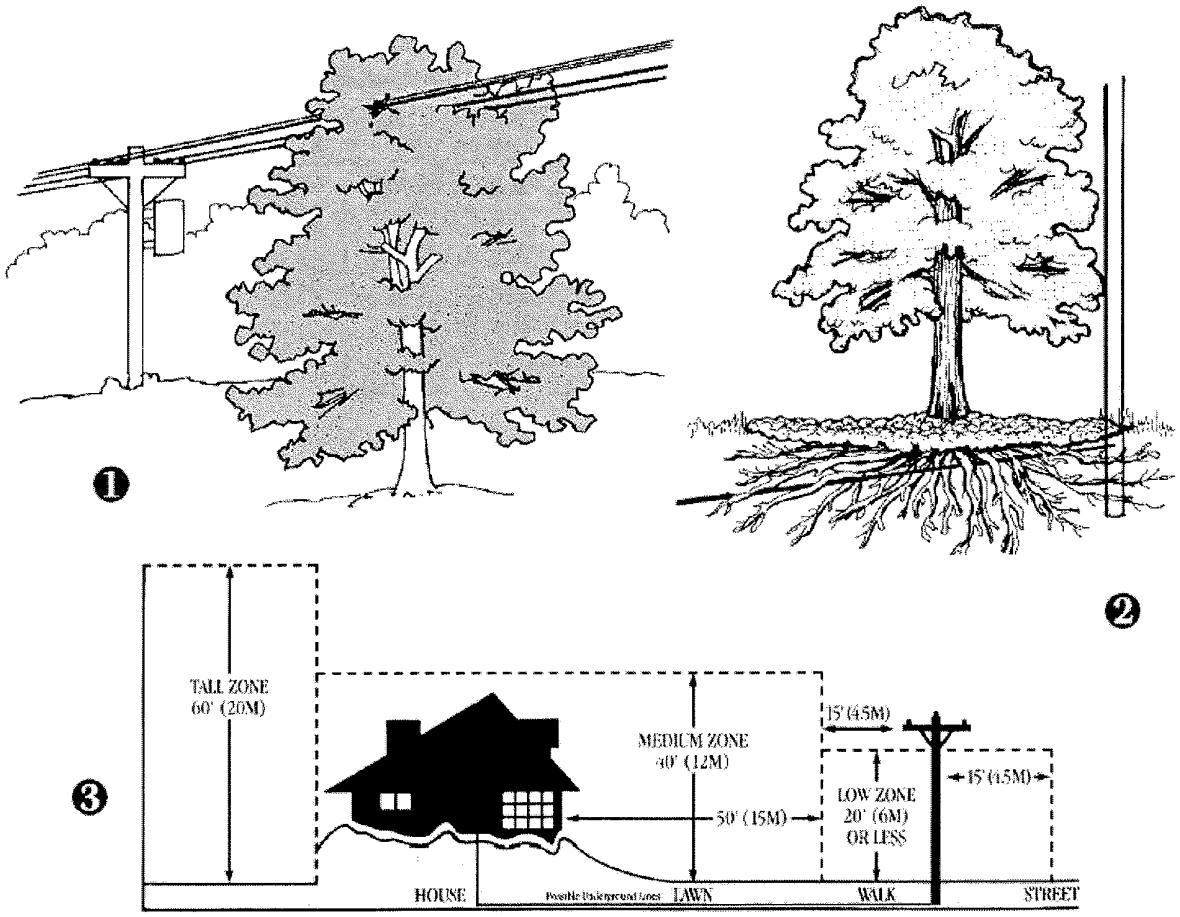


Diagram 7: (❶,❷) Know where power lines and other utility lines are before planting. ❸ Under power lines use only small-growing trees ("Low-Zone"), and avoid planting directly above underground utilities. Larger trees may be planted where space permits ("Medium" and "Tall" zones) (from ISA 1992)

Match tree to site on case-by-case basis. Maintenance requirements and public safety issues influence the type of trees selected for public places. The ideal public tree is not susceptible to wind damage and branch drop, does not require frequent pruning, produces negligible litter, is deep-rooted, has few serious pest and disease problems, and tolerates

a wide range of soil conditions, irrigation regimes, and air pollutants. Because relatively few trees have all these traits, it is important to match the tree species to the planting site by determining what issues are most important on a case-by-case basis. For example, parking lot trees should be tolerant of hot, dry conditions, have strong branch attachments, and be resistant to attacks by pests that leave vehicles covered with sticky exudates.

❖ General Guidelines to Maximize Long-Term Benefits

Selecting a tree from the nursery that has a high probability of becoming a healthy, trouble-free mature tree is critical to a successful outcome. Therefore, select the very best stock at your nursery and, when necessary, reject nursery stock that does not meet industry standards.

Root ball critical to survival. The health of the tree's root ball is critical to its ultimate survival. If the tree is in a container, check for matted roots by sliding off the container. Roots should penetrate to the edge of the root ball, but not densely circle the inside of the container or grow through drain holes. If the tree has many roots circling around the outside of the root ball or the root ball is very hard it is said to be pot-bound. The mass of circling roots can act as a physical barrier to root penetration into the surrounding soil after planting. Dense surface roots that circle the trunk may girdle the tree. Do not purchase pot-bound trees.

A good tree is well-anchored. Another way to evaluate the quality of the tree before planting is to gently move the trunk back and forth. A good tree trunk bends and does not move in the soil, while a poor quality trunk bends little and pivots at or below the soil line — a telltale sign indicating a poorly anchored tree.

Plant the tree in a quality hole. Dig the planting hole one inch shallower than the depth of the root ball to allow for some settling after it is watered in. The crown of the root ball should be slightly above ground level. Make the hole two to three times as wide as the root ball and roughen the sides of the hole to make it easier for roots to penetrate. Backfill with the native soil unless it is very sandy, in which case you may want to add composted organic matter such as peat moss or shredded bark (Diagram 8).

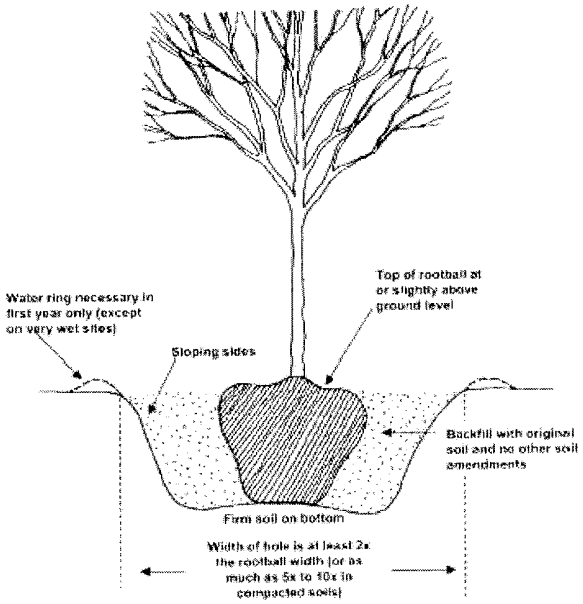


Diagram 8: Prepare a broad planting area, plant tree with rootball at ground level, and provide a watering ring to retain water (from Head et al. 2001).

Mulch and water. Use the extra backfill to build a berm outside the root ball that is 6 inches (15 cm) high and 3 ft (1 m) in diameter. Soak the tree, and gently rock it to settle it in. Cover the basin with a 4-inch (10 cm) thick layer of mulch, but avoid placing mulch

against the tree trunk. Water the new tree twice a week for the first month and weekly thereafter for the following two growing seasons.

Don't forget about the tree

Inspect your tree several times a year, and contact a local tree or landscape professional if problems develop. If your tree needed staking to keep it upright, remove the stake and ties as soon as the tree can hold itself up. Reapply mulch and irrigate the tree as needed. Prune the young tree to maintain a central leader and equally spaced scaffold branches. As the tree matures, have it pruned on a regular basis by a certified arborist or experienced professional. By keeping your tree healthy, you maximize its ability to intercept rainfall, reduce atmospheric CO2, and provide other benefits.

For additional information on tree planting, establishment, and care see the Tree City USA Bulletin series (Fazio undated), Principles and Practice of Planting Trees and Shrubs (Watson and Himelick 1997), Arboriculture (Harris et al. 1999), and the video Training Young Trees for Structure and Form (Costello 2000).

Local Committee Recommendations

Explain the top recommendations made by the committee and a list of committee members

References

American Forests. 2001. **Regional Ecosystem Analysis for the Willamette/Lower Columbia Region of Northwestern Oregon and Southwestern Washington State**. Washington, D.C.: American Forests.

Akbari, H.; Davis, S.; Dorsano, S.; Huang, J.; Winnett, S., (Eds.). 1992. **Cooling Our Communities: A Guidebook on Tree Planting and Light- Colored Surfacing**. Washington, DC: U.S. Environmental Protection Agency. 26 p.

Anderson, L.M.; Cordell, H.K. 1988. **Residential property values improve by landscaping with trees**. Southern Journal of Applied Forestry. 9: 162-166.

Bernhardt, E.; Swiecki, T.J. 1993. **The State of Urban Forestry in California: Results of the 1992 California Urban Forest Survey**. Sacramento: California Department of Forestry and Fire Protection. 51 p.

Brusca, J. 1998. **Personal communication on November 17**. Streets Superintendent, City of Modesto, CA. CO2e.com. 2002. CO2e Market Size and Pricing. Accessed via the World Wide Web <http://www.co2e.com/strategies/AdditionalInfo.asp?PageID= 273#1613> on October 23, 2002.

Costello, L.R. 2000. **Training Young Trees for Structure and Form**. Videotape Number: V99-A. University of California, Agriculture and Natural Resources, Communication Services Cooperative Extension Service, Oakland, CA. (Telephone: 800-994-8849).

Costello, L.R.; McPherson, E.G.; Burger, D.W.; Dodge, L.L. (Eds.). 2000. **Strategies to Reduce Infrastructure Damage by Tree Roots: Proceedings of a Symposium for Researchers and Practitioners**. International Society of Arboriculture, Western Chapter, Cohasset, CA.

Dwyer, J.F.; McPherson, E.G.; Schroeder, H.W.; Rowntree, R.A. 1992. **Assessing the benefits and costs of the urban forest**. Journal of Arboriculture. 18(5): 227-234.

Fazio, J.R. Undated. **Tree City USA Bulletin Series**. The National Arbor Day Foundation, Lincoln, NE.

Harris, R.W.; Clark, J.R.; Matheny, N.P. 1999. **Arboriculture**. 3rd ed. Englewood Cliffs, NJ: Regents/Prentice Hall.

Head, C.P.; Fisher, R.; O'Brien, M. 2001. **Best Management Practices for Community Trees: A Technical Guide to Tree Conservation in Athens-Clarke County, Georgia**. Landscape Management Division Office, Athens, GA.

Heisler, G.M. 1986. **Energy savings with trees**. Journal of Arboriculture. 12(5):113-125.

Hull, R.B. 1992. **How the public values urban forests**. J. Arboric. 18(2):98-101.

ISA. 1992. **Avoiding tree and utility conflicts.** Savoy, IL: International Society of Arboriculture. 4 p.

Kaplan, R. 1992. **Urban Forestry and the Workplace.** In P.H. Gobster (Ed). Managing Urban and High-Use Recreation Settings. USDA Forest Service, General Technical Report NC-163. Chicago, IL: North Central Forest Experimentation Center.

Lewis, C.A. 1996. **Green Nature/Human Nature: The Meaning of Plants in Our Lives**. University of Illinois Press, Chicago, IL.

McGannon, J. 2002. **Personal communication on September 26**. City Forester, City of Colorado Springs, CO.

McPherson, E.G. 1993. **Evaluating the cost effectiveness of shade trees for demand-side management**. The Electricity Journal. 6(9): 57-65.

McPherson, E.G.; Sacamano, P.L.; Wensman, S. 1993. **Modeling Benefits and Costs of Community Tree Plantings**. Davis, CA: USDA Forest Service, Pacific Southwest Research Station. 170 p.

McPherson, E.G. 1998. **Atmospheric carbon dioxide reduction by Sacramento's urban forest**. Journal of Arboriculture. 24(4): 215-223.

McPherson, E.G.; Mathis, S. (Eds.) 1999. **Proceedings of the Best of the West Summit**. Western Chapter, International Society of Arboriculture: Sacramento, CA: 93 p.

McPherson, E.G.; Simpson, J.R. 1999. **Guidelines for Calculating Carbon Dioxide Reductions through Urban Forestry Programs**. USDA Forest Service, PSW General Technical Report No. 171: Albany, CA.

McPherson, E.G.; Simpson, J.R.; Peper, P.J.; Xiao, Q. 1999a. **Tree Guidelines for San Joaquin Valley Communities**. Local Government Commission: Sacramento, CA. 63 p.

McPherson, E.G.; Simpson, J.R.; Peper, P.J.; Scott, K.; Xiao, Q. 2000. **Tree Guidelines for Coastal Southern California Communities**. Local Government Commission: Sacramento, CA. 97 p.

McPherson, E.G.; Simpson, J.R.; Peper, P.J.; Maco, S.E.; Xiao, Q.; Hoefer, P.J. 2003. **Northern Mountain and Prairie Community Tree Guide**. Davis, CA: USDA Forest Service, Pacific Southwest Research Station. 88 p.

Miller, R.W. 1997. **Urban Forestry: Planning and Managing Urban Greenspaces**. Second Edition. Upper Saddle River: Prentice-Hall. 502 p.

Neely, D. (Ed.) 1988. **Valuation of Landscape Trees, Shrubs, and Other Plants**. Seventh Edition. Urbana, IL: International Society of Arboriculture. 50 p.

Parsons, R.; Tassinary, L.G.; Ulrich, R.S.; Hebl, M.R.; Grossman- Alexander, M. 1998. **The view from the road: implications for stress recovery and immunization**. Journal of Environmental Psychology, 18, 2, 113-140.

Platt, R.H.; Rowntree, R.A.; Muick, P.C., (Eds). 1994. **The Ecological City**. Boston, MA: University of Massachusetts. 292 p.

Ramsay S. 2002. **Personal communication on December 19, 2002**. Executive Director, Trees Forever, Marion, IA.

Sand, M. 1991. **Planting for energy conservation in the north**. Minneapolis: Department of Natural Resources: State of Minnesota. 19 p.

Sand, M. 1993. **Energy conservation through community forestry**. St. Paul: University of Minnesota. 40 p.

Sand, M. 1994. **Design and species selection to reduce urban heat island and conserve energy**. In Proceedings from the sixth national urban forest conference: growing greener communities. Minneapolis, Minnesota: Sept. 14-18, 1993. Washington DC: American Forests. 282.

Schroeder, H.W.; Cannon, W.N. 1983. **The esthetic contribution of trees to residential streets in Ohio towns.** Journal of Arboriculture. 9: 237-243.

Scott, K.I.; McPherson, E.G.; Simpson, J.R. 1998. **Air pollutant uptake by Sacramento's urban forest.** Journal of Arboriculture. 24(4): 224-234.

Simpson, J.R. 1998. **Urban forest impacts on regional space conditioning energy use: Sacramento County case study**. Journal of Arboriculture. 24(4):201-214.

Sullivan, W.C.; Kuo, E.E. 1996. **Do trees strengthen urban communities, reduce domestic violence?** Arborist News. 5(2): 33-34.

Summit, J.; McPherson, E.G. 1998. **Residential tree planting and care: a study of attitudes and behavior in Sacramento, California.** Journal of Arboriculture. 24(2): 89-97.

Taha, H. 1996. **Modeling impacts of increased urban vegetation on ozone air quality in the South Coast Air Basin.** Atmospheric Environment. 30: 3423-3420.

Thompson, R.P.; Ahern, J.J. 2000. **The State of Urban and Community Forestry in California.** Urban Forest Ecosystems Institute, California Polytechnic State University, San Luis Obispo, CA.

Tretheway, R.; Manthe, A. 1999. **Skin cancer prevention: another good reason to plant trees.** In McPherson, E.G. and Mathis, S. Proceedings of the Best of the West Summit. University of California, Davis, CA.

Tschantz, B.A.; Sacamano, P.L. 1994. **Municipal Tree Management in the United States.** Davey Resource Group, Kent, OH.

Ulrich, R.S. 1985. **Human responses to vegetation and landscapes.** Landscape and Urban Planning. 13: 29-44.

Watson, G.W.; Himelick, E.B. 1997. **Principles and practice of planting trees and shrubs.** Savoy, IL: International Society of Arboriculture. 199 p.

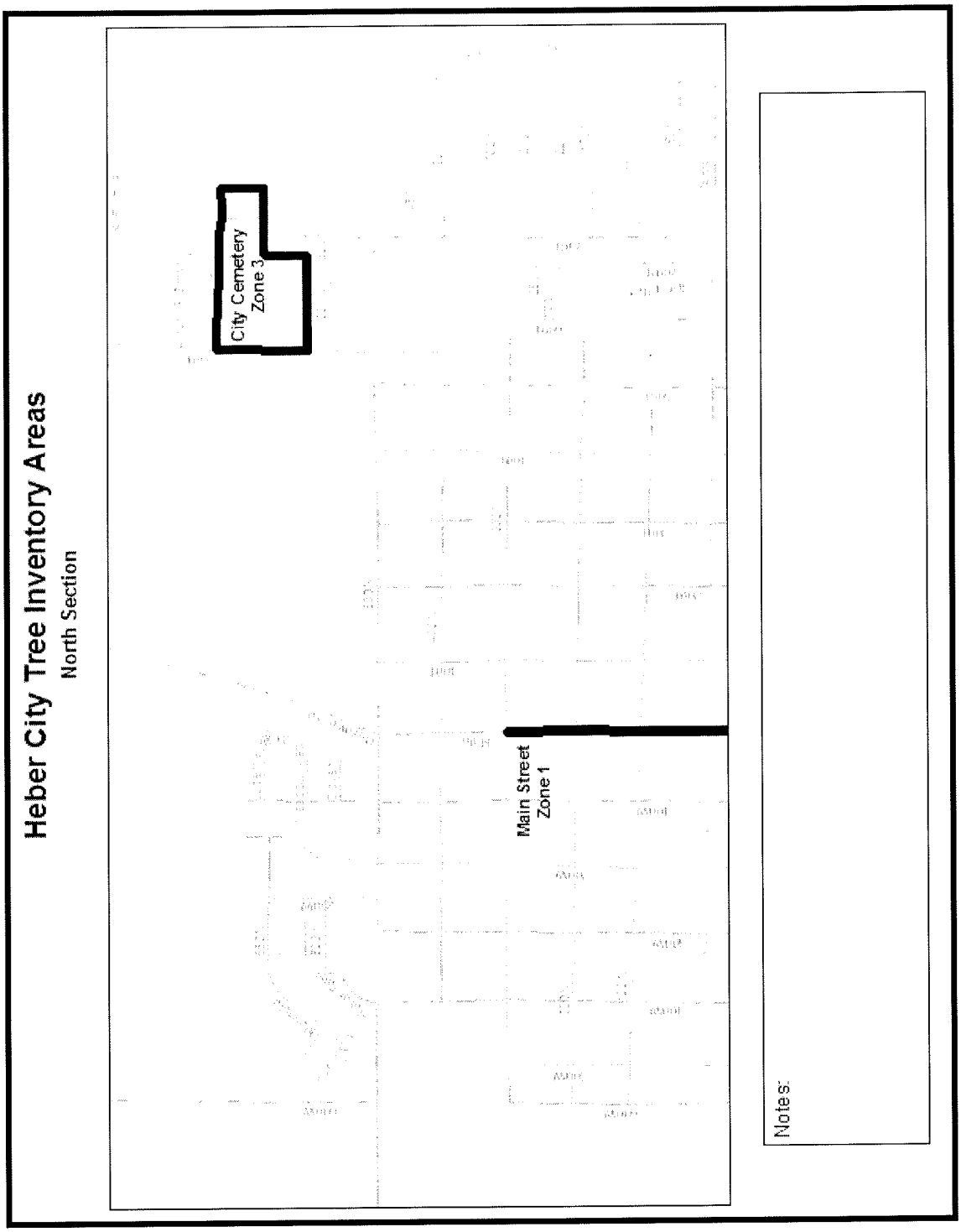
Wolf, K.L., 1999. **Nature and commerce: human ecology in business districts.** In C. Kollin (Ed.), Building Cities of Green: Proceedings of the 1999 National Urban Forest Conference. Washington, D.C. American Forests; 56-59.

Xiao, Q.; McPherson, E.G.; Simpson, J.R.; Ustin, S.L. 1998. **Rainfall interception by Sacramento's urban forest.** Journal of Arboriculture. 24(4): 235-244.

Appendix

Appendix includes;

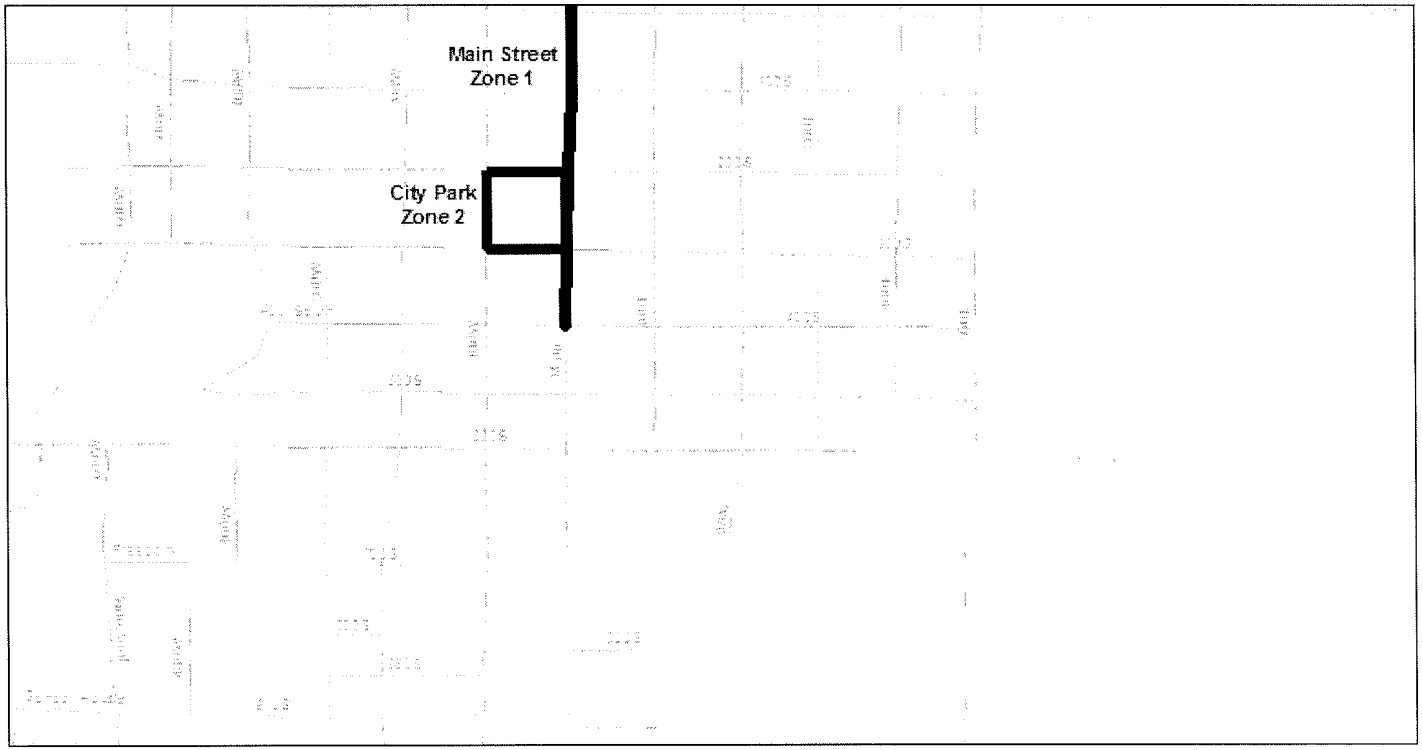
1) Data Collection Maps
2) Data Fields for the i-Tree Inventory System
3) Public Response Form
4) Project Idea Maps
5) PowerPoint Presentation
6) Outreach Poster



Data Collection Map

Heber City Tree Inventory Areas

South Section



Notes:

Data Fields for the i-Tree Inventory System

Zone; The city will be broken into management zones. If you already have management zones we will use your system. This field is used to look at the tree population characteristics in different parts of town (such as old vs. new or residential vs. commercial).

Species; The species of each tree inventoried will be recorded.

Voids; Public areas along streets that could support a tree but are currently vacant. Large, Medium, or Small void will be recorded based on the size of tree the surveyor thinks would be most appropriate for the vacant site (Large = 50 feet or taller, Medium = 30-50 feet, Small = less than 30 feet).

Land Use; The primary land use adjacent to the tree being inventoried.

1 = Single family- residential
2 = Multi-family- residential
3 = Small Commercial
4 = Industrial, Large Commercial
5 = Park, vacant lot, other

Location / Site; The most appropriate description of the area the tree is actually growing in. *Note:* "Planting Strips" are defined as being ten feet or longer and "Cutouts" are areas less than ten feet long.

1 = Front yard
2 = Planting strip
3 = Cutout
4 = Median
5 = Other maintained location
6 = Other un-maintained location
7 = Backyard

DBH; The Diameter at Breast Height (DBH) for each tree inventoried. We will use classes (0 to 3 inch, 3 to 6 inch, ect..) to speed up data collection.

Maintenance Recommendation; A maintenance recommendation provided by the person inventorying the tree.

1 = None – Tree does not need immediate or routine maintenance.
2 = Small tree (routine) – Tree is less than 18 ft tall and in need of maintenance; health or longevity of tree is not compromised by deferring maintenance for up to five years.
3 = Small tree (immediate) – Tree is less than 18 ft tall and in need of maintenance; deferring maintenance beyond one year would compromise health or longevity of tree.
4 = Large tree (routine) – Tree is more than 18 ft tall and in need of maintenance; health or longevity of tree is not compromised by deferring maintenance for up to five years.
5 = Large tree (immediate) – Tree is more than 18 ft tall and in need of maintenance; deferring maintenance beyond one year would compromise health or longevity of tree.
6 = Critical concern (public safety) – Tree should be inspected without delay.

Priority Task; The priority maintenance task as identified by the person inventorying the tree.

1 = None – Tree does not need maintenance.
2 = Stake/train – Staking or training needed to encourage a straight trunk, strong scaffold branching, or eliminate multiple leaders, crossing branches, and girdling ties. Includes removing or replacing stakes and ties to prevent damage to tree.
3 = Clean – Crown needs cleaning to remove dead, diseased, damaged, poorly attached, or crossing branches to increase health or longevity of tree.
4 = Raise – Crown should be raised by removing lower branches from the tree trunk to eliminate obstructions or clearance issues.
5 = Reduce – Crown should be reduced/thinned by pruning to reduce tree height, spread, overcrowding, wind resistance or an increase of light penetration.
6 = Remove – Tree is dangerous, dead or dying, and no amount of maintenance will increase longevity or safety.

Sidewalk Damage; Level of tree root related sidewalk damage.
1 = None – Sidewalk heaved less than ¾ inch, requiring no remediation.
2 = Low – Sidewalk heaved ¾ to 1½ inches, requiring minor grinding or ramping.
3 = Medium – Sidewalk heaved 1½ to 3 inches, requiring grinding or ramping and/or replacement.
4 = High – Sidewalk heaved more than 3 inches, requiring complete removal and replacement.

Wire Conflict; Level of power line conflict.
1 = No lines – No utility lines within vicinity of tree crown
2 = Present and not conflicting – Utility lines occur within vicinity of tree crown, but crown does not presently intersect wires.
3 = Present and conflicting – Utility lines occur and intersect with tree crown.

Condition of Wood; The most appropriate description of the condition of the trees wood
1 = Dead or Dying - Extreme problems
2 = Poor - Major problems
3 = Fair - Minor problems
4 = Good - No apparent problems

Condition of Leaves; The most appropriate description of the condition of the trees leaves
1 = Dead or dying - Extreme problems
2 = Poor - Major problems
3 = Fair - Minor problems
4 = Good - No apparent problems

Other; Up to three other data fields can be created to track other issues you want more information on.

Public Response Form

TreeUtah will use this response form to collect public input on how city trees should be managed. This information, along with information collected from an inventory of city managed trees, will be compiled in a report to the city with management recommendations. If you would like more information on this program please contact Brian Wiebler at (801) 364-2122, or brianw@treeutah.org.

Please take a few minutes to answer the questions below, and provide your comments.

1. Do you support the proposed 'General Goal' and 'Guiding Principles' listed below?
Please check 'don't support', 'support as proposed', or 'support with refinements' for each of the statements below. If you don't support the statement, please note your reasons or better ideas.

	Don't Support	Support as proposed	Support with refinements	Better ideas, refinements, or comments
General Goal: To maintain and increase the long-term sustainability of the City's trees.	❒	❒	❒	_____
Proposed Principals for City Land A. Increase environmental benefits, by striving to plant more trees that grow to a larger size in locations that don't have utilities conflicts.	❒	❒	❒	_____
B. Reduce risk of tree disease and insect infestations, by aiming for a mix of tree species with a target of no one species being greater than 10% of the city tree population.	❒	❒	❒	_____
C. Plan for a mix of tree ages and gradual tree replacement, recognizing that trees will eventually die.	❒	❒	❒	_____
D. Focus on planting long-lived tree species that will benefit the community long into the future.	❒	❒	❒	_____
E. Focus on planting tree species that require less water.	❒	❒	❒	_____
F. Develop scheduled pruning for existing and newly planted trees.	❒	❒	❒	_____

Additional comments relating to proposed principals: _____

2. Do you support the development of City ordinances to protect and manage trees?
Please check 'don't support', 'support as proposed', or 'support with refinements' for each of the statements below. If you don't support the statement, please note your reasons or better ideas.

Note: *These are not proposed actions by the City. TreeUtah is asking these questions to gauge public support for different management options.*

	Don't Support	**Support as proposed**	**Support with refinements**	**Better ideas, refinements, or comments**
A. Regulations to require the planting of at least one street tree per 30 feet of road frontage for all new commercial and residential developments.	❒	❒	❒	_____
B. Requirements for replacing any trees that are removed due to development.	❒	❒	❒	_____
C. Option for contributing to a 'tree fund' in lieu of replacing trees removed due to development.	❒	❒	❒	_____
D. Extra protection for 'significant trees' such as a designated heritage tree or special wildlife area.	❒	❒	❒	_____
E. Developing a volunteer City Tree Board to help guide and promote tree management and planting.	❒	❒	❒	_____
F. City sponsored tree education events to teach the public about tree selection, planting and care.	❒	❒	❒	_____

Additional comments relating to City activities: _____

3. How satisfied are you with the current level of tree planting and maintenance by City crews?

Very satisfied ❒ Somewhat satisfied ❒ Not satisfied ❒

Key problems, both from a personal and community point of view (list your three top problems or complements) : _____

4. Would you, your family, or your business be interested in acting as a volunteer to support trees in your community?

Please check 'No', 'Yes', or 'Yes with Conditions' regarding the proposed volunteer actions below.

	No	Yes	Yes with Conditions	Better ideas, conditions, or comments
A. Would participate on a City Tree Board	❒	❒	❒	_____
B. Would provide a charitable donation for a tree project	❒	❒	❒	_____
C. Would plant and maintain a tree provided by the City	❒	❒	❒	_____
D. Would organize my block to plant and maintain City trees on our street	❒	❒	❒	_____
E. Would adopt, plant and maintain the trees on another street within guidelines set by the City	❒	❒	❒	_____

Additional comments relating to volunteer activities: _____

5. Would you, your family, or your business pay a tax or other fee increase in support of street trees and their maintenance?

Please indicate you level of support by choosing one:

- ❒ $0 / year
- ❒ $10 / year
- ❒ $20 / year
- ❒ $30 / year
- ❒ $40 / year
- ❒ $50 / year

Other ideas for funding the planting and maintenance of street trees:_____

6. What street locations, or other public areas, do you think should be priorities for new tree planting projects?

Please list your top five tree project ideas (use back of page if needed): _____

_____

_____

_____

_____

_____

_____

7. Do you have other comments or suggestions that were not addressed in this response form? : _____

_____

_____

_____

8. Information about you:

Are you a resident of this town? ❒ Yes ❒ No

Are you a business owner in town? ❒ Yes ❒ No

If you are interested in being included in our list of community members who would like to participate in future tree related projects, please provide your contact information below.

Name: _____

Address: _____

_____

E-mail and/or phone number: _____

Thank you for you time and thoughtfulness. Please hand in the form at the end of the workshop, or mail it to the address below within two weeks of the workshop date. If you have questions, call Brian Wiebler at (801) 364-2122. This response form is adapted from a response from generated for the City of North Vancouver by LanArc Consultants Ltd.

Brian Wiebler
TreeUtah
511 West 200 South, Suite 150
Salt Lake City, UT 84101

Air photo of the City Park on Main Street demonstrating the opportunity to increase shady areas by planting more trees.

PLANTING THE SEEDS OF SUCCESS.

Trees in Our City

Trees. Worth Our Time. Worth Our Resources.

- Part of community infrastructure
- Vital to community health
- Community legacy
- Positive impact on business and tax base
- Wise investment of community dollars

Trees. Vital to Community Health.

- Tree-filled neighborhoods:
  - Lower levels of domestic violence
  - Are safer and more sociable
- Tree-filled landscapes reduce stress
- Trees decrease need for medication and speed recovery times

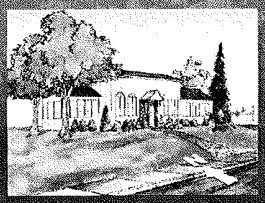
Trees. Important to Human Health.

- 100 trees remove five tons of CO_2/year
- 100 trees remove about 1000 lbs of pollutants per year, including:
  - 400 lbs of ozone
  - 300 lbs of particulates

Trees Help Save the Environment

- 100 mature trees catch about 100,000 gallons of rainwater per year...
  - Less $ for stormwater control
  - Cleaner water

Trees. A Savings for Homeowners.



- Save up to 30% of annual air conditioning costs
- Save 10-25% of winter heating costs

Trees Sell Houses. (At higher prices.)

- Each large front yard tree adds 1% to sales price
- Large specimen trees can add 10%, or more, to property values.

Trees Mean Better Business.

In tree-lined commercial districts...

- More frequent shopping
- Longer shopping trips
- Shoppers spend more for parking
- Shoppers spend 12% more for goods

The Large Tree Argument

Large trees do a better job of providing benefits

- More shade = more energy savings
- More leaf area = cleaner air
- More leaf area = better stormwater control
- Big trees = increased real estate value

Trees Pay Us Back.

100 Large Trees Over 40 Years...

Benefits = $225,000	Costs = $82,000
Energy	Planting + Pruning
Air Quality	Removal/Disposal
Runoff	Irrigation
Real Estate	Sidewalk Repair
	Litter
	Legal + Admin

Pay Off: $140,000

Plant Trees. Create a Legacy.

Central Park, New York City

The Bottom Line...

- Quality of life depends on tree benefits
- Benefits depend on healthy trees
- Healthy trees require quality care
- Quality care depends on you

What You Can Do...

- Support long-term goals for the community forest
- Tell elected officials about how important trees are to your community
- Get involved in a City Tree Board
- Organize a community tree planting event
- Champion community trees

TreeUtah's Strategic Planning Program

1. What is the current state of our community forest?
2. What do we want from our community forest?
3. How do we get what we want?

TreeUtah

PLANTING THE SEEDS OF SUCCESS.

Trees in Our City

Presented by TreeUtah

Funding for this program was provided in part through a grant from the National Tree Trust.

TreeUtah

NATIONAL TREE TRUST