

ACRONYMS

Following are acronyms used throughout this document.

BDS	Bureau of Development Services
BES	Bureau of Environmental Services
BOP	Bureau of Planning
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CO ₂	Carbon Dioxide
CSO	Combined Sewer Overflows
CWA	Clean Water Act
DEQ	Department of Environmental Quality (Oregon)
EPA	Environmental Protection Agency (U.S.)
ESA	Endangered Species Act
FOT	Friends of Trees
IPM	Integrated Pest Management
LEED	Leadership in Energy and Environmental Design (Green Building Rating System)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NR	Natural Resources Program (Portland Parks & Recreation)
OSD	Office of Sustainable Development
PDC	Portland Development Commission
PDOT	Portland Department of Transportation
PGE	Portland General Electric
PP&L	Pacific Power and Light
PP&R	Portland Parks & Recreation
PPS	Portland Public Schools
PSU	Portland State University
ROW	Right-of-Way
SWMM	Stormwater Management Manual
TMDL	Total Maximum Daily Load
TSP	Transportation Systems Plan
UF	Urban Forestry Program (Portland Parks & Recreation)
UFC	Urban Forestry Commission
UFMP	Urban Forestry Management Plan
UGB	Urban Growth Boundary
ULE	Urban Land Environment
USDA	U.S. Department of Agriculture

GLOSSARY

Following are definitions of terms used throughout this document.

Canopy Cover: The area directly beneath the crown and within the dripline of a tree or shrub. The crown consists of the above ground branches, stems and leaves.¹⁰⁴ Canopy cover is a good overall indicator of the quantity and health of the urban forest. It includes both public and private trees and provides a general picture of the urban forest. Canopy cover can be estimated using satellite images, aerial photographs and/or ground sampling.

Commercial/Industrial/Institutional Urban Land Environment: Landscape unit that includes urban and neighborhood commercial areas, malls, manufacturing and warehousing areas, industrial and wholesale sales, industrial parks, quasi-public areas such as schools and colleges, religious institutions and government facilities.

Cultivar: A cultivated variety of strain of a plant produced by horticultural techniques that is clearly distinguishable from others by one or more characteristics and that when reproduced retains its distinguishing characteristics. In the United States, *variety* is considered to be synonymous with *cultivar* (derived from 'cultivated variety'). A cultivar name is written after the Latin name, usually marked by single quotation marks, as in *Zinnia elegans* 'Tom Thumb'.¹⁰⁵

Developed Parks and Open Spaces Urban Land Environment: Landscape unit that includes public parks and open spaces with developed recreation, highly structured or programmed areas, golf courses and common open spaces — excluding natural areas.

Environmental Zones: Overlay zones that protect more than 19,000 acres of environmentally sensitive areas in Portland. These areas are typically wetlands, upland forests, steep slopes and areas along streams. These zones regulate the way development can take place in these zones.¹⁰⁶

Fish and Wildlife Habitat Areas: Lands that contain significant food, water or cover for native terrestrial and aquatic species of animals. Examples include forests, fields, riparian areas, wetlands and water bodies.

Flood Plain: A level, low-lying area adjacent to streams or rivers that is periodically flooded by stream water. It includes lands at the same elevation as areas with evidence of moving water, such as active or inactive flood channels, recent fluvial soils, sediment on the ground surface or in tree bark, rafted debris and tree scarring.¹⁰⁷

Functional Values: Benefits provided by resources. The functional value may be physical, aesthetic, scenic, educational or some other nonphysical function, or a combination of these. For example, the functional values of a wetland could be its ability to provide stormwater detention and its ability to provide food and shelter for migrating waterfowl. An unusual native

¹⁰⁴Portland City Code Chapter 33.900.010.

¹⁰⁵UNEP World Conservation Forest Monitoring Centre, "Glossary of Biodiversity Terms." <http://www.unep-wcmc.org/reception/glossaryA-E.htm> and The Chicago Botanic Garden, "Illinois Best Plants: Glossary." <http://bestplants.chicago-botanic.org/glossary.htm>

¹⁰⁶City of Portland Bureau of Planning, "Healthy Portland Streams: What are Environmental Overlay Zones?" http://www.planning.ci.portland.or.us/cp_hps_regs.html

¹⁰⁷British Columbia Ministry of Forests, "Glossary of Forest Terms." <http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm>

GLOSSARY

species of plant in a natural resource area could have educational, heritage and scientific functional values. Most natural resources have many functional values.¹⁰⁸

Green-frastructure: An interconnected system of urban forest, streams, rivers, wetlands, natural areas and neighborhood parks inside urban areas.

Green Streets: Streets that integrate land uses, transportation and natural resources to improve the region's water quality by incorporating stormwater treatment within the right-of-way.

Greenways: Corridors of protected public and private land established along rivers, stream valleys, ridges, abandoned railroad corridors, utility rights-of-way, canals, scenic roads or other linear features. Greenways link recreational, cultural and natural features, provide pathways for people and wildlife, protect forests, wetlands and grasslands and improve the quality of life for everyone.¹⁰⁹

Hazard Tree: A tree that is in an area frequented by people or is located adjacent to valuable facilities and has defects in roots, stem or branches that may cause a failure resulting in property damage or personal injury.¹¹⁰

Heritage Trees: Trees within the City which, because of their age, size, type, historical association or horticultural value, are of special importance to the City. No tree standing on private property shall be designated a "Heritage Tree" without the consent of the property owner; however, the consent of a property owner shall bind all successors, heirs and assigns.

Invasive Species: An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health.¹¹¹

Naturescaping: Landscaping that allows people and nature to coexist by incorporating native plants into landscape design to attract insects, birds and other creatures and to help keep rivers and streams healthy.¹¹²

Natural Area: A landscape unit composed of plant and animal communities, water bodies, soil and rock, and which is largely devoid of human-made structures.

Natural Areas Urban Land Environment: A landscape unit composed of plant and animal communities, water bodies, soil and rock, largely devoid of human-made structures. Lands in this ULE are publicly or privately owned and include significant natural resources. Environmental overlay zones cover many of these areas.¹¹³ This ULE includes wetlands and meadows as well as a variety of forested areas.

¹⁰⁸Portland City Code Chapter 33.900.010.

¹⁰⁹The Conservation Fund, "American Greenways Program: Creating Conservation Connections." <http://www.conservationfund.org/?article=2471&back=true>

¹¹⁰USDA Forest Service Northeastern Area, "Hazard Tree Definitions." <http://www.na.fs.fed.us/spfo/hazard/defin.htm>

¹¹¹US Department of Transportation Federal Highway Administration, "What are Invasive Plant Species?" <http://www.fhwa.dot.gov/environment/greenerroadsides/fal01p2.htm>

¹¹²Portland Bureau of Environmental Services, "What is Naturescaping?" http://www.cleanrivers-pdx.org/get_involved/naturescaping.htm

¹¹³ Environmental Zones are overlay zones that protect more than 19,000 acres of environmentally sensitive areas in Portland — including wetlands, upland forests, steep slopes and areas along streams. Development is regulated in these zones.

GLOSSARY

Planting Strip: The area between the roadway and the edge of a detached sidewalk. Planting strips can be continuous or individual tree wells within the right-of-way's furnishing zone — the area where elements such as street trees, poles, parking meters and street furniture are found and which buffers pedestrians from the roadway.

Right-of-Way (ROW): An area that allows for the passage of people or goods including free-ways, pedestrian connections, alleys and all streets; that portion of land that is dedicated for public use including pedestrians, bicycles, vehicles and transit, utility placement and signage.¹¹⁴ In the case of street trees, the City maintains the street, the property owner maintains the area behind the curb including the sidewalk and street trees.

Riparian Areas: Lands which are adjacent to rivers, streams, lakes, ponds and other water bodies. They are transitional between aquatic and upland zones, and as such, contain elements of both aquatic and terrestrial ecosystems. They have high water tables because of their close proximity to aquatic systems, soils that are usually made up largely of water-carried sediments and some vegetation that requires free (unbound) water or conditions that are more moist than normal.¹¹⁵

Street Trees: Trees growing in the public rights-of-way usually within the planting strip or in tree wells between the curb and sidewalk.

Stocking Level: The percent of available spaces for street trees that are currently planted. The available spaces do not include spaces where street trees would interfere with driveways, signs, intersections, etc.

Stormwater: Water runoff, originating as precipitation on a particular site, basin or watershed.¹¹⁶

Structural Soil: Specially mixed and graded fill soil intended to serve a particular purpose such as combining structural support for vehicles with a favorable root zone for street trees.¹¹⁷

Transportation Corridors and Rights-of-Way Urban Land Environment: Land used as major highways, local commercial streets, light rail rights-of-way, median strips and large interchanges, neighborhood and residential streets, bike paths and pedestrian trails.

Understory: Plants growing under the canopy formed by other plants, particularly herbaceous and shrub vegetation under a tree canopy.¹¹⁸

Uplands: Lands not characterized by the presence of riparian areas, water bodies, or wetlands.

Urban Forest: The complex system of trees and smaller plants, associated organisms, soil, water, air and people in and around human settlements ranging from rural communities to densely populated metropolitan areas.

¹¹⁴ Portland City Code Chapter 33.900.010.

¹¹⁵ Portland City Code Chapter 33.900.010.

¹¹⁶ Portland Bureau of Environmental Services, "Stormwater Management Manual."

¹¹⁷ Dell, Owen, "The New Watershed: Section 6. Glossary." County Landscape and Design. <http://www.owendell.com/watershed6.html#engin>

¹¹⁸ British Columbia Ministry of Forests, "Glossary of Forest Terms." <http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm>

GLOSSARY

Urban Land Environment (ULE): A specified type of land use with particular physical characteristics and issues. The urban forest in each of the five ULEs defined in this plan provides a variety of benefits and serves different needs.

Watershed: The land area that drains into a stream, an area of land that contributes runoff to one specific delivery point. Large watersheds may be composed of several smaller "subsheds," each of which contributes runoff to different locations that ultimately combine at a common delivery point.¹¹⁹

Watershed Management: The process of planning, establishing measurable objectives, characterizing watershed conditions and analyzing, selecting, implementing and monitoring projects, programs and activities to achieve the following citywide watershed health goals:

- Protect and improve stream flow and hydrology.
- Protect, enhance and restore aquatic and terrestrial habitat.
- Protect and improve surface water and groundwater quality.
- Protect, enhance and restore target aquatic and terrestrial species and biological communities.¹²⁰

Wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs and similar areas.¹²¹

¹¹⁹ Cumberland River Compact, "Glossary of Watershed Terms." <http://www.cumberlandrivercompact.org/glossary.htm>

¹²⁰City of Portland. Framework for Integrated Management of Watershed and River Health, Internal and 1st Draft Review, November 2002.

¹²¹Portland City Code Chapter 33.900.010



APPENDICES

1. Additional Sources of Information

- Frequent Contacts
- City Code
- Metro's Livable Streets Program
- Parking Lot Tree List
- Recommended Street Tree Lists
- Heritage Trees
- Portland Plant List
- Green Building Program and LEED Certification

2. Urban Forestry Brochures

3. Community Education, Outreach Programs and Volunteer Opportunities

4. Past and Current Urban Forest Inventories

5. Performance Measurement and Canopy Cover Targets

6. Estimated Annual Costs and Benefits of Trees

7. Sustainable City Principles

8. Environmental Zoning Summary

9. Planning for Development in the Urban Forest

10. Landscaping for Wildlife Habitat

11. Planning Process for the UFMP

APPENDIX 1: Additional Sources of Information

Frequent Contacts

Portland Parks & Recreation	503-823-2223	http://www.portlandparks.org
Urban Forestry	503-823-4489	http://www.portlandparks.org
Community Gardens	503-823-1612	http://www.portlandparks.org
Hoyt Arboretum	503-823-8733	http://www.hoytarboretum.org
Bureau of Maintenance	503-823-1700	http://trans.ci.portland.or.us
Bureau of Environmental Services	503-823-7740	http://cleanrivers~pdx.org
Portland General Electric	503-590-1454	http://portlandgeneral.com
Pacific Power	888-221-7070	http://pacificpower.net

City Code

Portland's city code is accessible online at: <http://www.ordlink.com/codes/portland/index.htm> or by contacting the City Auditor's office at: 503-823-4078

Ordinances related to urban forestry include:

- Chapter 33.630 TREE PRESERVATION
(Added by Ordinance 175965 and 176333, effective 7/1/02)
- Chapter 20.40 STREET TREE AND OTHER PUBLIC TREE REGULATIONS
(Added by Ordinance 134330; New Chapter substituted by 159490; Mar. 12, 1987)
- Chapter 20.42 TREE CUTTING
(Replaced by Ordinance No. 170775, effective Jan. 10, 1997)

Metro's Livable Streets Program

Streets are an important key to community livability. Metro's regional street design policies support implementation of the 2040 Growth Concept by linking the way a street is designed to the land uses it serves. A well-planned street system can help prevent congestion while encouraging walking, transit and bicycling. Good street design can promote community livability by emphasizing local travel needs and creating a safe, inviting space for community activity. Street design elements such as sidewalks, crosswalks, landscaped sidewalk buffers, bikeways, on-street parking, street trees, landscaping, street lighting, bus shelters, benches and corner curb extensions provide an environment that is not only attractive, but can slow traffic and encourage walking, bicycling and use of transit.

Streets also can be designed to be "green." Features such as street trees, landscaped swales and special paving materials can be used to limit stormwater runoff. Limiting runoff helps protect stream habitat. Metro has developed a series of three handbooks to guide the development of green and livable streets. *Creating Livable Streets*, *Trees for Green Streets*, and *Green Streets* are available from Metro by calling (503) 797-1839. For more information see: http://www.metro-region.org/transpo/greenstreets/green_streets.html

APPENDIX 1 cont.

Parking Lot Tree List

(List of tree species and common names adopted by Ordinance #175341, 2/14/01.)

Specific types of trees are recommended for use in parking lots. The recommended minimum clearance from the pavement provides guidance on the amount of planting space each tree needs for good results. Comments included in the list provide guidance as to best applications of the different trees and additional information that may help in tree selection. Some species of trees are well suited to landscaped areas that will receive stormwater runoff, while others will not tolerate the additional moisture from runoff. This list is available from Urban Forestry at 503-823-4489.

Recommended Street Tree Lists

The Urban Forestry Program has lists of recommended street trees for developed planting strips by size and the presence of overhead wires and for undeveloped planting strips. These lists are available by calling the Urban Forestry Program at 503-823-4489, as are the free permits required for planting trees in the right-of-way.

Heritage Trees

Between 1973 and 1993, six trees were declared Historic Landmarks by City Council. In May of 1993 a Heritage Tree Ordinance was adopted to facilitate designating historic trees. The Urban Forestry Commission (UFC) has primary responsibility for this. Trees are recommended for Heritage Tree status based upon their condition, age, size, type, historical association and horticultural value. Those that meet the established criteria are presented to City Council for adoption. Nominations can be referred to PP&R's Urban Forestry program.

As of December 1, 2003, there were 251 Heritage Trees. They represent public trees (on the streets or in parks) and private trees. There is a link to the Heritage Tree Web Site with color photographs, maps and descriptions.¹²² The *Portland Heritage Trees Through December 31, 2001 Second Edition* booklet, available from Portland Parks & Recreation, has a comprehensive list of these trees and tree tours in neighborhoods with particularly good specimens.

Portland Plant List

The Portland Plant List is an integral component of the City's natural resource protection program. Native plants on the list are required within the Environmental and Willamette River Greenway Zones; invasive or harmful plants (identified on the "Nuisance" or "Prohibited" Plant Lists) are prohibited.

Healthy native plant communities provide habitat for native wildlife and preserve critical habitat for rare, threatened and endangered animals and plants. They enhance air and water quality by trapping airborne particulates and by filtering sediments and pollutants from runoff before they enter streams and aquifers. They stabilize stream banks and hillside slopes, dissipate erosive forces, ameliorate the local microclimate and reduce water and energy needs. They enhance Portland's livability by providing scenic, recreational and educational values. Native plants are part of the region's natural heritage.¹²³

¹²²<http://www.portlandparks.org/urbanforestry/index.html>

¹²³http://www.planning.ci.portland.or.us/lib_plantlist.html

APPENDIX 2: Urban Forestry Brochures

The Urban Forestry Program has many helpful and informative brochures. These include:

- Dutch Elm Disease: A City and Community Elm Survival Guide
- Guidelines for Mature Tree Care
- Guidelines for Pruning Young Shade Trees
- Neighborhood Tree Liaison Program and Application
- Portland's Urban Forest and Oregon's Endangered Species
- Providing a Foundation for a community working toward a fully functional Urban Forest
- Street Tree Planting and Establishment Guidelines
- Tree Cutting Guidelines

Many of these brochures are available online at:

<http://www.portlandparks.org/services/urbanforestry.htm>

or by calling the Urban Forestry Program at 503-823-4489

APPENDIX 3: Community Education, Outreach Programs and Volunteer Opportunities

Green Building Program and LEED Certification

Information about the Office of Sustainable Development's Green Building Program and LEED Certification is available at: <http://www.green-rated.org/g Rated/grated.html>

Community Watershed Stewardship Program

(503) 823-5740

The Stewardship program provides opportunities for Portland community groups and residents to be involved in watershed issues by promoting community-initiated restoration projects that improve watershed health.

http://www.cleanriver-pdx.org/get_involved/stewardship.htm

Downspout Disconnect Program

(503) 823-5858

This Environmental Services Program pays homeowners or neighborhood groups to disconnect their downspouts from the combined sewer system and allow their roof water to drain to gardens and lawns, or disconnects them for homeowners free of charge.

http://www.cleanrivers-pdx.org/get_involved/downspout_disconnection.htm

Ivy Removal Project

(503) 823-3681

The No Ivy League project provides education about English ivy and other invasive species and uses volunteers for ivy control, removal and habitat restoration.

<http://www.noivyleague.com>

Naturescaping for Clean Rivers

(503) 823-2862

Naturescaping uses native plants, natural landscapes, and water-friendly gardening practices. Call to find out about naturescaping workshops scheduled for your area or to help organize one in the Portland area.

http://www.cleanrivers-pdx.org/get_involved/naturescaping.htm

Pollution Prevention Outreach/Education

(503) 823-7623

The Pollution Prevention Program trains business representatives, residents and city workers to identify pollution and prevent it at the source.

http://www.cleanrivers-pdx.org/pollution_prevention/index.asp

Southwest Watershed Resource Center

(503) 823-2862

The Center, located at Gabriel Park, lends tools and provides other resources to help keep our rivers and streams clean. The Center's goal is to help residents improve the health of their watershed.

Friends of Trees

(503) 284-8846

Friends of Trees (FOT) is a non-profit organizations that organizes tree planting and tree care projects along city streets, in urban natural areas and on school grounds. They also educate the public about the urban forest and make tree planting in yards affordable through their Branching Out program.

<http://www.friendsoftrees.org>

The executive summary of the FOT Strategic Vision is available at:

http://www.friendsoftrees.org/pdfimages/Exec_Summary.pdf

Neighborhood Tree Liaisons

(503) 823-1650

Neighborhood Tree Liaisons are local leaders that serve as neighborhood resources for proper tree care. Call to find out about the next training session.

APPENDIX 4: Past and Current Urban Forest Inventories

STREET TREE INVENTORIES

In the past, information about the urban forest consisted primarily of street tree inventories. The first census of street trees was completed with the aid of a Works Progress Administration grant in 1938. The result of the inventory was a list of 78,886 trees composed of 173 species. Seven genera accounted for 71% of the trees with conifers making up 15% of the total. Other deciduous tree species accounted for less than 1% each.

Maple	18,074	23%
Walnut	12,060	15%
Elm	6,719	9%
Hawthorn	6,366	8%
Birch	5,616	7%
Buckeye	4,803	6%
Mountain Ash	3,278	4%
Conifers (all species)	11,833	15%
<u>Other</u>	<u>10,137</u>	<u>13%</u>
Total	78,886	100%

A second inventory of street trees done in 1976 covered 57% of the city and estimated an approximate total of 69,564 street trees for the entire city – 9,322 fewer street trees than in 1938. This survey counted 197 varieties of trees. Though the species composition changed significantly since the 1938 survey, several genera still dominated the population. By 1976, conifers accounted for only 4% of the total.

Cherry and Plum	8,349	21%
Maple	7,759	20%
Birch	3,701	9%
Hawthorn	2,946	7%
Walnut	1,891	5%
Sweetgum	1,879	5%
Elm	1,768	4%
Oak	1,065	3%
Conifers (all species)	2,783	4%
<u>Others</u>	<u>15,304</u>	<u>22%</u>
Total	69,564	100%

The 1976 survey also provided important information about the health of street trees. Forty-one percent were in excellent or good condition with 56% in fair or poor condition. Thirteen percent needed pruning, 10% had been topped and 1% needed to be removed.

That survey sampled twenty-six neighborhood areas and showed that some neighborhoods had far more street trees per street mile than others. Irvington, Eastmoreland, and Laurelhurst were well above average. Eliot, Corbett-Terwilliger, Brooklyn and Buckman were below the average. These trends continue today in many parts of the city.

APPENDIX 4 cont.

STREET TREE COMPARISONS

In 1989, Kielbaso and Cotrone produced a report titled "The State of the Urban Forest" that included data on street trees in 320 cities across the country, including Portland. The inventory looked at numbers, sizes and conditions of street trees. In many respects, Portland was at or somewhat below the national average. In terms of tree sizes, Portland had many more sapling size trees (less than 3" diameter) and fewer trees in the small, medium and large sizes. The numbers of trees in excellent, good, fair, or poor condition were similar to the national average. However, Portland had nearly 50% more empty tree spaces than the national average. According to this study, there were three empty spaces for every tree. It should be noted that many areas that were surveyed included industrial areas and residential areas that have very narrow tree planting spaces. For reference, the street trees in Salem and Corvallis were much better than Portland's, while street trees in Eugene were about the same as Portland's.

CANOPY COVER INVENTORIES

A variety of aerial photos and satellite imagery provides information about the urban forest in the city and surrounding region. They include the following:

PSU Study of Portland's Urban Forest Canopy, 2003

Dr. Joe Poracsky and Mike Lackner collaborated on a satellite imagery study to determine the current state of Portland's urban forest canopy, how the canopy has changed over time in amount and composition and how canopy cover relates to geography (neighborhood and land-use). Their report also recommends canopy cover targets for the city as a whole and for specific land uses.

Poracsky and Lackner analyzed satellite imagery from 1972, 1991 and 2002, along with digital 2002 aerial photos and RLIS GIS data. Using an unsupervised classification process, pixels were grouped into eight categories, which were each given a relative canopy weight from 0 to 100. Areas with vegetation cover were grouped into four classes, which were each given a relative canopy weight from 0 to 100. A total canopy score for each pixel was produced by multiplying the canopy score for vegetation type by the canopy score for the cover class.

Four land-use categories were recognized:

- Parks / Greenspaces
- Residential
- Commercial / Industrial
- Right-of-way

Results

Current total canopy cover in Portland was estimated to be 26.3% with Forest Park included and 23.6% with Forest Park excluded. This is an *increase* of 1.2 % from 1972. Accuracy of results was estimated to be 61-72% by category; overall accuracy was 69.2%.

Greatest increases occurred in many established neighborhoods. Often these areas of canopy increase correlated to areas where Friends of Trees has led tree-planting efforts. As

APPENDIX 4 cont.

expected, parks and greenspaces had the highest canopy cover and commercial / industrial areas had very low canopy cover.

Recommended Canopy Cover Targets

Parks / Greenspaces: Tree planting depends on the uses of the park. Some areas such as sports fields, playgrounds and parking lots will never have trees, while other areas may be heavily wooded. Park managers should increase tree stocking levels where appropriate and replace aging trees.

Residential: A "high but achievable" target is 47% canopy cover (75th percentile). Many areas are available for large increases.

Commercial / Industrial: 12% is a realistic target.

Right-of-way: Use stocking levels rather than canopy cover since satellite analysis does not lend itself to individual trees. This will require ground surveys.

General Recommendations

- Educate citizens in all neighborhoods about the benefits of trees to stimulate tree planting.
- Encourage and support tree planting efforts.
- Quantify the relationship between canopy and water quality. Some areas, such as Columbia Slough, could experience great water quality gains with increased canopy.
- Use information about economic benefits of trees to educate public and inform policy makers.
- Focus planting in areas with relatively little canopy, rather than increasing canopy in areas with relatively good canopy cover.
- Repeat satellite canopy cover study in 5 to 8 years.

Modeling Benefits and Costs of Community Tree Plantings. In 1993, Gregory McPherson, Ph.D., Paul Sacamano and Steve Wensman of the USDA Forest Service conducted a study of twelve cities in the US — including Portland. They used aerial photographs of each city to estimate existing land cover and opportunities for new tree planting. Using 1990 photographs for this interpretation, Portland had a 42% tree/shrub cover overall — higher than any of the other eleven cities studied. The study also identified that Portland's overall stocking level at 64.9% — also higher than that of any other city studied.¹²⁴

Master's Thesis for Tree Crown Density. A master's thesis project by Paul Newman, of the Portland State University Geography Department in 1994 used satellite imagery to measure tree crown density within the city. This information could be coordinated with other information in a geographic system to correlate urban forest density with other features such as population density and zoning, as well as to show relative densities among neighborhoods or other land uses.

Portland Parks & Recreation Tree Canopy Assessment. The Urban Forestry Program completed a park tree canopy assessment in 2001 that showed approximately 60% canopy cover over the 2,800 acres of Portland Park and Recreation's developed parks. The replacement value for these trees is estimated at \$250 million, and the total replacement cost is estimated to be \$270 million.

¹²⁴McPherson, Sacamano, and Wensman (1993).

APPENDIX 4 cont.

Regional Ecosystem Analysis for the Willamette/Lower Columbia Region of Northwestern Oregon and Southwestern Washington State. In 2001, American Forests partnered with nine municipalities from Vancouver, WA to Eugene, OR. The study area covered more than 7 million acres and utilized data from Landstat satellite images to assess the changes to the landcover for a 28-year period from 1972 to 2000.¹²⁵ As expected, that study showed reductions in the urban forest as development has occurred. It should be noted that the information gathered and compared in that report came from sources that used different resolutions than earlier studies, so it is difficult to provide certainty about the degree of change.

Metro's Habitat Inventory. Metro is currently developing a region-wide inventory of riparian and wildlife habitat. This includes stream corridors and patches of the urban forest that are at least one acre in size. Most of the patches recognized in this inventory are "closed forest canopy" with at least a 75% canopy coverage. This inventory will continue to be updated using aerial photographs. Metro's recognition of these patches of urban forest as "regionally significant" will eventually lead to a regional management and protection plan that will include recommendations for incentives, acquisition, public education, stewardship opportunities and regulations (tentatively in late 2003).

BES Street Tree Canopy Assessment. BES is currently doing a street tree canopy assessment for the Holladay/Sullivan/Stark Street area. It will examine the canopy coverage provided by street trees in this study area and identify potential planting areas.

Green City Data Projects. Other assessments have been done for various neighborhoods including the Green City Data street tree project done by 8th grade students in 1998, and other inventories done by other students in subsequent years.¹²⁶

In 2000, Kim Wilson wrote *"Common Street Trees of Portland."* This report was developed to assist participants in the Youth Tree Inventory Project by providing guidance to identifying street trees throughout Portland.

¹²⁵American Forests (2001).

¹²⁶ Poracsky et al. (1999).

APPENDIX 5: Performance Measurement and Canopy Cover Targets

Performance Measurement

Urban forestry is considered by many to be a new and evolving science and there are no widely accepted standards or performance measures that assess the condition of the urban forest. Performance measurement will be increasingly important for urban forestry managers to evaluate their progress and rate of change.

Suggestions for assessing the urban forest health and condition include:

- Canopy cover
- Leaf surface area
- Species diversity
- Age diversity
- Condition assessment (using ISA standards for example)
- Stocking level
- Ratio of planting to removal

Other suggestions for performance measures include the number of volunteer hours, the number of education/outreach contacts and funding. Although these do not directly assess the condition of the urban forest, they address the management of urban forestry programs.

Canopy Cover

Canopy cover is defined as the proportion of an area, when viewed from above, that is occupied by tree crowns. Canopy cover is an overall indicator of forest health and quantity. It is measured using aerial photographs, satellite images and ground surveys. This is less complex than evaluating leaf surface area — although this may be a future tool. Performance measures with specific targets for canopy cover have been developed for the Urban Land Environments (ULEs) in this plan.

The specific targets set forth in this plan are based on research of the recommendations and/or code requirements of other cities, counties and states, as well as scientific literature and conversations with several urban forestry researchers. The table on page 100 summarizes this research.

Although several cities have adopted specific targets, so far there seems to be little scientific evidence that shows that any of these targets are necessarily correlated with a healthy, functioning urban forest. This may be an area for future urban forestry research.

The following table shows the wide range of performance targets or code requirements for residential areas and commercial/industrial/institutional areas. It is important to consider that these targets may reflect different growing conditions and climates. In addition, those figures that are code requirements may not reflect overall city or county canopy goals.

Canopy cover targets in this plan are based on current research (see Sources at end of this section), the knowledge and experience of Portland's urban forest managers and information from existing canopy analyses, although these are limited.

APPENDIX 5 cont.

Canopy Cover Targets for Portland ULEs

The canopy cover targets set forth in this plan are as follows:

Residential	35-40%
Commercial/Industrial/Institutional	15%
Natural Areas and Stream Corridors	Targets set by City Framework Plan
Transportation Corridors and Rights-of-Way	35%
Developed Parks and Open Spaces	30%

Sources – Performance Measures and Canopy Cover Targets

American Forests. "Regional Ecosystem Analysis for the Willamette/Lower Columbia Region of Northwestern Oregon and Southwestern Washington State: Calculating the Value of

Urban	Residential	Mixed Density/ Single Family	Commercial/ Multi-Family	Industrial/ Commercial	Industrial	Streets & ROW	Natural Areas & Stream Corridors	Developed Parks & Open Spaces	Overall	Urban	Residential	Mixed Density/ Single Family	Commercial/ Multi-Family	Industrial/ Commercial	Industrial	Streets & ROW	Natural Areas & Stream Corridors	Developed Parks & Open Spaces	Overall	
American Forests (for Portland area)	25%			15%	15%			40%		American Forests (for Portland area)	25%			15%	15%			40%		
Adams-Clarke County, GA, BMPs for Community Trees *	40-60%	60%	40-50%	0-40%	0-40%		70% for riparian zones & drainage areas			Adams-Clarke County, GA, BMPs for Community Trees *	40-60%	60%	40-50%	0-40%	0-40%		70% for riparian zones & drainage areas			
Botetourt County, VA Municipal Code	15%			10%						Botetourt County, VA Municipal Code	15%			10%						
Chesapeake, VA City Code	15-20%	20%	15%	10%						Chesapeake, VA City Code	15-20%	20%	15%	10%						
Cincinnati, OH (American Forests' Standards)	25%			15%				40%?		Cincinnati, OH (American Forests' Standards)	25%			15%						
Fauquier County, VA Zoning Ordinance	15%			10%						Fauquier County, VA Zoning Ordinance	15%			10%						
Georgetown, TX Draft Development Code			30%	10-25%	15-30%					Georgetown, TX Draft Development Code			30%	10-25%	15-30%					
Georgia Dept of Community Affairs Model Code	20%			15%						Georgia Dept of Community Affairs Model Code	20%			15%						
Phil Hoefer, Retired UR&CR Coordinator for CO	60%									Phil Hoefer, Retired UR&CR Coordinator for CO	60%									
Jefferson County, KY Land Development Code	10-20%	10-20%	10-20%	0-15%	0-15%					Jefferson County, KY Land Development Code	10-20%	10-20%	10-20%	0-15%	0-15%					
Massachusetts, VA City Code	15-20%			10%	15%					Massachusetts, VA City Code	15-20%			10%	15%					
Maryland's 1991 Forest Conservation Act (from Miller 1997)	15-25%			15-25%	7.5%					Maryland's 1991 Forest Conservation Act (from Miller 1997)	15-25%			15-25%	7.5%					
Greg McPherson, USDA Forest Service						25%**				Greg McPherson, USDA Forest Service						25%**				
Mark Mead, Seattle Dept of Transportation								25-35%		Mark Mead, Seattle Dept of Transportation										
Munich, Germany	20%									Munich, Germany	20%									
Potomac County, VA Design Construction Standards Manual	10-20%			10%						Potomac County, VA Design Construction Standards Manual	10-20%			10%						
Seattle, WA Urban Forest Assessment: Sustainability Matrix (American Forests' Standards)	25%			15%						Seattle, WA Urban Forest Assessment: Sustainability Matrix (American Forests' Standards)	25%			15%						
Smithfield County, VA Zoning Ordinance	10-20%			10%						Smithfield County, VA Zoning Ordinance	10-20%			10%						
Suffolk, VA Development Ordinance	10-20%			10%						Suffolk, VA Development Ordinance	10-20%			10%						
Syracuse, NY Urban Forest Master Plan								30%		Syracuse, NY Urban Forest Master Plan										
USDA NE Area Resource Guide (1993)						50%			50%	USDA NE Area Resource Guide (1993)						50%				50%

*These are all included in their site design standards (section 9 of code)

APPENDIX 6: Estimated Annual Costs & Benefits of Trees

Estimated annual costs for a small-, medium-, and large-sized public and private, residential yard tree located opposite a west-facing wall 20 years after planting.

Costs (\$/yr/tree)	Small Tree		Medium Tree		Large Tree	
	28 ft tall	25 ft spread	38 ft tall	31 ft spread	46 ft tall	41 ft spread
	LSA=1,891 ft ²		LSA=4,770 ft ²		LSA=6,911 ft ²	
	Private	Public tree	Private	Public tree	Private	Public tree
Tree & Planting	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pruning ¹²⁷	\$4.79	\$7.59	\$4.79	\$7.59	\$11.00	\$13.73
Remove & Dispose	\$0.28	\$1.45	\$0.34	\$1.79	\$0.42	\$2.22
Pest & Disease	\$0.31	\$0.08	\$0.38	\$0.10	\$0.47	\$0.12
Infrastructure	\$0.28	\$1.13	\$0.35	\$1.39	\$0.43	\$1.73
Irrigation	\$0.24	\$0.00	\$0.60	\$0.00	\$0.86	\$0.00
Clean-Up	\$0.28	\$1.11	\$0.34	\$1.37	\$0.43	\$1.71
Liability & Legal	\$0.06	\$0.25	\$0.08	\$0.31	\$0.10	\$0.38
Admin & Other	\$0.00	\$1.29	\$0.00	\$1.39	\$0.00	\$2.21
Total Costs	\$6.23	\$12.90	\$6.87	\$13.94	\$13.72	\$22.10
Total Benefits (see below)	\$17.96	\$18.12	\$36.04	\$37.24	\$65.18	\$68.92
Net Benefits	\$11.73	\$5.22	\$29.16	\$23.30	\$51.46	\$46.82

Estimated value of net annual benefits from a small-, medium- and large-sized residential yard tree opposite a west-facing wall 20 years after planting.

Benefit Category	Small Tree		Medium Tree		Large Tree	
	28 ft tall	25 ft spread	38 ft tall	31 ft spread	46 ft tall	41 ft spread
	LSA = 1,891 ft ²		LSA = 4,770 ft ²		LSA = 6,911 ft ²	
ElectriCity savings (\$0.06/kWh)	62 kWh	\$3.89	93 kWh	\$5.87	125 kWh	\$7.85
Natural gas savings (\$0.92/therm)	-150 kBtu	-\$1.38	-80 kBtu	-\$0.73	133 kBtu	\$1.22
Carbon dioxide (\$0.015/lb)	28 lb	\$0.42	76 lb	\$1.14	263 lb	\$3.95
Ozone (\$2.40/lb)	0.13 lb	\$0.32	0.21 lb	\$0.51	0.35 lb	\$0.84
NO ₂ (\$2.40/lb)	0.07 lb	\$0.18	0.14 lb	\$0.34	0.24 lb	\$0.58
SO ₂ (\$1.00/lb)	0.04 lb	\$0.04	0.07 lb	\$0.07	0.10 lb	\$0.10
PM ₁₀ (\$2.72/lb)	0.15 lb	\$0.41	0.24 lb	\$0.66	0.40 lb	\$1.09
VOC's (\$6.65/lb)	0.001lb	\$0.018	0.002 lb	\$0.063	0.005 lb	\$0.030
BVOC's (\$6.65/lb)	-0.004 lb	-\$0.024	-0.012 lb	-\$0.081	-0.034 lb	-\$0.224
Rainfall Interception (\$0.028/gal)	169 gal	\$4.70	288 gal	\$8.01	449 gal	\$12.47
Environmental Subtotal		\$8.58		\$15.85		\$27.91
Other Benefits		\$9.38		\$20.19		\$37.27
Total Benefits		\$17.96		\$36.04		\$65.18
Total Costs		\$6.23		\$6.87		\$13.72
Net Benefits		\$11.73		\$29.16		\$51.46

Source: McPherson, E. Gregory et al. Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting. Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station, 2002, pp. 28 & 30.

¹²⁷Portland Parks & Recreation staff feel that these pruning costs may be underestimated.

APPENDIX 7: Sustainable City Principles

November 1994

Goal: City of Portland will promote a sustainable future that meets today's needs without compromising the ability of future generations to meet their needs, and accepts its responsibility to:

- Support a stable, diverse and equitable economy
- Protect the quality of the air, water, land and other natural resources
- Conserve native vegetation, fish, wildlife habitat and other ecosystems
- Minimize human impacts on local and worldwide ecosystems

City elected officials and staff will:

1. Encourage and develop connections between environmental quality and economic vitality. Promote development that reduces adverse effects on ecology and the natural resource capital base and supports employment opportunities for our citizens.
2. Include cumulative and long-term impacts in decision making and work to protect the natural beauty and diversity of Portland for future generations.
3. Ensure commitment to equity so environmental impacts and the costs of protecting the environment do not unfairly burden any one geographic or socioeconomic sector of the City.
4. Ensure environmental quality and understand environmental linkages when decisions are made and regarding growth management, land use, transportation, energy, water, affordable housing, indoor and outdoor air quality and economic development.
5. Use resources efficiently and reduce demand for natural resources, like energy, land and water, rather than expanding supply.
6. Prevent additional pollution through planned, proactive measures rather than only corrective action. Enlist the community to focus on solutions rather than symptoms.
7. Act locally to reduce adverse global impacts of rapid growth population and consumption, such as ozone depletion and global warming, and support and implement innovative programs that maintain and promote Portland's leadership as a sustainable city.
8. Purchase products based on long-term environmental and operating costs and find ways to include environmental and social costs in short-term prices. Purchase products that are durable, reusable, made of recycled materials and non-toxic.
9. Educate citizens and businesses about Portland's Sustainable City Principles and take advantage of community resources. Facilitate citizen participation in City policy decisions and encourage everyone to take responsibility for their actions that otherwise adversely impact the environment.
10. Report annually on the health and quality of Portland's environment and economy.

From: Portland Office of Sustainable Development, <http://www.sustainableportland.org/Sustainable%20City%20Principles.pdf>

APPENDIX 8: Environmental Zoning Summary

Existing zoning to protect Portland's natural areas

Portland's Zoning Code regulates land use and development in the city and assigns each parcel of land a "base zone," such as residential, industrial or commercial.

To meet special needs, the City Council has adopted a second kind of zoning that overlays the base zones. These overlay zones address specific city goals — such as design or scenic resources — that apply to properties within them, whether it's a store, office or home.

Since 1989, the city has used environmental overlay zoning to protect more than 19,000 acres of environmentally sensitive areas in Portland. These areas are typically wetlands, upland forests, steep slopes and areas along streams — including many of the streams being considered under Healthy Portland Streams.

The environmental overlay zones regulate the way development can take place because paving, removing trees and adding to a building's size can increase erosion, noise or pollution and add to the flood threat.

The City's goal is for development to take place with greater sensitivity to our environment. The regulations don't seek to stop development, but rather to guide it to better protect and enhance the natural areas we value.

Under the current zoning code, there are two environmental overlay zones: the protection, or p-zone, and the conservation, or c-zone.

Environmental protection zone.

Offering the highest level of protection, this zone includes a regional network of urban natural areas and stream corridors. In the long-term, these lands will be shaped by healthy streams, wetlands, meadows and forests. Almost three-quarters of the land in the p-zone is publicly owned, such as Forest Park, Tryon Creek State Park, Powell Butte, and the Smith and Bybee Lakes.

The protection zone allows new development only when there is a public need and benefit, such as trails or interpretive facilities. Existing buildings and other structures (bridges, driveways) can be maintained without restriction.

Environmental conservation zone.

Less restrictive than the p-zone, this zone can allow limited urban development. Homes and other buildings may be built as long as all alternatives are considered and the development is designed to be sensitive to the natural environment. For example, the c-zone limits the amount of land area that may be disturbed during development, limits the number of trees that may be removed, and establishes minimum setbacks from streams, lakes, wetlands, and other water bodies. The zone also requires native plants for new landscaped areas.

Development proposals in the c-zone may be approved in one of two ways. They may be approved through an Environmental Plan Check that compares the proposal to strict, objective development standards with no flexibility. Or they can undergo an Environmental Review that allows considerably more flexibility and creativity tailored to the specific property, while still meeting conservation goals. For example, enhanced natural landscaping could compensate for the potential harm of paving a driveway.

APPENDIX 8 cont.

Currently the environmental overlay zones also include a 25-foot transition area that is located just inside the environmental overlay zone boundary, but it is not shown on official zoning maps. The current transition area has fewer restrictions than the rest of the environmental overlay zone.

Source: Portland Bureau of Planning, "Healthy Portland Streams: Summary of Discussion Draft Proposal." October 2001, http://www.planning.ci.portland.or.us/pdf/hps_summary.pdf, pp. 3-4.

APPENDIX 9: Planning for Development in the Urban Forest

New development in any of the Urban Land Environments potentially threatens the condition and extent of the urban forest. Inadequate attention is typically given to the presence of existing vegetation during site planning and throughout the development phase. However, retention and protection of some of the existing vegetation on a site has important environmental and economic benefits.

This appendix outlines steps involved in tree preservation, summarizes common methods to minimize damage to trees during construction and lists available resources to obtain more information. Some Certified Arborists are specially trained and experienced in tree preservation. The use of such qualified professionals during all aspects of site planning and development is highly recommended.

DESIGNING DEVELOPMENT WITH THE LANDSCAPE IN MIND

Site Survey

A qualified professional should be retained to review proposed site changes for potential impacts to the existing landscape. A site map should include: existing vegetation, elevation and proposed grade changes, existing utilities and proposed structures to be built.

Assessment

A qualified professional can assist in determining which individual trees and areas of vegetation should be retained depending on individual tree species, location and condition. Erosion control, slope stability and esthetic impacts are factors to be measured.

Conservation Plan

Individual and groups of trees to be protected need to be marked on construction plans. Delineation of effective root zones is especially critical. Several methods exist to reduce construction impacts to trees. Plans for preservation must be developed in advance of construction and effectively communicated to all appropriate parties.

Preservation Techniques

A certified arborist, not the general contractor, should do the tree work during construction. Examples of arborist work includes root inspections and tree and root pruning.

Monitoring during Construction

Vigilant monitoring by qualified professionals is needed to protect trees during construction. Protection zones must be maintained to guard trees from fill, bark damage, compaction, root loss during grading, etc. Additional landscaping must consider the requirements of the existing vegetation. Landscape professionals can assist with this work.

Post Construction Care

Mature trees will need to be monitored on a continual basis for signs of stress and treated accordingly.

Construction Impacts and Tree Preservation Techniques

Impact to Tree	Construction Activity	Methods and Treatments to Minimize Damage
Root Loss	Stripping site of organic surface soil during mass grading	Restrict stripping of topsoil around trees. Any woody vegetation to be removed adjacent to trees to remain should be cut at ground level and not pulled out by equipment; root injury to remaining trees may result.
	Lowering grade, scarifying, preparing subgrade for fills, structures	Use retaining walls with discontinuous footings to maintain natural grade as far as possible from trees. Excavate to finish grade by hand and cut exposed roots with a saw to avoid root wrenching and shattering by equipment, or cut with root pruning equipment. Spoil beyond cut face can be removed by equipment sitting outside the drip line of the tree.
	Subgrade preparation for pavement	Use paving materials requiring a minimum amount of excavation (e.g. reinforced concrete instead of asphalt). Design traffic patterns to avoid heavy loads adjacent to trees (heavy load bearing pavements require thicker base material and subgrade compaction). Specify minimum subgrade compaction under pavement within drip line.
	Excavation for footings, walls foundations	Design walls and structures with discontinuous footings, pier foundations. Excavate by hand. Avoid slab foundations, post and beam footings.
	Trenching for utilities, drainage	Coordinate utility trench locations with contractors. Consolidate utility trenches. Excavate trenches by hand in areas with roots larger than 11" diameter. Tunnel under woody roots rather than cutting them.
Wounding Top of Tree	Injury from equipment	Fence trees to enclose low branches and protect trunk. Report all damage promptly so arborist can treat appropriately.
	Pruning for vertical clearance for building and construction equipment	Prune to minimum height required prior to construction. Consider minimum height requirements of construction equipment and emergency vehicles over roads. All pruning should be performed by an arborist, not by construction personnel.
Damage to Roots, Stress From Reduced Root Systems	Compacted soils	Fence trees to keep traffic and storage out of root area. In areas of engineered fills, specify minimum compaction (usually 85) if fill will not support a structure. Provide a storage yard and traffic areas for construction activity well away from trees. Protect soil surface from traffic compaction with thick mulch. Following construction, vertical mulch compacted areas.
	Spills, waste disposal (e.g. paint, oil, fuel)	Post notices on fences prohibiting dumping and disposal of waste around trees. Require immediate cleanup of accidental spills.

Construction Impacts and Tree Preservation Techniques

	Soil sterilants (herbicides) applied under pavement	Use herbicides safe for use around existing vegetation and follow directions on the label.
	Impervious pavement over soil surface	Utilize pervious paving materials. Install aeration vents in impervious paving.
Inadequate Soil Moisture	Rechannelization of stream flow, redirecting runoff, lowering water table, lower grade	In some cases it may be possible to design systems to allow low flows through normal stream alignments and provide bypass into storm drains for peak flow conditions. Provide supplemental irrigation in similar volumes and seasonal distribution as would occur.
Excess Soil Moisture	Underground flow backup, raising water table	Fills placed across drainage courses must have culverts placed at the bottom of the low flow so that water is not backed up before rising to the elevation of the culvert. Study the geotechnical report for ground water characteristics to see that walls and fills will not intercept underground flow.
	Lack of surface drainage away from	Where surface grades are to be modified, make sure that water will flow away from the trunk, i.e. that the trunk is not at the lowest point. If the tree is placed in a well, drainage must be provided from the bottom of the well.
	Compacted soils, irrigation of exotic landscapes	Compacted soils have few macropores and many micropores. Core vent to improve drainage. Some species cannot tolerate frequent irrigation required to maintain lawns, flowers and other shallow-rooted plants. Avoid landscaping under those trees, or utilize plants that do not require irrigation.
Increased Exposure	Thinning stands, removal of undergrowth	Preserve species that perform poorly in single stands as groups or clusters of trees. Maintain the natural undergrowth.
	Reflected heat from surrounding hard surfaces	Minimize use of hard surfaces around trees. Monitor soil moisture needs where water use is expected to increase.
	Pruning	Avoid severe pruning where previously shaded bark would be exposed to sun. Where pruning is unavoidable, provide protection to bark from sun.

Source: *A Technical Guide to Urban and Community Forestry in Washington, Oregon, and California*. World Forestry Center, Portland, Oregon and Robin Morgan, 1993.

APPENDIX 10: Landscaping for Wildlife Habitat

The presence of wildlife in the city depends largely on the availability of habitat. All species require sources of food, water and cover. In addition to parks and refuges, landscaping in residential yards and other areas such as institutional campuses can be designed to provide for wildlife. Habitat can be enhanced by providing for the animals' needs as follows:

Food. Plant species that provide a food source. Many native plants are particularly useful and are quite beautiful as well. Some introduced plants provide food sources as well. Entire books are dedicated to plants that attract hummingbirds, butterflies and songbirds. Some of these resources are listed below.

Diversity. Vegetation patterns that include a variety of trees, shrubs and ground covers and a mix of plant species are more useful at providing habitat and wildlife cover than lawns with single trees.

Water. Water is essential to all life. If possible, incorporate pools or bird baths in the landscape. Provide water throughout the year and keep it clean.

Pest and Weed Control. Eliminate the use of harmful chemicals for pest and weed control. Indiscriminate use of pesticides can kill beneficial insects and reduce food sources for other species. Explore alternative methods of biological control if pests are a problem.

Domestic Pets. Keep domestic pets, especially cats, indoors. Cats kill songbirds and dogs can be disruptive to wildlife.

Resources for more information

"Backyard Wildlife Sanctuary." Washington Department of Fish and Wildlife http://www.wa.gov/wdfw/wlm/byw_prog.htm

"Backyard Wildlife Habitat Program." National Wildlife Federation <http://www.nwf.org/backyardwildlifehabitat/index.cfm>

Birdscaping Your Garden. George Adams, 1994.

The Butterfly Book. Donald and Lillian Stokes and Ernest Williams, 1991.

"Butterfly Gardening." <http://www.thebutterflysite.com/gardening.shtml>

The Hummingbird Garden. Matthew Tekulsky, 1990.

Kruckeberg, Arthur R. *Gardening with Native Plants of the Pacific Northwest.* University of Washington Press, 1982.

Landscaping for Wildlife in the Pacific Northwest. Russell Link, University of Washington Press, 1999.

"Landscaping to Avoid Wildlife Conflict." US Department of Agriculture. <http://www.aphis.usda.gov/oa/pubs/landscap.html>

"Portland Plant List." City of Portland, Bureau of Planning. http://www.planning.ci.portland.or.us/lib_plantlist.html

"Natural Gardening." Metro. <http://www.metro-region.org/rem/garden/natgar.html>

"Naturescaping for Clean Rivers." Bureau of Environmental Services. http://www.cleanrivers-pdx.org/get_involved/naturescaping.htm

"Native Plant Selection Guide." Bureau of Environmental Services. http://www.cleanrivers-pdx.org/get_involved/plant_selection_guide.htm

"Naturescaping: A Place for Wildlife." Oregon Department of Fish and Wildlife. <http://www.dfw.state.or.us/ODFWhtml/Education/Naturescaping.html>

"Naturescaping: A Wildlife Habitat in Your Own Backyard." Angela Deering, Royal British Columbia Museum. http://rbcm1.rbcm.gov.bc.ca/nh_papers/naturescaping/scaping-1.pdf

Your Backyard Wildlife Garden. Marcus Schneck, 1992.

"The Wildlife Gardening Web Site." Family of Nature, Inc. <http://wildlifegardening.com>

APPENDIX 11: The Planning Process for the UFMP

Work on the revised Urban Forestry Management Plan began in early 2002 with review of the 1995 UFMP to determine how to revise the plan. A series of individual meetings with current partners who manage and have responsibility for various aspects of the urban forest was held to gather initial information. A Technical Advisory Committee was formed. The members are listed on the inside cover of the document. The TAC received an initial information package that included:

- Reasons for updating the UFMP.
- Summary of current UF management by various bureaus and organizations.
- Issues and concerns raised during preliminary meetings with current partners.

Summary of UFMP TAC Meetings

Meeting 1 — May 17, 2002

Introductions

Reviewed 1995 Urban Forestry Management Plan — sections to be updated.

Discussed mutual goals and areas of common interest.

Identified and prioritized issues and concerns.

Meeting 2 — May 31, 2002

Determined goals of plan and primary responsibility of principal partners.

Meeting 3 — June 14, 2002

Discussed management, worked on definitions and management responsibilities for each Urban Land Environment.

Meeting 4 — June 28, 2002

Discussed Draft document.

Meeting 5 — August 9, 2002

Took final comments on Draft document.

Presentations

Urban Forestry Commission — May 16, 2002 and September 19, 2002

River Renaissance Natural Resource Team — August 30, 2002

Portland Park Board — October 1, 2002

Friends of Trees Staff — November 5, 2002

Friends of Trees Board — November 20, 2002

Public Review

Notice about the plan was sent to interested parties and it was available for review online at Portland Parks & Recreation's web site, or in hard copy, if requested. About a dozen comments and suggestions were received and responded to. Comments were for clarification of some points and suggestions for additional information. The document was revised as appropriate.

Approvals

The UFMP was adopted by the Urban Forestry Commission January 16, 2003.

BIBLIOGRAPHY

- Abbott, C. *Portland, Planning, Politics, and Growth in a Twentieth-Century City*. Lincoln and London: University of Nebraska Press, 1983.
- American Forests. "Regional Ecosystem Analysis for the Willamette/Lower Columbia Region of Northwestern Oregon and Southwestern Washington State: Calculating the Value of Nature." October 2001. http://www.americanforests.org/download.php?file=/real/AF_Portland.pdf 8/02.
- Belton, Sharon S. "Tree Budgets as Part of the City Infrastructure." *Growing Green Communities: Proceedings of the Sixth National Urban Forest Conference*. 1993.
- Bernhardt, Elizabeth A. and Tedmund J. Swiecki. "Guidelines for Developing and Evaluating Tree Ordinances." California Department of Forestry and Fire Protection, Urban Forestry Program, 1999. <http://www.wfei.calpoly.edu/data/abstracts/abstracts.html> 8/02.
- Bray, Jim N. "P.T.V: Park Tree Value." Portland Parks & Recreation, 1979.
- City of Portland Adopted Budget: Fiscal Years 1994-1996.
- City of Portland, Bureau of Environmental Services. "The Regulatory Link." http://www.cleanrivers-pdx.org/tech_resources/regulatory_link.htm 8/02.
- City of Portland, "City Code." <http://municipalcodes.lexisnexis.com/codes/portland/> 8/02.
- City of Portland, Bureau of Planning. "Portland Plant List." 1991. http://www.planning.ci.portland.or.us/lib_plantlist.html 8/02.
- City of Portland, Energy Office. "City of Portland Carbon Dioxide Reduction Strategy: Success and Setbacks." June 2000. <http://www.sustainableportland.org/co2update2000.pdf> 8/02.
- City of Portland, Office of Sustainability. "Sustainable City Principles: November 1994." 1994. <http://www.sustainableportland.org/sustainable%20City%20Principles.pdf> 8/02.
- City of Portland, Office of Transportation. *Portland Pedestrian Design Guide*. June 1998. <http://www.portlandtransportation.org/designreferences/Pedestrian/DesignGuide.PDF> 8/02.
- Cool Communities. "Urban Shade Trees." http://www.coolcommunities.org/urban_shade_trees.htm 8/02.
- Dwyer, John F., Herbert W. Schroeder and Paul H. Gobster. "The Deep Significance of Urban Trees and Forests." In *The Ecological City: Preserving and Restoring Urban Biodiversity*. Ed. Rutherford Platt, Rowan Rowntree and Pamela Muick. University of Massachusetts Press, 1994: pp. 137-150.
- Friends of Trees. "2001-2004 Three Year Strategic Plan." http://www.friendsoftrees.org/pdfimages/Exec_Summary.pdf 8/02.
- Grey, Gene W. and Frederick J. Deneke. *Urban Forestry 2nd Edition*. Malabar, FL: Krieger Publishing Company, 1992.
- Gutowski, Robert. "The Basics of Urban and Community Forestry." *The Public Garden*. January 1994.
- Harnik, Peter. *Inside City Parks*. Washington, DC: Urban Land Institute, 2000.
- Head, Constance P., Robinson Fisher and Maureen O'Brien. "Best Management Practices for Community Trees: A Technical Guide to Tree Conservation in Athens-Clarke County, Georgia." 2001. http://www.athensclarkecounty.com/documents/pdf/landscape_management/best_management_practices.pdf 8/02.
- Hull, Bruce R. and Roger S. Ulrich. "Health Benefits and Costs of Urban Trees." *Alliances for Community Trees, Proceedings of the Fifth Urban Tree Conference*. 1991: pp. 69-72.
- Kielbaso, J. James. *Street Tree Survey of US Cities and Towns*. American Forestry Association, 1989.
- Kielbaso, J. James and Vincent Cotrone. "The State of the Urban forest." *Make Our Cities Safe for Trees, Proceedings of the Fourth Urban Tree Conference*. 1989: pp. 11-18.

- McPherson, E. Gregory. Personal communication (email) 6/26/02 and 8/13/2002.
- McPherson, E. Gregory et al. *Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting*. Center for Urban Forest Research, U.S.D.A. Forest Service, Pacific Southwest Research Station, 2002.
- McPherson, E. Gregory, Paul Sacamano and Steve Wensman. *Modeling Benefits and Costs of Community Tree Plantings*. USDA Forest Service, Northeastern Forest Experiment Station. 1993.
- Metro. "2040 Growth Concept Report." December 1995. <http://www.metro-region.org/growth/tfplan/gcondoc.html> 8/02.
- Miller, Robert W. *Urban forestry: Planning and Managing Urban Greenspaces*. Englewood Cliffs, N.J.: Prentice Hall, 1988.
- Miller, Robert W. *Urban forestry: Planning and Managing Urban Greenspaces 2nd Edition*. Upper Saddle River, N.J.: Prentice Hall, 1997.
- Mock, Terry. "Building a Sustainable Urban Forest - Part III: Components of Greenfrastructure." Florida Urban Forestry Council. http://www.fufc.org/info_part3.html 8/02.
- Morales, D.J. "The Contribution of Trees to Residential Properties." *Journal of Arboriculture*. 1983, 6(11):305-308.
- Morales, D.J. et al. "Two Methods of Valuating Trees on Residential Sites." *Journal of Arboriculture*. 1983, 9(1):21-24.
- The National Arbor Day Foundation. "The Value of Trees to a Community." www.arborday.org/trees/aerialbenefits.html 8/02.
- Nelessen Associates, Inc. "Picture This...The Results of a Visual Preference Survey." Princeton, N.J. and Seattle, WA., 1993.
- Nowak, David. Personal communication (phone) 6/26/02.
- Oregon Department of Agriculture. "Oregon Noxious Weed Web." <http://oregonweeds.org/index.html> 8/02.
- Oregon Department of Land Conservation and Development. "Oregon's 19 Statewide Planning Goals and Guidelines." <http://www.lcd.state.or.us/goalpdfs/goals.pdf> 8/02.
- Poracsky, Joseph and Mark Scott. "Industrial-Area Street Trees in Portland, Oregon." *Journal of Arboriculture*. 1999, 25(1) : 9-17.
- Poracsky, Joseph. "Youth-Based Tree Inventory and GIS Analysis for Urban Ecosystem Education." April 1999. <http://web.pdx.edu/~poracskj/CaryPap-PSU%20Site.htm> 8/02.
- Portland Parks & Recreation. "Pest Management Program." 2001. <http://www.portlandparks.org/hort/pprpestmanprog.pdf> 8/02.
- Portland Parks & Recreation, Urban Forestry Program. "Street Tree Planting and Establishment Guidelines." 2002. <http://www.parks.ci.portland.or.us/services/treeplantingbrochure02.pdf> 8/02.
- Price, L. W. "Portland's Landscape Setting". *Portland's Changing Landscape*. L. W. Price Editor. Portland, OR: Department of Geography, Portland State University and the Association of American Geographers, 1987.
- Project for Public Spaces. "Traffic Calming." http://www.pps.org/topics/wtc_site/test 8/02.
- Reynolds, P. C. and E. D. Dimon. *Trees of Greater Portland*. Portland, OR: Timber Press, 1993.
- Reynolds, Phyllis. "Street Tree Care in Selected Cities." Report to Portland's Urban Forestry Commission, 2000.
- Sampson, R. Neil and Rowan Rowntree. "The Living City." *Alliances for Community Trees: Proceedings of the Fifth National Urban Forest Conference*. 1991.
- Stormwater Advisory Committee. "Status Report to Council." City of Portland. June 2002.

BIBLIOGRAPHY

- Tschantz, Barbara A. and Paul L. Sacamano. "Municipal Tree Management in the United States: A 1994 Report." Davey Resource Group and Communication Research Associates, Inc., 1994.
- University of Washington Climate Impacts Group. "Impacts of Climate Change, Pacific Northwest." 1999.
- U.S. Army Corps of Engineers. *Regional Urban Wildlife Habitat Report*. Portland, OR, 1979.
- U.S.D.A. Northeastern Area. *An Ecosystem Approach to Urban and Community Forestry: A Resource Guide 2nd Edition*. 1993.
- U.S.D.A. Soil Conservation Service. *Soil Survey of Multnomah County, Oregon*. 1983
- U.S. Environmental Protection Agency. "Portland Harbor Added to 'Superfund' List." December 2000. [http://yosemite.epa.gov/r10/cleanup.nsf/webpage/Superfund+\(CERCLA\)](http://yosemite.epa.gov/r10/cleanup.nsf/webpage/Superfund+(CERCLA)) 8/02.
- Willeke, Donald C. "A True and Full Accounting of the Urban forest." *Alliances for Community Trees, Proceedings of the Fifth Urban Tree Conference*. 1991; pp. 40-47.
- Wolf, Kathleen L. "Grow for the Gold: Trees in Business Districts." *TreeLink*. Spring 1999. <http://www.cfr.washington.edu/research.envmind/CityBiz/TreeLink.PDF> 8/02.