ARBOR VALUE PROJECT:
ASSESSING THE URBAN FOREST OF YAKIMA, WASHINGTON

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Introduction

The reasons to conduct plant appraisals are as numerous as the array of contributions made by plants to people, communities, and ecosystems. Urban trees function in architectural and ecological landscapes, benefiting both. Beneficial contributions are typically categorized as architectural, environmental, social, aesthetic, and ecological. A healthy urban forest can provide a total benefit package worth two to three times more than the cost of tree planting and maintenance (McPherson 1995). A portion of that benefit package is mitigation of stormwater impacts – flooding, non-point source pollution, and soil erosion. Nationally, urban stormwater runoff ranked second for estuaries, and third for both lakes and rivers as a leading source of water quality impairment (EPA 2000). Urban and community forestry programs are promoted by the state of Washington as a management opportunity for prevention of non-point source pollution (WDOE 2000). Trees affect stormwater runoff and flooding by intercepting and temporarily storing rainfall before it eventually drips to the ground or evaporates. Factors such as species composition, tree size, canopy density, and climate all influence rainfall interception rates in an urban forest. Studies conducted in Sacramento and Modesto, California quantified rainfall interception rates and calculated the value of improved water quality and flood attenuation. Modesto's tree canopy reduced stormwater runoff by 292 million cubic meters valued at $616,000 annually, averaging 3.2 m^3 and $6.76 per tree (McPherson et al. 1999). Results from flood simulations for Sacramento showed interception rates were greatest for small, short storms and lesser as storm precipitation increased (Xiao et al. 1998). Regionally, the economic and ecological implications of tree loss can be counted in billions of dollars (American Forests 2001). Vegetation loss across the Willamette/Lower Columbia region between 1972 and 2000 allowed an estimated 963 million cubic feet of stormwater flow, which increased the need for management by $2.4 billion.

Furthering the goal to "improve the care, management, vitality, diversity, and sustainability values of the urban forest in the city of Yakima and surrounding area" (chesney 1998a), the Arbor Value Project (AVP) calculates the economic value of a partial inventory of Yakima's urban forest. The dataset establishes a baseline from which urban foresters, monitors, managers, and decision-makers can examine ecological and economic changes in the green infrastructure of Yakima. These findings are intended to enable improvements in ecological monitoring, asset management, and civic education.

Methods

Local arborists charles chesney and Paul Adams conducted the Yakima Urban Forest Inventory (YUFI) in Spring 1998 producing a partial inventory of trees within the city of Yakima that catalogs tree location, species, size, condition, maintenance needs, and site information (chesney 1998b). The Arbor Value Project used the cost approach established by the Council of Tree and Landscape Appraisers' Guide for Plant Appraisal, 9th Edition (CTLA) to measure the value of each tree sampled.

The replacement cost method uses the local retail market value of a transplantable tree of similar size and species, adds any installation costs, and then adjusts this price downward in consideration of the quality of species, condition, and location (CTLA 2000).

Appraised Value = Installed Plant Cost x Species % x Condition % x Location %

The trunk formula method is used for trees larger than transplantable nursery stock. For AVP, this method applies to any tree with a diameter at breast height (dbh) greater than 4 inches. The trunk formula method follows the previous method, but adds any increase in value attributed to trunk area growth (CTLA 2000).

Appraised Value = Basic Tree Cost x Species % x Condition % x Location %

Basic Tree Cost = Trunk Area Increase x Unit Tree Cost + Installed Tree Cost

Costs associated with treating tree defects and repairing property damage were factored into the value of each tree. Typical treatments include pruning, tree removal, and replacement of damaged sidewalks and curbs. Treatment and repair costs were based on information provided by local arborists and the City of Yakima Public Works Department.

Results

The 2796 trees sampled in the Yakima Urban Forest Inventory are valued at $3,624,240. The sample includes trees of public and private ownership and represents 2% of the forest population estimate (139,916). Over 97% of inventoried trees, accounting for 95% of the total value, are privately owned. Individual trees ranged from a liability value of –$450 to an asset value of $57,200. Individuals of remarkable value were a single Chinese chestnut ($57,200), three Northern red oaks ($134,000 total), an English oak ($42,000), and a Mountain hemlock ($32,600). The Yakima urban forest inventory has 122 plant species representing 51 genera and 26 families. Tree species of greatest cumulative appraised value were silver maple (66 trees, $471,860), blue spruce (163 trees, $313,660), and paper birch (44 trees, $276, 410). While the ranking of blue spruce benefited from its relative abundance, other species did not show the same correlation. Chinese elm, Pacific willow, and Tree-of-Heaven were highly represented species of relatively moderate to low value. The Maple, Pine, and Birch families contributed over one-half million dollars each to the urban forest community, collectively accounting for 54% of the inventory's total value. Beech and Sycamore ranked as highly valuable plant families despite a relatively low abundance, primarily due to size, as most individuals were greater than 12 inches dbh. The YUFI sample indicates that this urban forest is relatively immature (Tables 1 and 2). Over three-quarters of the trees are smaller than 8 inches dbh trunk diameter and most are less than 15 feet tall. The bulk of the forest's value, as estimated by CTLA valuation methods, resides in the larger trees. Trees greater than 12 inches dbh trunk diameter represent two-thirds of the monetary value, yet only 11% of total abundance.

Conclusions

The relative immaturity of trees within the inventory suggests that monetary value and ecosystem benefits would increase with an effort to apply proper plant health care practices and preserve mature trees in the community forest. Two circumstances could potentially disrupt the straight path to ecological sustainability and economic efficiency. (1) The city has not adopted a consolidated tree ordinance to regulate forestry practices. (2) Most of Yakima's forest is privately owned.

In addition to mitigation of stormwater impacts, urban forests serve the ecosystem through air pollution abatement, carbon storage and sequestration, wind control, noise reduction, and temperature moderation. The CTLA Guide for Plant Appraisal recognizes and details these and other functional uses of plants but does not directly express the benefits in their valuation formulas. The methodology does not offer perfect clarity of ecosystem benefits derived from Yakima's urban forest, but the results give the community an analytical tool to highlight points of comparison between communities, from year to year, among tree species, and among land use classifications. Urban forest valuations can mark the advancement or decline of an urban ecosystem over time and influence planning and management decisions.

Table 1. Benefit distribution by tree size (dbh).

Trunk Diameter	Value (US$)	Number of Trees
< 4 inches	$48,100	1581
4 - 8 inches	$356,620	540
8 – 12 inches	$791,900	380
12 - 24 inches	$1,287,780	191
> 24 inches	$1,139,840	104

Table 2. Benefit distribution by tree height.

Tree Height	Value (US$)	Number of Trees
<15 ft	$283,200	1679
16-30 ft	$1,079,200	665
31-45 ft	$1,342,040	337
46-60 ft	$663,430	92
60-100 ft	$256,370	23

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