

Urban Forestry: Benefits and drawbacks of city trees

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Street and park trees often seem to be a “necessary evil.” Fallen leaves that clog gutters, roots that heave sidewalks, branches that litter streets after storms, and roosting birds that drop surprises give urban foresters plenty of headaches. Tree-happy residents, who refuse to allow hazardous trees to be removed, can turn a simple management decision into a bureaucratic nightmare. Managing conflicts between trees and the surrounding infrastructure—and trees and people—leaves little time to think about how benefits from trees can be optimized. Although no one pays trees to clean the air we breathe, a surprisingly large number of city dwellers recognize and appreciate benefits such as this. Managing the municipal urban forest to increase these benefits while controlling costs can enhance investment value and customer satisfaction with your program.

A recent nationwide survey by scientists at Washington State University found that urban residents overwhelmingly desire trees in cities; 83% strongly agreed that trees are important to their quality

of life. They attached greatest importance to shading and cooling downtown areas, making people feel calmer, and reducing smog, dust, and noise. Most respondents disagreed or strongly disagreed with statements about the problems that trees pose in cities. The highest ranked problems were causing allergies, blocking store signs, and damaging sidewalks and power lines. The least important problem with trees was that they cost the city too much. According to these findings, residents in large metropolitan areas across the U.S. believe that the problems trees pose are inconsequential and insufficient to justify not planting trees.

Our research is quantifying benefits and costs of street and park trees, and in some cases translating ecological services trees provide into financial terms. Although results are specific to each of the cities we studied, trends have been identified:

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- Mature shade trees provide annual benefits that range between \$40-80 per tree, while management costs are \$15-30 per tree.
- Benefits increase with tree size because larger trees support more leaf surface area than smaller trees.
- In general, larger trees are more expensive to maintain than smaller trees, but increased benefits more than offset the difference.
- Benefit-cost ratios range from 1.5 to 1.9 for all street and park trees, indicating that \$1.50 to \$1.90 is returned in benefits for every \$1 spent on managing an urban forestry program.
- Tree species selection matters. For example, benefit-cost ratios for a single species can range from 24.1 (\$24 benefit for every \$1 cost) for plane tree (*Platanus acerifolia*) to 2.4 for sweetgum (*Liquidambar styraciflua*).
- Pruning is usually the single greatest cost, followed by expenditures for tree planting, removal, administration, and hardscape repair.
- Irrigation costs vary regionally, but average nearly \$1 per tree annually in regions where trees receive hand-watering during periods of establishment and aridity.
- California cities spend about \$70 million annually due to conflicts between street tree root growth and hardscape. This amount, \$11 per tree on average, is 60% of the total spent by California cities for their planting and management programs.
- In a hot, arid climate, increasing street tree shade by 20% increases the pavement condition index 11%. Once large-stature shade trees have matured, their shade can extend the resurfacing cycle from 6 to 13 years, reducing preventive maintenance costs by 50%.
- Benefits from reduced stormwater runoff vary by region. In regions with winter rainfall, planting large-stature evergreens increases rainfall interception to as much as 4,000 gallons per tree annually.
- Air pollutant uptake benefits are greatest in regions where pollution concentrations are highest and tree canopy cover is most extensive. In such areas, net annual uptake for a large tree may be 3-5 lbs (\$25-35 implied value based on California emissions trading prices). One can see this by rubbing their hands over the foliage and noting the soot on their hands. If the tree wasn't there the soot would be in people's lungs, on their cars, clothes, homes, and other surfaces.
- Trees reduce atmospheric carbon dioxide annually by 100-200 lbs per tree depending on species, age, and location. This benefit is valued at \$1-2 per tree.
- Heating and cooling savings from street trees are highly dependent on local climate, building and HVAC characteristics, energy prices, as well as tree location, size, and species. Net savings tend to be greatest in the hottest regions, where shade is least detrimental during the winter heating season. Annual net savings from a large public tree can be \$10. Cooling benefits are greater from trees on north-south running streets that shade east- and west-facing walls, than from trees on east-west streets.

- A large street tree can increase home sales price by almost 1%, or \$1,500 for a \$150,000 property. Assuming this one-time benefit of \$1,500 is annualized over a 40-year tree life, the average annual benefit is \$30. The actual amount is greatest in areas where average residential property sales prices are highest.



Strategies to promote planting of large-stature trees for greater benefits while controlling sidewalk repair costs include "borrowing" sidewalk space with tree grates and eventually moving sidewalk over to easement on private property.

Making trees a visible part of your city's infrastructure is one of today's public works challenges. Municipal forestry programs that provide the benefits residents want from their trees while not straining city budgets usually have three things in common:

- 1) Well-integrated and effectively enforced policies, ordinances, specifications, and plans. These documents provide the foundation for protecting the existing resource and ensuring its perpetuation through appropriate planting and management.
- 2) A qualified urban forester on staff to manage the urban forest and efficiently allocate city resources to meet those needs. A sample or complete tree inventory is critical to needs assessment and prioritization. A management plan helps target limited resources to areas of greatest need.
- 3) A comprehensive public education program that creates public awareness, support, and participation. Successful tree programs partner with local nonprofits, schools, and other organizations on activities such as Arbor Day plantings, Great Tree Searches, and small tree care programs.

Trees have their drawbacks. Implementing strategies to reduce these drawbacks and control costs is one aspect of effective management. Less commonly practiced but equally important is managing trees to maximize their benefits. Examples of this include enlarging planting spaces in sidewalks to contain larger-stature trees, retaining more leaf area during pruning, selecting species that match the site's functional needs, and aggressively enforcing parking lot tree shade ordinances. By adding benefits into the municipal forestry equation, managers can deliver a higher level of service at less cost.

Gregory McPherson will present an educational session at the APWA Congress in San Diego entitled, "Urban Forestry: Benefits and Drawbacks of City Trees." The session begins at 2:00 p.m. on Sunday, August 24. He can be reached at (530) 752-5897 or at egmcperson@ucdavis.edu. 