

Urban Trees

Dan Brown, Director

School of Environmental and Forest Sciences

College of the Environment

University of Washington



UW – City of Seattle Partnerships

- Washington Park Arboretum
 - Professionally managed by UWBG in partnership with Seattle Parks and Recreation, with support from the Arboretum Foundation
 - 230 acres with a curated collection of ~46,000 plants (majority trees)
- UWBG contracts with the Trees for Seattle program to help distribute 1,000 trees to Seattle residents every year
- Nature and Health Program – EarthLab
 - Includes representation from UW, SPR, SPU, OPCD, OSE, and many other orgs.
- Green Cities Research Alliance – 2012 Report



University of Washington BOTANIC GARDENS



Key Points

- Trees have demonstrated environmental and human benefits.
- They carry some associated costs and negative impacts.
- Urban canopy is distributed unevenly, and can result in disparate social impacts.
- Planning and managing urban tree cover in social and ecological context can help maximize benefits and minimize disparities and negative outcomes.

Environmental Benefits of Urban Trees

- Carbon sequestration and storage
 - Sequestration estimated at 2% of Seattle emissions (2011)
- Air quality
 - removing pollutants like O₃, CO, SO₂, NO_x, PM₁₀
- Storm water quality and regulation
 - green infrastructure
- Shading and moderation of temperature extremes
- Noise reduction
- Enhancing habitat and biodiversity

Human Benefits of Urban Trees

- Social
 - Enhanced leisure, recreation, quality of life
- Economic
 - Increased property values
 - Reduced expenditures on storm water, air pollution removal, heating and cooling
- Health
 - Reduced stress, respiratory illness
- Visual and Aesthetic
 - Improved scenic quality and privacy

Cognitive and Mental Health Benefits

- Exposure to nature can increase attention, memory, and impulse inhibition, and decrease stress.
- What aspects of natural features and our experience with them are relevant to mental health? – many studies focus on nature generally.
- Tree and shrub cover significantly related to school test scores, after controlling for common educational determinants in urban elementary schools in California (Tallis et al. 2018).

Negative Impacts and Costs

- Health
 - pollen, insects and animals
- Visual and Aesthetic
 - lighting-related safety concerns, dropping branches and leaves, view obstruction
- Environmental problems/hazards
 - generating VOCs (terpenes, isoprenes), sidewalk cracks
- Costs
 - planting and establishment
 - irrigation, maintenance, management, infrastructure repairs

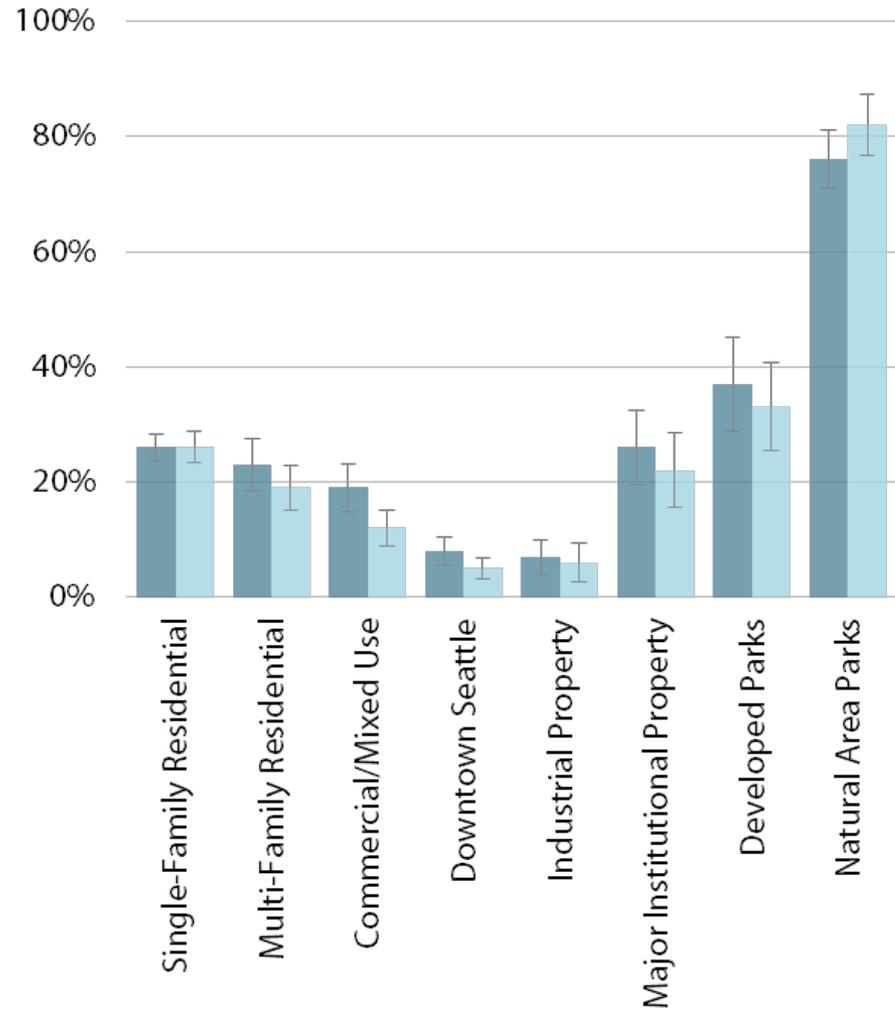
Social Disparities in Tree Cover

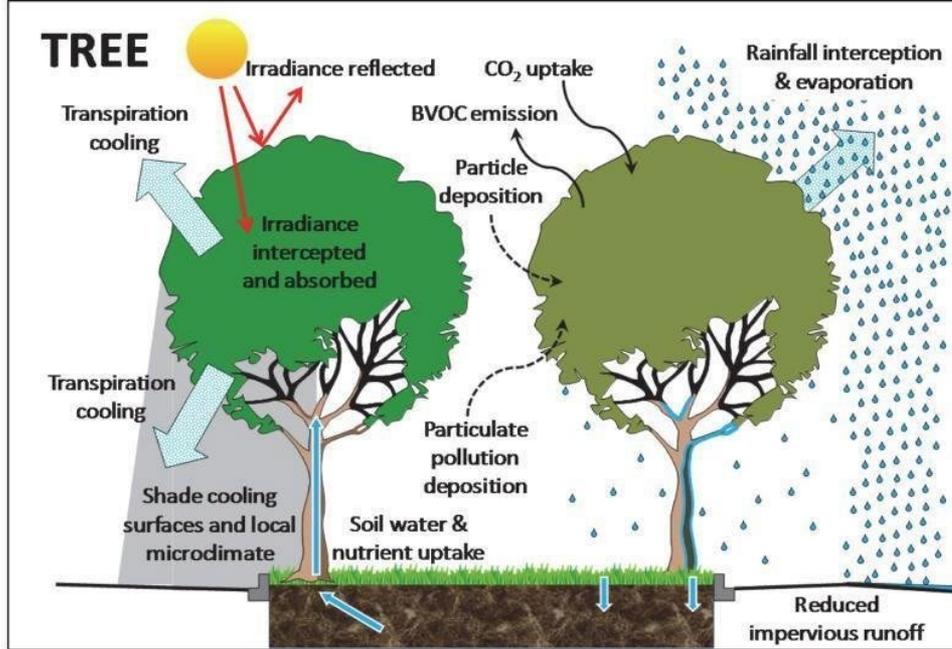
- “Trees grow on money” – strong positive correlations between household income and urban tree cover in neighborhoods.
 - Consistent pattern observed in many cities (Schwarz et al. 2015 studied seven).
 - Race is also a factor in some cities, with less tree cover in neighborhoods with more people of color
- Urban greening can have the paradoxical effect of promoting gentrification (Wolch et al. 2014).

Canopy Cover in Seattle

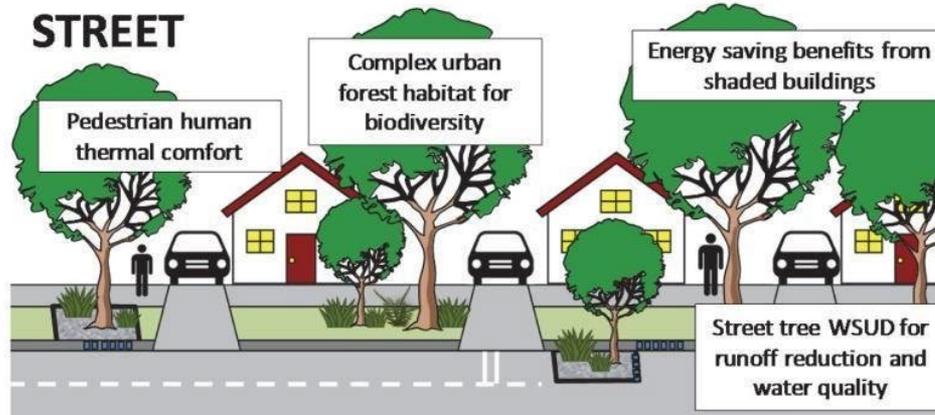
by Management Unit

- Shows differences by development density.
- Based on two different estimation approaches.
- From Cieko et al. 2012

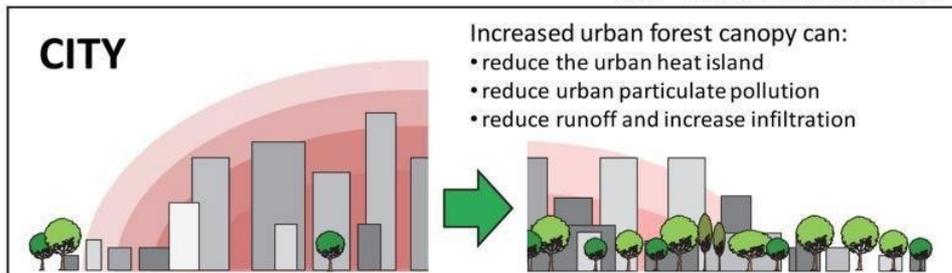




BVOC = Biological volatile organic compounds



WSUD = Water Sensitive Urban Design



Context Affects Outcomes

- Tree and forest structure and physiology
 - tree size, tree density, leaf area, leaf biomass, evergreen vs. deciduous
- Character of the built environment
 - lot sizes, street configurations, structural density, land use
- Environmental conditions
 - visibility, temperature, precipitation, soils, topographic position, etc.
- Planning for and management of urban trees that recognizes these contexts can maximize benefits

Key Points

- Trees have demonstrated environmental and human benefits.
- They carry some associated costs and negative impacts.
- Urban canopy is distributed unevenly, and can result in disparate social impacts.
- Planning and managing urban tree cover in social and ecological context can help maximize benefits and minimize disparities and negative outcomes.

Resources

- Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., De Vries, S., Flanders, J., ... & Kahn, P. H. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, 5(7), eaax0903.
- Ciecko, L., Tenneson, K., Dilley, J., & Wolf, K. (2012). Seattle's forest ecosystem values analysis of the structure, function, and economic benefits. *Green Cities Research Alliance*, 32.
- Livesley, S. J., McPherson, E. G., & Calfapietra, C. (2016). The urban forest and ecosystem services: impacts on urban water, heat, and pollution cycles at the tree, street, and city scale. *Journal of environmental quality*, 45(1), 119-124.
- Nowak, D. J., Randler, P. B., Greenfield, E. J., Comas, S. J., Carr, M. A., & Alig, R. J. (2010). Sustaining America's urban trees and forests: A Forests on the Edge report. *Gen. Tech. Rep. NRS-62. Newtown Square, PA: US Department of Agriculture, Forest Service, Northern Research Station. 27 p., 62.*
- Roy, S., Byrne, J., & Pickering, C. (2012). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. *Urban Forestry & Urban Greening*, 11(4), 351-363.
- Schwarz, K., Fragkias, M., Boone, C. G., Zhou, W., McHale, M., Grove, J. M., ... & Ogden, L. (2015). Trees grow on money: Urban tree canopy cover and environmental justice. *PloS one*, 10(4), e0122051.
- Tallis, H., Bratman, G. N., Samhour, J. F., & Fargione, J. (2018). Are California Elementary School Test Scores More Strongly Associated With Urban Trees Than Poverty?. *Frontiers in Psychology*, 9, 2074.
- Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and urban planning*, 125, 234-244.
- Benefits of nature in cities – Dr. Kathleen Wolf, SEFS, UW
 - greenhealth.washington.edu
 - naturewithin.info