

Street Tree Assessment Report

Arlington, Virginia

Overview

Street trees are a vital community asset that enhance our day-to-day lives and mitigate many of the negative impacts of urbanization. In 2003, a complete street tree inventory was conducted in Arlington, Virginia to assess tree abundance, composition, functional benefits, and monetary value. Trees residing within the right-of-way along public streets were surveyed to determine their species, size, condition, and placement. Inventory data were provided by Arlington for this assessment report. The inventory data were analyzed using i-Tree Streets assessment software developed by the U.S. Forest Service.

Key Findings

- Arlington has an estimated 20,355 street trees.
- Arlington's five most abundant street tree species are willow oak, red maple, Japanese zelkova, pin oak, and Callery pear.
- Each year, Arlington's street trees intercept over 28 million gallons of rainfall and sequester over 4 million pounds of carbon dioxide.
- In total, Arlington's street trees provide over \$2 million in benefits annually or roughly \$105 per tree.
- The replacement value of Arlington's street trees is estimated at nearly \$36 million.

*Prepared by Virginia Tech
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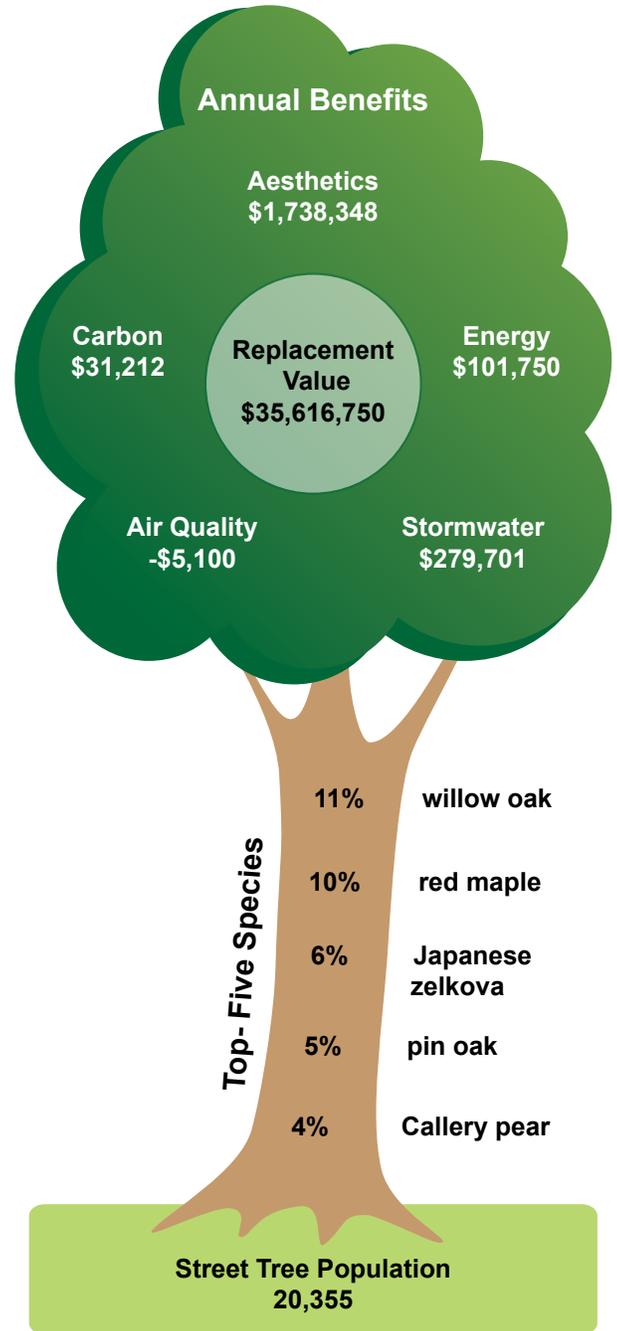
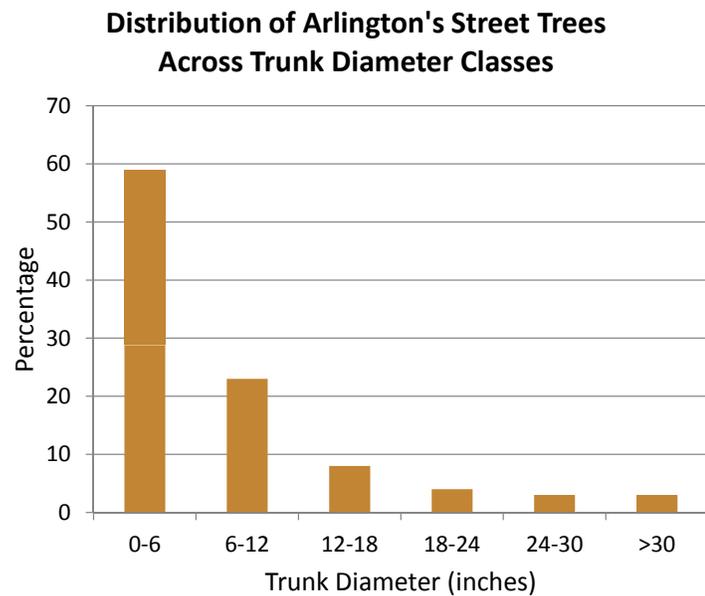
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Street Tree Abundance and Composition

Arlington’s estimated street tree population is 20,355. Arlington’s street trees provide about 176 acres of canopy, which cover roughly 1.1% of the land area. The five most abundant species are willow oak (11%), red maple (10%), Japanese zelkova (6%), pin oak (5%), and Callery pear (4%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include willow oak (13%), red maple (13%), pin oak (9%), silver maple (5%), and white oak (5%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Arlington’s street trees. Over 80% of Arlington’s street trees are smaller than 12 in. trunk diameter while less than 3% are larger than 30 in. The majority of Arlington’s street trees (~84%) were rated in fair to good condition.



Relative abundance of Arlington's street trees by foliage type and mature height class.

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	4,751	4,015	9,327	18,093	89
Broadleaf Evergreen	507	65	0	572	3
Conifer Evergreen	2	991	697	1,690	8
Total	5,260	5,071	10,024	20,355	100
% of Total	26	25	49	100	

Street Tree Benefits and Value

Gross annual benefits provided by Arlington's street trees are valued at \$2,145,911. These benefits come from contributions that street trees make to real estate aesthetics, rainfall interception, energy conservation, air pollution reduction, and CO₂ sequestration. Each year, Arlington's street trees intercept roughly 28 million gallons of rainfall, conserve a combined 877 megawatt-hour of electricity and 33 thousand therms of natural gas for home cooling and heating, and remove about 4.1 million pounds of carbon from the atmosphere. In addition, Arlington's street trees currently store nearly 42 million pounds of carbon, which is valued at over \$312 thousand. Although Arlington's street trees have a net positive impact on air pollution – removing over 3,100 pounds of pollutants annually – its current mix of tree species heavily emits biogenic volatile organic compounds (BVOCs), which results in a negative monetary value for pollution reduction.

On a per-tree basis, the most beneficial tree species are white oak (\$443 per year), silver maple (\$272 per year), pin oak (\$193 per year), sweetgum (\$182 per year), and red maple (\$157 per year). These values reflect the large size that these trees have attained, providing abundant leaf area and canopy cover. The average street tree provides about \$105 in gross benefits annually. Gross benefits do not account for annual costs associated with planting, maintenance, or removal, which were not available for this analysis.

The replacement value of Arlington's street trees is estimated at \$35,616,750. This is the value of street trees as a structural asset, and reflects the cost to replant trees in a quantity sufficient to replace their current level of functional benefits. Because a large street tree produces the same amount of benefits as numerous nursery-sized trees, replacing a large tree would require significant resources that may not be feasible due to both spatial and budgetary constraints.

Gross annual benefits provided by Arlington's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	1,738,348	85.4
Rainfall Interception (gallons)	28,250,709	279,701	13.74
Energy Conservation ¹	–	101,750	5
Electricity (MWh)	877	66,523	–
Natural Gas (therms)	33,678	35,227	–
Air Pollution reduction (lb) ²	3,111	-5,100	-0.25
CO ₂ sequestration (lb) ³	4,161,614	31,212	1.53
Total Benefits	–	2,145,911	105.42

¹Sum of electricity and natural gas conservation.

²Net pollution reduction (O₃, NO₂, PM₁₀, and SO₂) accounting for pollutant deposition, pollutant avoidance, and BVOC emissions. Note, if Resource Units value is negative, BVOC emissions exceeded pollution reduction. If only total \$ is negative, then BVOC pricing exceeded pollutant pricing, but pollution reduction still occurred.

³Net sequestration accounting for gross tree sequestration, tree decomposition emissions, and tree maintenance machinery emissions.

Street Tree Opportunities

Arlington has a highly valuable street tree population. To sustain this resource and its benefits, the city should continue to focus on planting diverse, functional species and maintaining trees to ensure their health, safety, and appearance. Urban forestry experts generally recommend that a municipal tree population comprise no more than 10% of a single species and 20% of a single genus in order to minimize impacts of pest outbreaks and other species-specific disorders. At 11% of the total street tree population, willow oak is just above this threshold. Collectively, the oak genus comprises approximately 30% of the street tree population. The maple genus is also very close to the 20% threshold. Planting efforts should temper the use of oak and maple species to ensure the diversity and health of Arlington's street trees.

One of the most noxious pests threatening Virginia's street trees is emerald ash borer, an insect introduced from Asia that has killed millions of native ash trees in the United States. Fortunately, native ash species comprise just 1.35% of Arlington's street trees and account for only 0.84% of the street tree canopy cover. However, Arlington must remain vigilant in managing street tree diversity because there is ongoing risk of unforeseen introduction of noxious tree pests into the United States.

About 75% of Arlington's street tree population comprises medium- and large-stature species such as maple and oak. This is a favorable distribution given that larger trees provide higher levels of benefits, yet presence of overhead utility lines may require planting of small-stature tree species in certain places to minimize power disruptions and pruning costs.

The size distribution of Arlington's street trees suggests a stable age structure. Because street trees inevitably

grow old and die or must be removed to accommodate land use changes, an ample number of young trees must always exist in order to sustain street tree benefits. The fact that the two diameter classes that encompass the largest percentage of the total street tree population are the 0-6 and 6-12 inch diameter classes, respectively, is a source of optimism. However, ongoing planting efforts, with particular focus on large stature, highly functional tree species, should be taken to ensure a high level of benefits will be provided by Arlington's street trees for the future.

Arlington's street trees comprise a number of species that produce large amounts of BVOCs, which are precursors to ground-based ozone. Heavy emitters of BVOCs in Arlington include sweetgum, willow oak, and pin oak. Arlington should consider planting more low-BVOC street trees such as ginkgo, linden, and certain maples if maximizing air quality benefits is a key community objective. However, this planting strategy should not compromise efforts to maximize canopy cover or species diversity. Urban forestry experts generally believe that trees have a net positive impact on air quality, regardless of BVOC emissions, by lowering air temperature and reducing fossil fuel combustion in urban areas.

This assessment has reported gross benefits of Arlington's street trees, which may not fully reflect the true value of this vital resource. Direct and indirect costs of administering and managing street trees can vary considerably based on species composition, tree size distribution, and other local environmental and economic factors. Therefore, findings of this report should be carefully interpreted in the context of local circumstances that impact tree benefits and costs.

About This Report

This report was co-authored by Eric Wiseman and Julia Bartens with the [Department of Forest Resources and Environmental Conservation](#) at Virginia Tech. Report layout and design by Sarah Gugercin.

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Inventory data were analyzed using i-Tree Streets assessment software version 4.0.4. Benefit estimates were based on i-Tree modeling data from the Charlotte, North Carolina reference city in the South Climate Zone. The 2010 median home price, used to calculate street tree aesthetic benefits for Arlington was \$571,700 as reported by the U.S. Census Bureau in <http://quickfacts.census.gov/qfd/index.html>. Additional information about methods used in this street tree assessment can be found [on our website](#).

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