

# Street Tree Assessment Report

## *Alexandria, 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 2004, a complete street tree inventory was conducted in Alexandria, 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 Alexandria for this assessment report. The inventory data were analyzed using i-Tree Streets assessment software developed by the U.S. Forest Service.

### Key Findings

- Alexandria has an estimated 7,565 street trees.
- Alexandria's five most abundant street tree species are red maple, Callery pear, Chinese elm, northern red oak, and Kwanzan cherry.
- Each year, Alexandria's street trees intercept about 15 million gallons of rainfall and sequester over 2.4 million pounds of carbon dioxide.
- In total, Alexandria's street trees provide roughly \$1 million in benefits annually or about \$138 per tree.
- The replacement value of Alexandria's street trees is estimated at about \$22 million.

*Prepared by Virginia Tech  
Department of Forest Resources and  
Environmental Conservation*

<http://urbanforestry.frec.vt.edu/>

[arborist@vt.edu](mailto:arborist@vt.edu)

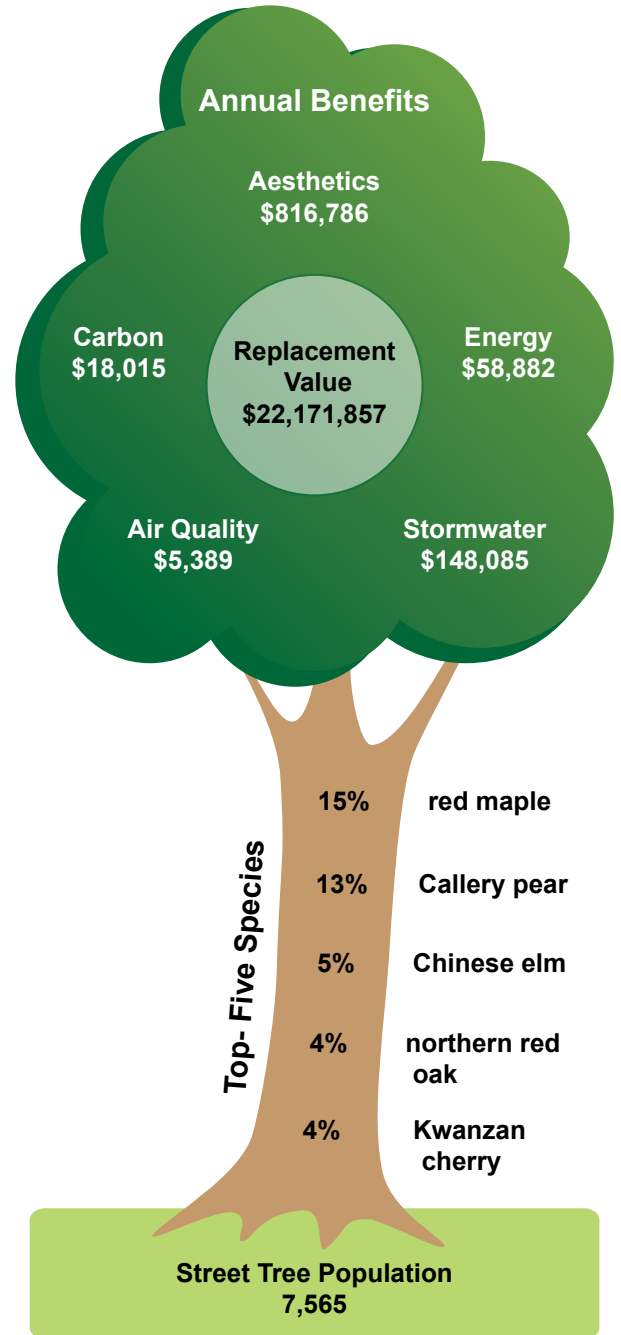
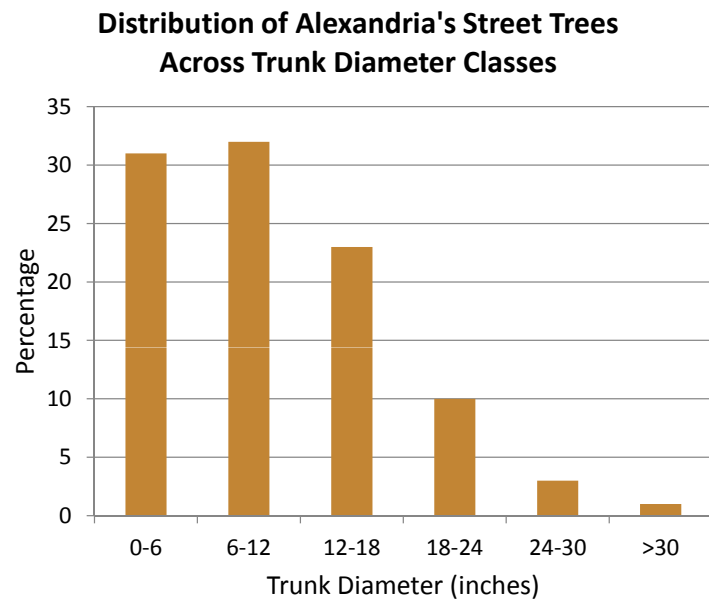
 **VirginiaTech**  
*Invent the Future®*



## Street Tree Abundance and Composition

Alexandria’s estimated street tree population is 7,565. Alexandria’s street trees provide about 100 acres of canopy, which cover roughly 1% of the land area. The five most abundant species are red maple (15%), Callery pear (13%), Chinese elm (5%), northern red oak (4%), and Kwanzan cherry (4%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include red maple (16%), Callery pear (12%), silver maple (7%), pin oak (6%), and northern red oak (6%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Alexandria’s street trees. About 62% of Alexandria’s street trees are smaller than 12 in. trunk diameter while less than 2% are larger than 30 in. The majority of Alexandria’s street trees (~81%) were rated in fair to good condition.



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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	2,251	2,511	2,646	7,408	98
Broadleaf Evergreen	0	2	0	2	0
Conifer Evergreen	0	6	149	155	2
<b>Total</b>	<b>2,251</b>	<b>2,519</b>	<b>2,795</b>	<b>7,565</b>	<b>100</b>
<b>% of Total</b>	<b>30</b>	<b>33</b>	<b>37</b>	<b>100</b>	

## Street Tree Benefits and Value

Gross annual benefits provided by Alexandria's street trees are valued at \$1,047,157. These benefits come from contributions that street trees make to real estate aesthetics, rainfall interception, energy conservation, air pollution reduction, and CO<sub>2</sub> sequestration. Each year, Alexandria's street trees intercept roughly 15 million gallons of rainfall, conserve a combined 507 megawatt-hour of electricity and 19 thousand therms of natural gas for home cooling and heating, absorb 3,110 pounds of air pollution, and remove about 2.4 million pounds of carbon from the atmosphere. In addition, Alexandria's street trees currently store about 21 million pounds of carbon, which is valued at over \$160 thousand.

On a per-tree basis, the most beneficial tree species are silver maple (\$297 per year), pin oak (\$289 per year), scarlet oak (\$211 per year),

northern red oak (\$208 per year), and black oak (\$199 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 \$138 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 Alexandria's street trees is estimated at \$22,171,857. 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 Alexandria's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	816,786	107.97
Rainfall Interception (gallons)	14,957,066	148,085	19.58
Energy Conservation <sup>1</sup>	–	58,882	7.78
Electricity (MWh)	507	38,462	–
Natural Gas (therms)	19,522	20,420	–
Air Pollution reduction (lb) <sup>2</sup>	3,110	5,389	0.71
CO <sub>2</sub> sequestration (lb) <sup>3</sup>	2,402,057	18,015	2.38
<b>Total Benefits</b>	<b>–</b>	<b>1,047,157</b>	<b>138.42</b>

<sup>1</sup>Sum of electricity and natural gas conservation.

<sup>2</sup>Net pollution reduction (O<sub>3</sub>, NO<sub>2</sub>, PM<sub>10</sub>, and SO<sub>2</sub>) 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.

<sup>3</sup>Net sequestration accounting for gross tree sequestration, tree decomposition emissions, and tree maintenance machinery emissions.

## Street Tree Opportunities

Alexandria 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 15% of the total street tree population, red maple exceeds this threshold. Callery pear is also excessive at 13%. Collectively, the maple genus comprises about 24% of the street tree population. Although maples are proven performers, planting efforts should temper their use to ensure the diversity and health of Alexandria'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 2.2% of Alexandria's street trees and account for only 1.8% of the street tree canopy cover. However, Alexandria must remain vigilant in managing street tree diversity because there is ongoing risk of unforeseen introduction of noxious tree pests into the United States.

Alexandria's street tree population is evenly composed of small-, medium-, and large-stature species. Where space constraints are not a limiting factor, large-stature species are preferable to smaller-maturing trees because larger trees provide higher levels of benefits. For example, the average oak in Alexandria provides nearly 3 times as much

annual benefit as a Callery pear. However, overhead utility lines and narrow street setbacks may require planting of small-stature tree species in certain places to minimize power disruptions and pruning costs.

The size distribution of Alexandria'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, there are relatively few trees greater than 18 inch diameter, which may indicate that street trees are failing to reach maturity or large-stature species have not been adequately planted in the past. 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 Alexandria's street trees for the future.

This assessment has reported gross benefits of Alexandria'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 Julia Bartens, Mason Patterson, and Eric Wiseman with the [Department of Forest Resources and Environmental Conservation](#) at Virginia Tech. Report layout and design by Sarah Gugercin.

This report was made possible through grants from the Virginia Department of Forestry and the U.S. Forest Service. Technical assistance was graciously provided by the Davey Resource Group.

Inventory data were analyzed using i-Tree Streets assessment software version 4.0.0. Benefit estimates were based on i-Tree modeling data from the Charlotte, North Carolina reference city in the South Climate Zone. The 2009 median home price, used to calculate street tree aesthetic benefits for Alexandria was \$458,100 as reported by [www.city-data.com](http://www.city-data.com). Additional information about methods used in this street tree assessment can be found [on our website](#).

Date of Publication: July 2012