

Street Tree Assessment Report

Leesburg, 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 Leesburg, 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 Leesburg for this assessment report. The inventory data were analyzed using i-Tree Streets assessment software developed by the U.S. Forest Service.

Key Findings

- Leesburg has an estimated 3,088 street trees.
- Leesburg's five most abundant street tree species are Kousa dogwood, red maple, Norway spruce, Austrian pine, and Callery pear.
- Each year, Leesburg's street trees intercept over 3 million gallons of rainfall and sequester over 525 thousand pounds of carbon dioxide.
- In total, Leesburg's street trees provide about \$217 thousand in benefits annually or roughly \$70 per tree.
- The replacement value of Leesburg's street trees is estimated at about \$5.3 million.

*Prepared by Virginia Tech
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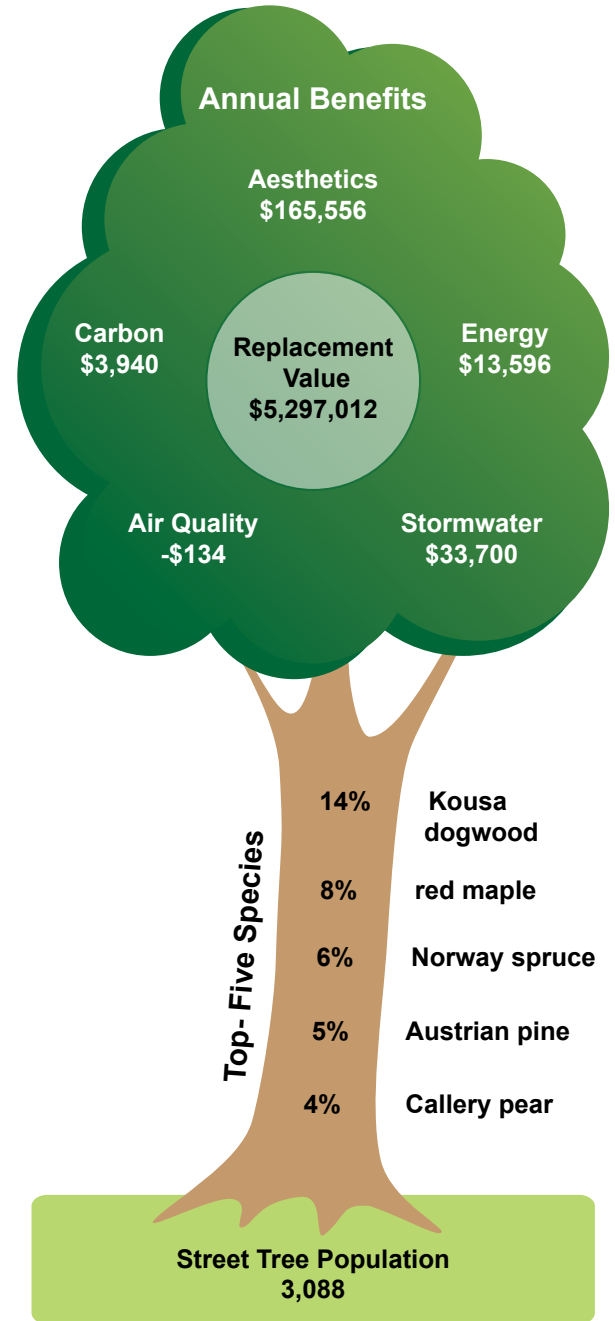
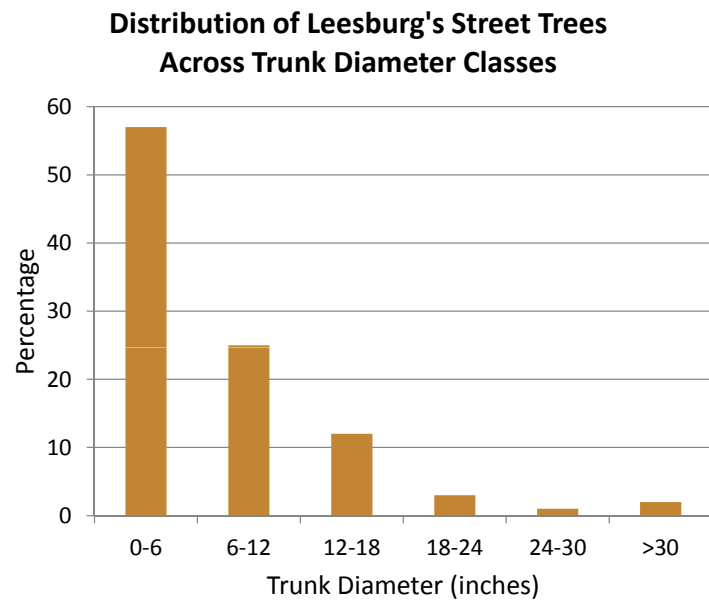
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Street Tree Abundance and Composition

Leesburg’s estimated street tree population is 3,088. Leesburg’s street trees provide about 23 acres of canopy, which cover roughly 0.3% of the land area. The five most abundant species are Kousa dogwood (14%), red maple (8%), Norway spruce (6%), Austrian pine (5%), and Callery pear (4%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include red mulberry (8%), red maple (6%), Kousa dogwood (6%), pin oak (5%), and Callery pear (5%).

Small-stature, broadleaf deciduous trees are the most common tree form amongst Leesburg’s street trees, but are nearly equaled by large-stature, broadleaf deciduous trees. About 82% of Leesburg’s street trees are smaller than 12 in. trunk diameter while less than 3% are larger than 30 in. The majority of Leesburg’s street trees (~86%) were rated in fair to good condition.



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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	967	494	879	2,340	76
Broadleaf Evergreen	72	3	0	75	2
Conifer Evergreen	0	255	418	673	22
Total	1,039	752	1,297	3,088	100
% of Total	34	24	42	100	

Street Tree Benefits and Value

Gross annual benefits provided by Leesburg’s street trees are valued at \$216,658. 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, Leesburg’s street trees intercept roughly 3.4 million gallons of rainfall, conserve a combined 116 megawatt-hour of electricity and 4,588 therms of natural gas for home cooling and heating, and remove about 525 thousand pounds of carbon from the atmosphere. In addition, Leesburg’s street trees currently store nearly 5.2 million pounds of carbon, which is valued at over \$38 thousand. Although Leesburg’s street trees have a net positive impact on air pollution – removing over 509 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 red mulberry (\$269 per year), tree-of-heaven (\$173 per year), green ash (\$157 per year), pin oak

(\$143 per year), and London planetree (\$139 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 \$70 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 Leesburg’s street trees is estimated at \$5,297,012. 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 Leesburg's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	165,556	53.61
Rainfall Interception (gallons)	3,403,786	33,700	10.91
Energy Conservation ¹	–	13,596	4.40
Electricity (MWh)	116	8,797	–
Natural Gas (therms)	4,588	4,799	–
Air Pollution reduction (lb) ²	509	-134	-0.04
CO ₂ sequestration (lb) ³	525,301	3,940	1.28
Total Benefits	–	216,658	70.16

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

Leesburg 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 14% of the street tree population, Kousa dogwood exceeds the species threshold. Similarly, red maple is approaching the threshold at 8% abundance. Although these are proven performers, planting efforts should temper their use to ensure the diversity and health of Leesburg'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 Leesburg's street trees and account for only 4.2% of the street tree canopy cover. However, Leesburg must remain vigilant in managing street tree diversity because there is ongoing risk of unforeseen introduction of noxious tree pests into the United States.

The size distribution of Leesburg'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 street trees greater than 18 inch diameter, which probably reflects the dominance of small-stature, broadleaf deciduous trees such as Kousa dogwood and Callery pear. Also, Leesburg has experienced rapid growth in residential developments, leading to a proliferation of tree planting along newly-constructed streets. This combination of small trees and young trees has shifted the tree size distribution downward. Although small-stature trees play a vital role in greening confined spaces, planting efforts should emphasize large stature, highly functional tree species to ensure a high level of benefits will be provided by Leesburg's street trees for the future.

This assessment has reported gross benefits of Leesburg'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 Leesburg was \$440,000 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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