

Street Tree Assessment Report

Lynchburg, 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 2009, a sample street tree inventory was conducted in Lynchburg, Virginia to assess tree abundance, composition, functional benefits, and monetary value. Trees residing within the right-of-way along 9% of public streets were surveyed to determine their species, size, condition, and placement. Inventory data were collected by Virginia Tech for this assessment report. The inventory data were analyzed using i-Tree Streets assessment software developed by the U.S. Forest Service.

Key Findings

- Lynchburg has an estimated 26,820 street trees.
- Lynchburg's five most abundant street tree species are flowering dogwood, red maple, black locust, Leyland cypress, and crapemyrtle.
- Each year, Lynchburg's street trees intercept almost 42 million gallons of rainwater and sequester over 6 million pounds of carbon dioxide.
- In total, Lynchburg's street trees provide over \$1.2 million in benefits annually or roughly \$45 per tree.
- The replacement value for Lynchburg's street trees is estimated at almost \$60.5 million.

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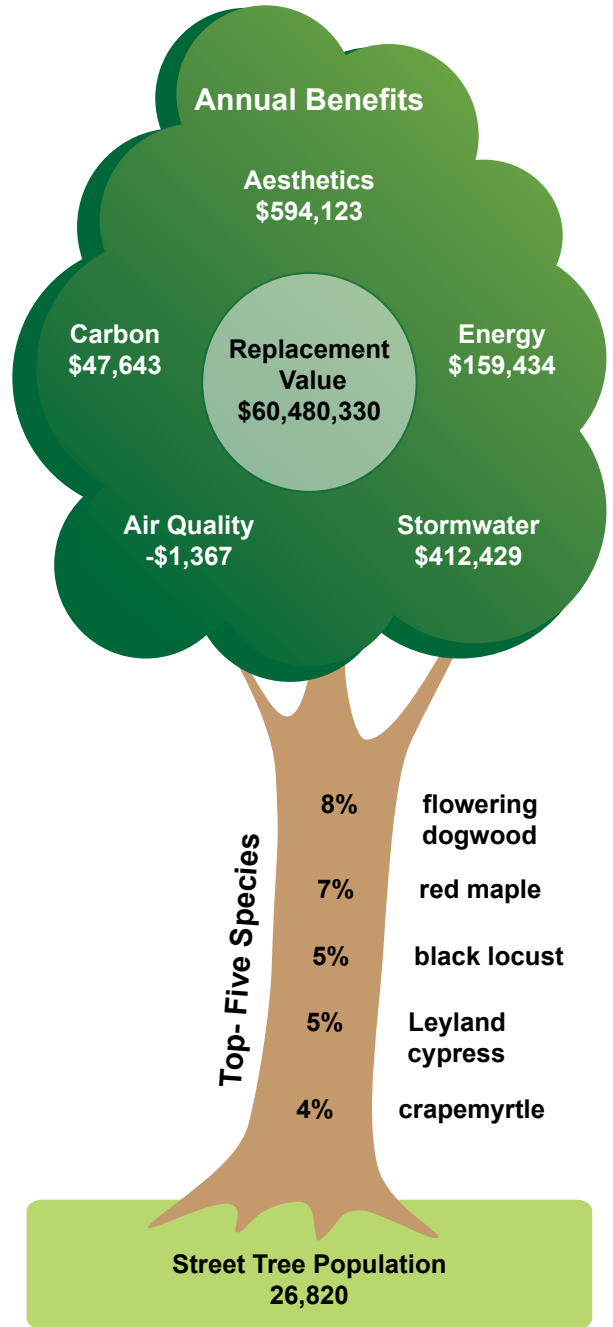
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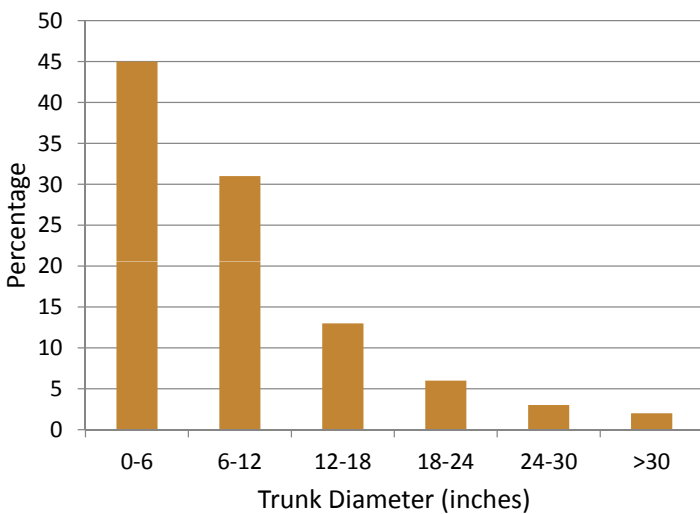
Street Tree Abundance and Composition

Lynchburg’s estimated street tree population is 26,820. Lynchburg’s trees provide about 275 acres of canopy, which cover roughly 0.9% of Lynchburg’s land area. The five most abundant species are flowering dogwood (8%), red maple (7%), black locust (5%), Leyland cypress (5%), and crapemyrtle (4%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include red maple (8%), tulip poplar (8%), black locust (6%), flowering dogwood (4%), and sugar maple (4%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Lynchburg’s street trees. Over 75% of Lynchburg’s street trees are smaller than 12 in. trunk diameter while less than 2% are larger than 30 in. The majority of Lynchburg’s street trees (~91%) were rated in fair to good condition.



Distribution of Lynchburg's Street Trees Across Trunk Diameter Classes



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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	7,003	5,723	8,495	21,221	79
Broadleaf Evergreen	1,280	56	0	1,336	5
Conifer Evergreen	67	2,271	1,925	4,263	16
Total	8,350	8,050	10,420	26,820	100
% of Total	31	30	39	100	

Street Tree Benefits and Value

Gross annual benefits provided by Lynchburg’s street trees are valued at \$1,212,262. 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, Lynchburg’s street trees intercept roughly 42 million gallons of rainfall, conserve a combined 1,376 megawatt-hour of electricity and 53 thousand therms of natural gas for home cooling and heating, and remove about 6.3 million pounds of carbon from the atmosphere. In addition, Lynchburg’s street trees currently store about 60 million pounds of carbon, which is valued at over \$450 thousand. Although Lynchburg’s street trees have a net positive impact on air pollution – removing over 6,050 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 American sycamore (\$128 per year), tulip poplar (\$93 per year), green ash (\$78 per year), red maple

(\$75 per year), and sugar maple (\$74 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 \$45 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 Lynchburg’s street tree population is estimated at \$60,480,330. 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 Lynchburg's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	594,123	22.15
Rainfall Interception (gallons)	41,656,550	412,429	15.38
Energy Conservation ¹	–	159,434	5.94
Electricity (MWh)	1376	104,441	–
Natural Gas (therms)	52,575	54,993	–
Air Pollution reduction (lb) ²	6,050	-1,367	-0.05
CO ₂ sequestration (lb) ³	6,352,360	47,643	1.78
Total Benefits	–	1,212,262	45.20

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

Lynchburg 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. Flowering dogwood (8%) and red maple (7%) are approaching the species threshold. Although these species are proven performers, planting efforts should temper their use to ensure the diversity and health of Lynchburg'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 1.8% of Lynchburg's street trees and account for only 3.2% of the street tree canopy cover. However, Lynchburg 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 70% of Lynchburg'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 Lynchburg'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. This situation may be attributed to highly active tree planting campaigns over the last decade as many of the veteran trees in the city have come down due to old age. This combination of young tree planting and old tree removal has shifted the tree size distribution downward. Continued focus on planting large stature, highly functional tree species will ensure that large street trees are well represented in the future.

Lynchburg'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 Lynchburg include tulip poplar, American sycamore, and green ash. Lynchburg 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 Lynchburg'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 Lynchburg was \$139,100 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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