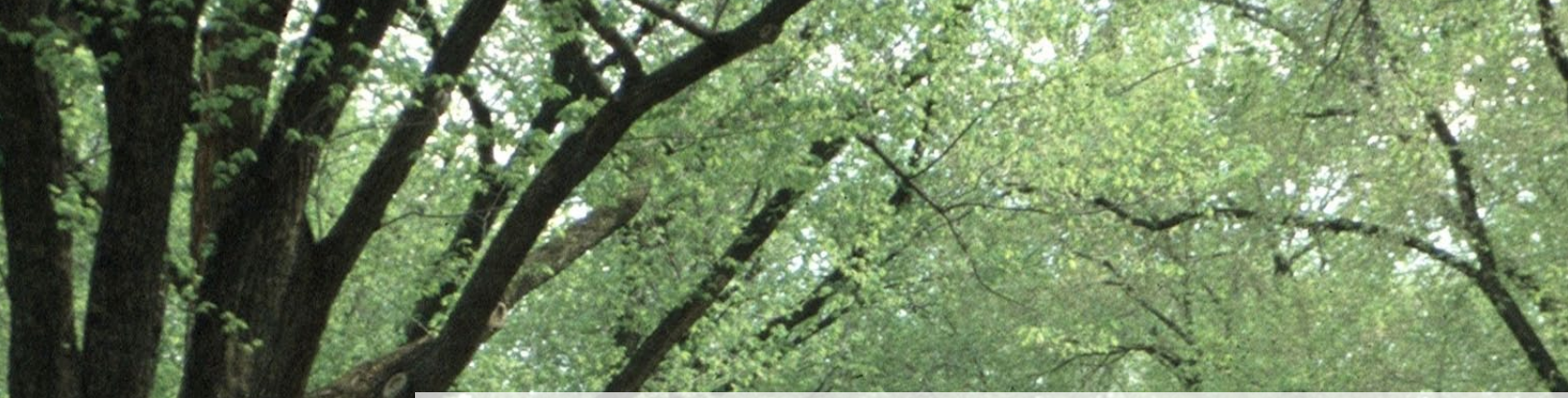

Street Tree Assessment Report

Lexington, 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 2008, a complete street tree inventory was conducted in Lexington, 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 Lexington for this assessment report. The inventory data were analyzed using i-Tree Streets assessment software developed by the U.S. Forest Service.

Key Findings

- Lexington has an estimated 868 street trees.
- Lexington's five most abundant street tree species are flowering dogwood, sugar maple, American elm, black walnut, and juniper.
- Each year, Lexington's street trees intercept about 2.7 million gallons of rainfall and sequester about 345 thousand pounds of carbon dioxide.
- In total, Lexington's street trees provide over $84 thousand in benefits annually or roughly $96 per tree.
- The replacement value of Lexington's street trees is estimated at over $3.2 million.

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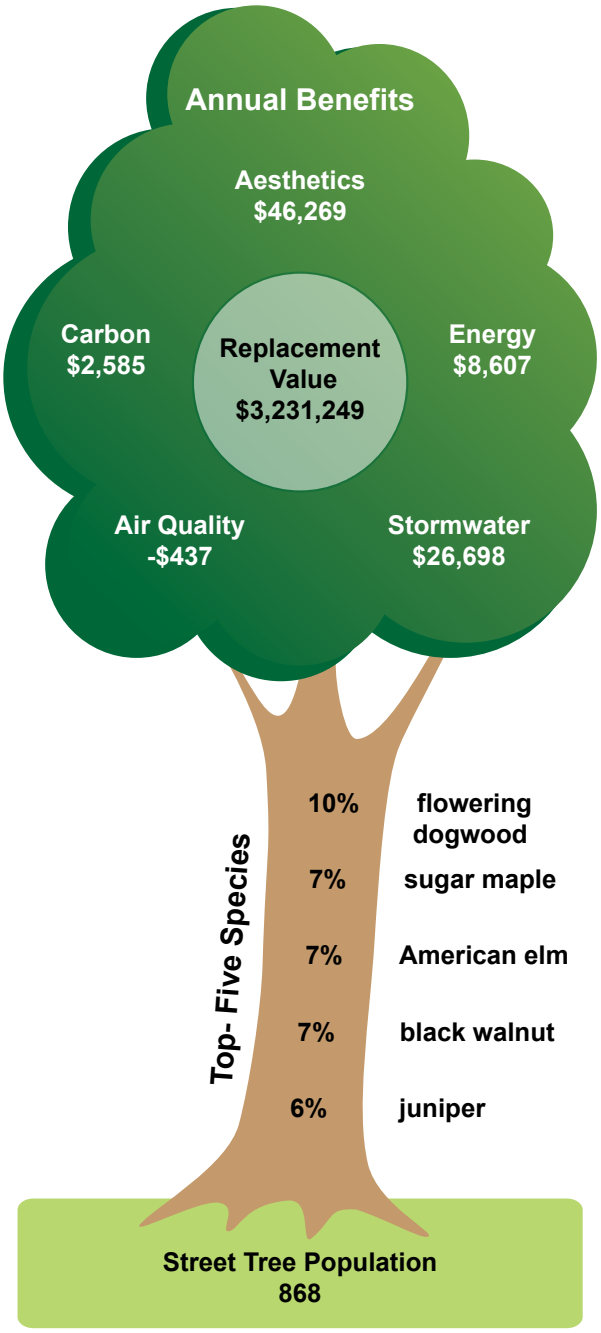
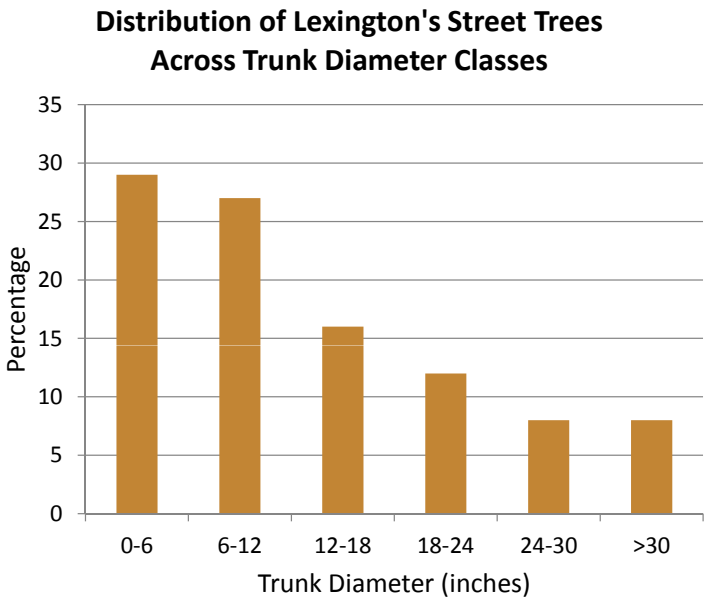
Street Tree Abundance and Composition

Lexington's estimated street tree population is 868. Lexington's street trees provide about 16 acres of canopy, which cover roughly 1% of the land area. The five most abundant species are flowering dogwood (10%), sugar maple (7%), American elm (7%), black walnut (7%), and juniper (6%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include sugar maple (13%), American elm (9%), American sycamore (8%), black walnut (7%), and boxelder (5%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Lexington's street trees. About 56% of Lexington's street trees are smaller than 12 in. trunk diameter while less than 10% are larger than 30 in. The majority of Lexington's street trees (~88%) were rated in fair to good condition.





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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	188	142	331	661	76
Broadleaf Evergreen	11	0	9	20	2
Conifer Evergreen	0	115	72	187	22
Total	**199**	**257**	**412**	**868**	**100**
% of Total	**23**	**30**	**47**	**100**	

Street Tree Benefits and Value

Gross annual benefits provided by Lexington's street trees are valued at $83,722. 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, Lexington's street trees intercept roughly 2.7 million gallons of rainfall, conserve a combined 78 megawatt-hour of electricity and 2,573 therms of natural gas for home cooling and heating, and remove about 345 thousand pounds of carbon from the atmosphere. In addition, Lexington's street trees currently store nearly 4.6 million pounds of carbon, which is valued at over $34 thousand. Although Lexington's street trees have a net positive impact on air pollution – removing over 288 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 ($368 per year), northern red oak ($238 per year), sugar maple ($191 per year), American sycamore ($182 per year), and oak ($177 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 $96 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 Lexington's street trees is estimated at $3,231,249. 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 Lexington's street trees.

Benefit Type	Resource Units	Total $	Avg. $/Tree
Aesthetic enhancements	–	46,269	53.31
Rainfall Interception (gallons)	2,696,609	26,698	30.76
Energy Conservation[1]	–	8,607	9.92
Electricity (MWh)	78	5,916	–
Natural Gas (therms)	2,573	2,691	–
Air Pollution reduction (lb)[2]	288	-437	-0.50
CO_2 sequestration (lb)[3]	344,633	2,585	2.98
Total Benefits	**–**	**83,722**	**96.47**

[1]Sum of electricity and natural gas conservation.

[2]Net 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.

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

Street Tree Opportunities

Lexington 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 10% of the street tree population, flowering dogwood is just above the species threshold. Although dogwood is an attractive, functional species, planting efforts should temper its use to ensure the diversity and heath of Lexington'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 Lexington's street trees and account for only 2.8% of the street tree canopy cover. However, Lexington 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 77% of Lexington's street tree population comprises medium- and large-stature species such as maple and elm. 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 Lexington'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 Lexington's street trees for the future.

Lexington'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 Lexington include American sycamore, various oaks, and various ashes. Lexington should consider planting more low-BVOC street trees such as gingko, 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 Lexington'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.

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 4.0.4. 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 Lexington was $244,300 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.

Date of Publication: July 2012.