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

Key Findings

- Charlottesville has an estimated 5,988 street trees.

- Charlottesville's five most abundant street tree species are flowering dogwood, eastern redcedar, eastern white pine, red maple, and sugar maple.

- Each year, Charlottesville's street trees intercept about 17 million gallons of rainfall and sequester over 2.2 million pounds of carbon dioxide.

- In total, Charlottesville's street trees provide over $603 thousand in benefits annually or roughly $100 per tree.

- The replacement value of Charlottesville's street trees is estimated at about $29 million.

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Street Tree Abundance and Composition

Charlottesville's estimated street tree population is 5,988. Charlottesville's street trees provide about 103 acres of canopy, which cover roughly 1.6% of the land area. The five most abundant species are flowering dogwood (14%), eastern redcedar (7%), eastern white pine (6%), red maple (6%), and sugar maple (5%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include red maple (8%), eastern white pine (7%), flowering dogwood (6%), white oak (6%), and sugar maple (5%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Charlottesville's street trees. About 50% of Charlottesville's street trees are smaller than 12 in. trunk diameter while about 6% are larger than 30 in. The majority of Charlottesville's street trees (~95%) were rated in fair to good condition.

Annual Benefits

Aesthetics
$360,619

Carbon
$16,655

Replacement Value
$28,892,459

Energy
$57,925

Air Quality
$421

Stormwater
$167,670

Top- Five Species

14%	flowering dogwood
7%	eastern redcedar
6%	eastern white pine
6%	red maple
5%	sugar maple

Street Tree Population 5,988
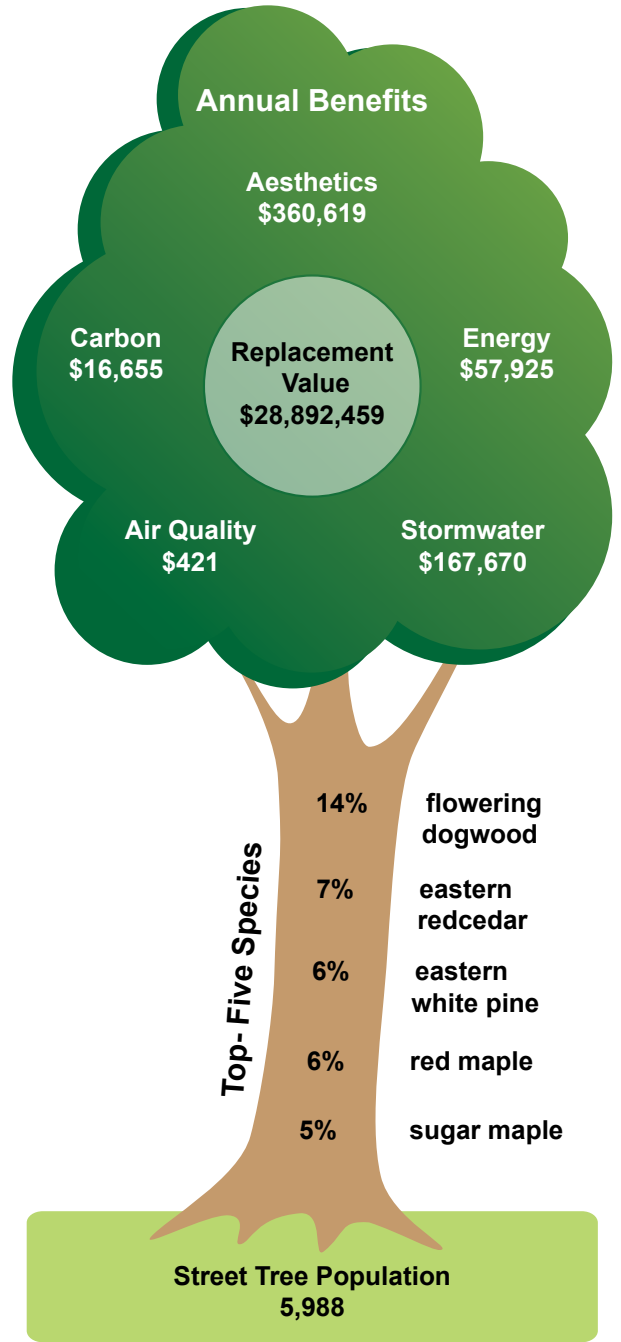
Distribution of Charlottesville's Street Trees Across Trunk Diameter Classes
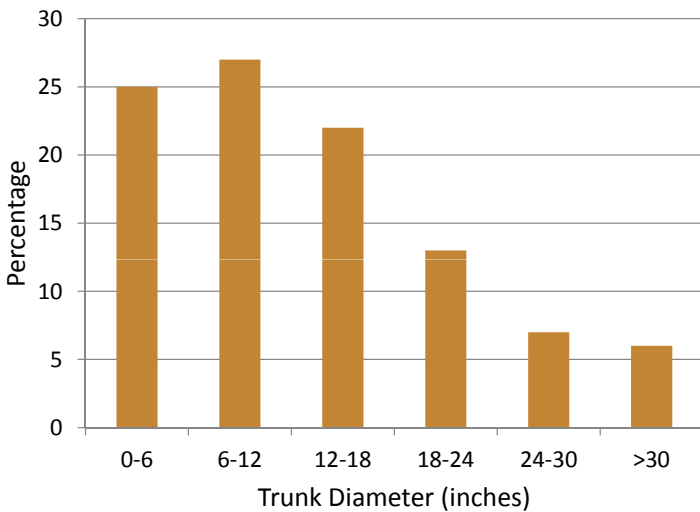
Relative abundance of Charlottesville's street trees by foliage type and mature height class.

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	1,628	796	2,143	4,567	76
Broadleaf Evergreen	120	39	1	160	3
Conifer Evergreen	1	660	600	1,261	21
Total	1,749	1,495	2,744	5,988	100
% of Total	29	25	46	100	

Street Tree Benefits and Value

Gross annual benefits provided by Charlottesville's street trees are valued at $603,290. These benefits come from contributions that street trees make to real estate aesthetics, rainfall interception, energy conservation, air pollution reduction, and CO_2 sequestration. Each year, Charlottesville's street trees intercept roughly 17 million gallons of rainfall, conserve a combined 517 megawatt-hour of electricity and 18 thousand therms of natural gas for home cooling and heating, absorb 2,494 pounds of air pollution, and remove about 2.2 million pounds of carbon from the atmosphere. In addition, Charlottesville's street trees currently store nearly 28 million pounds of carbon, which is valued at over $209 thousand.

On a per-tree basis, the most beneficial tree species are white oak ($308 per year), southern red oak ($267 per year), tulip poplar ($196 per year), pin oak ($190 per year), and red maple ($181 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 $100 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 Charlottesville's street trees is estimated at $28,892,459. 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 Charlottesville's street trees.

Benefit Type	Resource Units	Total $	Avg. $/Tree
Aesthetic enhancements	–	360,619	60.22
Rainfall Interception (gallons)	16,935,177	167,670	28.00
Energy Conservation[1]	–	57,925	9.67
Electricity (MWh)	517	39,232	–
Natural Gas (therms)	17,871	18,693	–
Air Pollution reduction (lb)[2]	2,494	421	0.07
CO_2 sequestration (lb)[3]	2,220,668	16,655	2.78
Total Benefits	–	603,290	100.74

[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

Charlottesville 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 total street tree population, flowering dogwood is above the species threshold. Although dogwood is a popular species, planting efforts should temper its use to ensure the diversity and heath of Charlottesville'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 1.89% of Charlottesville's street trees and account for only 2.67% of the street tree canopy cover. However, Charlottesville 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 Charlottesville'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 Charlottesville'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 Charlottesville's street trees for the future.

This assessment has reported gross benefits of Charlottesville'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