

Street Tree Assessment Report

Harrisonburg, 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 2010, a sample street tree inventory was conducted in Harrisonburg, Virginia to assess tree abundance, composition, functional benefits, and monetary value. Trees residing within the right-of-way along 12% 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

- Harrisonburg has 6,984 street trees.
- Harrisonburg's five most abundant street tree species are Callery pear, flowering dogwood, eastern redbud, northern white cedar, and Siberian elm.
- Each year, Harrisonburg's street trees intercept over 10 million gallons of rainwater and sequester over 1.6 million pounds of carbon dioxide.
- In total, Harrisonburg's street trees provide about \$374 thousand in benefits annually or roughly \$53 per tree.
- The replacement value of Harrisonburg's street trees is estimated at about \$13 million.

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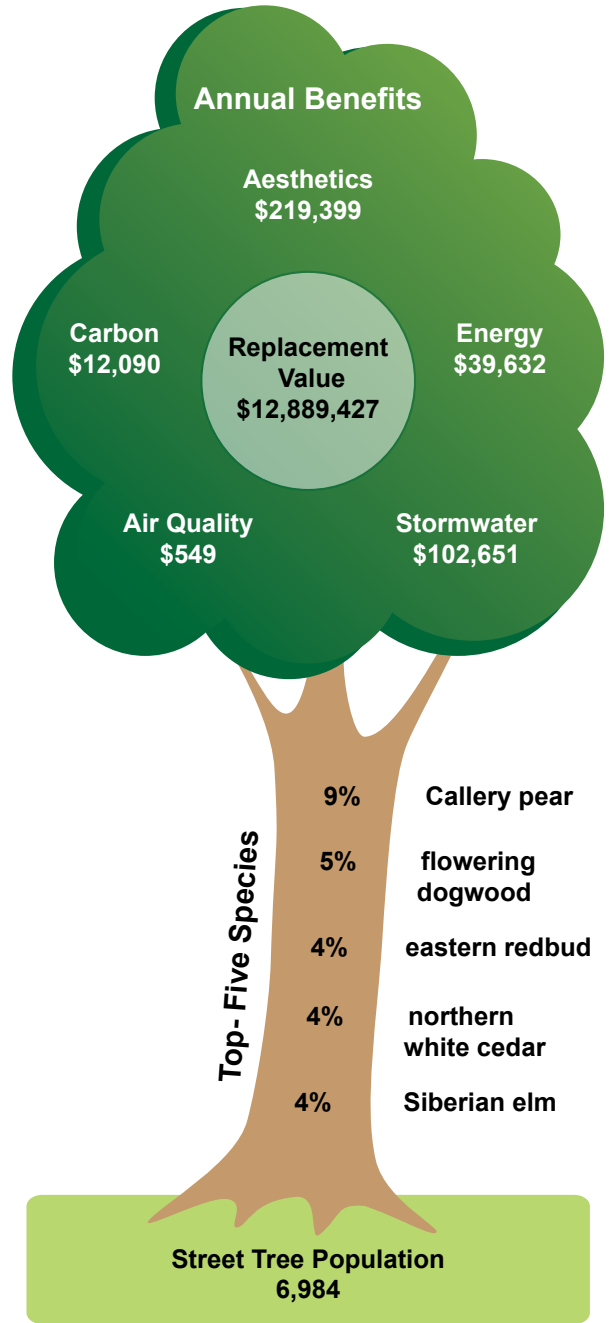
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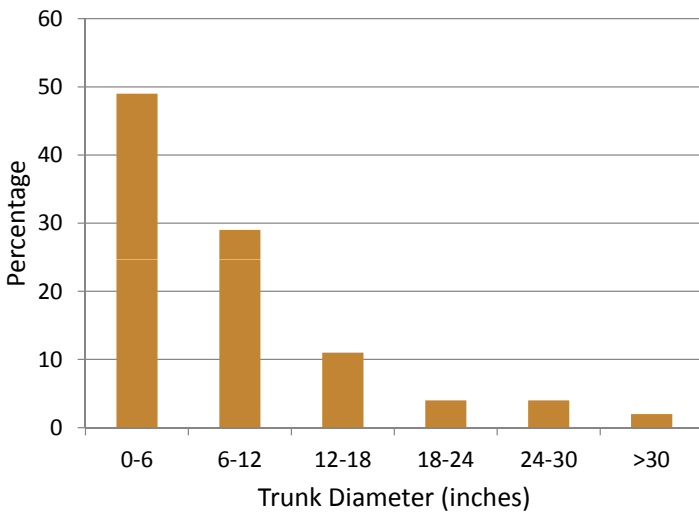
Street Tree Abundance and Composition

Harrisonburg’s estimated street tree population is 6,984. Harrisonburg’s street trees provide about 69 acres of canopy, which cover roughly 0.62% of the land area. The five most abundant species are Callery pear (9%), flowering dogwood (5%), eastern redbud (4%), northern white cedar (4%), and Siberian elm (4%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include Siberian elm (6%), Callery pear (5%), white oak (5%), black walnut (5%), and Norway maple (5%).

Small-stature, broadleaf deciduous trees are the most common tree form amongst Harrisonburg’s street trees, but are nearly equaled by large-stature, broadleaf deciduous trees. About 78% of Harrisonburg’s street trees are smaller than 12 in. trunk diameter while less than 3% are larger than 30 in. The majority of Harrisonburg’s street trees (~88%) were rated in fair to good condition.



Distribution of Harrisonburg's Street Trees Across Trunk Diameter Classes



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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	2,168	836	2,069	5,073	73
Broadleaf Evergreen	223	41	0	264	4
Conifer Evergreen	0	828	786	1,647	23
Total	2,391	1,738	2,855	6,984	100
% of Total	34	25	41	100	

Street Tree Benefits and Value

Gross annual benefits provided by Harrisonburg’s street trees are valued at \$374,321. 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, Harrisonburg’s street trees intercept roughly 10 million gallons of rainfall, conserve a combined 343 megawatt-hour of electricity and 13 thousand therms of natural gas for home cooling and heating, absorb 1,664 pounds of air pollution, and remove about 1.6 million pounds of carbon from the atmosphere. In addition, Harrisonburg’s street trees currently store about 15 million pounds of carbon, which is valued at over \$114 thousand.

On a per-tree basis, the most beneficial tree species are white oak (\$267 per year), silver maple (\$137 per year), black walnut (\$134 per year), Norway maple

(\$125 per year), and sugar maple (\$115 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 \$53 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 Harrisonburg’s street trees is estimated at \$12,889,427. 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 Harrisonburg's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	219,399	31.41
Rainfall Interception (gallons)	10,368,023	102,651	14.70
Energy Conservation ¹	–	39,632	5.67
Electricity (MWh)	343	26,018	–
Natural Gas (therms)	13,015	13,614	–
Air Pollution reduction (lb) ²	1,664	549	0.08
CO ₂ sequestration (lb) ³	1,611,968	12,090	1.73
Total Benefits	–	374,321	53.59

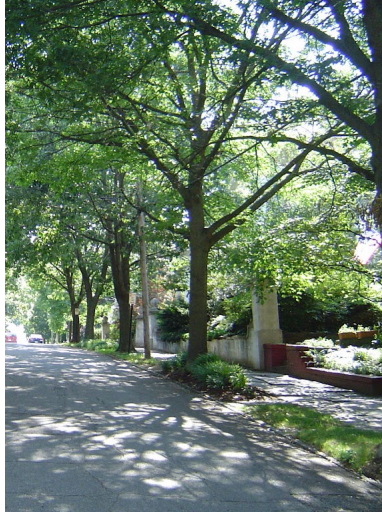
¹Sum of electricity and natural gas conservation.

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

Harrisonburg 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 9% of the total street tree population, Callery pear is approaching the species threshold. Although pear is a popular species, planting efforts should temper its use to ensure the diversity and health of Harrisonburg's street trees.



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 Callery pear, flowering dogwood, and eastern redbud. While these species are proven performers, particularly in small spaces under utility lines, the value of their annual benefits are only 11-25% of the benefits provided by large-stature trees such as sugar maple. 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 Harrisonburg's street trees for the future.

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 0.9% of Harrisonburg's street trees and account for only 3.3% of the street tree canopy cover. However, Harrisonburg 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 Harrisonburg's street trees suggests a stable age structure. Because street trees inevitably grow old and die or must be removed to

This assessment has reported gross benefits of Harrisonburg'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 Harrisonburg was \$213,400 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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