

Street Tree Assessment Report

Farmville, 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 2011, a sample street tree inventory was conducted in Farmville, Virginia to assess tree abundance, composition, functional benefits, and monetary value. Trees residing within the right-of-way along 17% 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

- Farmville has an estimated 3,613 street trees.
- Farmville's five most abundant street tree species are crapemyrtle, Virginia pine, loblolly pine, eastern redcedar, and eastern white pine.
- Each year, Farmville's street trees intercept over 6 million gallons of rainfall and sequester over 900 thousand pounds of carbon dioxide.
- In total, Farmville's street trees provide about \$195 thousand in benefits annually or roughly \$54 per tree.
- The replacement value of Farmville's street trees is estimated at about \$9.4 million.

*Prepared by Virginia Tech
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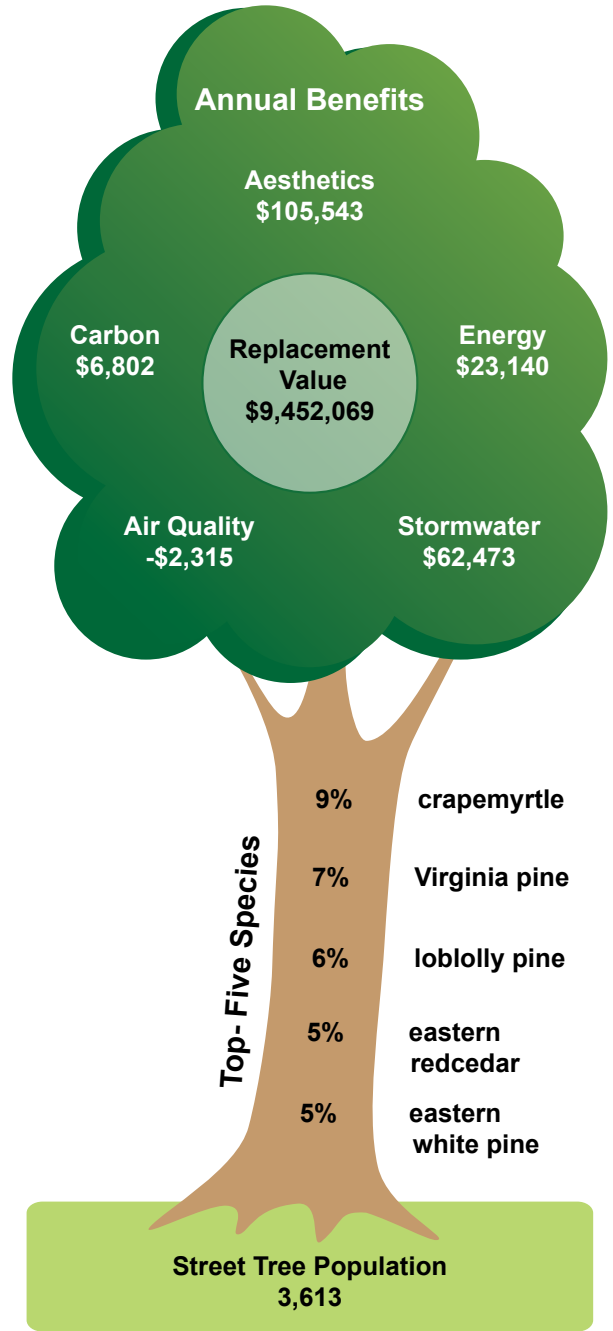
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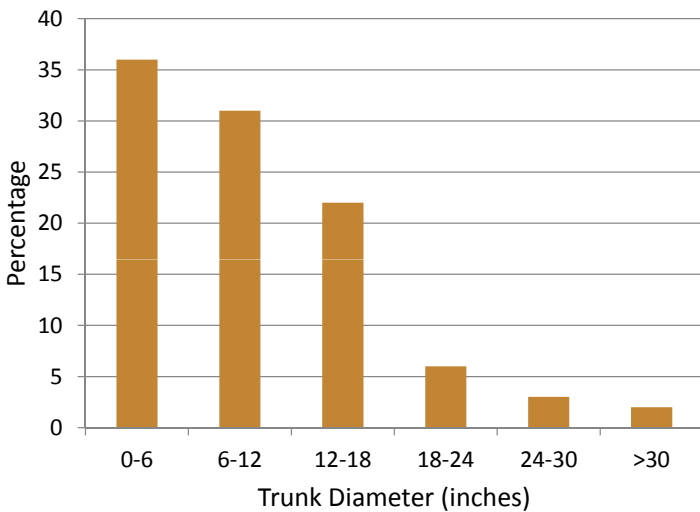
Street Tree Abundance and Composition

Farmville’s estimated street tree population is 3,613. Farmville’s street trees provide about 40 acres of canopy, which cover roughly 0.86% of the land area. The five most abundant species are crapemyrtle (9%), Virginia pine (7%), loblolly pine (6%), eastern redcedar (5%), and eastern white pine (5%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include loblolly pine (7%), northern hackberry (7%), willow oak (7%), red maple (6%), and eastern white pine (5%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Farmville’s street trees. About 67% of Farmville’s street trees are smaller than 12 in. trunk diameter while less than 3% are larger than 30 in. The majority of Farmville’s street trees (~96%) were rated in fair to good condition.



Distribution of Farmville's Street Trees Across Trunk Diameter Classes



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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	618	306	1,430	2,354	66
Broadleaf Evergreen	188	65	0	253	6
Conifer Evergreen	6	465	535	1,006	28
Total	812	836	1,965	3,613	100
% of Total	22	23	54	100	

Street Tree Benefits and Value

Gross annual benefits provided by Farmville’s street trees are valued at \$195,643. 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, Farmville’s street trees intercept roughly 6.3 million gallons of rainfall, conserve a combined 205 megawatt-hour of electricity and 7,275 therms of natural gas for home cooling and heating, and remove about 907 thousand pounds of carbon from the atmosphere. In addition, Farmville’s street trees currently store nearly 9 million pounds of carbon, which is valued at over \$64 thousand. Although Farmville’s street trees have a net positive impact on air pollution – removing over 590 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 maple (\$130 per year), northern hackberry

(\$115 per year), black walnut (\$109 per year), sugar maple (\$94 per year), and tulip poplar (\$94 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 \$54 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 Farmville’s street trees is estimated at \$9,452,069. 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 Farmville's street trees.

Benefit Type	Resource Units	Total \$	Avg. \$/Tree
Aesthetic enhancements	–	105,543	29.21
Rainfall Interception (gallons)	6,310,001	62,473	17.29
Energy Conservation ¹	–	23,140	6.41
Electricity (MWh)	205	15,531	–
Natural Gas (therms)	7,275	7,609	–
Air Pollution reduction (lb) ²	594	-2,315	-0.64
CO ₂ sequestration (lb) ³	906,948	6,802	1.88
Total Benefits	–	195,643	54.15

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

Farmville has a highly valuable street tree population. To sustain this resource and its benefits, the town 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. Farmville's street trees are predominantly naturally-occurring species that tend to develop in monoculture stands such as pines (20% of all trees). In such cases, it is difficult to influence species diversity. However, crape myrtle is a purposefully planted species, and at 9% of the total street tree population, it is nearing excessive abundance. Planting efforts should temper the use of crape myrtle to ensure the diversity and health of Farmville'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 1.5% of Farmville's street trees and account for only 2.3% of the street tree canopy cover. However, Farmville 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 78% of Farmville's street tree population comprises medium- and large-stature species such as maple and pine. 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 Farmville'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 trees greater than 18 inch diameter, which may indicate that street trees are failing to reach maturity or large-stature species have not been adequately planted in the past. 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 Farmville's street trees for the future.

Farmville'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 Farmville include northern hackberry, willow oak, and loblolly pine. Farmville 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 Farmville'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.

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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 Farmville was \$168,600 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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