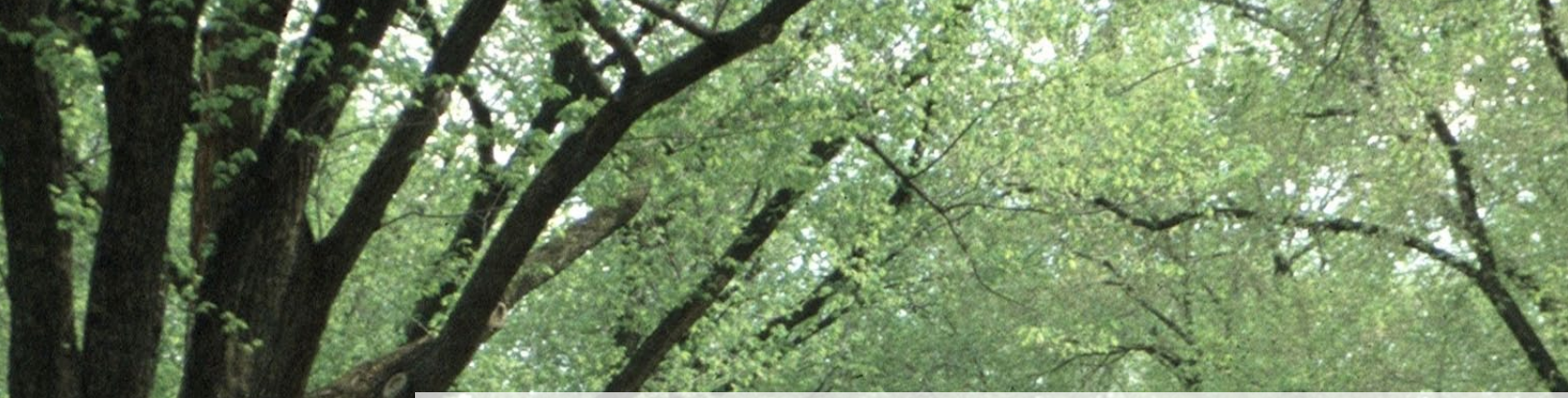

Street Tree Assessment Report

Radford, 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 sample street tree inventory was conducted in Radford, 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

- Radford has an estimated 12,723 street trees.
- Radford's five most abundant street tree species are eastern white pine, flowering dogwood, Japanese zelkova, black locust, and eastern hemlock.
- Each year, Radford's street trees intercept over 24 million gallons of rainfall and sequester over 3.5 million pounds of carbon dioxide.
- In total, Radford's street trees provide over $678 thousand in benefits annually or roughly $53 per tree.
- The replacement value of Radford's street trees is estimated at over $33 million.

Prepared by Virginia Tech
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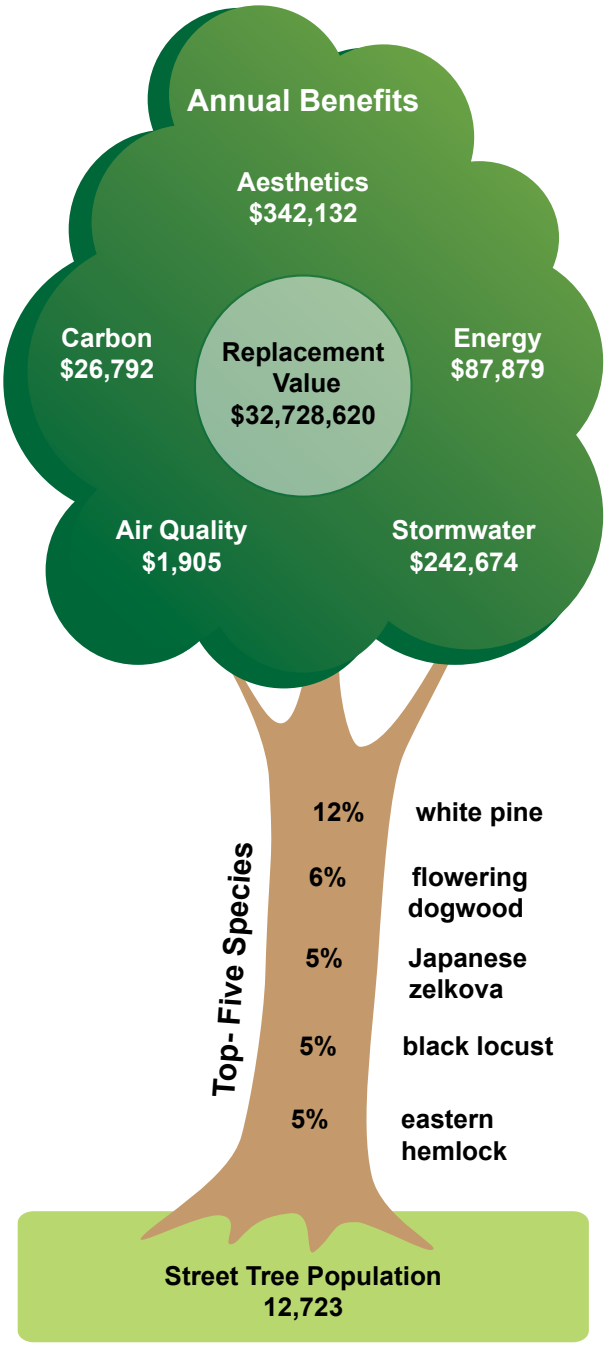
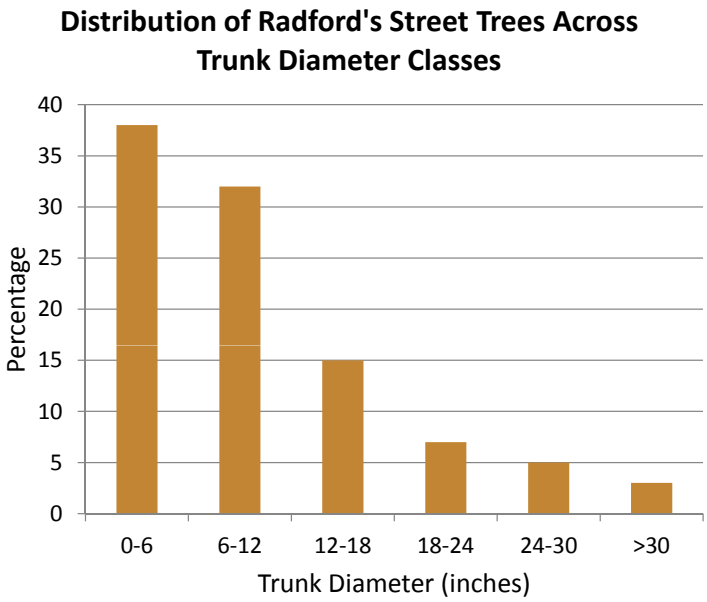
Street Tree Abundance and Composition

Radford's estimated street tree population is 12,723. Radford's street trees provide about 154 acres of canopy, which cover roughly 2.5% of the land area. The five most abundant species are eastern white pine (12%), flowering dogwood (6%), Japanese zelkova (5%), black locust (5%), and eastern hemlock (5%). The most important species (accounting for leaf area and canopy cover in addition to tree count) include eastern white pine (11%), red maple (6%), silver maple (6%), Siberian elm (6%), Japanese zelkova (5%) and Norway maple (5%).

Large-stature, broadleaf deciduous trees are the most common tree form amongst Radford's street trees. About 70% of Radford's street trees are smaller than 12 in. trunk diameter while less than 3% are larger than 30 in. The majority of Radford's street trees (~88%) were rated in fair to good condition.





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

Foliage Type	Small (< 25')	Medium (25 - 45')	Large (> 45')	Total	% of Total
Broadleaf Deciduous	2,794	1,700	4,174	8,668	68
Broadleaf Evergreen	463	8	0	471	4
Conifer Evergreen	34	1,388	2,162	3,584	28
Total	**3,291**	**3,096**	**6,336**	**12,723**	**100**
% of Total	**26**	**24**	**50**	**100**	

Street Tree Benefits and Value

Gross annual benefits provided by Radford's street trees are valued at $678,477. 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, Radford's street trees intercept roughly 25 million gallons of rainfall, conserve a combined 772 megawatt-hour of electricity and 28 thousand therms of natural gas for home cooling and heating, absorb 3,916 pounds of air pollution, and remove about 3.6 million pounds of carbon from the atmosphere. In addition, Radford's street trees currently store about 37 million pounds of carbon, which is valued at over $280 thousand.

On a per-tree basis, the most beneficial tree species are silver maple ($191 per year), Siberian elm ($134 per year), sugar maple ($116 per year), tulip poplar ($109 per year), and red maple ($96 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 $55 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 Radford's street trees is estimated at $32,728,620. 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 Radford's street trees.

Benefit Type	Resource Units	Total $	Avg. $/Tree
Aesthetic enhancements	–	342,132	26.89
Rainfall Interception (gallons)	24,510,780	242,674	19.07
Energy Conservation[1]	–	87,879	6.91
Electricity (MWh)	772	58,585	–
Natural Gas (therms)	28,006	29,294	–
Air Pollution reduction (lb)[2]	3,916	1,905	0.15
CO_2 sequestration (lb)[3]	3,572,248	26,792	2.11
Total Benefits	**–**	**701,382**	**55.12**

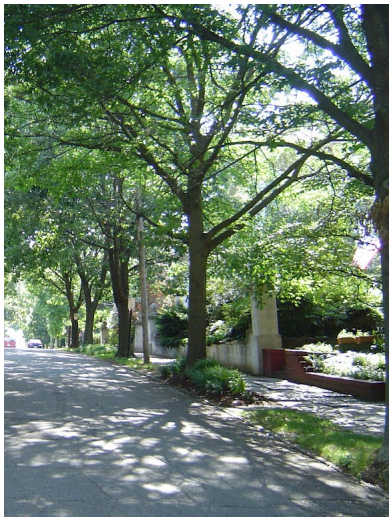
[1]Sum of electricity and natural gas conservation.

[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

Radford 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 12% of the street tree population, eastern white pine is overly abundant. Although many of these white pines are naturally occurring trees at the edge of forests, they are also commonly planted at the road edge to provide screening. There are numerous evergreen alternatives to white pine that could be used to diversify tree planting and help ensure the future heath of Radford'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 1.26% of Radford's street trees and account for only 1.43% of the street tree canopy cover. However, Radford 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 75% of Radford'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 Radford'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 Radford's street trees for the future.

This assessment has reported gross benefits of Radford'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 Radford was $154,700 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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