## DATA SHEET: TREE CANOPY DISTRIBUTION IN ROANOKE CITY USING THE VIRGINIA STATEWIDE LAND COVER DATASET

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Trees in urban areas provide a number of community benefits that have been well quantified (Roy et al., 2012), and the extent and distribution of trees are important drivers of stream and watershed health (Bartens et al., 2008, 2009). As part of the City Stormwater Utility's Watershed Master Planning efforts, the distribution of tree canopy has been characterized using the Virginia Statewide Land Cover Dataset (VSLCD) which was created for the Virginia Geographic Information Network (VGIN) by WorldView Solutions Inc. (2016). The VSCLD is a 1 meter x 1 meter raster (i.e. gridded) dataset that categorizes land



Figure 1 – An example of the Virginia Statewide Land Cover Dataset showing the two tree categories: "Forest" and "Tree"

cover into 12 classes including: water, impervious, barren, tree, forest, shrub/scrub, harvested/disturbed, turf grass, pasture, cropland and wetland<sup>1</sup>. Classifications were made using available local-government data combined with a machine-learning approach, which uses user-input training data to "teach" the model how to iteratively improve classifications. The stated accuracy of the dataset is 95% for impervious cover, forest cover, and water; and 85% for the remaining classes. One downside to using the VSLCD layer to estimate tree canopy, is that it has not been benchmarked against on-the-ground canopy measurements in Roanoke City. Moreover, the layer does not define tree type – only that a  $1m^2$  area of ground is covered by tree or forest canopy. As a result, this layer is useful for planning-level analysis, but should

be verified using a sample of on-the-ground canopy measurements within the City's service area before statistics from this dataset are incorporated into official City documents.

In this data sheet, tree canopy was assessed by City neighborhood and watershed by intersecting these GIS layers with the "forest" and "tree" categories of the VSLCD; the results of these overlays are shown in Figure 2 and Figure 3 as total area, total tree area, and percentage of tree area. It should be noted that the watersheds used for the overlay in Figure 3 were clipped to the City's jurisdictional boundary, as

<sup>&</sup>lt;sup>1</sup> There are two categories of impervious cover in the VSLCD – impervious cover delineated as part of local government datasets, and impervious cover delineated using the machine-learning approach.

several of the watersheds have a considerable drainage area outside of the City's service area. For example, the overall Tinker Creek watershed has nearly 50% tree canopy, but within the City, the watershed is comprised of only 20.4% canopy (Figure 3). For overall watershed land cover statistics, refer to Section 3.1.3 in the Peters Creek Watershed Master Plan (Aguilar, 2019). The results of this analysis indicate that the City has 7,106 acres (11.1 mi<sup>2</sup>) of tree canopy comprising approximately 26% of the City's service area. This canopy is largely concentrated on Mill Mountain and the surrounding neighborhoods, though the Grandin Court and Evans Spring neighborhoods and Barnhardt Creek watershed also have greater than 40% canopy by area. Tree canopy is sparse to the north and northwest of downtown as indicated by the low percentages in the Horton's Branch, Trout Run and Lick Run watersheds. Some of this is attributable to the relatively large footprint of the airport, though several residential neighborhoods also have less than 10% coverage (e.g. Gilmer, West End).

Overall, this data sheet should be used as a starting point for the assessment of tree canopy extent and distribution in Roanoke City, as it provides a planning-level view based on a GIS layer curated by the state information technology agency. However, a more robust tree canopy assessment that has been verified against on-the-ground canopy measurements could confirm the findings of this data sheet and provide more detailed information about tree type, characteristics and desirability, which are critical for effective management of the City's urban forest.



Neighborhood	Neighborhood Area (ac)	Neighborhood Tree Canopy (ac)	% Tree Canopy
Airport	1,267.4	75.5	6.0%
Belmont	327.8	34.0	10.4%
Cherry Hill	550.3	136.8	24.9%
Downtown	229.8	4.2	1.8%
Eastgate	1,154.3	256.0	22.2%
Edgewood-Summit Hills	302.1	103.4	34.2%
Evans Spring	183.9	94.6	51.4%
Fairland	148.0	27.0	18.2%
Fallon	216.8	45.9	21.2%
Franklin-Colonial	1,075.2	335.5	31.2%
Gainsboro	235.9	28.6	12.1%
Garden City	1,261.1	641.9	50.9%
Gilmer	155.6	12.9	8.3%
Grandin Court	526.8	221.3	42.0%
Greater Deverle	1.737.1	519.1	29.9%
Greater Raleigh Court	1.367.6	334.5	24.5%
Harrison	125.6	23.3	18.6%
Hollins	555.1	101.1	18.2%
Hurt Park	362.6	33.7	9.3%
Kenwood	284.9	81.6	28.7%
Loudon-Melrose	261.7	25.8	9.9%
Mecca Gardens	984.9	294.1	29.9%
Melrose-Rugby	546.7	86.4	15.8%
Mill Mountain	671.8	628.5	93.5%
Miller Court/Arrowood	821.8	101.9	12.4%
Monterey	1.085.9	279.4	25.7%
Morningside	595.8	108.2	18.2%
Mountain View	188.1	29.6	15.7%
Norwich	213.1	41.2	19.3%
Old Southwest	382.4	51.3	13.4%
Peachtree/Norwood	562.1	158.5	28.2%
Preston Park	1,153.1	135.7	11.8%
Ridgewood Park	272.9	105.7	38.7%
Riverdale	463.7	139.2	30.0%
Riverland/Walnut Hill	177.1	42.7	24.1%
Roundhill	922.4	96.9	10.5%
Shenandoah West	275.9	44.4	16.1%
South Jefferson	145.4	8.5	5.8%
South Roanoke	1,013.4	452.0	44.6%
South Washington Heights	327.0	63.3	19.3%
Southern Hills	868.3	481.4	55.4%
Villa Heights	659.6	117.2	17.8%
Wasena	306.2	67.6	22.1%
Washington Heights	184.1	43.5	23.6%
Washington Park	390.3	92.5	23.7%
West End	96.7	6.6	6.8%
Westview Terrace	447.5	105.4	23.6%
Wildwood	211.0	53.3	25.3%
Williamson Road	843.5	79.3	9.4%
Wilmont	321.2	54.6	17.0%
Citywide Totals	27,462	7,106	25.9%

Figure 2 – Tree canopy area and percentage of tree canopy by City neighborhood. Canopy estimated based on 1m<sup>2</sup> Virginia Statewide Land Cover Dataset (WorldView Solutions Inc., 2016), using categories 41 – Forest and 42 – Tree.



Watershed	Area of Watershed within City (ac)	Tree Canopy (ac)	% Tree Canopy
Back Creek	118	12	10.2%
Barnhardt Creek	624	250	40.1%
Carvin Creek	821	87	10.6%
Garnand Branch	1,491	925	62.1%
Glade Creek	1,301	341	26.2%
Hortons Branch	1,147	174	15.2%
Lick Run	3,779	503	13.3%
Mason Creek	37	12	31.6%
Mudlick Creek	1,110	306	27.6%
Murdock Creek	429	119	27.8%
Murray Run	1,111	436	39.3%
Ore Branch	1,711	769	45.0%
Peters Creek	2,703	728	26.9%
Roanoke River	4,911	1,371	27.9%
Roanoke River above Masons Creek	43	14	32.6%
Tinker Creek	4,396	897	20.4%
Trout Run	1,438	129	9.0%
W Fork Carvin Creek	292	32	11.0%
Citywide Totals	27,462	7,106	25.9%

Figure 3 - Tree canopy area and percentage of tree canopy by watershed clipped to the City's jurisdictional boundary. Canopy estimated based on 1m<sup>2</sup> Virginia Statewide Land Cover Dataset (WorldView Solutions Inc., 2016), using categories 41 - Forest and 42 – Tree.

## REFERENCES

- Aguilar, M. F. (2019). *Peters Creek Watershed Master Plan*. Roanoke, Virginia: City of Roanoke Department of Public Works.
- Bartens, J., Day, S. D., Harris, J. R., Dove, J. E., and Wynn, T. M. (2008). Can urban tree roots improve infiltration through compacted subsoils for stormwater management? *Journal of Environmental Quality*, *37*(6), 2048–2057. doi:10.2134/jeq2008.0117.
- Bartens, J., Day, S. D., Harris, J. R., Wynn, T. M., and Dove, J. E. (2009). Transpiration and root development of Urban trees in structural soil stormwater reservoirs. *Environmental Management*, 44(4), 646–657. doi:10.1007/s00267-009-9366-9.
- Roy, S., Byrne, J., and Pickering, C. (2012). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. *Urban Forestry and Urban Greening*, *11*(4), 351–363. doi:10.1016/j.ufug.2012.06.006.
- WorldView Solutions Inc. (2016). Technical Plan of Operations: Virginia Statewide Land Cover Data Development, 1870(804). Retrieved from https://www.vita.virginia.gov/media/vitavirginiagov/integratedservices/pdf/LandCover\_TechnicalPlanOfOperations\_v7\_20160506.pdf.