

A Report on the RVARC's Existing and Possible Urban Tree Canopy

Project Background

The analysis of RVARC's urban tree canopy (UTC) was carried out by the Virginia Department of Forestry in collaboration with RVARC and the Roanoke Valley—Alleghany Regional Commission. Assistance was provided by the Virginia Geospatial Extension Program (VGEP) at Virginia Tech's Department of Forestry and by the Spatial Analysis Laboratory (SAL) of the University of Vermont.

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to RVARC. This analysis was conducted based on year 2008 data.

Why is Tree Canopy Important?

Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. Urban tree canopy provides many benefits to communities including improving water quality, conserving energy, lowering county temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits.

Key Terms

UTC: Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

Land Cover: Physical features on the earth mapped from satellite or aerial imagery such as trees, or water.

Existing UTC: The amount of UTC present within parcel boundaries.

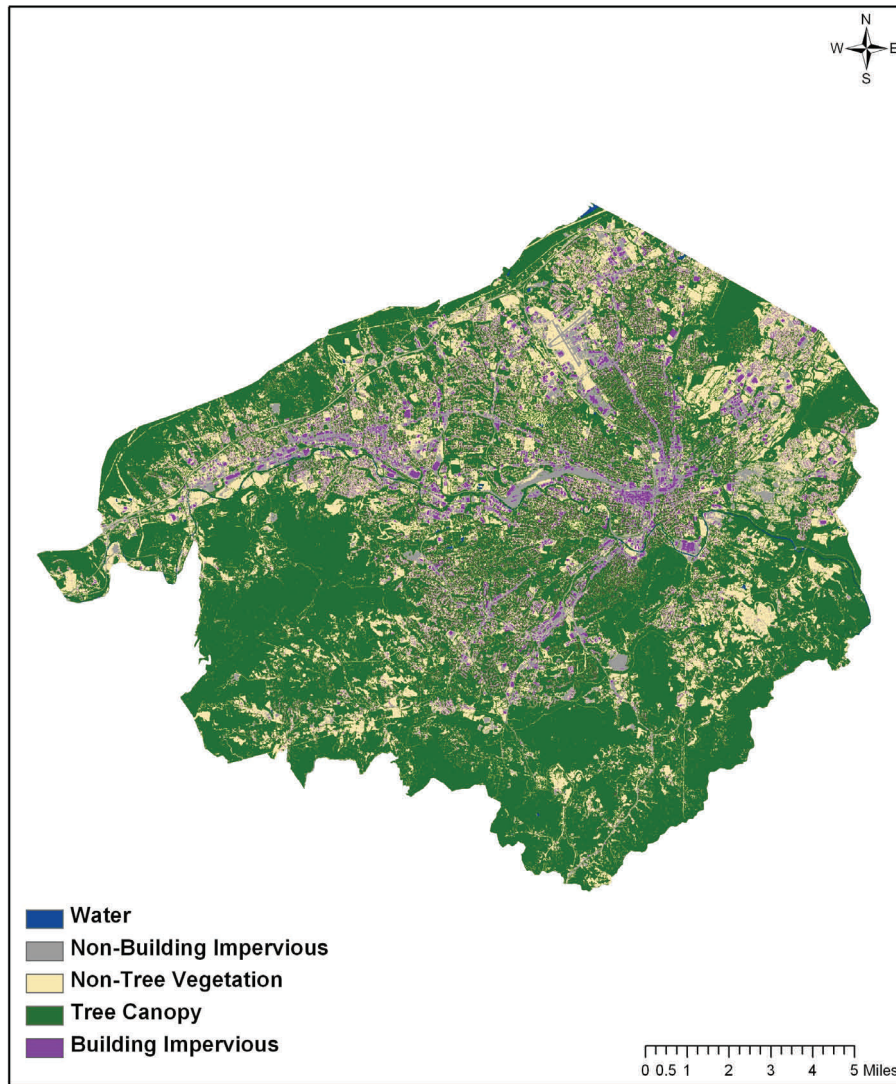
Possible UTC: The amount of land that is theoretically available for the establishment of tree canopy within parcel boundaries. Possible UTC excludes areas covered by tree canopy, roads, buildings, and water. It is the combination of Possible UTC - Vegetation and Possible UTC - Impervious.

Possible UTC - Vegetation: The amount of land that is theoretically available for the establishment of tree canopy in non-tree vegetation areas within parcel boundaries. This excludes areas covered by tree canopy, impervious surfaces, and water.

Possible UTC - Impervious: The amount of land that is theoretically available for the establishment of tree canopy in impervious areas within parcel boundaries. This includes impervious areas (roads, parking lots, and sidewalks) except for buildings.

How Much Tree Canopy Does RVARC Have?

Figure 1 shows the urban tree canopy (UTC) analysis for RVARC, which is derived from high resolution aerial imagery. 74064 acres of RVARC is covered by tree canopy (termed Existing UTC). This corresponds to 61.8% of all land area within the county (Table 1). An additional 33324 acres of the county could theoretically be improved to support urban tree canopy (termed Possible UTC), Table 2.



UTC Classes	Existing UTC		
	Acres	% Total Area	% Land Area
Tree Canopy	74064	61.6%	61.8%
Non-Tree Vegetation	26007	21.6%	21.7%
Non-Building Impervious	15537	12.9%	13.0%
Buildings	4286	3.6%	3.6%
Water	399	0.3%	0.3%
Total Area	120292	100%	100%

Table 1: Existing UTC area and percentages for the County * % Total Area includes area covered by

Figure 1: Land cover for RVARC.

Mapping RVARC's Trees

Using high-resolution (1 meter) National Agriculture Imagery Program (NAIP) imagery acquired in the summer of 2008 (Figure 2a) in combination with remote sensing techniques, land cover data for the county was generated (Figure 2b). An accuracy assessment was conducted. Single trees (tree canopies larger than 16 square meters) were detected with a 93% accuracy.

Who "Owns" RVARC's Trees?

The detailed land cover mapping conducted as part of this assessment allowed the percentage of Existing and Possible UTC to be calculated for each parcel of land (Figure 3). Using this data, ownership patterns for Existing UTC and Possible UTC (Figure 4) can be examined.

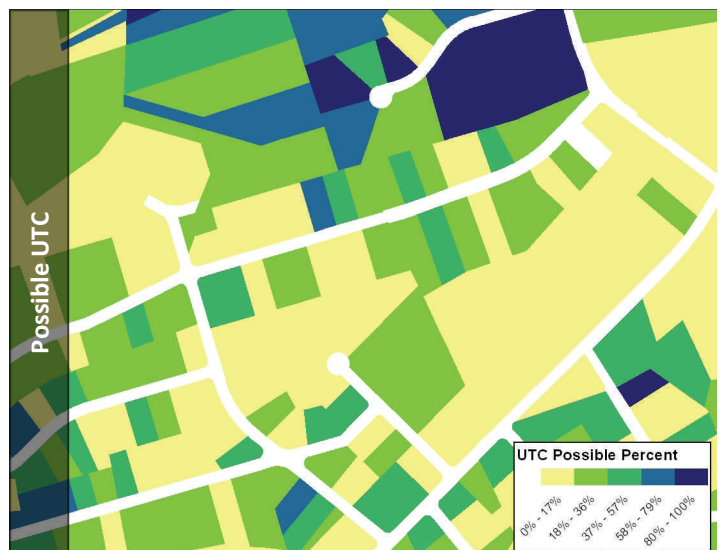
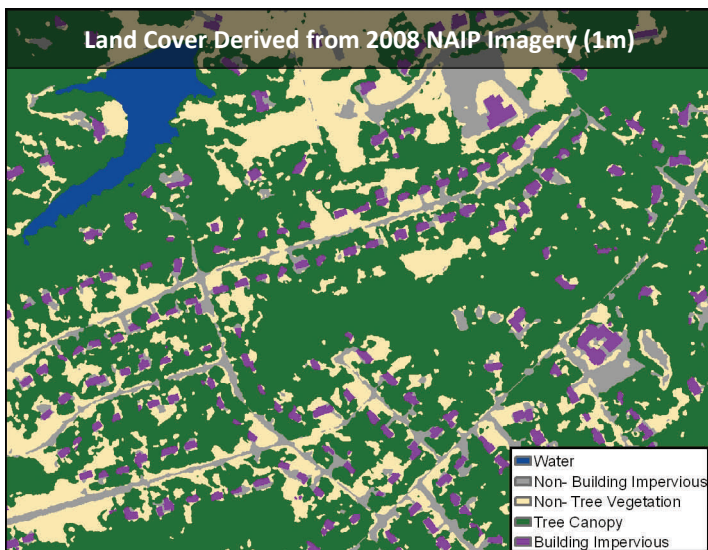
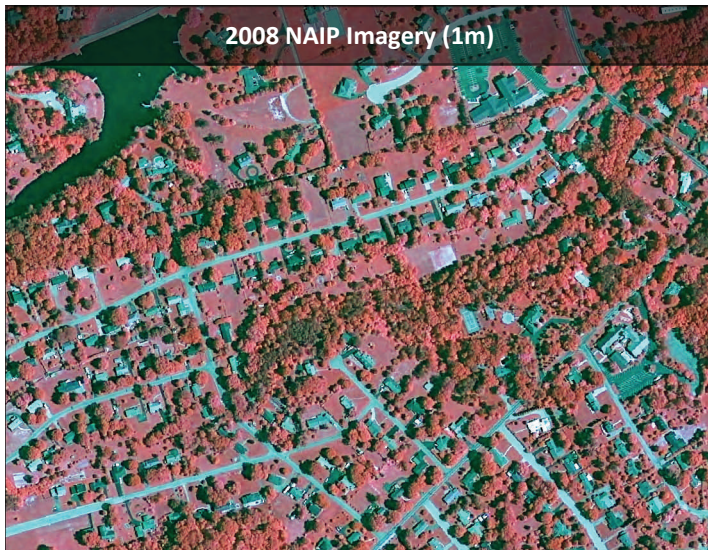
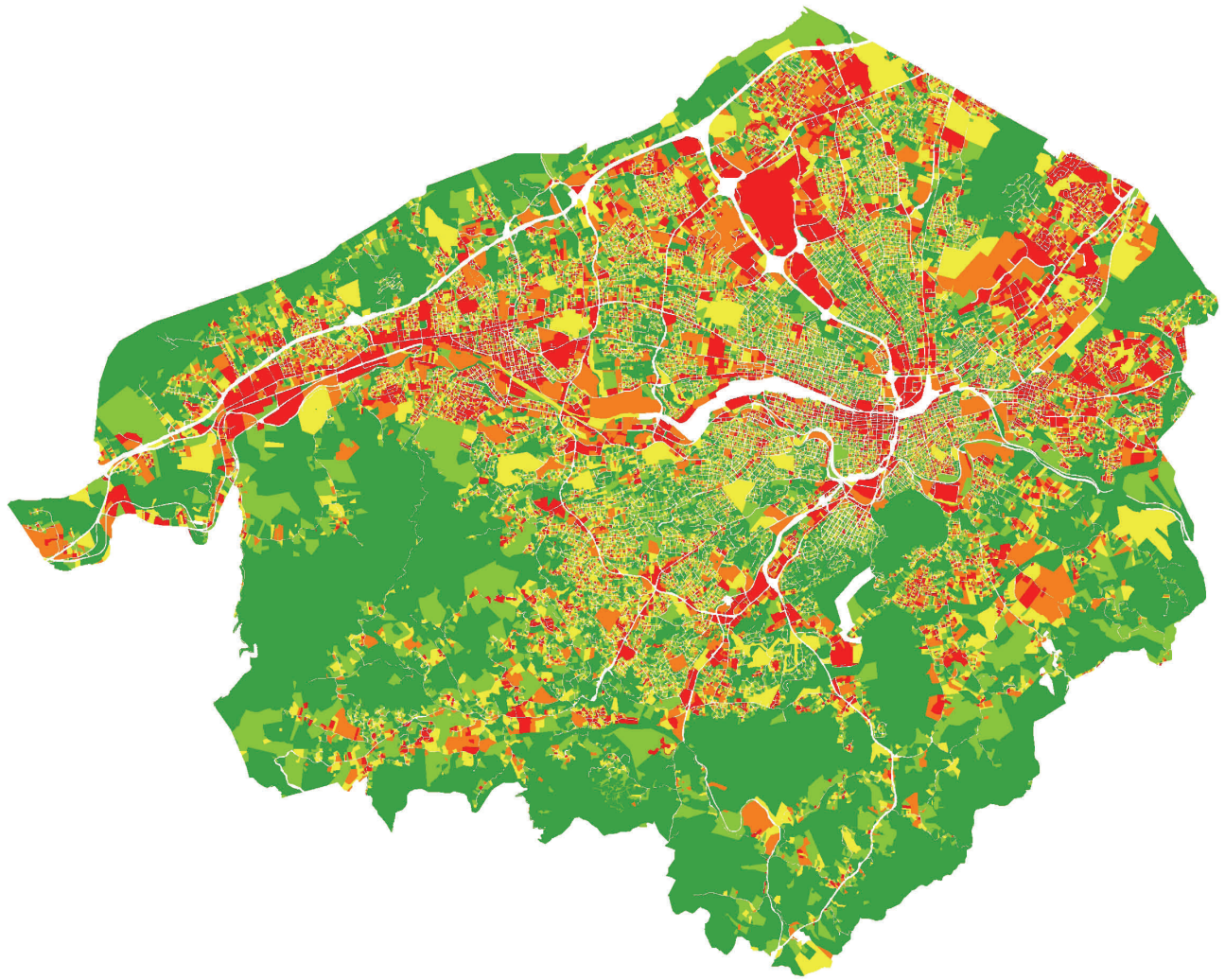


Figure 2a, 2b: Comparison of 2008 NAIP imagery to the resulting high-resolution land cover.

Figure 3: UTC metrics summarized at the property parcel level

Urban Tree Canopy Analysis Summarized by Property Parcel - RVARC, VA



0 0.5 1 2 3 4 5 Miles

UTC Existing Percent	
0% - 16%	39% - 60%
17% - 38%	61% - 81%
	82% - 100%



Canopy analysis completed 2009/12/15 JAP

Figure 4: UTC metrics summarized by property parcel.

1/6/2010

Urban Tree Canopy Summarized by Property Parcels

Using the parcel data provided by RVARC, Existing and Possible UTC were summarized by property parcels. This summary excludes any area outside of property parcel boundaries and areas covered by water. RVARC has 65.3% (70555 acres) Existing UTC and 30.8% (33324 acres) Possible UTC. Possible UTC has two components, Possible UTC - Vegetation and Possible UTC - Impervious. 21.7% (23514 acres) of parcel land area is associated with Possible UTC - Vegetation. 9.1% (9811 acres) of parcel land area is associated with Possible UTC - Impervious (Figure 5). Figure 4 shows Existing UTC throughout RVARC.

Urban Tree Canopy Summarized by Zoning

Using the zoning data provided by RVARC, Existing and Possible UTC were summarized by zoning category (page 5). The zoning category R1 has the largest amount of land area with 22069 acres (Table 3a & 3b). The R1 category also contains 20.1 %of the Existing UTC in the county. Zoning Categories AG3 and AG1 contain 27.2% and 19.1% in Existing UTC respectively. Figure 6 compares zoning categories with greater than 500 acres by the amount of land area within the categories. Figure 7 shows the spatial distribution of Possible UTC by zoning category for the County.

UTC Parcel Metrics	Acres	% Parcel Land Area
Parcel Land Area	108121	100%
Existing UTC	70555	65.3%
Possible UTC	33324	30.8%
Possible UTC - Vegetation	23514	21.7%
Possible UTC - Impervious	9811	9.1%
Not Suitable for UTC	4684	4.3%

Table 2: Acres and percent land area from UTC metrics summarized by property parcels. *Not Suitable for UTC includes all water areas some of which may lay outside of parcel boundaries.

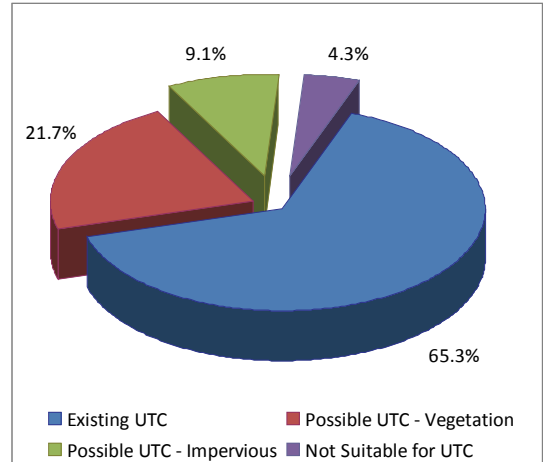


Figure 5: Pie chart showing RVARC UTC distribution.

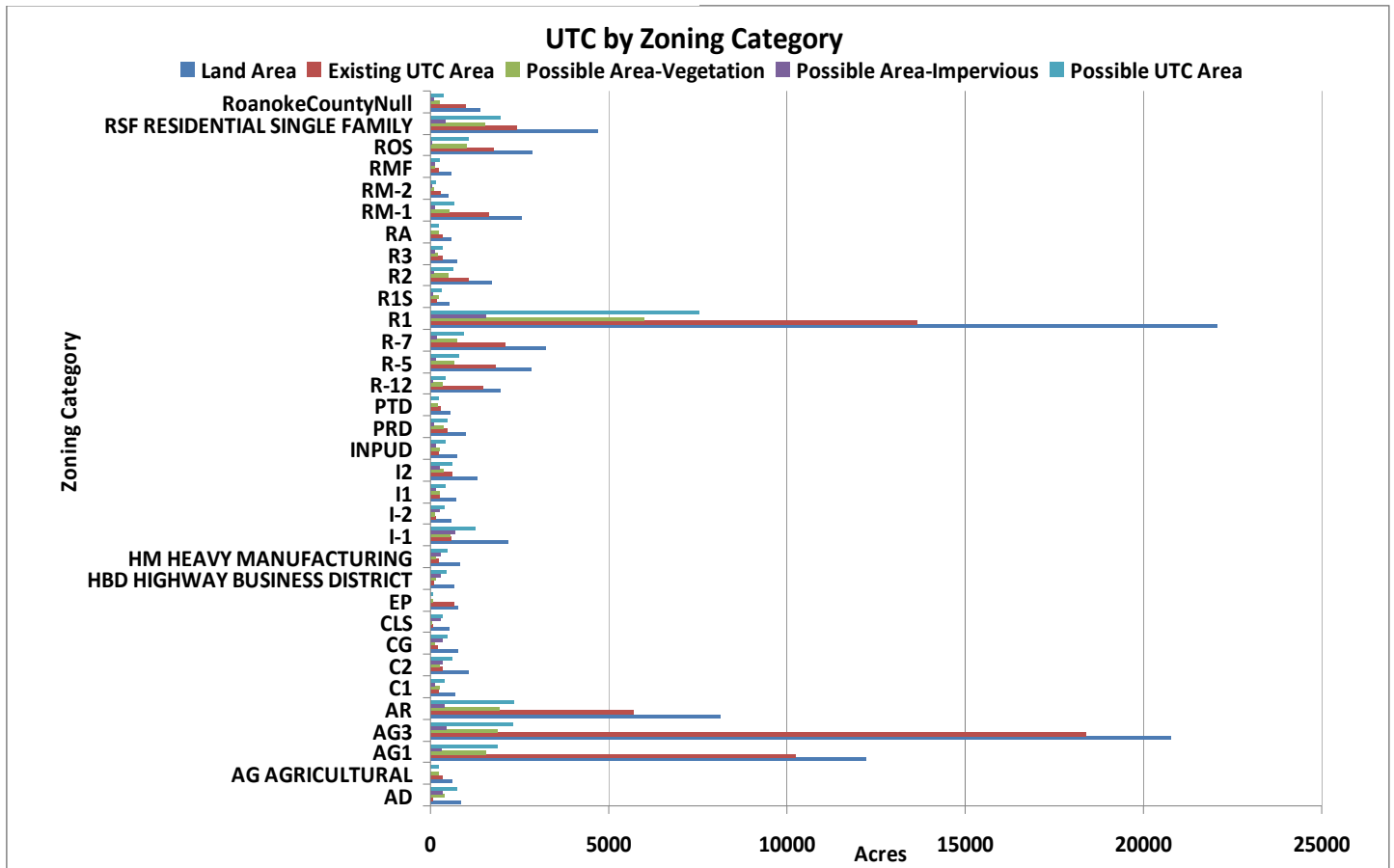


Figure 6a: UTC metrics for zoning categories with more than 500 acres of land area (not including water).

Urban Tree Canopy Summarized by Zoning Category

Zoning Category	Land Area (Acres)	Existing UTC		Possible UTC Vegetation		Possible UTC Impervious	
		% Land Area	% Zoning Category	% Land Area	% Zoning Category	% Land Area	% Zoning Category
AD	854	0.1%	9.4%	0.1%	47.9%	0.3%	39.1%
AG AGRICULTURAL	601	0.3%	58.4%	0.5%	39.0%	0.0%	2.4%
AG1	12206	10.1%	84.0%	15.1%	12.8%	0.3%	2.7%
AG3	20761	18.2%	88.6%	27.2%	9.0%	0.4%	2.2%
AR	8129	5.6%	69.9%	8.4%	23.9%	0.4%	4.9%
C1	700	0.2%	35.9%	0.4%	39.6%	0.1%	18.5%
C2	1057	0.3%	31.6%	0.5%	25.5%	0.3%	32.7%
CG	770	0.2%	26.4%	0.3%	17.4%	0.3%	43.7%
CLS	535	0.1%	14.7%	0.1%	11.8%	0.3%	55.3%
EP	760	0.7%	89.2%	1.0%	9.0%	0.0%	1.6%
HBD HIGHWAY BUSINESS DISTRICT	663	0.1%	16.6%	0.2%	22.7%	0.3%	46.1%
HM HEAVY MANUFACTURING	832	0.2%	27.6%	0.3%	19.8%	0.3%	36.5%
I-1	2190	0.6%	27.1%	0.9%	25.1%	0.7%	31.9%
I-2	585	0.2%	26.3%	0.2%	21.3%	0.3%	45.2%
I1	728	0.3%	36.9%	0.4%	35.4%	0.2%	21.6%
I2	1305	0.6%	47.2%	0.9%	28.1%	0.3%	19.7%
INPUD	744	0.2%	33.1%	0.4%	35.2%	0.2%	22.3%

$$\% \text{ Land} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all land}}$$

$$\% \text{ Category} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all land for specified land use}}$$

$$\% \text{ UTC Type} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all UTC type}}$$

The % Land Use value of 0.2% indicates that 0.2% of "INPUD" land is covered by tree canopy.

The % Category value of 33.1% indicates that 33.1% of RVARC's land area is tree canopy in areas where the land use is "INPUD".

The % UTC Type value of 0.4% indicates that 0.4% of all Existing UTC lies in areas of "R3" land use.

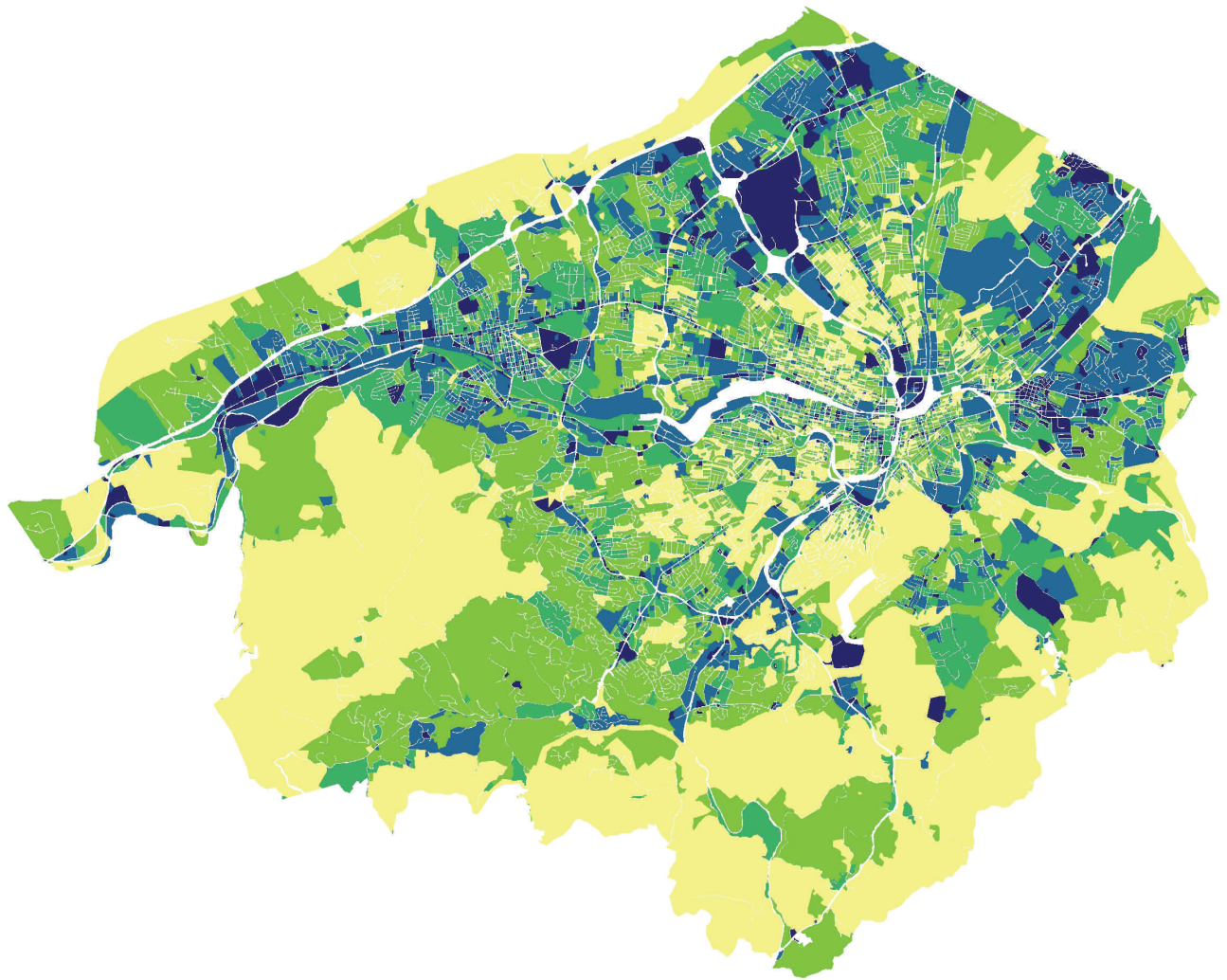
Table 3a: UTC metrics by type, summarized by zoning categories with greater than 500 acres. For each category UTC metrics were computed as a percent of all zoned land in the county (% Land Area), as a percent of land area by zoning categories (% Zoning Category) and as a percent of the area for the UTC type (% UTC Type).

Urban Tree Canopy Summarized by Zoning Category

Zoning Category	Land Area (Acres)	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
		% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type
PRD	987	0.5%	49.8%	0.7%	0.4%	37.5%	1.7%	0.1%	11.1%	1.3%
PTD	548	0.3%	55.6%	0.4%	0.2%	39.4%	1.0%	0.0%	3.5%	0.2%
R-12	1962	1.4%	74.1%	2.1%	0.3%	17.3%	1.6%	0.1%	4.0%	1.0%
R-5	2826	1.8%	65.0%	2.7%	0.6%	23.1%	3.0%	0.1%	5.2%	1.8%
R-7	3249	2.1%	64.7%	3.1%	0.7%	22.8%	3.4%	0.2%	5.7%	2.3%
R1	22069	13.5%	61.8%	20.1%	5.9%	27.1%	27.4%	1.5%	7.1%	19.1%
R1S	533	0.2%	35.4%	0.3%	0.2%	43.1%	1.1%	0.1%	16.6%	1.1%
R2	1727	1.0%	61.5%	1.6%	0.5%	29.5%	2.3%	0.1%	6.8%	1.4%
R3	747	0.3%	47.4%	0.5%	0.2%	29.7%	1.0%	0.1%	16.7%	1.5%
RA	574	0.3%	58.5%	0.5%	0.2%	40.6%	1.1%	0.0%	0.7%	0.0%
RM-1	2559	1.6%	64.7%	2.4%	0.5%	20.4%	2.4%	0.1%	5.7%	1.8%
RM-2	517	0.3%	57.3%	0.4%	0.1%	22.9%	0.5%	0.1%	9.8%	0.6%
RMF	579	0.2%	42.8%	0.4%	0.1%	23.7%	0.6%	0.1%	21.5%	1.5%
ROS	2858	1.8%	62.5%	2.6%	1.0%	35.3%	4.6%	0.1%	1.8%	0.6%
RSF RESIDENTIAL SINGLE FAMILY	4717	2.4%	51.5%	3.6%	1.5%	32.5%	7.0%	0.4%	9.3%	5.4%
RoanokeCountyNull	1371	1.0%	71.7%	1.5%	0.3%	19.2%	1.2%	0.1%	8.7%	1.5%

Table 3b: UTC metrics by type, summarized by zoning categories with greater than 500 acres. For each category UTC metrics were computed as a percent of all zoned land in the county (% Land Area), as a percent of land area by zoning categories (% Zoning Category) and as a percent of the area for the UTC type (% UTC Type).

Urban Tree Canopy Analysis Summarized by Zoning - RVARC, VA



0 0.5 1 2 3 4 5 Miles

UTC Possible Percent

■ 0% - 19%	■ 20% - 36%	■ 37% - 55%	■ 56% - 76%	■ 77% - 100%
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Canopy analysis completed 2009/12/15 JAP

Figure 7: Possible percentage increase of UTC mapped using zoning categories provided by RVARC.

Where to Plant Trees?

Decision makers can use GIS to find out specific UTC metrics for a parcel or set of parcels. This information can be used to estimate the amount of tree loss in a planned development or set UTC improvement goals for an individual property.

Attribute	Value
Land Use	Exempt Commercial
Owner	St Peter & Paul Catholic Church
Address	320 Cathedral Street
Existing UTC	5%
Possible UTC	72%
Possible UTC—Vegetation	47%
Possible UTC—Impervious	25%

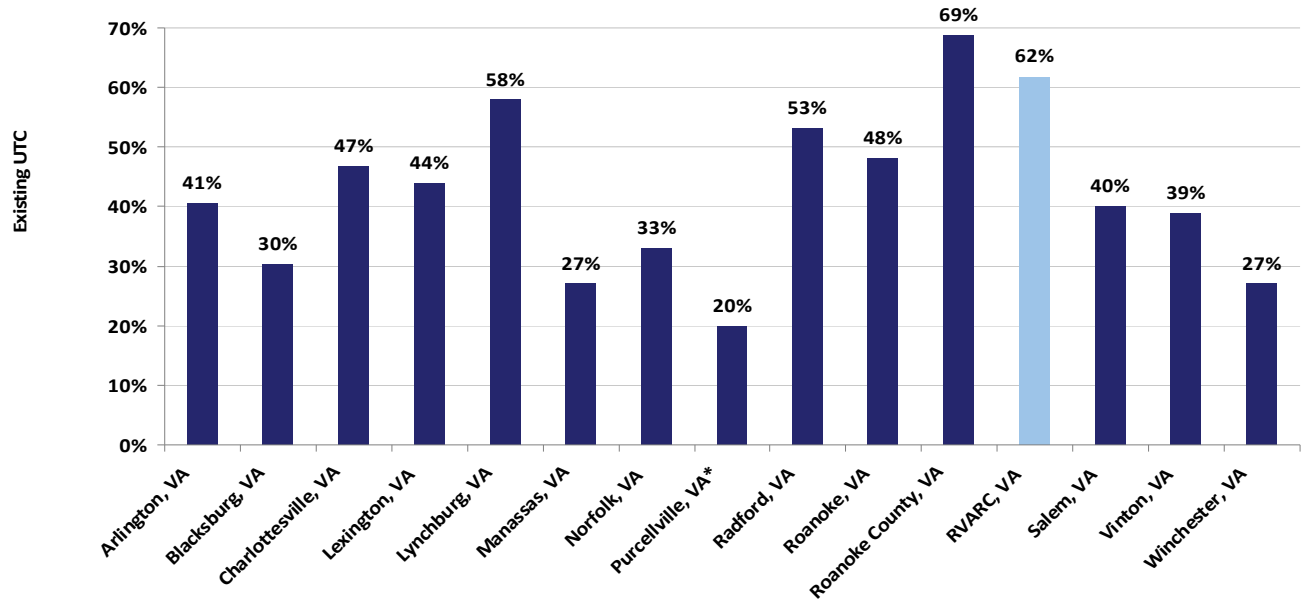


Figure 8: Parcel-based UTC metrics can be used to support targeted UTC.

Conclusions

- RVARC's urban tree canopy is a vital community asset, reducing storm water runoff, improving air quality, reducing the county's carbon footprint, enhancing quality of life, contributing to savings on energy bills, and serving as habitat for wildlife.
- With 62% tree canopy cover, RVARC has more UTC coverage than all other localities examined to date except Roanoke County. Figure 9 shows how RVARC compares to other Virginia localities participating in Urban Tree Canopy Assessments.
- When summarized by parcels, RVARC has 65.3% Existing UTC. 54.8% of all parcels have greater than 50% canopy coverage.
- 15.9% of RVARC's Possible UTC is within the R1 Zoning Category.

Urban Tree Canopy Comparison



Prepared by:

Jim Pugh
GIS/Remote Sensing Technician
Virginia Department of Forestry
900 Natural Resources Drive,
Suite 800
Charlottesville, VA 22903
(434) 220-9062
jim.pugh@dof.virginia.gov

Additional Information

The study was conducted with funding from the VDCR and VDOF. More information on the UTC assessment project can be found at the following web sites:
<http://www3.cnr.vt.edu/gep/VA.UTC.html>
<http://nrs.fs.fed.us/urban/utc/>



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