

# A Report on the City of Roanoke's Existing and Possible Urban Tree Canopy

## Project Background

The analysis of the City of Roanoke's urban tree canopy (UTC) was carried out by the Virginia Department of Forestry in collaboration with the City of Roanoke 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 the City of Roanoke. 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 city 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.

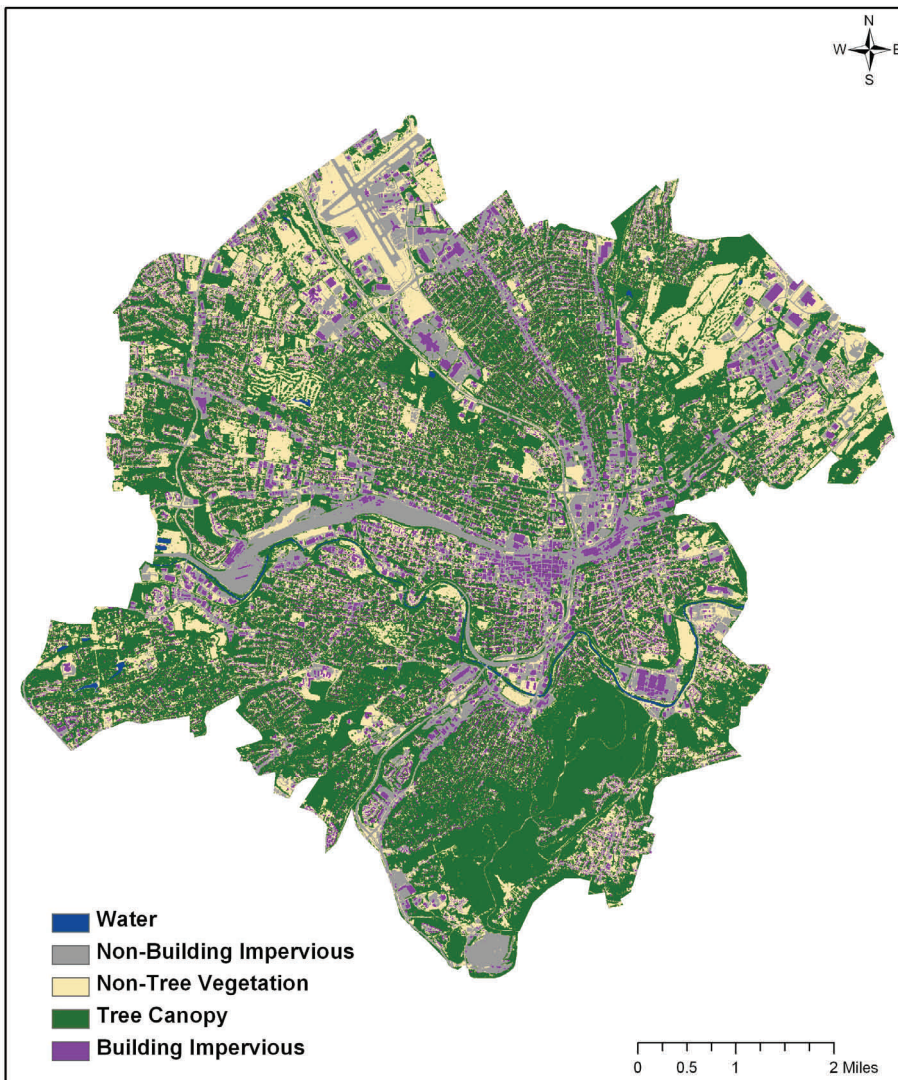
**Land Cover:** Physical features on the earth mapped from satellite or aerial imagery such as trees, or water.

**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 Roanoke Have?

Figure 1 shows the urban tree canopy (UTC) analysis for Roanoke, which is derived from high resolution aerial imagery. 13146 acres of Roanoke is covered by tree canopy (termed Existing UTC). This corresponds to 48.1% of all land area within the city (Table 1). An additional 8980 acres of the city could theoretically be improved to support urban tree canopy (termed Possible UTC), Table 2.

UTC Classes	Existing UTC		
	Acres	% Total Area	% Land Area
<b>Tree Canopy</b>	13146	47.9%	48.1%
<b>Non-Tree Vegetation</b>	6616	24.1%	24.2%
<b>Non-Building Impervious</b>	5757	21.0%	21.0%
<b>Buildings</b>	1838	6.7%	6.7%
<b>Water</b>	105	0.4%	0.0%
<b>Total Area</b>	27461	100%	100%

Table 1: Existing UTC area and percentages for the City \* % Total Area includes area covered by water.

Figure 1: Land cover for the City of Roanoke.

## Mapping Roanoke'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 city 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" Roanoke'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.

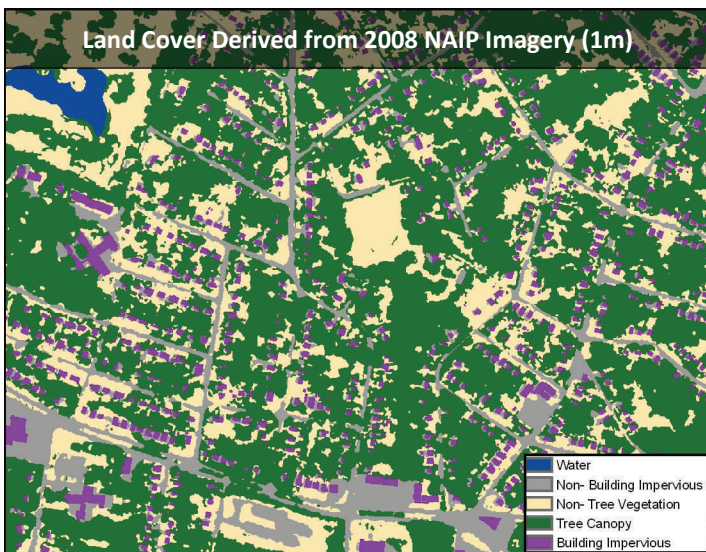
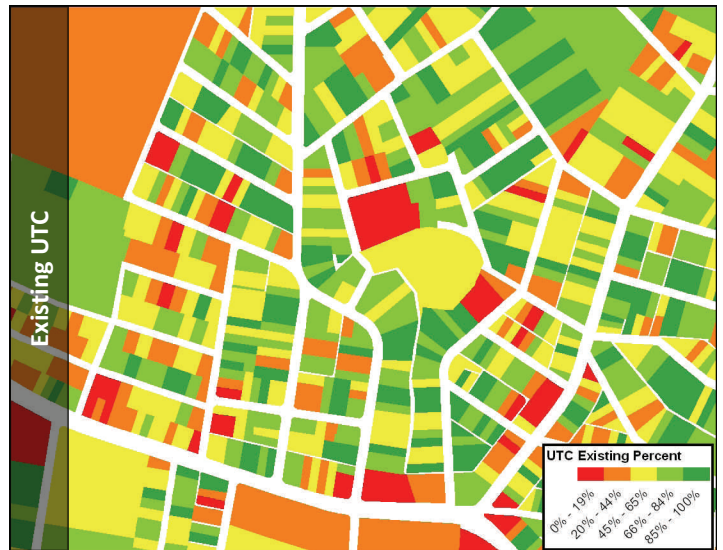
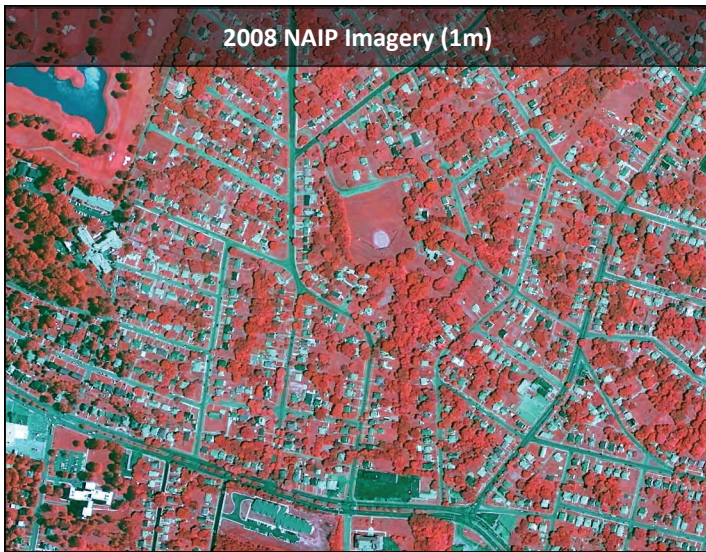
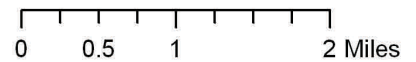
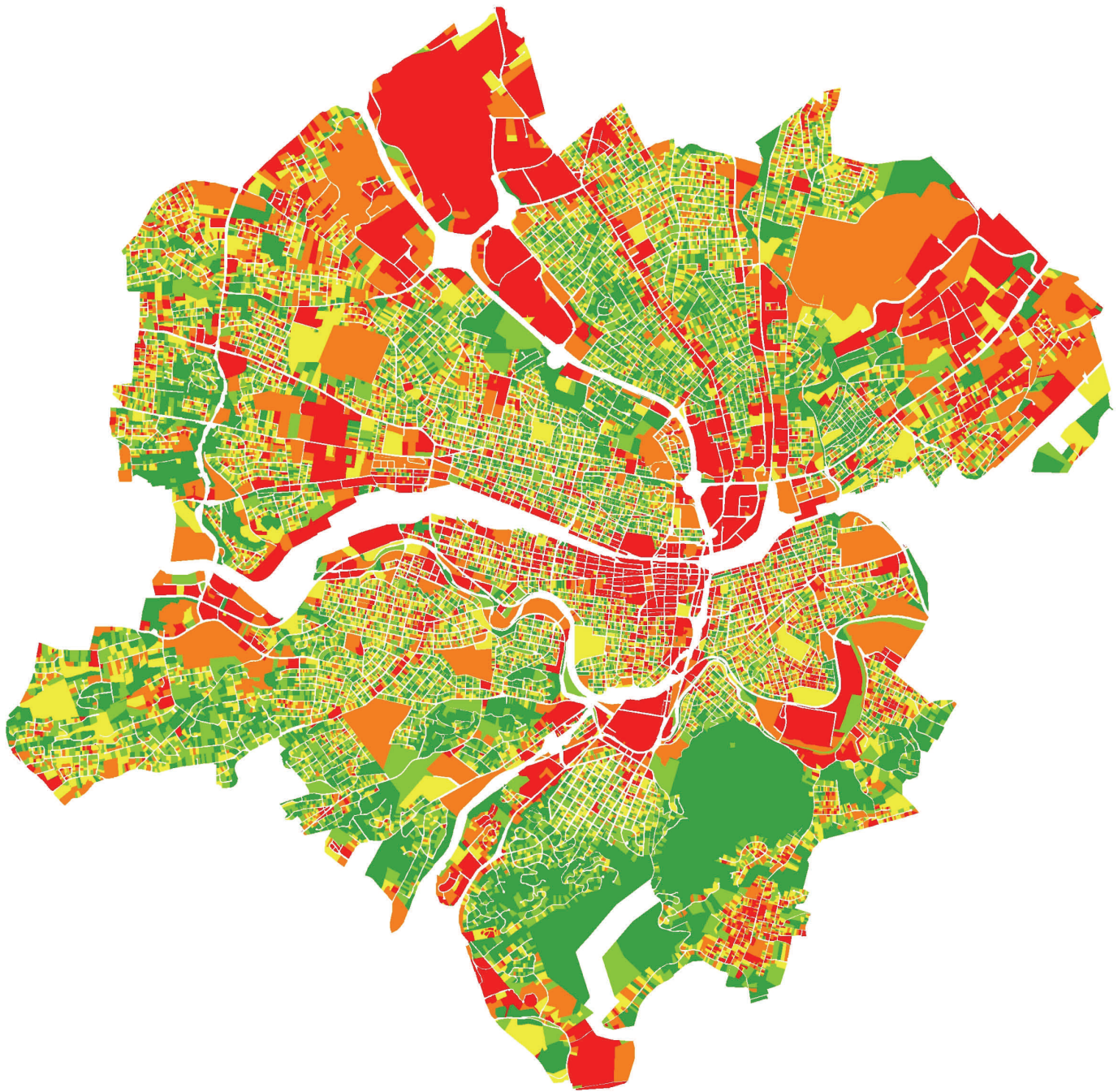


Figure 2a, 2b: Comparison of 2008 NAIP imagery to the resulting high-resolution land cover.

Figure 3: UTC metrics summarized at the property parcel level

# Urban Tree Canopy Analysis Summarized by Property Parcels - Roanoke, VA



UTC Existing Percent	
0% - 19%	45% - 65%
20% - 44%	66% - 84%
	85% - 100%



Figure 4: UTC metrics summarized by property parcel.

## Urban Tree Canopy Summarized by Property Parcels

Using the parcel data provided by the City of Roanoke, Existing and Possible UTC were summarized by property parcels. This summary excludes any area outside of property parcel boundaries and areas covered by water. Roanoke has 51.7% (11,553 acres) Existing UTC and 40.2% (8980 acres) Possible UTC. Possible UTC has two components, Possible UTC - Vegetation and Possible UTC - Impervious. 25.2% (5634 acres) of parcel land area is associated with Possible UTC - Vegetation. 15.0% (3346 acres) of parcel land area is associated with Possible UTC - Impervious (Figure 5). Figure 4 shows Existing UTC throughout the City of Roanoke.

## Urban Tree Canopy Summarized by Zoning

Using the zoning data provided by the City of Roanoke, Existing and Possible UTC were summarized by zoning category (page 5). The zoning category R-7 has the largest amount of land area with 3,255 acres (Table 3). The R-7 category also contains 18.4% of the Existing UTC in the city. Zoning Categories R-5 and RM-1 are 2nd (16.0%) and 3rd (14.4%) in Existing UTC respectively. Figure 6 compares zoning categories with greater than 100 acres by the amount of land area within the categories. Figure 7 shows the spatial distribution of Possible UTC by Zoning category for the City.

UTC Parcel Metrics	Acres	% Parcel Land Area
Parcel Land Area	22331	100%
Existing UTC	11553	51.7%
Possible UTC	8980	40.2%
Possible UTC - Vegetation	5634	25.2%
Possible UTC - Impervious	3346	15.0%
Not Suitable for UTC	1942	8.7%

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.

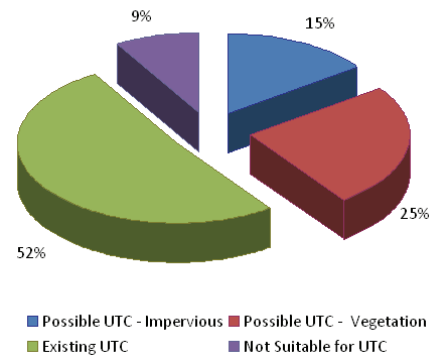


Figure 5: Pie chart showing Roanoke UTC distribution.

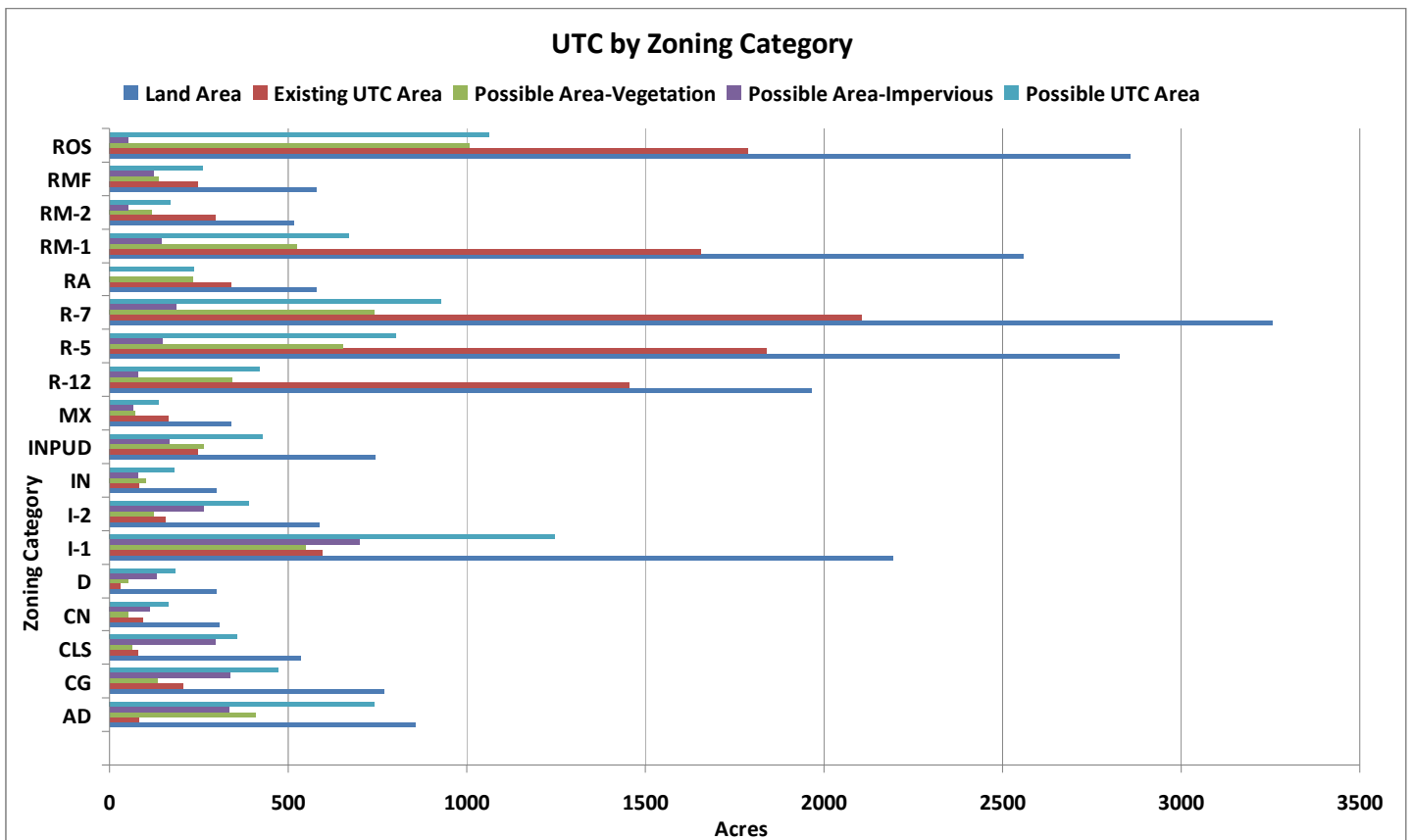


Figure 6: UTC metrics for zoning categories with more than 100 acres of land area (not including water).

## Urban Tree Canopy Summarized by Zoning Category

Zoning Category	Land Area (Acres)	Existing UTC		Possible UTC Vegetation		Possible UTC Impervious				
		% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type
AD	854	0.4%	9.4%	0.7%	1.9%	47.9%	7.3%	1.5%	39.1%	10.2%
CG	770	0.9%	26.4%	1.8%	0.6%	17.4%	2.4%	1.5%	43.7%	10.3%
CLS	535	0.4%	14.7%	0.7%	0.3%	11.8%	1.1%	1.3%	55.3%	9.0%
CN	307	0.4%	30.2%	0.8%	0.2%	16.7%	0.9%	0.5%	37.1%	3.5%
D	298	0.1%	10.3%	0.3%	0.2%	17.3%	0.9%	0.6%	43.9%	4.0%
I-1	2192	2.7%	27.1%	5.2%	2.5%	25.1%	9.9%	3.2%	31.9%	21.3%
I-2	586	0.7%	26.4%	1.4%	0.6%	21.3%	2.2%	1.2%	45.2%	8.1%
IN	300	0.4%	26.9%	0.7%	0.5%	34.0%	1.8%	0.4%	26.3%	2.4%
INPUD	745	1.1%	33.2%	2.2%	1.2%	35.2%	4.7%	0.8%	22.3%	5.1%
IMX	338	0.7%	48.4%	1.4%	0.3%	20.9%	1.3%	0.3%	19.4%	2.0%
R-12	1965	6.6%	74.1%	12.7%	1.5%	17.4%	6.1%	0.4%	4.0%	2.4%
R-5	2828	8.3%	65.0%	16.0%	3.0%	23.1%	11.7%	0.7%	5.2%	4.5%
R-7	3255	9.5%	64.7%	18.4%	3.4%	22.8%	13.3%	0.8%	5.7%	5.6%
RA	578	1.5%	58.7%	3.0%	1.1%	40.3%	4.2%	0.0%	0.7%	0.1%
RM-1	2559	7.5%	64.7%	14.4%	2.4%	20.4%	9.4%	0.7%	5.7%	4.4%
RM-2	517	1.3%	57.3%	2.6%	0.5%	22.9%	2.1%	0.2%	9.8%	1.6%
RMF	579	1.1%	42.8%	2.2%	0.6%	23.7%	2.5%	0.6%	21.5%	3.8%
ROS	2859	8.1%	62.5%	15.6%	4.6%	35.3%	18.1%	0.2%	1.8%	1.6%

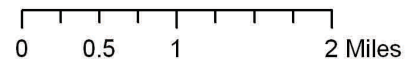
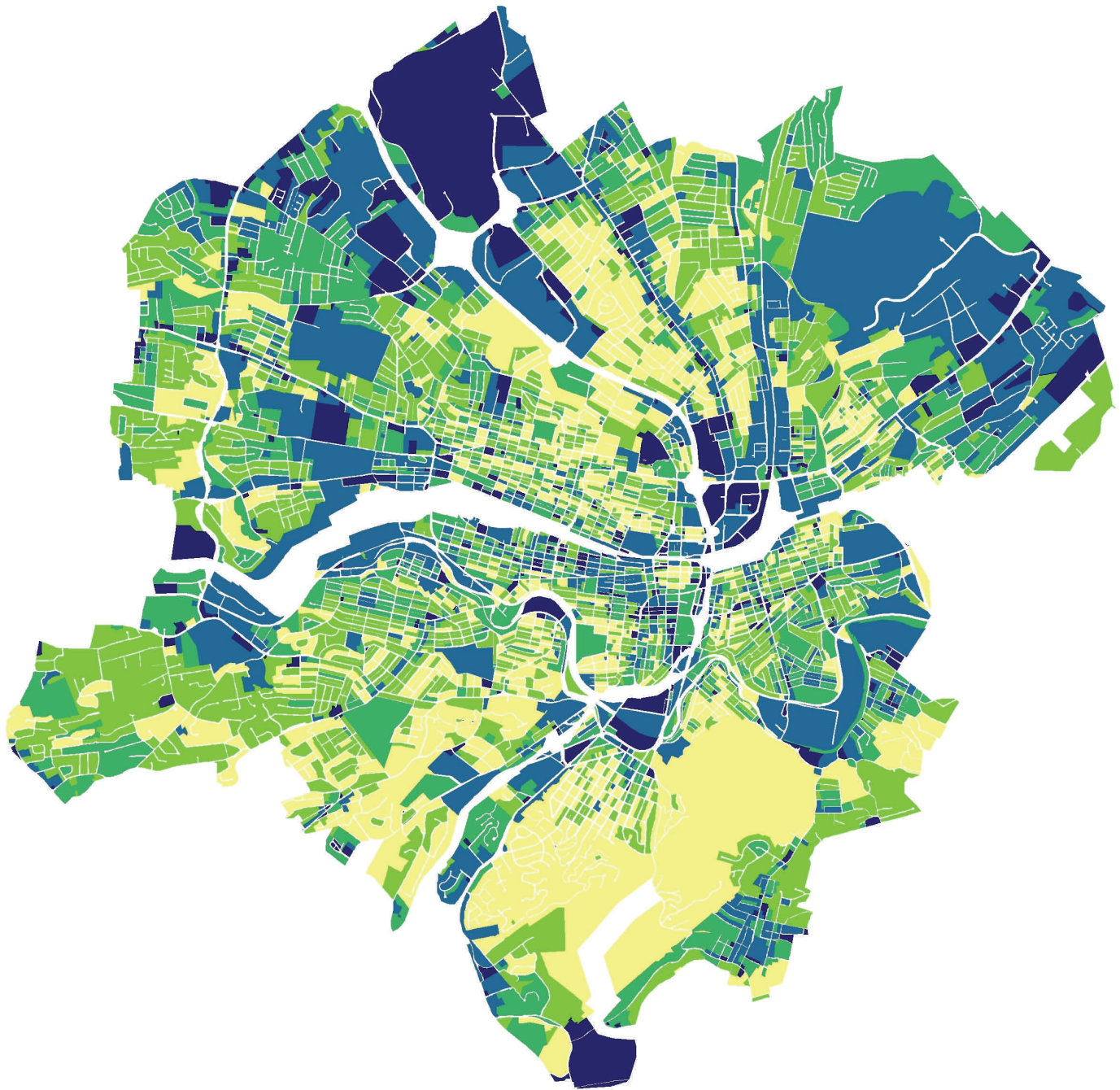
$\% \text{ Land} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all land}}$   
 The % Land Use value of 8.1% indicates that 8.1% of "ROS" land is covered by tree canopy.

$\% \text{ Category} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all land for specified land use}}$   
 The % Category value of 62.5% indicates that 62.5% of Roanoke's land area is tree canopy in areas where the land use is "ROS".

$\% \text{ UTC Type} = \frac{\text{Area of UTC type for specified land use}}{\text{Area of all UTC type}}$   
 The % UTC Type value of 15.6% indicates that 15.6% of all Existing UTC lies in areas of "ROS" land use.

Table 3: UTC metrics by type, summarized by zoning categories. For each category UTC metrics were computed as a percent of all zoned land in the city (% 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 - Roanoke, VA



Zoning - UTC Possible Percent	
0% - 18%	34% - 51%
19% - 33%	52% - 73%
	73% - 100%



Figure 7: Possible percentage increase of UTC mapped using zoning categories provided by the City of Roanoke.

## 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%

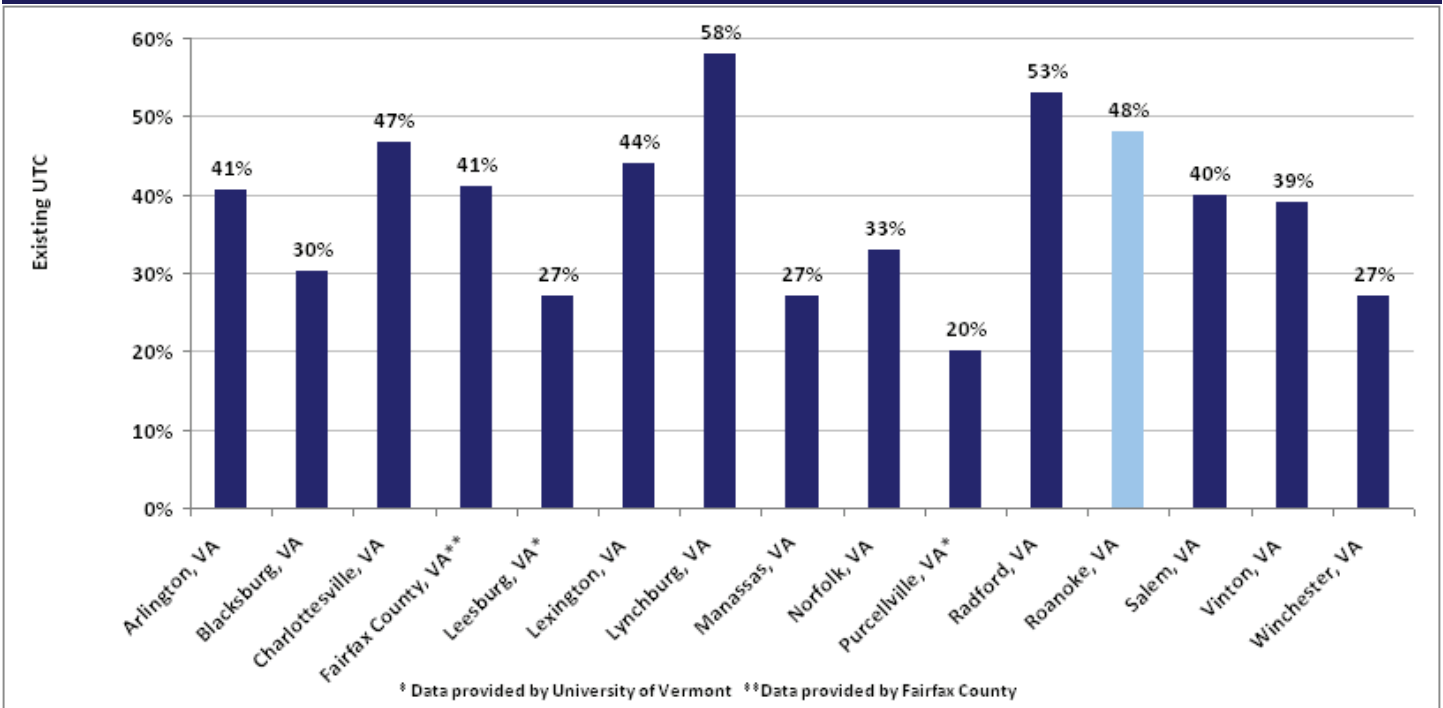


Figure 8: Parcel-based UTC metrics can be used to support targeted UTC.

## Conclusions

- Roanoke's urban tree canopy is a vital community asset, reducing storm water runoff, improving air quality, reducing the city's carbon footprint, enhancing quality of life, contributing to savings on energy bills, and serving as habitat for wildlife.
- With 48% tree canopy cover, Roanoke has similar coverage to Lexington and Charlottesville. Figure 9 shows how Roanoke compares to other Virginia localities participating in Urban Tree Canopy Assessments.
- When summarized by parcels, Roanoke has 51.7% Existing UTC. Only 20.8% of all parcels have less than 30% canopy coverage.

## Urban Tree Canopy Comparison



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### 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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