

A Report on Woodstock's Existing and Possible Urban Tree Canopy

Project Background

The analysis of the City of Woodstock's urban tree canopy (UTC) was carried out by the Virginia Department of Forestry. 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 Woodstock. 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.

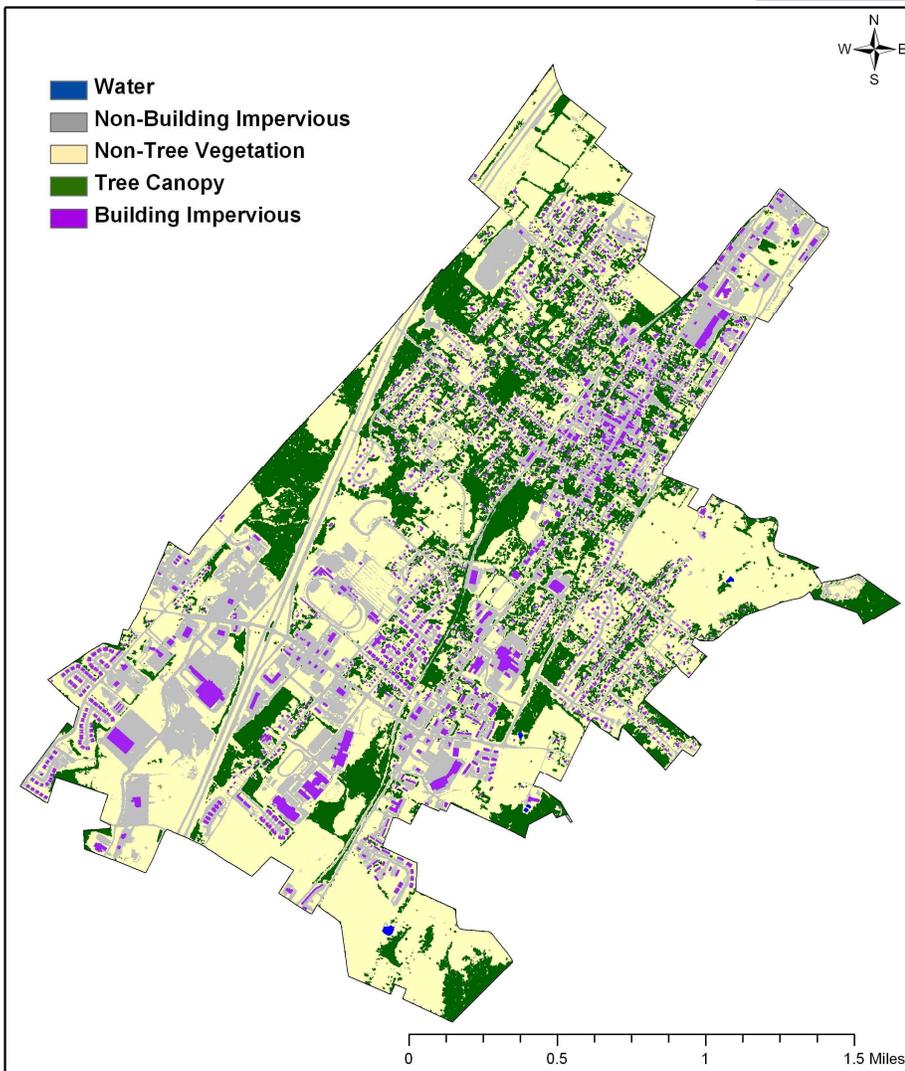
Land Cover: Physical features on the earth mapped from satellite or aerial imagery such as trees, or water.

Existing UTC: The amount of UTC present within the city boundary..

Possible UTC: The amount of land that is theoretically available for the establishment of tree canopy within the city boundary. 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 the city boundary. 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. This excludes areas covered by tree canopy, non-tree vegetation, roads, buildings, and water.



How Much Tree Canopy Does Woodstock Have?

Figure 1 shows the urban tree canopy (UTC) analysis for Woodstock, which is derived from high resolution aerial imagery. **529** acres of Woodstock is covered by tree canopy (termed Existing UTC). This corresponds to **21.7%** of all land area within the city (Table 1). An additional **1552** 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
Tree Canopy	529	21.7%	21.7%
Non-Tree Vegetation	1225	50.2%	50.3%
Non-Building Impervious	547	22.4%	22.4%
Buildings	136	5.6%	5.6%
Water	1	0.1%	0.0%
Total Area	2438	100.0%	100.0%

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 Woodstock.

Mapping Woodstock'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" Woodstock'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 category of land (Figure 3). Using this data, ownership patterns for Existing UTC and Possible UTC (Figure 4) can be examined.

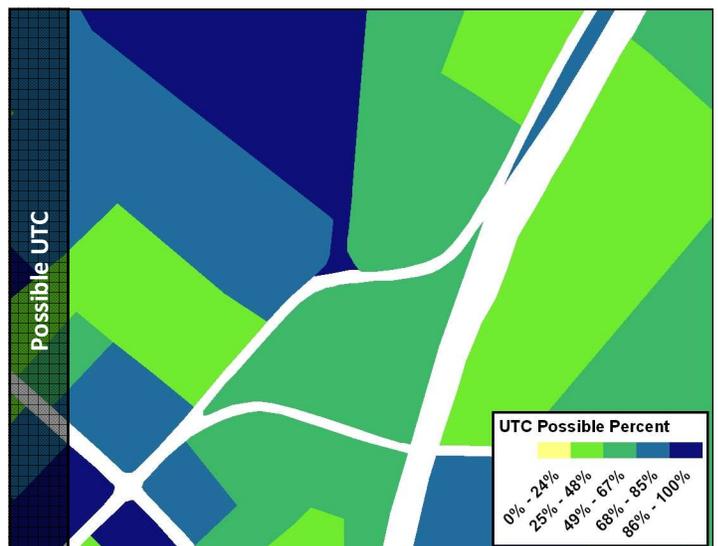
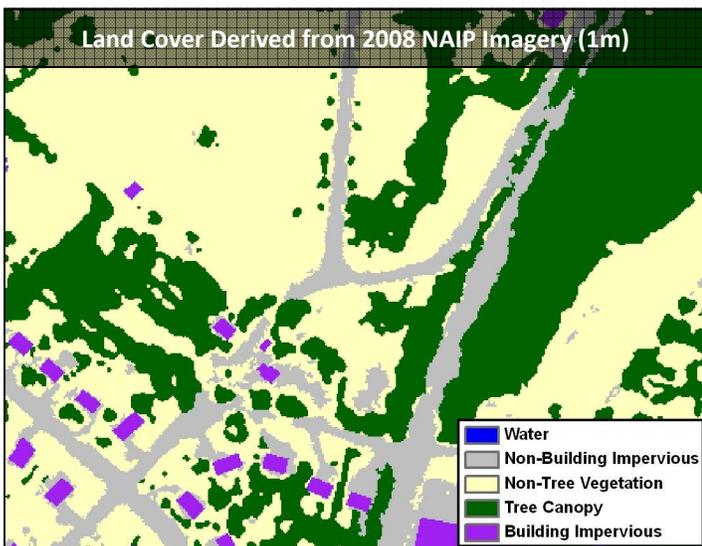
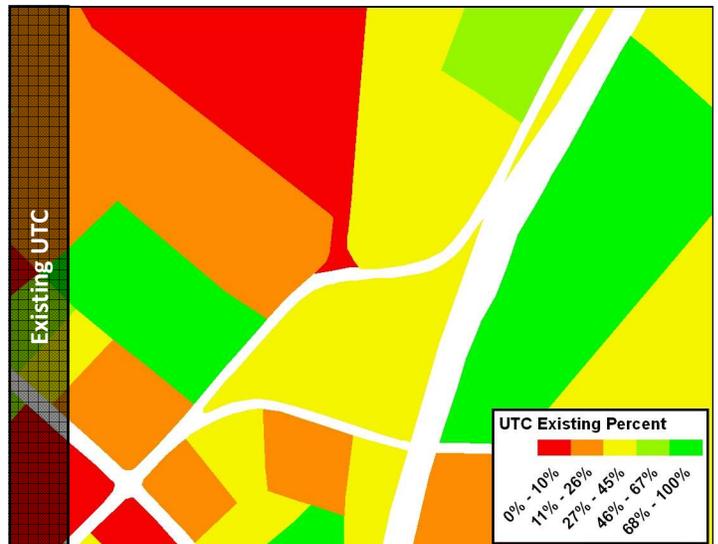
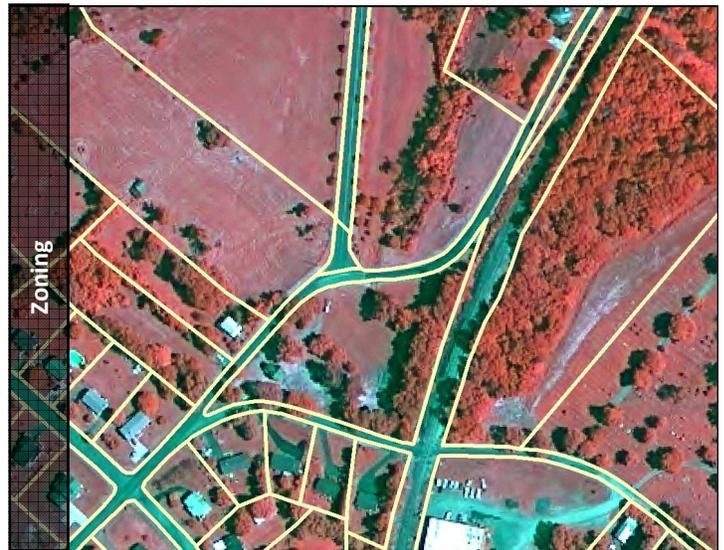
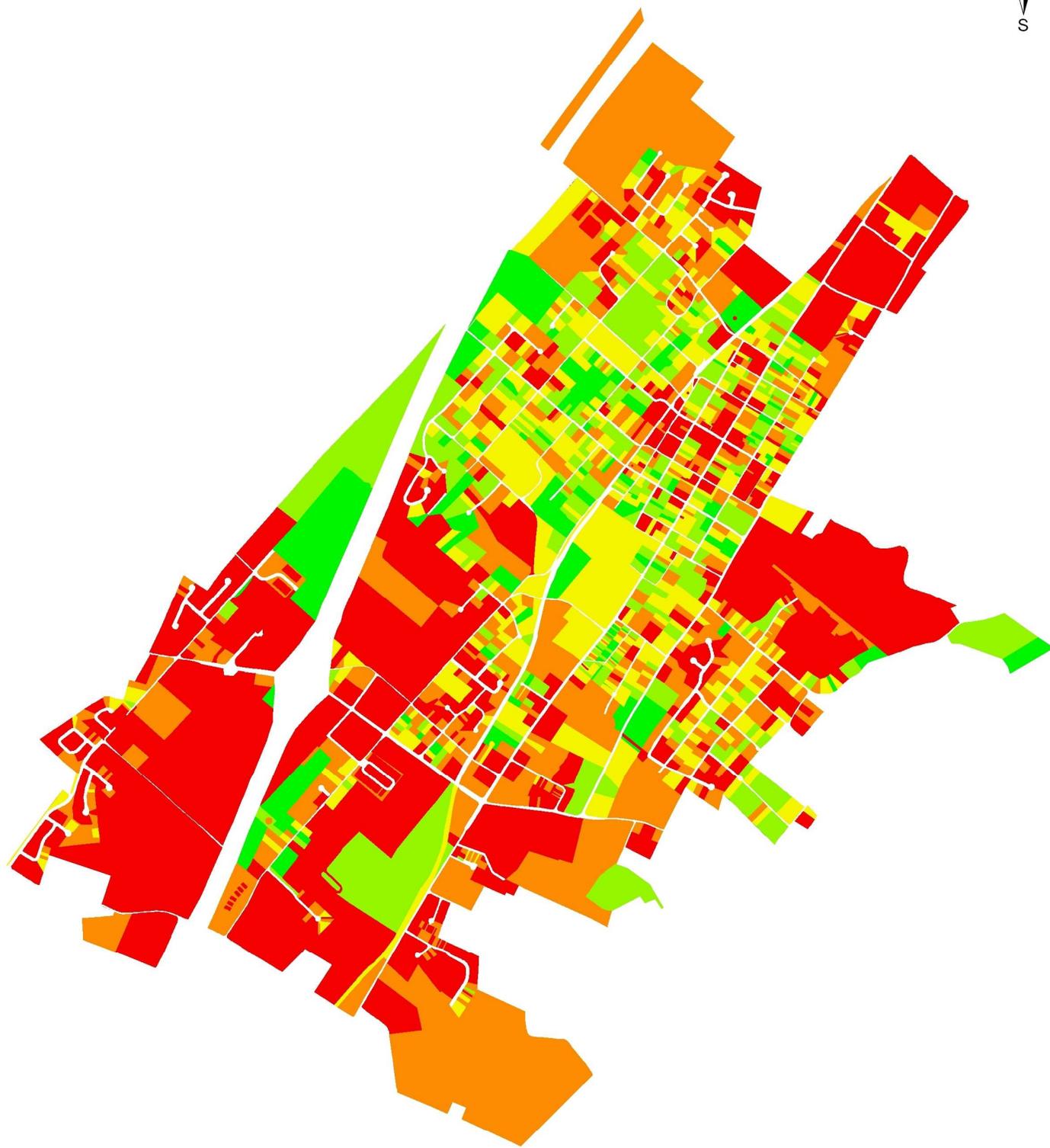


Figure 2a, 2b: Comparison of 2008 NAIP imagery to the resulting high-resolution land cover.

Figure 3: UTC metrics summarized at the property parcel level

Existing Urban Tree Canopy Summarized by Parcel - Woodstock, VA



0 0.5 1 1.5 Miles

UTC Existing Percent	
0% - 10%	27% - 45%
11% - 26%	46% - 67%
	68% - 100%



Figure 4: Existing UTC summarized by Property Parcel.

Urban Tree Canopy Summarized by Property Parcel

Using data provided by the City of Woodstock, Existing and Possible UTC were summarized by property parcel. This summary excludes any area outside of zoning boundaries and areas covered by water. Based on this analysis Woodstock has 23.4% (515 acres) Existing UTC and 70.4% (1552 acres) Possible UTC (Figure 5). Possible UTC has two components, Possible UTC - Vegetation and Possible UTC - Impervious. 52.3% (1153 acres) of zoning land area is associated with Possible UTC - Vegetation. 18.1% (399 acres) of zoning land area is associated with Possible UTC - Impervious. Figure 4 shows Existing UTC throughout the City of Woodstock.

Using the zoning data provided by the City of Woodstock, Existing and Possible UTC were summarized by Subdivision (page 5). The subdivision Falcon Place has the largest amount of land area with 141 acres (Table 3) but contains less than 9% UTC. Shenwood East has the highest percentage of existing UTC (49.1%) followed by Towering Heights with 45.3% and Park Manor Estates with 44.6%. Figure 6 compares subdivisions by the amount of UTC area within each. Figure 7 shows the spatial distribution of Possible UTC by property parcel for the City.

UTC Parcel Metrics	Acres	% Parcel Land Area
Parcel Land Area	2204	100.00%
Existing UTC	515	23.4%
Possible UTC	1552	70.4%
Possible UTC - Vegetation	1153	52.3%
Possible UTC - Impervious	399	18.1%
Not Suitable for UTC	138	6.3%

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

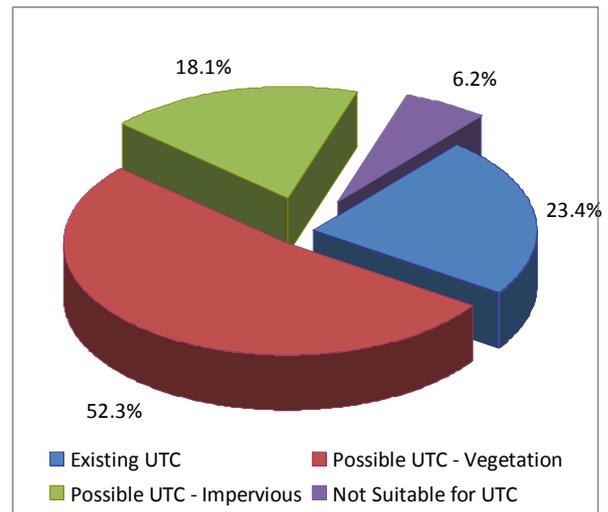


Figure 5: Pie chart showing Woodstock UTC distribution.

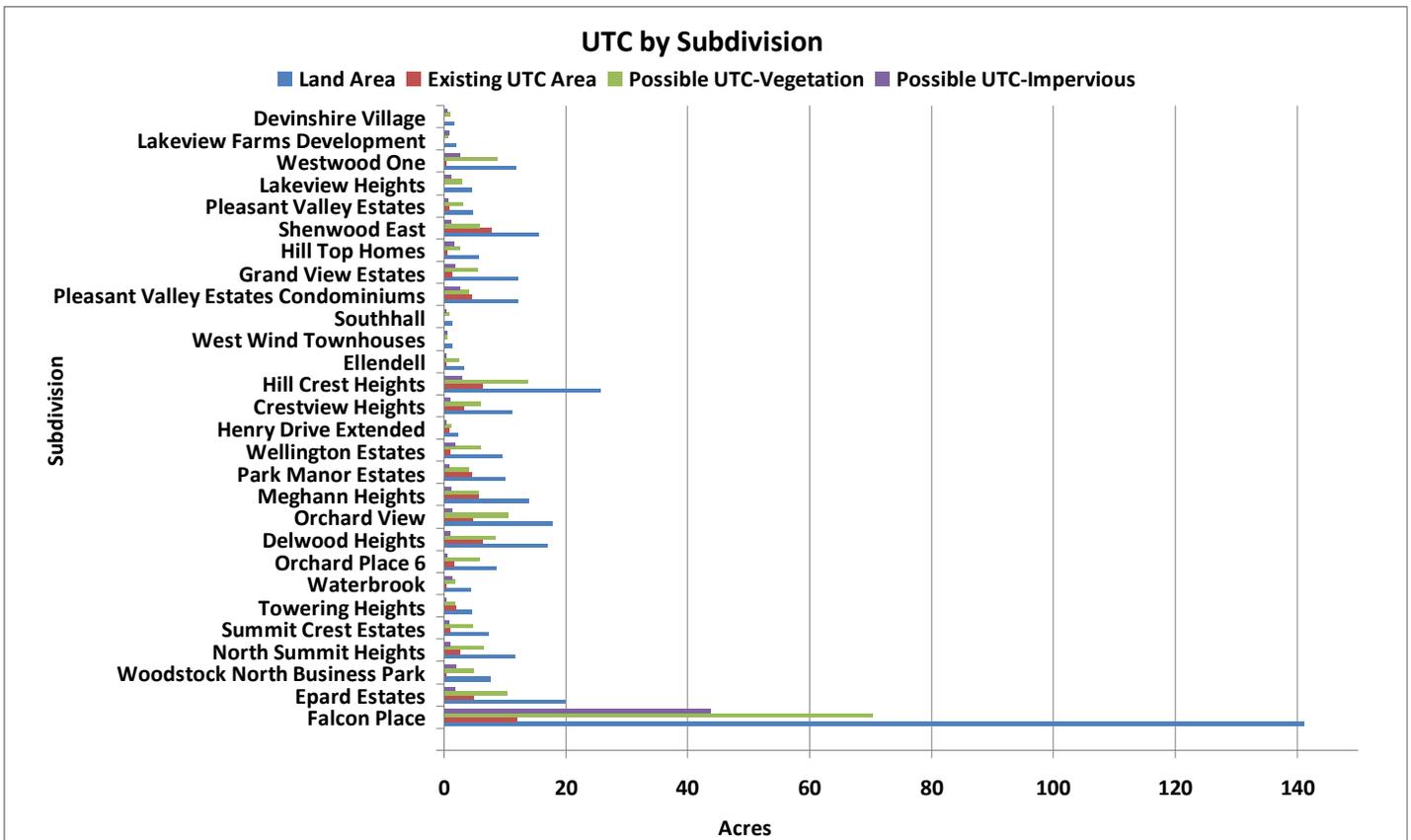


Figure 6: UTC metrics for subdivisions.

Urban Tree Canopy Summarized by Subdivision

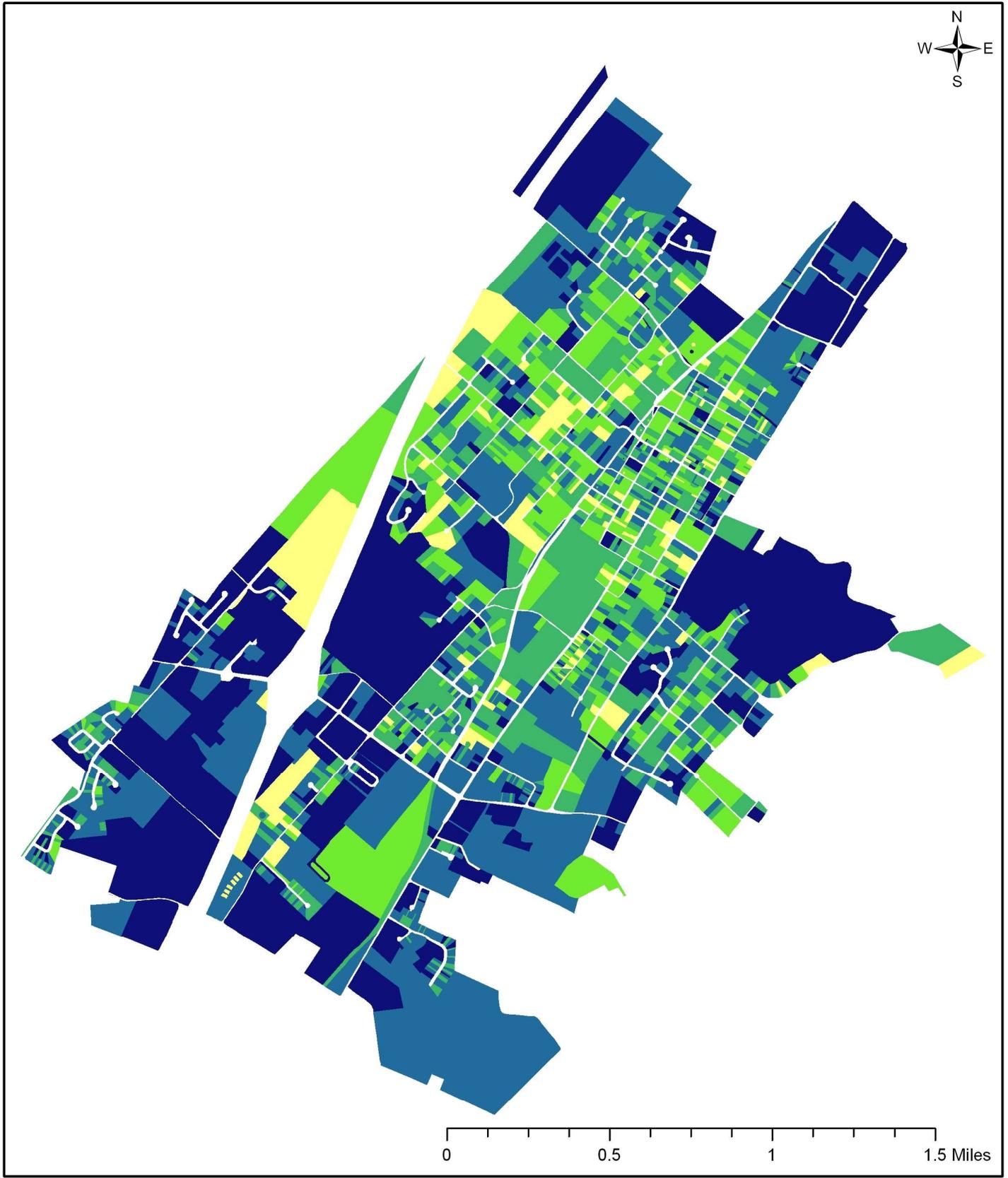
Subdivision	Land Area (Acres)	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
		% Land Area	% Subdivision	% UTC Type	% Land Area	% Subdivision	% UTC Type	% Land Area	% Subdivision	% UTC Type
Falcon Place	141	3.1%	8.5%	16.3%	18.1%	49.9%	35.1%	11.2%	31.0%	21.8%
Hill Crest Heights	26	1.6%	24.8%	8.6%	3.5%	53.3%	6.8%	0.8%	11.5%	1.5%
Epard Estates	20	1.3%	24.9%	6.7%	2.7%	52.3%	5.2%	0.5%	9.9%	1.0%
Orchard View	18	1.2%	26.7%	6.4%	2.7%	59.5%	5.3%	0.4%	8.3%	0.7%
Delwood Heights	17	1.6%	37.0%	8.5%	2.1%	48.8%	4.2%	0.2%	5.2%	0.4%
Shenwood East	16	2.0%	49.1%	10.4%	1.5%	37.7%	2.9%	0.3%	7.4%	0.6%
Meghann Heights	14	1.5%	41.4%	7.8%	1.5%	41.3%	2.9%	0.3%	8.1%	0.6%
Grand View Estates	12	0.3%	10.3%	1.7%	1.4%	45.6%	2.8%	0.5%	15.6%	1.0%
Pleasant Valley Estates Condominiums	12	1.2%	37.2%	6.1%	1.1%	34.1%	2.1%	0.7%	22.6%	1.4%
Westwood One	12	0.1%	2.4%	0.4%	2.2%	73.5%	4.3%	0.7%	22.1%	1.3%
North Summit Heights	12	0.7%	22.7%	3.6%	1.7%	55.6%	3.3%	0.2%	8.0%	0.5%
Crestview Heights	11	0.9%	30.2%	4.6%	1.5%	53.6%	3.0%	0.2%	8.7%	0.5%
Park Manor Estates	10	1.2%	44.6%	6.1%	1.1%	40.8%	2.1%	0.2%	7.8%	0.4%
Wellington Estates	10	0.2%	9.1%	1.2%	1.6%	63.2%	3.0%	0.5%	20.2%	1.0%
Orchard Place 6	9	0.4%	19.6%	2.3%	1.5%	67.4%	2.9%	0.1%	5.4%	0.2%
Woodstock North Business Park	8	0.1%	4.1%	0.4%	1.2%	63.6%	2.4%	0.5%	26.5%	1.0%
Summit Crest Estates	7	0.3%	13.4%	1.3%	1.2%	65.9%	2.4%	0.2%	10.3%	0.4%
Hill Top Homes	6	0.1%	7.0%	0.5%	0.7%	48.0%	1.4%	0.4%	30.4%	0.9%
Pleasant Valley Estates	5	0.2%	16.6%	1.1%	0.8%	65.7%	1.6%	0.1%	12.2%	0.3%
Towering Heights	5	0.5%	45.3%	2.8%	0.5%	41.2%	1.0%	0.1%	6.6%	0.2%
Lakeview Heights	5	0.0%	3.4%	0.2%	0.8%	65.1%	1.5%	0.3%	24.0%	0.5%

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

The % Land Use value of 0.5% indicates that 0.5% of "ROS" land is covered by tree canopy.
 The % Category value of 45.3% indicates that 45.3% of Roanoke's land area is tree canopy in areas where the land use is "ROS".
 The % UTC Type value of 2.8% indicates that 2.8% 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 (% Subdivision) and as a percent of the area for the UTC type (% UTC Type).

Possible Urban Tree Canopy Summarized by Parcel - Woodstock, VA



UTC Possible Percent	
0% - 24%	49% - 67%
25% - 48%	68% - 85%
	86% - 100%

Figure 7: Possible percentage increase of UTC by Property Parcel.

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%

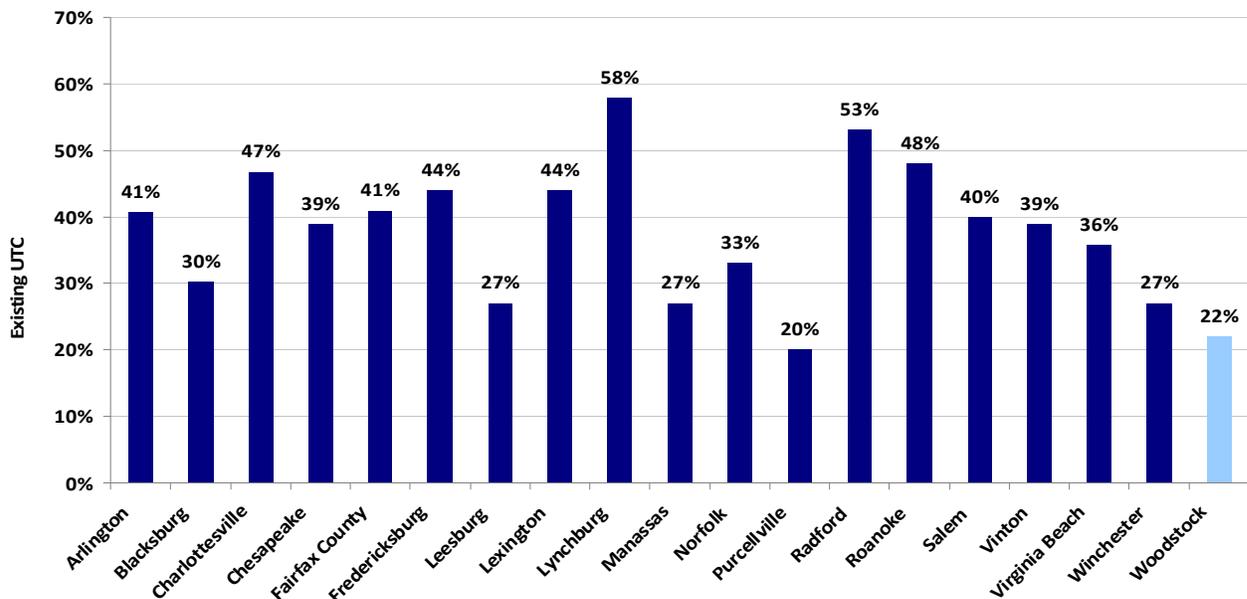


Figure 8: Parcel-based UTC metrics can be used to support targeted UTC.

Conclusions

- Woodstock'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 22% tree canopy cover, Woodstock has slightly more UTC than Purcellville and slightly less than Leesburg and Manassas. Figure 9 shows how Woodstock compares to other Virginia localities participating in Urban Tree Canopy Assessments.
- The Subdivisions with the highest percentage of Possible UTC are Westwood One and with 95.6% and 90.1% respectively.

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 Virginia Department of Forestry and the Chesapeake Bay Program. More information on the UTC assessment project can be found at the following web sites:
http://www.gep.frec.vt.edu/va_utc.html

