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

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, saving energy, lowering city temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits.

How Much Tree Canopy Does Cumberland Have?

An analysis of Cumberland's urban tree canopy (UTC) based on high resolution aerial imagery found that more than 3107 acres of the city is covered by tree canopy (termed Existing UTC). This corresponds to 49% of all land within the city. An additional 32% (2058 acres) of the city could theoretically be improved to support urban tree canopy (termed Possible UTC).

Unlike many other urban communities the City of Cumberland has several contiguous forested areas that are more than 20 acres in size (Figure 1). These large forested patches contain 60% of the city's tree canopy. Within the city's more urbanized areas Existing UTC is 27% and Possible UTC is 46%. (Figure 2).

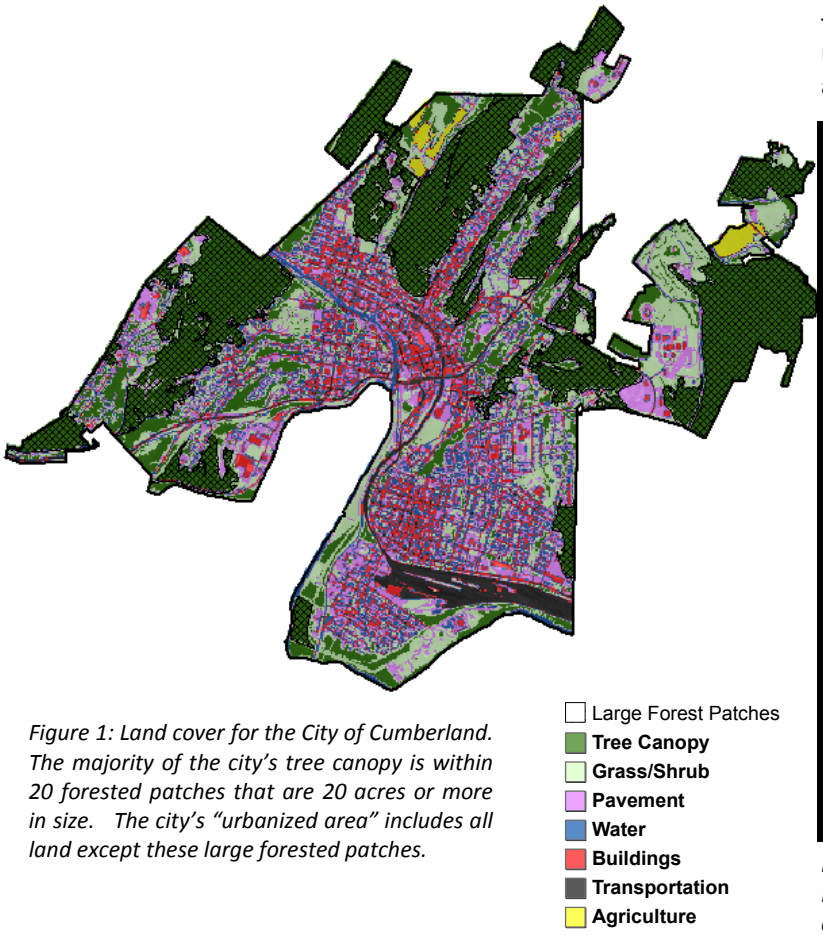

Figure 1: Land cover for the City of Cumberland. The majority of the city's tree canopy is within 20 forested patches that are 20 acres or more in size. The city's "urbanized area" includes all land except these large forested patches.

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 imagery such as trees, grass, water, and impervious surfaces.

Existing UTC: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.

Possible UTC: The amount of land that is theoretically available for the establishment of tree canopy. Possible UTC excludes areas covered by tree canopy, roads, buildings, and water.

Project Background

The analysis of Cumberland's urban tree canopy (UTC) was carried out at the request of the Maryland Department of Natural Resources in collaboration with the City of Cumberland and the Chesapeake Bay Program. The analysis was performed by the Spatial Analysis Laboratory (SAL) of the University of Vermont's Rubenstein School of the Environment and Natural Resources in consultation with the USDA Forest Service's Northern Research Station

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to the City of Cumberland. This analysis was conducted based on year 2007 data.

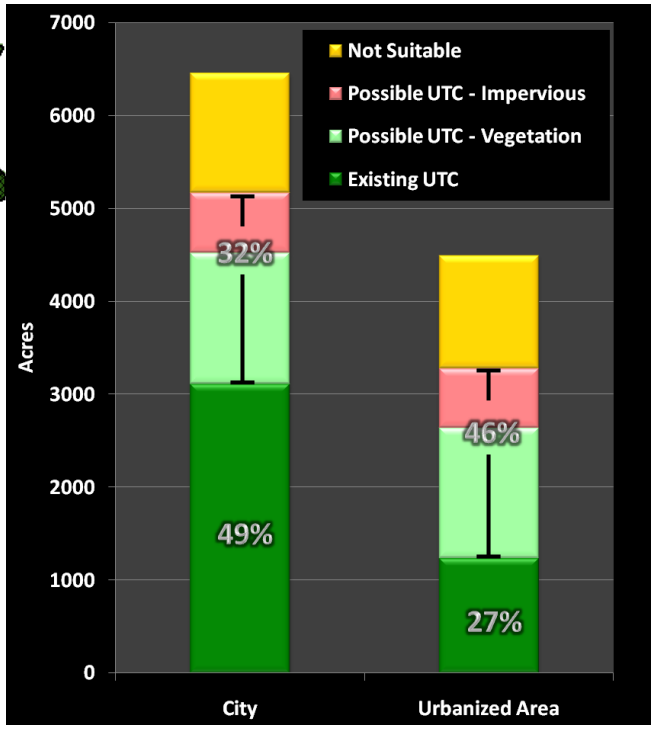

Figure 2: UTC metrics for the city and the city's urbanized areas. Percentages are based on % of land area. The urbanized area excludes forest patches that are 20 acres or larger. Percentages represent the proportion of Existing/Possible UTC of all land in the city and urbanized area.

Mapping Cumberland's Trees

Prior to this study the only available estimates of tree canopy for Cumberland were from the 2001 National Land Cover Dataset (NLCD 2001). While NLCD 2001 is valuable for analyzing land cover at the regional level, it is derived from relatively coarse, 30 meter resolution satellite imagery (Figure 3a). Using high-resolution (1 meter) aerial imagery acquired in the summer of 2007 (Figure 3b) in combination with advanced automated processing techniques land cover for the city was mapped with such detail that single trees were detected (Figure 3c). NLCD 2001 estimated the city to have only 28% land cover, compared to the actual amount of 49%.

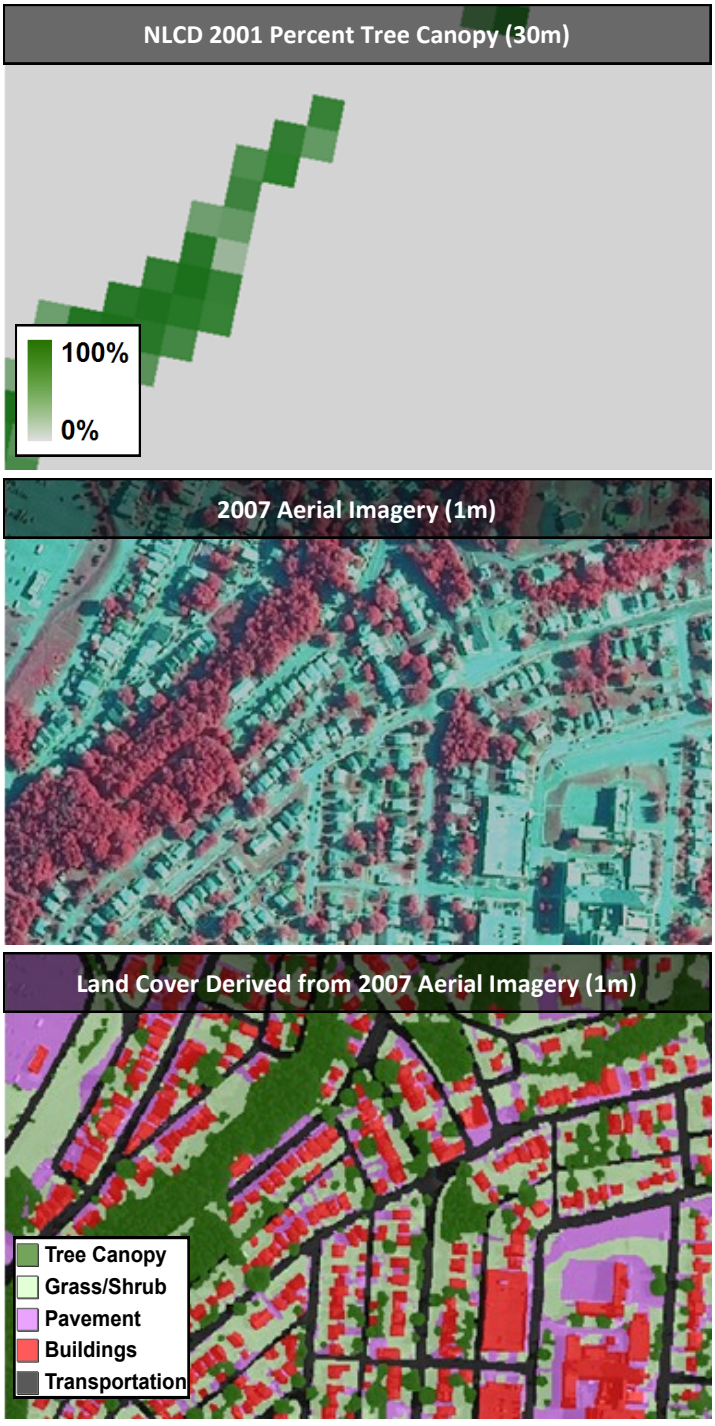

Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

Who "Owns" Cumberland'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 4). Subsequently, land use information from the city's parcel database was used to examine ownership patterns for Existing UTC and Possible UTC (Figure 5). The majority of Cumberland's tree canopy and the majority of the land available to plant new trees is on land zoned designated as "residential" (Figure 5). As with the city as a whole much of this "residential" tree canopy is contained within a limited number of "estate" parcels. Approximately 50% of Cumberland's residential properties have less than 20% of their area covered by tree canopy. Following residential land, tax exempt properties and trees in the public rights of way contribute most significantly to the city's tree canopy.

Figure 4: UTC metrics summarized at the property parcel level

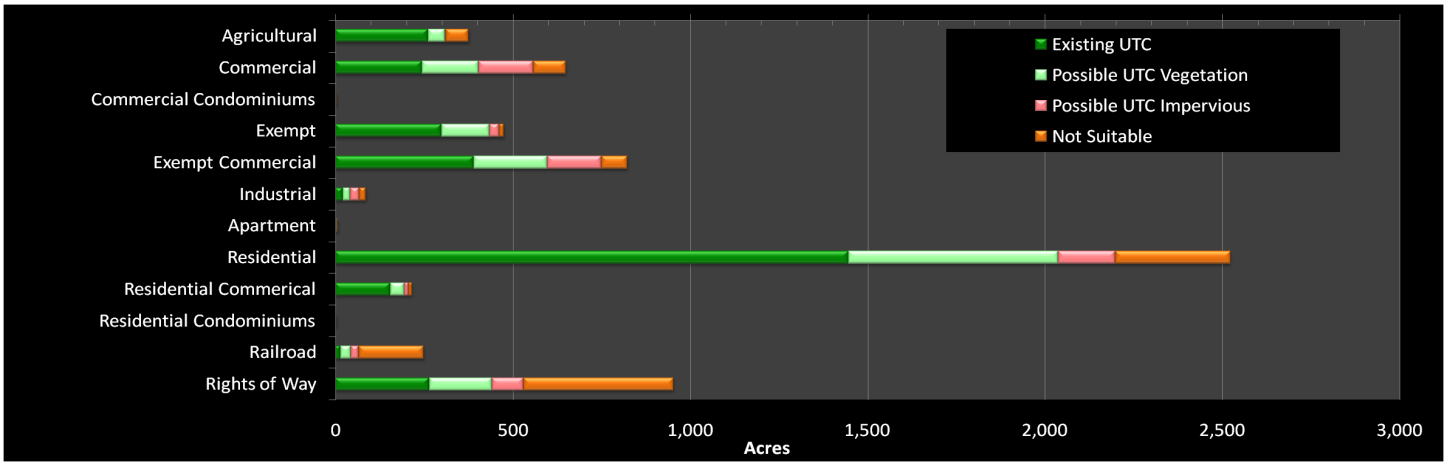

Figure 5: UTC metrics summarized by parcel land use.

Land Use	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type
Agricultural	4%	69%	8%	1%	13%	3%	0%	1%	0%
Commercial	4%	38%	8%	2%	24%	11%	2%	24%	11%
Commercial Condominiums	0%	18%	0%	0%	22%	0%	0%	47%	0%
Exempt	5%	63%	10%	2%	28%	10%	0%	6%	2%
Exempt Commercial	6%	47%	13%	3%	25%	15%	2%	18%	11%
Industrial	0%	26%	1%	0%	22%	1%	0%	29%	2%
Apartment	0%	33%	0%	0%	17%	0%	0%	26%	0%
Residential	23%	57%	47%	9%	23%	42%	3%	6%	11%
Residential Commerical	2%	72%	5%	1%	18%	3%	0%	5%	1%
Residential Condominiums	0%	18%	0%	0%	35%	0%	0%	29%	0%
Railroad	0%	6%	1%	0%	11%	2%	0%	9%	2%
Rights of Way	4%	28%	9%	3%	18%	13%	1%	9%	6%

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

The % Land Area value of 23% indicates that 23% of Cumberland's land area is tree canopy in areas where the land use is "residential."

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

The % Land Use value of 57% indicates that 57% of "residential" land is covered by tree canopy.

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

The % UTC Type value of 47% indicates that 47% of all Existing UTC lies in areas of "housing" land use.

Table 1: UTC metrics by type, summarized by land use. For each land use category UTC metrics were computed as a percent of all land in the city (% Land), as a percent of land area by land use category (% Category) and as a percent of the area for the UTC type (% UTC Type).

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%

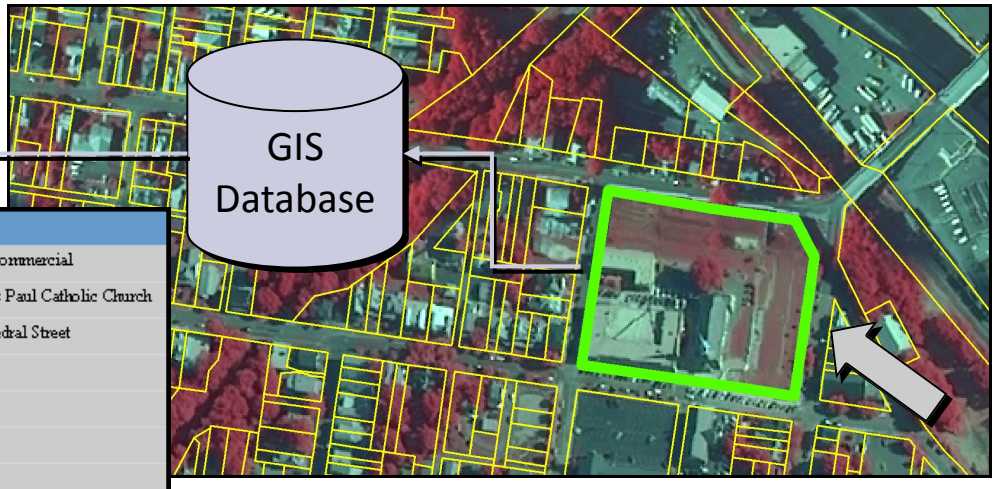

Figure 6: Parcel-based UTC metrics can be used to support targeted UTC.

Conclusions & Recommendations

- Cumberland's urban tree canopy is a vital city asset; reducing stormwater 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.
- Occupying 49% of the city's land area, Cumberland clearly has above average tree canopy, both in the state of Maryland and in comparison to cities of similar size.
- The majority of the city's tree canopy is clustered in 20 large forested patches. These large patches constitute 60% of the city's overall tree canopy. Preserving tree canopy in these patches is crucial to maintaining the city's overall tree canopy.
- The tree canopy is not evenly distributed throughout the city. Approximately half of the residential parcels in the city have less than 20% of their land area covered by tree canopy.
- Cumberland should consider establishing a UTC goal. Such a goal should not be limited to increasing the city's overall tree canopy, it should focus on increasing tree canopy in those parcels or blocks that have the least Existing UTC and highest Possible UTC. This targeted effort can be performed using the UTC parcel database that was produced as part of this assessment.
- By ownership type, it is Cumberland's residents that control the largest percentage of the city's tree canopy. Programs that educate residents on tree stewardship and incentives provided to residents that plant trees are crucial if Cumberland is going to sustain its tree canopy in the long term.
- Tax-exempt parcels (government and institutional land) and parcels used for commercial purposes also offer ample opportunity for UTC increases. As these parcels are generally larger in size, and in some cases under government control, the opportunity exists to engage in more directly in larger scale greening initiatives.
- Of particular focus for UTC improvement should be parcels within the city that have large contiguous impervious surfaces. These parcels contribute high amounts of runoff, degrading water quality. The establishment of tree canopy on these parcels will help to reduce runoff during periods of peak overland flow.
- The city has room for a comprehensive street tree planting initiative, as 28% of the land in the public right-of-way could theoretically support tree canopy.

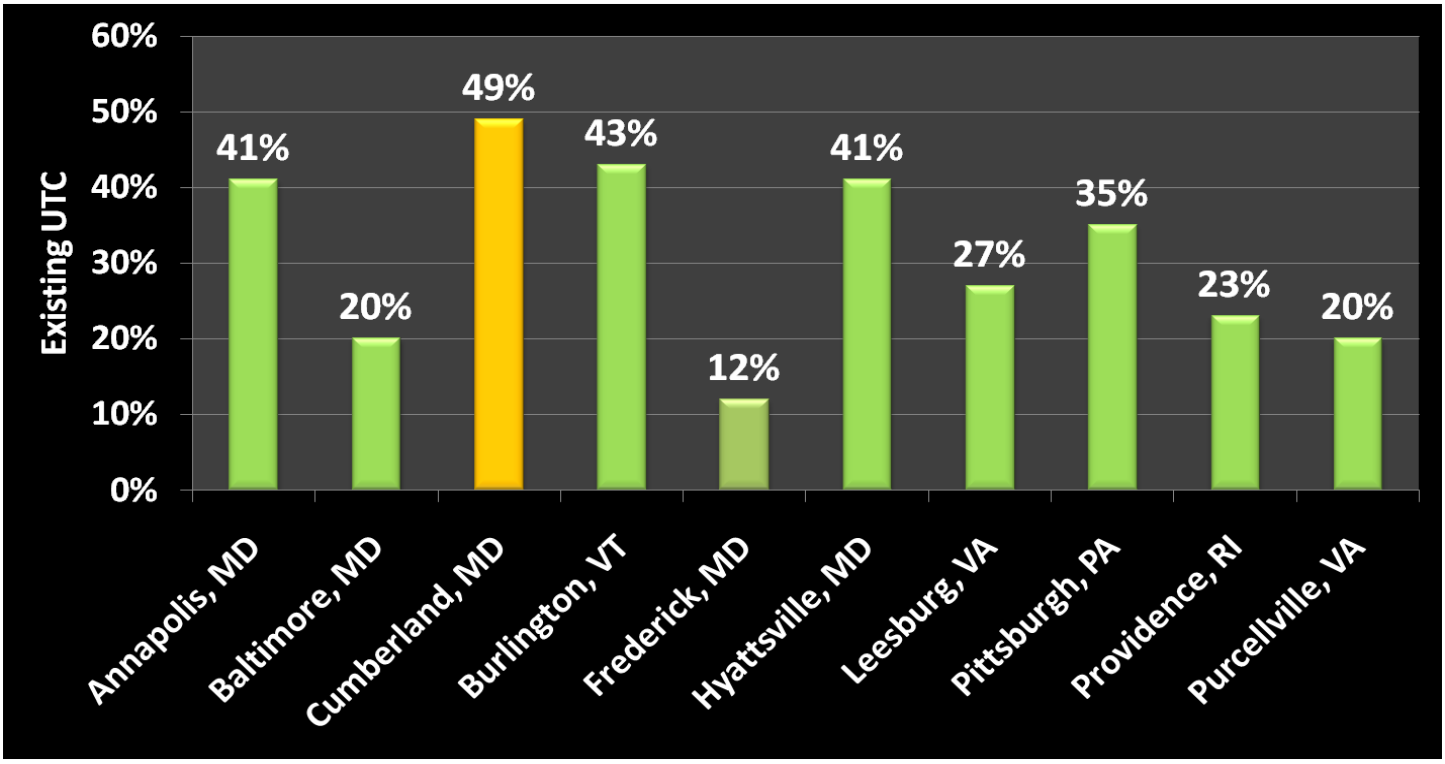

Figure 6: Comparison of Existing UTC with other selected cities that have completed UTC assessments.

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Additional Information

The study was conducted with funding from the Maryland Department of Natural Resources. More information on the UTC assessment project can be found at the following web site.
http://nrs.fs.fed.us/urban/utc/