A Report on the City of Rockville'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. Establishing a UTC goal is a critical for those communities seeking to improve their green infrastructure. A UTC assessment, which provides the amount of tree canopy currently present (Existing UTC) along with the amount of tree canopy that could be established (Possible UTC), is the first step in the UTC goal setting process.

How Much Tree Canopy Does Rockville Have?

An analysis of Rockville's urban tree canopy (UTC) based on high-resolution aerial imagery found that more than 3744 acres of the city is covered by tree canopy (termed Existing UTC). This corresponds to 44% of all land within the city. An additional 37% (3177 acres) of the city could theoretically be improved to support urban tree canopy (termed Possible UTC). Possible UTC includes non-canopy vegetation (e.g., grass/shrubs), bare earth, and certain paved surfaces (e.g., driveways, sidewalks) that, under the right circumstances, could be modified to increase tree cover.
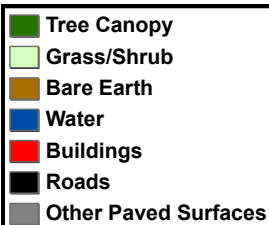

Legend:
- Tree Canopy
- Grass/Shrub
- Bare Earth
- Water
- Buildings
- Roads
- Other Paved Surfaces

Figure 1: Land cover derived from high-resolution aerial imagery for the City of Rockville.

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 Rockville's urban tree canopy (UTC) was carried out with funding from the Maryland Department of Natural Resources (MD DNR) and in collaboration with the City of Rockville. The analysis was performed by the University of Vermont's (UVM) Spatial Analysis Laboratory (SAL) in consultation with the USDA Forest Service's Northern Research Station. Data for this project was provided by MD DNR, the City of Rockville, and Montgomery County Department of Technology Services—Geographic Information Systems Services.

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to the City of Brunswick. This analysis was conducted based on year 2007 and 2008 imagery and LiDAR data.
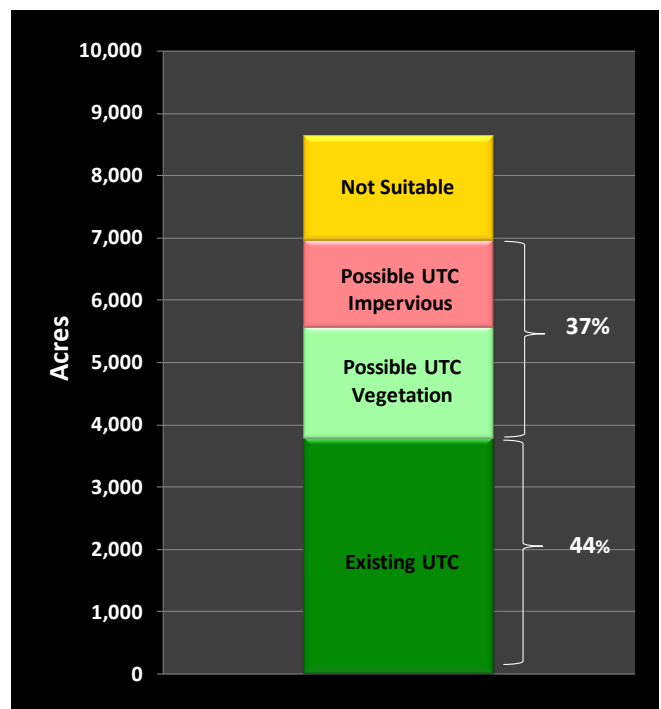

Figure 2: UTC metrics for the city. Percentages represent the proportions of total land area. Percentages represent the proportion of Existing/Possible UTC of all land in the city and urbanized area.

Mapping Rockville's Trees

Prior to this study the only available estimates of tree canopy for Rockville 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 imagery (Figure 3b) and LiDAR, advanced automated processing techniques were employed to map land cover with such detail that single trees were detected (Figure 3c). NLCD 2001 estimated the city to have only 20% land cover, compared to the actual amount of 44%, which was derived from the land cover in Figure 3c.
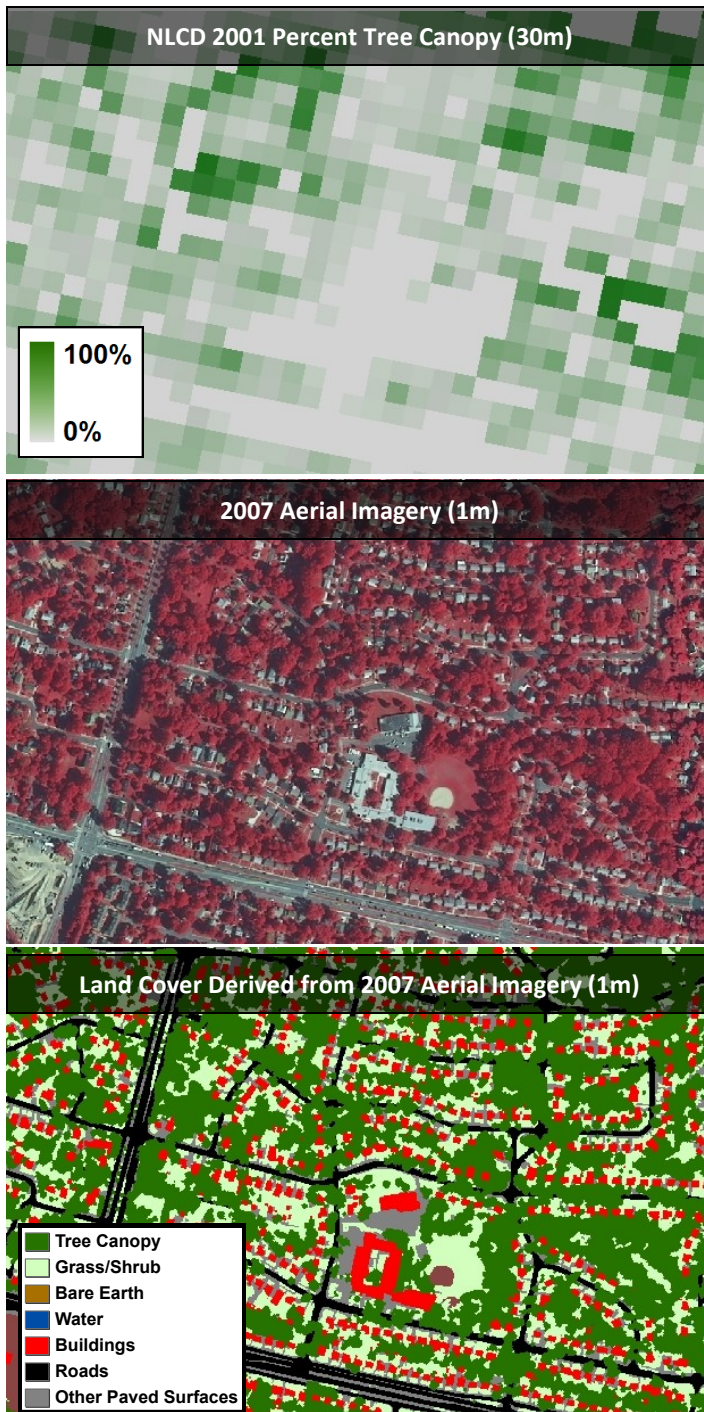

Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

Who "Owns" Rockville's Trees?

The detailed land cover mapping conducted as part of this assessment enabled Existing UTC and Possible UTC percentages to be calculated for each parcel of land (Figure 4). Ownership patterns in relation to the UTC metrics were examined by incorporating land use information from the county's parcel database (Figure 5). The UTC metrics (Table 1) summarize the information for each land use type in the comprehensive plan relative to all the land in the city (% land), the land area within that particular land use category (%category), and the total of the UTC type (%UTC type). This information allows conclusions to be drawn at multiple scales. For example, although residential parcels contain the greatest total area of Existing UTC, parcels in the exempt category have the greatest percentage of their land in the covered by tree canopy. It is important to note that the Possible UTC metrics indicate only what is possible, not what is socially desirable or financially feasible.
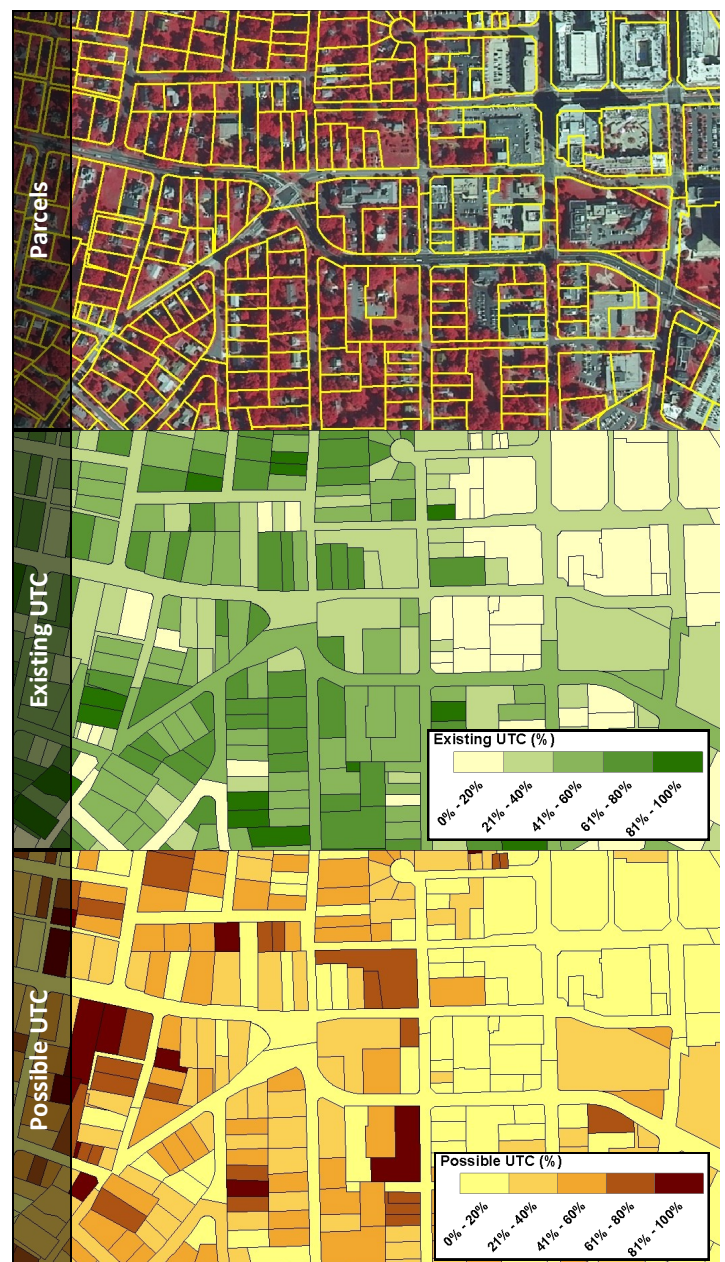

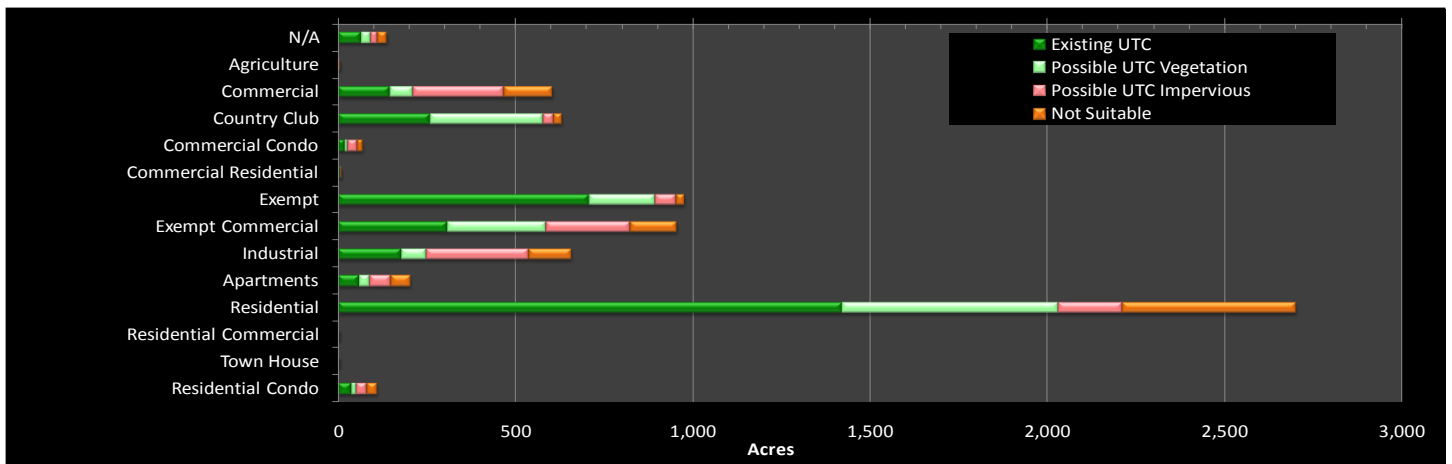*Figure 4: UTC metrics summarized at the property parcel level*

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
N/A	1%	47%	2%	0%	19%	2%	0%	15%	1%
Agriculture	0%	5%	0%	0%	85%	0%	0%	0%	0%
Commercial	2%	24%	5%	1%	11%	4%	4%	42%	16%
Country Club	4%	41%	8%	5%	51%	20%	0%	5%	2%
Commercial Condo	0%	27%	1%	0%	13%	1%	0%	36%	2%
Commercial Residential	0%	47%	0%	0%	14%	0%	0%	22%	0%
Exempt	10%	72%	22%	3%	19%	12%	1%	6%	4%
Apartments	1%	29%	2%	0%	14%	2%	1%	30%	4%
Residential	20%	53%	44%	9%	23%	38%	3%	7%	11%
Residential Commercial	0%	22%	0%	0%	61%	0%	0%	8%	0%
Town House	0%	13%	0%	0%	11%	0%	0%	27%	0%
Residential Condo	1%	33%	1%	0%	14%	1%	0%	26%	2%

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

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

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

The % Land Area value of 20% indicates that 20% of Rockville's land area is tree canopy in areas where the land use is "residential."

The % Land Use value of 53% indicates that 53% of "residential" land is covered by tree canopy.

The % UTC Type value of 44% indicates that 44% of all Existing UTC lies in areas of "housing" land use.
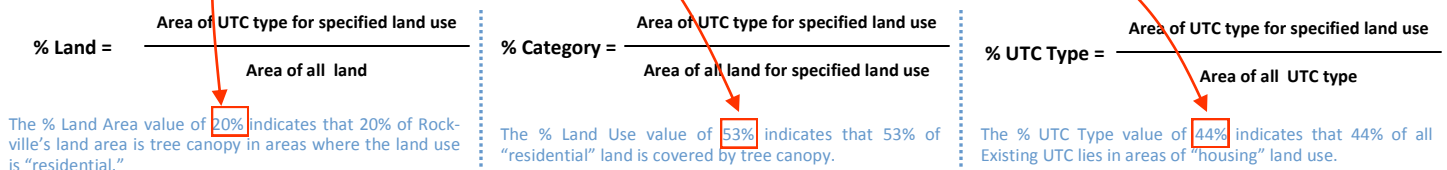
Table 1: UTC metrics by type, summarized by land use. For each land use category UTC metrics were computed as a percent of all land in the city (% Land), as a percent of land area by land use category (% Category) and as a percent of the area for the UTC type (% UTC Type).
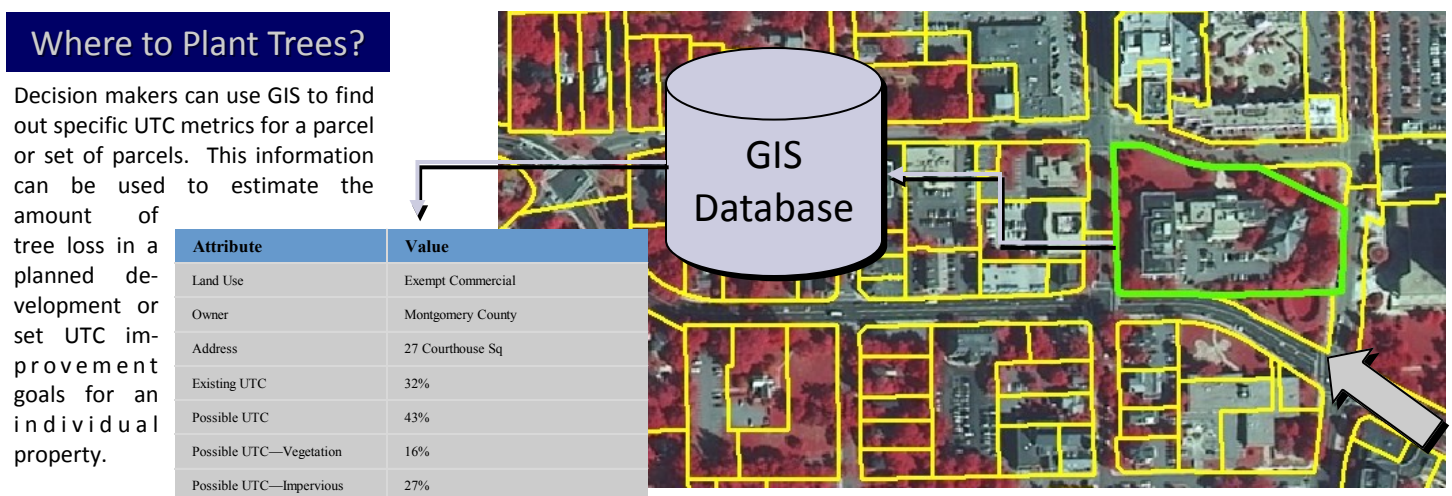
Where to Plant Trees?

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	Montgomery County
Address	27 Courthouse Sq
Existing UTC	32%
Possible UTC	43%
Possible UTC—Vegetation	16%
Possible UTC—Impervious	27%

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

Conclusions & Recommendations

- Rockville'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 44% of the city's land area, Rockville is similar to cities such as Bowie and Cumberland with respect to overall percent tree canopy.

- Given the city's relatively high amount of tree canopy, one of the challenges will be preserving its trees and forests for future generations though maintenance and regeneration.

- Rockville 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 Rockville'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 Rockville is going to sustain its tree canopy in the long term.

- Publicly owned right-of-ways, at 37%, are fairly well covered by tree canopy, but room does exist to expand street tree plantings to help reduce noise pollution and improve aesthetics.

- The dense residential areas in the northwestern part of the city that fall in the PD zoning class offer opportunity for the establishment of tree canopy. Existing UTC percentages for parcels in this area are consistently below 20%, while Possible UTC is consistently above 40%. As the trees in these areas are newly planted it will be years before they contribute in a measurable way to the city's overall tree canopy.

- Tree canopy is relatively high in Rockville's more established residential areas, such as those zoned as R60, R75, and R90. Mortality will likely lead to a decline in tree canopy in these areas over the next several decades.

- Tree canopy in the three major subwatersheds that fall within Rockville exceed 40%. It is important that this level of tree canopy be maintained, and that the tree canopy be as evenly distributed as possible, to reduce runoff and improve water quality.
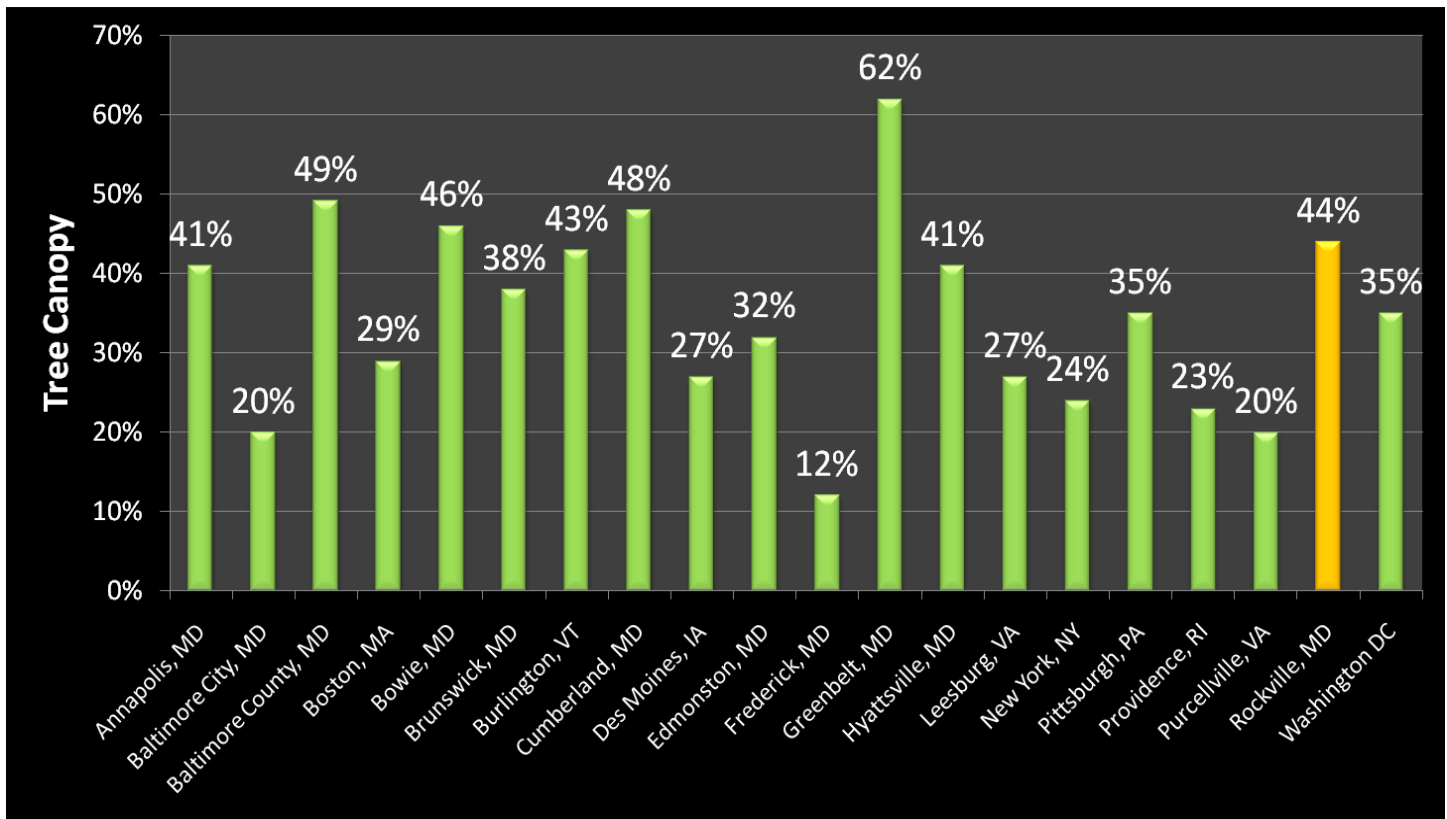

Figure 6: Comparison of Existing UTC with other selected cities that have completed UTC assessments.

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