

A Report on the City of Brunswick'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 numerous benefits to the City of Brunswick 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 Brunswick Have?

Urban tree canopy (UTC) estimates were obtained from a newly created detailed land cover dataset for the City of Brunswick (Figure 1). This dataset was derived from high resolution aerial imagery ($1\frac{1}{2}$ ft resolution) acquired in 2007. Seven land cover classes were mapped: tree canopy, grass/shrub, bare earth, water, buildings, roads/railroads, and other paved surfaces (e.g. driveways and parking lots). As aerial imagery was used, the land cover map represents a top-down perspective.

742 acres of the city are covered by tree canopy (termed Existing UTC). This corresponds to 38% of all land within the city and 33% of the city's total area (total area includes water). An additional 51% (1,007 acres) of the land area could theoretically be improved to support tree canopy (termed Possible UTC). 10% of the city is occupied by buildings and roads, areas where only small amounts of overhanging tree canopy could be established. Of the city's total area, 12% is open water. The UTC metrics, specifically the percentages, presented in this report exclude the portion of the city occupied by water. Other paved surfaces, such as parking lots and driveways, are 4% to city's total area and 9% of it's land area.

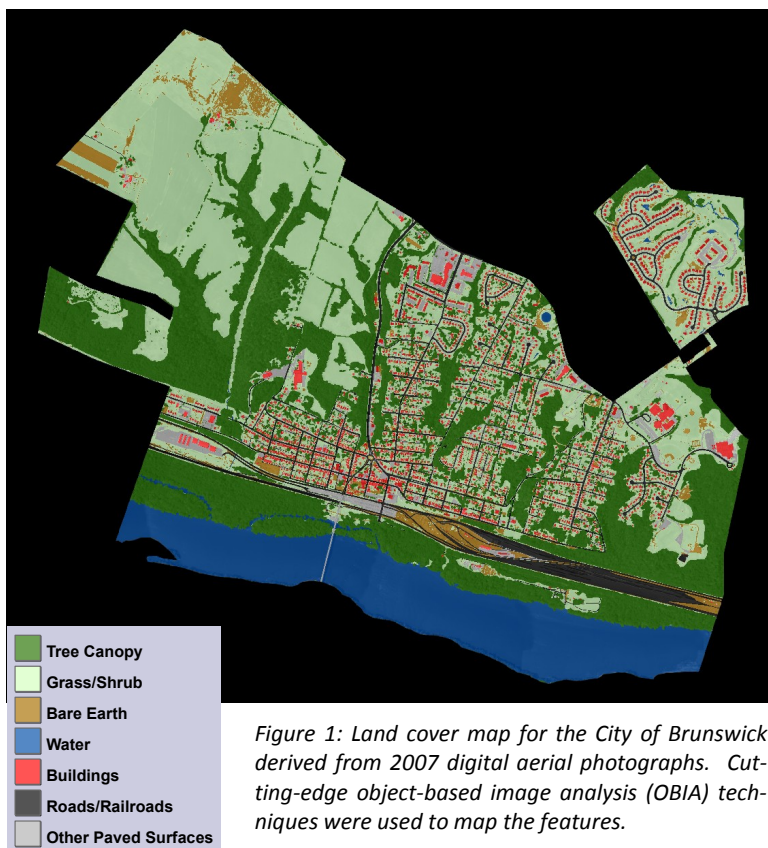


Figure 1: Land cover map for the City of Brunswick derived from 2007 digital aerial photographs. Cutting-edge object-based image analysis (OBIA) techniques were used to map the features.

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 Brunswick's urban tree canopy (UTC) was carried out at the request of the City of Brunswick with funding from the Chesapeake Bay Trust. 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. The Maryland Department of Natural Resources (MD DNR) and Frederick County provided the data for this project.

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 data.

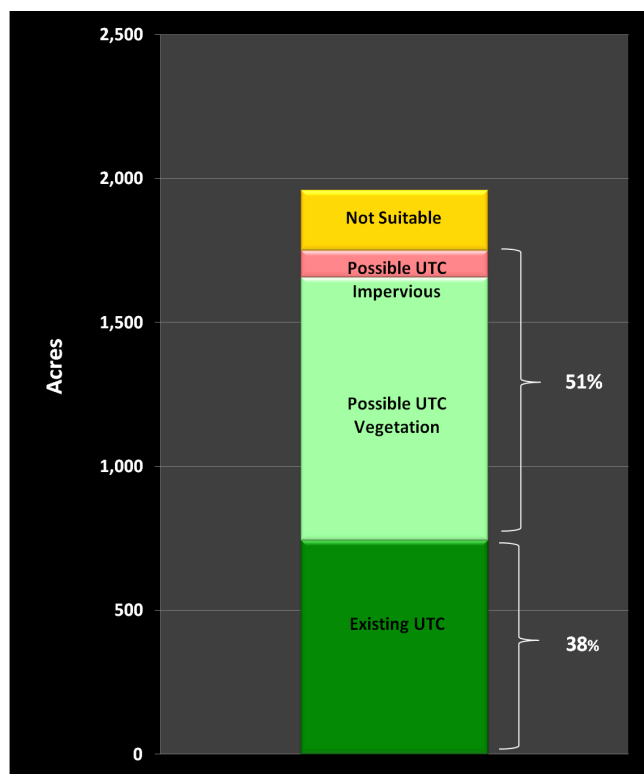


Figure 2: UTC metrics for the city. Percentages are based on % of land area (excludes water).

Mapping Tree Canopy

This study represents the most detailed inventory of tree canopy in Brunswick to date. Previous estimates of UTC, such as those obtained from the 2001 National Land Cover Dataset (NLCD 2001) tree canopy layer (Figure 3a), are artificially low. While NLCD 2001 is valuable for analyzing land cover at the regional level, it is derived from relatively coarse, 30 meter resolution satellite imagery. This imagery that does not capture small forest patches and individual trees in urban areas. High-resolution data (Figure 3b), in combination with advanced automated processing techniques, allowed for more detailed land cover mapping (Figure 3c). NLCD 2001 estimated the city to have only 22% land cover, compared to the actual amount of 33%.

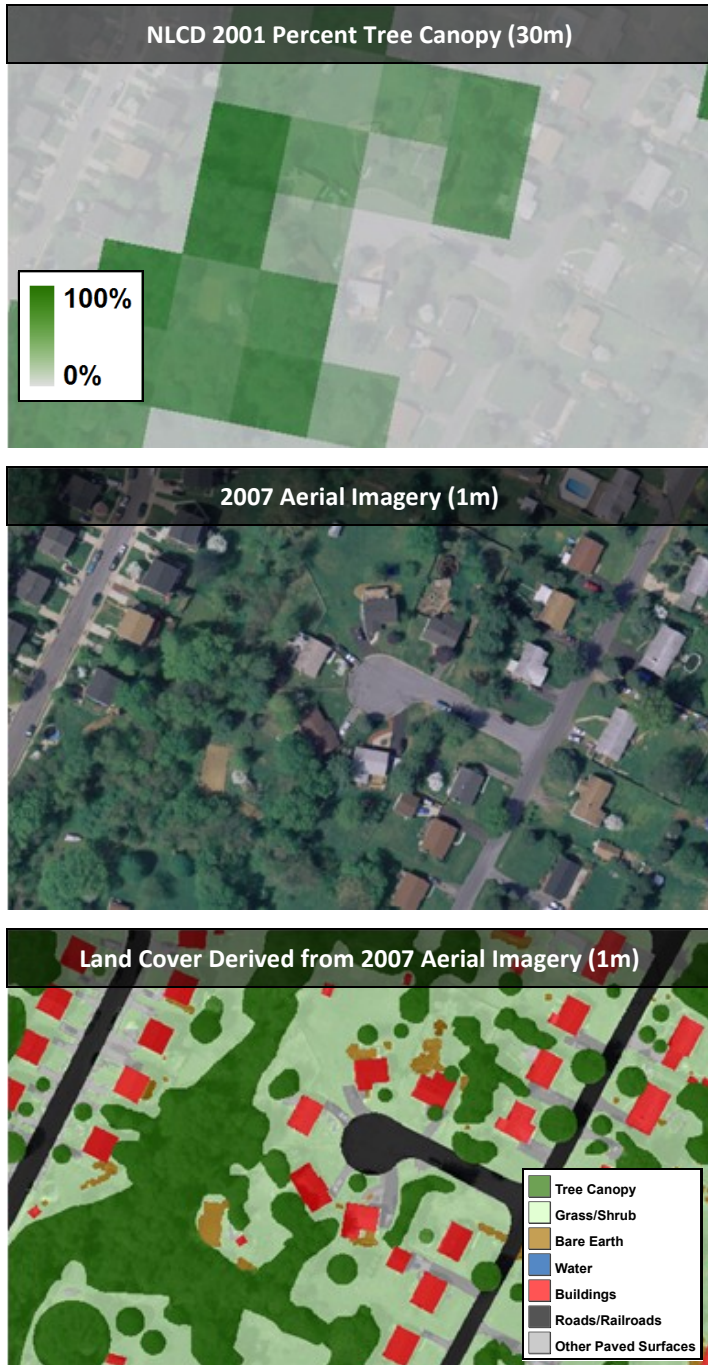


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution imagery land cover.

Who "Owns" the 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 comprehensive plan 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 low density residential parcels contain the greatest total area of Possible UTC, agricultural parcels have the greatest percentage of their land in the Possible UTC category. It is important to note that the 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

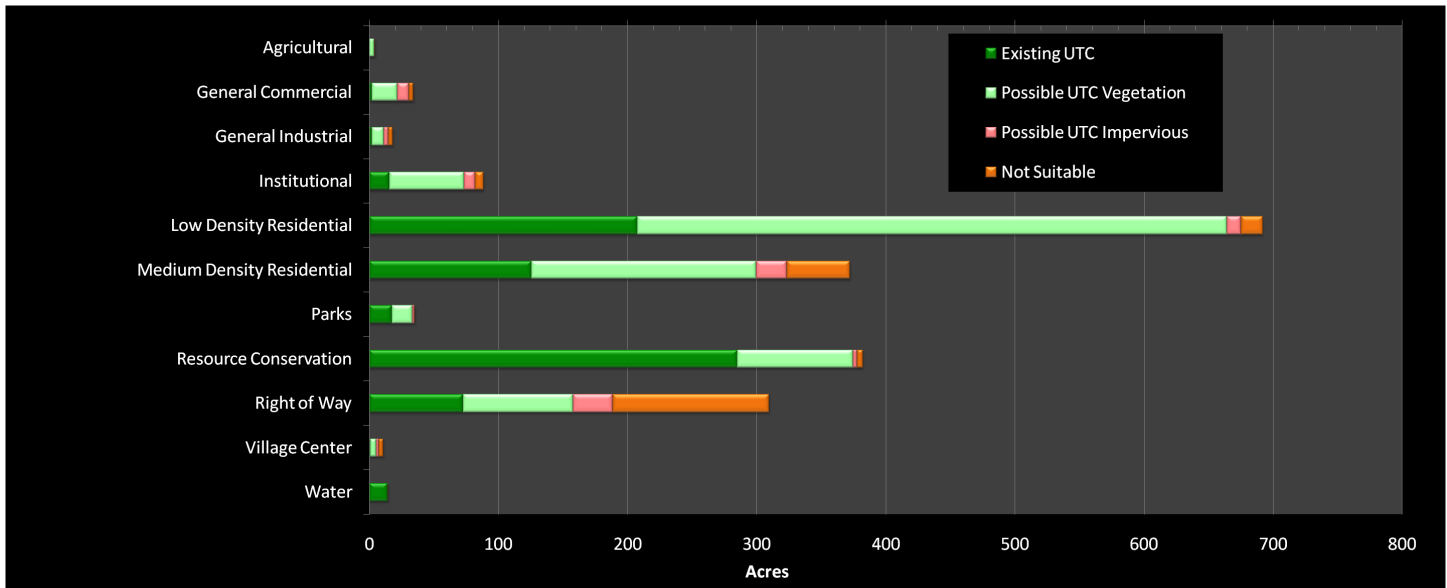


Figure 5: UTC metrics summarized by comprehensive plan land use categories

Land Use	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type
Agricultural	0%	2%	0%	0%	97%	0%	0%	0%	0%
General Commercial	0%	6%	0%	1%	58%	2%	0%	26%	1%
General Industrial	0%	10%	0%	0%	51%	1%	0%	20%	0%
Institutional	1%	18%	2%	3%	65%	6%	0%	9%	1%
Low Density Residential	11%	30%	28%	23%	66%	50%	1%	2%	1%
Medium Density Residential	6%	34%	17%	9%	47%	19%	1%	6%	3%
Parks	1%	50%	2%	1%	44%	2%	0%	5%	0%
Resource Conservation	15%	75%	38%	5%	23%	10%	0%	1%	0%
Right of Way	4%	23%	10%	4%	28%	9%	2%	10%	3%
Village Center	0%	8%	0%	0%	41%	0%	0%	18%	0%
Water	1%	99%	2%	0%	0%	0%	0%	0%	0%

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

The % Land Area value of 11% indicates that 11% of the city's land area is tree canopy in areas where the land use is low density residential.

% 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 30% indicates that 30% of low density residential land is covered by tree canopy.

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

The % UTC Type value of 28% indicates that 28% of all Existing UTC lies in areas of low density residential 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
Tax Account	1125476514
Type	MDR
Parcel	1550
Existing UTC Area	1024
Existing UTC Percent	2%
Possible UTC Area	29,646
Possible UTC Percent	62%
Possible UTC Vegetation	36%
Possible UTC Impervious	25%



Figure 6: Parcel-based UTC metrics can be target tree plantings.

Conclusions & Recommendations

- Brunswick' 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.
- Brunswick should consider establishing a UTC goal, but any goal must be coupled with a maintenance plan to preserve existing tree canopy.
- Targeted tree planting efforts can be performed using the UTC parcel database that was produced as part of this assessment.
- Occupying 38% of the city's land area, tree canopy in Brunswick is on par with cities such as Annapolis (41%). It is lower than cities such as Cumberland (62%) that have large forested patches and higher than cities like Frederick (12%) that have a higher percentage of their vegetation in grassy areas.
- Tree canopy within 100ft of streams is considerably higher (60%) than the average tree canopy in the city due to the fact that a considerable portion of this land is designated as "resource conservation." While these forested buffers undoubtedly help improve water quality and aquatic habitat, research shows that in urban areas tree canopy needs to be evenly distributed, within reason, across a watershed.
- Tree canopy within 25ft of roads (17%) is lower than the average for the city. Possible UTC Vegetation within this 25ft buffer amount to 36%, pointing that the potential exists to improve tree canopy along the city's streets. Such an initiative would help reduce noise, remove air pollutants, and be aesthetically pleasing.
- Parcels in the comprehensive plan identified as low density residential and medium density residential account for 17% of the city's tree canopy, slightly more than what is contributed by resource conservation parcels (15%). Brunswick's residential areas are not only important to the city's current tree canopy as these residential parcels also contain the majority of the land available for the establishment of tree canopy.
- Commercial and industrial parcels have a very small percentage of their land covered by tree canopy, 6% and 10% respectively. These low numbers are not the result of large buildings or parking lots as the Possible UTC Vegetation is 58% and 51% respectively for these two land use types.
- Brunswick's three schools have differing amounts of tree canopy due to the existence of playing fields. The elementary school has 65% of its land covered by tree canopy. This declines to 32% at the middle school, and 13% at the high school. Playing fields contribute to the fact that 75% institutional land is identified as Possible UTC.

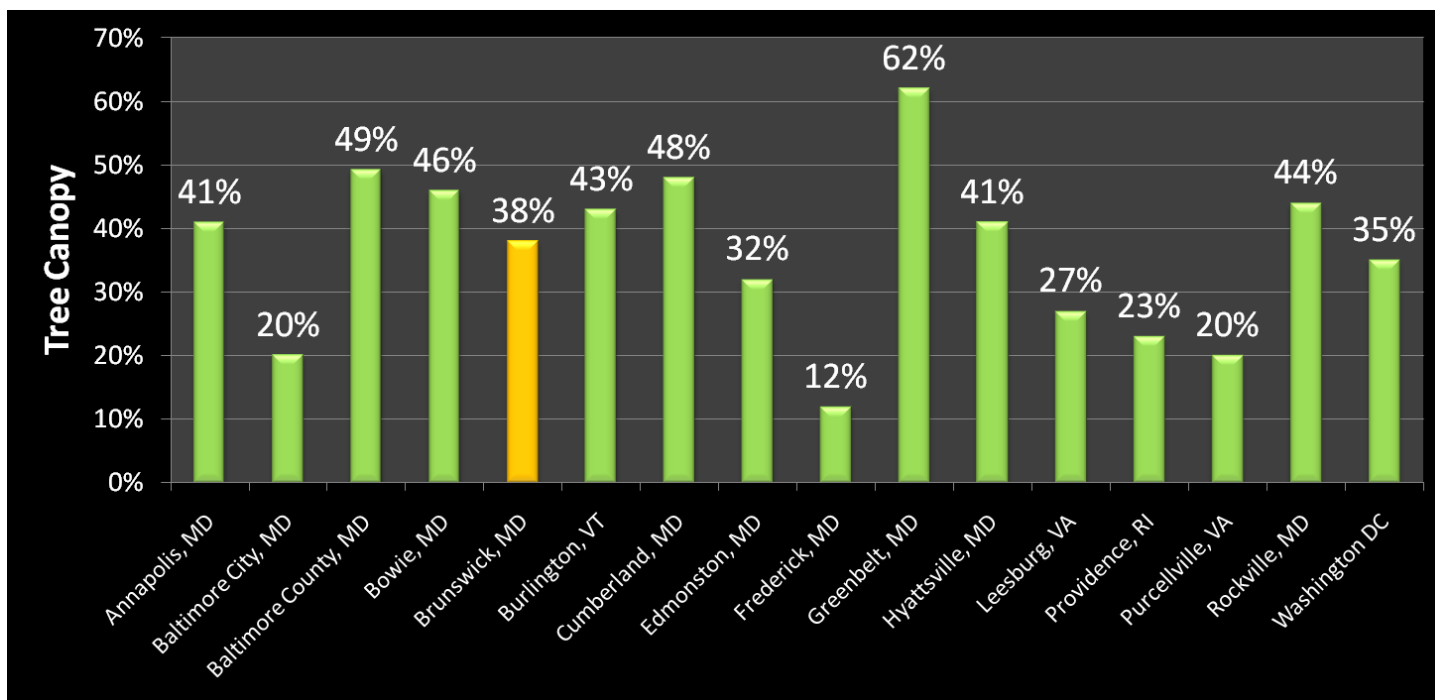


Figure 6: Comparison of Existing UTC with other selected cities that have completed UTC assessments.

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Additional Information

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