

A Report on Anne Arundel County, Maryland's Existing and Possible Tree Canopy

Why is Tree Canopy Important?

Tree canopy (TC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. In urban and suburban settings, this layer is called urban tree canopy (UTC). Tree canopy provides many benefits to communities, 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 A.A. County Have?

An analysis of Anne Arundel County, Maryland's land cover based on high-resolution aerial imagery found that 151,415 acres of the county is covered by tree canopy (termed Existing TC). This corresponds to 59% of all land within the county, excluding the City of Annapolis (Figure 1). However, 34% (88,909 acres) of the county could theoretically be improved to support tree canopy (termed Possible TC). Possible TC 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. The county's Existing TC generally occurs in networks of patches interspersed with developed land-use types (Figure 2). These patches tend to be small in northern part of the county, where urban and suburban features predominate, and larger in central and southern sections. Agriculture is still an important part of the county's landscape, particularly in the south. Note that agricultural land-cover types were not specifically mapped as part of this project but are included in the Grass/Shrubs land-cover category.

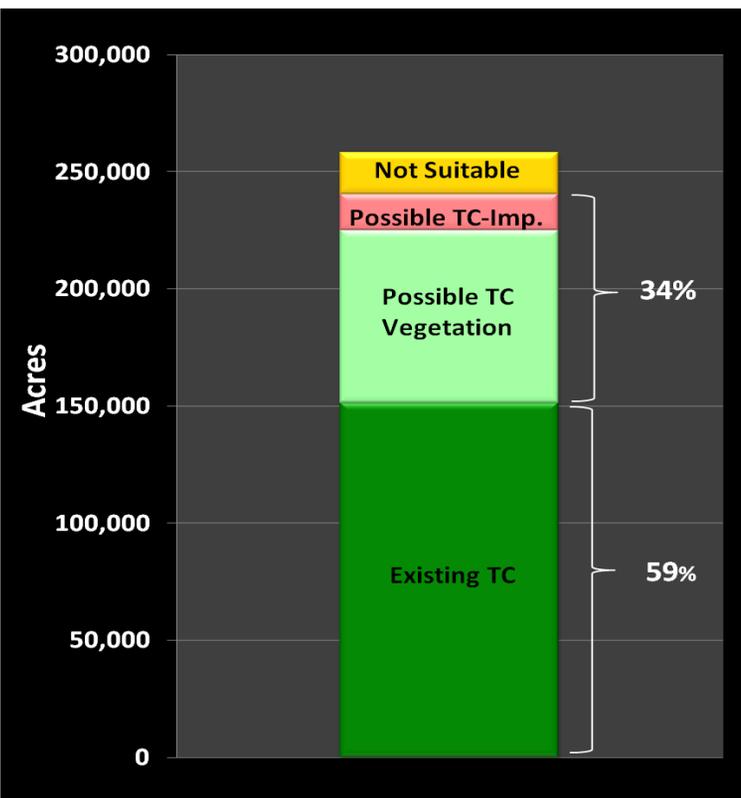


Figure 1: TC metrics for Anne Arundel County, MD (excluding the City of Annapolis). Percentages are based on % of land area.

Project Background

This analysis of Anne Arundel County's tree canopy was a collaborative effort between Anne Arundel County, the Maryland Department of Natural Resources (MD DNR), and the Baltimore Ecosystem Study (BES; www.beslter.org). It was performed by the Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of 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, methods successfully used and refined with a diverse set of cities and municipalities in the eastern United States, to Anne Arundel County, Maryland. The land-cover data are based on year 2007 imagery provided by the MD DNR.

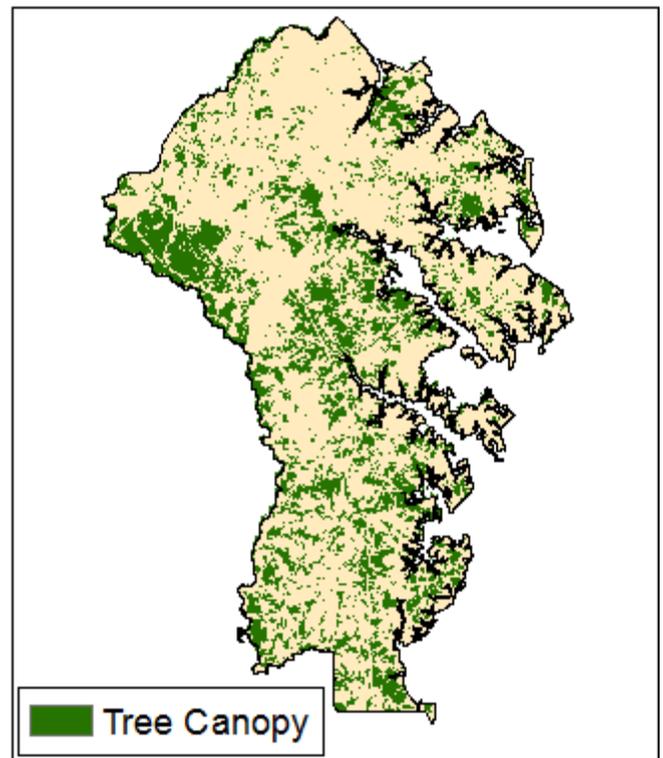


Figure 2: Tree canopy in Anne Arundel County, MD (excluding the City of Annapolis). Existing tree canopy represents 59% of the county's land area.

Key Terms

TC: Tree canopy (TC) 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 aerial or satellite imagery such as trees, grass, water, and impervious surfaces.

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

Impervious Possible TC: Asphalt or concrete surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy.

Vegetated Possible TC: Grass or shrub area that is theoretically available for the establishment of tree canopy.

Mapping Anne Arundel County's Trees

Previous estimates of tree canopy for Anne Arundel Co., Maryland, such as the 2001 National Land Cover Dataset (NLCD 2001), were derived from relatively coarse, 30-meter resolution satellite imagery (Figure 3a). Such data lack the spatial resolution needed for fine-scale mapping. Using high-resolution (1 meter, or 3.28 feet) aerial imagery acquired in the summer of 2007 (Figure 3b) in combination with advanced automated processing techniques, land cover for the county was mapped with such detail that single trees were detected (Figure 3c). NLCD 2001 estimated a mean percent tree canopy of 40% for Anne Arundel Co., failing to capture many isolated trees.

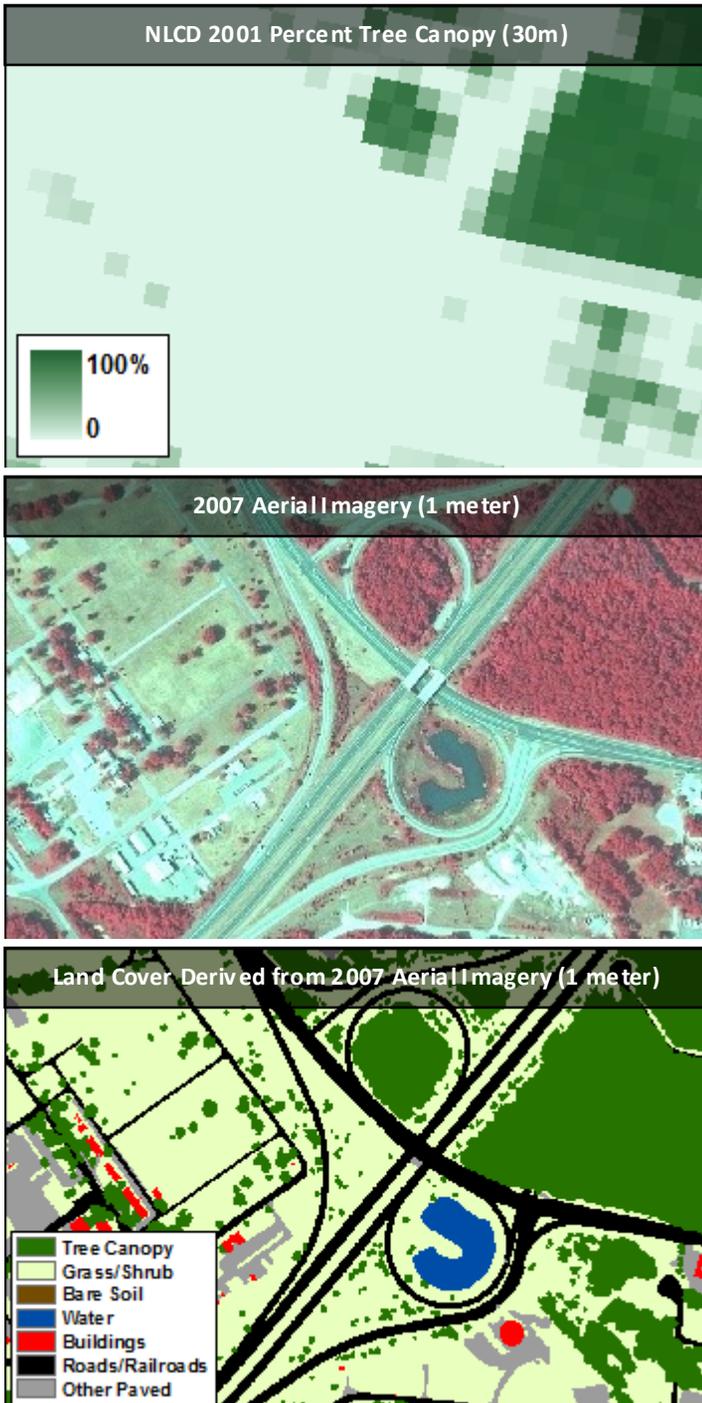


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

Parcel & Land Use Summary

The detailed land-cover mapping conducted as part of this assessment permitted calculation of the percentage of Existing and Possible TC for each parcel of government-owned land (Figure 4). Similar analyses can be performed for all ownership parcels in the county. Additional analyses were performed with land-use designations to examine general ownership and use patterns (Figure 5, Table 1). The highest proportion of Anne Arundel County's Existing TC occurs in the rural agricultural zone (34%), followed by residential zones (32%) and natural features (22%). The natural features zone includes parks and other conservation lands, including the Patuxent Research Refuge. Most of the land suitable for establishing additional tree cover also occurs in the rural agricultural zone (38%), although it is important to remember that maintenance of local agricultural landscapes is often a public-policy goal in its own right. The next largest proportion occurs in residential zones (27% of Possible TC), where expanses of lawn and paved surfaces could theoretically be modified to support additional tree growth.

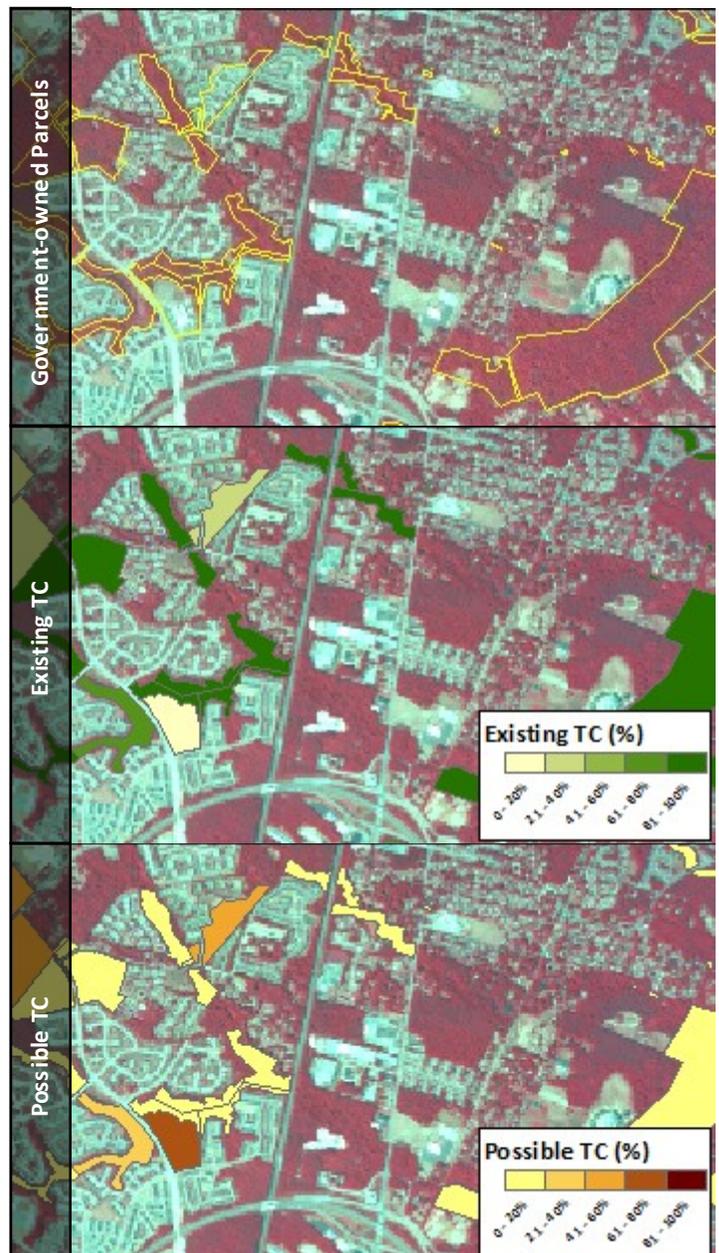


Figure 4a, 4b, 4c: TC metrics summarized at the property parcel level.

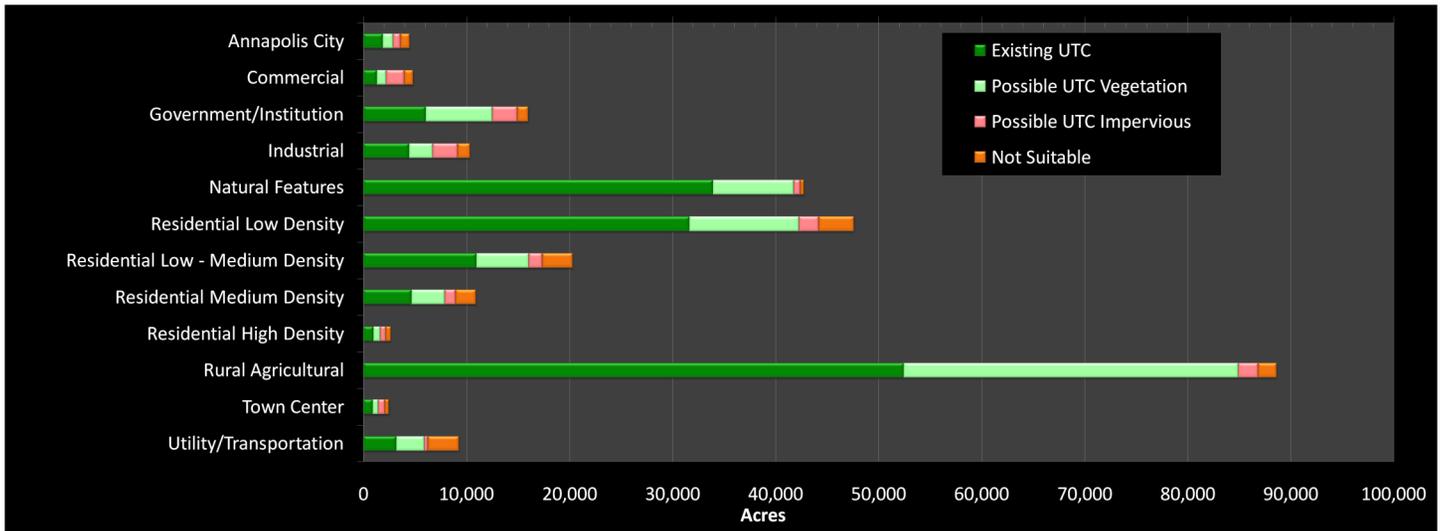


Figure 5: TC metrics summarized by land-use designation. Note that land-use classes with less than 1% of the county's land area are not shown.

Land Use	Existing TC			Possible TC Vegetation			Possible TC Impervious		
	% Land	% Category	% TC Type	% Land	% Category	% TC Type	% Land	% Category	% TC Type
Annapolis City	1%	42%	1%	0%	23%	1%	0%	16%	1%
Commercial	1%	27%	1%	0%	18%	1%	1%	37%	2%
Government/Institution	2%	38%	4%	3%	40%	9%	1%	15%	3%
Industrial	2%	43%	3%	1%	22%	3%	1%	23%	3%
Natural Features	13%	79%	23%	3%	18%	11%	0%	1%	1%
Residential Low Density	12%	66%	21%	4%	22%	15%	1%	4%	3%
Residential Low/Med. Density	4%	54%	7%	2%	25%	7%	1%	6%	2%
Residential Medium Density	2%	43%	3%	1%	30%	4%	0%	9%	1%
Residential High Density	0%	36%	1%	0%	25%	1%	0%	20%	1%
Rural Agricultural	20%	59%	35%	13%	37%	45%	1%	2%	3%
Town Center	0%	36%	1%	0%	21%	1%	0%	26%	1%
Utility/Transportation	1%	34%	2%	1%	30%	4%	0%	3%	0%

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

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

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

The % Land Area value of 4% indicates that 4% of Anne Arundel County's land area is tree canopy in areas where the zoning is "Residential Low/Med. Density."

The % Land Use value of 54% indicates that 54% of "Residential Low/Med. Density" land is covered by tree canopy.

The % TC Type value of 7% indicates that 7% of all Existing TC lies in the "Residential Low/Med. Density" land use.

Table 1: TC metrics summarized by land-use category. For each category, TC metrics were computed as a percentage of all land in the county (% Land), as a percentage of land area by land-use category (% Category), and as a percentage of the area for the TC type (% TC Type). Note that land-use classes with less than 1% of the county's land area are not shown.

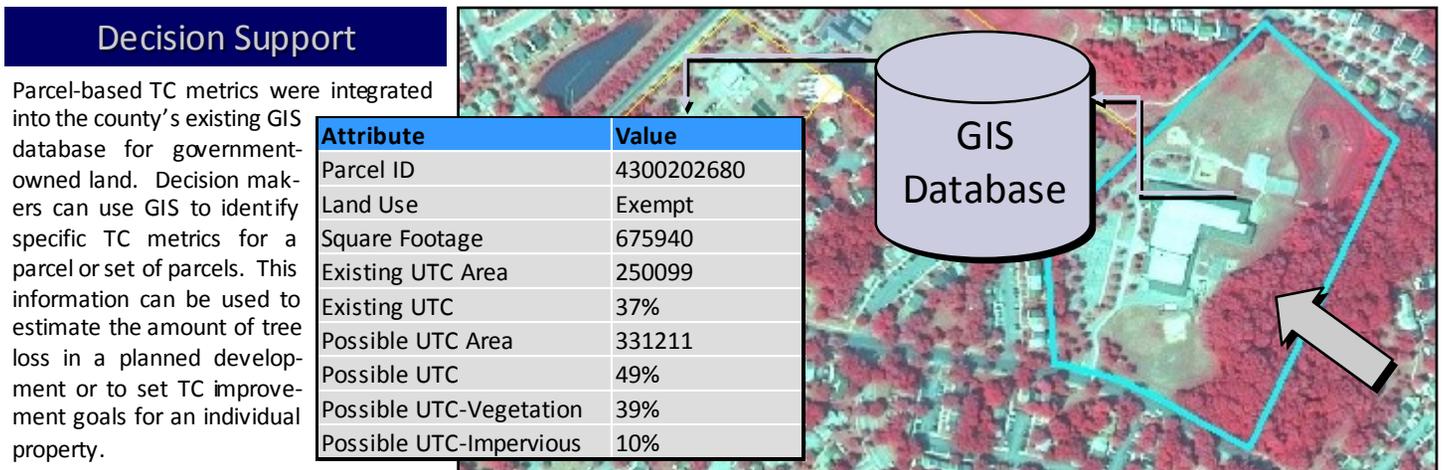


Figure 6: GIS-based analysis of parcel-based TC metrics for decision support. In this example, GIS is used to select an individual government-owned parcel. The attributes for that parcel are displayed in tabular form, providing instant access to relevant tree-canopy information.

Environmental Analysis—Watersheds

Many different environmental variables can be factored into TC assessments, including watersheds, storm sewer systems, and other features that influence storm-water runoff. By watershed, for example, the Severn and South River Watersheds have among the largest volume of Existing TC by both total and proportional area (Figure 7, 8a); not surprisingly, these watersheds contain relatively large and contiguous blocks of forest. Conversely, these watersheds have relatively low proportions of Possible TC (Figure 8b). The Middle Patuxent Watershed has the highest possible proportion of Possible TC, although it is again important to remember that this watershed contains agricultural areas that may not be appropriate for focused tree-planting programs.

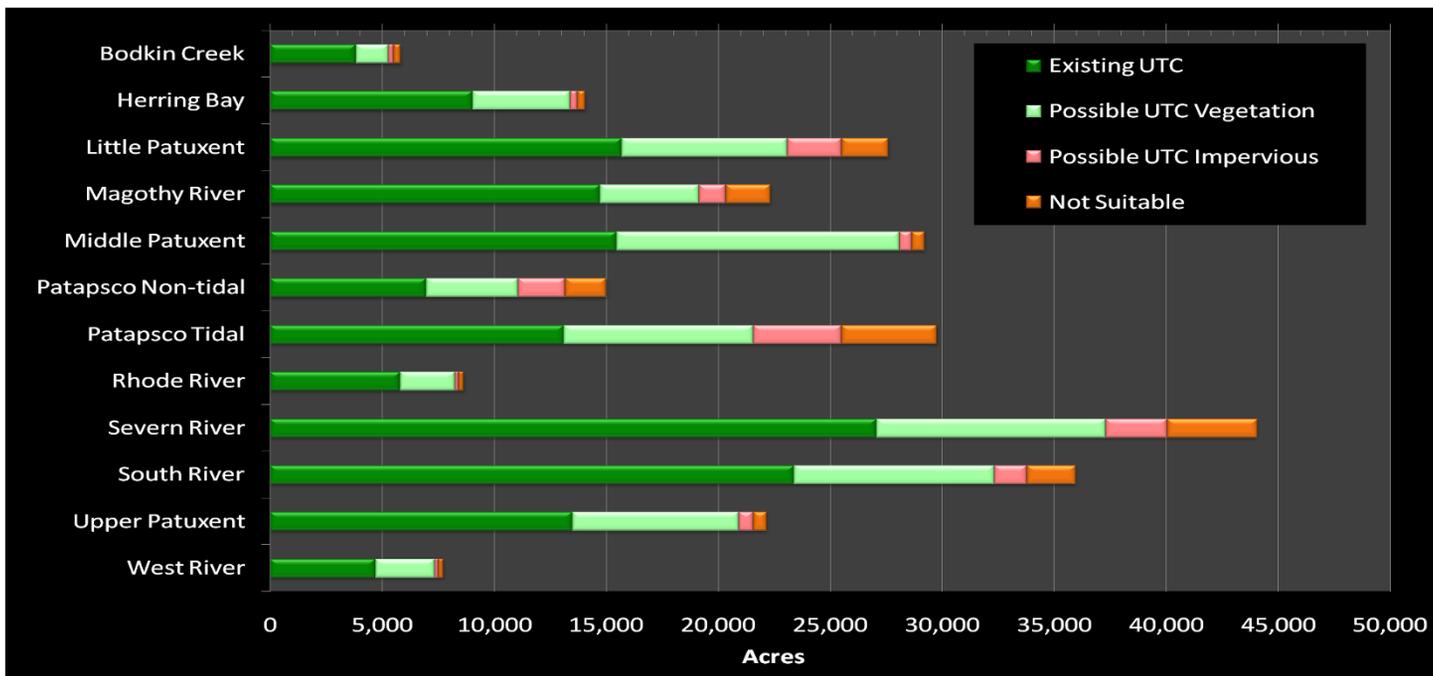


Figure 7: Distribution of existing and possible tree canopy in Anne Arundel County, MD watersheds.

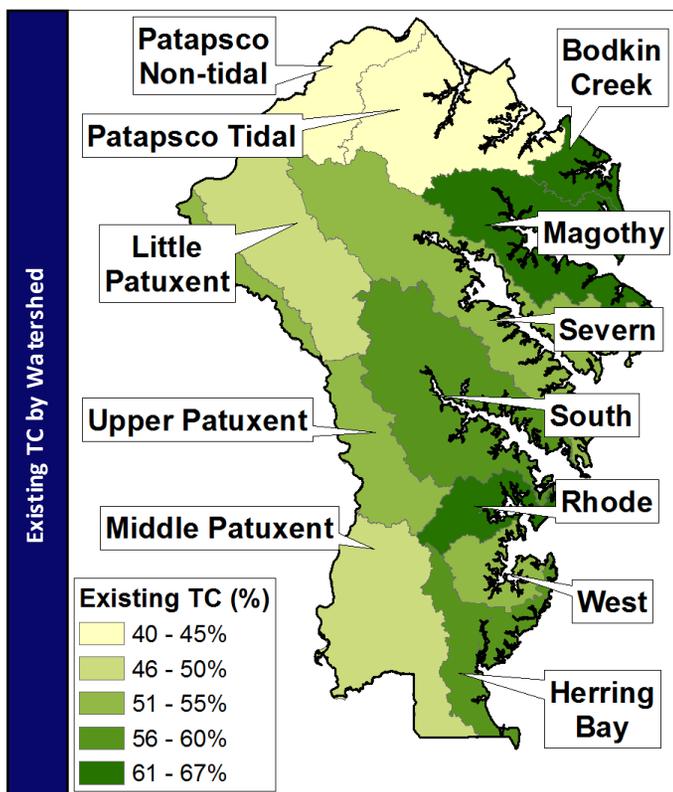


Figure 8a: Existing TC, expressed as the percentage of land area, for watersheds.

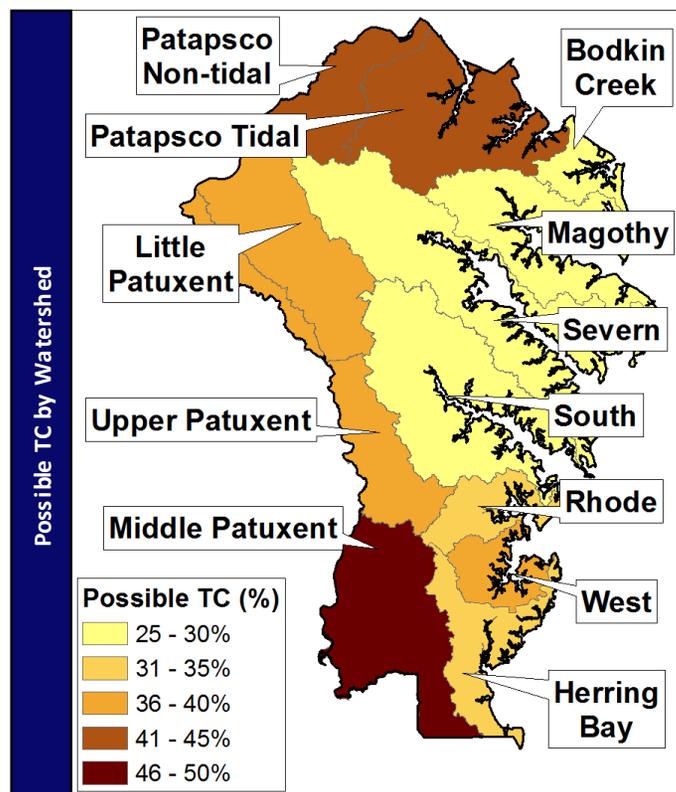


Figure 8b: Possible TC, expressed as the percentage of land area, for watersheds.

Environmental Analysis—Critical Areas

Environmental analyses are also possible at finer scales, including assessment of Existing and Possible TC in riparian zones and coastal areas. When vegetated with contiguous tree canopy, these ecologically-important landscape features are known to reduce runoff and protect habitat for a diversity of aquatic and terrestrial species. For example, examination of critical areas along the Chesapeake Bay and tidal rivers shows that the county’s coastal zones are largely forested, especially in the Limited Development Area and Resource Conservation Area classes (Figure 9). However, these two critical-area classes also contain substantial areas of Possible TC, suggesting that opportunities exist for further tree-canopy improvements. Detailed maps can then help identify priorities (Figures 10a, 10b).

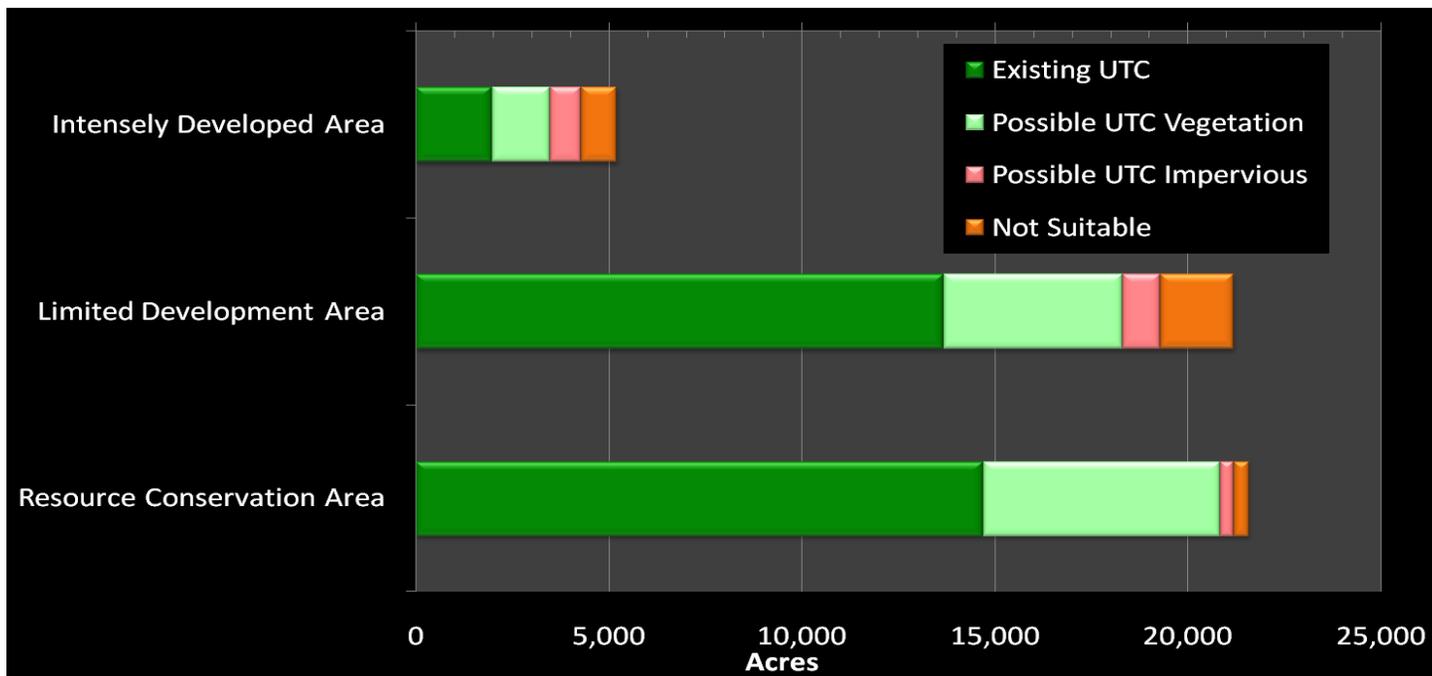


Figure 9: Distribution of existing and possible tree canopy by land use in critical areas along the Chesapeake Bay and tidal rivers.

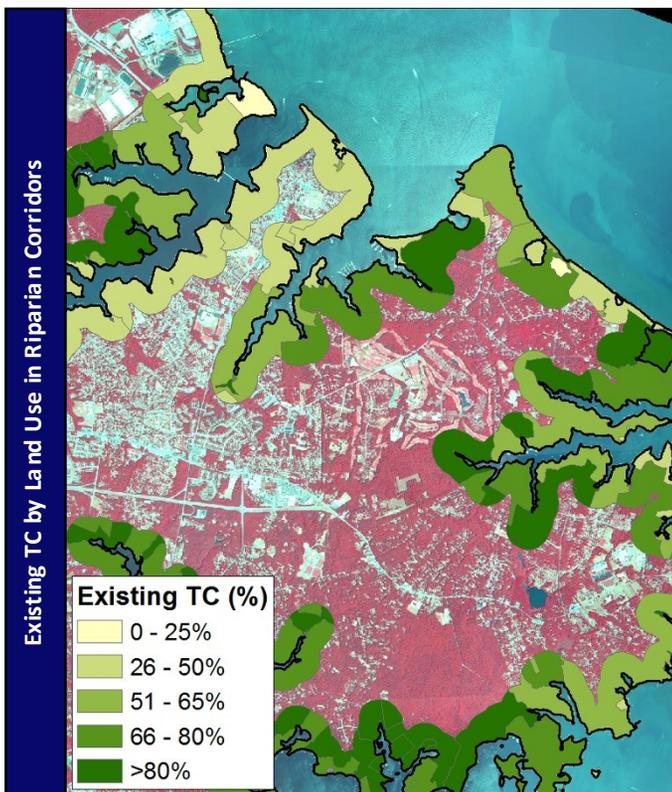


Figure 10a: Existing TC, expressed as the percentage of land area, in critical areas along the Chesapeake Bay and tidal rivers.

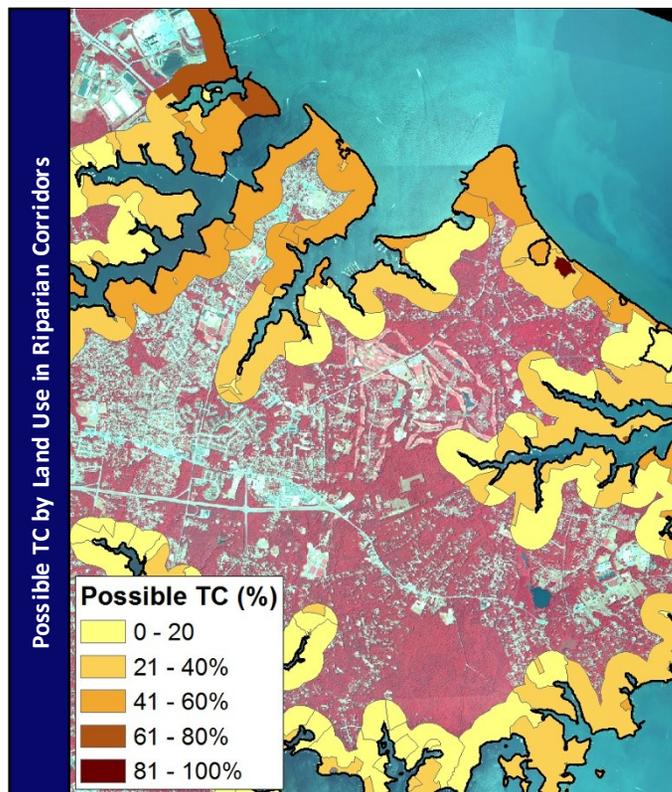


Figure 10b: Possible TC, expressed as the percentage of land area, in critical areas along the Chesapeake Bay and tidal rivers.

Conclusions & Recommendations

- Anne Arundel County's tree canopy is a vital community and regional asset, reducing storm-water runoff, improving air quality, reducing the county's carbon footprint, enhancing quality of life, contributing to savings on energy bills, and serving as habitat for wildlife.
- With 59% of its land area occupied by tree canopy (excluding Annapolis), Anne Arundel County is similar to other counties and municipalities in Maryland (Figure 11). Predictably, it generally contains more canopy than dense urban centers.
- Most of the county's Existing TC is located in areas designated as rural agricultural, followed by residential and natural features (e.g., parks) land uses. Preserving canopy in these areas is crucial to maintaining the county's overall tree canopy.
- Residential areas provide a rich opportunity for expanding TC, encompassing proportionately large areas of non-canopy vegetation and paved surfaces that theoretically could be modified to accommodate additional tree growth. Agricultural areas also contain large areas where tree planting is possible, but TC-improvement efforts in these areas will have to be balanced with maintenance of local agriculture.
- TC goals for Anne Arundel County should not be limited to increasing the county's overall tree canopy; they should also focus on increasing tree canopy in those parcels or blocks that have the lowest Existing TC and highest Possible TC. This targeted effort can be performed using the land-cover map that was produced as part of this assessment.
- Private residential and agricultural landowners control the largest percentage of Possible TC. Programs that educate residents on tree stewardship and provide incentives for tree planting are essential if the county is to sustain its TC in the long term.
- Other land-use categories (e.g., Government, Industrial) also offer potential TC improvements. Because these parcels are generally larger in size and are often managed by commercial, institutional, or government entities, the opportunity exists to engage more directly in large-scale greening initiatives.
- Of particular focus for TC improvement should be parcels in the county 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 reduce runoff during periods of peak overland flow.

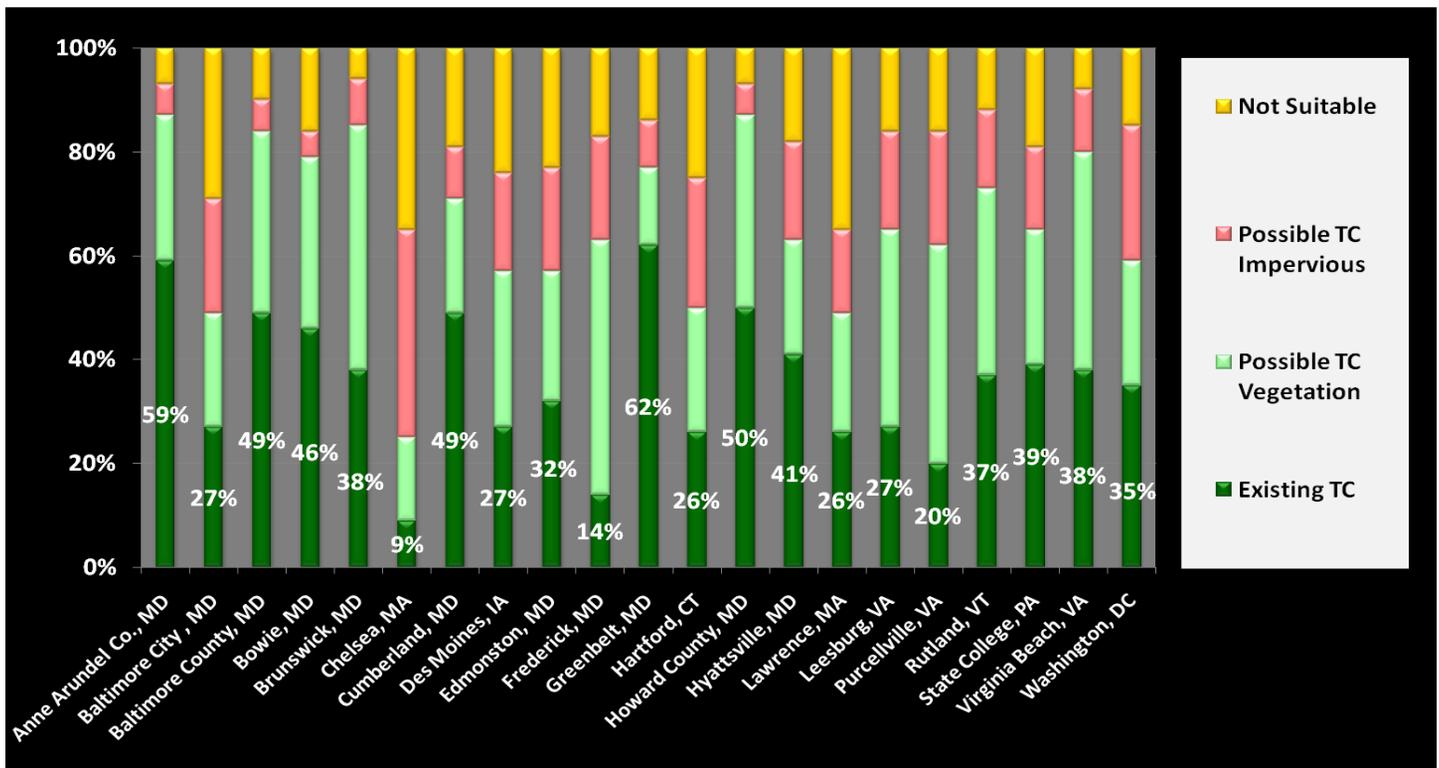


Figure 11: Comparison of Existing and Possible TC in selected cities and counties that have also completed TC assessments.

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Additional Information

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<http://nrs.fs.fed.us/urban/TC/>



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