# A Report on Wicomico 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. Tree canopy provides many benefits to communities, improving water quality, saving energy, lowering summer temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits. Establishing a tree canopy goal is essential for communities seeking to improve their green infrastructure. A tree canopy assessment is the first step in urban forest planning, providing estimates for the amount of tree canopy currently present in a county as well as the amount of tree canopy that could theoretically be established.

# How Much Tree Canopy Does Wicomico Co.

An analysis of Wicomico County based on land cover data derived from high-resolution aerial imagery and LiDAR (Figure 1) found that 117,327 acres of the county were covered by tree canopy (termed Existing TC), representing 49% of all land in the study area (Figure 2). An additional 48% (114,392 acres) of the region's land area could theoretically be modified (termed Possible TC) to accommodate tree canopy. In the Possible TC category, 46% (108,696 acres) of total land area was classified as Vegetated Possible TC and another 2% as Impervious Possible TC (5,695 acres). Vegetated Possible TC, or grass/shrub, is more conducive to establishing new tree canopy, but establishing tree canopy on areas classified as Impervious Possible TC will have a greater impact on water quality and summer temperatures.



Figure 1: Study area and example of the land cover derived from highresolution imagery for this project.

# **Project Background**

The goal of the project was to apply the USDA Forest Service's Tree Canopy Assessment protocols to Wicomico County, Maryland. The analysis was conducted using imagery and LiDAR acquired in 2011. This project was made possible through funding from Wicomico County and NASA. The Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of the Environment and Natural Resources carried out the assessment in collaboration with Wicomico County, the University of Maryland, SavATree, NASA, and the USDA Forest Service's Northern Research Station.



Figure 2: TC metrics for Wicomico County based on % of land area covered by each TC type.

# **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 urban 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.

**Not Suitable**: Areas where it is highly unlikely that new tree canopy could be established (primarily buildings and roads).

# Mapping Wicomico County's Trees

A previous estimate of tree canopy for Wicomico County, derived from the 2001 National Land Cover Database (NLCD 2001), was 31%, much lower than the 46% obtained in this study (based on the total area of county, including water). This large difference was attributable to the low resolution of NLCD 2001 (Figure 3a), which only accounted for relatively large patches of tree canopy. Using high-resolution satellite imagery acquired in the summer of 2011 (Figure 3b), in combination with advanced automated processing techniques, land cover for Wicomico County was mapped with such detail that trees as short as 8ft tall were detected (Figure 3c).







Figure 3: Comparison of NLCD 2001 (a) to high-resolution imagery (b) and tree canopy (c) derived for this study.

# **Parcel Summary**

After land cover was mapped for the study area, Tree Canopy (TC) metrics were summarized for each property in the study area's parcel database (Figure 4). Existing TC and Possible TC metrics were calculated for each parcel, both in terms of total area (square footage) and as a percentage of the land area within each parcel (TC area divided by land area of the parcel).



Figure 4: Parcel-based TC metrics. TC metrics are generated at the parcel level, allowing each property to be evaluated according to its Existing TC and Possible TC.

# Land Use

UTC assessment methods permit analysis of Existing and Possible Tree Canopy according to any geography of interest. For example, tree canopy in Wicomico County was examined relative to the County's existing land-use database. Not surprisingly, whether simplified to generic classes (Figure 5) or summarized by specific land-use designations (Figure 6), the highest proportions of tree canopy were associated with forested land uses (e.g., Mixed Forest, Deciduous Forest), followed by brushy areas with young tree growth. Residential areas had the next highest proportion of tree canopy, containing both remnant forest patches and planted urban trees (e.g., shade trees, ornamental plantings, street trees). These results also confirmed that agricultural land uses have the highest proportion of land that could accommodate additional trees; residential and commercial land users offer further opportunities for expanded tree canopy.



Figure 5: A graphic summary of tree canopy relative to generic land-use categories for Wicomico County, Maryland. The size of each rectangle is proportionate to the total amount of land in each land-use category, while the color gradient represents the percentage of tree canopy.



Figure 6: Tree Canopy (TC) metrics summarized for selected land uses (categories with less than 1% of county area not shown).

# **Municipalities**

Existing and Possible Tree Canopy were also summarized according to the Wicomico County's municipal areas (Figures 7 and 8). Although it is the largest and most densely-developed municipality in the County, Salisbury contained a comparatively high proportion of Existing Tree Canopy, exceeded only by Fruitland. However, the distribution of tree canopy in these municipalities was uneven; pockets of contiguous forest accounted for much of the total canopy area (e.g., western extension third of Fruitland is undeveloped with little agriculture). These municipalities also had comparatively less Possible Tree Canopy, in part because they contained the largest proportion of areas not suited to expanded tree canopy (e.g., buildings and transportation infrastructure). Hebron, Pittsville, and Willards had the highest proportions of Possible Tree Canopy, attributable primarily to large areas of still-active agriculture. These results underscored one of the key differences between Possible TC Vegetation and Possible TC Impervious: conversion of impervious surfaces to tree canopy may have the most direct effect on runoff, shade, and the other benefits, but it may also be more expensive and logistically challenging.



Figure 7: Existing and Possible Tree Canopy for municipalities in Wicomico County, Maryland.



Figure 8: Tree Canopy metrics summarized by municipality.

# Watersheds

In addition to political and social criteria, tree-canopy patterns can be summarized according to many environmental geographies of interest. Watershed boundaries, for example, better show the county's distribution of tree canopy relative to agricultural lands and developed zones (Figures 9 and 10). The lowest proportions of tree canopy generally occurred in the densely-developed subwatersheds (12-digit watersheds from Maryland DNR) encompassing Salisbury and adjacent areas, spanning the watersheds (8-digit) of the Lower Wicomico River and Wicomico River Head. Highly agricultural subwatersheds in the Upper Pocomoke River and Nanticoke River regions similarly had relatively little tree canopy, especially in flat riparian zones with productive soils. Accordingly, these subwatersheds usually had the highest proportion of Possible Tree Canopy, with Possible TC Vegetation dominating the agricultural areas and Possible TC Impervious constituting important land cover in developed zones. In contrast, the highest proportions of tree canopy occurred in undeveloped areas upslope from agricultural bottomlands, including parts of the Nassawango Creek and lower Nanticoke areas. Possible Tree Canopy was correspondingly lower in these areas.



Figure 9: Existing and Possible Tree Canopy for selected Maryland DNR 12-digit watersheds in Wicomico County, Maryland.



Figure 10: Tree Canopy metrics summarized by selected Maryland DNR 12-digit watersheds.

# **Urban Heat Island Effect**

A well-known benefit of trees is their ability to reduce ground-surface temperatures, both by direct shading and retention of soil moisture. In areas where tree canopy has been removed, surface temperatures can be substantially higher than adjacent forested areas. The effect may be most pronounced in areas with extensive impervious surfaces, which absorb and hold thermal radiation from the sun, but it also occurs in agricultural areas with bare or sparse vegetative cover. Analysis of recent thermal data (Landsat, August 31, 2011) illustrated this effect in Wicomico County. Salisbury and other densely-developed areas showed the highest surfaces temperatures, but agricultural field also showed temperatures higher than forested cover (Figure 11). This relationship was further confirmed by plotting surface temperature versus Existing Tree Canopy, summarized according to 300-meter grid cells; a statistically-significant inverse relationship was apparent, with surface temperatures increasing as tree canopy decreased (Figure 12).



Figure 11: Landsat-derived surface temperatures for Wicomico County, Maryland, August 31, 2011.



Figure 12: Plot of surface temperatures versus percent Existing Tree Canopy, summarized according to 300-meter grid cells, Wicomico County, MD, August 31, 2011.

# Additional Summary Materials and Decision Support

UTC metrics calculated for each geography of interest provide a wealth of information for decision support. When summarized by Countywide zoning categories (Table 1), for example, tree-canopy metrics were calculated as a percentage of all land in the County (% Land), as a percentage of land area in the specified zoning category (% Category), and as a percentage of total area in the tree canopy type (% TC Type). These results shows the distribution of Existing and Possible Tree Canopy across pertinent zoning categories and can be used to inform subsequent planning efforts. When combined with other geographies of interest, TC metrics provide an efficient method for not only summarizing County-wide trends but also for querying individual units of analysis (Figure 13).

71	Existing TC			Possible TC Vegetation			Possible TC Impervious		
Zoning	% Land	% Category	% TC Type	% Land	% Category	% TC Type	% Land	% Category	% TC Type
A - 1 Agricultural - Rural	42%	53%	85%	36%	45%	78%	1%	1%	35%
Municipality	2%	31%	4%	3%	43%	6%	1%	13%	36%
R - 20 Residential	2%	42%	4%	2%	50%	5%	0%	4%	9%
TT Town Transitional	1%	38%	3%	2%	59%	4%	0%	2%	3%
VC Village Conservation	1%	44%	1%	1%	52%	2%	0%	3%	2%
R - 15 Residential	0%	41%	1%	1%	50%	1%	0%	5%	2%
R - 8 Residential	0%	37%	1%	1%	50%	1%	0%	8%	4%
I - 2 Heavy Industrial	0%	38%	1%	0%	44%	1%	0%	13%	5%
Airport Business Park	0%	19%	0%	0%	67%	1%	0%	5%	1%
LB - 1 Light Business & Institutional	0%	40%	0%	0%	49%	0%	0%	9%	2%
C - 2 General Commercial	0%	36%	0%	0%	35%	0%	0%	22%	2%

Area % Land =	Area o	TC type for zoning category	Area	of TC type for zoning category	A N/ TC Turne –	Area of TC type for zoning category		
		Area of all land	Area o	of all land for specified land use	% TC Type =	Area of all TC type		
The % Land Area co County's land a Residential zoning	value of 2 area is cov g district.	indicates that 2% of Wicomi- ered by tree canopy in the R-20	The % Land value of 429 R-20 Residential zoning	6 indicates that 42% of land in the district is covered by tree canopy.	The % TC Type value canopy is in land classi	of 4% indicates that 4% of all tree fied as the R-20 Residential district.		

Table 1: Tree Canopy (TC) metrics were summarized by zoning district. For each zoning category, TC metrics were computed as a percentage of all land in the county(% Land), as a percentage of land in the specified category (% Category), and as a percentage of the area for TC type (% TC Type).

	GIS Database		Attribute	Value	
		Z	Zoning	Municipality	
		C C	DESCLU	Exempt Commercial	1
	and the second second	A	ACCTID	2313052875	1
		E	Existing TC	2%	I
	A A A A A A A A A A A A A A A A A A A	F	Possible TC	84%	I
		F	Possible TC-Vegetation	54%	1
Parcel-based Tree Canopy (TC) metrics were integrated into the County's			Possible TC-Impervious	31%	
existing GIS database. Decision makers can use GIS to query specific TC and land-cover metrics for a parcel or set of parcels. This information can be			mpervious Surfaces	39%	1
used to estimate the amount of tree loss in a planne improvement goals for an individual property.		15-5-			

Figure 13: GIS-based analysis of parcel-based TC metrics for decision support. In this example, GIS is used to select an individual parcel. The attributes for that parcel, including the parcel-based TC and land-cover metrics, are displayed in tabular form providing instant access to relevant information.

### **Conclusions**

- Tree canopy in Wicomico County is a vital asset that reduces stormwater runoff, improves air quality, reduces the County's carbon footprint, enhances quality of life, contributes to savings on energy bills, and serves as habitat for wildlife.
- Wicomico County should consider setting tree canopy goals, not only for increasing the County's overall tree canopy but to focus on increasing tree canopy in urban and residential areas that have low Existing Tree Canopy and high Possible Tree Canopy.
- Strategies for increasing tree canopy will likely differ by land-use type. For example, agriculture is still an important part of the County's economy, history, and social traditions, and protection of agricultural lands is an important land-use policy in its own right. It is thus unlikely that extensive areas of active agriculture will be planted with or left to revert to trees. However, it may be possible to plant trees in riparian buffers, hedgerows, and other adjacent areas while simultaneously maintaining active agriculture.
- In the County's municipalities and growth areas, residential or commercial development in former agricultural fields should provide for tree plantings in yards, common areas, and transportation rights-of-way. These new trees will produce a net gain in canopy while mitigating the effects of increased impervious surfaces.

- As with agriculture, some land uses will not necessarily be appropriate for planting trees, including vegetated lands that are occupied by cemeteries, golf courses, wetlands, and airfields. Efforts to increase tree canopy in these areas and other highly-developed zones might be most efficiently focused on extensive impervious surfaces such as parking lots and industrial sites, where tree canopy must be limited in areal extent yet often offer important reductions in stormwater runoff. The shade produced by trees in developed areas also help reduce the urban heat island effect.
- This type of limited but strategic tree planting is pertinent to all land-use types that contain vegetated or impervious surfaces; many opportunities exist for expanding tree canopy. For example, other potential sites include road medians, sidewalks, driveways, storage areas, large expanses of lawn, and brushy vegetation. Under the right circumstances, these sites could be modified to support additional trees.
- Efforts to preserve Wicomico County's current tree canopy and establish new tree canopy will likely take many forms. Tree canopy prioritization analyses can help managers make strategic decisions to match their objectives, from the property parcel level to the watershed scale.



Figure 14: Comparison of Existing and Possible Tree Canopy with other similar communities that have completed Tree Canopy Assessments.

#### Prepared by:

### Additional Information

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