A Report on Howard 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 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 Howard Co. Have?

An analysis of Howard County, Maryland's tree canopy (TC) based on high resolution aerial imagery found that about 80,000 acres of the county is covered by tree canopy (termed Existing TC). This corresponds to 50% of all land within the county (Figure 1). However, 43% (69,000 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. Because eastern portions of Howard County are heavily suburbanized while extensive areas of grass and shrubs occur in western sections, the county's Existing TC generally occurs in networks of patches (Figure 2). The largest, most contiguous patches tend to occur in the river valleys that constitute the county's northern and southern boundaries and are often publicly-owned (e.g., state parks). 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 Howard County, MD. Percentages are based on % of land area.

Project Background

This analysis of Howard County's tree canopy (TC) was a collaborative effort between the Howard County Department of Recreation and Parks (DRP) and the Baltimore Ecosystem Study (BES—www.beslter.org). It 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, methods successfully used and refined with a diverse set of cities and municipalities in the eastern United States, to Howard County, Maryland. This analysis was conducted based on year 2007 data.



Figure 2: Land cover for Howard County, MD. Existing tree canopy represents 50% 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 Howard County's Trees

Previous estimates of tree canopy for Howard County, 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 lacks the spatial resolution for fine-scale mapping in urban areas. 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 28% for Howard 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 land (Figure 4). This information was then combined with land-use designations to examine general ownership and use patterns (Figure 5, Table 1). Howard County's trees are located primarily in the county's residential zones, which accommodate a combined 43% of the Existing UTC. The Agricultural (18%) and Exempt (14%) land-use classes account for much of the remaining tree canopy. Note that the Exempt category includes both publiclyowned lands (e.g., state parks) and private properties with taxexempt status (e.g., churches). Most of the land suitable for planting new trees is also located in residential zones (35% of Possible TC), where expanses of lawn and paved surfaces could theoretically be modified to support additional tree growth. Agricultural areas contain the next highest proportion of Possible TC (31%), although it is important to remember that maintenance of local agricultural landscapes is often an important public-policy goal in its own right.



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



Figure 5: TC metrics summarized by land-use designation.

Land Use % Lan			Existing TC		Possible TC Vegetation			Possible TCImpervious		
		% Land	% Category	% TC Type	% La nd	% Category	% TC Type	% Land	% Category	% TC Type
Agricultural		9%	39%	18%	13%	59%	36%	0%	1%	5%
Apartments		0%	48%	0%	0%	16%	0%	0%	15%	1%
Commercial		1%	34%	2%	1%	26%	2%	1%	29%	14%
Commercial Condominium		0%	30%	0%	0%	12%	0%	0%	40%	1%
Com merci al Resi dential		0%	41%	0%	0%	15%	0%	0%	34%	0%
Exempt		7%	78%	14%	2%	20%	5%	0%	1%	2%
Exempt Commercial		2%	44%	3%	1%	37%	4%	1%	14%	9%
Industrial		1%	28%	2%	1%	19%	2%	1%	35%	20%
Non-parcel		0%	85%	0%	0%	7%	0%	0%	2%	0%
Residential		22%	56%	43%	13%	34%	36%	2%	4%	27%
Residential Condominium		0%	36%	0%	0%	21%	0%	0%	16%	1%
Town House		0%	33%	0%	0%	37%	0%	0%	13%	1%
Transportation ROW		3%	37%	6%	2%	20%	4%	1%	7%	9%
Unknown		6%	54%	11%	4%	38%	11%	1%	6%	10%
Area o % Land =	f TC type for specified land use Area of all land		% Category	Area of TC t	Area of TC type for specified land use		% UTC Type	Area of TC type for specified land use		
			Area of		Ill land for specified land use		78 OTC Type	-	Area of all TC type	
The % Land Area value of	10/ indicator that 10/			_				-	N	

The % Land Area value of 1% indicates that 1% of Howard County's land area is tree canopy in areas where the zoning is "Industrial.

The % Land Use value of 28% indicates that 28% of The % TC Type value of 2% indicates that 2% of all Existing "Industrial" land is covered by tree canopy.

TC lies in the "Industrial" land use.

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

Decision Su	pport 👘 👘	1123		1 1 1 1	1
Parcel-based TC metrics	were integrated	- Contraction			(A
into the county's ex- isting GIS database. Decision makers can use GIS to identify 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 TC improvement goals for an individual property.	Attribute	Value	GIS		
	Parcel ID	1404343107	Databasa		
	Land Use	Exempt	Database		
	Square Footage	189418		ST 5.2"	1 66
	Existing UTC Area	29428	L'AND STORE	2	Sp.
	Existing UTC	16%	A A A A A A A A A A A A A A A A A A A	a and a f	
	Possible UTC Area	156485	O. Dein		121
	Possible UTC	83%	Ma 129 15	Conserver FT.	N
	Possible UTC-Vegetation	79%	S Ruel	1 1 1 L	- 12
	Possible UTC-Impervious	4%	A Print		

Figure 6: 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 UTC metrics, are displayed in tabular form providing instant access to relevant 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 Patapsco and Patuxent River Watersheds have among the largest volume of Existing TC by both total and proportional area (Figure 7, 8a); not surprisingly, these watersheds encompass several state parks and other contiguous blocks of river-corridor forest. Conversely, these watersheds have relatively low proportions of Possible TC (Figure 8b). The Cattail Creek 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 Howard 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—Land Use in Riparian Corridors

Environmental analyses are also possible at finer scales, including assessment of Existing and Possible TC in riparian corridors. 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 riparian wildlife. For example, when rivers, streams, and other water bodies are buffered by 75 feet on each side and then superimposed with land-use designations, it becomes apparent that riparian corridors in Howard County occur primarily in Agricultural and Residential zones and are largely forested (Figure 9). However, these two land-use zones also contain the largest area 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 Howard County, MD river/stream corridors (75-foot buffer on each side).



Figure 10a: Existing TC, expressed as the percentage of land area, by land use in river/stream corridors (75-foot buffers).



Figure 10b: Possible TC, expressed as the percentage of land area, by land use in river/stream corridors (75-foot buffers).

Political Unit Analysis—Council Districts

Political units can also be considered in UTC assessments to further help gauge the distribution of county-wide tree canopy. In Howard County's council districts, for example, District 5 has the largest total area of Existing TC (Figure 11). As a percentage of land area, however, this district has a comparatively low tree-canopy volume and the highest proportion of Possible TC (Figures 12a, 12b). This pattern is attributable to the disproportionate size of District 5 and its prevalence of agricultural land uses. Districts 2 and 3, which are more heavily developed, also have low Existing TC and relatively high Possible TC, emphasizing the potential importance of tree-planting programs in suburban and urban areas. Although District 1 has the highest proportion of Existing TC, its suburban areas could also benefit from expanded tree canopy.



Figure 11: Distribution of existing and possible tree canopy in Howard County, MD council districts.



Figure 12a: Existing TC, expressed as the percentage of land area, for council districts.



Figure 12b: Possible TC, expressed as the percentage of land area, for council districts.

Political Unit Analysis—Columbia Villages

An example of a political-unit analysis at a finer scale involves villages in the planned community of Columbia. Long Reach Village has the largest land area and the largest volume of Existing TC (Figure 13), and its northeastern neighborhood has among the highest proportion of Existing TC relative to total land area (Figure 14a). However, other neighborhoods in Long Reach have smaller proportions of Existing TC. Additional villages with high proportions of Existing TC include River Hill, Hickory Ridge, Dorsey Search, and Oakland Mills. Not surprisingly, Commercial village areas have among the lowest proportions of Existing TC and highest proportions of Possible TC (Figure 14b). Nonetheless, opportunities for expanded tree canopy exist in all of the villages.



Figure 13: Distribution of existing and possible tree canopy in Columbia, MD villages.



Figure 14a: Existing TC, expressed as the percentage of land area, for Columbia villages.



Figure 14b: Possible TC, expressed as the percentage of land area, for Columbia villages.

Potential Analysis — Excluding Agricultural Preservation Areas

The initial TC statistics provide a useful overview of Possible TC, but they do not reflect the environmental, social, and legal constraints that would limit actual tree-planting efforts in some parts of the county. Additional analyses can be performed to refine Possible TC estimates and focus planning goals. For example, agricultural preservation areas have been established in the county to facilitate protection of farmland and local agricultural economies (Figures 15a, 15b). An analysis of Potential TC was conducted by subtracting the Possible TC amounts in agricultural areas (Figure 16) by the Possible TC county totals (Figure 1), yielding Potential TC estimates (Figure 17). Due to the relatively small amount of Possible TC in the agricultural preservation areas (13,610 acres), the difference between the Possible and Potential TC is only 2%.



Figure 15a: Agricultural preservation areas in Howard County, MD, shown at a countywide scale.



Figure 15b: Agricultural preservation areas in Howard County, MD, shown at a local scale.



Figure 16: Distribution of existing and possible tree canopy agricultural preservation areas .



Figure 17: Potential TC analysis. Possible TC in the agricultural preservation areas was subtracted from the total Possible TC.

Conclusions & Recommendations

- Howard 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 50% of its land area occupied by tree canopy, Howard County is similar to other counties and municipalities in Maryland, most notably Baltimore County (Figure 17). Predictably, it generally contains more canopy than dense urban centers.
- A majority of the county's existing tree canopy is located in areas designated as residential, followed by agricultural and exempt (e.g., parks) land uses. Preserving canopy in these areas is crucial to maintaining the county's overall tree canopy.
- Residential areas also 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 TCimprovement efforts in these areas will have to be balanced with maintenance of local agriculture.

- TC goals for Howard 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 least Existing TC and highest Possible TC. This targeted effort can be performed using the TC parcel database that was produced as part of this assessment.
- By land-use type, Howard County's residents control the largest percentage of Possible TC. Programs that educate residents on tree stewardship and provide incentives for tree planting are essential if Howard County is to sustain its TC in the long term.
- Other land-use categories (e.g., Exempt, Industrial, Commercial) 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 18: 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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