A Report on the City of Takoma Park'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 city 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 crucial for communities seeking to improve their green infrastructure. A tree canopy assessment is the first step in this goal-setting process, providing estimates for the amount of tree canopy currently present in a city as well as the amount of tree canopy that could theoretically be established.

How Much Tree Canopy Does Takoma Park Have?

An analysis of Takoma Park's tree canopy based on land cover data derived from high-resolution aerial imagery and LiDAR (Figure 1) found that 784 acres of the city were covered by tree canopy (termed Existing TC), representing 59% of all land in the city. An additional 25% (328 acres) of the city could theoretically be modified (termed Possible TC) to accommodate tree canopy (Figure 2). In the Possible TC category, 8% (107 acres) of the city was classified as Impervious Possible TC and another 17% was Vegetated Possible TC (221 acres). Vegetated Possible TC, or grass and shrubs, 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.
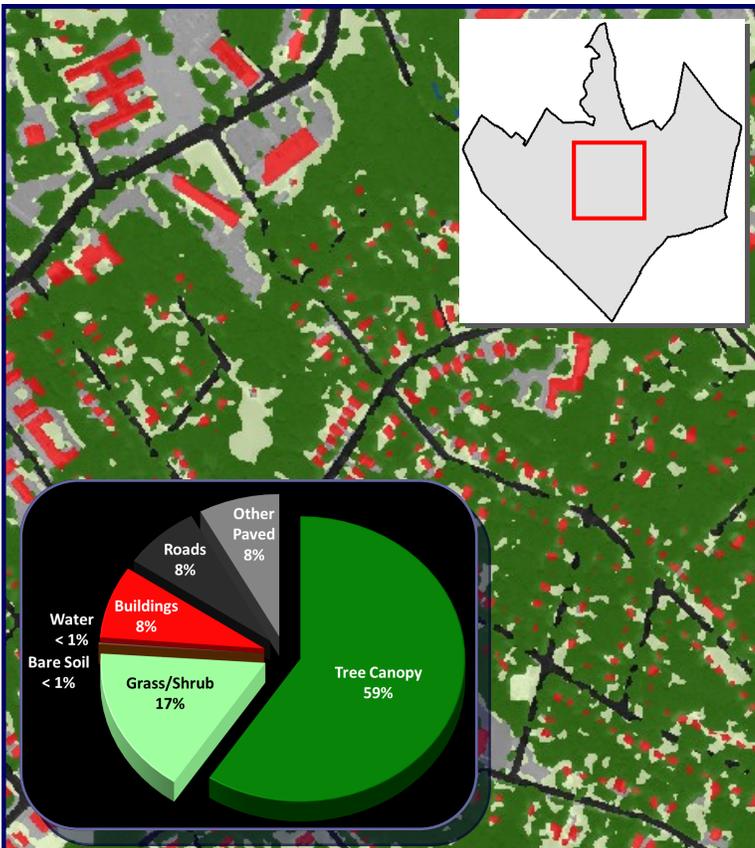

Figure 1: Land cover derived from high-resolution aerial imagery for the City

Project Background

The goal of the project was to apply the USDA Forest Service's Tree Canopy Assessment protocols to the City of Takoma Park. The analysis was conducted based on year 2009 data. This analysis of Takoma Park's tree canopy (TC) was conducted in collaboration with Montgomery County, the Maryland National Capital Park and Planning Commission, the City of Takoma Park, and the USDA Forest Service's Northern Research Station. The Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of the Environment and Natural Resources carried out the assessment.
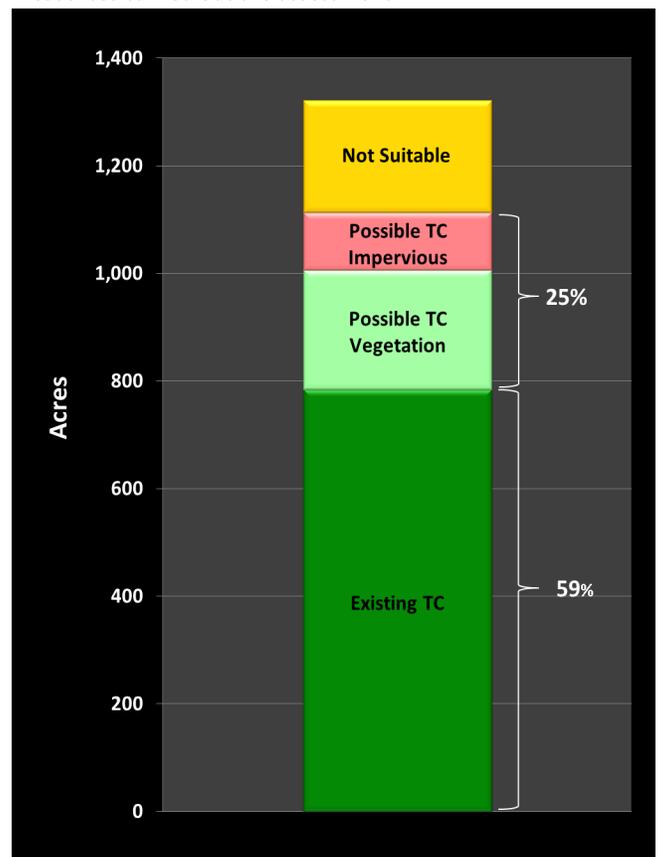

Figure 2: TC metrics for Takoma Park based on % of land area covered by each TC type.

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.

Mapping Takoma Park's Trees

Prior to this study, the only comprehensive remotely-sensed estimates of tree canopy for Takoma Park was from the 2001 National Land Cover Database (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 aerial imagery and LiDAR acquired in 2009 (Figure 3b), in combination with advanced automated processing techniques, land cover for the city was mapped with such detail that trees as short as 6ft tall were detected (Figure 3c). NLCD 2001 estimated a mean percent tree canopy of 38% for Takoma Park largely because it failed to capture many isolated trees.
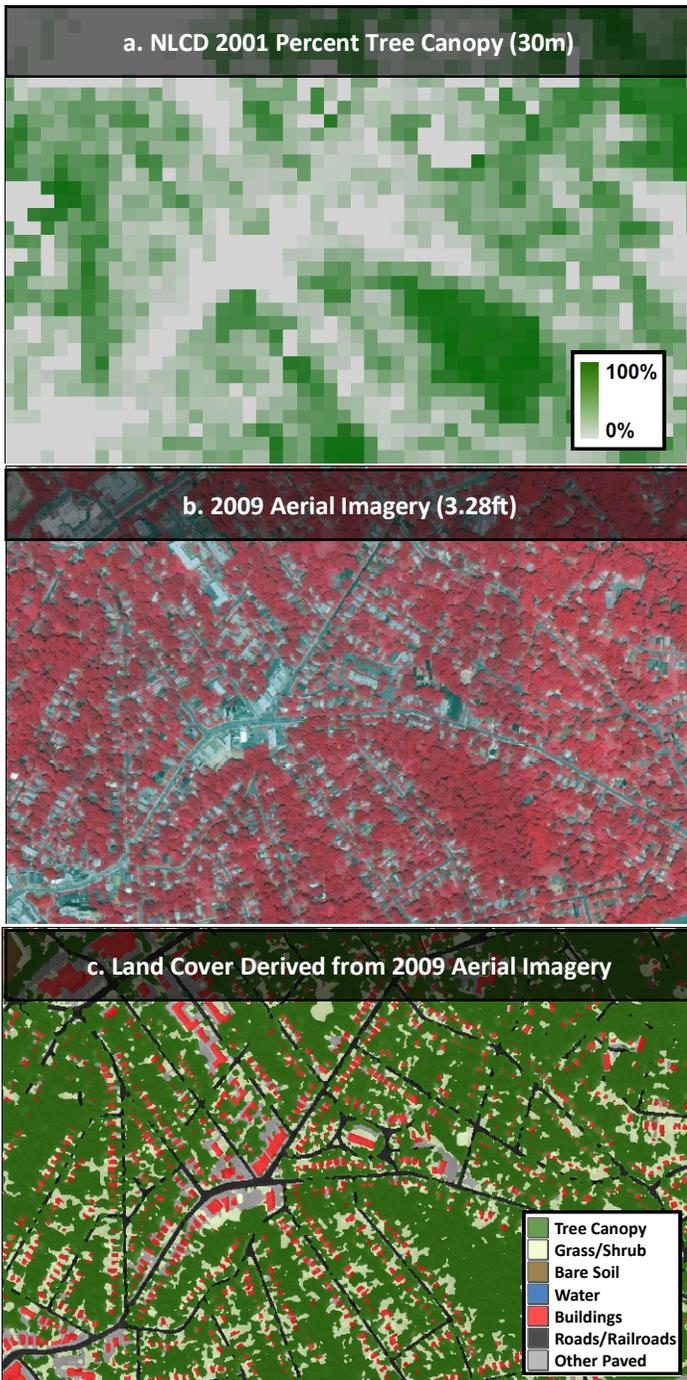
a. NLCD 2001 Percent Tree Canopy (30m)

100%

0%

b. 2009 Aerial Imagery (3.28ft)

c. Land Cover Derived from 2009 Aerial Imagery

Tree Canopy
Grass/Shrub
Bare Soil
Water
Buildings
Roads/Railroads
Other Paved

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

Parcel Summary

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

Parcels

Existing Tree Canopy (TC)

TC Existing Percent
0% - 26%
27% - 50%
51% - 69%
70% - 86%
87% - 100%

Possible Tree Canopy (TC)

TC Possible Percent
0% - 10%
11% - 24%
25% - 40%
41% - 61%
62% - 100%

Figure 4a, 4b, 4c: 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

An analysis of Existing and Possible tree canopy by land use category was conducted using the city's current land use layer (Figure 5, Table 1). For each land use category, TC metrics were calculated as a percentage of all land in the city (% Land), as a percentage of land area in the specified zoning category (% Category), and as a percentage of the area for TC type (% TC Type). Areas zoned as "Medium Density Residential" have the largest amount of tree canopy of any category with 59% of all tree canopy. "Deciduous Forest" had the largest percentage of their area covered by tree canopy (85%). "Medium-density residential" areas have most of the Vegetated Possible TC land (59%) available to support tree plantings, while "Commercial—Retail and Wholesale Services" had the most Impervious Possible TC (34%) of all land use categories.
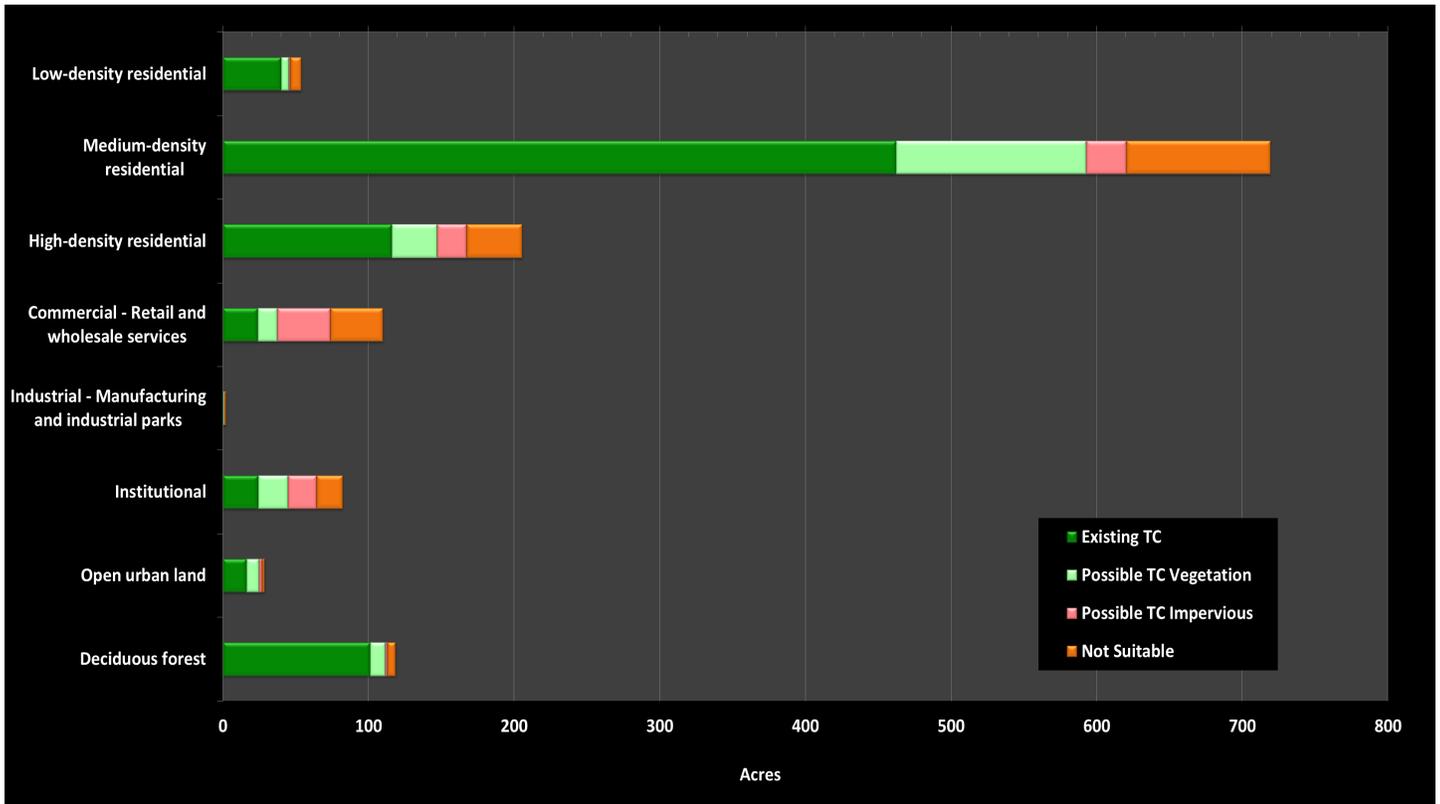

Figure 5: Tree canopy metrics summarized by land use category.

Land Use	Existing TC			Possible TC Vegetation			Possible TC Impervious		
	% Land	% Category	% TC Type	% Land	% Category	% TC Type	% Land	% Category	% TC Type
Low-density residential	3%	75%	5%	0%	10%	2%	0%	1%	1%
Medium-density residential	35%	64%	59%	10%	18%	59%	2%	4%	25%
High-density residential	9%	56%	15%	2%	15%	14%	2%	10%	19%
Commercial - Retail and wholesale services	2%	22%	3%	1%	12%	6%	3%	33%	34%
Industrial - Manufacturing and industrial parks	0%	19%	0%	0%	28%	0%	0%	7%	0%
Institutional	2%	30%	3%	2%	25%	9%	1%	24%	18%
Open urban land	1%	57%	2%	1%	29%	4%	0%	7%	2%
Deciduous forest	8%	85%	13%	1%	9%	5%	0%	1%	1%

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

The % Land Area value of 35% indicates that 35% of Takoma Park's land area is covered by tree canopy in the Medium-density Residential land use category.

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

The % Land value of 64% indicates that 64% of land in the Medium-density Residential land use category is covered by tree canopy.

$$\% \text{ TC Type} = \frac{\text{Area of TC type for zoning district}}{\text{Area of all TC type}}$$

The % TC Type value of 59% indicates that 59% of all tree canopy is in Medium-density Residential land use.

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

Parks Analysis

Existing and Possible Tree Canopy (TC) was analyzed for parks within Takoma Park (Figure 6). As expected, these lands have relatively high existing tree canopy, with parks such as Takoma Park South and Glengary Place Park having 100% of its land area covered by tree canopy. The assessment does reveal potential opportunities to increase coverage. For example, Takoma-Piney Branch LP has 26% of its land available for tree planting. While maintaining open spaces for recreation is an important social consideration, there still exists room for establishing new tree canopy.
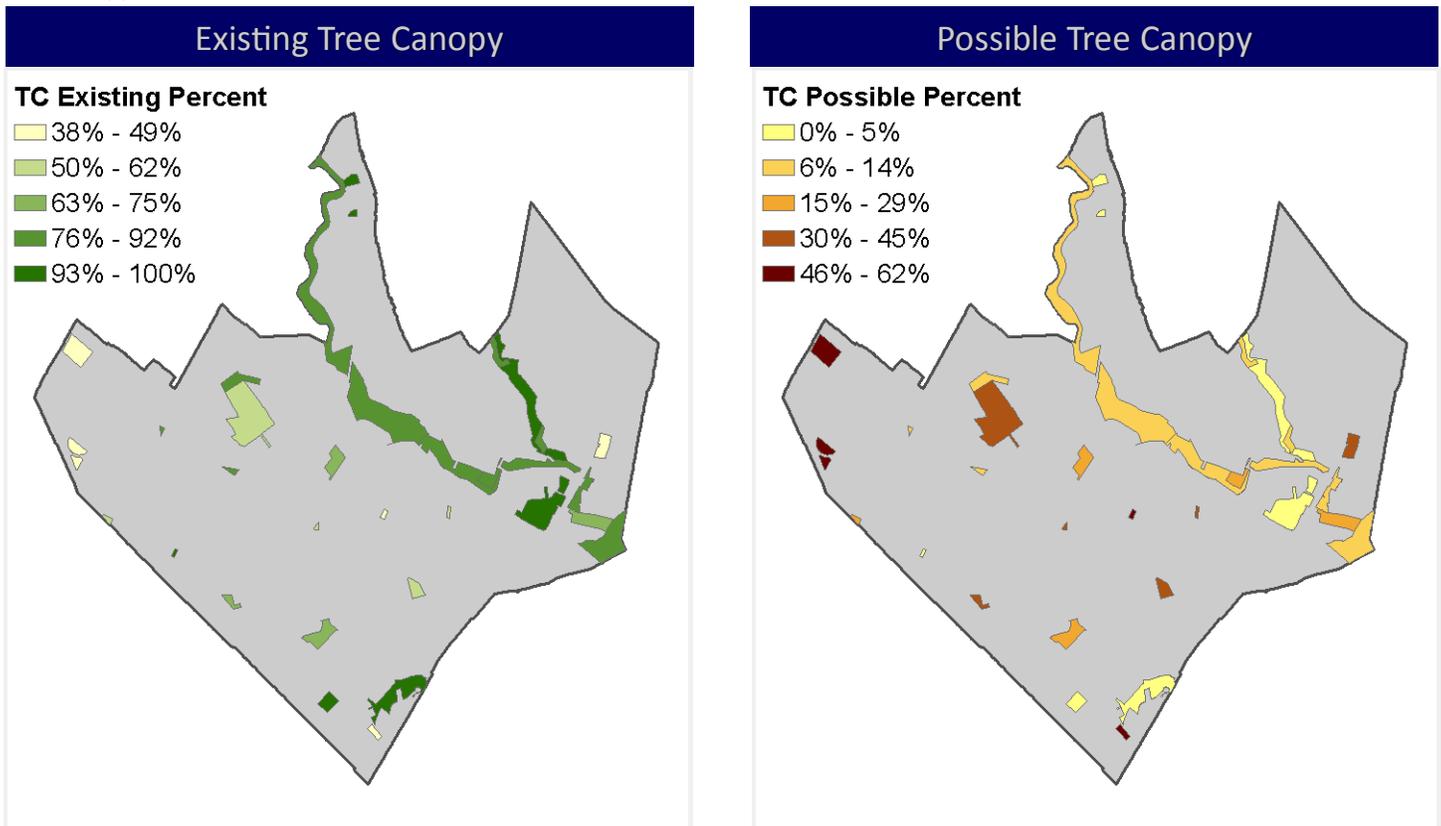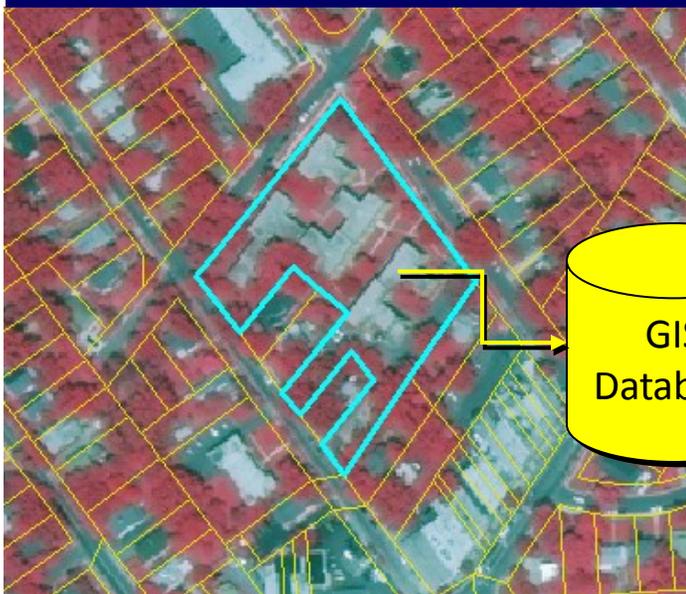
Existing Tree Canopy

TC Existing Percent
- 38% - 49%
- 50% - 62%
- 63% - 75%
- 76% - 92%
- 93% - 100%

Possible Tree Canopy

TC Possible Percent
- 0% - 5%
- 6% - 14%
- 15% - 29%
- 30% - 45%
- 46% - 62%

Figure 6. Existing TC (left) and Possible TC (right) as a percentage of land area by park.

Decision Support

Parcel-based Tree Canopy (TC) metrics were integrated into the city's existing GIS database (Figure 7). Decision makers can use GIS to query specific TC and land cover metrics for a parcel or set of parcels. For example, 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
ACCT	1069271
Existing TC	43%
Possible TC	38%
Possible TC—Vegetation	23%
Possible TC—Impervious	16%

Figure 7: 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.

Subwatershed Analysis

Existing and Possible TC were analyzed for the portion of subwatersheds boundaries within Takoma Park. The subwatersheds of Lower Sligo Creek and Long Branch have the highest Existing Tree Canopy at 62% and 57% respectively. Northwest Branch had the highest percentage of their land available for tree canopy with 51% in Possible Tree Canopy
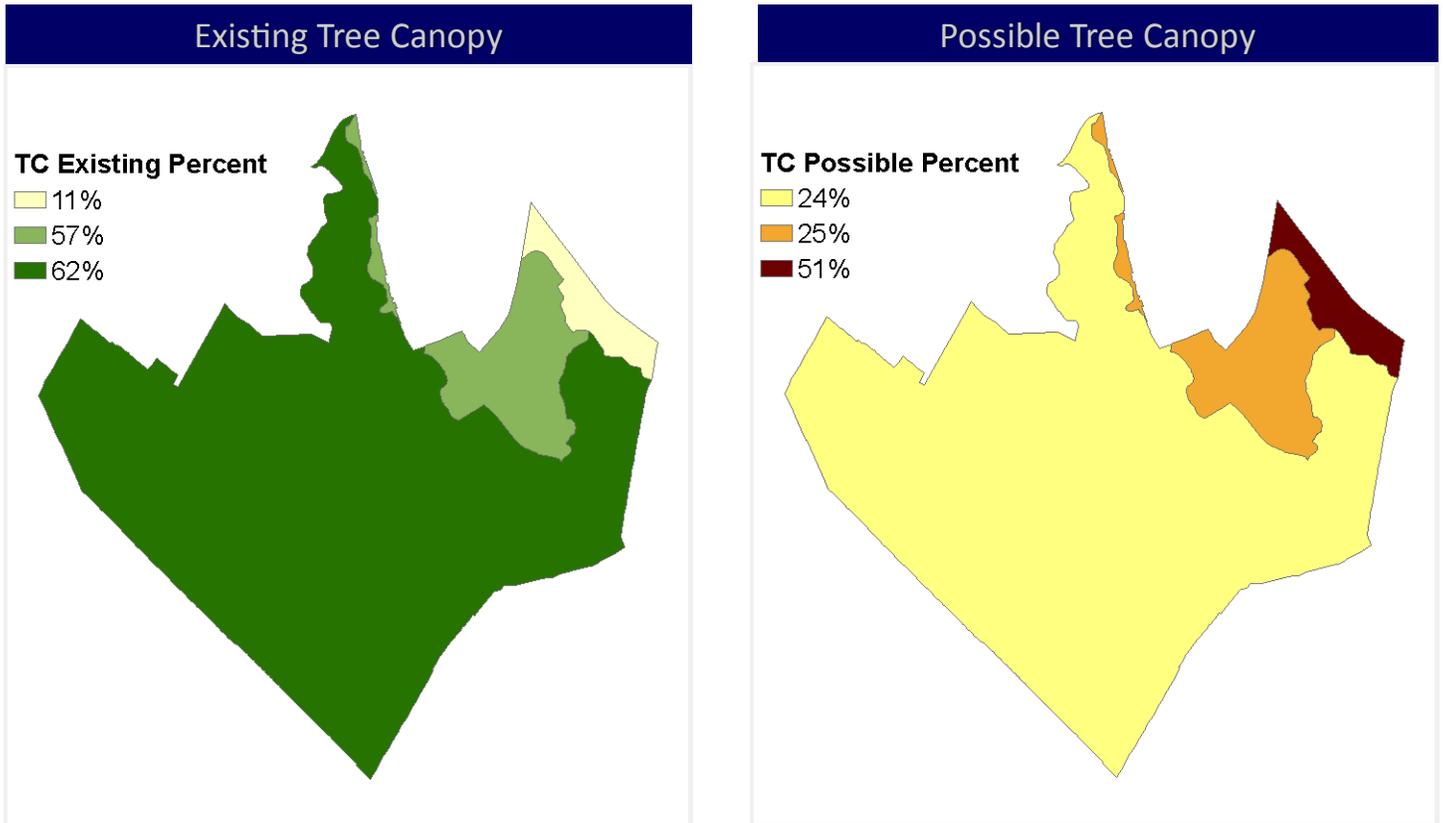
Existing Tree Canopy

TC Existing Percent
- 11%
- 57%
- 62%

Possible Tree Canopy

TC Possible Percent
- 24%
- 25%
- 51%

Figure 8. Possible TC (left) and Existing TC (right) as a percentage by subwatershed.

Parcel Land Use Analysis

Tree Canopy (TC) metrics were computed for all land use classes within the City's GIS parcel database. Parcels assigned to the "SF Detached" class have the highest percentage of their land covered by tree canopy (62%) and "Retail" parcels have the lowest (10%). "Parking" parcels have the highest percentage of their land available for the establishment of new tree canopy (70%)
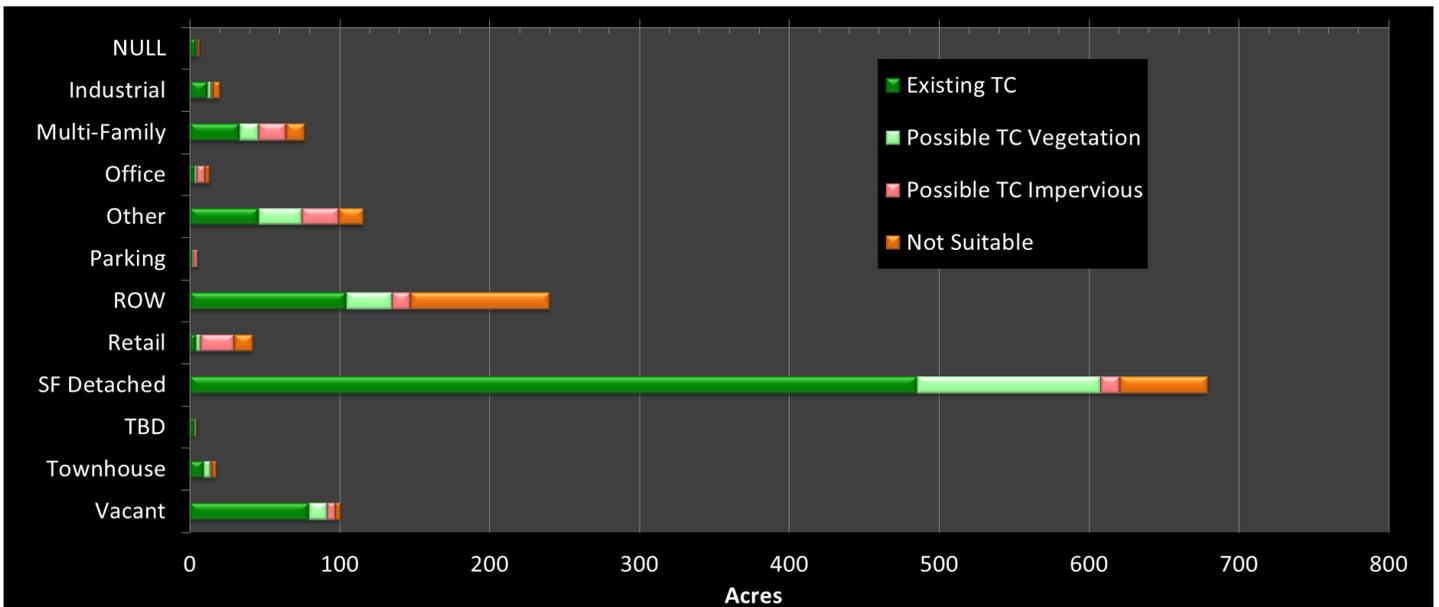
Figure 9: TC metrics summarized by parcel billing class.

Zoning Analysis

Tree canopy metrics were computed for all zoning categories (Figure 10). The highest amounts of Existing Tree Canopy were found in categories RE-2 and RT-8 with 92% and 91% respectively. Zoning categories C-2/Overlay and O-M had the most Possible TC with 62% and 60% respectively.
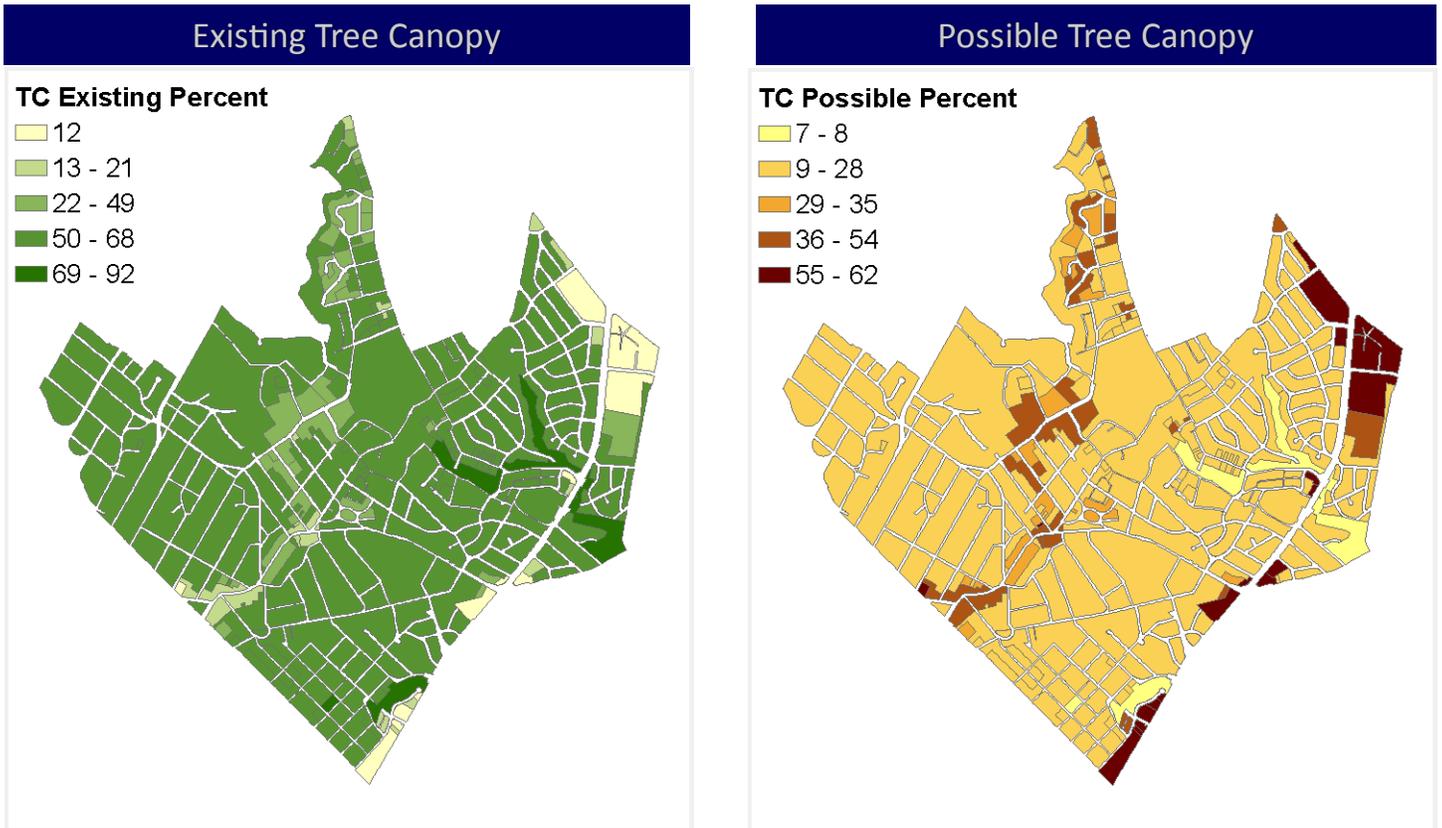
Existing Tree Canopy

TC Existing Percent
- 12
- 13 - 21
- 22 - 49
- 50 - 68
- 69 - 92

Possible Tree Canopy

TC Possible Percent
- 7 - 8
- 9 - 28
- 29 - 35
- 36 - 54
- 55 - 62

Figure 10. Possible TC (left) and Existing TC (right) as a percentage by zoning category.

Sensitive Areas Analysis

Tree Canopy (TC) metrics were computed for Sensitive Areas as defined by Montgomery County within the Sligo Creek watershed. Existing TC covers over 84% of these areas while Possible TC represents 8% of the area.
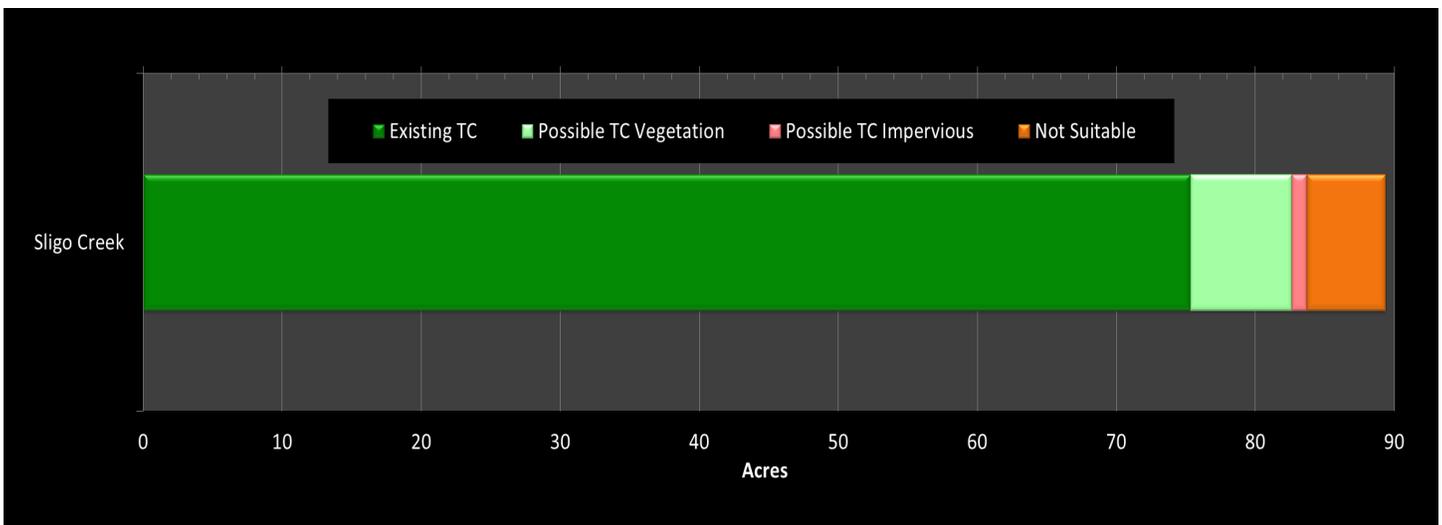
Figure 11: Tree Canopy metrics summarized for Sensitive Areas within Takoma Park.

Conclusions

- Takoma Park's urban tree canopy is a vital city asset that reduces stormwater runoff, improves air quality, reduces the city's carbon footprint, enhances quality of life, contributes to savings on energy bills, and serves as habitat for wildlife.

- Given Takoma Park's relatively high amount of tree canopy considerable attention should be paid to preserving the existing tree canopy.

- Takoma Park's residents control the majority of the City's tree canopy and have most of the land to plant trees. Programs that educate residents on tree stewardship and provide incentives for tree planting are crucial if Takoma Park is going to sustain its tree canopy in the long term.

- Although this assessment indicates that 25% of the land in Takoma Park could theoretically support tree canopy, planting new trees on much of this land may not be social desirable (e.g. recreation fields) or financially feasible (e.g. parking lots). Setting a realistic goal requires a detailed feasibility assessment using the geospatial datasets generated as part of this assessment.

- With Existing and Possible TC summarized at the parcel level and integrated into the city's GIS database, individual parcels and subdivisions can be examined and targeted for TC improvement. Of particular focus for TC improvement should be parcels in the city that have large, contiguous impervious surfaces. These parcels contribute high amounts of runoff, which degrades water quality. The establishment of tree canopy on these parcels will help reduce runoff during periods of peak overland flow.

- The city's rights-of-way (ROW) contain 43% Existing TC and 18% Possible TC, suggesting that opportunities exist for increasing the number of street trees.

- Particular attention should be paid to increasing tree canopy in the northeast portion of the city, which largely falls within the "Northwest Branch—Lower Mainstem" subwatershed. Research by Goetz et al. (2003) indicates that watersheds with 45% tree canopy can be categorized as having "good" water quality. The portion of this subwatershed within the city has only 11% tree canopy.
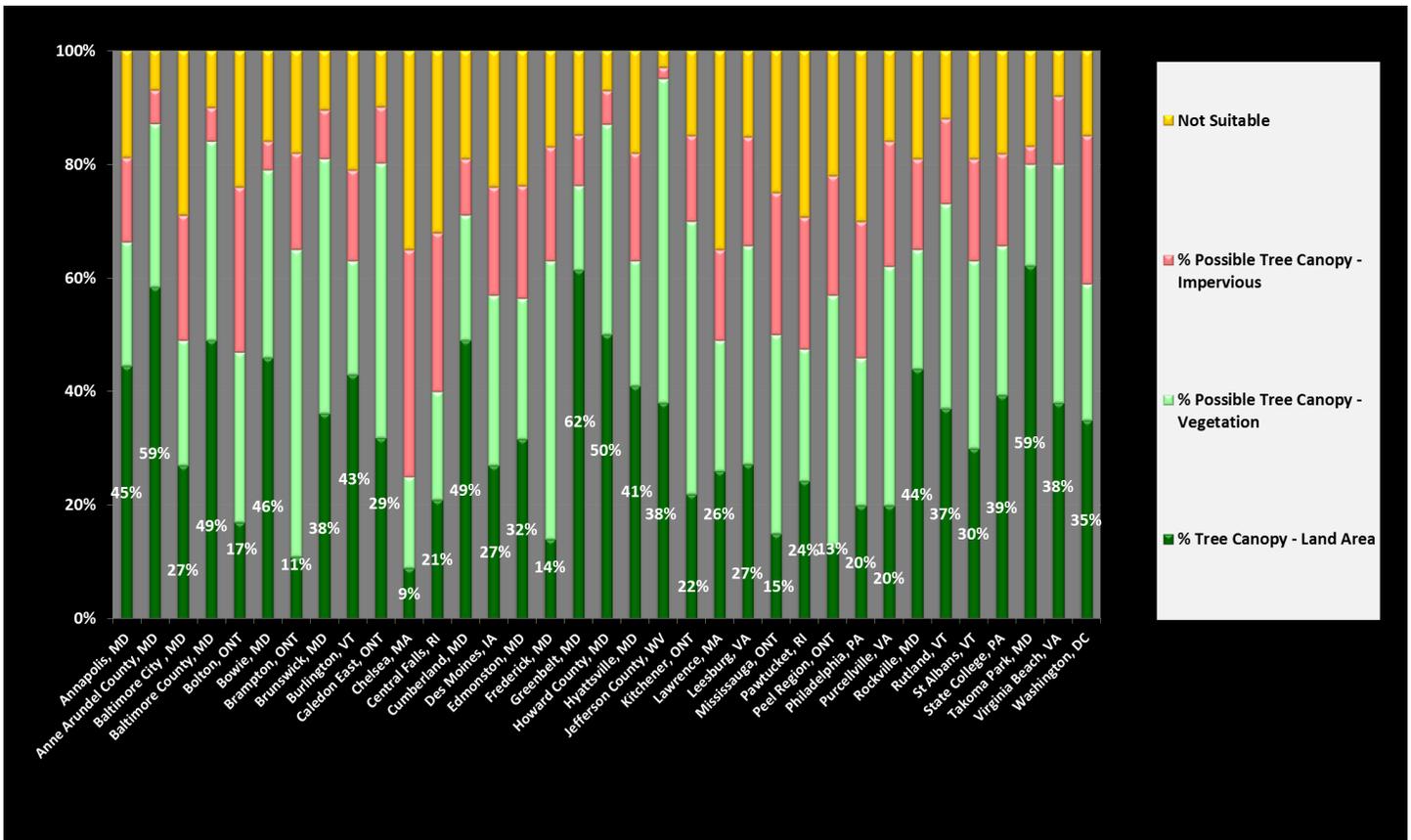

Figure 12: Comparison of Existing and Possible Tree Canopy with other selected cities that have completed Tree Canopy Assessments.

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