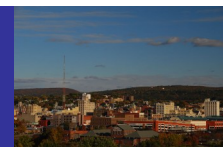


A Report on Scranton Metro Area's Existing and Possible Tree Canopy



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 Scranton Metro Area

An analysis of Scranton Metro Area's tree canopy based on land cover data derived from high-resolution aerial imagery and LiDAR (Figure 1) found that 33,149 acres of the area were covered by tree canopy (termed Existing TC), representing 55% of all land in the county. An additional 34% (20,757 acres) of the area could theoretically be modified (termed Possible TC) to accommodate tree canopy (Figure 2). In the Possible TC category, 12% (7,300 acres) of the Metro Area was classified as Impervious Possible TC and another 22% was Vegetated Possible TC (13,458 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.

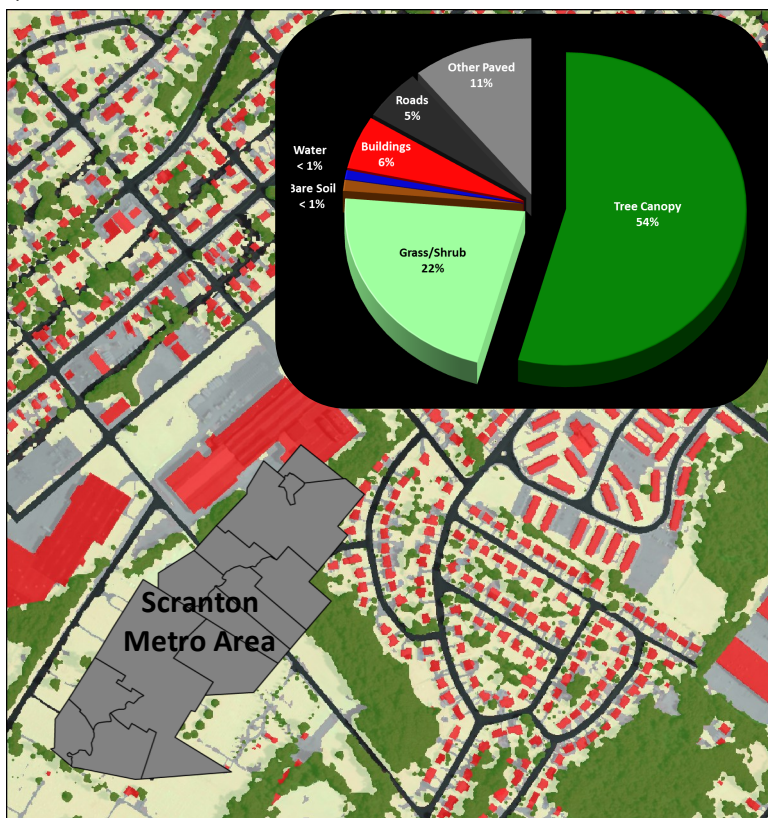


Figure 1: Land cover derived from high-resolution aerial imagery for Scranton Metro Area.

Project Background

The goal of the project was to apply the USDA Forest Service's TC assessment protocols to the Scranton Metro Area. The analysis was conducted based on year 2010 data. This analysis of Scranton Metro Area's tree canopy (TC) was conducted in collaboration with the PA Department of Conservation and Natural Resources Bureau of Forestry, the University of Vermont, and the Northern Research Station. The Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of the Environment and Natural Resources conducted the assessment.

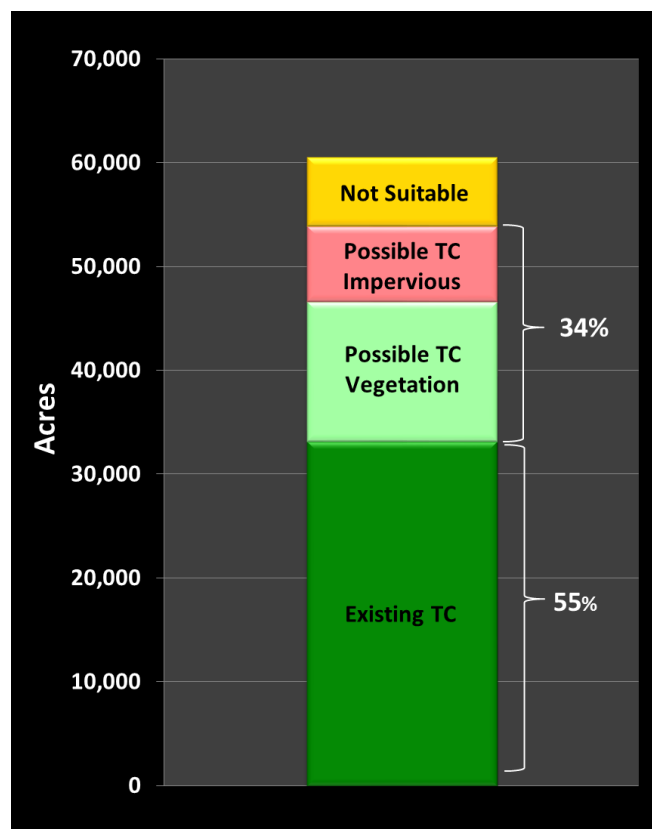


Figure 2: TC metrics for Scranton Metro Area based on % of land area covered by each TC type.

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 the City of Lackawanna's Trees

Prior to this study, the only comprehensive remotely sensed estimates of tree canopy for the Scranton Metro Area 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 acquired in 2010 (Figure 3b), in combination with LiDAR and advanced automated processing techniques, land cover for the city was mapped with such detail that individual trees were detected (Figure 3c). NLCD 2001 estimated a mean percent tree canopy of 23% for the area largely because it failed to capture many isolated trees.

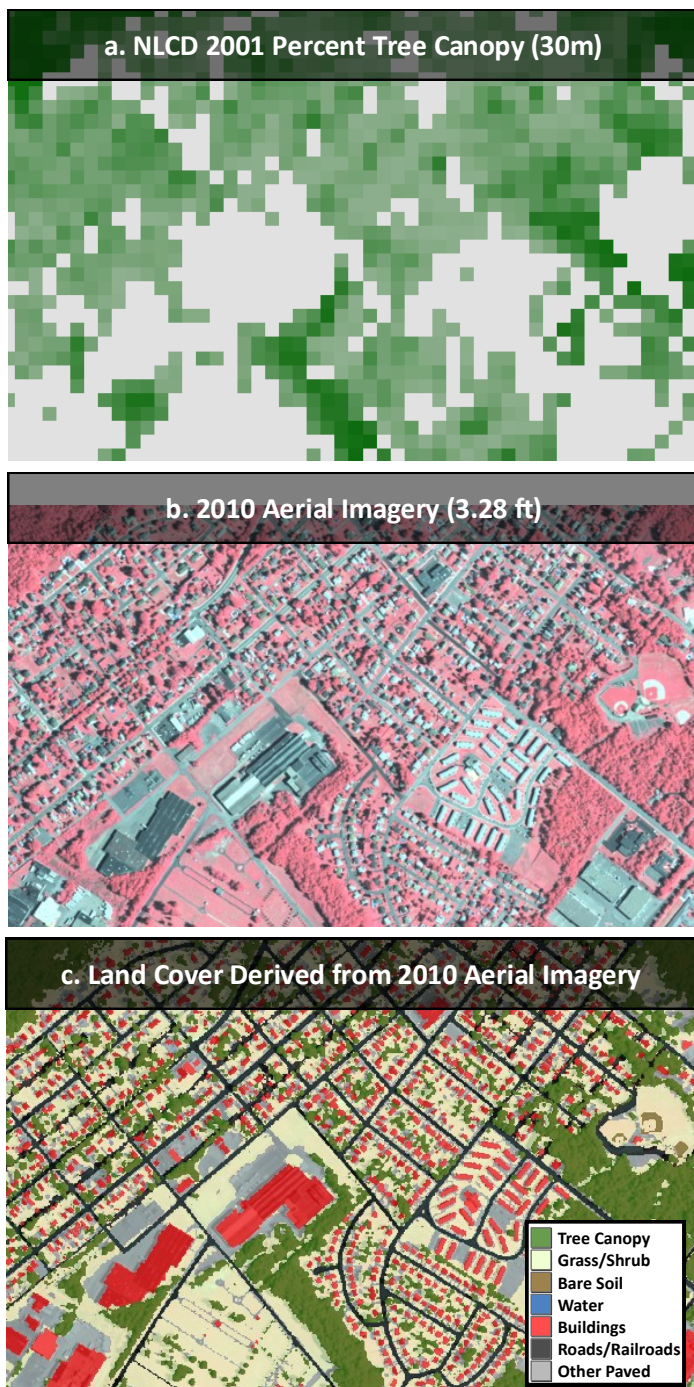


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

Parcel Summary

Tree Canopy (TC) metrics were summarized for each property in the Metro Area'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).

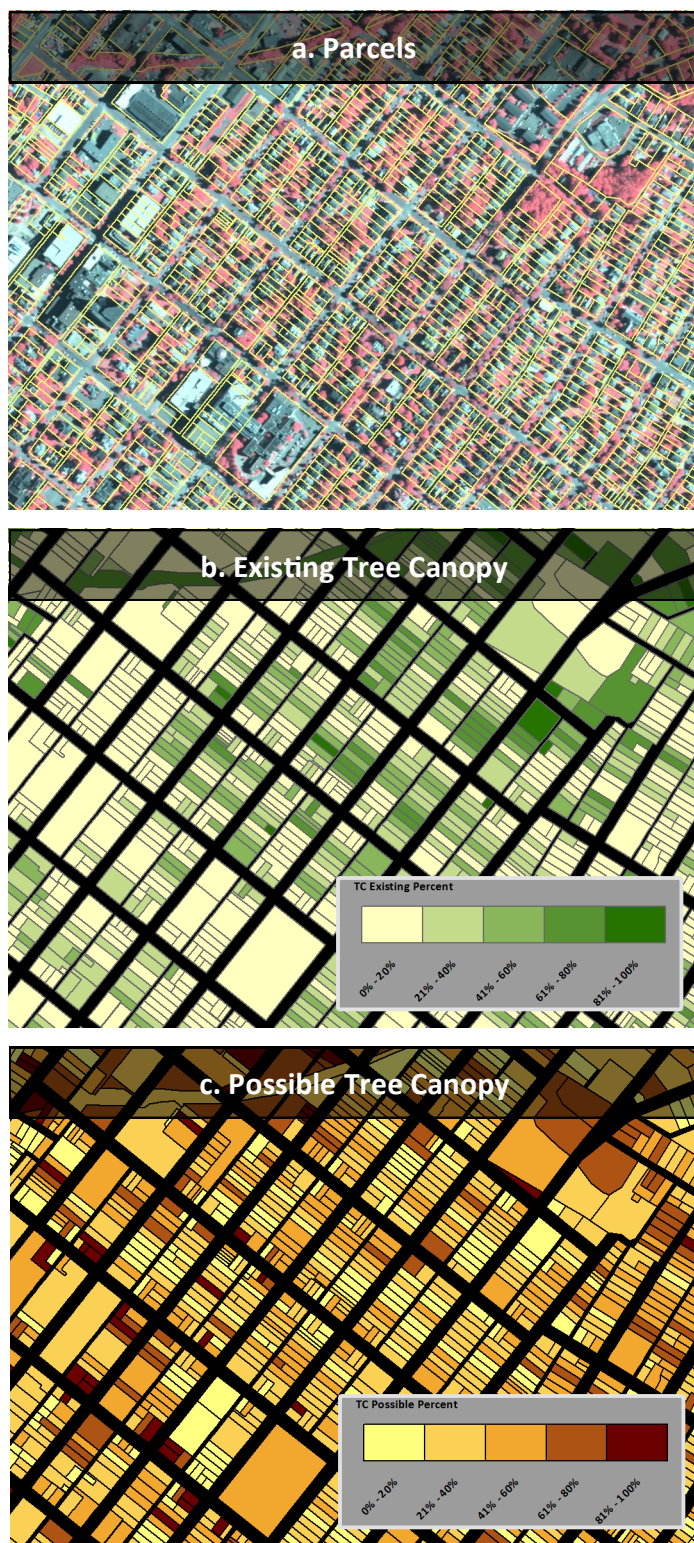


Figure 4a, 4b, 4c: Parcel-based TC metrics. TC metrics are generated at the parcel level, allowing each property to be evaluated according

Land Use

A comprehensive land use layer for the Scranton Metro Area was aggregated into eleven general categories and used in this study. Existing and Possible tree canopy was summarized for the aggregated land use classes (Figure 5, Table 1) where Tree Canopy (TC) metrics were calculated as a percentage of all land in the city (% Land), as a percentage of land area in the specified land use category (% Category), and as a percentage of the area for TC type (% TC Type). Protected Open Space land use had the greatest amount of tree canopy of any land use category with 76% of all tree canopy while Agricultural and Vacant land use had the largest percentage of land area covered by tree canopy (31%). Institutional land use had the most Possible Vegetated TC available to support tree plantings (35%) while Urban Center had the most Impervious Possible TC (31%) available for planting trees of all land use categories.

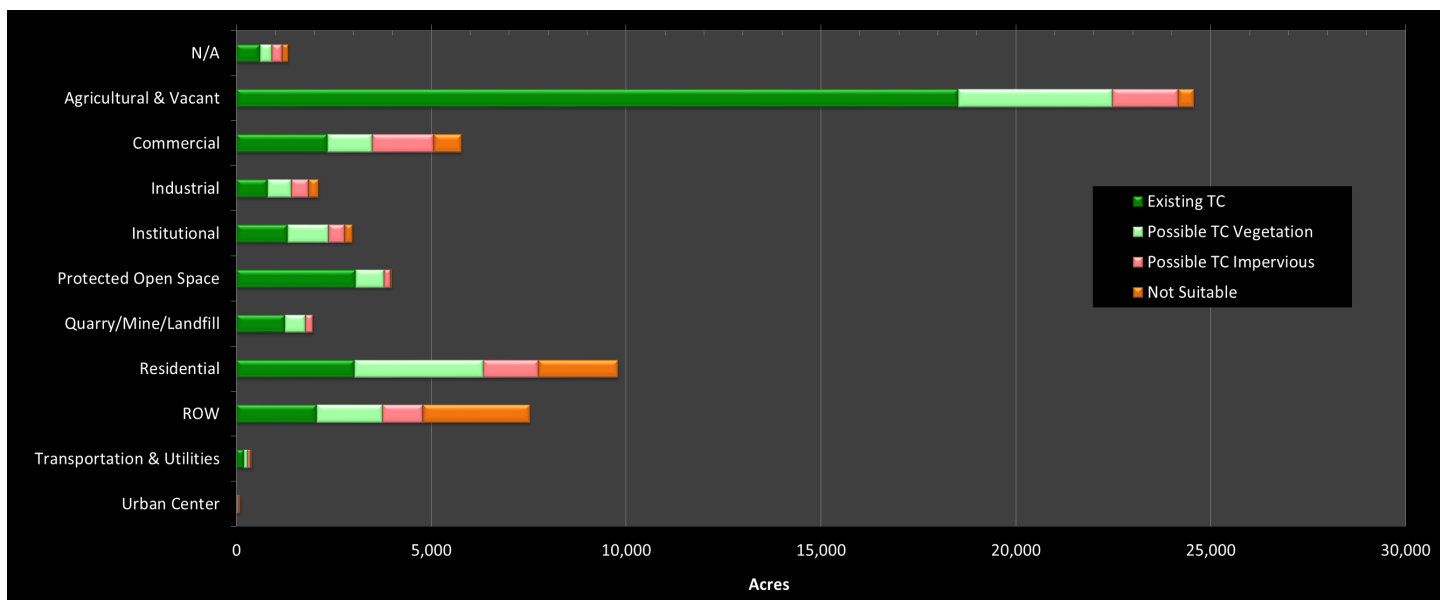


Figure 5: Tree Canopy (TC) metrics summarized by land use category.

Table 1: Tree Canopy (TC) metrics were summarized by land use category. For each land use category, TC metrics were computed as a percentage of all land in the area (% 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).

Land Use	Existing TC			Possible TC Vegetation			Possible TC Impervious		
	% Land	% Category	% TC Type	% Land	% Category	% TC Type	% Land	% Category	% TC Type
N/A	1%	46%	2%	1%	23%	2%	0%	19%	3%
Agricultural & Vacant	31%	75%	56%	7%	16%	29%	3%	7%	23%
Commercial	4%	40%	7%	2%	20%	9%	3%	27%	22%
Industrial	1%	38%	2%	1%	29%	5%	1%	21%	6%
Institutional	2%	44%	4%	2%	35%	8%	1%	14%	6%
Protected Open Space	5%	76%	9%	1%	18%	5%	0%	4%	2%
Quarry/Mine/Landfill	2%	63%	4%	1%	27%	4%	0%	9%	3%
Residential	5%	31%	9%	5%	34%	25%	2%	14%	19%
ROW	3%	27%	6%	3%	23%	13%	2%	14%	14%
Transportation & Utilities	0%	49%	1%	0%	23%	1%	0%	18%	1%
Urban Center	0%	13%	0%	0%	18%	0%	0%	31%	0%

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

The % Land Area value of 5% indicates that 5% of the Metro Area's land area is covered by tree canopy in the Open Protected Space land use class.

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

The % Land value of 76% indicates that 76% of land in the Open Protected Space land use category is covered by tree canopy.

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

The % TC Type value of 9% indicates that 9% of all tree canopy is in the Open Protected Space land use category.

Municipal Analysis

Existing and Possible Tree Canopy (TC) was analyzed by Municipality in Scranton Metro Area (Figure 6). All of the municipalities within the Scranton Metro Area had more than 34% Existing Tree Canopy. Archbald had the highest percent Existing Tree Canopy while Taylor had the most Possible Tree Canopy (52%).

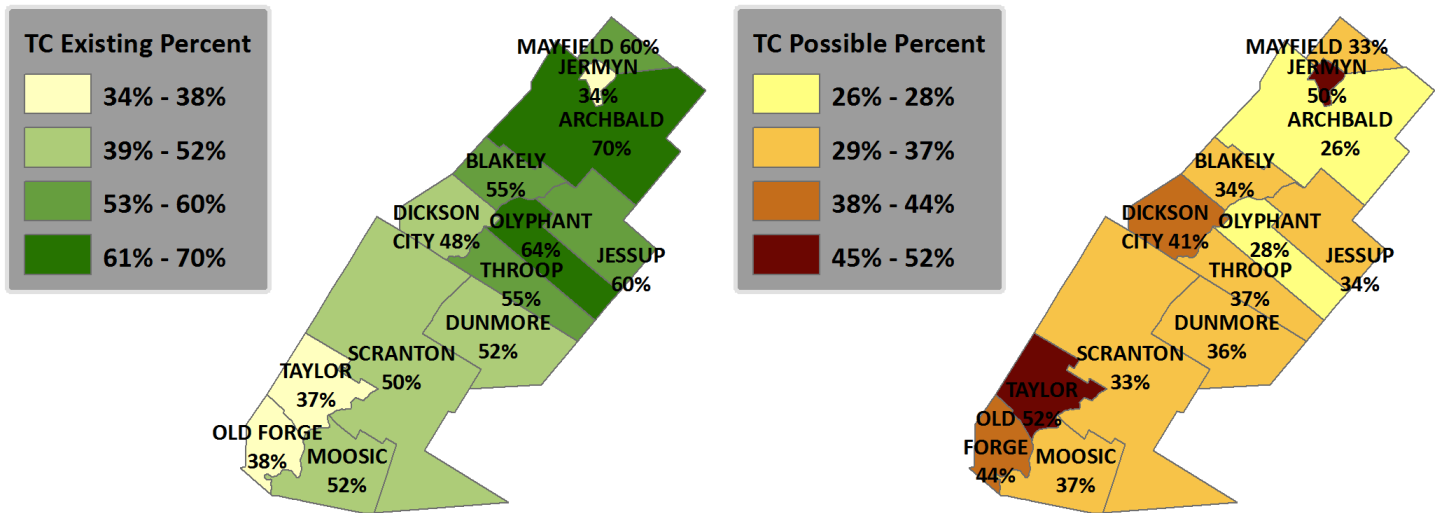


Figure 6: Tree Canopy (TC) metrics summarized by municipality.

Community Water System Analysis

Existing and Possible Tree Canopy (TC) was analyzed by the Community Water System covering the Scranton Metro Area.

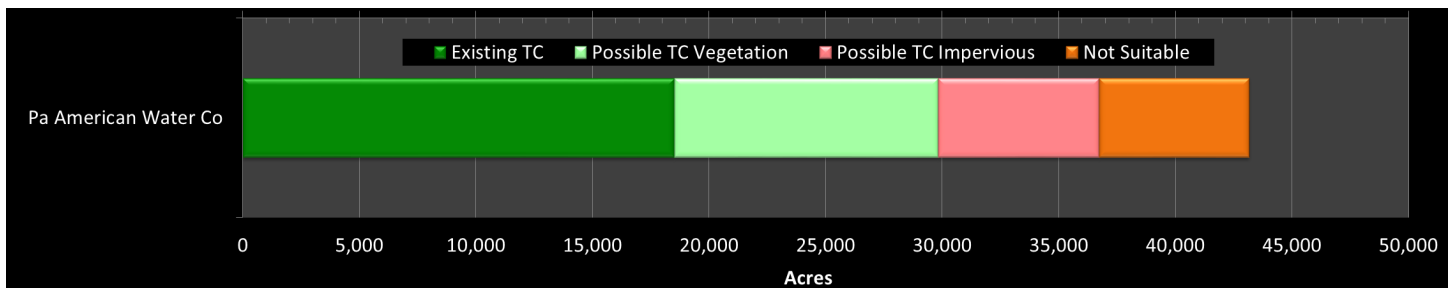
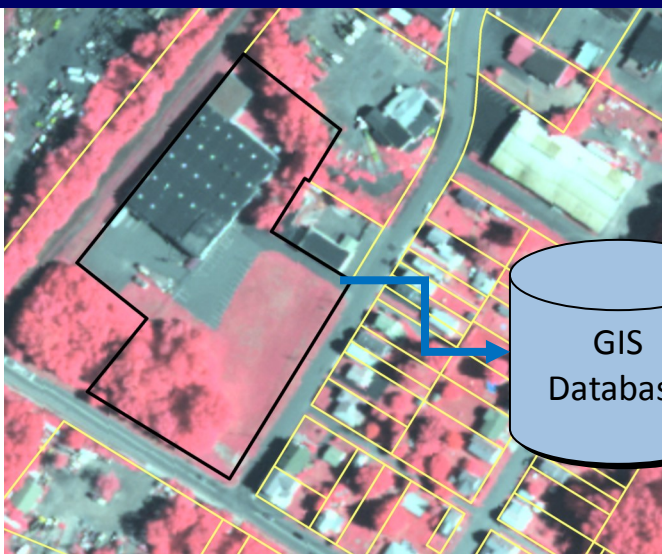


Figure 7: Tree Canopy (TC) metrics summarized by municipality.

Decision Support



Parcel-based Tree Canopy (TC) metrics were integrated into the Metro Area's existing GIS database (Figure 8). 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
Land Use	Commercial
PIN	5436113840
Address	2202 Luzerne St
Existing TC	27%
Possible TC	51%
Possible TC—Vegetation	28%
Possible TC—Impervious	23%

Figure 8: 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 metrics, are displayed in tabular form providing instant access to relevant information.

Small Watershed Analysis

Green Run, Indian Cave Creek, and South Branch Tunkhannock Creek had the highest Existing Tree Canopy (> 94%) while two watershed had less than 30%. Meadow Brook, Mill Creek, Powderly Creek, Red Spring Run and West Branch Wallenpaupack had relatively high amounts of Possible TC (> 50%).

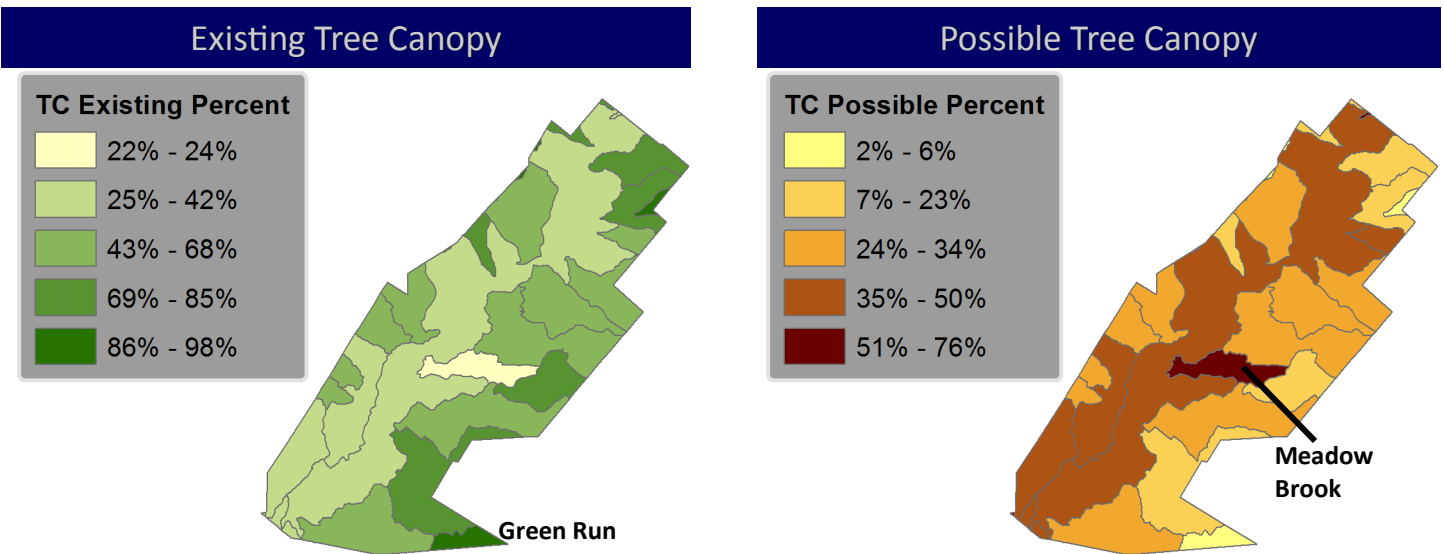


Figure 9: Existing TC (left) and Possible TC (right) as a percentage of small watershed within the Scranton Metro Area.

Large Watersheds Analysis

Tree Canopy metrics were also summarized by large watersheds, of which the Lackawanna River covers most of the Metro Area.

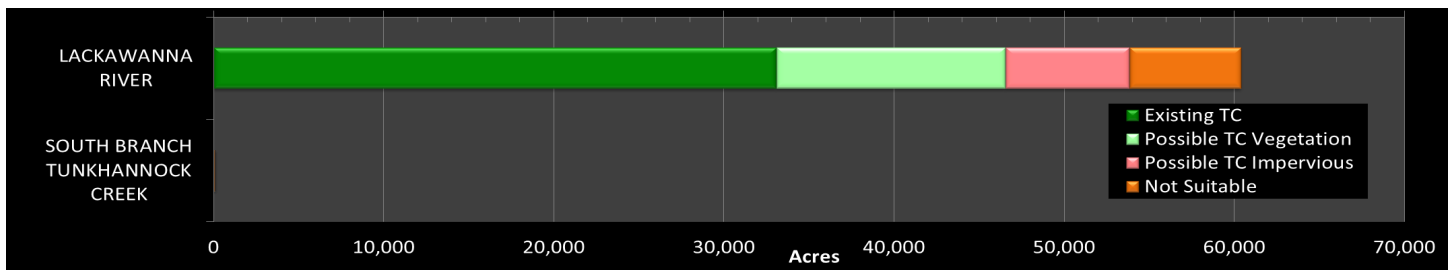


Figure 10: Existing TC (left) and Possible TC (right) as a percentage of large watersheds within the Scranton Metro Area.

Floodplain Analysis

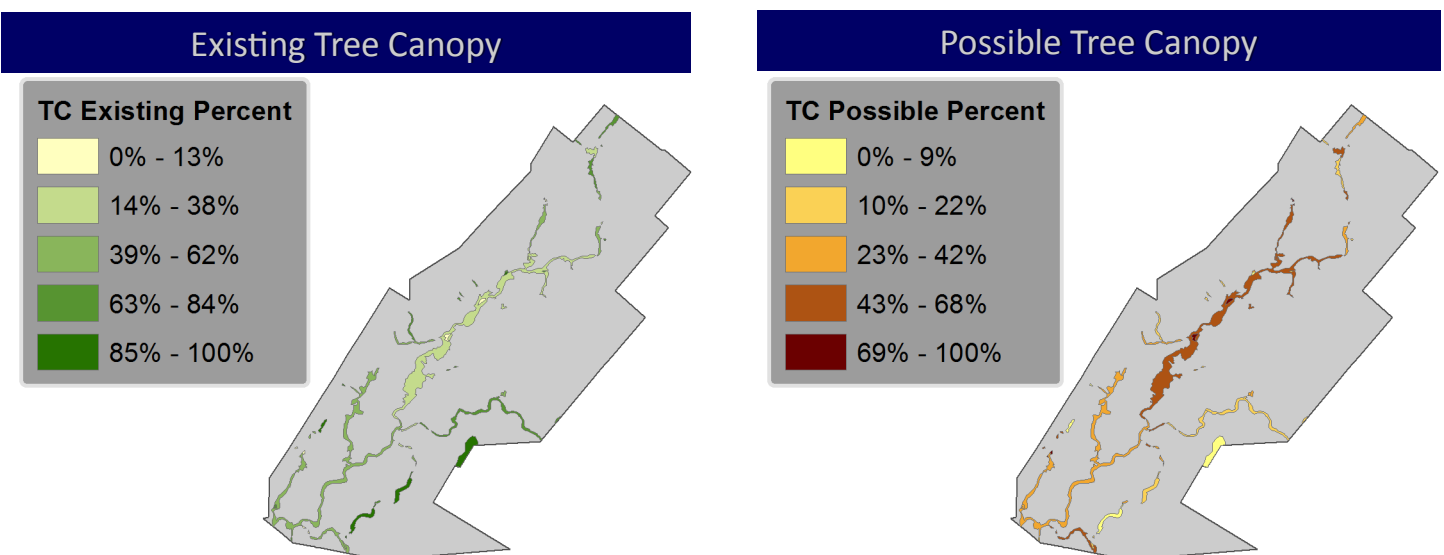
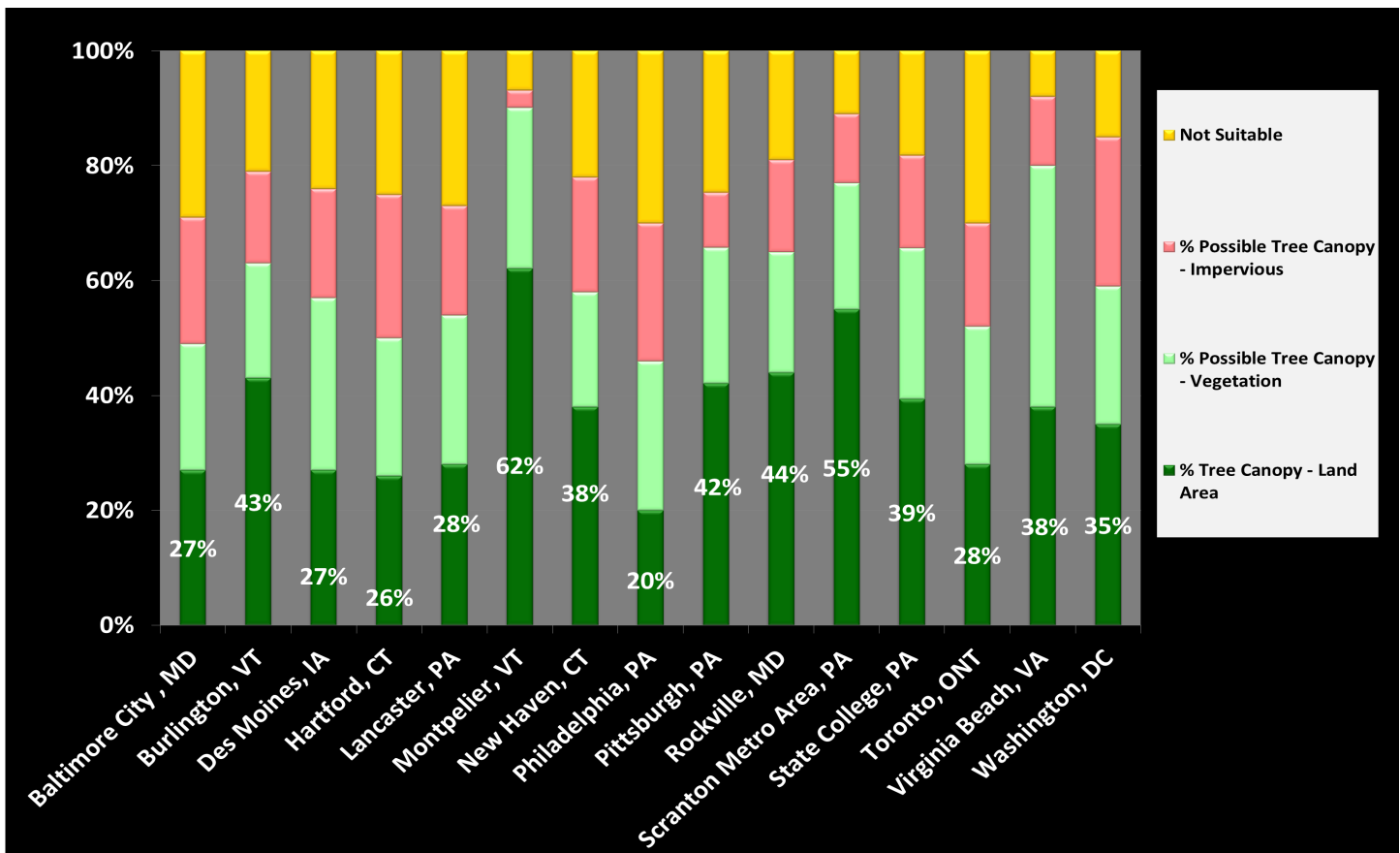


Figure 11: Existing TC (left) and Possible TC (right) as a percentage by Floodplains.

Conclusions

- Scranton Metro Area's urban tree canopy is a vital asset that reduces stormwater runoff, improves air quality, reduces the Metro Area's carbon footprint, enhances quality of life, contributes to savings on energy bills, and serves as habitat for wildlife.
- Although this assessment indicates that 34% of the land in the Metro Area could theoretically support tree canopy, planting new trees on much of this land may not be social desirable (e.g. agricultural lands) 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 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.
- Programs that educate residents on tree stewardship and provide incentives for tree planting are crucial if the Metro Area is going to sustain its tree canopy in the long term.
- Public lands such as Vacant Lands, Institutional, Protected Open Spaces, and rights-of-ways have large percentages of Existing and Possible TC and are areas that municipalities can most readily implement policies for increasing or preserving TC.
- Municipal summaries can be used for targeting tree planting and preservation efforts in different communities across the Metro Area.
- With TC metrics summarized by small and large watersheds and floodplains, individual streams can be examined and targeted for TC improvement and establishing or maintaining tree canopy along streams for reducing surface runoff, controlling stream-bank erosion, and providing wildlife habitat.
- The rights-of-way (ROW) within the Metro Area contain 27% Existing TC and 36% Possible TC, suggesting that opportunities exist for increasing the number of street trees.



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Additional Information

Funding for the project was provided by PA Department of Conservation and Natural Resources Bureau of Forestry. More information on the TC assessment project can be found at the following web site: <http://nrs.fs.fed.us/urban/utc/>



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