A Report on the Town of Williamsport 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, including water quality improvement, 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 TC goal is crucial for those communities seeking to improve their green infrastructure. A TC assessment that estimates the amount of tree canopy currently present (Existing TC), along with the amount of tree canopy that could theoretically be established (Possible TC), is the first step in the TC goal-setting process.

How Much Tree Canopy Does Williamsport Have?

An analysis of Williamsport's tree canopy, based on land cover derived from high-resolution aerial imagery (Figure 1), found that more than 175 acres of the town were covered by tree canopy (termed Existing TC), representing 28% of all land in the town. An additional 56% (349 acres) of the town could theoretically be improved to support tree canopy (Figure 2). In the Possible TC category, 11.9% (74 acres) of the city were Impervious Possible TC and another 44.2% were Vegetated Possible TC (275 acres). Vegetated Possible TC, or grass and shrubs, is more conducive to establishing new tree canopy, but establishing tree canopy on Impervious Possible TC will have a greater impact on water quality.

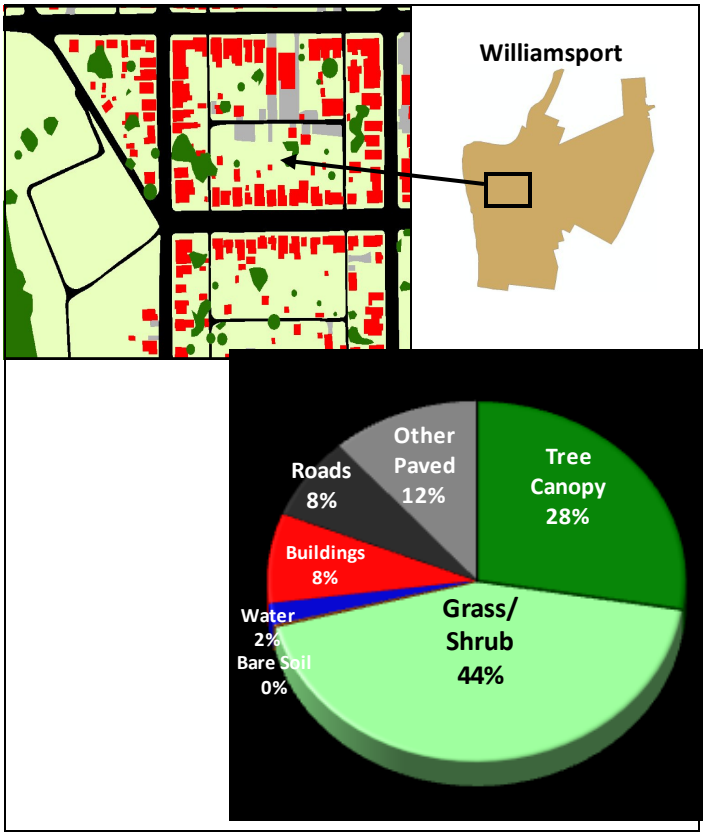

Figure 1: Land cover derived from high-resolution aerial imagery for the town of Williamsport.

Project Background

The analysis of Williamsport's tree canopy (TC) was carried out in collaboration with the City of Williamsport, the Chesapeake Bay Trust, Washington County Government, the Maryland Department of Natural Resources and the USDA Forest Service. The analysis was performed by the Spatial Analysis Laboratory (SAL) of the University of Vermont's Rubenstein School of the Environment and Natural Resources.

The goal of the project was to apply the USDA Forest Service's TC assessment protocols to the town of Williamsport. This analysis was

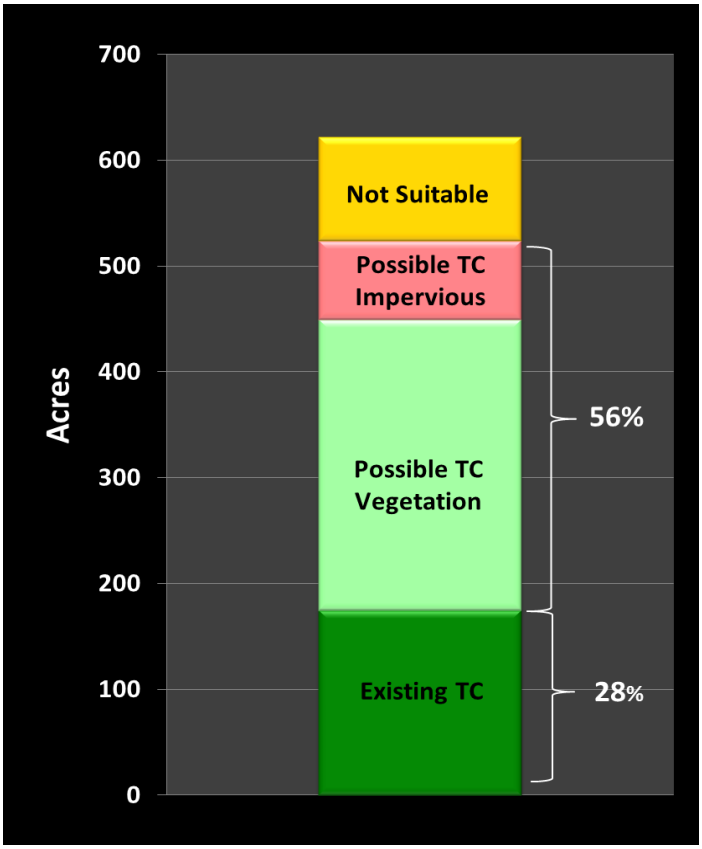

Figure 2: TC metrics for Williamsport based on % of land area covered by each TC type.

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 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 Williamsport Trees

Prior to this study, the only available estimates of tree canopy for Williamsport, MD were from the 2001 National Land Cover Dataset (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 (0.5 foot) aerial imagery acquired in the 2007 (Figure 3b), in combination with advanced automated processing techniques, land cover for the city was mapped with such detail that single trees were detected (Figure 3c). NLCD 2001 estimated the city to have only 13% tree canopy, compared to the more precise estimate of 28% found in this assessment.

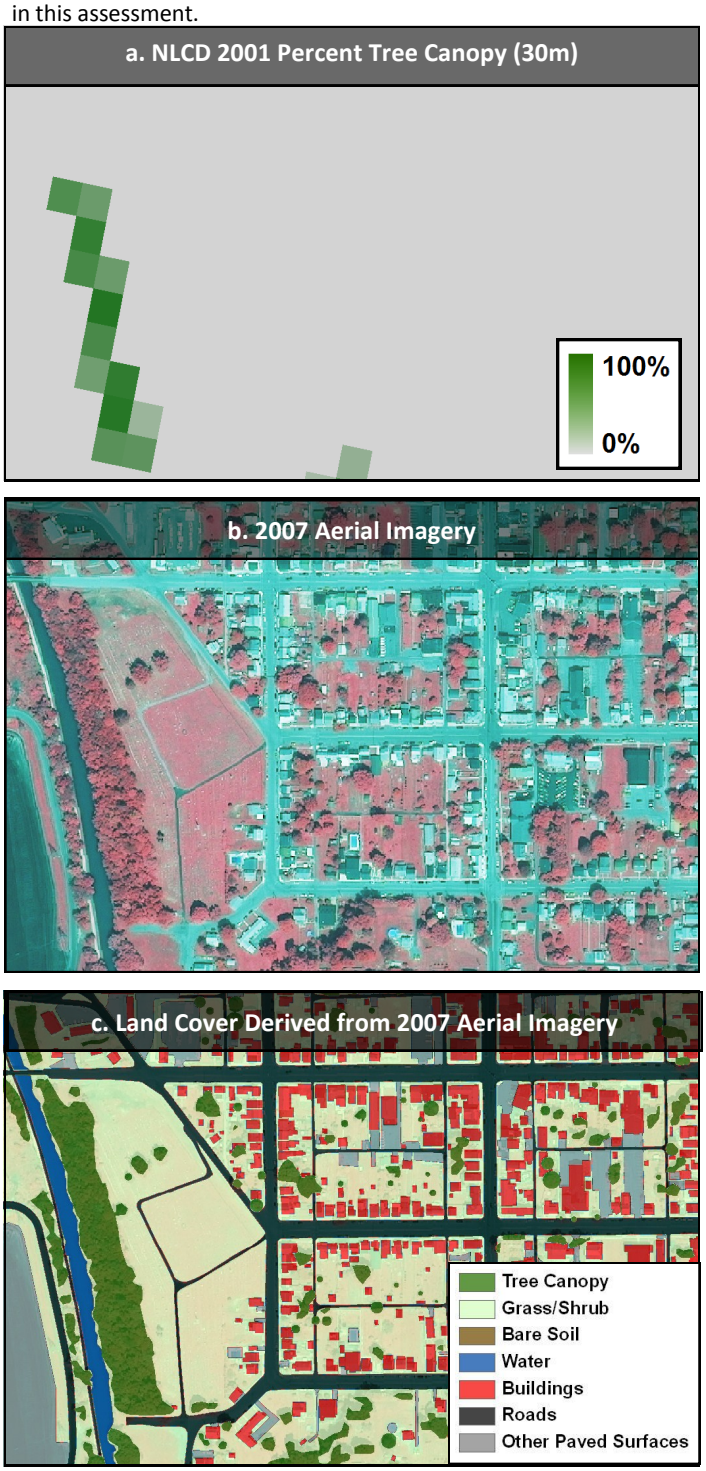

Figure 3a, 3b, 3c: Comparison of NLCD 2001 to 2007 high-resolution land cover.

Land Division Summary

As no property parcel data were available for Williamsport, polygons representing land divisions were created (Figure 4a) and subsequently used to summarize the TC metrics. Land divisions were derived using roadways and grouping together areas of homogeneous land use. Dividing Williamsport into land divisions allows the town to focus efforts on manageable areas and therefore more effectively allocate resources and implement projects.

For each land division, the absolute area of Existing TC and Possible TC was computed along with the percent of Existing TC and Possible TC (TC area/area of the land division) (Figure 4b and 4c).

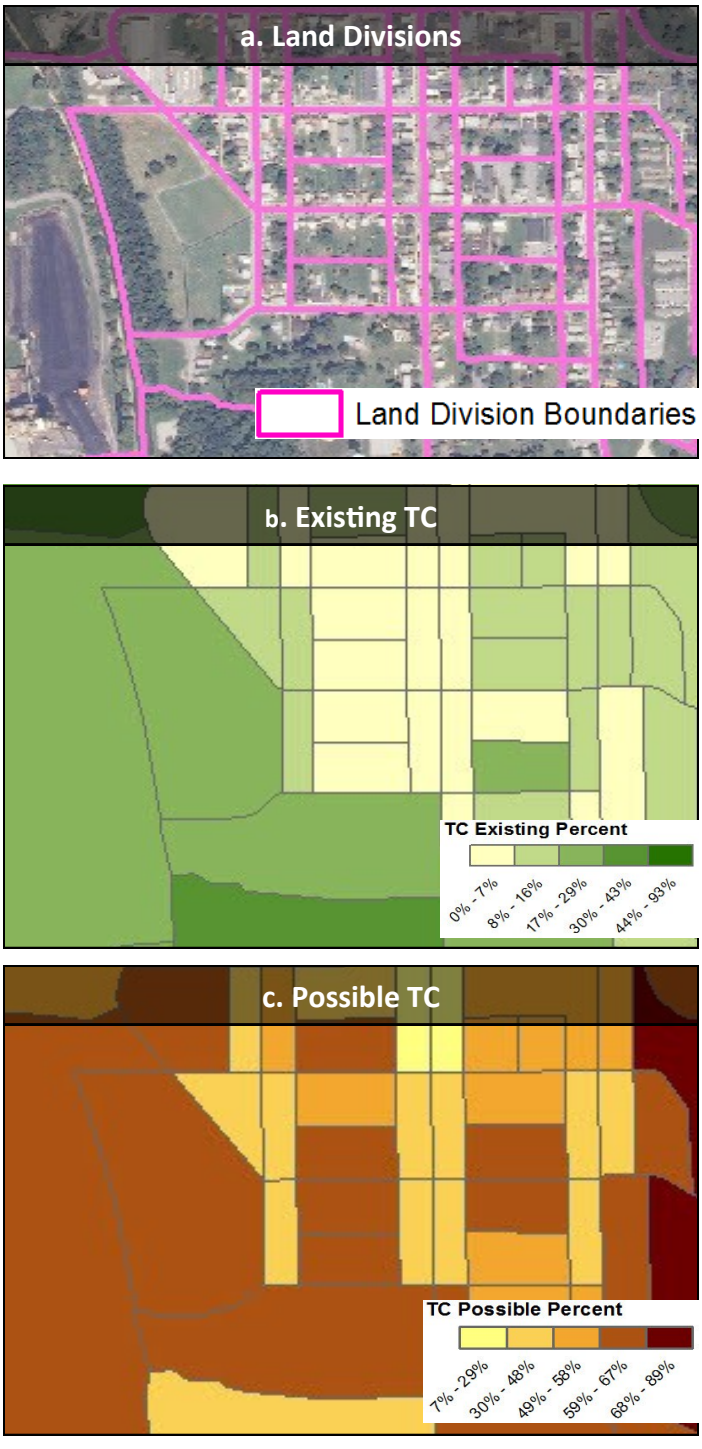

Figure 4a, 4b, 4c: Example of the land divisions of Williamsport, based on roadways, and from which TC metrics were derived.

Land Division Analysis

The land divisions highlight small, manageable areas that can be used to target conservation of or improvements to tree canopy (Figure 5). Tree canopy is generally lowest in the smaller residential divisions located in the town's center. Possible TC tends to vary by division within this same area. In order to focus its efforts the town should evaluate the land use and feasibility of increased canopy in areas that have low Existing TC and high Possible TC values. For example Divisions A and B (arbitrarily labeled for this example), indicated in Figure 5, represent two divisions with low Existing TC and high Possible TC. Both land divisions include schools and their associated sports fields. Consequently, increasing tree canopy on all land within these divisions would conflict with the existing and future land use of the division, but targeted improvements could be make to the parking lots and non-field vegetated surfaces.

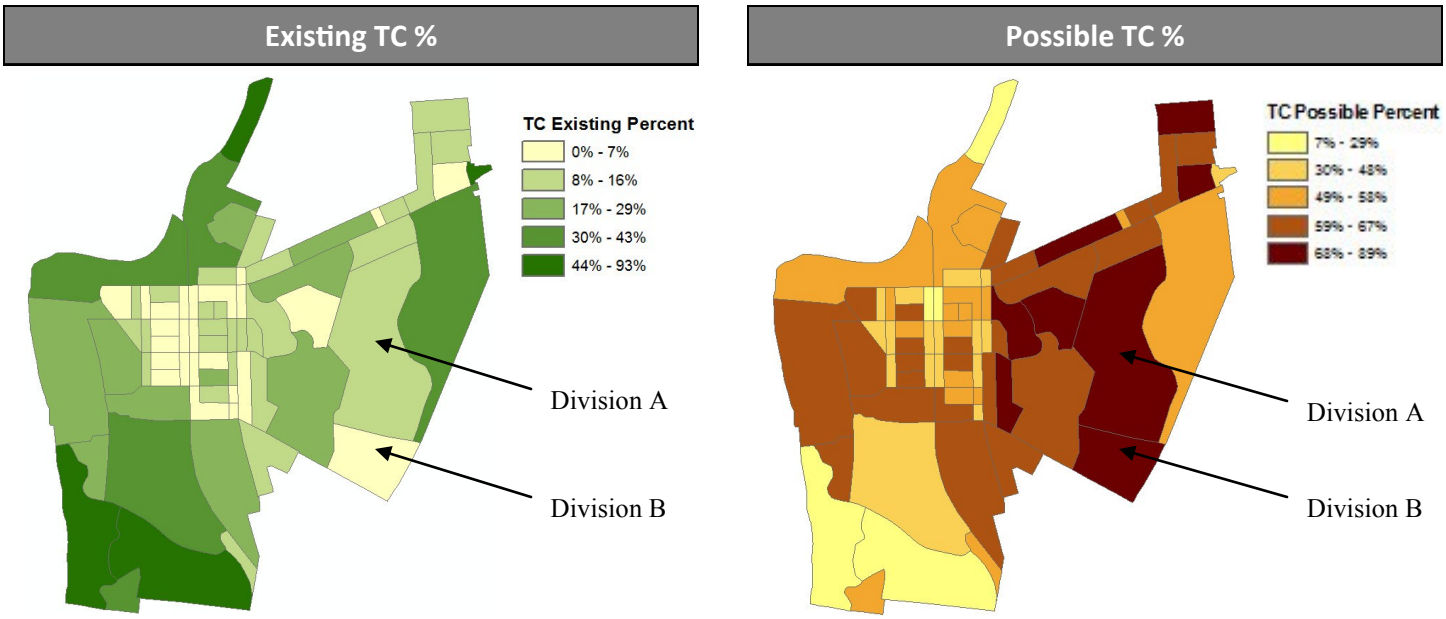

Figure 5. Existing TC (left) and Possible TC (right) as a percentage of each Williamsport land division. Both divisions indicated above (A and B) show areas where Existing TC is relatively low and Possible TC is high, despite appearing to be optimal areas for increased TC, consideration of the current land use (i.e. sports fields in division A) of Division A may alter the decision of targeting that area for TC improvement.

Riparian Buffer Analysis

Riparian areas play a major role in environmental quality in terms of water resources, wildlife habitat and soil retention. Currently, 62% (22 acres) of all the area within the 35 foot riparian buffer of Williamsport is composed of tree canopy, 32% of the riparian area represents possible tree canopy (Figure 6).

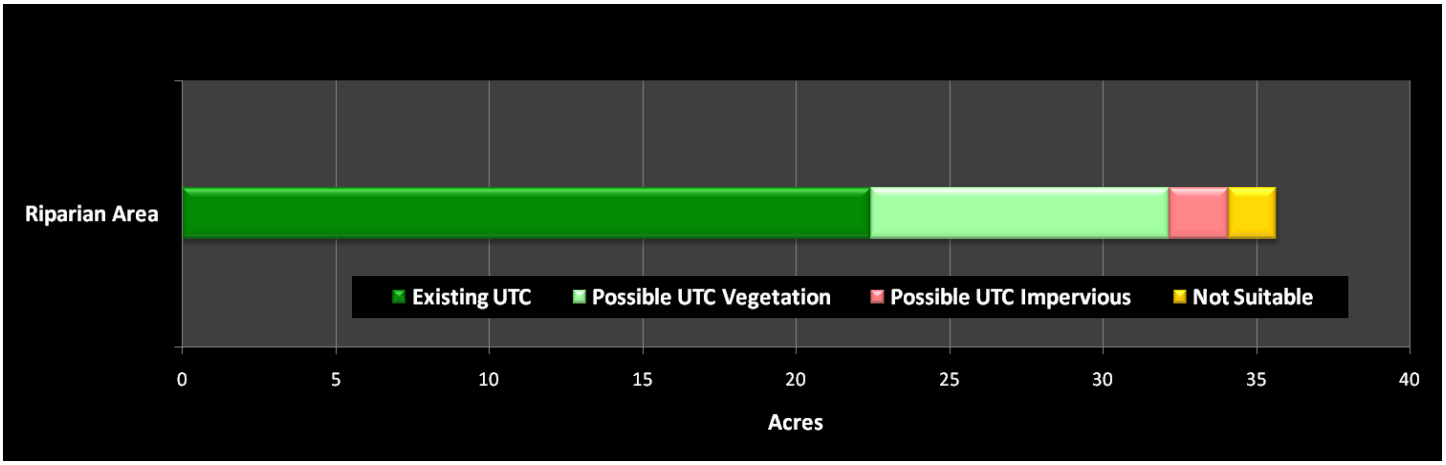

Figure 6. UTC metrics summarizing 35 foot buffer around all streams, lakes, rivers and swamps in Williamsport.

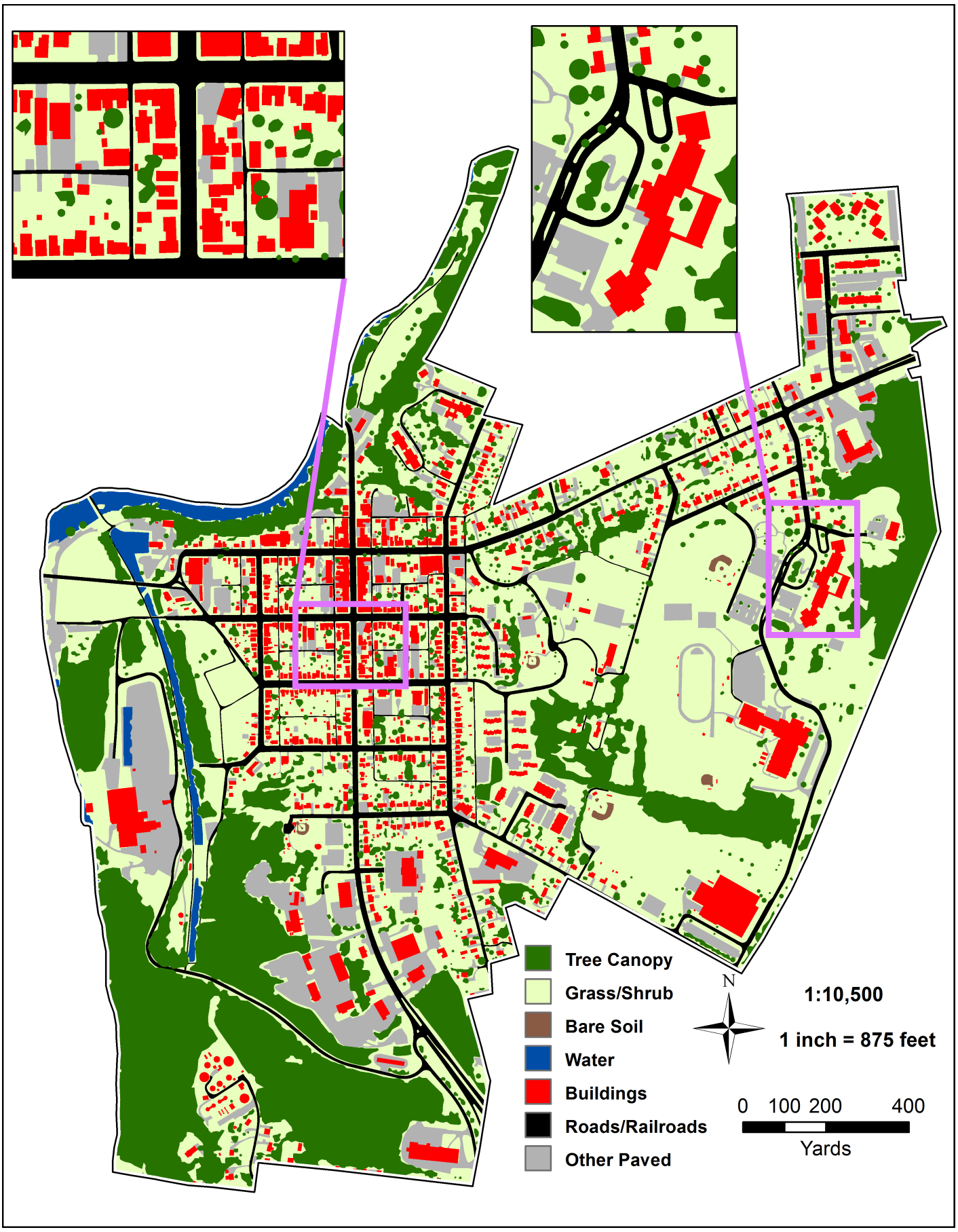

Figure 7: Detailed land cover map based on year 2007 data that was generated for this study.

Three Dimensional Analysis from LiDAR

Light Detection and Ranging (LiDAR) data exists for the entirety of Washington County. LiDAR data is acquired using a plane mounted laser sensor that returns a 3D point for each feature the laser pulse comes in contact with. This 3D data can be viewed graphically (Figure 8a), detailed elevation profiles of trees can be reconstructed (Figure 8b), and height measurements made. LiDAR elevation models can be combined with imagery to create powerful 3D visualizations (Figure 9). As part of this study a 3D LiDAR viewer was provided to Williamsport to assist in identifying larger trees that may be candidates for preservation.

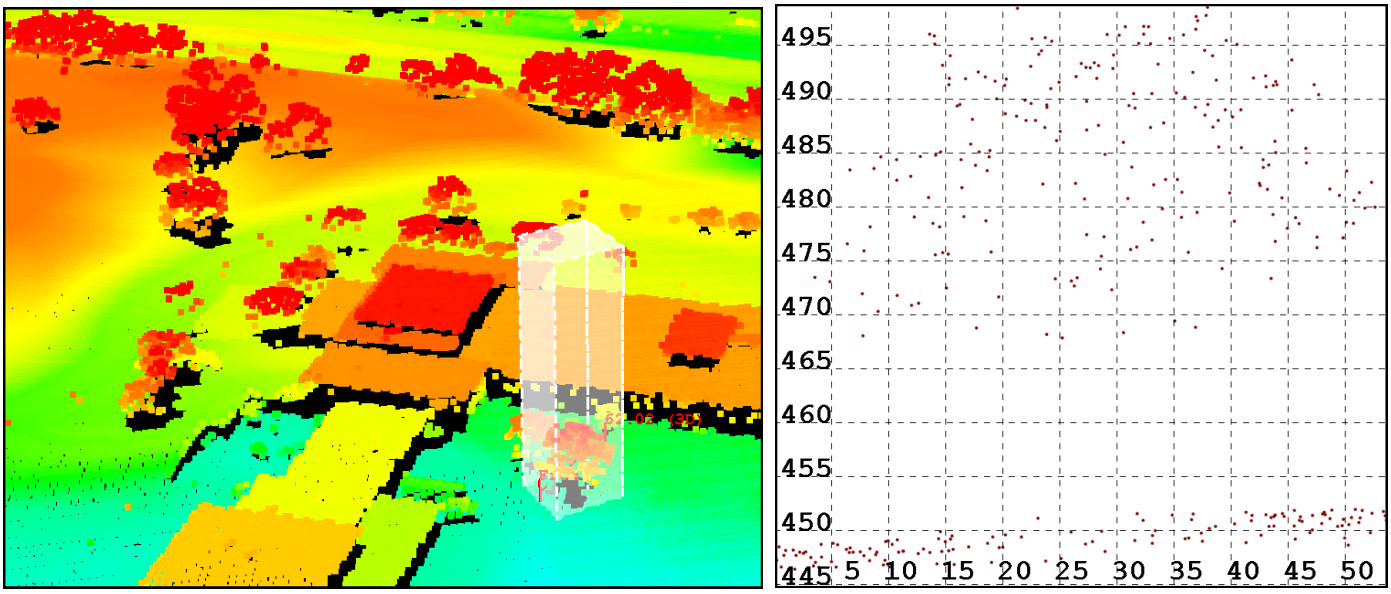

Figure 8a, 8b: LiDAR point cloud (left) for the high school region and elevation profile (right) for all LiDAR points from the tree inside the white box. Elevation units are in feet. Each point represents a laser pulse being returned from a portion of the tree. As LiDAR is acquired under leaf-off conditions the points correspond to the branches and trunk of the tree.

Figure 9: Imagery draped over a LiDAR surface to provide a 3D perspective of the region near the middle school.

Conclusions

- Williamsport's tree canopy is a vital town asset that reduces stormwater runoff, improves air quality, reduces the town's carbon footprint, enhances quality of life, contributes to savings on energy bills, and serves as habitat for wildlife.
- Within the town, 28% of the acreage is currently tree canopy with 56% of the land identified as possibly suitable for establishing new tree canopy.
- Williamsport should consider establishing a tree canopy goal. Such a goal should not be limited to increasing the city's overall tree canopy; it should also focus on increasing tree canopy in those land divisions that have the least Existing TC and highest Possible TC.
- Research (Geotz et al., 2003) indicates that for small watersheds 37% tree canopy results in a "fair" stream health rating, and 45% tree canopy results in a stream health rating of "good." Currently, 92% of Williamsport land divisions fall below the 37% TC required for a "fair" stream rating.
- Land division-level summaries can be used for targeting tree planting and preservation efforts within different regions of the town.
- With Existing TC and Possible TC summarized at the land division level and integrated with the town's GIS database, individual land divisions can be examined and targeted for specific TC improvement.
- Of particular focus for TC improvement should be divisions that have large contiguous impervious surfaces. These divisions contribute high amounts of runoff, which degrades water quality. The establishment of tree canopy on these divisions will help reduce runoff during periods of peak overland flow.
- Census data will help determine ownership of the areas in which tree canopy can be increased. Determining ownership will provide a starting point for any future TC initiatives. In general, programs that educate the public on tree stewardship and provide incentives for tree planting will be crucial for Williamsport to sustain its tree canopy goals in the long term.

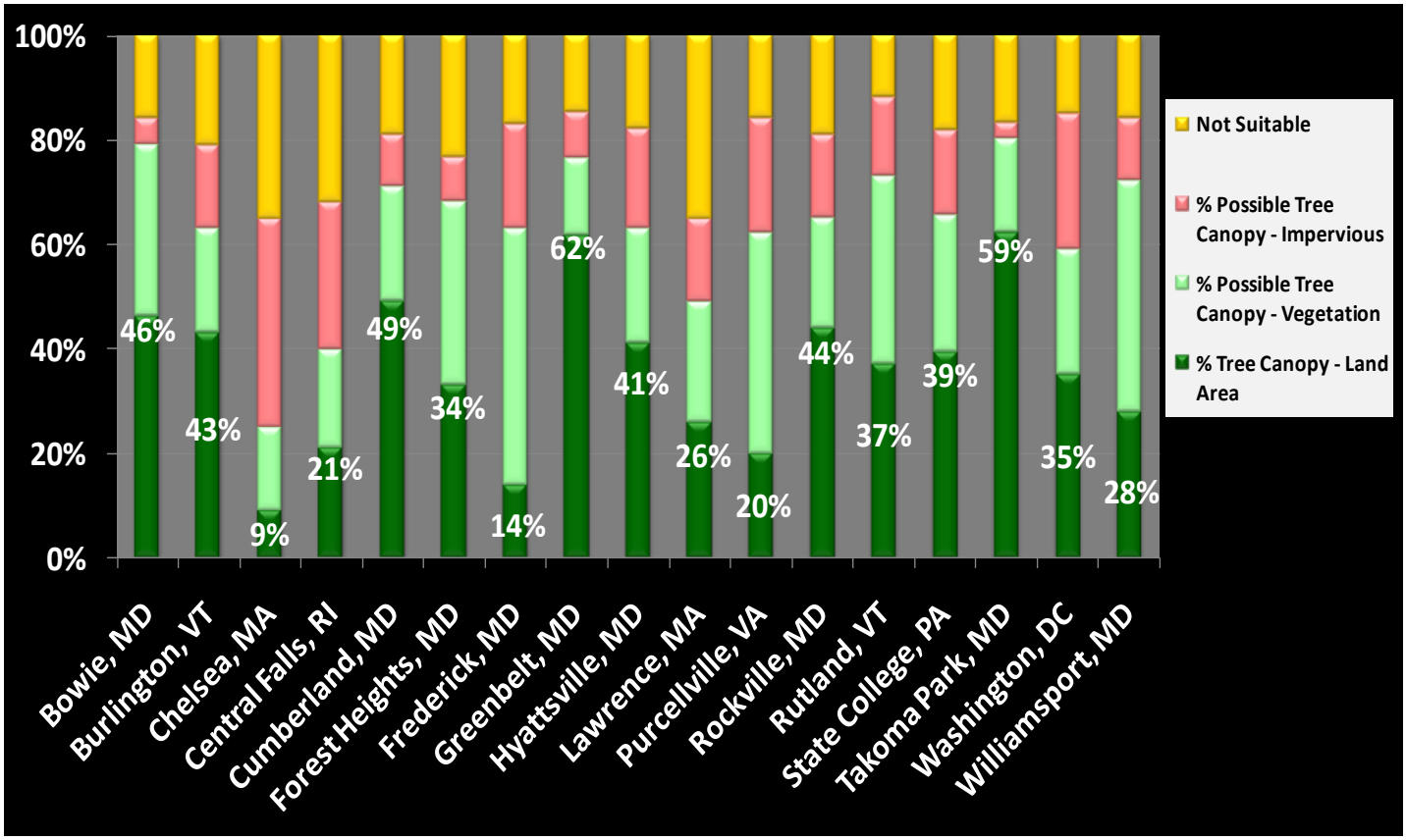

Figure 10: Comparison of tree canopy metrics with other communities.

Prepared by:

Jarlath O'Neil Dunne
Spatial Analysis Laboratory
Rubenstein School of the Environment & Natural Resources
University of Vermont
joneildu@uvm.edu
802.656.3324

Additional Information

Funding for the project was provided by MD DNR and USDA Forest Service. More information on the TC assessment project can be found at the following web site:

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

Spatial Analysis Lab Tree Canopy Assessment Team: Brian Beck, Ray Gomez, Claire Greene, Dan Koopman, Sean MacFaden, Jarlath O'Neil-Dunne, Kelsea Peace, Keith Pelletier, Eleanor Regan, Anna Royar, Bobby Sudekum, and Emily West