# A Report on the City of State College's Existing and Possible Urban Tree Canopy

# Why is Tree Canopy Important?

Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. Urban 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. Establishing a UTC goal is a crucial for those communities seeking to improve their green infrastructure. A UTC assessment, that provides the amount of tree canopy currently present (Existing UTC) along with the amount of tree canopy that could be established (Possible UTC), is the first step in the UTC goal setting process.

# How Much Tree Canopy Does State College Have?

An analysis of State College's urban tree canopy (UTC) based on land cover derived from high resolution aerial imagery (Figure 1) as well as LIDAR data, found that more than 1130 acres of the city is covered by tree canopy (termed Existing UTC) representing 39% of all land in the city. An additional 43% (1244 acres) of the city could theoretically be improved (Possible UTC) to support tree canopy (Figure 2). Of the areas for Possible UTC, 16% (476 acres) of the city is Impervious Possible UTC and another 27% (768 acres) is Vegetated Possible UTC. Vegetated Possible UTC or grass and shrub areas are much easier for establishing new tree canopy while establishing tree canopy on Impervious Possible UTC will have a greater impact on water quality.



Figure 1: Land cover derived from high-resolution aerial imagery and LIDAR data for State College, PA.

# Key Terms

**UTC**: Urban tree canopy (UTC) 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 UTC**: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.

**Possible UTC**: The amount of land that is theoretically available for the establishment of tree canopy. Possible UTC excludes areas covered by tree canopy, roads, buildings, and water.

## Project Background

The analysis of State College's urban tree canopy (UTC) was carried out with funding from the Pennsylvania Department of Conservation and Natural Resources and in collaboration with the City of State College. The analysis was performed by the University of Vermont's (UVM) Spatial Analysis Laboratory (SAL) in consultation with the USDA Forest Service's Northern Research Station. Data for this project was provided by State College and Centre County.

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to the City of State College. This analysis was conducted based on year 2006 data.



Figure 2: UTC metrics for State College based on % of land area covered by each UTC type.

# Mapping State College's Trees

Prior to this study the only available estimates of tree canopy for State College 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 4a). Using high-resolution (1 meter) lknonos Imagery (Figure 4b), in combination with advanced automated processing techniques, land cover for the city was mapped with such detail that single trees were detected (Figure 4c). NLCD 2001 estimated the city to have only 11% tree canopy, compared to the actual amount of 39%.



2006 lkonos Imagery (1m)



Figure 4a, 4b, 4c: Comparison of NLCD 2001 to high-resolution land cover.

# Parcel & Land Use Summary

Following the computation of the Existing and Possible UTC the UTC metrics were summarized for each property in the city's parcel database (Figure 5). For each parcel the absolute area of Existing and Possible UTC was computed along with the percent of Existing UTC and Possible UTC (UTC area / area of the parcel).

An updated land use layer was generated using the city's parcel's layer in combination with the 2006 Ikonos imagery and LIDAR data. This land use layer was used to summarize UTC by land use category (Figure 4). For each land use category UTC metrics were computed as a percentage of all land in the city (% Land), as a percent of land area by zoning land use category (% Category) and as a percent of the area for the UTC type (% UTC Type). For example, land designated as "Residence" has the most Existing UTC in raw acreage (28% by % Land), but in terms of the percent of the land use type occupied by tree canopy, land designated for "culture and recreation" (60% by % Category) has the most (Table 1).



Figure 5: Parcel-based UTC metrics. UTC metrics are generated at the parcel level, allowing each property to be evaluated with respect to its Existing UTC and Possible UTC.



Figure 5: UTC metrics summarized by parcel land use.

| Land Use                      | Existing UTC |            |            | Possible UTC Vegetation |            |            | Possible UTC Impervious |            |            |
|-------------------------------|--------------|------------|------------|-------------------------|------------|------------|-------------------------|------------|------------|
|                               | % Land       | % Category | % UTC Type | % Land                  | % Category | % UTC Type | % Land                  | % Category | % UTC Type |
| COMMERCIAL                    | 0%           | 13%        | 196        | 0%                      | 5%         | 0%         | 0%                      | 28%        | 2%         |
| COMMERCIAL INCENTIVE DISTRICT | 0%           | 16%        | 196        | 0%                      | 2%         | 0%         | 0%                      | 33%        | 2%         |
| LIGHT INDUSTRIAL              | 0%           | 13%        | 0%         | 0%                      | 16%        | 0%         | 0%                      | 43%        | 0%         |
| PARK                          | 2%           | 61%        | 5%         | 1%                      | 32%        | 496        | 0%                      | 4%         | 0%         |
| PLANNED COMMERCIAL 1          | 0%           | 92%        | 0%         | 0%                      | 2%         | 0%         | 0%                      | 096        | 0%         |
| PLANNED COMMERCIAL 2          | 1%           | 21%        | 2%         | 1%                      | 20%        | 3%         | 2%                      | 35%        | 6%         |
| PLANNED OFFICE                | 0%           | 27%        | 196        | 0%                      | 26%        | 196        | 096                     | 25%        | 1%         |
| PUBLIC                        | 0%           | 31%        | 096        | 0%                      | 15%        | 0%         | 0%                      | 39%        | 0%         |
| PUBLIC ACTIVITIES             | 0%           | 20%        | 0%         | 1%                      | 69%        | 2%         | 0%                      | 6%         | 0%         |
| RESIDENCE                     | 28%          | 46%        | 72%        | 18%                     | 29%        | 63%        | 6%                      | 10%        | 21%        |
| RESIDENCE OFFICE              | 1%           | 29%        | 196        | 0%                      | 6%         | 0%         | 1%                      | 33%        | 2%         |
| UNIVERSITY PLANNED DISTRICT   | 6%           | 26%        | 15%        | 7%                      | 3096       | 25%        | 5%                      | 23%        | 19%        |
| URBAN VILLAGE                 | 0%           | . 25%      | 1,96       | 0%                      | 9%         | 096        | 0%                      | 32%        | 196        |
| URBAN VILLAGE                 | 0%           | 25%        | 196        | 0%                      | 9%         | 0%         | 0%                      | 32%        | 1%         |



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

### **Decision Support**

The parcel-based UTC metrics were integrated into the city's existing GIS database. Decision makers can use GIS to find out specific UTC metrics for a parcel or set of parcels. This information can be

used to estimate the amount of tree in loss а planned development or set UTC improvement goals for individual an property.

| Attribute               | Value              |
|-------------------------|--------------------|
| Address                 | 1107 WILLIAM STREE |
| Zoning                  | Residential        |
| Tax ID                  | 36-018-,466-,0000- |
| Existing UTC            | 36%                |
| Possible UTC            | 52%                |
| Possible UTC—Vegetation | 31%                |
| Possible UTC-Impervious | 22%                |
|                         |                    |



Figure 6: Parcel-based UTC metrics can be used to support targeted UTC.

### Conclusions

- State College's urban tree canopy is a vital city asset; reducing stormwater runoff, improving air quality, reducing the city's carbon footprint, enhancing quality of life, contributing to savings on energy bills, and serving as habitat for wildlife.
- Occupying 39% of the city's land area, State College's tree canopy is similar in extent to that of comparably sized cities.
- Given the city's relatively high amount of tree canopy the city's chief challenge will be preserving its trees and forests for future generations though maintenance and regeneration.
- State College should consider establishing a UTC goal. Such a goal should not be limited to increasing the city's overall tree canopy, it should focus on increasing tree canopy in those areas that have the least Existing UTC and highest Possible UTC. This targeted effort can be performed using the UTC metrics created for this study.
- With Existing UTC and Possible UTC summarized at the parcel, subdivision, and neighborhood levels and integrated with the City's GIS database, specific locations can be examined and targeted for UTC improvement.

- Of particular focus for UTC improvement should be areas within the city that have large contiguous impervious surfaces. These properties contribute high amounts of runoff, degrading water quality. The establishment of tree canopy on these parcels will help to reduce runoff during periods of peak overland flow.
- By ownership type, it is State College's residents that control the largest percentage of the city's tree canopy. Programs that educate residents on tree stewardship and incentives provided to residents that plant trees are crucial if Bowie is going to sustain its tree canopy in the long term.
- There is some potential for increasing canopy along transportation corridors. Analysis of UTC within a 20-foot buffer of roads revealed that there are 62 acres of Possible UTC in these areas of the city.
- The Orchard Park and Green Tree neighborhoods in the southern part of the city offer good opportunity to increase tree canopy. Possible UTC makes up 60% (179 acres) and 42% (63 acres) of these neighborhoods.



Figure 12: Comparison of Existing UTC with other selected cities that have completed UTC assessments.

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#### Additional Information

The study was conducted in collaboration with the Pennsylvania Department of Conservation and Natural Resources (DCNR) http://nrs.fs.fed.us/urban/utc/

