A Report on the City of Frederick's Existing and Possible Urban Tree Canopy

Summary

An analysis of the City of Frederick's urban tree canopy (UTC) found that 12% of the city is covered by tree canopy (termed Existing UTC). An additional 72% of the city could conceivably be covered by urban tree canopy (termed Possible UTC).

Land under residential and institutional use play key roles in Frederick's urban forest, accounting for 47% and 14% of the Existing UTC respectively and 34% and 24% of the Possible UTC respectively.

Frederick has far less UTC than other cities that have been assessed. An aggressive program to improve UTC in Frederick should maximize protection and maintenance in combination with new plantings and natural regeneration.

The impacts of setting a UTC goal will likely include focusing or reallocating public agency resources (funds, staff, etc.) to enhance UTC urban open land. On private lands, a combination of education and outreach, landowner and redevelopment incentives, and refocusing of regulatory mechanisms to specifically achieve the objectives of the UTC goal will likely be required.

Project Background

The analysis of Frederick's urban tree canopy (UTC) was carried out by the Maryland Department of Natural Resources, The University of Vermont's Spatial Analysis Laboratory, and the USDA Forest Service's Northern Research Station, with collaboration from the City of Frederick.

The goal of the project was to implement the USDA Forest Service's UTC assessment protocols. The UTC assessment protocols make use of high resolution geospatial datasets, enabling the computation of UTC metrics at the parcel level. UTC metrics provide detailed information on a community's urban forests and form the basis for UTC goal setting. This project sought to leverage existing investments in geospatial data made by the city, enabling the analysis to be completed with minimal cost.

High Resolution Land Cover

The need for high resolution land cover

Readily available land cover datasets lack both the detail and accuracy to effectively map tree canopy in urban areas. The National Land Cover Dataset's (NLCD) tree canopy layer is very valuable for regional analysis but with a relatively coarse resolution (30 meters) it fails to capture all of the tree canopy in Frederick's urban forest (Figure 1). NLCD
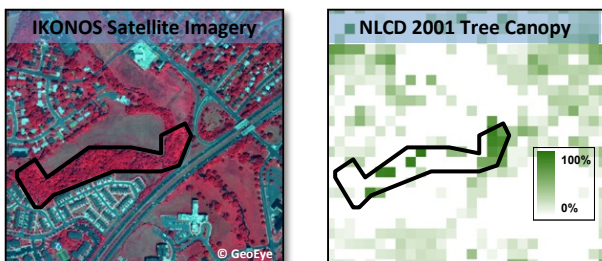

Figure 1: NLCD 2001 Canopy comparison.

2001 estimates put the city's tree canopy at 4%. The 12% estimate presented in this report was derived using high resolution imagery from the IKONOS satellite purchased by MD DNR. Although other high resolution imagery from the county's aerial orthophotography program was available, it was leaf-off and thus not suited for UTC mapping.

Automated procedures were used to derive a four class land cover layer from the IKONOS satellite imagery.

Figure 2: High resolution land cover.
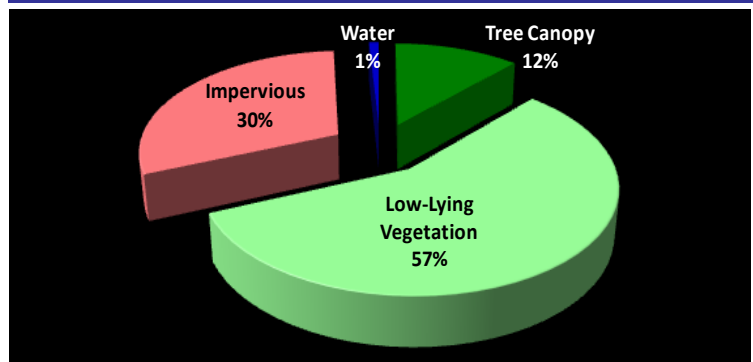
Land Cover & UTC Summaries

Figure 3: Land cover summary. Percentages are based on % of land area in the city.
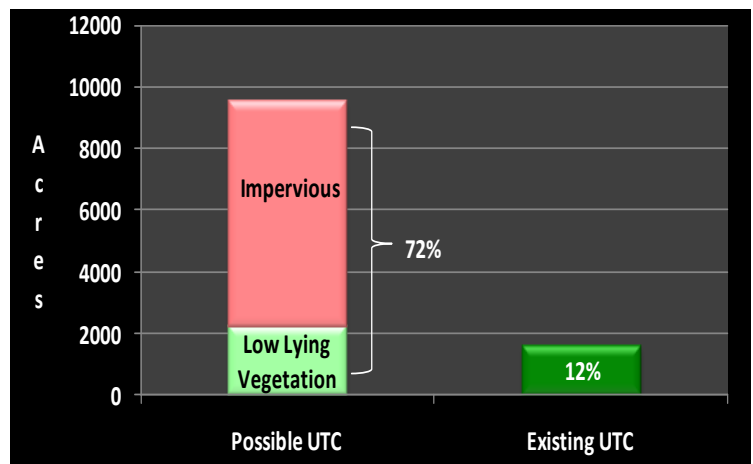

Figure 4: UTC Summary. Percentages are based on % of land area in the city. Possible UTC is land where it is biophysically feasible to establish tree canopy. Possible UTC excludes structures, roads, and water; it is divided into two subcategories: impervious and low-lying vegetation.

Existing and Possible UTC

Existing UTC was computed by summarizing the tree canopy land cover class. Two types of Possible UTC were computed: Possible UTC—Vegetation, and Possible UTC-Impervious. Possible UTC—Vegetation was computed by finding all areas in the land cover layer identified as "low lying vegetation." Possible UTC-Impervious was computed by summarizing all land cover in the impervious category excluding buildings and roadways. Water is excluded from both Possible UTC categories. UTC increases are typically more easily achieved on Possible UTC—Vegetation as compared to Possible UTC-Impervious areas.

Parcel-Based UTC Metrics

UTC metrics (Possible UTC and Existing UTC) were summarized for each property in the city's parcel database. The area of Existing UTC and Possible UTC was computed along with the percent of Existing UTC and Possible UTC*. The parcel-based UTC metrics can be linked to the city's existing parcel layer (Figure 5), and be used in subsequent analyses to examine current conditions, target key parcels for improvement, and integrated with other GIS layers for spatial analysis.

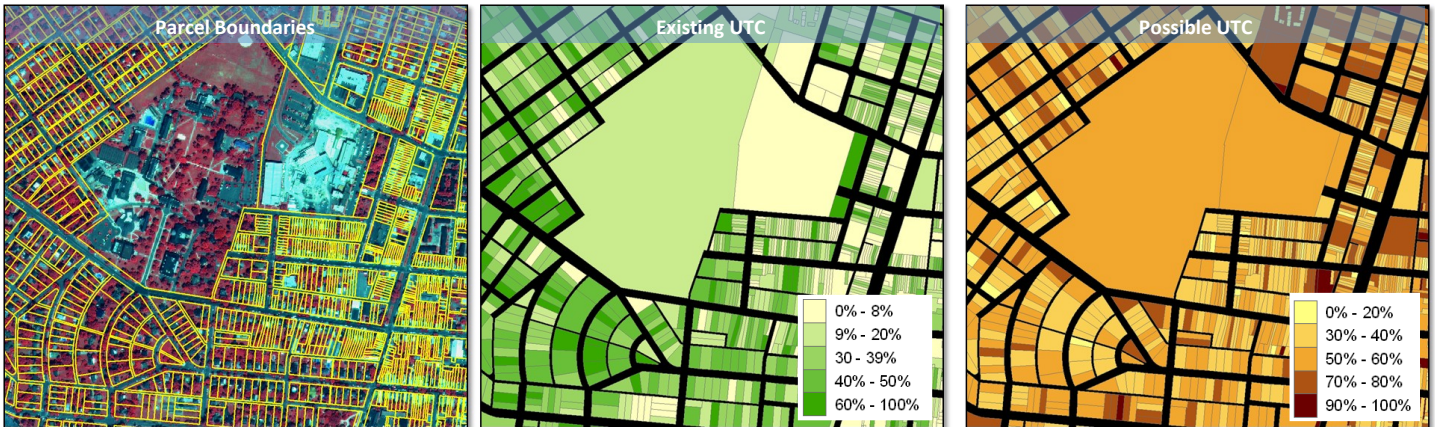$$* \%\ [Type]\ UTC = \frac{UTC\ [Type]\ Area}{Parcel\ Land\ Area}$$

Figure 6: Parcel-based UTC metrics

Land Use Analysis

Existing UTC and Possible UTC were summarized using the city's land use layer (Figure 6). For each land use category the Existing UTC, the two types of Possible UTC—low-lying vegetation and impervious, were computed, along with the amount of land not suitable for the establishment of UTC.
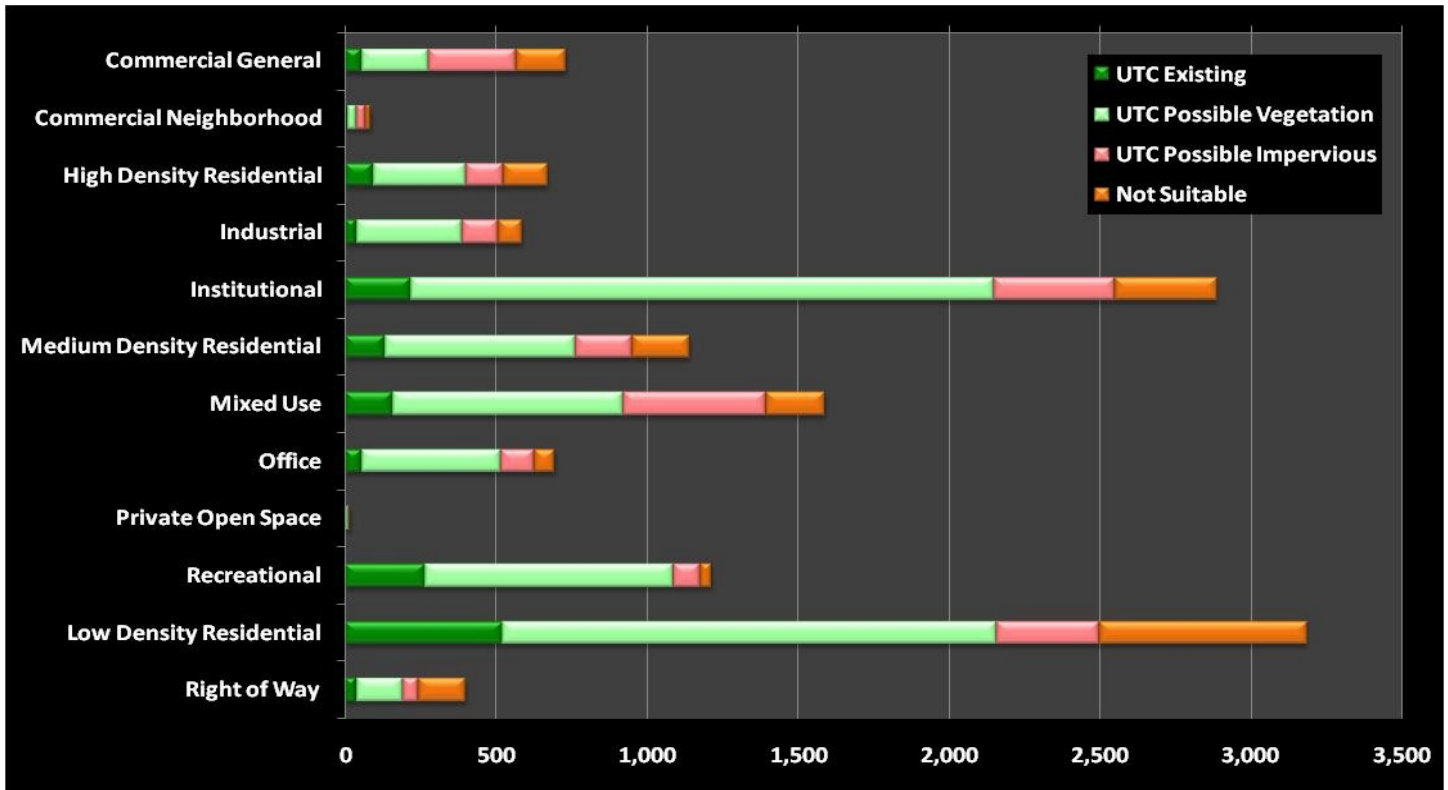

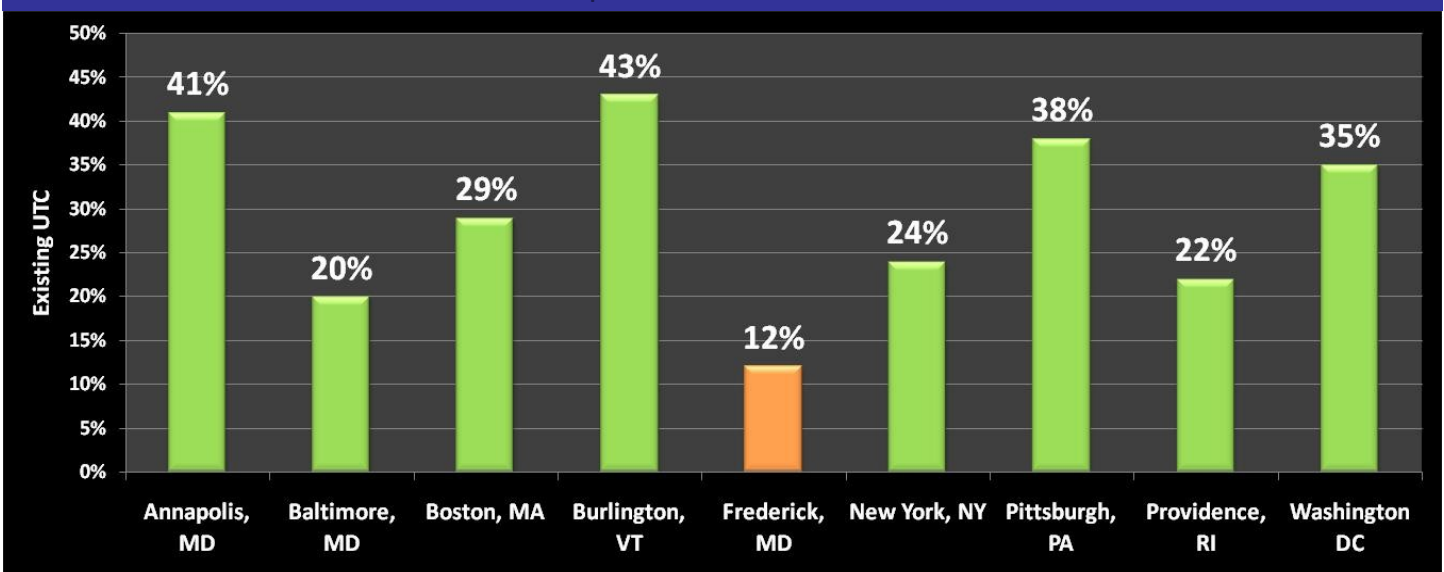Figure 6: UTC metrics summarized by land use

Results

- 12% of Frederick's land area (excluding water) is covered by tree canopy (Existing UTC), which encompasses 1592 acres.

- 72% (9553 acres) of the land area in the city is not a road or structure, and thus could conceivably support tree canopy. The vast majority of Possible UTC is low-lying vegetation.

- The majority of land in Frederick (38%) is in residential land use (3 types: low, medium, and high density). These three residential land use types hold the majority of the city's UTC (47%). Low density residential land accounts for 22% of the city's land area, 33% of it is Existing UTC, and 21% of it is Possible UTC.

- Recreational land is the most densely stocked with trees, with 22% of its land area occupied by Existing UTC. Although it only comprises 9% of the city's total land area, it accounts for 17% of the overall Existing UTC.

- Institutional land accounts for 22% of the city's land area and 14% of its Existing UTC. However, only 8% of institutional land is covered by UTC and 81% of the institutional land area could support UTC. Institutional land accounts for 24% of Frederick's Possible UTC.

Conclusions

1. National level land cover datasets underestimated Frederick's Existing UTC by 8 percentage points.

2. This report presents broad generalizations. With Existing UTC and Possible UTC summarized at the parcel level and integrated with the City's GIS database, individual parcels and groups of parcels can be examined and targeted for UTC improvement.

3. Frederick's urban tree canopy is a vital city asset; reducing stormwater runoff, enhancing quality of life, reducing the city's carbon footprint, and serving as habitat for wildlife. The city's Existing UTC percentage is substantially lower than other cities. The amount of Possible UTC indicates that there is the requisite land area to support a sizable increase in tree canopy.

4. Increases in UTC will be most easily achieved on institutional lands, where the government can more readily implement policy. However, it must be recognized that residential land plays an important role in the city with respect to both Existing UTC and Possible UTC.

5. Tree plantings in Frederick's rights-of-way (street trees), should be continued due to the numerous benefits they afford, but street tree plantings alone will not be able to substantially increase the UTC in Frederick.

Comparison to Other Cities

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