

# A Report on Washington, D.C.'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.

## 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 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.

## How Much Tree Canopy Does Washington Have?

An analysis of Washington, D.C.'s urban tree canopy (UTC) based on high resolution satellite imagery found that 13,673 acres of the city is covered by tree canopy (termed Existing UTC). This corresponds to 35% of all land within the city (Figure 1). An additional 32% (12,508 acres) of the city could theoretically be improved to support urban tree canopy (termed Possible UTC). Possible UTC includes non-canopy vegetation (e.g., grass/shrubs), bare earth, and certain paved surfaces (e.g., driveways, sidewalks) that, under the right circumstances, could be modified to increase tree cover.

Washington's singular status as the nation's capitol affects the distribution of tree canopy; 58% of Existing UTC (6,293 acres) is owned by the Federal government, including large, relatively contiguous forest blocks like Rock Creek Park and Fort DuPont Park (Figure 2).

## Project Background

The analysis of Washington, D.C.'s urban tree canopy (UTC) was carried out as part of a multi-state UTC grant from the USDA Forest Service, in collaboration with the D.C. Urban Forestry Administration, the Metropolitan Washington Council of Governments, D.C. Office of the Chief Technology Officer, and the Casey Trees Foundation. The analysis was performed by the Spatial Analysis Laboratory (SAL) of the University of Vermont's Rubenstein School of the Environment and Natural Resources in consultation with the USDA Forest Service's Northern Research Station

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to Washington, D.C. This analysis was conducted based on year 2006 data.

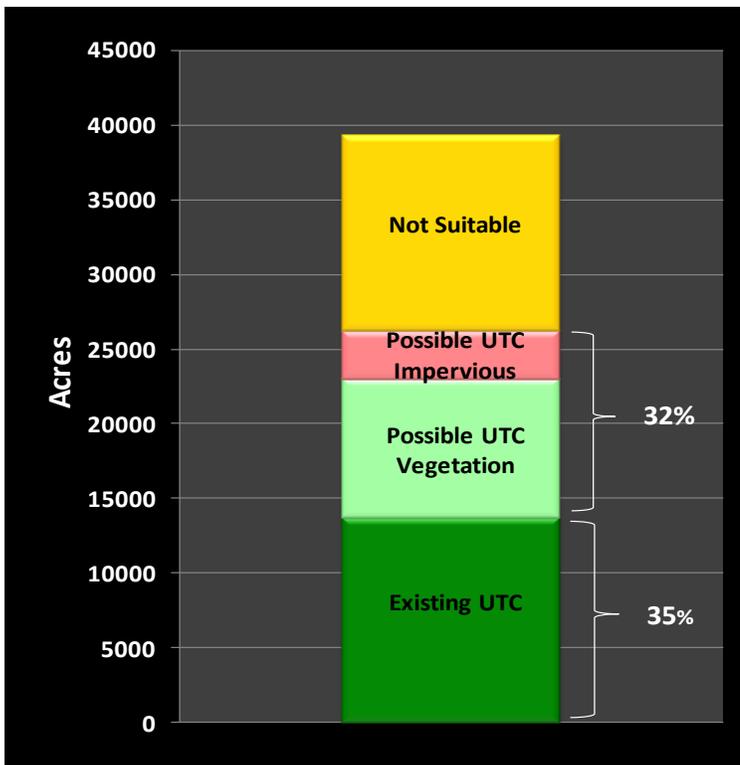


Figure 1: UTC metrics for Washington, D.C. Percentages are based on % of land area.

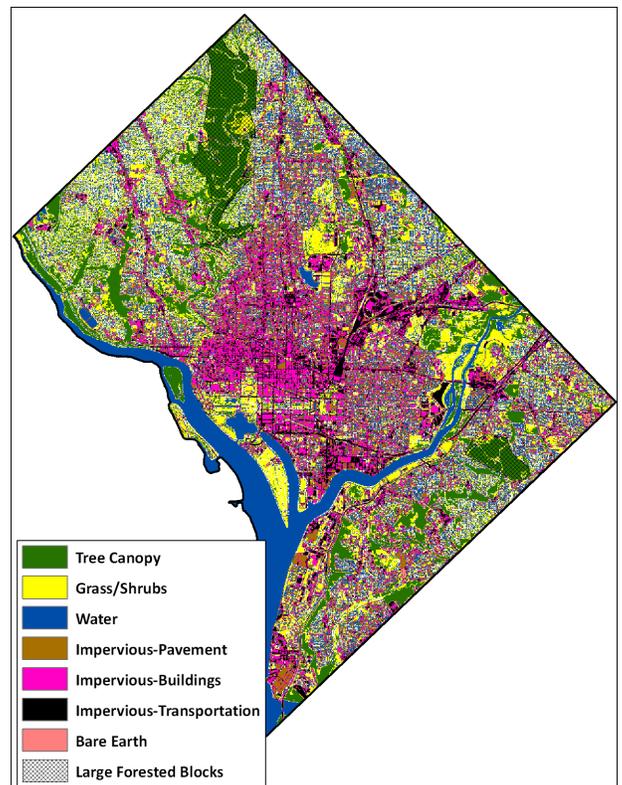


Figure 2: Land cover for Washington, D.C. Nearly 60% of existing tree canopy is owned by the Federal government.

## Mapping Washington, D.C.'s Trees

Previous estimates of tree canopy for Washington, D.C., such as the 2001 National Land Cover Dataset (NLCD 2001), were derived from relatively coarse, 30-meter resolution satellite imagery (Figure 3a). Such data lacks the spatial resolution for fine-scale mapping in urban areas. Using high-resolution (0.6 meter) satellite imagery acquired in the summer of 2006 (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 cover, compared to the more precise estimate of 35%.

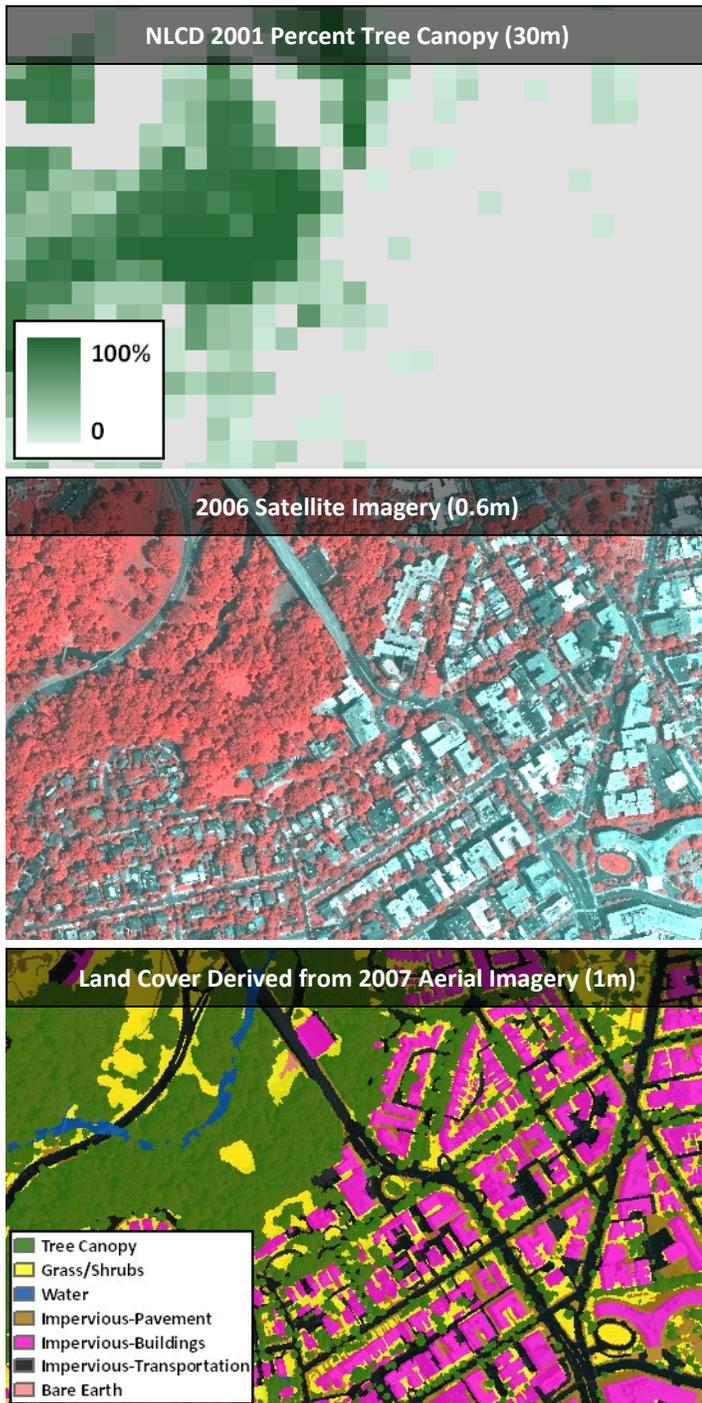


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

## Who "Owns" Washington, D.C.'s Trees?

The detailed land-cover mapping conducted as part of this assessment permitted calculation of the percentage of Existing and Possible UTC for each parcel of land (Figure 4). This information was then combined with land-use data to examine general ownership patterns (Figure 5, Table 1). Much of Washington's tree canopy occurs in publicly-owned parks and recreation zones (note that the Federal land-use category does not include Federally-owned parks). However, residential zones also contain a significant proportion of Existing UTC, particularly low- and moderate-density areas (on average, Existing UTC occupies 37% of low-density residential parcels, 16% of moderate-density residential parcels, and 11% of medium- and high-density residential parcels). Institutional and non-park Federal lands add further contributions. Interestingly, most of the land suitable for planting new trees is also in lower-density residential zones and parks/recreation zones.

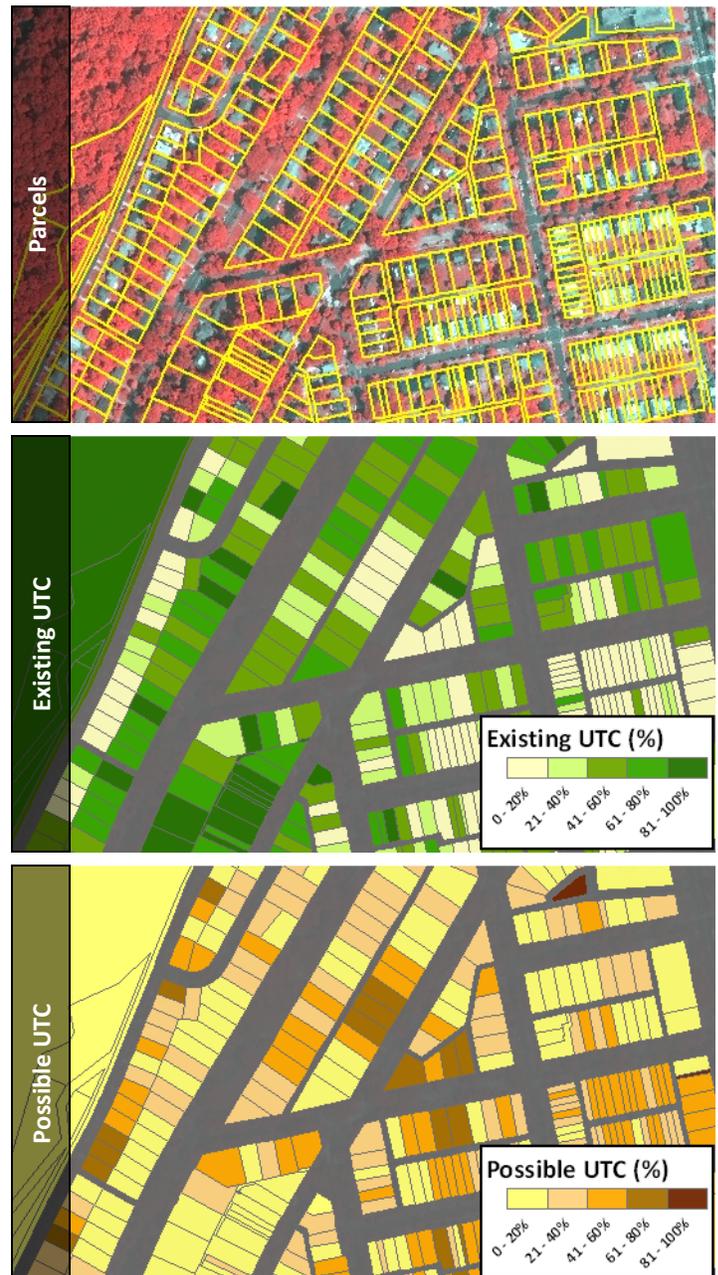


Figure 4: UTC metrics summarized at the property parcel level

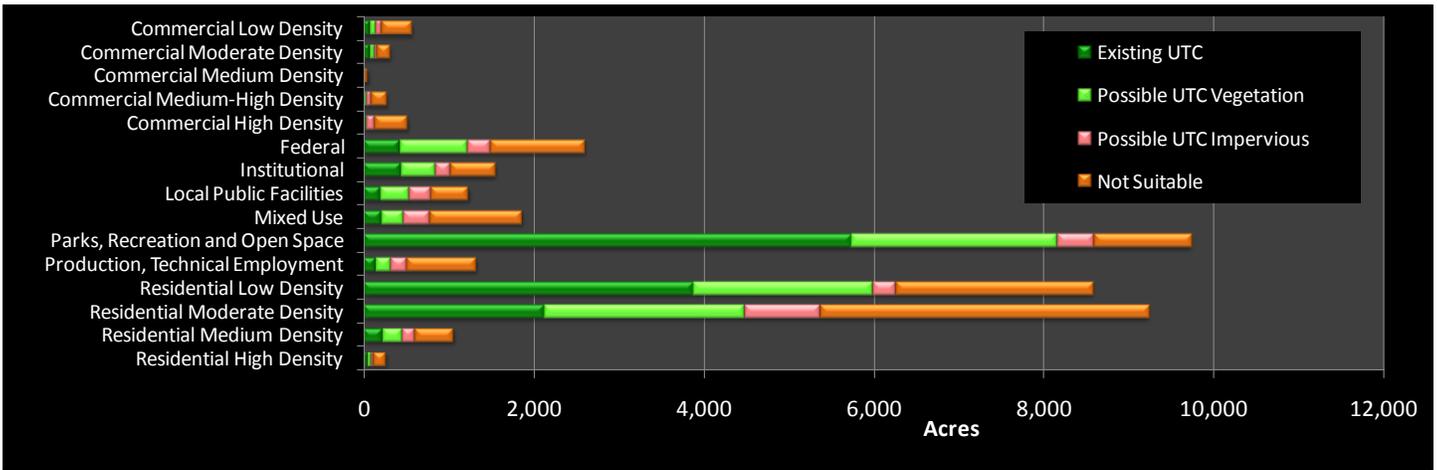


Figure 5: UTC metrics summarized by land use.

Land Use	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type
Commercial High Density	0%	6%	0%	0%	3%	0%	0%	18%	3%
Commercial Low Density	0%	15%	1%	0%	12%	1%	0%	11%	2%
Commercial Medium Density	0%	6%	0%	0%	5%	0%	0%	15%	0%
Commercial Medium-High Density	0%	7%	0%	0%	8%	0%	0%	21%	2%
Commercial Moderate Density	0%	24%	1%	0%	18%	1%	0%	9%	1%
Federal	1%	16%	3%	2%	30%	8%	1%	11%	9%
Institutional	1%	28%	3%	1%	26%	4%	0%	11%	5%
Local Public Facilities	0%	16%	1%	1%	28%	4%	1%	20%	8%
Mixed Use	1%	12%	2%	1%	14%	3%	1%	16%	9%
Parks, Recreation and Open Space	15%	59%	42%	6%	25%	26%	1%	4%	14%
Production, Technical Employment	0%	11%	1%	0%	13%	2%	0%	14%	6%
Residential High Density	0%	19%	0%	0%	14%	0%	0%	12%	1%
Residential Low Density	10%	45%	28%	5%	25%	23%	1%	3%	8%
Residential Medium Density	1%	22%	2%	1%	22%	2%	0%	13%	4%
Residential Moderate Density	5%	23%	16%	6%	26%	25%	2%	10%	28%

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

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

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

The % Land Area value of 10% indicates that 10% of Washington's land area is tree canopy in areas where the land use is "Residential Low Density."

The % Land Use value of 45% indicates that 45% of "Residential Low Density" land is covered by tree canopy.

The % UTC Type value of 28% indicates that 28% of all Existing UTC lies in the "Residential Low Density" land use.

Table 1: UTC metrics 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).

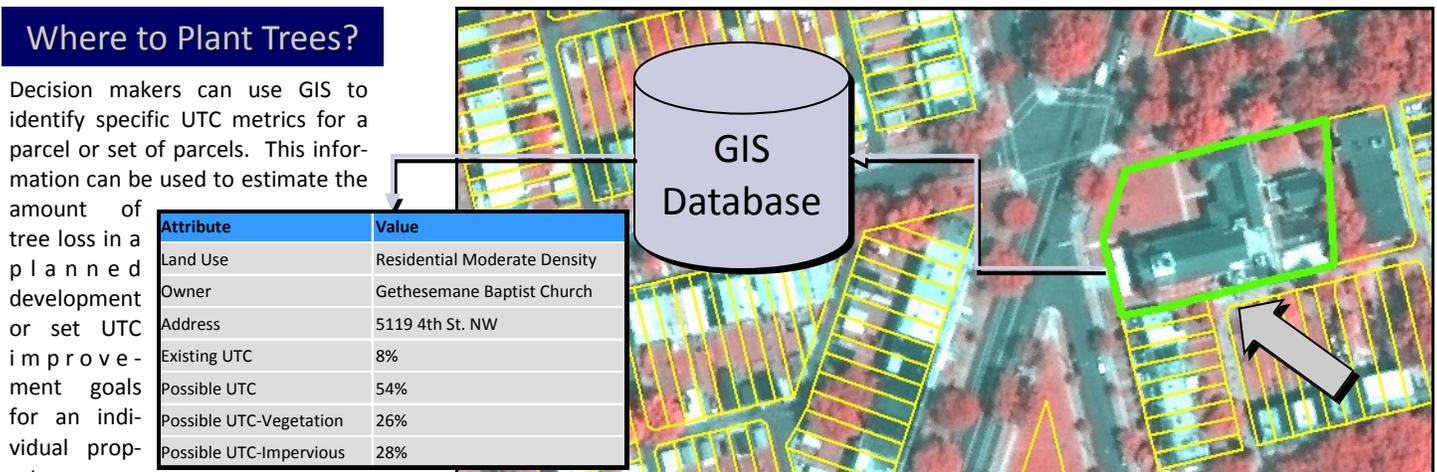


Figure 6: Parcel-based metrics can be used to support targeted UTC improvements.

## Conclusions & Recommendations

- Washington, D.C.'s urban tree canopy is a vital city asset, reducing storm-water 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.
- With 35% of its land area occupied by tree canopy, Washington's UTC is similar to other major cities but is generally less than small cities or suburban areas (Figure 7).
- A majority of the city's tree canopy is owned by the Federal government in parks and other open spaces. Presumably these forest resources will be maintained in perpetuity. However, a large proportion of Existing UTC is also owned by residential landowners. Preserving tree canopy in these residential areas is crucial to maintaining the city's overall tree canopy.
- Existing tree canopy is not evenly distributed in the city's residential areas, with medium- and high-density residential land-use classes under-represented. Although these classes occupy a much smaller proportion of the city's land area, they should be included in UTC planning efforts.
- UTC goals for Washington should not be limited to increasing the city's overall tree canopy; they should also focus on increasing tree canopy in those parcels or blocks that have the least Existing UTC and highest Possible UTC. This targeted effort can be performed using the UTC parcel database that was produced as part of this assessment.
- By land-use type, Washington's residents control the largest percentage of Possible UTC. Programs that educate residents on tree stewardship and provide incentives for tree planting are essential if Washington is to sustain its tree canopy in the long term.
- Other land-use types (e.g., parks and recreation, non-park Federal, institutional, commercial) also offer ample opportunity for UTC improvements. Because these parcels are generally larger in size, and in some cases under government control, the opportunity exists to engage more directly in large-scale greening initiatives.
- Of particular focus for UTC improvement should be parcels in the city that have large, contiguous impervious surfaces. These parcels contribute high amounts of runoff, degrading water quality. The establishment of tree canopy on these parcels will help reduce runoff during periods of peak overland flow.

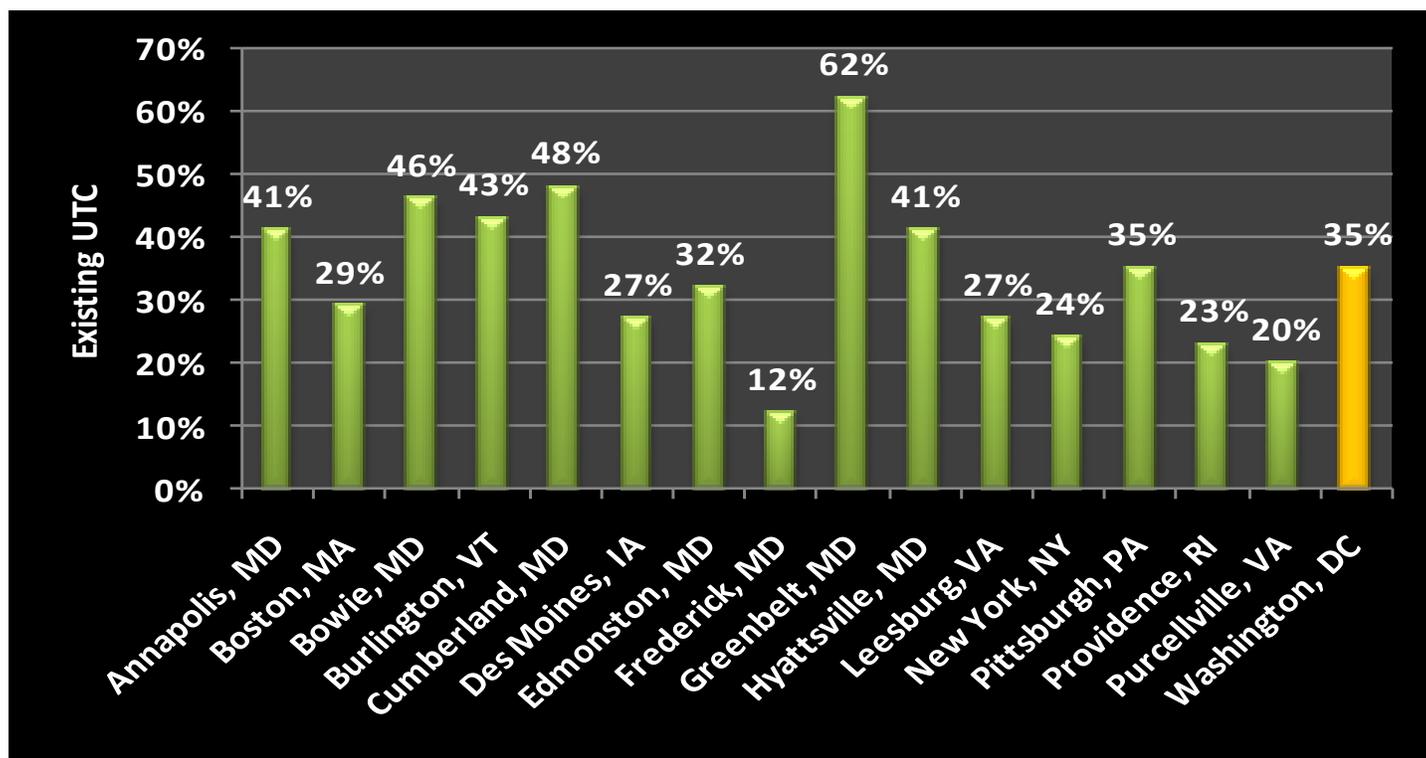


Figure 7: Comparison of Existing UTC in selected cities that have also completed UTC assessments.

### Prepared by:

Jarlath O'Neil-Dunne  
 Geospatial Analyst  
 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 the USDA Forest Service under award 09-CA-41420004-026. More information on the UTC assessment project can be found at the following web site:

<http://nrs.fs.fed.us/urban/utc/>



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