

A Report on Chelsea, Massachusetts'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.

How Much Tree Canopy Does Washington Have?

An analysis of Chelsea, Massachusetts's urban tree canopy (UTC) based on high resolution satellite imagery found that 129 acres of the city is covered by tree canopy (termed Existing UTC). This corresponds to only 9% of all land within the city (Figure 1). However, 56% (776 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.

As a densely-built city with a significant industrial presence, Chelsea's Existing UTC is concentrated in residential areas (Figure 2). A few contiguous forest patches exist in parks or in transition zones between residential areas and industrial/commercial areas, but much of the existing canopy occurs as individual trees.

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.

Project Background

The analysis of Chelsea'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 City of Chelsea. 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 Chelsea, Massachusetts. This analysis was conducted based on year 2008 data.

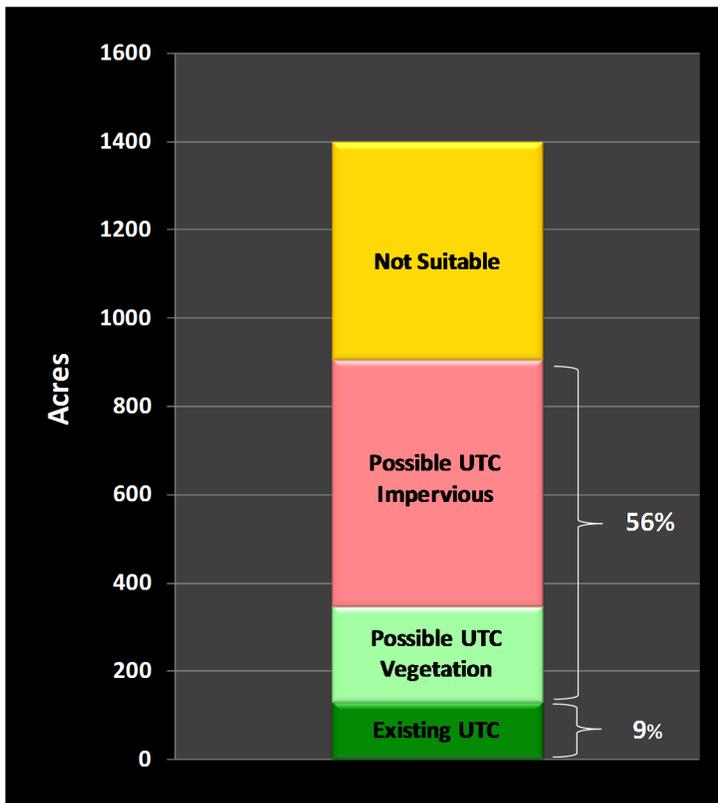


Figure 1: UTC metrics for Chelsea, MA. Percentages are based on % of land area.

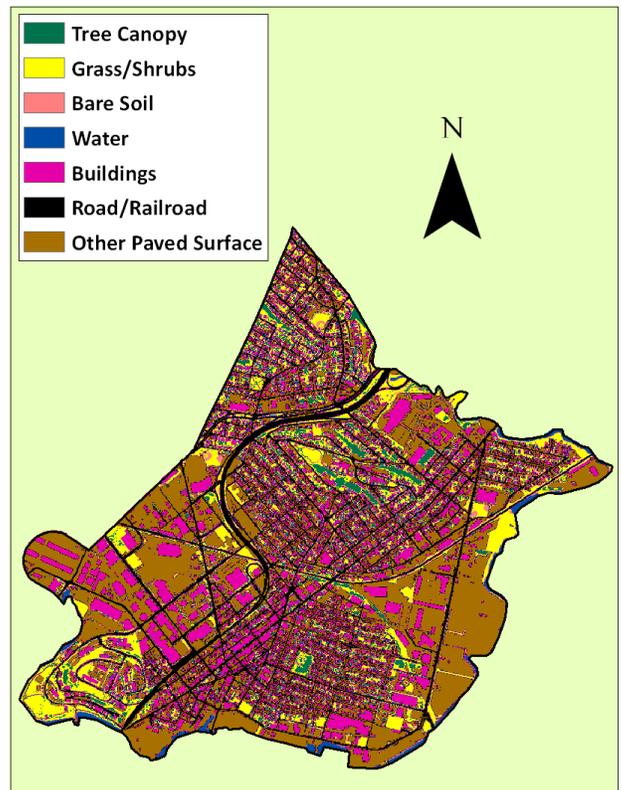


Figure 2: Land cover for Chelsea, MA. Existing tree canopy represents only 9% of the city's land area.

Mapping Chelsea's Trees

Previous estimates of tree canopy for Chelsea, Massachusetts, 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 (0.15 meter, or 0.50 feet) aerial imagery acquired in the summer of 2008 (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 a mean percent tree canopy of 1.2% for Chelsea, failing to capture many isolated trees.

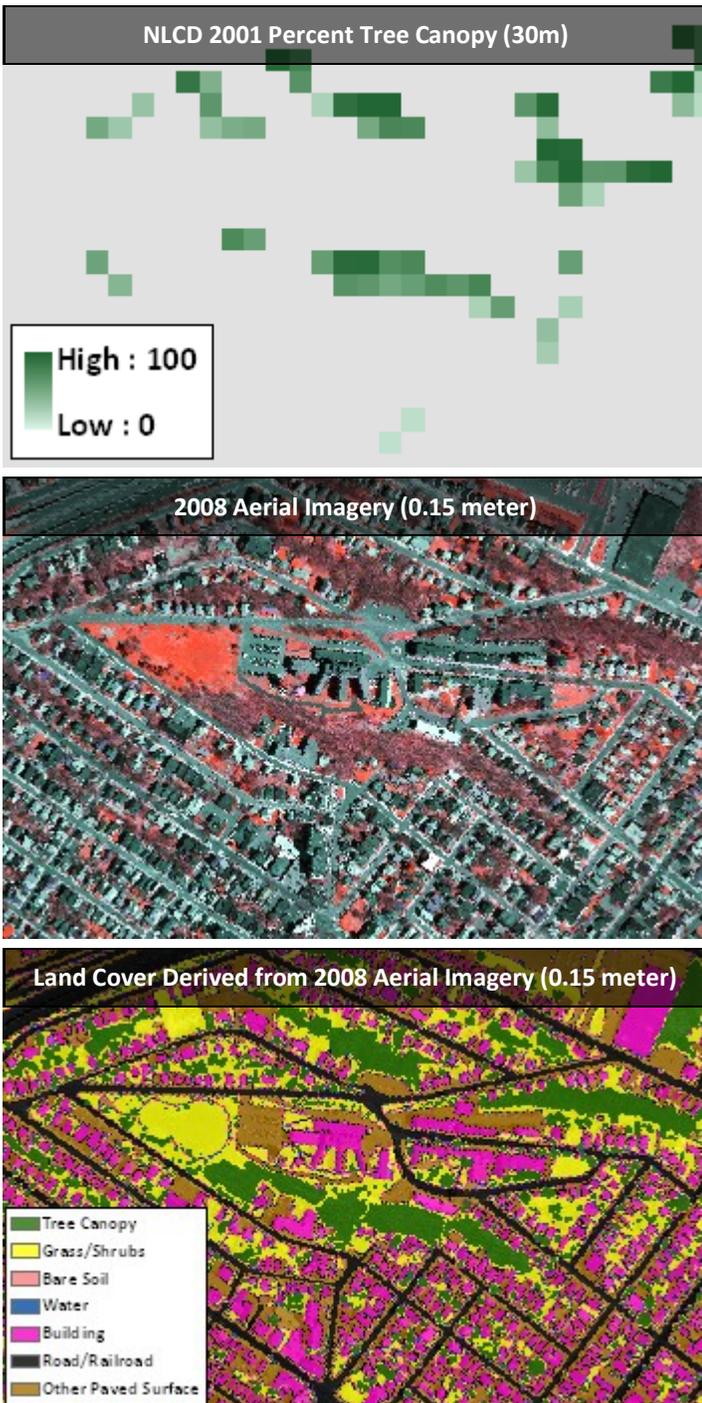


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

Who "Owns" Chelsea'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 zoning boundaries to examine general ownership patterns (Figure 5, Table 1). Chelsea's trees are located overwhelmingly in the city's four residential zones (Residential 1, 2, 3, and Naval Hospital Residential), which accommodate a combined 85% of the Existing UTC. The Industrial (5%), Shopping Center (3%), Retail Business (3%), and Waterfront (2%) zones account for most of the remaining tree canopy. Interestingly, most of the land suitable for planting new trees is also located in the residential zones (49% of Possible UTC), where expanses of lawn and paved surfaces could theoretically be modified to support additional tree growth. The Industrial and Waterfront zones (32% of Possible UTC) provide additional opportunities for UTC expansion.

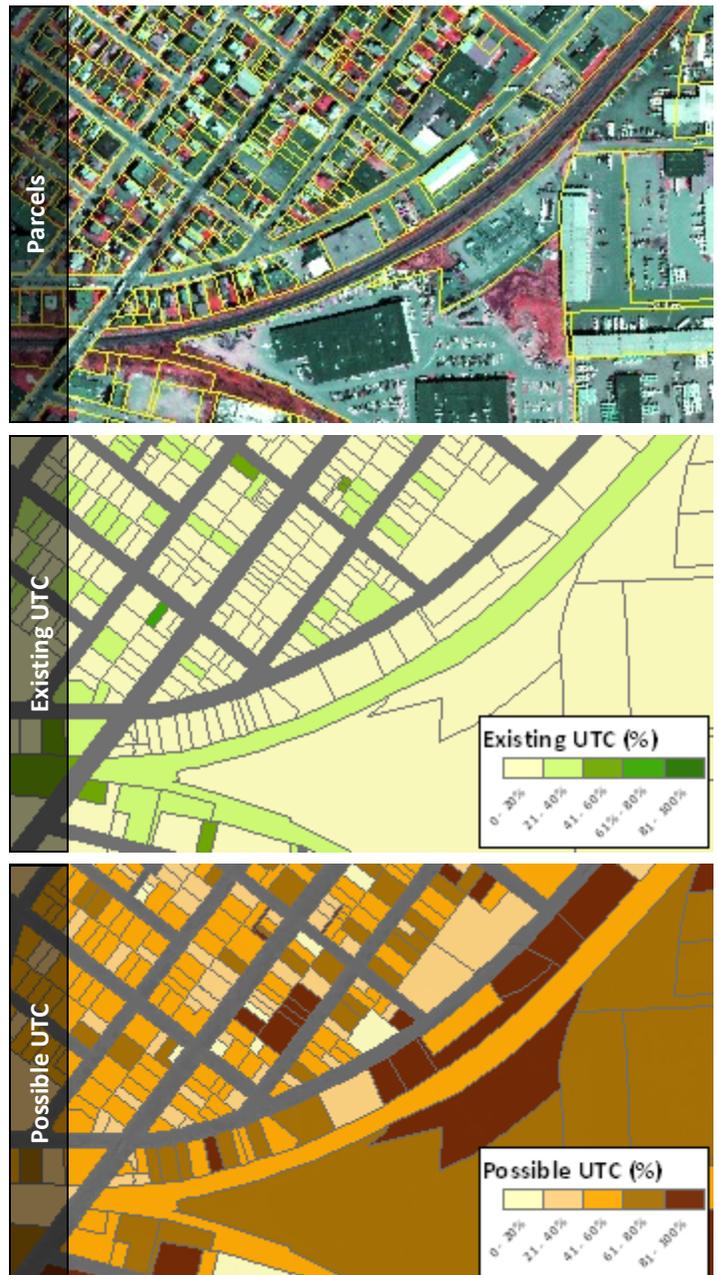


Figure 4: UTC metrics summarized at the property parcel level

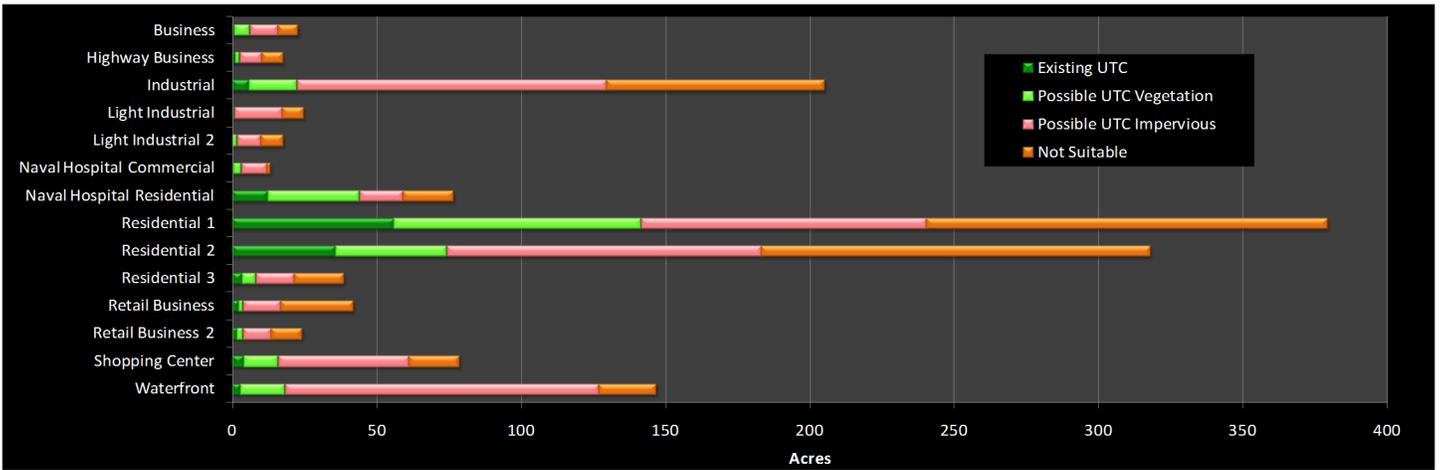


Figure 5: UTC metrics summarized by zoning category.

Land Use	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type	% Land	% Category	% UTC Type
Business	0%	4%	1%	0%	23%	2%	1%	42%	2%
Highway Business	0%	7%	1%	0%	8%	1%	1%	44%	1%
Industrial	0%	3%	5%	1%	8%	8%	8%	52%	19%
Light Industrial	0%	2%	0%	0%	2%	0%	1%	65%	3%
Light Industrial 2	0%	2%	0%	0%	8%	1%	1%	45%	1%
Naval Hospital Commercial	0%	5%	1%	0%	19%	1%	1%	66%	2%
Naval Hospital Residential	1%	16%	10%	2%	41%	14%	1%	20%	3%
Residential 1	4%	15%	44%	6%	22%	39%	7%	26%	17%
Residential 2	3%	11%	28%	3%	12%	18%	8%	34%	19%
Residential 3	0%	9%	3%	0%	12%	2%	1%	34%	2%
Retail Business	0%	5%	2%	0%	4%	1%	1%	31%	2%
Retail Business 2	0%	8%	1%	0%	8%	1%	1%	40%	2%
Shopping Center	0%	5%	3%	1%	15%	5%	3%	57%	8%
Waterfront	0%	2%	2%	1%	10%	7%	8%	74%	19%

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

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

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

The % Land Area value of 4% indicates that 4% of Chelsea's land area is tree canopy in areas where the zoning is "Residential 1."

The % Land Use value of 15% indicates that 15% of "Residential 1" land is covered by tree canopy.

The % UTC Type value of 44% indicates that 44% of all Existing UTC lies in the "Residential 1" land use.

Table 1: UTC metrics summarized by zoning category. 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).

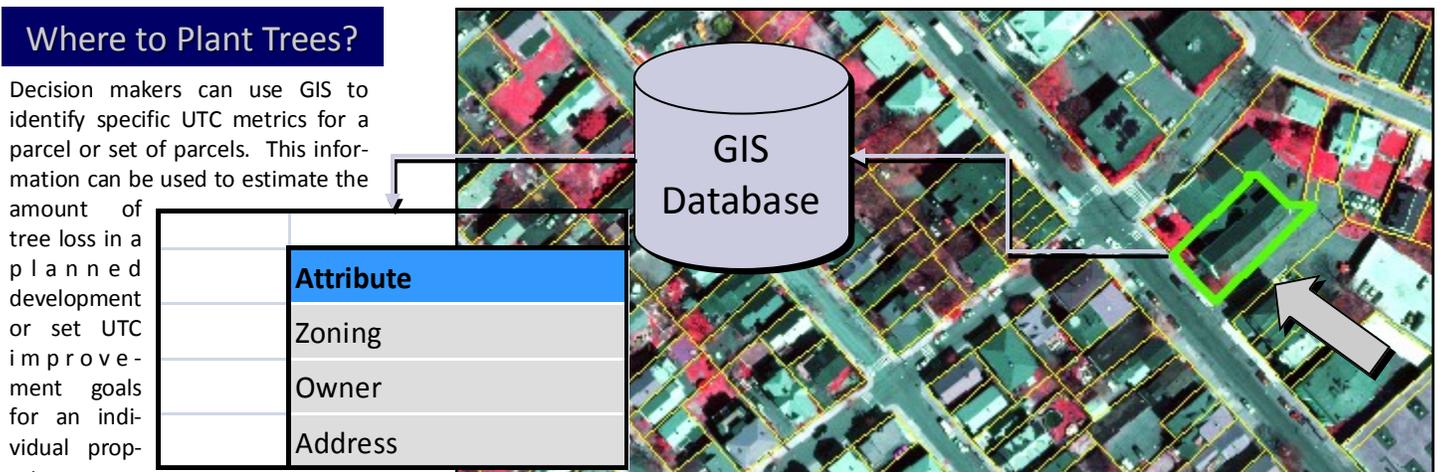


Figure 6: Parcel-based metrics can be used to support targeted UTC improvements.

Conclusions & Recommendations

- Chelsea’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 just 9% of its land area occupied by tree canopy, Chelsea has less UTC than any other city evaluated to date (Figure 7). However, Chelsea is much smaller than most of the other cities and contains dense residential and industrial land uses.
- A majority of the city’s existing tree canopy is located in residential areas, including the former naval hospital grounds. Preserving tree canopy in these residential areas is crucial to maintaining the city’s overall tree canopy.
- The city’s residential areas also provide the richest opportunity for expanding UTC, encompassing proportionately large areas of non-canopy vegetation and paved surfaces that theoretically could be modified to accommodate additional tree growth.
- UTC goals for Chelsea 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, Chelsea’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 Chelsea is to sustain its tree canopy in the long term.
- Other zoning categories (e.g., Industrial, Waterfront, Shopping Center) also offer ample opportunity for UTC improvements. Because these parcels are generally larger in size and are often managed by large commercial, institutional, or government entities, 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.

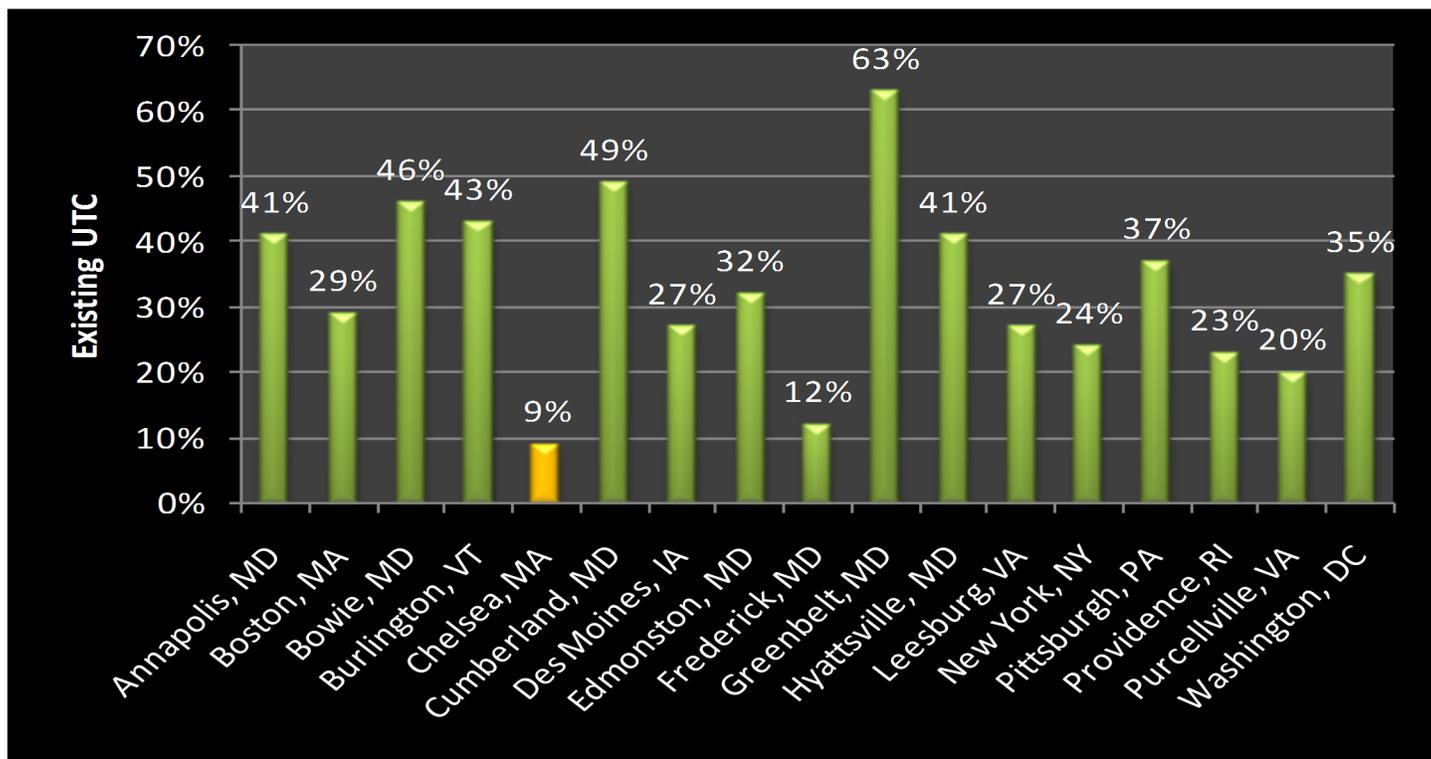


Figure 7: Comparison of Existing UTC in selected cities that have also completed UTC assessments.

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The study was conducted with funding from a multi-state grant from the USDA Forest Service. 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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