Updated - A Report on the County of Arlington's Existing and Possible Urban Tree Canopy

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 or aerial imagery such as trees, or water.

Existing UTC: The amount of UTC present within parcel boundaries.

Possible UTC: The amount of land that is theoretically available for the establishment of tree canopy within parcel boundaries. Possible UTC excludes areas covered by tree canopy, roads, buildings, and water. It is the combination of Possible UTC - Vegetation and Possible UTC - Impervious.

Possible UTC - Vegetation: The amount of land that is theoretically available for the establishment of tree canopy in non-tree vegetation areas within parcel boundaries. This excludes areas covered by tree canopy, impervious surfaces, and water.

Possible UTC - Impervious: The amount of land that is theoretically available for the establishment of tree canopy in impervious areas within parcel boundaries. This includes impervious areas (roads, parking lots, and sidewalks) except for buildings.

Project Background

The analysis of Arlington's urban tree canopy (UTC) was carried out at the request of the Virginia Department of Forestry in collaboration with the County of Arlington and the Chesapeake Bay Program. The analysis was performed by the Virginia Geospatial Extension Program (VGEP) at Virginia Tech's Department of Forest Resources and Environmental Conservation in consultation with the Spatial Analysis Laboratory (SAL) of the University of Vermont.

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to the County of Arlington. This analysis was conducted based on year 2008 data.

In this update all federal lands have been removed from the analysis, so that all of the land area included may possibly be affected by Arlington County.

UTC Classes	Existing UTC		
	Acres	% Total Land Area*	% Land Area
Tree Canopy	6353.1	43.3%	43.5%
Non-Tree Vegetation	2504.2	17.1%	17.2%
Non-Building Impervious	4100.9	28.0%	28.1%
Buildings Impervious	1632.1	11.1%	11.2%
Water	72.6	0.5%	0.0%
Total Area	16701	100.0%	100.0%

Table 1: Existing UTC area and percentages for the County.
**% Total Land Area includes area covered by water.*

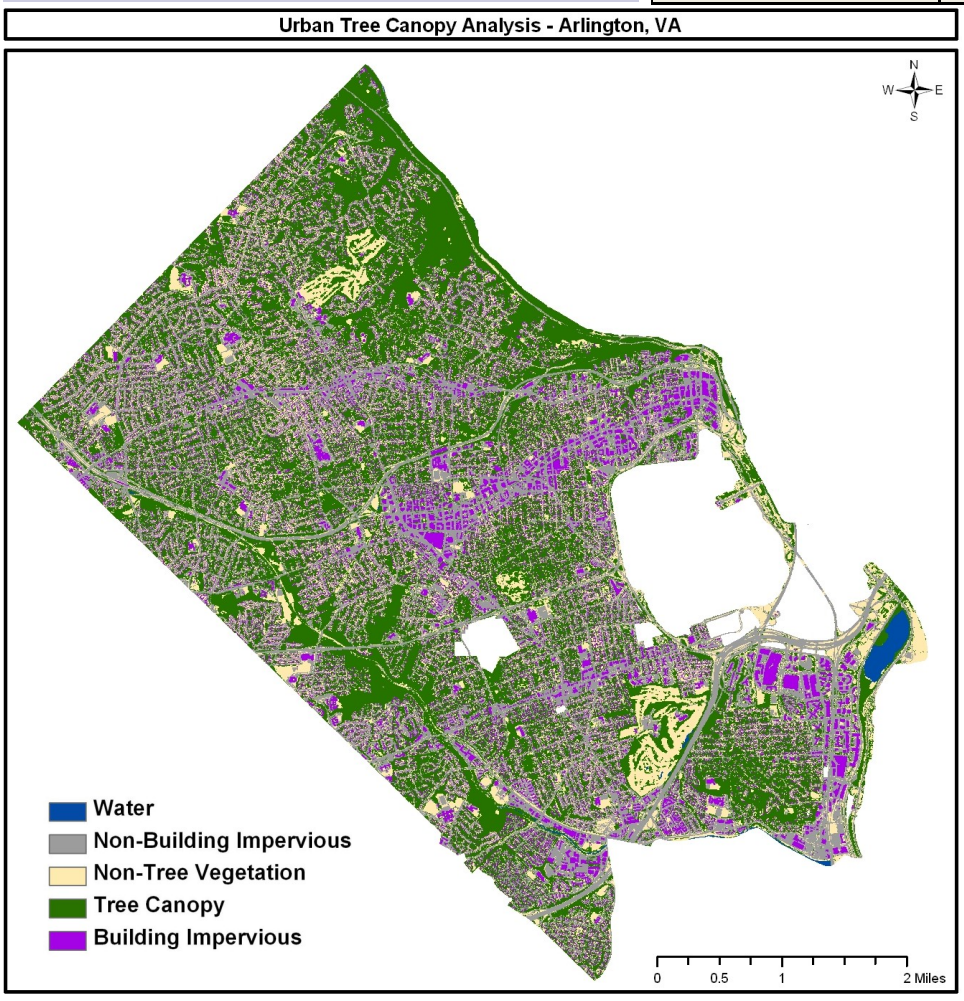


Figure 1: Land cover for the County of Arlington.

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, conserving energy, lowering county temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits.

How Much Tree Canopy Does Arlington Have?

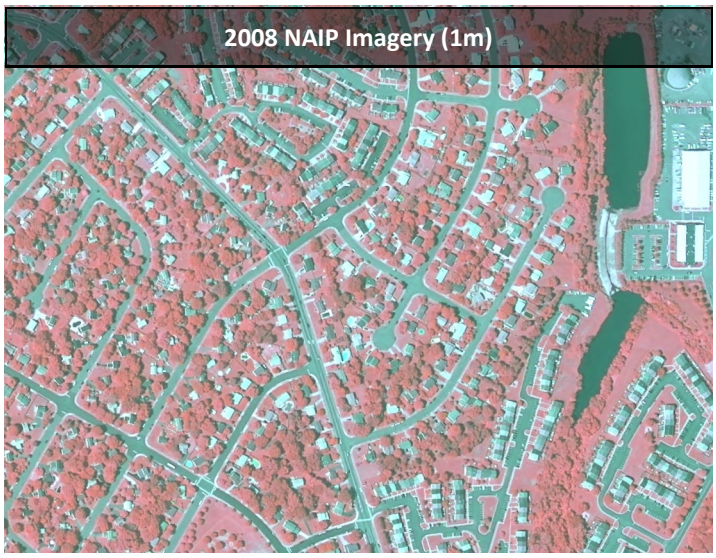
Figure 1 shows the UTC analysis for Arlington, which is derived from high resolution aerial imagery. 6,353 acres of Arlington is covered by tree canopy (termed Existing UTC). This corresponds to 43% of the total land area within the County (Table 1). An additional 4010 acres of the county could theoretically be improved to support urban tree canopy (termed Possible UTC), Table 2.

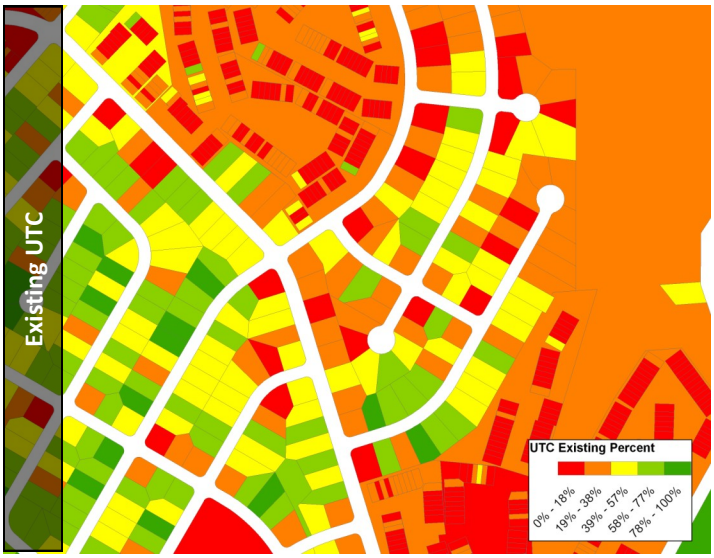
Mapping Arlington's Trees

Using high-resolution (1 meter) National Agriculture Imagery Program (NAIP) imagery acquired in the summer of 2008 (Figure 2a) in combination with remote sensing techniques, land cover data for the County was generated (Figure 2b). A 94% accuracy rate was found after conducting an accuracy assessment. Single trees with canopies larger than 16 square meters were detected.

Who "Owns" Arlington's Trees?

The detailed land cover mapping conducted as part of this assessment allowed the percentage of Existing and Possible UTC to be calculated for each parcel of land (Figure 3). Using this data, ownership patterns for Existing UTC and Possible UTC (Figure 4) can be examined.





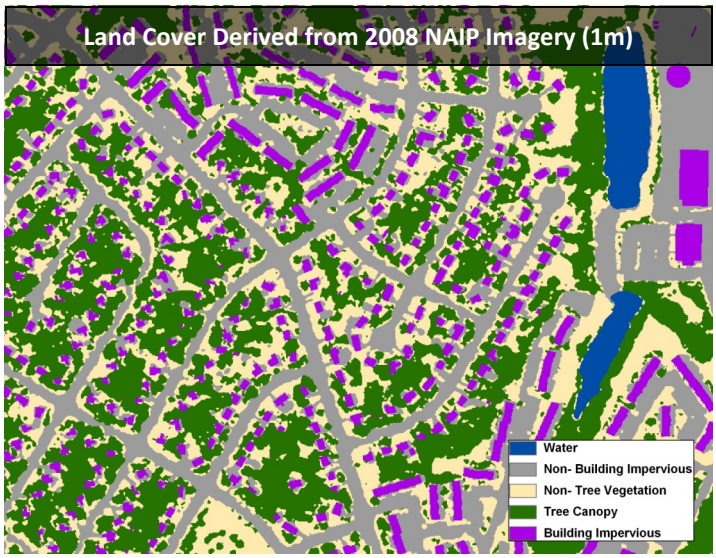


Figure 2a, 2b: Comparison of 2008 NAIP imagery to the resulting high-resolution land cover.

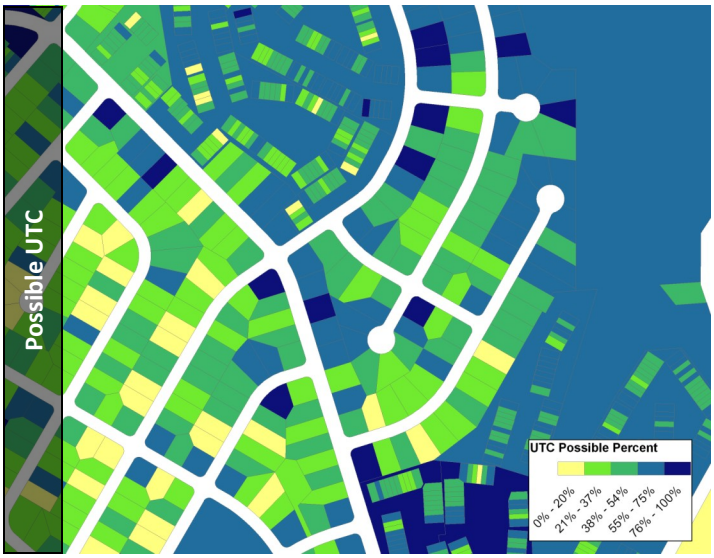


Figure 3: UTC metrics summarized at the property parcel level

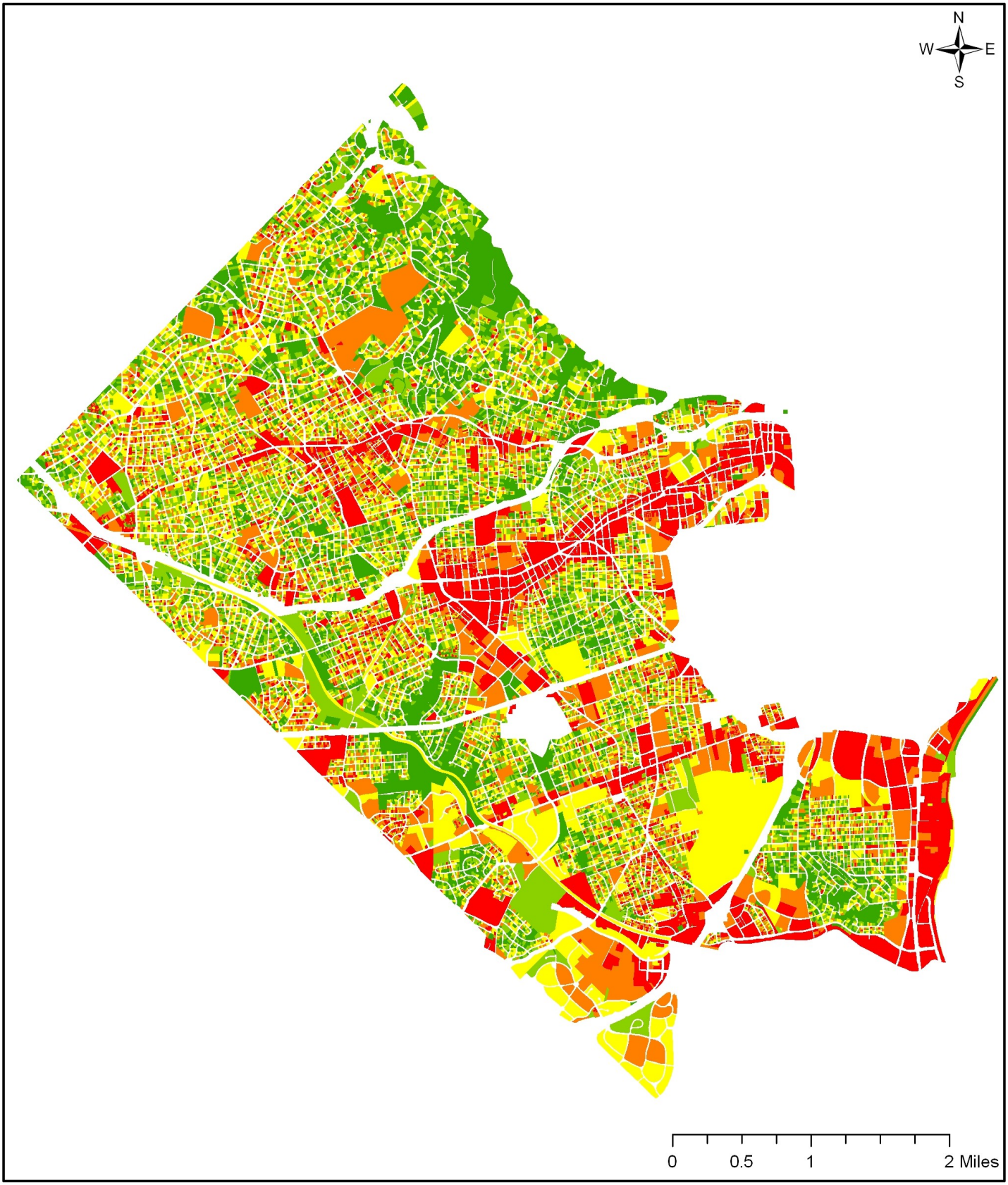


Figure 4: Existing UTC mapped using Non-Federal property parcels provided by the County of Arlington.

Urban Tree Canopy Summarized by Non-Federally Owned Property Parcels

Using the parcel data provided by the County of Arlington, Existing and Possible UTC were summarized by property parcels with federally owned parcels removed. This summary excludes any area outside of non-federally owned property parcel boundaries and areas covered by water. Figure 4 shows Existing UTC through out the County of Arlington summarized by non-federal property parcels. Arlington has 48% (5,174 acres) Existing UTC and 37% (4,009 acres) Possible UTC, table 2. Possible UTC has two components, Possible UTC - Vegetation and Possible UTC - Impervious. 18% (1,899 acres) of parcel land area is associated with Possible UTC - Vegetation. 20% (2,110 acres) of parcel land area is associated with Possible UTC - Impervious (Figure 5).

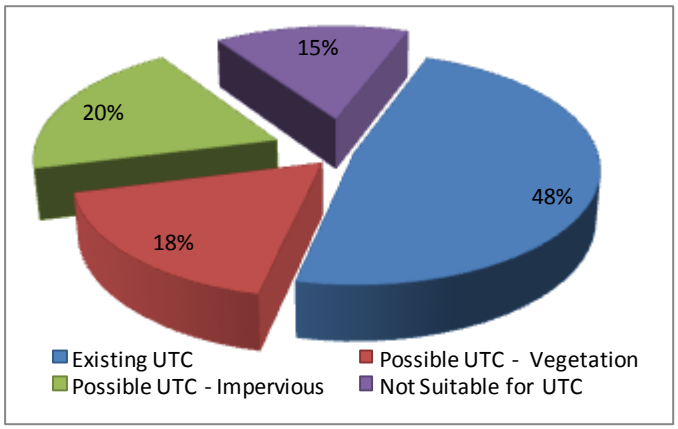


Figure 5: Pie chart showing Arlington UTC distribution within non-federally owned parcels.

Urban Tree Canopy Summarized by Zoning Categories

Using the zoning data provided by the County of Arlington, Existing and Possible UTC were summarized by zoning category (pages 4 - 8). This summary excludes any area outside the analysis boundary and areas covered by water. The zoning category One-Family Dwelling District: R-6 has the largest amount of land area with 4,319 acres and the largest amount of Existing UTC, 33.9% (Table 3a). Special District: S3-A and One-Family Dwelling District: R-10 are 2nd (22.2%) and 3rd (17.5%) in Existing UTC respectively. Figure 6a and 6b compare zoning categories by the amount of land area within the categories. Figure 6a compares zoning categories that have more than 400 acres, which comprises 83% of the land area. Figure 6b compares zones with less than 400 acres of land area (17% of the land area). Figure 7 shows Possible UTC by zoning category for the County.

Table 2: Acres and percent land area from UTC metrics summarized by non-federally owned property parcels.

**Not Suitable for UTC includes all Building Impervious areas within the parcel boundaries.*

UTC Parcel Metrics	Acres	% Parcel Land Area
Parcel Land Area	10810.0	100.0%
Existing UTC	5173.9	47.9%
Possible UTC	4009.1	37.1%
Possible UTC - Vegetation	1898.7	17.6%
Possible UTC - Impervious	2110.4	19.5%
Not Suitable for UTC*	1626.9	15.1%

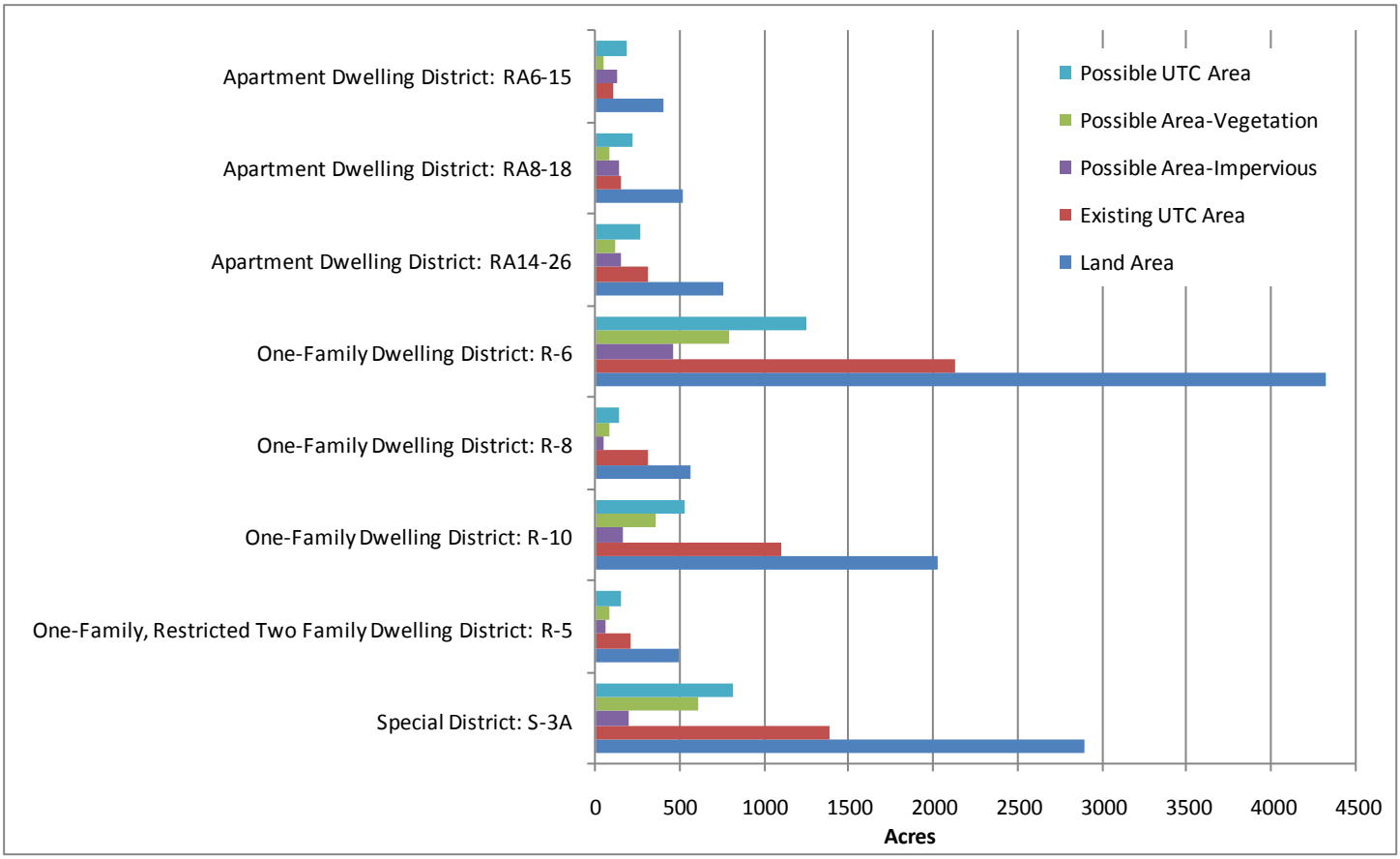


Figure 6a: UTC metrics summarized by zoning categories with more than 400 acres of land area (not including water area) which comprises 83% (11,987 acres) of the land area in zoning.

Urban Tree Canopy Summarized by Arlington's Zoning Categories

Figure 6b: UTC metrics summarized by zoning with less than 400 acres of land area (not including water area) which comprises 17% (2,436 acres) of the land area.

Urban Tree Canopy Summarized by Zoning Categories

Zoning Category	Land Area (Acres)	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
		% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type
Apartment Dwelling and Commercial District: RC	41	0.03%	10.31%	0.07%	0.02%	5.89%	0.10%	0.11%	38.06%	0.34%
Apartment Dwelling District: RA4.8	62	0.08%	18.81%	0.19%	0.03%	7.39%	0.19%	0.19%	43.91%	0.60%
Apartment Dwelling District: RA6-15	407	0.76%	27.07%	1.76%	0.39%	13.67%	2.25%	1.30%	46.05%	4.10%
Apartment Dwelling District: RA7-16	109	0.26%	33.85%	0.59%	0.12%	16.12%	0.71%	0.30%	39.05%	0.93%
Apartment Dwelling District: RA8-18	523	1.07%	29.58%	2.47%	0.56%	15.55%	3.28%	1.54%	42.59%	4.87%
Apartment Dwelling District: RA14-26	759	2.19%	41.59%	5.04%	0.83%	15.74%	4.83%	1.89%	35.97%	5.97%
Columbia Pike - Form Based Code District: CP-FBC	2	0.01%	37.07%	0.01%	0.00%	25.57%	0.02%	0.01%	43.82%	0.02%
Commercial Off. Bldg, Hotel and Apartment District: C-O-A	42	0.02%	5.22%	0.03%	0.00%	1.02%	0.02%	0.11%	37.85%	0.35%
Commercial Off. Bldg, Hotel and Multiple-Family Dwelling: C-O	212	0.09%	6.42%	0.22%	0.09%	6.31%	0.54%	0.62%	42.48%	1.97%
Commercial Office Building, Hotel and Apartment District: C-O-1.0	22	0.03%	23.06%	0.08%	0.01%	8.78%	0.08%	0.06%	41.54%	0.20%
Commercial Office Building, Hotel and Apartment District: C-O-1.5	192	0.21%	15.44%	0.47%	0.24%	17.76%	1.38%	0.68%	51.10%	2.15%
Commercial Office Building, Hotel and Apartment District: C-O-2.5	225	0.16%	10.48%	0.38%	0.14%	9.20%	0.84%	0.70%	44.67%	2.19%
Commercial Redevelopment District: C-R	14	0.00%	3.47%	0.01%	0.00%	3.53%	0.02%	0.03%	29.25%	0.09%
Commercial Town House District: C-TH	6	0.00%	8.00%	0.01%	0.00%	10.23%	0.03%	0.02%	34.52%	0.05%
C-O-ROSSLYN: C-O-ROSS	13	0.00%	1.80%	0.00%	0.00%	0.82%	0.00%	0.03%	29.55%	0.09%
General Commercial District: C-3	64	0.03%	7.02%	0.07%	0.03%	5.83%	0.15%	0.18%	39.93%	0.56%
Hotel District: RA-H	30	0.02%	8.95%	0.04%	0.01%	6.18%	0.08%	0.13%	59.74%	0.39%
Light Industrial District: M-1	87	0.05%	9.03%	0.13%	0.04%	6.95%	0.24%	0.34%	56.46%	1.07%
Limited Commercial - Professional Office Building District: C-1-O	3	0.00%	26.62%	0.01%	0.00%	11.05%	0.01%	0.01%	40.59%	0.02%
Limited Industrial District: CM	38	0.03%	9.78%	0.06%	0.04%	15.79%	0.24%	0.15%	55.06%	0.46%
Local Commercial District: C-1	90	0.05%	8.00%	0.12%	0.04%	6.39%	0.23%	0.29%	46.40%	0.91%
Mixed Use-Virginia Square: MU-VS	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	24.73%	0.01%
Multiple-Family Dwelling and Hotel District: RA-H-3.2	70	0.05%	11.00%	0.12%	0.04%	7.83%	0.22%	0.18%	36.57%	0.56%
One-Family Dwelling District: R-6	4319	**14.75%**	**49.26%**	**33.95%**	5.54%	18.49%	32.26%	8.70%	29.07%	27.46%

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

The % Category value of 14.75% indicates that **14.75%** of Arlington's land area is tree canopy in areas where the land use is "One-Family Dwelling District: R-6".

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

The % Land Use value of 49.26% indicates that **49.26%** of "One-Family Dwelling District: R-6" land is covered by tree canopy.

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

The % UTC Type value of 33.95% indicates that **33.95%** of all Existing UTC lies in areas of "One-Family Dwelling District: R-6" land use.

Table 3a: UTC metrics by type, summarized by zoning categories. For each zone, category UTC metrics were computed as a percent of all zoned land in the County (% Land Area), as a percent of land area by zoning categories (% Zoning Category) and as a percent of the area for the UTC type (% UTC Type).

Urban Tree Canopy Summarized by Zoning Categories Continued

Zoning Category	Land Area (Acres)	Existing UTC			Possible UTC Vegetation			Possible UTC Impervious		
		% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type	% Land Area	% Zoning Category	% UTC Type
One-Family Dwelling District: R-8	563	2.14%	54.95%	4.94%	0.62%	0.62%	0.62%	0.96%	24.67%	3.04%
One-Family Dwelling District: R-10	2025	7.64%	54.40%	17.58%	2.52%	2.52%	2.52%	3.68%	26.22%	11.61%
One-Family Dwelling District: R-20	250	1.21%	69.79%	2.79%	0.20%	0.20%	0.20%	0.32%	18.30%	1.00%
One Family Residential-Town-House Dwelling District: R-10T	83	0.24%	41.22%	0.54%	0.07%	0.07%	0.07%	0.17%	29.91%	0.54%
One-Family, Restricted Two Family Dwelling District: R-5	497	1.49%	43.10%	3.42%	0.61%	0.61%	0.61%	1.05%	30.36%	3.30%
Public Service District: P-S	108	0.10%	13.93%	0.24%	0.15%	0.05%	0.00%	0.49%	66.16%	1.56%
Residential Town House Dwelling District: R15-30T	61	0.10%	24.51%	0.24%	0.05%	0.00%	0.12%	0.16%	37.61%	0.50%
Restricted Local Commercial District: C-1-R	3	0.00%	6.85%	0.00%	0.00%	0.12%	0.03%	0.01%	47.30%	0.03%
Service Commercial - Community Business Districts: C-2	260	0.16%	8.76%	0.36%	0.12%	0.03%	0.04%	0.80%	44.67%	2.54%
Service Industrial District: M-2	15	0.01%	11.55%	0.03%	0.03%	0.04%	4.24%	0.07%	64.96%	0.22%
Special Development District: S-D	51	0.10%	28.25%	0.23%	0.04%	4.24%	0.33%	0.14%	38.98%	0.44%
Special District: S-3A	2894	9.65%	48.08%	22.21%	4.24%	0.33%	0.00%	5.63%	28.08%	17.77%
Two-Family and Town House Dwelling District: R2-7	282	0.69%	35.48%	1.60%	0.33%	0.00%	0.00%	0.67%	34.06%	2.10%

Table 3b : UTC metrics by type, summarized by zoning categories. For each zone, category UTC metrics were computed as a percent of all zoned land in the County (% Land Area), as a percent of land area by zoning categories (% Zoning Category) and as a percent of the area for the UTC type (% UTC Type).

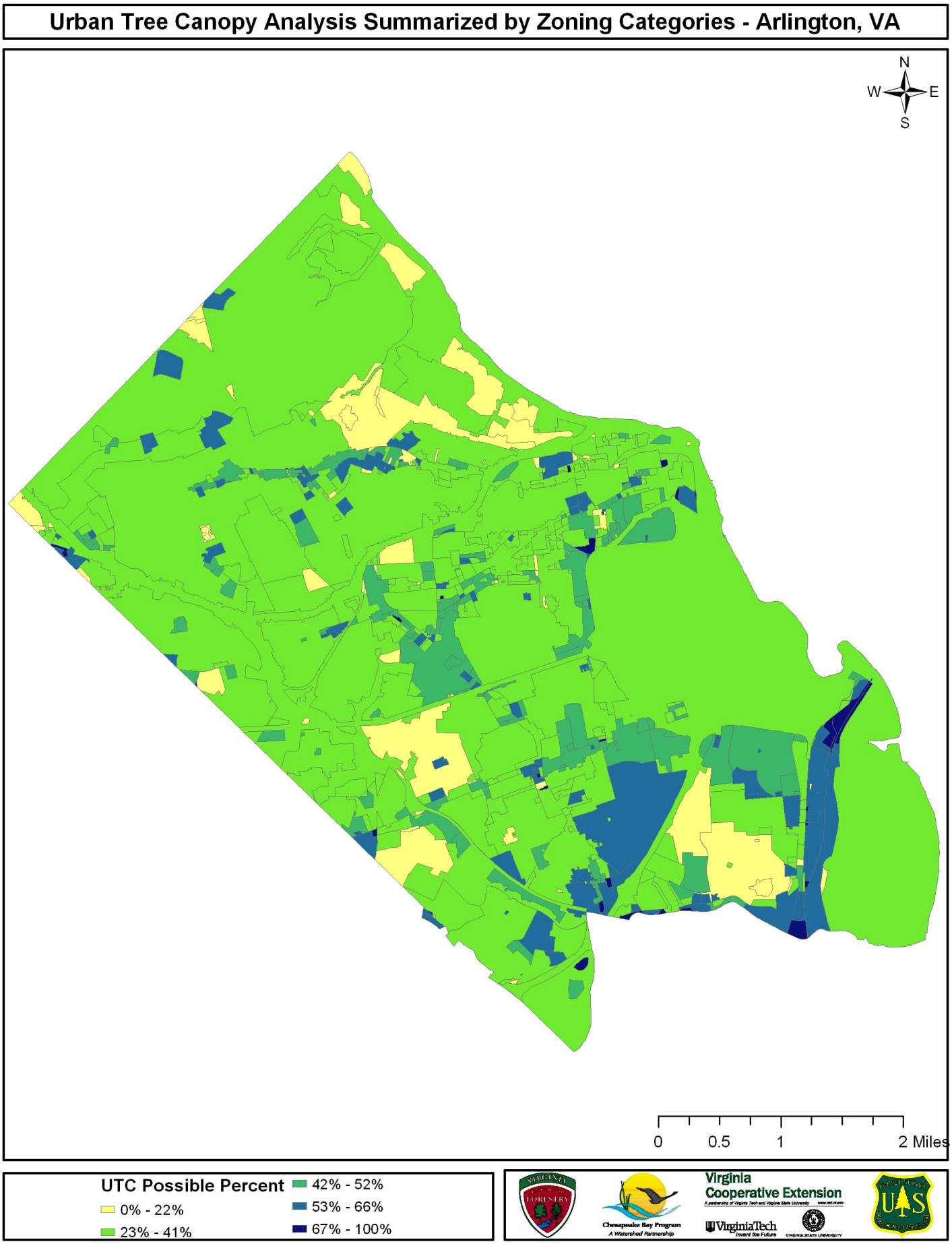


Figure 7: Possible percentage increase of UTC mapped using zoning categories provided by the County of Arlington.

Where to Plant Trees?

Decision makers can use GIS to find out specific UTC metrics for a parcel or zoning category. This information can be used to estimate the amount of tree loss in a planned development or set UTC improvement goals for an area.

Attribute	Value
Land Use	Exempt Commercial
Owner	St Peter & Paul Catholic Church
Address	320 Cathedral Street
Existing UTC	5%
Possible UTC	72%
Possible UTC—Vegetation	47%
Possible UTC—Impervious	25%

Figure 8: Parcel-based UTC metrics can be used to support targeted UTC.

Conclusions

- Arlington's urban tree canopy is a vital community asset, reducing stormwater runoff, improving air quality, reducing the County's carbon footprint, enhancing quality of life, contributing to savings on energy bills, and serving as habitat for wildlife.
- With 43.5% canopy coverage of all land area within the county, Arlington has similar coverage as Charlottesville, Fairfax County, and Lexington. Figure 9 shows how Arlington compares to other Virginia localities participating in Urban Tree Canopy Assessments.
- When summarized by property parcels, Arlington has 48% Existing UTC with only 28% of all parcels with less than 30% canopy coverage.
- 74% (4,621 acres) of the Existing UTC is located within the following zoning categories: One-Family Dwelling District: R-6, Special District: S-3A, and One-Family Dwelling District: R-10.

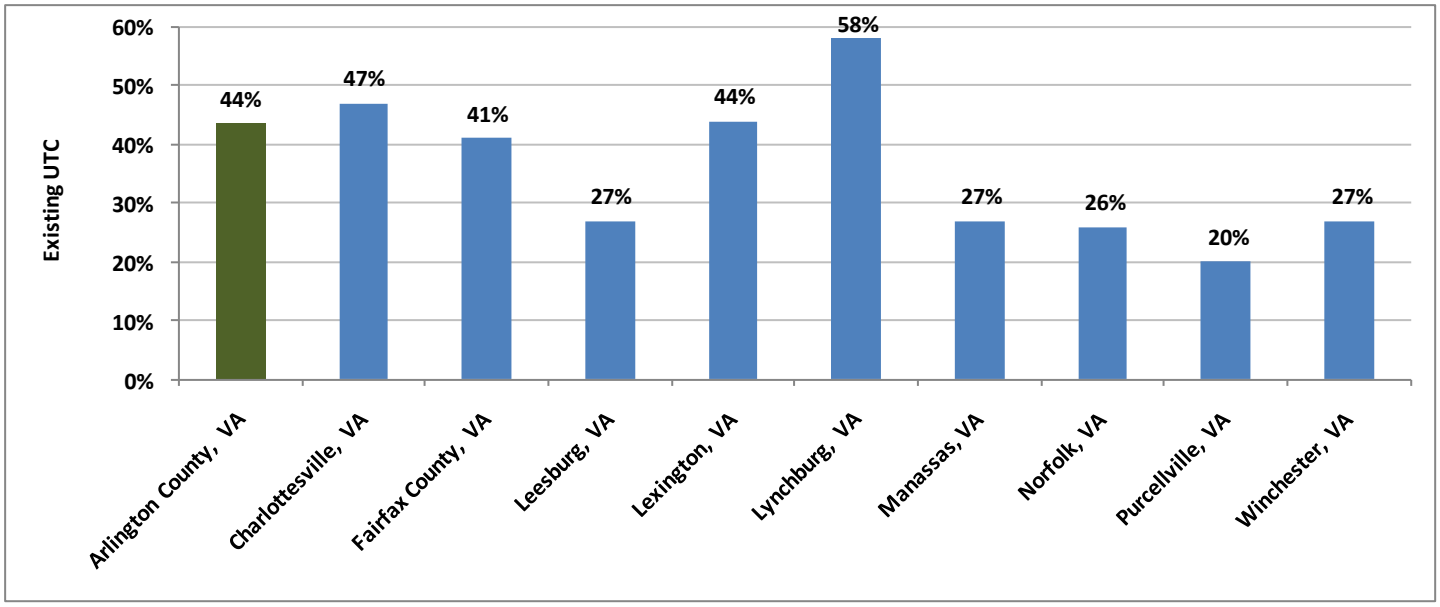


Figure 9: Comparison of Existing UTC of % land area (excludes water area) with other Virginia localities that have completed UTC assessments.

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Additional Information

The study was conducted with funding from the Virginia Department of Forestry. More information on the UTC assessment project can be found at the following web site.
http://nrs.fs.fed.us/urban/utc/
http://www.gep.frec.vt.edu/va_utc.html