

The following report was prepared by  
University of Vermont for Cacapon Institute  
in support of the WV UTC A&E project.

*Understanding our tree canopy is an essential first step in setting urban tree canopy goals, determining high priority planting areas, and fostering tree planting initiatives within the Potomac River Basin and Chesapeake Bay Watershed in West Virginia*



### **Cacapon Institute**

*From the Cacapon River to the Potomac to the Chesapeake Bay, we protect rivers and watersheds using science and education.*

**As Fact Finders**, we conduct research to gain insight into watershed issues of local and regional importance.

**As Educators**, we work to create a future where a stream without a buffer looks as out of place as a smoker in a conference room looks today. To foster that vision, our environmental education efforts focus on students first and, through them, the larger community.

**As Problem Solvers**, we seek innovative solutions to environmental problems.

## WEST VIRGINIA URBAN TREE CANOPY

*ASSESSMENT AND ENHANCEMENT*

### *What is Urban Tree Canopy?*

Urban Tree Canopy, or UTC, is a measure of the trees we live with, the trees that grace our neighborhoods, towns, parks, schools, and roadsides. WV UTC is a partnership of the USDA Forest Service, WV Conservation Agency, WV Division of Forestry, WV Division of Highways, and Cacapon Institute. We are working with local



government agencies and volunteers to improve our UTC. We are helping to develop land management strategies at county and municipal levels. Strategies include assessing UTC to determine high priority planting areas, setting UTC goals, and fostering tree planting initiatives. These strategies are increasing the public benefits of UTC including cleaner air, shade, and less stormwater runoff pollution.

Not to mention the beauty trees add. The Eastern Panhandle of WV is one of the fastest developing regions of the state with potential negative

impacts to air quality, water quality, competing land uses, quality of life and public health. Assessing and enhancing UTC is a practical and effective means for urban forestry to positively influence these issues.

### **Assessment**

Using statistical sampling and aerial imagery Cacapon Institute, WV Division of Forestry, and the USDA Forest Service’s analysts at University of Vermont are determining the extent of



the existing tree canopy. In addition to UTC we are assessing the impervious surfaces (surfaces water can not pass through such as buildings, roads, and pavement) along with bare soil & open green space (grassy areas that might benefit from trees). Based on the sampling, we are identifying the locations that would benefit the most from expanded tree canopy and targeting those areas for tree plantings.

Municipalities are encouraged to declare a UTC goal and develop plans for increasing tree canopy and care for existing trees. Towns are encouraged to set land aside as woodlots to enhance wildlife habitat. We need to adopt best management practices for public and private lands.

### **Enhancement**



One way we will assist communities and volunteers is through Project CommuniTree. CommuniTree promotes urban tree planting and public education through volunteerism on a regional scale by providing important trainings. CommuniTree focuses on urban tree plantings within small communities by teaching proper tree selection, planting placement, and long term care and maintenance. It promotes watershed awareness—awareness of the land areas that drains into our

rivers and streams. CommuniTree reduces stormwater runoff pollution by planting trees in urban/suburban areas and in riparian zones (the land just along the riverside). This improves wildlife habitat, increases green space and prevents soil erosion. Volunteer tree planting projects are a major component in the process of communities making priority decisions. CommuniTree provides a strong educational message so citizens know to plant the right tree in the right place for the right reason.

### ***Trees Are Good!***

Support for the WV Urban Tree Canopy Assessment & Enhancement comes from:



[www.forestsforwatersheds.org](http://www.forestsforwatersheds.org)



[www.wvforestry.com/urban.cfm](http://www.wvforestry.com/urban.cfm)



[www.wvca.us/bay/communitree.cfm](http://www.wvca.us/bay/communitree.cfm)



[www.potomacpartnership.org](http://www.potomacpartnership.org)

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# A Report on the Jefferson County's Existing and Possible Tree Canopy



## Why is Tree Canopy Important?

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

## How Much Tree Canopy Does Jefferson Co. Have?

An analysis of Jefferson County, West Virginia's tree canopy (TC) based on high resolution aerial imagery found that about 134,000 acres of the county is covered by tree canopy (termed Existing TC). This corresponds to 38% of all land within the county (Figure 1). However, 59% (79,000 acres) of the county could theoretically be improved to support tree canopy (termed Possible TC). Possible TC 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. Because much of Jefferson County is devoted to agriculture, the county's Existing TC generally occurs in scattered patches. The largest, most contiguous patches occur east of the Shenandoah River in the Blue Ridge Mountain area. Note that agricultural land-cover types were not specifically mapped as part of this project but are included in the Grass/Shrubs land-cover category.

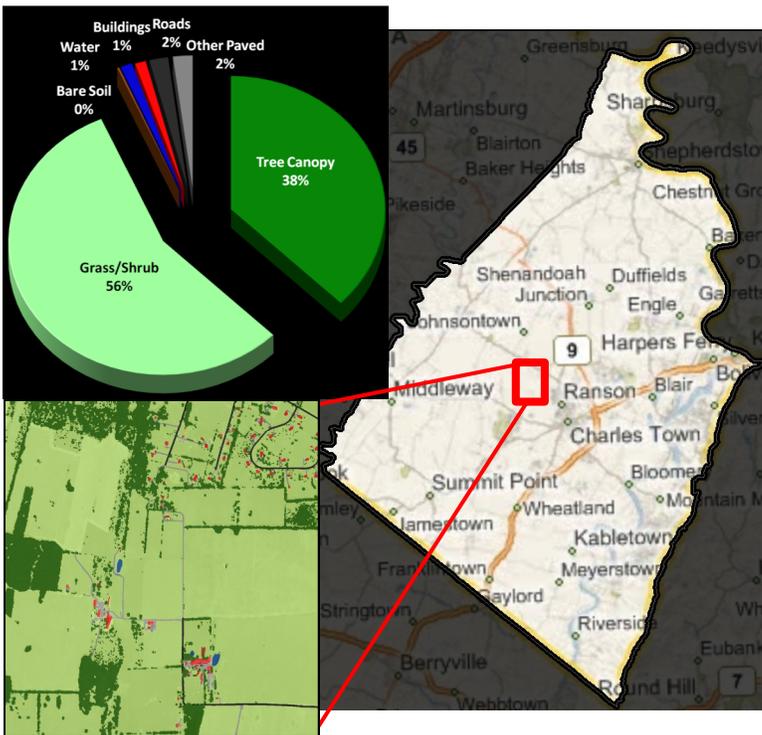


Figure 1: Sample land cover dataset for a portion of the county and overall land cover summaries for the entire county.

## Project Background

The analysis of Jefferson County's Tree Canopy (TC) was carried out in collaboration with the Jefferson County Commission, Cacapon Institute, and the USDA Forest Service. 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 tree canopy assessment protocols to the Jefferson County. This analysis is primarily based on year 2007 aerial imagery provided by the USDA.

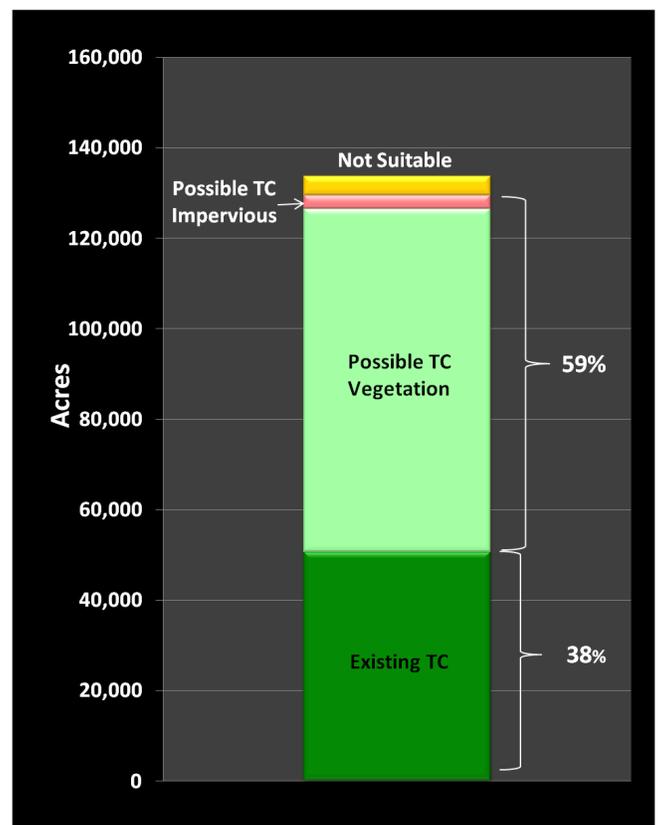


Figure 2: TC metrics for Jefferson County based on % of land area covered by each TC type.

## Key Terms

**TC:** Tree Canopy (TC) 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 TC:** The amount of Tree Canopy present when viewed from above using aerial or satellite imagery.

**Impervious Possible TC:** Asphalt or concrete surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy.

**Vegetated Possible TC:** Grass or shrub area that is theoretically available for the establishment of tree canopy.

## Mapping Jefferson County's Trees

Prior to this study, the only available estimates of tree canopy for Jefferson County were from the 2001 National Land Cover Dataset (NLCD 2001). While NLCD 2001 is valuable for analyzing land cover at the state-wide level, it is derived from relatively coarse, 30-meter resolution satellite imagery (Figure 3a). Using high-resolution (1 meter) aerial imagery acquired in the summer of 2007 (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 County to have only 30% tree canopy, compared to the more precise estimate of 38%.

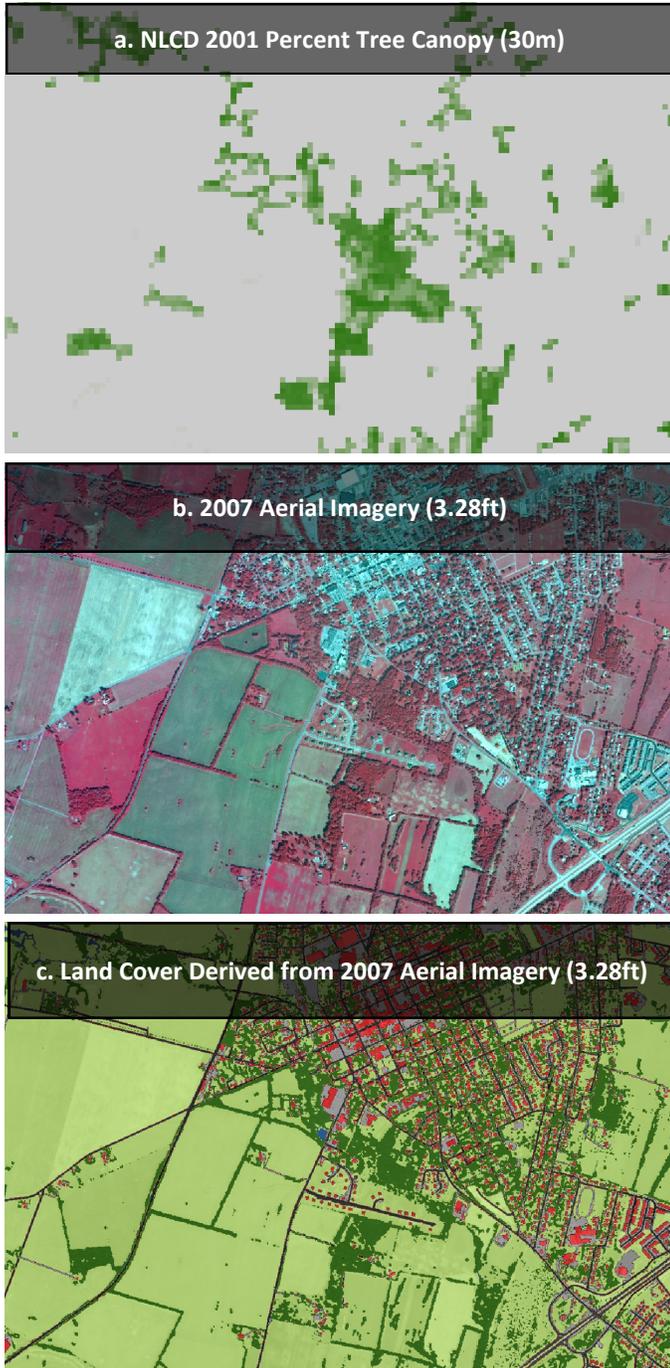


Figure 3a, 3b, 3c: Comparison of NLCD 2001 to high-resolution land cover.

## Zoning Summary

Following computation of Existing and Possible TC, the TC metrics were summarized for each category in the County's zoning layer. (Figure 4). For each zoning category, the absolute area of Existing and Possible TC was computed along with the percent of Existing TC and Possible TC (TC area/area of the zoning category).

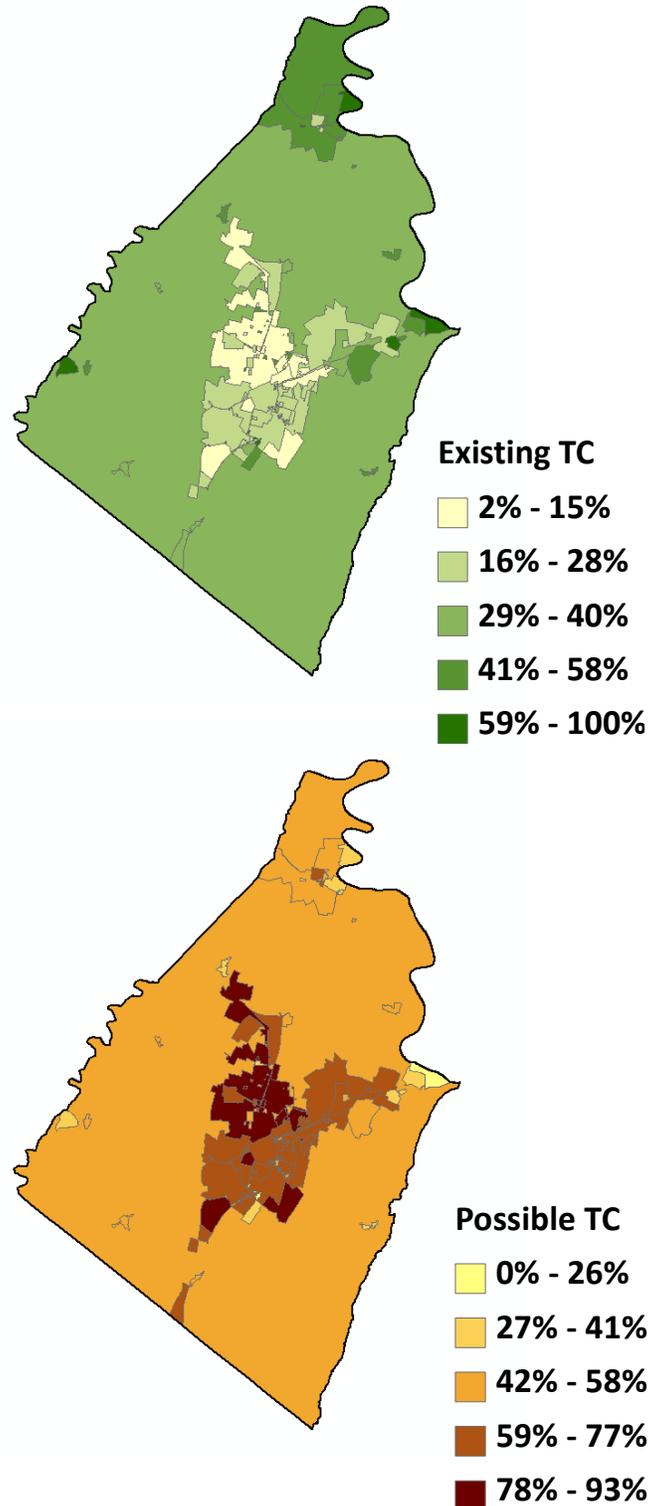


Figure 4: Zoning-based TC metrics. TC metrics are generated at the zoning level, allowing each zoning category to be evaluated according to its Existing TC and Possible TC.

## Zoning Districts

An analysis of Existing and Possible TC by zoning district was conducted using the most recent zoning layer for the County. As indicated in Figure 5 the largest zoning category by overall area, amount of tree canopy, and room to plant trees is "Rural." Table 1 presents, for each zoning district, the TC metrics computed as a percentage of all land in the County (% Land), as a percent of land area by the amount of land in the specified zoning district (% Category), and as a percent of the area for TC type (% TC Type). For example, land designated as "Rural" has the most Existing TC in raw acreage, with 33% of all land in Jefferson County consisting of tree canopy in "Rural." "Rural" and "Village" zoned land has the highest percentage of tree canopy relative to its land area at 41%. Areas zoned as "Rural" also encompasses 88% of Existing TC by TC Type.

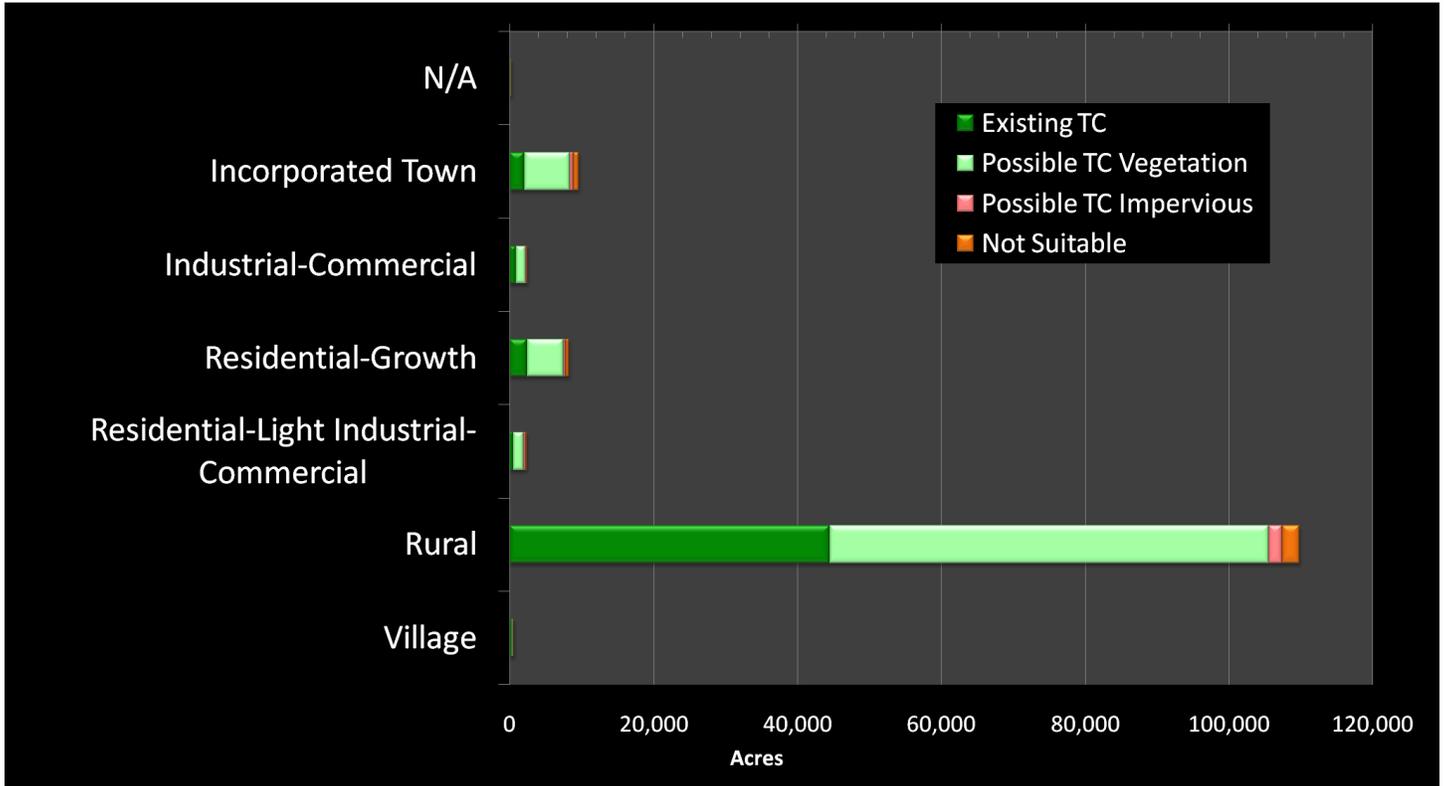


Figure 5: TC metrics summarized by zoning district

Zoning District	Existing TC			Possible TC Vegetation			Possible TC Impervious		
	% Land	% Category	% TC Type	% Land	% Category	% TC Type	% Land	% Category	% TC Type
N/A	0%	27%	0%	0%	57%	0%	0%	5%	0%
Incorporated Town	1%	21%	4%	5%	66%	8%	0%	4%	1%
Industrial-Commercial	1%	34%	2%	1%	54%	2%	0%	6%	0%
Residential-Growth	2%	29%	5%	4%	61%	7%	0%	4%	0%
Residential-Light Industrial-Commercial	0%	18%	1%	1%	63%	2%	0%	9%	0%
Rural	33%	41%	88%	46%	56%	81%	1%	2%	3%
Village	0%	41%	1%	0%	38%	0%	0%	7%	0%

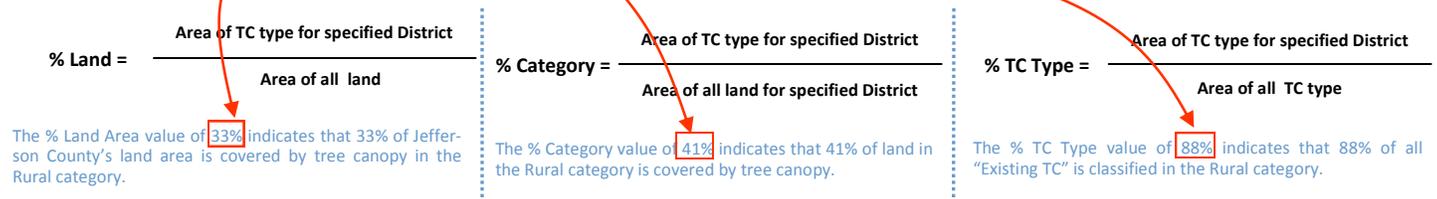


Table 1: TC metrics were summarized by zoning district. For each zoning district, TC metrics were computed as a percent of all land in the County (% Land), as a percent of land area by zoning district (% Category), and as a percent of the area for TC type (% TC Type).

## Municipalities

Existing TC and Possible TC were summarized by the five municipalities within Jefferson County (Figure 6). Ranson is the largest municipality and has the most acreage of Existing TC and Possible TC compared to the other municipalities (Figure 7). Harpers Ferry had the highest percentage of Existing TC by land area while Ranson had the highest percentage of Possible TC by land area.

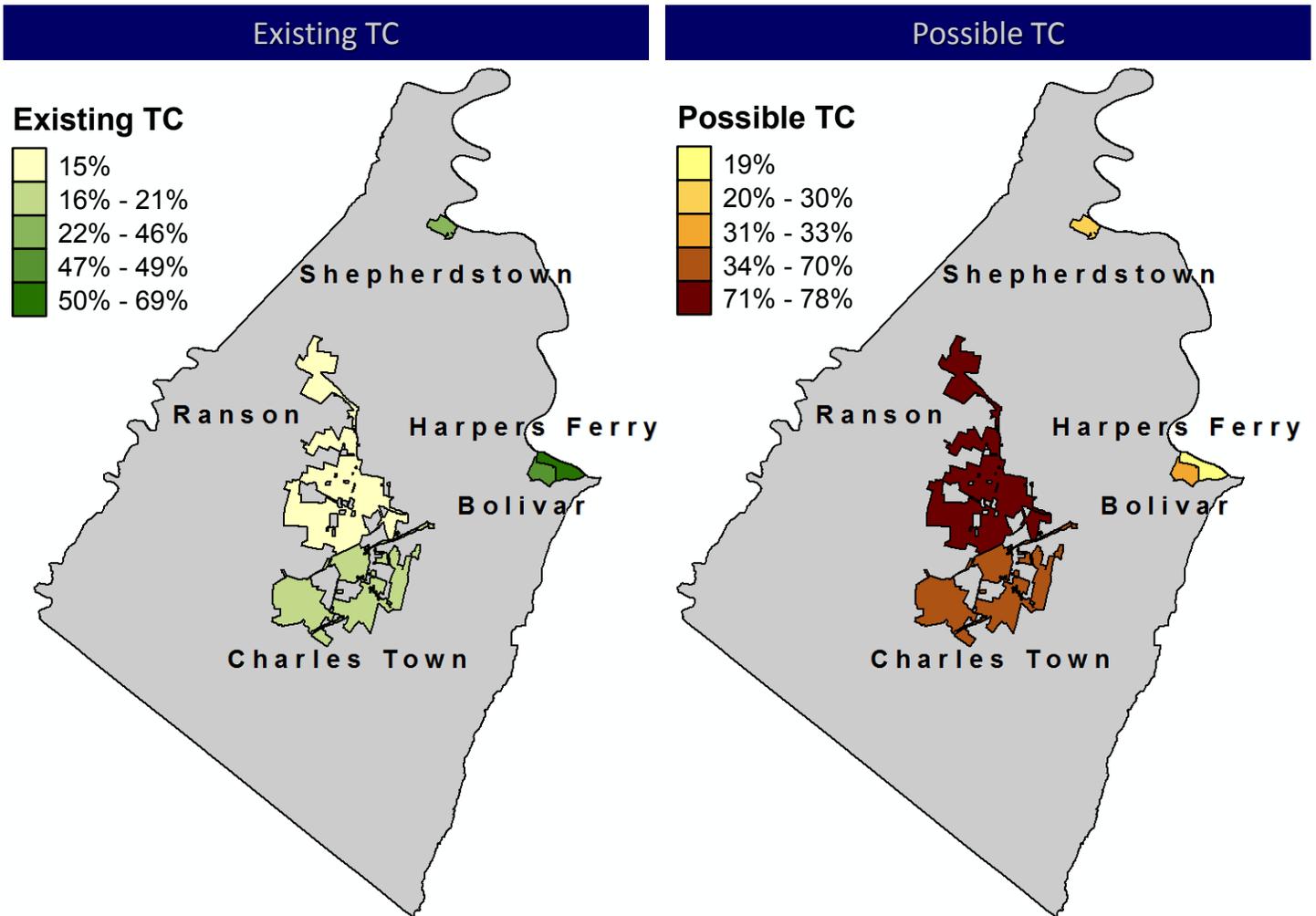


Figure 6. Existing TC (left) and Possible TC (right) as a percentage of land area by municipal boundaries.

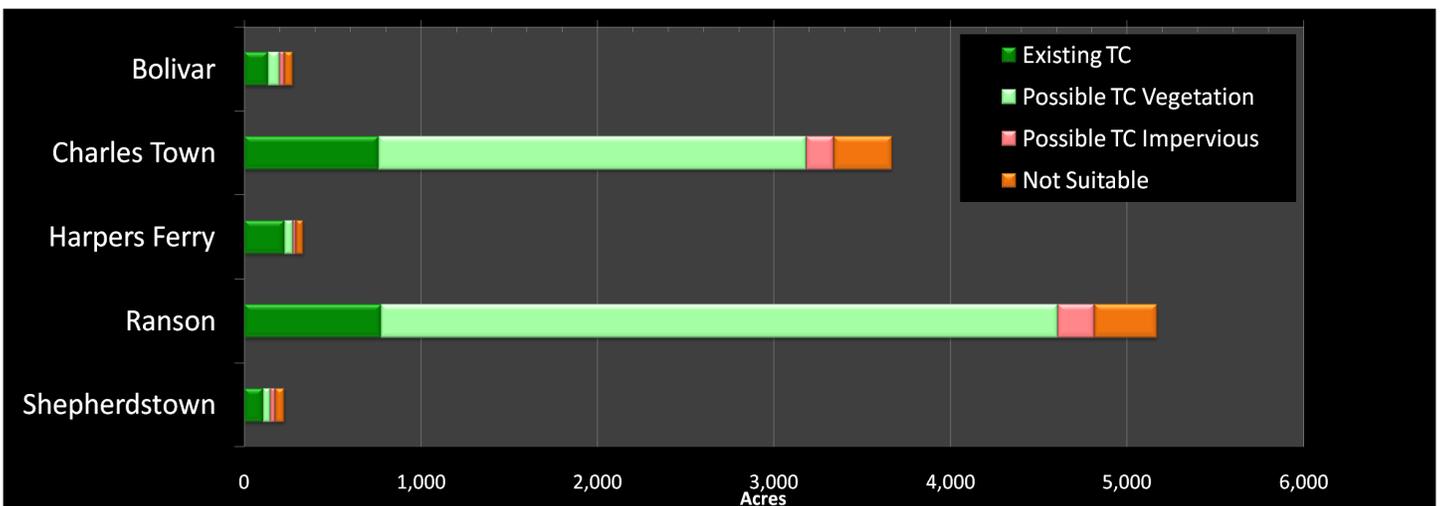


Figure 7: Distribution of existing and possible tree canopy by municipality in Jefferson County.

## Urban Growth Centers

Existing TC and Possible TC were summarized by the four Urban Growth Centers within Jefferson County (Figure 8). Charles Town occupies the largest area and has the most Existing TC and Possible TC in raw acreage compared to the other Urban Growth Centers. Bolivar occupies the least amount of area but has the highest percentage of Existing TC by land area when compared to other Urban Growth Centers. Charles Town has the highest percentage of Possible TC compared to the other Urban Growth Centers.

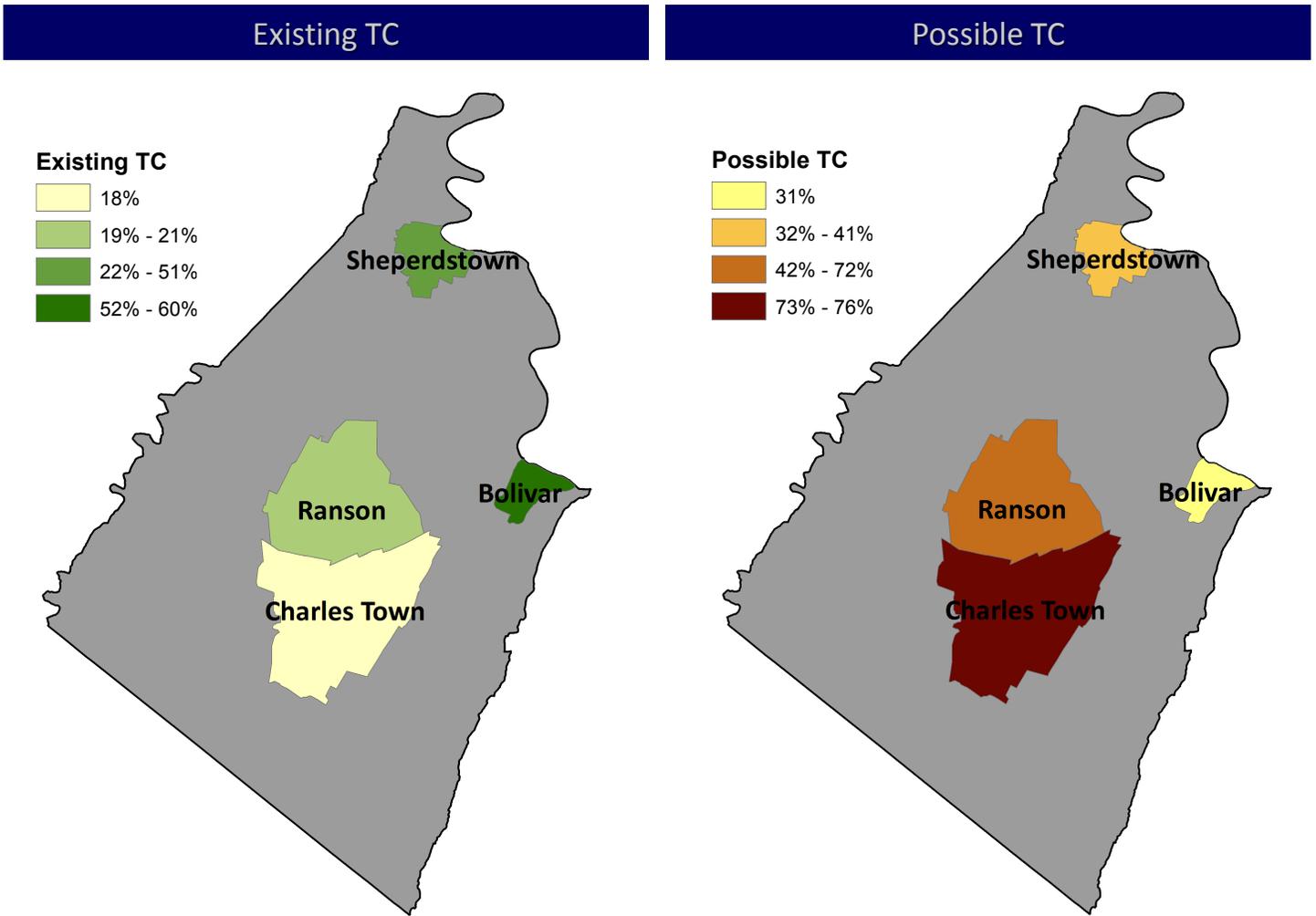


Figure 8. Existing TC (left) and Possible TC (right) as a percentage of land area by Urban Growth Centers.

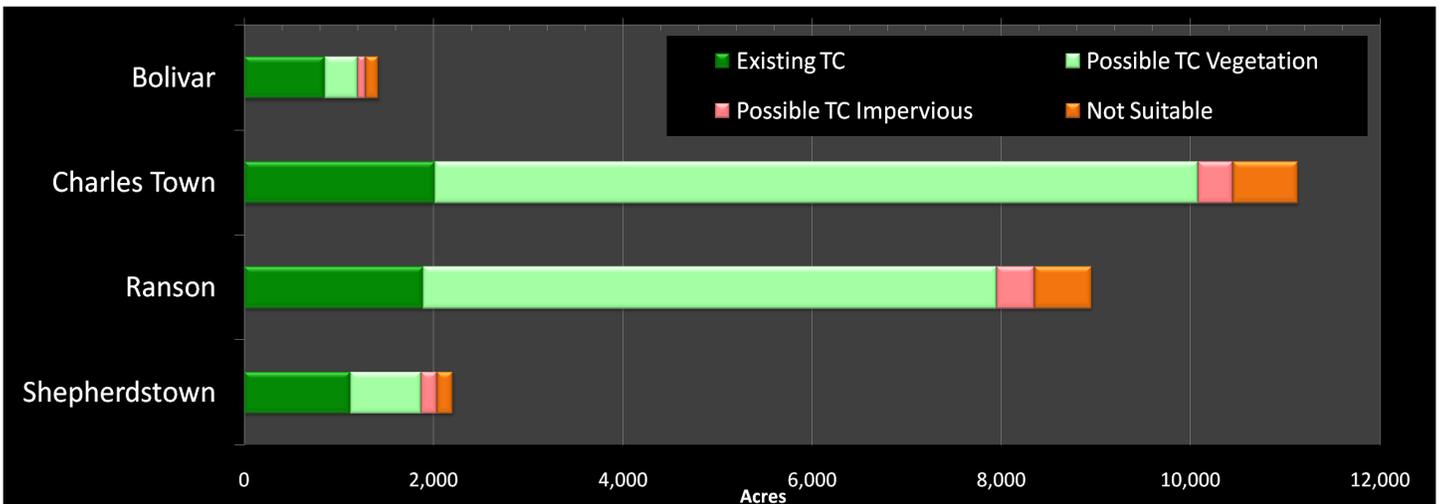


Figure 9: Distribution of Existing TC and Possible TC by Urban Growth Center

# Slope Classes

High-resolution topographic data was used to generate slope maps for the county. In the old slopes classes, slopes ranging from 0-9.9% had largest overall area and greatest amount of Existing and Possible UTC. This range of slope values also had the highest percentage of Existing and Possible TC by % land area. In the new slope classes, the slopes ranging from 0-14.9% covered the largest area of the County area and had the greatest area of Existing and Possible TC and highest percentage of land area covered by both TC metrics. The steepest class for the old classes (>35%) and the new slope classes (>50%) had less than 1% of both Existing and Possible TC.

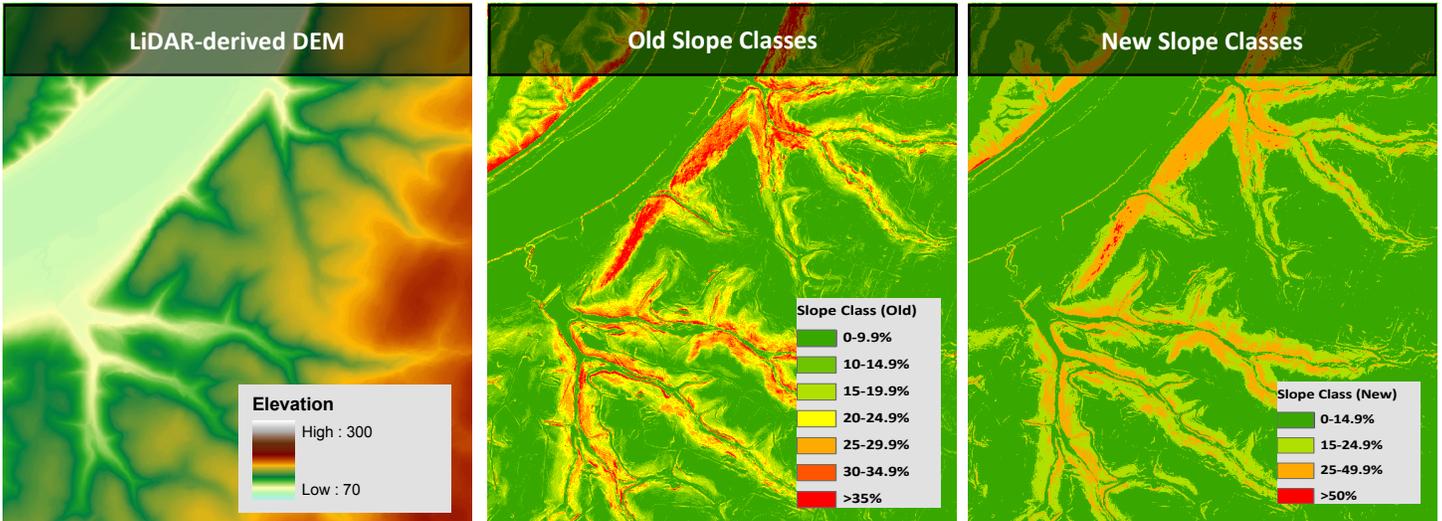


Figure 9: High-resolution slope maps were generated from a LiDAR-derived DEM (left). The slope map is displayed according to old slope classes (center) and new slope classes (right).

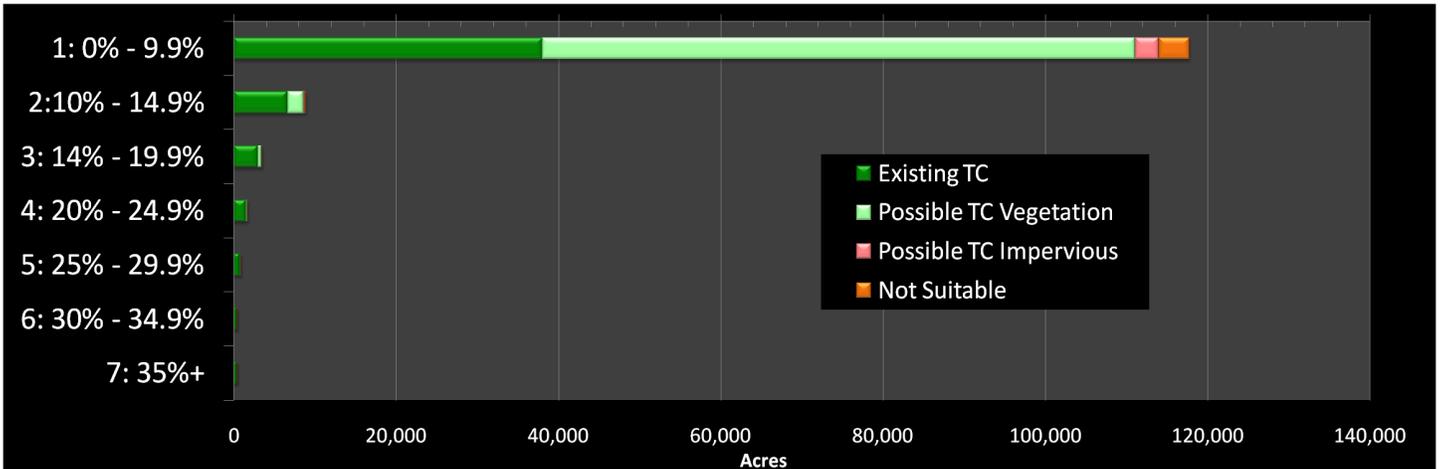


Figure 10: TC metrics summarized by old slope classes for Jefferson County.

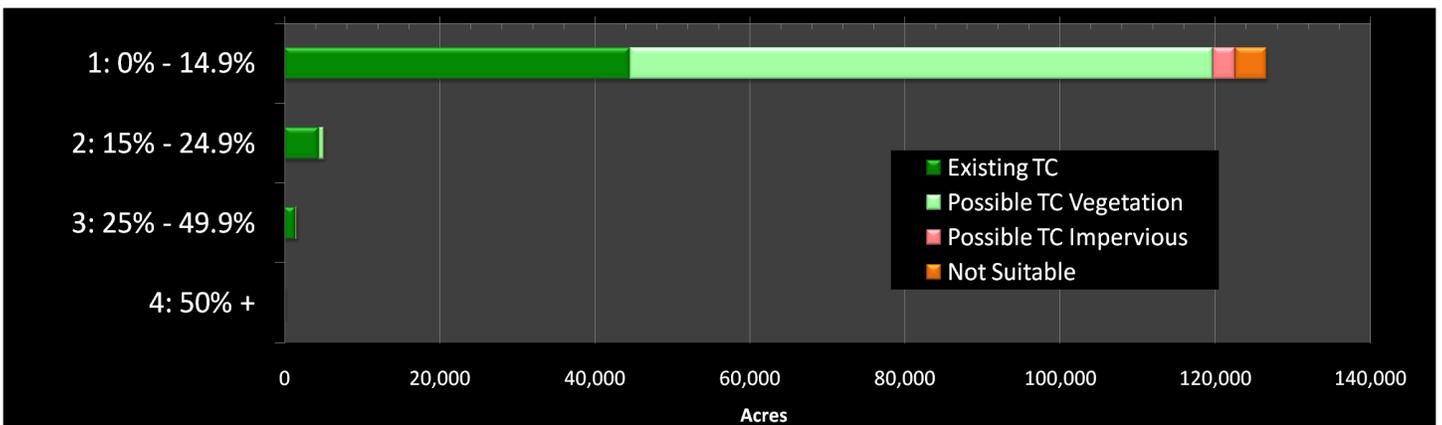


Figure 11: TC metrics summarized by new slope classes for Jefferson County.

## Blue Ridge Mountains

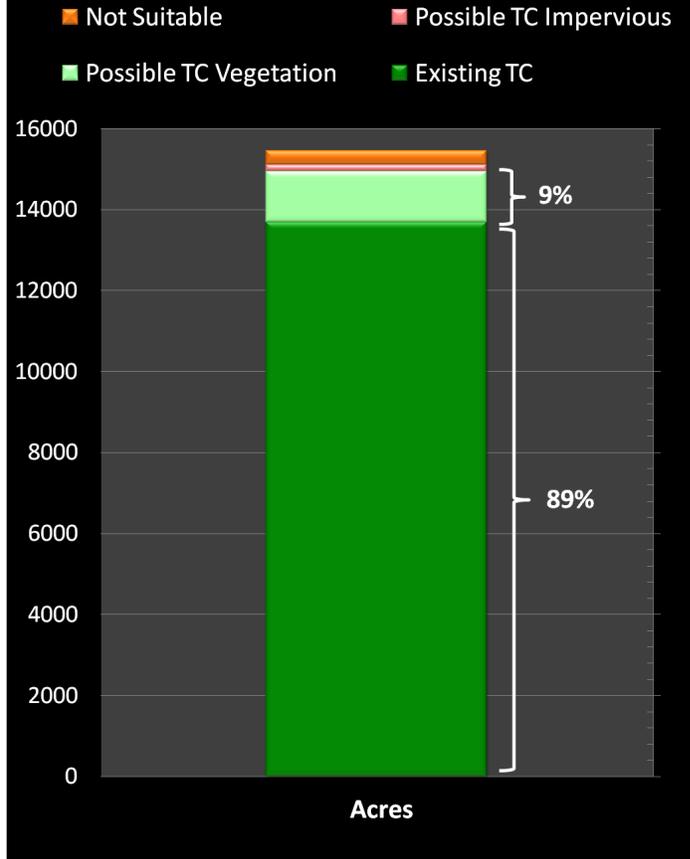
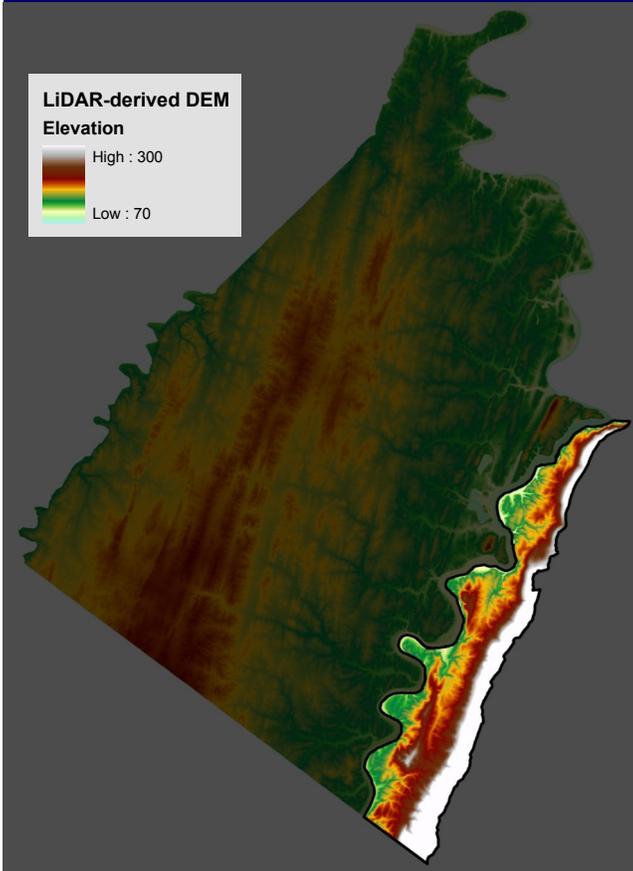


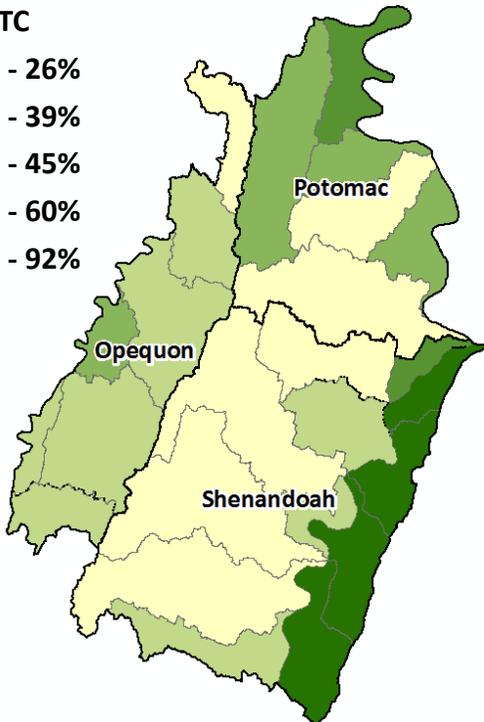
Figure 13. LiDAR-derived digital elevation model (DEM) showing topography for the Blue Ridge Mountain Area.

Figure 14: TC metrics for the Blue Ridge Mountain Area show that the area is primarily covered by tree canopy.

## Hydrologic Basins

### Existing TC

- 19% - 26%
- 27% - 39%
- 40% - 45%
- 46% - 60%
- 61% - 92%



### Possible TC

- 7% - 14%
- 15% - 40%
- 41% - 60%
- 61% - 67%
- 68% - 80%

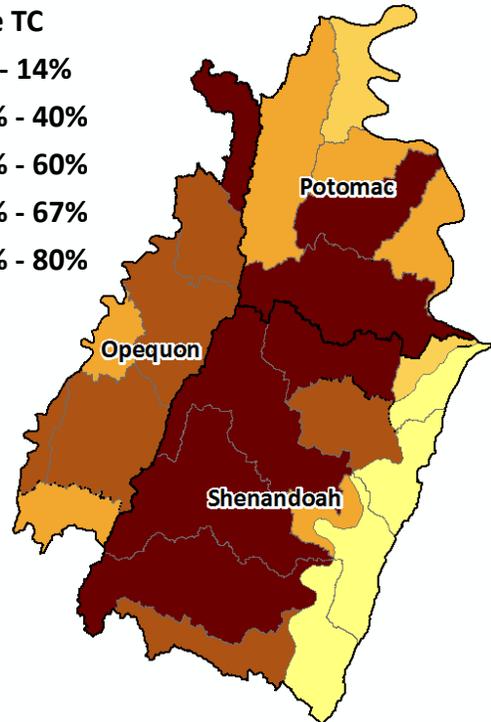


Figure 15: Existing TC and Possible TC were summarized by hydrologic basins and corresponding subwatersheds for Jefferson County.

## Conclusions and Recommendations

- Jefferson County’s Tree Canopy is a vital county asset that reduces stormwater runoff, improves air quality, reduces the county’s carbon footprint, enhances quality of life, contributes to savings on energy bills, and serves as habitat for wildlife.
- Jefferson County should consider establishing a TC goal. Such a goal should not be limited to increasing the county’s overall tree canopy; it should also focus on increasing tree canopy in those zoning districts or municipalities that have the least Existing TC and highest Possible TC.
- Zoning-level summaries can be used for targeting tree planting and preservation efforts within different regions of the County.
- “Rural” areas had the highest percentage of Existing and Possible TC for the County. Policies and management strategies should be developed to preserve and promote tree canopy within this zoning district.
- Residential, industrial and commercial zoning districts are covered by 2% or less Existing tree canopy. Regulations or incentive programs should be implemented to encourage establishing more tree canopy in these areas.
- Of particular focus for TC improvement should be municipalities or urban growth centers within the county that have large contiguous impervious surfaces. These areas contribute high amounts of runoff, which degrades water quality. The establishment of tree canopy in these municipalities will help reduce runoff during periods of peak overland flow.
- Policies should be implemented that encourage tree planting as part of development within the urban growth centers.
- Tree canopy should be preserved or established in steeper slope areas. Establishing tree canopy and other vegetation on steep slopes can reduce soil erosion and landslide risks.
- With Existing TC and Possible TC summarized at the watershed and basin level and integrated with the County’s GIS database, individual watersheds or basins can be examined and targeted for TC improvement.. Research (Goetz et al., 2003) indicates that watersheds with 37% tree canopy results in a “fair” stream health rating, and 45% tree canopy results in a stream health rating of “good.”

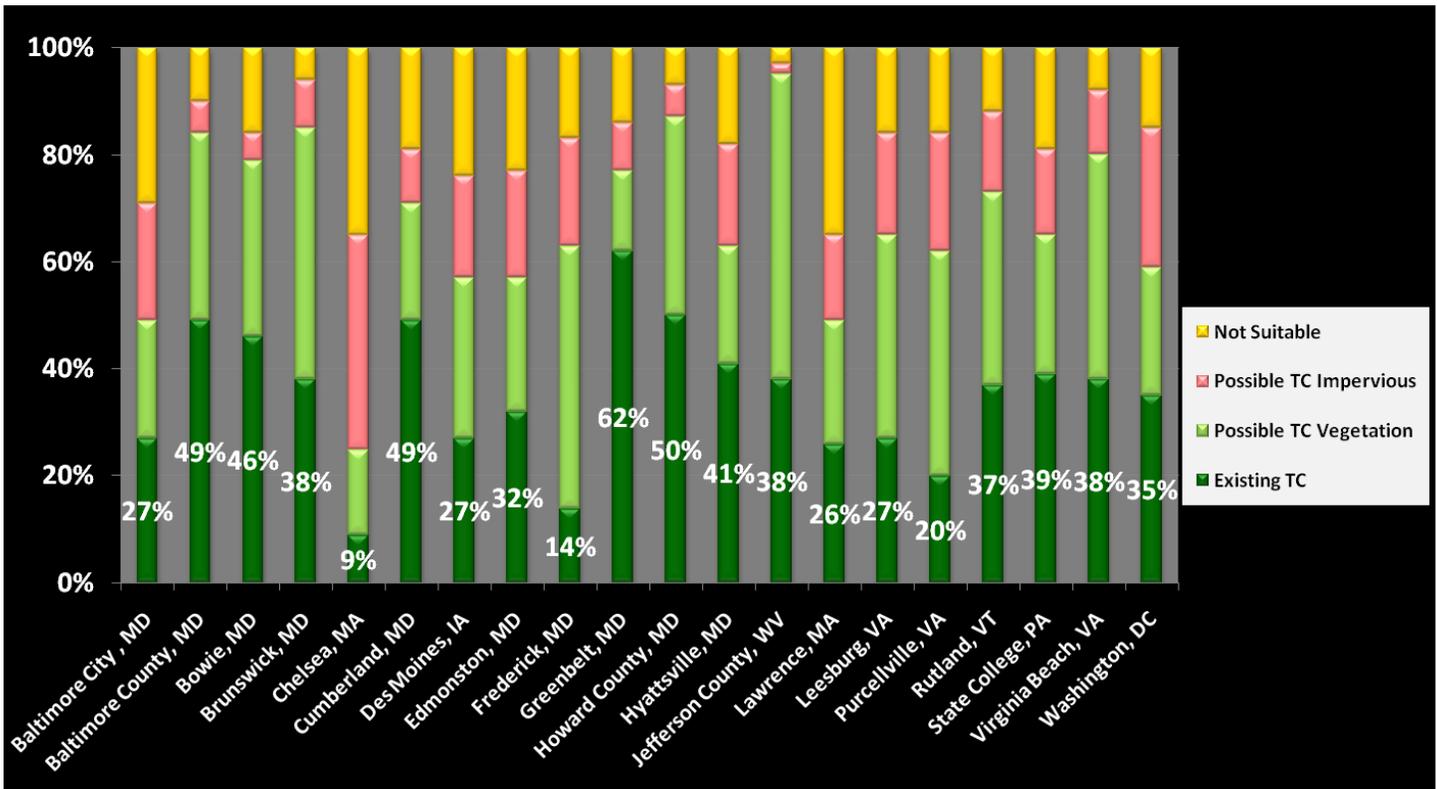


Figure 16: Comparison of TC Metrics with other selected counties and cities that have completed TC assessments.

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### Additional Information

Funding for the project was provided by the Jefferson County Commission. More information on the tree canopy assessment can be found at the following web site:

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



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