TREES & INCOME

WASHINGTON D.C. TREE CANOPY CHANGES FROM 2006-2011 AND WHICH NEIGHBORHOODS EXPERIENCED THEM

Leadership in city governments increasingly recognizes the well-known benefits of trees, and numerous cities throughout the United States[1] have established tree canopy goals or tree planting programs [1-3]. Washington, D.C. has committed to increasing tree canopy to 40 percent of its land area [4] to aid in stormwater mitigation, reduction of the heat island effect, and more.

THIS REPORT ADDRESSES THREE QUESTIONS

- HOW IS TREE CANOPY DISTRIBUTED ACROSS THE DISTRICT?
- WHERE ARE CHANGES IN CANOPY FROM 2006 TO 2011 GEOGRAPHICALLY DISTRIBUTED?
- WHO LIVES NEAR THE CHANGES OCCURRING IN D.C.'S URBAN FOREST?

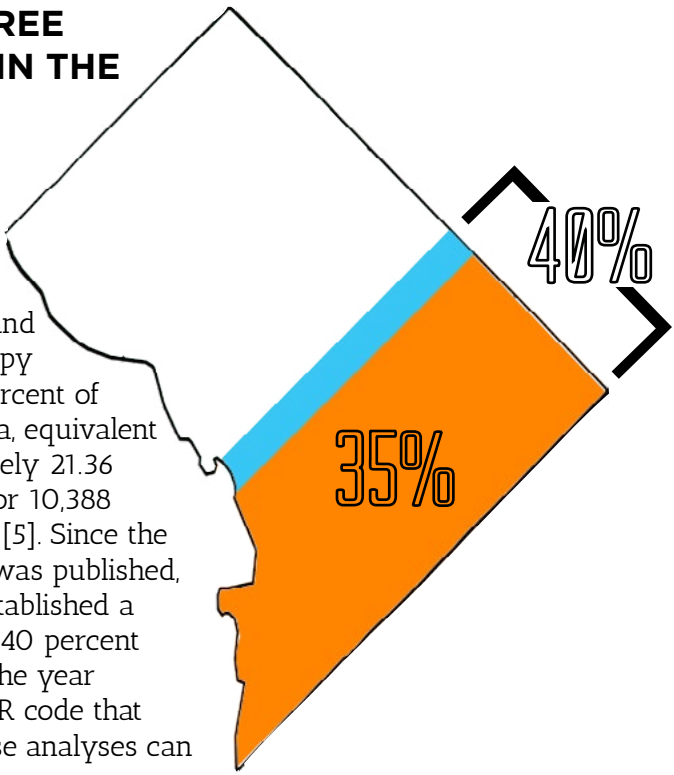
[1] Alliance for Community Trees, 2012. Benefits of Trees and Urban Forests - Alliance for Community Trees. Retrieved June 17, 2013. **[2]** MillionTrees NYC, 2011. Urban Forestry Bibliography Created by the ... - MillionTreesNYC. Retrieved June 17th, 2013, **[3]** Young, R. F., & McPherson, E. G. (2013). Governing metropolitan green infrastructure in the United States. Landscape and Urban Planning, 109(1), 67–75. doi:10.1016/j.landurbplan.2012.09.004 **[4]** District of Columbia Urban Tree Plan, 2013. District of Columbia Urban Tree Plan. Retrieved July 6th, 2013.

URBAN TREE CANOPY ASSESSMENTS

Until recently, accurate, detailed maps of tree canopy remained inaccessable for urban forest managers and other key decision makers. However, many cities and counties now have access to essential tree canopy metrics thanks to Urban Tree Canopy (UTC) Assessments, created by several organizations nationwide. The USDA Forest Service in collaboration with the University of Vermont Spatial Analysis Laboratory has produced nearly 70 **assessments**. UTC Assessments answer both "How much tree canopy do we have?" and "How much tree canopy could we have?" Such baseline data has frequently been employed in tree canopy goal-setting and planning, as was the case for D.C..

URBAN TREE CANOPY IN THE DISTRICT

A UTC assessment based on 2006 conditions found that tree canopy covered 35 percent of D.C.'s land area, equivalent to approximately 21.36 square miles or 10,388 football fields [5]. Since the initial report was published, the District established a goal to reach 40 percent coverage by the year 2035 [4]. The R code that replicates these analyses can be found **here**.



[5] O'Neil-Dunne, J.P.M., 2009. **A Report on Washington, D.C.'s Existing and Possible Tree Canopy**. The Spatial Analysis Lab at the University of Vermont's Rubenstein School of the Environment and Natural Resources. (p.4).

HOW ARE TREE CANOPY AND CANOPY CHANGE DISTRIBUTED ACROSS WASHINGTON D.C.?

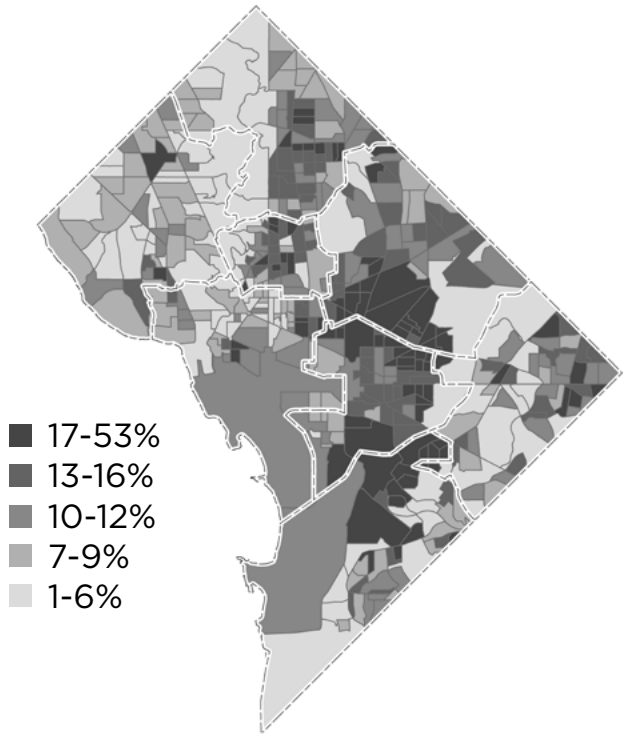
This report serves to improve the understanding of how tree canopy and canopy change from 2006 to 2011 were distributed across the District, and how that change was distributed relative to median household income. Income is chosen as a general social indicator, though we recognize there are others. But we are interested in, broadly, which communities may have experienced the changes in tree canopy. Answers to these questions may have important implications for social equity and other policy issues.

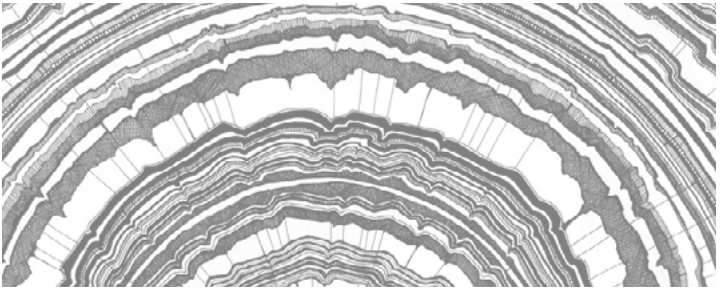
The analyses were carried out by integrating 2010 U.S. Census block groups with a new detailed, high-accuracy, and publicly available tree canopy change **dataset**. Block groups are mapped to have roughly the same number of people and households for comparison purposes, and may approximate sub-neighborhood areas. The tree canopy data includes three classes: Persistence, Loss and Gain. Persistence indicates that tree canopy did not change from 2006 to 2011, while Loss indicates that canopy was removed. Gain indicates that new tree canopy was established during the five-year period. A Net Change category was calculated by taking the difference in canopy from 2011 to 2006 divided by the canopy present in 2006, so that negative values indicate net loss, and positive values indicate net gain.

Block groups were ranked by median household income and placed into five equal-sized groups. After summarizing the Persistence, Loss, Gain, and Net Change, we found that higher income areas tended to have more canopy than lower income areas. Lower income areas also tended to lose more canopy, despite the fact these areas had less canopy to begin with. Gains were modest throughout.

Block groups in the District had canopy in 2006 that ranged from 5 percent to 89 percent of the land area, and each block group experienced canopy loss. The percentage of total canopy per block group lost between 2006 and 2011 ranged from 0.65 percent to 52.90 percent. Not all block groups experienced gains in canopy cover, however. Fourteen of the 450 block groups showed no gain at all, the highest gain in a block group was 18.45%. The Net Change figures were even more striking. Nearly all block groups experienced a net loss, and when gains did occur, they were generally small. The largest block group net gain was just 8.62 percent. Thirty-six block groups lost between 20 and 30 percent of their entire canopy, a substantial portion of the urban forest.

LOSS IN CANOPY (% OF TOTAL)





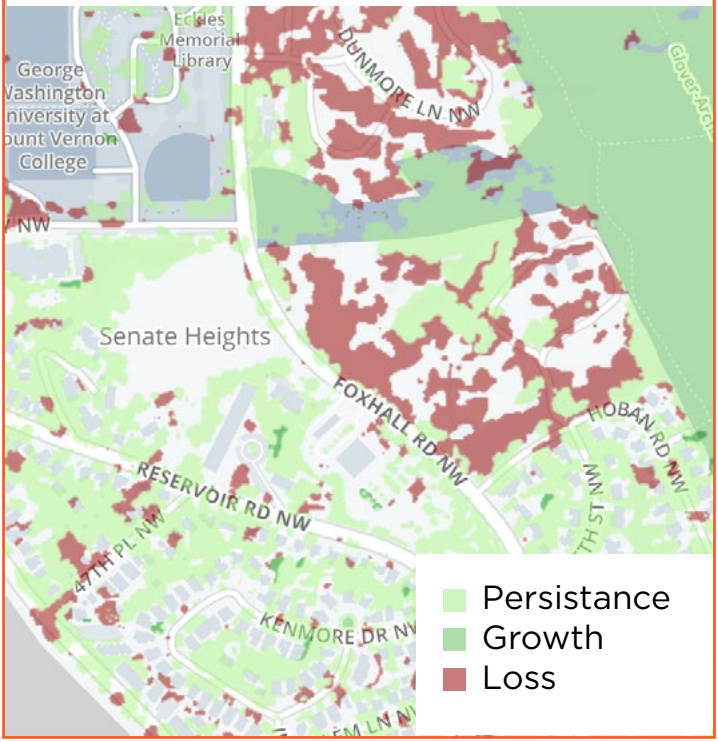
CHALLENGES AND OPPORTUNITIES

These findings have implications for the **agencies and organizations** engaged in tree maintenance, planting and removal. Because the precise causes of loss have not been determined, different types of losses and gains should be further analyzed to better understand their causes and consequences, which may inform future management practices.

It is important to note that losses in tree canopy measured from satellite and aerial imagery over relatively short time periods, as they were measured in this study, are easier to detect than gains, as newly planted trees may not be detectable due to the small size of their canopy.

The aggregate figures reported above highlight important trends at the city and block group level that reveal otherwise unknown tree-canopy change patterns, but management efforts including planting and preservation occur at the human scale. It remains unclear how much tree canopy was lost on permitted construction sites. Examining building permit records in conjunction with canopy loss at the parcel scale may elucidate one potential cause of decline. Are gains primarily comprised of existing canopy growth or the establishment of new trees from planting efforts? The answer to such a question may imply that a different mix of canopy maintenance, protection and planting programs would be more cost effective than current management strategies.

TREE CANOPY CHANGE 2006 - 2011



Finally, how do losses and gains vary across different ownership regimes? It is possible that the myriad of public and private landowners and managers in the District have different motivations, capacities and interests that influence tree canopy-related decisions. A better understanding of these trends will inform ongoing planting efforts and improved management practices, and **Casey Trees** is committed to understanding these issues in order to improve our urban forest outcomes.

Casey Trees
3030 12th Street NE, Washington, DC 20017
JESSICA R. SANDERS, PhD
jsanders@caseytrees.org

Graduate School of Geography, Clark University
950 Main Street, Worcester, MA 01610
DEXTER H. LOCKE
dexter.locke@gmail.com

University of Vermont, Spatial Analysis Laboratory
81 Carrigan Drive Burlington, VT 05405
JARLATH P. M. O'NEIL-DUNNE
jarlath.oneil-dunne@uvm.edu
SEAN W. MACFADEN
smacfade@uvm.edu
ANNA ROYAR
anna.royar@gmail.com

University of Minnesota, Department of Forest Resources
115 Green Hall, 1530 Cleveland Avenue N, St. Paul, MN 55108
KEITH C. PELLETIER
pelle155@umn.edu

USDA Forest Service, Northeastern Research Station
705 Spear St., P.O. Box 968, Burlington, VT 05402
RAY GOMEZ