

A Market Analysis of Opt-In Tree Planting and Rain Barrel Installation in Baltimore, MD, 2008—2012



This report is motivated by the overarching question “**Where were trees planted and rain barrels installed, as part of opt-in programs in relation to Baltimore’s priorities?**” In particular:

1. Who participated in planting and installation programs in terms of available space?
2. How did participation vary by TreeBaltimore priorities?
3. Where are there opportunities for tree planting in terms of available space and priorities?

Why Are Trees and Rain Barrels Important?

The Baltimore Sustainability Plan¹ established a goal to increase tree canopy cover from 27%² to 40% by the year 2037¹. [TreeBaltimore](#) is helping to grow the urban forest in partnership with other groups. Rain barrels reduce the volume of water flowing off of buildings and into storm drains. They reduce pollution and prevent erosion³. Blue Water Baltimore (BWB) has a number of environmental education and storm water management programs. These include three types of rain barrel installation programs.

How Do Tree and Rain Barrel Programs Work?

The data analyzed here represent a selection of programs where residents actively opted in and participated. Four types of tree planting programs were analyzed: **I) Street trees:** Baltimore City Recreation and Parks (BCRP) plants street trees. This report analyzes only those street trees planted by the BCRP staff in response to resident-placed requests, which does not include all street trees planted by BCRP or trees planted in other places such as parks.

Note too that other organizations plant street trees in Baltimore City. **II) Giveaway trees:** TreeBaltimore and BWB give trees to residents at farmers’ markets, school plantings, and other events to be planted on private property (Figure 1, left). This includes trees distributed by TreeBaltimore to partner organizations. **III) Volunteer plantings:** Trees planted by larger and highly professionalized organizations using volunteers. These groups include the Alliance for the Chesapeake Bay, Baltimore Orchard Project, Baltimore Tree Trust, BWB, Jones Falls Watershed Association, and the Parks & People Foundation. **IV) Neighborhood plantings:** Trees planted by local, smaller community organizations, business improvement districts and faith-based groups including Downtown Partnership, Druid Hill Community Development Group, Ellerslie Public Housing, Episcopal Community Church, Gary Letteron, Labyrinth Sacred Space, Midtown Community Benefits District, Morgan State Delta Sigma Theta Sorority, Mt Vernon Business Association, New Cathedral Cemetery, Reservoir Hill Improvement Council, The Samaritan Women’s Rain Garden, and Windsor Hills Elementary.

This report examines 3 types of rain barrel installation programs (Figure 1, right): **BWB’s auditor** visits a residence and determines site suitability with the resident and makes a recommendation whether to install a rain barrel. **BWB acts as wholesaler** of the rain barrel and associated equipment. Note that water audit and workshop participants can purchase the materials at a reduced cost. **BWB hosts educational workshops** either at their headquarters (walk ups welcome) or in different neighborhoods at the request of residents or community groups.

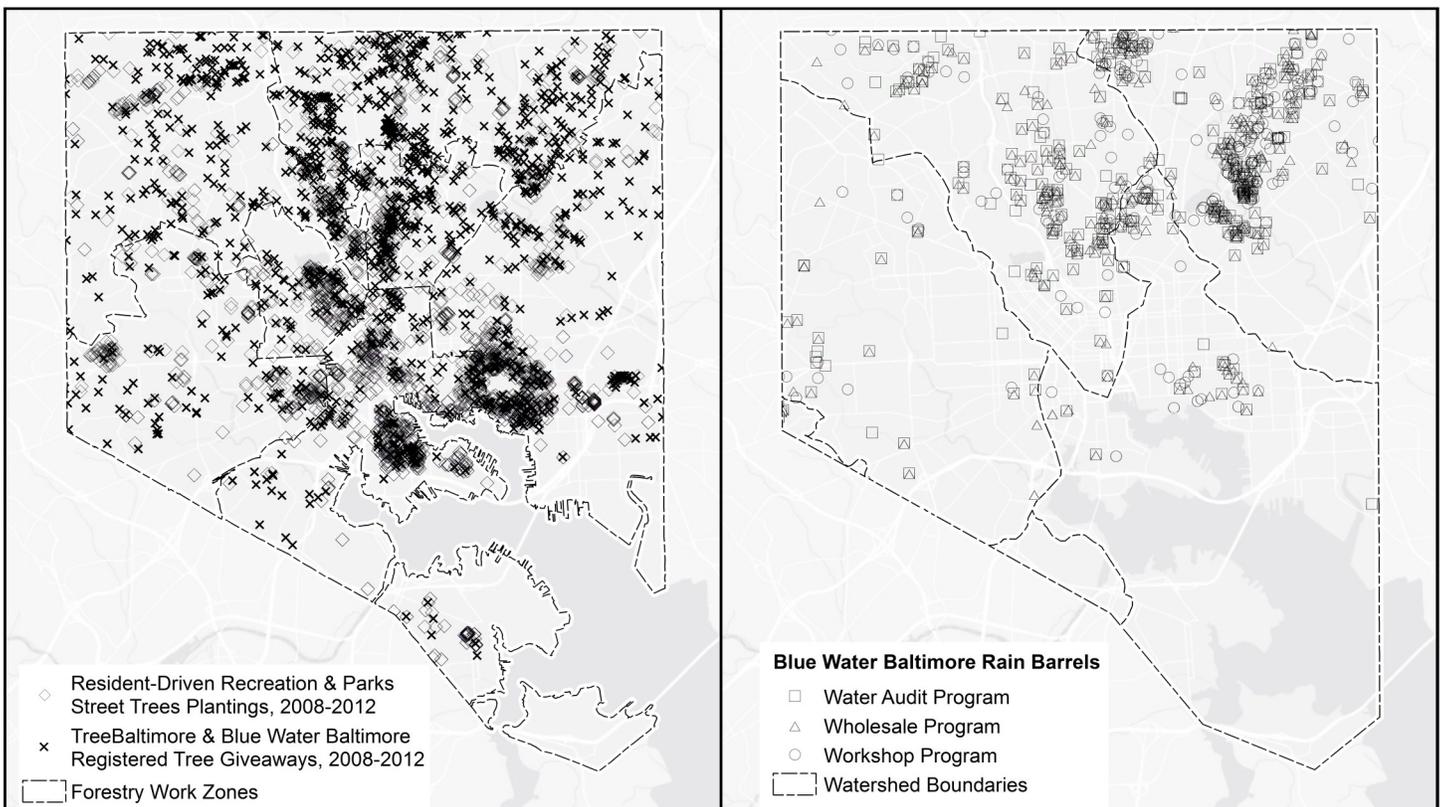


Figure 1. Resident-requested planted street trees and giveaway trees for residential properties (left), rain barrels installed via Blue Water Baltimore’s different programs (right). Data are from year 2008 to 2012. Trees and rain barrels beyond Baltimore City boundaries are not shown.

What are Geodemographic Analyses?

To answer the question “Who participated in planting and installation programs?” we used geodemographic market analyses. Geodemographic market analysis is the process of classifying neighborhoods into groups based on a combination of demographic, socioeconomic and lifestyle characteristics. These market groups do not correspond neatly to a single characteristic such as race/ethnicity, or the age distribution within a neighborhood. Instead, each market group describes a range of useful traits among people clustered in similar geographical locations, such as consumer behaviors and preferences and lifestyles. This analysis uses Environmental Systems Research Institute’s (ESRI) Tapestry Segmentation system, which includes 65 market segments that are consolidated into 12 Tapestry Groups to provide profiles at the US census block level⁴. Figure 2 shows how these categories are distributed across the city geographically (left), and quantitatively, (right).

Who Are the Tapestry Groups in Baltimore?

The tree and rain barrel programs strive to work throughout Baltimore City (Figure 1, previous page). Baltimore City is comprised of 11 Tapestry Groups. The three most common Tapestry Groups are Metropolis (comprising 42% of all households), Solo Acts (15%), and Traditional Living (13%; Figure 2). Together these three Tapestry Groups contain 70% of all households living in Baltimore City. Below, some of the dominant and defining characteristics of each of these three Tapestry Groups are highlighted from ESRI’s Tapestry classification system.

More information on all Tapestry Groups can be found in the Reference Guide: <http://www.esri.com/library/brochures/pdfs/tapestry-segmentation.pdf>

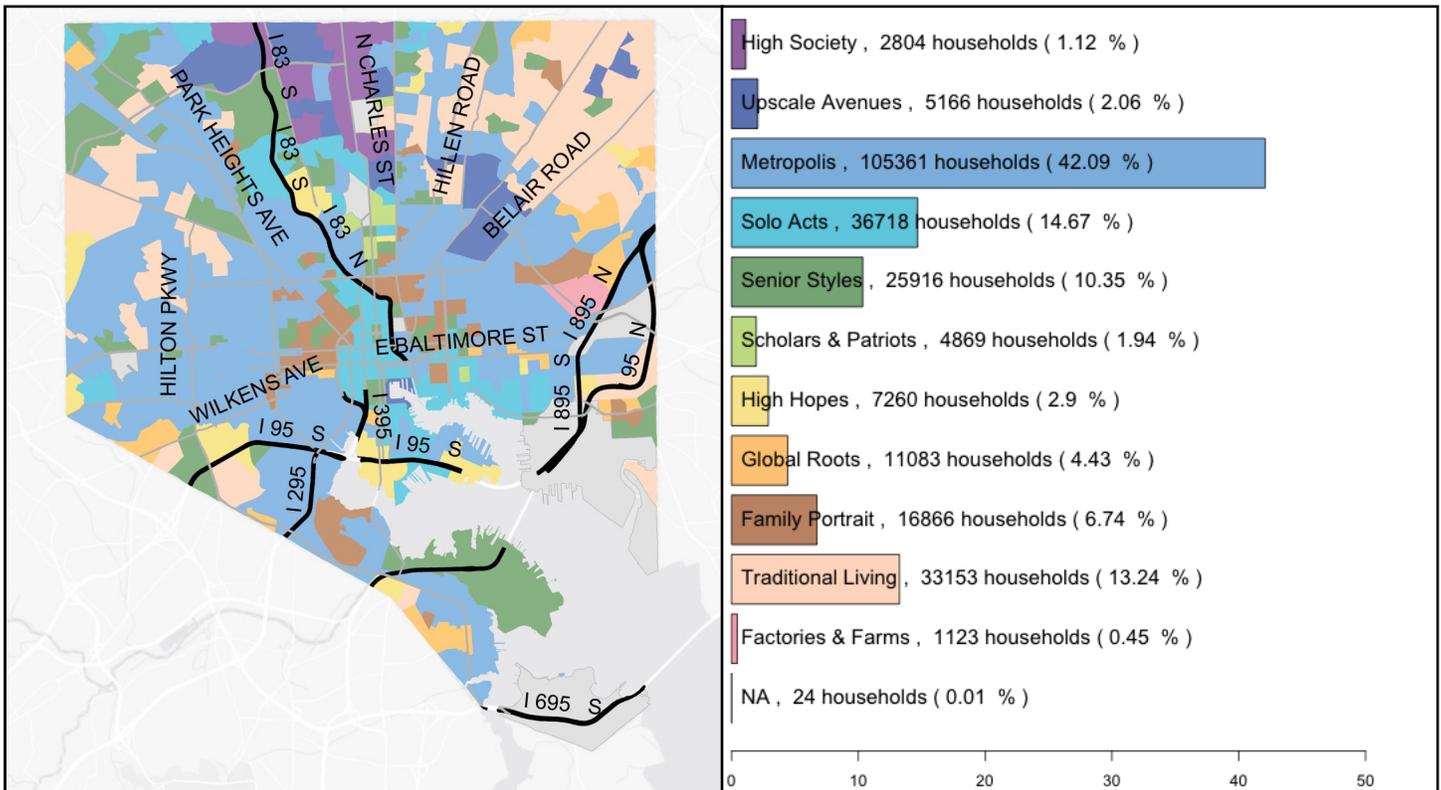


Figure 2. ESRI’s geodemographic market segments called Tapestry Groups have a geographic (left) and quantitative (right) distribution.

As the ESRI Tapestry Reference Guide explains:

Metropolis: They live in older, single-family homes or row houses built in the 1940s or earlier. Workers in most of the *Metropolis* segments commute to service-related jobs. The *Metropolis* group reflects the segments’ diversity in housing, age, and income. For example, ages among the segments range from Generation Xers to retirees; households include married couples with children and single parents with children. Employment status also varies from well-educated professionals to unemployed. Their lifestyle is also uniquely urban and media oriented.

Solo Acts: residents are singles who prefer city life. Many are young, just starting out in more densely populated US neighborhoods; others are well-established singles who have no home ownership or child-rearing responsibilities. Residents of this group tend to be well-educated, working professionals who are either attending college or already hold a degree. Their incomes reflect their employment experience, ranging from a low median of \$44,601 among the newest households to approximately \$93,899 among established singles.

Home ownership is at 28 percent. Contrary to modern migration patterns that flow away from the largest cities, *Solo Acts’* residents are moving into major cities. With considerable discretionary income and few commitments, their lifestyle is urban, including the best of city life—dining out, attending plays and concerts, and visiting museums—and, for a break from constant connectivity, extensive travel domestically and abroad.

Traditional Living: The households in *Traditional Living* convey the perception of real middle America—hardworking, settled families. The group’s higher median age of 38.2 years also conveys their lifestage—a number of older residents who are completing their child-rearing responsibilities and anticipating retirement. Many still work hard to earn a modest living. They typically own single-family homes in established, slow-growing neighborhoods. They buy standard, four-door American cars, belong to veterans’ clubs and fraternal organizations, take care of their homes and gardens, and rely on traditional media such as newspapers for their news.

Key Terms

Geodemographic market segmentation: the process of classifying neighborhoods into categories based on a combination of demographic, socioeconomic and lifestyle characteristics. Tapestry Groups are an example of a market segment.

Tree Canopy (TC): Tree canopy is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

Existing TC: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.

Possible TC: Asphalt or concrete surfaces, excluding roads and buildings, and grass or shrub areas which are theoretically available for the establishment of tree canopy.

Not Suitable: Areas where it is highly unlikely that new tree canopy could be established (primarily buildings and roads).

Odds ratio: A measure of association where 1 indicates that participation is proportional to the number of households in that Tapestry Group. A value of 2 would indicate that twice as many trees were registered than if giveaways were equitably distributed by Tapestry Group. See Figure 4 (over).

Tree Canopy: PROW and Residential Lands

To answer the question “How did participation vary by available space and priorities?” we report results for both street trees in the public right of way (PROW) and for private residential lands. Within the PROW, the amount of existing and possible tree canopy and areas not suitable for planting were calculated within each Tapestry Group (Figure 3). For existing PROW, High Society block groups have the most tree canopy (54%), while Family Portrait has the least tree canopy (12%). For possible PROW, High Society block groups have the least area (14%), while Factories & Farms have the most area (34%). These analyses were repeated for residential properties too. Residential properties include apartments, condominiums, row homes, single-family and two-family homes. Existing tree canopy on residential properties was highest among High Society block groups (65%) and lowest in Scholars & Patriots areas (18%). The Tapestry Groups with the greatest opportunities for additional canopy were Factories & Farms and Traditional Living. Each had 46% possible tree canopy. High Society block groups had the least room for additional possible tree canopy on residential lands (26%). There were ample opportunities for additional tree canopy on residential properties and in the PROW in every Tapestry Group (Figure 3A & C).

Tree Canopy in the Public Right of Way and on Residential Parcels in Baltimore, MD by Tapestry Group

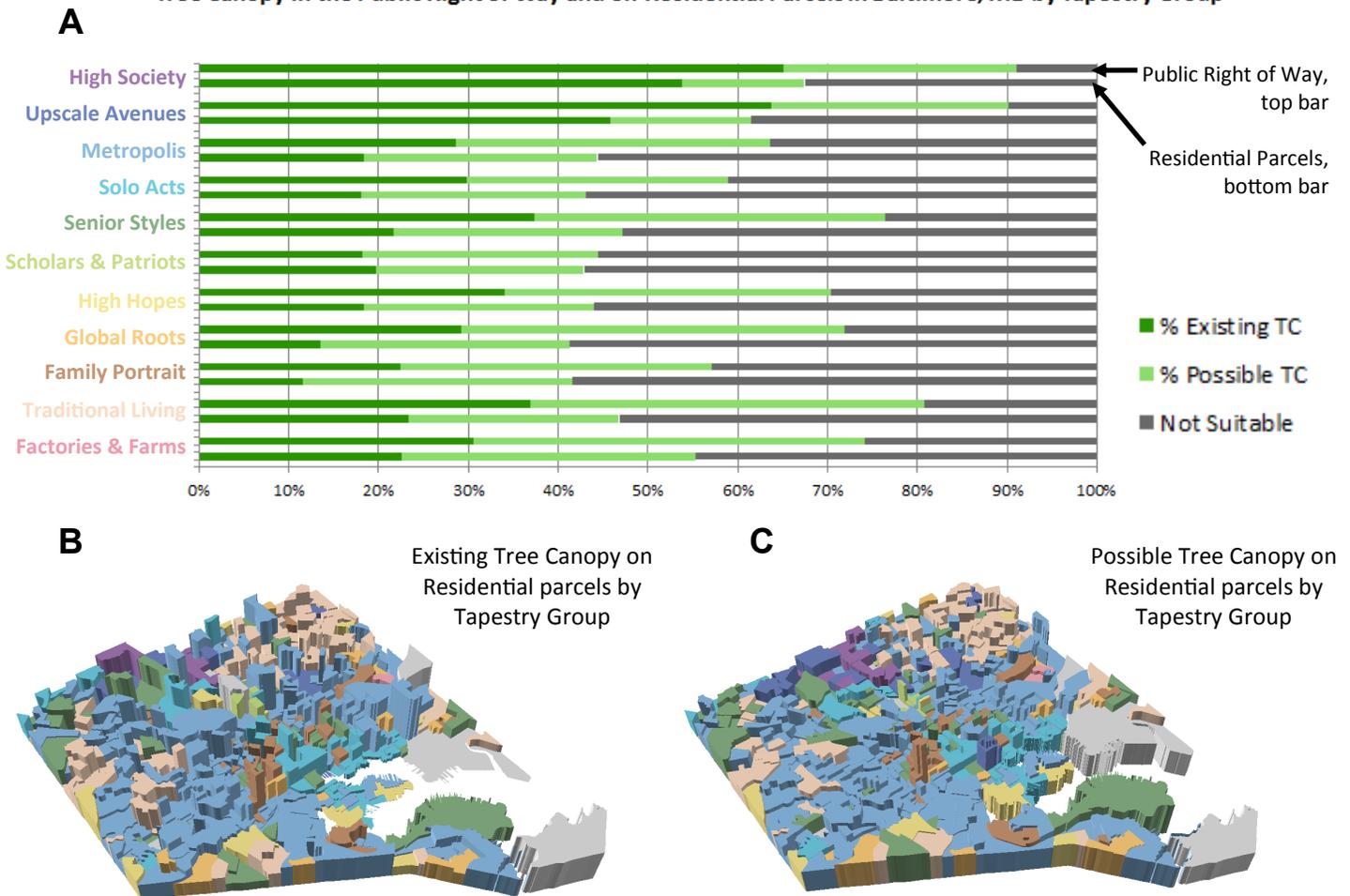


Figure 3. Existing and possible tree canopy in the PROW and on residential parcels, per Tapestry Group (A), existing tree canopy (B) and possible tree canopy (C) on residential parcels only by Tapestry Group. Colors correspond to the Tapestry Groups. The height of each block group indicates the existing (B) or possible tree canopy (C). Canopy calculations were made possible with the combination of Baltimore City’s parcel database, and the 3-foot [freely available land cover data](#) created by the [Spatial Analysis Lab](#) at the University of Vermont.

Measuring Participation Rates with Spatial Analyses and Tapestry

Addresses representing the four types of tree programs, and three rain barrel programs described on page 1 were converted to points using a geographic information system (GIS), or computer mapping software (Figure 1). These analyses assume that the tree was planted or the rain barrel was installed at that location, but the actual location is unknown. These points were analyzed within each market segment as defined by ESRI's Tapestry Groups (Figures 2, 3B & C) by calculating odds ratios. Figure 4 describes how odds ratios were calculated with points representing the assumed planting location of trees and installation sites of rain barrels within Tapestry Groups, using the fictitious example of "Phake City"⁵. Actual odds ratios for all trees and rain barrels are shown in Figure 5.

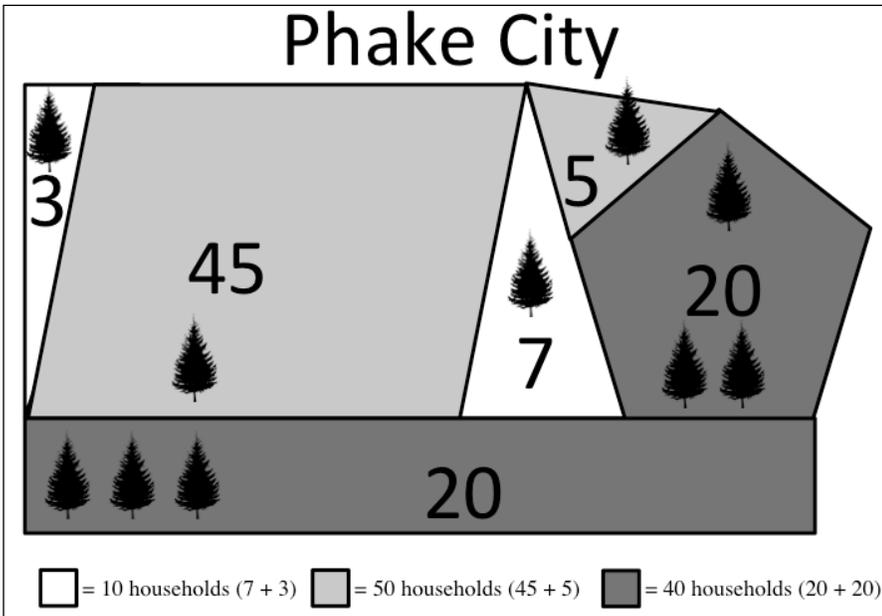


Figure 4. An odds ratio (OR) is a measure of association where a value of one indicates an equal proportion effect in a single Tapestry Group. Odds ratios greater than one indicate higher odds of occurrence, and a value less than one means there is a lower odds. Phake City⁵ has 3 types of market segments, the number of households are shown in each market. There are 100 households in total. The hypothetical urban forestry program gave out 10 trees last year, reaching 10% of all households. If each type of market segment were reached equally (ie. proportionally to the number of households in that Tapestry Group), then the white segment would have 1 tree, the gray would have 5 trees, and the remaining 4 would be in the darkest gray. But that is not the case. Instead households in the white market segment received 2 (twice as many, OR = 2), the gray received 2 trees (40% of expected, OR = .4), and 6 trees went to the households in the darkest gray segment (50% above expected, OR = 1.5).

Odds Ratios (OR) & 95% Confidence Intervals for Tree & Rain Barrel Programs, by Tapestry Group

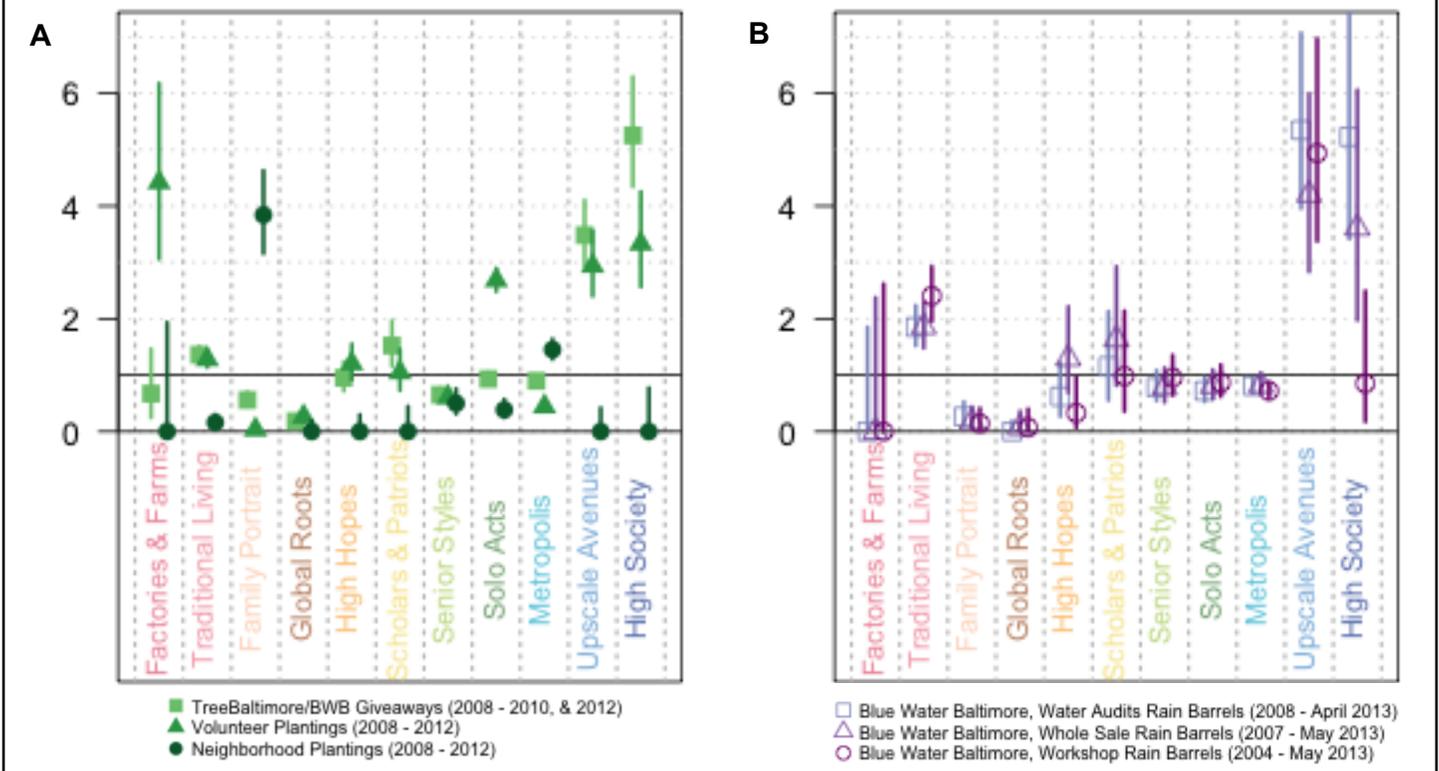
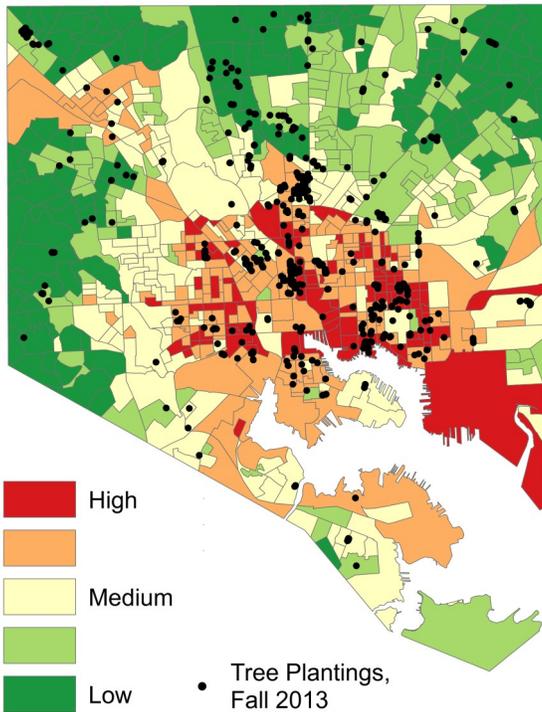


Figure 5: Participation in tree (A) and rain barrel (B) programs varies by Tapestry Group. Tree giveaways were most popular in the High Society areas (OR = 5.25), volunteer plantings were most popular in Farms & Factories neighborhoods (OR = 4.42), and neighborhood plantings were most popular in Family Portrait areas (OR = 3.84). BWB's water audits were most popular in Upscale Avenue & High Society neighborhoods (OR = 5.34 & 5.22), wholesales and workshop rain barrels were most popular in Upscale Avenues neighborhoods (OR = 4.20 & 5.93).

Urban Tree Canopy Prioritization

An urban tree canopy prioritization map was created for Baltimore based upon a stakeholder engagement process lead by TreeBaltimore and its partners in collaboration with the USDA Forest Service in 2012 (see Figure 6 and reference #5 for more details). Examples of priorities include stormwater and air quality mitigation, and environmental equity.

A Summary UTC Prioritization Map



B

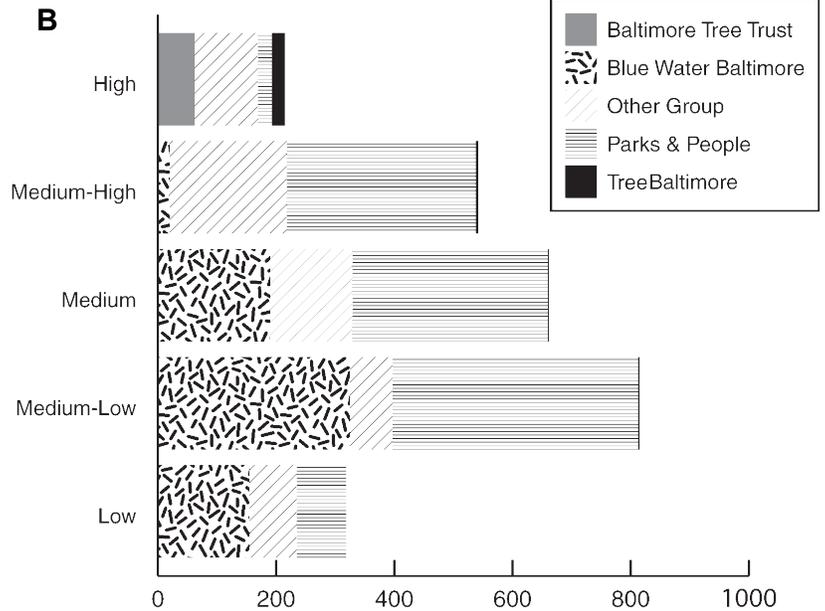


Figure 6: Trees planted in the Fall of 2013 are mapped along with UTC priorities (A) and the organizations that planted the trees (B). Some organizations work across priority areas like Parks & People Foundation, while other groups work predominantly in High priority areas like the Baltimore Tree Trust and TreeBaltimore.

How Does Possible Tree Canopy Relate to Market Segments and Planting Priorities?

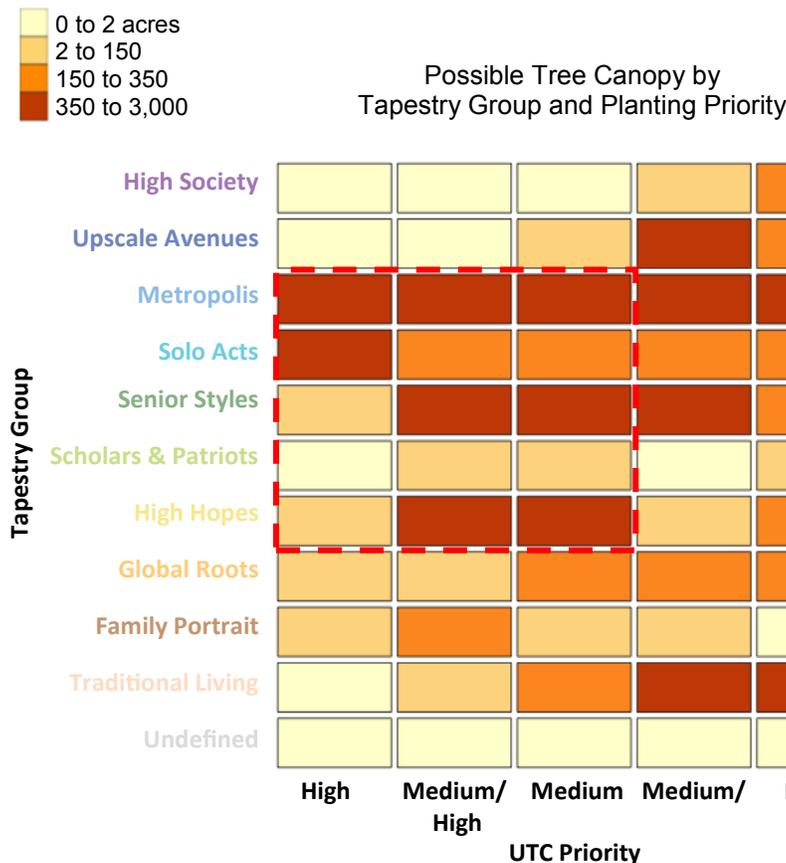


Figure 7 (left) shows how possible tree canopy relates to market segments and planting priorities.

This table can be used in several ways to create market strategies based upon combining UTC Assessments (available land), UTC Prioritizations (priority areas) and UTC Market Analyses (participation rates among Tapestry Groups). The following are some illustrations:

1) Current programs are most successful with High Society and Upscale Avenues (Figure 5A), but there is very little additional space in High priority areas within those Tapestry Groups (Figure 3A & C). Current programs might continue in these two Tapestry Groups, but only in those neighborhoods that are a high priority.

2) Hit the 'sweet spot' within the dotted red line where participation rates are currently very low but extensive areas are available in High to Medium priority areas. New marketing strategies may be needed to increase participation for these Tapestry Groups to achieve the City's Urban Tree Canopy Goal with trees in the highest priority areas.

3) Developing new marketing strategies for areas with low participation rates may not be useful because some of these High priority areas have little available land for tree planting, such as Traditional Living and Family Portrait areas (Figure 3A & C).

Other combinations and strategies are possible.

Findings

Question 1: Who participated in planting and installation programs in terms of available space?

- Tree giveaways were most popular in the High Society and Upscale Avenues neighborhoods. These are the two most affluent market segments and collectively comprise about 3% of Baltimore City's households. Tree planting program participation covaried with the existing tree canopy in a potentially counterintuitive manner—the more canopied neighborhoods, which have less available planting space (Figure 3A), also tended to have the greatest participation in tree planting programs (Figure 5A).
- Volunteer plantings were most popular in Farms & Factories neighborhoods, the least affluent market segment, which makes up less than half a percent of households (Figure 5A).
- Neighborhood plantings were most popular in Family Portrait neighborhoods, but were generally low overall (Figure 5B).
- BWB's water audits were most popular in Upscale Avenue & High Society neighborhoods.
- Wholesale and workshop rain barrels were dominated by households in the Upscale Avenues, High Society, and Traditional Living market segments. Notable exceptions include unpopular workshop programs in the High Society areas, and higher than expected participation in the wholesale program by Scholars & Patriots households (Figure 5B).

Question 2: How did participation vary by the City's priorities (Figure 6A & B)?

- TreeBaltimore and the Baltimore Tree Trust planted only in High priority areas in the fall of 2013.
- Parks and People Foundation planted across all priority areas.
- Blue Water Baltimore planted in all priority areas except for High priority areas.

Question 3: Where are there opportunities for tree planting in terms of available space and priorities?

- There is ample opportunity for additional tree planting in every market segment (Figure 3A & C). This is especially true for the street trees in the Farms and Factories and Family Portrait market segments where more than 30% of the PROW is possible tree canopy. On private residential lands, the greatest opportunities by area can be found in the High Hopes, Senior Styles, Global Roots, Factories and Farms, and Traditional Living market segments where more than 35% of land area is possible tree canopy.
- A plurality of Baltimore City's households are classified as Metropolis (42%) and they are a media-oriented segment. Since the TreeBaltimore outreach campaign has used more digital media since 2012, follow up analyses could examine the increase of programs specifically in this market segment because participation was previously low (Figure 5). There are extensive areas of available land to plant in Metropolis neighborhoods (Figures 3A & C, 7).
- While more resources may be needed overall to reach the tree canopy goals² to achieve the environmental and social benefits of trees, there may be alternative, more cost-effective ways of reaching these different social groups in different priority areas through more effective marketing (Figure 7, Suggestion #2).

Suggestions

1. The Green Pattern Registry can be used for further tracking and analyses. New capabilities are being added to the Green Pattern Registry to track tree plants by location, and by organization or household. The Green Pattern Registry is hosted by the Baltimore Neighborhood Indicators Alliance (water.bnijafi.org/map/). Green Pattern Registry supports the Growing Green Initiative and [City of Baltimore's Green Pattern Book](#), a guide to help convert vacant lots into multi-functional, sustainable, and resilient landscapes.
2. Adoption rates were highest in areas that already had the highest rates of canopy cover and were the most affluent. The 'sweet spot' areas containing the most available land for tree planting in the highest priority areas had low rates of participation. Tree programs may consider which messages, delivered with which messenger, will be most successful in these market segments? For instance, it may be possible that outreach could be more effective when a locally appropriate type or combination of messages—content or the "what"—and messengers—means of message delivery or the "how"—are matched to the needs and perceptions of people in different market segments.
3. Finally, in addition to the programs examined here, there are several other urban forestry programs and projects carried out by TreeBaltimore and their partners. Each of these efforts helps reach the 40% tree canopy. For example, the Parks & People Foundation and Blue Water Baltimore plant trees on schoolyards because of their ample space, the availability of student volunteers, and relatively low costs.

References

1. [Baltimore Sustainability Plan \(2009\)](#).
2. [O'Neil-Dunne, J.P.M \(2009\). A report on the City of Baltimore's Existing and Possible Tree Canopy.](#)
3. [Blue Water Baltimore \(2015\)](#).
4. [ESRI \(2010\) Tapestry Segmentation Reference Guide - Esri.](#)
5. Adapted from [Locke, D.H. \(2014\): Phake City. figshare.](#)
6. [Locke, D. H., Grove, J., Galvin, M. F., O'Neil-Dunne, J. P. M., & Murphy, C. \(2013\). Applications of Urban Tree Canopy Assessment and Prioritization Tools: Supporting Collaborative Decision Making to Achieve Urban Sustainability Goals. *Cities and the Environment \(CATE\)*, 6\(1\).](#)
6. Note that most of this report is adapted from [Locke, D.H., & Grove, J.M. \(2014\). Doing the Hard Work Where it's Easiest? Examining the Relationships Between Urban Greening Programs and Social and Ecological Characteristics. *Applied Spatial Analysis and Policy*. doi:10.1007/s12061-014-9131-1](#)

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