

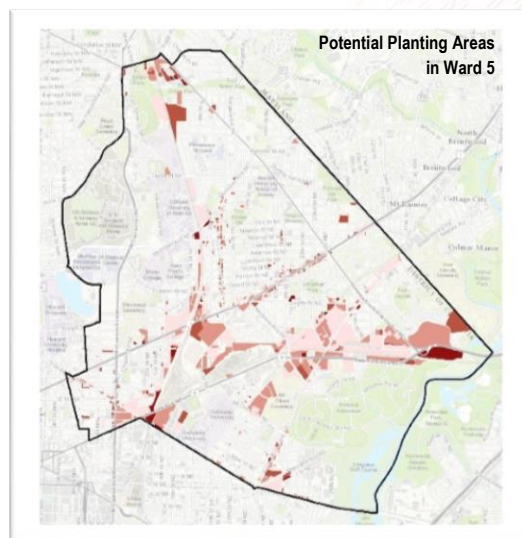
# A Demonstration Project for Community-Level Urban Forest Assessment, Management, and Engagement in the District of Columbia



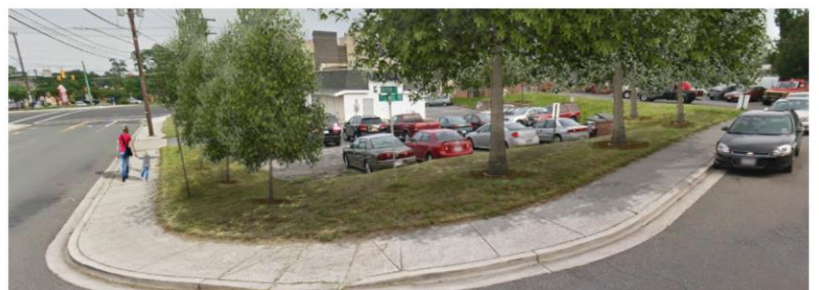
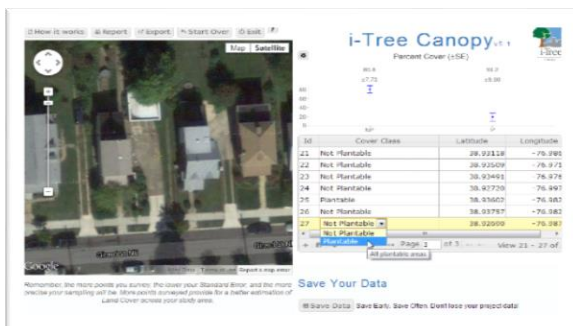
**Report #1:**  
Community Forestry Resource  
Management Handbook

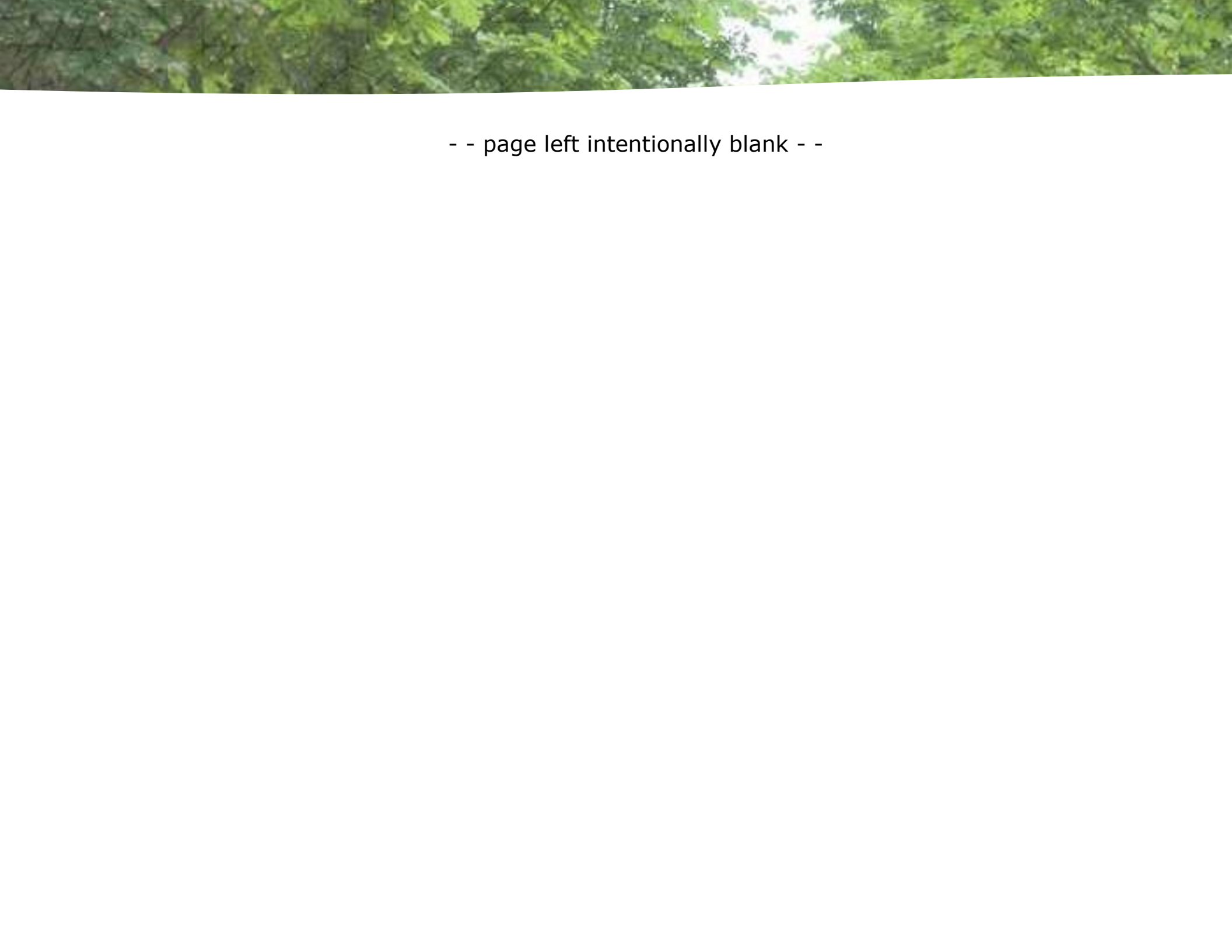
**Report #2:**  
Assessment & Engagement  
Demonstration in Ward 5

**Report #3:**  
Best Practices Guide to Aerial Imagery  
Interpretation of Land Cover



**Created By:** Plan-It Geo  
**Prepared For:** MWCOG  
**Completed:** Dec. 2016





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# A DEMONSTRATION PROJECT FOR COMMUNITY-LEVEL URBAN FOREST ASSESSMENT, MANAGEMENT, AND ENGAGEMENT IN THE DISTRICT OF COLUMBIA

## Prepared for:

The Metropolitan Washington Council of Governments and The District of Columbia – Department of Transportation – Urban Forestry Administration

## As a part of the project:

“Maximizing i-Tree Canopy: A Demonstration and Assessment Tool for Community-Level Engagement and Urban Forest Management”



## Prepared by:

Plan-It Geo LLC, Arvada, Colorado



## Acknowledgements:

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**USFS:** Julie Mawhorter

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## Project Overview

This project demonstrates a new protocol and framework for the District of Columbia's Urban Forestry Administration (UFA) to engage with community groups on private property. The importance of trees in neighborhoods, parks, natural areas, and business districts cannot be overstated. Tree canopy provides our communities with a myriad of social, economic, and environmental services.

UFA manages 150,000 trees along public rights-of-way and has planted up to 10,000 trees per year in priority areas recently. With limited space remaining along streets, UFA is employing creative approaches to community engagement on private property where the majority of planting potential is to reach and sustain the District's urban tree canopy (UTC) goal of 40%. The protocol builds upon traditional tree canopy assessments by providing a process to further analyze and understand the District's urban forest opportunities.

Partners include the Metropolitan Washington Council of Governments (MWCOC), UFA, Casey Trees, Plan-It Geo, and the USDA Forest Service, Urban & Community Forestry Program.

### Goals

- Expand outreach components connecting UFA with community groups and volunteers to influence canopy goals on private property
- Increase citizen knowledge of their community forest using existing tools employed in new ways
- Inform and verify potential planting areas in neighborhoods and sample sites
- Continue to develop strategies to reach the District's 40% tree canopy goal

### The Assessment and Engagement Protocol

The protocol uses both "top down" and "bottom up" techniques as approaches for creative conversation starters to support the District's tree canopy. *Top down* assessment uses maps and aerial imagery to evaluate existing trees, changes in canopy over time, and locations for new trees. *Bottom up* approaches include stakeholder workshops and on-the-ground site visits to potential planting areas. As described below, when used together these techniques provide an opportunity to visually and verbally engage residents and businesses, explain who you are and what you do, learn about their challenges and community goals, and connect groups with resources and tools to enhance the District's tree canopy.

**At the core**, this demonstration project and protocol involve evaluating sample sites using maps and field visits to start a conversation and ask questions such as:

- *Where do we have existing canopy?*
- *Why have we lost or gained canopy?*
- *Why isn't there a tree in an open space already?*
- *How suitable is a given site for tree planting?*
- *What are the impedances to planting trees and establishing tree canopy?*
- *How can we apply this as an engagement tool through a simple protocol?*
- *Will it produce the canopy goals and community benefits we seek?*





## Objectives of the Demonstration Project and Resulting Components of the Protocol

- 1) Develop a creative, flexible framework for UFA and community groups to increase their knowledge and understanding of where, why, and how tree canopy can be enhanced, focused on DC's Ward 5 (demonstration area).
- 2) Use an online map tool called i-Tree Canopy to assess types of trees, changes in tree canopy, and potential planting sites to begin a conversation about their local resource. This is optional but can set the stage for the next components of the protocol.
- 3) Perform site visits in the field with target groups to verify sample sites and better understand planting opportunities and impedances.
- 4) Host a workshop to give input on the process and conduct a SWOT Analysis (Strengths-Weaknesses-Opportunities-Threats), led by UFA or by a community group, to better understand perspectives, develop partnerships, and connect and coordinate resources at UFA and Casey Trees with areas in need.
- 5) Identify strategies and applications for management, policy, and outreach that preserve and expand the District's canopy on private property.

### Products of the Demonstration Project

Local knowledge and insights can be obtained from community activists to foster relationships with planners or resource professionals through this process. The following three reports present the protocol, lessons learned, and innovative outreach and engagement activities underway in the District of Columbia. The framework that was developed by this demonstration project can be applied or repurposed by any organization. A brief introduction to each report is found on the next page.

#### 1. Community Forestry Resources Management Handbook

#### 2. Assessment and Engagement Demonstration in D.C.'s Ward 5

#### 3. Best Practices Guide to Aerial Imagery Interpretation of Land Cover

**i-Tree Canopy**, part of the free, online suite of i-Tree tools, is used by planners or resource managers to **quantitatively** assess the % of tree canopy, open space, or impervious surfaces in random sample sites for a study area. This demonstration project asked: "Can it be used with community groups more **qualitatively** to assess on-the-ground opportunities, challenges, threats, and planting suitability to engage private property land owners and develop strategies to plant and preserve more trees?" What evolved over the three-year project period is a framework for engagement of which i-Tree Canopy is one small part.

<http://www.itreetools.org/>



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## Report #1: Community Forestry Resource Management Handbook

The handbook outlines the protocol and numerous resources to implement it. Five broad categories of “tools” are introduced to summarize what is available in the District and to support a flexible outreach and engagement framework. They are: Existing Data Sources, Online Maps and Apps, Field-based Planting Suitability, a Modified SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats), and Existing Programs & Policies. Examples of each are then presented across four target groups: Individuals and Community Groups, Businesses, Schools and Campuses, and Local or Regional Governments.

Each target group is a stakeholder and potential partner who come with their own unique challenges and opportunities; one standard approach cannot be recommended for use by UFA across the District. The handbook offers a framework to start a dialogue, foster relationships, form public/private partnerships, and engage the community using selected tools and resources to increase tree canopy on private land.

Other resources and components of the handbook include:

- A timeline of urban forestry studies and plans in the District
- Summary of assessment results in the Ward 5 demonstration area
- Overall **oUTC**omes, lessons learned, and implementation strategies
- Links and resources including a questionnaire and sample SWOT questions



## Report #2: Assessment & Engagement Demonstration in Ward 5

A more technical document, the assessment demonstration report is intended for resource managers, planners, foresters, or community leaders. It compiles the terms, methods, and results of this “place-based assessment” engagement protocol and includes:

- i-Tree Canopy methods and classifications for creatively evaluating existing tree canopy, changes in tree canopy, and the suitability of potential planting areas using online aerial imagery
- A modified SWOT Analysis that is blended with a Model of Urban Forest Sustainability (Clark, 1997) and results from a June 2014 workshop with 18 staff from UFA, hosted at MWCOG
- Field verification results for a subset of the i-Tree Canopy sample sites in Ward 5 led by MWCOG and UFA
- Results from field visits with UFA, Casey Trees, and volunteers using a questionnaire and SWOT analysis based in and around Catholic University and associated Metro stop
- Appendix with additional results and resources such as the field-based questionnaire

## Report #3: Best Practices Guide to Aerial Imagery Interpretation of Land Cover

As a supplementary guide, this report presents best practices to assess types of land cover (existing canopy, changes in canopy, and available planting areas) using aerial imagery. It includes visuals, sample classifications, and technical training when using i-Tree Canopy or similar aerial, map-based tools.





REPORT #1:

COMMUNITY FORESTRY RESOURCE MANAGEMENT  
HANDBOOK



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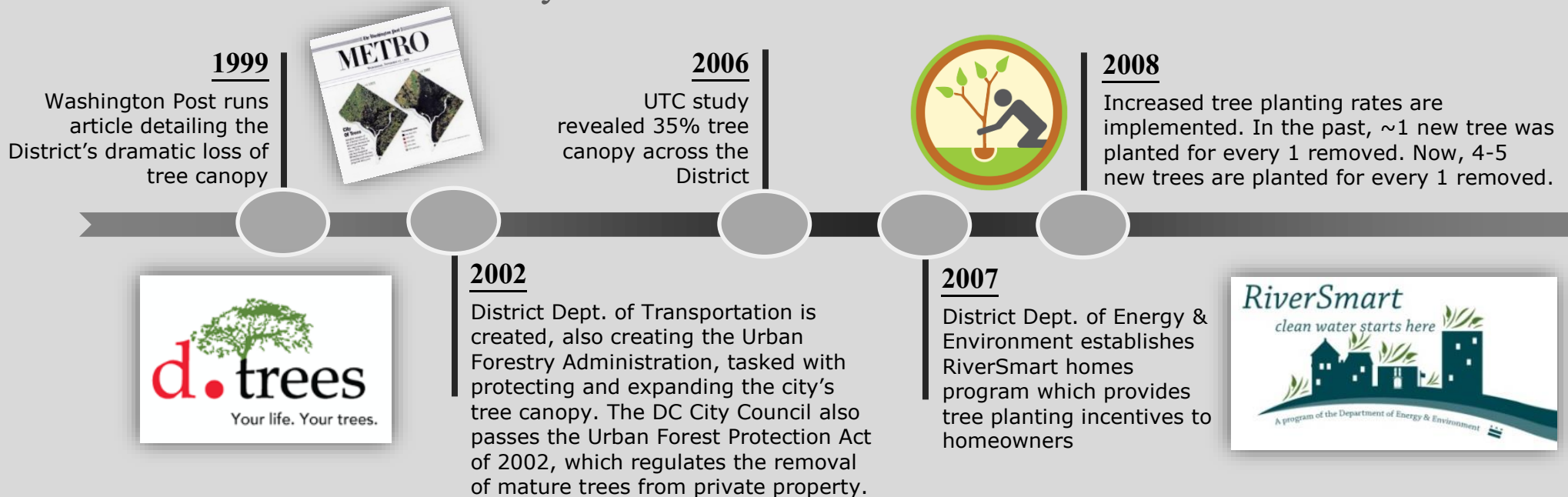
## Urban & Community Forestry in the Nation's Capital

This District of Columbia has a long history of urban forestry, dating back to Pierre L'Enfant, best known for designing the layout of the City's streets. The extensive tree canopy you see today along streets, in yards and parks and near memorials is a result of this intentional planning. The tree shade you enjoy when temperature and humidity hover at 90 is due to decades of hard work from professionals and advocates in public and private sectors.

Urban forestry is about people as much as it is about trees. This handbook serves to connect government resources and knowledge with the community in an engaging and creative way to build relationships. It also compiles and applauds many of the innovative community forestry programs, policies, and initiatives that are underway.

During the course of this 3-year demonstration project, a new analysis shows that the District's tree canopy has

### A Timeline of Urban Forestry in the District of Columbia





increased from roughly 35% to 39% average cover since 2006. The aforementioned efforts are paying off as the District nears its goal of sustaining 40% overall tree cover.

DDOT UFA, Casey Trees, MWCOG, and others have studied, mapped and reported on the state of trees in D.C. The information gleaned from these assessments has provided benchmarks to measure progress of tree planting, tree maintenance, and related policies. The data is also being applied to make real change as intended, through plans, technologies, and outreach activities, many of which are highlighted and summarized in this handbook.

This project advances goals from the [District's 2010 Forest Action Plan](#): **Priority Issue #3:** Build UCF Program Capacity in Washington, DC; **Strategy #12:** Educate citizens on the importance of urban forestry and its multiple benefits. Some of the recent studies, plans, awards, and laudable achievements on tree canopy in the Nation's Capital are presented in a brief timeline below.



## We all benefit from trees!

Why is this so important? Trees provide many valuable direct and indirect “ecosystem services,” or benefits that people obtain from urban forest biological functions and structure. We all benefit from trees, and we all can contribute efforts to grow our urban tree canopy.

### Environmental

#### Air quality:

Trees absorb, trap, offset, and hold pollutants such as particulates, ozone, sulfur dioxide, carbon monoxide, and CO<sub>2</sub>.

#### Water quality:

Soil aeration, evapotranspiration, and rainfall interception by trees increases water quality and reduces stormwater flow.

#### Erosion control:

Tree roots hold soil together along stream banks and slopes.

#### Wildlife habitat:

Increases biodiversity in urban areas.

**625,000 automobiles**

The equivalent PM<sub>10</sub> removal that D.C.’s trees provided

### Economic

#### Property value:

Each 10% increase in tree cover increases home prices by \$1,300+ (Sander, Polasky, & Haight, 2010).

#### Energy conservation:

Trees lower energy demand through summer shade and winter wind block, additionally offsetting carbon emissions at the power plant.

#### Stormwater mitigation:

Urban forests intercept stormwater, reducing the need for costly gray infrastructure.

**\$.7 Million**

Annual energy savings trees provide to buildings in the District

### Social

#### Public health:

Trees diminish asthma symptoms and reduce UV-B exposure by about 50% (Shade: Healthy Trees, Healthy Cities, Healthy People, 2004).

#### Crime and domestic violence:

Urban forests help build stronger communities. Nature and trees provide settings in which relationships grow stronger and violence is reduced.

#### Noise pollution:

Trees act as a buffer, absorbing up to 50% of urban noise (U.S. Department of Energy).

**619 Tons**

Annual air pollution removal by the District’s urban forest

Source: Casey Trees 2015 i-Tree Eco Study

## Tools to support Outreach and Engagement

There are numerous tools and resources available to engage residents, communicate tree benefits, and promote efforts to encourage participation by the local community. These include existing data and studies, interactive map applications, field verification validate planting sites, exercises that inform strategies, and existing programs. Five categories of tools and resources are highlighted below that UFA and community groups can use in their efforts. Further below they are described in more detail with examples of how they apply to four specific target groups.



### Existing Data

Understanding the conditions of a community forest is critical in developing strategies, for example where trees already exist and to target locations that are lacking in canopy. Knowing not only where there is space for plantings but also the context or challenges and causes for the lack of canopy can further refine the approach and drive an effective conservation. Washington D.C. has a comprehensive [street tree inventory](#), a completed [urban tree canopy \(UTC\) assessment](#), [maps online of parcel zoning status](#), and [planting prioritization tools](#) that can all contribute to strategically engaging target groups. By assessing both the quantitative and qualitative information available, outreach and communication strategies can be refined.



### Online map applications

New apps and interactive technologies help us share information about trees and our policies and practices to care for them. These visual, powerful communication tools serve to engage a variety of stakeholders. Decision makers and the public can explore existing tree canopy cover data or tree inventories, create new data through crowdsourcing, and prioritize new plantings and planning. Online maps allow users to suggest planting sites, request trees from give-a-way programs, or otherwise interact with local organizations that manage planting events. ArcGIS Online is an existing platform used by UFA to allow the public to access existing data and to create “[story maps](#)” that walk the user through interesting data with an associated narrative. Additionally, an online canopy viewer map can be explored at <http://pg-cloud.com/DDOTUFA/>.



### Tree Planting Site Suitability and Field Verification

“Top-down” views of tree canopy only tell part of the story. This project developed a protocol to use i-Tree Canopy software (<http://itreetools.org/index.php>) in a creative way to evaluate random sample locations for



suitability of tree planting. UFA can engage a community group to verify potential planting sites and at the same time learn about local challenges or causes for a lack of tree canopy.

The process helps to start a conversation and unveil qualitative, context-based issues, challenges, opportunities, and strategies to expanding tree canopy. This “post-assessment” step can lead to a better understanding of local conditions and mitigating actions. See the Demonstration and Assessment report from Ward 5 that accompanied this study which describes how UFA, MWCOG, and Casey Trees volunteers applied this outdoor step of the protocol.

“i-Tree is a state-of-the-art, peer-reviewed software suite that provides urban forestry analysis and benefits assessment tools. The tools help communities strengthen their urban forest management and advocacy efforts by quantifying the environmental services that trees provide and the structure of the urban forest. i-Tree Design shows the economic impacts of individual trees in relation to energy use, air quality, stormwater, and property values.”



### **Strength-Weaknesses-Opportunities-Threats (SWOT)**

A SWOT analysis is a planning method used to determine and review internal and external forces that impact efforts to meet a specific objective. SWOT employs a series of factors (i.e. questions) to solicit information and opinions from stakeholders. In the demonstration in Ward 5, a workshop was held at MWCOG to facilitate a SWOT with 18 staff from DDOT UFA. In the process, UFA identified strengths and opportunities of the community forest to combat weaknesses and threats. A lighter SWOT process was also used with Casey Trees volunteers while visiting six sites near the Brookland / Catholic University of America metro station. See the Demonstration and Assessment report that accompanies this project for details and resources.



### **Existing Policies and Programs**

Many policies and outreach programs exist that target groups in this report can adopt. DDOT UFA, DDOT Dept. of Energy, MWCOG, Casey Trees, and other organizations have programs and resources to leverage funding and connect underserved areas with nature-based solutions to urban environmental and social issues. Examples below highlight local and regional accomplishments for outreach and tree preservation.

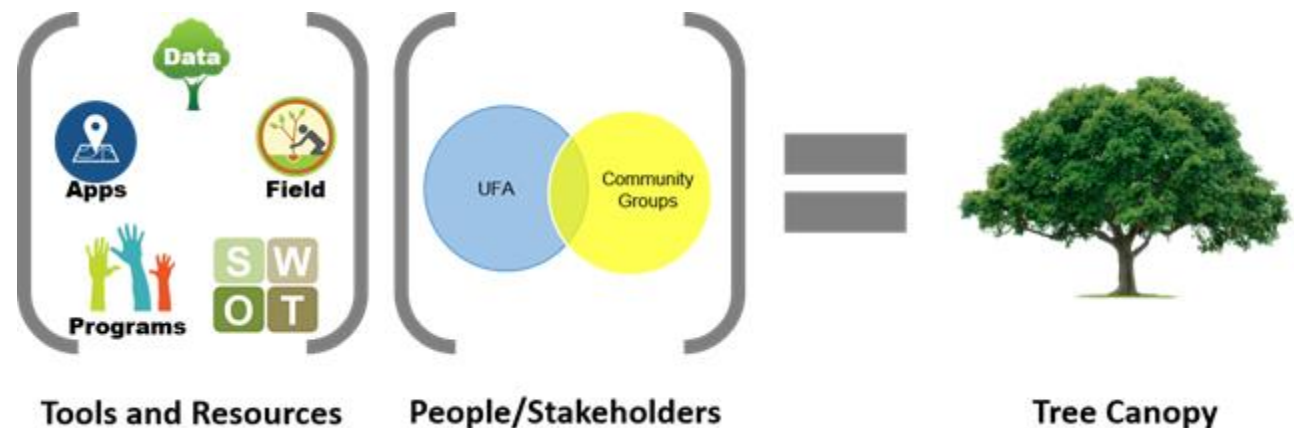
UFA has been making great strides to grow the District’s tree canopy and engage the community. Taking advantage of any of these available tools will assist UFA in their outreach approach, and help make their efforts more effective.

## The Protocol: An Outreach and Engagement Framework

Growing, maintaining, and promoting a healthy urban tree canopy takes a combination of tools, resources, and people. The high-level steps of the engagement protocol and framework developed through this demonstration project are as follows (Note: review Report #2 from this project for specific instructions, results, and resources):

1. Identify a community group, business, or neighborhood for the engagement (or they can self-identify).
2. Compile existing data, tools, partners, and policies/programs in that area.
3. Use i-Tree Canopy to assess existing trees/forests, types of planting sites, and/or areas of canopy change.
4. Invite the group to conduct a site visit to provide input on local conditions and to get to know the stakeholders. Use or modify the questionnaire (see Appendix of Report #2) for participants to verify suitability of planting sites. You might also conduct a light SWOT Analysis (Strengths – Weaknesses – Opportunities – Strengths) to engage citizens or businesses and make a plan with short- and long-term goals. See sample SWOT questions in the Appendix as a way to learn about their Community Framework (engaged groups, awareness of tree benefits, etc.), the Vegetation Resources (trees, forests and planting sites in the area), and share your knowledge on Resource Management (policies, regulations, ordinances, etc.).
5. Be a resource: identify funds, partners, and programs to stay engaged and connected using awards, social media, and other means

The protocol should be flexible. Use the opportunity to plant trees, teach, learn, and monitor the social capital you've created. Steps can be skipped or new ones can be introduced based on the setting. The framework is meant to be used by UFA with community groups or by organizations with other community groups.



## Target Community Groups

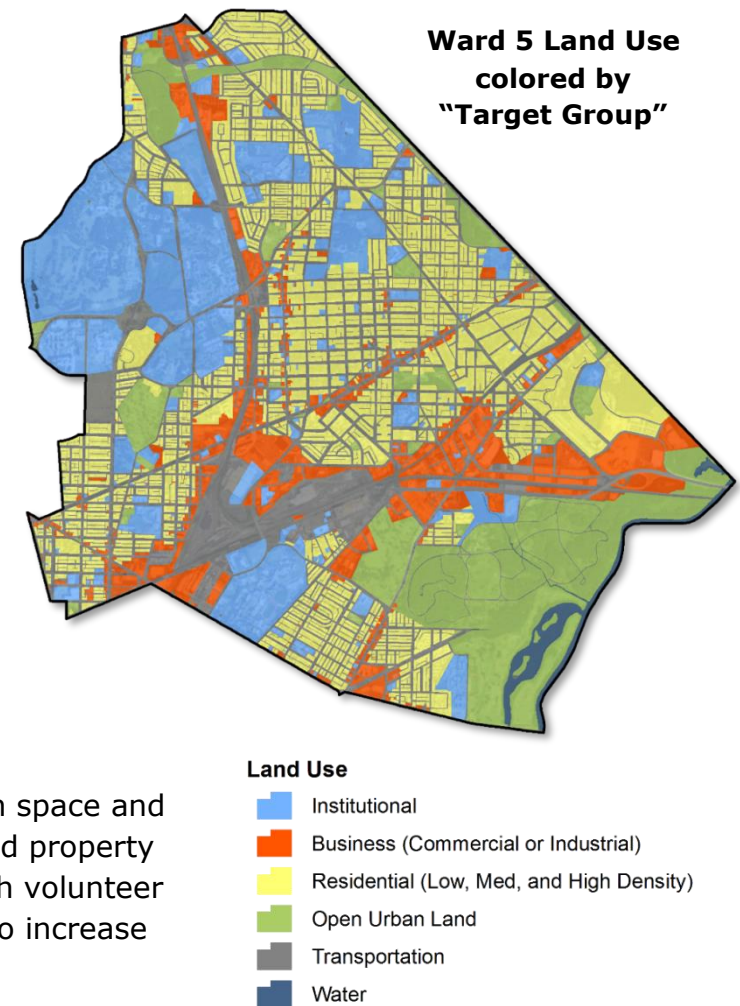
While recent efforts have been significant with UFA planting up to 10,000 trees per year, available planting space in public lands is limited. As such, community engagement and contribution is essential to further growing the urban forest canopy. Key target community groups presented below include:

- Individuals and volunteers community groups
- Businesses
- Public and private schools and campuses
- Local and regional governments

UFA requires creative approaches to community engagement on private property where the majority of planting potential is. Mapping ownership shows the distribution of these four target groups in Ward 5 where the project demonstration focused. Institutional land use includes schools, while commercial and industrial land uses will contain a broad range of business types.

Local and regional governments do work that impacts every existing and future District citizen. They directly manage public lands such as parks, open space and transportation corridors, but they can only indirectly influence developers and property owners. Outreach and implementation strategies can reach residents through volunteer community groups, government programs, and public/private partnerships to increase tree canopy.

Target groups are presented below along with innovative tools, resources, programs, technology examples, and implementation strategies being applied in the District.





## Volunteer Community Groups

Trees conserve energy and reduce energy costs on residential properties, increase property values, and make the community a more desirable and healthier place to live, all the while helping to reach DC's canopy goal. Residents and community groups can be engaged through education and outreach, initiated by both grass-roots efforts as well as from the top-down. Any group should be able to organize and participate in neighborhood planting events, promote awareness of trees as a community resource, and care for new trees by their home.



# 16%

of all *plantable* points in Ward 5 fell within residential backyards (See Report #2).

## Tools for Outreach and Engagement



**(Data)** Use canopy data and priority planting tools at <https://pg-cloud.com/DDOTUFA/> to target communities with greater needs and opportunities. Find gaps in the street tree inventory data in these areas and ones adjacent to private property.



**(Apps)** Request a tree through <http://getdctrees.org/>. UFA also uses ArcGIS Online story maps to highlight the value of trees. Visit "[Our Diverse Canopy](#)" on your phone, tablet or computer.



**(Field)** i-Tree Design is a tool that can be used by individuals to estimate the value and benefits they will receive from individual trees. This may encourage planting of additional trees to receive benefits personally, as well as in the greater community.



**(SWOT)** Conduct a SWOT analysis with the targeted community groups to explore questions about the vegetation, community framework, and resources. Are the existing trees in good condition? Is there already involvement from the community? Are there financial limitations where trees are lacking?



**(Programs)** Identify programs and be sure the community is aware of them. For example, use DDOT's [watering app](#) to find young trees that need water and record your efforts to keep the tree healthy, safe, and growing.

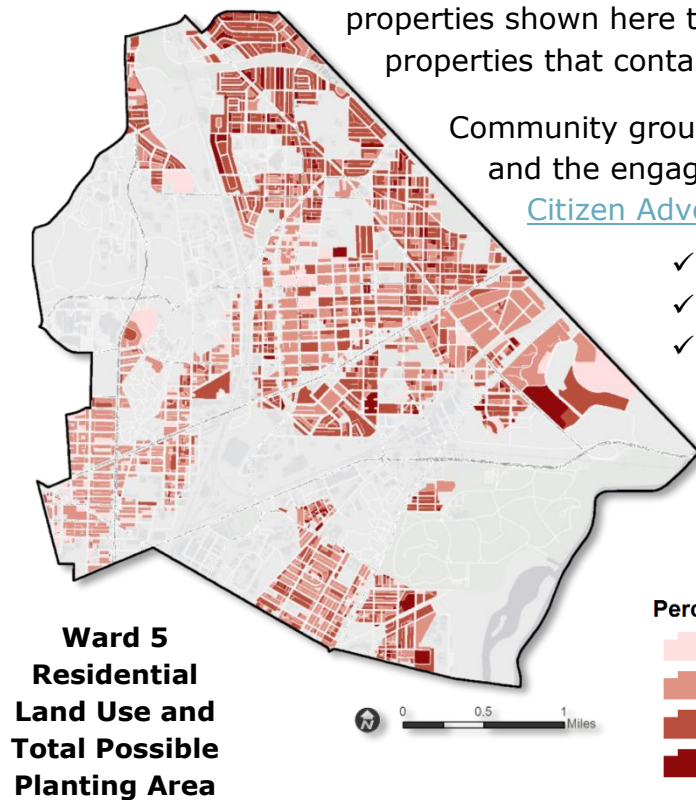


## Implementation Techniques for Volunteer Community Groups

UFA can connect with existing volunteer community groups and share information and resources identified the outreach and engagement tools above. Sharing data about existing canopy and engaging the groups in a SWOT analysis will not only improve communication between the UFA and volunteer groups, but also empower the groups to make more informed decisions for their own efforts. In Ward 5 alone, there are 641 acres of possible planting area, and 32% of plantable locations are within residential yards. That represents a significant amount of planting potential on private property where citizens hold the key to reach the District's UTC goal. The map of Ward 5 residential land use shows the percentage of total possible planting area by parcel. There are over 100 properties shown here that are at least 60% plantable, and almost 700 properties that contain at least 40% plantable space.

Community groups can be trained on this data and other resources and the engagement techniques described in the [Casey Trees Citizen Advocate Handbook](#):

- ✓ Attend public meeting (UFA, ANC's)
- ✓ Get involved with Neighborhood Associations
- ✓ Communicate with local elected officials



## Become a Canopy Keeper!

Adopt a tree and DDOT will provide a free slow-drip watering device for your tree.

Tree Keepers agree to protect their tree for 2 years by:

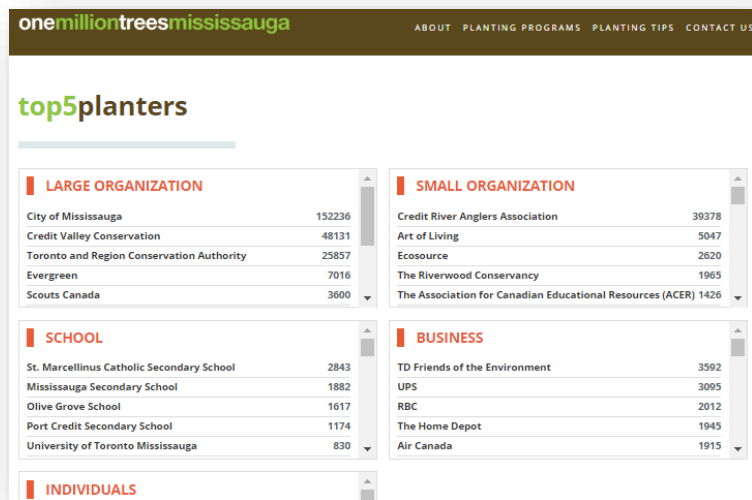
- 🌳 Reporting any service needs to [311.dc.gov](https://311.dc.gov) or calling 311.
- 🌳 Filling the device with 10 gallons of water once a week from spring bloom until winter freeze.
- 🌳 Mulch 2-4" deep if possible, and keep mulch away from the trunk.
- 🌳 Clean weeds and debris from the planting space

# 32%

of all *plantable* points in Ward 5 fell within residential yards.  
(see Report #2)

## Businesses

Large or small businesses can get involved in efforts to improve the urban tree canopy. Incentives for planting trees at retail shops and corporate campuses include increased shopping or recreation by creating outdoor spaces we want to live and work in. Trees in front of shopping centers and around parking lots add curb appeal and help mitigate the stormwater runoff from parking lots. Trees planted in industrial areas improve air quality and provide a noise and aesthetic buffer.



onemilliontreesmississauga		ABOUT PLANTING PROGRAMS PLANTING TIPS CONTACT US	
<b>top5planters</b>			
<b>LARGE ORGANIZATION</b>			
City of Mississauga	152236		
Credit Valley Conservation	48131		
Toronto and Region Conservation Authority	25857		
Evergreen	7016		
Scouts Canada	3600		
<b>SMALL ORGANIZATION</b>			
Credit River Anglers Association	39378		
Art of Living	5047		
Ecosource	2620		
The Riverwood Conservancy	1965		
The Association for Canadian Educational Resources (ACER)	1426		
<b>SCHOOL</b>			
St. Marcellinus Catholic Secondary School	2843		
Mississauga Secondary School	1882		
Olive Grove School	1617		
Port Credit Secondary School	1174		
University of Toronto Mississauga	830		
<b>BUSINESS</b>			
TD Friends of the Environment	3592		
UPS	3095		
RBC	2012		
The Home Depot	1945		
Air Canada	1915		
<b>INDIVIDUALS</b>			

# 5%

of all *plantable* sites in Ward 5 were in parking lots. Only **1%** of existing trees in Ward 5 fell within these lots (see Report #2).



## Tools for Outreach and Engagement



**(Data)** Distribute a recommended tree planting list that is appropriate for the local environment and the property's intended use, and encourage native, large shade trees.



**(Apps)** Use <https://pg-cloud.com/DDOTUFA/> to locate areas large paved areas and possible planting space. This will allow UFA to target outreach to big box stores that might have large surface parking lots where trees can be planted, promoting urban heat island mitigation, and benefiting businesses with stormwater issues.



**(Field)** Provide planting designs with species that minimize maintenance costs, blockage of signs, and conflicts with infrastructure, while maximizing shade. Participate in public / private partnerships that include community greening.



**(SWOT)** Conduct a SWOT analysis with business groups to explore questions about the vegetation, community, and resources. *Are there locations where trees could be planted within large commercial properties? Could hosting a planting event promote team building? Is information about tree or landscaping ordinances and regulations being transmitted effectively to business owners? How can tree conflicts be addressed?*



**(Programs)** Identify existing programs and be sure that the business community is aware of them. Encourage businesses to sponsor community planting events. See "top5planters" at [www.OneMillionTrees.ca/](http://www.OneMillionTrees.ca/) showing how to track business sector contributions to planting goals.





## Implementation Techniques for the Business Community

- ✓ Assist with tree plantings to ensure best practices and the DDOT's Green Infrastructure Standards are used.
- ✓ Provide an educational experience and inform business owners about tree rules and regulations while emphasizing the benefits of trees. Refer to the [DDOT's Green Infrastructure Standards](#).
- ✓ Encourage community groups to engage businesses using examples described below and utilize the [Casey Trees Citizen Advocate Handbook](#) and other resources.

### Local Examples

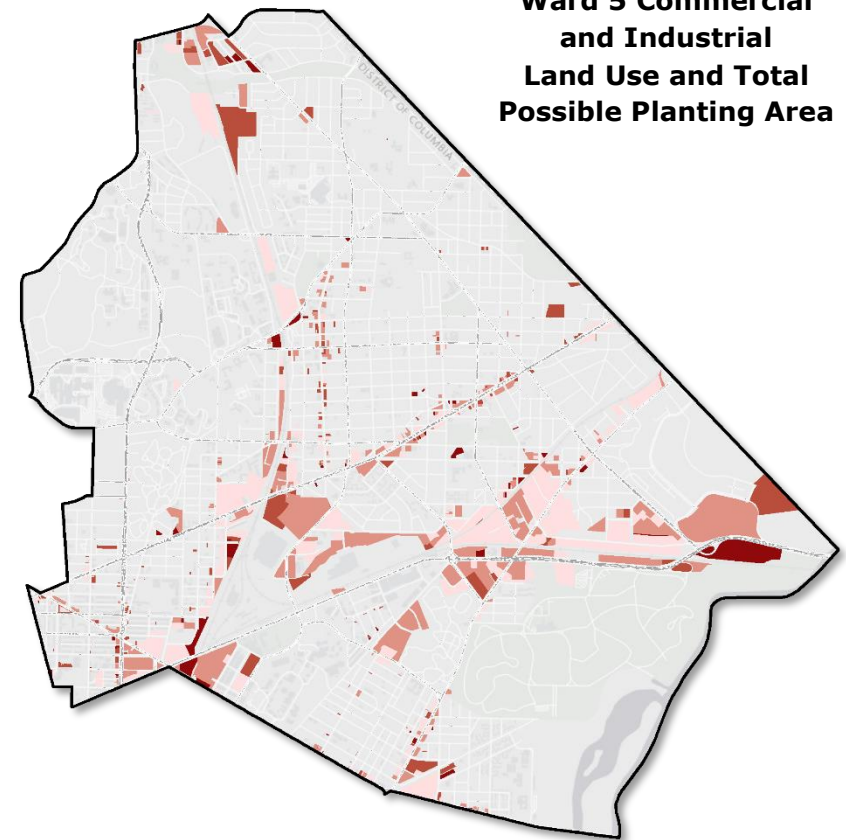
Stoddert Terrace Dwellings FedEx and partners project: Over 30 volunteers from FedEx partnered with UFA, US Forest Service, DC Housing Authority, and Earth Conservation Corps & Washington Parks & People to install 50 new trees.

Law Firm and UFA Park Inventory: On Arbor Day 2016, 20 DC-based law firm volunteers assisted in a public park inventory of more than 300 trees.

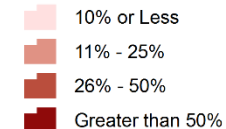


Trees provide shade for pedestrians and vehicles, and promote shopping

**Ward 5 Commercial and Industrial Land Use and Total Possible Planting Area**



**Percent Possible Planting Area**



## Public and Private Schools

School grounds have abundant opportunities for planting and education. Trees offer shade to play spaces and help cool school grounds, while their presence alone can help improve student focus. More trees reduce the maintenance costs of mowing, and they beautify the landscape for students, teachers, families and the greater community.

UFA recently took over the management of roughly 200 public schools in the District where they can have a direct influence on tree canopy cover and quality. Public and private K-12 schools, colleges, and universities can all help contribute to the District's trees and urban tree canopy.

Below: Arbor Day Event at Ketcham Elementary School, which UFA "adopted" in 2016, showed career paths through "tools of the trade", and came up with Treengo (Tree + Bingo, played with acorns).



Photo Credit: DC DDOT UFA

## Tools for Outreach and Engagement



**(Data)** As part of geospatial technology and science programs, students could collect data about the existing trees on their campus, and locate new planting sites.



**(Apps)** Esri offers many grants and software resources to educational institutions. Consider promoting the use of ArcGIS Online as a tool to engage students in learning about geospatial technology and as a tool to view existing tree canopy and inventory data.



**(Field)** Science teachers can use tools like i-Tree Lessons (<http://www.itreelessons.com/>) to teach students the value of trees and the concept of ecosystem services.



**(SWOT)** Use this with the schools to explore questions about the vegetation, their community, and resources. *Can the value of trees be integrated into existing science programs? Is there opportunity to host planting events at the school? Are there funds available to plant and maintain new trees?*



**(Programs)** Project Learning Tree (PLT) is an American Forest Foundation program that uses the forest as a window to the world, engaging students across the country with integrated lesson plans. The program network includes over 500,000 trained educators and material that covers environmental education. STEM programs also offer an opportunity to use apps and learn about tree biology/ecology.





## Implementation Techniques for Public and Private Schools

### *Species Selection*

Public and student safety is the highest priority for any public space and the selection of tree species should be carefully considered. Factors influencing selection include:

- ✓ Allergies – certain fruit and nut trees, as well as heavy pollen producing species should be limited
- ✓ Safety – especially in heavy trafficked areas, choose trees that are thornless, strong with good form, and limited lower branches which encourage climbing. Consider pedestrian safety by limiting blind spots caused by branches
- ✓ Design – use trees and landscape to guide pedestrian travel and maximizes the benefits that trees provide



### *Rebate System*

Institutions can maximize their resources by developing a system to support science programs at schools or by hosting tree planting fundraisers. At the same time they provide important outdoor education about the earth and the value that trees have on the natural environment.

### *Programs and Arbor Day Celebration*

Conduct surveys of the faculty and students to understand their interests and level of understanding to provide information on available, pertinent programs like [Project Learning Tree](#), [STEM](#), and [Arbor Day Foundation's Educational Resources](#).

Schools should celebrate Arbor Day with activities and poster contests to engage students and get them excited about trees. Educating students of the importance of urban forests and the environmental challenges of today and tomorrow is a critical step in promoting the urban canopy. Consider UFA's Ketcham Elementary School Arbor Day event for future implementation.



# 10%

of all *plantable* space in Ward 5 fell on school properties. 74% of those points fell on private school properties.



## Local and Regional Government

Managers and staff of District departments and regional government organizations have direct and indirect influence on the maintenance and development of the urban tree canopy. Examples include City Planners, Parks and Recreation, the District Department of Transportation Urban Forestry Administration (UFA), the Metropolitan Washington Council of Governments (MWCOCG), and the Department of the Environment. Government agencies gain from trees' effect of reduced crime, reduced pollution, urban heat island mitigation, and their help in naturally managing stormwater runoff.

These agencies establish policies and regulations that influence tree planting, inventory and analysis of existing tree canopy, and manage trees on public land. It is government organizations that directly influence the effects of regulatory tools on the natural and built environment. By collaborating across departments, agencies can be more effective in their efforts to promote the urban tree canopy and achieve their broader goals. It is also the role of government agencies to engage the general public and large landholders in the promotion of trees.

While the UFA cannot directly engage with private property owners, they can contribute to a cooperative effort among other departments to enact and enforce tree planting, care, and protection standards. They can provide the resources for ANC's and community groups to engage private property owners.

## Tools for Outreach and Engagement



**(Data)** Promote open data policies where the District can share existing urban tree canopy and tree inventory GIS data to the general public. See example below.



**(Apps)** To avoid crowds on the National Mall during the spring Cherry Blossom Festival, use the DC Cherry Picker app. This example of open data links to UFA's tree inventory database to find the nearest cherry tree and gives you walking directions: <http://www.dccherrypicker.com/>.



**(Field)** Conduct a canopy change analysis to show the impact (loss of benefits) of lost canopy as it relates to the wellbeing of the governmental organization's constituents.



**(SWOT)** Conduct a SWOT analysis with individual departments to explore questions about the vegetation, community framework, and resources. *How are they currently managing their trees and tracking their condition? Are they engaging the community in their plans for public ROW improvements and urban design? Is there a management plan guiding urban forestry actions?*



**(Programs)** UFA launched Canopy 3000, a public-private initiative to plant 3,000 trees in 2016 above and beyond their street tree planting efforts.



## Implementation Techniques for Local and Regional Government

### ✓ *Utilize and Strengthen Existing Programs, Organizations, and Initiatives*

[Sustainable DC](#): Continue to use the strength, reputation, and support of Sustainable DC to reach UFA and District-wide planting and canopy goals.

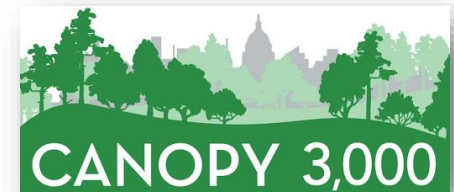
"The Urban Forestry Advisory Council is an essential, forward-thinking component in the District's push to increase tree canopy cover in all eight wards"

-Dept. of Energy & Environment

[Urban Forestry Advisory Council](#): Utilize the UFAC's mission of connecting and engaging agencies and other public and private partners to increase outreach and plantings on private property.

[Canopy 3000](#): Use this short-term effort and diverse partner group as a model to apply throughout the District.

[Casey Trees](#): Continue this symbiotic partnership by utilizing the Citizen Scientists and other community- and volunteer-focused programs.



### ✓ *Education and Enforcement of Tree Regulations and Standards*

Strategically inform the public about the Green Infrastructure Standards, Special Tree Protection, Heritage Trees, General Tree Damage, Green Area Ratio, Stormwater Regulations and others.

### ✓ *Continued Cooperation and Planning*

UFA should continue to engage in inter and intra-departmental discussions and planning.

### ✓ *Proactive Management*

Stay informed and educated about potential widespread pests and diseases, invasive plants, research, and new technology.

### ✓ *Be an Example and Utilize Available Tools*

Use best practices and implement conservation easements, DDOT's 311 Service, opinion surveys, available tree data (UTC, i-Tree Eco, tree inventory), and tools such as the District's [Canopy Planner online map](#).





## Trees for People

That is the purpose of community forestry.

Efforts related to tree establishment and stewardship provide a natural framework for generating social capital in urban areas. The strategies discussed in this handbook provide tools for establishing improved engagement with interested stakeholders.

When neighborhoods engage more robustly in efforts to enhance tree resources, the benefits that community trees deliver extend beyond strictly the environmental realm and also contribute to better social outcomes.

We encourage you to read the second and third complementary reports in this series:

- **Report #2: Assessment and Engagement Demonstration in D.C.'s Ward 5**
- **Report #3: Best Practices Guide to Aerial Imagery Interpretation of Land Cover**



## Report #2

### Assessment and Engagement Demonstration in D.C.'s Ward 5

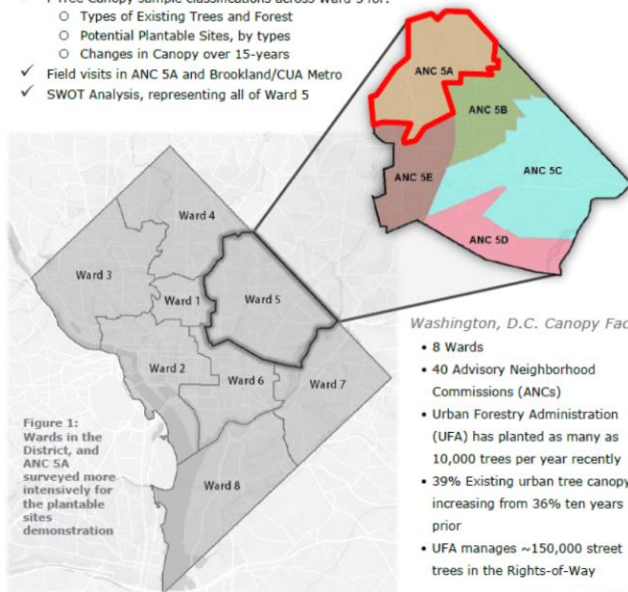


#### Canopy in the District and the Ward 5 Demonstration Area

The District has a land area of roughly 68 sq. mi. Based on a recent analysis of LiDAR and aerial imagery flown in 2015, D.C. averages 39% tree canopy cover.

To understand the opportunities, impedances, and actions required to plant in different land use types, several demonstrations were performed. Ward 5 (Figure 1) was selected because it has average canopy and plantable space compared to other wards, and many community groups such as Casey Trees. i-Tree Canopy and ground-truth visits were conducted more intensively in ANC 5A for the plantable sites category.

- ✓ i-Tree Canopy sample classifications across Ward 5 for:
  - Types of Existing Trees and Forest
  - Potential Plantable Sites, by types
  - Changes in Canopy over 15-years
- ✓ Field visits in ANC 5A and Brookland/CUA Metro
- ✓ SWOT Analysis, representing all of Ward 5



## Report #3

### Best Practices Guide to Aerial Imagery Interpretation of Land Cover



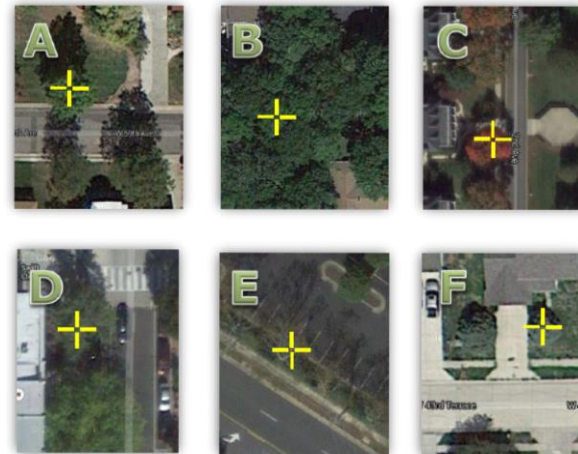
#### Best Practices for Aerial Photo Interpretation

##### Introduction to Aerial Photo Interpretation

Photo interpretation is the act of examining photographic images to identify unique objects on a landscape. In i-Tree Canopy, the user must first identify the object that the point falls on. Then, the user must classify the object according to the classification scheme being used. To get the most useful results, the land cover at each point must be analyzed in the context of its placement in the urban landscape. For instance, a point may fall on a grassy area. Without the context of the surrounding area, the user would be inclined to call this point a plantable area. However, using context, the user can see that this vegetation is in a median in the middle of a busy road, and the location would not be suitable for planting a tree.

##### Examples of Common Urban Land Cover in Aerial Photos

##### Trees (general)



Each of these crosshairs falls on a tree crown. Trees are often identified by their color and texture (A, B, C). Shadows are also important when identifying trees (D, E, F).



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**REPORT #2:**

**ASSESSMENT & ENGAGEMENT  
DEMONSTRATION IN WASHINGTON, D.C.'S  
WARD 5**



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## Report Overview

### *Terms Used in This Project and Report*

The following terms are used in this assessment and relate to demonstrating a new protocol to assess existing tree canopy and potential planting areas when engaging private property owners.

#### **Advisory Neighborhood Commission (ANC)**

Bodies of local government in Washington, D.C. There are currently 40 ANC's within the District's eight Wards.

#### **i-Tree Canopy:**

Software within the i-Tree suite of tools from the USDA Forest Service that estimates tree cover and tree benefits for a given area with a random sampling process that lets you easily classify ground cover types. <http://www.itreetools.org/canopy/index.php>

#### **Plantable Space**

All space where tree planting is biophysically possible (e.g. grass, turf, shrub land, and open space).

#### **Hardscape vs. Softscape**

This refers to elements of landscaping. Hardscape includes heavier elements such as stones, rocks, patios, and driveways (mostly impervious surfaces in terms of stormwater runoff) whose removal would be required to plant a tree. Softscape refers to everything else, such as soil, plants, flower and color schemes (all pervious surfaces).

#### **SWOT Analysis**

A structured planning method used to evaluate the **Strengths, Weaknesses, Opportunities, and Threats** involved in a business, organization, initiative, or program.

#### **Urban Tree Canopy (UTC)**

The layer of leaves and stems of trees that cover the ground when viewed from above.

#### **Ward**

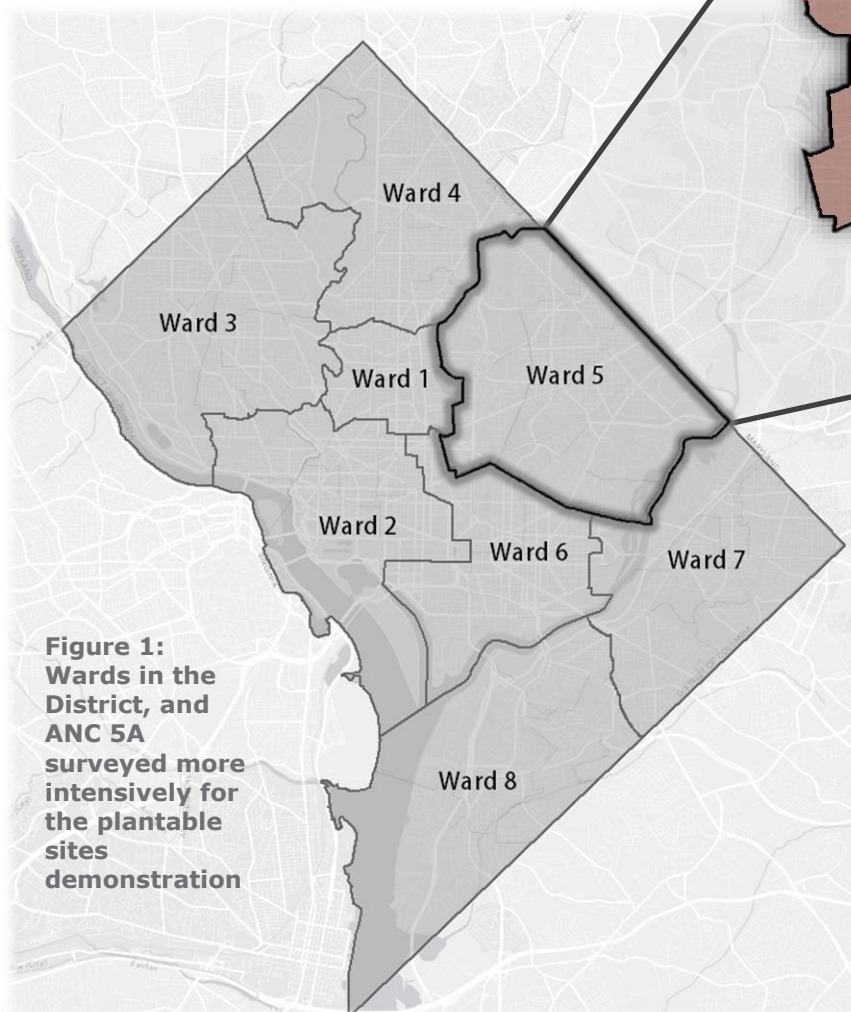
An administrative division of a city or borough that typically elects and is represented by a counselor or councilors. There are eight Wards within the District's boundaries.

## Canopy in the District and the Ward 5 Demonstration Area

The District has a land area of roughly 68 sq. mi. Based on a recent analysis of LiDAR and aerial imagery flown in 2015, D.C. averages approximately 39% tree canopy cover.

To understand the opportunities, impedances, and actions required to plant in different land use types, several demonstrations were performed. Ward 5 (Figure 1) was selected because it has average canopy and plantable space compared to other wards, and many community groups such as Casey Trees. i-Tree Canopy and ground-truth visits were conducted more intensively in ANC 5A for the plantable sites category.

- ✓ i-Tree Canopy sample classifications across Ward 5 for:
  - Types of Existing Trees and Forest
  - Potential Plantable Sites, by types
  - Changes in Canopy over 15-years
- ✓ Field visits in ANC 5A and Brookland/CUA Metro
- ✓ SWOT Analysis, representing all of Ward 5



**Figure 1:**  
Wards in the  
District, and  
ANC 5A  
surveyed more  
intensively for  
the plantable  
sites  
demonstration

### Washington, D.C. Canopy Facts:

- 8 Wards
- 40 Advisory Neighborhood Commissions (ANCs)
- Urban Forestry Administration (UFA) has planted as many as 10,000 trees per year recently
- ~39% Existing urban tree canopy, increasing from 36% ten years prior
- UFA manages ~150,000 street trees in the Rights-of-Way



"Plantable" Findings from i-Tree  
Canopy Demonstration in Ward 5

**32%**

of all Plantable space fell in Residential yards. Roughly half of those points fell in backyards.



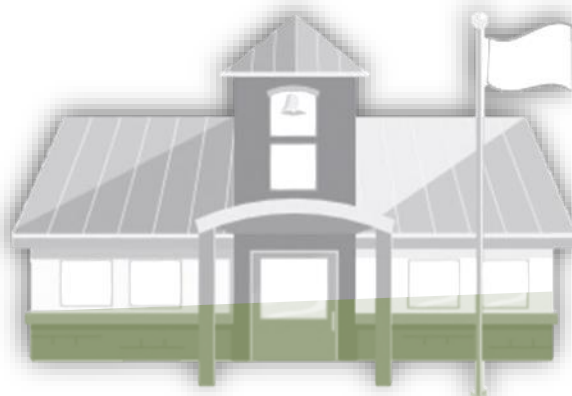
**17%**

of all Plantable space fell within Street Rights-of-Way, with over 2/3 on softscapes such as grassy, open areas.



**19%**

of all Plantable space fell within Parks and open space/natural areas.



**10%**

of all Plantable space fell on School properties. 70% of those points fell on *private* schools.

**27%**

of all space in Ward 5 is deemed plantable.



**5%**

of all Plantable space fell within commercial parking lots. 80% of the planting space is on commercial softscape, where minimal site preparation for planting is needed.

Note: i-Tree Canopy sampling in Ward 5 showed 29% average canopy cover.

## Methods

Several demonstrations were performed within Ward 5 to develop, design, and test components of the engagement protocol between project partners.

Input on i-Tree Canopy classifications was first solicited from UFA's staff during a workshop hosted by MWCOG and included a SWOT Analysis from UFA's perspective. UFA and MWCOG also conducted initial site visits in ANC 5A to provide feedback on the plantable spaces verification process. Lastly, UFA, Casey Trees, and Plan-It Geo met with a group of volunteers to go through the project's purpose and the protocol and then visited six sites near the Brookland / Catholic University of America (CUA) Metro station. A questionnaire was completed for each site, and a SWOT Analysis was completed from the community's perspective on the areas that were visited. See Results and Appendix.



Figure 2: MWCOG Workshop

This repeatable, flexible process offers a method to evaluate community forestry resources and create connectivity between community groups and officials at the neighborhood level.

### *Classifications using i-Tree Canopy*

Plan-It Geo used the GIS boundary for Ward 5 to create a new i-Tree Canopy project. The program then allows a user to create classifications, or types of land cover, with default values of Canopy vs. Non-Canopy. Random points are plotted in Google Maps within a study area, and the user tallies each point by the type of land cover at that location. This is a quantitative tool for estimating land cover percentages. A total of 1,500 random points were assessed.

Three assessment categories were created to demonstrate and evaluate past, present, and future community forestry conditions using i-Tree Canopy:

1. Plantable Area
2. Existing Tree Canopy
3. Canopy Change



Figure 3: i-Tree Canopy interface

A listing of the classes for each assessment category can be seen in the Results and Appendix sections. More information on the selection of categories and classifications is available in the Appendix of this report and the *Aerial Imagery Interpretation Guide* from this project. In addition, [YouTube](#) videos on i-Tree Canopy are provided by the USDA Forest Service.

### Plantable Sites Field Verification

To ground-truth sites and identify impedances to tree planting, 81 “plantable” sites were selected from the 1,500 i-Tree Canopy points based on access and other factors. The points were brought into a mobile map application for UFA and MWCOC to navigate between sites and enter data confirming or refuting the sites as plantable or non-plantable. During the field verification, “qualitative attributes” were assigned to each point (i.e. each site) to indicate why there is not already a tree at the location, what steps would be required to plant there, and impedances preventing a tree from being planted. Plan-It Geo then used feedback to modify the process and document results and lessons learned in this report.

In a later phase of the project, staff from UFA, Casey Trees, and Plan-It Geo met with a group of volunteers to conduct a second series of field visits. Six sites were chosen where these volunteers had already collected data in i-Tree Eco plots (2015). A questionnaire was filled out by each volunteer. The results as well as a map of the sites near Brookland / Catholic University Metro Area are provided further below.

### Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis

The next component of the demonstration protocol provides a way to engage community groups, document their input, and develop plans and strategies. A SWOT analysis is a method for determining *internal* and *external* forces that impact efforts to meet a specific objective. SWOT employs a series of questions (aka, factors) to solicit information from individuals and a group. In the context of this study, *internal* describes factors that are in the control of the community, while *external* indicates an influence from outside the community.



For the demonstration with professionals (MWCOC and UFA), factors were organized into the traditional SWOT matrix below. These factors were further customized for the outreach and engagement protocol by incorporating three categories from a Model of Urban Forest Sustainability (Clark, et al. 1997). See next page.

Table 1: SWOT Analysis Matrix

Internal:	<u>Strength:</u> Positive factors for community forestry originating from <i>inside</i> the community	<u>Weakness:</u> Factors for improvement from <i>inside</i> the community
	<u>Opportunity:</u> Positive factors for community forestry originating from <i>outside</i> the community	<u>Threats:</u> Factors for improvement from <i>outside</i> the community
External:		



To develop the questions and populate meaningful factors for the SWOT analysis demonstration, the process was slightly modified using the three categories from a Model of Urban Forest Sustainability. This process is used widely in urban forest management planning. Stakeholders can self-evaluate performance measures using a series of criteria and indicators. SWOT questions were created for the three categories: *Vegetation Resource*, *the Community Framework*, and *Resource Management*. At the MWCOG workshop, the SWOT Analysis was conducted, once for each of the three categories, led by Plan-It Geo as facilitator with input collected from 18 of UFA's staff. See the Results section.

Criteria and indicators (C & I) of the model of sustainable urban forestry are below. The Appendix includes the list of sample questions used to develop SWOT factors.

<i>Vegetation Resource</i>	<i>Community Framework</i>	<i>Resource Management</i>
The extent, quality, distribution, and composition of trees and forests	The ways and extent to which residents and stakeholders are engaged and interact in planning and caring for trees	The policy, planning, and resources including staff, funding, and tools
Criteria & Indicators		
<ul style="list-style-type: none"> <li>... canopy cover</li> <li>... age distribution</li> <li>... species mix</li> <li>... native vegetation</li> <li>... condition/quality</li> <li>... natural areas</li> </ul>	<ul style="list-style-type: none"> <li>... public agency cooperation</li> <li>... involvement of large private and institutional landholders</li> <li>... green industry cooperation</li> <li>... neighborhood action, citizen + city + business interaction</li> <li>... awareness of trees as a community resource</li> <li>... regional cooperation</li> </ul>	<ul style="list-style-type: none"> <li>... management plan</li> <li>... funding and staffing</li> <li>... assessment tools</li> <li>... tree protection</li> <li>... species/site selection</li> <li>... standards and safety</li> <li>... urban wood utilization</li> </ul>

Once all factors are identified and organized, each group was asked to consider how their members can capitalize on *strengths*, minimize *weaknesses*, collaborate for *opportunities*, and mitigate or minimize the impact of *threats*. SWOT should incorporate diverse stakeholders to ensure that all interests are accounted for in the engagement process.

### *Tips for a Successful SWOT Analysis*

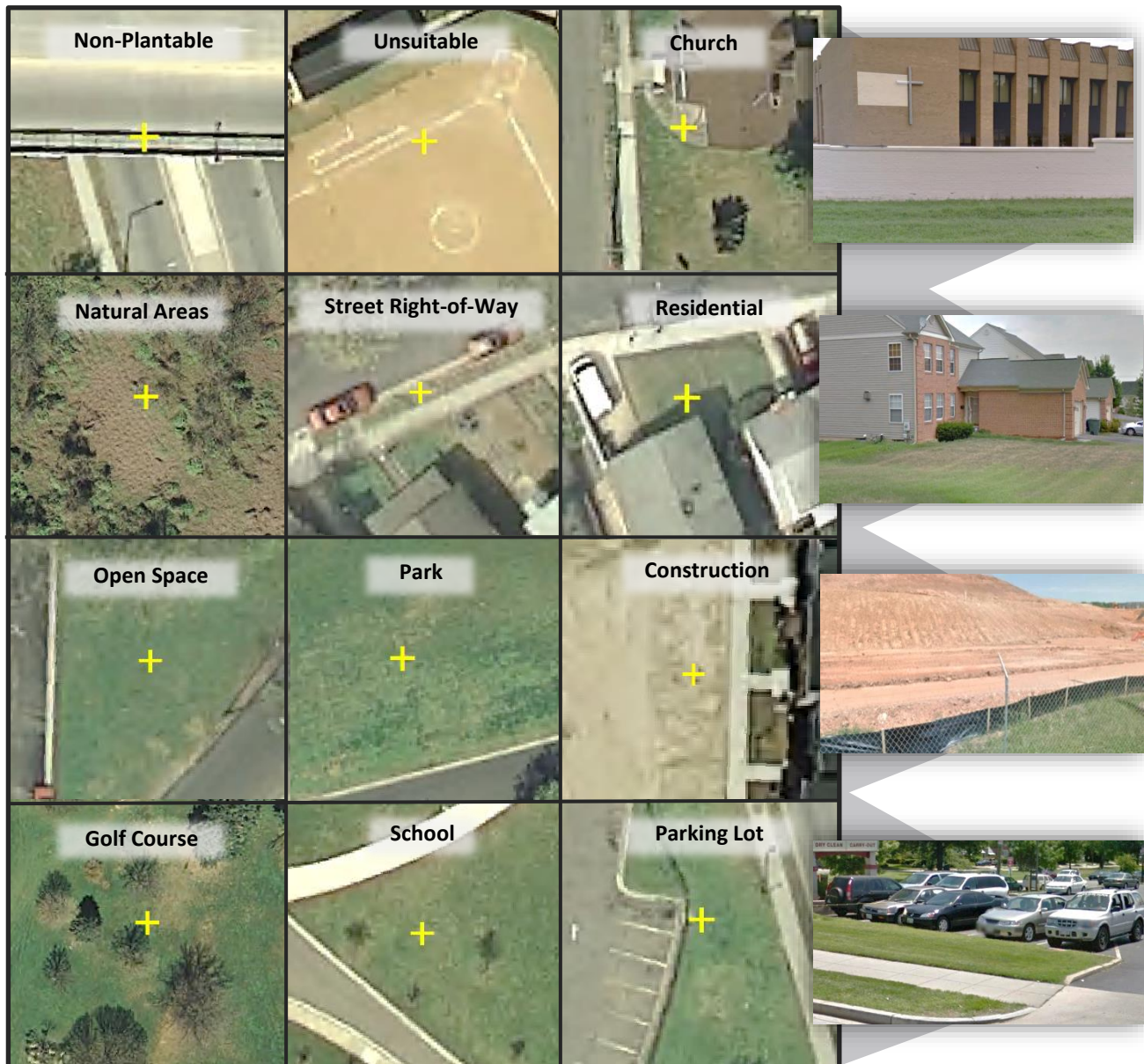
- Make factors as specific and detailed as possible.
- Prioritizing factors is important for efficiently allocating community resources.
- Establish achievable benchmarks for engaging factors.
- Revisit SWOT factors (and the analysis itself) since conditions, resources, and organizations are dynamic over time.

## Results

This section highlights results of each demonstration applied in Ward 5 and ANC 5A, beginning with -Tree Canopy classifications (plantable, existing canopy, and canopy change), followed by field verification, SWOT Analysis, and volunteer site visits.

### *Plantable Areas Demonstration*

A detailed list of “Plantable” classes was developed to creatively assess types of potential planting areas from i-Tree Canopy sample locations. See Figure 4 below and on the next page. For a more detailed description of each class, refer to pages 29-30 in the Appendix as well as the Aerial Imagery Interpretation Best Practices Guide from this project.



**Figure 4: Generalized Plantable and Non-Plantable Points Classes used in the i-Tree Canopy Study**

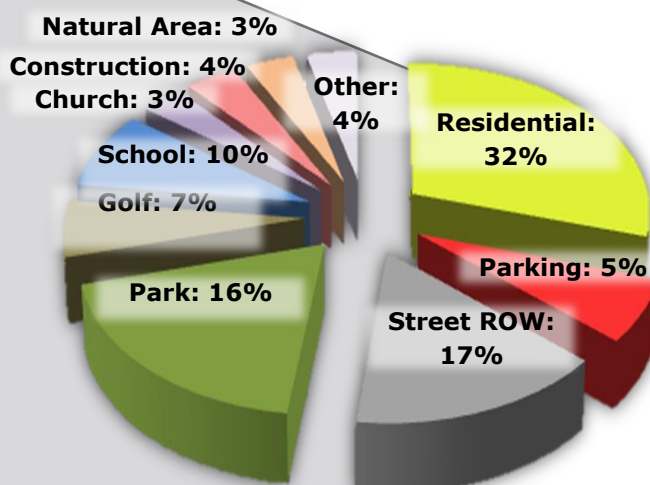


The plantable areas demonstration reviewed 1,000 randomly generated locations in ANC 5A, a subset of Ward 5, whereas the demonstrations for existing canopy and canopy change used 1,500 points over a larger area (i.e. all of Ward 5). The smaller area and higher density of sample points was chosen to provide a more intensive sampling of plantable areas since the emphasis in later stages of the demonstration protocol were on field visits (verification and ground-truth of planting potential) by UFA, MWCOC, and volunteers. The results and overall process helps UFA staff, community groups, and citizen foresters to describe the types of tree planting opportunities in a community.

Of the 1,000 sample points in ANC 5A, 71% were identified as non-plantable areas such as existing tree canopy, roads, water, and buildings. An additional 2% of points were deemed unsuitable such as on baseball fields or fairways where planting will not occur. Of all plantable points, 30% fell on residential land, which was further broken out by front and backyards. The pie chart below (Figure 5) lists the plantable point results by category.

**Table 2: Breakdown of plantable space in ANC 5A by 17 individual classes and land use types**

Classes	% Cover
Non-Plantable Land Cover	N/A
Unsuitable Land Cover	N/A
Residential (Front yard)	16%
Residential (Backyard)	13%
Residential (Other)	3%
Parking Lot / Commercial Hardscape	1%
Parking Lot / Commercial Softscape	4%
Rights-of-Way (Vegetated)	12%
Rights-of-Way (Impervious)	5%
Park (Near Facilities)	2%
Park (Open Area)	14%
Non-Plantable Intentional Open Space	0%
Golf Course	7%
School Public	3%
School Private	7%
Church / Temple / Place of worship.	3%
Open Space / Natural Area	3%
Construction	4%
Unclassified / Other	4%
* Values add up to 101% due to rounding	



**Figure 5: Breakdown of plantable space in ANC 5A by 10 broader classes**

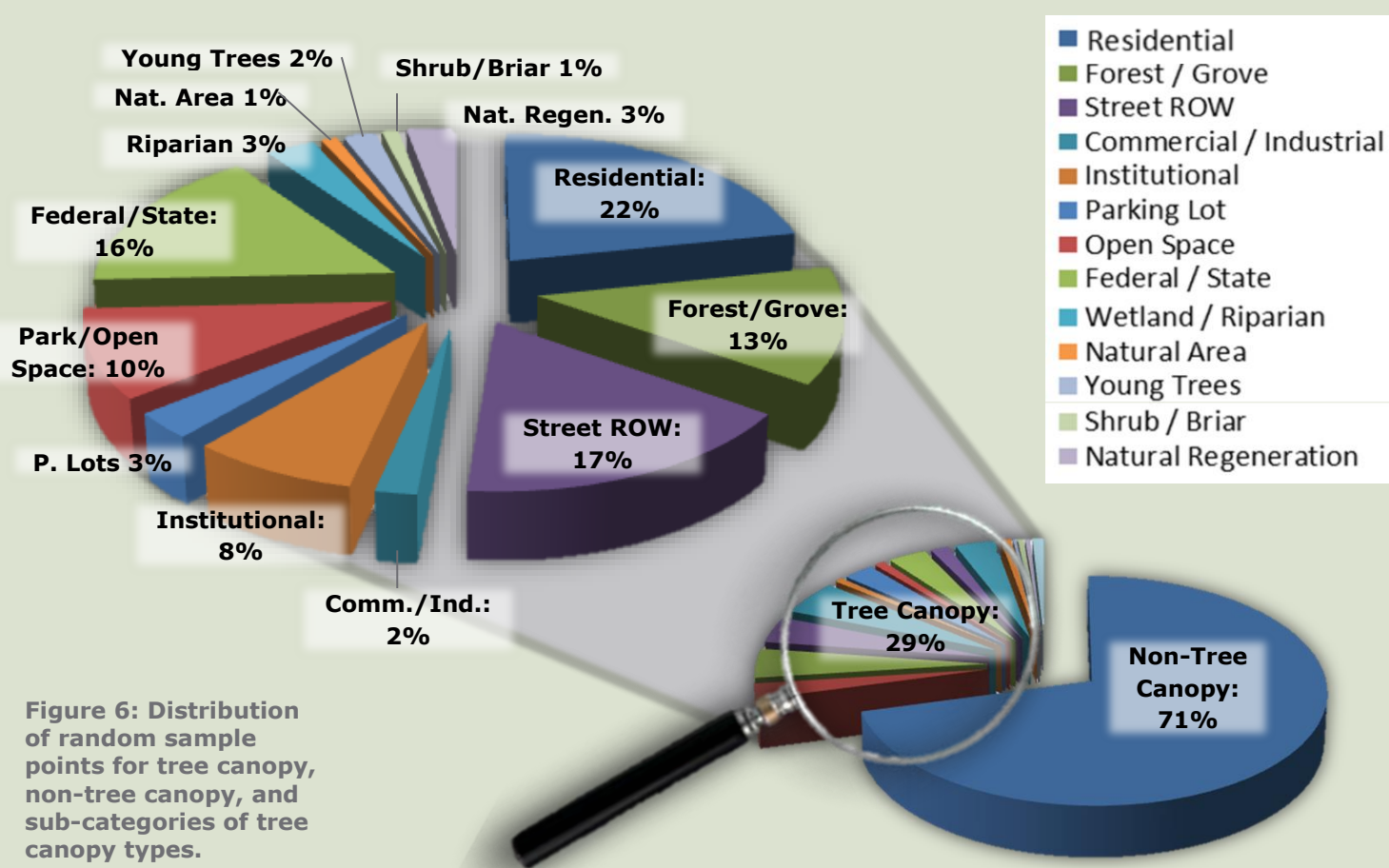


## Existing Tree Canopy Demonstration

A list of custom classes was also created in i-Tree Canopy to assess types of existing trees and forest. This demonstration assessed 1,500 points across all of Ward 5.

The process resulted in an average tree canopy of 29% in Ward 5 (438 out of 1,500 points) with 71% of points identified as non-tree canopy land cover. The points falling on tree canopy were then sub-categorized into specific land uses and ecological zones that are meaningful for management, planning, and outreach. See Figure 6 below.

Of these sites, 22% (96 points) fell within residential lots, 2/3 of which fell in backyards. Additionally, 16% of tree canopy points fell within Federal lands and 17% fell within Public Street Rights-of-way. See pages 31-32 in the Appendix for more results.



## Canopy Change Demonstration

i-Tree Canopy can also be used to assess changes in tree canopy using two different time periods of aerial imagery. Gains and losses can be identified in specific land uses or zones.

A change analysis resulted in an overall tree canopy increase of 3% in Ward 5 over a 15-year period. While the sample size is small, tree cover in the Public Rights-of-Way (ROW) increased 1%. Most tree canopy change occurred in parcels where land use has changed and where tree growth was visible. See pages 32-33 in the Appendix for more results.

### In Ward 5, over the last 15 years:

- ✓ Tree cover **increased 3%** of total area
- ✓ Tree cover in the Public ROW **increased 1%** (1/3 of total tree cover increase)
- ✓ Tree cover in residential backyards **increased 1%**
- ✓ Plantable area **increased 1%** of the total area in Ward 5
- ✓ Open Space / Natural Area plantable space **decreased 1%** of total area



Figure 7: Example of Canopy Gain in Ward 5

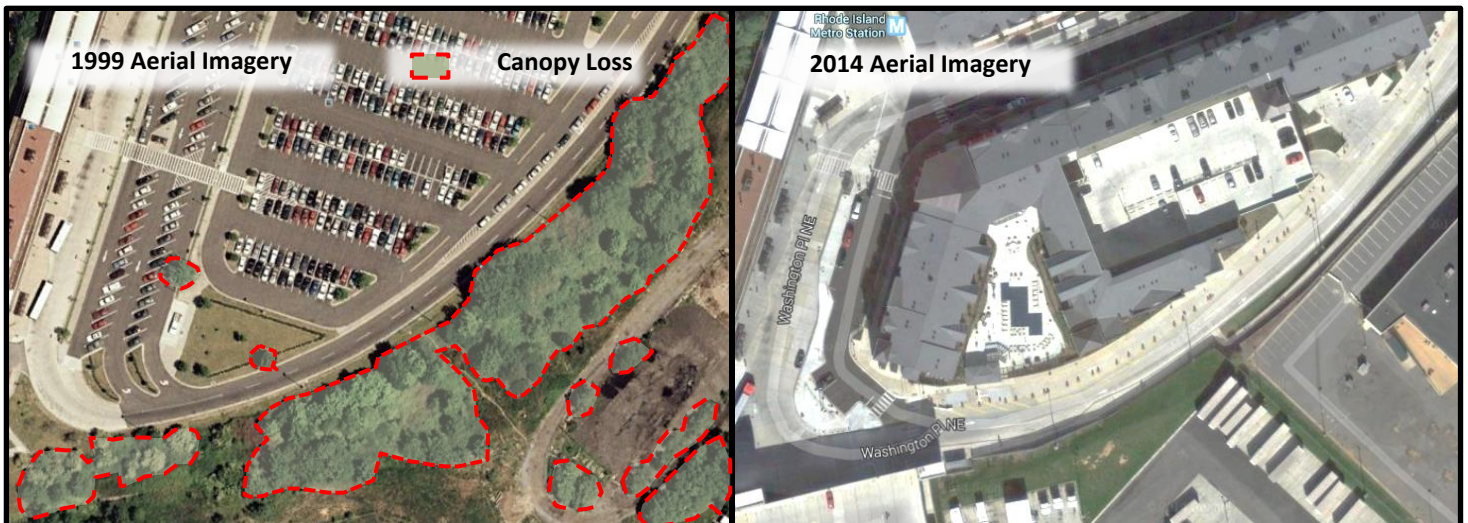


Figure 8: Example of Canopy Loss in Ward 5



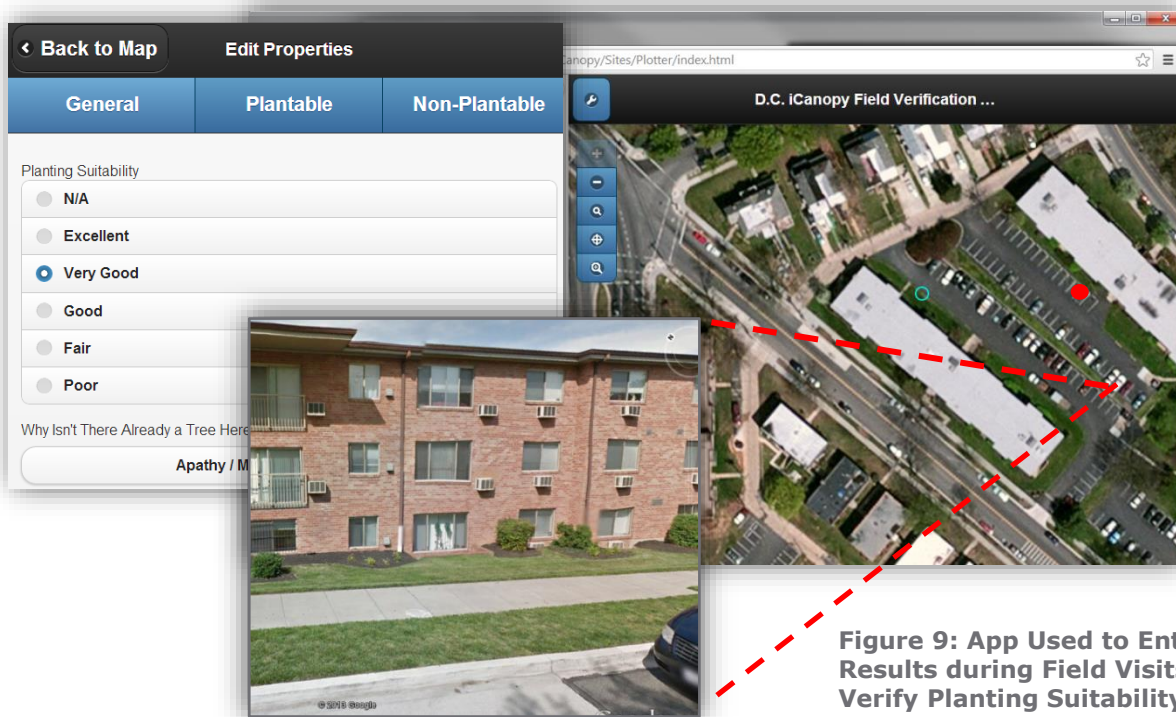
## Field Verification Demonstration

MWCOG and UFA visited 81 of the 1,000 sites in ANC 5A to add a qualitative step in the demonstration and protocol by professionals. In the field, 44 sites (54%) were deemed plantable and 37 as non-plantable. For the plantable sites, the most common reason why a tree was not already in the location was apathy or monetary resources (33%), and the most common action required to plant a tree was educating the land owner. Of the 44 plantable sites, the highest amount of plantable space was found in Rights-of-Way (24%), followed by Private Schools (21%), Parks (14%), and Parking Lots (12%).

The suitability for planting was also reviewed for each site, where 35 of the 44 (80%) were noted as Good or Excellent. Mixed responses were provided by UFA and MWCOG when answering why a tree does not currently exist at a plantable point, but “Apathy / Monetary Resources” was the most common (33%).

Of the 37 non-plantable points, 72% were due to impedances from land use or ownership (Federal/State/Institutional). However, this was biased by the large amount of federal lands found in the District and determined from the perspective of UFA and MWCOG who do not have the ability to plant on these properties.

Other observations were identified that impact or relate to the presence or non-presence of a tree at a plantable point. For example, conditions can change rapidly in the District from new development to infill development, and in some locations, newly planted trees were adjacent to the sample sites, prohibiting new planting.



**Figure 9: App Used to Enter Results during Field Visits to Verify Planting Suitability**



## SWOT Analysis

The goal of the SWOT demonstration was to create an engaging process for stakeholders to identify outreach and management strategies.

At a workshop hosted by MWCOG, UFA staff were asked to consider a series of questions (see pages 35-36 in the Appendix) and formulate factors to populate the SWOT matrix. The observed weaknesses and threats can be matched with strengths and opportunities to create action. While the demonstration focused on Ward 5, the matrix provides a framework for developing strategies to enhance forestry efforts in any Ward, community, or city.

The modified SWOT analysis revealed internal strengths and weaknesses, and external opportunities and threats, as depicted in Figure 10 below.

<b>Strengths (<i>internal</i>)</b> <ul style="list-style-type: none"><li>• Personnel and funding available for necessary tasks</li><li>• Street tree planting has increased; few vacant sites</li><li>• Native species that are diverse in size and age makeup the overall street tree composition</li><li>• Strong internal interaction between governmental groups in the greater regional area</li><li>• Casey Trees located in Ward 5; known community group to provide routine monitoring and support</li><li>• Active, verbal, vocal ANCs; some more than others</li><li>• Staff size has increased</li><li>• Special Tree Permit working but not at optimal level</li></ul>	<b>Weaknesses (<i>internal</i>)</b> <ul style="list-style-type: none"><li>• No District-wide or neighborhood-level urban forest management plans (<u>Note: at time of workshop</u>)</li><li>• Need for stronger regulations to preserve forest extent and health (<u>Note: at time of workshop</u>)</li><li>• Limited remaining planting sites on public lands</li><li>• Lack of communications &amp; awareness of UTC goal</li><li>• Departments/agencies working in silos</li><li>• No convening authority for impact on public lands</li><li>• Lost outreach staff; time needed to rebuild relations</li><li>• No restrictions for private trees &lt;55" circumference</li><li>• Socioeconomics; need medium to address concerns</li></ul>
<b>Opportunities (<i>external</i>)</b> <ul style="list-style-type: none"><li>• Many apps, tools, and data available to understand urban forest extent, quality, and potential</li><li>• Increase involvement among non-forestry environmental groups</li><li>• Access to affordable and adequate tree planting stock; wide range of well-adapted species</li><li>• Group involvement of tree planting and planning</li><li>• Planting potential on vacant lots / private property</li><li>• Insight into community's "environmental psyche"; unveil why there's detachment from nature, if they see a tree, it has no value, if they see it at all</li><li>• Community gardens; involvement and sense of community (fruit trees, environmental stewardship)</li></ul>	<b>Threats (<i>external</i>)</b> <ul style="list-style-type: none"><li>• Existing ordinances / regulations not distributed adequately to reach interest groups</li><li>• Limited guidelines available for community-based tree planting and maintenance</li><li>• Lack of communication between interest groups</li><li>• Indifference about benefits/care of the urban forest</li><li>• Mortality from lack of tree care and education</li><li>• Funding in underserved areas for planting/watering</li><li>• Cannot plant or care for trees on federal/state lands</li><li>• Vandalism; perception of trees as a liability</li><li>• Transportation; lack of connectivity, fragmented</li><li>• Aging infrastructure (curbs, water lines, etc.)</li><li>• Insects, diseases, climate change, development</li></ul>

See the Appendix to view sample questions for engaging a stakeholder group in an urban forestry SWOT analysis.

**Figure 10: SWOT Analysis results**

A lighter SWOT Analysis was also conducted with Casey Trees volunteers after visiting potential planting sites in the field (next page).

## Field Visits Demonstration with Volunteer

UFA can visit potential planting sites with communities to start a two-way conversation and build relationships in the process. This step can unveil place-based issues, opportunities, and strategies to expanding tree canopy, and provide UFA's resources where needed most.

For demonstration, six sites in Ward 5 were evaluated by a group of Casey Trees volunteers. The sites varied in land use, existing tree canopy, and parcel status, and three were owned by Washington Metropolitan Area Transit Authority (WMATA). Each volunteer filled out a questionnaire (see Appendix and questions/descriptions below). Responses were then summarized with input from UFA and Casey Trees. Finally, a light SWOT process was used to document input representing all sites and the greater community forest.

Resulting actions, strategies, outcomes, recommendations, and lessons learned are presented below. While these are site-specific observations, the issues, trends, and suggested actions can be applied District-wide, to any neighborhood, or any city.

### Questions | Descriptions during volunteer field-engagement exercise

- What is the site type? – *Describe the land use or parcel status (vacant, developed, etc.)*
- Is the site plantable? – *Are there obstructions (e.g. utilities, competing views, etc.)?*
- What is the suitability for planting? – *A qualitative ranking from Poor to Excellent*
- Why isn't there a tree at the site? – *What condition or event resulted in a lack of trees?*
- What action is needed to plant here? – *Identify the tools, resources, benefits, or means*
- Are there impedances to planting? – *Beyond physical limitations, what else hinders planting?*
- What other notes should be made? – *List observations and/or conversations that arose.*



**Figure 11:**  
Location of  
volunteer sites  
near Brookland  
/ CUA Metro



# 1 Basilica (Front)



## Site Details

This site is on a religious institution property. While there is ample open space for tree plantings, the group identified potential conflicts and restraints.

## Issue

The large open space was designed to provide abundant views of the Basilica. Mature trees could hinder this objective.

## Action

UFA and community organizations should consider educational opportunities about species selection (smaller stature trees that don't obstruct views) as a first step. It was noted that the area is well landscaped with mature trees.

Education and discussions with community groups and the ANC could influence the institution to consider new plantings that will maintain this image.

# 2 Catholic University (Quad)



## Site Details

Large open areas available for tree planting exist on this site, though the campus has intentionally designed certain areas as open space for specific uses and events.

## Issue

Considering the design and intended uses for this open area, tree plantings may not be preferred by the designers and campus managers given the intended purpose of a campus quad. It was noted that the nearby parking lot would benefit from shade trees.

## Action

The volunteers suggested that a planting design and visualization for campus planners be created to help illustrate the potential. The visualization could integrate feedback from student surveys, planned quad events, and university support. One freely available tool to create tree canopy visualizations is at <https://coast.noaa.gov/ccapatlas/>.



### 3 Father O'Connell Hall



#### Site Details

This site contains excellent planting suitability consisting of mulch beds, open grass, and no observed underground or overhead utilities.

#### Issue

Design took precedence over the practical placement of trees as seen in the picture. Trees were planted in the corner of the mulch beds, reducing the available soil volume and increasing potential sidewalk damage as trees mature. Open grass areas have light poles rather than trees and tree injury from construction was observed.

#### Action

For pedestrians and visitors to more thoroughly enjoy and acknowledge the benefits of trees and their shade, it is suggested to add benches since trees may alter the intended design. Consider increasing the species diversity as the monoculture of honey locust trees are removed and replaced.

### 4 Monroe & 9<sup>th</sup>



#### Site Details

This WMATA-owned green space property has existing trees, ample planting space, and is adjacent to new condos built up to the road edge (low Green Area Ratio, or GAR), which volunteers learned on site from industry professionals from Casey Trees and UFA.

#### Issue

This lot is currently open space but development can occur. The property in the background represents a common issue in D.C.: development pressures and limited area consumes potential green spaces. Development may have preceded the GAR rule or developers met GAR requirements by means other than trees.

#### Action

This small, remaining green space is surrounded by development and across from Site 5 (under construction for condos), making it a high priority for a conservation easement.

More educational opportunities to discuss the tree preservation rules, GAR, and mitigation are needed so ANC's can be more aware and proactive as the first line of defense for trees. Volunteers learned about zoning and urban forestry issues, rules, and regulations at this site, which can be applied to other areas with green space preservation priorities.

## 5 Construction Site (Brooks Tavern)



### Site Details

This open construction site is across the street from Site 4 and is denuded of tree canopy. It represents a common issue in D.C. where redevelopment and narrow sidewalks offer limited planting space.

### Issue

Conflicts exist between the retention of green space and the high value of Transit Oriented Development (TOD) near a metro stop. Volunteers remarked that this only increases the priority of conserving Site 4.

### Action

Discuss options to apply for a variance in building height restrictions with the ANC, developer, and planners. This would allow for dense development and less impact on green space opportunities within the parcel. The District's minimum soil volume standards should also be promoted where space permits to allow for shade trees.

## 6 WMATA Property (Land Swap)



### Site Details

This site is currently plantable and has been under WMATA ownership.

### Issue

Volunteers learned from UFA and Casey Trees that the property will be developed. It is adjacent to Brookland/CUA Metro station where TOD is highly valued. Across the street is a park that was previously owned by WMATA. Through a land exchange agreement, the pocket park will now be maintained by the District.

### Action

This site demonstrated that the community and ANC can engage engineers, designers, and developers by attending early planning meetings to provide input on trees, green spaces, and land swap or other conservation practices. Through the engagement protocols, volunteers learned of techniques such as the land exchange agreement which they can apply as a strategy for Site 4 and elsewhere. Knowing a parcel's zoning and development status is critical before making planting plans.

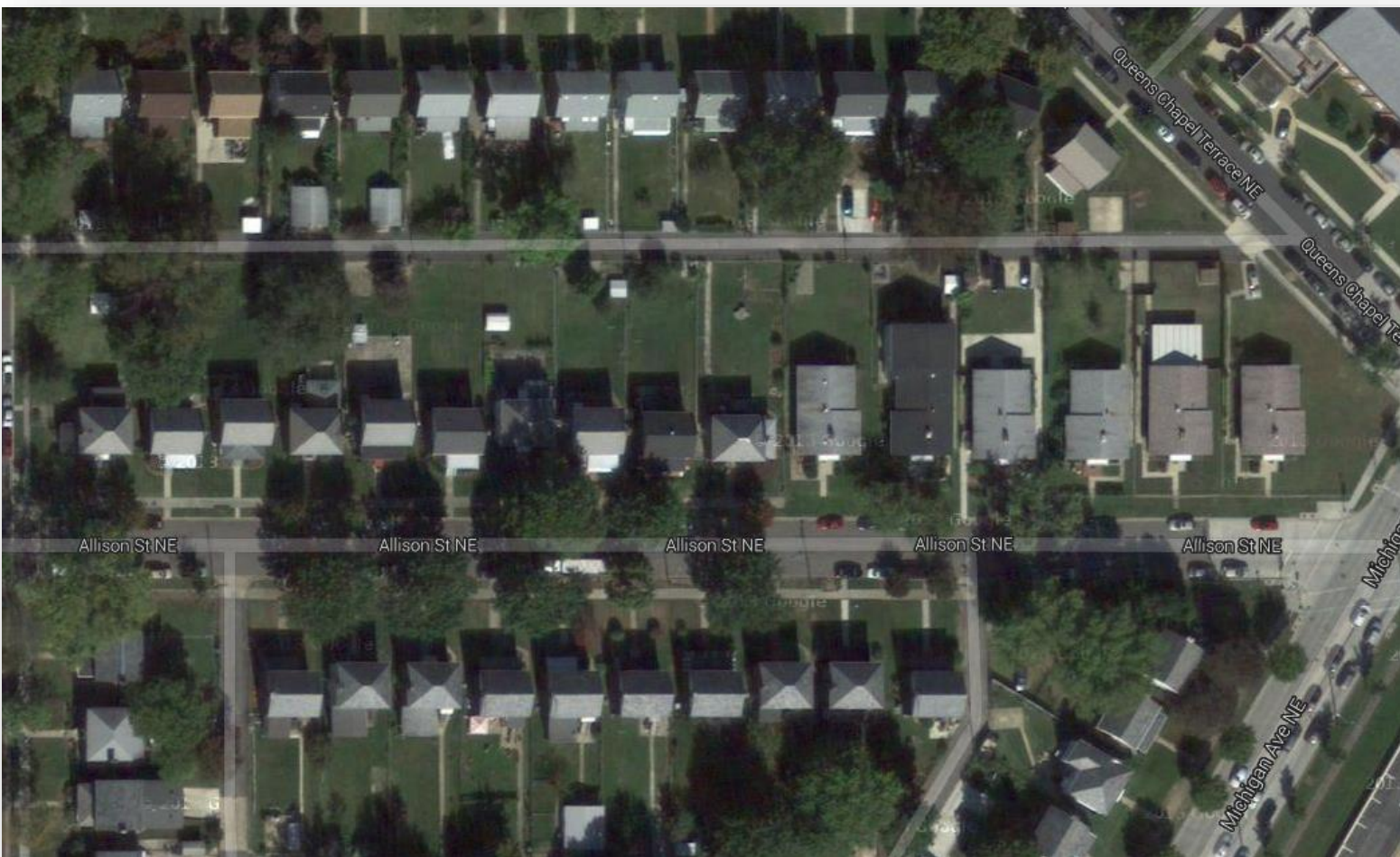


## Conclusion

The District and other cities are complex systems with a dynamic social and political fabric. Urban forests and green infrastructure are critical for public health, thriving communities, and balancing the built and natural environments to benefit the people who live, work, and play there.

Green and gray infrastructure are maintained by many agencies, departments, organizations, and individuals driven by goals and objectives for economic growth, transportation, community development, and public safety. Managing these interdependencies comes with conflicts that must be understood and planned for accordingly.

This demonstration project produced many lessons learned, outcomes, and potential strategies for urban and community forestry engagement. The following summarizes what the project partners – MWCOG, UFA, Casey Trees, Plan-It Geo, and volunteers – observed, shared, and discussed.



**Figure 12: View from Google Maps of residential, backyard tree planting potential in Ward 5**





## o **UTC**omes and Lessons Learned

### **Conflicting uses**

For field verification of planting potential, understanding the parcel status is one of the first steps. Development permits can be viewed online at <https://eservices.dcr.dc.gov/obpat/default.aspx>. It is suggested that Casey Trees utilize staff to provide training on existing tools that display permit locations and associated information. Casey Trees may develop a class for finding parcel information, listing the conflicting uses, and detailing the parcel plans before plantings are planned.

Some sites may appear to be available for planting but are planned for development. Others may be planned open space such as the campus quad at Catholic University, which was intentionally designed for areas with and without trees. Trees can complement the area if strategically intended. Measures to address these conflicts include visualizations and proactive education.

### **Conflicting viewpoints**

Demonstrations with i-Tree Canopy, the workshop, and volunteer field visits showed conflicting opinions on which sites were suitable for planting. If assessing areas generated from i-Tree Canopy, decide early on whether the exact location will be evaluated or the entire plot/site. In addition, differing cultural backgrounds, experiences, expertise, and motives all play a part in determining planting suitability for a given site. Understanding the individuals participating in this activity will yield better conclusions. It is suggested that diverse groups be organized when planning and visiting potential planting projects. Surveys/questionnaires can assist in arriving at local solutions.

### **Competition for limited resources**

While the interests and efforts in preserving and enhancing tree canopy and open space are increasingly supported, real estate in the District is in high demand. Citizens understand the need for clean air and water, recreational opportunities, and the aesthetics and community-feel that trees provide. Thus, a balance between growth and greening is critical. Rules and regulations such as the minimum soil volume standards, heritage and special trees, and Green Area Ratio (GAR) are tools that should be taught, understood, and followed by District planners and developers.

### **Look beyond the site**

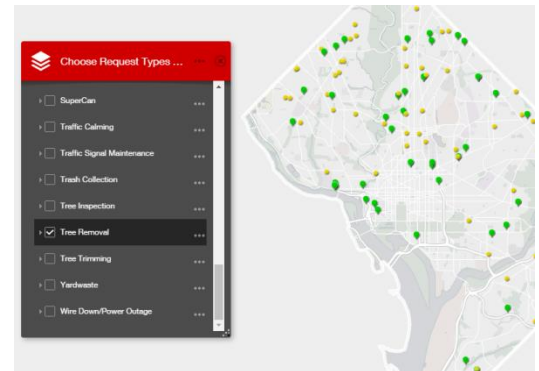
Examining sample planting areas with community groups provides a means to gather local context and information about opportunities and constraints. In some cases, members of demonstrations arrived at the same conclusion that parcel status, conflicting interests, and purpose of the site do not favor tree planting, even though there is open space for trees. In some cases, properties across or adjacent to the sample site presented completely different scenarios and opportunities. Learning what is happening on surrounding properties can help you come up with a plan for the site you are at.

### **Do your homework**

In order to use everyone's time effectively and provide a good volunteer engagement experience, gather as much information about the sites prior to a field assessment and evaluation. Parcel status

can be viewed at <http://atlasplus.dcgis.dc.gov/>. This way, the future use for the site is understood and the project organizer can determine whether it's a suitable site for evaluation.

Additionally, the District's Department of Transportation's 311 Service has an interactive map to show areas planned for tree inspection, removal, maintenance, and more (<https://311.dc.gov/>). Other layers like sidewalk repair and street/alley repair sites can be used to understand potential planting project sites and provide opportunities for tree and other greening retrofits. The map at right shows the location of planned tree removals in the District using the DDOT 311 service.



### Know your data

The District is equipped with many data sources and tools about trees, planting spaces, and development plans. Where applicable, use existing urban tree canopy (UTC) GIS data including the potential planting areas, tree and planting space inventory data, and i-Tree Eco studies.

As an alternative to using i-Tree Canopy, UTC data can be used to identify planting suitability verification sites by querying parcels or blocks with low tree canopy and high plantable area. As another example, sample plots from the 2015 i-Tree Eco project conducted by Casey Trees were revisited for this project through a different lens: how suitable an area is for planting and stewardship. By doing this, the projects complement one another and staff and resources were used efficiently.

### Plan your route

Community volunteers are committing their time to help identify opportunities and constraints at possible planting sites. Make the event enjoyable and rewarding through proper planning. Identify an easily walkable route and meeting point, identify areas to plant trees using UTC data or i-Tree Canopy, and test the route. Provide questionnaires (use or modify the example in the Appendix), clipboards, sunscreen, and refreshments. Then you will be ready to gather local area expertise about the site and listen to their views and opinions.

### Gather the appropriate team

For an informed, educational work session, a diverse team for evaluating the project sites is needed. Example participants include arborists, planners, engineers, landscape architects, water resource managers, businesses, community groups, volunteers, academia, seniors, and youth.

**Tip!** include a professional arborist, planner, or engineer to educate volunteers or a community group on ordinances or policies that they may not be aware of. Information such as existing District regulations (GAR and soil volume requirements), recommended species and their physiology, and other resources can be shared with the group during the event for the greatest benefit.

### Understand limitations

The UFA and community groups want to increase plantings and tree canopy on private property, but some limitations need to be considered. It was noted for instance, that while newly planted trees



need adequate water to reach establishment, lower income areas may not have water hose connections which are expensive to install. Understanding social and economic limitations is key.

While it is important to plant trees, private property owners need to be educated on ways to care for trees once planted and beyond. Otherwise, mortality and tree or branch failure may occur sooner, elevating distaste towards trees. Another educational point is that while large stature trees are often preferred, adequate soil volume is critical and the use of tree boxes or trenches should be considered where feasible.

### Use the data

After completing these site evaluations, UFA and community groups are equipped with information that can make implementation easier. These sites can serve as “low hanging fruit” for achieving planting and canopy goals. Constraints, limitations, and challenges identified in the SWOT analysis can be used to make neighborhood-level recommendations on policy and community priorities.

### Apply this elsewhere

The protocol to verify sample plantable sites should be applied and extrapolated to the community to improve management of urban trees and awareness of their value. Volunteers noted that Gallaudet and Howard Universities (both in Ward 5) are not part of the [Arbor Day Foundation’s Tree Campus](#) program and should be considered when UFA and community groups approach the campus managers.

Many more lessons learned, outcomes, and innovative examples of ongoing outreach and engagement in the District can be found in the Community Forest Resource Management Handbook that accompanies this report.

**Figure 13: Volunteers discuss a land swap between WMATA and the District at Site 6 of the field session in June 2016.**







## Appendix

- I. Detailed i-Tree Canopy Classifications
- II. Complete i-Tree Canopy Demonstration Results
- III. SWOT Analysis Criteria
- IV. Questionnaire

## I. Detailed i-Tree Canopy Classifications

The *Plantable* and *Existing Trees* classification descriptions below were used as a basis for the i-Tree Canopy classification demonstration.

**Table 3: Plantable i-Tree Canopy Classification Descriptions**

Primary Class	Classes	Description
Non-Plantable	Non-Plantable Land Cover	Building / Road / Water / Existing Trees / Physical Impedance including parking lots for industry that are non-plantable
Unsuitable	Unsuitable Land Cover	Sports Fields / Cemetery / Golf Course Fairway
Plantable	Non-Plantable Intentional Open Space	Subjective; open areas likely open for a reason; separate from real plantable
	Residential (Front yard)	Residential planting in front yards
	Residential (Backyard)	Residential planting in backyards
	Residential (Other)	Large open residential or side of yard (not back or front)
	Parking Lot / Commercial Hardscape	Requires removal of impervious surfaces or other significant site prep
	Parking Lot / Commercial Softscape	Medians & planting strips in lots where planting is easier (no tear out of impervious area required)
	Rights-of-Way (Vegetated)	Vegetated planting strip within Street ROW (NOTE: for this demonstration ROW assigned up to 10 feet outwards from street edge, or 6 feet outwards from sidewalk)
	Rights-of-Way (Impervious)	Wide impervious sidewalk area between road and building where planting is biophysically possible
	Park (Near Facilities)	Plantable park area near park facilities (i.e. near sports field, public restroom, etc.)
	Park (Open Area)	Plantable park open area (not near facilities, usually less maintained)
	Golf Course	Plantable golf course area (not on/near fairway, etc.)
	School Public	Plantable space on public school lands (NOTE: use google maps labels as reference, see aerial interpretation guide)
	School Private	Plantable space on private school lands (NOTE: use Google maps labels as a reference, see aerial interpretation guide)
	Church / Temple / Place of worship	Community worship centers (NOTE: use Google maps labels as a reference, see aerial interpretation guide)
	Open Space / Natural Area	Natural areas
	Construction	In transition, land use change, new development
	Riparian	Within 200 feet of riparian habitat (Wetland, waterway, etc.)
	Unclassified / Other	Other plantable area

**Table 4: Existing Trees i-Tree Canopy Classification Description**

Primary Class	Classes	Comments
Other	Non-Tree Canopy	All areas not treed, forested, or covered by other shrubby vegetation
Tree Canopy	Tree - Residential – Front yard	Tree canopy within residential front yard
Tree Canopy	Tree - Residential - Backyard	Tree canopy within residential back yard
Tree Canopy	Forest/Grove	Connected, non-linear canopy generally >.25 acre, +10 trees, or continuous across properties
Tree Canopy	Street / ROW	Tree canopy within Street ROW (NOTE: for this demonstration ROW assigned up to 10 feet outwards from street edge, or 6 feet outwards from sidewalk)
Tree Canopy	Tree - Commercial / Industrial	Any Commercial/Industrial land use type except not in or adjacent to parking lot (that is classified separately)
Tree Canopy	Tree - Institutional	School, campus, church/place of worship, cemetery, etc.
Tree Canopy	Tree - in Parking Lot	In or adjacent to any parking lot on any land use type
Tree Canopy	Tree - Park / Open Space	Tree (non-grove) in park or open space
Tree Canopy	Tree - Federal/State	Individual tree on federal or state government property
Tree Canopy	Forest - Federal/State	Forested area on federal or state government property
Tree Canopy	Forest - Floodplain/Wetland/Riparian	Forested area on or adjacent to visible hydrologic features
Tree Canopy	Tree/Forest - Scattered	Scattered trees, natural area
Tree Canopy	Young Tree - Residential	Small, individual tree or cluster of young trees, not in ROW, on Residential lot
Tree Canopy	Young Tree – Non-Residential	Small, individual tree or cluster of young trees, not in ROW or on Residential lot
Tree Canopy	Shrub / Briar	Transitional, landscaped vegetation, textured, shorter shadows, hedges, etc.
Tree Canopy	Natural Regeneration	Transitional, natural vegetation, textured, shorter shadows, etc.



## II. Complete i-Tree Canopy Demonstration Results

**Table 5: 'Plantable Areas' Demonstration Results**

Planting Area Classifications			
Original Classes	No. of Pts	% Cover	% of Plantable
Non-Plantable Land Cover	709	71%	N/A
Unsuitable Land Cover	15	2%	N/A
Residential (Front yard)	44	4%	16%
Residential (Backyard)	36	4%	13%
Residential (Other)	7	1%	3%
Parking Lot / Commercial Hardscape	4	0%	1%
Parking Lot / Commercial Softscape	12	1%	4%
Rights-of-Way (Vegetated)	33	3%	12%
Rights-of-Way (Impervious)	13	1%	5%
Park (Near Facilities)	6	1%	2%
Park (Open Area)	39	4%	14%
Non-Plantable Intentional Open Space	0	0%	0%
Golf Course	19	2%	7%
School Public	7	1%	3%
School Private	20	2%	7%
Church / Temple / Place of worship.	9	1%	3%
Open Space / Natural Area	7	1%	3%
Construction	10	1%	4%
Unclassified / Other	10	1%	4%
<b>TOTAL</b>	<b>1,000</b>	<b>100%</b>	<b>100%</b>

**Table 6: 'Plantable Areas' Demonstration Results (Cont.)**

Planting Area Classifications (Grouped)			
Grouped	Total Grouped	Plantable Grouped	Final Grouped
Not Plantable	73%	N/A	Non-Plantable 73%
Residential	9.0%	32.1%	Plantable 27.0%
Parking Lots	1.0%	3.6%	
Street Rights-of-Way	4.0%	14.3%	
Parks	5.0%	17.9%	
Golf Course	2.0%	7.1%	
Schools	3.0%	10.7%	
Church / Temple etc.	1.0%	3.6%	
Open Space Natural Area	1.0%	3.6%	
Construction	1.0%	3.6%	
Other	1.0%	3.6%	
<b>TOTAL</b>	<b>28.0%</b>	<b>100.0%</b>	

**Table 7: 'Existing Forest' i-Tree Canopy Demonstration Results**

Existing Forest Classification						
Classes	no. of Pts.	% Cover	% of Urban Forest	Grouped Classes	% Urban Forest Grouped	Grouped % Cover
Non-Tree	1062	71%	N/A	Non-Tree	N/A	71%
Tree - Residential – Front yard	33	2%	8%	Residential	22%	6%
Tree - Residential - Backyard	63	4%	14%			
Forest/Grove	57	4%	13%	Forest / Grove	13%	4%
Street / ROW	73	5%	17%	Street ROW	17%	5%
Tree - Commercial / Industrial	10	1%	2%	Commercial / Industrial	2%	1%
Tree - Institutional	36	2%	8%	Institutional	8%	2%
Tree - in Parking Lot	13	1%	3%	Parking Lot	3%	1%
Tree - Park / Open Space	44	3%	10%	Open Space	10%	3%
Tree - Federal / State	21	1%	5%	Federal / State	16%	4%
Forest - Federal / State	46	3%	11%			
Floodplain/Wetland/Riparian	12	1%	3%	Wetland / Riparian	3%	1%
Scattered Trees / Natural Area	4	0%	1%	Natural Area	1%	0%
Young Tree - Residential	0	0%	0%	Young Trees	2%	0%
Young Tree – Non-Residential	7	0%	2%			
Shrub / Briar	6	0%	1%	Shrub / Briar	1%	0%
Natural Regeneration	13	1%	3%	Natural Regeneration	3%	1%
<b>TOTAL</b>	<b>1,500</b>	<b>100%</b>	<b>100%</b>		<b>100%</b>	<b>29%</b>



**Table 8: 'Existing Trees' Change Analysis Results**

Cover Class	999 Points	1999 % of Total	2014 Points	2014 % of Total	Points Change	Change %
Non-Tree	1102	73%	1062	71%	-40	-2.7%
Tree - Residential – Front yard	30	2%	33	2%	3	0.2%
Tree - Residential - Backyard	50	3%	63	4%	13	0.9%
Forest/Grove	61	4%	57	4%	-4	-0.3%
Street / ROW	61	4%	73	5%	12	0.8%
Tree - Commercial / Industrial	10	1%	10	1%	0	0.0%
Tree - Institutional	32	2%	36	2%	4	0.3%
Tree - in Parking Lot	6	0%	13	1%	7	0.5%
Tree - Park / Open Space	40	3%	44	3%	4	0.3%
Tree - Federal / State	21	1%	21	1%	0	0.0%
Forest - Federal / State	48	3%	46	3%	-2	-0.1%
Floodplain/Wetland/Riparian	12	1%	12	1%	0	0.0%
Scattered Trees / Natural Area	10	1%	4	0%	-6	-0.4%
Young Tree - Residential	0	0%	0	0%	0	0.0%
Young Tree – Non-Residential	4	0%	7	0%	3	0.2%
Shrub / Briar	3	0%	6	0%	3	0.2%
Natural Regeneration	10	1%	13	1%	3	0.2%
<b>TOTAL</b>	<b>1500</b>	<b>100%</b>	<b>1500</b>	<b>100%</b>		



### *III. SWOT Analysis Urban Forestry Community SWOT Framework*

#### Questions for the Urban Forestry Community SWOT Framework

The UFC SWOT framework revolves around the three principles of urban forest management posited by Clark and others (1997); (1) the vegetated or physical resources comprised of trees, flora, and fauna that are the urban forest, (2) the community framework of individuals, groups, businesses, agencies and other partners involved with urban forestry, and (3) the resource management systems that allocate how time, money, and personnel are distributed toward the urban forest.

The level of success with SWOT implementation is directly impacted by the strength and organization of identified factors. Strong factors will (a) be specific and provide details that are easily understood by all stakeholders, (b) be prioritized to provide a focused engagement plan over time, (c) include ways to measure successful engagement and (d) be revisited as people and conditions change over time.

The following questions (grouped by urban forest management principals) are meant to encourage and inspire stakeholders to seek out meaningful solutions to the most important topics related to their own experiences.

#### 1. Trees, Forests, and Related Natural Resources

- Are existing trees providing the greatest possible benefits?
- Are the trees in my community of diverse ages and species?
- Do native species represent a prominent proportion of overall tree composition?
- Is there access to affordable and adequate tree planting stock to support community goals?
- Are trees that die replaced quickly and adequately?
- Are there locations where trees could be planted but are currently vacant?

#### 2. Community Outreach and Education

- Do groups involved with urban forestry communicate and/or collaborate?
- Are private land owners (especially large holders) involved with urban forest planning and activities?
- Is there involvement among other (non-forestry focused) key environmental groups?
- What level of participation do other (non-forestry related) community citizens engage in forestry activities?
- What is the level of interaction among all groups in the community and greater regional area?
- Are groups involved with tree planting planning and activities? Which groups?
- Are groups involved with providing information about the benefits of trees? Which groups?



### 3. Management

- Is there a management plan guiding urban forestry actions?
- If so, are the plans understood and utilized by groups working with the urban forest resources?
- Are available funds adequate to meet the urban forestry needs?
- Are there typically enough people to perform the tasks necessary?
- What tools are available for assessing and understanding urban forest extent and potential?
- What guidelines are available for community-based tree planting and maintenance?
- Are protections (i.e. ordinances, regulations, and other institutions) adequate to preserve current forest extent and health?
- Is information about tree protections (i.e. ordinances, regulations, and other institutions) distributed adequately to reach groups working with the urban forest?





#### IV. Questionnaire

See next page for the questionnaire. This is a resource for DC DDOT Urban Forestry Administration, Casey Trees, volunteers, community groups, and others when conducting the protocols laid out in this project. There are two components, and each can be adapted for specific intents or to assess existing forest conditions or changes in canopy instead of planting potential.

1. A simple checklist to use in the field when evaluating tree planting potential at sample sites
2. A "SWOT Analysis" form to list *strengths, weaknesses, opportunities, and threats* about the community forest

# Questionnaire for i-Tree Canopy Demonstration Project

This is a resource for DC DDOT Urban Forestry Administration, Casey Trees, volunteers, community groups, and others when conducting the protocols laid out in this project. There are two components: a simple checklist to use in the field when evaluating tree planting potential at sample sites (1), and a "SWOT Analysis" form to list *strengths, weaknesses, opportunities, and threats* about the community forest (2). Each can be adapted for specific intents or to assess existing forest conditions or changes in canopy instead of planting potential. For more details, see the **Demonstration Project Assessment Report**.



## Field Verification of Planting Suitability

At each sample site, enter the requested information based on the template and example responses in gray. For this purpose, non-plantable sites (buildings, water, etc.) have already been removed from the sample sites being evaluated.

### Sample Site #:

#### Site Type

*residential (front), residential (back), residential (other), parking lot / commercial (hardscape), parking lot / commercial (landscape), rights-of-way, park (near facilities/amenities), park (open area), intentional open space (not plantable), golf course, school (public), school (private), place of worship, natural area, construction, other.*

#### Plantable?

☐ Yes

☐ No

#### Planting Suitability

☐ Poor

☐ Fair

☐ Good

☐ Excellent

#### Reason There Is Not a Tree

*apathy, monetary resources, transitional area (construction), trees already present, other/existing landscaping present, infrastructure conflict, mortality (not replanted), other.*

#### Action Needed to Plant

*education land owner, add to UFA vacant planting sites list, provide free tree program (e.g. River Smart Homes), organize a volunteer group, strengthen tree policies, improve monitoring / enforcement, remove impervious surfaces, other.*

#### Impedance(s) to Planting

*safety, views, industrial use, infrastructure or utility conflict, regulated landscape, sufficient trees/landscaping, limited soil volume / growing space, ecological (wetland), other.*

#### Notes/Comments

Enter site information on the following pages.

## Site #1:

Site Type

Plantable?

☐ Yes

☐ No

Planting Suitability

☐ Poor

☐ Fair

☐ Good

☐ Excellent

Reason There Is Not a Tree

Action Needed to Plant

Impedance(s) to Planting

Notes/Comments

## Site #2:

Site Type

Plantable?

☐ Yes

☐ No

Planting Suitability

☐ Poor

☐ Fair

☐ Good

☐ Excellent

Reason There Is Not a Tree

Action Needed to Plant

Impedance(s) to Planting

Notes/Comments



### Site #3:

Site Type

Plantable?

☐ Yes

☐ No

Planting Suitability

☐ Poor

☐ Fair

☐ Good

☐ Excellent

Reason There Is Not a Tree

Action Needed to Plant

Impedance(s) to Planting

Notes/Comments

### Site #4:

Site Type

Plantable?

☐ Yes

☐ No

Planting Suitability

☐ Poor

☐ Fair

☐ Good

☐ Excellent

Reason There Is Not a Tree

Action Needed to Plant

Impedance(s) to Planting

Notes/Comments

## 2

## SWOT Analysis Factors & Responses

Provide SWOT responses for all sites in your community forest that were evaluated. Enter responses in the four categories at each sample site if possible. Not all sites need to elicit a response for all four SWOT categories. Sample "SWOT factors" (aka, questions) are provided below.

**Definition:** A SWOT analysis is a method for determining and reviewing internal and external forces that impact efforts to meet a specific objective among diverse stakeholders. SWOT employs a series of questions to solicit information and opinions from individuals and groups involved.

Optional: SWOT responses can be categorized into three sustainability categories – the **vegetation resource** (the physical makeup of the community forest), **community framework** (individuals, groups, businesses, agencies and other partners involved with urban forestry), **and resource management** (how time, money, and personnel are distributed toward the urban forest).

### Sample SWOT Factors/Questions:

#### Trees, Forests, and Related Natural Resources

- *Are trees providing the greatest possible benefits, are they diverse in age and species?*
- *Do native species represent a prominent proportion of overall tree composition?*
- *Is there access to planting stock and are trees that die replaced quickly and adequately?*
- *Are there locations where trees could be planted but are currently vacant?*

#### Community Outreach and Education

- *Do groups involved with urban forestry communicate and/or collaborate?*
- *Are private land owners involved with urban forest planning and activities?*
- *Is there involvement among other (non-forestry focused) key environmental groups?*
- *What level of participation do other (non-forestry related) community citizens engage in forestry activities?*
- *What is the level of interaction among groups in the community or region?*
- *Are groups involved with tree planting planning and activities? Which groups?*

#### Resource Management

- *Is there a management plan guiding forestry actions, if so is it understood/utilized?*
- *Are funds and staff adequate to meet the urban forestry needs?*
- *What tools are available for assessing/understanding urban forest extent and potential?*
- *What guidelines are available for community-based tree planting and maintenance?*
- *Are protections (i.e. ordinances/regulations) adequate to preserve forest extent and health and do they reach groups working in the community forest equitably?*

Enter SWOT responses on the following page.

## SWOT Analysis Responses:

---

Strengths:

---

Weaknesses:

---

Opportunities:

---

Threats:





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**REPORT #3:**

**BEST PRACTICES FOR AERIAL IMAGE  
INTERPRETATION AND I-TREE CANOPY  
ASSESSMENT**

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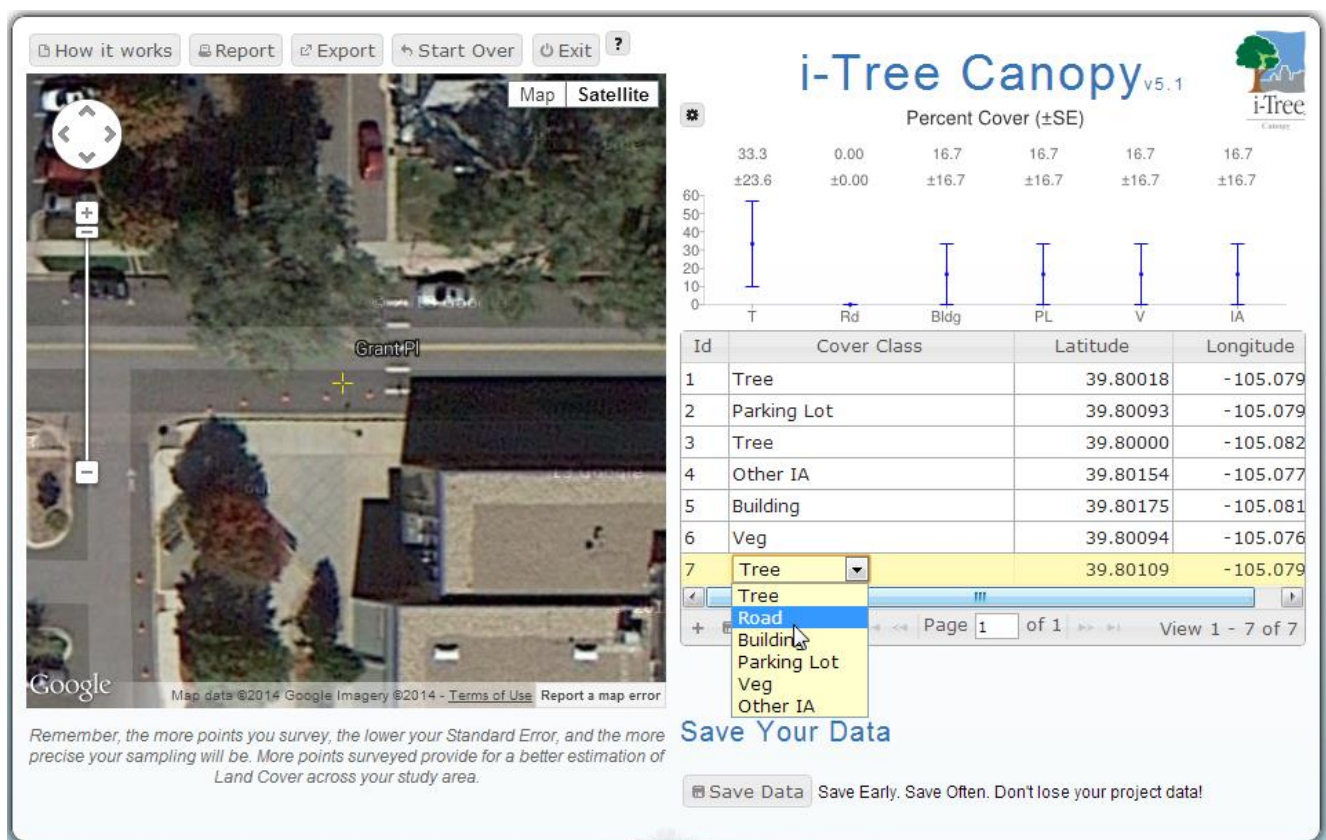




# i-Tree Canopy

## Overview

[i-Tree Canopy](#)® is a free, web-based tool that is part of the i-Tree suite of software developed by the U.S. Forest Service. i-Tree Canopy combines a Google Maps® base map with a data spreadsheet to estimate the area of different land cover types in a study area and continually assess statistical error. The tool, along with other i-Tree tools, is publicly available for free at [www.itreetools.org](http://www.itreetools.org). When used creatively, i-Tree Canopy can reveal much more about a community than just basic land cover statistics, as this guide will show.



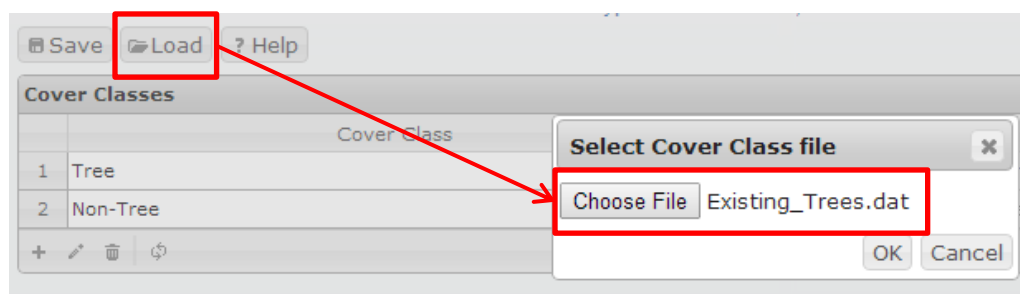
## Using i-Tree Canopy

The U.S. Department of Agriculture (USDA) has produced a series of how-to videos, published on YouTube. These simple demonstration videos walk the user through the i-Tree Canopy application.

The following i-Tree Canopy demonstration videos are available:

- 1.) [Overview Video](#):
  - a. Explains intent and goals for users (community members, planners, etc.)
- 2.) [Define Project Area Video](#):
  - a. How to use the "Draw" tool to draw your project area of interest.
- 3.) [Cover Class Set Up Video](#):
  - a. How to develop your classes from scratch.

NOTE: To use the i-Tree Canopy Existing Trees or Plantable Space classifications developed for this project, upload the *ExistingTrees.dat* or *PlantableAreas.dat* files to i-Tree Canopy during Step 2 "Configure and Begin Your Survey". When asked to develop your cover classes, click the Load button, and select the desired .dat file provided.



- 4.) [Classify Sample points Video](#):
  - a. How to begin the project classification.
  - b. How the program works (random point classification).
  - c. How to save data and where it is archived.
- 5.) [Prepare Reports & Save your Data](#):
  - a. How to complete the classification and create your report (tabular and graphic format).
  - b. How to save your data by exporting to a Microsoft Excel spreadsheet.
- 6.) [Tree Cover change](#):
  - a. How to compare your project with historical imagery in Google Earth by exporting points into a .kmz file and importing the file into Google Earth.

For more information, visit the [i-Tree Canopy landing page](#).

# Best Practices for Aerial Photo Interpretation

## Introduction to Aerial Photo Interpretation

Photo interpretation is the act of examining photographic images to identify unique objects on a landscape. In i-Tree Canopy, the user must first identify the object that the point falls on. Then, the user must classify the object according to the classification scheme being used. To get the most useful results, the land cover at each point must be analyzed in the context of its placement in the urban landscape. For instance, a point may fall on a grassy area. Without the context of the surrounding area, the user would be inclined to call this point a plantable area. However, using context, the user can see that this vegetation is in a median in the middle of a busy road, and the location would not be suitable for planting a tree.

## Examples of Common Urban Land Cover in Aerial Photos

### Trees (general)



Each of these crosshairs falls on a tree crown. Trees are often identified by their color and texture (A, B, C). Shadows are also important when identifying trees (D, E, F).



## Small Trees



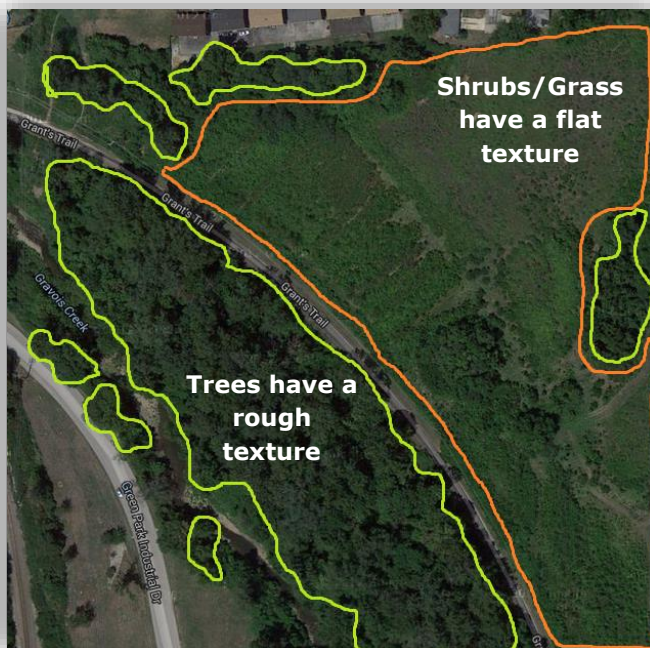
Each of these crosshairs falls on a small tree. Small trees are often identified by their shadow (A, B, D, E). They can also be identified more easily if the interpreter knows which types of sites are more likely to contain small trees (new development or construction, street right-of-way, or parking lots without existing large trees). Tree infrastructure such as planting rings or a row pattern may also give away the location of a small tree (A, C, D, E).

## Trees vs. Shrubs

Distinguishing between trees, shrubs, brush, or grass can be difficult, even for the experienced photo interpreter. There is a certain amount of gray area, even when observing a plant on the ground, as to what constitutes a tree versus a shrub. In general, a tree's height is its defining characteristic, and any vegetative object over three meters (10 ft.) in height can be called a tree. Like all photo interpretation, determining whether an object is a tree or a shrub relies on a convergence of evidence and not any one single piece. Size, texture, shadowing, and location all play a role in making this distinction.

### Tree or Shrub? Tips & Tricks

- ✓ Trees very often have significant shadows. The presence of a significant shadow signifies that a vegetative object is almost certainly a tree.
- ✓ Not all trees have shadows though! The absence of a shadow doesn't always mean it is not a tree.



- ✓ Size is important, too. Individual trees are larger than shrubs and trees often grow in stands or groups. Shrubs or thickets of shrubs are usually smaller in area than a tree or tree stand.
- ✓ Trees usually have a rougher or well-defined texture in aerial photos than shrubs or grass which tend to be blotchier with soft edges.



- ✓ Sometimes it is difficult, and you must use your best judgment to delineate edges of shapes. Look for subtle changes in texture and tone. Pull your eyes back, and look at the whole area before deciding what the land cover is at one certain point!



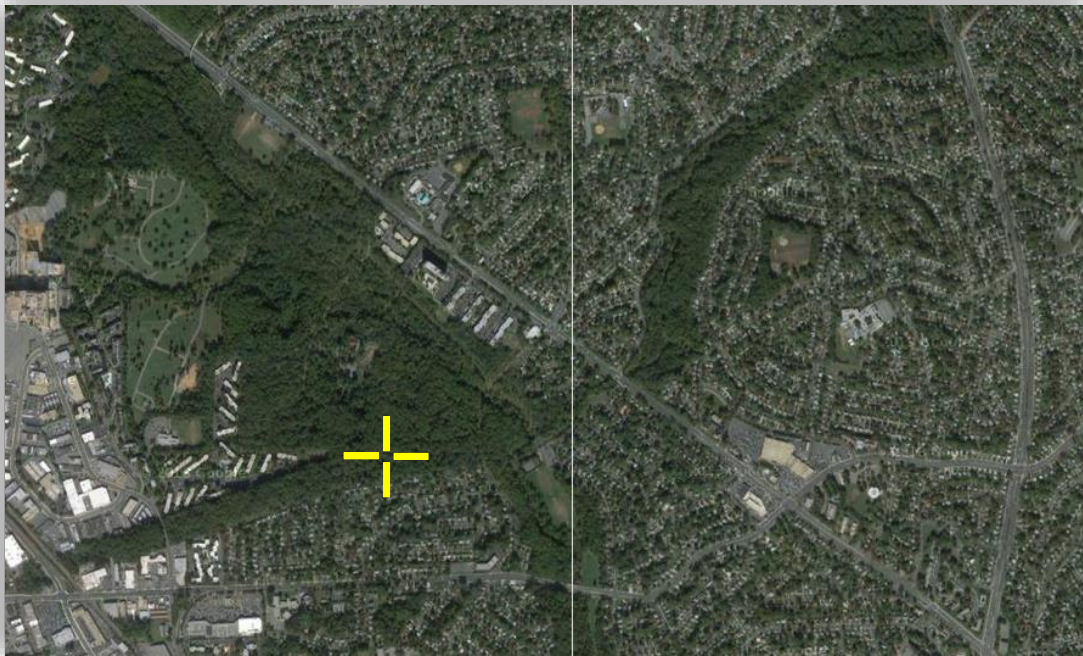


### Wetlands/Riparian

The presence of a waterbody, such as a stream, river, pond, or lake, or a wetland area has a significant effect on tree resource management. Identifying these areas on a photo can be done with practice. Some things to consider are:



- ✓ The point above can be quickly identified as a tree. However, it is not until you pull back and look at the broader scale of the point, as shown below, that you can see it has a unique attribute.

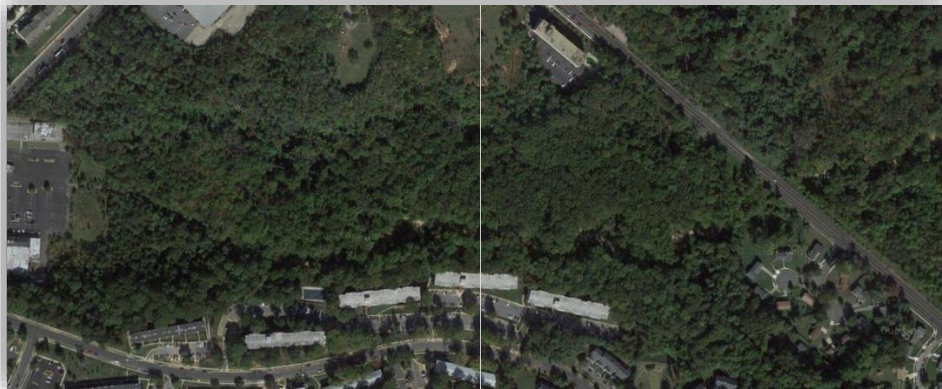


- ✓ When the map is zoomed out, two stream corridors become visible, and it becomes obvious that the point lies in a riparian area.

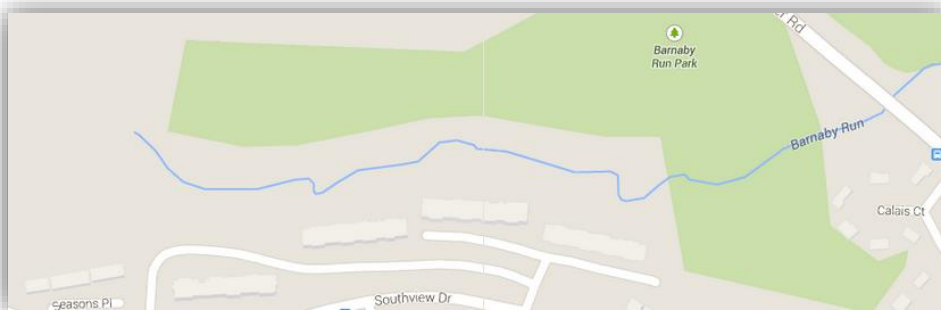




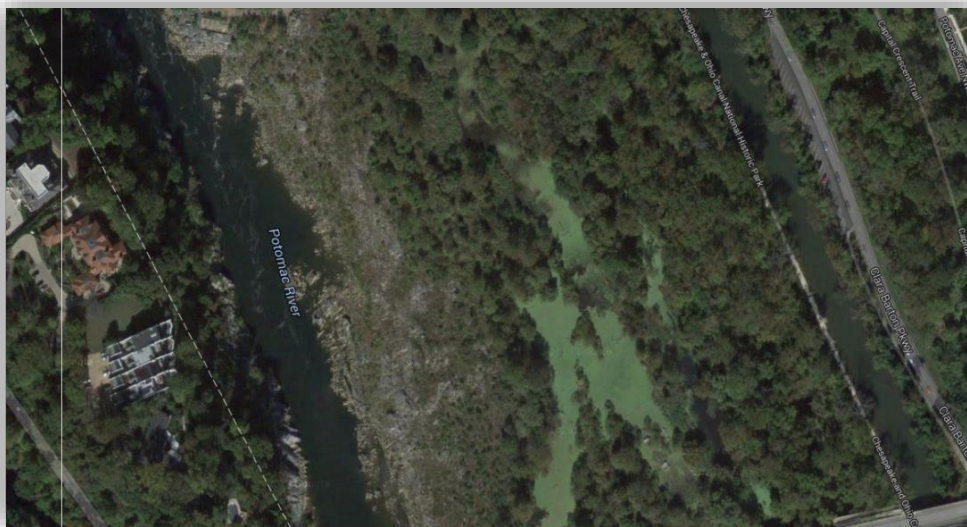
- ✓ The area outlined in blue is adjacent to a river, has few trees, dark discolorations on the ground surface, and small ponds. These are all good indicators that this area is a wetland.



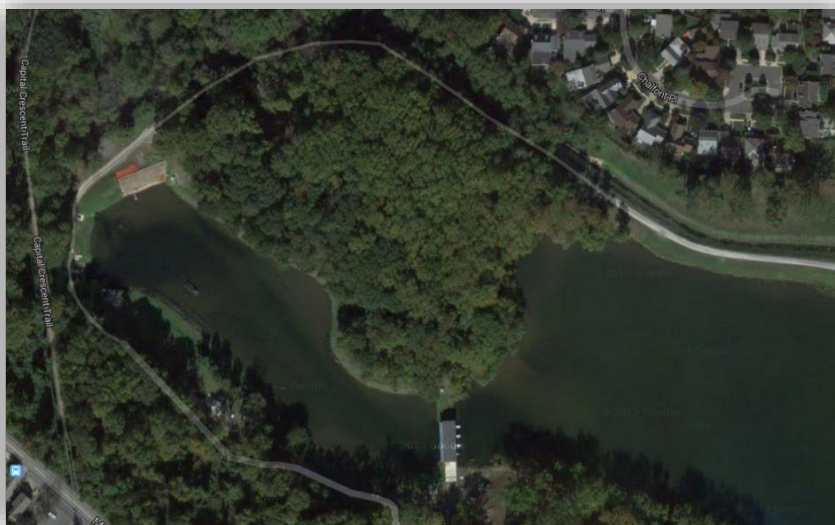
- ✓ A curved gap in the trees that is **not** a road is probably a stream (photo above, map below).







- ✓ Low-lying areas near a significant water source



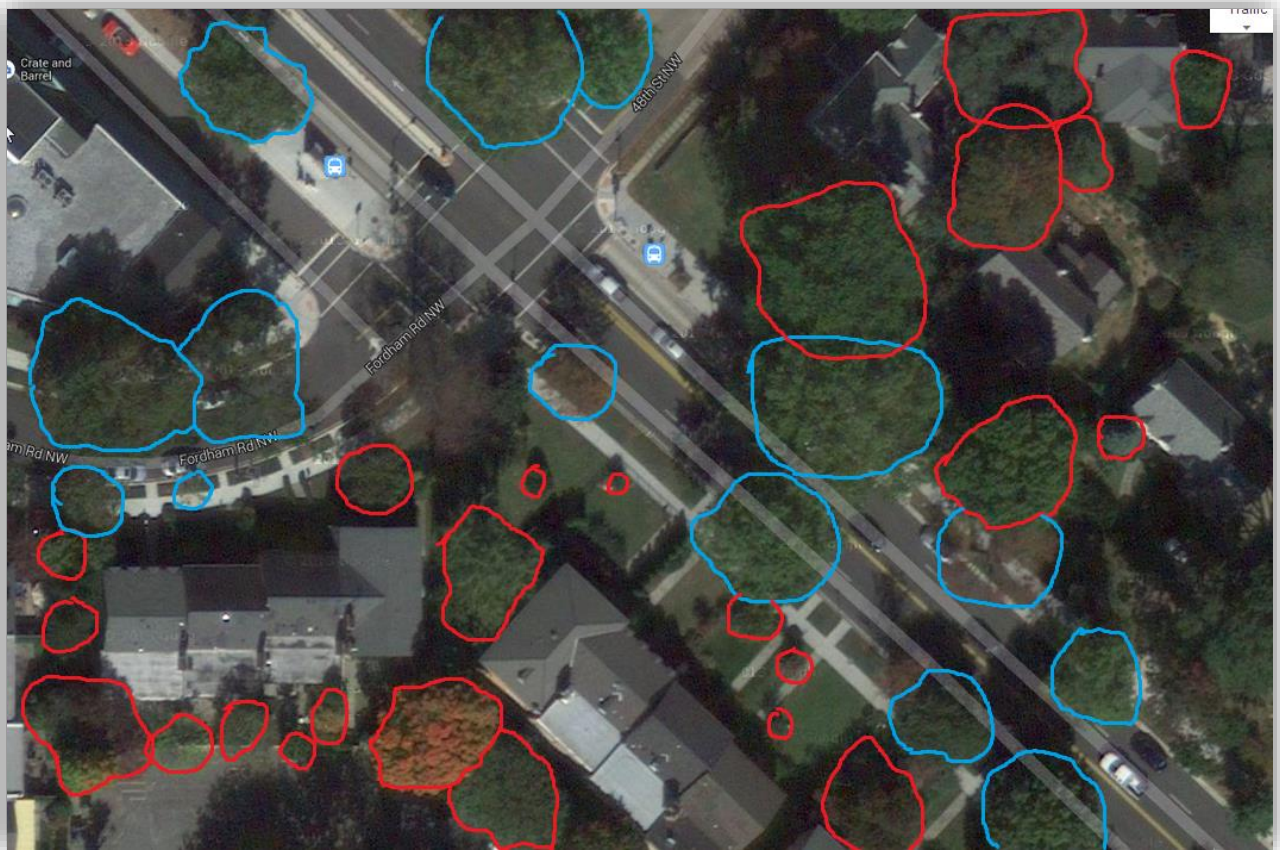
- ✓ Manmade water features, such as a dam, can also create riparian habitat.



## Public vs. Private

Determining public vs. private ownership of a site plays an important role in analyzing many aspects of resource management. Some things to consider when determining public vs. private ownership are:

- ✓ Street Right-of-Way: Streets, sidewalks, and medians are public property.
  - In general, the line between public property and private property is 5-10 feet beyond the furthest pavement (sidewalk or edge of street when no sidewalk exists).
- ✓ Parks and schools are typically public property.
- ✓ A tree's ownership is based on where the trunk hits the ground. However, local regulations about public trees with crowns overhanging private property (and vice-versa) vary. Check local regulations and bylaws before making management decisions about trees in these areas.



- ✓ In the picture above, crowns of public trees are outlined in blue and crowns of private trees are outlined in red.



## Summary of Interpretation Practices

When identifying objects from an aerial perspective, it can be helpful to remember the seven general practices below, along with those described in the previous sections. Using many or all of these practices will increase the chances of correctly classifying land cover in any situation.

1. Size
2. Shape
3. Shadow
4. Color
5. Texture
6. Pattern
7. Context

### ***Size:***

If a scale is available, then the size of an object is relatively easy to estimate. If no scale exists, try comparing it to an object of known size like a car or a sports field. Knowing the size of an object will help you better interpret what the object could be.

### ***Shape:***

As mentioned in the sections above, the shape of an object is crucial to determining what it is. For example, very rarely in nature do straight lines and right angles exist. Perfect-looking geometry is often an indicator that the object is manmade. However, the opposite may not be true. A curved cut through a forested area could be a river or stream, but it also could be a curved road.

### ***Shadow:***

Shadow becomes incredibly important when attempting to differentiate between shrubs and trees. Typically, trees will cast large shadows and shrubs will not. As a good practice, one of the first things that should be done with aerial imagery is to determine which way or at what angle the shadows are facing in a particular area. This will help with the overall understanding of the imagery and provide insight into better identifying objects.


Oftentimes, imagery over a large area is taken at different times of day. For example, imagery from one side of the city may have been collected in the morning and the other side collected in the afternoon. This means that when viewing different areas of the city, the shadows may change direction. This may or may not be an issue with the data that is being analyzed, but it is a good thing to be aware of.

### ***Color:***

Be sure to consider the color of an object when identifying objects. This can be as simple as making note of different shades or tones of color. As always, it is best not to classify an object based solely on color. For example, imagery during leaf-off months (fall through the beginning of spring) will show large stands of trees as mostly brown. This can be easily overlooked as dry vegetation if the user is not aware of what season the imagery was collected in.

### ***Texture:***

Texture is important when differentiating between objects that have similar colors or shapes. As mentioned above, one of the most difficult things to do is differentiate between shrubs and



trees. Texture is often the most distinct difference in this case. A rougher texture will normally indicate tree canopy.

***Pattern:***






Be on the lookout for specific patterns in the landscape. Very distinct patterns or “perfect” looking spacing or shape are uncommon in nature. A deliberate looking pattern can be an indication of manmade structures or trees planted for new developments.




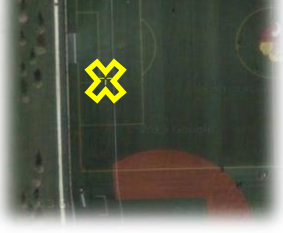
***Context:***

Arguably the most important thing that can be done when interpreting imagery is to be aware of the context of the image. In what geographic region is the imagery? What kind of overall land use is present (is it a major city or rural farmland)? More specifically, does the point fall within a neighborhood or an industrial area? When in doubt, zoom to a larger extent and get a better idea of what is around the point. This will provide invaluable information as to what the point may be.



## Interpretation Examples

Aerial Photo	Land Cover Type	UTC Classification	Notes
	Tree	Individual Yard Tree	<ul style="list-style-type: none"> <li>Privately Owned</li> <li>Energy Conserving</li> </ul>
	Tree	Parking Lot Tree	<ul style="list-style-type: none"> <li>Privately Owned</li> <li>Urban heat island mitigation</li> </ul>
	Tree	Forest Patch - Protected	<ul style="list-style-type: none"> <li>Publicly Owned</li> <li>Protected/Conserved</li> <li>Wildlife Habitat</li> <li>Recreation enhancement</li> </ul>
	Tree	Street Tree	<ul style="list-style-type: none"> <li>Publicly owned</li> <li>Protected by ordinances</li> </ul>
	Vegetation	Wetland – Plantable Area	<ul style="list-style-type: none"> <li>Possible planting area</li> <li>Publicly owned</li> <li>Wildlife habitat</li> <li>Protected/conserved</li> <li>Good site for restoration project</li> </ul>

Aerial Photo	Land Cover Type	UTC Classification	Notes
	Vegetation	Planting Area – irrigated vegetation	<ul style="list-style-type: none"> <li>Publicly owned</li> <li>Easily plantable</li> <li>Pollution mitigation</li> <li>Noise mitigation</li> <li>Street landscaping ordinances</li> </ul>
	Impervious	Planting Area Impervious	<ul style="list-style-type: none"> <li>Privately Owned</li> <li>Sidewalk near parking lot</li> <li>Planting requires tearing out concrete</li> <li>Urban heat island mitigation</li> </ul>
	Vegetation	Unsuitable Vegetation	<ul style="list-style-type: none"> <li>Privately Owned</li> <li>Maintained as a cleared lawn space</li> <li>Owner most likely does not want a tree here</li> </ul>
	Vegetation	Unsuitable Vegetation	<ul style="list-style-type: none"> <li>Publicly owned</li> <li>Maintained as a sports field</li> <li>No trees appropriate here</li> </ul>






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**A DEMONSTRATION PROJECT FOR COMMUNITY-LEVEL URBAN FOREST ASSESSMENT,  
MANAGEMENT, AND ENGAGEMENT IN THE DISTRICT OF COLUMBIA**

**DECEMBER 2016**

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