District of Columbia Urban Tree Canopy Plan

GOVERNMENT OF THE DISTRICT OF COLUMBIA

DISTRICT DEPARTMENT OF THE ENVIRONMENT

green forward

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Executive Summary

In July 2011, Mayor Vincent C. Gray announced Sustainable DC—a planning effort to make the District of Columbia the greenest, healthiest, and most livable city in the nation. One of Sustainable DC's major initiatives is to increase the District's urban tree canopy. The urban tree canopy is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. The District's tree canopy provides many environmental and social benefits, including reduced stormwater runoff and carbon footprint, improved air quality, additional wildlife habitat, savings on energy bills, increased property values, and enhanced quality of life. The District's tree canopy also fosters social and educational opportunities and provides aesthetic benefits to residents.

The Mayor's goal is to increase the District's tree canopy cover from 35 to 40% by 2032. This Plan provides historical context for the tree canopy goal, explains how a healthy tree canopy will benefit the District, and outlines planting targets for different landowner categories.

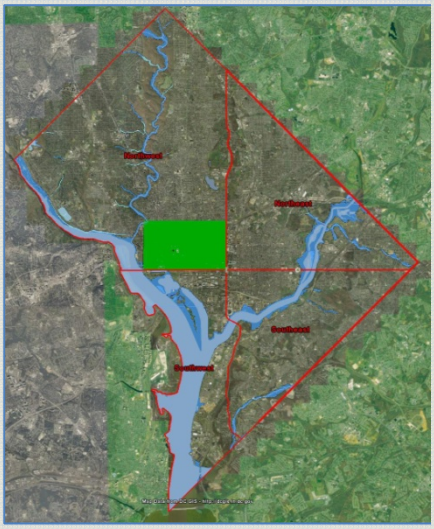

Figure 1: The area in green represents an addition of 5 percent of tree canopy in the District.

This plan also includes an appendix of possible initiatives for meeting the tree canopy goal (Appendix A). This table is by no means a list of every potential restoration activity. It is meant to include the major efforts required to achieve the canopy goal and will be updated regularly as new information and activities come to light. The District will determine the feasibility and implement these action items based on priority and availability of resources, as well as the commitments of other partners.

Achieving a 5% increase in canopy cover by 2032 will not be easy. It will require a sustained 25% increase in tree planting rates district-wide for the next twenty years, shared between District, Federal, and private sectors. The Urban Tree Canopy Plan is being released at a time when budgets are tight and additional funding for new initiatives is scarce. Public investment now in the health, well-being, and number of trees in the District will bring long-term infrastructure improvements that justify the increase. Five percent of additional canopy cover will provide $4.2 million annually in benefits to the District by improving air quality, reducing stormwater volumes, trapping greenhouse gasses, reducing the urban heat island effect, and increasing tourism and property values[1]. This initiative will also stimulate the burgeoning green economy—from entry-level tree planters and landscapers to high level planners, landscape architects, and arborists; creating jobs and a ladder for professional growth and development for District residents.

[1] Based on projections from current tree values published in an i-Tree Ecosystem Analysis - Urban Forest Effects and Values Report for Washington (January 2010)

The District sees the federal government as a vital partner in achieving the canopy goal given that they are a large landholding presence in the District. The federal government owns 33% of District land, private owners have 37%, and the District government owns 30%. Given land ownership distribution in the city, the District must work collectively with various federal agencies to ensure the federal government prioritizes protection of its existing tree spaces and expansion of its tree canopy. This plan articulates how federal partners can join the District in working toward the canopy goal.

Figure 2: Photograph showing the tree canopy in the public parking area.

The initiatives outlined in this document provide a roadmap for achieving the District's 40% canopy goal. Like any roadmap, there are multiple routes that end at the same destination. The District's Urban Tree Canopy Plan does not identify one linear approach. Instead, this plan is meant to be a seed document that will spur initial efforts and further conversation about the best path towards the ultimate goal. The District views this plan as a framework for how residents, the private sector, and government agencies can work collectively toward achieving the canopy goal.

Introduction

One of the reasons people find the District of Columbia so attractive and livable is its trees. Thousands of visitors come to the District each year to witness the cherry blossoms in all their splendor and to stroll along the National Mall with walkways shaded by American elm trees. District residents all have their favorite outdoor spot—whether it is walking the tree-lined boulevards of Connecticut and Minnesota Avenues, picnicking in Rock Creek or Fort Dupont Park, or enjoying a cup of coffee in one of dozens of sidewalk cafes. The one thing that all of these unique and beautiful spots have in common is their trees. It could have been different though if it were not for the vision and actions of a few important figures and the support of the residents of the District of Columbia.

I. Historical Background of Trees in the District of Columbia

The history of the District's trees goes back to its establishment. In the 1790's, George Washington chose the confluence of the Potomac and Anacostia Rivers as the spot for the nation's capital and selected Pierre L'Enfant, a French-born engineer, to design the city. L'Enfant melded what he believed were the best aspects of London, Paris, and Rome in creating his "Plan of the city intended for the permanent seat of the government of the United States.[2]"

Included in this plan were wide tree-lined boulevards and many tree-filled public parks. In fact, even smaller avenues and streets were intended to be planted and have a park-like feel. L'Enfant's vision of a city with wide streets and boulevards has had a lasting impact on the District in many ways. The dramatic changes in the city during and immediately after the Civil War brought a new impetus to improve public space. Both federal and local leaders advocated narrowing the "imperial widths" of District streets by converting parts of the right-of-way into parkland, giving the capital "a leading feature of rare beauty.[3]"

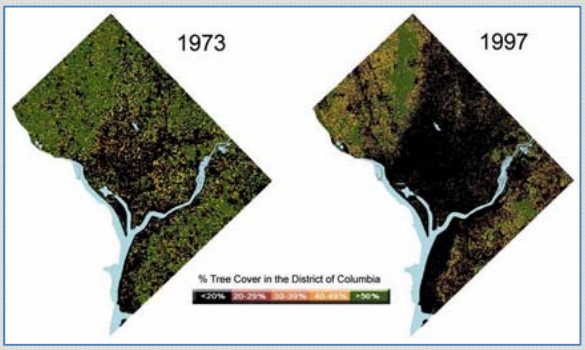

Figure 3: Satellite imagery showing canopy loss from the American Forest Urban Ecosystem Analysis.

The Parking Act, passed by Congress in 1870, designated part of the right-of-way immediately next to private property as a park area to be landscaped and maintained by the adjacent property owner. This area is still referred to as "parking," a term that predates the emergence of the automobile as a dominant part of American culture. The road right-of-way, the area that defines public space, occupies 9,039 acres, over 20% of the District's total land area. Almost half of that area—4,270 acres—is the space between the curb and property line that includes sidewalks and landscaped areas.[4]

[2] Melanie Choukas-Bradley, *City of Trees: The Complete Field Guide to the Trees of Washington, D.C.*, (University of Virginia Press, 2008), 2.
[3] "Public Space: A Defining Characteristic of Washington, DC," District of Columbia Office of Planning, accessed January 15, 2013. http://planning.dc.gov/DC/Planning/Planning%20Publication%20Files/Background.pdf
[4] Chris Shaheen, District of Columbia Office of Planning, email communication, April 20, 2011

During his tenure in the 1870's as Governor of the District of Columbia, Alexander "Boss" Shepherd, made several improvements to the District's infrastructure, from paving roadways to installing sewer systems. In 1872, he directed the systematic planting of 60,000 street trees to improve the quality of life in the nation's capital. Based on Shepherd's actions, the District gained the unofficial title of the City of Trees.[5]

> In 1889, Harper's Magazine proclaimed, "The city of Washington, the capital of the nation, exceeds in beauty any city of the world. The grand conception of the plan of its broad streets and avenues paved with asphalt, smooth as marble, and its hundreds of palatial residences erected in the highest style of art, but above all, its magnificent trees, make it without peer.[7]"

The District's tree canopy has had its ebbs and flows. Before the Civil War, much of the canopy was cut for development or farmland. In the early to mid-1900s, Dutch elm disease and chestnut blight heavily impacted the District's trees and many had to be removed. The cutting of diseased trees prompted President Woodrow Wilson to write Colonel Ridley, who oversaw Rock Creek Park at that time, asking, "Couldn't you give the trees in Rock Creek Park a vacation? I have been distressed by the number I have seen cut down there.[6]" In the 1960s, Ladybird Johnson stepped in to improve the District's declining open spaces by creating the Committee for a More Beautiful Capital, which worked tirelessly to make improvements to parks by planting trees, flowers, and shrubs.

As the District's population declined in the '70s, '80s and '90s, so did tax revenues. With a smaller tax base, the District had less money to spend on infrastructure—including trees and open spaces. The effect of this lack of investment became clear in 1999 when the Washington Post ran an article detailing the District's dramatic loss of tree canopy. The impact of the article was immediate and pervasive. The Mayor at the time, Anthony Williams, was moved to action and his leadership jump-started the city's tree planting and preservation efforts by reinvigorating the District Department of Transportation (DDOT) and approving the District's first tree ordinance.[8]

The urgency to increase urban tree canopy in the District continued under the Administration of the next Mayor as well, Adrian Fenty. During his administration, the Urban Forestry Administration (UFA), a division of the Department of Transportation, planted over 4,150 trees a year and employed innovative techniques to maintain existing street trees and keep them healthy in the difficult living conditions found on urban streets. *The District of Columbia UTC Report, A Report on Washington, DC's Tree Canopy*, was released in early 2009 by UFA. This analysis established the District's existing tree canopy at 35%. Using this data, Mayor Fenty established an urban tree canopy goal of 40%. Casey Trees followed this announcement by setting 2035 as the date for achieving this goal, a target the District adopted as well. More recently, Mayor Gray

[5] Choukas-Bradley, *City of Trees*, 5.
[6] Wilson, Woodrow. Letter to Colonel Ridley, General Correspondence file, Public Buildings and Grounds Records, April 22, 1920.
[7] C. Lanham, "The Tree System of Washington," *Harper's Magazine*, 1926, 19.
[8] Choukas-Bradley, *City of Trees*, 8.

increased this ambitious goal by moving the date from 2035 to 2032 in his *Vision for a Sustainable DC*. This Urban Tree Canopy Plan is an effort to detail steps to achieve this goal.

The complete history of the District's trees is longer and far more complex than can be documented here. It involves dozens of organizations, hundreds of paid staff, and thousands of volunteers and District residents. Government agencies such as the Office of Planning, the Urban Forestry Administration, the National Park Service, the National Arboretum; non-profit organizations such as Casey Trees and Washington Parks and People; and the dozens of small groups such as Trees for Georgetown and Capitol Hill have played a critical role in protecting, preserving and expanding the city's tree canopy. The thousands of individual actions taken by District residents have also been vital. Their combined efforts volunteering to plant trees in city parks, removing invasive ivy from tree trunks, watering street trees, and maintaining trees and landscaping on their own property certainly add up to more time and labor than all those paid to care for the District's trees. As will be demonstrated in later sections, for the District to attain its urban tree canopy goal it will have to build upon its rich history and redouble its efforts to create a new chapter for the City of Trees.

Figure 4: Haze in the District on a summer day.

II. The Benefits of Urban Tree Canopy

As noted in the previous section, the District has a rich tree history. There is an abundance of anecdotal evidence that trees have beautified the District, helped draw tourists, and been a positive asset to residents. However, the myriad benefits trees create have also been quantified. It is important to calculate these benefits to show that trees are not only objects of beauty to be planted and cared for when times are good and government and individual budgets are in the black, but also assets vital to our collective health and well-being. As the City of Trees, the District appreciates that trees are an essential component of the urban infrastructure that provide concrete benefits to the environment, reduce property owner and city government expenditures in many ways, and improve property values.

Trees Improve Air Quality

The air within the Washington Metropolitan Area does not meet federal air quality standards for ground level ozone and particulate matter. Although the ultimate way of improving the area's air quality is to reduce emissions of these pollutants, trees have been shown to be effective for removing air pollution. Trees remove gaseous pollutants by absorbing them with normal air components through the stomates in the leaf surface.[9] Furthermore trees can reduce street level particulate matter by 60%.[10] Based on an Urban Forests Effects Model (UFORE) analysis, District trees remove 490 metric tons of air pollution per year; a benefit that is valued at $3.7

[9] International Society of Arboriculture, "Benefits of Trees," *Tree Care Bulletin*. (International Society of Arboriculture, 2004).
[10] Dr. Kim D. Coder, "Identified Benefits of Community Trees and Forests" (University of Georgia Cooperative Extension Service Forest Resources Unit Publication FOR96-39, October, 1996).

million per year in reductions of air pollution related health care spending. Specifically, District trees are estimated to remove the following pollutants annually:

- 23 metric tons of carbon monoxide ($32,000 value);
- 65 metric tons nitrogen dioxide ($645,000 value);
- 196 metric tons of ozone ($1.9 million value);
- 66 metric tons of sulfur dioxide ($160,000 value); and
- 140 metric tons of particulate matter ($928,000 value).

In addition to improving local air quality, trees are effective at removing carbon dioxide (CO_2) from the atmosphere, an important greenhouse gas. Trees act as a carbon sink by capturing CO_2 from the atmosphere and using it to form carbohydrates that are stored as cellulose in their trunks, branches, leaves, and roots. A single mature tree can store up to 48 pounds of CO_2 a year.[11] Trees also reduce the greenhouse effect by shading and sheltering our homes and office buildings, reducing the amount of fossil fuels needed to heat and cool them.[12] The UFORE analysis found that the District's current tree canopy stores 474,000 metric tons of carbon each year (a value of $10.8 million) and captures an additional 14,600 metric tons per year (an additional value of $334,000).

Figure 5: A riparian buffer along Rock Creek helps water quality.

Trees Improve Water Quality

The main way that trees improve water quality in urban areas is simply by slowing the flow of stormwater. Much of the rainwater that falls in natural environments slowly infiltrates the ground where it is naturally filtered and recharges groundwater. In urban areas, the natural system is interrupted by impervious surfaces which prevent infiltration, such as pavement and rooftops. As a result, rainwater flows quickly off site, picking up pollutants and transporting them directly to local waterways. Planting trees helps re-create the natural system by slowing the flow of stormwater, absorbing water, and increasing groundwater recharge. Trees reduce erosion by trapping soil around their roots to keep it in place. Tree roots also absorb and use nutrients such as nitrogen and phosphorus which are common pollutants from urban streams.[13] For every 5% of tree cover added to a community, stormwater runoff is reduced by approximately 2%.[14]

[11] Mike McAliney, "Arguments for Land Conservation: Documentation and Information Sources for Land Resources Protection" (Trust for Public Land, December 1993).
[12] Stephen H. Broderick and David M. Miller, "Trees, Cities, and Global Warming" (University of Connecticut Cooperative Extension Forestry, 1989) Accessed March 31, 2011. http://www.canr.uconn.edu/ces/forest/fact2.htm.
[13] American Forests, "Trees Tackle Clean Water Regulations." *American Forests Magazine* (Summer 2000). 18–20.
[14] Coder, "Benefits of Community Trees and Forests," (October, 1996).

Trees Save Energy

As already noted, trees shade our houses and offices which, when properly placed, can reduce energy use. The United States Forest Service (USFS) estimates that well-positioned trees can reduce the energy use of a conventional house by 20–25%.[15]

Trees not only reduce energy use by shading, they also lower air temperatures directly around them by transpiring water. The evaporation from a single large tree can produce the cooling effect of ten room-size air conditioners operating 24 hours a day.[16] On a larger scale, trees cool cities by reducing the urban heat island effect. The large amounts of dark paved areas in cities absorb heat during the day and radiate it at night—keeping cities 6–19 degrees Fahrenheit warmer than surrounding forested areas.[17] Trees help shade and cool paved areas—mitigating the urban heat island effect.

Trees are Good for Roads

It may seem on the surface that trees and roads do not go well together. Although roadways can make life difficult for trees, trees have been shown to extend the life of roadways. In direct sunlight the oil that binds asphalt heats up and volatizes making roadways vulnerable to cracking. Tree shade keeps asphalt cooler, reducing the frequency with which streets need to be resurfaced.

Another way that trees benefit roads is by making them safer. Tall trees make streets feel narrower, which slows driving speeds.[18] Conversely, treeless streets create the perception that they are wider, which can lead to higher speeds and more accidents. Street trees also create a buffer between moving vehicles and pedestrians, making sidewalks safer.

Trees are Good for the Economy

The economic benefits of trees are varied and numerous:

- Trees increase productivity of workers;
- Trees reduce worker absenteeism;
- Shoppers spend more time in shops on tree-lined streets; and
- Apartments and office space in wooded areas have higher occupancy and lower turnover rates.[19]

[15] Broderick and Miller, "Trees, Cities, and Global Warming" (University of Connecticut Cooperative Extension Forestry, 1989).
[16] USDA Pamphlet #FS-363
[17] Davis H. Akbari, et al, "Cooling Our Communities: A Guidebook on Tree Planting and Light-colored Surfacing," (U.S. Environmental Protection Agency, 1992).
[18] E. Dumbaugh, "Safe Streets, Livable Streets." *Journal of the American Planning Association* Volume 71 Number 3 (2005): 283-298.
[19] R.J. Laverne and K. Winson-Geideman, "The influence of trees and landscaping on rental rates at office buildings." *Journal of Arboriculture*, Volume 29, Number 5 (2003): 281–290.

Perhaps, because of the higher occupancy rates and greater demand, property values in areas with trees are higher than properties in areas without trees. One study found that trees could add as much as 18% to the sale price of a suburban house.[20]

Trees Create Jobs

Growing, selling, planting, and maintaining trees are big business. For the most part, the jobs created through planting and maintaining trees in the District are local to the region. Furthermore, planting trees creates jobs at all levels—from entry level jobs planting and watering trees to skilled arborist and landscape designer positions.

Trees are Good for Our Health and Communities

Trees seem to have a calming effect on people. Trees improve individual well-being and impact social relations. Different researchers have found that trees offer the following benefits:

- Hospital patients with views of trees recover faster than patients without windows with tree views;[21]
- Areas with more trees can reduce social service budgets by decreasing domestic violence, crime, and child abuse and strengthening urban communities;[22] and
- People who live in areas with more trees have stronger bonds with their neighbors.[23]

Figure 6: UFA arborist inspecting a street tree.

III. Present State of the District's Trees and Existing Efforts to Maintain and Expand Urban Canopy Cover

The District government, non-profits, and city residents have undertaken many efforts to maintain and increase the city's canopy cover. Understanding these actions will help to place the District's Urban Tree Canopy Plan in context.

Analyses of the District's Urban Tree Canopy

Over the past ten years, the District's tree canopy has been studied in depth. These analyses began with the American Forests Urban Ecosystem Analysis in 1999 and continue with the Urban Forestry Administration's Urban Tree Canopy Analysis in 2009. A brief history of these analyses and their findings are found below.

American Forests Urban Ecosystem Analysis

The American Forests analysis was the spark that reignited tree canopy efforts in the District[24]. One can argue that this analysis led to the creation of Casey Trees and to the passing of the City's Urban Forests Protection Act. Some of the findings of this analysis include:

[20] Coder, "Benefits of Community Trees and Forests," (October, 1996).
[21] Coder, "Benefits of Community Trees and Forests," (October, 1996).
[22] W.C. Sullivan and F.E. Kuo, "Do Trees Strengthen Urban Communities, Reduce Domestic Violence?" (USDA Forest Service/Southern Region, Forestry Report R8-FR 56, January 1996).
[23] Sullivan and Kuo, "Do Trees Strengthen Urban Communities," (January, 1996).

- The District's tree canopy declined by 16% between 1973 and 1997;
- Areas with over 50% tree canopy decreased from 37.4 to 13.4% of the city, while areas with only 20% tree canopy increased from 51to 71.8% of the city;
- Tree canopy loss over this time period resulted in a 34% increase in stormwater runoff; and
- The losses in ecosystem services provided by trees (such as cleaning the air and water) were estimated at $1.2 million a year.

Casey Trees Analyses

The non-profit Casey Trees whose mission is to restore, enhance and protect the tree canopy of the nation's capital, has performed several analyses that have aided in understanding the District's tree canopy, its makeup and health, and its economic value. Three of these studies are highlighted below.

Citywide Tree Inventory

In 2002, Casey Trees coordinated hundreds of volunteers to survey the 133,000 existing street tree spaces in the District. Through this effort they collected data including:

- Tree species;
- Health indicators;
- Economic value; and
- Environmental worth.

Figure 7: A Green Summer crew performing street tree maintenance.

i -Tree Studies

In 2004 and 2009, Casey Trees statistically sampled a portion of the District's trees to perform a citywide assessment of the District's tree canopy[25]. By examining approximately 200 plots on private and federal lands, Casey Trees estimated the number, species composition, size constitution, and economic and environmental value of the District's trees. Highlights of this study's findings include the following:

- The number of trees in the city has increased from 1.9 to 2.6 million;
- Small trees (under 6 inches in diameter) have increased from 56.3 to 62.6%;
- The most common trees in 2004 were the American beech, box elder, and red maple. In 2009, the American beech, tulip poplar, and callery pear were the most common; and
- The value of the tree canopy increased from $3.6 to $4 billion, while the pollutant removal of the urban forest dropped from 540 to 492 tons per year.

[24]American Forests Urban Ecosystem Analysis. Accessed January 16, 2013. http://www.systemecology.com/4_Past_Projects/AF_WashingtonDC2.pdf.
[25] Casey Trees Urban Tree Inventory. Accessed January 16, 2013. http://www.itreetools.org/eco/resources/Casey_Trees_UFORE_Management_GUIDE.pdf.

The CapitalSpace Initiative

The District of Columbia Department of Parks and Recreation (DPR), District of Columbia Office of Planning (DCOP), the National Park Service (NPS), and National Capital Planning Commission (NCPC) formed CapitalSpace in 2006 to coordinate existing management plans, maximize limited resources, and create a stronger park system for the District.

The CapitalSpace coalition is also interested in the maintenance, connectivity, accessibility, and overall quality of the green space in the District. It develops spaces for new uses and continues traditional uses for commemoration and public events that are specific to the nation's capital. Since the creation of the partnership, several additional agencies have participated, including the District Department of Transportation, District Department of the Environment, District of Columbia Public Schools, and the U.S. Commission of Fine Arts.

Following an initial assessment of available local and federal parks, CapitalSpace proposed six "Big Ideas"—many of which include the potential for planting new trees and enhancing the existing tree canopy.

Figure 8: An impervious surface removal and tree planting project.

Urban Forestry Administration Existing and Possible Tree Canopy Report

In 2009, the Urban Forestry Administration and the University of Vermont performed a new urban canopy analysis through a grant from the U.S. Forest Service.[26] This analysis used the most recent and highest quality data and techniques. The report found that the District had an existing tree canopy of 35%, the potential to add 32% more tree canopy, and 33% of area not suitable for urban tree canopy.

Possible areas to add urban tree canopy include sites containing non-canopy vegetation, such as grass and shrubs. These sites include military bases, athletic fields, community gardens, residential lawns, and federal and city parks. This requires further review to determine whether they present good opportunities for planting to increase urban tree canopy. Some possible urban tree canopy areas are impervious, containing paved surfaces that might be modified. They require an on the ground review of the land area to determine if tree planting opportunities truly exist. Areas not suitable for urban tree canopy include buildings, local and federal roads, railroads, permanently developed features, and water.

The report also found that residential areas, particularly low and medium density residential areas, had the greatest portion of suitable land for tree planting. The report recommended the following:

[26] Jarlath O'Neil-Dunne, "A Report on Washington, D.C.'s Existing and Possible Urban Tree Canopy" (USDA, National Forest Service and University of Vermont, April 2009), 1–4.

- Focusing planting in areas that have the lowest tree canopy and those with the highest potential for tree canopy growth;
- Planting in and around areas with large contiguous impervious areas where stormwater runoff is the greatest; and
- Looking at large parcels with the potential for large-scale greening efforts.

Urban Forestry Administration Assessment of Urban Forest Resources and Strategy

The 2008 Farm Bill amended the Cooperative Forestry Assistance Act (CFAA) by requiring states to complete a statewide assessment of forest resource conditions and a long-term statewide forest resource strategy. The new requirements were intended to ensure that federal and state programs are targeting shared management priorities and achieving meaningful outcomes. For the state to be eligible to receive CFAA funding, state assessments and strategies had to be completed by June, 2010 and updated every 5 years thereafter.

Both in an effort to meet the CFAA requirements and to build upon the 2009 Urban Tree Canopy report, UFA released *A Report on Washington, DC's Tree Canopy*, in early 2010[27]. The report provides information regarding the background conditions and urban forest trends that are present in the District and outlines three priority issues:

- Increasing urban canopy across all District ownerships;
- Protecting and improving air and water quality; and
- Building urban community forestry program capacity in the District.

Urban Forestry Administration Street Tree Data

The District's Urban Forestry Administration manages and updates a database that includes the location and species of street trees they have planted. The database is housed on the Office of the Chief Technology Officer's website and is updated every two months. The data is free to download or an interactive map is available for viewing on the Casey Trees website[28]. Users can click on each tree to bring up the tree's characteristics in a pop-up window.

Current Efforts to Expand the City's Tree Canopy

Tree planting and tree maintenance in the District of Columbia has grown over the past decade due to the hard work of District agencies and several non-profit organizations. Listing the actions of every group involved in tree planting in the city would be expansive. Instead, this section will highlight the major initiatives that are underway to preserve and expand the District's urban tree canopy.

Sustainable DC

In July 2011, Mayor Gray announced the Sustainable DC initiative—a planning effort to make the District the greenest, healthiest, and most livable city in the nation. This process is still

[27]District of Columbia Assessment of Urban Forest Resources and Strategy. Accessed January 16, 2013. http://fems.dc.gov/DC/DDOT/On+Your+Street/Urban+Forestry/DC+Assessment+of+Urban+Forest+Resources+and+Strategy+-+June+2010.

[28] District of Columbia Street Trees Map. Accessed January 16, 2013. http://caseytrees.org/resources/maps/dc-street-trees/.

ongoing, but in the summer of 2012, the District released its *Vision for a Sustainable DC*. This document, the framework for a more detailed sustainability plan, calls for the District to achieve a 40% tree canopy by the year 2032—three years earlier than the original canopy goal.

It is clear that achieving a 40% tree canopy is a keystone goal for Sustainable DC. Of the nine public working groups established to develop initiatives for the Sustainable DC plan, four identified increasing tree canopy in their top twenty-five recommendations.

Urban Forestry Administration Street Tree Planting

Every year the Urban Forestry Administration (UFA) plants approximately 4,150 trees in the public right of way. A significant amount of work goes into getting these trees in the ground. This work includes identifying open tree boxes, removing dead trees from tree boxes, creating new tree box locations, determining appropriate species for the tree boxes, and prepping the tree boxes for tree installation. UFA also reviews site plans for new development as part of public space permit reviews to maximize tree planting by the private sector.

Urban Forestry Administration Street Tree Preservation

In addition to the work that the UFA does in managing street tree planting, it also works hard to maintain the District's existing tree canopy in the right of way. This work, although often unnoticed, requires a great deal of effort. UFA's tree maintenance work includes the following activities:

- Pruning trees to keep them healthy and remove dangerous limbs;
- Injecting American Elms to keep Dutch Elm Disease at bay;
- Expanding tree boxes for trees that have outgrown their location;
- Managing tree/power line interactions to keep trees healthy and power service secure;
- Watering newly planted trees to ensure their survival;
- Removing dead, dying, or hazardous street trees;
- Citywide storm and emergency response;

Urban Forestry Administration Canopy Keeper Program

It is difficult to maintain the number of new trees the District is planting in the right-of-way. Newly planted trees are especially vulnerable to drought and summer heat in their first

Figure 9: A RiverSmart Homes tree planting being watered.

RiverSmart Homes: The RiverSmart Homes program has reached over a thousand District single family homes to assess the homes and educate District homeowners about stormwater management techniques that can be installed on their properties.

One of the techniques is the planting of canopy trees. In its first year of plantings the program subsidized the planting of 35 trees in the Penn Branch neighborhood. When the program expanded citywide in 2010, 531 total trees were planted across the city. Since that time the District has consistently planted around 500 trees a year through RiverSmart Homes.

The District further expanded the RiverSmart brand in 2011 when it began auditing multi-family buildings. Because the largest space for canopy expansion is on private property, the RiverSmart Homes program will be a key component of tapping into the potential space for urban tree canopy expansion.

two years. To help these trees survive and to protect the District's investment, UFA has started an adopt-a-tree program called Canopy Keepers[29]. Through this program, UFA provides residents who sign an agreement to mulch and water a street tree with free watering bags and instructions on how to properly maintain their tree.

Urban Forest Preservation Act

The Urban Forest Preservation Act was enacted in 2001 to protect and expand the District's tree canopy[30]. This legislation includes a "special tree" provision that establishes mitigation requirements for removal of healthy trees larger than 55 inches in circumference (17.5-inch diameter at breast height) and a schedule of fines for violations. It also includes a fund to provide for tree planting.

American Recovery and Reinvestment Act (ARRA) Funded Initiatives

Tree Canopy Renovation Project

The goal of the Tree Canopy Renovation project was to improve the condition and coverage of the tree canopy so that additional rainfall is intercepted and does not enter the stormwater system. To meet this goal, UFA removed trees that are dead or dying and planted new trees in those open tree boxes. Replacing dead and dying trees that have a limited canopy with newly planted trees with vigorous canopy provides for net canopy increases. This process is dramatically improving the canopy coverage for the combined sewer system area, increasing interception of rainfall and decreasing stormwater runoff.

Figure 10: A worker removing invasive ivy from a mature tree.

Impervious Surface Reduction Project

Prior studies have shown that, in rain events, large amounts of water run quickly over impervious surfaces and enter the combined sewer system at a high rate of speed, frequently leading to combined sewer overflows that empty into the District's waterways. The Impervious Surface Reduction Project removed concrete and other impervious surfaces around tree boxes in the area of the District served by the combined sewer system to mitigate runoff that causes overflows. By removing impervious surfaces, the District increased the soil area for root expansion, intercepted stormwater runoff, and planted larger canopy tree species that provide increased environmental benefits.

The District increased the size of existing tree boxes and linked them to create expanded planting strips. In areas where it was not appropriate to plant trees, UFA created grassed swales.

[29] District Department of Transportation Canopy Keeper Program. Accessed January 16, 2013. http://ddot.dc.gov/DC/DDOT/Services/Tree+Services/Become+a+Canopy+Keeper:+Adopt+a+Tree.
[30] Urban Forest Preservation Act. Accessed January 16, 2013. http://ddot.dc.gov/DC/DDOT/Services/Tree+Services/Tree+Permits/Urban+Forest+Preservation+Act+of+2002.

Green Medians Project

The goal of the Green Medians Project is to demonstrate potential opportunities to reduce the amount of impervious surface in the District and increase stormwater retention by greening existing medians. Impervious concrete will be removed from selected paved medians within the combined sewer system area and retrofitted with amended soils, structural soils, and drought tolerant low maintenance plants. Soil retrofits will have a standard depth of three feet. When appropriate, this project will capture stormwater from District streets and allow it to flow and infiltrate into grass swales.

Casey Trees Tree Rebate Program

Funded through a grant from DDOE, the Casey Trees Tree Rebate Program offers homeowners up to $100 for each tree they purchase and plant[31]. Casey Trees has run this program for four years and found that the majority of trees planted are smaller understory trees.

Casey Trees Community Tree Planting Program

Through this program, Casey Trees provides competitive grants to businesses and communities that apply to plant ten or more trees[32]. The grant includes technical assistance to help applicants determine the proper tree for each planting location, tools and assistance to plant the trees, and of course the trees—all free-of-charge. Approximately 850 trees are planted through this program annually.

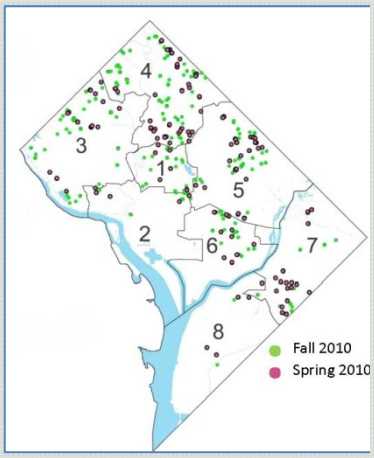

Figure 11: A map of RiverSmart homes tree planting in 2010.

District Department of the Environment RiverSmart Homes Program

RiverSmart Homes is an incentive program that offers homeowners free audits to identify ways they can landscape their property to reduce stormwater pollution[33]. After completing the audit, participating homeowners are eligible for up to $1,200 in landscaping enhancements, which include tree planting. Trees are planted by DDOE's grantee, Casey Trees, at a cost to the homeowner of $50 per tree.

Watts Branch Upland Tree Planting Initiative

As a part of a larger stream restoration effort, DDOE has provided Washington Parks and People with a grant to plant trees on residential land in the Watts Branch watershed. Through this program, homeowners in the Watts Branch watershed can have trees planted on their property free-of-charge. Over a three year period, 600 trees were planted on public and private properties in the Watts Branch watershed.

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[31] Casey Trees Tree Rebate Program. Accessed January 16, 2013. http://caseytrees.org/programs/planting/rebate/.
[32] Casey Trees Community Tree Planting. Accessed January 16, 2013. http://caseytrees.org/programs/planting/ctp/.
[33] District Department of the Environment RiverSmart Home Program. Accessed 16, 2013. http://ddoe.dc.gov/riversmarthomes.

Other Tree Planting Efforts

Several other groups are involved in ongoing tree planting efforts in the District, such as:

- **The National Park Service** plants and maintains trees on National park land. NPS generally plants to replace dead or dying trees, but does not work to expand its existing canopy cover;
- **Trees for Georgetown** is a volunteer group that plants street trees in Georgetown. The group is entirely funded by private donations;
- **Metropolitan Washington Council of Governments** plants trees with a focus on the Anacostia Watershed;
- **Restore Massachusetts Avenue** plants trees along Embassy Row with the help of Casey Trees and
- **PEPCO** provides up to 1,000 trees annually to customers in the District of Columbia.

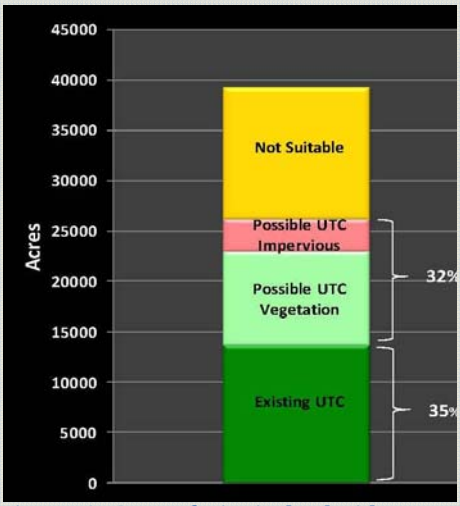

Figure 12: Acres of District land with existing and possible tree canopy, and land not suitable for tree canopy.

IV. Canopy Goal and Rationale

The District adopted the goal of 40% tree canopy coverage by 2032 to set a clear target within its overall efforts to improve air and water quality. This goal was chosen because it is specific, measurable, achievable, realistic, and time oriented. Based on current estimates, the District, Federal agencies, and private property owners will need to plant a total of 216,300 trees over the next 20 years. This amount translates to 10,800 trees per year including current planting efforts. This effort will yield 2,270 acres of new canopy cover over 20 years, which is an average of 114 acres of new canopy cover per year. Based on present conditions, this goal will require all parties—government, non-profit, for profit, and individuals—to increase the trees they are planting and step-up their work to protect and maintain existing canopy trees.

The District's Urban Forestry Administration plants approximately 4,000 trees per year, but also removes roughly 1,500 trees each year for a net gain of 2,500 trees per year. Urban environments are rough on trees, especially with the restrictions on root growth space due to soil compaction and a high percentage of impervious space. Increasing tree canopy cover by five percent over the next 20 years will require not only planting more trees, it will also necessitate that the District improve the maintenance of its existing trees. The process of maintenance and upkeep requires time, money, and commitment. The 40% canopy cover goal will only be achieved by working collectively to create a sound regulatory environment and to provide incentive programs, implementation, maintenance, upkeep, and technical assistance.

The considerable financial investment to increase the tree canopy will not only make the District a more aesthetically pleasing place to visit, it will deliver significant financial and environmental benefits for individual homes and municipal services. By achieving 40% tree canopy cover, the

District will increase pollution removal from 492 to 547 tons per year, carbon storage from 596,000 to 681,000 tons per year, carbon sequestration from 19,000 to 21,700 tons per year, and building energy savings from $3.5 to $3.9 million per year.[34]

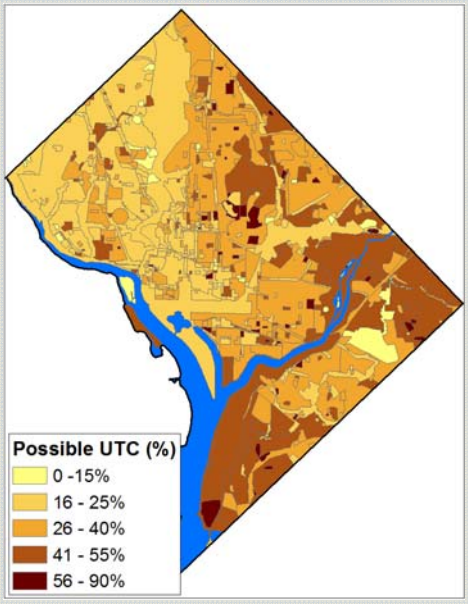

Figure 13: Possible UTC, expressed as the percentage of land area, for U.S. Census block groups.

DC's urban tree canopy goal is achievable over the next 20 years, but it will not happen at the current pace and with the present practices. Public, private, and non-profit sector stakeholders must all work harder, smarter, and be innovate to add 2,041 acres of canopy cover to the District over the next 20 years. Government plays an extremely important role in this effort, but the biggest area where canopy can be added lies in the front and back yards of private residences throughout the District. While District government must create sound rules and policies and provide adequate funding to reach this goal, the individual property owner must adopt this effort and take it to heart. The attainment of this goal does not fall to any one entity. Rather, it requires the collective will and energy of people and agencies across the District.

V. Plan for Achieving the District's Forty Percent Canopy Goal

In 2009, the District's Urban Forestry Administration released a *Report on Washington, D.C.'s Existing and Possible Urban Tree Canopy*. This analysis found that the District's tree canopy currently covers 35% of District lands and that an additional 32% of the District's lands are suitable to have tree canopy cover (see Figure 12). Although it is theoretically possible to have tree canopy over this additional 32 percent of lands, this area includes spaces where it is not preferable to encourage tree canopy, such as sports fields and other spaces that are intentionally left open.

The report found that parks, recreation, open space, low- and medium-density residential properties, and federal lands are the land uses with the greatest potential to support additional tree canopy. The report also identified the existing canopy and potential for increased canopy on District, federal, and residential lands (see Figure 13). Examination of the potential for tree canopy by land use, census block, and ward found that the greatest potential for planting is primarily in areas east of 16th Street, NW (see Figure 14).

Annual targets for the number of new trees (including current planting efforts) and acres of land needed to meet the goal have been apportioned based on the percent of land area for each ownership type (Table 1). Potential action items to increase canopy in each land ownership type can be found in Appendix A.

[34] Casey Trees Urban Tree Inventory.

Table 1: Projected Planting Necessary to Achieve Canopy Goal

Land Ownership Type	Percent of District Land Area	Annual Number of New Trees	Annual Number of New Acres	20-Year Total of New Acres
District	30	3,240	32	681
Federal	33	3,564	36	749
Private	37	3,996	40	840

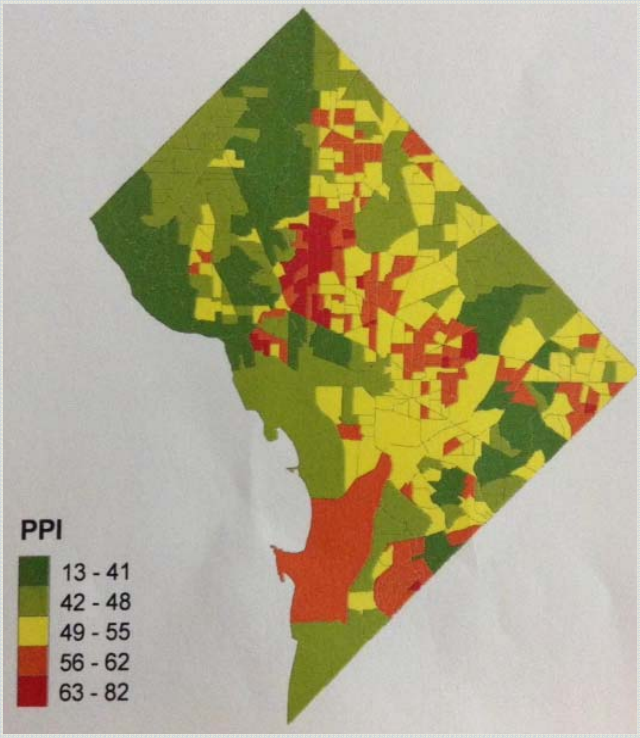

Figure 14: Priority Planting Index (PPI) by census block. Higher PPI numbers represent a higher planting priority.

After apportioning the responsibility for planting by land ownership type, the District developed a three-pronged approach to increase canopy cover on the lands under its control:

1. Maintain existing tree canopy cover. This is crucial because existing small trees will become the future canopy. This approach will be the focus where canopy cover is already greater than 40%.
2. Focus new planting in priority planting areas (see Figure 14). These are areas where an urban canopy analysis has ranked parcels from highest potential to increase canopy to lowest potential (highest existing canopy cover).
3. Strengthen District tree policies and regulations. Strengthening laws and regulations will both help protect existing canopy but also potentially provide additional funding to increase planting in priority areas.

Although the District cannot commit federal or private landholders to this strategy, it will provide them with data and analysis of the tree canopy on their parcels.

Maintain existing tree canopy cover

In current practice, most trees on District lands outside of the right-of-way are only maintained in emergencies. Yet, studies have found that one of the best ways to increase tree canopy cover is to maintain existing trees so that they can grow. In order to maintain tree canopy cover on its lands, the District commits to putting in place a robust tree canopy maintenance program. Tree

maintenance is a crucial first step because it is essential to ensuring that existing small and newly planted trees survive to become the future canopy.

Focus new planting in priority areas

As a part of its UTC analysis, the Urban Forestry Administration is prioritizing planting areas on District lands. This process, which should be completed in the spring of 2013, uses the possible canopy cover data as the base layer and filters it using existing data from pertinent geographic information system (GIS) data layers. Some of the layers being used to prioritize planting may include the following:

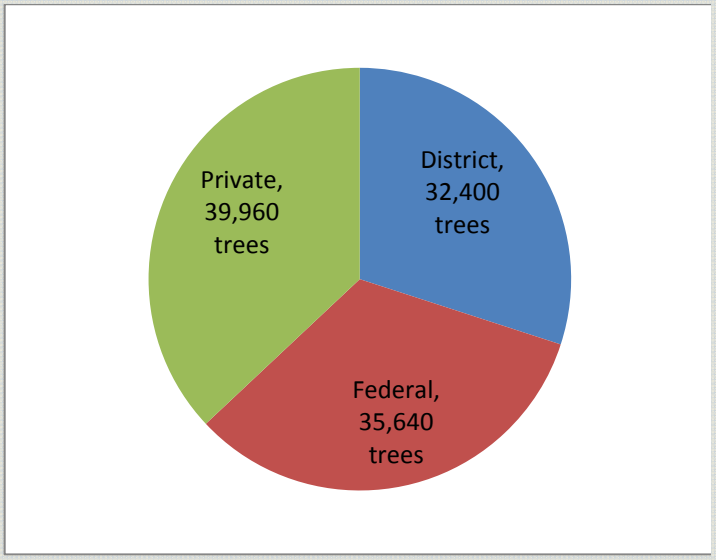

Figure 15: Projected Ten-Year District Tree Planting from the Urban Tree Canopy Plan.

- Sewershed data – to provide details on priority areas in the separate and combined sewer systems;
- Stormwater volume and pollutant data – to focus planting on areas where modeling has predicted the greatest stormwater benefit;
- Landowner parcel data – to provide details on potential for planting to individual landowners;
- Income data – to focus planting where there are disparities in environmental justice; and
- Asthma rate data – to prioritize planting where there may be the greatest health benefits.

The District commits to analyzing GIS data, prioritizing planting areas, and implementing planting efforts based on priority areas. Based on this analysis, grantees and contractors receiving District funds for tree planting may be asked to focus their efforts in priority planting areas. Furthermore, the District commits to providing this data to non-profits, private landowners, and federal agencies to help guide their tree planting efforts. Finally, the District commits to performing a canopy cover analysis every five years and revising its planting priority based on the new data. This analysis will provide the District with the tools to direct funds to accomplish planting on specific parcels, provide direction for maintenance to preserve existing canopy cover, and engage land owners specifically on actions that best suit their parcel's existing status.

The District has developed a list of potential actions to achieve the tree canopy goal (see Appendix A). For each action that involves tree planting, the District has estimated the number of additional trees that would be planted based on the assumption that the District will take responsibility for planting the entire annual target of 10,800 trees. Even though these estimates are based on meeting the target alone, the District believes that the responsibility for planting should be apportioned proportionally to federal and private landholders based on the percent of

land area they own. The District will determine the feasibility and implement these action items based on priority and availability of resources, as well as the commitments of other landowners.

Strengthen District Tree Policies and Regulations
Currently, there are two primary tree laws and regulations: the Tree and Slope Overlay (Zoning Code Chapter 11-15 Miscellaneous Overlay Districts Section 11-1516 Forest Hills Tree and Slope Protection Overlay District, Final Rulemaking published at 54 DCR 4835, 4840 (May 18, 2007)) and the Urban Forest Preservation Act (D.C. Law 14-309; D.C. Official Code §§ 8-651.03(a)(1) and 8-651.07(b)). The Tree and Slope Overlay is a regulation that restricts the number and size of trees that can removed on any given property within a specific geographical area. The Urban Forest Preservation Act does not restrict tree removal, but requires payment of a fee when a healthy tree being greater than 55 inches in circumference is removed.

The District commits to reviewing, improving, and updating tree-related policies, regulations, and standards to provide better tree preservation, greater involvement by the public, increased tree planting opportunities, and additional incentives for improving tree management on private lands.

Conclusions

Gaining 5% in canopy cover over the next 20 years will not be easy. It will require the development of new and innovative programs, additional funding, and sustained leadership in a time of tight city budgets. However, the investment in planting new trees and maintaining those that the District currently has will more than pay for itself through the services that these trees provide. The additional canopy cover will provide $4.2 million dollars annually in benefits to the city by improving air quality, reducing stormwater volumes, trapping greenhouse gasses, reducing the urban heat island effect, and increasing tourism and property values. Furthermore, this initiative will be a stimulant to the burgeoning green economy at every level—from entry-level tree planters and landscapers to high level planners, landscape architects, and arborists; creating a ladder for professional growth and development for city residents.

To successfully achieve a 40% tree canopy, the District will need the aid of landowners and interested parties in all areas of the city. This goal requires the collective work of federal and District agencies, businesses, non-profits, and individual residents; coordinating this effort will be both exciting and complex. The District looks forward to sharing both the journey and the reward with all residents and landowners as it moves towards a greener Washington, D.C.

If you are interested in taking action to help reach this goal, or if you have additional ideas on how to get there, please do not hesitate to contact the Stormwater Management Division at 202-741-2136 or the Urban Forestry Administration at 202-673-6813.

Appendix A: Potential Actions to Achieve the Urban Tree Canopy Goal

Type of Action	Action Item	Trees Planted Annually	Targeted Area		
			District Lands	Federal Lands	Private Lands
Planting	Expand funding for the RiverSmart Homes tree planting program	2,000			X
Planting	Expand the District tree rebate program	1,000			X
Planting	Reduce the stormwater fee and/or property tax for properties that plant and maintain trees	300	X	X	X
Planting	Institute a competitive tree planting grant program aimed at Advisory Neighborhood Commissions (ANCs), Civic & Citizens Associations, and Wards	200	X	X	X
Planting	Pay hydrant converter fees for groups maintaining trees	0	X	X	X
Planting	Encourage the federal government to adopt riparian buffer policies	0		X	
Planting	Undertake social marketing research and launch a tree planting outreach initiative	0			X
Planting	Continue planting street trees through UFA contracts	4,150	X		
Planting	Task District Agencies to Develop Site Specific Tree Planting Plans for District-owned Properties	0	X		
Planting	Craft a large property canopy plan grant program	0	X	X	X
Planting	Create a citywide contest/award for best canopy plan/action	200	X	X	X
Planting	Offer grants for property owners to plant large trees safely back from overhead wires and/or adjacent to impervious areas	300	X	X	X
Planting	Fund targeted upland tree planting and non-recreational space planting efforts	1,000	X	X	X
Planting	Create a large property tree planting grant program	1,200	X	X	X

Type of Action	Action Item	Trees Planted Annually	Targeted Area		
			District Lands	Federal Lands	Private Lands
Planting	Encourage the Army Corps of Engineers to reexamine the Anacostia and Potomac flood walls for conversion to riparian flood zone forests	0		X	
Maintenance	Cull the deer population through work in coordination with NPS	0	X	X	
Maintenance	Create a weed warrior program	0	X		
Maintenance	Remove invasive tree species through a coordinated inter-agency effort	0	X	X	
Maintenance	Subsidize invasive species removal	0	X	X	X
Maintenance	Expand and advertise the District Department of Public Works free mulch for District residents	0			X
Maintenance	Develop outreach materials on: Tree-related laws and policies; Invasive species identification and control; How to choose an arborist; and Specific outreach to landowners adjacent to forested areas	450			X
Maintenance	Institute a unified tree maintenance and tree planting contract for the District	0	X		
Maintenance	Expand the number and role of city arborists at landholding agencies	0	X		
Maintenance	Provide professional development courses	0	X	X	X
Maintenance	Offer scholarships for arboriculture training	0	X	X	X
Maintenance	Create a Canopy Keepers on Public Lands program	0	X		
Maintenance	Integrate the District summer jobs program into tree maintenance programming	0	X	X	X
Maintenance	Amend DDOT's regulations and standards and specifications to where possible adopt larger tree box volumes	0	X		

Type of Action	Action Item	Trees Planted Annually	Targeted Area		
			District Lands	Federal Lands	Private Lands
Maintenance	Maintain all open soil tree boxes and retrofit tree boxes to meet Tree Space Design Manual sizing	0	**X**		
Maintenance	Perform a city-wide tree box analysis to find areas where tree boxes can be expanded and fund the removal of these impervious surfaces	0	**X**		
Maintenance	Study the potential to adopt more street tree friendly de-icing measures	0	**X**		
Maintenance	Expand Urban Forestry Administration's Canopy Keeper program including: An online database; Expanding the program to include outside public right of way (PROW); and Additonal outreach and advertising	0	**X**		
Maintenance	Expand large tree preservation efforts	0	**X**	**X**	**X**
Maintenance	Expand efforts to recruit and train BIDs and Federal Agencies for tree maintenance	0	**X**	**X**	**X**
Maintenance	Develop and maintain a tree planting database	0	**X**	**X**	**X**
Tracking	Perform a tree mortality study	0	**X**	**X**	**X**
Tracking	Perform a District canopy analysis every 5 years	0	**X**	**X**	**X**
TOTAL		**10,800**			