Washington DC's

Urban Forestry Master Plan

2022

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

DEPARTMENT OF ENERGY & ENVIRONMENT

Casey Trees
WASHINGTON DC

"We are well on our way to making Washington, DC the healthiest, greenest, most livable city for all residents."

MAYOR MURIEL BOWSER

Letter from Earl Eutsler

WASHINGTON, DC, situated at the confluence of the Anacostia and Potomac Rivers, possesses an unmatched urban forest. Nestled in the eastern temperate deciduous forest, the District naturally develops rich an abundant forest cover. This resource has supported the lives and wellbeing of residents stretching back to the first inhabitants. Trees and urban forests continue to sustain and support those who call the District home. The combination of private, federal, and District-owned lands ensures robust tree and forest resources are distributed throughout the city. Today, Washingtonians are the beneficiaries of the deliberate decisions made more than 200 years ago to blend the built with the natural, and create a grand and livable city. The L'Enfant Plan, developed in 1791, established remarkably wide public rights of way, a unique urban feature for its time. Additionally, L'Enfant's vision created many small park areas where diagonal avenues intersected the traditional city grid, further integrating greenspace throughout the city. Nearly 100 years later, the Parking Acts of 1870 and 1872 delineated these wide rights of way into dedicated zones for roadways, street trees, sidewalks and linear green spaces buffering private property from the right of way. The combination of remarkably wide streets and avenues with dedicated space for trees, combined with building height restrictions resulted in an urban fabric where the built environment is often dominated by mature trees. Trees and forests were further integrated into Washington, DC with the development of the McMillan Plan in 1902. It is thanks to this plan that we enjoy not only the National Mall as we know it today, but also the network of National Parks and Parkways that circle the entire city. The network of Fort Circle Parks, along with DC's own park resources, provide remarkable access to shared forests and greenspaces throughout the entire city.

More recently, Washington, DC has adopted a goal of achieving an overall tree canopy of 40% by the year 2032. Mayor Bowser has made achieving her vision to "make the District of Columbia the healthiest, greenest, and most livable city for all District residents" a top priority. This plan supports those efforts by outlining the programs, policies, approaches and partnerships in place to help Washington, DC achieve its goal of 40% tree cover, and ensure a thriving and livable community for all residents. Together, we will make the decisions that ensure this resource grows equitably, and supports not only our current needs, but also those of future generations.

Please join with us and our partners, as we work to create an inclusive, connected and engaged urban forest across the District, to be enjoyed by all. Because we strongly believe that a city where trees can thrive is one where our people will too!

Earl Eutsler

Associate Director & State Forester, Urban Forestry Administration, District Department of Transportation

Acknowledgements

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VISION STATEMENT

The vision of the DC Urban Forestry Master Plan is to identify how DC‘s tree canopy and surrounding natural environment can flourish as a sustainable ecosystem that supports a healthy, resilient and inclusive city.

INTRODUCTION

The Urban Forestry Master Plan is the District's commitment to shape a vibrant, healthy, and sustainable urban environment for its residents, workers, and visitors. It outlines how the District can continue to grow, maintain and sustain its tree canopy by providing tangible goals, defined responsibilities and a clear pathway to surpassing the District's 40 percent tree canopy goal. The Urban Forestry Master Plan was developed through collaborative and comprehensive interagency and intergovernmental work. Its aim is to create an inclusive, connected and engaged urban forest across the District to be enjoyed by all.

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SECTION 1

Livable Communities through Urban Forestry

Understanding the District's urban forest begins with recognizing it as the living backdrop of vibrant urban experiences in the nation's capital, asking us to treat it as a national resource worthy of conservation. DC's original design - the L'Enfant Plan - was influenced by European cities, such as Paris and Versailles, where a capital, federal buildings and monuments were constructed so as to seamlessly integrate among the natural features and terrained vistas. Expansive road systems lined with trees connected communities; their stitching broke up the city into neighborhoods, with tree canopy as a defining characteristic and public space in the form of square, medians and urban parks that provided both active and passive recreation opportunities.

In the 1900's the McMillan Commission established a comprehensive recreation and park system and expanded L'Enfant's original plan to reclaim land for waterfront parks, parkways, an improved Mall, and new monuments.

Today, this overhead greenery is maintained through continued collaboration between federal and local government agencies. Their coordinated efforts in the form of urban design, economic development, transportation and historical preservation create blueprints for a modern, livable and prosperous city.

What is Urban Forestry?

Urban forestry is the planting, maintenance, care and protection of trees in an urban or city setting.

Throughout its centuries of existence, Washington, DC has been planned around the concept that an urban forest can be used to not only connect the city, but also the people in it. Beginning in 1791 with the L'Enfant Plan and continuing with Frederick Olmstead, James McMillan and Boss Shepherd, DC's urban design has been centered around its park systems and the open spaces which have become a central part of life for those who live, work and visit the District.

Close to a quarter of DC's land is devoted to parks and open space resources, with the urban forest comprising 2.14 million trees stretching across federal, private and District-owned land. However, DC is unique in that 33 percent of the land within city limits is federally owned, meaning DC does not have jurisdiction over a third of the land within its borders.These constraints have forced the District to work collaboratively with all stakeholders, to develop unified actions for the planting, caring and maintaining of all trees and green spaces within DC. This creative policymaking has allowed the District to develop progressive plans to rehabilitate, preserve and expand its urban tree canopy, including adopting an urban tree canopy goal of 40% by 2032, placing it among ambitious cities like Pittsburgh, Baltimore, Orlando and Boston for urban forestry goals.

Source: Sustainable DC 2.0

DC's Tree Milestones: 1700-Present

1790 Pierre L'Enfant designs the city around trees & greenspaces

1800 Thomas Jefferson plants trees as a response to tree loss from development

1870 Alexander "Boss" Shepherd plants 60,000 trees; DC becomes known as the "City of Trees;" Congress enacts "public parking" provisions

1900 McMillan Commission has American elms planted on the national mall

1912 Yoshino Cherries gifted from Japan in the Tidal Basin

1927 The U.S. National Arboretum was founded as the USDA Ag. Research Service

1960's Tree Division becomes well-known for its cutting-edge tree database

1990's The Committee of 100 advocates for more focus on trees

2000 Mayor Anthony Williams increases street tree budget; Casey Trees gets its start

2001 DC's Tree Division becomes the Urban Forestry Administration

2002 Urban Forest Preservation Act signed into law

2005 DOEE created in part to "establish tree policy" for the District

2013 DC's Sustainability Plan establishes a 40% tree canopy goal

2016 Existing tree laws strengthened; Heritage Tree Protections enacted; maintenance and planting responsibilities on all public lands are consolidated within UFD

2018 DC commits to long-term canopy tracking, ground surveys (Urban FIA)

2022 Urban Forest Preservation Act expanded with protections for DC - owned lands and stronger penalties for illegal tree removal

The City's Urban Forest

comprises over 2 Million trees distributed across public and private lands. Our urban forest improves air and water quality, mitigates flooding, supports wildlife, cools our communities and makes our city more walkable and livable.

1 STREET TREES
There are over 170,000 trees located in the public right-of-way and maintained by the City's Urban Forestry Division. Trees along sidewalks and medians provide shade for pedestrians, reduce heat island effects, and improve air quality.

2 TREES ON PRIVATE PROPERTY
22% of the city's trees are located on private property. The District offers free trees for residents through programs such as RiverSmart Homes.

3 PARKS AND OPEN SPACE
The city's parks include large National Parks, District managed recreation areas, and small neighborhood pocket parks. Regardless their size, each offers health and wellness benefits to DC residents.

4 UNDERSTORY/SHRUBS
Landscaping and plantings along sidewalks and the public right-of-way increase vegetation in the urban environment.

5 WILDLIFE
People aren't the only beneficiaries of our urban forest. DC is home to over 240 species of birds as well as 1000s of animals and insects that rely on urban trees for food and shelter.

Community Benefits of Urban Forestry

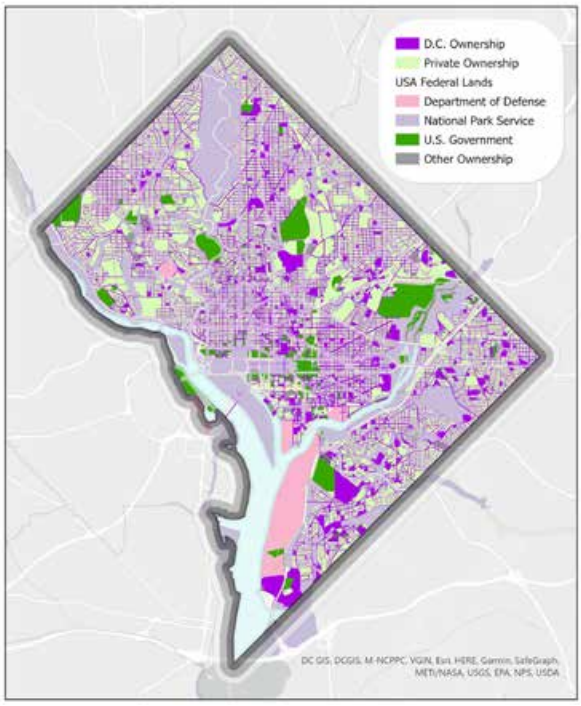
Trees can be a defining feature of a community. However, they do more than beautify, they provide extensive ecosystem services that clean the air and water, as well as other critical public health benefits to our communities.

Per the USDA Forest Inventory Analysis, there are over two million trees in Washington; approximately 440,000 trees are on private land and 1.57 million trees are on public land. Forested areas provide significant ecosystem services, as well as co-benefits for residents across the District.

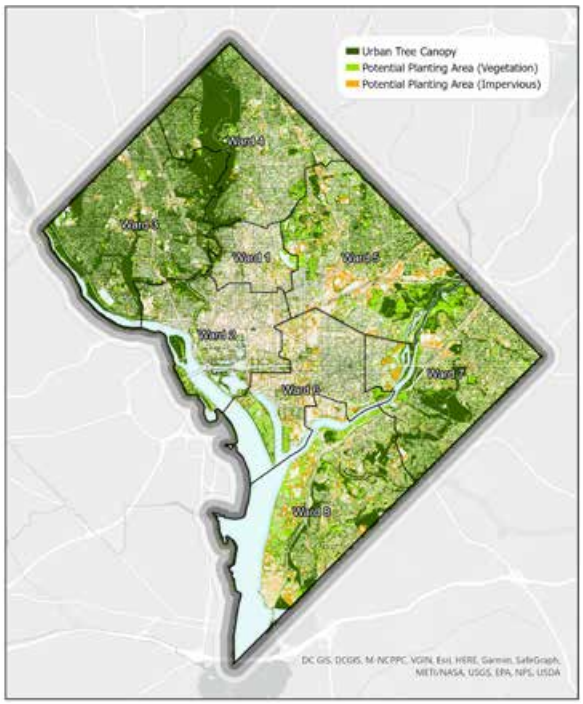
Trees are natural carbon sinks. They uptake carbon dioxide, process and store carbon, and release oxygen. The trees in DC sequester approximately 487,300 tons of carbon, equating to a year's worth of carbon dioxide emissions from over 100,000 passenger vehicles. Source: EPA

The urban heat island effect is a phenomenon in which low-albedo surfaces – such as concrete – absorb heat, causing significantly higher ambient temperatures in areas with more impervious surface cover. Tree canopy coverage mitigates this effect by intercepting sunlight and shading these surfaces. In DC, trees provide $4.33 million in energy savings by reducing the heat island effect, in turn reducing the need for centralized indoor cooling and protecting human health.

Land Ownership



Existing UTC and Potential Planting Areas



Stormwater management is one of the largest water quality concerns for urban areas. In a natural ecosystem, stormwater is intercepted by vegetation or held in soil before it makes its way to bodies of water. In urban areas, impervious ground cover prevents infiltration into soil, and the lack of trees means there is little interception to slow down rainfall. Storm drains become overwhelmed during high-intensity precipitation events, and pollution can enter bodies of water through sewer overflow or stormwater runoff. Trees provide the necessary service of both slowing down precipitation as it falls and intaking it through roots, which reduces the load on stormwater infrastructure and cleans rainwater before it ever reaches waterways. In the District, trees provide 30.13 million cubic feet of surface water runoff filtration capacity.

Trees also provide health benefits, to the tune of 318.2 tons per year of air pollution removed. This can help reduce the aggravating effects of air pollution on people suffering from asthma. The 2018 Health Equity Report estimated that the economic value of avoided human health impacts from pollution removal at $11.4 million per year.

Tree Benefits

ENERGY SAVINGS

$4.2 Million

(Annual savings in residential energy costs)

HEALTH SAVINGS

$11.4 Million

(Annual avoided human health impacts from pollution removal)

WATER POLLUTION REDUCTION

30,000,000 Cubic Feet

(Surface/stormwater runoff diverted from the sewer system annually)

AIR POLLUTION REMOVAL

318.2 Tons

(Atmospheric pollutants removed from the air every year)

CARBON STORAGE

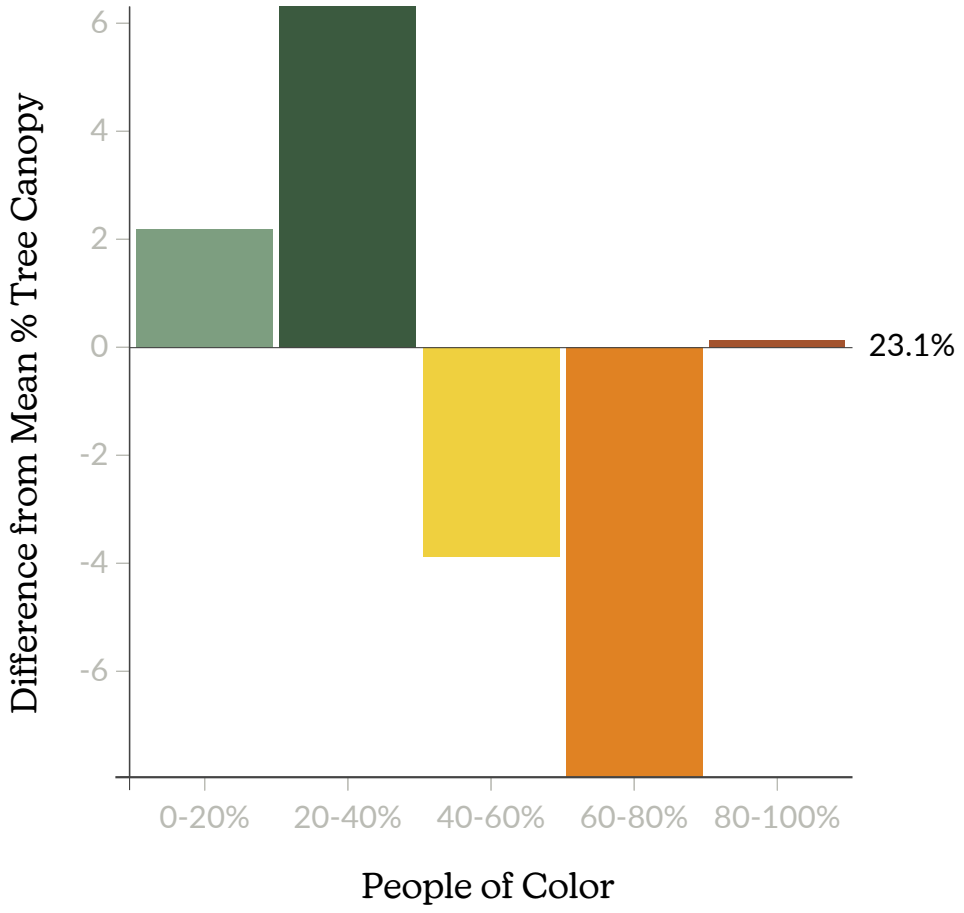
487,200 Tons

(Carbon stored by the city's trees every year)

Environmental Justice and Urban Forestry

Environmental injustice occurs when communities or specific groups are disproportionately subjected to higher levels of environmental risk and the harms associated with poor environmental services than other segments of society. Frequently, this occurs across racial and socioeconomic boundaries. American Forests developed a "Tree Equity Score" for urban areas across the United States. They found that because of decades of redlining and other discriminatory policies, at the national scale, trees are often sparse in neighborhoods with more low-income families and people of color. Neighborhoods that were redlined often have fewer trees, preventing the people living there from reaping the benefits trees provide.

Washington DC received a Tree Equity Score of 90; however, DC is unique in the sense that, while the Ward with the densest tree canopy does also have the highest median household income, the Wards with the next highest canopy cover are also the ones with some of the lowest reported household incomes. Generally speaking, for most of the District, areas with a high percentage of people of color are also the areas with the lowest tree canopy.



Each bar represents the mean tree canopy % for block groups within the specified range of people of color. The amount above or below the thick horizontal line indicates the difference from the area-wide mean canopy %.

Source: Tree Equity Score

Looking Forward

CHANGING WEATHER PATTERNS

Average annual precipitation in the DC area has increased by **5 to 10 percent**
in the last century, but
precipitation from extremely heavy storms has increased by **more than 25 percent**
across the eastern United States since 1958.
–
EPA What Climate Change Means for the District of Columbia

Cherry Tree Blooming Earlier
Then (1931-1960) April 6th
Now (1981-2010) April 1st

Growing season **increased 17 days** over the last 50 years,
meaning longer allergies and higher production of tree pollen.
–
Climate Central - Changing Growing Season

FOOD & AGRICULTURE

11.2% of DC households are food insecure
meaning they lack consistent access throughout the year to enough food they need.
–
Sustainable D.C 2.0 page 83

134 District schools have active school gardens.
–
Sustainable D.C 2.0 page 83

HEALTH

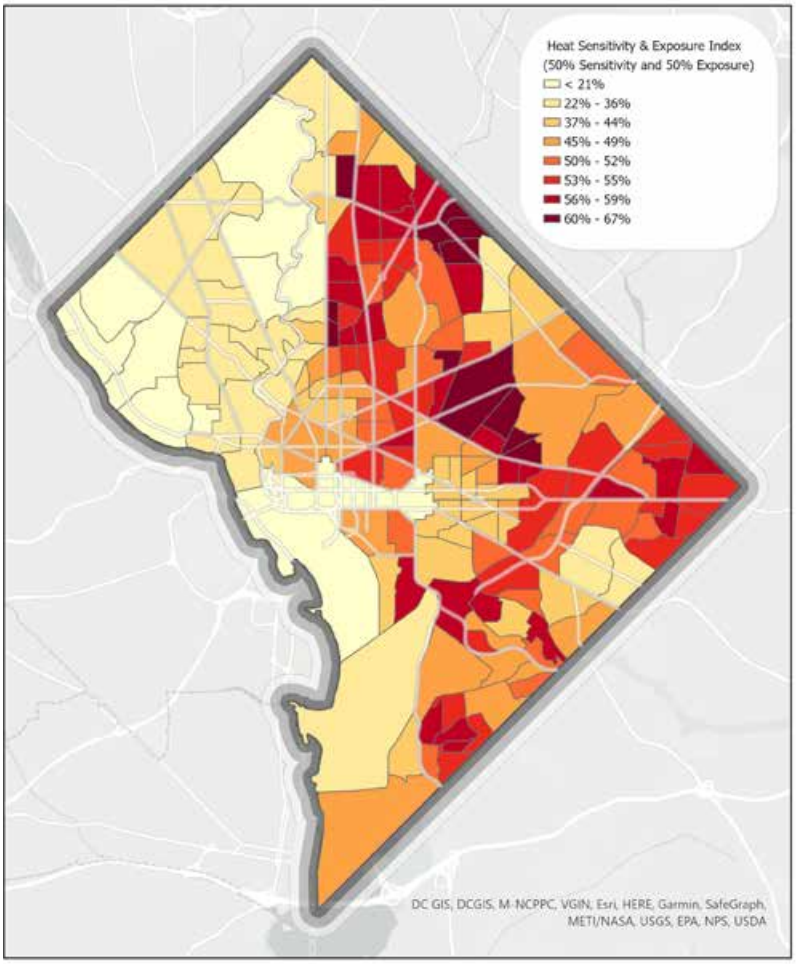
14% of black adults in DC suffer from Asthma
while only 5.6% of white adults do.

The rate of asthma — which often occurs alongside pollen allergies — **nearly tripled between 1980 and 2010.**
Symptoms range from uncomfortable to dangerous, with asthma killing about 3,500 Americans in 2016.

EDUCATION

115 Public schools, 123 DC Public Charter schools, 32 schools have adopted the Environmental Literacy Program
–
Sustainable DC pg 64

Heat Sensitivity and Exposure Areas



Climate Change and the Urban Forest

In the Mid-Atlantic, the impacts of climate change include more frequent extreme heat days and longer heat waves, along with more frequent and intense precipitation events. Such extremes in weather patterns will impact both the people living in the District, and the trees they depend on. Now and in the future, trees in the District will be called on to help alleviate impacts of climate change, such as flooding and extreme heat events. The Urban Forestry Division has partnered with the US Forest Service and Northern Institute of Applied Climate Science (NIACS) to better understand how climate change will impact trees in the District and what actions can be taken to improve the resilience of our urban forest.

The Urban Forestry Division worked with USFS and NIACS to understand risks related to climate change and develop a climate change adaptation plan. Details on this process are provided in "Section 5: Measurement and Monitoring."

SECTION 2

Trees in Private Spaces

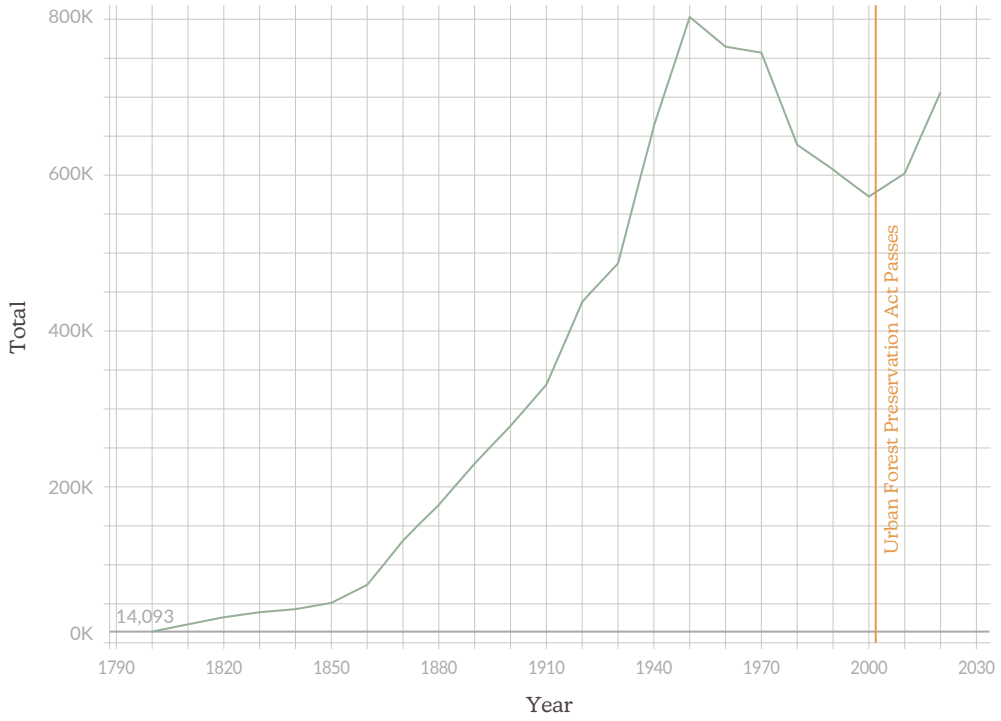
The interconnectedness of the District's urban forest means that, wherever a tree sits, the entire District can benefit from it being healthy and well cared for. Many benefits of trees can be directly identified, like the amount of air pollution reduced or stormwater mitigated, while others are more abstract. These advantages, such as neighborhood beautification or placemaking, are intrinsic values that are equally as important to residents as the quantifiable alternatives. As a result, many District residents and businesses choose to maintain the trees already on their property and add trees to their property when none exist.

Privately owned lands within the District contain approximately 440,000 trees. Preserving tree canopy on private lands provides ecosystem benefits including stormwater mitigation, cooling, habitat for native species, and many others. Private lands also provide the largest ongoing opportunities for new tree plantings, and working with private landowners to protect and plant trees is critical to the long term growth of our urban tree canopy.

The District government has incentivized and supported these efforts through funding opportunities, environmental education programs, equitable service delivery and laws protecting trees on private property. Through partnerships and individual action, D.C agencies are directly motivating planting and management while stimulating improved strategies - enabling the trees on private land to continue to flourish.

Residential Landuse and Potential Planting Areas

Population in Washington, DC: 1800 to Present



Despite an increase of ~150,000 residents since the passage of the Urban Forest Preservation Act of 2002, and the increasing pace of infill development activity, DC has still managed a net increase of 425 acres of Urban Tree Canopy since our initial study in 2006

Tree Protection

Regulations Protecting Private Trees

URBAN FOREST PRESERVATION ACT

As trees age, their capacity to absorb and store carbon, retain stormwater, and filter the surrounding air increases at an exponential rate. These immense benefits are ongoing, no matter their location. DC has a number of mature trees anchored throughout its parks, historic squares, along streetways and in front and backyards. In recognition of the value of these trees, DC Council passed the Urban Forest Preservation Act in 2002 and the Tree Canopy Protection Amendment Act in 2016 to protect the District's largest trees. This law is one of the most stringent tree protection laws in the country and underscores the important role DC's trees play in fostering happy, healthy and vibrant communities.

In 2022, the Council amended the Urban Forest Preservation Act again, granting new authority to city agencies to better protect mature trees and expanding these protections to mature trees to District-owned lands. The Urban Forest Preservation Authority Amendment Act added a new definition for Critical Root Zone to the city's tree protection laws, and established a new permitting review process for any development projects that would impact a Special or Heritage tree or its Critical Root Zone. Additionally, the Act allows for city officials to issue stop work orders on construction projects that pose an immediate risk to a Special or Heritage tree.

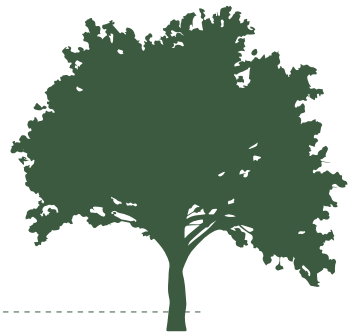
TREE AND SLOPE PROTECTION OVERLAY DISTRICTS

Storms, high winds, and other weather events can wear away land surfaces, causing severe erosion. Trees have the capacity to capture and stabilize soil through their extensive root systems. The Tree and Slope Protection (TSP) Overlay Districts were established to preserve and enhance the park-like setting of designated neighborhoods adjacent to streams or parks by regulating alteration or disturbance of terrain, destruction of trees, and ground coverage of permitted buildings and other impervious surfaces.

Special Trees

CIRCUMFERENCE = 44" - 99.9"

Special trees are trees with a circumference between 44 inches and 99.9 inches. Permits may be issued if the tree is Hazardous, if the tree is of a species that is appropriate for removal or if a permit is purchased. A permit costs $55 for each inch of circumference. Removing a Special tree without a permit will result in a fine of $300 per inch of circumference.



Heritage Trees

CIRCUMFERENCE = 100"+

Heritage trees may not be cut down unless they are determined to be hazardous or are a species that has been identified as appropriate for removal. Removing a Heritage Tree unlawfully will result in a fine of no less than $300 per inch of circumference.

Awaiting new photos and captions

Cronartium ribicola on western white pine

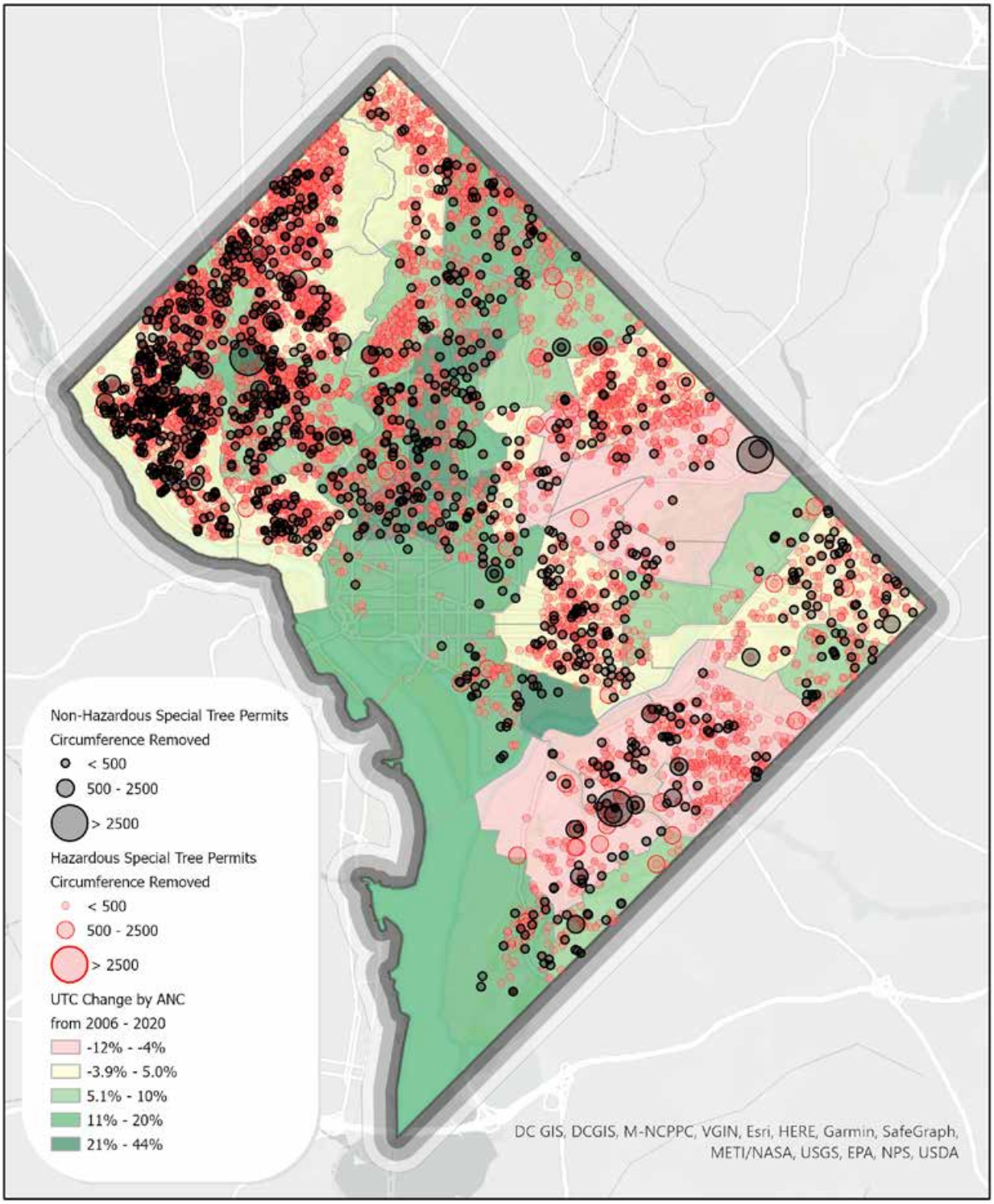
On Pinus strobus

Hypoxylon mammatum signs on aspen

Tree Removal

Trees on private property may be removed for a number of reasons including declining or poor tree health, sudden tree damage rendering the tree unsafe or due to competing land use interests of the tree owner.

Special and Heritage Tree Removal



Tree Planting

Residential neighborhoods, religious institutions, cemeteries and other nongovernmental lands represent critical space for establishing new tree canopy. Through targeted and strategic tree planting efforts on such spaces, the District can ensure an equitable tree canopy that stretches across all eight Wards. Green parks and corridors, beyond traditional street trees, helped Washington, DC, earn the moniker “City of Trees”. Ongoing tree planting on private land is necessary to maintain and grow our canopy.

Community Tree Programs

The District of Columbia offers a multitude of programs to promote planting trees on private land.

CITY-WIDE PROGRAMS

The Department of Energy and Environment offers

RiverSmart Homes: An incentive to install green infrastructure for single-family residential properties. It offers the opportunity for homeowners to plant shade trees, install rain gardens and more free of charge

RiverSmart Communities: An incentive program to install green infrastructure for community nonprofit organizations (501(c)(3)) and houses of worship

RiverSmart Rebates: An incentive program for property owners who would like to install their own trees and green infrastructure. This program offers rebates for homeowners who plant eligible trees on their property.

NEIGHBORHOOD PROGRAMS

Anacostia Watershed Society Tree Planting

Trees for Capital HIll

Trees for Georgetown

Restore Massachusetts Avenue

Neighborhood Business Improvement Districts

Washington Parks and People

Pepco

Special & Heritage Tree Replacement Planting

Types of Trees to Plant

TALL TREES
- Maple
- Oak
- Elm
- Pine

MEDIUM TREES
- Washington Red Horsechestnut
- Hornbeam

SMALL TREES
- Star magnolia
- Chokecherry

Want a Tree?

VISIT CASEYTREES.COM/PLANT

Your Trees

For many residents who purchase property, there are already mature trees there. However, no matter the type or age of your tree, it still requires care.

Watering

The single most important factor for young tree survival is water. Continue watering through the first two to three years after planting.

WHERE

Use a watering bag that wraps around the base of the tree, a bucket with holes drilled in the bottom, or a soaker hose to provide a long, slow watering directed at the roots.

WHEN

Water weekly from early spring until soil freezes in winter. Water twice weekly during times of drought.

HOW MUCH

Twenty-five gallons a week. Allow soil to dry out completely between waterings.

Tree Watering

Once a tree is planted, it is the responsibility of the tree's owner to give it adequate and consistent care to ensure it can grow to full maturity. Unlike the District or federal government, a private land or home owner is typically less primed to see the signs of decline and stress exhibited by a newly planted tree. Watering is universally the most impactful thing a private landowner can do to support their trees.

Tree Pruning

Tree pruning is an easy way to maintain tree health and improve a tree's structure. People will also frequently prune tree limbs for safety reasons or if they desire a certain shape. A property owner should make sure that they fully understand how a tree will respond before they begin pruning their tree in order to make sure that the cuts will be good for them and good for the tree.

While trees on private property are the responsibility of the landowner, when a tree extends beyond the property line or threatens power lines, the city and utility line servicers do have the power to prune the tree in order to make sure that both the people and property remain safe.

SECTION 3

Trees in Public Places

Beginning with the L'Enfant Plan and followed by the McMillan Commission, Washington, DC has long utilized public land as a means of defining character and livability of the city. Public land is defined as all land owned by the District government and public trees are those that originate from this land. This includes more than 170,000 street trees, about 80,000 park trees, and at least 75,000 trees on school grounds, libraries and on other various other District properties. As urbanization has changed our natural landscape sine the Civil War, urban forestry has emerged to help cities strike a balance between development and environmental protection. Shifting away from expansive woodlands to corner parks and green corridors, DC has been able to retain the social and environmental value of trees and green space for its residents. Planting, maintaining and protecting public trees, no matter where they are, is the government's way of recognizing the importance of urban forests and green space benefits they provide to overall quality of life.

Lifecycle of Public Trees

Our city's growth and transformation mirrors changes in our urban forest is not unlike its urban forest. Trees are dynamic and their growth is a result of location, species quality, competition for sunlight, moisture and nutrients. Monitoring and maintaining trees in public places takes a comprehensive effort to ensure they each full maturity and deliver the maximum environmental benefits. Up against impervious surfaces, fluctuating temperatures, storms and man-made stressors, it takes a lot for an urban tree to transition through a natural cycle from sapling to stump. By examining a trees growth, management and disposal, this cycle can be optimized throughout the tree's lifetime, from the time the sapling is planted to our ability to reuse the woody biomass as lumber or other wood products.

Tree Inspection & Inventory

To ensure longevity and survival, city arborists regularly inspect the trees on District land for potential health issues or damage. These can include signs of structural problems, defects or any signs of pest and disease infestation. Arborists will check soil conditions, leaf, twig, branch, limb, and trunk health and overall tree vigor. Tree inspections are crucial in ensuring a strong and sound urban forest. Any resident can submit a tree inspection request through the 311 portal.

Within the District government, the Urban Forestry Division is in charge of inspecting a large portion of DC's expansive tree population; with oversight of more than 170,000 street trees and and a similar number on park, school and other public lands.

Before a tree is actually planted, UFD arborists evaluate site conditions and actively maintain an inventory of public trees and spaces. Over 350 trees and open spaces are inspected on a daily basis citywide. These inspections provide the city with reliable data to inform and prioritize tree planting activities, routine pruning, tree removals and the coordination of emergency work.

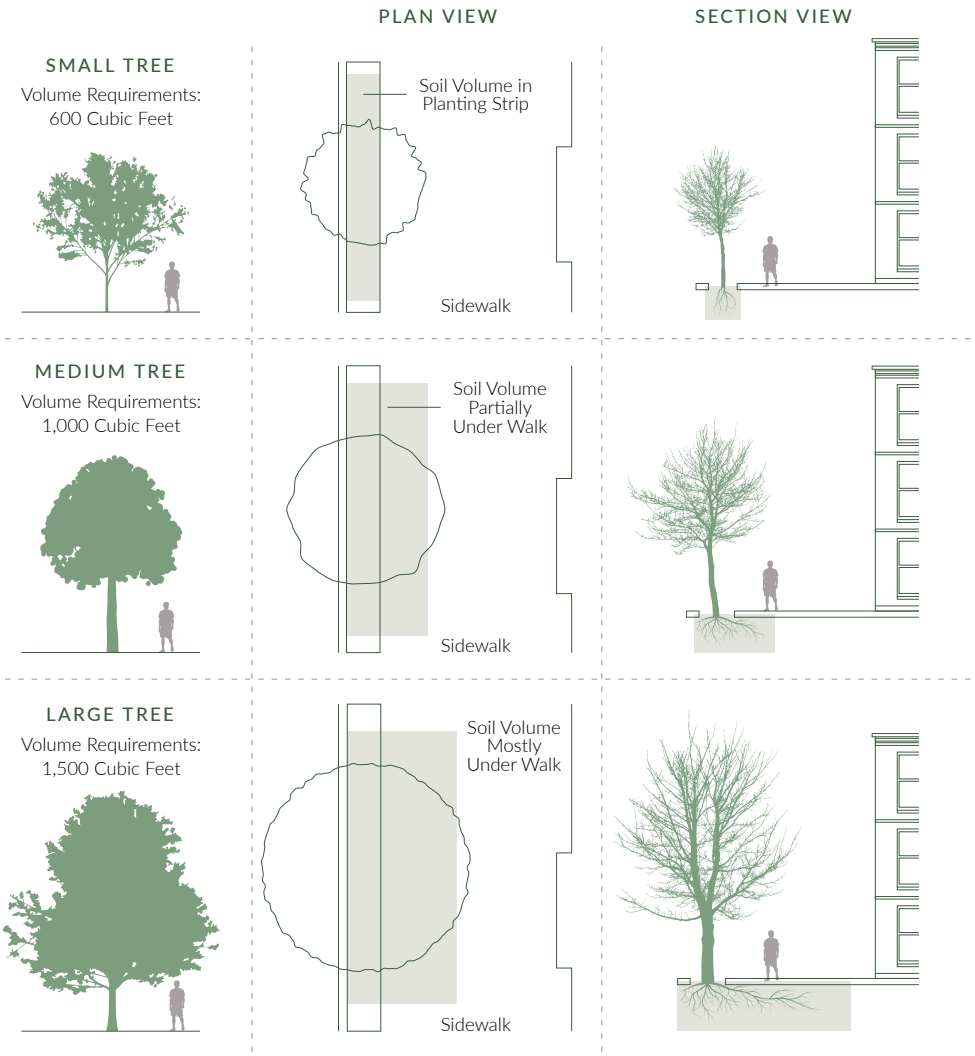
Tree Planting

Trees planted in the city are traditionally grown in a nursery for two to five years. After being harvested or grown in a container, the tree is ready to establish its roots. Once brought to the District, agency staff plant the young tree in its designated location. This is a critical time in a tree's life because if their roots are harmed, if the weather does not cooperate or early tree care is not maintained, these trees may not survive. In fact, the first two to three years of a trees' life are the most important in order to ensure they thrive in their new environment. Because of the especially stressful environment that urban trees are placed in, city trees require consistent care to ensure root establishment.

However, there is more to tree planting than digging a hole. Smart streetscape and landscape designs should be implemented to ensure long term survival of the new tree.

Trees can only grow as large as their roots are allowed to spread. By using tree growth technology, such as silva cells and porous pavement and building street tree boxes and street tree bump outs at maximum capacity, urban trees will have the soil volume to grow without risk of soil compaction, critical root harm or other common urban issues that could hinder tree growth.

Washington, DC, has a goal to achieve 40% canopy cover by 2032. By identifying locations throughout the District in need of higher tree canopy or at risk of losing tree canopy, the District can ensure that it remains on track to meet its goal. The work that goes into planting new trees highlights the District's dedication to establishing new leaf acreage and a successful tree canopy. Through a collaborative and unified effort across stakeholders, Washington DC can see expanded and equitable distribution of its tree canopy - allowing everyone who lives and works in the District to receive their benefits.



When to Call 311

TREE INSPECTION

Report urgent street tree matters including fallen trees and limbs impeding roadways, sidewalks, and other safety hazards

TREE PRUNING

Request trees to be pruned for clearance over sidewalks and roadways, alleys, and pedestrian walkways. UFD prunes the District's street trees to maintain overall health, form, and safety.

TREE REMOVAL

Request removal of trees from public space that are dead, dying/diseased, or unsafe (those that have structural defects which cannot be corrected)

TREE PLANTING

Request new tree planting in an empty street tree space, in a public park, or on a schoolyard.

Tree Watering

One of the crucial steps that must be taken to ensure stability, anchorage and nutrient uptake in a new tree is watering. Water is a crucial determinant for a tree's ability to adapt and survive in city soils. The tree's establishment in these first two years is dependent on 25 gallons of water a week. However, the demands on land managers for other tree services often make it difficulture for these trees to receive this critical resource needed, especially with climate exacerbated needs. With the distribution, age and extreme heat factor faced by these young urban trees, city wide tree watering programs are vital.

To support newly planted trees, DDOT UFD delivers regular irrigation for all of its young trees. Residents are encouraged to assist, by augmenting the watering provided by the city. **To learn more visit https://treewatering.ddot.dc.gov/treewatering/ to identify those trees in your neighborhood that could benefit from irrigation support.**

Tree Pruning

To minimize risk and ensure tree longevity, DC relies on tree pruning throughout a tree's life. With utility lines, traffic overhangs and nearby buildings, it is a critical duty of the Urban Forestry Division and other District, federal, and private land owners to maintain the trees in order to ensure that they are structurally sound, have sturdy branch attachment, and and provide adequate clearances.

The purpose of pruning is to remove dead, damaged or diseased branches from the tree, while also encouraging development of proper structure and form. By removing a section of trees, such as a branch or portion of a branch, we can prevent or mitigate the risk of insect infestation or decaying organisms from entering the main tree structure.

Protecting Trees During Construction

As the District continues to develop, it is important to look at tree protection in conjunction with development, not separately. Thoughtful development can allow for the preservation of existing tree canopy and incorporation of new trees while allowing our city to meet growing demand for more housing and commercial space.

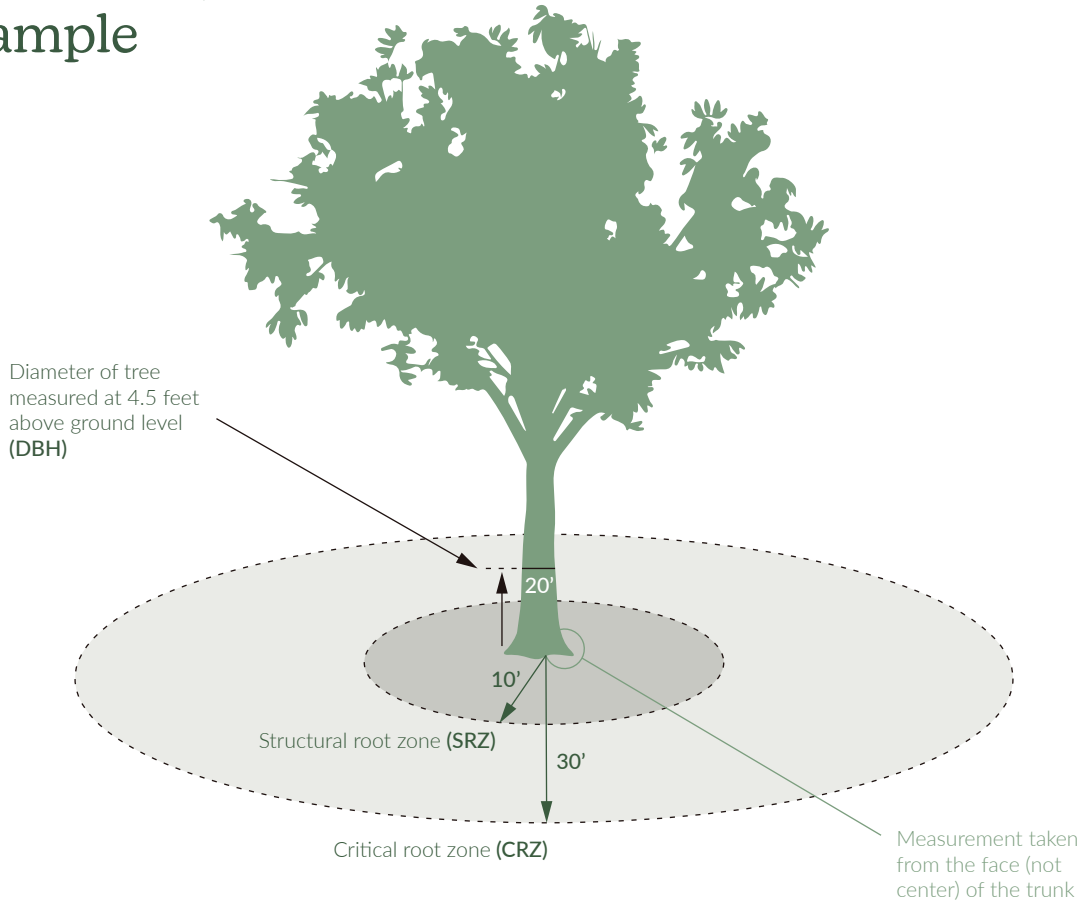
There are many potential hazards for trees during construction - the soil could be polluted, building material can be stored on the critical root zone, there can be excavation and stripping of topsoil, change in soil levels, trunk wounds and more. District government has created guidelines to make sure that, when there is construction that affects trees on public land, there will also be measures taken to protect those trees. By following these guidelines, trees have an exponentially higher likelihood of surviving a construction project.

All construction projects in the vicinity of a street tree must install 6 foot tall chain link fence [4] to protect the Critical Root Zone (CRZ) of the trees from the construction activity, equipment and material. Within the CRZ, the following applies:

- No alterations or disturbance of existing grade
- No storage of construction materials, equipment, soil or debris
- No disposal of any liquides (ie: concrete, gas oil, paint and blacktop)
- No trenching
- Trees must be watered every 10 days from April to September

If construction cannot be avoided within the CRZ, the tree must be protected with fencing and all other unpaved areas must be covered with a protective 10 inch layer of wood chips.

Tree Root Zone Example



DBH = Tree trunk diameter at 4.5 ft above grade
CRZ = Radius protection of 1.5 ft per inch of DBH
SRZ = Radius protection of 1/2 ft per inch of DBH

If a site is found to be in violation of these policies, DDOT can issue a stop work order until proper tree protection is in place. If a tree that had not been designated for removal was severely injured, removed or killed, the contractor must replace it and pay a fine of up to $1,000 per inch of caliper (according to Standards for Highways and Structures)

This rule only applies to trees on District owned land. Land owned by the federal government, such as National Park Service sites and privately owned property is not subject to these regulations, although it is considered best management practices to use these techniques.

Tree Removal

District-owned trees are removed if they are dead, dying, diseased, badly damaged or otherwise objectionable. Once a tree is inspected by a certified arborist, the responsible entity will determine what measures should be taken to mitigate potential risk to those who live, work and play in the surrounding area. If a tree is downed in the public space and blocking the flow of traffic, obscuring the view of a traffic sign or is downed on District property, the Urban Forestry Division is responsible. If a tree is downed on other public land, it is the responsibility of the land-owner agency to remove the tree. Calling 311 or submitting a request via the 311 online portal will mobilize the needed forces. If a tree is on federally owned land, such as on the National Mall, in Rock Creek or Stanton Park, the National Park Service would be the responsible entity.

Wood Reuse

More trees are removed annually from urban areas than our national forests, creating an opportunity for a new industrial economy within our cities. Urban wood reuse or urban wood waste management programs address the piles of logs and brush and its transformation into quality goods.

The Urban Forestry Division runs a sawmill to give street trees a second chance in the District. They work with the Office of the State Superintendent of Education to provide DC schools with wood products to improve school grounds at no cost. These wood products serve as a living classroom and natural storage lockers for carbon, all the while connecting students to the natural resources around them.

SECTION 4

Partnerships

Partnerships are a way to build and strengthen our tree canopy. By working together to emphasize the value of our trees and the diversity of activity that surrounds them into our community, we can grow an urban forest that is rooted in community connectedness.

District Agency Involvement in Tree Service

Within the District, trees are rooted along our streets, in our parks, schools, recreation area and in forested plots. While the Urban Forestry Division, located within the District Department of Transportation, is the governmental agency responsible for managing the trees in many of these public areas, a variety of District agencies, including the Department of General Services, Department of Parks and Recreation, National Park Service and more, also have a say in how the District's urban forest is governed. For all of these agencies, their duties range from planting and pruning to removal and maintenance.

Department of Transportation: Urban Forestry Division (UFD)

The Urban Forestry Division (UFD) within the District Department of Transportation (DDOT) maintains approximately 170,000 trees along streets and and a similar number of trees growing on park, school and other public lands. They provide services such as pruning, tree removal, tree debris cleaning and stumps maintenance for safe sidewalks and street clearance across the District. UFD also responds to Routine Maintenance Requests from residents. This includes pruning, removing, treating, replanting or clearing fallen trees and limbs from roadways and sidewalks. Additionally they work in partnership with other District agencies to help them with tree planting, maintenance and safety on properties such as parks, recreation centers and schools.

Department of Energy and Environment (DOEE)

The DC Department of Energy and Environment (DOEE) is responsible for enforcing environmental regulations, monitoring and assessing environmental risk, issuing permits and providing funding for environmental programs. Within these tasks, DOEE partners with DDOT to utilize the Urban Forestry Division's Tree Fund to finance and deliver no cost tree planting incentive programs across the District. Together DDOT UFD and DOEE work in close partnership to help DC achieve its Sustainable DC Tree Canopy Goal.

Department of General Services (DGS)

The DC Department of General Services (DGS) performs construction, maintenance, sustainability, security and portfolio management of District owned property. This includes locations like public schools, libraries and office buildings.

Department of Parks and Recreation (DPR)

The DC Department of Parks and Recreation (DPR) provides urban recreation and leisure services for those residing and visiting the city. They supervise all the city's parks, recreation and community centers, including athletic fields, spray parks, tennis courts, community gardens, dog parks and aquatic facilities. Trees on DPR land are monitored and maintained by the Urban Forestry Division.

National Park Service (NPS)

The National Park Service (NPS) is entrusted with the care of national parks. NPS takes care of a wide variety of land types, including the National Mall and surrounding memorials, Rock Creek Park (ROCR), National Capital Parks-East (NACE), Kenilworth Park and Aquatic Gardens, Anacostia Park, Chesapeake & Ohio Canal National Historical Park and Roosevelt Island. These different branches manage iconic landmarks and densely forested plots with their respective staff and maintenance crews. NPS also has developed partnerships with District agencies, such as DPR and DDOT, regional bodies, such as the National Capital Planning Commission, and local nonprofit organizations to help with regular tree care and maintenance.

National Capital Planning Commission (NCPC)

The DC Office of Planning (OP) and the National Capital Planning Commission (NCPC) outline a modern vision of what the nation's capital should look like through federal and local Comprehensive plans. These plans pave the future of D.C through the lens of urban design, economic development, transportation, historic preservation and open space. It is the responsibility of OP and NCPC to create these blueprints for development so we can continue to respect the District's historical integrity while also creating a modern, livable and prosperous city.

CASE STUDY

RiverSmart Homes

DEPARTMENT OF ENERGY & ENVIRONMENT

RiverSmart Homes is the city-wide stormwater management program run by DOEE that is funded through DDOT's Tree Fund and run in partnership with non-profits such as the Alliance for the Chesapeake Bay and Casey Trees. It is specifically aimed at private residents. Through RiverSmart Homes, homeowners can have their property assessed for stormwater solutions. Rain barrels, rain gardens, native plant gardens, permeable pavers, and shade trees can be provided to residents or subsidized by the city. Over 9,980 trees have been planted across DC through RiverSmart Homes since 2010. Nearly half of RiverSmart Homes trees have been planted in Wards 5, 7 and 8, where some of the greatest opportunity for canopy expansion exist. These trees provide stormwater management through interception, evapo-transpiration, and infiltration. They also contribute to localized heat island mitigation at the neighborhood level.

Nongovernmental Partnerships

The District of Columbia works with many nongovernmental partners as one way of supporting their tree canopy. These organizations work with the city through grants, partnerships and contracts on program development and implementation, tree planting and maintenance and tree canopy monitoring. Through these partnerships, the DC government is able to increase its protection and enhancement of the District's tree canopy.

Casey Trees

Casey Trees, established in 2002 has been working diligently within the District boundary to restore, enhance and protect the tree canopy. Their volunteer lead programs turn residents into citizen foresters as they move through quantifying urban forestry in an inventory program, make structural pruning cuts on city trees through their inventory program, or wield spaced and pickaxes as they plant a tree in all 8 wards.

Anacostia Parks and Community Collaborative

The Anacostia Parks & Community Collaborative (APACC) is a network of community leaders and organizations working together to make the Anacostia River and its park system the best possible resource for residents of Ward 7 and 8 in the District of Columbia.

Anacostia Watershed Society

AWS's mission is to protect and restore the Anacostia River by bringing partners and communities together to achieve a clean and safe Anacostia River for the benefit of all living in its watershed and for future generations.

Friends of Oxon Run Park

Oxon Run Park is the largest park in the Department of Parks and Recreation's inventory in the District of Columbia. Friends of Oxon Run partner's with DC Department of Parks and Recreation (DPR), DC Department of Transportation (DDOT) and DC Department of Energy and Environment (DOEE) to establish partnerships with local schools, organizations, churches, police cadets and others to enhance Oxon Run Park.

Green Spaces for DC

Green Spaces for DC works to advance the quality of parks and green spaces in DC, focusing on equitable access and open spaces that enhance the health and well-being of neighborhoods.

Living Classrooms

Living Classrooms provides access to more equitable education, workforce development, community safety, and health and wellness opportunities that enable individuals to achieve their aspirations and build safer, stronger, and healthier communities for all.

Metropolitan Washington Council of Governments

COG is an independent, nonprofit association, with a membership of 300 elected officials from 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress. Every month, more than 1,500 officials and experts connect through COG to share information and develop solutions to the region's major challenges.

Restore Massachusetts Avenue

Working along a two-mile stretch of Embassy Row, this non-profit has arranged more than 450 new trees to revive the once symmetrical double row along this diplomatic avenue using direct community advocacy and engagement.

Rock Creek Conservancy

Rock Creek Conservancy is the only organization dedicated solely to Rock Creek and its parks, and exists to restore the creek and its parklands as a natural oasis for all people to appreciate and protect.

Ward 8 Woods

Ward 8 Woods Conservancy is a grassroots nonprofit organization that works to rejuvenate and enhance the beauty, ecological health, and public enjoyment of the more than 500 acres of forest in the Ward 8 section of Washington, DC, for the benefit of all.

Washington Area Bicyclist Association

WABA empowers people to ride bikes, build connections, and transform places. We envision a just and sustainable transportation system where walking, biking, and transit are the best ways to get around.

Washington Parks & People

Washington Parks & People is the capital's hub for activating public lands & waters for broad community revitalization – through partnership, innovation, discovery, and workforce development. Their mission is to grow city-wide park-based community health & vitality by nurturing innovation & partnerships.

Pepco

Each year, Pepco offers 250 trees on a first-come, first-serve basis to District of Columbia homeowners through the "Right Tree, Right Place" tree planting program. This is a program offered in partnership with Casey Trees.

Tree Canopy by Ward and Ownership Type

WARD	PRIVATE	DISTRICT	FEDERAL	UNKNOWN (OWNERSHIP IS BLANK)	SUM
Ward 1	668	632	148	127	**1574**
Ward 2	1195	1096	1364	148	**3804**
Ward 3	3009	1533	1886	210	**6638**
Ward 4	2410	1700	1474	48	**5632**
Ward 5	3113	1710	1335	227	**6384**
Ward 6	957	1193	938	148	**3236**
Ward 7	2160	1617	1590	170	**5537**
Ward 8	1449	1514	2568	105	**5635**
Sum	**14961**	**10995**	**11303**	**1182**	38442

* area measured in Acres

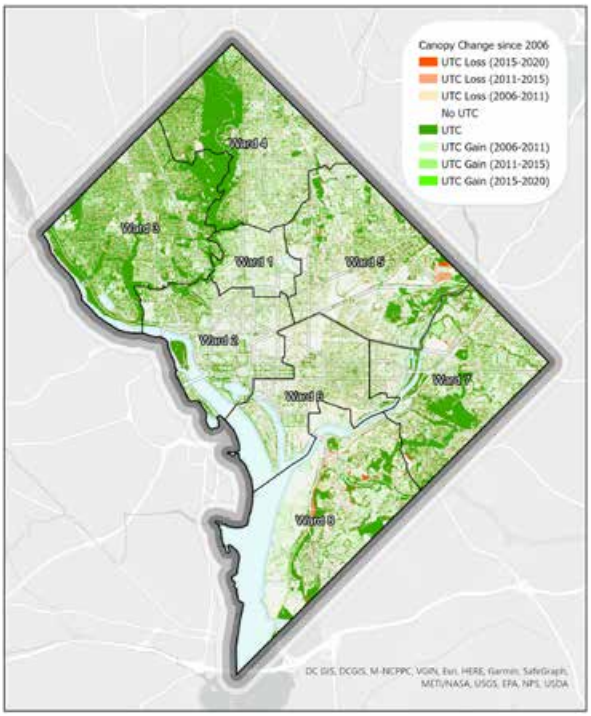
230
Sustainable DC Goals

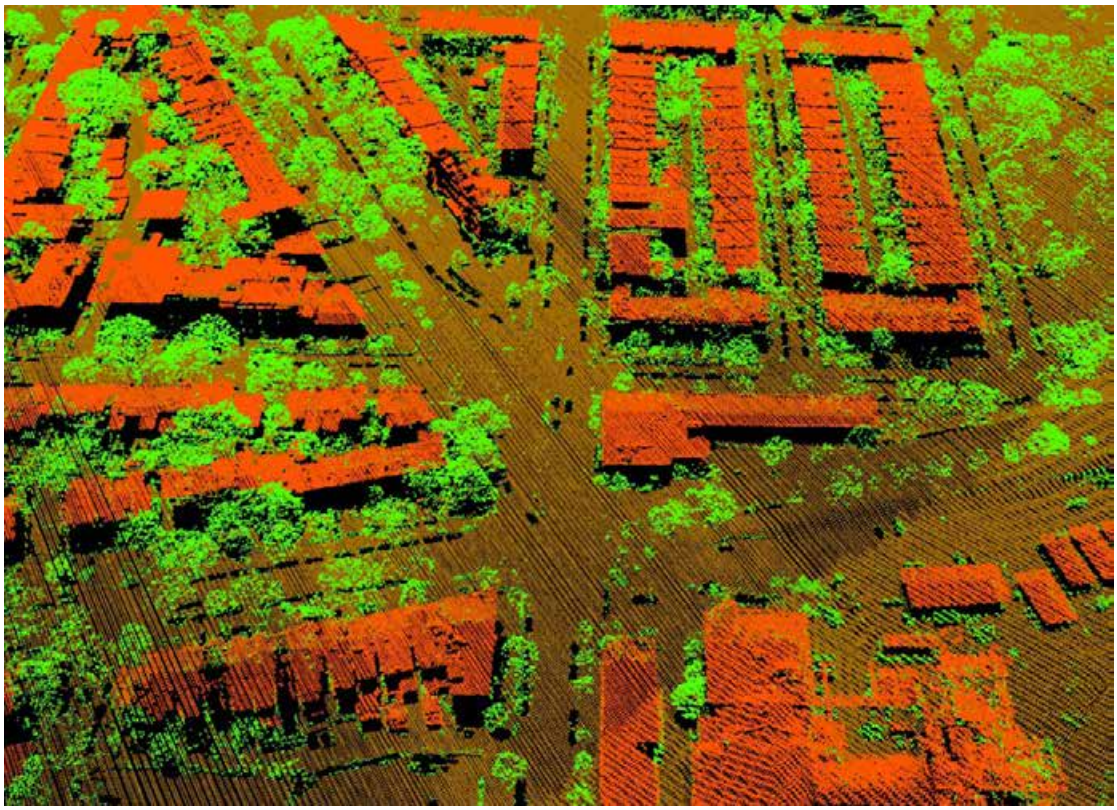
SECTION 5

Monitoring and Measurement

Municipal foresters have a number of responsibilities associated with the care and management of urban vegetation. Management of any resource begins with an inventory or quantification of tree characteristics and health. Monitoring and measurement of these living resources are essential in understanding the current makeup of the District's tree canopy, planning for future canopy growth, scheduling work and deploying maintenance tasks. Having this information is vital for the current and future management of our urban forest because it tells us what we have, what we need and how to fill in that gap. Being able to define this then gives decisionmakers the opportunity to create plans and policies to help us achieve our goals.

Urban Tree Canopy Change Since 2006





Methods for Measuring and Monitoring

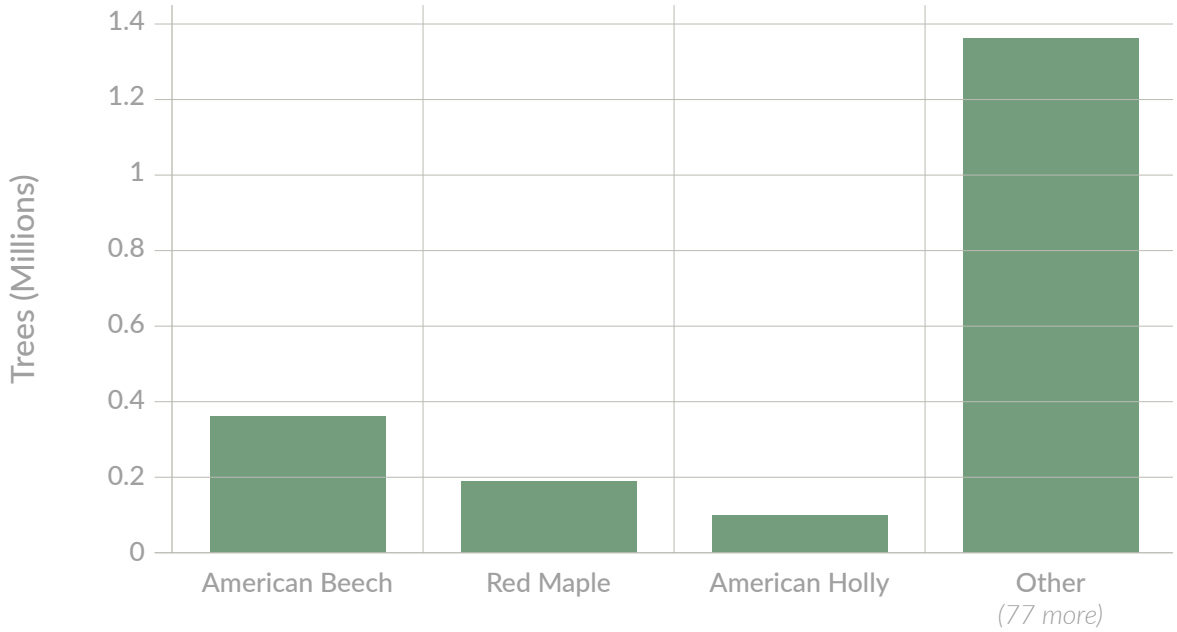
Land Cover Assessment

DDOT's Urban Forestry Division performs land cover assessments every five (5) years. To date, four (4) studies have been conducted, spanning the period between 2006 and 2020. Land cover data provides information on impervious areas, plantable areas, and vegetation such as tree cover. Tree cover can be used as an indicator of environmental health. Trees play a large role in the ecosystem, because of this, we can use the quality of our tree canopy to indicate the health of different plants and animals or the quality of water and soil. Canopy cover can be measured through aerial imagery or through ground sampling.

Tree Canopy is measured by quantifying the portion of the city's land surfaces which are covered by tree leaves. To obtain the most accurate results, DDOT UFD combines multiple data sources, such as aerial imagery and LiDAR (see below) to model the extent and distribution of tree canopy citywide. This assessment can then be summarized into political geographies such as ward boundaries, census blocks or neighborhoods. Other methods, such as ground-based sampling, can also help approximate the structure and composition of urban forest resources.

Monitoring with Light Detection and Ranging (LiDAR)

This analysis of urban tree canopies uses aerial imagery to provide a description of the tree cover. Known as a remote sensing method (scanning of earth by satellite or aircraft), this technique uses light in the form of a pulsed laser measuring the variable distances to Earth. LiDAR provides detailed three dimensional modeling of hte earth and its surfaces. From these digital elevation models, elements such as buildings, and trees can be identified. The instrument is composed of a laser, scanner and specialized GPS receiver. This technique is used for an accurate accounting of tree canopy in the District.



My City's Trees: https://mct.tfs.tamu.edu/

Monitoring with Ground Sampling

On the ground field measurements are the only way to define the true vertical projection of a canopy. This form of sampling measures the stretch of the crown, tree height, and crown base, providing information on leaf coverage and density three dimensionally.

i-Tree

i-Tree is a statistical sampling program that uses tree measurements and other field data to estimate the overall makeup and benefits of an urban forest. In 2004 and 2009, Casey Trees, using I-Tree Eco sampled approximately 200 plots on private and federal lands to get a portion of these tree measurements. After collecting this data, Casey Trees was able to use i-Tree to estimate the number, species composition, size, health, and economic and environmental value of the District's tree canopy as a whole. In 2015, this methodology was replaced with the Urban Forest Inventory & Analysis (FIA).

Urban Forest Inventory & Analysis (FIA)

The USDA Forest Service's Forest Inventory & Analysis (FIA) program is an annual census for our nation's trees. In existence since the 1930s, this program collects forestry data, including tree size, species and health and uses it to analyze status and trends of forest resources nationwide. Historically the FIA program deliberately excluded census-defined urban areas. However, the 2014 Farm Bill recognized the importance of urban forests as a vital component of the nation's forest resources, and specifically expanded the program's focus to include urban areas. By incorporating urban areas, the FIA program provides resource managers with regularly updated data on forest health, structure, composition and function.. The Urban FIA program expandsenlarges the traditional FIA program by combining the methods and protocols of the FIA with urban inventory analysis from i-Tree. Because of the nation-wide use of both the FIA and the Urban FIA programs, use of this method to analyze the District's urban forest enables land managers and policymakers to view it in the context of regional and national forest resources.

Typically, FIA expands into urban areas slowly, assessing 1/7th of a city's randomly selected study locations annually. To accelerate this initial data collection, DDOT's Urban Forestry Division funded a comprehensive, citywide effort in 2018. By performing a comprehensive study area collection in the program's first year, the District was able to obtain data outputs far more quickly than would otherwise have been possible. What would have traditionally required seven (7) years to collect and report on, was completed in a single year, with results made available beginning in 2019. Following the District's initial up-front investment, ongoing annual reassessment will be performed by the US Forest Service. FIA data have since been blended with locally-relevant information, including demographic information, geographic and political boundaries, as well as heat stress sensitivity data. These findings are made easily available through the Urban FIA

Datamart as well as in the My City's Tree web application.

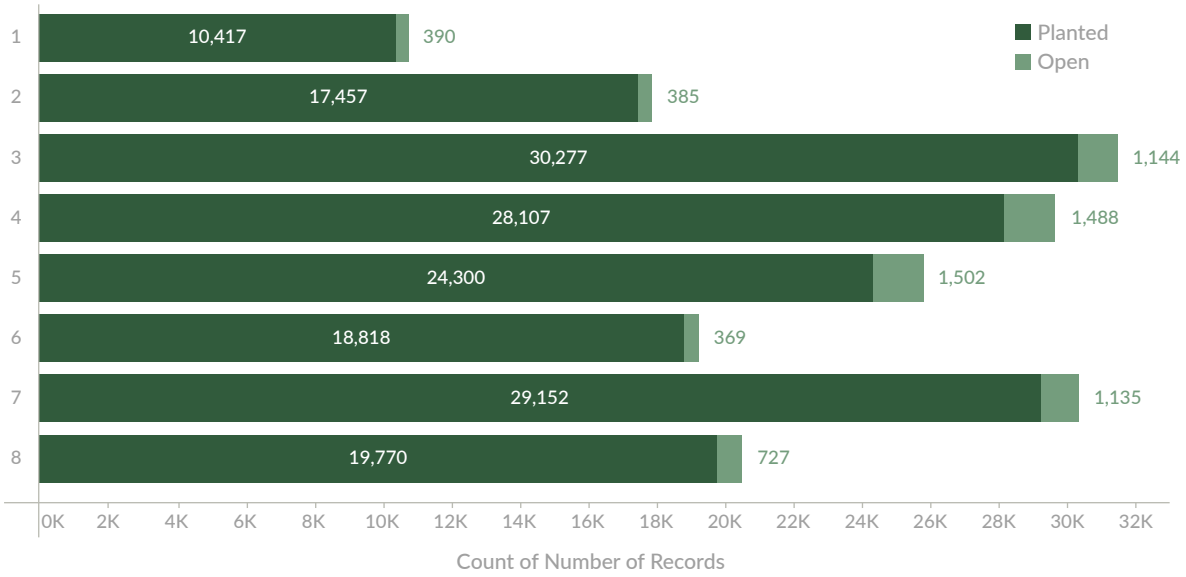
City-Wide Tree Inventory

Tree inventory systems have existed in the District from the early twentieth century. A card index system, an inspector and a human "computer" documented trees and their maintenance. This was state of the art in the 1920s. Currently, the city-wide tree inventory is an on the ground monitoring program where city arborists taking inventory of the trees manually identify the species, size, condition and health of a tree, any pests and pathogens, as well as information about the planting space. Existing hardscape, other assets such as signs, signals and utilities are also cataloged. This information is then compiled in a Geographic Information System (GIS) to allow for the monitoring and management of existing trees.

DC's current tree inventory was initiated in 2002 when the Urban Forestry Division (then the Urban Forestry Administration), in association with Casey Trees, coordinated hundreds of volunteers to survey the 133,000 existing street trees in the District. This effort created the foundation of the existing public tree inventory, which continues to monitor the planting, maintenance and removal of DC's trees. The resulting tree inventory is a complete street tree inventory that also includes other public trees managed by UFD, such as those in District Parks and Public Schools. On average UFD inspects over 350 trees per day as part of their routine workflow.

Tree data is coupled with UFD's tree asset management system. As arborists respond to service requests from the public and inventory their respective geographic areas, as part of their routine workflow, tree assets are updated continuously with the goal of all trees being inspected within a

Open Tree Spaces vs. Planted Tree Spaces



five year period. This allows for a more proactive approach to management. Accurate inventory has become a foundational component of how we encourage shared stewardship among residents and visitors, through interpretation, engagement, advocacy and awareness.

Many stakeholders impact the health of our community's trees. Open data is readily available to share with engineers, developers, planners, utilities, emergency management officials, academia, tree advocates and residents. The spatial context allows for a collaborative approach to management as well as an opportunity for shared stewardship. Our open data posture equates to transparency around resource management decisions, which in turn builds trust among residents. Openly shared and accessible data has fostered community use, such as a flowering cherry tree finder map and edible tree map. The dataset is a favorite among universities and instructors for research and training purposes.

In conjunction with land cover assessments described earlier, the tree inventory has enabled UFD to ensure long term equitable distribution of urban forest resources throughout the City. Species distribution is also analyzed spatially to make the best planting selections for species diversity, resilience and climate adaptability. This will ensure that the ecosystem services our urban forests provide will benefit District residents for years to come.

Tree Survivability

DDOT's Urban Forestry Division implements a program to assess the survival and establishment of newly planted trees.. A complete inspection of each newly planted cohort is conducted to assess the condition and survival of trees after one growing season. Trees in Fair, Poor, or Dead condition are covered by a warranty and replaced according to the planting contract. On average more than 9 out of 10 trees survive the first growing season.

A second monitoring effort is conducted after two growing seasons, during which a sample (10%) of the cohort is assessed for survival, condition, biotic and abiotic factors. After two growing seasons, annual survival of newly planted trees has varied between 90% and 95%, with an average survival rate of approximately 92%. These ongoing monitoring efforts allow for continued improvement of planting protocols and enhanced establishment.

Climate Resiliency

In 2020, Urban Forestry used the NIACS Adaptation Workbook to address climate change impacts on trees and to identify related challenges and opportunities that such impacts would have on urban forest management goals..

The first step in this process was identifying climate change risks in the Mid-Atlantic. Fortunately, this was thoroughly examined by the District Department of Energy & Environment in Climate Ready DC. Projected changes include an increase in average high temperatures between of 93-97°F by the 2080s and up to 40-70 days of extreme heat (heat index reaches or exceeds temperatures exceed 95° F) by the 2080s. Projected changes in precipitation include more extreme and frequent rainfall events.

After identifying projected climate impacts, the next step required an assessment of the publicly-owned tree inventory with regard to climate change vulnerability. The USFS and NIACS were instrumental in this process and developed a list of common trees in the District, assessed in terms of their

Vulnerability of Street Tree Population to Climate Change

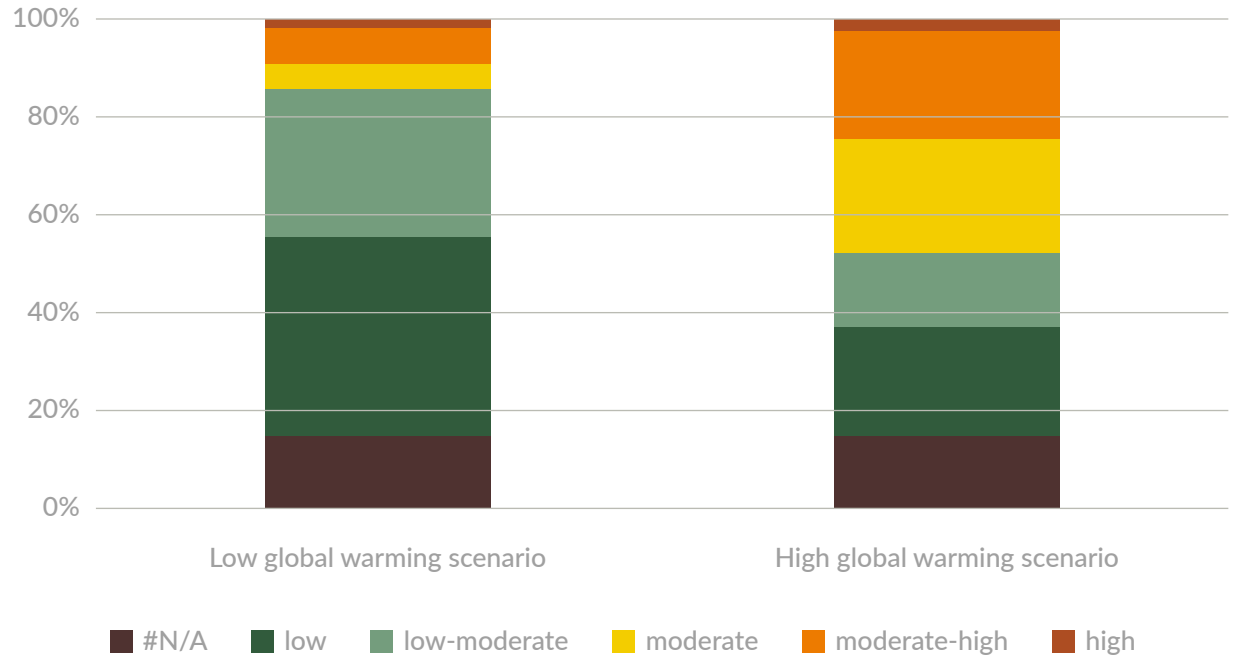
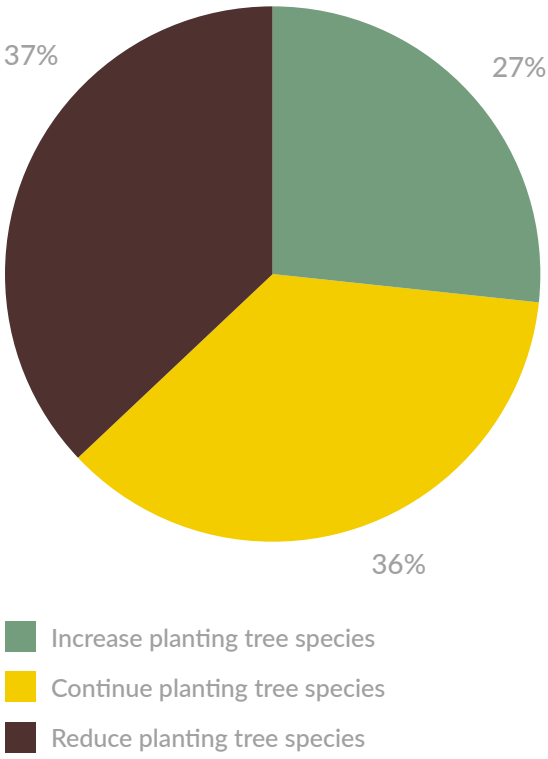


Fig X. Vulnerability of street trees to climate change at two warming scenarios. Three inventory data were downloaded on 1/21/21 and assessed for climate vulnerability using the NIACS climate change vulnerability list. Trees labeled N/A were species not included in the climate change vulnerability list, or were only identified by genus.

vulnerability to climate change. Preliminary assessments of the street tree population indicated that for a low global warming scenario a majority of the street trees (71%) have low to low-moderate vulnerability to climate change. However, for the high global warming scenario, the proportion of trees with low and low-moderate climate change vulnerability declines to ~37%.

Urban Forestry Division used the NIACS Adaptation Workbook to apply projected climate change impacts to management goals of enhancing the resilience of the public tree population. For example, tree species planting priorities were re-evaluated with climate change impacts in mind. This process was open to all Urban Foresters and resulted in a plan that adjusted tree species selection based on climate change vulnerability, as well as other metrics such as vulnerability to pests and pathogens, and subject matter expertise of UFD staff. After an initial assessment of a subset of tree species, UFD staff chose to prioritize approximately 27% of tree species, continue planting 36% of tree species at current rates, and reduce planting rates of approximately 37% of species.

Tree Planting Prioritization (2021)



Urban Forestry Division evaluated a subset of tree species (N=116) incorporating vulnerability to climate change, pests, and pathogens, as well as subject matter expertise to prioritize tree species for future planting.

Tree Health Monitoring

The Urban Forestry Division (UFD) monitors forest health through a variety of programs that include active trapping for invasive species and community outreach. Programs such as the Early Detection Rapid Response and Cryptic Wood Boring Survey aim to detect the presence of invasive insect species early before they become established in the urban forest. Likewise, community outreach at public events, in schools, and online encourage the public to assist in identifying and reporting new pests or pathogens. For example, the UFD website established an online reporting system for the public, which was critical in detecting early introductions of the spotted lanternfly in 2021, https://trees.dc.gov/pages/forest-health#spot

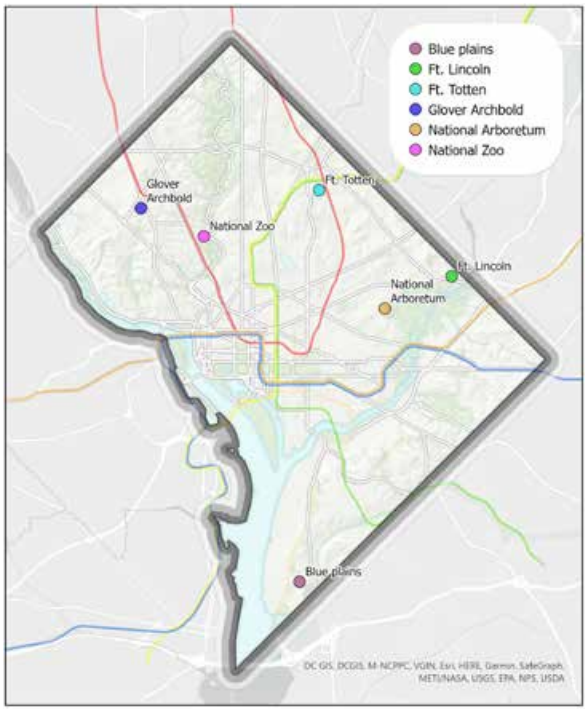
Early Detection Rapid Response (EDRR)

Urban areas are increasingly subject to introductions of exotic insects, in part due to high rates of commerce. The Washington DC metropolitan area ranks 8th out of 25 urban areas for current and projected establishment rates of exotic forest insect species. The costs of such introductions largely fall to local governments and individual homeowners. In an effort to detect and limit introductions of exotic forest insects, Urban Forestry Division (UFD) deploys traps throughout the District as part of the Early Detection Rapid Response (EDRR) Program with the US Forest Service. The EDRR Program aims to detect early introductions of exotic bark and ambrosia beetles in order to prevent their establishment in the urban forest and in surrounding forested areas. In 2016, UFD set up traps in partnership with the National Park Service, National Zoo and US National Arboretum. Each site contained three traps and pheromone lures targeting exotic bark and ambrosia beetles. The 2016 trapping effort resulted in 37 species of bark and ambrosia beetles (Subfamily Scolytinae) collected throughout the season. Twenty three species of ambrosia beetles were collected, of which 57% were non-native and 14 species of bark beetles were collected. Of the bark beetles collected, one was a non-native species, *Scolytus multistriatus*, a significant vector of Dutch Elm Disease.

Cryptic Wood Borer Insect (CWBI) Program

In 2014, Urban Forestry Division (UFD), Earth Conservation Corps (ECC), and US Forest Service, Northeastern Area, embarked on a collaboration to carry out a Cryptic Wood-Borer

EDRR Trapping Sites



Detection Program (CWBI). Wood samples were collected from individual trees and stored in a tube for up to two years. Any wood-boring insects contained in samples continued to develop and emerge from the wood where they were collected in plastic jars. Thirty six species of wood-boring and wood-inhabiting beetles were identified from samples that included red maple, American elm, cherry, oak, and ash trees. Eight species of bark and ambrosia beetles (Subfamily Scolytinae), seven species of long-horned beetles (Family Cerambycidae), and one metallic wood-boring beetle (Family Buprestidae) species were identified.

Pest Vulnerability Matrix

The Pest Vulnerability Matrix (PVM) enables municipal arborists and urban foresters to evaluate the overall vulnerability of their urban forest, to display this information and communicate it to others, and to evaluate the potential effects of emerging pests and diseases. In 2015, UFD partnered with Dr. Sunshine Brosi (Frostburg State University) to assess the diversity of the street tree population and the vulnerability to pests and pathogens. Dr. Brosi adapted Laćan and McBride's (2008) Pest Vulnerability Matrix (PVM) to help guide UFD planting efforts and identify which neighborhoods are most vulnerable to pests and pathogens. The PVM reports a vulnerability index, or PVM score, for all pests and pathogens but can also be calculated for an individual pest or for an individual ward.

Emerging Issues

Challenges to forest health include chronic issues such as Dutch elm disease and invasive vines, but also new, emerging threats such as the spotted lanternfly. The following are examples of emerging forest health issues UFD has responded to using reports from the public and also prepared for through targeted trapping efforts.

Spotted lanternfly *(Lycorma delicatula)* is native to parts of China, India, and Vietnam and was first discovered in the Mid-Atlantic (Pennsylvania) in 2014. To date it has been detected in several Northeastern states including the neighboring states of Virginia and Maryland. It feeds by piercing the tissue of trunks, branches, and small stems and sucking the sap from the host plant or tree. Spotted lanternfly impacts plants and trees directly by feeding on sap and reducing resources available to the host. Indirect impacts of spotted lanternfly include accumulation of its sugary waste on hosts and subsequent growth of a fungus called sooty mold. Sooty mold may entirely cover the plant or tree, reducing its ability to grow and may result in dieback. Some spotted lanternfly aggregations can grow quite large, becoming a nuisance to homeowners and the general public. Urban Forestry Division started a trapping program for spotted lanternfly in 2019 and received reports of the invasive insect in late 2021. Collaborating with USDA APHIS and Department of Energy & Environment, UFD is actively trapping, responding to reports from the public, and mapping the preferred host, Tree of heaven *(Ailanthus altissima)*.

Crape myrtle bark scale *(Acanthococcus lagerstroemiae)* is a relatively new invasive species in the District of Columbia. This insect was first reported in DC on EDDMapS in 2020 and has since been observed widely across the District. Originally from East Asia, crape myrtle bark scale (CMBS) is similar to other scale, feeding on plants and trees

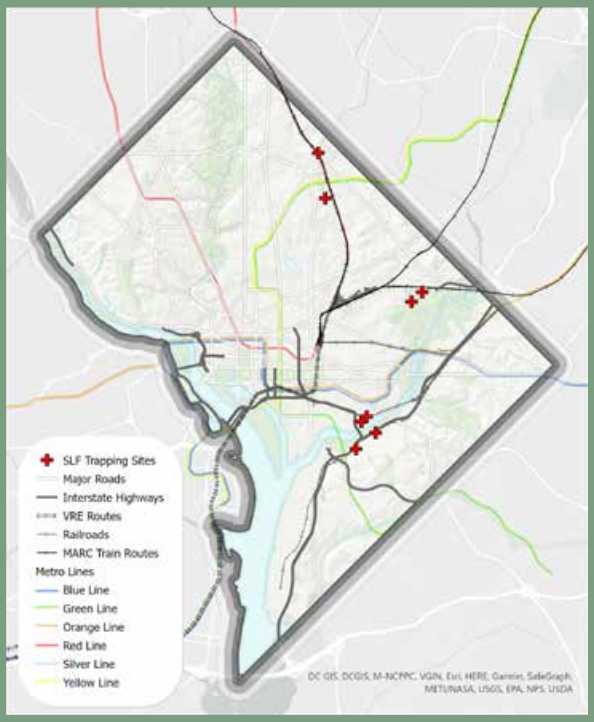
using sucking mouthparts. In doing so they generate a sugary liquid waste, often referred to as honeydew, usually resulting in copious amounts of sooty mold growth. Crape myrtle bark scale are unlikely to cause mortality, but may impact growth and flowering of crape myrtles, as well as reduce their aesthetic appeal. Consistent maintenance of crape myrtles and avoiding improper pruning, such as topping, will support healthy growth and longevity. Urban Forestry Division is assessing the distribution of crape myrtles in the District and consulting with Extension Researchers from Texas, where CMBS was first discovered. The CMBS management plan includes evaluating current inventory of crape myrtle, reduced planting of crape myrtles, targeted inspection of new trees for planting, proper disposal of any pruned limbs/branches of crape myrtle, consideration of Integrated Pest Management protocols for safe control of CMBS while supporting natural enemies, and finally, coordination of management efforts with other agencies in the District of Columbia.

Oaks make up a significant proportion of the urban forest in Washington, DC. Of the top ten most important species in the District's urban forest, two are oaks, Quercus palustris and Q. alba (iTree 2015). Among street trees, Quercus accounts for 22% of the street tree population (DC Open Data, 3/9/2020). In the District, Q. alba is one of the top five trees in carbon sequestration and oxygen production (iTree, 2015). Oak trees are also known to support high numbers of insect larvae (Tallamy, et al., 2009). Given the importance of oaks in providing benefits to both human and wildlife residents, heightened mortality of oaks could have wide-ranging impacts on the urban forest in Washington, DC.

District residents began reporting declining oak trees in the summer of 2019, mostly privately-owned white oaks, Quercus alba. The Urban Forestry Division (UFD) responded to reports with site visits and later in the summer invited USFS staff from the Morgantown Field Office to further investigate reports of rapidly declining oaks. Further investigation led to development of a collaborative project with the University of the District of Columbia and US Forest Service Forest Health Protection. The objectives of this project were to determine the current status of oaks (Quercus spp) in the District of Columbia and to assess the presence of pests and pathogens, particularly in association with decline or mortality.

Invasive plants present a significant threat to DC's urban forest. English Ivy, for example, is pervasive throughout all Wards and

Spotted Lanternfly Trapping Sites



has already killed many mature trees. Invasive management is left largely to an ad-hoc, volunteer-led approach. The District government previously operated an invasive management program, but it has not been active since 2015. Organizations such as Rock Creek Conservancy lead volunteer events to remove invasives, but are often limited in scope and the ability to work in only specific sections of DC or federal land. In 2022, the Citizens Forest Health Working Group - composed of concerned residents, non-profit stakeholders, and community leaders - began discussions ofn a coordinated approach to invasive management. Volunteer training programs have been successful in teaching how to identify and remove certain invasive plants from specific areas, and the Working Group has started working with city officials to outline how resources can be used to support these programs across the District.

SECTION 6

Goals of the Urban Forestry Master Plan

TREES IN PRIVATE SPACES

GOAL

Expand the City's Tree Canopy for All Private Land

TARGET

Pursue and expand participation in tree planting programs and care of private trees

ACTION	LEAD AGENCY	PARTNERS
Research the distribution of current tree giveaways and use information to focus application approvals, planting, and maintenance in areas of lower canopy, low income and areas with fast canopy removal	DDOT	OCTO, DOEE
Undertake social marketing research and launch a tree planting outreach initiative that includes feedback from neighborhood advocates on ways to engaging and increasing green infrastructure in their designated neighborhoods	DDOT	DOEE
Develop an outreach plan for areas with low program application but high need for tree canopy	DDOT	OCTO, DOEE, Casey Trees
Create outreach material to give to all residents receiving trees through a District program about how to water their trees (how often, when (time of year and day), best practices, etc)	DDOT	DOEE, Casey Trees

GOAL

Enhance Tree Policies and Protections Impacting Private Land

TARGET

Review planning and development procedures

ACTION	LEAD AGENCY	PARTNERS
Integrate Tree Permitting and Preservation into other Land Disturbing Permitting Authorities and Processes.	DDOT	DCRA
Expand tree and slope protection designation by identifying target areas within the District, particularly Wards 7&8	OP/OZ	OCTO, DDOT, ANCs
Increase tree planting goal in next update of Sustainable DC to be above tree planting replacement numbers	DDOT	DOEE, DGS, OCTO
Review green area ratio to remove flexibility developers have to remove forested plots & fulfill GAR with simply planting new trees or having solar panels	DDOE	DDOT

TARGET

Promote the use of trees as a method for stormwater management

ACTION	LEAD AGENCY	PARTNERS
Reduce the stormwater fee and/or provide a property tax credit for properties that plant and maintain trees	DOEE	DDOT, OTR

TREES IN PUBLIC SPACES

GOAL

Plant and maintain 10,500 new trees per year in priority areas to achieve 40% tree canopy cover by 2032

TARGET

Review planning and development procedures

Partners work together to meet the city's tree yearly planting goal:

TREES PLANTED	YEAR
13,722	2021
13,182	2020
13,748	2019
12,441	2017

GOAL

Improve, expand and coordinate tree care

TARGET

Standardize tree care across all D.C. land

ACTION	LEAD AGENCY	PARTNER AGENCY
Begin an annual mortality rate study for trees 0 to 3 and identify and implement tree mortality reduction strategies based on the findings	DDOT	OCTO
Collaborate with Pepco, District arborists and contractors to standardize pruning methods	DDOT	DOEE, Pepco, DGS, contractors
Implement a comprehensive watering and new tree maintenance program	DDOT	DOEE, DGS, DPR, DCPS, Casey Trees
Develop a response plan to emerging situations that threaten the urban forest	DDOT	DGS, DOEE, NPS

GOAL

Reach and maintain 40 percent Tree Canopy Goal

TARGET

Increase District Capacity for Tree Canopy on D.C. Land

ACTION	LEAD AGENCY	PARTNER AGENCY
Ensure that 95 percent of tree boxes in each Ward are stocked	DDOT	
Collaborate with Pepco, District arborists and contractors to standardize Coordinate tree planting with public land development projects	DDOT	DGS, DOEE, DPR, OP
Remove impervious surfaces to increase tree spaces when practicable	DDOT	DGS, DPR, OP
Explore opportunities to expand soil space during Streetscape improvements	DDOT	OP, OCTO, OP
Design the placement of infrastructure in right of way (overhead wires, sidewalks and underground utilities) to minimize the impact of]n existing or proposed trees.	DDOT	OP

TARGET

Increase Equitable Distribution of Tree Canopy

ACTION	LEAD AGENCY	PARTNER AGENCY
Increase tree planting in Wards with health disparities to achieve equity	DDOT	DGS, DOEE, DPR, OP, OCTO, Casey Trees
Equitable street tree canopy - continue to focus tree box planting in areas of greatest opportunity	DDOT	
Continue to implement a planting action plan to prioritize future tree planting with a focus on environmental justice and areas at risk to the effects of climate change (storm surge/floodplains, urban heat island	DDOT	DGS, DOEE, DPR, OCTO, OP

TARGET

Maintain or Improve Tree and Canopy Health

ACTION	LEAD AGENCY	PARTNER AGENCY
Remove harmful invasive plant species through a coordinated inter-agency effort	DDOT	DOEE, DGS, DPR
Conserve impaired Hardwood Forests and Urban Landscapes habitat ecosystems	DDOT	DOEE
Ensure every tree is pruned for the first 3 years after planting and at regular intervals to promote tree health and safety	DDOT	DGS, Pepco, Contractors
Monitoring for signs of emerging pests or disease	DDOT	DOEE, DGS, DPR

GOAL

Support Climate adaptation and mitigation

TARGET

Increase Diversity of D.C.'s Tree Canopy

ACTION	LEAD AGENCY	PARTNER AGENCY
Assess and integrate species best adapted to the District's changing climate into planting programs. Include strategic diversification of species and ongoing adaptive management.	DDOT	DGS, DOEE, DPR
Support riparian zone planting programs (UFD Strategy 2010)	DOEE	DDOT

TARGET

Maintain or Improve Tree and Canopy Health

ACTION	LEAD AGENCY	PARTNER AGENCY
Continue urban wood reuse program	DDOT	
Manage tree through cycle include reducing miles on tree, tree removal, successional planting and reuse	DDOT	DGS, DOEE, DPR, OCTO
Expand protection of tree based on curb cuts	DDOT	OP