CITY OF
WILMINGTON
NORTH CAROLINA

URBAN FORESTRY
MASTER PLAN

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Executive Summary

The urban forest is a defining and fundamental part of Wilmington's landscape. Made up of a mosaic of trees growing across the city, along its streets and parks, and in private landscapes, Wimington's urban forest—a green infrastructure asset—provides essential environmental, economic, and social benefits to the community. It helps lower summer temperatures, reduce stormwater run-off, improve human health, provide habitat for wildlife, improve water quality, and mitigate the effect of climate change. These, plus many other benefits trees provide, highlight the essential role that the urban forest plays in the quality of life of the Wilmington community.

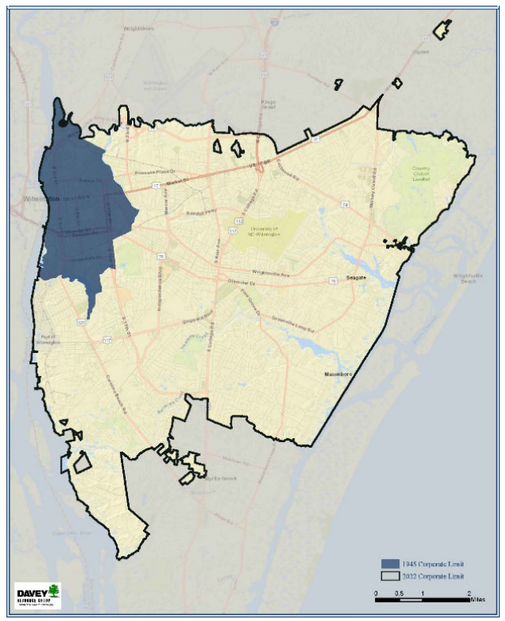
In 2022, the City of Wilmington began the process of developing this plan, the City's first comprehensive urban forestry master plan (UFMP/Plan). The UFMP provides a framework to develop a healthy, resilient, and sustainable urban forest by proactively managing, preserving, and growing Wilmington's urban forest. The UFMP highlights the current state of Wilmington's urban forest and outlines recommendations and actions to manage it as a sustainable community asset. While the urban forest includes all of the trees in the city—those on both public and private property—the UFMP focuses primarily on the public trees the City of Wilmington directly manages.

The Planning Process

The development, organization, and structure of the Wilmington Urban Forest Master Plan is based on answering four key questions of adaptive management: (1) what do we have; (2) what do we want; (3) how do we get there; (4) how are we doing. The principles of adaptive management are commonly used for resource planning and management, and provide a useful conceptual framework for managing Wilmington's urban forest resource.

Wilmington's Public Trees

The City of Wilmington is responsible for the management of an estimated 32,500 street trees as well as trees growing on 750 acres of City-owned parks and other properties. An inventory of the street trees within the city's 1945 corporate limits was conducted in 2022. The inventory, which represents an estimated one third of the city's public street trees, identified 10,449 trees and stumps in the 1945 corporate limit (see dark blue shaded area in the map below). There are over 160 different tree species growing in the inventoried area. **The top five species are crapemyrtle (28%), laurel oak (14%), live oak (8%), dogwood (5%), and willow oak (3%). They make up more than half (58%) of the area's inventoried street tree population.**



Dark blue shaded area is the 1945 corporate limits and the location of the 2022 street tree inventory.

In general, Wilmington's inventoried street trees are in good condition with young trees in better condition than more mature trees.

Public Tree Benefits

The 10,126 street trees inventoried in the 1945 corporate limits provide the city over $40,000 in benefits each year, including:

- Removing 6,000 pounds of air pollutants.
- Absorbing 88 tons of carbon each year.
- Intercepting and absorbing over 1.3 million gallons of stormwater in their canopies and roots.

These are just the benefits that can be quantified and only for those of the inventoried trees in the 1945 corporate limits. Trees also increase property values, reduce energy costs, lower crime rates, and help create more successful business districts. As Wilmington completes the street and park tree inventory and conducts an updated urban tree canopy assessment, benefits should be recalculated for the public street and park trees and the entire urban forest, using USDA Forest Service's tree benefits software, i-Tree Eco.

Managing Wilmington's Urban Forest

The care, planting, and maintenance of Wilmington's public street and park trees is provided by the City of Wilmington's Parks and Recreation Tree Maintenance Section. As with other infrastructure, such as roads, bridges, and utilities, City-managed trees require proactive and routine maintenance to ensure a resilient, safe, and sustainable urban forest that maximizes benefits to the community. The care and maintenance of Wilmington's public trees is primarily reactive, driven by storms, emergencies, resident requests, and high-risk trees identified by City staff. The Plan serves as a guide for Wilmington to transition to a proactive management program to improve efficiencies and create a sustainable and resilient urban forest.

Engagement

Community, City staff, and stakeholder engagement was instrumental in determining the vision, goals, and recommendations of the UFMP. Three groups were engaged during the process: the City project tream, stakeholders, and the Wilmington community (public).

The City project team was made up of City of Wilmington staff from various departments that provided technical input, feedback, and guidance during the UFMP development process.

Stakeholders representing groups and organizations whose work impacts Wilmington's urban forest helped identify local tree-related issues, challenges, and opportunities. These groups and organizations provided input through focus groups and individual interviews:

- Wilmington Tree Commission.
- Alliance for Cape Fear Trees.
- Historic Wilmington Foundation.
- University of North Carolina Wilmington.
- Wilmington Downtown, Inc.
- Cape Fear Public Utility Authority.
- North Carolina Department of Transportation.
- Duke Energy.

The Wilmington Community (public) were engaged to understand their values, needs, and priorities related to Wilmington's trees and urban forest. Over 1,535 community members completed the UFMP survey, and over 94% of respondents strongly agreed that trees are important to Wilmington.

Themes and Priorities

These engagement and outreach activities identified a set of themes and priorities that were used in the development of the UFMP's vision, goals, and recommendations.

- Tree Preservation and Protection.
- Staffing.
- Goals and Metrics.
- Public Tree Maintenance and Management.
- Sidewalk/Infrastructure/Property Damage.
- Tree Planting & Care.
- Species Selection and Diversity.
- Storm Damage.
- Policies and Standards.
- Interdepartmental Coordination.
- Partnerships.

Vision for the Future of Wilmington's Urban Forest

Wilmington's urban forest is an essential infrastructure asset that is highly valued for the positive contributions it makes to the quality of life and character of the city. It is proactively and sustainably managed through proper care, planting, policies, and community stewardship.

Urban Forest Master Plan Goals and Recommendations

The urban forest master plan vision, goals, and recommendations are based on input from the engagement and outreach activities, along with information and data gathered and analyzed during the planning process.

The UFMP's vision defines Wilmington's future urban forest. The UFMP's goals and their corresponding recommendations provide a framework for the proactive management, growth, and preservation of Wilmington's urban forest. The UFMP recommendations are listed by number for ease of identification and have not been prioritized. The UFMP includes an action plan that provides action items for each recommendation, along with timeframes for completion. While the action plan should serve as the basis for UFMP implementation, acceleration in implementation of recommendations and action items is encouraged as opportunities arise.

PLAN AND MANAGE

Plan and manage Wilmington's public trees through development and coordination in planning, design, and care to ensure its long-term health and sustainability.

- **Recommendation #1.** Complete the inventory of all public trees in Wilmington.
- **Recommendation #2.** Update Wilmington's urban tree canopy assessment.
- **Recommendation #8.** Dedicate City staff to support urban forest operations and education.
- **Recommendation #10.** Improve communication, collaboration, and coordination among City departments and outside entities.

PROACTIVELY GROW AND MAINTAIN

Proactively grow and maintain public trees to create a healthy, equitable, and resilient urban forest that maximizes the environmental, quality-of-life, and climate-mitigation benefits Wilmington's trees provide.

- **Recommendation #3.** Establish a proactive management program for Wilmington's public trees.
- **Recommendation #6.** Focus tree planting and care in locations that advance City equity and sustainability goals and priorities.
- **Recommendation #11.** Develop a strategy to manage wood waste and identify the highest and best use of wood from trees removed by the City of Wilmington.

PROTECT AND PRESERVE

Protect and preserve the urban forest from loss and threats to ensure the long-term sustainability of Wilmington's tree canopy.

- **Recommendation #5.** Ensure Wilmington's regulations, best management practices, and guidelines are in place to support tree canopy growth and preservation.
- **Recommendation #9.** Create and implement a program to monitor and address environmental threats to Wilmington's urban forest.

CONNECT AND ENGAGE

Connect and engage with the community about Wilmington's urban forest and the important role they play in its growth and care.

- **Recommendation #4.** Develop and strengthen relationships and partnerships to support implementation of the UFMP.
- **Recommendation #7.** Develop and implement a public engagement, outreach, and education plan.

Section 1

INTRODUCTION

INTRODUCTION

Vision for the Future of Wilmington's Urban Forest

Wilmington's urban forest is an essential infrastructure asset that is highly valued for the positive contributions it makes to quality of life and character of the city. It is proactively and sustainably managed through proper care, planting, policies, and community stewardship.

Developing a Plan for Wilmington's Trees

The urban forest includes all of the trees within the City of Wilmington—those growing around homes and businesses, along streets, in city parks, and on undeveloped land. A healthy, well-maintained, and abundant urban forest has been shown to improve air quality, help manage stormwater, lower summer temperatures, positively impact human health, and mitigate the effects of climate change.[1,2,3] In these ways, **trees play an essential role in enhancing the quality of life** of the Wilmington community. While trees are an important part of Wilmington, they can be most effective when **proactive tree care, management, and preservation are priorities** that are well-supported by the community and City government.

In 2022, the City of Wilmington embarked on a project to develop the city's first comprehensive urban forestry master plan. The UFMP serves as a guide for Wilmington to proactively manage, care for, protect, and grow the city's tree canopy. It provides insight into the current state of Wilmington's urban forest and outlines recommendations and actions to manage it as a sustainable community asset. While the urban forest encompasses all of the trees in the city—those on both public and private property—the UFMP focuses primarily on the public trees that the City of Wilmington manages.

Figure 1. Adaptive management process.

The Planning Process

The development of the Wilmington Urban Forestry Master Plan is based on the principles of adaptive management, which seeks to develop an effective plan by answering a series of questions about Wilmington's present and future. Adaptive management is commonly used for resource planning and management and provides a useful conceptual framework for managing Wilmington's urban forest resource.[4]

Wilmington's Changing Tree Cover

In 2016, 48.1% of Wilmington was covered by tree canopy.*

Today, based on an initial assessment of 2020 aerial imagery by the City of Wilmington's Department of Information Technology, **Wilmington's tree canopy is estimated to have decreased to 41.4%**.

Causes for Wilmington's loss in tree canopy include Hurricane Florence in 2018, development activities, and natural mortality of large, mature trees.

*Green Infrastructure Center, 2018. Trees to Offset Stormwater, Case Study 03: Wilmington, NC. Scottsville, VA: Green Infrastructure Center. 17pp.

> The roles trees play in implementing the Create Wilmington plan underscore their importance in improving and enhancing the quality of life in Wilmington by providing essential benefits and services.

Trees As Part of Wilmington's Future Growth

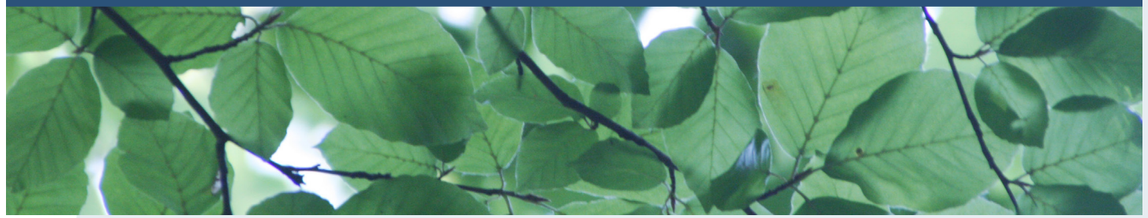
As a regional center for jobs and economic development, Wilmington is projected to grow in population for at least the next 25 years. By some estimates, the city will grow by 50,000 residents to 166,000 people—a 43% increase—by 2040.[5] Nestled between the Cape Fear River and the Intracoastal Waterway, Wilmington is geographically limited in its ability to expand its boundaries in response to growth. Adding connectivity, multi-modal transport, and sustainable development are all part of Wilmington's plan to grow in place while protecting its natural resources and beauty.

The 2016 "Create Wilmington Comprehensive Plan" sets the general direction for future growth and redevelopment across the city for the next 25 years by addressing various topics, including the environment, economy, housing, land use, transportation, and community services. The comprehensive plan includes trees as a component of many suggested practices and policies. These can be broadly categorized into three main areas where trees can help the City achieve its goals: (1) street trees to improve the comfort and safety of pedestrians, cyclists, and rapid transit users; (2) preserved and expanded tree canopy to help protect natural resources; and (3) trees as aesthetic elements that boost economic development and enhance the character of neighborhoods.

The roles trees play in implementing the "Create Wilmington" plan underscore their importance in improving and enhancing the quality of life in Wilmington by providing essential benefits and services. The next section highlights these benefits; the research and studies cited show the strong correlation (connection) between trees and these services.

TREES IMPROVE THE:

ENVIRONMENT



Trees Clean Water

Existing stormwater management systems are not always adequate to accommodate runoff. When a system is overtaxed, peak flows can cause stormwater to back up, causing flooding. During storm events, trees intercept rainfall in their canopies, acting as mini reservoirs. This intercepted rainfall evaporates from leaves or slowly soaks into the ground, reducing and slowing stormwater runoff and lessening erosion. Underground, tree roots create macropores (voids in the soil), which help to increase the amount of water soil can hold, allowing for greater absorption of rain compared to grass and open fields.[6] Each of these processes greatly reduces stormwater runoff, reducing flooding and erosion, and preventing sediments and pollutants from entering waterways.

As development in Wilmington converts more vegetated open space to impervious surface, natural buffers shrink, and the volume of stormwater runoff increases. This can contribute to localized flooding during large storm events, which can be further exacerbated by sea level rise. Flooding and storms threaten human health and well-being by increasing stress and providing vectors for disease. Flooding and storms also disrupt business activities in Wilmington and divert resources toward emergency response. Trees are also sensitive to storm damage and saltwater inundation. Ensuring that trees are properly cared for and maintained can reduce the risk that extreme weather will damage their condition and ability to withstand storms.[7]

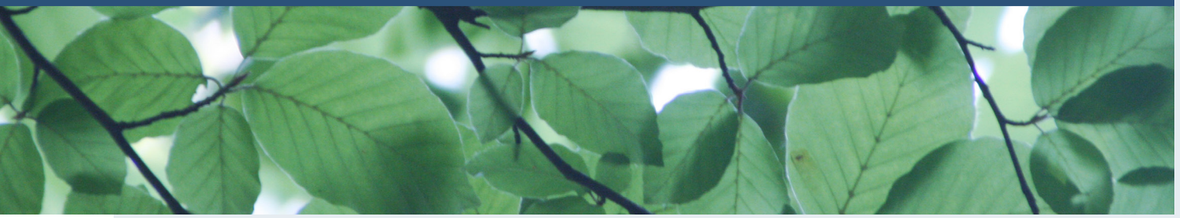
Allowing rainwater to slowly soak into the ground where it lands can reduce stormwater runoff and pollutants by 20–60%.[8] A 2018 study of Wilmington, "Trees to Offset Stormwater," demonstrates how trees contribute to stormwater management and help alleviate flooding in the city.[9] It estimates that **Wilmington's existing trees absorb 240 million gallons of water during an average high-volume storm event.** The study notes that tree canopy preservation and expansion are a major priority for Wilmington's stormwater management plan.

Trees Help Mitigate Climate Change

Trees reduce greenhouse gases that can trap and retain heat in the atmosphere and cause the city to get warmer. Carbon dioxide, a major greenhouse gas, is absorbed (sequestered) in tree trunks, branches, leaves, and roots during photosynthesis. The amount of carbon that can be stored is directly related to the size of the tree—larger trees store more carbon.[10] **A large, healthy live oak tree *(Quercus virginiana)* stores 3.5 times more carbon over its lifetime than a healthy, mature crapemyrtle *(Lagerstroemia indica).***[11]

Wilmington is one of the original signatories of the U.S. Conference of Mayors' Climate Protection Agreement, which established targets to reduce greenhouse gas emissions.[12] **The City's targets include reducing greenhouse gas emissions from municipal operations by 58% by 2050** from a 2007 baseline of 9,704 metric tons of carbon dioxide equivalent.[13] Proper investments in tree planting, care, and preservation can ensure that Wilmington's trees reach maturity, where their larger sizes can help achieve greenhouse gas targets and maximize the important benefits they provide.

ENVIRONMENT (continued)



Trees Clean the Air

Trees serve an important function in improving air quality, reducing air pollutants, and helping to lessen the public health effects of air pollution. Trees intercept and filter particulate matter from the air, including dust, ash, pollen, and smoke. They absorb harmful gaseous pollutants, such as ozone, nitrogen dioxide, and sulfur dioxide, and reduce ozone formation by shading surfaces and reducing air temperatures. **A large, healthy live oak tree *(Quercus virginiana)* growing in Wilmington can remove nearly four pounds of pollutants from the air each year,** including ozone, carbon monoxide, nitrogen dioxide, and particulate matter.[12]

Wilmington currently experiences among the best air quality in the U.S.—it was named the fourth best city in the country for air quality by the American Lung Association in 2021.[14] As the climate warms and development converts more land into impervious surface, planting new trees and preserving existing canopy will be an important strategy for maintaining the great air quality currently enjoyed by the city's residents and visitors.

Trees Cool the City

High temperatures in cities contribute to a phenomenon called the urban heat island. An urban heat island occurs when impervious surfaces such as roads, buildings, and sidewalks trap and hold heat, causing air temperatures to be hotter than in nearby areas that are less built up and have more green space. According to the Environmental Protection Agency, a city that has extensive areas of impervious surfaces can be 1–7 °F warmer than surrounding suburban areas during the day and up to 5 °F warmer at night.[15] With 30% of Wilmington's land cover consisting of impervious surface, urban heat island impacts can be significant.[16] Wilmington's current humid subtropical climate, characterized by hot, humid summers and mild winters, is predicted to become increasingly warmer with climate change.[17,18] Wilmington is likely to see 10 more days above 95 °F (extreme heat days) per year by 2045 and at least 16 additional warm nights, where the minimum temperature does not fall below 75 °F, per year.[15] Warm nights do not allow buildings and paved surfaces to cool off as quickly after hot days and can increase the risk of heat-related illness in urban residents.

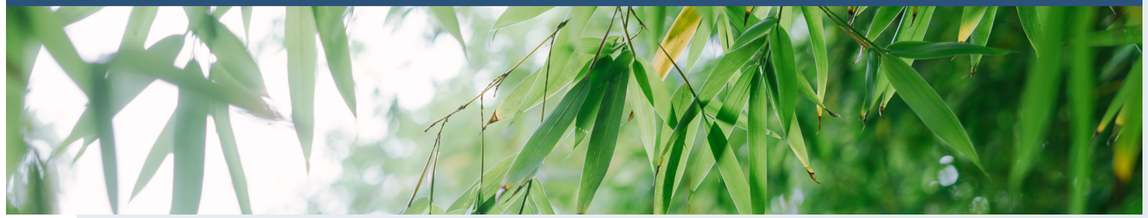
Shade from large, healthy, mature trees reduces the amount of sunlight that is absorbed and stored by impervious surfaces **while leaves release water vapor (transpiration) to cool the surrounding area**. Through shade and transpirational cooling, trees modify the environment and reduce urban heat island effects—reducing peak surface temperatures by 20–45 ºF.[19] Expansion of tree canopy, including over impervious surfaces, is important for reducing urban heat island effect.

Trees Support Wildlife

Trees provide critical wildlife habit for birds, mammals, reptiles, insects, fish, and other aquatic species. For birds in particular, the city's trees play a vital role; Wilmington is located within the Atlantic Flyway for migrating birds and is adjacent to three Audubon Important Bird Areas that provide nesting, feeding, and stopover points for a variety of native bird species.[20] Tree flowers provide a valuable source of pollen and nectar to hundreds of species of native bees and other pollinators, and canopies provide both food and shelter to a variety of wildlife.

TREES ENHANCE:

QUALITY OF LIFE



Because of the benefits that trees provide to human health, trees in Wilmington can help address two of the top three health priorities named by New Hanover County—obesity and violence.[21]

Trees Enhance Neighborhoods

Trees enhance neighborhoods by strengthening ties between neighbors, encouraging outdoor play by children, reducing crime, and providing an overall sense of safety.[22] A 10% increase in neighborhood tree canopy cover has been associated (correlated) with a 12–15% reduction in violence and property crimes.[23,24,25] Tree canopy cover near and around middle schools has been associated (correlated) with higher standardized student test scores in reading and math.[26]

Trees Encourage Physical Activity

Tree-lined streets are important assets for encouraging physical activity and supporting alternative transportation networks. Residents are three times more likely to be physically active when they live in areas with high levels of trees and vegetation.[27] Trees growing in street rights-of-way help slow traffic, making streets friendlier to pedestrians and cyclists.[28,29] Trees also shade and cool streets and sidewalks, making them more comfortable for walking, biking, and using public transit as well as increasing the appeal of cycling routes.[30]

Trees Improve Human Health

Increases in temperature are associated with increased rates of respiratory difficulties (such as asthma), heat stroke, and heat-related mortality. For every 1 °F increase in temperature during a heat wave, there is a 2.5% increase in the risk of heat-related mortality.[31] Heat-related illnesses cause more deaths in the United States each year than any other natural disaster, including hurricanes, lightning, tornadoes, floods, and earthquakes.[32]

Trees are an important tool in reducing stressors, such as heat, poor air quality, and flooding, that impact vulnerable populations and in helping to build adaptive capacity. People who live in neighborhoods with more tree canopy cover have better overall health, including lower rates of obesity, more social cohesion, less stress, and lower blood pressure.[33,34] In one study, the number of residents who reported poor mental health decreased 63% within 18 months after vacant lots near their homes were planted with grass and trees. A study of the ancillary health benefits that trees provide through reductions in air pollution finds trees save over 850 lives and prevent 670,000 incidents of acute respiratory symptoms in the United States each year.[35]

LOCAL ECONOMY

Trees impact the local economy indirectly through lowering energy bills and directly through increasing property values and increasing business.

Trees Can Lower Electricity Bills

Properly placing three trees around a home can reduce energy costs for the average household by $100 to $250 per year while shading air conditioning units can help them run up to 10% more efficiently and use less energy.[36] The U.S. Department of Energy found that low income households spend three times more—nearly 9% of their household income—on energy bills, compared to 3% of household income for non-low income households.[37] Less electricity use also leads to a reduction in power that needs to be generated, reducing greenhouse gas emissions by power plants.

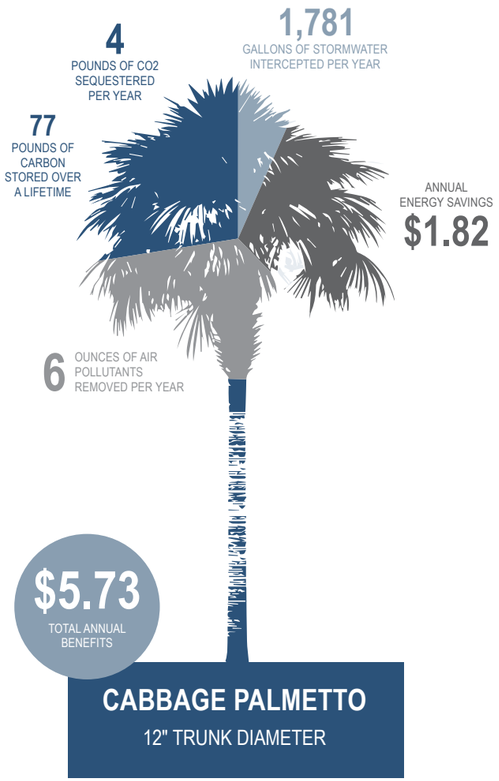
Trees Increase Property Values and Business

Mature, healthy trees can increase property values for both residential and commercial properties by an average of 10%.[38] A study in Riverside, California, found that the **property value of a residential lot adjacent to a preserved oak woodland was 17% higher** than a property that was 1,000 feet away from it. The **preserved oak woodland also increased the overall value of the community.**[39]

Researchers have found shoppers spend more time and money in shopping districts that have mature, healthy tree canopy.[40]

Tree Benefits by the Numbers

To illustrate the benefits that **individual trees** provide, four tree species and one palm species commonly found in Wilmington were examined, using the iTree MyTree tool—dogwood (*Cornus florida*), crapemyrtle (*Lagerstroemia indica*), southern magnolia (*Magnolia grandiflora*), live oak (*Quercus virginiana*), and sabal/cabbage palm (*Sabal palmetto).* As Figure 1 shows, different tree and palm species provide different levels of benefits, depending on their size, canopy, and age. For example, a live oak intercepts and absorbs nearly six times more stormwater (rainwater) than a sabal palm. **Planting and maintaining a diversity of tree species is key in creating resiliency and maximizing the benefits of Wilmington's urban forest.**



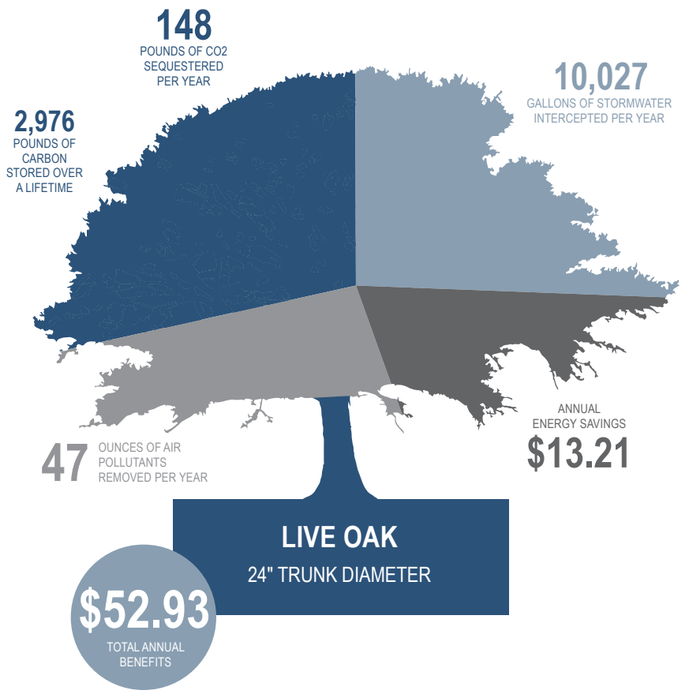
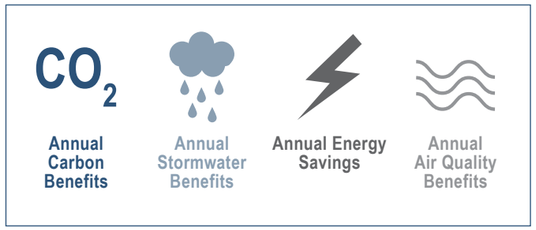
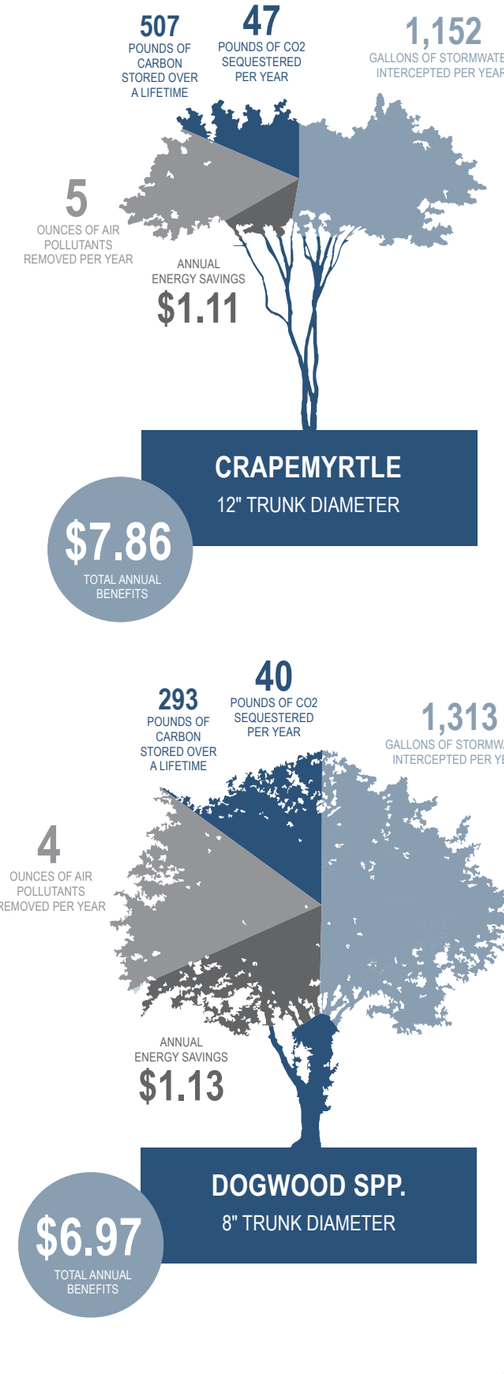
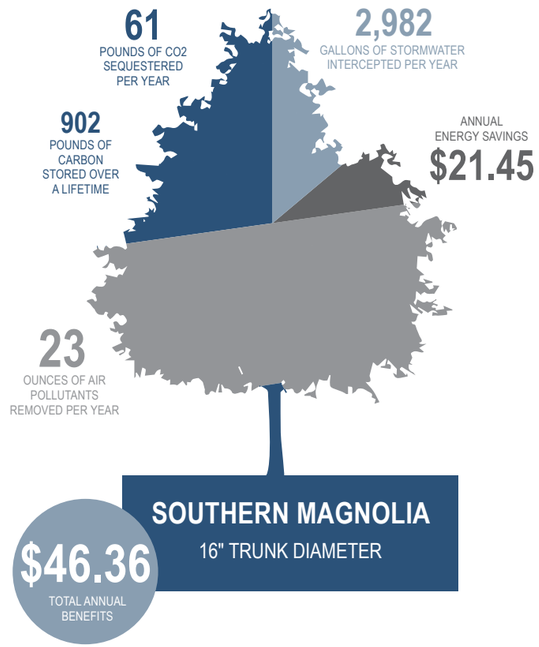


Figure 2. Benefits of tree and palm species common to Wilmington.





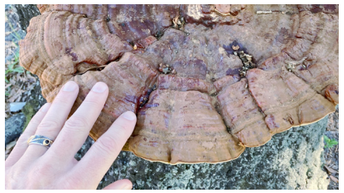


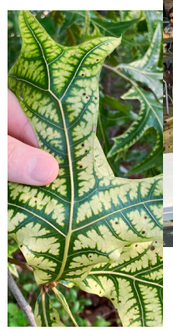
Moving Ahead

As this section illustrates, trees are essential to enhancing the quality of life in Wilmington and making the city sustainable and resilient. To harness and maximize the benefits that the urban forest provides, tree planting and maintenance must increase to match the level of public support that trees have in Wilmington. The Wilmington UFMP serves as a guide to do just that by offering a vision of the future of the urban forest that supports the care, preservation, planting, and protection of Wilmington's trees. Section 2 details the current state of Wilmington's urban forest by presenting information and data on Wilmington's trees to help us understand where the city is today to establish a baseline to measure future progress. It also examines priorities the Wilmington community and stakeholders have around trees and the urban forest. The UFMP's recommendations, actions, and goals are presented in Section 3. They focus on improving Wilmington's urban forest through proactive planning, management, and engagement. Section 4 provides ways to monitor and measure Wilmington's progress in improving the urban forest and maximizing its benefits.

Section 2

WILMINGTON'S URBAN FOREST





Wilmington's URBAN FOREST

The Wilmington area was originally inhabited by the Waccamaw (Woccon), Lumbee, and Manu—Yi Isuwa (Catawba) Nations, who farmed, hunted, and fished in the area's abundant forests and waters.[42]

Location and Climate

Let's begin by exploring Wilmington's urban forest. Wilmington is situated between the Cape Fear River and the Atlantic Ocean in southeastern North Carolina. It is located in the Middle Atlantic Coastal Plain ecoregion, which extends from New York to North Carolina. This ecoregion is considered to be one of the most ecologically diverse and species-rich ecoregions in the United States.[41]

Today, at nearly 53 square miles, Wilmington is a mix of built and natural landscapes. The climate is considered humid subtropical and receiving over 60 inches of rain on average each year. It is characterized as having hot, humid summers and cool winters with temperatures dipping below freezing throughout the winter. The average high temperature in July is 90 °F, and the average low temperature in January is 36 °F.[43] The city's primary soil type is sand with areas of clay and urban soils.[44]

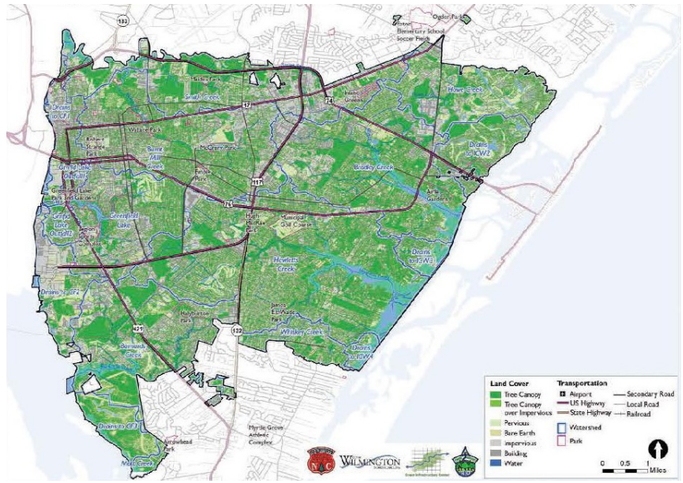
Urban soils are human-made, having been modified during development, and lack the structure, profile, and physical properties of native soils.

To manage Wilmington's urban forest proactively and sustainably, it is essential to have knowledge and insights into its current conditions and management. The sections that follow explore Wilmington's urban forestry data, resources, management, and policies to gain an understanding of the current state of the urban forest.

> “Causes for Wilmington’s tree canopy loss include Hurricane Florence, development activities, and natural mortality of large, mature trees.

Tree Canopy Cover

An urban tree canopy (UTC) assessment was completed for Wilmington in 2018 that measured the amount of leaves, branches, and stems from trees and other woody plants that cover the ground when viewed from above (Green Infrastructure Center 2018).[45] The UTC assessment used **2016 aerial imagery and found the city had 48.1% canopy cover** (Map 1); however, **this information is now considered out of date**. The study was conducted prior to Hurricane Florence, which made landfall in Wilmington in September 2018. Hurricane Florence caused significant tree damage and tree canopy loss in the city. A preliminary assessment of 2020 aerial imagery by the City of Wilmington’s Department of Information Technology **estimates Wilmington’s tree canopy has decreased to 41.4%**. Causes for Wilmington’s tree canopy loss include Hurricane Florence, development activities, and natural mortality of large, mature trees. The complete assessment by the Department of Information Technology is expected mid-2023.



Map 1. Map of Wilmington tree canopy cover (2016).

Regular tree canopy assessment updates are needed to measure canopy cover trends and to identify causes of canopy losses and gains in Wilmington. This information is crucial for prioritizing areas for tree planting, care, and preservation activities.

While Wilmington’s urban tree canopy assessment is currently being updated, it can nonetheless be helpful to examine its canopy cover against other communities. Exploring canopy cover in communities that are similar to Wilmington in terms of size, location, and/or climate can help to understand where Wilmington is and to learn what may be possible from other communities (Figure 2). Figure 2 includes both Wilmington’s 2016 tree canopy cover and the estimated 2020 canopy cover.

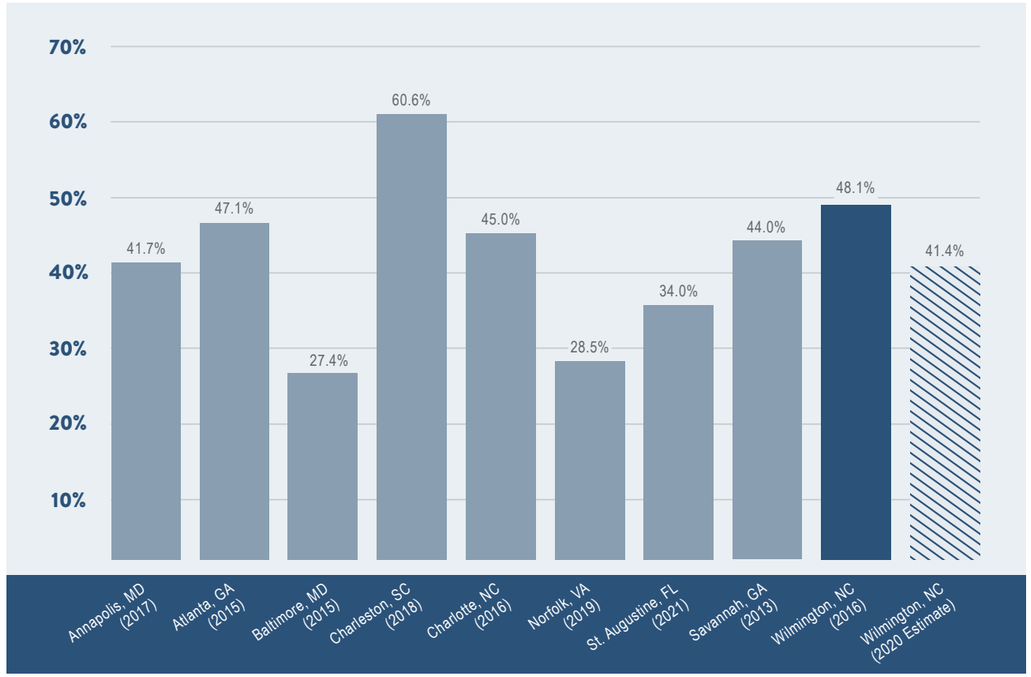
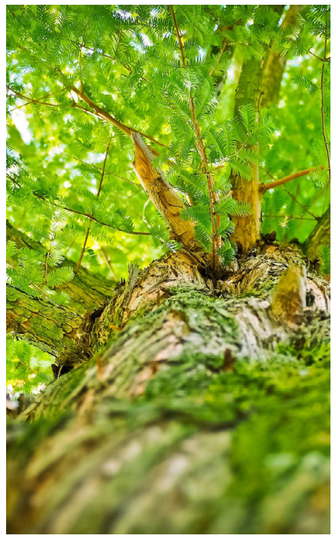


Figure 2. Tree canopy comparison by city.

Note: This is for general comparison purposes only. The methodologies used to calculate tree canopy cover may differ between communities referenced and/or the information may be outdated.



Wilmington's Public Trees

The City of Wilmington manages an estimated 32,500 street trees growing along the City's 490 miles of public streets as well as trees located on 750 acres of City-owned parks and other properties.[46] As part of the development of the UFMP, an inventory of public street trees was conducted within the Wilmington 1945 corporate limits (Figure 3). The street tree inventory was limited to the 1945 corporate limits due to budget resources; the UFMP recommends that Wilmington inventories all of its public trees on streets, in parks, and on public properties. In January–March 2022, ISA Certified Arborists with Davey Resource Group, Inc. (DRG), visited each street tree and gathered information about species, size, location, condition, and maintenance needs. A summary of the composition and benefits of the inventoried public street trees in the 1945 corporate limits is presented next. It is important to note that the information provided next represents approximately one third of the city's public street tree population, and the composition of these trees may be different than those in non-inventoried areas of Wilmington.

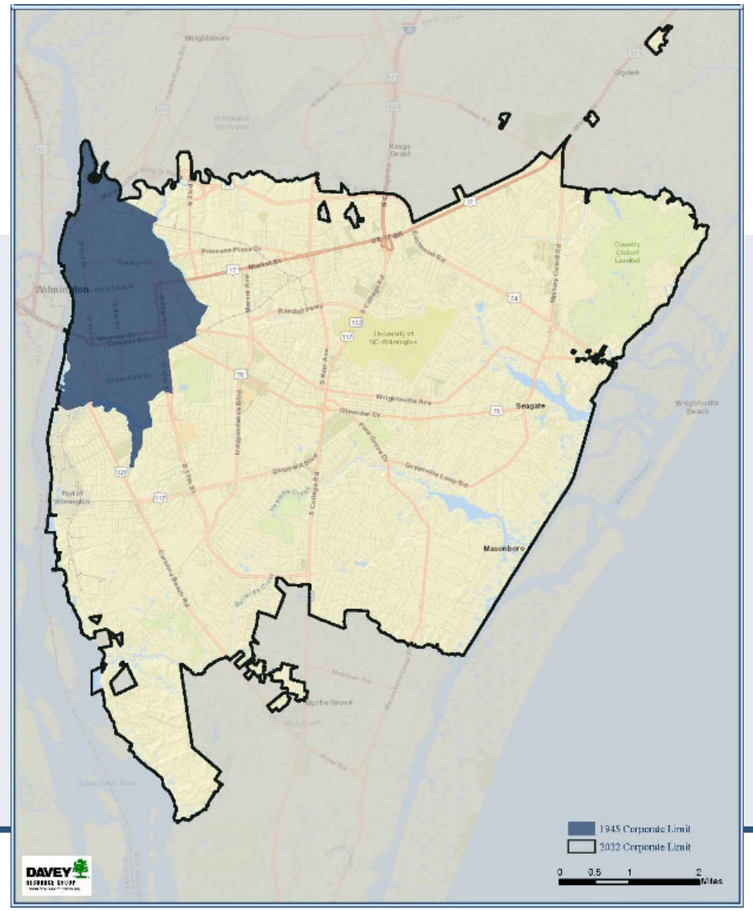


Figure 3. City of Wilmington boundary in black. Dark blue shaded area is the 1945 corporate limits where the 2022 street tree inventory occurred.

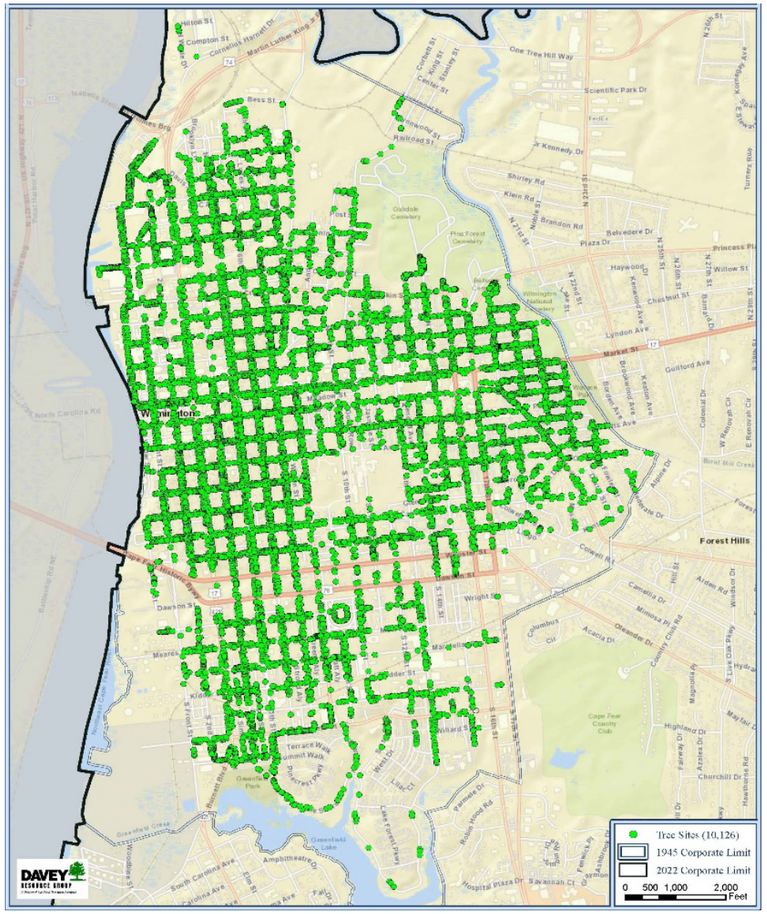
STREET TREES WITHIN THE 1945 CORPORATE LIMITS

The inventory identified 10,126 trees and 323 stumps in Wilmington's 1945 corporate limits (Map 2).

Street Tree Benefits

The 10,126 inventoried public stree and trees in the 1945 Corporate Limits, which represents only one third of the Wilmington's street trees, provide **$40,166 or $3.97 per tree in annual environmental benefits to residents**.

Source: USDA Forest Service i-Tree Eco, itreetools.org.
i-Tree quantifies the value and benefits trees provide.



Map 2. 2022 1945 corporate limits tree inventory sites.

Tree Diversity in the 1945 Corporate Limits

Species Diversity

Species diversity is the variety of different tree species in an urban forest. Having more tree species (greater diversity) maximizes the benefits of the urban forest while improving its resilience to threats, including tree pests/diseases and extreme weather events, such as storms and drought. The inventory catalogued **163 different tree species** within the inventoried area. The **top five species** within the 1945 corporate limits are **crapemyrtle (28%)**, **laurel oak (14%)**, **live oak (8%)**, **dogwood (5%)**, and **willow oak (3%)**. They **make up more than half (58%)** of that area's inventoried street tree population (Figure 4).

Industry guidelines recommend that a single species should not compose more than 10% of the tree population to reduce the tree population's susceptibility to pests and diseases**. Crapemyrtle and laurel oak exceed the recommended 10% threshold.**

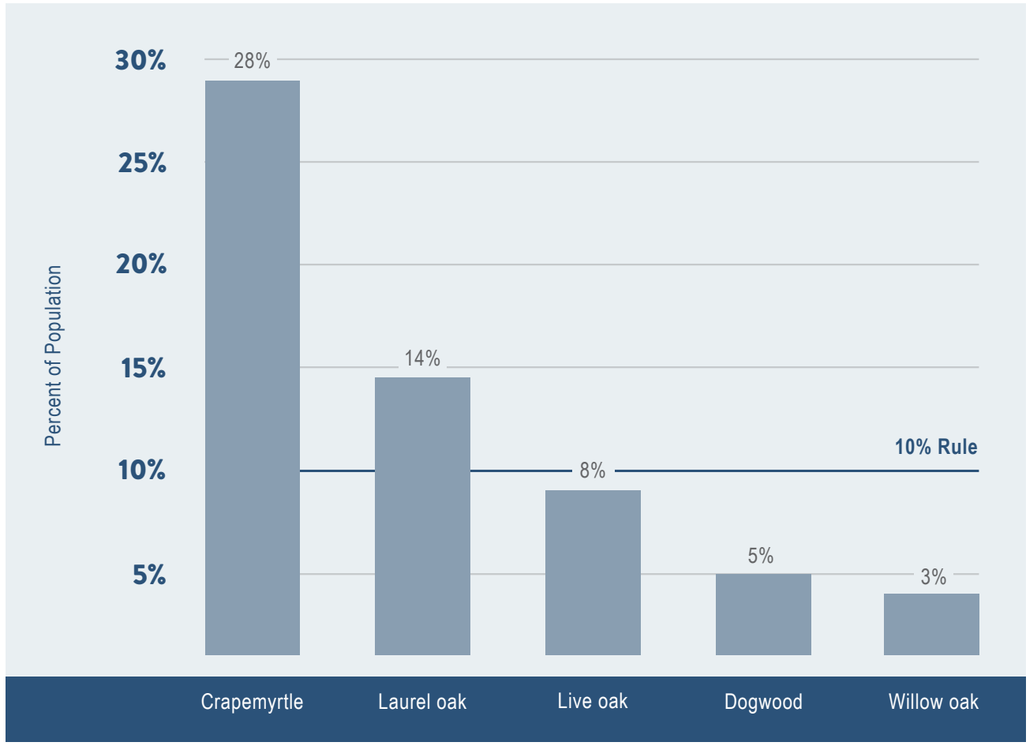


Figure 4. Top five tree species in Wilmington's 1945 corporate limits.

Genus Diversity

Genus diversity is another way to measure the variety of trees in the urban forest based on broader groupings of related tree species.[47] As with species diversity, more varieties of genera (greater diversity) help make the urban forest resilient to threats. The 163 different tree species that were inventoried can be grouped into 82 different genera. Of these, **oaks (29%) and crapemyrtles (28%) exceed industry guidelines** that a single genus should not make up more than 20% of the tree population (Figure 5).

When planting new trees, Wilmington should look at planting species that are less common but suitable for growing in Wilmington's climatic conditions with a preference towards North Carolina native tree species where appropriate.

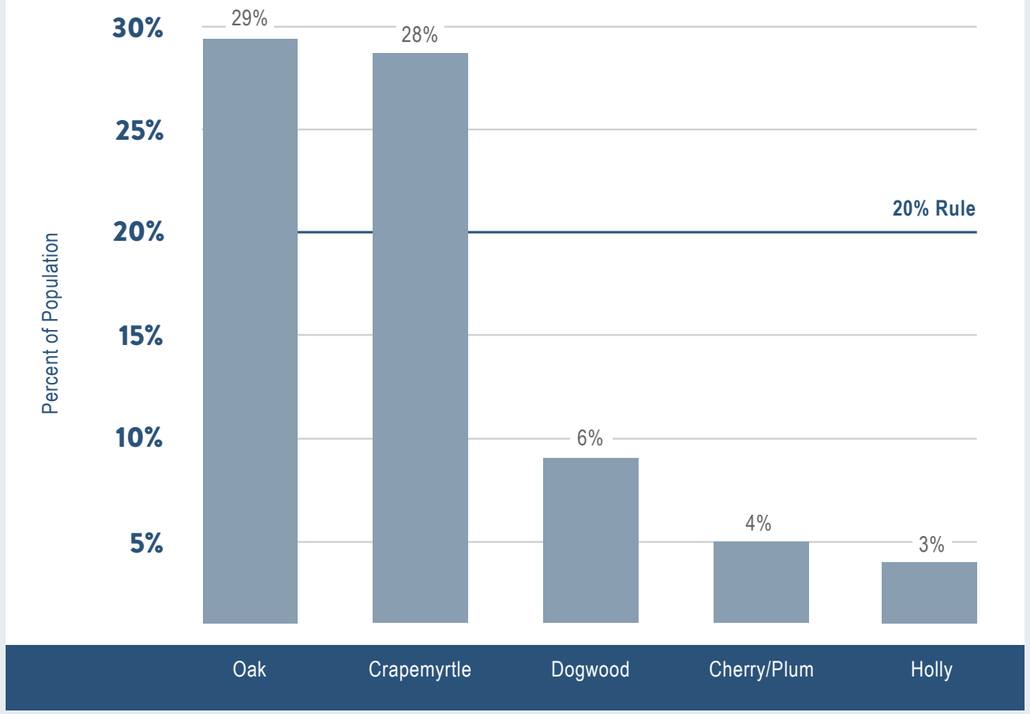


Figure 5. Top five tree genera in Wilmington's 1945 corporate limits.

> Approximately 2% of inventoried trees in Wilmington belong to species that are classified as invasive by the North Carolina Forest Service.

Invasive Tree Species

Wilmington's inventoried street trees are made up of a variety of native and non-native species. Based on DRG's experience conducting tree inventories for hundreds of U.S. cities, this composition is typical since harsh urban environments require species that are tolerant of these conditions.

Non-native species that are of most concern are those that are considered invasive tree species because they seed and grow prolifically, impacting native forests. Approximately **2% of inventoried trees in Wilmington belong to species that are classified as invasive by the North Carolina Forest Service**.[48]

These include Callery pear (*Pyrus calleryana*), silk tree/mimosa (*Albizia julibrissin*), Chinese tallowtree (*Triadica sebifera*), and tree of heaven (*Ailanthus altissima*). A periodic review of the types of trees planted in the city should be conducted to ensure invasive species are not being planted, and invasive species should be added to the City's do-not-plant list. Additionally, natural areas, parks, vacant lots, and yards near plantings of new, unproven, non-native tree species should be monitored to ensure new species do not start to become invasive.

Invasive Callery pear (*Pyrus calleryana*).

Invasive silk tree/mimosa (*Albizia julibrissin*).

Species Vulnerability

Climate Change

Wilmington's urban forest is vulnerable to the many effects of climate change, including flooding, extreme heat, and drought. By later this century, the region's plant hardiness zone is expected to move from 8a toward 9.[49] As Wilmington's climate warms, the types of trees that are planted in the city may need to change to ensure trees can survive summer heat waves, saltwater inundation, and drought as well as winter ice storms. Although tree species will vary in their ability to adapt to these changes, it is certain that habitat suitability will shift due to these climatic factors.

Table 1 lists species currently found growing in Wilmington, based on the inventory of the 1945 corporate limits and whether they are expected to gain, lose, or see no change to their habitat suitability. This information is provided by the USDA Forest Service Climate Change Tree Atlas,[50] which models climate change scenarios to measure the current and future distribution of 134 native tree species in the eastern U.S. The model used for this table predicts these changes for the end of the century under a high emissions scenario in Wilmington. This information should be reviewed and updated regularly to provide an accurate projection of climate suitability. While choosing the right tree for the right place is a complex decision, considering projected climatic suitability during species selection will contribute to growing a resilient urban forest in Wilmington.

> As Wilmington's climate warms, the types of trees that are planted in the city may need to change to ensure trees can survive summer heat waves and drought as well as winter ice storms.

Table 1. Predicted habitat change due to climate change of tree species growing in Wilmington.

PREDICTED HABITAT CHANGE	TREE SPECIES COMMON NAME	TREE SPECIES SCIENTIFIC NAME
Species Habitat Predicted to INCREASE	American holly	*Ilex opaca*
	Sweetgum	*Liquidambar styrociflua*
	Blackgum	*Nyssa sylvatica*
	Laurel oak	*Quercus laurifolia*
	Water oak	*Quercus nigra*
	Live oak	*Quercus virginiana*
	Bald cypress	*Taxodium distichum*
	American elm	*Ulmus americana*
Species Habitat Predicted to NOT CHANGE	Red maple	*Acer rubrum*
	Flowering dogwood	*Cornus florida*
	Longleaf pine	*Pinus palustris*
	Overcup oak	*Quercus lyrata*
Species Habitat Predicted to DECREASE	Eastern red cedar	*Juniperus virginiana*
	Yellow poplar	*Liriodendron tulipifera*
	Sourwood	*Oxydendrum arboreum*
	Loblolly pine	*Pinus taeda*
	Scarlet oak	*Quercus coccinea*

> 47% of inventoried trees in Wilmington are susceptible to at least one significant pest or disease.
>
> Routine inspection of City trees should be conducted to catch and control infestations early.

Tree Pests & Diseases

Insects and diseases can cause considerable damage to trees—even death. Their impacts can negatively affect the health, resilience, and benefits that Wilmington's urban forest provides and can lead to unexpected costs to treat or remove affected trees. Climate change impacts (drought, flooding, and high heat) will compound this issue not only by stressing trees and making them more vulnerable to invasion but also by providing suitable habitat to pests and diseases not currently suited to Wilmington.

Overall, at least **47% of inventoried trees in Wilmington are susceptible to at least one significant pest or disease** currently found in or around North Carolina. Of these, more than one third of the inventoried tree population is susceptible to the introduced pests: spotted lanternfly (*Lycroma delicatula*), eastern tent caterpillar (*Malacosoma americanum*), European spongy moth (*Lymantria dispar*), or Lecanium scale (*Parthenolecanium* species). The ability of these pests and diseases to impact oaks in particular make them significant threats to trees in Wilmington.

It is important to remember that the number of trees that are susceptible to pests and diseases only represents inventoried street trees in the 1945 corporate limits. Many more trees throughout Wilmington, including those on private property, may be susceptible to hosting these and other invasive pests. **Routine inspection of city trees for signs and symptoms of pests and diseases should be conducted** to catch and control infestations early before they can become well established within Wilmington's urban forest.

Defoliation caused by insect feeding.

Spotted lanternfly (*Lycroma delicatula*) is a non-native, invasive planthopper that feeds on a wide variety of hosts, including fruit, ornamental and hardwood trees, vegetables, herbs, grains, and vines. It has been confirmed in several counties across North Carolina as close as Onslow County.

Eastern tent caterpillar (*Malacosoma americanum*) is a tree defoliator commonly found in Wilmington. It was given its name for the tent-like nests that it makes. Caterpillars feed on tree leaves just after bud-break, and while it can cause defoliation, healthy trees usually leaf out again in a matter of weeks. Cherry, crabapple, and apple are common hosts, but many other trees also can be occasionally infested. It is primarily an aesthetic nuisance.

Photo credit: William Fountain, University of Kentucky, Bugwood.org. Creative Commons License licensed under a Creative Commons Attribution-Noncommercial 3.0 License.

Spongy moth (*Lymantria dispar*) is a highly invasive pest known for defoliating oak trees. Trees can typically withstand more than one year of defoliation, but multiple years can cause stress and eventual decline. North Carolina is currently the southernmost edge of its range with several counties under quarantine to limit its spread.

Photo credit: itchydogimages

Lecanium scale (*Parthenolecanium sp.*), also known as the European fruit lecanium, is a sap-sucking scale common to Wilmington that feeds on a wide variety of trees, including oak, hickory, birch, and fruit trees.

Photo credit: Joe Boggs, OSU Extension

Crapemyrtle bark scale (*Acanthococcus lagerstroemiae*) is a non-native, invasive pest newly introduced to North Carolina that primarily feeds on Crapemyrtle trees. Although rarely fatal, the tree's overall health and visual appearance is negatively impacted.

Young Dogwood

Established Dogwood

Maturing Dogwood

Mature Dogwood

Size and Age Composition

A tree's size—measured as the trunk diameter at standard height (DSH)—four and a half feet from ground level) can serve as a general predictor of its relative age (Table 2).

Table 2. Relative tree age estimated based on trunk size (diameter, DSH).

RELATIVE TREE AGE	LARGE-GROWING Greater than 35 feet in height at maturity (DSH)	SMALL-GROWING Less than or equal to 35 feet in height at maturity (DSH)
Young	0–8 inches	0–4 inches
Established	9–17 inches	5–8 inches
Maturing	18–24 inches	9–12 inches
Mature	Greater than 24 inches	Greater than 12 inches

The relative age distribution of the inventoried street tree population in Wilmington's 1945 corporate limits shows **that young, small-growing trees and mature, large-growing trees are overrepresented** relative to industry-recommended ideals (Figure 6). An ideal age distribution of 40% young trees, 30% established trees, 20% maturing trees, and 10% mature trees helps to prevent a scenario where a majority of trees reach maturity at the same time. This reduces the risk that canopy cover will be negatively impacted when these trees die or are removed around the same time.

To maintain a sustainable urban forest, it is important for Wilmington to have a mix of size/age classes to prevent a significant loss in tree canopy cover. To ensure there is an adequate mix of size/age classes:

- The preservation and care of mature trees should be prioritized to prevent loss of current tree canopy.
- New trees, especially species with large canopies at maturity, should be planted to replace old, dying, or dead trees.
- A variety of tree species that have different growth rates, mature size, and life spans should be planted.

Condition of Inventoried Trees

The condition of the inventoried tree population provides insight into its health and sustainability. Overall, inventoried trees are in good condition, meaning that at least 80% of trees' branches are in good health (Figure 7). Young trees have the highest overall condition while mature trees are most likely to be in "Fair" condition (at least 60% of branches in good health). Proper tree maintenance and care will help reduce the proportion of mature and maturing trees in "Poor" or worse condition.

> "Proper tree maintenance and care will help reduce the proportion of mature and maturing trees in 'Poor' or worse condition.

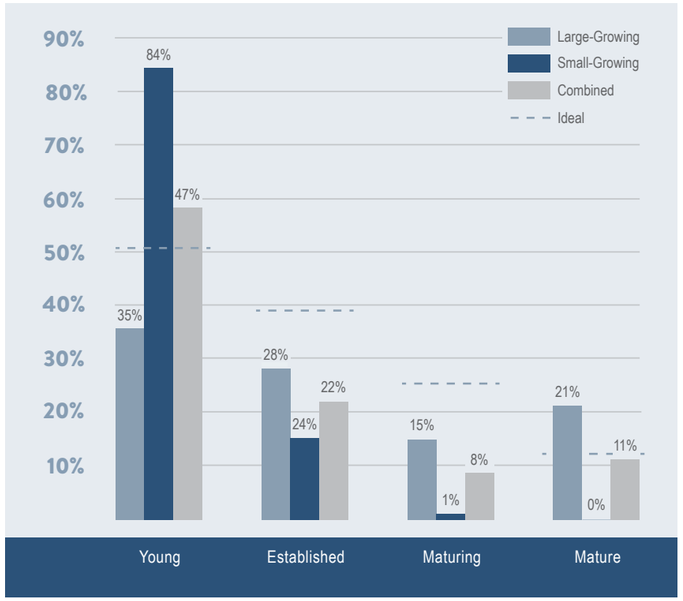


Figure 6. Percentage of large- and small-growing inventoried trees, grouped by estimated age and compared to an ideal percentage for each age group.

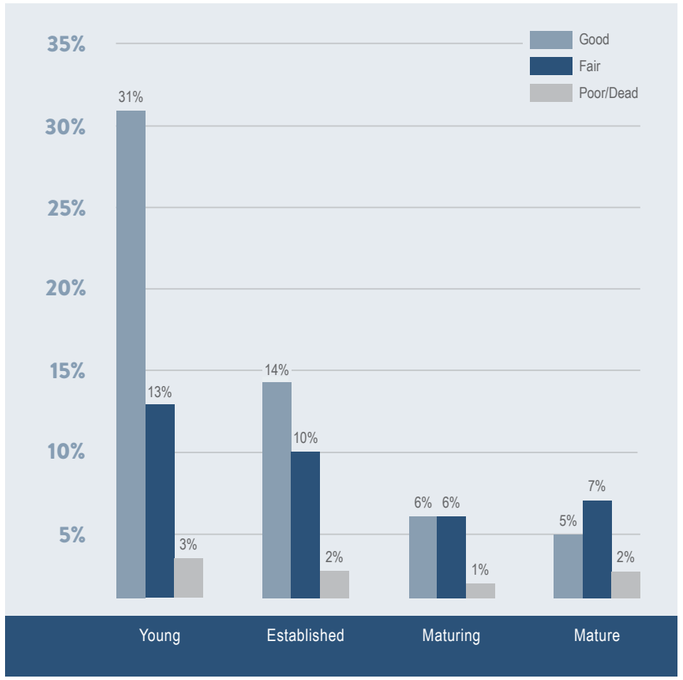


Figure 7. Condition of street trees in Wilmington's 1945 corporate limits.

Laurel Oaks

Wilmington is home to a sizable population of *Quercus laurifolia* (laurel oak) trees. As the 2022 street tree inventory shows, **laurel oaks constitute 13% of all existing street trees within the 1945 limits**. Many decades ago, when Wilmington's now-mature laurel oaks were originally planted, the species was commonly recommended as a prime choice for municipal street tree plantings in the southeastern United States. This early recommendation was based on the laurel oak's tolerance of poor soils, its quick growth rate, and its ability to provide large areas of shade over municipal streets and sidewalks. Today, fast-growing oak trees, such as the laurel oak, are understood to have short life spans (up to 80 years on average) when compared to their slower-growing relatives. Fast-growing tree species often suffer from health maladies and structural defects associated with a rapid rate of growth. For laurel oaks, the primary defect of concern is heartwood decay (heart rot), which typically sets in at 50 years of age and is now becoming more prevalent in Wilmington's canopy as more laurel oaks reach this milestone. The different species of fungi that cause heart rot in laurel oaks are untreatable. Disease resulting from heartwood infection will ultimately lead to partial or whole tree failure, at some point during a laurel oak's lifetime. Wilmington's Forestry staff are faced with the challenge of mitigating public safety hazards caused by decaying trees while preventing substantial canopy loss.

Maintenance Needs

Each of the 10,461 inventoried sites was assigned a recommended maintenance activity (Figure 8). The **most common primary maintenance need of inventoried sites is pruning** with 54% of established street trees in need of routine pruning, 24% of young trees in need of training pruning, and 11% of trees in need of higher-priority (risk-based) pruning. The remaining sites required removal of stumps to make way for future planting (3%). The backlog in stump removals is due to the Tree Maintenance Section's need to prioritize tree maintenance activities based on identified tree-related risk, and day-to-day staff capacity and equipment availability. Stumps are a not a high-risk priority, so their removal has not been prioritized.

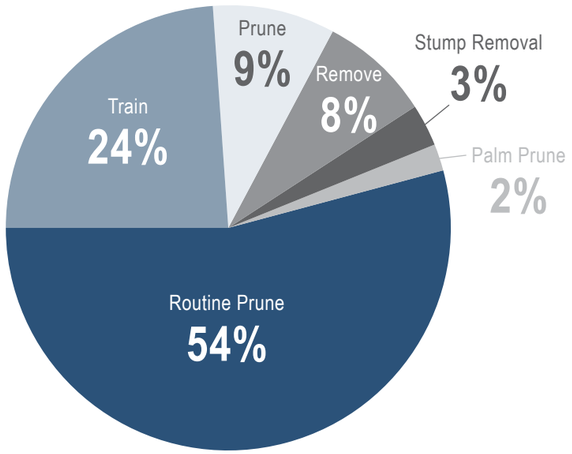


Figure 8. Primary maintenance needs of inventoried sites

TREE BENEFITS

Wilmington's 10,126 inventoried street trees provide **over $40,000 in benefits each year**,[51] (Figure 9) including:

- **Removing 6,000 pounds of air pollutants**, including ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, and fine particulate matter. This helps reduce atmospheric warming, improving air quality and the public health effects of air pollution.
- **Absorbing 88 tons of carbon each year** (carbon dioxide), which helps reduce greenhouse gas that can trap and retain heat in the atmosphere, causing the city to warm.
- **Intercepting and absorbing over 1.3 million gallons of stormwater** in their canopies and roots, which helps reduce the amount of water entering Wilmington's storm sewer system.

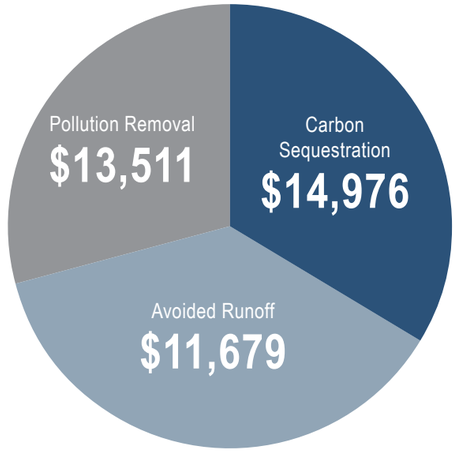


Figure 9. Annual benefits of inventoried trees

The structural value of the inventoried population is $11.6 million. Structural value represents the cost of replacing a given tree with an identical one. Structural value increases over time as more trees are planted and existing trees mature. The total value of Wilmington's trees will grow considerably in future years as the City works towards achieving its urban forestry and sustainability goals by planting more trees and maintaining existing ones.

These benefits just represent those of the inventoried trees in the 1945 corporate limits and can be quantified. Trees also boost property values, reduce energy costs, lower crime rates, and help create more successful business districts. As Wilmington completes the street and park tree inventory and conducts an updated urban tree canopy assessment, benefits should be recalculated for the public street and park trees and the entire urban forest, using i-Tree Eco.

Carbon Benefit

Over their lifetime, Wilmington's 10,126 inventoried street trees have stored over **4,748 tons of carbon**. That's the amount of carbon dioxide 1,079 cars in Wilmington produce each year.

1 ton = 2,000 pounds

According to NASA*, the average U.S. car produces 4.4 tons of carbon dioxide per year.

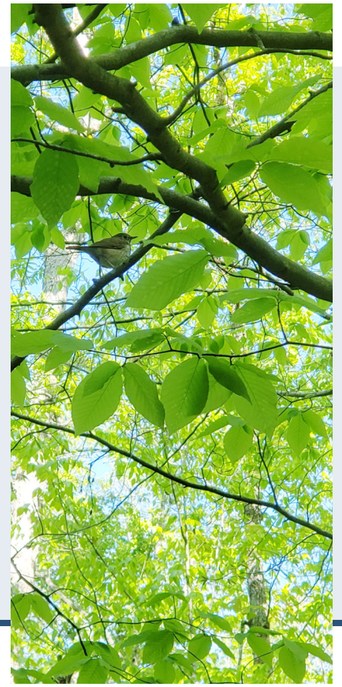
*https://climate.nasa.gov/news/3020/how-much-carbon-dioxide-are-we-emitting/

> A healthy, well-maintained, and abundant urban forest has been shown to improve air quality, help manage stormwater, lower summer temperatures, positively impact human health, and mitigate the effects of climate change.

Public Tree Management & Maintenance

The care, planting, and maintenance of Wilmington's public street and park trees is provided by the City of Wilmington's Parks and Recreation Tree Maintenance Section (Forestry).[52] Forestry is responsible for managing the estimated 32,500 street trees and trees growing on City-owned properties, including parks.

As with other infrastructure, such as roads, bridges, and utilities, City-managed trees require proactive and routine maintenance to ensure a resilient, safe, and sustainable urban forest that maximizes benefits to the community. The care and maintenance of Wilmington's public trees is primarily reactive, driven by resident requests, storms, emergencies, and high-risk trees identified by City staff. The UFMP will help Wilmington transition over time to a proactive management program that improves efficiencies and creates a sustainable urban forest (see "Benefits of Proactive Maintenance sidebar").



Benefits of Proactive Maintenance

- **Manages Risk & Improves Public Safety.** Addresses maintenance of trees that pose the highest risk—reducing liabilities and improving public safety.
- **Lowers Pruning Costs.** Lowers per-tree pruning costs compared to reactive pruning done in response to requests, emergencies, and storms.
- **Lessens Storm Damage.** Properly and regularly pruned trees develop better structure and form and are less susceptible to storm damage.
- **Reduces Future Tree-Care Costs.** Trees pruned regularly, especially when young, require less maintenance as they age, reducing future maintenance costs.
- **Improves Customer Service.** Reduces the number of tree-related service requests and improves customer service by pruning and removing trees before they become a problem or risk.
- **Creates a Sustainable & Equitable Urban Forest.** Helps to create a healthy, sustainable, and equitable urban forest by ensuring that tree maintenance occurs on all public trees—not just ones where maintenance has been requested.

TRANSITIONING TO A PROACTIVE MAINTENANCE PROGRAM

Reactive Tree Maintenance Program (top)

Addressing tree maintenance based on requests and emergencies is costly and can lead to damage to infrastructure, which negatively affects long-term tree health.

Transitioning to Proactive Maintenance (middle)

To begin the transition, current conditions need to be addressed. Trees need to be removed and replaced and sidewalks and streets need to be repaired. At the same, time proactive maintenance activities can begin using inventory data to establish pruning cycles for young and established trees.

Proactive Tree Maintenance Program (bottom)

Trees are pruned, removed, and planted proactively based on tree inventory data and an implementation of the urban forest management plan.

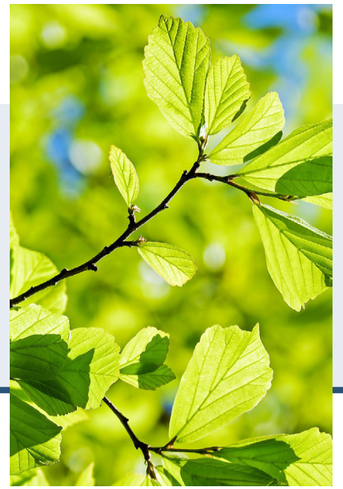
INDICATORS OF A SUSTAINABLE URBAN FOREST

To better understand and evaluate the level of urban forest care, management, and engagement in Wilmington, the city was assessed on 30 sustainable urban forest indicators. The Indicators of a Sustainable Urban Forest is a program assessment tool that uses industry standards and best management practices to assess a city's urban forest, its management, and the community and stakeholders that influence it.[53,54,55] Table 3 provides a summary of Wilmington's assessment for each Indicator. The full assessment can be found in Appendix A.

Wilmington's assessed performance level for each component:

- The Trees & Urban Forest: **LOW-MODERATE**.
- The Community & Stakeholders: **LOW**.
- The Management Program: **LOW-MODERATE**.

The results of the assessment identify areas where Wilmington's urban forestry program can be improved and were used in development of the plan's recommendations.



Summary of Wilmington's Performance Level on the Indicators of a Sustainable Urban Forest

Wilmington was assessed as:

LOW on 47% of the Indicators.

LOW-MODERATE on 13% of the Indicators.

MODERATE on 30% of the Indicators.

MODERATE-HIGH on 10% of the Indicators.

No Indicators were assessed as **HIGH**.

Table 3. Wilmington's assessed performance level on the Indicators of Sustainable Urban Forest. The full assessment can be found in Appendix A.

INDICATORS OF A SUSTAINABLE URBAN FOREST		CITY OF WILMINGTON ASSESSED PERFORMANCE LEVEL		
		Low	Moderate	High
The Trees & Urban Forest	Urban Tree Canopy		■	
	Equitable Distribution		■	
	Size/Age Distribution	■		
	Condition of Public Trees—Streets, Parks		■	
	Condition of Public Trees—Natural Areas	■		
	Trees on Private Property		■	
	Species Diversity	■		
	Suitability		■	
The Community & Stakeholders	Neighborhood Action	■	■	
	Large Private & Institutional Landholder Involvement	■	■	
	Green Industry Involvement	■		
	City Department/Agency Cooperation		■	
	Funder Engagement	■		
	Utility Engagement	■		
	State Engagement	■		
	Developer Engagement	■		
	Public Awareness		■	■
	Regional Collaboration	■		
The Management Program	Tree Inventory		■	
	Canopy Assessment		■	■
	Management Plan	■		
	Risk Management Program	■	■	
	Maintenance of Publicly Owned Trees (ROWs)	■		
	Maintenance of Publicly Owned Natural Areas	■		
	Planting Program		■	
	Tree Protection Policy		■	
	City Staffing & Equipment	■		
	Funding	■		
	Disaster Preparedness & Response		■	■
	Communications	■	■	

MANAGEMENT TOOLS

Tree Inventory

A comprehensive, up-to-date, computer-based geographic public tree inventory is the foundation of a municipal urban forestry program. It provides information on the composition, condition, risk, and maintenance needs of the city's publicly managed trees. Data from the tree inventory is critical for the development of plans and programs that sustainably manage the urban forest to maximize its benefits and minimize risk. It also aids in identifying work priorities and ensuring there are adequate resources, including funding, staff, and equipment to sustainably, efficiently, and cost-effectively manage and care for the urban forest.

As discussed in the "Wilmington's Public Trees" section, an inventory of the street trees in Wilmington's 1945 corporate limits was conducted in 2022. The inventory identified 10,126 street trees and 323 stumps, which represents approximately one third of the Wilmington's street trees. **A complete inventory that includes all street trees, park trees, and vacant street tree planting locations is important for Wilmington to manage and care for its urban forest resource**.

There are a variety of ways that tree inventories can be conducted, including by staff, consultants, or volunteers. However, with the technical data and information that needs to be captured during this initial inventory and to be consistent with the inventory data collected in the 1945 corporate limits, it should be performed by City Forestry staff and/or an urban forestry consultant. The staff/consultant should be trained urban forestry professionals and International Society of Arboriculture (ISA) Certified Arborists to ensure accurate information is collected on risk and recommended tree maintenance. Urban forestry industry standards recommend that municipal tree inventories are updated on a regular basis and re-inventoried every 10 years. To help maintain the inventory, volunteers could be trained to add newly planted trees to the inventory.

Urban Tree Canopy Assessment

While an urban tree canopy assessment was conducted in 2018, as discussed previously, the assessment is outdated due to the impacts that Hurricane Florence had on Wilmington and its tree canopy cover in September 2018. Industry standards recommend UTC assessments are conducted every 5–10 years, or more often dependent on natural disasters or development, to measure changes and also serve as a tool for understanding how City policies and procedures are impacting canopy cover. An updated canopy assessment will provide critical information on the trending direction of canopy cover in Wilmington. The City has 2020 aerial imagery and is working on conducting an assessment using City GIS staff and resources.

> "A sustainable, equitable, and resilient urban forest requires plans and programs in place that guide its development and management.

URBAN FORESTRY PLANS & PROGRAMS

A sustainable, equitable, and resilient urban forest requires plans and programs in place that guide its development and management. The following urban forestry plans and programs need to be developed for Wilmington:

Urban Forest Management Plan & Public Tree Maintenance Program

A management plan differs from a master plan in that it focuses specifically on the maintenance needs of Wilmington's public trees. Using current tree inventory data, the plan assesses risk and maintenance needs of the city's public trees and establishes a 3–5 year work plan along with identifying the resources needed to implement it.

The management plan should include the following sections as part of a **proactive public tree management program:**

Risk Management Program

A risk management program concentrates on proactively managing Wilmington's public trees to eliminate hazards and risk with a focus on public safety.

Urban Forest Disaster Preparedness & Response Plan

A disaster preparedness and response plan addresses how Wilmington responds to disasters that impact trees and the urban forest. The plan outlines staff roles, contracts, response priorities, debris management, and the communication plan. The Vibrant Cities Lab website provides resources on developing an urban forestry-specific disaster preparedness and response plan.[56] Information from the urban forest response plan should be included in Wilmington's emergency operations manual.

Tree Planting Plan

A tree planting plan establishes the areas of tree planting over a one- to five-year timeframe. The plan uses data from the tree inventory and/or urban tree canopy assessment to target planting in areas of greatest need within Wilmington to ensure equitable distribution of tree canopy.

Developing these plans and programs will help Wilmington identify and communicate program needs. Many communities have seen increases in budgets and resources as a result of plan and program development. For example, with the adoption of Columbus, Ohio's urban forestry master plan, new funding was allocated to conduct a tree inventory and hire additional program staff. Following the completion of Ann Arbor, Michigan's urban forest management plan, one-time funding was provided to address a backlog in street tree maintenance, and an annual forestry budget increase re-established a yearly street tree pruning program. These successful efforts serve to reinforce the importance of planning.

RESOURCES

Funding

Stable and sufficient funding is critical for Wilmington to proactively manage, maintain, and grow the urban forest.

Wilmington's urban forestry program is funded through the Community Services budget (General Fund) for street tree maintenance and the Tree Mitigation Fund for street tree planting. From fiscal year 2020–2022, the forestry operations and maintenance budget increased in part due to funding allocated for the development of the urban forestry master plan and to conduct the street tree inventory in the 1945 corporate limits (Figure 10).

Competing budgetary priorities and staffing resources have led Wilmington to operate a reactive forestry program. Tree maintenance activities are primarily driven by resident requests, high-risk trees identified by City staff and emergencies. A reactive urban forestry program leads to inefficient service delivery, low customer satisfaction, and negatively impacts the overall condition, value, and sustainability of Wilmington's trees.

The actual amount of funding needed to maintain a proactive program cannot be determined without a complete inventory of Wilmington's public trees. Benchmarking can help to see how Wilmington's urban forestry activities and budget align with other communities (see "Budget Benchmarking" sidebar). For Wilmington to increase funding to achieve the $53.46 per street tree "all cities average" shown in the "Budget Benchmarking" sidebar will **require a sustained budget increase of $607,720**. With this increase, Wilmington could fund activities, including:

- Completing the inventory of all City street and park trees (estimated one-time cost $175,000–$200,000).
- Exploring salary increases for tree trimmers to attract skilled staff and assist in job retention.
- Addressing the backlog of tree maintenance.
- Shifting to proactive maintenance and implementing an annual street tree pruning program.

To reach the national per-tree average and ensure there is sufficient funding to address maintenance needs from the complete public tree inventory, alternative funding sources should be explored (see "Investing in Wilmington's Urban Forest" sidebar).

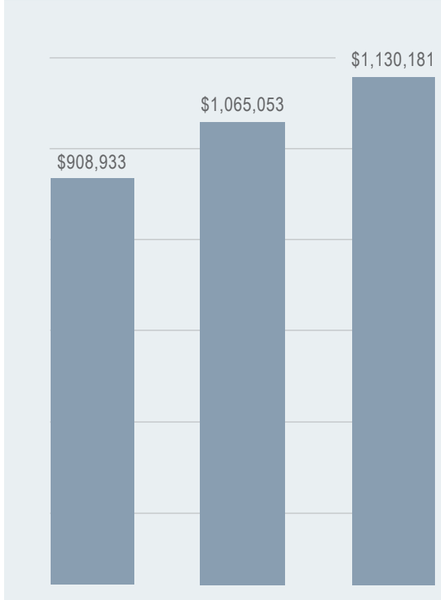
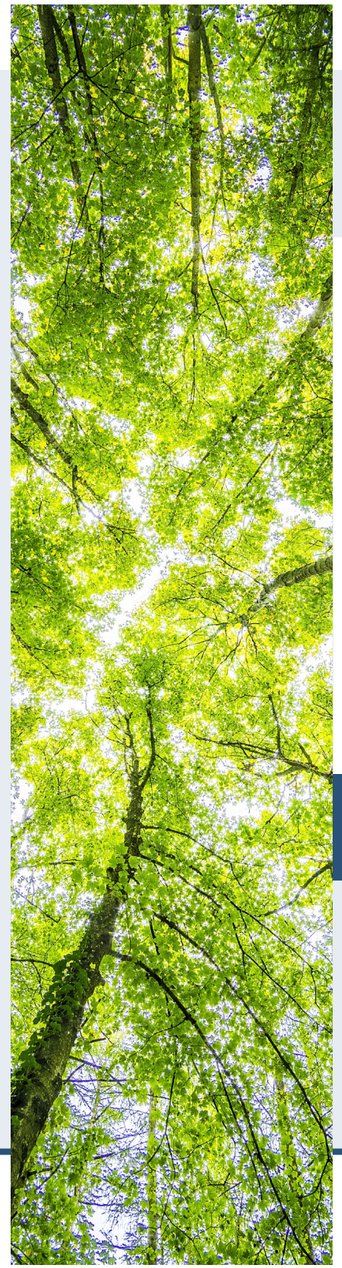
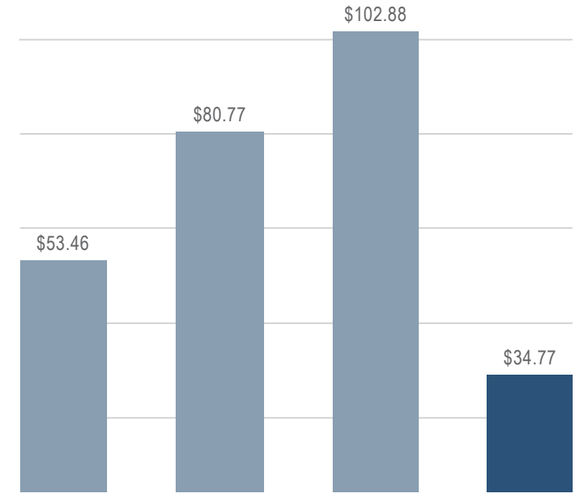


Figure 10. Wilmington's forestry budget fiscal year 2020–2022.



Budget Benchmarking

Wilmington's **urban forestry maintenance and planting budget** was compared to communities in the United States that completed the Municipal Tree Census survey.* Wilmington's **per-street-tree spending** is **35% lower than all surveyed cities** and 66% lower than Southern cities surveyed.



Important Note: 36% of surveyed communities stated their current budget was inadequate to meet urban forestry program needs, and on average were 45% below identified needs.

†2014 Municipal Urban Forest Census per-street-tree spending has been adjusted for inflation, based on the October 2022 Consumer Price Index

†† Based on estimated number of street trees in Wilmington (32,500) & Wilmington's FY22 budget.

*Hauer R. J. and Peterson W. D. 2016. *Municipal Tree Care and Management in the United States: A 2014 Urban & Community Forestry Census of Tree Activities*. Special Publication 16-1, College of Natural Resources, University of Wisconsin – Stevens Point. 71 pp.

Investing in Wilmington's Urban Forest

Street Tree Assessment. An assessment charged to property owners for the planting, care, and maintenance of street trees in a community. For example, the State of Ohio permits municipalities to collect fees for the planting, care, and maintenance of public trees (Ohio Revised code Chapter 721.011). The most common method of assessment is charging a fee based on the amount of right-of-way frontage—amounts range from $0.19–$1.16 per foot of right-of-way frontage.

In-Lieu Tree Mitigation Fees. Ensure fees for in-lieu tree mitigation (replacement) is assessed, collected, and deposited into the Tree Improvement Fund. Revise City codes to allow the Tree Improvement Fund to be used for all urban forestry management and planning activities, not just the planting of public trees.

Create a Wilmington Tree Fund. A new Wilmington Tree Fund could accept donations and grants to be utilized for both public and private property and urban forestry activities and programs. Current City code restricts the use of Wilmington's Tree Improvement Fund to the planting of public trees.

Establish a "Percent for Trees" Program. A percentage of all City Capital Improvement Project budgets are set aside for public tree maintenance and planting related to or within the project area.

Plan Review and Inspection Fees. Institute fee-based forestry plan review and inspections for both private and public activities.

Stormwater Utility Fees. Direct a portion of the fees collected through the City's Stormwater Utility to the forestry program in recognition of the stormwater benefits street trees provide. The 10,000-plus street trees in the 1945 corporate limits alone intercept 1.3 million gallons of stormwater each year.

Designate Special Taxing Districts/Assessment District. Designate an area as a special taxing district, where a majority of property owners allow the City to provide a public improvement or special service through a non-ad valorem assessment (not based on property value).

Internal Budget Transfers Between Departments. Analyze budgets to identify where Forestry can recoup costs for work provided to other City departments. Determine if there may be justifiable reallocations of budget resources or opportunities to share resources between departments.

Explore Carbon Financing to Support Tree Planting and Maintenance. Urban tree planting and maintenance projects are qualifying for carbon credits in the U.S. voluntary carbon market. These projects are especially attractive to companies looking to offset their carbon emissions because of their high visibility and the co-benefits that they provide. Carbon financing might be a viable option to support long-term tree planting and preservation projects in Wilmington and could support City sustainability and green-house gas reduction targets.

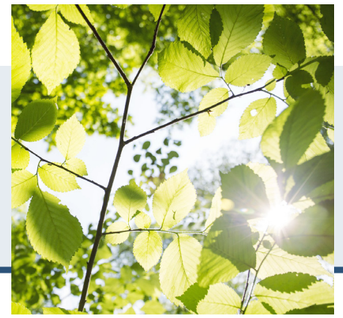
Grant Options. Explore grants connected to the benefits trees provide, such as public health and equity.

Staff

Wilmington's Tree Maintenance (Forestry) division has 11 budgeted positions: a forest management supervisor (City Arborist), a tree crew supervisor, three crew leaders and six tree trimmers. Table 4 provides the current full-time (FTE) Forestry positions and their duties. There are currently two vacant FTE positions (two tree trimmers).

Wilmington's Forestry staff hold many industry certifications, including:

- International Society of Arboriculture (ISA) Board Certified Master Arborist.
- ISA Municipal Specialist.
- ISA Certified Arborists.
- ISA Certified Tree Worker Climber Specialist.
- Tree Risk Assessment Qualified (TRAQ).
- Incidental Lie Clearance Certification.



Staff Training

The City of Chicago Bureau of Forestry has designated training agents, that teach city tree trimmers about arboriculture, climbing, safety and the City's tree work specifications.

Table 4. Tree maintenance (Forestry) section staff.

FULL TIME STAFF	NUMBER OF POSITIONS	NUMBER OF VACANCIES	CURRENT DUTIES
Forest Management Supervisor (City Arborist)	1	0	Manages Wilmington's urban forestry program and public tree care and assists planning with tree preservation reviews for private development.
Tree Supervisor	1	0	Oversees crews, creates, and delegates work assignments, conducts tree inspections, and supports the Forestry Management Supervisor.
Crew Leaders	3	0	Leads City tree crews and performs tree pruning, removal, and stump grinding.
Tree Trimmers	6	2	Performs tree pruning, removal, and stump grinding of City trees. (Tree planting is primarily contracted out.)

Wilmington's ISA Certified staff are an asset to a professional urban forestry program; however, the City lacks a formal training policy, and staff need City support in pursuing continuing education credits needed to maintain certifications.

Transitioning Wilmington to a proactive tree maintenance program while continuing to address resident requests and conduct management and planning activities will require additional skilled staff, in-house and/or contractors. The following staffing needs and priorities have been identified:

- Staff succession plans needs to be developed to ensure the transfer of institutional and technical knowledge as Forestry staff transition into retirement.
- Vacancies have hindered the ability of Forestry to complete their work, leading to backlogs in tree maintenance activities and service requests (described in Tree Maintenance Activities section).
  - » The City of Wilmington has had great difficulty in filling vacancies, specifically in community and public services, which includes tree trimmers.[57] This is due in part to compensation and the technical skills involved in doing tree-care and arboricultural work. The private sector provides higher compensation for skilled arborists than the City of Wilmington currently provides.
- The volume of plan reviews and inspections far exceeds the capacity of current Forestry staff. A new plan review arborist position should be created and filled.
- Urban forestry technician positions are needed to support tree-planting activities, tree inventory maintenance, outreach and education, tree assessments, and contract management.
- The use of contractors to conduct tree-care activities and provide plan review and other consulting services should be considered if staffing remains an issue.
- Utilize the talents of students from local colleges and universities (e.g., University of North Carolina-Wilmington, Cape Fear Community College, Miller-Motte College) by developing an urban forestry internship program. Interns can help with tree inventory data management/entry, outreach efforts, inspections, and minor tree maintenance tasks.

Equipment

The Forestry Section has small and large power equipment, bucket trucks, stump grinders and other equipment to perform routine tree pruning, tree removal, stump grinding, and inspections (Table 5). Equipment condition varies from "Excellent" to "Poor" with many pieces of equipment due for replacement. In addition to equipment that requires replacement, Forestry staff identified the following equipment needs:

- Large capacity chip truck (do not have a dedicated chipper truck).
- 18-inch chipper (current chippers can only handle logs 12 inches or smaller).
- 80-foot tracked spider lift with trailer.
- Double-axle boom truck for hauling logs.
- Trailer for stump grinding.

Equipment age, condition, and usage hours should be assessed periodically to determine when equipment needs to be replaced. Due to manufacturing timelines, the purchasing process should begin at least one year prior to the projected age-out date. As new Forestry staff are hired and new crews are brought online, equipment should be re-evaluated to ensure it is safe, reliable, and meets the needs of the crews.

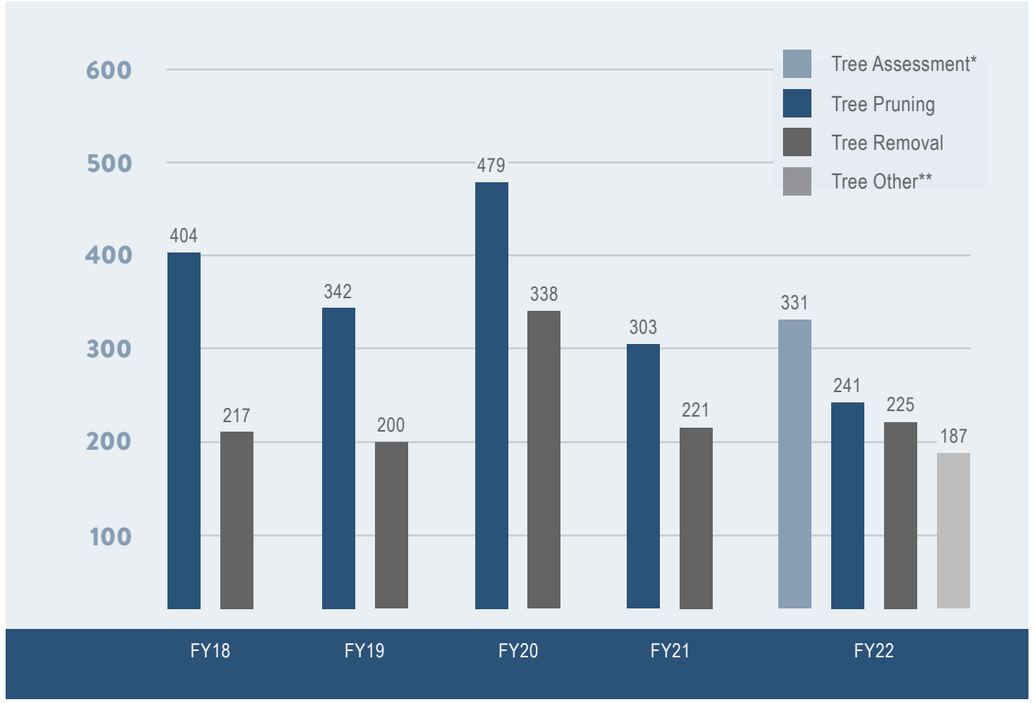
Table 5. Forestry equipment as of January 2023.

EQUIPMENT TYPE	QUANTITY	CONDITION RATING BY STAFF
Bucket truck	1	Excellent (2020)
Bucket trucks with chip boxes	3	Varies—two due for replacement
Chippers (12-inch)	3	Good—all three due for replacement
Knuckleboom/grapple loader truck (single axle)	1	Fair—replacement due in one year
Flatbed dump trucks	3	Poor—well beyond replacement
Pickup trucks	2	Good
Tracked stump grinder	1	Excellent (2021)
Tree spade (55-inch)	1	Excellent (2021)
Rubber-tired loader	1	Poor—due for replacement

TREE MAINTENANCE ACTIVITIES

As detailed previously, Wilmington's forestry program does not operate proactively. Tree maintenance activities, work priorities, and assignments are based primarily on resident service requests. **From fiscal year 2018–2022, tree pruning was the most requested tree care activity** (Figure 11). Wilmington, like many communities across the U.S., saw an uptick in tree-related service requests in FY20. This is likely due to residents being home and around the city's street trees more during the COVID-19 pandemic.

Figure 11. Forestry service request received by fiscal year 2018–2022



*Request type did not exist in former asset management system (INTELLIGOV). New system (Tyler Munis) started in FY22.
**Interdepartmental requests, stump removal, call for urban forester, stump grinding, planting, watering, equipment maintenance, custodial

Forestry strives to address service requests as quickly as practical; however, due to staff and budget resources (detailed previously), **there is a backlog of 904 open forestry work orders** (Table 6). Additional resources, such as funding, staff/contractors, and planning, would help address the work order backlog and improve customer service.

There are currently no industry standards or guidelines for the ratio of time that should be assigned to proactive and reactive work in a model urban forestry management program. However, based on DRG's experience, an ideal urban forestry management program would address the highest priority tree removals and tree pruning activities first (20% allocated to this task), followed by routine pruning and tree planting (60% allocated to this task) and reactive maintenance (service requests) (20% allocated to this task).

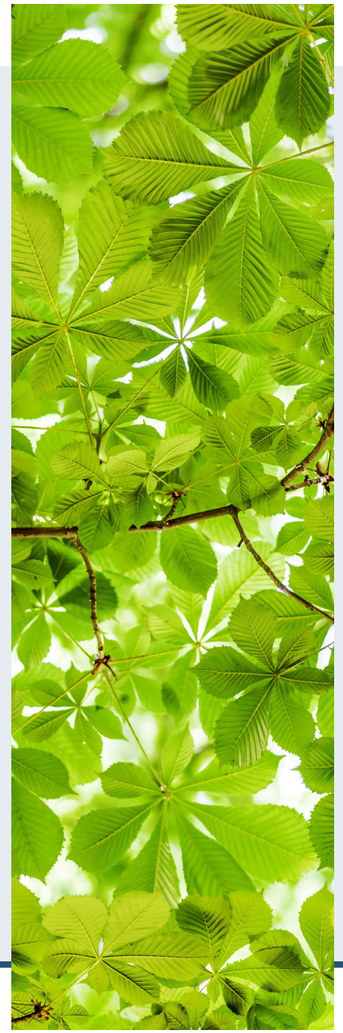
Table 6. Open Forestry work orders as of July 2022.

OPEN FORESTRY WORK ORDERS	
Tree Assessment	252
Tree Pruning*	221
Tree Removal*	147
Stump Grinding	274
Other Tree Work/ Miscellaneous	10
Total	**904**

*Note: Tree pruning and tree removal work orders may include work requested on multiple trees (e.g., tree pruning in a neighborhood).

Tree Planting

Tree planting is an important activity in maintaining a sustainable urban forest. It ensures that there is tree canopy now and for future generations. For Wilmington's public street and park trees, the City should, at a minimum, strive to **plant as many trees as it removes each year** (on average 600 trees per year). Additional trees should be planted to account for new tree mortality.



Wilmington Tree Initiative

Established in 2020, the Wilmington Tree Initiative is a partnership organization with a goal to plant trees on public and private property in Wilmington. WTI develops partnerships with schools, neighborhoods, and other organizations to support and encourage tree planting through tree giveaways, education, and outreach.

- WTI Partner Organizations.
- City of Wilmington.
- Wilmington Tree Commission.
- Alliance for Cape Fear Trees.
- Cape Fear Garden Club.
- Cape Fear Community College.
- Plastic Ocean Project.
- Keep New Hanover Beautiful.
- New Hanover County.
- North Carolina Cooperative Extension.
- University of North Carolina Wilmington.

WTI Partner Tree Planting and Tree Giveaways 2020–2022

873 **trees planted** by the City of Wilmington.

9,164 **trees and seedlings distributed** through tree giveaways.

2,422 **trees planted** by partner organizations.

CITY POLICIES, PLANS, AND STANDARDS

Across the City, divisions and departments are actively working to improve and enhance the services provided to the Wilmington community. To enhance these services and aid in implementation, City departments develop plans, studies, and strategies. A review of select City of Wilmington plans, studies, and standards was conducted to evaluate the degree to which tree preservation, protection, and planting are incorporated.

Trees fully incorporated & implemented

Trees incorporated but requires revisions or implementation

Trees not incorporated

Technical Standards and Specifications Manual (2007)

The "Technical Standards and Specifications Manual" provides standards and specifications required by the City of Wilmington for the construction of public infrastructure and improvements. Related to trees, the specifications provide tree removal and permit requirements, approved species list for street trees and buffer yard trees, and standard details for tree protection and street tree spacing.

The Manual's tree specifications and standards should be reviewed and revised to strengthen tree protection and preservation and develop/revise tree maintenance and planting standards to align with industry standards and International Society of Arboriculture best management practices.

"Create Wilmington Comprehensive Plan" (2016)

The "Create Wilmington Comprehensive Plan" provides a vision and strategy for growth and redevelopment in Wilmington over the next 25 years. The importance of trees and the urban forest is mentioned throughout the comprehensive plan. The comprehensive plan's policies document identifies specific policies to support growth, preservation, and care of Wilmington's urban forests while reducing infrastructure conflicts (Section 6.3 Urban Forest). The development and implementation of the urban forestry master plan recommendations and actions will aid in addressing urban forest and street tree priorities identified in the comprehensive plan.

"Trees to Offset Stormwater": Case Study 03, Wilmington, North Carolina (2018)

The "Trees to Offset Stormwater" study, conducted in 2018, used 2016 aerial imagery to map the tree canopy cover in Wilmington. A modeling spreadsheet was developed for Wilmington to estimate stormwater runoff under different tree canopy scenarios. The study found the city had 48.1% canopy cover in 2016; however, this information (as previously highlighted) is now considered out of date. Hurricane Florence impacted Wilmington in September 2018, causing significant tree damage and tree canopy loss in the city. An updated tree canopy assessment is recommended.

Street Tree Removal and Planting Guidelines (Internal Use DRAFT—Not Dated)

The "Street Tree Removal and Planting Guidelines (Internal DRAFT)," developed by the Tree Maintenance Division, provide specific criteria for public tree removal and standards for tree planting. These guidelines should be formally adopted by the City of Wilmington after review and necessary revisions.

Tree Root and Sidewalk Study Report (2020)

The "Tree Root and Sidewalk Study" identifies strategies for mitigating and preventing tree root and sidewalk conflicts. The study sampled 72 trees in four neighborhoods that comprise 90% of documented root-sidewalk conflicts in the city. A decision flowchart helps guide users to potential solutions based on the condition of the tree and sidewalk. Additional technical information is presented to aid in implementing the solutions, including design details and cost estimates.

This study provides useful and detailed information to both mitigate current tree and sidewalk conflicts and prevent future conflicts. The processes for determining tree preservation or removal along with the solutions detailed in this study should continue to be implemented by Wilmington.

Urban Design Policy (DRAFT 2022)

Using the 2016 "Create Wilmington Comprehensive Plan" as the foundation, the "Urban Design Policy (DRAFT)" focuses on protecting and preserving Wilmington's "natural and cultural assets."

The Urban Design guidelines include recommendations for the planting and preservation of trees on public and private property. To align priorities from the comprehensive plan, the "Urban Design Policy" could name trees more explicitly by:

- Using updated tree canopy assessment data and the "Trees to Offset Stormwater" study to set canopy goals and identify and prioritize planting areas.
- Prioritizing planting in publicly owned rights-of-way along main pedestrian, bike, and transit corridors and along main connectors to parks.
- Prioritizing tree plantings over impervious surfaces.
- Ensuring the forestry management supervisor (city arborist) is an active member on the design review panel for complete streets and new public/private development.

Wilmington Heritage Tree Program

Wilmington's Heritage Tree Program is administered by the Wilmington Tree Commission with support from the forest management supervisor (city arborist). The purposes of the program are to identify and record Wilmington's old, rare, and/or significant trees and increase awareness of the value they bring to the city's landscape. The program accepts nominations and maintains a Heritage Tree map and list available on the city's website. There are currently over 55 locations with designated heritage trees.

City Codes and Regulations

City regulations and ordinances establish the regulatory framework for the protection, preservation, planting, and care of public and private trees. Wilmington's ordinances (Chapter 7, Parks and Recreation and Chapter 18, Land Development Code) and City Charter were reviewed by Davey Resource Group in May 2022, using a set of criteria developed based on the 2016 Municipal Tree Census and International Society of Arboriculture Ordinance Guidelines.[58,59] Any changes to City codes and regulations after May 2022 are not reflected in this ordinance review. The ordinance review (Appendix B) identifies several criteria that could be strengthened or are not currently addressed, including:

- Strengthening tree protection and preservation measures for public trees, including penalties for encroachment into the dripline/critical root zone of public trees.
- Incentivizing private tree preservation and protection.
- Requiring adherence to ANSI A300 standards and best management practices for public trees.
- Requiring outside contractors conducting public tree work to be ISA Certified Arborists.
- Establishing a formula for determining the monetary value of removed or damaged public trees.

There are **not sufficient staff in place to enforce the City's tree protection and preservation** regulations. The **number one issue raised by residents** in the urban forestry master plan community survey was the **loss of trees due to development**. This is a real concern for the community and could be addressed in part by adequate, consistent, and strong enforcement of city tree ordinances.

Trees fully incorporated & implemented

Trees incorporated but requires revisions or implementation

Trees not incorporated

> When we plant a tree, we are doing what we can to make our planet a more wholesome and happier dwelling-place for those who come after us if not for ourselves.
>
> —Oliver Wendell Holmes

ENGAGEMENT AND OUTREACH

Community and stakeholder engagement played an important part in developing the UFMP. Three groups were engaged during the plan development process—the City Project Team, stakeholders, and the Wilmington community. Input gathered from the outreach and engagement activities provides important context for understanding community and stakeholder needs and priorities.

City Project Team

The City project team's role was to provide technical input, feedback, and guidance during the plan development process. The project team provided insights into the engagement and outreach plan, reviewed stakeholder and community feedback, and provided guidance and direction the on the UFMP's recommendations. The City project team was made up of City of Wilmington staff who represented the following departments and divisions: Community Services, Parks and Recreation, Tree Maintenance, Planning and Development, Stormwater, and Public Services.

Stakeholders. Stakeholder engagement gathered input from groups whose work has an impact (positive or negative) on Wilmington's trees and the urban forest. Stakeholder engagement provided an opportunity to identify and learn about urban forest/tree issues, challenges, and opportunities in Wilmington. The following organizations provided input through focus groups and individual interviews:

- Wilmington Tree Commission.
- Alliance for Cape Fear Trees.
- Historic Wilmington Foundation.
- University of North Carolina Wilmington.
- Wilmington Downtown, Inc.
- Cape Fear Public Utility Authority.
- North Carolina Department of Transportation.
- Duke Energy.

Wilmington Community

The Wilmington community (public) was engaged to understand their values, needs, and priorities related to Wilmington's trees and urban forest. An online survey was developed to gather community feedback. To publicize the survey, fliers were posted at public park facilities and community centers in Wilmington. Paper copies of the survey were also available at these locations as an alternative to the online survey. The paper surveys were collected and responses were incorporated in the survey analysis. 1,536 community members completed the survey.

Community Survey Results

Most Valued Tree Benefits

1. Improve air quality.
2. Provide wildlife habitat.
3. Reduce stormwater and flooding.
4. Create shady canopies & reduce temperatures.
5. Prevent the city from becoming hotter.

Biggest Challenges with Trees

1. Risk of storm damage.
2. Block street lights, signs, and visibility.
3. Cause property damage.
4. Damage sidewalks & streets.
5. Damage utilities.

Of the 1537 Respondents:

50+% HAVE LIVED IN WILMINGTON FOR OVER 11 YEARS

66% FEEL THERE ARE TOO FEW TREES IN THEIR NEIGHBORHOOD

AGREE THAT HAVING TREES IS WORTH THE FINANCIAL COST OF MAINTAINING THEM **96%**

87% AGREE THAT PLANTING TREES ON PRIVATE PROPERTY IS IMPORTANT

67% AGREE THAT THE CITY OF WILMINGTON DOES NOT SPEND ENOUGH MONEY ON TREES

86% OWN THEIR HOME

14% RENT THEIR HOME

DISAGREE THAT STREET TREES SEEM WELL CARED FOR IN WILMINGTON **52%**

83% AGREE THAT LARGE, MATURE TREES SHOULD BE PRESERVED ON PRIVATE PROPERTY

AGREE THAT PLANTING TREES IN PUBLIC PARKS AND ON STREETS IS IMPORTANT **97%**

57% AGREE THAT PARK TREES SEEM WELL CARED FOR IN WILMINGTON

94% STRONGLY AGREE THAT TREES ARE IMPORTANT TO WILMINGTON

FEEL THERE ARE TOO FEW TREES IN WILMINGTON **93%**

97% AGREE THAT LARGE, MATURE TREES SHOULD BE PRESERVED ON PUBLIC PROPERTY

Urban Forestry Themes and Priorities

The engagement and outreach activities identified a set of urban forestry themes and priorities.

- **Wilmington community values trees and their benefits.** The results of the survey demonstrate that the Wilmington community appreciates and values trees and understands the important benefits they provide.
- **Tree Preservation and Protection.** The loss of trees to development and tree preservation were the top themes identified by the Wilmington community. There was great concern by the community and stakeholders regarding the impact that development is having on Wilmington's tree canopy.
- **Staffing.** Due in part to issues hiring and retaining staff, Forestry does not have enough staff to perform all of the tasks and duties that need to be completed. This has led to Forestry not meeting City resident and inter-departmental level of service expectations.
- **Goals and Metrics.** Clear goals and metrics need to be developed to elevate and prioritize trees. For example, tree canopy and benefit goals along with tree maintenance and planting targets.
- **Public Tree Maintenance.** There is a need to prioritize proactive tree maintenance that focuses on establishment and the long-term care and maintenance of trees.
- **Proactive Management.** Plans need to be established that focus on no net loss of public tree canopy and ensuring there are plans in place to remove and replace mature dying trees.
- **Sidewalk/Infrastructure/Property Damage.** The community and stakeholders expressed concerns with the damage that trees can cause to sidewalks, infrastructure, and property. Damage to sidewalks can impact accessibility, which has equity implications. Proper, proactive care and planning must be prioritized.
- **Education and Outreach.** Improved and coordinated education and outreach around trees, for both the Wilmington community and City staff, was identified as a priority during the planning process. Topics identified include proper tree care, benefits of trees, youth outreach, city forestry activities, and staff arboricultural training.
- **Tree Planting & Care.** Increased street tree planting and young tree care was a top theme identified by the community. Ensuring that trees are planted where they are needed most (equity), trees are property planted, and the right tree is planted in the right location were also considerations mentioned within this theme.
- **Species Selection and Diversity.** As the climate shifts and new tree and disease pests emerge, Wilmington needs to ensure they are planting a wide variety of species while promoting the use of native species (where appropriate).
- **Storm Damage.** As a coastal city, Wilmington experiences severe storms and hurricanes that can lead to storm damage. Residents are concerned that trees will damage property and utilities during storms.
- **Policies and Standards.** There is a need for Wilmington to formally adopt and implement policies, standards, and guidelines to support tree preservation, planting, and care.
- **Interdepartmental Coordination.** Good working relationships exist between Forestry and other City departments. However, with the exception of planning, communication typically only occurs when there is a conflict between trees and a City construction/ infrastructure project or a violation of the City's tree ordinance.
- **Partnerships.** Stakeholders and community partners, including Wilmington Tree Commission, Alliance for Cape Fear Trees, University of North Carolina-Wilmington, and Cape Fear Public Utility Authority expressed interest in partnering to support urban forestry management and planning efforts in Wilmington.

Now that we have an understanding of the current state of Wilmington's urban forest and the needs and priorities of the community and stakeholders, it is time to get to work! The next section details the UFMP's recommendations, actions, and goals, which focus on improving Wilmington's urban forest through proactive planning, management, and engagement.

Section 3

MOVING FORWARD

Moving FORWARD

Vision, Goals, & Recommendations

Wilmington's urban forest is an essential infrastructure asset that is highly valued for the positive contributions it makes to the quality of life and character of the city. It is proactively and sustainably managed through proper care, planting, policies, and community stewardship.

The vision, goals, recommendations, and actions of the Wilmington Urban Forestry Master Plan are based on the engagement and outreach themes and priorities along with information and data gathered and analyzed during the planning process.

THE VISION FOR THE FUTURE OF WILMINGTON'S URBAN FOREST

Wilmington's urban forest is an essential infrastructure asset that is highly valued for the positive contributions it makes to the quality of life and character of the city. It is proactively and sustainably managed through proper care, planting, policies, and community stewardship.

GOALS

Protect and preserve the urban forest from loss and threats to ensure the long-term sustainability of Wilmington's tree canopy.

Plan and manage Wilmington's public trees through development and coordination in planning, design, and care to ensure its long-term health and sustainability.

Proactively grow and maintain public trees to create a healthy, equitable, and resilient urban forest that maximizes the environmental, quality-of-life, and climate-mitigation benefits Wilmington's trees provide.

Connect and engage with the community about Wilmington's urban forest and the important role they play in its growth and care.

RECOMMENDATIONS

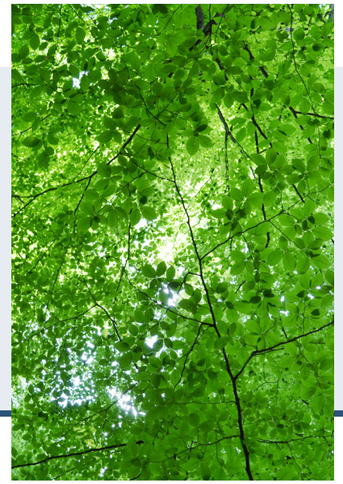
The Plan recommendations are listed by number for ease of identification and are not listed in priority order. Each recommendation includes a set of action items to aid in implementing the plan's recommendations. An action plan follows that includes a timeframe for each action item. These should be used as the basis for plan implementation. While the timeframes provide a road map for Plan implementation, acceleration in implementation of recommendations and action items is encouraged as funding and resource opportunities arise.

1. Complete the inventory of all public trees in Wilmington.
2. Update Wilmington's urban tree canopy assessment.
3. Establish a proactive management program for Wilmington's public trees.
4. Develop and strengthen relationships and partnerships to support implementation of the Urban Forestry Master Plan.
5. Ensure Wilmington regulations, best management practices, and guidelines are in place to support tree canopy growth and preservation.
6. Focus tree planting and care in locations that advance city equity and sustainability goals and priorities.
7. Develop and implement a public engagement, outreach, and education plan.
8. Dedicate City staff to support urban forest operations and education.
9. Create and implement a program to monitor and address environmental threats to Wilmington's urban forest.
10. Improve communication, collaboration, and coordination among City departments and outside entities.
11. Develop a strategy to manage wood waste and identify the highest and best use of wood from trees removed by the City of Wilmington.

1. Complete the inventory of all public trees in Wilmington.

Wilmington has a partial inventory of the city's public trees with the street tree inventory of the 1945 corporate limits conducted in 2022. Completion of the city's public tree inventory to include the remaining street trees and trees in maintained/mowed areas of public parks and other City-owned land is needed. As the assessment of the Indicators of Sustainable Urban Forest in Section 2 shows**, having and utilizing a public tree inventory will have the most significant impact on moving Wilmington toward a sustainable urban forest.**

A comprehensive, up-to-date, GIS-based public tree inventory is the foundation of a municipal urban forestry program. It provides crucial information on the composition, condition, risk, and maintenance needs of the publicly managed tree resource. The inventory also serves as the basis for prioritizing tree care activities and delivering urban forestry services efficiently and cost effectively.



Actions

1.1. **First Step:** Identify and secure funding to complete full street tree and park tree inventory.

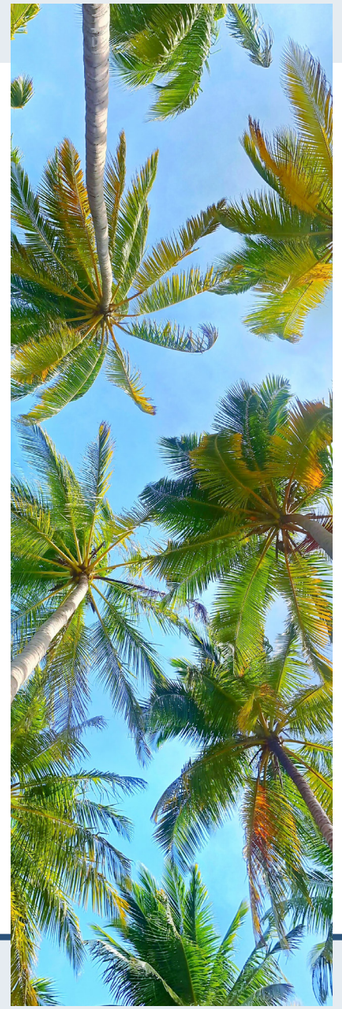
1.2. Develop bid specifications and request for proposal to contract out the completion of the street and park tree inventory.

1.3. Develop a process to regularly update the street tree inventory after tree maintenance activities are completed.

1.4. Create a plan to complete a comprehensive re-inventory of Wilmington's public trees every 5–10 years.

2. Regularly update Wilmington's urban tree canopy assessment.

Wilmington completed an urban tree canopy (UTC) assessment in 2018, utilizing aerial imagery from 2016, and Wilmington's Department of Information Technology is in the process of analyzing 2020 aerial imagery to determine more recent canopy cover. Industry standards recommend UTC assessments are conducted every 5–10 years or more often depending upon natural disasters or development in order to measure changes and serve as a tool for understanding how City policies and procedures are impacting canopy cover. Regularly updating the tree canopy assessment will provide critical information on the trending direction of canopy cover in Wilmington.



Actions

2.1. **First Step:** Develop a schedule to regularly update Wilmington's urban tree canopy assessment every 10 years.

2.2. Using 2020 tree canopy data (in progress), conduct a historic change analysis to compare canopy cover change over time to identify areas of tree canopy gains, losses, and overall trends.

2.3. Use socio-economic and environmental data (e.g., population characteristics, income, urban heat island, flooding) to prioritize areas for tree planting and care.

2.4. Use i-Tree to measure changes in tree canopy benefits over time.

- **Note:** The software tools in i-Tree are routinely updated based on the latest science and research. To measure changes in benefits over time, both the new and previous urban tree canopy assessment data must be analyzed through the same version of i-Tree.

2.5. Conduct urban tree canopy assessment using 2030 aerial imagery. Develop tree canopy assessment specifications.

- This action item can be completed by a consultant (as in 2018) or by the City of Wilmington's Department of Information and Technology (as is currently being done with the 2020 aerial imagery).

2.6. Identify and explore low-cost tools and technologies to measure and track canopy cover.

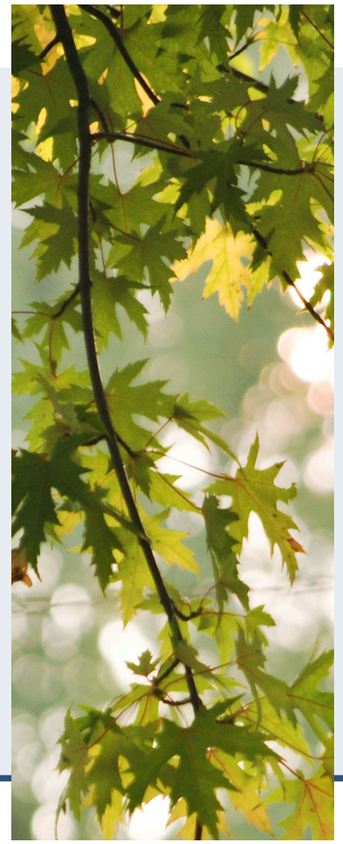
- i-Tree (Our Trees, i-Tree Landscape, and i-Tree Canopy)
- Google Environmental Insights Explorer Tree Canopy
  - » Data is not currently available for Wilmington.

3. Establish a proactive management program for Wilmington's public trees.

As with other city infrastructure, such as roads, bridges, and utilities, public trees need proactive management and routine maintenance. The City of Wilmington's current public tree management can best be described as reactive. Due to limited resources, tree maintenance activities are driven by resident requests, emergency work, and storm events.

Reactive public tree maintenance negatively impacts the overall condition, value, and sustainability of Wilmington's trees. It also leads to inefficient, inequitable, and more costly service delivery as well as lower customer satisfaction because service levels are not meeting resident expectations. Proactive tree management maximizes benefits; improves tree health, longevity, and public safety (fewer risks); and improves customer service by addressing trees before they become a risk or problem.

A complete, up-to-date inventory is a key component in developing an urban forest management plan; however, a lack of a full inventory of all public trees should not keep Wilmington from beginning to plan and manage its public street and park trees.



Actions

3.1. **First Step:** Complete inventory of all public trees (Recommendation #1).

3.2. Prioritize completing maintenance tasks for high- and moderate-risk trees identified in the recently completed street tree inventory in the 1945 corporate limits.

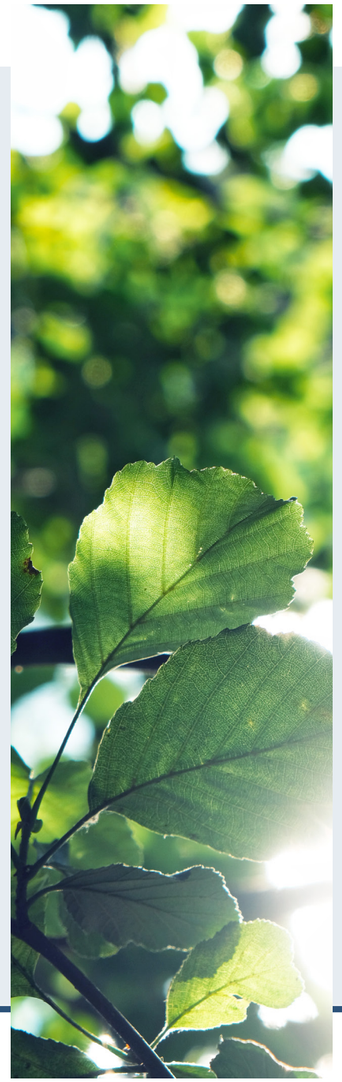
3.3. Track the number of service requests by activity received along with the number of trees removed, pruned, and planted as well as stumps removed each year.

3.4. Develop processes and standard operating procedures for incorporating tree inventory data from TreeKeeper® into the Tyler Munis system.

3.5. Fill existing vacant forestry positions.

3.6. Develop an urban forestry management plan using data from the complete public tree inventory that includes a risk management program, a public tree maintenance program, a disaster preparedness and response plan and that also explores wood utilization options.

- **3.6.1.** Expand the routine pruning schedule for established trees and the structural training of young trees.
- **3.6.2.** Address aging tree canopy cover, and establish successional plans to ensure canopy cover is continuously maintained.



Actions (continued)

- **3.6.3.** Establish goals and develop (document) standards to investigate service requests, and complete work requested. Data can be used to measure performance and help communicate/demonstrate staff and contractor needs.

3.7. Develop and implement a strategy to maximize investment and resources to meet the current and future needs of Wilmington's urban forestry program. Use information from the urban forestry management plan to assess budget needs in order to proactively manage Wilmington's public trees. In the interim, establish the $53.46 per street tree ($607,270 annual budget increase) as the street tree funding goal.

- **3.7.1.** Research and implement supplemental funding sources to support budget increases (see "Investing in Wilmington's Urban Forest" sidebar).
- **3.7.2.** Explore carbon financing options to support Wilmington's GHG reduction targets.

3.8. Initiate other urban forestry planning and program efforts while the management plan is being developed.

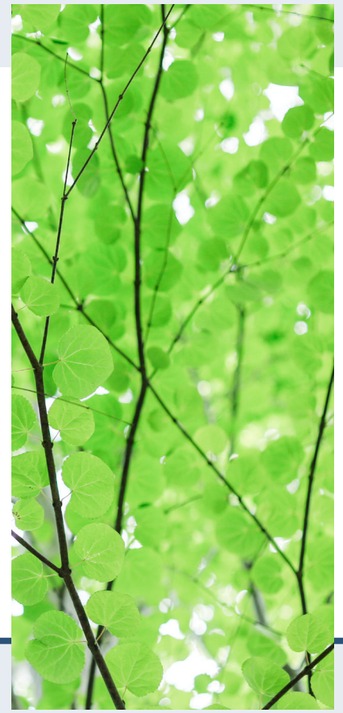
- **3.8.1.** Create and implement a windshield survey program to identify risks.
- **3.8.2.** Develop an annual work plan that prioritizes tree risk based on the inventory of the 1945 corporate limits and results of the windshield survey.
- **3.8.3.** Create an annual tree planting plan and tree establishment and care plan (e.g., watering, mulching, and pruning) (Recommendation #6).

Windshield Survey

A windshield survey is a basic street-tree assessment, conducted from a vehicle, that identifies trees that require immediate maintenance. This type of survey is completed with a minimum of one licensed driver and one qualified risk assessor.

4. Develop and strengthen relationships and partnerships to support implementation of the Urban Forestry Master Plan.

Successfully implementing the UFMP will require Wilmington to develop and strengthen its relationships with community, regional, and state stakeholders. Fostering and nurturing partnerships can help align the goals and recommendations of the UFMP with stakeholder organizations, which can serve as a catalyst to support urban forestry efforts in Wilmington. The Wilmington Tree Initiative is an excellent example of how partnerships can support the growth and care of Wilmington's urban forest. The Wilmington Tree Commission, Alliance for Cape Fear Trees, University of North Carolina Wilmington, and Cape Fear Public Utility Authority all expressed interest in partnering to support urban forestry management and planning efforts in Wilmington.



Actions

4.1. **First Step:** Share the Urban Forestry Master Plan with members of the Wilmington Tree Initiative to identify ways they can support plan implementation.

4.2. Share how Wilmington's urban forest can help advance equity, health, climate resilience, and sustainability strategies of local and regional organizations.

4.3. Evaluate hosting a "Wilmington Tree Summit" to foster collaboration, education, and engagement about trees in Wilmington and the Urban Forestry Master Plan. Bring together partners of the Wilmington Tree Initiative along with other public, private, and non-profit organizations, including those that focus on equity, environmental justice, health, and work force development.

4.4. Incorporate urban forestry messaging into existing City initiatives (e.g., greenhouse gas reduction targets, sustainability, capital improvement projects, *Create Wilmington Comprehensive Plan* implementation).

5. Ensure Wilmington regulations, best management practices, and guidelines are in place to support tree canopy growth and preservation.

The needs of development and gray infrastructure, such as utilities and roads, can at times be prioritized over the needs of Wilmington's trees and green infrastructure assets. When done without coordination and oversight, certain activities, such as cutting tree roots during excavation, tree pruning for utility clearance, tree removal for development, and improper tree planting can have a negative impact on public trees and on Wilmington's overall urban forest.

City policies, regulations, and practices communicate and reflect the values and priorities of the community. The Wilmington community values trees and is concerned about the impacts that development is having on them. The actions below recommend improvements to City regulations, policies, and practices that reflect community values more effectively. These will help ensure that tree planting, care, and preservation activities are conducted based on industry and arboricultural best management practices.

Actions

5.1. **First Step:** Review and revise the draft "Street Tree Removal and Planting Guidelines" and the Wilmington Tree Commission's draft "Street Tree Policy" documents to establish and document public tree maintenance best management practices for use by the City and contractors (depending on budgetary capacity).

5.2. Continue to implement solutions from "Tree Root and Sidewalk Study Report" to reduce tree and sidewalk conflicts, develop standards/ specifications, and help preserve public trees.

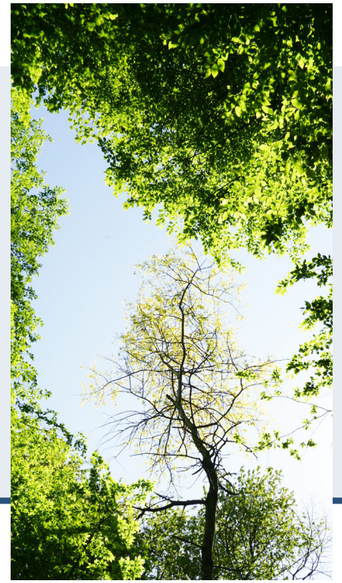
5.3. Include tree recommendations more explicitly in the "City of Wilmington Urban Design—Policies for Equitable, Resilient and Sustainable City Building" (DRAFT 2022).

5.4. Plan for tree preservation and care in capital improvement projects and ensure new and replacement trees are included in project budgets.

5.4.1. Adopt a policy to replace trees removed as part of drainage Capital Improvement Projects.

5.5. Revise City codes and ordinances to strengthen protections of public trees (street and park) and incentivize preservation of trees on private property.

5.6. Ensure sufficient staff and/or consultants are in place to enforce City public and private tree regulations.



Actions (continued)

5.7. Revise Wilmington's "Technical Standards and Specifications Manual" to develop and align tree standards and specifications, including tree planting, with urban forestry industry standards and best management practices (reference ANSI A300 standards and International Society of Arboriculture best management practices).

5.7.1. Standards and specifications should include but not be limited to species selection and tree diversity, site selection and minimum soil volumes, proper tree planting, post-planting care, watering, mulching, tree pruning specifications, tree protection and construction, tree preservation, and pruning.

5.8. Develop an invasive species policy for public and private property.

Incentivizing Tree Preservation

- **Atlanta, GA |** If a development exceeds tree preservation requirements, tree planting and mitigation requirements can be reduced by up to 75%.

  Source: Atlanta, GA
  https://www.atlantaga.gov/home/showpublisheddocument/45366/637196196587170000

- **Boone, NC |** Tree preservation can be credited towards meeting street, parking lot, and buffer tree landscaping requirements. For example, if a 25-inch live oak is preserved, a five tree credit can be applied towards the development's landscaping requirements.

  Source: Boone, NC
  https://www.townofboone.net/DocumentCenter/View/1089/Article-31-Landscape-Standards

- **Fayetteville, NC |** In addition to offering credits towards landscaping requirements, Fayetteville also offers a reduction in required parking and credits towards required open space for the preservation of trees.

  Source: Fayetteville, NC
  https://www.fayettevillenc.gov/home/showpublisheddocument/3459/637847822799500000

Resources:

- North Carolina Forest Service—Developing Tree Protection Ordinances in North Carolina
- NC State Extension—Protecting and Retaining Trees: A Guide for Municipalities and Counties in North Carolina

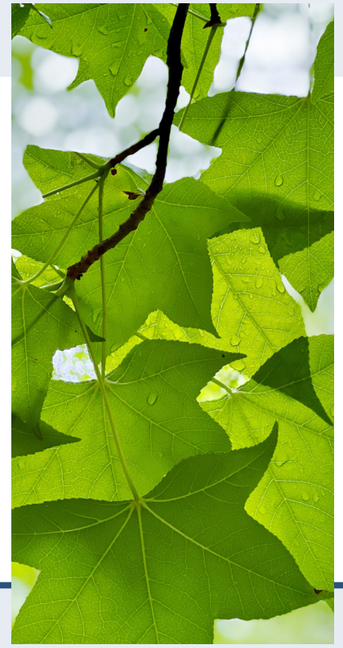
6. Focus tree planting and care in locations that advance city equity and sustainability goals and priorities.

Wilmington's trees provide essential benefits to the city and are an important tool in helping to achieve City sustainability goals and priorities, such as greenhouse gas reduction targets. However, the amount and quality of tree canopy varies across the city. This means that neighborhoods with lower tree canopy receive less tree benefits, such as improved air quality and lower temperatures and shading, which impacts public health, property values, and overall quality of life. This variability, which is due to a variety of factors including economics, development patterns, land use, and weather, leads to an inequitable distribution of tree canopy cover.

An equity- and sustainability-focused approach to tree planting, establishment, and care can help to ensure that trees and the benefits they provide are available to all Wilmington residents. Comparing data on City social equity and sustainability priorities (e.g., health, demographic, economic, high heat/temperature, air quality, stormwater runoff) and the location of tree canopy across Wilmington can help **prioritize tree planting and care in neighborhoods with fewer trees and highest need**.

Urban Heat Island Mapping Opportunity

The National Oceanic and Atmospheric Administration's (NOAA) National Integrated Heat and Health Information System operates an urban heat island mapping program. Each year, the agency solicits proposals to map extreme heat in communities. The program has mapped the urban heat island of over 60 communities since 2017.



Actions

6.1. **First Step:** Use data from the updated urban tree canopy assessment (Recommendation #2) along with information from American Forests Tree Equity Score to develop a priority planting map.

6.2. Create an annual tree planting and maintenance plan that aligns with City equity and sustainability priorities, using the priority planting map developed in Action Item 6.1.

6.2.1. Plan elements should include standards for species selection based on location (right tree, right place), tree planting and soil specifications, and a three-year post-planting care and maintenance plan to ensure successful establishment.

6.3. Pursue grant opportunities to conduct and gather environmental and socio-economic data (e.g., urban heat island studies, socio-economic/environmental priority planting analysis, etc.).

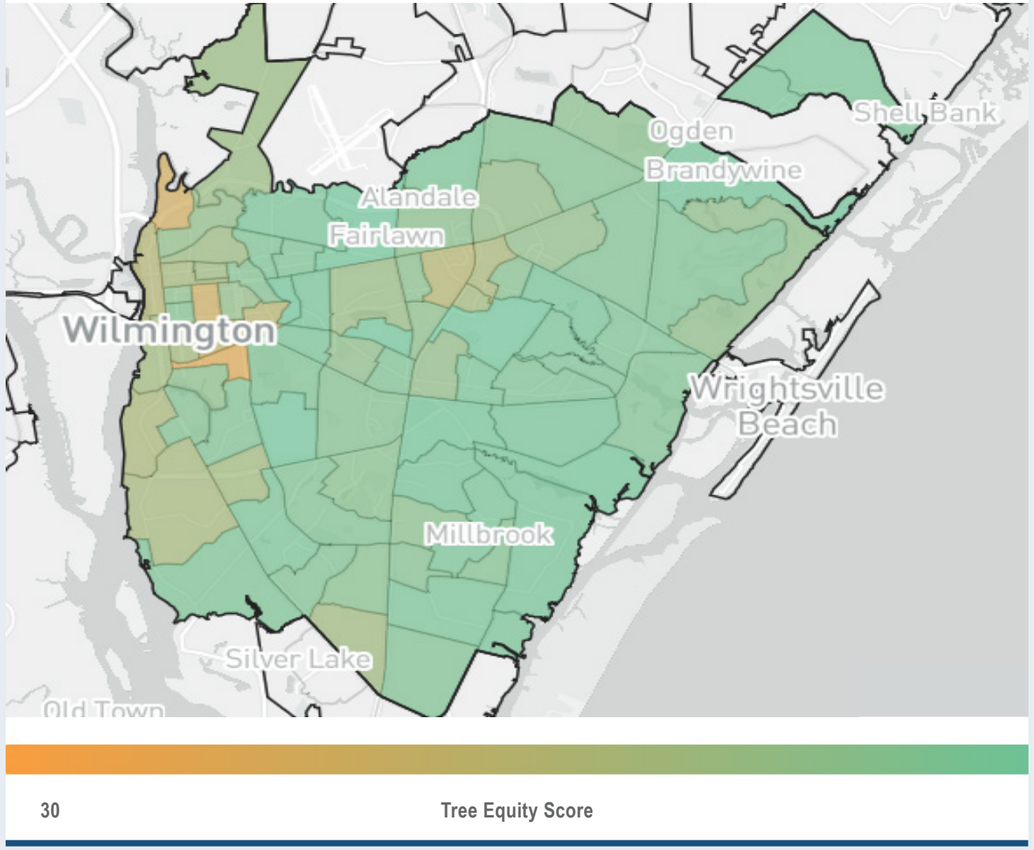
What Is Equity in Urban Forestry?

Equity is allocating resources and opportunities based on each person's individual needs and circumstances, to achieve equal outcomes. These outcomes include equal access to "environmental benefits," like a healthy urban forest.

In urban forestry, equity means allocating the resources and opportunities needed to improve the size, quality, number, and maintenance of trees and greenspaces in neighborhoods that may be lacking tree canopy and greenspace. The goal of equity-focused efforts in urban and community forestry is to achieve equal environmental, economic, social, and cultural urban forest benefits across *all* neighborhoods, regardless of race, income, or other characteristics.

American Forests Tree Equity Score

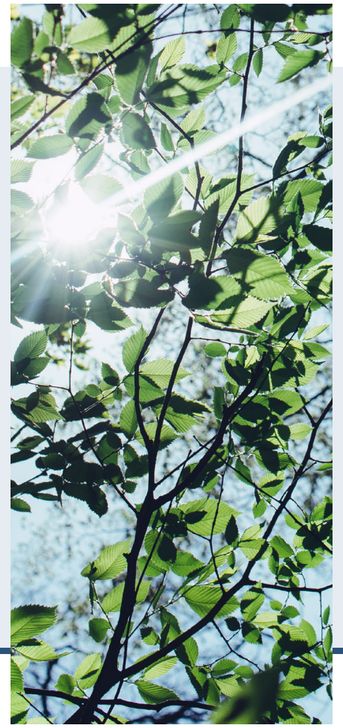
American Forests' Tree Equity Score is a metric that assesses how equitably a city's urban forest is distributed, based on tree canopy cover, climate, demographic, and socioeconomic data. The Tree Equity score ranges from zero (least equitable) to 100 (most equitable). Wilmington has an average Tree Equity Score of 88 with some areas of the city scoring as low as 45 and others as high as 99 (see map).



Tree canopy data for the Tree Equity Score tool for Wilmington is from Earth Define, U.S. Tree Map 2020.

7. Develop and implement a public engagement, outreach, and education plan.

Development of an engagement, outreach, and education strategy in collaboration with members of the Wilmington Tree Commission and Wilmington Tree Initiative can build community awareness, support for the urban forest, and promote action. Sharing information about programs like the Wilmington Tree Initiative, City's Heritage Tree Program, and tree giveaways, together with understanding resident's concerns or resources needed (e.g., storm damage, assistance with species selection), can help develop a robust public outreach program that meets City, partner, and resident needs. The engagement plan should recognize that some parts of the community may require extensive interaction and open communication in order to develop trust in Wilmington's tree planting program. To be effective, the program should be responsive, emphasize two-way communication, and identify unique ways to reach and target different audiences, using traditional and innovative engagement tools.



Actions

7.1. **First Step:** Use the results of the Urban Forestry Master Plan survey to identify communication needs and priorities to serve as the basis of the plan.

7.2. Develop education and outreach materials on topics identified from the survey, including:

- City maintenance (tree life cycle, why maintenance is needed).
- Tree maintenance and management responsibilities (City, private property owners, utilities, etc.
- Tree planting and care.
- Benefits of trees.

7.3. Periodically gather input from the community to identify engagement and education needs with brief surveys/questions.

7.4. Support, enhance, and develop programs that encourage and support active participation by volunteers in the planting and care of Wilmington's urban forest.

8. Dedicate City staff to support urban forest operations and education.

Wilmington does not have enough Forestry staff to address all of the city's current public tree care, planning, and management needs. As the city's tree canopy ages and new residential developments add public street trees, the demands on Forestry will only increase. To address these needs and transition Wilmington to a proactive tree management program—while also attending to resident requests and conducting maintenance, planning, and outreach activities—additional skilled staff and in-house and/or contractors will be required.

The expanded staffing scenario for Forestry (Table 7), will increase the number of staff by three, adding a new arborist position for plan review and development inspections and two urban forestry technicians for tree planting coordination, inventory management, and outreach and education. The new positions can support current efforts along with new initiatives and needs identified in the urban forestry master plan. These new positions will also provide a pathway for career advancement for staff within Forestry.

Table 7. Wilmington Forestry expanded staffing scenario.

FULL TIME STAFF	NUMBER OF POSITIONS
Forest Management Supervisor (City Arborist)	1
Tree Crew Supervisor (Assistant City Arborist)	1
Crew Leaders	3
Tree Trimmers (1 and 2)	4
Grounds People	2
Plan Review Arborist (site/development plan review, field inspections related to development, tree permits)	1
Urban Forestry Technician (stump grinding coordination, tree planting coordination [internal/external], tree inventory maintenance, outreach and education, assessments, contract management)	2
Total	**14**

Actions

8.1. **First Step:** Identify and secure funding to implement the ideal staffing scenario.

8.2. Implement ideal staffing scenario.

- **8.2.1.** Revise titles of "Forest Management Supervisor" to "City Arborist" and "Tree Crew Supervisor" to "Assistant City Arborist."
- **8.2.2.** Reorganize staffing positions to add a tiered tree trimmer position, and add new positions—grounds person (2), plan review arborist (1), and urban forestry technician (2).
- **8.2.3.** Fill tree trimmer and crew lead vacancies to improve tree-to-staff ratio.
- **8.2.4.** Continue to evaluate and implement the use of contractors for tree-care work and consulting services.

8.3. Create transition/succession plans for retiring workers.

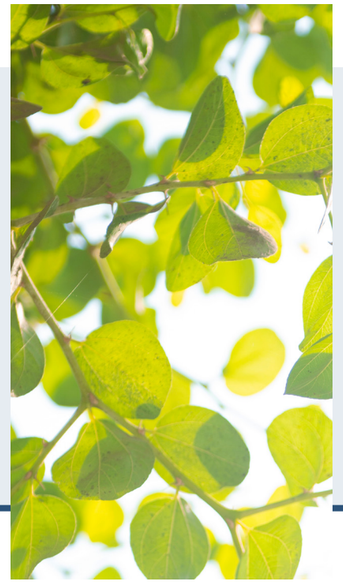
8.4. Develop training plans for new tree trimmers and crew lead hires.

8.5. Determine future Forestry operational staffing needs after full public tree inventory and urban forest management plan have been completed.

8.6. Begin an urban forestry internship program to assist Forestry with tree inventory data management/entry, outreach efforts, inspections, and minor tree maintenance tasks.

9. Create and implement a program to monitor and address environmental threats to Wilmington's urban forest.

Wilmington's urban forest is an ever-changing, dynamic system, where both living and non-living elements can have a substantial impact on its condition, quality, and health. It is threatened by factors including insects, diseases, climate change (e.g., high heat and flooding), invasive/undesirable species, wildlife, and storms. To ensure that Wilmington's urban forest is resilient and adaptable to these environmental threats, a program needs to be established to actively monitor and address threats. Threats to the urban forest may also impact the health and quality of life of residents and should also be considered when implementing this recommendation (Recommendation #6).



Actions

9.1. **First Step:** Using information from the tree inventory and urban forestry master plan, develop a list of current and potential threats to Wilmington's urban forest. Threats to the urban forest may also impact the health and quality of life of residents and should also be considered (Recommendations #6).

9.2. Develop an urban tree health program to scout/monitor for threats. This program may benefit from a combination of professionals, partners, and trained volunteers (Recommendations #4 and #7 can support implementation).

9.3. Include specifications to scout and monitor for threats in tree pruning and tree removal contracts, and share with Forestry staff.

10. Improve communication, collaboration, and coordination among City departments and outside entities.

Good working relationships exist between Forestry and other City departments; however, communication typically only occurs when there is a conflict between trees and a City project. A formal process to proactively coordinate with other City departments and outside entities (e.g., utility companies, non-profit organizations, and developers) whose activities impact public city trees is needed. While impacts may be positive or negative, a lack of proactive coordination, collaboration, and communication can lead to other city assets (e.g., public utilities, streets, and sidewalks) being prioritized over trees. It is important that Forestry has a seat at the table when City and other projects are being designed and implemented to ensure trees are preserved, protected, and mitigated.

Actions

10.1. **First Step:** Share tree benefits with different departments to make connections between other department goals and priorities. For example, share with the Public Services Department's stormwater program that street trees within the 1945 corporate limits absorb 1.3 million gallons of stormwater each year.

10.2. Ensure that Forestry has staff and capacity to fully engage and participate in inter-departmental meetings and capital improvement plan development to identify projects where trees may be impacted and may require alternative designs and/or additional budget resources.

10.3. Implement the "Smart Sheet" developed by Tree Maintenance and Public Services (Streets and Sidewalks).

10.4. Develop a process for Forestry to share and coordinate tree planting a and maintenance activities to ensure activities do not conflict with future plans of other City departments.

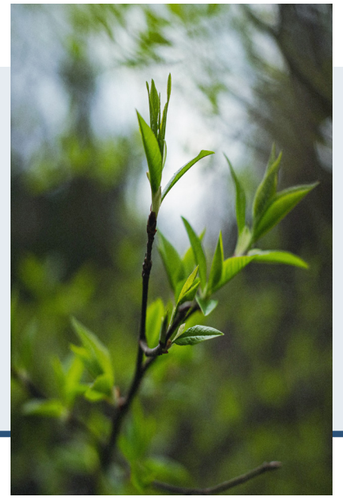
10.5. Formalize program between Forestry and the Wilmington Fire Department for after-hour tree emergency support, including establishing an annual forestry training program for fire department staff and establishing a budget for Forestry equipment and personal protective equipment.

11. Develop a strategy to manage wood waste and identify the highest and best use of wood from trees removed by the City of Wilmington.

In the development of a sustainable and resilient urban forest, it is important to consider all aspects of a tree's life cycle, from tree planting to the disposal of wood created in the management of the urban forest. Identifying higher uses of the wood generated from tree removals other than mulch and compost can help the City meet its GHG reduction targets. Wood turned into furniture, flooring, or other wood products continues to keep the carbon stored in the tree, locked up instead of returning to the atmosphere during the decomposition process.

Fort Collins, CO Wood Utilization Program

The City of Fort Collins, CO, partners with a local urban sawmill to utilize logs from city tree removals. The City notifies the mill of trees scheduled for removal. The mill inspects the trees prior to removal identifying the trees/logs they are interested in. The City removes the trees cutting them in logs at least 6-feet long and delivers them to the City yard. The sawmill mills the logs at the City yard leaving the wood waste for the city to dispose through their existing mulch and compost program. The mill moves all milled lumber back to their location. No money is exchanged between the City and the mill.



Actions

11.1. **First Step:** Research local wood workers, tree-care companies, and resource recovery operations that may be able to use wood waste generated by the City.

11.2. Examine programs in other cities, including other southeastern cities with aging laurel oak populations, to find a model that may work for Wilmington.

11.3. Develop a pilot program to implement the wood utilization model. Monitor and evaluate the program after one year and expand or re-evaluate based on results.

Action Plan

Timeframe: Immediate (0–1 years); Short-Term (1–3 years); Mid-Term (4–6 years); Long-Term (>6 years)

RECOMMENDATION 1. Complete the inventory of all public trees in Wilmington.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
1.1. First Step: Identify funding source(s) to complete full street tree and park tree inventory.	Immediate (0–1 years)	**Funding.** New funding needed (one-time). Grant funding may be available to assist in this action step. **Staff.** Tree Maintenance Division.
1.2. Develop bid specifications and request for proposal to contract out the completion of the street and park tree inventory.	Short-Term (1–3 years)	**Funding.** Funding identified in 1.1. Tree Maintenance staff can develop bid specifications and RFP. **Staff.** Tree Maintenance Division Contractors. Conduct street and park tree inventory.
1.3. Develop a process to regularly update the street tree inventory after tree maintenance activities are completed.	Immediate (0–1 years)	**Funding.** No budget implications. **Staff.** Tree Maintenance Division to develop process.
1.4. Create a plan to complete a comprehensive re-inventory of Wilmington's public trees every 5–10 years.	Mid-Term (4–6 years)	**Funding.** New funding may be needed in 5–10 years (one-time). Grant funding may be available to assist in this action step. **Staff.** Tree Maintenance Division .

RECOMMENDATION 2. Update Wilmington's urban tree canopy assessment.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
2.1. First Step: Using 2021 tree canopy data (in progress), conduct a historic change analysis to compare canopy cover change over time to identify areas of tree canopy gains and losses, and overall trends.	Immediate (0–1 years)	**Funding.** No budget implications. **Staff.** Tree Maintenance Division to develop process.
2.2. Using 2021 tree canopy data (in progress), conduct a historic change analysis to compare canopy cover change over time to identify areas of tree canopy gains, losses, and overall trends.	Immediate (0–1 years)	**Funding.** No budget implications. **Staff.** Department of Information and Technology.
2.3. Use socio-economic and environmental data (e.g., population characteristics, income, urban heat island, flooding) to prioritize areas for tree planting and care.	Immediate (0–1 years)	**Funding.** No budget implications. **Staff.** Department of Information and Technology.
2.4. Use i-Tree to measure changes in tree canopy benefits over time.	Immediate (0–1 years)	**Funding.** No budget implications. **Staff.** Tree Maintenance Division.
2.5. Conduct urban tree canopy assessment using 2030 aerial imagery. Develop tree canopy assessment specifications.	Long-Term (>6 years)	This action item could be done by Wilmington's Department of Information and Technology or a consultant. **Funding.** No budget implications if done in-house; new funding needed (one-time) if done by a consultant. Grant funding may be available to assist in this action step. **Staff.** Department of Information and Technology; Tree Maintenance Division.
2.6. Identify and explore low-cost tools and technologies to measure and track canopy cover.	Mid-Term (4–6 years)	**Funding.** No budget implications. **Staff.** Tree Maintenance Division.

RECOMMENDATION 3. Establish a proactive management program for Wilmington's public trees.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
3.1. First Step: Complete inventory of all public trees (Recommendation 1).	Immediate (0–1 years)	**Funding.** New funding needed (one-time). Grant funding may be available to assist in this action step. **Staff.** Tree Maintenance Division **Contractors.** Conduct street and park tree inventory.
3.2. Prioritize completing maintenance tasks for high and moderate risk trees identified in the recently completed street tree inventory in the 1945 corporate limits.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division.
3.3. Track the number of service requests by activity received along with the number of trees removed, pruned, planted and stumps removed each year.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Department of Information and Technology.
3.4. Develop processes and standard operating procedures for incorporating tree inventory data from TreeKeeper® into the Tyler Munis system.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Department of Information and Technology.
3.5. Fill existing vacant forestry positions.	Immediate (0–1 years)	**Funding.** No budgetary impacts—positions currently budgeted. **Staff.** Tree Maintenance Division.
3.6. Develop an Urban Forest Management Plan using data from the complete public tree inventory that includes a risk management program, public tree maintenance program, disaster preparedness and response plan, and explores wood utilization options.	Short-Term (1–3 years)	This action item could be done by Wilmington's Tree Maintenance Division or a consultant. **Funding.** No budget implications if done in-house; new funding needed (one-time) if done by a consultant. Grant funding may be available to assist in this action step.
3.6.1. Expand the routine pruning schedule for established trees and the structural training of young trees.	Short-Term (1–3 years)	This action item could be done by Wilmington's Tree Maintenance Division and/or tree care contractors. **Funding.** Additional new funding may be needed (on-going)—the management plan will provide guidance on budget needs. **Staff.** Tree Maintenance Division.
3.6.2. Address aging tree canopy cover and establish successional plans to ensure canopy cover is continuously maintained.	Short-Term (1–3 years)	This action item could be done by Wilmington's Tree Maintenance Division and/or tree care contractors. **Funding.** Additional new funding may be needed (on-going)—the management plan will provide guidance on budget needs. **Staff.** Tree Maintenance Division.
3.6.3. Establish goals and develop (document) standards to investigate service requests and complete work requested. Data can be used to measure performance and help communicate/demonstrate staff/contractor need.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division.
3.7. Develop and implement a strategy to maximize investment and resources to meet the current and future needs of Wilmington's urban forestry program.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division.
3.7.1. Research and implement supplement funding sources to support budget increases (see "Investing in Wilmington's Urban Forest" sidebar).	Immediate (0–1 years)	**Funding.** To implement this action item, there are no budgetary impacts. New funding needs are identified within each action item. **Staff.** Tree Maintenance Division.
3.7.2. Explore carbon financing options to support Wilmington GHG reduction targets.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division.
3.8. Initiate other urban forestry planning and program efforts while the management plan is being developed (Action Items 3.8.1–3.8.3).	Immediate (0–1 years)	**Funding.** No budgetary impacts. Development of plans and programs. **Staff.** Tree Maintenance Division.

RECOMMENDATION 4. Develop and strengthen relationships and partnerships to support implementation of the urban forest master plan.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
4.1. First Step: Share the Urban Forest Master Plan with members of the Wilmington Tree Initiative to identify ways they can support plan implementation.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division. **Support.** Wilmington Tree Commission.
4.2. Share how Wilmington's urban forest can help advance equity, health, climate resilience, and sustainability strategies of local and regional organizations.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division. **Support.** Wilmington Tree Commission.
4.3. Evaluate hosting a "Wilmington Tree Summit" to foster collaboration, education, and engagement about trees in Wilmington and the Urban Forest Master Plan.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division. **Support.** Wilmington Tree Commission.
4.4. Incorporate urban forestry messaging into existing City initiatives (e.g., greenhouse gas reduction targets, sustainability, capital improvement projects, *Create Wilmington Comprehensive Plan* implementation).	On-going	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Planning & Development; Public Services; Sustainability Program; Engineering; Community Services.

RECOMMENDATION 5. Ensure Wilmington's regulations, best management practices, and guidelines are in place to support tree canopy growth and preservation.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
5.1. First Step: Review, revise, and formally adopt the Street Tree Policy and Street Tree Removal and Planting Guidelines.	Immediate (0–1 years)	**Funding.** No budgetary impacts to develop best management practices. May be budget impacts to implement best management practices if not already being done by the City of Wilmington. **Staff.** Tree Maintenance Division
5.2. Continue to implement solutions from Tree Root and Sidewalk Study Report to reduce tree and sidewalk conflicts and help preserve public trees.	On-going	**Funding.** Additional funding may be needed for sidewalk projects to address tree and sidewalk conflicts. **Staff.** Tree Maintenance Division; Public Services
5.3. Include tree recommendations more explicitly in the City of Wilmington Urban Design—"Policies for Equitable, Resilient, and Sustainable City Building" (DRAFT 2022).	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division (lead); All City Departments.

RECOMMENDATION 5. (continued) Ensure Wilmington's regulations, best management practices, and guidelines are in place to support tree canopy growth and preservation.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
5.4. Plan for tree preservation and care in capital improvement projects and ensure new and replacement trees are included in project budgets.	On-going	**Funding.** Additional funding may be needed for capital improvement projects to provide tree preservation and care. **Staff.** Tree Maintenance Division; Engineering; Public Services; Community Services.
5.5. Revise City codes and ordinances to strengthen protections of public trees (street and park) and incentivize preservation of trees on private property.	Short-Term/ Mid-Term (1–6 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Planning and Development.
5.6. Ensure sufficient staff and/or consultants are in place to enforce City public and private tree regulations.	Short-Term (1–3 years)	**Funding.** Additional funding will be needed to hire new staff/consultants for code enforcement. **Staff.** Tree Maintenance Division; Planning and Development.
5.7. Revise Wilmington's Technical Standards and Specifications Manual to develop and align tree standards and specifications with urban forestry industry standards and best management practices (reference ANSI A300 standards and International Society of Arboriculture best management practices).	Short-Term/ Mid-Term (1–6 years)	This action item could be done by Wilmington's Tree Maintenance Division or a consultant. **Funding.** No budget implications if done in-house; new funding needed (one-time) if done by a consultant. Grant funding may be available to assist in this action step. **Staff.** Tree Maintenance Division.
5.8. Develop an invasive species policy for public and private property.	Immediate (0-1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division, Planning & Development. **Support.** Wilmington Tree Commission; Wilmington Tree Initiative.

RECOMMENDATION 6. Focus tree planting and care in locations that advance city equity and sustainability goals and priorities.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
6.1. First Step: Use data from the updated urban tree canopy assessment (Recommendation #2), along with information from American Forests Tree Equity Score, to develop a priority planting map.	Short-Term (1–3 years)	This action item could be done by Wilmington's Department of Information and Technology or a consultant. **Funding.** No budget implications if done in-house; new funding needed (one-time) if done by a consultant. Grant funding may be available to assist in this action step. **Staff.** Department of Information and Technology; Tree Maintenance Division
6.2. Create an annual tree planting and maintenance plan that aligns with city equity and sustainability priorities using the priority planting map developed.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division
6.3. Pursue grant opportunities to conduct and gather environmental and socio-economic data (e.g., urban heat island studies; socio-economic/environmental priority planting analysis, etc.).	On-going	**Funding.** No budgetary impacts to apply for grants. Grants will provide additional budgetary support to implement this recommendation. **Staff.** Tree Maintenance Division

RECOMMENDATION 7. Develop and implement a public engagement, outreach, and education plan.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
7.1. First Step: Use the results of the urban forest master plan survey to identify communication needs and priorities to serve as the basis of the plan.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Community Services. **Support.** Wilmington Tree Commission.
7.2. Develop education and outreach materials on topics identified from the urban forest master plan survey.	Short-Term/ On-going	This action item could be done by Wilmington's Communication Office and Tree Maintenance Division or a consultant. **Funding.** New budget resources may need to be allocated for printing and/or publicity if done in-house; new funding needed (as needed) if done by a consultant. Grant funding may be available to assist in this action step. **Staff.** Communication Office; Tree Maintenance Division.
7.3. Periodically gather input from the community to identify engagement and education needs with brief surveys/questions.	Long-Term (>6 years)	This action item could be done by Wilmington's Communication Office and Tree Maintenance Division or a consultant. **Funding.** No budget impacts if done in-house; new funding needed (periodically) if done by a consultant. **Staff.** Communication Office; Tree Maintenance Division.
7.4. Support, enhance, and develop programs that encourage and support active participation by volunteers in the planting and care of Wilmington's urban forest.	Short-Term/ Mid-Term (1–6 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division.

RECOMMENDATION 8. Dedicate city staff to support urban forest operations and education.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
8.1. First Step: Identify and secure funding to implement the. ideal staffing scenario.	Short-Term (1–3 years)	**Funding.** New funding needed (on-going) to hire five new staff. **Staff.** Community Services; Tree Maintenance Division; City Manager **Support.** Wilmington City Council
8.2. Implement ideal staffing scenario.	Short-Term (1–3 years)	
8.2.1. Revise titles of Forest Management Supervisor to City Arborist and Tree Crew Supervisor to Assistant City Arborist.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Community Services; Tree Maintenance Division
8.2.2. Reorganize staffing positions to add a tiered tree trimmer position and add new positions—grounds person (2), plan review arborist (1), and urban forestry technician (2).	Immediate (0–1 years)	Same as 8.1
8.2.3. Fill tree trimmer and crew lead vacancies to improve tree to staff ratio.	Immediate (0–1 years)	**Funding.** No budgetary impacts positions currently budgeted. **Staff.** Community Services; Tree Maintenance Division
8.2.4. Continue to evaluate and implement the use of contractors for tree care work and consulting services.	Immediate/ On-going (0–1 years)	**Funding.** New funding may be needed (as needed) to hire tree care contractors if existing budget resources cannot be re-allocated. **Staff.** Community Services; Tree Maintenance Division
8.3. Create transition/succession plans for retiring workers.	Short-Term (1–3 years)	**Funding.** No budgetary impacts positions currently budgeted. **Staff.** Tree Maintenance Division
8.4. Develop training plans for new tree trimmers and crew lead hires.	Immediate (0–1 years)	**Funding.** New funding will be needed for staff to receive training (estimated budget per staff $1,500). Additional funding should be allocated annually for staff training. **Staff.** Tree Maintenance Division

RECOMMENDATION 8. (continued) Dedicate city staff to support urban forest operations and education.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
8.5. Determine future Forestry operational staffing needs after full public tree inventory and urban forest management plan have been completed.	Short-Term (1–3 years)	**Funding.** No budgetary impacts to determine operational staffing needs. Additional funding needs would be determined based on conducting this assessment. See Action Item #3.6. **Staff.** Tree Maintenance Division.
8.6. Begin an urban forestry internship program to assist Forestry with tree inventory data management/entry, outreach efforts, inspections, and minor tree maintenance tasks.	Short-Term/ Mid-Term (1–6 years)	**Funding.** New funding needed (annual) to hire interns. Grant funding or college/university support may be available to assist in this action step. **Staff.** Tree Maintenance Division.

RECOMMENDATION 9. Create and implement a program to monitor and address environmental threats to Wilmington's urban forest.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
9.1. First Step: Using information from the tree inventory and urban forest master plan, develop a list of current and potential threats to Wilmington's urban forest.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division
9.2. Develop an urban tree health program to scout/monitor for threats.	Short-Term/ On-going (1–3 years)	**Funding.** Budget impacts to be determined based on 9.1. **Staff.** Tree Maintenance Division
9.3. Include specifications to scout and monitor for threats in tree pruning and tree removal contracts and share with Forestry staff.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division

RECOMMENDATION 10. Improve communication, collaboration, and coordination among city departments and outside entities.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
10.1. First Step: Share tree benefits with different departments to make connections between other department goals and priorities.	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Community Services
10.2. Ensure that Forestry has staff and capacity to fully engage and participate in inter-departmental meetings.	Short-Term (1–3 years)	**Funding.** May be budget impacts—see Recommendation #8. **Staff.** Tree Maintenance Division
10.3. Implement the "Smart Sheet" developed by Forestry and Public Services (Streets and Sidewalks).	Immediate (0–1 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Public Services
10.4. Develop a process for Forestry to share and coordinate tree planting and maintenance activities to ensure activities do not conflict with future plans of other City departments.	Short-Term/ On-going (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division

RECOMMENDATION 11. Develop a strategy to manage wood waste and identify the highest and best use of wood from trees removed by the City of Wilmington.		
ACTION STEPS	TIME FRAME	IMPLEMENTATION NOTES
11.1. First Step: Research local wood workers, tree care companies and resource recovery operations that may be able to use wood waste generated by the City.	Short-Term (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Community Services; City Manager.
11.2. Examine programs in other cities to find a model that may work for Wilmington.	Short-Term/ On-going (1–3 years)	**Funding.** No budgetary impacts. **Staff.** Tree Maintenance Division; Community Services; City Manager.
11.3. Develop a pilot program to implement the wood utilization model. Monitor and evaluate the program after one-year and expand or re-evaluate based on results.	Immediate (0–1 years)	**Funding.** To be determined—there may be no budget impacts. **Staff.** Tree Maintenance Division; Community Services.

Section 4

MEASURING PROGRESS

Measuring PROGRESS

> “Proactively grow and maintain public trees to create a healthy, equitable, and resilient urban forest that maximizes the environmental, quality-of-life, and climate-mitigation benefits Wilmington’s trees provide.

For the urban forestry master plan to be an effective tool in creating a sustainable and resilient urban forest that is proactively managed, it is vital that both its implementation and the condition of Wilmington’s urban forest is regularly monitored and assessed. Progress assessment helps to identify and highlight urban forestry successes and also identifies emerging opportunities and challenges that may need to be incorporated into the future UFMP updates.

Urban Forestry Master Plan Goals

Establishing metrics to measure the progress of the Plan’s goals can help in staying on task and implementing the Plan’s recommendations.

Protect and Preserve

Protect and preserve the urban forest from loss and threats to ensure the long-term sustainability of Wilmington’s tree canopy.

Progress Metrics:

- No net loss in tree canopy.
- Increases in staff for Plan review and enforcement of tree protection regulations.
- Regular participation by Tree Maintenance Division in the Technical Review Committee.

Plan and Manage

Plan and manage Wilmington’s public trees through development and coordination in planning, design, and care to ensure its long-term health and sustainability.

Progress Metrics:

- Development of an urban forest management plan.
- Inclusion and participation by the Tree Maintenance Division in the City’s capital improvement plan development process.
- Revisions to City policies, plans, and standards that support Wilmington’s public trees as recommended in this Plan.

Proactively Grow and Maintain

Proactively grow and maintain public trees to create a healthy, equitable, and resilient urban forest that maximizes the environmental, quality-of-life, and climate-mitigation benefits Wilmington’s trees provide.

Progress Metrics:

- Implementation of the urban forest management plan.
- Analyzing change in public tree benefits, using i-Tree Eco.
- Tracking and monitoring the number of trees planted, pruned, and removed each year and comparing over time.

Connect and Engage

Connect and engage with the community about Wilmington’s urban forest and the important role they play in its growth and care.

Progress Metrics:

- Participation in community events to share information about tree planting and care.
- Number of volunteers that participate in programs that support Wilmington’s urban forest.
- Number of public trees planted by volunteer and community partners and tree giveaways for private property.

TRACKING TREE PLANTING AND CARE ACTIVITIES

To evaluate whether Wilmington’s urban forestry efforts are having a real impact on the ground involves tracking tree planting, tree care, tree watering, and other activities. Developing a uniform system in Tyler Munis and TreeKeeper® where this information can be tracked by the City can help identify and prioritize needs, and can highlight program accomplishments. **The data can also be used during analysis of updated tree canopy data to see if these activities have had a measurable impact on the amount of tree canopy cover in areas where work has occurred.**

TREE INVENTORY UPDATES

As outlined in the UFMP, a public tree inventory provides critical information to manage and maintain Wilmington’s trees and also provides an opportunity to monitor the resource over time. Urban forestry industry standards recommend that municipal tree inventories are updated on a regular basis as planting, maintenance, and removals occur and are **re-inventoried every 5–10 years**. As Wilmington’s public trees are inventoried and re-inventoried, the City can monitor changes in:

- Tree genus and species composition.
- Number of trees.
- Size.
- Condition.
- Maintenance needs.

Assessing these changes can help measure progress in implementing UFMP’s recommendations.

Note: The original inventory data should be downloaded after the inventory has been complete to provide the baseline data to compare with future inventory data.

CHANGES IN TREE BENEFITS

Wilmington's trees and urban forest provides quantifiable benefits to the community. Measuring Wilmington's progress in growing and caring for its urban forest can be done by examining changes in these tree benefits. Did the amount of air pollutants removed increase or decrease over time? Does the canopy intercept more gallons of stormwater? Has the amount of carbon stored increased? iTree—the USDA Forest Service's suite of tools that measures and quantifies the benefits of trees—can be used to measure changes in tree benefits over time. The software tools in iTree are routinely updated based on the latest science and research. To measure changes in benefits over time, both the new and previous urban tree canopy assessment data must be analyzed through the same version of i-Tree.

Note: The benefits that are currently known for Wilmington's trees are based only on the inventory of street trees in the 1945 corporatelLimits, which represents an estimated one third of the public street trees in the city.

Using the urban tree canopy assessment data, the City can use i-Tree to determine the benefits of both the 2016 canopy cover and the new canopy cover assessment. The 2016 data can serve as the City's baseline.

> "Conducting updates of Wilmington's urban tree canopy assessment on a regular basis will provide important data on how and why tree canopy cover is growing or shrinking.

TREE CANOPY ANALYSIS

Conducting updates of Wilmington's urban tree canopy assessment on a regular basis (every 5–10 years) will provide important data on how and why tree canopy cover is growing or shrinking and will monitor progress toward achieving tree canopy goals (no net loss). Future Wilmington urban tree canopy assessments should include a tree canopy change analysis that examines current and previous urban tree canopy data to measure change and identify trends in tree canopy cover. Following any new urban tree canopy assessment update, the UFMP's goals, recommendations, and actions should be reviewed to ensure any opportunities or issues uncovered during the new assessment are addressed.

INDICATORS OF A SUSTAINABLE URBAN FOREST/USDA FOREST SERVICE URBAN FOREST SUSTAINABILITY AND MANAGEMENT REVIEW

To gauge the current state of Wilmington's urban forest, the Indicators of a Sustainable Urban Forest and the USDA Forest Service Urban Forest Sustainability and Management Review were used to assess Wilmington's urban forestry program.

The Indicators are broadly categorized into three groups—The Trees, The Players, and The Management. It uses urban forestry industry standards and best management practices to evaluate and rate Wilmington's trees, how they are managed, and the level of engagement there is around trees and urban forestry activities.

For each Indicator, Wilmington's current performance level was rated as LOW, MODERATE, or HIGH by the project team and consultants based on information, data, and public and stakeholder engagement during the Plan's discovery phase. The assessment identified areas where the city's urban forest can be improved and was used in the development of the UFMP recommendations. Wilmington's current overall performance for each component:

- **The Trees:** LOW-MODERATE.
- **The Players:** LOW.
- **The Management:** LOW-MODERATE.

The Indicators assessment was followed up with a review of Wilmington's urban forestry program using the USDA Forest Service's Urban Forest Sustainability and Management Review.[60] Wilmington's urban forestry program was evaluated on 116 components in 11 categories to provide a comprehensive assessment of the City's overall management and sustainability level. A summary of this review is in Table 8; the full review has been shared with the City of Wilmington.

Wilmington's overall management and sustainability level is 53%. It has achieved 60% of the Standard of Care Components and 29% of the Base Practices. As Wilmington continues to work on elevating its program, this score will improve. Of the 116 components assessed, Wilmington has adopted 34% as common practices, 26% are in development, 2% exceed common practices, and 38% are not currently practiced. The results of this assessment were used to develop recommendations in the UFMP to help Wilmington adopt more of these elements as common practices.

CATEGORY	DESCRIPTION	OVERALL CATEGORY EVALUATION	CATEGORY GOAL	OVERALL (% ACHIEVED)	STANDARD OF CARE* (% ACHIEVED)	BASE PRACTICES** (% ACHIEVED)
1	Management Policy and Ordinances	13	28	46%	75%	17%
2	Professional Capacity and Training	5	12	42%	100%	NA
3	Funding and Accounting	2	12	17%	50%	NA
4	Decision and Management Authority	7	8	88%	0%	100%
5	Inventories	10	22	46%	75%	17%
6	Urban Forest Management Plans	8	18	44%	NA	25%
7	Risk Management	9	18	50%	67%	0%
8	Disaster Planning	9	14	14%	NA	33%
9	Practices, Standards, and BMPs	29	56	52%	50%	14%
10	Community	18	24	71%	100%	NA
11	Green Asset Evaluation	13	20	65%	NA	NA
	Total	**123**	**232**	**53%**	**60%**	**29%**

*Standard of Care (SOC) elements represent the minimum group of urban forestry management "best practices" that a municipality/owner should consider for implementation. Standard of Care refers to the degree of prudence and caution required of an individual who is under a duty of care (i.e., legal obligation of the controlling authority, owner, or manager) to minimize risk. Neither state, regional, nor national minimum management components have been established for Standard of Care, but these are interim recommendations for your consideration.

**Base Practices (BP) elements represent additional urban forest management activities or components that may effectively expand a program beyond the SOC group. These elements are typically precursors to other "non-core" elements in the category (elements not highlighted).

Table 8. Summary of the USDA Forest Service Urban Forest Sustainability and Management Review for Wilmington.

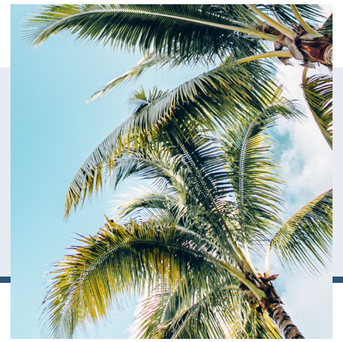
As the UFMP is implemented, periodic re-assessments (every 3–5 years) of the Indicators of a Sustainable Urban Forest and Urban Forest Sustainability and Management Review components should be conducted. The re-assessments can highlight successes in implementation; identify areas for improvement; and establish new program priorities, recommendations, and action steps.

PERIODIC REVIEW AND UPDATES OF THE UFMP

The UFMP is designed to be a living document that is periodically reviewed and updated (every 5–10 years) based on the changing needs of Wilmington's trees, community priorities, and successes in Plan implementation. The key to this monitoring activity is identifying who will spearhead Plan reviews and updates.

CONCLUSION

As detailed throughout the urban forestry master plan, trees play an essential role in the quality of life, resilience, and sustainability of Wilmington and its residents. To ensure that its benefits are maximized today and into the future, the Plan provides a path to proactively manage, grow, preserve, and care for Wilmington's trees. The Introduction (Section 1) highlights the essential benefits trees provide to Wilmington. Section 2 presents the current state of Wilmington's urban forest to establish a baseline of where the city is today. It also outlines community and stakeholder priorities and themes, which were used in establishing the Plan's goals, recommendations, and actions. The goals, recommendations, and actions are shared in Section 3. They focus on improving Wilmington's urban forest through proactive planning, management, and engagement. Section 4 provides ways that Wilmington can monitor and measure its progress in proactively managing Wilmington's urban forest to create a sustainable and resilient resource. Ultimately, the urban forestry master plan provides a vision for the future of Wilmington's urban forest—that we can all be a part of creating.



Vision for the Future of Wilmington's Urban Forestry

Wilmington's urban forest is an essential infrastructure asset that is highly valued for the positive contributions it makes to quality of life and character of the city. It is proactively and sustainably managed through proper care, planting, policies, and community stewardship.

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Section 5

APPENDICES

Appendix A: Indicators of a Sustainable Urban Forest

THE TREES & URBAN FOREST	City of Wilmington Assessed Performance Level		
	Low	Moderate	High
Urban Tree Canopy Canopy cover 48% (2018 urban tree canopy assessment, using 2016 imagery). Tree canopy cover has not been assessed post-Hurrican Florence (2018).			
Equitable Distribution of Tree Canopy Wilmington is deliberatoin in planting where there is a need.			
Size/Age Distribution of Public Trees Street trees in 1945 corporate limits are trending young and do not meet industry guidelines for size/age distribution. Wilmington does not have an inventory of all public trees to determine age distribution for the complete public tree population.			
Condition of Public Trees—Streets & Parks Wilmington has a partial inventory of street trees in 1945 corporate limits that is used to assess tree condition and risk.			
Condition of Public Trees—Natural Areas Wilmington does not have information on the condition of trees in natural areas.			
Private Property Trees Wilmington has basic information on private property canopy from the 2018 urban tree canopy assessment but lacks information on condition.			
Species Diversity—Public Trees The top five species inventoried in the 1945 corporate limits make up 58% of the population. Wilmington does not have an inventory of all public trees to determine species diversity for the complete public tree population.			
Species Suitability—Public Trees 50–75% of the species are suited to Wilmington's urban environment and adapted to the overall region.			

THE MANAGEMENT PROGRAM	City of Wilmington Assessed Performance Level		
	Low	Moderate	High
Public Tree Inventory Wilmington has an inventory of street trees in 1945 corporate limits (2022) but does not have an inventory of all public trees.			
Tree Canopy Assessment Urban tree canopy assessment completed in 2018 using 2016 aerial imagery. The assessment has not been updated post-Hurricane Florence (2018).			
Urban Forest Management Plan An urban forest management plan is not in place.			
Rise Management Program Wilmington management program is primarily reactive—based on resident requests. Requested tree work is prioritized based on risk.			
Maintenance of Publicly Owned Trees—Streets & Parks Wilmington's maintenance program is request-based, and there is not a systematic pruning program in place for publicly owned trees.			
Maintenance of Publicly Owned Natural Areas No formal natural area management program in place.			
Tree Planting Program—Streets & Parks Annual planting program in place that is consistently funded.			
Tree Protection Policy Wilmington has tree protection policies in place, but there are not enough staff for enforcement.			
City Staffing & Equipment There are not sufficient staff in place to conduct all street and park tree maintenance.			
Funding Forestry program does not have adequate funding to maintain all of the city's public trees.			
Urban Forestry Disaster Preparedness & Response Wilmington has a city-wide disaster plan. The plan needs to be reviewed and revised to address trees and the urban forest.			
Communication Avenues are in place for both internal and resident communication; however, they are used sporadically and/or only on a one-way basis.			

THE COMMUNITY & STAKEHOLDERS	City of Wilmington Assessed Performance Level		
	Low	Moderate	High
Neighborhood/Action The Alliance for Camp Fear Trees and the Wilmington Tree Commission are actively engaged in urban forestry; however, there is minimal involvement by resitdents in urban forestry.			
Large Private and Institutional Landholder Involvement Few private landholders and/or institutions have urban forest management plans in place for their property.			
Green Industry Involvement Limited involvement from green industry leaders in urban forestry in Wilmington.			
City Department/Agency Cooperation Good working relationships exist between Forestry and other City departments; however, communication typically only occurs when there is a conflict between trees and a City project.			
Funder Engagement Local funders are not engaged in City urban forestry initiatives.			
Utility Engagement Limited engagement and coordination with utilities about trees and city-wide goals and objectives.			
State Engagement Limited coordination exists between state department and agencies.			
Developer Engagement The development community is not well-engaged in urban forestry and advancing city-wide urban forestry goals and objectives.			
Public Awareness In general, the Wilmington community understands the value and benefits of trees.			
Regional Collaboration Little or no interaction between neighboring communities and regional groups around trees and the urban forest.			

Appendix B. Ordinance Review

TOPIC	ADDRESSED (X)	CHAPTER & SECTION	COMMENTS
Credentials			
Requires certified arborist for paid private tree work.			
Requires certified arborist for public tree work.			
Requires licensing of private tree care firms			
Defines official authority for public tree management.	X	Chapter 7, Section 7-52, 7-53; City Charter XXI, Section 21-5	
Public Tree Management and Protection			
Establishes/Authorizes City Forester to regulate public trees.	X	Chapter 7, Section 7-52, 7-53	City Manager
Establishes/Authorizes City position (e.g., Mayor, City Administrator, DPW Director) to regulate public trees.			
Requires annual community tree work plans.			Street Tree Policy (not code)
Identifies formula for determining monetary tree value.			
Establishes responsibility for public tree maintenance (e.g., City, adjacent property owner).	X	Chapter 7, Section 7-52, 7-53	City of Wilmington—Department of Parks and Recreation
Requires regular public tree maintenance.			Street Tree Policy (not code)
Requires particular types of maintenance (e.g., pruning).			Street Tree Policy (not code)1Q
Requires adherence to ANSI A300 standards and best management practices.			ANSI A300 is included in the Land Development Cod (LDC) glossary, but it is not referenced in the LDC.
Establishes permit system for work on public trees.	X	Chapter 4, Section 4-240; Chapter 7, Section 7-54	
Establishes provisions for penalties for non-compliance.			

TOPIC	ADDRESSED (X)	CHAPTER & SECTION	COMMENTS
Public Tree Management and Protection (continued)			
Restricts tree removal on public property.	X	Chapter 7, Section 7-54; Chapter 18 (LDC), Section 18-315	
Permit or approval required for tree removal, pruning, or excavating near public trees.	X	Chapter 7, Section 7-54; Chapter 18 (LDC), Section 18-315	
Prohibits damange to public trees (e.g., attaching ropes, signs, wires, chemicals, storing materials, excavation, etc.).	X	Chapter 7, Section 7-54 and 7-61	
Restricts burning of solid wood waster.	X	Chapter 7, Section 3-22	
Establishes a wood utilization program.			
Establishes an insect/disease control strategy.			
Defines tree maintenance requirements on public property.	Partially	Chapter 18 (LDC), Section 18-315, C2	Lists prohibited maintenance activities, but does not list required/ best practices.
Prohibits tree topping.	X	Chapter 18 (LDC), Section 18-31, C2.a	
Regulates abatement of hazardous or public nuisance trees.	X	Chapter 18 (LDC), Section 18-327A	
Regulates removal of dead or diseased trees.	X	Chapter 18 (LDC), Section 18-327B	
Tree Planting			
Regulates tree species which may or may not be planted on **private** property (approved tree list).	X	Chapter 18 (LDC), Sections 18-315	Prohibited species in the Technical Standards and Specifications Manual (2007) are not allowed to be planted.
Requires tree planting around reconstructed parking lots.	X	Chapter 18 (LDC), Section 18-318; 18-321	
Requires replacement of removed publicly owned trees.	X	Chapter 18 (LDC), Section 18-316 F	
Requires tree plantings around new parking lots.	X	Chapter 18 (LDC), Section 18-321	
Requires tree plantings around new developments.	X	Chapter 18 (LDC), Section 18-318, 18-321	
Regulates tree species, which may or may not be planted on public property (approved tree list).	X	Technical Standards & Specifications Manual, p. 6-2	

TOPIC	ADDRESSED (X)	CHAPTER & SECTION	COMMENTS
Private Tree Protection and Preservation			
Restricts tree removal on private property.	X	Chapter 18 (LDC), Section 18-317	Residential lots in historic districts or greater than one acre; and all non-residential lots.
Permit or approval required for tree removal on private property.	X	Chapter 7, Sections 7-54; Chapter 18 (LDC), Section 18-317 A.1	
Requires preservation of trees during development on private property.	X	Chapter 18 (LDC), Section 18-316	Requires protection of trees of certain species & size.
Encourages preservation of trees during development on private property.	X	Chapter 18 (LDC), Sections 18-316	
Prohibits damage to preserved/protected trees.	X	Chapter 18 (LDC), Sections 18-316 B.D.	
Prohibits damage or removal of trees on another person's property.			
Inventory of trees on site required.	X	Chapter 18 (LDC), Section 18-316 A.1	
Identification of forests/woodlands required.	**Partially**	Chapter 18 (LDC), Section 18-316 A.7	The areas that are designated as tree protection areas that will not be disturbed shall be delineated as such and do not require inventorying individual trees.
Specific species and/or size tree regulated (e.g., heritage/significant trees).	X	Chapter 18 (LDC), Section 18-318	Requires protection of trees of certain species & size; see Table 18-316.1.
Location of Critical Root Zone/Dripline required.	X	Chapter 18 (LDC), Section 18-316 A.4, D	Table 18-316.3.
Minimum canopy coverage requirement set.	**Partially**	Chapter 18 (LDC), Section 18-318	For impervious surfaces only
Identification of riparian buffers, natural areas, preservation zones.	X	Chapter 18 (LDC), Sections 18-285 A	1. The following are identified as conservation resources and subject to these regulations: a. Primary nusery areas identified by the State of North Carolina; b. Coastal wetlands identified by the North Carolina Division of Coastal Management or its successors; and c. 404 wetlands as identified by the United States Army Corps of Engineers.

TOPIC	ADDRESSED (X)	CHAPTER & SECTION	COMMENTS
Private Tree Management and Protection (continued)			
Tree protection/preservation plan required.	X	Chapter 18 (LDC), Section 18-316A	
Tree protection fencing required.	X	Chapter 18 (LDC), Section 18-316 D.1	
Location/type of other tree protection measures (e.g., root pruning, aeration, vertical mulching, trunk protection, soil protection, irrigation) on development plans (e.g., site plans, construction plans, etc.).			
Provide credits/incentives for tree preservation.	X	Chapter 18 (LDC), Section 18-316 C.5	
Landscape plan with proposed landscaping and mitigation trees to be planted.	X	Chapter 18 (LDC), Section 18-315 F	
Requires grading plan to include protected/ preserved trees.	X	Chapter 18 (LDC), Section 18-316 D.1a	Tree protection fencing shall be shown on site plans and grading plans around each tree, cluster of trees, perimeter of tree-save areas, required streetscape landscaping and transitional buffers, and limits of disturbance.
Utility plan with trees to include protected/ preserved trees.			
Tree planting requirements for removal of regulated trees.	X	Chapter 18 (LDC), Section 18-316 F	
Fee in lieu of planting mitigation trees.	X	Chapter 18 (LDC), Section 18-316 F.3	The LDS says fee per caliper inch, but the city's fee schedule just lists a flat $350 fee.
Tree mitigation survival requirements.	X	Chapter 18 (LDC), Section 18-316 E, G.4	Three years.
Fine for removal of regulated trees.	**Partially**	Chapter 18 (LDC), Section 18-316 F.3	The LDS requires mitigation for all regulated trees, and there is a fee in lieu of mitigation; see above.
Penalties established for damage and removal of preserved/saved trees.	X	Chapter 18 (LDC), Section 18-315, C.2, D.5a	The code suggests a fee or fine but does not spell it out clearly; see above about fee-in-lieu.
Bonding utilized to discourage tree removals.			
Tree Fund.	X	Chapter 18 (LDC), Section 18-316, F.3	Tree Improvement Fund.