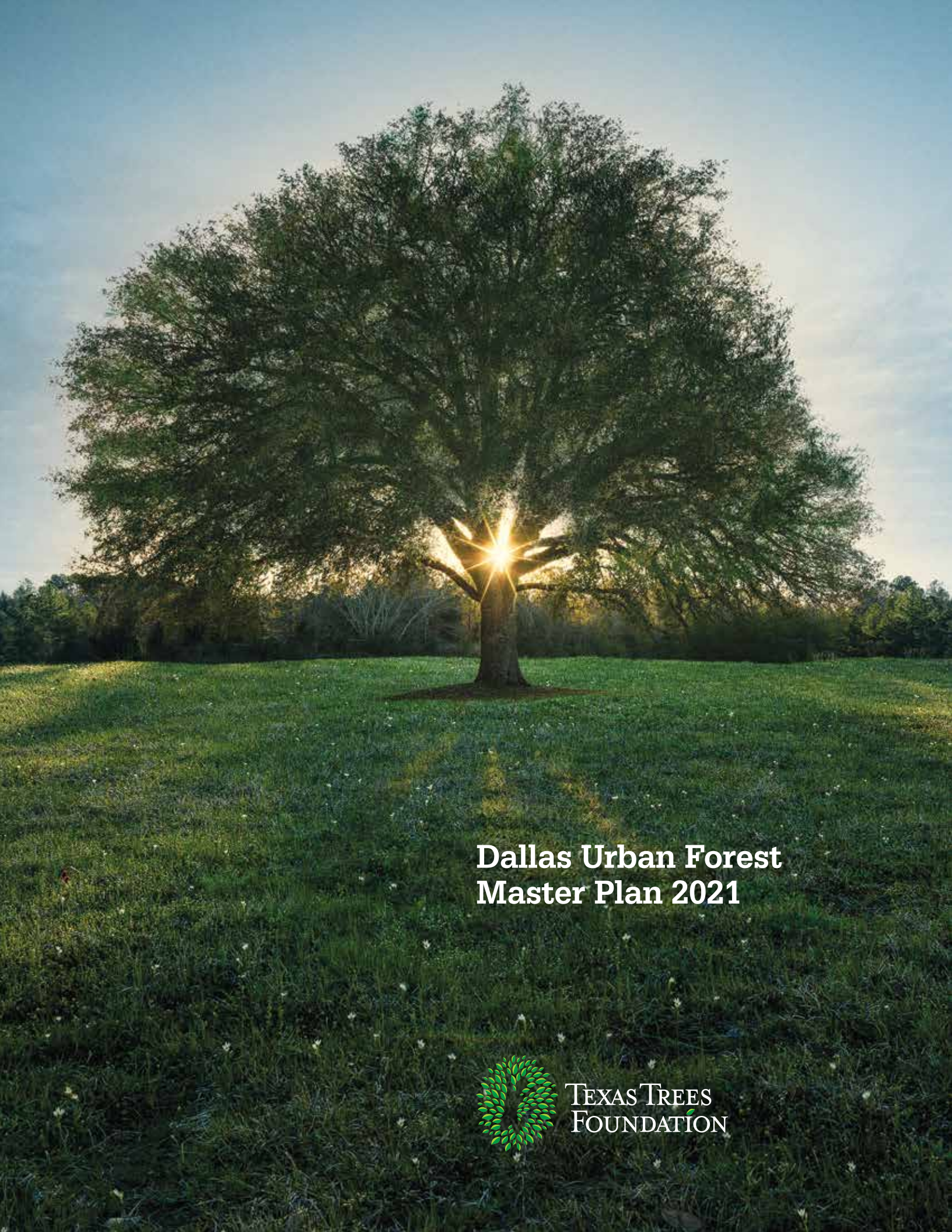

Dallas Urban Forest Master Plan 2021

Texas Trees Foundation

A MESSAGE FROM TEXAS TREES

It's a simple fact that trees are good. It's also a fact that trees in cities just don't happen by chance, except the Trinity Forest. The reality that the City of Dallas has a natural forest, and a built urban forest is remarkable. But we've come to a crossroads; nurture and manage this resource - or lose it.

Bulldozers, urban heat, pests, climate change, and a myriad of other maladies are affecting one of our most important natural resources—trees. And it's up to us to come together, as a community, and have the will to consolidate efforts, both within the city and with external partners, to protect, expand, and manage our urban forest resource. It's up to all of us to make trees a priority.

The Dallas Urban Forest Master Plan sets forward a strategic and cohesive agenda to manage this "green infrastructure". If centralized within the City, there can be a comprehensive cost-effective approach to aligning investments for a greater return while at the same time providing a roadmap for private partners to help reach the goals and objectives of a strategic urban forestry plan.

The Texas Trees Foundation is here to help, as we've been since 1982, and we will continue to provide technical assistance, support, expertise, volunteers, and sponsors to help make Dallas cooler, greener and cleaner for our residents and to the visitors to this great city.

Janette Monear, CEO & President // Texas Trees Foundation

Texas Trees Foundation is pleased to lead the Urban Forest Master Plan with these Key Partners

CITY OF DALLAS // LYDA HILL PHILANTHROPIES // ONCOR

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Executive Summary

WHY DALLAS'S URBAN FOREST MATTERS

Imagine it is a typical summer day in the City of Dallas, and you go for a walk. It is 110 degrees and too hot to stand on the sidewalk. Ahead, a row of trees lines your path and relief from the heat is instant as you stand in their shade. The City of Dallas hosts an impressive, yet underappreciated resource in its trees, forests, and greenspace, known collectively as the urban forest. The urban forest is a capital infrastructure asset, and like any other capital infrastructure asset, requires management input and sustained action. However, unlike other infrastructure, the urban forest's value increases over time, returning on average $2.25 dollars per dollar spent (McPherson et al., 2005). Trees produce a myriad of important benefits to Dallas's environment, residents, and visitors. These benefits, including cooling, air quality regulation, improved human health and well-being, and stormwater mitigation, are enhanced with proper urban forest management action. In the City of Dallas, there are an estimated 14.7 million trees (Texas Trees Foundation, 2015) producing $239 million in quantifiable environmental benefits annually (Texas Tree Foundation, 2019). In addition, these trees also provide aesthetic, social, and spiritual benefits that go beyond monetary value.

URBAN FOREST THREATS AND OPPORTUNITIES

Unfortunately, Dallas's urban forest resource is at risk. Diffused management, pests and disease, and rapid urban development pose serious threats to the city's trees. Currently, Dallas has a tree canopy cover of 32%, relatively high for a city of its size. At the same time, the inequitable distribution of tree canopy across the city cause some of its residents to be deprived of the key benefits of these trees altogether. As trees grow, their benefits supplied increase exponentially, meaning preservation of mature trees is critical, and the planting of new trees is urgently needed to supply future benefits. Dallas's unique urban forest, composed of trees on both private and public property, in parks, medians, and in the 6,000-acre Great Trinity Forest, must be properly managed to ensure the greatest benefit for the City's inhabitants. Furthermore, as opportunities, such as carbon credits and cap-and-trade programs, become increasingly viable, the value of a healthy, well managed forest resource will continue to grow. Currently, a decentralized governance structure with varying management strategies and a lack of focused resources and action, cause the City's urban forest resource to be underutilized and threatened.

A PLAN FOR ACTION

A sound plan for the management of the urban forest is critical to ensure the resource is protected, maintained, and grown. Building on decades of high-quality local and national urban forest research, this Urban Forest Master Plan (UFMP, the Plan), sets a strategic and cohesive agenda to improve urban forest management across the City of Dallas. Informed by the State of the Dallas Urban Forest assessments performed by the Texas Trees Foundation (2015; 2019), driven by goals outlined in the Dallas Comprehensive Environmental and Climate Action Plan (2020), Dallas's commitment to the World Economic Forum's One Trillion Trees initiative (2020), the UFMP sets the stage for increased and improved urban forest stewardship action.

MAKING TREES A PRIORITY

All too often, the urban forest is treated not as an asset, but relegated to a luxury, or worse, as a hinderance to other land uses and infrastructure. To accomplish the goals set out in this plan, trees must be recognized for their full inherent, monetary, health, and cultural values. City decision-makers must recognize these values in the context of decisions made around funding allocations, infrastructure, zoning, and development, and become a priority for city decision-makers in order to ensure the health and longevity of the urban forest. This plan lays out 14 recommendations, with recommended action steps and timelines, for the City to create a more resilient, well-managed, and sustainable urban forest. Without increased, cohesive support, trees will continue to be an afterthought, and the City of Dallas will miss extraordinary opportunities to enhance the lives and health of its residents through green infrastructure. With herculean challenges such as climate change, poor air quality, and rapid development looming on Dallas's doorstep, urban forests provide a key tool to combat issues facing every Dallas decision-maker and their constituents. Ultimately, without champions for urban forests at the political and management levels of the City of Dallas, the opportunities and benefits of urban forestry will not be realized.

Dallas is at a crossroads. Is it going to continue down a path towards intolerable outdoor activities in summer months? Or will it respond to the challenges of a super-heated city head-on by managing and aggressively taking action for its urban forest, so that a summer walk can be along cool, green, healthy tree-lined streets.

ONE TRILLION TREES INITIATIVE

In 2020, the City of Dallas joined the World Economic Forum's One Trillion Trees Initiative to plant one trillion trees worldwide by 2030.

Through the Dallas Urban Forestry Initiative, the City of Dallas and its partners have pledged to:

- **Plant 31,000 trees**
- **Protect 14.7 million existing trees**
- **Facilitate Natural Regeneration of 3.3 million trees**

The Dallas Urban Forest Master Plan can help meet this pledge.

For information on the Initiative and Dallas's pledge, visit 1t.org.

DALLAS'S URBAN FOREST MASTER PLAN

Trees are an important part of the solution in addressing the challenges facing Dallas and making the city sustainable and resilient. However, to harness and maximize the benefits the urban forest provides, trees must become a priority in Dallas. **Adoption of the Dallas Urban Forest Master Plan is the first step in making trees a priority**, and action on its recommendations is the next.

The foundation and direction of the Plan was established based on a set of priorities, themes, and guiding principles identified through input and feedback from a wide range of stakeholders and the community at large. Using these themes, priorities, and guiding principles, the Plan is designed to move Dallas towards a sustainable and resilient urban forest by proactively managing, preserving, caring for, and growing the city's tree canopy.

The Urban Forest Master Plan will help Dallas to:

Plan for a sustainable and resilient urban forest by developing strategies and policies that align with internationally-established best management practices.

Manage tree maintenance, care, and tree planting activities more effectively by improving data, technology, communication, decision-making, and collaboration.

Protect the urban forest and maximize the benefits it provides, by ensuring systems are in place to support its long-term growth, preservation, and care.

Grow the urban forest in an equitable and sustainable manner to ensure that all Dallas residents have access to trees and the benefits they provide.

Engage and connect with the community about the important role that they play in the growth, preservation, and care of Dallas's trees.

DALLAS URBAN FOREST MASTER PLAN GOALS

1. Create a healthy, equitable, and resilient urban forest through proper planning and implementation of management strategies that maximize the benefits that Dallas's trees provide.
2. Protect and grow tree canopy in Dallas to reduce temperatures, improve air quality, and address the most pressing challenges facing the city.
3. Achieve the Dallas Comprehensive Environmental and Climate Action Plan target of 37% tree canopy cover by 2040.
4. Actively engage with the community about the instrumental role they play in caring and growing Dallas's urban forest and making trees a priority.

DALLAS URBAN FOREST MASTER PLAN RECOMMENDATIONS

1. **Complete** a comprehensive tree inventory of all right-of-way and park trees.
2. **Centralize** the City of Dallas's urban forestry programs and activities.
3. **Create** a Storm Response and Recovery Plan for the City of Dallas.
4. **Strengthen and support** existing relationships and partnerships.
5. **Work** towards development of a City Urban Forest Management Plan.
6. **Ensure** Dallas regulations, best-management practices, and guidelines are in place to support tree canopy growth, protection, and preservation.
7. **Develop and implement** a strategy to maximize investment and resources to meet Dallas's desired level of service for urban forestry programs and management.
8. **Create** a plan to strategically plant and care for trees to ensure equitable access to tree canopy across Dallas.
9. **Create and implement** a management program to monitor and address environmental threats to Dallas's urban forest.
10. **Develop and implement** a public engagement, outreach, and education plan.
11. **Formulate** a strategy to manage wood waste and identify the highest and best use of wood from trees removed by the City of Dallas.
12. **Strengthen** working relationships and partnerships with private utilities, organizations, and contractors whose activities impact trees by instituting regular dialogue and project coordination.
13. **Enhance and develop** programs that encourage and support active participation by residents and volunteers in the planting and care of Dallas's urban forest.
14. **Review and update** the Great Trinity Forest Management Plan.

SECTION 1: Introduction

In 2019, the Texas Trees Foundation and the City of Dallas embarked on a project to develop the city's first Urban Forest Master Plan (UFMP/Plan).

The goal of the Plan is to provide a unified vision and framework to manage Dallas's urban forest as a sustainable community asset.

WHY DEVELOP AN URBAN FOREST MASTER PLAN?

Dallas's urban forest is made up of all the trees that surround us every day, those growing around our homes and workplaces, along streets, in City parks, and in the Great Trinity Forest. Studies conducted by the Texas Trees Foundation estimate that Dallas has over **14.7 million trees** (Texas Trees Foundation, 2015) and a **tree canopy cover of 32%** (Texas Trees Foundation, 2019).

An abundant and healthy urban forest has been shown to reduce city temperatures, improve air quality, manage stormwater, positively impact human health, and mitigate the effects of climate change, serving as an important tool in helping to address many of the challenges facing Dallas today (Bastin, 2019; Johnson, 2017; Ulmer, 2016). The City of Dallas Comprehensive Environment and Climate Action Plan (2020) cites trees as an important solution in making Dallas a more equitable, sustainable, and climate resilient city.

> **Dallas's 14.7 million trees have a replacement value of $9 billion.**
>
> *Texas Trees Foundation 2015 State of the Dallas Urban Forest Report*

While trees are an important solution in helping to address the challenges facing Dallas, they can only be effective if their **care, management, and preservation become a priority.** The Dallas Urban Forest Master Plan serves as guide to make this happen by providing additional insights into the current state of Dallas's urban forest and outlining recommendations and actions to **proactively manage, care, protect, and grow the city's tree canopy.** It provides a shared vision for the future of the urban forest to inspire us all to plant, care for, and protect Dallas's trees.

THE PLANNING PROCESS

The development of the Dallas Urban Forest Master Plan was based on answering four key questions:

- **What Do We Have?**
- **What Do We Want?**
- **How Do We Get There?**
- **How Are We Doing?**

This structure, termed "adaptive management," is commonly used for resource planning and management and provides a useful conceptual framework for managing Dallas's urban forest resource (Miller, 1998).

TREES WORK

Trees and the urban forest are constantly working to improve and enhance our health, environment, and quality of life.

Trees Make Cities More Livable. Large, healthy trees are a key component in making cities more livable and improving the quality of life for its residents. Decreasing summer temperatures, reducing flooding, and improving the air we breathe are part of the range of environmental, economic, and social benefits trees provide.

Trees and greenspace enhance neighborhoods by strengthening ties between neighbors, encouraging outdoor play by children, reducing crime, and providing an overall sense of safety (Kuo, 2003). **A 10% increase in neighborhood tree canopy cover has been associated with a 12-15% reduction in violent and property crimes** (Gilstad-Hayde, 2015; Troy, 2012). Tree canopy cover near and around middle schools has been associated with higher standardized student test scores in reading and math (Kuo, 2021).

Trees Improve Human Health. People living in neighborhoods with more tree canopy cover have been shown to have better overall health, including lower rates of obesity, more social cohesion, less stress, and lower blood pressure (Roe, 2013; Ulmer, 2016). Residents that self-reported their mental health as "poor" **decreased 63%** 18 months after vacant lots near their homes were planted with grass and trees.

With the negative impacts of chronic stress on human health, from anxiety and depression to weight gain and heart disease, trees are proving to be a low-cost solution in helping to mitigate these health problems.

Trees Can Save Lives. A study of the health impacts that trees have on air pollution removal finds **trees save over 850 lives and prevent 670,000 incidents of acute respiratory symptoms in the United States each year** (Nowak et al., 2014).

Trees Reduce Temperatures. Shade from large, healthy mature trees reduces the amount of sunlight that is absorbed and stored by impervious surfaces (like roads and buildings), while their leaves release water vapor (transpiration) cooling the surrounding area. Through shade and transpirational cooling, trees modify the environment and reduce urban heat island effects. The Texas Trees Foundation's 2017 *Urban Heat Island Management Study* for Dallas found:

- **tree preservation and planting is the most effective strategy** in lowering temperatures in Dallas. The cooling benefits from **trees reduces temperatures by up to 15° F in some areas of Dallas.**

- **planting and caring for 250,000 new trees in Dallas** can provide significant cooling and health benefits. Increased tree canopy can **reduce nighttime temperatures by more than 2° F**, reducing the stress on respiratory and cardiovascular systems and allowing the body to recover from high heat exposure during the day.

Trees Can Lower Electricity Bills. Trees planted in proper locations around a home can reduce energy costs by $100 to $250 per year for the average household. While shading air conditioning units can help them run up to 10% more efficiently, reducing energy use (U.S. Department of Energy).

A large, healthy live oak tree can remove nearly 5 pounds of pollutants from the air each year.

Trees Improve Air Quality. Trees serve an important function in improving air quality, reducing 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 like 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 Dallas can remove nearly 5 pounds of pollutants from the air each year – including ozone, carbon monoxide, nitrogen dioxide, and particulate matter (USDA Forest Service iTree MyTree).

Trees Help Reduce the Effects of Climate Change. Trees reduce greenhouse gases that can trap and retain heat in the atmosphere, causing 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, meaning larger trees store more carbon (Gomez & Barton, 2013). A large, healthy live oak tree (*Quercus virginiana*) stores 3.5 times more carbon over its lifetime than a small, healthy, mature crape myrtle (*Lagerstroemia indica*) (iTree MyTree).

The Dallas Comprehensive Environmental Climate Action Plan (2020) established targets to reduce greenhouse gas emissions. Proper investments in tree planting, care, and preservation can ensure that Dallas's trees reach maturity where their larger sizes can help achieve these targets and maximize the important benefits they provide.

Trees Reduce Stormwater Runoff and Improve Water Quality. Existing stormwater management systems are not always adequate to accommodate runoff; when a system is overtaxed, peak flows can cause stormwater to back up and cause flooding. During storm events trees intercept rainfall in their canopies acting as a mini reservoir (Xiao et al., 1998). This intercepted rainfall evaporates from leaves or slowly soaks into the ground, reducing and slowing stormwater runoff, and lessening erosion. While underground, the growth and decomposition of tree roots helps to increase the amount of water the soil can hold, allowing for greater absorption of rain (McPherson et al., 2002). Each of these processes greatly reduces stormwater runoff, reducing flooding and erosion, and preventing sediments and pollutants from entering waterways.

Allowing rainwater to slowly soak into the ground where it lands can reduce stormwater runoff and pollutants by 20 to 60 percent (Johnson et al., 2017).

Trees Support Wildlife. Trees provide critical habit for birds, mammals, reptiles, insects, fish, and other aquatic species. Their flowers provide a valuable source of pollen and nectar to hundreds of species of native bees and other pollinators, and their canopies provide food and shelter to a variety of wildlife.

Texas provides habitat for nearly 70% of North American bird species (Audubon Texas). **Dallas is along migration routes of songbirds, bats, and insect species that use the city's trees for shelter and food during their migration.**

Trees Make Economic Sense. The economic benefits trees provide reflect both their importance, and the value that people place on having trees in cities. Mature, healthy trees can increase property values, for both residential and commercial properties, by an average of 10% (USDA Forest Service, 2011). A study in Riverside, CA 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** (Standiford, 2001). Researchers have also found that shoppers spend more time and money in shopping districts that have mature, healthy tree canopy (Wolf, 2005).

BENEFITS OF TREES – BY THE NUMBERS

While some of the benefits that trees provide cannot be measured, like how they make a person feel, there are many benefits that can be valued and quantified. To introduce these benefits, an analysis using the iTree MyTree tool was conducted on four tree species commonly found in Dallas - redbud (*Cercis canadensis* var. texensis), crepe myrtle (*Lagerstroemia indica*), cedar elm (*Ulmus crassifolia*), and live oak (*Quercus virginiana*).

As the analysis illustrates (Figure 1), different tree species provide different levels of benefits depending on their size, structure, form, and age. For example, an 8" redbud intercepts 36% more stormwater than a 12" crepe myrtle, while a crepe myrtle absorbs 67% more carbon dioxide than a redbud. A 24" live oak has stored over 21,000 pounds of carbon in its trunk and branches over its lifetime; however, as it matures its ability to absorb large amount of carbon dioxide each year is significantly reduced. **Planting and maintaining a diversity of tree species is the key to maximizing the benefits trees provide and creating resiliency in Dallas's urban forest.**

Figure 1. Benefits of four common tree species in Dallas.
The larger the tree, the greater the benefits.

TEXAS REDBUD

Cercis canadensis var. texensis

$10.25 VALUE OF ENERGY SAVINGS EACH YEAR

1,783 POUNDS OF CO2 STORED OVER LIFETIME TO DATE

7 POUNDS OF CARBON DIOXIDE (CO2) SEQUESTERED (ABSORBED) EACH YEAR

12 OUNCES OF OZONE REMOVED FROM AIR EACH YEAR

74 KWH OF A/C ENERGY SAVINGS EACH YEAR

393 GALLONS OF RAINFALL INTERCEPTED EACH YEAR

8" TRUNK DIAMETER

$13.71 ANNUAL VALUE OF BENEFITS

CREPE MYRTLE

Lagerstroemia indica

$3.00 VALUE OF ENERGY SAVINGS EACH YEAR

5,394 POUNDS OF CO2 STORED OVER LIFETIME TO DATE

316 POUNDS OF CARBON DIOXIDE (CO2) SEQUESTERED (ABSORBED) EACH YEAR

9 OUNCES OF OZONE REMOVED FROM AIR EACH YEAR

20 KWH OF A/C ENERGY SAVINGS EACH YEAR

250 GALLONS OF RAINFALL INTERCEPTED EACH YEAR

12" TRUNK DIAMETER

$7.64 ANNUAL VALUE OF BENEFITS

CEDAR ELM

Ulmus crassifolia

$25.50 VALUE OF ENERGY SAVINGS EACH YEAR

5,728 POUNDS OF CO2 STORED OVER LIFETIME TO DATE

602 POUNDS OF CARBON DIOXIDE (CO2) SEQUESTERED (ABSORBED) EACH YEAR

43 OUNCES OF OZONE REMOVED FROM AIR EACH YEAR

183 KWH OF A/C ENERGY SAVINGS EACH YEAR

1,143 GALLONS OF RAINFALL INTERCEPTED EACH YEAR

16" TRUNK DIAMETER

$41.05 ANNUAL VALUE OF BENEFITS

LIVE OAK

Quercus virginiana

$16.00 VALUE OF ENERGY SAVINGS EACH YEAR

21,000 POUNDS OF CO2 STORED OVER LIFETIME TO DATE

<1 POUNDS OF CARBON DIOXIDE (CO2) SEQUESTERED (ABSORBED) EACH YEAR

67 OUNCES OF OZONE REMOVED FROM AIR EACH YEAR

84 KWH OF A/C ENERGY SAVINGS EACH YEAR

1,661 GALLONS OF RAINFALL INTERCEPTED EACH YEAR

24" TRUNK DIAMETER

$40.10 ANNUAL VALUE OF BENEFITS

RESEARCH
Tree Canopy, Crime & Health

TREES IMPROVE HUMAN HEALTH

New York City The presence of street trees was associated with a lower prevalence of asthma in early childhood.

Lovasi, G. S., J.W. Quinn, K.M. Neckerman, M.S. Perzanowski, and A. Rundle. 2008. Children Living in Areas With More Street Trees Have Lower Prevalence of Asthma. Journal of Epidemiology and Community Health 62: 647-49.

United States Mortality rates due to cardiovascular and lower respiratory disease increased in counties that lost trees due to the emerald ash borer.

Donovan, G.H., D.T. Butry, Y.L. Michael, J.P. Prestemon, A.M. Liebhold, D. Gatziolis, and M.Y. Mao. 2013. The Relationship Between Trees and Human Health: Evidence From the Spread of the Emerald Ash Borer. American Journal of Preventive Medicine 44, 2: 139-145.

Pennsylvania Patients with views of trees outside their hospital room had shorter hospitalizations and required less medication than patients who had a view of a brick wall.

Ulrich, R.S. 1984. View Through a Window May Influence Recovery from Surgery. Science 224 (4647): 420-1.

England Health inequities and mortality in low income populations were lower for those living in the greenest areas.

Mitchell, R. and F. Popham. 2008. Effect of Exposure to Natural Environment on Health Inequalities: An Observational Population Study. The Lancet 372: 1655-660.

TREES HELP MAKE NEIGHBORHOODS SAFER

Portland, OR Street trees planted in neighborhoods with single-family homes were associated with lower crime.

Donovan, G. H. and Prestemon, J. P. (2012). The effect of trees on crime in Portland, Oregon. Environment and Behavior, 44 (1), 3–30.

Baltimore, MD A 10% increase in tree canopy was associated with a 12% decrease in crime (robbery, burglary, theft, and shooting). Tree canopy on public land provided a greater benefit than private lands.

Troy, A., J.M. Grove and J. O'Neil-Dunn. 2012. The relationship between tree canopy and crime rates across an urban–rural gradient in the greater Baltimore region. Landscape and Urban Planning 106: 262–270.

Philadelphia, PA Neighborhoods with abundant vegetation had lower rates of crime (assault, robbery, and burglary) than areas with sparse or no vegetation.

Wolfe, M. K. and Mennis, J. (2012). Does vegetation encourage or suppress urban crime? Evidence from Philadelphia, PA. Landscape and Urban Planning. 108 (2-4), 112-122.

DALLAS IS FACING CHALLENGES

Dallas is Getting Hotter. One effect of climate change already being felt in Dallas is an increase in the number of days above 100° F (high heat days). Between 1960 and 2019, the average number of high heat days in Dallas increased **58%**, and 2011 saw a record-breaking 71 high heat days (National Weather Service Climatology). This trend is predicted to continue and **by 2050, Dallas could have 30 to 60 more days per year with temperatures over 100° F** (US Global Change Research Program, 2018).

In the United States, extended periods of high temperatures, heavy rain events, severe flooding, and droughts have increased over the last 50 years (US Global Change Research, 2018). As Dallas temperatures increase and the climate changes, extreme and unpredictable weather patterns with which residents are all too familiar, are forecasted to increase in frequency, intensity, and duration in the coming decades (City of Dallas, 2020). In 2019, Dallas experienced two of these events in less than 6 months: the June 9, 2019 storm that produced straight-line winds and the October 20, 2019 tornadoes that touched down in North Dallas.

Why does it matter? High temperatures in cities contribute to a phenomenon called the urban heat island. An urban heat island occurs, when impervious surfaces, like roads, buildings, and sidewalks, trap and hold heat causing air temperatures to be hotter than nearby areas that are less built-up and have more greenspace (Figure 2). According to the United States Environmental Protection Agency, a city which 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. In Dallas, the Texas Trees Foundation's Urban Heat Island Management Study determined that densely developed areas of the city with high amounts of impervious surfaces and low tree canopy cover were up to **9° F warmer during the day and up to 4° F warmer at night than less built-up areas** (2017).

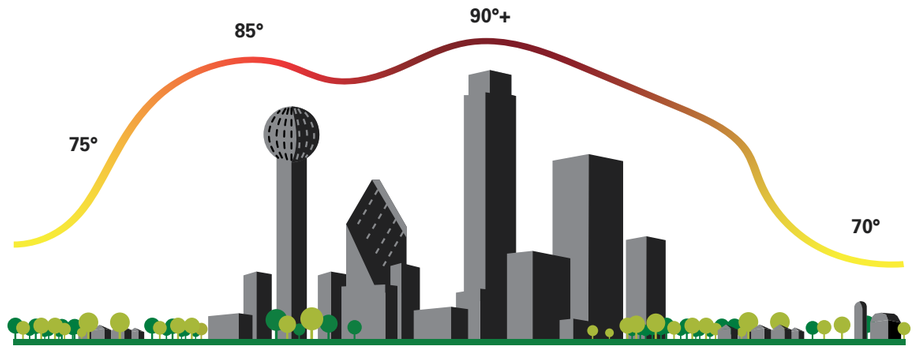


Figure 2. Illustration of the urban heat island effect in Dallas.
Higher temperatures are shown downtown where there are more buildings and roads (impervious surfaces) and less tree canopy cover. Moving away from downtown, as tree canopy increases and impervious surfaces decrease, temperatures are lower.

With over 40% of the City of Dallas's land covered with impervious surfaces and other non-vegetated cover – as identified in the 2019 urban tree canopy assessment update (Texas Trees Foundation, 2019) – urban heat island impacts can be significant and include:

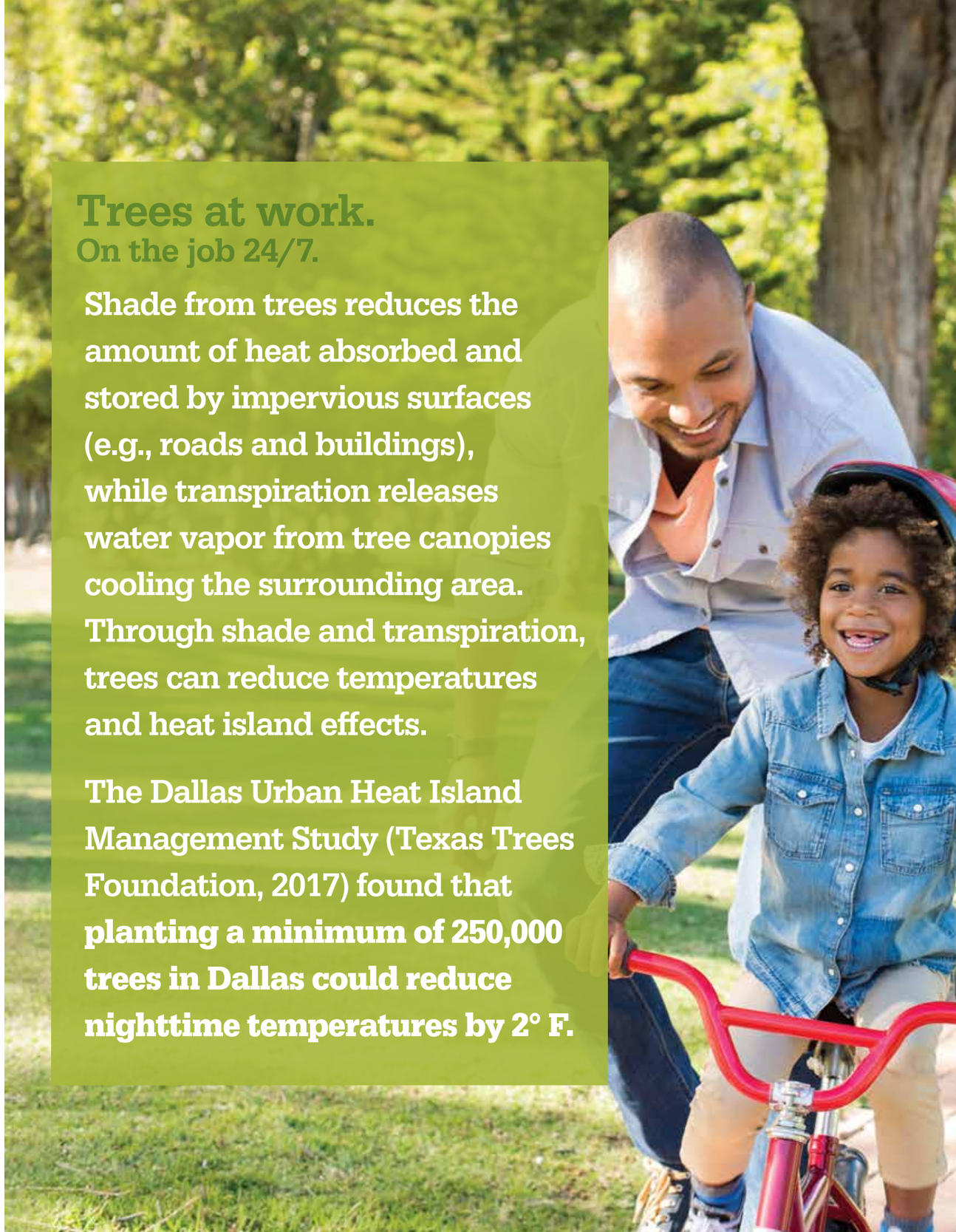
- **Negative Health Effects.** As temperatures increase, respiratory difficulties (e.g., asthma), heat stroke, and heat-related mortality also increase. For every 1° F increase in temperature during a heat wave, there is a 2.5% increase in the risk of heat-related mortality (Anderson et al., 2011). Heat-related illnesses cause more deaths in the United States each year than any other natural disaster (e.g., hurricanes, lightning, tornadoes, floods, earthquakes) (Borden & Cutter, 2008).

- **Increased Ozone Levels.** Ground level ozone is created by chemical reactions of atmospheric gases and compounds with sunlight and heat. The hazy skies seen in Dallas during high-heat days are caused by ground level ozone.

- **Higher Energy Usage.** When the city gets hotter, there is an increase in electricity used to cool homes and businesses, resulting in higher energy bills.

Extreme weather events caused by increasing temperatures can also impact the health, safety, and well-being of Dallas's residents. The effects of these events on residents are complex and dependent on the elements of vulnerability – exposure, sensitivity, and adaptive capacity (U.S. Global Change Research, 2016). For example, a neighborhood with low tree canopy cover that experiences a heat wave (exposure), that has residents that are at high risk for heat-related illnesses due to heart disease (sensitivity), and do not have the resources to cool their homes (adaptive capacity) are more vulnerable than neighborhoods that may have only one element of vulnerability. Developing and having access to the tools, skills, and strategies to adjust to and/or address the consequences of these events, **building adaptive capacity is a key to creating resiliency in Dallas.**

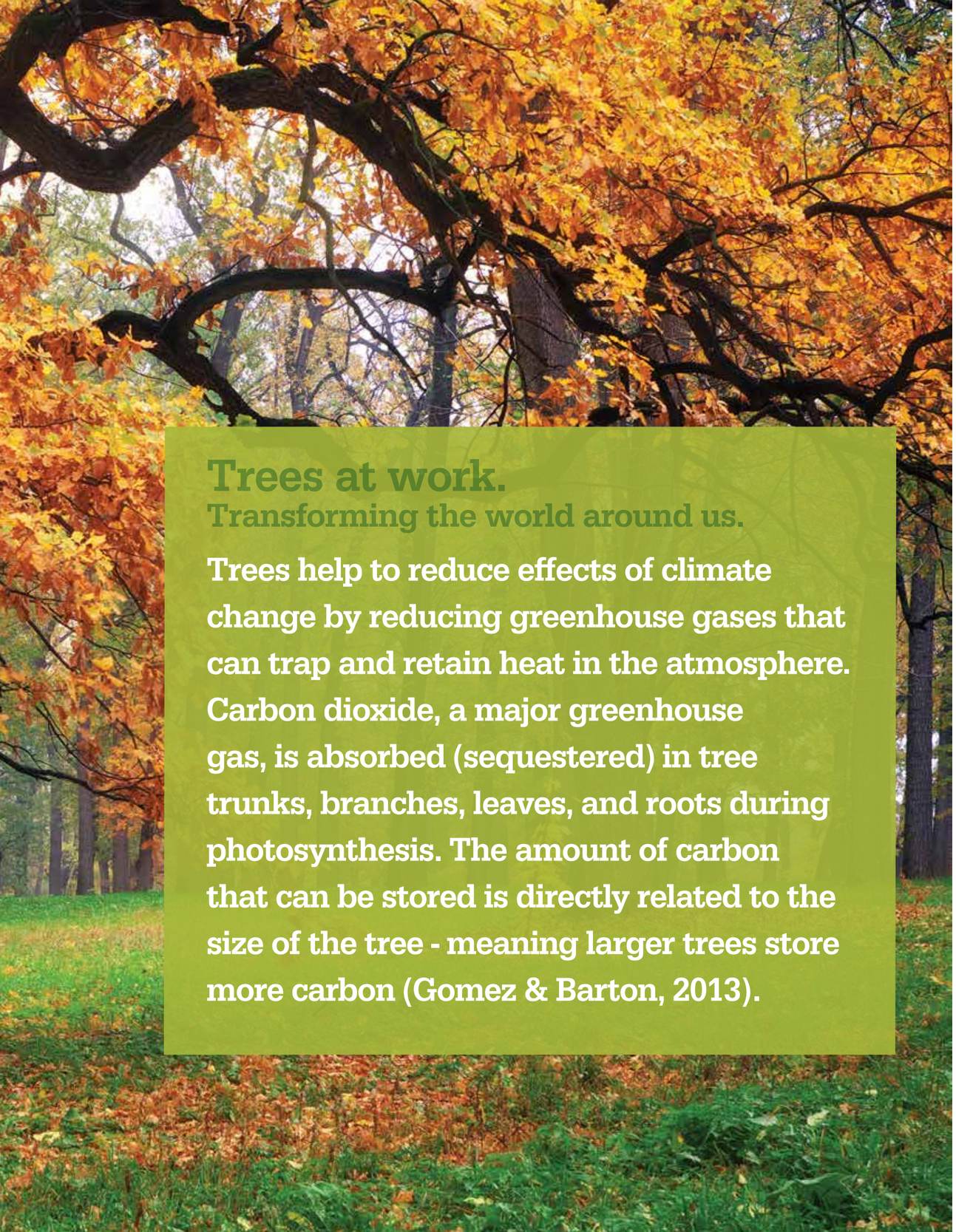
Trees are an important tool in reducing stressors that impact vulnerable populations, such as heat, poor air quality, and flooding, and helping to build adaptive capacity. However, trees are also impacted by high temperatures and extreme weather events. Ensuring that trees are properly cared for and maintained can reduce the risk that extreme weather can have on their condition and ability to withstand storms (Richards et al., 2004).



Trees at work.
On the job 24/7.

Shade from trees reduces the amount of heat absorbed and stored by impervious surfaces (e.g., roads and buildings), while transpiration releases water vapor from tree canopies cooling the surrounding area. Through shade and transpiration, trees can reduce temperatures and heat island effects.

The Dallas Urban Heat Island Management Study (Texas Trees Foundation, 2017) found that planting a minimum of 250,000 trees in Dallas could reduce nighttime temperatures by 2° F.



Trees at work.

Transforming the world around us.

Trees help to reduce effects of climate change by reducing greenhouse gases that can trap and retain heat in the atmosphere. 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 - meaning larger trees store more carbon (Gomez & Barton, 2013).

Dallas is Growing (Fast). Dallas is a thriving and diverse city in the Dallas-Fort Worth (DFW) metroplex that has experienced rapid growth over the last decade. The population of the DFW region is 6.3 million with an estimated 1.3 million people calling the city of Dallas home – making it the 9th largest city in the United States (United State Census Bureau). With growth expected to continue in the DFW area over the next decade, the population is projected to increase by nearly 1.4 million people by 2029 (Egan, 2020). New development will be needed to meet the housing, retail and employment needs of new residents.

Why does it matter? The majority of the city's undeveloped land is located in Dallas's southern neighborhoods, where more than 1/3 of the city's tree canopy cover is located and significant populations of economically and medically vulnerable residents live (City of Dallas, 2006). As development occurs in these areas, there is a **significant risk of tree canopy loss and an increase in roads and buildings** (impervious surfaces). As tree canopy is lost and impervious surfaces increase, there will be more hard surfaces to trap and retain heat, which will lead to higher temperatures and an increase in the urban heat island effect in an area that currently does not experience it. The Texas Trees Foundation Dallas Urban Heat Island Management Study (2017) found that an **11% loss in tree canopy in this area is projected to increase temperatures by more than 1°F and decrease overall city canopy cover by 1.4%**. This will negatively affect the health and well-being of residents who may not have the economic or social resources to escape the heat, increasing their vulnerability.

Dallas's Air Can Make It Hard to Breathe. Ozone is naturally found in the upper atmosphere where it protects the Earth from the sun's ultraviolet radiation. While it is beneficial in the upper atmosphere, **at ground level, ozone is an air pollutant** that causes serious harm to human health. Ground level ozone is formed by a chemical reaction between nitrogen oxides and volatile organic compounds (VOCs), and sunlight. **Add heat and ozone formation is exacerbated**. VOCs are a class of carbon-based particles emitted from automobile exhaust, lawnmowers, human activities, and even some tree species.

Particulate matter (PM) is the dust, pollen, soot, smoke, and chemicals floating in the air. Fine particulate matter (PM2.5) is most harmful to human health because of its ability to be inhaled and get deep into lung tissue and sometimes even the bloodstream.

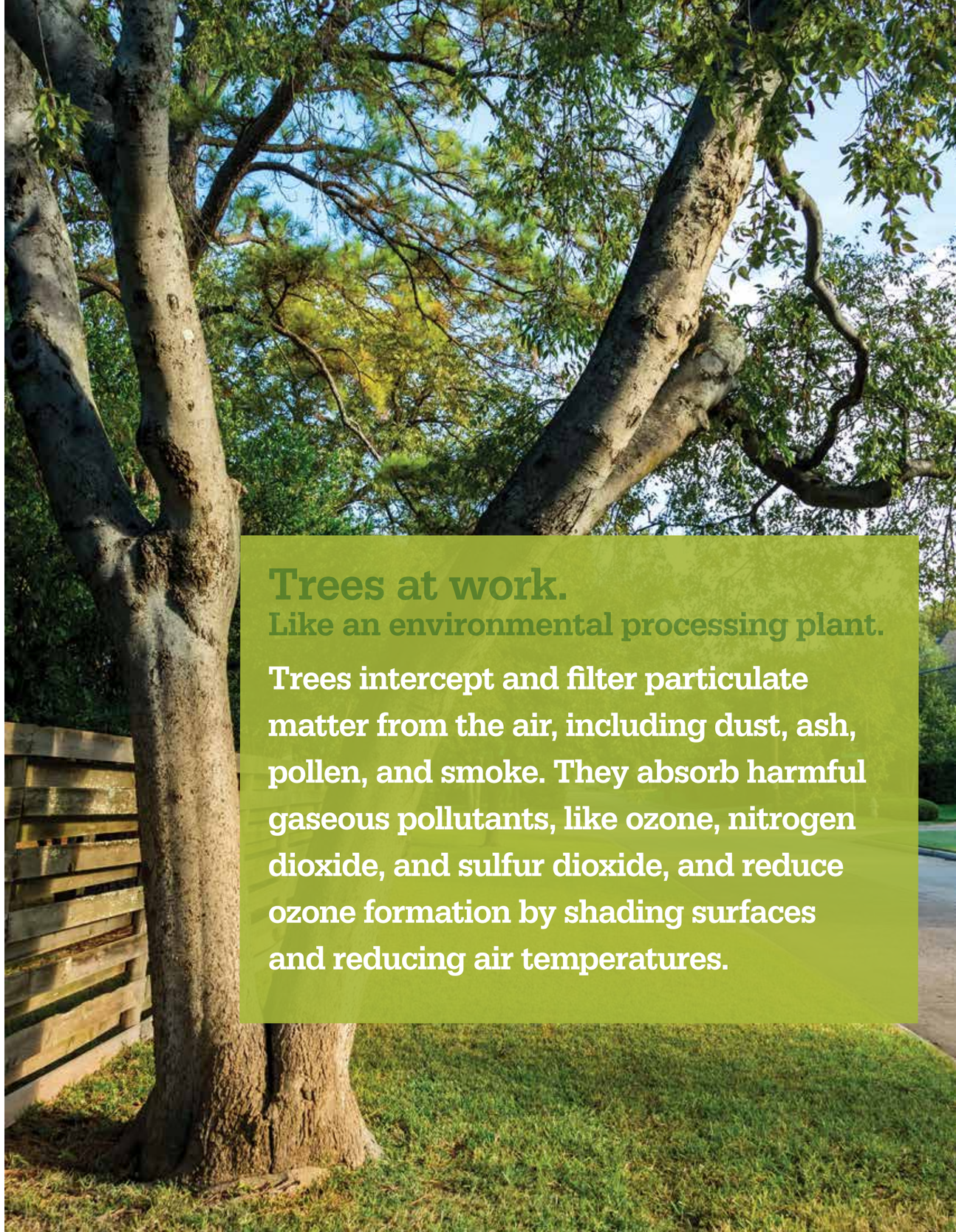
Dallas has faced challenges meeting Federal air quality standards and currently **does not meet the 2008 and 2015 Federal air quality standards for ground level ozone – current compliance status "non-attainment."** The 2020 American Lung Association State of Air report gave Dallas County an "F" grade for ozone and a "C" grade for particulate matter. In 2019, there were 23 days where ozone levels and 5 days where particulate matter levels were "unhealthy for sensitive populations" in Dallas (American Lung Association, 2020).

Why does it matter? Ground level ozone and particulate matter are the two forms of air pollution that have the greatest impact on human health. Exposure to ground level ozone and particulate matter cause similar health effects, including:

- Premature death in people with heart or lung disease
- Heart attacks (non-fatal)
- Irregular heartbeat
- Asthma attacks
- Decreased lung function
- Irritation of lungs and airways, coughing or difficulty breathing

Individually, the effects of these air pollutants can have a significant impact on human health. In combination, their effects are exacerbated. Populations most vulnerable to these pollutants are children, older adults, and those with pre-existing lung or heart disease. Economically and socially vulnerable populations tend to live closer to industrial areas that produce fine particulate matter putting those populations at higher risk. A project by Harvard University researchers found that people who lived in areas with historically high levels of particulate matter (long-term exposure) had a higher risk of mortality from COVID-19. The research found that an increase in fine particulate matter in the air (1 µg/m3 of PM2.5) was associated with an 8% increase in the COVID-19 death rate (Wu et al., 2020).

As Dallas's population grows, emissions from vehicles are also increasing. Since 1990 emissions from passenger and freight vehicles in Dallas increased 133% (Popvich and Lu, 2019). This increase in emissions adds more VOCs, leading to the creation of more ground level ozone and particulate matter, which negatively impacts the health and well-being of Dallas's residents.



THE GREAT TRINITY FOREST

Photograph by Robert Nunnally

Photograph by Scot Miller

The Great Trinity Forest, growing along the Trinity River, is a unique gem in the heart of Dallas. At over 6,000 acres it is the largest contiguous city-managed forest in the United States, containing nearly half of all of the trees growing in Dallas (Texas Trees Foundation, 2015). It is a bottomland hardwood forest dominated by a mixture of floodplain tree species, including green ash, American elm, and hackberry.

The Urban Forest Master Plan, while recognizing the significant role that the Great Trinity Forest plays in Dallas's urban forest, does not specifically address its management. Due to its unique nature, ecology, and function within the city, the management needs of the Great Trinity Forest are addressed in the City of Dallas's 2008 Great Trinity Forest Management Plan. The recommendations of the Urban Forest Master Plan, however, should be applied to the care and management of the Great Trinity Forest, when appropriate.

THE WAY FORWARD

Trees are essential to addressing the challenges facing Dallas and making the city sustainable and resilient. However, to harness and maximize the benefits the urban forest provides, trees must become a priority in Dallas. The Dallas Urban Forest Master Plan services as a guide to do just that by offering a vision of the future of the urban forest to inspire us to care, preserve, plant, and protect Dallas's trees.

The Plan is designed to move Dallas along the road towards a sustainable and resilient urban forest by proactively managing, preserving, caring for and growing the city's tree canopy. The next section (Section 2) presents information and data on the current state of the Dallas's urban forest to help us understand where Dallas's is today and serves as baseline to measure future progress. Section 3 examines the values, needs, and priorities the Dallas community and stakeholders have around trees and the urban forest. The Plan's recommendations, recommended action steps, and goals which were developed based on community priorities, themes, and guiding principles are presented in Section 4. They focus on improving Dallas's urban forest through planning, managing, protecting, growing, and engaging. Section 5 provides ways to monitor and measure Dallas's progress in improving the urban forest and making it a priority.

Let's begin by exploring Dallas's urban forest.

SECTION 2:
State of the Urban Forest

WHAT DO WE HAVE?

Landscape

Dallas, at 386 square miles, is a patchwork of both natural and urban landscapes, including roads and buildings, trees and lakes, and the city's defining natural features, the Trinity River and Great Trinity Forest. Prior to its settlement, Dallas's primary landcover was tall grass prairies (Blackland Prairie eco-region) with occasional wooded areas (Crosstimbers eco-region) to the west (Texas Parks and Wildlife Department). As the city grew and developed, the landscape and its rich and fertile native soils were replaced with urban soils (USDA Natural Resource Conservation Service). Urban soils, created through development of the land, lack the structure, profile, and physical properties of native soils. They can contain dust and rubble from construction activities and can be severely compacted, which impacts the types of tree species that can grow and thrive in Dallas.

Climate

The National Weather Service classifies Dallas's climate as humid, subtropical with seasonal temperature variations. August, the city's hottest month, can see high temperatures average 96°F; while, in January, its coldest month, temperatures average 36° F. Between 1960 and 2019, the average number of high-heat days (days above 100°F) increased 58% from an average of 14 days per year to 22 days per year (National Weather Service Climatology). This trend is predicted to continue and by 2050, Dallas is projected to have an average of 52 days per year above 100°F (US Global Change Research Program, 2018).

Precipitation amounts vary considerably each year (Figure 3), with an average of 37 inches (National Weather Service Precipitation). This variability is predicted to continue as Dallas's climate changes (NOAA National Center for Environmental Information).

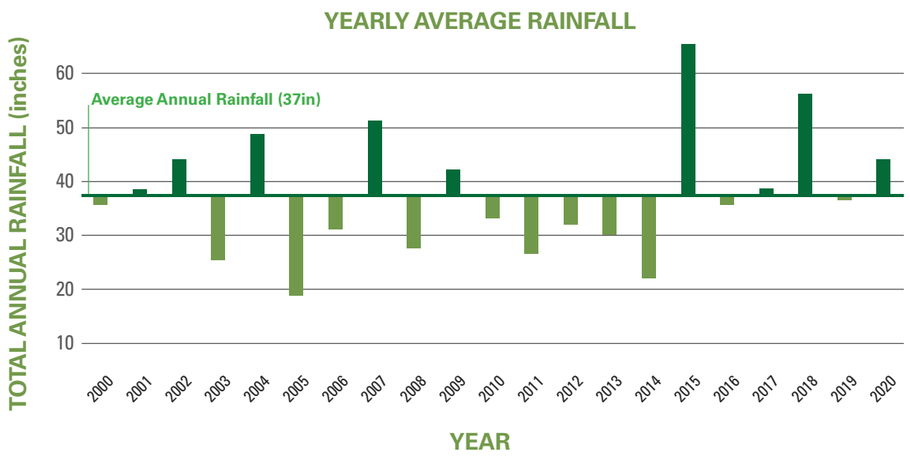


Figure 3. Dallas annual precipitation 2000-2019
Source: National Weather Service

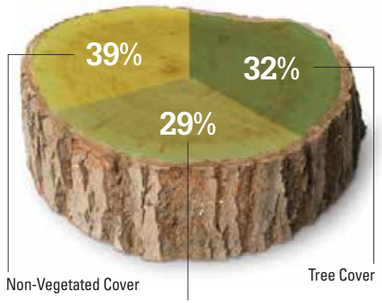


Figure 4. Dallas land cover
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

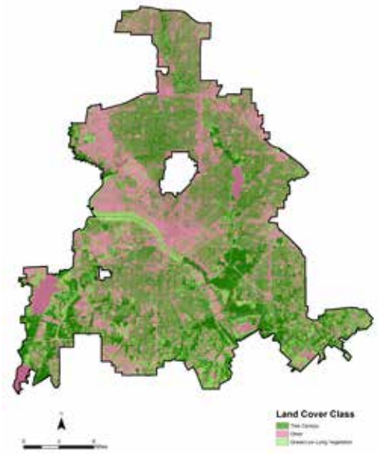


Figure 5. Dallas land cover map
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)
View larger map detail on pg. 121, Appendix A

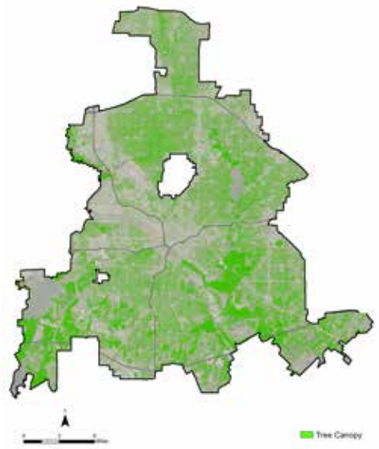


Figure 6. Dallas urban tree canopy cover map
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)
View larger map detail on pg. 122, Appendix A

DALLAS'S URBAN FOREST

Dallas's urban forest, which include all trees within the city, are a capital infrastructure asset, but unlike other capital assets, the value of the tree resource increases over time. The City of Dallas is directly responsible for managing the trees on street medians, parks, The Great Trinity Forest, and other City-owned properties. To protect this asset the City needs to consider not only those trees that are on public lands but support the 70% of trees that reside on private property, whose owners steward the resource.

Urban Tree Canopy and Land Cover Summary

The amount, location, and distribution of tree canopy is the driving force behind Dallas's urban forest's ability to produce benefits for the community; **as tree canopy increases, so do the benefits.** In 2019, the Texas Trees Foundation completed an updated urban tree canopy assessment for communities in Dallas County, including the City of Dallas. The assessment used 2016 aerial imagery to measure the amount of tree canopy and other land cover across the city. **Tree canopy is measured as the layer of leaves, branches, and stems of trees and other woody plants that cover the ground when viewed from above.**

The following is a summary of tree canopy and land cover in Dallas (Figures 4, 5, 6) (Texas Trees Foundation, 2019):

- **32% of Dallas is covered by tree canopy.**
- **39% of the city is non-vegetated cover**, which includes hard surfaces like roads, parking lots, and buildings (impervious surfaces) and bare soil.
- **29% of Dallas is covered by pervious surfaces**, like grass and vegetated open space.
- **70% of Dallas's tree canopy is on private residentially-zoned property.**
- **43%** is the **average tree canopy cover in Dallas parks.**
- **58%** is the **maximum tree canopy cover possible in Dallas** *if all* open areas on public and private property were planted with trees. Important note: not all pervious land is suitable for tree planting, for example: recreational fields and utility corridors.

BY THE NUMBERS

Benefits of Dallas's Urban Forest

DALLAS'S TREE CANOPY PROVIDES $239 MILLION IN BENEFITS EACH YEAR

The UFMP introduction provided the benefits individual trees provide to Dallas. This section explores the cumulative benefits that all of the City's trees, Dallas's urban forest, provide to the community. The urban forest benefits were calculated by analyzing the 2019 urban tree canopy assessment using i-Tree Canopy and i-Tree Hydro, the USDA Forest Service programs that quantify tree benefits.

239 MILLION IN ANNUAL ENVIRONMENTAL BENEFITS

$179 in annual benefits per resident

96,000 TONS

Amount of carbon absorbed by Dallas's trees each year—helping to reduce the amount of greenhouse gases in the atmosphere

Annual Value: $8.62 million

1.3 BILLION GALLONS

Number of gallons of stormwater trees intercept and absorb in their canopies and roots—helping to reduce the amount entering Dallas's storm sewer system

Annual Value: $221 million

1.3 MILLION POUNDS

Amount of air pollutants (ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide) trees remove from the atmosphere, helping to reduce atmospheric warming, improving air quality and public health effects from air pollution

Annual Value: $5.3 million

1.5 MILLION POUNDS

Amount of partiulate matter trees trap and remove from Dallas's air each year, improving air quality and public health

Annual Value: $4.6 million

Dallas's Tree Canopy Cover Compared to Other Cities

Comparing tree canopy cover, regionally and nationally can help Dallas visualize what an increase in tree canopy cover could look like in the city and gain an understanding of how other communities preserve and make space for trees. Dallas, at 32%, is above both the average tree canopy cover for area communities (28%) and peer U.S. cities (27%) (Figures 7 and 8, respectively).

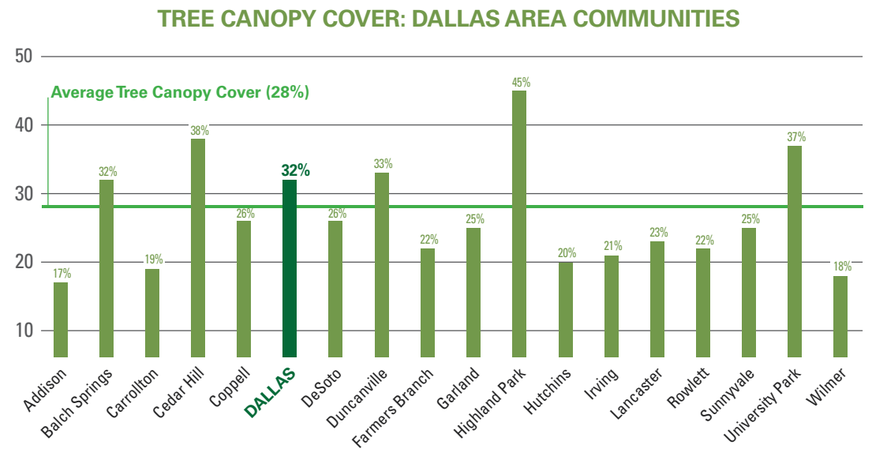


Figure 7. Tree canopy cover in Dallas area communities
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

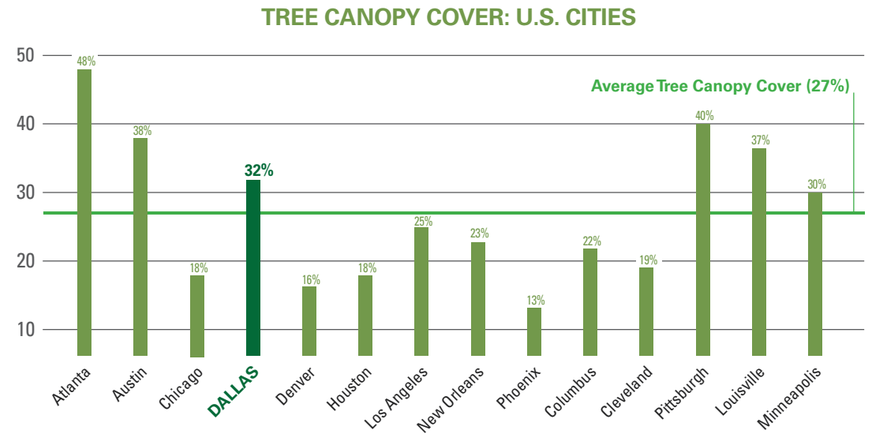


Figure 8. Tree canopy cover in select U.S. cities
Sources: Davey Resource Group and publicly available city data

Tree Canopy Across the City

Tree canopy varies across the city (Figures 9 and 10) with Council Districts ranging from 17% to 43% canopy cover. This variability highlights that there is not a one-size-fits-all solution to growing Dallas's tree canopy and ensuring that all residents have access to the benefits trees provide.

Southern Dallas where tree canopy cover is high, is also where the majority of undeveloped land is in the city. Focus in this area should be on **preservation and protection of trees** during development, proper maintenance of mature trees, and ensuring new trees are planted and property maintained to replace aging canopy. While in **areas of Dallas with lower tree canopy cover**, activities should target increasing canopy cover through **tree planting, young tree care, watering, and proper maintenance** of establishing and mature trees.

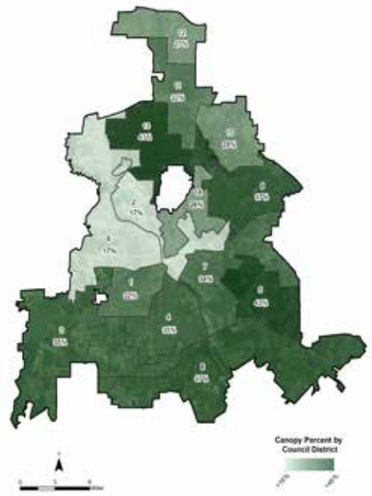


Figure 9. Map of tree canopy cover by Dallas city council district
Source: Texas Trees Foundation Urban Tree Canopy Assessment
View larger map detail on pg. 123, Appendix A

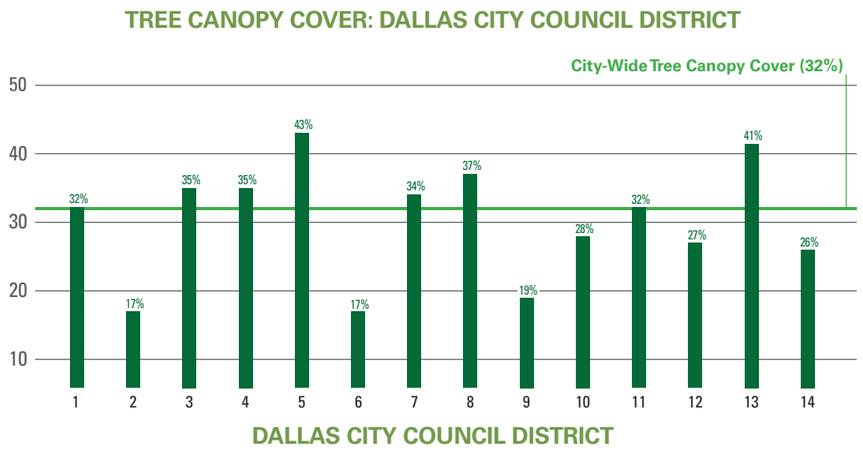
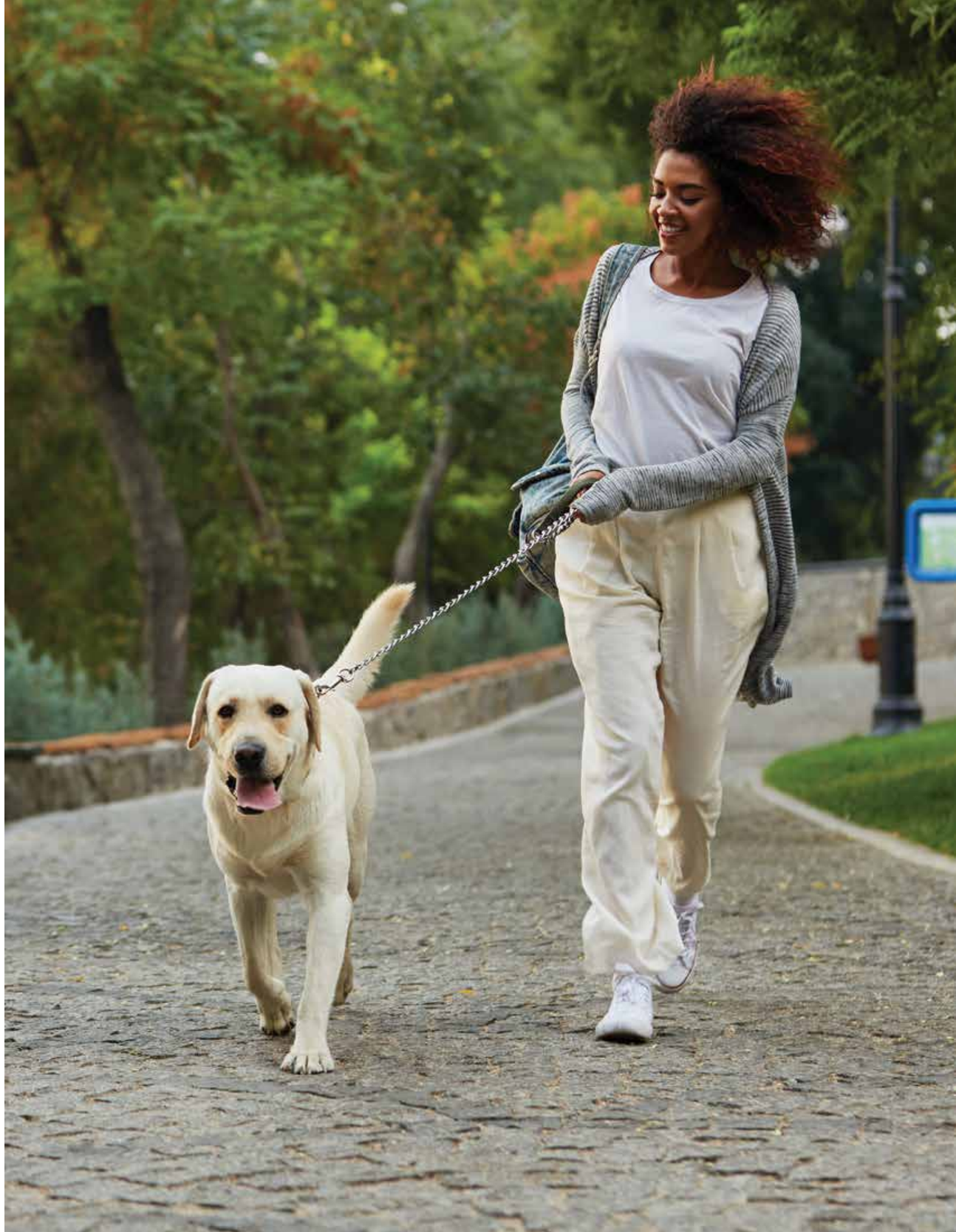


Figure 10. Tree canopy cover by Dallas city council district compared to city-wide tree canopy cover
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)



Tree Canopy in City Parks

Parks provide opportunities for residents to play, exercise, and interact with trees and nature. Well-managed city parks and greenspaces provide important mental and physical health benefits to urban residents. Investing in these spaces is estimated to **provide $11.7 billion annually in avoided healthcare costs in the United States** (Wolf, 2016).

With 394 parks in Dallas, there are many opportunities for parks and greenspaces to help improve the health and quality of life of city residents. To begin leveraging the benefits that trees and parks can provide, Dallas can focus tree preservation, maintenance, and planting efforts on parks that are below the City park tree canopy average of 43%.

How Has Dallas's Canopy Changed Since 2008?

Tree canopy changes over time, sometimes gradually and sometimes abruptly, due to weather, climate, levels of tree planting and care, insects/diseases, disinvestment, economics, and development factors. To understand how canopy has changed in Dallas, tree canopy data from two urban tree canopy (UTC) studies completed by the Texas Trees Foundation were analyzed. The first study, completed in 2010, used 2008 aerial imagery to map Dallas's canopy cover. The second study, completed in 2019, used 2016 aerial imagery to map canopy cover. For this discussion, the aerial imagery years, 2008 and 2016, will be used to discuss canopy changes.

Between 2008 and 2016, the City's tree canopy cover increased from 29.5% to 32%. **While this represents an overall increase of 2.5%, this increase was not seen equally across Dallas.** In fact, there were areas that saw significant losses in tree canopy cover within the study period. Figures 11, 12 and 13 display the absolute change in Dallas's tree canopy cover between 2008 and 2016 at three different scales, from largest (Figure 11 - council district) to smallest (Figure 13 - census block). As these maps highlight, when data is combined, the results may show a net gain in tree canopy for the combined area (e.g., council district). However, by looking at smaller units of tree canopy data (e.g., census block), areas of both tree canopy gains and losses within the combined area can be seen.

Tree canopy gains between 2008 and 2016 were primarily the result of growth of existing trees and new tree planting; while tree losses were caused primarily by development activities (though the droughts of 2011 and 2015 also contributed to tree loss). The tree canopy losses seen in the southwest areas of Dallas were not caused by the removal of a large number of trees for a single development project, but rather the cumulative effect of losing a small number of trees from multiple development projects. This highlights the important role that the **preservation and protection of trees** on all development projects, regardless of size or the number of trees removed, can have on maintaining and increasing tree canopy cover in Dallas. Recognizing that tree canopy changes at both large and small scales can help target tree planting, care, and preservation activities.

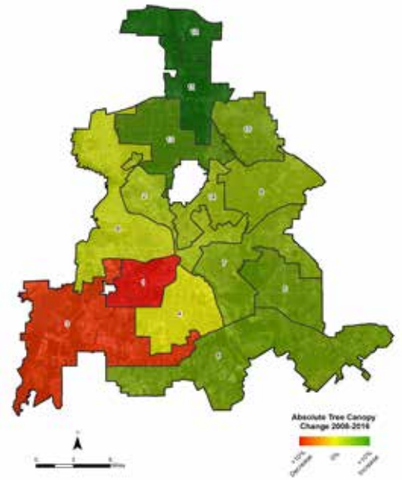


Figure 11. Absolute tree canopy change by council district (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019)
View larger map detail on pg. 124, Appendix A

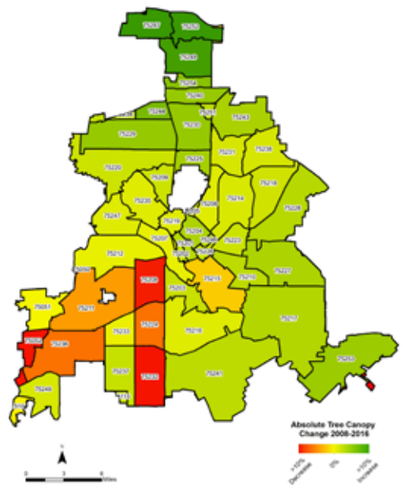


Figure 12. Absolute tree canopy change by Zip Code (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019) Update (2019)
View larger map detail on pg. 125, Appendix A

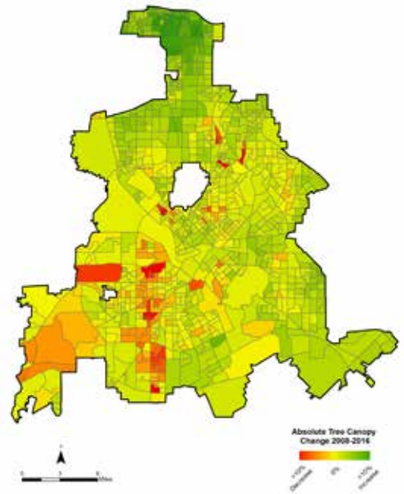


Figure 13. Absolute tree canopy change by census block (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019) Update (2019)
View larger map detail on pg. 126, Appendix A

Impacts of Extreme Weather Events Continue to Change Dallas's Tree Canopy

Since the 2019 urban tree canopy assessment update was completed, Dallas experienced two extreme weather events: straight-line winds in June 2019 and tornadoes in October 2019 that led to damage and loss of large mature trees. An analysis by Davey Resource Group estimated that approximately 200 acres (0.70%) of tree canopy was lost in north Dallas during the October 2019 tornadoes (Figure 14).

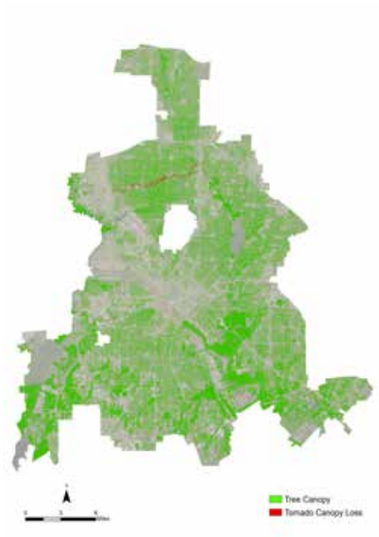


Figure 14. City of Dallas Tree Canopy Loss October 2019 Tornado

Data Sources: City of Dallas post-tornado aerial imagery (October 2019); Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

View larger map detail on pg. 127, Appendix A

Equitable Access to the Benefits of Trees

Tree canopy cover, as discussed previously, is not evenly distributed across the city. Some areas like southern Dallas and the Great Trinity Forest have high tree canopy cover, while others like neighborhoods on the central and west side of the city have much lower tree canopy cover.

Focusing tree planting, preservation, and care in areas with low tree canopy is one way to increase Dallas's overall canopy cover. However, using areas of low canopy cover as the only criteria for deciding where these activities occur will not necessarily ensure that tree canopy and its benefits will be equitably distributed across the city. Understanding the extent and distribution of tree canopy related to economic, demographic, environmental, and health factors can identify high-need equity areas. These high-need equity areas are those with low or aging canopy cover and medically, socially, and/or economically vulnerable populations that may benefit most from tree canopy cover.

Photo courtesy of The Washington Post © 2017

As part of the development of the Urban Forest Master Plan, a study was conducted to examine how tree canopy cover in Dallas was related to the following factors:

- Human Health, a composite of asthma, cancer, high blood pressure, general physical health, mental health, and obesity factors (Center for Disease Control and Prevention, 2019)
- Average Temperature (Texas Trees Foundation, 2017)
- Average Electricity Spending (ESRI Living Atlas, 2019)
- Median Household Income (U.S. Census, 2018)

Note: while some of these factors are correlated with tree canopy cover, correlation does not necessarily equal causation.

Data for each factor was mapped against Dallas tree canopy cover from the Texas Trees Foundation's 2019 assessment to identify areas of highest need for tree canopy.

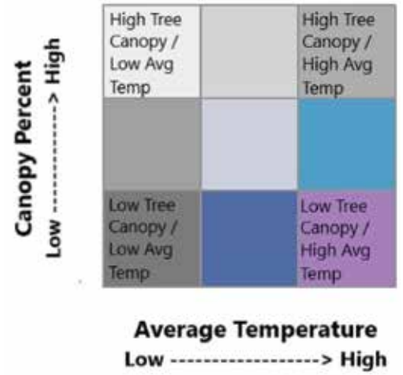
Low Tree Canopy Cover
+ High Prevalence/Occurrence/Amount of Factor
Areas of High Need for Tree Canopy

Figures 15 and 16 provide examples of how tree canopy can be examined through a benefits lens by exploring canopy cover and average temperature and electricity spending, respectively. The areas on each map shaded in blues and purples are the areas with high prevalence of the factor (i.e., highest average temperature, highest electricity spending) and low canopy cover. Maps for each factor studied can be found in Appendix A. This concept can be further explored in the future by examining the size and age of tree canopy related to different environmental, economic, demographic, and health factors.

Reading the Maps

Figures 15 and 16 are called bivariate maps, because they display data for two different variables. To understand the maps, let's take a closer look at Figure 15 which maps average temperature and tree canopy cover in Dallas using Zip Codes as the geographic boundary.

Figure 15's legend displays the average high temperature on the x-axis from low (left side) to high average temperature (right side) and percent tree canopy cover on the y-axis from low (bottom) to high canopy cover (top). Areas of lowest need are shown in the upper left corner – having high tree canopy cover and low average temperatures. While areas of highest need are those shown in the blue and purple on the lower right side of the legend – having low to moderate tree canopy cover and moderate to high average temperatures.



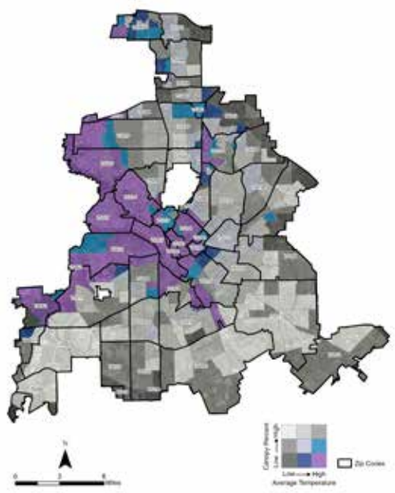


Figure 15. Areas of high average temperatures and low tree canopy cover

Areas shaded in purple and blue are those that have low to moderate tree canopy cover and moderate to high average temperatures. Trees can reduce temperatures by up to 15°F in Dallas.

Data Sources: Texas Trees Foundation Urban Heat Island Management Study (2017) and Urban Tree Canopy Assessment Update (2019)

View larger map detail on pg. 128, Appendix A

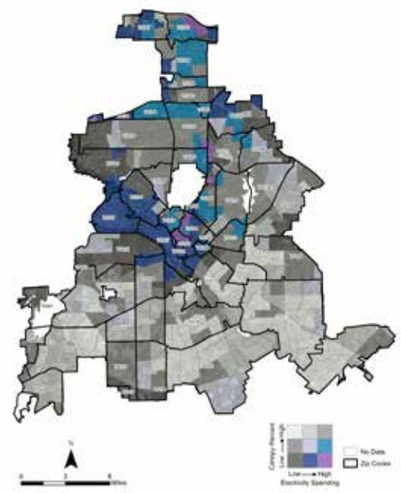


Figure 16. Areas of high electricity spending and low canopy cover by Zip Code

Areas shaded in purple and blue are those that have low to moderate tree canopy cover and moderate to high electricity spending. Research from the U.S. Department of Energy finds that properly placed trees around homes can reduce air conditioning costs.

Data Sources: ESRI Living Atlas (2019) and Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

View larger map detail on pg. 129, Appendix A

ABOUT DALLAS'S TREES

The Texas Trees Foundation's 2015 State of the Dallas Urban Forest report provided the data and information for this section of the Urban Forest Master Plan. The 2015 report was based on an i-Tree Eco field study that assessed over 6,500 trees in sample plots on public and private property throughout Dallas. The field data collected on Dallas's trees was entered into the USDA Forest Service's i-Tree Eco model to estimate the composition and benefits of the urban forest, both public and private trees.

The **City of Dallas does not have a comprehensive inventory of public trees** growing in the right-of-way, along city streets and medians, or in City parks. Therefore, the composition, benefits, risk, and maintenance needs of the public tree resource was not analyzed in this section.

Size and Age Composition

The *2015 State of the Dallas Urban Forest* report found that over 61% of the trees in Dallas are young or small in size (<less than 6" in diameter); and of these only 20% are species that will eventually grow into large, mature trees (mature height over 50-feet tall).

To maintain a sustainable and resilient urban forest, it is important for Dallas to have a mix of size/age classes to prevent all trees from maturing at the same time, which can lead to a significant loss in tree canopy cover. Some of Dallas's signature parks, established in the 1930's and 40's, are experiencing this type of tree canopy loss today, as many of the trees originally planted have matured and are dying. To ensure there is an adequate mix of size/age classes in Dallas:

- 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 should be planted that have different growth rates, mature size, and life spans.

Species Diversity

Species diversity is the variety of tree species in the urban forest. **Having more tree species (greater diversity) maximizes the many benefits trees provide and safeguards the urban forest from pests, diseases, and extreme weather events**, like storms and drought.

Dallas's urban forest is made up of **80 different tree species** growing on public and private property; 60% of the species are native to the city. The number of tree species growing in Dallas is higher than other Texas cities (Figure 17) (City of El Paso, TX, 2014; USDA Forest Service, 2016; USDA Forest Service, 2017).

The top 5 species in Dallas, which includes species growing in the Great Trinity Forest, are estimated to make up nearly 1/3 of the city's tree population (Figure 18). When planting new tree species, Dallas and its partners should look at planting species that are less common but suitable for growing in Dallas's climatic conditions with a preference towards Texas native tree species typically found in the Blackland Prairie and Cross Timbers ecoregions.

Ensuring species diversity exists at the neighborhood level is also important for maintaining a sustainable and resilient urban forest in Dallas. This ensures that a particular tree species does not dominate a neighborhood and protects the neighborhood's trees from pests that could lead to canopy loss. Without an inventory of trees growing along streets and medians, species diversity at the neighborhood level is not currently known.

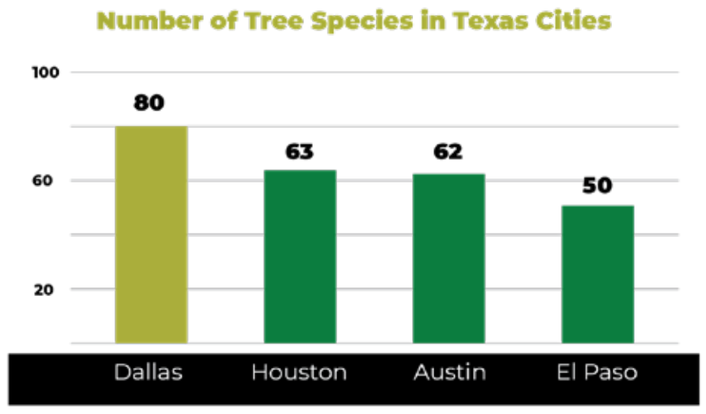


Figure 17. Number of tree species reported in Texas cities

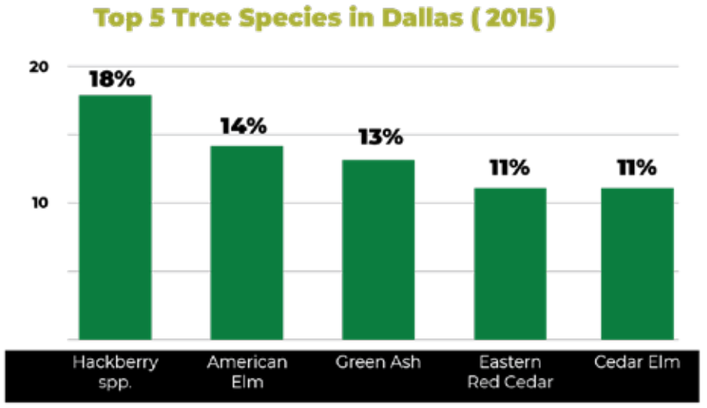


Figure 18. Top 5 tree species in Dallas
Source: Texas Trees Foundation State of the Dalas Urban Forest (2015)

Species Vulnerability

Climate Change

Dallas's urban forest faces challenges related to climate change including rising temperatures, variability in precipitation, extreme storms, and flooding. These challenges will have an impact on the tree species that can grow in Dallas, since not all species currently growing in the city will be able to adapt to these climate change effects.

The USDA Forest Service Climate Change Tree Atlas utilizes climate change models to measure the current and future distribution of 134 native tree species in the eastern United States. The Atlas provides predicted habitat changes for tree species growing in the south-central region of the United States, which includes Texas. However, it should be noted that Texas is on the western edge of this region and **many of Texas's native species are not currently modeled in the Tree Atlas** (USDA Forest Service; Iverson, et al., 2019).

Table 1 provides species that may be found growing in Dallas (though they may not be native) and their predicted vulnerability to habitat loss due to climate change. The habitat is predicted to increase for many of the top species growing in Dallas. This table should be reviewed and revised annually as information on the resilience, adaptation, and vulnerability of native Texas tree species becomes available.

While climate change will have an impact on the species composition of the urban forest, it may also offer opportunities to increase species diversity and add to the palette of species that can grow in Dallas.

PREDICTED HABITAT CHANGE	TREE SPECIES — COMMON NAME	TREE SPECIES — SCIENTIFIC NAME	CURRENT SPECIES IMPORTANCE VALUE BASED ON ABUNDANCE
Species Habitat Predicted to **INCREASE**	Ashe Juniper	*Juniperus ashei*	High
	Cedar Elm	*Ulmus crassifolia*	High
	Eastern Red Cedar	*Juniperus virginiana*	High
	American Elm	*Ulmus americana*	Medium
	Hackberry	*Celtis occidentalis*	Medium
	Pecan	*Carya illinoinensis*	Low
	Live Oak	*Quercus virginiana*	Low
	Gum Bully / Brazos Bumelia	*Sideroxylon lanuginosum ssp. rigidum*	Low
	Water Oak	*Quercus nigra*	Absent - NEW Habitat
Species Habitat **NOT** Predicted to Change	Osage Orange	*Maclura pomifera*	High
	Green Ash	*Fraxinus pennsylvanica*	Medium
	Eastern Cottonwood	*Populus deltoides*	Medium
	Blackjack Oak	*Quercus marilandica*	Medium
	Winged Elm	*Ulmus alata*	Medium
	Boxelder	*Acer negundo*	Low
	Black Willow	*Salix nigra*	Low
	Slippery Elm	*Ulmus rubra*	Low
Species Habitat Predicted to **DECREASE**	Sugarberry	*Celtis laevigata*	High
	Black Walnut	*Juglans nigra*	Medium
	Common Persimmon	*Diospyros virginiana*	Low
	White Ash	*Fraxinus americana*	Low
	Red Mulberry	*Morus rubra*	Low
	Bur Oak	*Quercus macrocarpa*	Low
	Chinkapin Oak	*Quercus muehlenbergii*	Low

Table 1. USDA Forest Service Climate Change Atlas Dallas–Fort Worth–Arlington, TX predicted tree species habitat change (low emission scenario)

Important Note: *The USDA Forest Service Tree Atlas models predict habitat change for 134 native tree species in the eastern United States. Dallas is on the western edge of the model's south-central region, and many of Texas's native tree species are not currently modeled in the Tree Atlas. With limited data currently available on the resilience and vulnerability of native Texas tree species, this table provides a glimpse of how the species' composition of Dallas's urban forest may change.*
https://www.fs.fed.us/nrs/atlas/combined/resources/summaries/urban/

Tree Pests and Diseases

Insects and diseases can cause considerable damage and even death to trees. Their impacts can negatively affect the health, resilience, and benefits the urban forest provides and can also lead to unexpected costs for residents and cities who must care for or remove the affected trees. Dallas should stay alert to the following pests and diseases that are of most concern to the city's trees.

- **Oak wilt.** A vascular disease of oak trees (*Quercus*) caused by the fungus *Bretziella fagacearum*. It is considered one of the deadliest tree diseases in Texas.
- **Emerald ash borer.** An invasive wood boring beetle from Asia that feeds on and kills all North American species of ash (*Fraxinus*). Emerald ash borer was found in northeast Texas in 2016 and is currently present in six Texas counties: Harrison, Cass, Marion, Tarrant, Denton, and Bowie; some of which are in close proximity to Dallas. All species of ash trees are susceptible to emerald ash borer and without treatment, trees can die from infestations.
- **Asian longhorned beetle.** Not currently present in Texas, the Asian longhorned beetle (*Anoplophora glabripennis*) is an invasive wood boring beetle that feeds on a wide variety of hardwood tree species. Heavy infestations of Asian longhorned beetle can kill trees.

Oak Wilt Disease

Emerald Ash Borer

- **Cotton root rot.** A disease of trees and agricultural crop caused by the fungus *Phymatotrichum omnivorum*. The fungus infects plant roots, ultimately leading to the death of the plant. The disease also known as Texas root rot is known to infect 2,000 different plant species.
- **Crepe myrtle bark scale.** An exotic, invasive insect that has been found infecting crepe myrtle trees in Texas. Heavy infestations of the insect, while not fatal, can lead to poor flowering and impact the overall health and visual appearance of the tree.
- **Dutch elm disease.** A vascular disease of elm trees caused by the fungus *Ophiostoma ulmi*. Dutch elm disease is one of the most destructive shade tree diseases in the United States and can cause rapid decline and death of native elm species, including American elm. Outbreaks of Dutch elm disease have occurred in the Dallas-Fort Worth area.
- **Bacterial leaf scorch.** A disease caused by the bacterium *Xylella fastidiosa* that causes tree leaves to look burned or scorched. This common disease is present in the Dallas-Fort Worth area.

DALLAS'S PUBLIC TREE CARE & MANAGEMENT

Public Tree Management

City Departments

The care, planting, and maintenance of Dallas's public trees is provided by a combination of the City of Dallas, private property owners and contracted professional services. While many City offices and departments influence the urban forest, including Risk Management, City Attorney, and Code Compliance, there are four main departments that have tree maintenance, care, and management responsibilities: Sustainable Development and Construction, Public Works, Park and Recreation, and Dallas Water Utilities. Each department has a unique set of duties and has staff that maintain International Society of Arboriculture Certified Arborist and other tree care and landscape industry certifications and credentials.

Each of these departments provides important urban forestry services for Dallas. However, this **decentralized approach** to urban forest management with different, and at times conflicting, department efforts and goals has impeded development of a sustainable urban forest management program in Dallas. For trees and the urban forest to become a higher priority in Dallas, the **development of a centralized program** with extensive coordination, collaboration, and communication between departments **is critical.**

- **Building Inspection | Sustainable Development and Construction Department**
  The Building Inspection Division of the Sustainable Development and Construction Department houses the Chief Arborist and five District Arborists who provide regulatory oversight. The Arborists are responsible for the enforcement of Article X of City code (landscape and tree conservation regulations), regulating the protection and removal of existing trees, oversight of the Reforestation Fund, review and inspection of landscape plans on private and public property, and providing technical guidance on tree care and installation.

- **Urban Forestry | Public Works Department**
  The Urban Forestry Division of the Public Works Department houses the Public Works City Forester and a crew of four staff who are responsible for the maintenance and planting of trees growing in street medians. In addition to tree care and planting activities, staff inspect public trees impacted by right-of-way construction; provide assistance with trees following storms; review tree planting and maintenance plans; respond to resident service requests; and review tree planting projects for the MOWmenutm program when active.

- **Park Maintenance and Operations – Forestry | Park and Recreation Department**
  The Park Maintenance and Operations – Forestry Division of the Park and Recreation Department houses the Park and Recreation City Forester and 20 staff who are responsible for managing, growing, and maintaining 18,000 acres of tree canopy in Dallas's City parks system. The Division conducts routine preventative maintenance as well as on-demand failure response. Staff inspects and carries out storm response operations on park property through the Forestry Emergency Response Policy.

  The Park and Recreation City Forester provides technical expertise and guidance to the public, park executives, and department managers and oversees the Branching Out Dallas tree planting program with the goal of re-foresting neighborhood parks. In addition, the City Forester routinely inspects Park and Recreation Department construction projects to ensure proper tree protection and preservation measures
  are utilized.

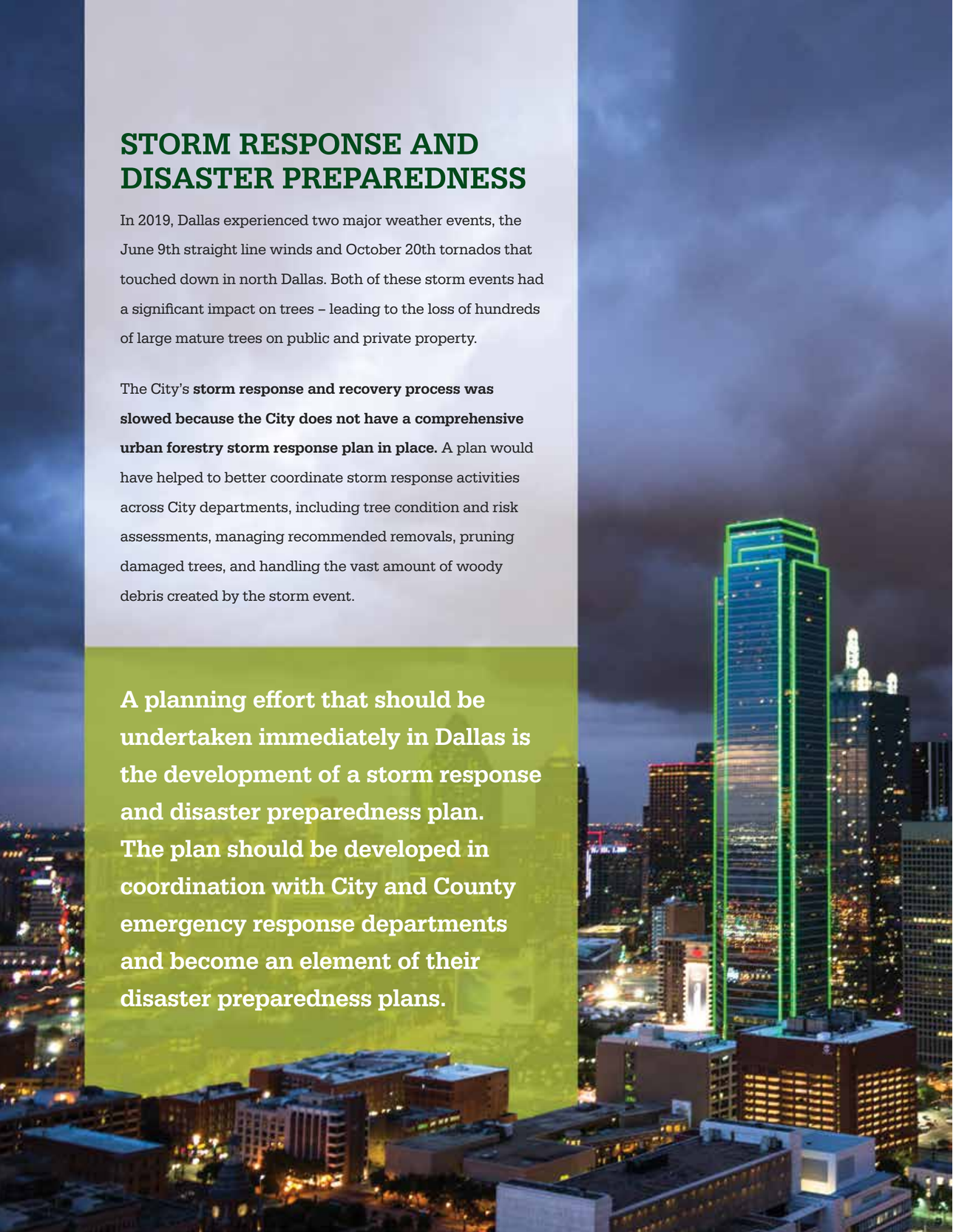
- **Forestry | Dallas Water Utilities Department**
  The Neighborhood Services Division in the Dallas Water Utilities department houses the department's City Forester and trained staff who are responsible for planting, maintaining, and caring for trees within the Great Trinity Forest, Dallas floodway extension, and publicly-owned creeks, and floodway management areas. The Dallas Water Utilities City Forester provides technical expertise and guidance to the public and other city departments, and oversees the Dallas City Forester Academy, Dallas Arborist School, and the Branch Out Dallas program, which coordinates with eight City departments to provide trees for private residential properties.

STORM RESPONSE AND DISASTER PREPAREDNESS

In 2019, Dallas experienced two major weather events, the June 9th straight line winds and October 20th tornados that touched down in north Dallas. Both of these storm events had a significant impact on trees – leading to the loss of hundreds of large mature trees on public and private property.

The City's **storm response and recovery process was slowed because the City does not have a comprehensive urban forestry storm response plan in place.** A plan would have helped to better coordinate storm response activities across City departments, including tree condition and risk assessments, managing recommended removals, pruning damaged trees, and handling the vast amount of woody debris created by the storm event.

A planning effort that should be undertaken immediately in Dallas is the development of a storm response and disaster preparedness plan. The plan should be developed in coordination with City and County emergency response departments and become an element of their disaster preparedness plans.



Tree Inventory and Planning

A comprehensive, up-to-date, GIS-based **public tree inventory is the foundation of a municipal urban forestry program**, providing crucial information on the composition, condition, risk, and maintenance needs of public trees. It serves as the basis for managing risk, prioritizing tree care activities, delivering urban forestry services cost-effectively, and developing plans and policies that maximize tree benefits and minimize risks. Using tree inventory data to identify work priorities helps to identify the resources needed, including funding, staff, and equipment to sustainably manage and care for the urban forest. **The City of Dallas does not currently have a comprehensive inventory of public trees.**

While a lack of tree inventory data and coordinated management are two major reasons that Dallas's forestry program is reactionary, another major reason is that the **City does not have fundamental urban forestry plans or programs in place** (see urban forestry plans and programs sidebar). An urban forest management plan and public tree maintenance program, risk management program, tree planting plan, and a storm response and disaster preparedness plan are all essential plans and programs to create a sustainable and resilient urban forest. The development of a comprehensive **urban forest management plan should address cohesive management of the urban forest across City departments** and fold in many of the other plans and programs that Dallas is missing (risk management, public tree maintenance, disaster preparedness) to develop a comprehensive management plan. A public tree inventory is a key component in developing an urban forest management plan; however, **lack of an inventory should not stop Dallas from beginning to plan.**

STREET & PARK

Tree Inventories Across the United States

"If you can't measure it, you can't manage it."
Peter Drucker, renowned business management consultant

Many large cities across the United States have completed, or are in the process of completing, inventories of their public street and/or park trees.

- **Baltimore, MD** 128,600 public trees (2017-2018)
- **Detroit, MI** 190,000 public trees (2011-2014)
- **Kansas City, MO** 135,500 public trees (2014)
- **Los Angeles, CA** 700,000 trees and planting sites estimated (in progress)
- **Oakland, CA** 120,000 trees and planting sites estimated (in progress)
- **Phoenix, AZ** 105,000 trees and planting sites (2014)

While not an exhaustive list, these cities show that completing public tree inventories in large cities is possible.

How long does it take? The timeframe for cities to complete their inventories varies. Some cities choose to phase their tree inventory and spread the cost out over several fiscal years (e.g., Baltimore and Detroit), while others complete it all at one time using capital budgets or other funding sources (e.g., Los Angeles and Oakland).

How much does it cost? Costs to complete a public tree inventory vary depending on several factors, including the number of trees and the information being collected. The average inventory cost in the United States is $4.00 per tree.

URBAN FORESTRY PLANS AND PROGRAMS

URBAN FOREST MANAGEMENT PLAN AND PUBLIC TREE MAINTENANCE PROGRAM

A 3- to 5-year **work plan for the city's publicly managed trees** based on updated data from a public street and park tree inventory. It provides an assessment of the current city-managed trees based on inventory data, identifies risk and maintenance needs, the resources needed to address them, and a schedule for completion.

RISK MANAGEMENT PROGRAM

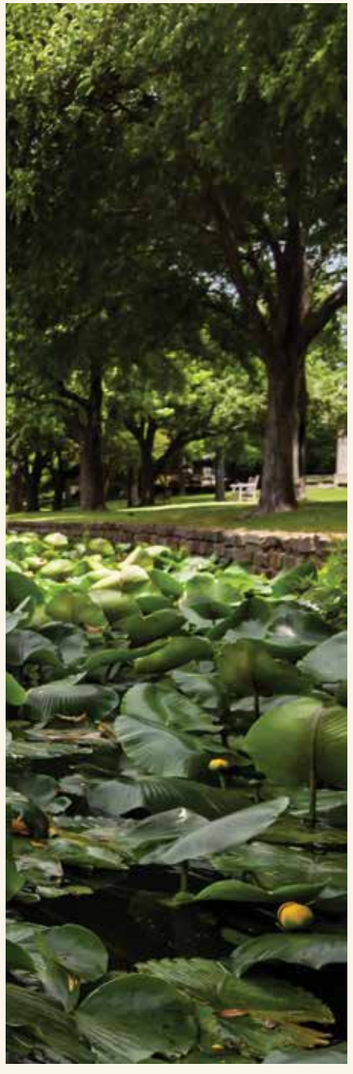
A risk management program focuses on ensuring the urban forest is proactively managed to **eliminate hazards and risk with a focus on public safety**. This program can be outlined in an urban forest management plan.

STORM RESPONSE AND DISASTER PREPAREDNESS

A disaster preparedness and response plan **addresses and responds to disasters in the community**. The plan includes staff roles, contracts, response priorities, debris management, and a communication plan.

TREE PLANTING PLAN

Outlines the locations of tree planting over a 1- to 5-year time horizon. The plan uses data from the tree inventory and/or urban tree canopy assessment to target planting in areas of greatest need within the community and ensures the right tree is planted in the right location.



PUBLIC TREE MAINTENANCE

In accordance with City of Dallas Code, Chapter 48, Section 48-11, the primary responsibility for the maintenance of trees in the right-of-way/parkway (ROW) is the adjacent property owner. The City's Urban Forestry Division in the Department of Public Works is responsible for the maintenance of median trees growing in the ROW; however, this is a smaller number of trees and **the vast majority of public ROW trees are the responsibility of the adjacent property owner.**

How Can You Help? Private Tree Maintenance

Over 70% of Dallas's tree canopy is actually located on private property. Preserving, caring for, and planting trees on private property are essential for a healthy, resilient, and sustainable urban forest in Dallas.

For resources and programs on tree care and planting, visit the Texas Trees Foundation at texastrees.org and City of Dallas at dallascityhall.com.

Property owners are required to obtain a permit from the City of Dallas (per Chapter 48, Section 48-4) for the planting, pruning, or removal of any ROW tree. However, not all property owners/residents apply for a permit leading to tree care activities that do not meet City standards and leave ROW trees vulnerable to decay, insects, diseases, and storm damage.

Tree care activities in the public right-of-way that occur under City-approved permits or by City staff/contractors, are generally **completed on a reactive basis and not through a proactive or routine maintenance program.**

Lack of a routine and systematic tree maintenance program puts Dallas's public trees at risk, impacting their health and storm-readiness. Trees pruned on a routine basis by trained professionals develop proper form and structure which leads to a variety of benefits, including (Richards et al., 2004):

- **Lowering costs.** Reduces per tree pruning costs (economies of scale) compared to reactive pruning done in response to storm damage (Table 2).

ROUTINE PRUNING COSTS FOR SHADE/ORNAMENTAL TREES*	
Tree Size	Cost**
Small	$75-150
Medium	$150-300
Large	$200-600

*Tree pruning costs are provided as a reference. They are based on generalized tree care contractor costs to prune for thinning, deadwood, and canopy raising. To determine actual costs, detailed tree pruning specifications need to be developed along with number, size, and location of trees.

**2020 Dollars

Table 2. Tree care contractor average per tree routine tree pruning costs

- **Addressing risks and reducing liability.** Eliminates sight clearance and immediate risks.
- **Actively monitoring tree health.** Early identification and correction of insect and disease problems can reduce tree mortality.
- **Lessening storm damage.** Properly pruned trees develop correct form and structure and are less susceptible to storm damage.
- **Reducing future tree care costs.** Trees pruned on a regular cycle, especially when young, require less work in the future lowering maintenance costs.
- **Improving customer service.** Reduces the number of tree-related service requests and improves customer service by pruning before trees become a problem or risk.
- **Creating a resilient urban forest.** Proactive tree pruning helps to develop a healthy, sustainable, and resilient urban forest.

Tree Maintenance through an Equity Lens

Tree pruning, care, and removal activities can be costly and with adjacent property owners in Dallas responsible for bearing these costs for both street trees and those on their property, what happens when a resident cannot afford it? And who is liable if an unmaintained street tree falls and causes damage or injury? With Dallas's southern neighborhoods home to more than 1/3 of the city's tree canopy cover and populations of economically vulnerable residents, this code requirement **raises equity issues** for residents. As trees mature, the cost of maintenance may increase, especially if trees were not properly cared for when they were young. As tree maintenance is neglected, due to lack of financial resources, branches can die **posing a risk not only to the property owner but also the public.** According to stakeholders interviewed during development of the Plan, residents will decline the planting of a street tree, not because they do not want one, but because they may not have the resources or want the financial or legal responsibility of maintaining the tree in the future. This can significantly impact the growth of canopy cover in Dallas, especially in neighborhoods where canopy cover is needed most.

Figure 19 displays median household income and tree canopy cover. The blue shaded areas represent parts of the city that have low/moderate median income and moderate/high tree canopy cover (shown in the lower right area of the legend).

Dallas should **evaluate options of offering financial assistance for street tree maintenance or assuming the tree maintenance responsibility for all trees in the City of Dallas right-of-way/parkway** to help alleviate the financial responsibility from residents, improve care, and continue to grow the city's tree canopy cover.

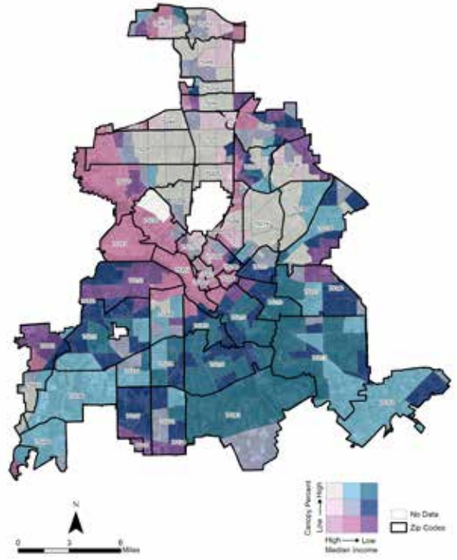


Figure 19. Median household income and tree canopy cover
Data Sources: US Census Bureau (2018); Texas Trees Foundation urban tree canopy assessment update (2019)
View larger map detail on pg. 130, Appendix A

CITY REGULATIONS AND POLICIES

City regulations and policies are an important component of a sustainable urban forestry program. They establish the regulatory framework for the protection and preservation of the urban forest, as well as the standards for planting, installation, and care of Dallas's trees. Dallas's tree-related municipal ordinances were reviewed against a set of criteria developed using the 2014 Municipal Tree Census and International Society of Arboriculture Ordinance Guidelines. (Hauer and Peterson, 2016; Swiecki and Bernhardt, 2001). The review of Dallas's ordinances (Appendix B) identifies several criteria that are not currently addressed, including:

- Requiring replacement of removed public trees
- Prohibiting topping (or hat-racking) of public trees
- Identifying activities prohibited in the root zone of trees during construction
- Requiring regular public tree maintenance
- Establishing an insect/disease control strategy
- Regulating the abatement or removal of high risk or public nuisance trees

The City of Dallas Tree and Landscape Manual is an important tool in helping to navigate the Article X (Dallas landscape and tree conservation regulations). However, there are revisions and updates, identified by City staff, that need to be made to make this document a strong resource and companion to Article X.

CITY PLANS

Across the City, offices, divisions, and departments are actively working to improve and enhance the services provided to the Dallas community. To enhance these services, plans, studies, and strategies are developed and implemented. A review of select City of Dallas plans, studies and policies was conducted to evaluate the degree to which tree preservation, protection, and planting are incorporated.

As Figure 20 illustrates, Dallas has a history of developing plans that support trees. However, these planning efforts, like the goal and actions to "preserve and increase canopy cover" in the 2006, forward Dallas Plan were never implemented. This inaction supports a common theme expressed by stakeholders interviewed during the UFMP planning process: "Dallas is good at planning, but poor at execution."

When plans are implemented, a lack of coordination, collaboration, and engagement between departments has led to tree damage and removals that could have been avoided. To support trees and the urban forest, collaboration and engagement across City departments and divisions is essential.

Figure 20. The degree to which trees are incorporated into select City of Dallas plans

ENGAGEMENT AND PARTNERSHIPS

Engaging the entire **Dallas community**, from individuals to private companies (and everyone in between), about the essential role trees play in their lives and how they can help advocate and support their growth and care is **key to expanding and growing Dallas's urban forest.** The City of Dallas with support from partner organizations understands the importance of offering outreach and educational opportunities to foster this engagement. Here are some examples of current activities.

Partnerships and Volunteers. The City has formed partnerships with non-profit organizations, including the Texas Trees Foundation that provide resources, programs (e.g., Cool Schools, Southwest Medical District), and volunteer opportunities to support the management, planning, and growth of Dallas's urban forest.

Fostering and nurturing strong public-private urban forestry partnerships helps to **align and promote the goals of partnering organizations and help meet their missions while also achieving urban forestry targets.** These partnerships can help drive investment in trees and urban forestry helping to build momentum and make trees a priority in Dallas.

Branch Out Dallas. A program of the City of Dallas offers free trees to residents for planting on private residential property to increase tree canopy cover and conveys the benefits that trees provide at a neighborhood scale. Since the program began in 2018, the City has given away over 5,000 trees.

Branching Out Dallas – Park and Recreation. A partnership program between the City of Dallas Park and Recreation, the Texas Trees Foundation, and a variety of community and corporate sponsors plants trees in Dallas parks. Since the program began in 2019, 670 trees have been planted in City parks and 600 trees are planned to be planted in 2021.

Citizen Forester. A City of Dallas program organized and facilitated by the Dallas Water Utilities City Forester and supported by the Dallas Urban Forest Advisory Committee, this program trains volunteers to plant and care for newly planted trees. The program has trained over 250 Citizen Foresters since it began in 2007.

Arborist School. A six-month course taught by City of Dallas staff covers a variety of arboricultural topics from tree identification and biology to insect/diseases and construction impacts. The program is free and open to everyone. Attendees include City of Dallas employees, private tree care companies, and residents.

INDICATORS OF A SUSTAINABLE URBAN FOREST

To assess the current state of Dallas's urban forest, the Indicators of a Sustainable Urban Forest, a comprehensive resource and program assessment tool, was used during the UFMP development process. (Clark et al., 1997; Kenney, et al., 2011).

The Indicators, in three broad categories – The Trees, The Players, and The Management, use urban forestry industry standards and best management practices to evaluate and rate Dallas's trees, how they are managed, and the level of community engagement there is around trees and urban forestry.

For each indicator, Dallas's current performance level was rated as low, medium, or high based on data and information from the Project Team, Technical Advisory Committee, and Stakeholder Focus Groups. The assessment identified areas where the City's urban forest can be improved and was used in the development of the Urban Forest Master Plan recommendations. Appendix C provides Dallas's complete Indicators Assessment.

Figure 21 provides the rating of Dallas's current performance level for each of the Indicators. Dallas's current overall performance for each component is:

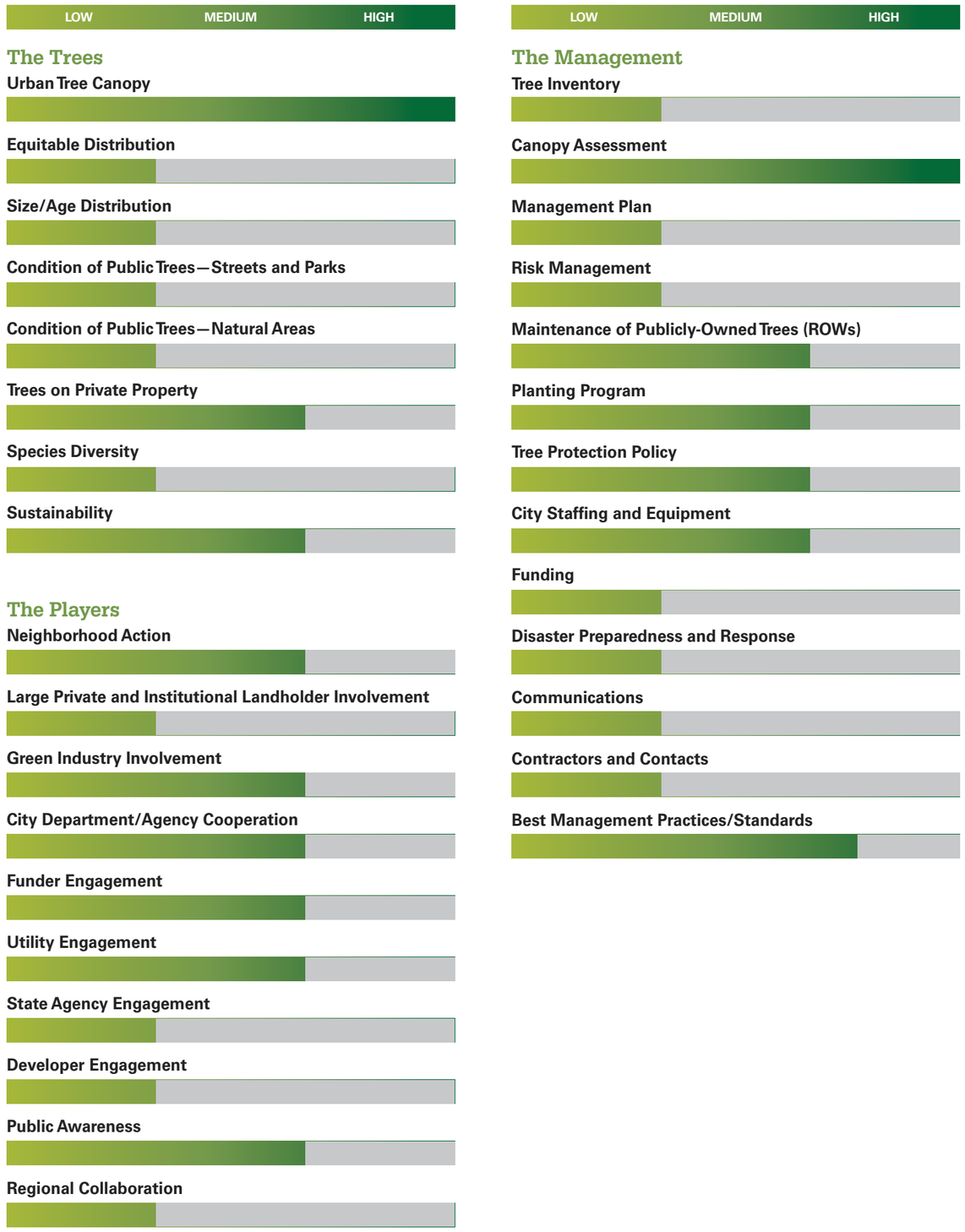
The Players: LOW-MEDIUM

The Management: LOW

The Trees: LOW

Understanding the current state of Dallas's urban forest, as highlighted in this section, is the first step along the path of making trees a priority and creating a sustainable and resilient urban forest in Dallas. The next section looks at the community and their values, needs, and priorities for Dallas's urban forest.

Figure 21. Dallas's rating on the indicators of a sustainable urban forest



SECTION 3:
Understanding Dallas's Priorities

COMMUNITY AND STAKEHOLDER INPUT

Four groups were engaged during the development of the Dallas Urban Forest Master Plan: the Project Team, Technical Advisory Committee, Stakeholder Focus Groups, and the Dallas Community (public).

Project Team. The Project Team's role was to develop the recommendations, provide technical input and guidance, create plan documents, and lead and facilitate the engagement process. The Project Team developed the recommendations and recommended action steps based on feedback and input from the Technical Advisory Committee, Stakeholder Focus Groups, and the Dallas community. The Project Team included members from the Texas Trees Foundation, City of Dallas, and the consulting team from Davey Resource Group and The Consulting Group of Preservation Tree.

Technical Advisory Committee. The Technical Advisory Committee was established to provide input and feedback on the direction, content, and recommendations of the UFMP. Members represented community stakeholder groups and City of Dallas departments.

Stakeholder Focus Groups. The Stakeholder Focus Groups provided targeted input about urban forest issues, challenges, and opportunities in Dallas. Stakeholder focus group participants represented different organizations throughout Dallas that were interested or involved in urban forestry, including, environmental, community and non-profit groups, utilities, private tree care companies, green industry and allied professionals, and the Dallas Urban Forest Advisory Committee.

Dallas Community. At the broadest level, the Dallas community was engaged during the planning process to understand their values and knowledge about trees and Dallas's urban forest and identify priorities and issues important to them.

Input gathered from the Dallas community and stakeholders during development of the Urban Forest Master Plan provided important context for understanding community priorities, where Dallas is today, and urban forest challenges and opportunities.

WHAT DID WE HEAR?

The Dallas community and stakeholders were invited to participate in a series of meetings, focus groups, and/or on-line surveys to understand and benchmark their values and views around trees and the urban forest. There were three on-line surveys that sought different levels of input during the planning process.

- **URBAN FOREST MASTER PLAN SURVEY**
  Questions in this survey focused on gauging community knowledge about trees and the benefits they valued, identifying tree maintenance, and planting priorities, and discovering opportunities and challenges facing the urban forest.
  Responses: 287

- **DALLAS TREES**
  This survey focused on gaining an understanding about the values residents have towards trees and the benefits they want Dallas trees to provide.
  Responses: 65

- **VISUAL PREFERENCE SURVEY**
  This survey provided photographs of trees growing in variety of landscapes to understand how the community sees trees in Dallas today and how they would like to see them in the future.
  Responses: 71

In total, 423 responses were received for all three surveys, which was lower than expected. Broader outreach efforts were planned at Dallas EarthX and other events during spring 2020 to promote and conduct the surveys in person, however due to COVID-19, those events did not occur. Due to the loss of these in-person opportunities, the surveys were open longer to receive community input. Key findings of the Urban Forest Master Plan and Dallas Trees surveys are presented here.

KEY FINDINGS OF THE URBAN FOREST MASTER PLAN AND DALLAS TREES SURVEYS

URBAN FOREST MASTER PLAN SURVEY

What do you define as the urban forest?

Two thirds of respondents define the urban forest as all trees and woody vegetation in the

Which three words describe Dallas trees?

- **Beauty**
- **Need**
- **More**

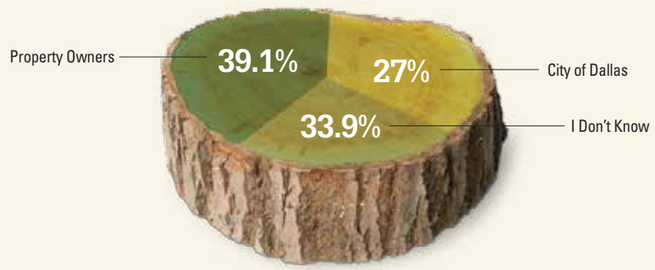
Respondents were asked to select up to three answers:
What roles of the urban forest do you feel are most important to the community?

1. **Lessens effects of increasing temperatures.**
2. **Improves the quality of life for residents and visitors.**
3. **Enhances and improves community health and wellness.**

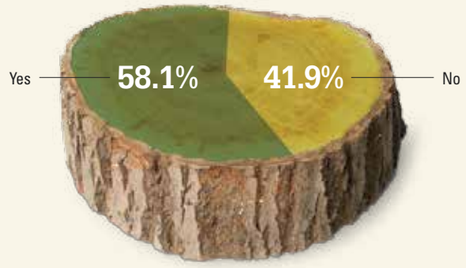
What are the top threats to Dallas's urban forest?

1. **Impacts from development.**
2. **Lack of maintenance.**
3. **Climate change (e.g. increasing temperatures).**

Who is responsible for managing parkway trees?



Would you like the City of Dallas to be responsible for the management/maintenance of the parkway trees in front of homes?



If you would prefer the City of Dallas to manage/maintain parkway trees, would you be willing to pay more in taxes to support the maintenance activities?

DALLAS TREES SURVEY

90% of respondents agreed or strongly agreed that **trees are important to Dallas.**

85% of respondents agreed or strongly agreed that **planting new trees in Dallas is important.**

86% of respondents agreed or strongly agreed that **large, mature trees should be preserved on public and private property.**

35% of respondents agreed or strongly agreed that **trees seem neglected in Dallas.**

Respondents were asked to select up to three answers:
I want Dallas trees to...

1. Prevent the city from becoming a hotter, drier, and dustier place.
2. Improve air quality and reduce air pollution.
3. Create lush, shady canopies to help reduce temperatures and keep my house cool and shady.

URBAN FOREST MASTER PLAN SURVEY

Priorities and Themes

Through the input and engagement activities, the community and stakeholders identified a set of urban forestry priorities and themes for Dallas. They are listed in order below based on the frequency each was referenced by the engagement participants. For example, tree protection/preservation/development is listed as #1, because it was referenced the most.

01. Tree Protection/Preservation/Development

02. Routine Tree Maintenance and Tree Data

03. Climate Concerns

04. Public Education/Outreach/Communication

05. Pests and Diseases

06. Resources (Budget/Staff)

07. Ordinance/Requirements

08. City Collaboration / Interdepartmental Communication

09. Infrastructure Conflicts

10. Tree Planting and Post Planting Care

11. Partnerships

12. Wood Utilization / Debris Management

These priorities and themes along with the assessment of the Indicators of a Sustainable Urban Forest established the initial foundation of the plan.

Guiding Principles

During analysis of data, information, and stakeholder input, a series of five overarching guiding principles emerged that helped to set the plan's direction and solidify its foundation.

1 **Trees have historically held a low priority** within many City departments and the Dallas Community.

2 **Inability to sustain momentum** around urban forestry initiatives

3 **Absence of a clearly defined municipal urban forestry management approach** due to the decentralized urban forestry program within the City of Dallas

4 **Lack of unified voice and vision** for trees in Dallas

5 **Difficulty acquiring and maximizing investments** for urban forest management

Priority. Many individual issues, challenges, and opportunities were unearthed throughout the Urban Forest Master Plan's explorative planning process. While specific challenges are discussed in the plan, they are often just symptoms of larger, underlying issues. It is important to identify and address the fundamental barriers that have limited productive and sustainable urban forest management in Dallas and to identify opportunities for improvement. **One of the main underlying issues in Dallas is that, for most, trees have historically been a low priority.**

Trees have been viewed by many in Dallas (City departments, business and development community, and the public) as a hindrance and/or only aesthetic in nature and use. This is evident in the sometimes unclear and conflicting goals among City departments, limited community understanding about the value and benefits trees provide, and the on-going loss of mature trees during development.

Because these community views conflict with the actual ability of trees to mitigate the most significant challenges facing Dallas – heat, health, air quality, and stormwater management – it is clear that the low priority placed on trees is due to a lack of understanding or knowledge that trees are a valuable part of the city's infrastructure.

While other economic priorities may have pushed urban forestry down the list, there is an opportunity to help the Dallas community understand and support the important role that trees play in mitigating Dallas's challenges and helping to create a vibrant, healthy, and sustainable city.

Momentum. One of the comments heard repeatedly during the planning process was that "Dallas is good at planning, but poor at execution." Dallas has a history of developing plans that support trees. The City's comprehensive master plan *forward*Dallas, adopted in 2006, included a goal to "preserve and increase canopy cover" and provided innovative action steps, which were ahead of their time, to measure, protect and increase canopy cover. The Texas Trees Foundation's *State of the Dallas Urban Forest* report (2015) and *Urban Heat Island Management Study* (2017) provided further recommendations to improve and expand the urban forest in Dallas.

While these plans and studies are crucial to identify the path forward, there has been an inability to sustain momentum during implementation and turn these recommendations into action. Establishing community support around the benefits of trees and their role in a sustainable and resilient Dallas is part of the puzzle in building momentum around urban forestry. Harnessing and strengthening the network of urban forestry partners in Dallas can elevate urban forestry and be the catalyst in successfully implementing the Urban Forest Master Plan.

Management Approach. There are many City departments working to improve the urban forest in Dallas; however, most are working independently and with varying goals and messages. For example, in any given day, Dallas Park and Recreation is pruning trees in parks; Dallas Water Utilities is holding Arborist School training for staff and residents; the Department of Public Works is inspecting median trees; and the Department of Sustainable Development and Construction is reviewing development plans for compliance with Article X (landscape and tree conservation regulations).

All of these efforts are important; however, this decentralized approach with so many independent efforts and different department goals can impact City progress towards sustainable urban forestry management. Development of a centralized management approach can help in achieving this management goal and provide opportunities for extensive inter-departmental coordination, collaboration, and communication.

Unified Voice and Vision. Along with the City of Dallas, there are many other active players that are working to improve the city's urban forest, including non-profit environmental organizations training volunteers and planting trees and the green industry and allied professionals planning and caring for trees across the city. Dallas is fortunate to have so many active organizations; however, they lack a unified voice and path forward. Developing a unified voice and vision that includes all the urban forestry players in Dallas is critical to building an effective campaign that fosters progress, increases support, and leverages resources to build a strong and sustainable urban forest in Dallas. That voice could take shape by developing a culture of collaboration that strengthens and supports existing relationships and partnerships.

Maximizing Investment. Each of these principles has contributed to difficulty in acquiring and maximizing investments in Dallas's urban forest. Without community support, and a strong, unified voice, vision, and management approach, the needs of the urban forest are often overlooked during the budget process. By fostering an environment of collaboration and improved coordination across City departments and amongst external stakeholders, existing resources and funding can be used more efficiently and leveraged to gain new investments in urban forestry.

SECTION 4:
Making Trees a Priority

THE PATH FORWARD

The goals, recommendations, and recommended action steps of the Dallas Urban Forest Master Plan were developed based on the priorities, themes, and guiding principles identified during the plan development process and outlined in Section 3. They focus on improving and growing Dallas's urban forest and making trees a priority.

The recommendations and recommended action steps will help Dallas to...

Plan for a sustainable and resilient urban forest by developing strategies and policies that align with best management practices

Manage tree maintenance, care, and tree planting activities more effectively by improving data, technology, communication, and collaboration

Protect the urban forest and maximize the benefits it provides by ensuring systems are in place to support its long-term growth, preservation, and care

Grow the urban forest in an equitable and sustainable manner to ensure that all Dallas residents have access to trees and the benefits they provide

Engage and connect with the community about the important role that they play in the growth, preservation, and care of Dallas's trees

GOALS

Goal 1. Create a healthy, equitable, and resilient urban forest through proper planning and implementation of management strategies that maximize the benefits that the Dallas's trees provide

Goal 2. Protect and grow tree canopy in Dallas to reduce temperatures, improve air quality, and address the most pressing challenges facing the City

Goal 3. Achieve the Dallas Comprehensive Environmental and Climate Action Plan target of 37% tree canopy cover by 2040

Goal 4. Actively engage with the community about the instrumental role they play in caring and growing Dallas's urban forest and making trees a priority

RECOMMENDATIONS AND RECOMMENDED ACTION STEPS

The recommendations were ranked by the Technical Advisory Committee based on implementation priority, with #1 being the highest priority for implementation and #14 being the lowest. However, no matter where a recommendation is ranked, its implementation is an important piece in making trees a priority and ensuring that Dallas's urban forest is equitable, sustainable, and resilient.

1. Complete a comprehensive tree inventory of all right-of-way and park trees.

A comprehensive, up-to-date, GIS-based public tree inventory is the foundation of a municipal urban forestry program, providing crucial information on the composition, condition, risk, and maintenance needs of the city's trees. The inventory serves as the basis for prioritizing tree care activities and delivering urban forestry services efficiently and cost-effectively. Completing a tree inventory will provide Dallas the information needed to address maintenance and planning needs.

As shown in the Indicators report card (Section 3), completing a tree inventory would have the most significant impacts on moving the needle towards a sustainable and resilient urban forest in Dallas.

RECOMMENDED ACTION STEPS

First Step. Identify one City department to manage and oversee collection of tree inventory data.

1.A. Conduct a small pilot tree inventory in a neighborhood identified as having low canopy cover and high need based on the social equity and health data. To aid in developing tree inventory specifications, a small pilot tree inventory could be conducted. The purpose of the pilot inventory would be to identify which information should be collected to ensure that all data can be used in some way for management and planning. Focusing on an area of low canopy cover and high need can also help to understand why the area may have lower canopy cover.

1.B. Create a work plan and budget to complete tree inventory. Utilizing the information from the pilot tree inventory, a proposed work plan would be developed for completing the tree inventory city-wide, including inventory specifications (i.e., data fields to collect , including species, size, risk, condition, etc.), estimated number of trees, budget, and who will conduct (i.e., city staff, consultants). If City staff are to conduct the inventory, identify staff qualifications (i.e., International Society of Arboriculture Certified Arborists) and technology/data resources that will be required.

1.C. Secure funding to complete tree inventory project. The work plan should be presented to City leadership or outside funders to secure resources and funding to complete tree inventory.

1.D. Develop and release tree inventory bid; select consultant (if applicable). If a consultant will be conducting the tree inventory, development of tree inventory bid specifications will be needed. Bid specifications should include data fields to collect, methods of collection, qualifications of consultants performing work (i.e., International Society of Arboriculture Certified Arborist), and data deliverables.

1.E. Prepare and implement plan to regularly update inventory as maintenance and tree planting occurs by ALL City departments. A tree inventory is only as good as its data; therefore, documented standards and practices should be put into place on how and when to update the tree inventory. In general. The tree inventory should be updated, at a minimum, on a daily or weekly basis as tree planting and maintenance activities are completed.

SHORT-TERM TARGET 1:
Inventory 1/5 of Dallas's streets and parks by 2025.

2. Centralize the City of Dallas's urban forestry programs and activities.

With four different departments supporting urban forestry efforts for the City of Dallas, the goal of this recommendation is to centralize all urban forestry programs and activities.

- **Park and Recreation Department** – manages trees in City parks
- **Public Works Department** – manages trees in street medians
- **Sustainable Development and Construction Department** – regulates the protection and removal of existing trees in the City; oversees reforestation fund.
- **Dallas Water Utilities** – manages trees in the Great Trinity Forest and all creeks and floodway management areas in the City, and provides urban forestry training for City staff, residents, private businesses, and other municipalities.

This can be accomplished in a variety of ways, from combining all forestry programs into a single department to establishing a leadership position that serves as a liaison between the existing departments to assist in managing and coordinating activities. Implementing this recommendation will not only support efforts between groups performing tree care activities but will also provide a platform to develop a unified voice and consistent messaging that can be shared and communicated both within and outside the City.

RECOMMENDED ACTION STEPS

First Step. Form an urban forestry working group with forestry staff from Park and Recreation, Public Works, Dallas Water Utilities and Sustainable Development along with department leadership.

2. Explore options for centralizing City urban forestry programs and activities. Conduct a review of the urban forestry services performed by each department. Using that information, the urban forestry working group should explore options for centralizing the program. Options may include combining all forestry programs into a single City department or establishing an urban forestry coordinator position at the director-level that could coordinate activities among departments.

SHORT-TERM TARGET 2:
Establish the urban forest working group by September 2021.

3. Develop a Storm Response and Recovery Plan for the City of Dallas.

The development of an urban forestry storm response and recovery plan will provide the City of Dallas with the tools and resources needed to adequately prepare, respond, and recover from storm events. The plan documents the policies and procedures that must occur before, during, and after a storm event, including:

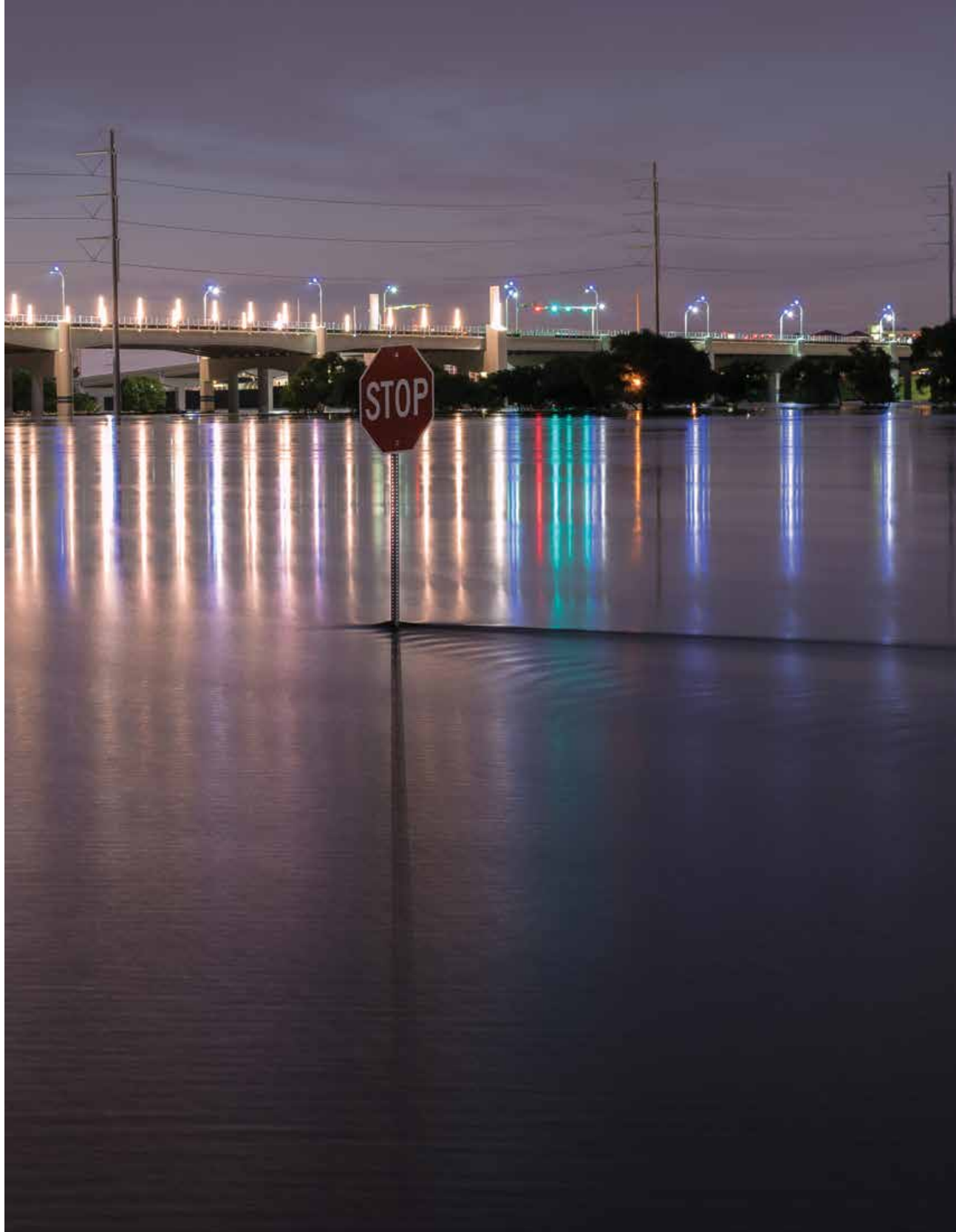
- identification of staff responsible for leading storm response
- creation of a list of on-call staff/contractors
- how to conduct tree damage assessments and provide documentation to aid in securing FEMA funding for debris removal
- identification of priority streets that must remain open (e.g., routes to hospitals)
- debris management (including the identification of suitable landings or debris management yards, setting up a temporary marshaling, or renting tub grinders to manage waste)
- identifying sources of additional local/state/federal assistance (e.g., US Forest Service Urban Forest Strike Team)

An urban forestry storm response and recovery plan should be developed in coordination with City and County waste management and emergency response departments and become an element of their disaster preparedness plans.

RECOMMENDED ACTION STEPS

First Step. Create a team of City of Dallas staff that are involved in tree maintenance and representatives from the City and County waste management and emergency response departments to develop plan.

3.A. Identify team lead and department that will oversee plan development. To ensure the urban forestry storm response plan is completed, a lead person/department (team lead) responsible for its development should be identified. The team lead would serve as the project manager working with the other City and County departments to complete the plan. A consultant can also be utilized to assist in development of this plan.



3.B. Utilize resources and planning guides to assist in developing the storm response and recovery plan. There are many resources from the USDA Forest Service and other organizations on developing storm response and recovery plans. These resources should be utilized, when practical, during the development of Dallas's storm response plan.

SHORT-TERM TARGET 3:
Create storm response plan team by June 2022.

4. Strengthen and support existing relationships and partnerships

For the UFMP to be successful, it will require harnessing and strengthening the network of urban forestry, environmental, and equity partners to build momentum and a unified voice around the urban forest. Strengthening and supporting existing relationships and partnerships among active and committed urban forestry partners in Dallas can be the catalyst to create that voice and effectively foster and support urban forestry efforts in Dallas.

RECOMMENDED ACTION STEPS

First Step. Identify all public, private, and non-profit organizations involved in urban forestry, natural resources, environmental justice, and equity efforts in Dallas.

4.A. Build momentum around Dallas's urban forest and the Urban Forest Master Plan by planning and hosting a "Dallas Tree Summit." Bring together the Urban Forest Master Plan Technical Advisory Committee and Stakeholder Focus Group members, along with other public, private, and non-profit organizations and funders involved in urban forestry, environmental, and equity efforts to roll out the Dallas Urban Forest Master Plan and foster collaboration, education, and engagement around trees in Dallas.

4.B. Use the Dallas Tree Summit to identify ways to continue to engage, strengthen, and support existing relationships throughout the year. Build urban forestry momentum by using the annual Dallas Tree Summit to identify ways to build and strengthen partnerships throughout the year.

SHORT-TERM TARGET 4:
Host the first Dallas Tree Summit in 2023.

5. Work towards development of a City Urban Forest Management Plan.

An urban forest management plan is a work management plan for the City's publicly managed tree population based on updated data from the City's tree inventory. It provides an assessment of priority management needs, identifies risk and maintenance needs, develops a budget that details the resources needed to address them, and outlines a schedule for completion. The plan should include both short-term (e.g., annual work plans) and long-term planning and policy goals (e.g., 5-10 years). A comprehensive urban forest management plan can also include a risk management program, public tree maintenance program, and disaster preparedness and response plan (see recommendation 3). An up-to-date tree inventory is a key component in developing an Urban Forest Management Plan; however, a lack of a competed inventory should not keep Dallas from beginning to plan.

RECOMMENDED ACTION STEPS

First Step. Develop an annual urban forestry work plan, coordinated among the different City departments that conduct tree work, detailing the tree maintenance and planting activities.

5.A. Identify City of Dallas department responsible for leading the development of the urban forest management plan and whether the plan will be written by City staff or an outside consultant. As with the other recommendations, identifying a lead staff person and department responsible for plan development and implementation is key to its successful implementation. Depending on how recommendation 2 is implemented, the urban forestry coordinator position could lead this effort.

5.B. Utilize data from tree inventory to develop Urban Forest Management Plan. An up-to-date tree inventory is the foundation for the development of an urban forest management plan. The management plan can be developed for the entire city or for smaller geographic units

PLANNING WITHOUT A TREE INVENTORY

A work plan can be created based on historical work trends, identified priorities (e.g., a specific area of city that staff knows requires tree work), or as the result of a windshield survey. A windshield survey is an assessment of trees conducted from a vehicle that identifies trees that require immediate maintenance. This type of survey is typically completed with a minimum of two staff, one driving and the other assessing trees.

Conducting tree maintenance and planting activities based on a work plan can help track costs for performing work and understand which activities are best conducted in-house with City staff or by contractors.

(e.g., management areas). The geographic area for the management plan can also be based on how tree inventory data is collected (all at once or phased) and City of Dallas management priorities (for example: remove all high risk trees throughout the city first or focus management activities on particular areas of the city).

SHORT-TERM TARGET 5:
Develop the first annual work plan for fiscal year 2023.

6. Ensure Dallas regulations, best management practices, and guidelines are in place to support tree canopy growth, protection, and preservation.

City policies, regulations and practices communicate and reflect the values and priorities of the community. The Tree and Landscape Manual is an important tool in helping to navigate Chapter 51A, Article X, Landscape and Tree Conservation Regulations, but there are revisions and updates that need to be made to make this document a strong resource and companion to Article X. The manual can also be used to document best management practices and standards related to tree maintenance, planting, and care activities, serving as a "one-stop shop" for all tree-related information in Dallas.

RECOMMENDED ACTION STEPS

First Step. Provide resources to support completion of revisions/updates to Tree and Landscape Manual.

6.A. Create a new City urban forestry webpage to serve as a "one-stop shop" for tree-related information in Dallas. This webpage can host the Landscape Manual, the Urban Forest Master Plan, best management practices, and other important tree-related information to share with developers and Dallas residents.

6.B. Compile a revised list of management activities in Article X that the existing Reforestation Fund can support. Article X currently permits the following to be funded through the Reforestation Fund – "…to purchase trees to plant on public property, to create an urban forest master plan and to update it periodically, to fund a staff position for managing and directing the fund for planting and urban forest education, or to acquire conservation easements or wooded property." The planning process identified a need to expand activities that the Reforestation Fund can fund. Suggested activities to fund include public tree inventory, risk

assessments, site preparation, tree irrigation, post planting tree care, and establishing a fund to help residents care for mature street trees.

6.C. Review existing landscaping and tree planting policies and requirements for alignment with best management practices and current City operations. Ensure that regulations and guidelines for landscaping and tree planting (e.g., parking lot landscaping) align with urban forestry best management practices and current City operations, goals, and policies.

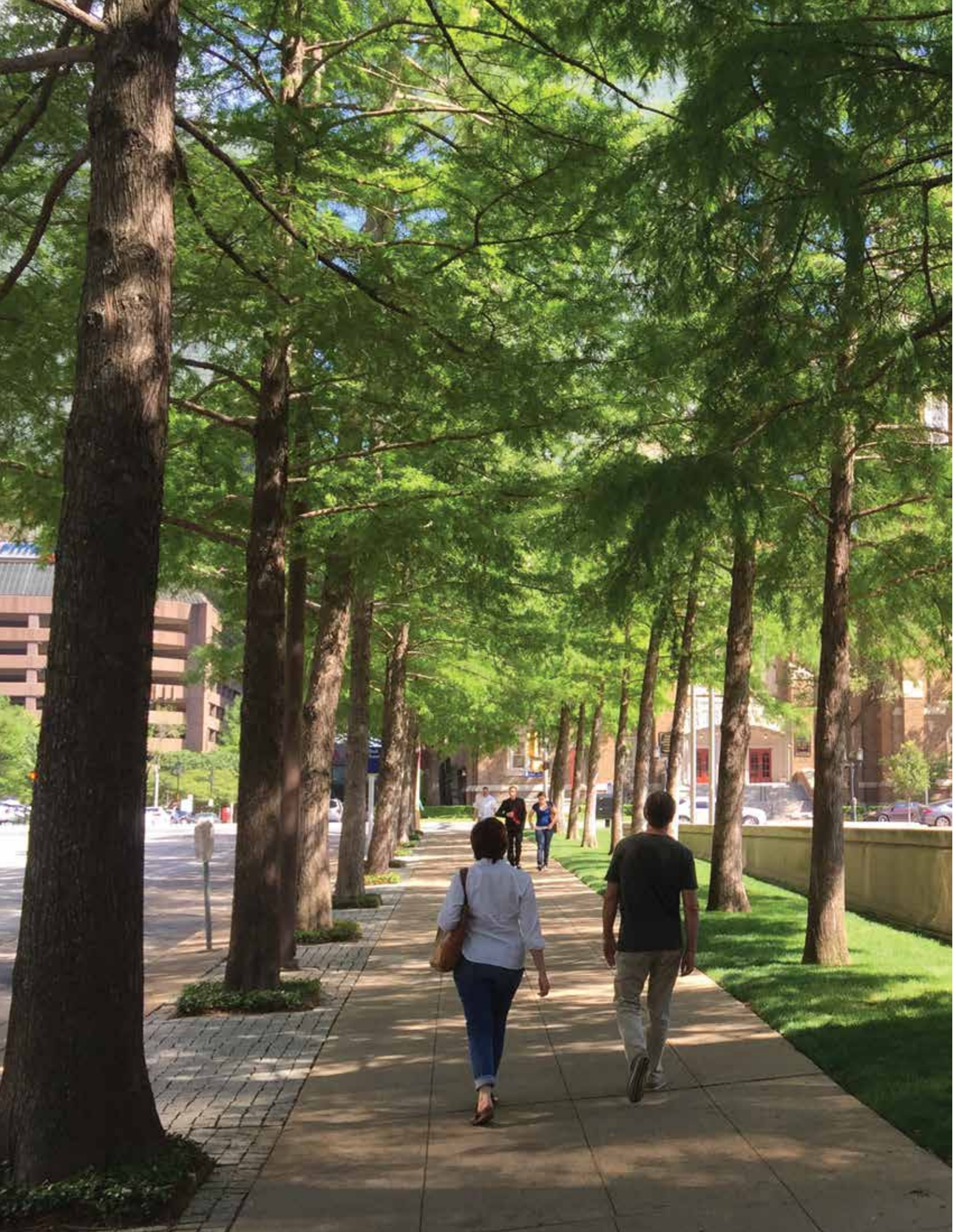
6.D. Engage the development community to build support for trees and identify solutions where healthy, mature trees and development can co-exist. The highest priority identified by stakeholders and the community was tree protection, preservation, and development.

6.E. Develop best management practices for tree planting and maintenance to support proper care. Establishing and documenting best management practices can help to ensure that trees in Dallas are properly planted and cared for as they grow and mature.

6.F. Explore development of a heritage tree program. Recognize and provide protecion for significant, historic, and/or large trees in Dallas.

6.G. Train and educate City of Dallas design and engineering staff and consultants. Provide training to non-tree professionals on the benefits and values of the urban forest and how their work can support UFMP goals, targets, and recommendations.

SHORT-TERM TARGET 6:
Initiate the Tree and Landscape Manual revisions by December 2022.



7. Develop and implement a strategy to maximize investment and resources to meet Dallas's desired level of service for urban forestry programs and management.

To make trees a priority in Dallas will require additional funding and resources. However, to gain these resources requires the development of a strategy that describes program needs, actions required, consequences of not acting, and funding needed. The strategy should consider two types of funding needs: long-term operational funding, and short-term project-based funding.

Short-term project-based funding is for projects that are 1-5 years in length and may be better suited to be raised through project partners. Funding options may include grants/gifts, creation of a Dallas Tree fund, and capital improvement project budgets. Long-term operational funding is for activities that extend out past five years and typically include operational tasks such as annual street tree pruning cycles but could also include long-term projects. Funding options may include street tree assessments, a fee based on the street frontage of a property, mitigation funds, establishment of a "percent for trees" program, plan review fees, stormwater utility fees, special taxing districts/assessment districts, and internal budget transfers.

RECOMMENDED ACTION STEPS

First Step. Identify one Urban Forest Master Plan recommendation that is a priority for implementation and develop an action plan and funding strategy for its implementation.

7.A. Conduct an analysis to determine the level of funding needed to perform urban forestry activities that will improve and grow Dallas's urban forest and develop an action plan and funding strategy. The information from the tree inventory and urban forest management plan will identify the work that needs to be done to improve and grow Dallas's urban forest. This data and information can be used to determine the level of service and funding required to accomplish the needed activities. A funding action plan can then be developed that includes what can be accomplished and how increases in urban forestry funding will benefit the community.

7.B. Create messaging about the value of Dallas urban forest and its benefits to the community to share with funders. People are more likely to support something if they understand its value and benefit, and that includes trees. Developing messaging around the important role that trees play in Dallas can help build support for the urban forest and lead to increased investments in maintenance and planting.

7.C. Foster, nurture, and grow relationships with potential funders by inviting them to attend the "Dallas Tree Summit." The Dallas Tree Summit (recommendation 4) can be an opportunity to showcase to potential funders trees in Dallas and the hard work that is happening (and needs to happen) to improve it. The messaging created in 5.A. can help to focus attention on the areas where resources and investment are needed most.

SHORT-TERM TARGET 7:
Develop an action plan and funding strategy for one UFMP recommendation by January 2022.

8. Create a plan to strategically plant and care for trees to ensure equitable access to tree canopy across Dallas.

A comprehensive city-wide tree planting and establishment plan can help to ensure that the right species of tree is planted in the right location, and there is a more equitable distribution of trees and the benefits they provide for all Dallas residents, today and into the future. Comparing social equity factors (e.g., health, demographic, economic) and the distribution of tree canopy across the city can help prioritize tree planting and care in neighborhoods with fewer trees and highest need. An analysis of the 2019 Dallas tree canopy assessment was conducted looking at the relationship between tree canopy cover and selected social equity, health, and urban heat island factors. The analysis resulted in GIS-based maps that can be coupled with City data to create plans that focus tree planting and care activities in areas of highest need based on City priorities.

Environmental justice and equity are a central component of the Dallas Comprehensive Environmental and Climate Action Plan (CECAP) released in 2020. This recommendation aligns with CECAP's focus on providing equitable solutions to address the impacts of climate change.

RECOMMENDED ACTION STEPS

First Step. Utilize the prioritized planting maps to develop a one-year planting plan, with a goal of developing multi-year planting plans in the future.

8.A. Identify health and socio-economic issues that are a priority in Dallas and develop plans to direct tree planting and maintenance activities in neighborhoods of highest need. The analysis of socio-economic and health factors presented in Section 2 of the Plan provides an understanding of how tree

canopy cover relates to those specific factors. Additional analyses should be conducted for other high priority health, demographic, and socio-economic factors in Dallas to help prioritize tree planting and maintenance activities in areas of highest need.

8.B. Cultivate relationships with neighborhood residents to implement plans and build community support about the important role that trees play in their neighborhood. Understanding areas that will most benefit from tree planting and care is only the first part of providing equitable access to tree canopy in Dallas. Developing and building relationships with residents in neighborhoods that would benefit most from tree canopy cover is equally important. It provides an opportunity for residents to have a voice and input into how they want their neighborhood to look in the future.

SHORT-TERM TARGET 8:
Develop a one-year tree planting plan for fiscal year 2023.

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

Dallas'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. This recommendation creates and implements a comprehensive program to monitor Dallas's urban forest to identify and address potential and future threats to the urban forest.

RECOMMENDED ACTION STEPS

First Step. Use information from the UFMP to understand current pests and diseases that are a threat to Dallas's urban forest and develop a program to begin to scout and monitor for these threats.

9.A. Develop an urban tree health program to conduct field assessments and scout/monitor for threats. The UFMP highlights several current threats to Dallas's urban forest, but new threats are constantly emerging from a wide variety of sources. For example, the emerald ash borer is believed to have arrived in Michigan on wood packing material that still contained bark that hid the insect larvae. A comprehensive urban tree health program needs to be developed to scout and monitor for current, emerging, and new threats. Evaluate the use of volunteers and other community partners to aid in pest monitoring and scouting (recommendation 13).

9.B. Support and encourage attendance by City of Dallas staff at urban forestry conferences, webinars, and other education events to stay up to date on new threats to Texas' trees and the urban forest. The best way to stay up to date on current threats to the urban forest is through participation in state and national urban forestry conferences, webinars, and other educational events.

SHORT-TERM TARGET 9:
Develop and implement an emerald ash borer monitoring program in 2021.

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

RECOMMENDED ACTION STEPS

First Step: Utilize results of the Urban Forest Master Plan community input activities to identify which messages should be used to launch an initial outreach and education campaign.

10.A. Conduct focus groups or other engagement activities with urban forestry, environmental and equity partners to identify key messages for the outreach campaign. To develop a unified urban forestry voice will require hearing the perspectives of everyone. Understanding where everyone is coming from can help develop a message that everyone can stand behind and promote. The Dallas Urban Forestry Summit could be a good venue for this engagement.

10.B. Identify advertising/marketing agency to help with the urban forestry branding and messaging and develop budget for campaign. An advertising/marketing agency can help develop content, branding, identify methods for content delivery (e.g., social media, web, billboard, print, etc.), and provide costs to implement the outreach campaign.

10.C. Seek funding for outreach and education campaign. Develop a funding plan using the information from recommended action steps 10.A and 10.B to present to City leadership and funders.

SHORT-TERM TARGET 10:
Develop and implement an outreach campaign for one key urban forestry message by June 2022.

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

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 waste created in the management of the urban forest. The purpose of this recommendation is to investigate alternative strategies to extend the usefulness of a tree after it is removed from the landscape. Alternatives can range from mulch and compost to picture frames, furniture, flooring, or other wood products created by local artisans.

RECOMMENDED ACTION STEPS

First Step. Determine how much wood waste is generated from Dallas forestry operations.

11A. Research local wood workers, tree care companies, and resource recovery operations that may be able to use wood waste generated by the City. There are many different uses for wood from creating high-end furniture and flooring to mulch and compost. Understanding the products that local artisans and recovery operations create with wood can identify what markets are available for Dallas's wood waste.

11.B. Establish evaluation criteria for different wood markets. Working with local wood workers, artisans, tree care companies and recovery operations can help develop criteria to use in determining which trees have potential for mulch/compost/firewood versus a higher end use (e.g., furniture, flooring, art).

11.C. Create partnerships with companies and individuals who can use City-generated wood waste. Based on research conducted in 11.A. and the evaluation criteria established in 11.B., partnerships with companies and individuals may be developed to use City-generated wood waste.

11.D. Identify wood waste strategies and develop pilot program(s) to test feasibility and identify challenges/opportunities for implementation. With wood utilization being a new program for Dallas the development of pilot program(s) to test strategies can help ensure successful implementation.

SHORT-TERM TARGET 11:
Create an initial list of companies and organizations that may be able to utilize City-generated wood waste by June 2022.

12. Strengthen working relationships and partnerships with private utilities, organizations, and contractors whose activities impact trees by instituting regular dialogue and project coordination.

The creation of working relationships with key personnel whose activities impact trees can provide opportunities for collaboration and reduce the negative impacts that their work can have on the urban forest. The purpose of this recommendation is to provide effective methods of communication with outside entities that will allow for improved coordination in the management, care, and protection of Dallas's urban forest.

RECOMMENDED ACTION STEPS

First Step: Assemble a list of utilities, organizations, and contractors, including contact information, that work within Dallas and designate City staff to contact and create working relationships.

12.A. Educate businesses, organizations, and contractors on City's best management practices and tree related policies. Building awareness about the City's best management practices and tree related policies will help reduce unnecessary tree damage and removal.

12.B. Identify opportunities for partnership and collaboration on projects that can preserve and save trees. There are many instances where creative thinking and collaboration can help preserve trees that would otherwise have been removed. To identify these opportunities will require engineering and design professionals to be educated on what is possible, so they can recognize opportunities in the future.

SHORT-TERM TARGET 12:
Compile list of utilities, organizations, and contractors by December 2021.

13. Enhance and develop programs that encourage and support active participation by residents and volunteers in the planting and care of Dallas's urban forest.

With over 70% of the urban forest on private property, it is critical to engage the community its care, growth, and management. Since 2007, the City of Dallas and the Urban Forest Advisory Committee have trained over 250 volunteers through the Citizen Forester Program. The program provides volunteers the opportunity to learn tree management skills (e.g., tree pruning, care, and planting) that they can use to improve Dallas's tree canopy, both public and private. The program helps to create community tree stewards who can serve as advocates for Dallas's trees and help build awareness about their value to their families, friends, and neighbors. The purpose of this recommendation is to expand, enhance and encourage volunteer opportunities through the City, non-profit, business, and environmental groups that can enhance and increase tree canopy in Dallas.

RECOMMENDED ACTION STEPS

First Step: Identify appropriate activities that volunteers can participate in and develop a list of existing programs that can best utilize volunteer assistance.

13.A. Evaluate, improve, and expand upon current volunteer programs. Utilize the list of activities from the "First Step" to expand and improve current volunteer programs or identify new ones.

13.B. Identify ways to engage vulnerable populations in the planting and care of trees. Utilize the relationships built through action step 8.B. to offer volunteer opportunities to vulnerable populations and residents that live in vulnerable neighborhoods.

13.C. Establish volunteer programs that utilize groups from local corporations and businesses. Local businesses and corporations can provide volunteers to supplement resident volunteers on neighborhood plantings or participate in park or larger city-wide tree planting or tree care efforts.

SHORT-TERM TARGET 13:
Develop list of existing urban forestry volunteer programs by September 2021.

14. Review and update the Great Trinity Forest Management Plan

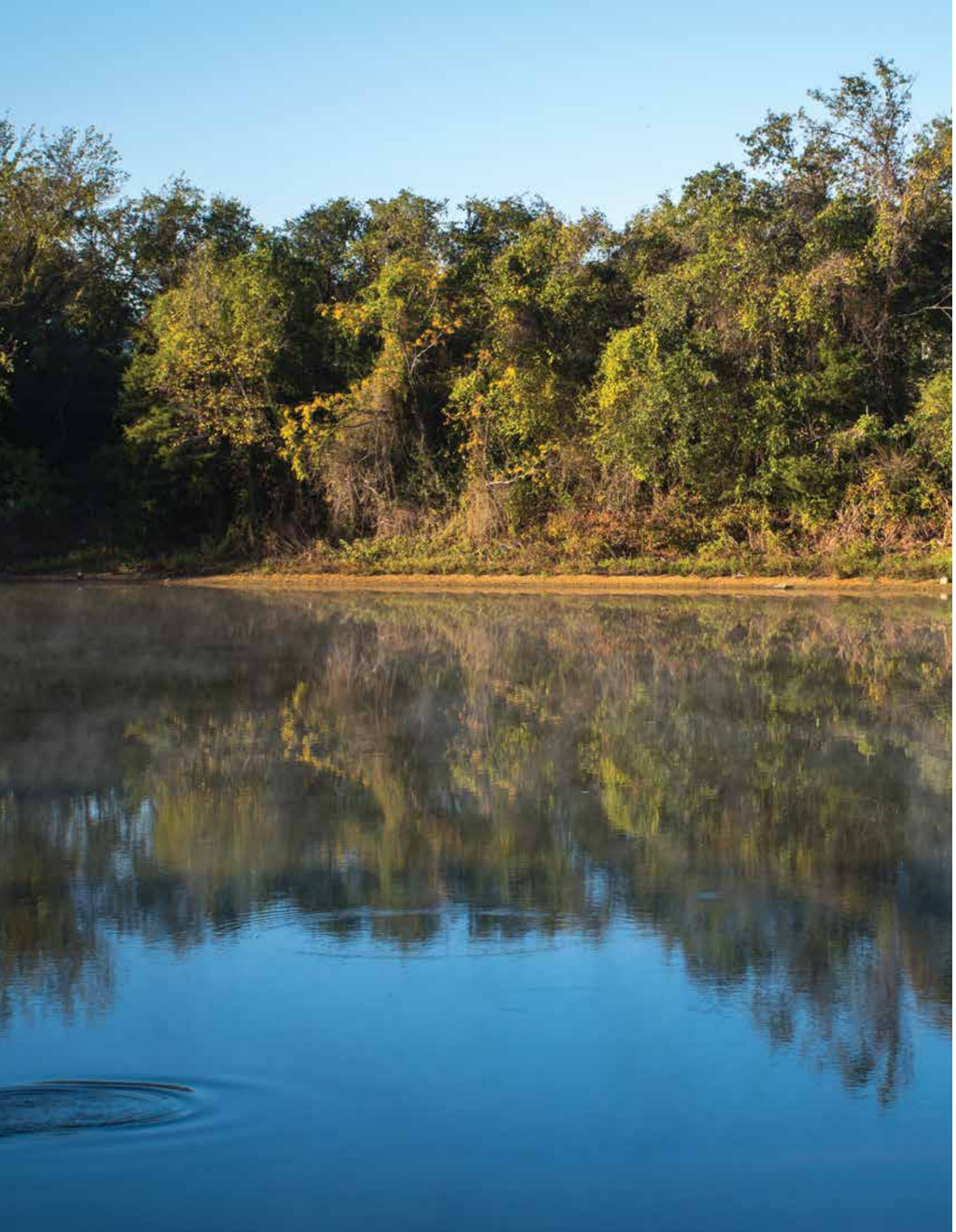
The Great Trinity Forest at 6,000 acres dwarfs New York City's 843-acre Central Park. At seven times the size of Central Park, this jewel in the middle of Dallas has unique ecology, function, and management needs that differ from those of Dallas's street and park trees (mowed areas). Due to the Great Trinity Forest's unique nature and because there is already a plan in place for its management, the Urban Forest Master Plan did not specifically address its management. The Great Trinity Forest Management Plan, released by the City of Dallas in 2008, provided a comprehensive inventory of its ecosystems along with management and recreation recommendations and costs for implementation over the next 25 years.

Since adoption of the Great Trinity Forest Management Plan, few recommendations have been implemented, and today the Forest is being threatened by climate change, development pressure, and insects and diseases, particularly the emerald ash borer. The i-Tree Eco study conducted as part of the *2015 State of the Dallas Urban Forest* report found that the top tree species growing in the Great Trinity is green ash (*Fraxinus pennsylvanica*), however, the management plan does not provide specific recommendations to scout, address, and manage the threat that emerald ash borer poses to the Forest. The purpose of this recommendation is to review and update the Great Trinity Forest Management Plan with a particular focus on identifying and developing management recommendations to address the current needs, management practices, opportunities, and threats it faces (i.e., emerald ash borer). Due to the comprehensive nature of the 2008 Management Plan, it is recommended that the Plan review and update be conducted over time, addressing the Great Trinity Forest's most pressing opportunities, needs and threats first.

RECOMMENDED ACTION STEPS

First Step: Develop a team of City of Dallas staff and outside partners to undertake the Great Trinity Forest review and update.

14.A. Identify the most immediate opportunities and challenges facing the Great Trinity Forest. Utilizing information and data to identify the resource threats and opportunities within the Great Trinity, could include the ecosystem inventories from the management plan, Dallas planning information, the Dallas Comprehensive Environmental and Climate Action Plan, 2015 State of the Dallas Urban Forest Report, 2019 urban tree canopy study.



14.B. Develop management and maintenance recommendations to address opportunities and threats and revise plan. Management recommendations, including costs and timelines, will address the opportunities and threats.

14.C. Identify the next sections of the plan to revise and update. After the immediate issues are addressed, the next sections of the plan should be revised and updated to continue this process until the Great Trinity Management Plan has been completely updated.

14.D. Develop a schedule to review, measure progress, and update the management plan. To measure implementation progress and ensure the Great Trinity Management Plan remains relevant based on current opportunities, needs and challenges develop a schedule to regularly review and update the plan.

SHORT-TERM TARGET 14:
Create Great Trinity Forest Management Plan update team by January 2025.

ACTION AND IMPLEMENTATION

Table 3 outlines an implementation strategy for the Dallas Urban Forest Master Plan. While the strategy lays out timeframes and short-term targets, implementation of the Plan should remain flexible and fluid to allow for shifts and changes in needs, priorities, and resources in Dallas.

Implementation of the Urban Forest Master Plan will require a community effort, from the City of Dallas government and leadership to community partners and residents. To make trees a priority in Dallas will require partnerships and resources. The UFMP lays out our path forward and invites our partners to help.

TABLE 3.

RECOMMENDATION 1. Complete a comprehensive tree inventory of all right-of-way and park trees

Short-Term Target 1: Inventory 1/5 of Dallas's streets and parks.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Identify which City department(s) will manage and oversee collection of tree inventory data.	Immediate (1-5 years)	1
1.A	Conduct a small pilot tree inventory in a neighborhood identified as having low canopy cover and high need based on the social equity and health data.		
1.B	Create a work plan and budget to complete tree inventory.		
1.C	Secure funding to complete tree inventory.		
1.D	Develop and release tree inventory bid; select consultant (if applicable).		
1.E	Prepare and implement plan to regularly update inventory as maintenance and tree planting occurs by ALL City departments.		

RECOMMENDATION 2. Centralize the City of Dallas's urban forestry programs and activities.

Short-Term Target 2: Establish the urban forest working group.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Form an urban forestry working group with forestry staff from Park and Recreation, Public Works, Water Utilities, Sustainable Development, and department leadership.	Immediate (1-3 years)	2
2.	Explore options for centralizing City urban forestry program and activities.		

RECOMMENDATION 3. Develop a Storm Response and Recovery Plan.

Short-Term Target 3: Develop a storm response plan team.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Create a team of City of Dallas staff that are involved in tree maintenance and representatives from the City and County waste management and emergency response departments to develop plan.	Immediate (3-5 years)	3
3.A	Identify team lead and department that will oversee plan development.		
3.B	Utilize resources and planning guides to assist in developing the storm response and recovery plan.		

RECOMMENDATION 4. Strengthen and support existing relationships and partnerships.

Short-Term Target 4: Host the first Dallas Tree Summit.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Identify all public, private, and non-profit organizations involved in urban forestry, natural resources, environmental justice, and equity efforts in Dallas.	Immediate/ Ongoing (1-3 years)	4
4.A	Build momentum around Dallas's urban forest and the UFMP by planning and hosting a "Dallas Tree Summit."		
4.B	Use the Dallas Tree Summit to identify ways to continue to engage, strengthen, and support existing relationships throughout the year.		

TABLE 3. Continued

RECOMMENDATION 5. Work towards development of a City Urban Forest Management Plan

Short-Term Target 5: Develop the first annual work plan for fiscal year 2023.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Develop an annual urban forestry work plan, coordinated among the different City departments that conduct tree work, detailing the tree maintenance and planting activities.	Short-Mid Term (3-5 years)	5
5.A	Identify City of Dallas department responsible for leading the development of the urban forest management plan and whether the plan will be written by City staff or an outside consultant.		
5.B	Utilize date from tree inventory to develop Urban Forest Management Plan.		

RECOMMENDATION 6. Ensure Dallas regulations, best management practices, and guidelines are in place to support tree canopy growth, protection, and preservation.

Short-Term Target 6: Initiate the Tree and Landscape Manual revisions.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Provide resources to support completion of revisions/updates to Tree and Landscape Manual.	Short-Mid Term (1-7 years)	6
6.A	Build a new City urban forestry webpage to serve as a "one-stop-shop" for tree-related information in Dallas.		
6.B	Compile a revised list of management activities in Article X that the existing Reforestation Fund can support.		
6.C	Review existing landscaping and tree planting policies and requirements for alignment with best management practices and current City operations.		
6.D	Engage the development community in revising Article X to build support for trees and identify solutions where healthy, mature trees and development can co-exist.		
6.E	Develop best management practices for tree planting and maintenance to support the proper care.		
6.F	Explore development of a heritage tree program that could recognize and provide protection for significant, historic, and/or large trees in Dallas.		
6.G	Train and educate City of Dallas design/engineering staff and consultants on the benefits and value of the urban forest and their role in supporting the UFMP goals, targets, and recommendations.		

RECOMMENDATION 7. Develop and implement a strategy to maximize investment and resources to meet Dallas's desired level of service for urban forestry programs and management

Short-Term Target 7: Develop an action plan and funding strategy for one UFMP recommendation.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Identify one UFMP recommendation that is a priority for implementation and develop an action plan and funding strategy for its implementation.	Mid-Term (3-10 years)	7
7.A	Conduct an analysis to determine the level of funding needed to perform urban forestry activities that will improve and grow Dallas's urban forest, and develop an action plan and funding strategy.		
7.B	Create messaging about the value of Dallas urban forest and its benefits to the community.		
7.C	Foster, nurture, and grow relationships with potential funders by inviting them to attend the Dallas Tree Summit. Utilize messaging to demonstrate value of urban forest.		

TABLE 3. Continued

RECOMMENDATION 8. Create a plan to strategically plant and care for trees to ensure equitable access to tree canopy across Dallas.

Short-Term Target 8: Develop a one-year tree planting plan for fiscal year 2023.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Utilize the prioritized planting maps to develop a one-year planting plan, with a goal of developing multi-year planting plans in the future.	Short-Term (3-7 years)	8
8.A	Identify health and socio-economic issues that are a priority in Dallas and develop plans to direct tree planting and maintenance activities in neighborhoods of highest need.		
8.B	Cultivate relationships with neighborhood residents to implement plans and build community support about the important role that trees play in their neighborhood.		

RECOMMENDATION 9. Create and implement a management program to monitor and address environmental threats to Dallas' urban forest.

Short-Term Target 9: Develop and implement an emerald ash borer monitoring program in 2021.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Use information from the UFMP to understand current pests and diseases that are a threat to Dallas's urban forest and develop a program to begin to scout and monitor for these threats.	Short-Term (1-10 years)	9
9.A	Develop an urban tree health program to conduct field assessments and scout/monitor for threats.		
9.B	Support and encourage City of Dallas staffs' attendance at urban forestry conferences, webinars, and other education events to stay up to date on new threats to Texas' trees and the urban forest.		

RECOMMENDATION 10. Develop and implement a public engagement, outreach, and education plan.

Short-Term Target 10: Develop and implement an outreach campaign for one key urban forestry message by June 2022.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Utilize the results of the UFMP community input activities to identify which messages should be the first priority in an outreach and education campaign.	Immediate/ Ongoing (1 year)	10
10.A	Conduct focus groups or other engagement activities with urban forestry, environmental, and equity partners to identify key messages for the outreach campaign.		
10.B	Identify advertising/marketing agency to help with the urban forestry branding and messaging and develop budget for campaign.		
10.C	Seek funding for outreach and education campaign.		

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

Short-Term Target 11: Create an initial list of companies and organizations that may be able to utilize City-generated wood waste.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Determine how much wood waste is generated from City forestry operations.	Mid-Long Term (5-10 years)	11
11.A	Research local wood workers, tree care companies, and resource recovery operations that may be able to use wood waste generated by the City.		
11.B	Establish evaluation criteria for different wood markets.		
11.C	Create partnerships with companies and individuals who can use City-generated wood waste.		
11.D	Identify wood waste strategies and develop pilot program(s) to test feasibility and identify challenges/ opportunities for implementation.		

TABLE 3. Continued

RECOMMENDATION 12. Strengthen working relationships and partnerships with private utilities, organizations, and contractors whose activities impact trees by instituting regular dialogue and project coordination.

Short-Term Target 12: Compile list of utilities, organizations, and contractors.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Assemble a list of utilities, organizations, and contractors, including contact information, that work within the City; identify City staff to contact and create working relationships.	Long-Term (5-10 years)	12
12.A	Educate businesses, organizations, and contractors on City's best management practices and tree related policies.		
12.B	Identify opportunities for partnership and collaboration on projects that can preserve and save trees.		

RECOMMENDATION 13. Enhance and develop programs that encourage and support active participation by residents and volunteers in the planting and care of Dallas's urban forest.

Short-Term Target 13: Develop list of existing urban forestry volunteer programs.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Identify appropriate activities that volunteers can participate in and develop a list of existing programs that can best utilize volunteer assistance.	Long-Term (5-10 years)	13
13.A	Evaluate, improve, and expand upon current volunteer programs.		
13.B	Identify ways to engage vulnerable populations in the planting and care of trees.		
13.C	Establish volunteer programs that utilize groups from local corporations/businesses.		

RECOMMENDATION 14. Review and update the Great Trinity Forest Management Plan.

Short-Term Target 14: Create Great Trinity Forest Management Plan update team.

Recommended Action Steps		Timeframe	Priority for Implementation
First Step	Develop a team of City of Dallas staff and outside partners to undertake the Great Trinity Forest review and update.	Long-Term (5-10 years)	14
14.A	Identify the most immediate opportunities and challenges facing the Great Trinity Forest.		
14.B	Develop management and maintenance recommendations to address opportunities and threats, and revise plan.		
14.C	Identify the next sections of the plan to revise and update.		
14.D	Develop a schedule to review, measure progress, and update the management plan.		

SECTION 5:
Assessing Progress

HOW ARE WE DOING?
Monitoring and Measuring

For the Urban Forest Master Plan to be an effective tool in making trees a priority in Dallas, it is vital that both its implementation and the conditions of Dallas's urban forest are regularly monitored and assessed. Progress assessment helps to identify urban forestry successes that can used in building momentum around trees and also identifies emerging opportunities and challenges that may need to be incorporated into the Plan.

Tree Canopy Analysis

Tree canopy in Dallas changes over time, as illustrated in the 2008 and 2016 canopy change analysis described in Section 3. This change can be gradual due to natural mortality, tree growth and new tree planting or due to significant storms, development activities, or insect/disease pests. Conducting updates of Dallas's **urban tree canopy assessment** on a regular basis (**every 5-10 years**) can provide important data on how and why tree canopy cover is growing or shrinking and monitor progress towards achieving tree canopy goals. Future Dallas urban tree canopy assessments should continue to 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, targets, and recommendations should be reviewed to ensure any opportunities or issues uncovered during the new assessment are addressed.

Changes in Tree Benefits

As described in Sections 1 and 2, Dallas's trees and urban forest provide many quantifiable benefits to the community. Measuring Dallas'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? 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, and both the new and previous urban tree canopy assessment data must be analyzed through the same version of i-Tree.**

Tracking Tree Planting and Care Activities

To evaluate whether the 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 (mobile app, website) where this information can be tracked by the City, residents, and organizations alike can help standardize data collection and information. Through this effort a variety of information and data can be gathered:

- Activity (tree planting, tree watering, etc.)
- Location of activity
- Number of people in engaged

The uses of this information go far beyond just tracking the number of trees planted. For example, it could help study residents' attitudes towards trees by following residents in a neighborhood over time to see if their attitudes towards trees change based on the results of the activity. It 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.

Berlin, Germany: CityLab Berlin has created a website where residents can adopt and water City street trees. Residents can then log their watering activities and exchange information with other participants to help coordinate their care activities.

To view the map visit: https://www.giessdenkiez.de/about

Indicators of a Sustainable Urban Forest

The assessment of the Indicators of a Sustainable Urban Forest established the baseline of where Dallas's urban forest is today.

The Players: LOW-MEDIUM
The Management: LOW
The Trees: LOW

As the Urban Forest Master Plan is implemented, **periodic assessments (every 3-5 years) of the Indicators to see if the results have changed** can highlight successes in implementation, identify improvement areas and new program priorities, and establish new recommendations and recommended action steps. The Technical Advisory Committee assisted in determining the initial rating of many of the indicators of a sustainable urban forest and could be reconvened to conduct the update.

Research and Academic Studies

Participating in research and academic studies on topics such as climate change vulnerability, urban heat islands, human health, and equity issues can help continue to address issues that are impacting Dallas. The information and data can help prioritize planting and care in areas of the city that can benefit most from increases in tree canopy cover.

Periodic Review and Updates of the UFMP

The Urban Forest Master Plan identifies a short-term target for each of the recommendations. Achieving plan targets is a metric that can be used to measure plan implementation. As the targets are achieved, and the plan evolves and is updated, new targets can be developed.

The Plan is designed to be a living document that is periodically reviewed and updated (every 5-10 years) based on changing needs of Dallas's trees, community priorities, and successes in plan implementation. **The key to this monitoring activity is identifying who will spearhead plan reviews and updates.** The Dallas Urban Forest Summit may serve as a resource to help identify accomplishments and identify challenges. A subcommittee of summit attendees could be created and charged with reviewing and updating the plan.

CONCLUSION

The Texas Trees Foundation and the City of Dallas would like to thank everyone who contributed to developing Dallas's first Urban Forest Master Plan.

The Plan serves as a guide to make trees and the urban forest a priority in Dallas. It is designed to move Dallas along the road towards a sustainable and resilient urban forest by proactively managing, preserving, caring for, and growing the city's tree canopy. The **Introduction** (Section 1) highlighted the important benefits trees provide, the challenges facing Dallas, and how trees and the urban forest can be part of the solution to address them. Section 2 presented the **current state of Dallas's urban forest** to establish a baseline of where the city is today. It used the Indicators of a Sustainable Urban Forest to create a report card that can be used to measure Dallas's progress. Section 3 examined **community and stakeholder values and needs** around trees and the urban forest. It identified the priorities, themes, and guiding principles which served to set the foundation and direction of the plan. The **recommendations, recommended action steps, and goals** were presented in Section 4. They were developed based on the priorities, themes, and guiding principles and focus on improving Dallas's urban forest through planning, managing, protecting, growing, and engaging. Section 5 provided ways that Dallas can **monitor and measure its progress** in improving Dallas's urban forest and making it a priority. Ultimately, the Dallas Urban Forest Master Plan provides a vision for the future of the urban forest to inspire us to care for, preserve, plant, and protect Dallas's trees. Let's get started!

A VISION FOR DALLAS'S URBAN FOREST:

An abundant, healthy, and well-maintained urban forest is an integral and valued part of the city of Dallas. Its trees positively impact the health, wellness, safety, and quality of life of the community, who actively advocates and participates in its growth, preservation, and care.

APPENDICES AND REFERENCES

Figure 5. Dallas land cover map
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

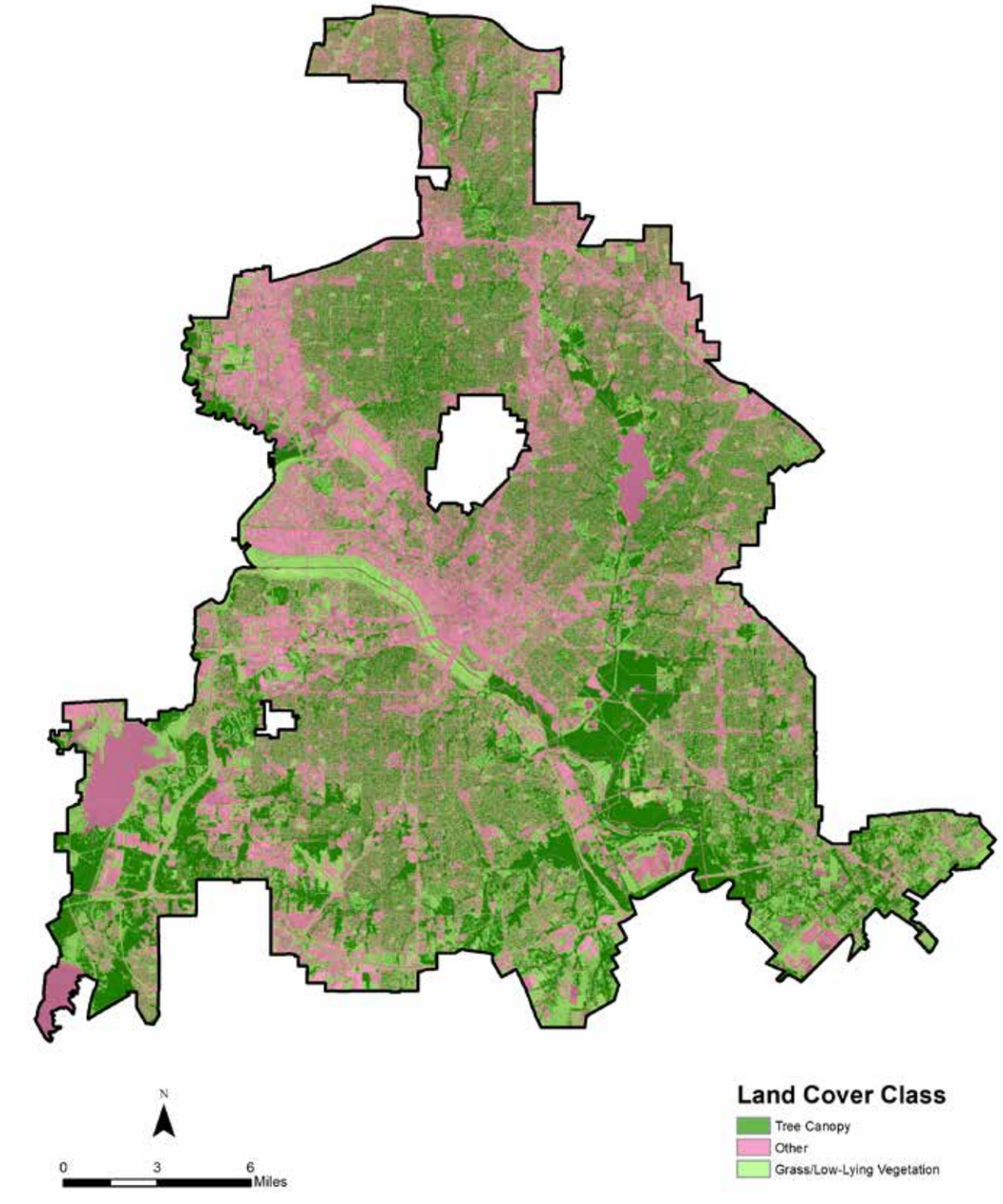


Figure 6. Dallas urban tree canopy cover map
Source: Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

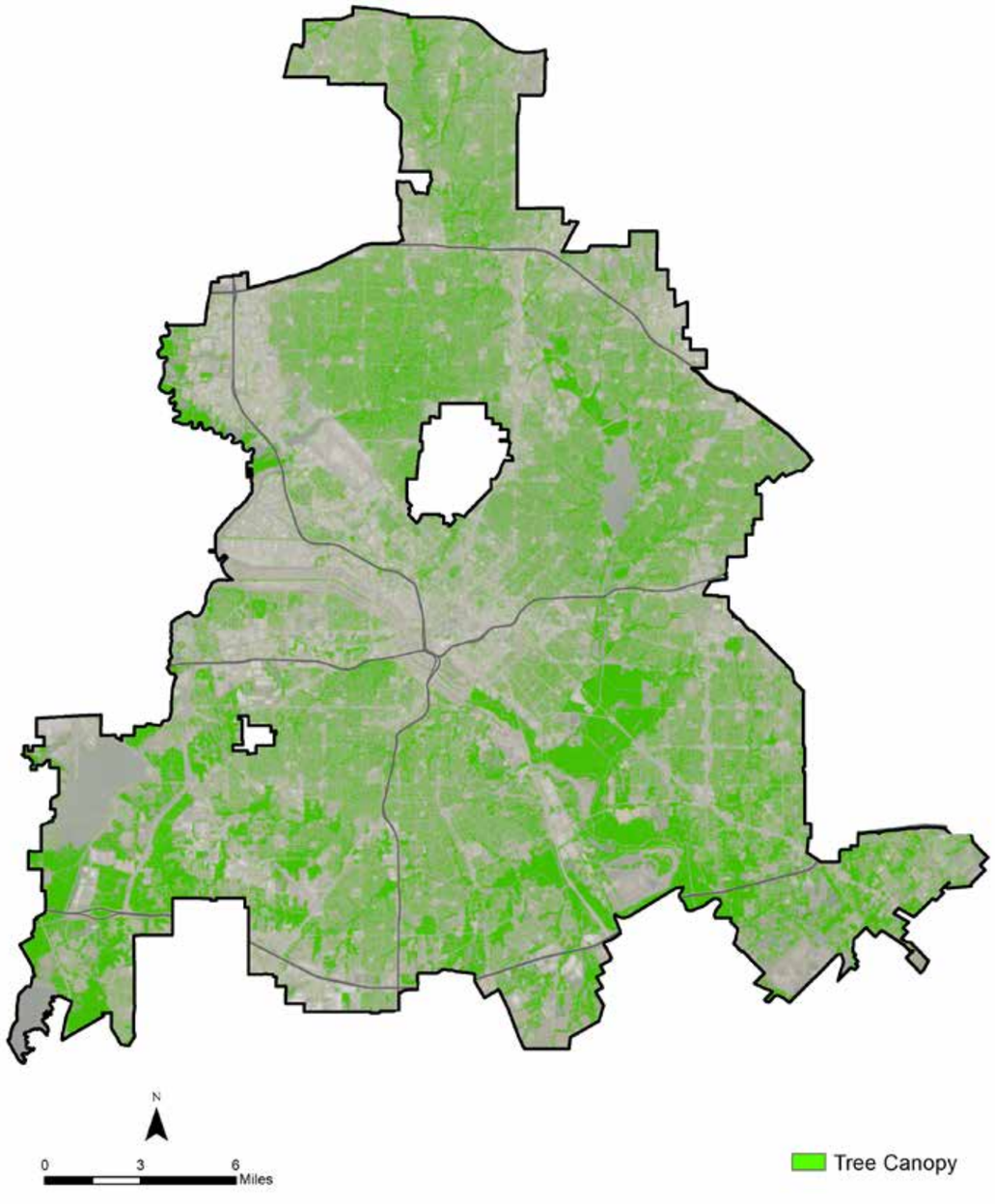


Figure 9. Map of tree canopy cover by Dallas City Council District
Source: Texas Trees Foundation Urban Tree Canopy Assessment

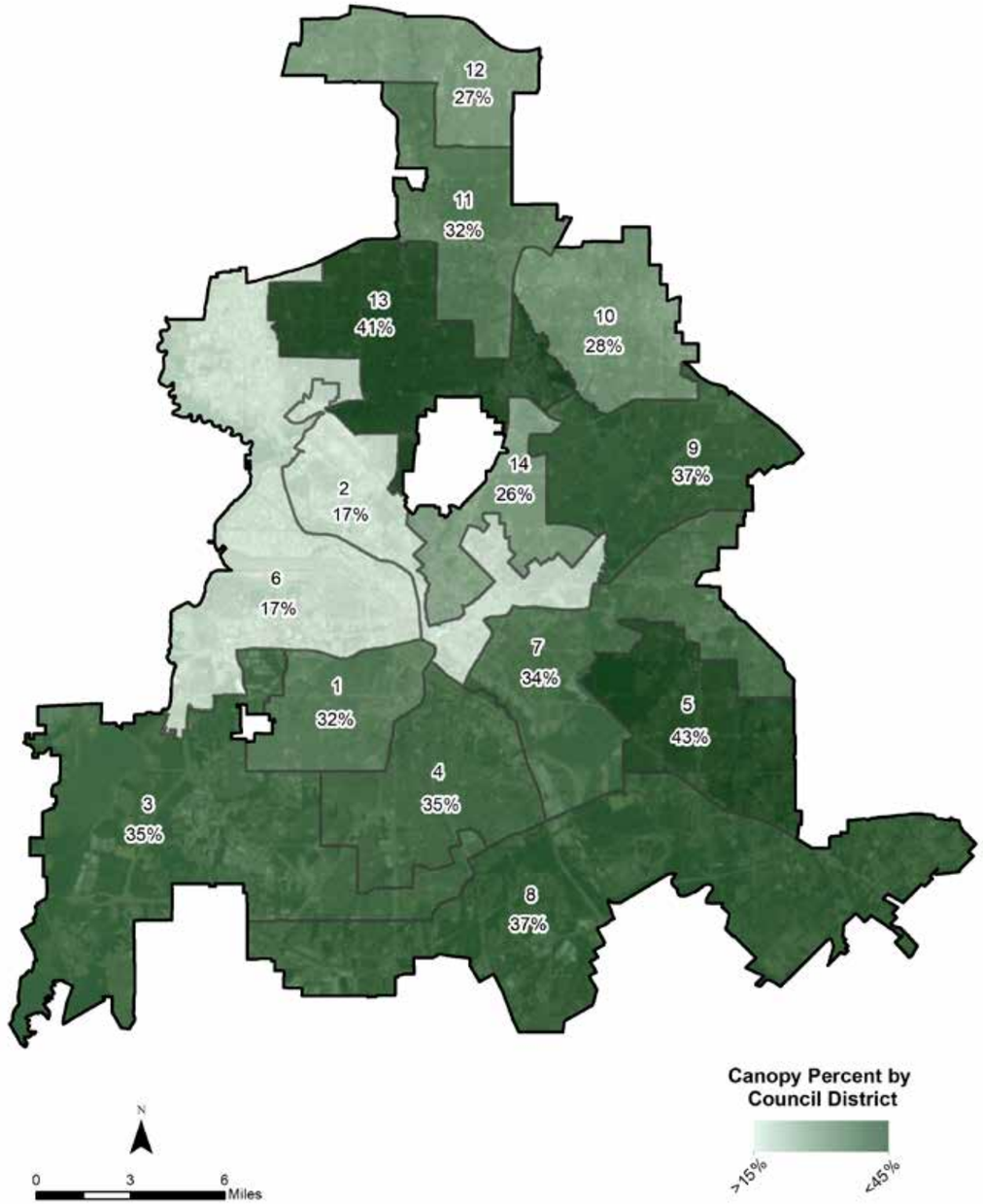


Figure 11. Absolute tree canopy change by council district (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019)

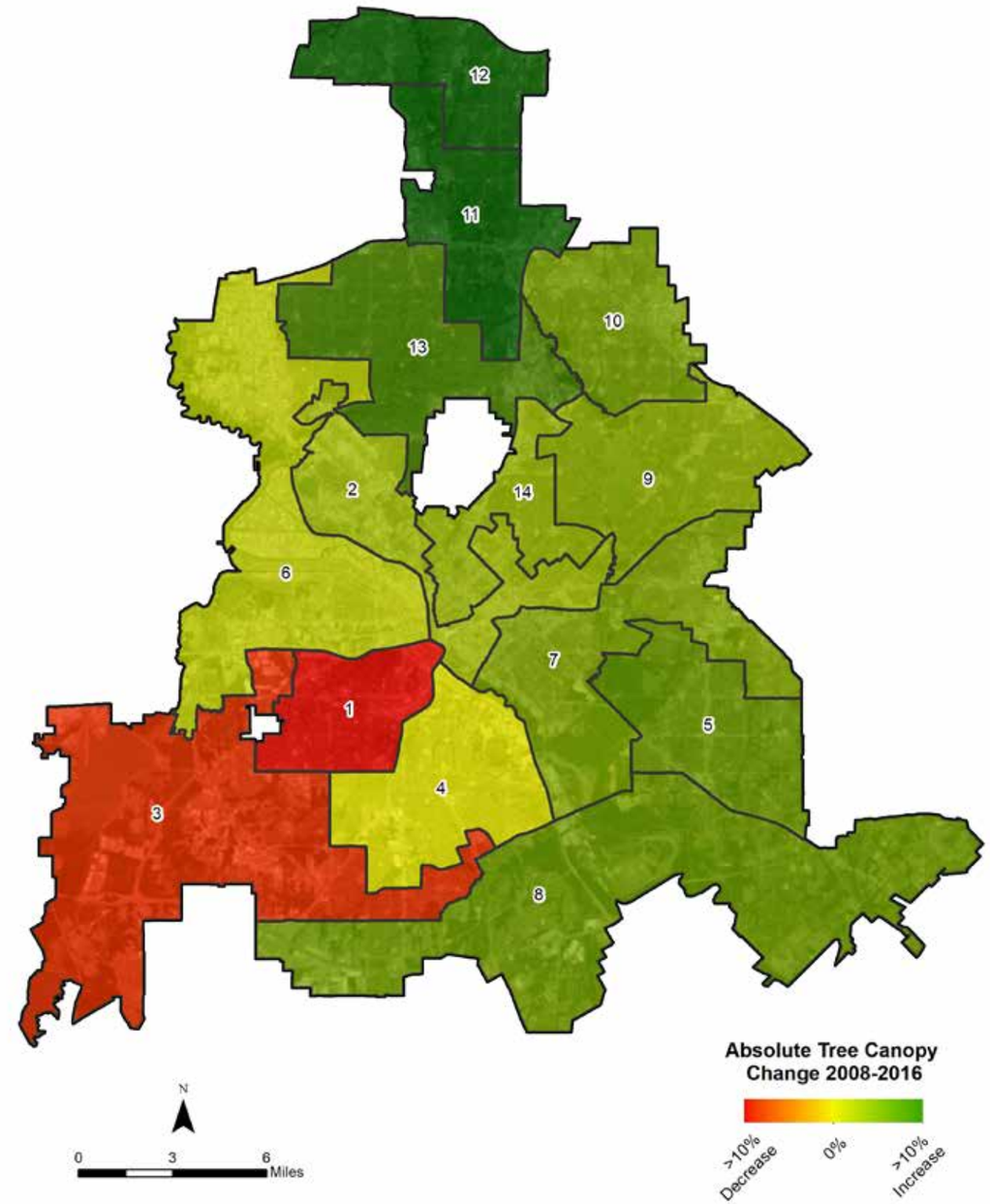


Figure 12. Absolute tree canopy change by Zip Code (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019) Update (2019)

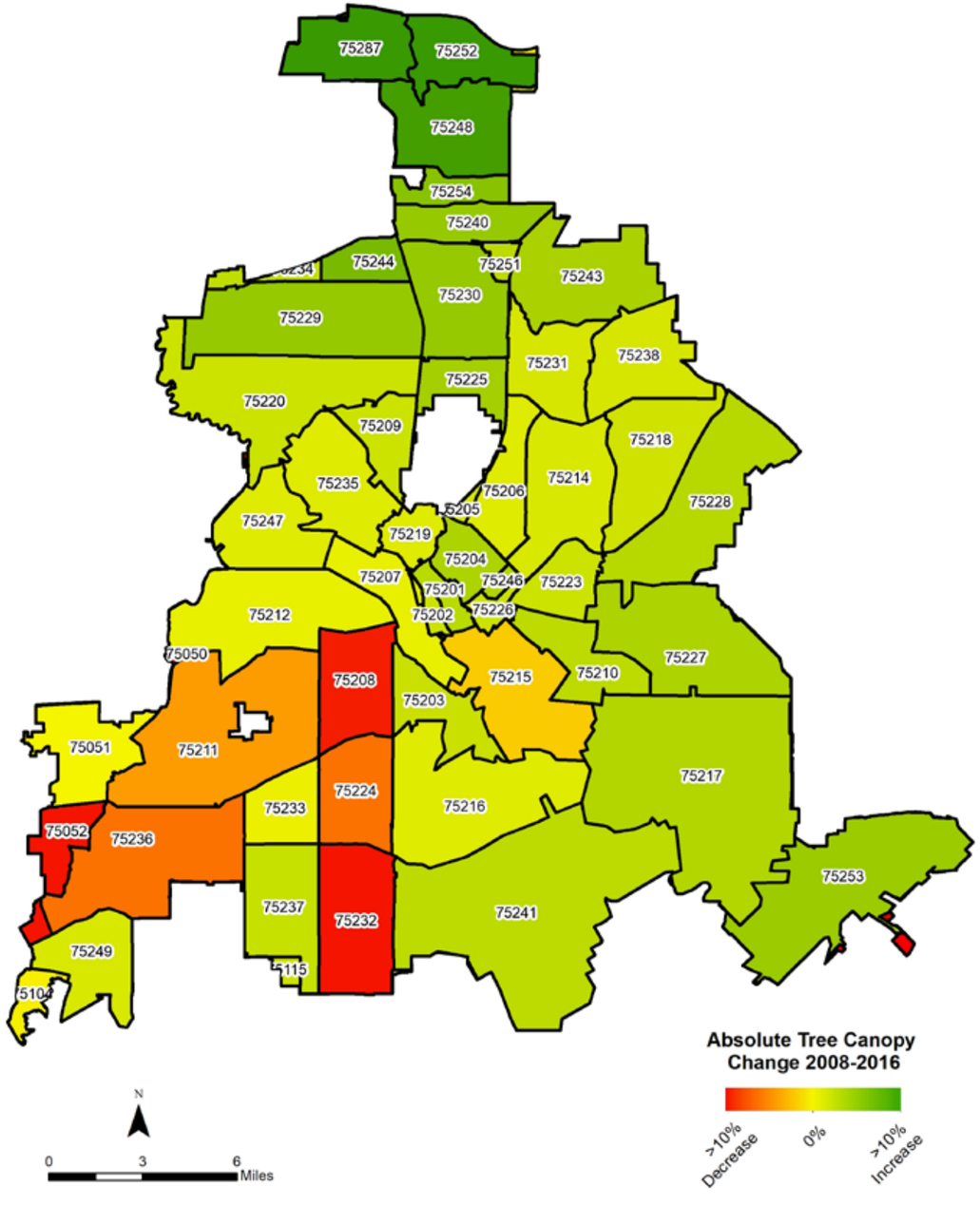


Figure 13. Absolute tree canopy change by census block (2008-2016)
Source: Texas Trees Foundation Urban Tree Canopy Assessments (2010 and 2019) Update (2019)

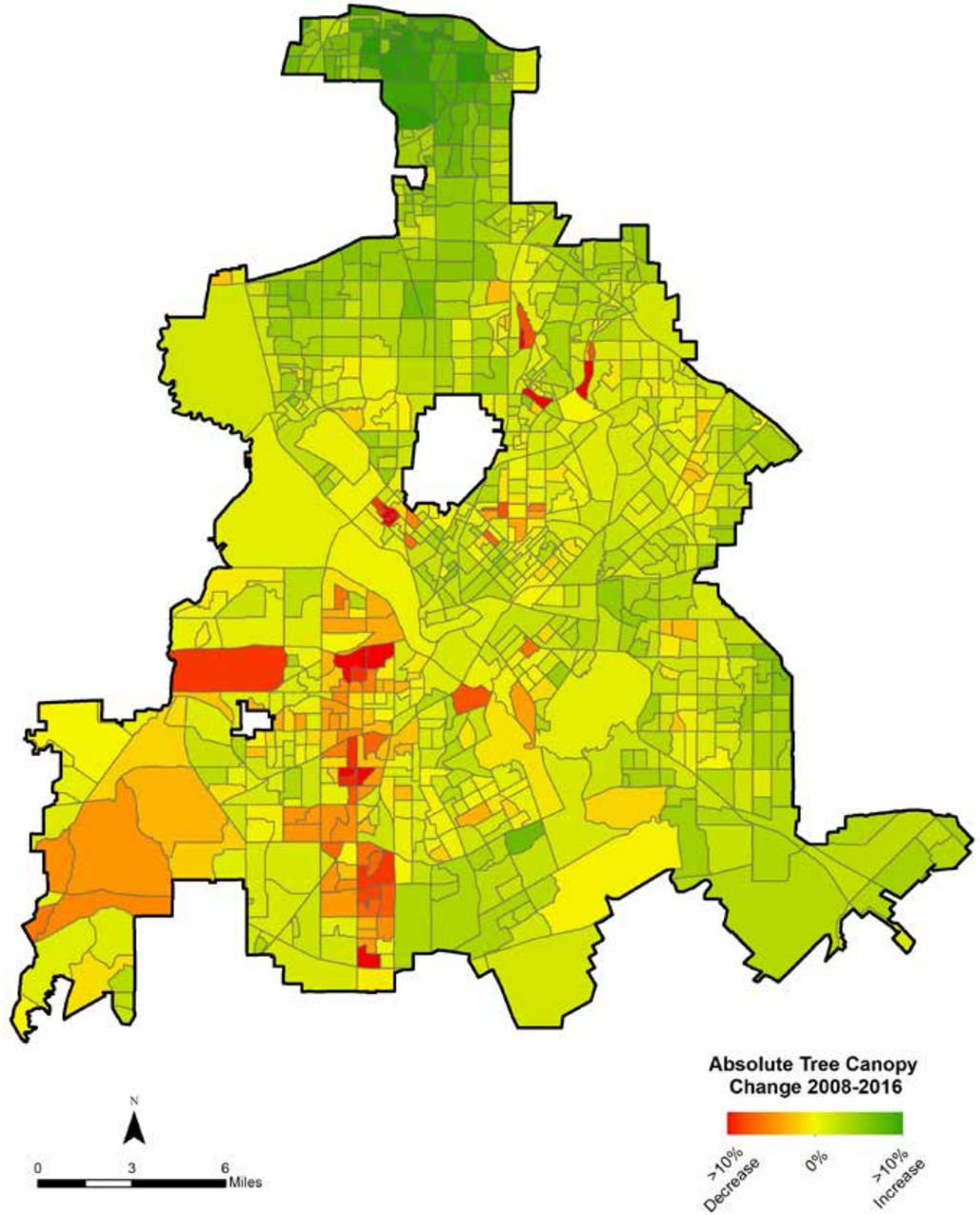


Figure 14. City of Dallas Tree Canopy Loss October 2019 Tornado

Data Sources: City of Dallas post-tornado aerial imagery (October 2019); Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

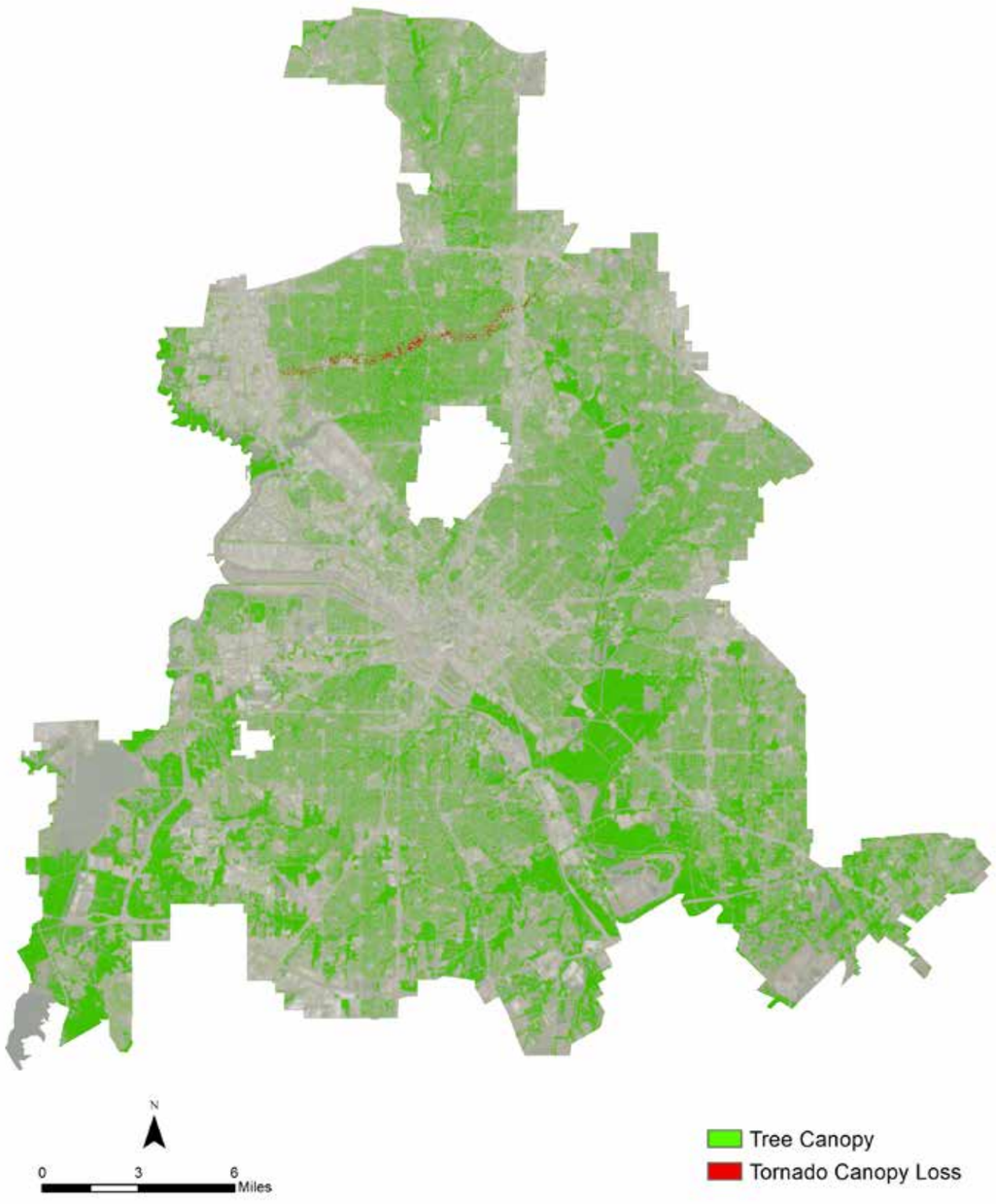


Figure 15. Areas of high average temperatures and low tree canopy cover

Areas shaded in purple and blue are those that have low to moderate tree canopy cover and moderate to high average temperatures. Trees can reduce temperatures by up to 15°F in Dallas.

Data Sources: Texas Trees Foundation Urban Heat Island Management Study (2017) and Urban Tree Canopy Assessment Update (2019)

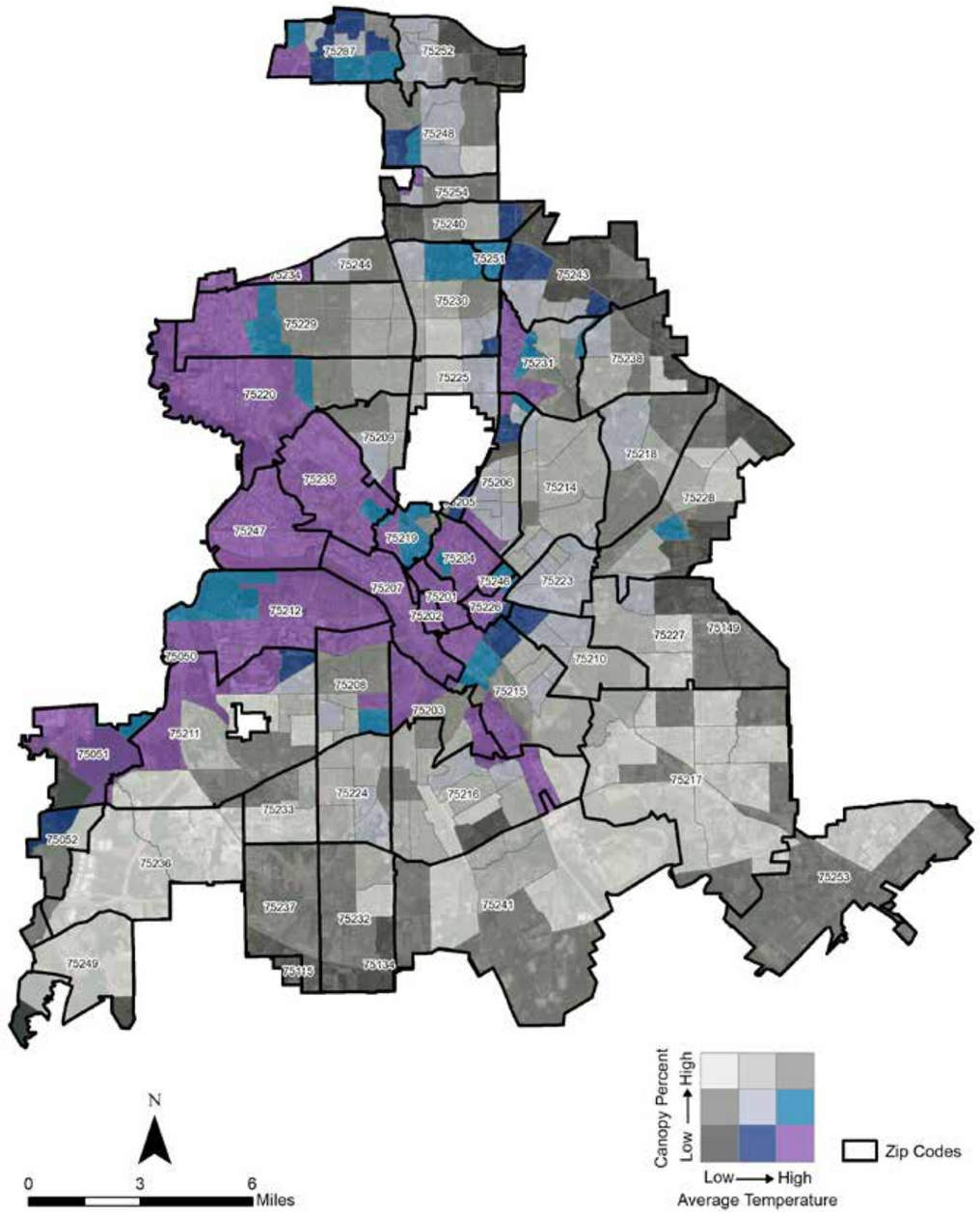


Figure 16. Areas of high electricity spending and low canopy cover by Zip Code

Areas shaded in purple and blue are those that have low to moderate tree canopy cover and moderate to high electricity spending. Research from the U.S. Department of Energy finds that properly placed trees around homes can reduce air conditioning costs.

Data Sources: ESRI Living Atlas (2019) and Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)

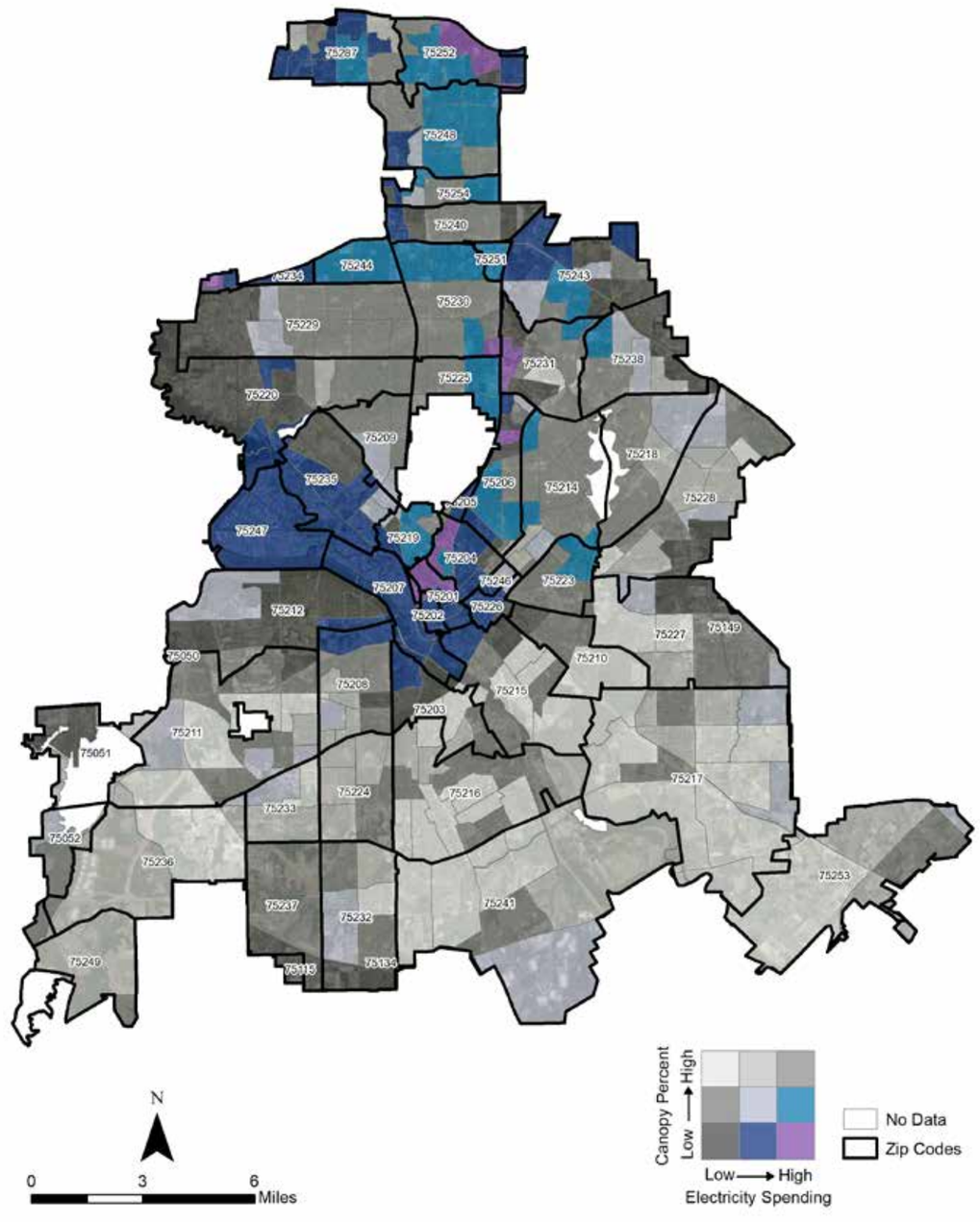
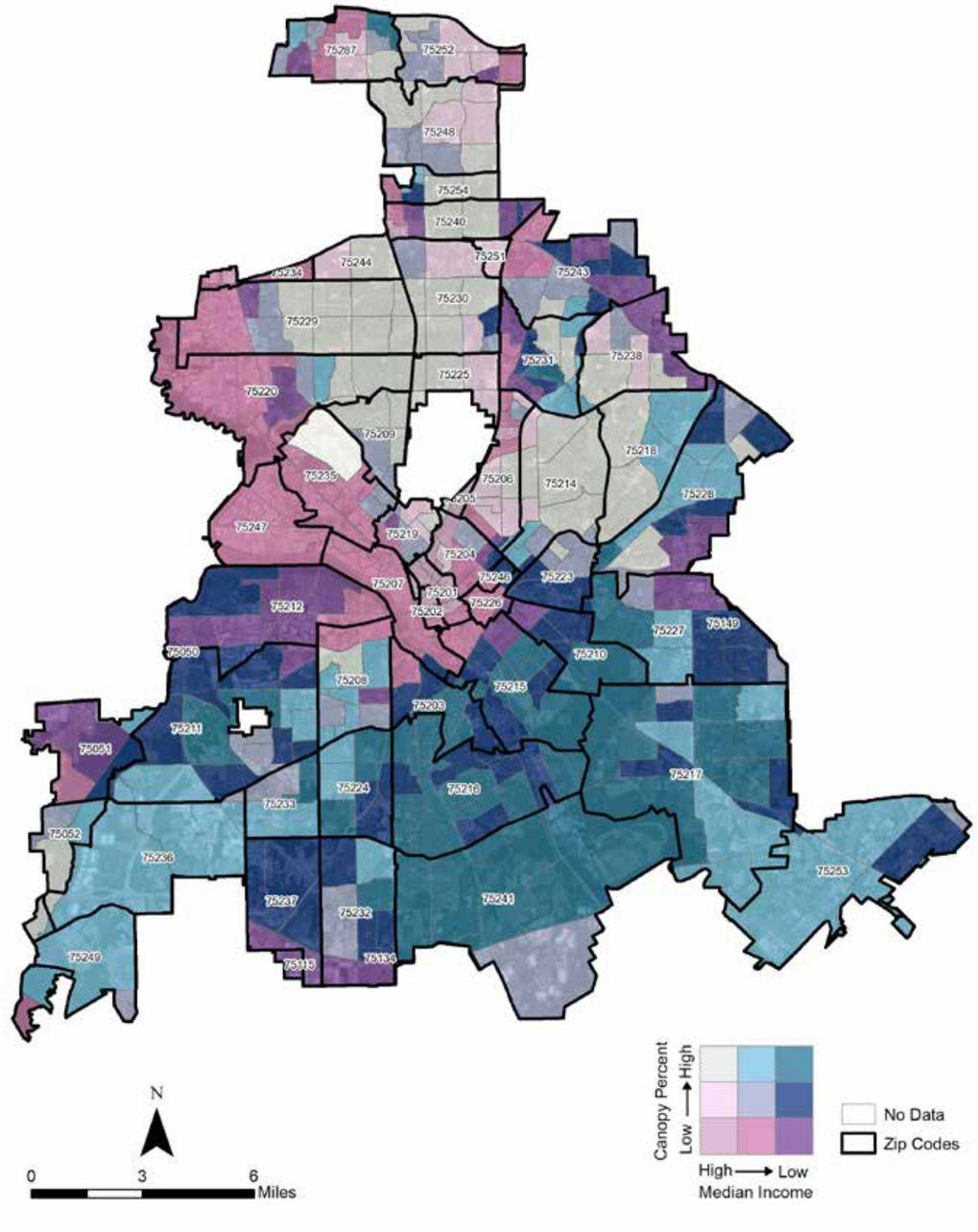


Figure 19. Median household income and tree canopy cover

Data Sources: US Census Bureau (2018);
Texas Trees Foundation Urban Tree Canopy Assessment Update (2019)



APPENDIX B: ORDINANCE REVIEW

	Addressed (YES/NO)	Chapter & Section	Comments
CREDENTIALS			
Requires Certified Arborist for paid private tree work	YES	Article X, Chapter 51A, Section 51A-10.135	If tree work is part of a development project (tree protection plans, inspection of preservation trees, legacy tree plantings, forest stand delineation, soil resource assessment, or landscape plan)
Requires Certified Arborist for public tree work	NO		
Requires licensing of private tree care firms	YES	Article X, Chapter 51A , Section 51A-10.135	For development projects, consulting arborist or licensed landscape architect must provide forest stand delineation, landscape plan, soil resource assessment.
Defines official authority for public tree management	YES	Chapter 48, Section 48-1	Park board has authority over trees within highways and city streets.
PUBLIC TREE MANAGEMENT AND PROTECTION			
Establishes/Authorizes City Forester to regulate public trees	YES	Chapter 48, Section 48-2	City Forester appointed by park board. City forester oversees the maintenance of public trees.
Establishes/Authorizes City position (e.g. Mayor, City Administrator, DPW Director) to regulate public trees	YES	Chapter 48, Section 48-1	Park board regulates public trees.
Requires annual community tree work plans	NO		
Identifies formula for determining monetary tree value	YES	Article X, Chapter 51A, Section 51A-10.135	Value of trees for payment into the Reforestation Fund is established based on the Guide for Plant Appraisal.
Establishes responsibility for public tree maintenance (e.g. City, adjacent property owner)	YES	Chapter 48, Section 48-11	Adjacent property owners are responsible for maintenance of ROW (parkway) trees
Requires regular public tree maintenance	NO		
Requires particular types of maintenance (e.g., pruning)	YES	Article X, Chapter 51A, Section 51A-10.136	For development projects, trees on City property have to be established and maintained according to ANSI A300 standards and ISA Best Management practices.
Establishes permit system for work on public trees	YES	Chapter 48, Section 48-4	Permits are required to plant, prune, remove tree along streets and “public highways.”
Establishes provisions for penalties for non-compliance	YES	Article X, Chapter 51A, Section 51A-10.127	During development, if landscape plan is not installed, property owner is given a civil penalty.
Restricts tree removal on public property	YES	Article X, Chapter 48, Section 48-4	Permits are required to remove tree on streets or “public highway.”
Requires permit or approval for tree removal, pruning or excavating near public trees	YES	Article X, Chapter 51A, Section 51A-10.132	Private development projects near public trees need permits for tree removals and excavation.
Prohibits damage to public trees (e.g. attaching ropes, signs, wires, chemicals, storing materials, excavation etc.)	YES	Chapter 48, Section 48-9, Section 48-10	Unlawful to injure a tree or allow the discharge of oil, brine or harmful substances on trees.
Restricts burning of solid wood waste	NO		

	Addressed (YES/NO)	Chapter & Section	Comments
PUBLIC TREE MANAGEMENT AND PROTECTION (Continued)			
Establishes a wood utilization program	NO		
Establishes an insect/disease control strategy	NO		
Defines tree maintenance requirements on public property	Limited	Article X, Chapter 51A, Section 51A-10.136	Only under Development Code, Chapter 51A, Article X. Does not apply to general ROW or public property maintenance.
Prohibits tree topping	Limited	Article X, Chapter 51A, Section 51A-10.136	Only under Development Code, Chapter 51A, Article X. Does not apply topping of ROW or other public property outside of development.
Regulates abatement of high risk or public nuisance trees	NO		
Regulates removal of dead or diseased trees	YES	Chapter 48, Section 48-11	Property owner’s responsibility to remove diseased or dead trees in parkway abutting the property. Parks department issues removal notices.
TREE PLANTING			
Regulates tree species which may or may not be planted on private property (approved tree list)	YES	Article X, Chapter 51A, Section 51A-10.125	For development sites, tree species planted must be from approved list.
Requires tree planting around reconstructed parking lots	YES	Article X, Chapter 51A, Section 51A-10.125	Trees are required in different types and sizes of parking lots.
Requires replacement of removed publicly owned trees	Limited	Article X, Chapter 51A, Section 51A-10.134	Only under Development Code, Chapter 51A, Article X. Chapter 48 prohibits removal but does not require replacement.
Requires tree plantings around new parking lots	YES	Article X, Chapter 51A, Section 51A-10.125	Trees are required in the construction of surface parking lots.
Requires tree plantings around new developments	YES	Article X, Chapter 51A, Section 51A-10.125	Trees are required in development projects of different sizes.
Regulates tree species which may or may not be planted on public property (approved tree list)	YES	Article X, Chapter 51A, Section 51A-10.103	Director shall maintain approved species list.

	Addressed (YES/NO)	Chapter & Section	Comments
TREE PROTECTION AND PRESERVATION			
Restricts tree removal on private property	YES	Article X, Chapter 51A, Section 51A-10.131, Section 51A-10.132	Tree removal permits required for protected trees, except single family or duplex lots < 2 acres. Tree Overlay district or planned development districts have different preservation regulations.
Requires permit or approval for tree removal on private property	YES	Article X, Chapter 51A, Section 51A-10.131, Section 51A-10.132	Tree removal application is required for development projects and on properties greater than 2 acres.
Requires preservation of trees during development on private property	NO	Article X, Chapter 51A, Section 51A-10.131, Section 51A-10.132	Article X encourages tree preservation but does not require it. Mitigation fees are charged for the removal of protected trees and penalties are assessed if protected trees are removed without a permit. Landscape design points can be gained through tree preservation.
Encourages preservation of trees during development on private property	YES	Article X, Chapter 51A, Section 51A-10.126	For a building site, property owner has option to preserve trees to earn landscape design points.
Prohibits damage to preserved/ protected trees	YES	Article X, Chapter 51A, Section 51A-10.123, Section 51A-10.136	In development projects, trees must be protected from damage during construction. Trees must be replaced if damaged during construction.
Prohibits damage or removal of trees on another person's property	YES	Chapter 48, Section 48-9	It is unlawful to damage or destroy tree on another person's property.
Requires inventory of trees on site	NO	Article X, Section 51A-10.132	Trees that are 20 feet or greater from the proposed construction activity proposed to be preserved do not need to be surveyed. Review comment: How is it known if a preserved tree was removed if not on original survey?
Requires identification of forests/ woodlands	YES	Article X, Section 51A-10.132	A forest stand, delineation stand, and landscape plan, including natural features and areas is required before building permit is issued.
Establishes responsibility for public tree maintenance (e.g. City, adjacent property owner)	YES	Chapter 48, Section 48-11	Adjacent property owners are responsible for maintenance of ROW (parkway) trees.
Specific species and/or size tree regulated (e.g. heritage/significant trees)	YES	Article X, Chapter 51A, Section 51A-10.132, 51A-10.133, 51A-10.134	Significant and historic trees are defined separately. Mitigation for historic trees is 3:1. Mitigation for significant trees is 1.5: 1. Historic trees must be approved by director.
Requires location of Critical Root Zone/ Dripline	YES	Article X, Chapter 51A Section 51A-10.136	Tree protection fences must be located at drip line or edge of critical root zone, whichever is farthest from trunk. Building official approves tree protection fence location.
Minimum canopy coverage requirement set	YES	Article X, Chapter 51A Section 51A-10.135	There are canopy cover goal percentages for developments based off of use type (residential, mixed use, commercial and freeways, industrial, parkways).
Identification of riparian buffers, natural areas, preservation zones	YES	Chapter 51A, Article X, Section 51A-10.135; Texas Pollutant Discharge Elimination System (TPDES) permit; Article IX, Chapter 19, Section 19-118.6	Article X: For development projects, a conceptual landscape plan must be provided identifying riparian buffers, natural areas, and preservation zones. TPDES permits require a minimum buffer along streams for all construction sites that disturb >1 acre or are within ¼ mile of other construction. Regulations restated in Chapter 19, Article IX.
Requires tree protection fencing	YES	Article X, Chapter 51A, Section 51A-10.136	Tree protection fencing required at development sites. However, it can be moved into the CRZ or dripline at the direction of the "Building Official" and not a City Arborist
Location/type of other tree protection measures (e.g. root pruning, aeration, vertical mulching, soil protection) on development plans	YES	Article X, Chapter 51A, Section 51A-10.104	Soil resource plan needs to be submitted with landscape plan or tree protection plan.
Provides credits/incentives for tree preservation	YES	Article X, Chapter 51A, Section 51A-10.125, Section 51A-10.126	Landscape credits

	Addressed (YES/NO)	Chapter & Section	Comments
TREE PROTECTION AND PRESERVATION (Continued)			
Landscape plan with proposed landscaping to be planted	YES	Article X, Chapter 51A, Section 51A-10.104	A conceptual landscape plan is required before building permit is issued.
Requires grading plan to include protected/preserved trees	NO		Sustainable Development incentives outlined in Article X, Chapter 51A, Section 51A-10.135(d) mentions grading activities around preserved trees must be planned to limit disturbance.
Utility plan with trees to include protected/preserved trees	NO		Sustainable Development incentives outlined in Article X, Chapter 51A, Section 51A-10.135(d) mentions that utility easements should be designed and located to minimize impacts to preserved trees.
Tree planting requirements for removal of regulated trees	YES	Article X, Chapter 51A, Section 51A-10.134	
Fee in lieu of planting mitigation trees	YES	Article X, Chapter 51A, Section 51A-10.135	Mitigation requirements may be met via payment into Reforestation Fund.
Tree mitigation survival requirements	YES	Article X, Chapter 51A, Section 51A-10.135	Planting and soil requirements for installation of trees.
Fine for removal of regulated trees	YES	Article X, Chapter 51A, Section 51A-10.139	A person can be fined $2,000 for violations, such as removing or injuring protected trees.
Penalties established for damage and removal of preserved/saved trees	NO	Article X, Chapter 51A, Section 51A-10.128	Stop Work Order issued for violation; monetary penalties not established.
Bonding utilized to discourage tree removals	NO		
Tree Fund	YES	Article X, Chapter 51A, Section 51A-10.135	Mitigation requirements may be met via payment into Reforestation Fund. Fifty percent of funds must be available for public plantings, acquirement of conservation easements or wooded property.

APPENDIX C: INDICATORS OF A SUSTAINABLE URBAN FOREST

THE TREES				
Indicators of a Sustainable Urban Forest	**Overall Objective or Industry Standard**	**Dallas: Current Performance Level**		
		Low	**Medium**	**High**
Urban Tree Canopy	Achieve the desired tree canopy cover according to goals set for the entire city and neighborhoods. Alternatively, achieve 75% of the total canopy possible for the entire city and in each neighborhood.		MEDIUM-HIGH: City urban tree canopy goal recently established as part of 2020 CECAP. Canopy cover is trending upward.	
Location of Canopy (Equitable Distribution)	Achieve low variation between tree canopy and equity factors citywide and by neighborhood. Ensure that the benefits of tree canopy are available to all, especially for those most affected by these benefits.	LOW: Tree canopy is not equitably distributed. Nearly half of all the city's tree canopy is in the Great Trinity Forest.		
Age of Trees (Size and Age Distribution)	Establish a diverse-aged population of public trees across the entire city and for each neighborhood. Ideal standard: 0-8" DBH: 40% 9-17" DBH: 30% 18-24" DBH: 20% Over 24" DBH: 10%	LOW: No current information available. A comprehensive inventory of Dallas right-of-way and park trees has not been conducted.		
Condition of Publicly Owned Trees (trees managed intensively)	Possess a detailed understanding of tree condition and potential risk of all intensively-managed, publicly-owned trees. This information is used to direct maintenance actions.	LOW: No current information available. A comprehensive inventory of Dallas right-of-way and park trees has not been conducted.		
Condition of Publicly-Owned Natural Areas (trees managed extensively)	Possess a detailed understanding of the ecological structure and function of all publicly-owned natural areas (such as woodlands, ravines, stream corridors, etc.), as well as usage patterns.	LOW-MEDIUM: Some natural area surveys have been completed.		
Trees on Private Property	Possess a solid understanding of the extent, location and general condition of trees on private lands.	LOW: No data available on private trees.		
Diversity	Establish a genetically diverse population of publicly-owned trees across the entire city and for each neighborhood. Tree populations should be comprised of no more than 30% of any family, 20% of any genus, or 10% of any species.	LOW: No current information available. A comprehensive inventory of Dallas right-of-way and park trees has not been conducted.		
Suitability	Establish a tree population suited to the urban environment and adapted to the overall region. Suitable species are gauged by exposure to imminent threats, considering the "Right Tree for the Right Place" concept and invasive species.	LOW-MEDIUM: Some information on tree species from 2014 i-Tree Eco study, but no species information on street, right-of-way and park trees.		

THE PLAYERS				
Indicators of a Sustainable Urban Forest	**Overall Objective or Industry Standard**	**Dallas: Current Performance Level**		
		Low	**Medium**	**High**
Neighborhood Action	Citizens understand, cooperate, and participate in urban forest management at the neighborhood level. Urban forestry is a neighborhood-scale issue.		MEDIUM: Groups that promote urban forestry activities/tree planting active at the neighborhood level but not coordinated and lack unified goals/priorities.	
Large Private & Institutional Landholder Involvement	Large, private, and institutional landholders embrace citywide goals and objectives through targeted resource management plans.	LOW: Little or no involvement by large landholders in urban forestry		
Green Industry Involvement	The green industry works together to advance citywide urban forest goals and objectives. The city and its partners capitalize on local green industry expertise and innovation.		MEDIUM: Limited involvement on short-term projects	
City Department and Agency Cooperation	All city departments and agencies cooperate to advance citywide urban forestry goals and objectives.	LOW-MEDIUM: Lack coordinated effort between City departments that manage/maintain trees		
Funder Engagement	Local funders are engaged and invested in urban forestry initiatives. Funding is adequate to implement citywide urban forest management plan.		MEDIUM: Few funders are supporting environmental initiatives.	
Utility Engagement	All utilities are aware of and vested in the urban forest and cooperate to advance citywide urban forest goals and objectives.	LOW-MEDIUM: Lack of collaboration or coordination		
State Agency Engagement	State of Texas agencies are aware of city urban forestry goals and objectives and assist in achieving them.	LOW: Lack of engagement with state agenices		
Developer Engagement	The development community is aware of and vested in the urban forest and cooperates to advance citywide urban forest goals and objectives.	LOW: Conflicting priorities and perception that developers do not value trees		
Public Awareness	The general public understands the benefits of trees and advocates for the role and importance of the urban forest.	LOW-MEDIUM: Lack coordinated messaging and engagement		
Regional Collaboration	Neighboring communities and regional groups are actively cooperating and interacting to advance the region's stake in the city's urban forest.	LOW: Lack of a shared regional urban forestry vision		

THE MANAGEMENT				
Indicators of a Sustainable Urban Forest	**Overall Objective or Industry Standard**	**Dallas: Current Performance Level**		
		Low	**Medium**	**High**
Tree Inventory	Comprehensive, GIS-based, current inventory of all intensively-managed public trees to guide management, with mechanisms in place to keep data current and available for use. Data allows for analysis of age distribution, condition, risk, diversity, and suitability.	LOW: A comprehensive inventory of Dallas right-of-way and park trees has not been conducted.		
Canopy Assessment	Accurate, high-resolution, and recent assessment of existing and potential city-wide tree canopy cover that is regularly updated and available for use across various departments, agencies, and/or disciplines.			HIGH: Urban tree canopy assessment completed in 2019 (based on 2016 aerial imagery)
Management Plan	Existence and buy-in of a comprehensive urban forest management plan to achieve city-wide goals. Re-evaluation is conducted every 5 to 10 years.	LOW: No urban forest management plan exists.		
Risk Management Program	All publicly-owned trees are managed for maximum public safety by way of maintaining a city-wide inventory, conducting proactive annual inspections, and eliminating risks within a set timeframe based on risk level. Risk management program is outlined in the management plan.	LOW: Program has not been established; tree inventory risk data is not available.		
Maintenance Program of Publicly-Owned Trees (trees managed intensively)	All intensively-managed, publicly-owned trees are well maintained for optimal health and condition in order to extend longevity and maximize benefits. A reasonable cyclical pruning program is in place, generally targeting 5 to 7 year cycles. The maintenance program is outlined in the management plan.	LOW-MEDIUM: Park trees pruned on a cycle. Property owners responsible for maintenance of right-of-way trees. Routine maintenance not required		
Planting Program	Comprehensive and effective tree planting and establishment program is driven by canopy cover goals, equity considerations, and other priorities according to the plan. Tree planting and establishment is outlined in the management plan.	LOW-MEDIUM: Lack of systematic City street tree planting program. Branch Out Dallas offers trees for private property planting.		

THE MANAGEMENT (**Continued**)				
Indicators of a Sustainable Urban Forest	**Overall Objective or Industry Standard**	**Dallas: Current Performance Level**		
		Low	**Medium**	**High**
Tree Protection Policy	Comprehensive and regulary updated tree protection ordinance with enforcement ability is based on community goals. The benefits derived from trees on public and private property are ensured by the enforcement of exisitng policies.	LOW-MEDIUM: Article X Landscape and tree conservation ordinance		
City Staffing and Equipment	Adequate staff and access to the equipment and vehicles to implement the management plan. A high level urban forester or planning professional, strong operations staff, and solid certified arborist technicians.		MEDIUM: ISA Certified Arborists on staff; lack sufficient staff in some program areas.	
Funding	Appropriate funding in place to fully implement both proactive and reactive needs based on a comprehensive urban forest management plan.	LOW: Funding from public sources only		
Disaster Preparedness & Response	A disaster management plan is in place related to the city's urban forest. The plan includes staff roles, contracts, response priorities, debris management and a crisis communication plan. Staff are regularly trained and/or updated.	LOW: City lacks a disaster management plan for the urban forest.		
Communication	Effective avenues of two-way communication exist between the city departments and between city and its citizens. Messaging is consistent and coordinated, when feasible.	LOW: Lack of a coordinated public outreach program and internal communication process		
Best Management Practices/ Standards	Comprehensive manual of tree care, planting and maintenance best management practices and standards for use by city staff, contractors, residents, developers or anyone engaged in tree related activities.		MEDIUM: Some documented standards exist but not in a consolidated manual.	

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