

Midtown Management District

# BALDWIN PARK

## URBAN FORESTRY MANAGEMENT PLAN



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# EXECUTIVE SUMMARY

Elizabeth Baldwin Park has beautiful, sprawling live oak trees over 100 years old that provide a variety of benefits for the surrounding community. It is the testing ground for the analysis and inventory of urban forestry within the Midtown District. This plan provides a framework for understanding how Midtown can help the City of Houston achieve their goal set through the Houston Climate Action Plan. Using data backed by leading online tree analysis software, i-Tree, this document illustrates the development of specific goals for the Midtown District.

The Baldwin Park Urban Forestry Management Plan evaluates the health of the existing urban forest within the park and documents the types, species, condition, and general distribution of trees throughout the site. At the time the study was completed, the District did not have a comprehensive tree preservation ordinance nor a comprehensive plan to preserve, expand, or manage the urban forest. As the District population grows, there is increased interest from the community to preserve the urban forest present, find opportunities to plant new trees, and manage or replace trees that are of age and/or that create hazards.

The eight data points captured included; Species, Land Use (Street tree, Park, etc), DBH (Diameter at breast height), % Dieback, Crown height (ft), Height to Crown Base, Crown width N/S, Crown width E/W. Capturing this data required multiple days of field inventory work to understand the full condition of the trees within the park. Based on the findings of the Baldwin Park investigation, it is clear the tree canopy is dominated by Live Oak - *Quercus virginiana*.

Midtown is in a prime position to lead the charge in Houston of developing and accomplishing the City's urban forestry goals that ensure long term health and vitality of one of the most underrated assets in any city - the urban forest. With further exploration and analysis, Midtown can drastically improve their position and knowledge in the City of Houston by not only understanding the importance of this infrastructure, but leveraging the tools made available in this study to make the largest, sustained impact of central Houston's urban forest. This document is an example of how a single park assessment can be applied and replicated across the entire district.





# INTRODUCTION

One of the oldest parks in Houston, Elizabeth Baldwin Park, is a 5 Acre Park that was acquired by the City of Houston in 1905. The park has been a place for refuge for people, mammals, and birds alike with sprawling live oak trees over 100 years old that provide dense shade for human comfort, habitat for animals, and protection from severe weather events. It is set as the testing ground for the analysis and inventory of urban forestry within the Midtown District. This plan will provide a framework for understanding how Midtown can help the City of Houston achieve their goal set through the Houston Climate Action Plan to plant 4.6 million new trees by 2030. Using data backed by leading online tree analysis software, i-Tree, this document illustrates the importance of developing specific goals for the Midtown District to allow, among other things, their urban forest to capture carbon, decrease stormwater runoff, increases air quality, and provides the greatest ecological benefit.

The large, picturesque Live Oaks seen today at Baldwin Park are believed to be over 100 years old. Balancing the needs to preserve the historic nature of the park and increase the function and safety of the beautiful Live Oaks on site is the number one priority. Baldwin Park is a critical environmental resource in Midtown; one worth protecting the legacy of for centuries to come so residents and visitors alike can enjoy this historic park in the heart of the Midtown District.

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# PROJECT GOALS & HISTORY

The City of Houston has implemented a Climate Action Plan with a goal of planting 4.6 Million new trees by 2030. The Baldwin Park Urban Forestry Master Plan was used to evaluate the health of the existing urban forest within the park and document the types, species, condition, and general distribution of trees throughout the site. In this case, Elizabeth Baldwin Park was used as a launching point to understand the tools available to properly inventory and assess trees within the context of the larger district so that strategies can be developed and replicated for the Midtown District at large.

At the time this study was completed, the District did not have a comprehensive tree preservation ordinance nor a comprehensive plan to preserve, expand, or manage the urban forest, which resulted in canopy loss and missed opportunities for the urban forest to perform a bigger job throughout the District. As the District population grows and the general consensus that climate change is upon us, there appears to be increased interest from the community to preserve the urban forest we have, find opportunities to plant new trees throughout the District, and manage or replace trees that are of age and species that create hazards for the residents and visitors of Elizabeth Baldwin Park.

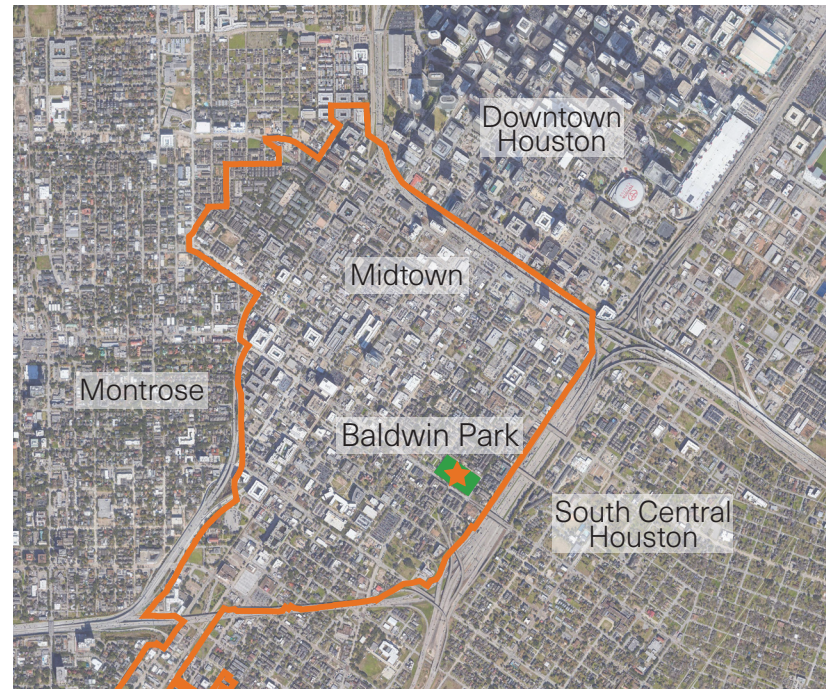


# CONTEXT AND GOALS

## Project Goal

Document the existing conditions and performance of the trees on site at Elizabeth Baldwin Park to better inform a maintenance strategy and a vision for the future of Midtown's Urban Forestry Plan.

The Midtown District has an opportunity to develop a plan and goals for how the urban forest within Midtown looks and functions. This booklet is an introduction to the inventory and analysis tools available today, so that it can be replicated throughout all of Midtown and Houston. Meant to educate members of the management team on the values that trees can provide and potential steps to take to lead Midtown to a more resilient and diverse tree canopy; an important piece to establishing obtainable goals moving forward.



## HOW DO OTHER CITY'S COMPARE?

Many cities around the United States have implemented canopy coverage goals with an average increase in canopy cover at 55%.

City, State	Initial Canopy Cover Level		Canopy Cover Goal	
	UTC Cover	Year Assessed	UTC Cover	Target Date
Annapolis, MD	42.0%	2006	50%	30-year plan (2036)
Atlanta, GA	47.9%	2008	Increase	Ongoing
Austin, TX	32.0%	2006	40%	Ongoing
Baltimore, MD	20.0%	2007	40%	2036
Boston, MA	29.0%	2006	49%	10-year plan (2016)
Chicago, IL	17.2%	2007	25%	Ongoing
Denver, CO	16.4%	2010	31%	20-year plan (2025)
Detroit, MI	22.5%	2008	40%	Ongoing
Indianapolis, IN	13.8%	2008	19%	10-year plan (2018)
Las Vegas, NV	8.6%	2012	20%	2035
Leesburg, VA	27.0%	2006	40%	25-year plan (2031)
Los Angeles, CA	21.0%	2006	28%	2040
Milwaukee, WI	21.6%	2008	40%	Ongoing

# WHY ARE TREES IMPORTANT?

## Environmental Benefits



Air Pollution Removal

Noise Pollution Reduction



Water Quality Enhancement

Carbon Sequestration



Rainfall/Stormwater Interception

Flood Mitigation



Urban Heat Island Mitigation

Shading/Reducing Energy Usage



Controlled Channel Erosion

Habitat Provided for Wildlife

## Social Benefits



Crime Reduction

Traffic Calming

Increase Public Health

## Economic Benefits



Increased Property Value

Improved Retail Business

Enhanced Rental Rates

Infrastructure Cost Savings

# WHAT IS HARMING OUR TREES?

## Threats



Development



Drought



Climate Change



Soil Compaction



Invasive Species

Pest and Disease



Nursery Availability



# WHAT IS URBAN FORESTRY?

## DEFINITION

Urban Forestry is the management of publicly and privately owned trees in and adjacent to urban areas. Urban forests include many different environments, such as city greenbelts, street and utility right-of-way, forested watersheds, and residential, commercial, and industrial property. The difference in rural and urban forestry is that urban trees are more valued than rural trees and often receive expensive individual care and attention.

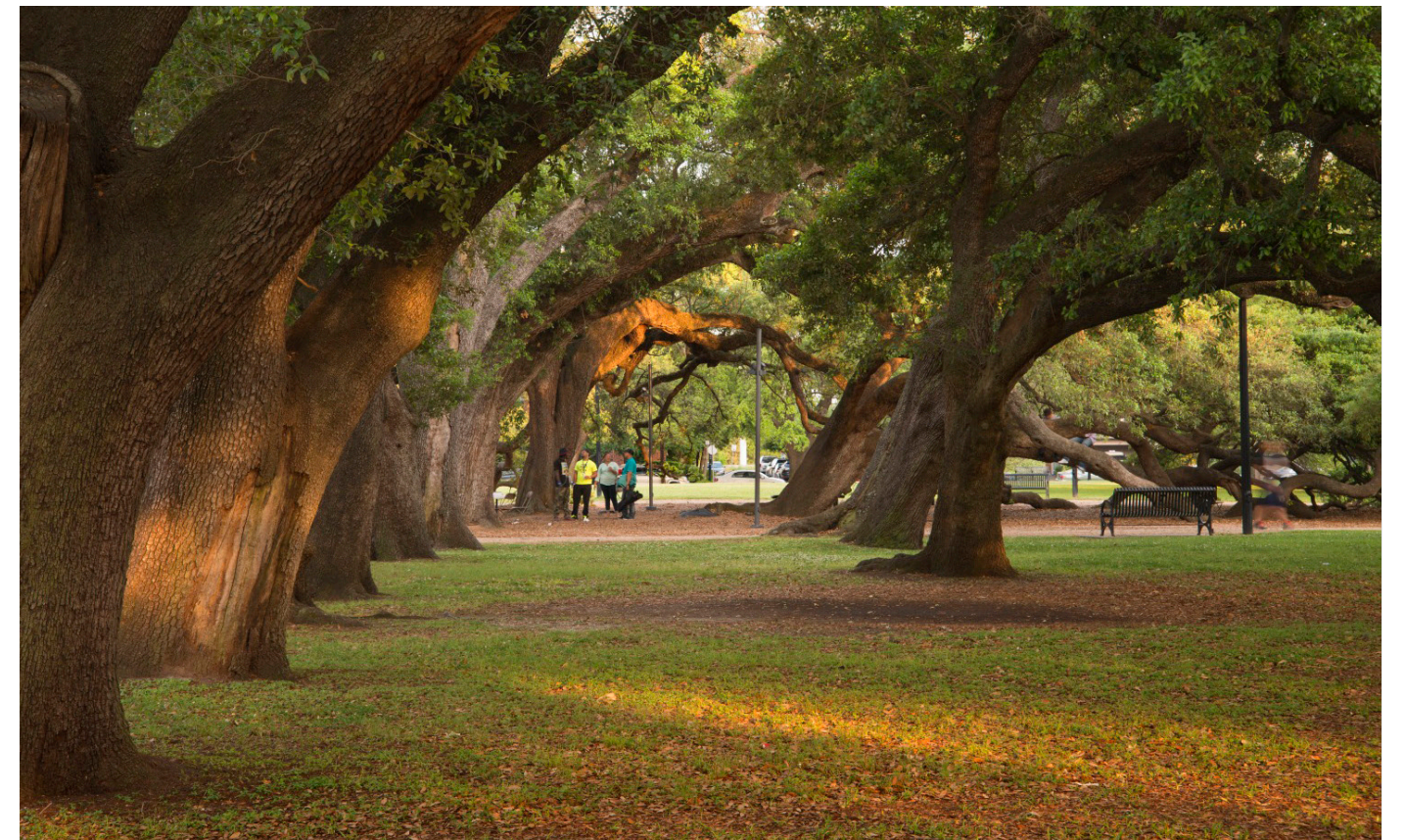
## HISTORY

Urban Forest pressure built towards a management concept in the 1930's as diseases were introduced to trees, such as dutch elm, phloem necrosis, and oak wilt but the concept of Urban Forestry did not emerge until the mid-1960's. Urban tree management was previously limited and centered around the concept of an individual tree over the concept of an integrated management of the whole urban forest ecosystem. It was not recognized by name in the United States until 1978; when the Cooperative Forestry Assistance Act officially recognized that urban and community forests "improve the quality of life for residents; enhance the economic value of residential and commercial property; improve air quality, reduce the buildup of carbon dioxide, mitigate heat island effect in urban areas, and contribute to the social well-being and sense of community". This was the first time the U.S. government allocated federal funds to cultivate and maintain city trees. Since the Cooperative Forestry Assistance Act was established, research has proved that maintaining and growing urban forests creates aesthetic, economic, and environmental benefits to all Americans.



## URBAN FORESTRY BEST PRACTICES

- Planting strategies for public sites that deliver benefits to neighborhoods where needed
- Policies and incentives that promote tree preservation and planting on private lands
- Systematic monitoring
- Regular, scheduled maintenance
- Pro-active risk assessment and management
- Long-term funding and staffing
- Active support from municipal agencies, volunteers, non-profits
- Disaster response, mitigation and remediation





# EXISTING CONDITIONS

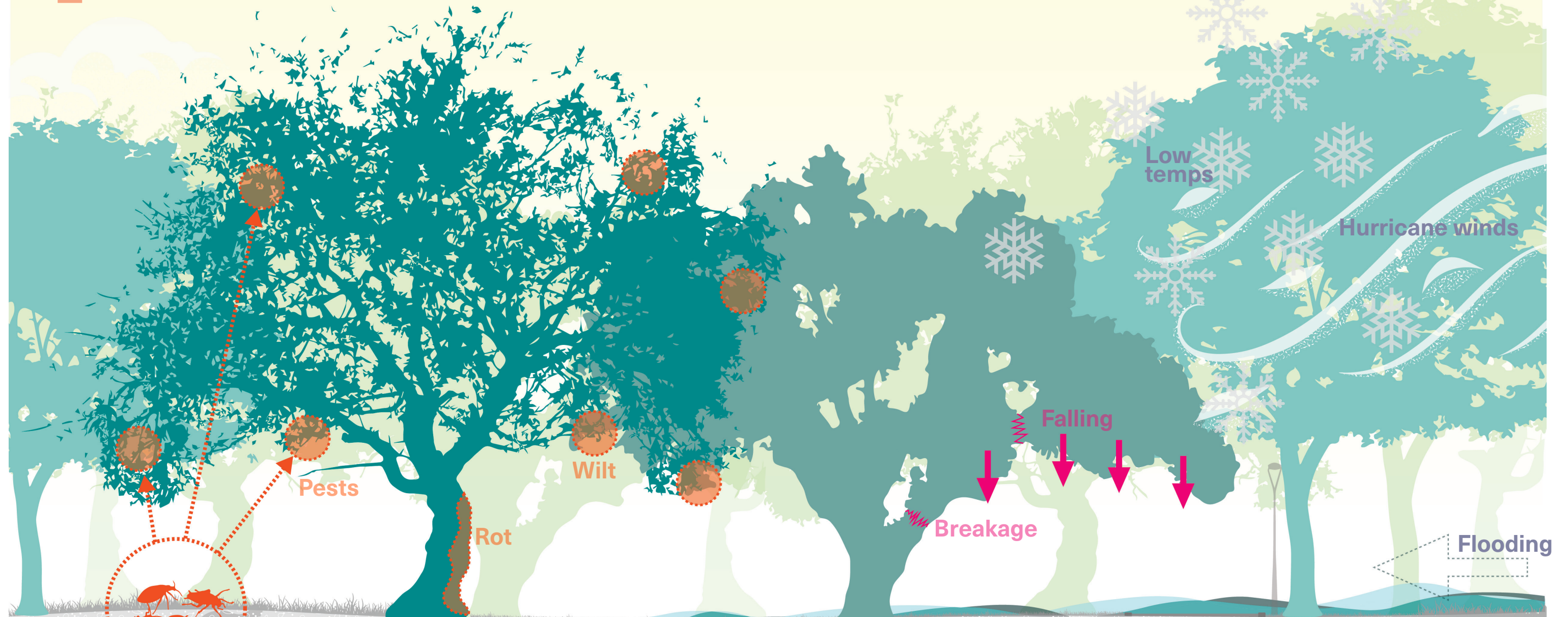
## CONFLICTS WITH TREES

### 1 LACK OF DIVERSITY

Without a diversity of tree species, pest and disease can create disastrous circumstances that can wipe out a majority of tree population. In the Houston area, the current invasive threats include the Chinese tallow tree, oak wilt, Emerald Ash Borer and Southern Pine Beetle.

### 3 EXTREME WEATHER

Houston is prone to many natural disasters such as flooding, hurricanes, tornadoes, extreme heat, and freezing temperatures. A plan and appropriate funds are needed to account for unforeseen disasters that can affect more of the District's urban forest than accounted for.



### 2 GROWTH MANAGEMENT

Aging trees and failing limbs may have extreme risks to pedestrians and higher maintenance costs. It is the responsibility of the management district to ensure correct planting methods and the proper removal and replacement of failing trees.



# REGULAR MAINTENANCE & CARE PROMOTES THE HEALTH OF TREES



## 1 FUNDING & BUDGETING

Identifying funding sources can be a challenge as a need for tree planting, public awareness and volunteer training increases. Exploring different opportunities for funding can create a fund to continue growing and developing the tree planting program.

## 3 SAFETY MONITORING

Trees can present public safety hazards if planted incorrectly or enter into the end of their life span. Continued monitoring increases the health and safety of nearby pedestrians and trees alike, while also reducing overall costs.



## 2 MAINTENANCE

Maintenance of trees can come at a great expense to the management district. It is important to ensure that proper funds are allocated to plan for regular maintenance and pruning so that the greatest amount of benefits are received from each tree planted in the future and existing today.

## 4 PUBLIC ENGAGEMENT

Public relations and community education is essential to increase support for tree planting. When possible, the District should host public meetings to increase understanding and knowledge of the benefits that trees can provide.





## SITE INVENTORY & ANALYSIS

The Design Workshop team initiated the project by completing an inventory and analysis of the existing conditions of Elizabeth Baldwin Park. This inventory and analysis included documenting, recording, and cataloging all tree species within the park by measuring each tree's DBH (Diameter at Breast Height), height to top of canopy, height to bottom of canopy, width, and canopy health conditions.

By integrating this information into a tree software called i-Tree, the design team was able to further analyze the baseline conditions to better understand what benefit the trees in the park are providing today. This i-Tree software includes a variety of tools and applications that detail the benefits of existing trees today based on the inventory collected. In addition, this software can model how new trees and new species will grow and survive over a period of 100 years, while detailing the projected benefits that will be provided from each tree within the geographic location of Elizabeth Baldwin Park.

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# TOOLS & METHODOLOGY

Resources such as the 2004 Midtown Tree Inventory; which took sample plots throughout Midtown, and a site survey were collected and studied at project kick off. A site assessment was then conducted to verify the location and relative size of all trees within the park as shown in these documents. Further attention was given to the health, characteristics, habitat, and function.

The tools used to assist in the inventory of Baldwin Park created a wholistic view of the conditions today. Eight data points for each tree were measured and tracked through an ID system that assigned each tree a geolocation and a corresponding number. Capturing this data required multiple days of field inventory work to understand the full condition of the trees within the park. The eight data points captured included; Species, Land Use (Street tree, Park, etc), DBH, % Dieback, Crown height (ft), Height to Crown Base, Crown width N/S, Crown width E/W.

## TREE CALLIPER MEASURE (DBH)

Tree diameter breast height is measured at 4.5 feet above ground.



## 200' TAPE MEASURE

Used to measure the canopy width from North to South and East to West.



## NIKON FORESTRY PRO II

This tool was used to capture total tree height and from base of canopy to top of crown height.



## I-TREE DESIGN

A full-featured web tool with forecasting for estimating the benefits of individual trees.



## I-TREE ECO

i-Tree's flagship tool for tree inventory import or field data evaluation to derive individual tree benefit estimates.



## CERTIFIED ARBORIST

Bartlett Tree Experts assisted Design Workshop in evaluating and recommending maintenance for trees on site today.



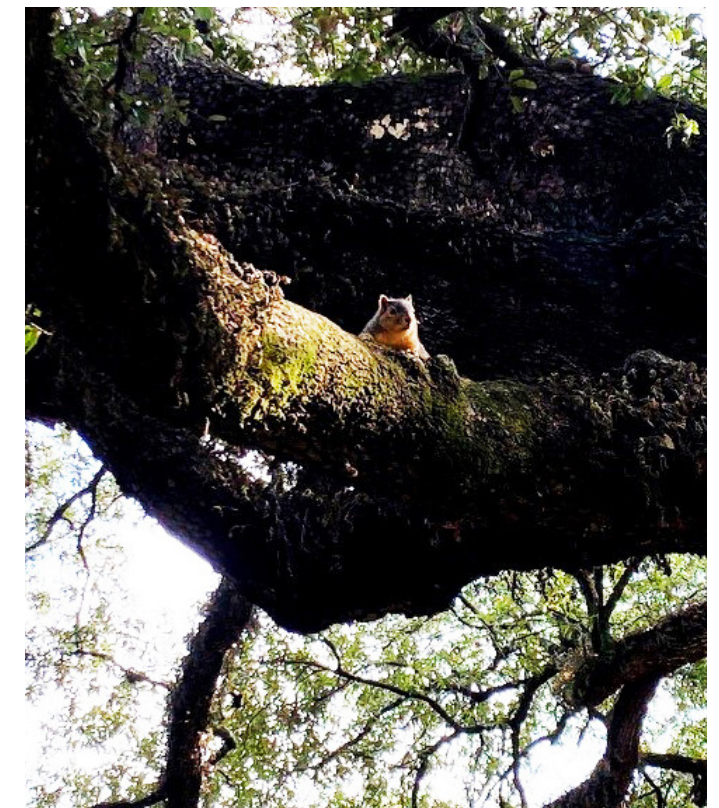
Canopy Width Measurements of an Existing Live Oak



Sprawling Live Oaks Branches Growing into the Ground



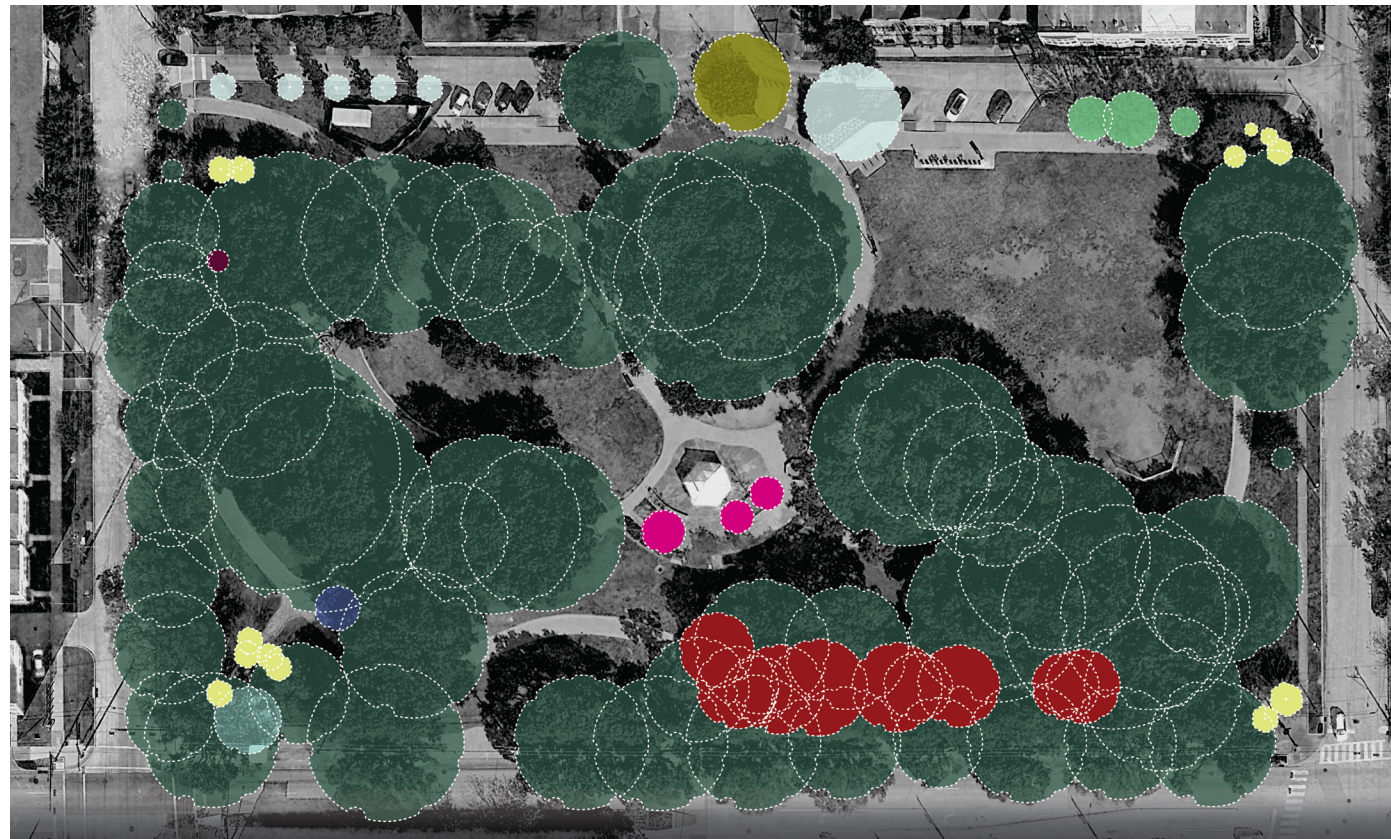
Tree Growth around a Tree Stake



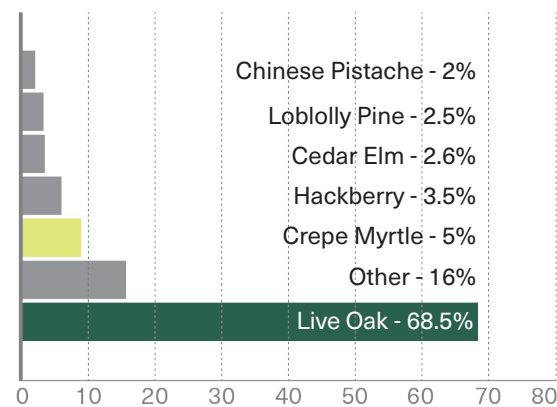
Baldwin Park is Essential for Wildlife



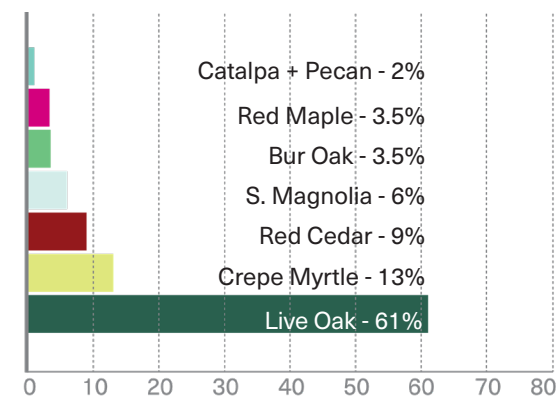
# INVENTORY MAPPING



2004 Midtown District Inventory



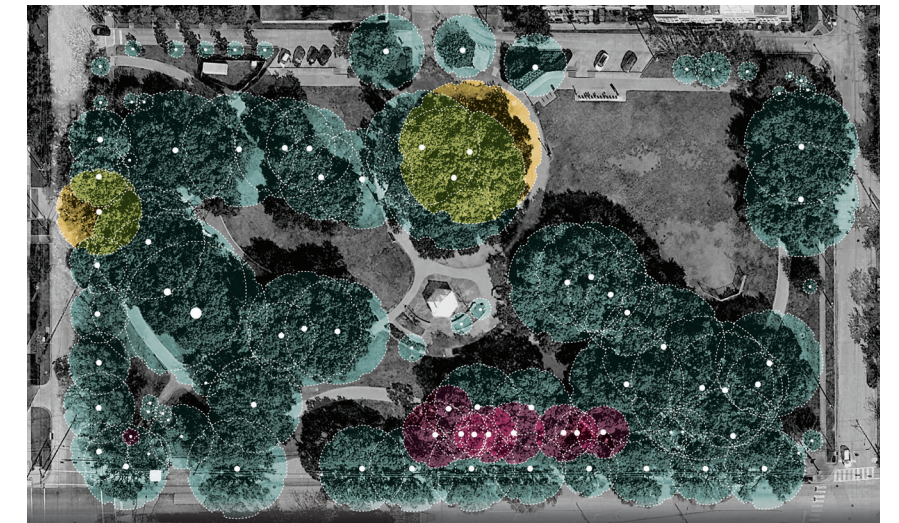
2023 Baldwin Park Inventory



Based on the findings of the Baldwin Park investigation, it is clear the tree canopy is dominated by Live Oak - *Quercus virginiana*. This is consistent with findings from the previously completed 2004 study, where Live Oaks made up more than 68% of the urban tree canopy.

## Dead or Removed

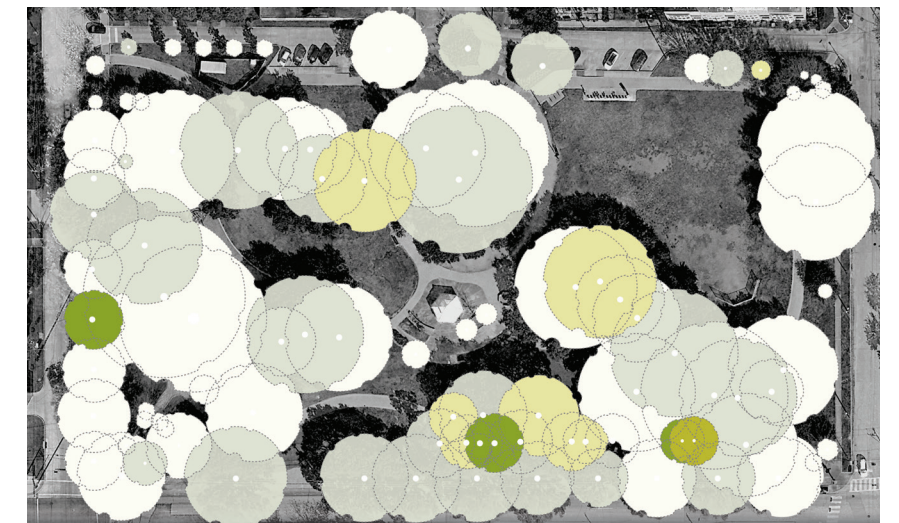
Majority of the trees within Baldwin Park today are in fair or good condition. However, some tree species have been more affected than others. The Red Cedars on site have been dramatically more affected than other species.



Safe Damaged Dead / Removed

## Canopy Loss

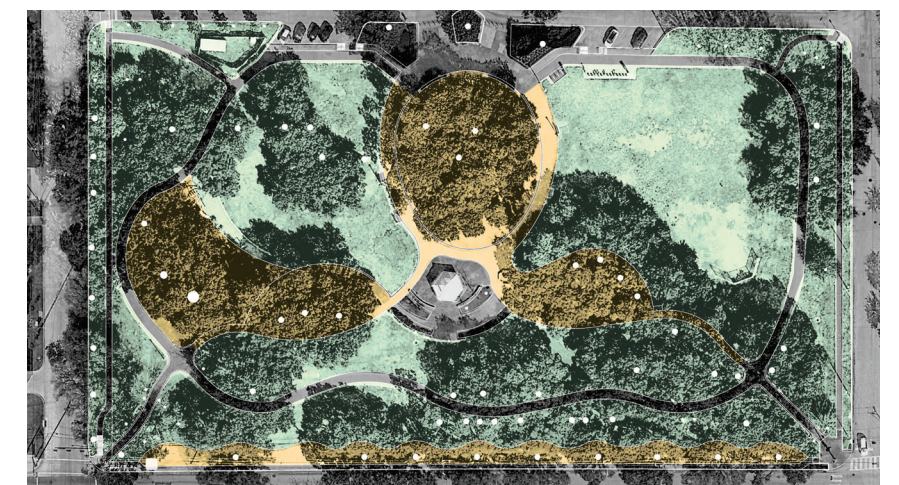
Tree Canopy loss can be caused by conflicts with utilities, a group of trees growing in close proximity with each other, and the conditions of the soil below. Trees have a tendency to compete with each other resulting in one outperforming the other.



81-100% 61-80% 41-60% 21-40% 11-20% 0-10%

## Ground Materials

The ground materials throughout the park can impact a trees health. The growing conditions of a tree depend on the health and quality of the soil it is planted in. Turf can cause trees to receive too much nutrients and decomposed granite can inhibit the trees from receiving enough nutrients.

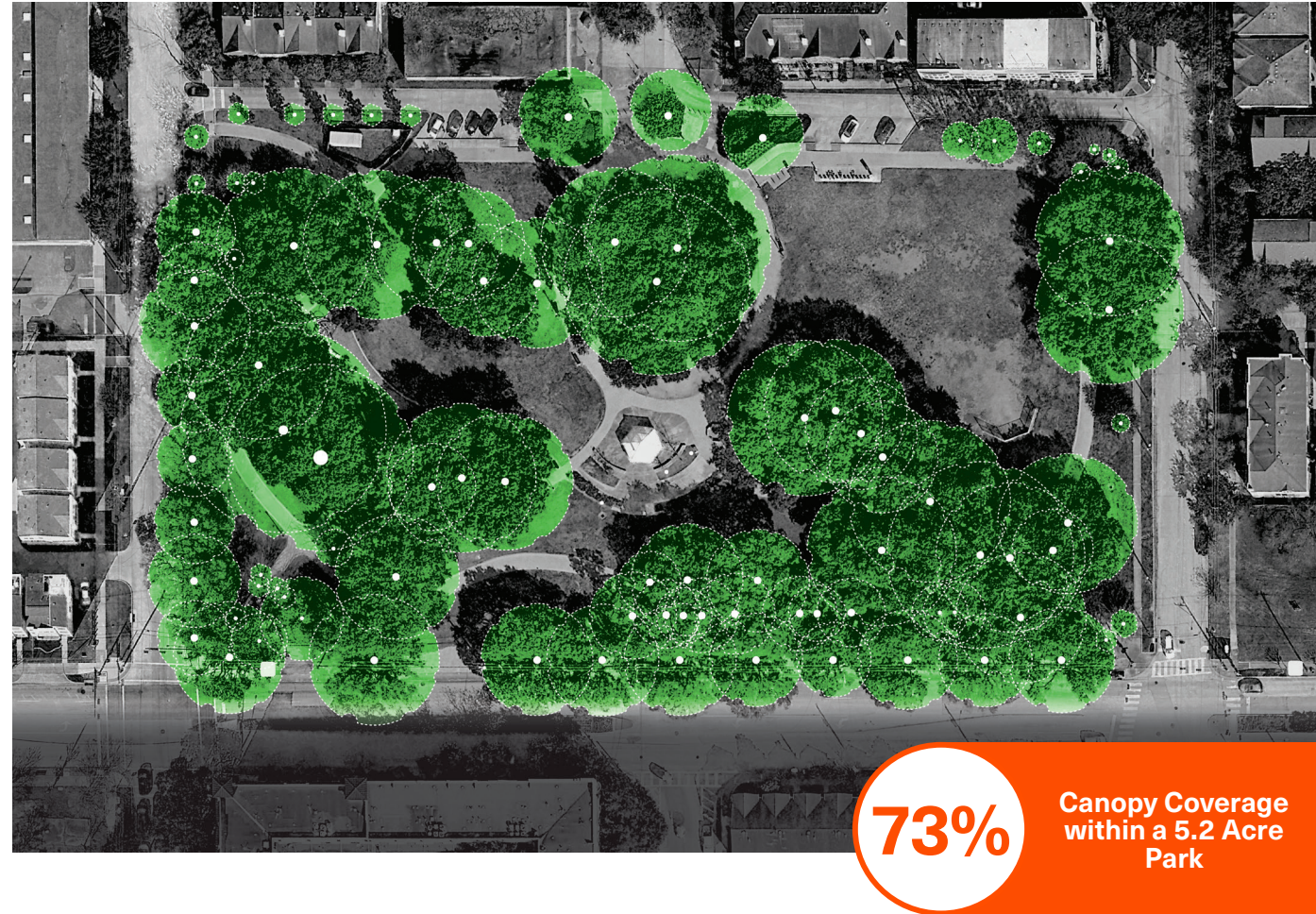


Lawn Decomposed Granite



# INVENTORY RESULTS

To understand the benefits that trees provide, it is important to properly capture all eight data points of a tree's condition; including, but not limited to, height, width, DBH, and health. Trees are the only infrastructure that increases in value over its lifetime. The following summarizes some of the benefits of the existing tree canopy within Elizabeth Baldwin Park today.



**94**  
Trees surveyed

**65"**  
DBH is the largest live oak on site

Approximately  
**\$1 Million**

**53**  
Trees surveyed over a 20" DBH

**16**  
Live Oaks have a replacement value of over \$20,000

In Tree Value in Baldwin Park Today

## Carbon Storage And Sequestration

Carbon dioxide is the most commonly produced greenhouse gas. Carbon storage is the amount of carbon bound in tissue of woody vegetation. In other words, carbon storage is the total amount of carbon contained in a forest (trees and soil). Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. Carbon sequestration removes carbon from the atmosphere and stores it in a form that cannot be immediately released, like the wood of a tree.

**464,568 lbs**  
Embodied Carbon Storage

**\$39,616**  
In Carbon Storage to date

**3,888 lbs/yr**  
Carbon Sequestration

**46.5**  
Yearly car emissions stored within Baldwin Park today

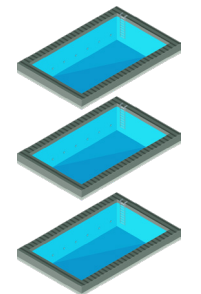


## Avoided Runoff

Annual surface water runoff that was avoided (referred to as avoided surface runoff) is estimated by i-Tree Eco based on rainfall interception and evapotranspiration by vegetation and ground surface storage and infiltration of precipitation, or more specifically, the difference between annual runoff with and without vegetation. Although tree leaves and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted and water evapotranspired is accounted for.

**8,472 ft<sup>3</sup>/yr**  
Avoided Runoff

**3**  
20,000 gallon swimming pools avoided every year in stormwater runoff



## Pollution Removal

Outputs are provided for ozone (O<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), and particulate matter less than 2.5 microns (PM<sub>2.5</sub>). Estimates are derived from calculated hourly tree-canopy resistances for O<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub> based on a hybrid of 7 big-leaf and multi-layer canopy deposition models.

**4,602 oz/yr**  
Pollution Removal

**230**  
Bottles of







## RECOMMENDED MAINTENANCE FOR ELIZABETH BALDWIN PARK

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The trees within Elizabeth Baldwin Park provide a vast amount of benefits for the surrounding community and the entire city of Houston. To ensure the success and survival of these beautiful and historic live oaks, a maintenance plan must be initiated that includes a variety of methods to maximize the potential of the trees on site today.

This maintenance strategy includes specific pruning for different trees, mulching strategies that are broken into priority levels for trees on varying surfaces, including grass, decomposed granite, and along streets and rights-of-way. In addition, specific recommendations for trees within areas of high risk and heavy traffic around the playground feature and pedestrian paths are included for future use and reference.

3



# ARBORIST RECOMMENDATIONS

Bartlett Tree Experts conducted their own analysis of the trees in Baldwin Park and provided 3 priority levels of pruning and maintenance. This allows for the Midtown District to focus funds on the most important maintenance first and when more funds become available, the following two priority levels could be executed. A variety of maintenance recommendations were made for each specific tree; pruning, fertilization (which includes applying mulch to the root zone), root invigoration, removing dead or failing species, and support systems such as cables and props. The following diagrams indicate which trees are recommended for corresponding maintenance.



Severely Damaged Live Oak Tree

## PRIORITY PHASE GROUPS

### 1. Immediate Needs

Trees and shrub issues that require immediate attention. These consist of the pruning of dead branches that overhang walkways, driveways, structures, or lawn areas. If left unattended, it could create a dangerous or costly situation.

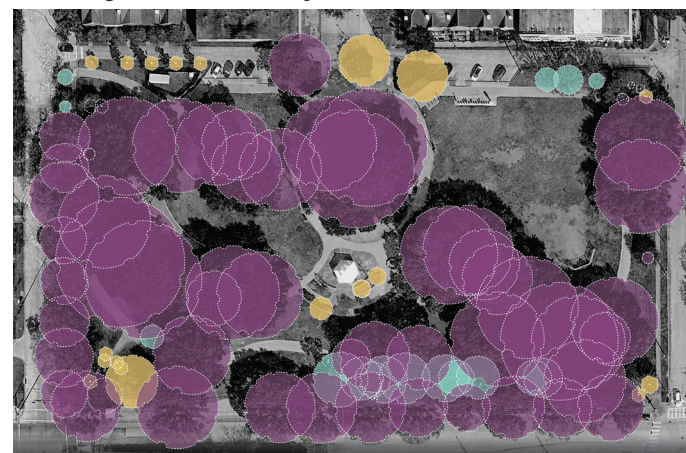
### 2. Intermediate Recommendations

Tree and Shrub maintenance needs, such as routine pruning, lightning protection systems, and cabling and bracing system requirements.

### 3. Future Recommendations

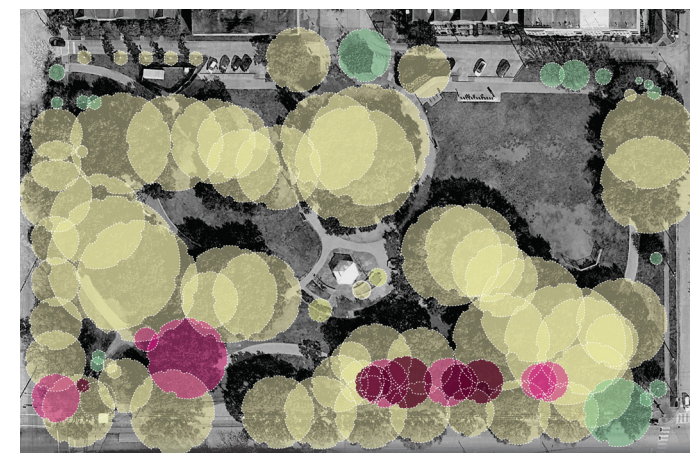
Anticipated tree and shrub growth or to promote proper plant structure.

## Priority Phase Groups



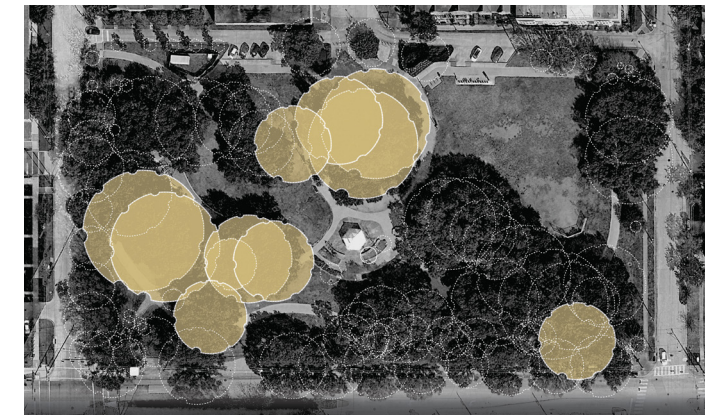
Phase 1 Phase 2 Phase 3

## Tree Condition



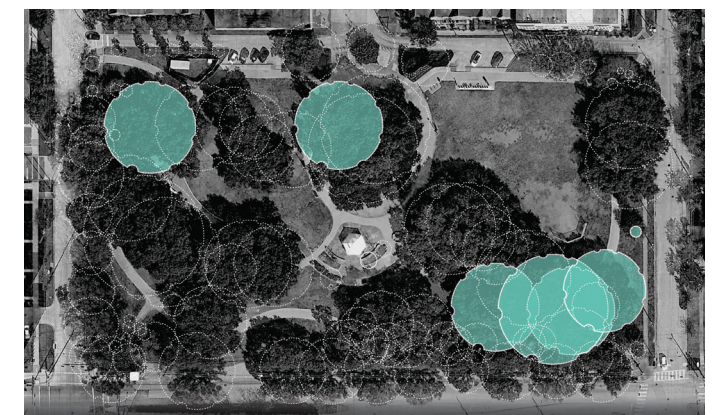
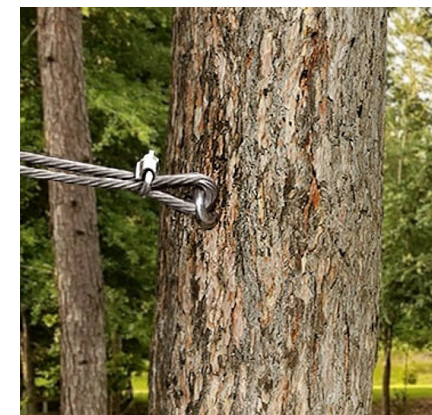
Good Fair Poor Dead

## Root Invigoration



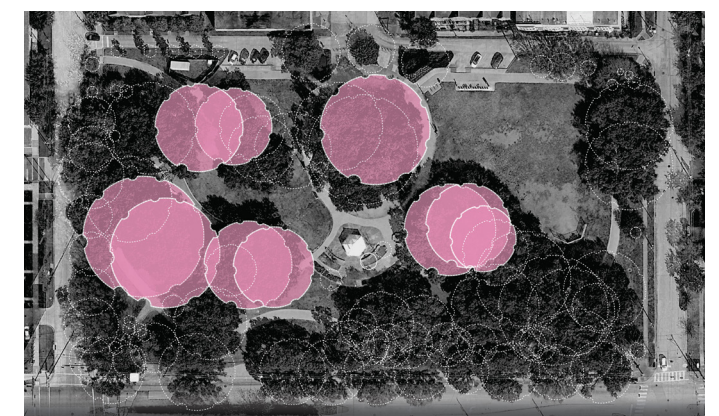
Designed to repair damaged soils and promote an efficient soil environment which optimizes fine root performance. This creates a natural, forest-like soil in a developed environment which allows for efficient uptake of higher levels of water and nutrients by the fine root system.

## Tree Cable



Cables restrict the distance that branches can move in relation to each other. Installed across a weak union, they will greatly reduce the risk of failure. On over-extended branches, they can be used to support the branch.

## Tree Prop



Props are used under leaning branches when cables will not provide sufficient support to reduce risk of failure. Used under parts that are nearly horizontal and close to the ground. Props can be made from wood, steel, concrete or other materials.



# INITIAL MAINTENANCE SERVICE

Bartlett Tree Experts completed the initial stage of maintenance at Baldwin Park in the spring of 2024. This work focused on the trees adjacent to the playground and at the northwestern corner of the site. Bartlett conducted precautionary pruning to remove dead/hazardous branches overhanging the walking trails and the playground. Cautionary tape was used to protect the park visitors during the tree maintenance process. Additionally, Bartlett installed a tree cable to support the weight of a large limb on site. Finally, Bartlett provided deep root fertilization to promote long term health of the trees on site. Continued monitoring of the park is recommended to understand an appropriate maintenance schedule.

## BARTLETT TREE EXPERTS



Cautionary Tape



On-ground Pruning



Tree Cable



Above Ground Tree Pruning



Before Pruning



After Pruning



# LIVE OAK MAINTENANCE & CARE

Because Live Oaks make up a vast majority of the population of trees throughout Houston and Midtown, it is important to understand how to properly maintain and care for the trees that exist today.

## BENEFITS OF LIVE OAKS

- Most highly prized landscape tree throughout Texas
- Evergreen tree
- Known for its longevity and durability - can live for 200 years or more in undisturbed landscapes
- Contains strong wood characteristics with a spreading, low branching habit and a deep root system that combines to make Live Oaks highly resistant to storm damage.
- Tolerates urban conditions, including compacted or severely disturbed soils

## COMMON PROBLEMS



### Oak Wilt

Dominant pest problem of Live Oak's caused by fungus (*Ceratocystis fagacearum*) which causes rapid wilting and death of the tree. It can travel long distances by oak bark beetles, sap beetles, and through the trees interconnected roots



### Phytophthora root rot

Caused by wet poorly drained soils. Root disease occurs on old trees which are stressed by drought and root disturbances such as development



### Other

Powdery Mildew

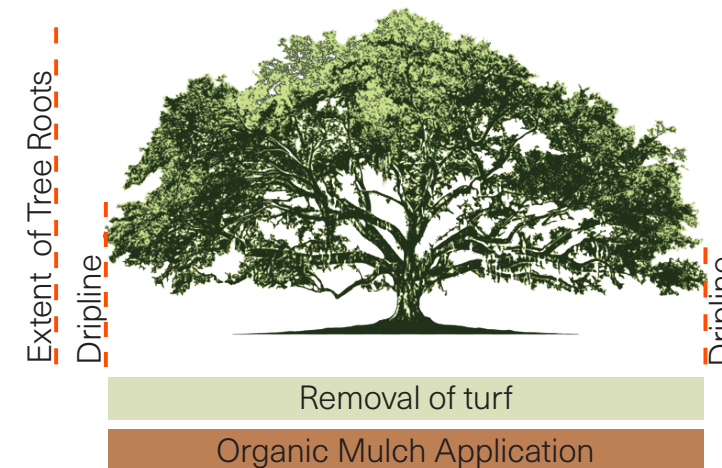
Leaf Spots

Twig Blight

Insects pests



Leaf curl, Tent caterpillars and cankerworms can go unnoticed until decline in health is evident.



## LIVE OAKS CAN SPROUT FROM THEIR ROOT SYSTEM

Stands of trees, referred to as "Motts" develop and have a shared interconnected root system. These can be hundreds of trees spreading across many acres of land. Live Oaks throughout a neighborhood may share root systems and can communicate with each other as well as transmit pest/disease across vast areas.

Tree roots of Live Oaks can span over 1.5x the distance from the trunk to the dripline. It is crucial to continue to monitor and treat Live Oaks especially those with such significance and age as the Live Oaks present in Baldwin Park today. The use of turf around Oak trees requires high levels of nitrogen fertilizer which can provide too much nutrients to Live Oaks and in turn become damaged and deplete the health of trees dramatically. Common herbicides in turf, such as Metsulfuran, used to control weeds can cause problems with Live Oaks. The use of organic mulch throughout the root zone and as far as the dripline can help improve the health of the trees. Mini-pine bark chips or wood chips can come directly from grinding the removed branches of Live Oaks on site.

## RECOMMENDED SEASONAL MAINTENANCE

### Winter (December - March)

- Prune crown to remove dead, dying, and conflicting limbs
- Thin crown to improve light and air penetration.
- Excavate soils as needed to expose root collar
- Sample soil for nutrient and PH levels and fertilize as needed

### Spring (March - May)

- Monitor for spring defoliators and treat as needed
- Apply fungicide treatment to suppress twig blight
- Remove diseased trees and consider installing trenches between diseased and healthy trees

### Summer (May - September)

- Continue to monitor species for signs of distress, pest, and disease. Apply treatment as needed.

### Fall (September - December)

- Soil applied insecticide treatment to suppress scale, aphid, and gall wasp populations
- Fertilize as needed





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## MIDTOWN URBAN FORESTRY STRATEGY FOR THE MIDTOWN DISTRICT

Midtown is in a prime position to lead the charge in Houston of developing and accomplishing the City's urban forestry goals that ensure long term health and vitality of one of the most underrated assets in any city - the urban forest, a critical piece of infrastructure often scrutinized and undervalued. With further exploration and analysis, Midtown can drastically improve their position and knowledge in the City of Houston by not only understanding the importance of this infrastructure, but leveraging the tools made available in this study to make the largest, sustained impact of central Houston's urban forest by ensuring goals and metrics are developed to guide implementation toward tree canopy diversity, while considering human comfort, carbon sequestration, stormwater runoff, and air quality.



# TREE RECOMMENDATIONS - I-TREE DESIGN

## PROCESS

During this phase, Design Workshop utilized the tools provided by i-Tree Design, which uses planting location, tree species and DBH to calculate the benefits the tree will provide from the current year up to 99 years in the future.

The process started by sorting through the Houston Park's and Recreation Master Tree List which contains around 120 trees. We then used our professional judgement and analysis to determine 20 trees based on a range of type, species, and ecological benefits and tracked the performance of each from a 3" caliper tree for the next 100 years.

We projected the performance of these trees every 10 years and captured data points for each tree species in value benefits, stormwater capture, air quality, and CO2. The average of each category was taken for each tree species to calculate the Top 5 Trees based on performance. The charts that follow are the top 5 species from our sample group within each category.

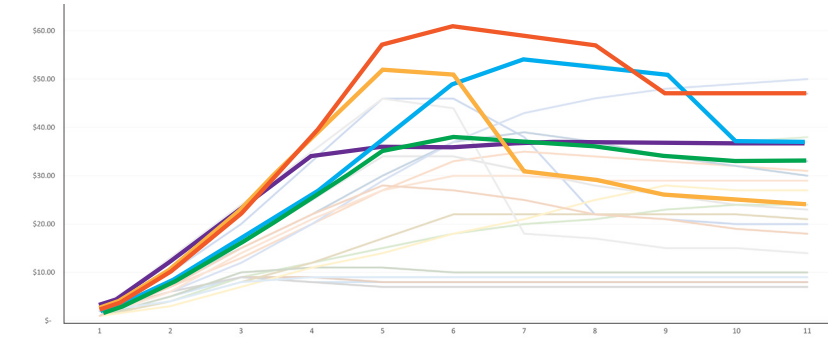
Scientific Name	Species	Common Name	Protected	Planting Eligibility	Usage
Acer barbatum	Southern or Texas Sugar Maple	Y	None	Large Tree	
Acer negundo	Box Elder	Y	NA	Large Tree	
Aster cubum	Red Maple	Y	ROW, Park, NA	Large Tree	
Betula nigra	River Birch	Y	PL, Park, NA	Large Tree	
Corylus caroliniana	American Hiccup	Y	PL, Park, NA	Large Tree	
Coryne alba	Water Hickory	Y	Park, NA	Large Tree	
Coryne cordiformis	Bitternut Hickory	Y	ROW, PL, Park, NA	Large Tree	
Coryne dissecta	Pecan	Y	ROW, Park, NA	Large Tree	
Coryne ovata	Black Hickory	Y	ROW, Park, NA	Large Tree	
Coryne tomentosa	Mockernut Hickory	Y	ROW, PL, Park, NA	Large Tree	
Catalpa bignonioides	Southern Catalpa	Y	PL, Park, NA	Large Tree	
Celtis laevigata	Sugarberry	Y	NA	Large Tree	
Diospyros virginiana	Common Persimmon	Y	ROW, PL, Park, NA	Large Tree	
Fraxinus americana	White Ash	Y	ROW, Park, NA	Large Tree	
Fraxinus pennsylvanica	Green Ash	Y	ROW, PL, Park, NA	Large Tree	
Ginkgo biloba	Ginkgo	Y	None	Large Tree	
Ilex opaca	American Holly	Y	ROW, Park, NA	Large Tree	
Juglans nigra	Eastern Black Walnut	Y	ROW, Park, NA	Large Tree	
Liquidambar styraciflua	Sweetgum	Y	ROW, Park, NA	Large Tree	
Liriodendron tulipifera	Tulip tree or Yellow Poplar	Y	None	Large Tree	
Magnolia grandiflora	Southern Magnolia	Y	ROW, Park, NA	Large Tree	
Quercus muhlenbergii	Swamp Chestnut Oak	Y	ROW, Park, NA	Large Tree	
Abutilon	Wright Acacia	Y	None	Small Tree	
Sambucus nigra	Black Elderberry	Y	Park, NA	Small Tree	

Houston Park's and Recreation Master Tree List

# TREE PERFORMANCE STUDIES - RESULTS

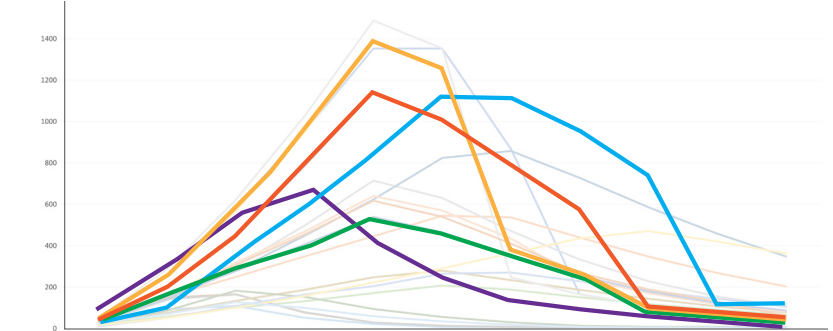
## Value of Benefits (\$)

The value of benefits increases steadily until year 40 when Live Oak levels out at \$40/year; whereas Willow Oak, River Birch, and Mexican Sycamore continue to increase in benefits. Willow Oak reaches a peak at \$60/yr in year 60. Tree species diversity ensure benefits from trees are captured for longer periods of time.

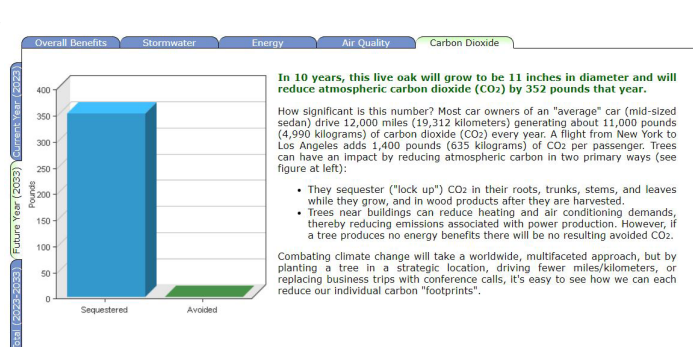
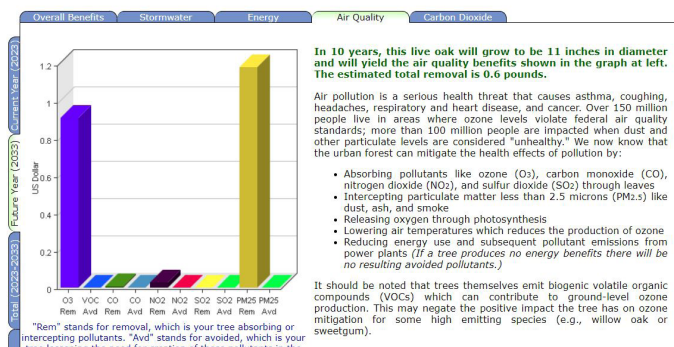
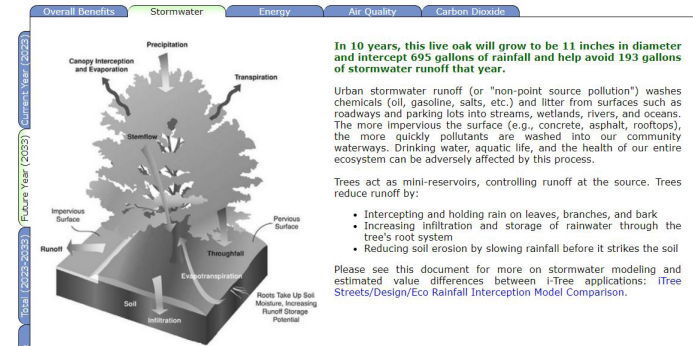
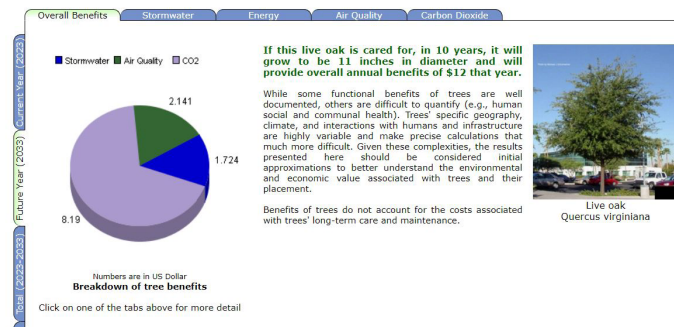


## Co2 Sequestered (lbs)

Co2 sequestration can vary greatly by species; while Live Oak peaks at year 40 and begins to decline, other species continue to outperform Live Oak and sequester more carbon yearly and for a longer period of time. For example, Mexican Sycamore sequesters the highest amount of Co2 for 90 years.

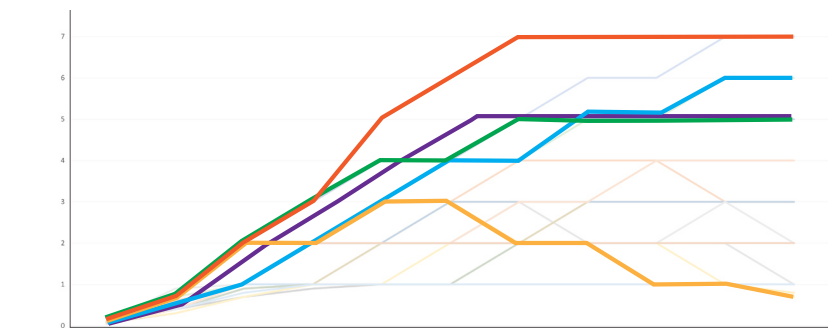


## i-Tree Design - Tools and Results



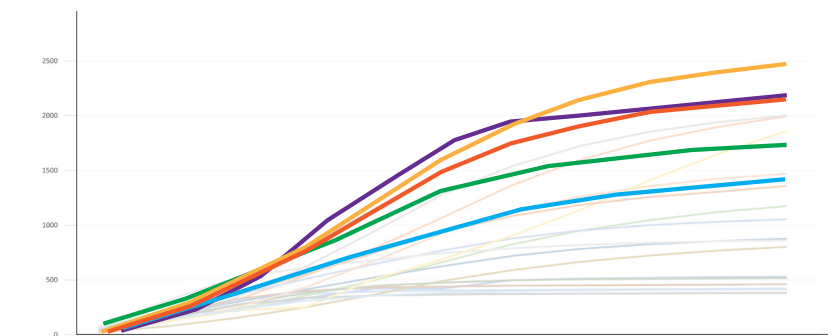
## Air Quality (lbs)

Air Quality is based on i-Tree's estimates of air pollution removal by trees. Most species continue to improve in air quality as they grow towards the end of their life span but others such as River Birch decrease in air quality benefits after year 60.



## Stormwater Run-Off Avoided (gal/yr)

Stormwater run-off avoided is directly correlated to size of canopy and size of the tree species. This continues to increase as the size of the canopy increases considering that it is in fact a healthy tree throughout the 100 year span.







## POTENTIAL GOALS FOR MIDTOWN'S URBAN FOREST

**45%**  
Increase in canopy cover

**10%**  
Of one tree species on all new projects

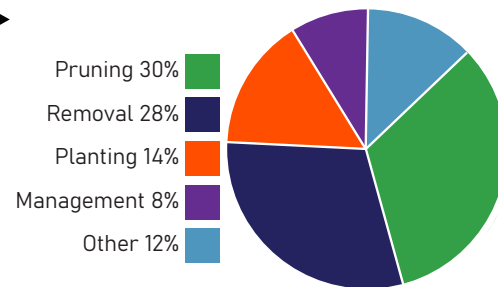
**150**  
Trees planted a year

### BUDGETING AND FUNDING

The appropriate allocation of funding is essential to plan for the success of the entire district. This method can be flexible and shift on an annual basis. However, a proper inventory and analysis of the entire Midtown District Tree should be conducted to fully understand where funding should be allocated. It will be necessary to understand how many vacant planting sites exist, how many trees of each size and species, and where the most maintenance is required. Initially, national guidelines can be followed to begin putting funds in appropriate pots for different activities.

#### National Average For Urban Forest Budget

The national average allocates 58% of the annual budget to pruning and removal. The remaining funds go towards planting new trees and administrative costs.



### PLANTING STRATEGY

As indicated by this investigation and the study completed in 2004, Midtown has over 60% Live Oak canopy. It is our recommendation to increase diversity, when possible, of the tree species throughout the district to ensure pest or disease do not significantly impact or compromise the tree population in Midtown.

One strategy to diversify Midtown's Tree Canopy is to only allow 10% of newly specified trees to be Live Oak. While Live Oak has great historical presence in Houston, it should be used sparingly to ensure the diversity of the trees throughout Midtown reaches adequate levels.

Most urban planners and foresters agree that no more than 10% of a tree species and no more than 20% of any genus should dominate a given tree population. As stated, this is important to prevent epidemic disease and insect outbreaks that can devastate urban forests.

## TOP 5 TREES

Of the trees studied and modeled through this analysis, the following trees were the top performing tree across all categories.... 1,2,3,4,5. Moving forward, each tree within the Houston recommended tree list should be scrutinized and modeled through the i-Tree software to understand the potential benefit of each tree and how those benefits might adjust this list. Considering a species diversity goal of no more than 10% of any given tree species, the Design Workshop team recommends diversifying the urban tree canopy to achieve a better balance across the District.



### 1. Tulip Tree

*Liriodendron tulipifera*

Type: Large Deciduous

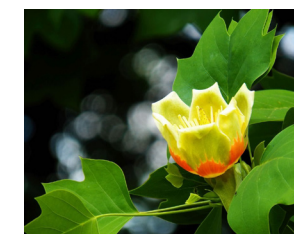
Height: 70'-90', up to about 150' tall

Fruit: Long brown cone

Leaves: 4-6" long and broad.

Wildlife: Support wide variety; deer, songbirds, and hummingbirds

Comments: One of the fastest growing hardwoods, at over 2' per year.





## 2. Willow Oak

*Quercus phellos*

Type: Deciduous Shade Tree

Height: 50'-80'+

Fruit: Acorn, 1/2" long

Leaves: Green narrow leaves

Wildlife: Attracts birds and butterflies.  
Fruit - mammals + Birds, Nesting site

Comments: Wide Spread tree, found in lowlands and along borders of swamps and rivers but often on rich sandy uplands. Not widely available in nurseries within the Houston Area.



## 4. Box Elder

*Acer negundo*

Type: Large deciduous

Height: 35'-55'

Fruit: winged nutlets or samaras ripen on female trees in August - September

Leaves: made up of 3~7 leaves with 3~5" long each. Emerge in April - May.

Wildlife: Provide habitat to birds and many insects rely on its fruits.

Comments: Fast growing. Tolerant of insects and disease.



## 3. American Sycamore

*Platanus occidentalis*

Type: Large Deciduous

Height: 80'-110', up to 150' tall

Fruit: Small achene - 1 1/2"

Leaves: Large maple-shaped green leaves

Wildlife: Seeds and nesting habitat for many bird species, Important for raptors (hawks and owls).

Comments: Low maintenance. Unique mottled bark. Tolerant of disease and drought.



## 5. Nuttall Oak

*Quercus texana*

Type: Large evergreen

Height: 40'-80'

Fruit: Dark brown acorn, around 1" long

Leaves: Dark green, waxy, unlobed leaves

Wildlife: Its acorn attracts many species of squirrels and deer.

Comments: Tolerates intermittent flooding during dormant season. Thrives when planted on moist, fertile sites with good drainage.





# NEXT STEPS FOR THE MIDTOWN DISTRICT

## 1. Develop a vision and goals for Midtown

To begin, we would like to work closely with Midtown to understand what they would like to accomplish and how the future of the Urban forest within Midtown can work.

## 2. Phased Inventory and Analysis of the Entire District

This can include mapping the district for species diversity, canopy coverage, an overall heat map that can show how species are distributed throughout the district, where canopy coverage is failing, and where opportunity exists to plant new trees in areas disproportionately affected.

## 3. Work Closely with other Organizations and non-profits

Working with other organizations such as Trees for Houston, Trees of Hope, United States Urban Forestry Service, Houston Urban Forestry Council, Houston Wildlife, Air Alliance, and community outreach organizations. This lets us understand the best methods for moving forward, such as educating the community and understanding what they want, understanding best strategies to incorporate wildlife into our assessment, and finding new ways to increase Midtown's Urban Forest success.

## 4. Develop a tree and Shrub Matrix

A tree and shrub Matrix creates a systematic method to applying appropriate trees to different areas, such as residential areas, transportation corridors, streets, commercial areas, and parks or open space. Further developing on our top performing trees by analyzing the entirety of the Houston Recommended Tree List and discovering which Trees perform the best in each category (Carbon sequestration, Stormwater, air quality, etc) and where to appropriately use them.

## 5. Create Performance indicators

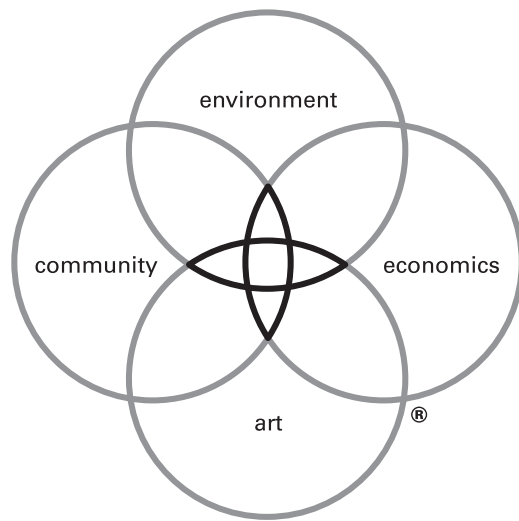
Optimal performance indicators should be developed to set targets in canopy coverage, invasive species removal, replacement strategy for when trees fail or no longer function to their full potential, new project tree planting requirements, education of all parties involved including government parties, and a mitigation and maintenance strategy.



# GLOSSARY OF TERMS

Term	Definition
<b>Air Quality</b>	The degree to which the air is clean, clear, and free from pollutants such as smoke, dust, and smog, among other gaseous impurities.
<b>Biodiversity</b>	The variety of life in a particular habitat or ecosystem; includes diversity within species, among species, and of ecosystems.
<b>Canopy Coverage</b>	The percentage of the ground covered by a vertical projection of the trees crown. Expressed as a percentage of an area of forest land.
<b>Carbon Sequestration</b>	A natural process by which carbon dioxide is removed from the atmosphere and transformed into biomass through photosynthesis.
<b>Carbon Storage</b>	Process of trapping carbon dioxide and permanently storing it in its fibers until it is released from fire or decomposition.
<b>Diameter Breast Height (DBH)</b>	Standard method of expressing the diameter of the trunk of a standing tree, measured at 4.5' above ground.
<b>Forest</b>	A large area covered with trees and undergrowth.
<b>Habitat</b>	A natural home or environment of an animal, plant or other organism, that supports the survival and reproduction of such species.
<b>Hazardous Tree</b>	A tree that, in the opinion of a certified arborist, is defective, diseased, dying, or dead and should be removed. Poses a high risk of failure.
<b>Heritage Tree</b>	A tree that is typically large with unique value. Considering age, size, rarity as well as aesthetic, botanical, ecological, and historic value.
<b>Invasive Species</b>	A species introduced to an environment that becomes overpopulated and harms its new environment. Adversely affect habitats and bioregions.
<b>Replacement Value</b>	Dollar amount assigned to an individual tree; based on a formal tree appraisal, which provides an estimate or approximate value of a tree.
<b>Resiliency</b>	The capacity to withstand or recover quickly from difficulties; limit tree exposure to significant loss.
<b>Species</b>	A group of trees in the same genus made up of similar individuals.
<b>Urban Forestry</b>	The care and management of single trees and populations in an urban setting for the purpose of improving the urban environment.
<b>Wildlife habitat</b>	Areas distributed horizontally and vertically that fulfill the needs of specific wildlife species for basic requirements of food, water, reproduction, and protection against predators.





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