URBAN FOREST PLAN

September 2022

CITY of BOSTON

Magnolia | Erica Holm

SEPTEMBER 21, 2022

Dear Neighbor,

Earlier this summer, Boston experienced its three hottest weeks on record. Heat waves like the ones we experienced this year will only become more common as the climate crisis continues bearing down on us. Right now, we have an obligation—and an opportunity—to protect our city and our residents from intense heat with the *Boston Urban Forest Plan* (UFP).

The UFP is a major milestone in our efforts to meet our environmental goals while establishing a blueprint for the preservation, cultivation, and expansion of our urban forest over the next two decades. This plan is the first of its kind in Boston and explores the many, interconnected benefits of a robust urban forest.

A living network of trees controls drainage and flooding, filters groundwater, cools and purifies the air we breathe, beautifies our city, and mitigates the dangers of extreme heat. The UFP ensures that Boston's tree canopy is not only resilient against climate change, but equitably distributed—improving quality of life for all our residents.

To effectively execute the UFP, we are expanding City resources for tree planting, preservation, and proactive care. We will be creating a new, standalone Forestry Division housed in our Parks and Recreation Department with 11 new full-time staff positions—including a Director of Urban Forestry. We've also scaled up investments in our operating and capital budgets and allocated federal grant funding to clear our maintenance backlog, accelerate planting and pruning, and create an innovative pilot program to encourage planting on private properties.

Developing a climate resilient urban forest will improve the health, longevity, and number of trees in Boston. It will also improve the health and well-being of our communities, tackling some of our most significant environmental challenges while addressing racial and social inequities in our existing tree coverage. When it comes to making Boston the greenest city in the country, we're not leaving anything to chance.

See you in the shade!

Michelle Wu

Mayor of Boston

Franklin Park Arbor Day | Matthew McNamara

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CITY OF BOSTON

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Cover Image: View towards Boston from Cambridge

ACKNOWLEDGEMENTS

The Project Team wishes to acknowledge the many partners and community stakeholders who supported this project. This plan was developed through a Community Advisory Board, as well as input from the broader community.

The Community Advisory Board contained three subgroups: **The Equity Council, The Interdepartmental Working Group,** and **The Collaborating Partners.** These members were essential to the process of determining plan goals and strategies. Without their participation, this project would not have been possible.

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Emerald Necklace | Erica Holm

Dorchester

CHAPTER 1
A Vision For Boston's Urban Forest

A VISION FOR BOSTON'S URBAN FOREST

The Urban Forest Plan (UFP) is a long-term citywide strategic plan to create a sustainable and equitable urban forest in Boston. It sets a vision not only for the care, management, and expansion of the urban forest but also for how the Boston community works together to plan for its future.

Social equity and environmental justice are key to long-term resilience and therefore at the heart of the Urban Forest Plan. From the start, the planning process has recognized that access to the urban forest and the benefits its canopy provides are not equitably distributed, and that this lack of equity is reflective of historic and ongoing physical, political, and social barriers. Many important voices and concerns have historically been excluded from formal decision making processes. Specifically, communities of color, linguistically isolated communities, socio-economically disadvantaged populations, and others are too often left outside formal public input and planning processes.

Together the community and City leadership are working to eliminate these barriers and change practices that perpetuate them. Through these efforts and the recommended actions included in this plan, we can work towards long-term resilience, protect and grow our urban forest, establish management practices that support a diverse, healthy climate adapted urban forest and ensure these critical resources are available for the enjoyment and benefit of all of Boston's residents for years to come.

Like all environmental resources, the urban forest spans both public and private land and therefore requires participation from the entire community in its care and management. This plan was developed by the Boston Parks and Recreation Department in collaboration with community members, City staff, industry experts, and partner organizations. Together, the community explored the issues and challenges facing Boston's urban forest today, identified solutions to these challenges, and set a series of goals and actions to achieve them.

The plan will need the help of the entire community to be implemented, including individual community members, private groups and organizations, utilities, and service providers, as well as City and State departments and staff. The implementation guide includes recommendations as to which departments or organizations should lead on any given action and, where relevant, whose collaboration will be critical to success.

The planning process began in Spring 2021 and has already had positive impacts on public investment in trees. As a result of the knowledge gathered over the course of the Urban Forest Plan, Mayor Michelle Wu's fiscal year 2023 budget took a major leap forward by including 11 additional staff positions for the Tree Division. Another $2.5 million from the American Recovery Protection Act (ARPA) will be used to decrease the wait time on street tree pruning by employing additional tree crews in the field. Funds will also be used to start a pilot program for residents willing to plant trees on their private residential properties. The City will collaborate with a local non-profit to run this initiative where residents will have a tree planted on their private property to help increase the overall canopy. In Spring 2022 PowerCorpsBOS was launched, a City-run workforce development program for youth aged 18 to 30 years old. This program will help provide pathways for more diverse candidates

to enter into the urban forestry field and gain the skills needed to excel in this field. These resources are a critical step in transitioning to a proactive tree program.

GOAL SETTING: FORGING A PATH TO A SUSTAINABLE URBAN FOREST FOR ALL BOSTONIANS

The identification of the goals that guide this plan emerged through a community-led process that sought to answer the questions "What does success look like?" and "What will Boston look like or be like that day when we can say 'we did it'?" The community determined that success comes when equity guides action, when trees are proactively cared for and protected, when the community is involved in the decisions made for their neighborhood, and when trees are prioritized and valued for their true and full role in the services provided to Boston's residents.

These became the overarching goals for Boston's Urban Forest Plan outlined below. More information on these goals and the process to determine them can be found in Chapter 3: Equity-Centered Goals.

Goal #1: Equity First
Focus investments and improvements in under-canopied, historically excluded and socially vulnerable areas

Goal #2: Proactive Care and Preservation
Ensure trees/tree canopy are proactively cared for

Goal #3: Community-Led
Ensure community priorities drive urban forest decisions and management

Goal #4: Prioritize and Value Trees
Increase awareness and buy-in regarding the importance of trees in Boston, across the public and private sectors

WHAT IS AN URBAN FOREST?

The urban forest is a term used to describe all the trees within a city. This spans across all land, private and public, including trees on parks and streets, on campuses, residences, and more.

WHAT IS TREE CANOPY?

From an aerial view, the leaves and branches covering the ground make up our tree canopy. Tree canopy can be referred to in general, talking about all trees, or can be expressed in a more specific quantity. In Boston, 27% of the land is covered by tree canopy.

These goals are ambitious and forward-thinking. They do not lay out specific numbers, such as a percent canopy coverage, that can be quantitatively measured to understand progress toward these goals. Instead, the recommendations and actions outlined in this plan are geared toward implementing programs and taking actions that support these goals. Evaluating progress will best be done through regular re-evaluation (every 5-10 years) of the indicators of a sustainable urban forest outlined in Appendix D in addition to continued communication with the community leaders involved in the creation of this plan and in tree care.

WHY TREES, WHY NOW?

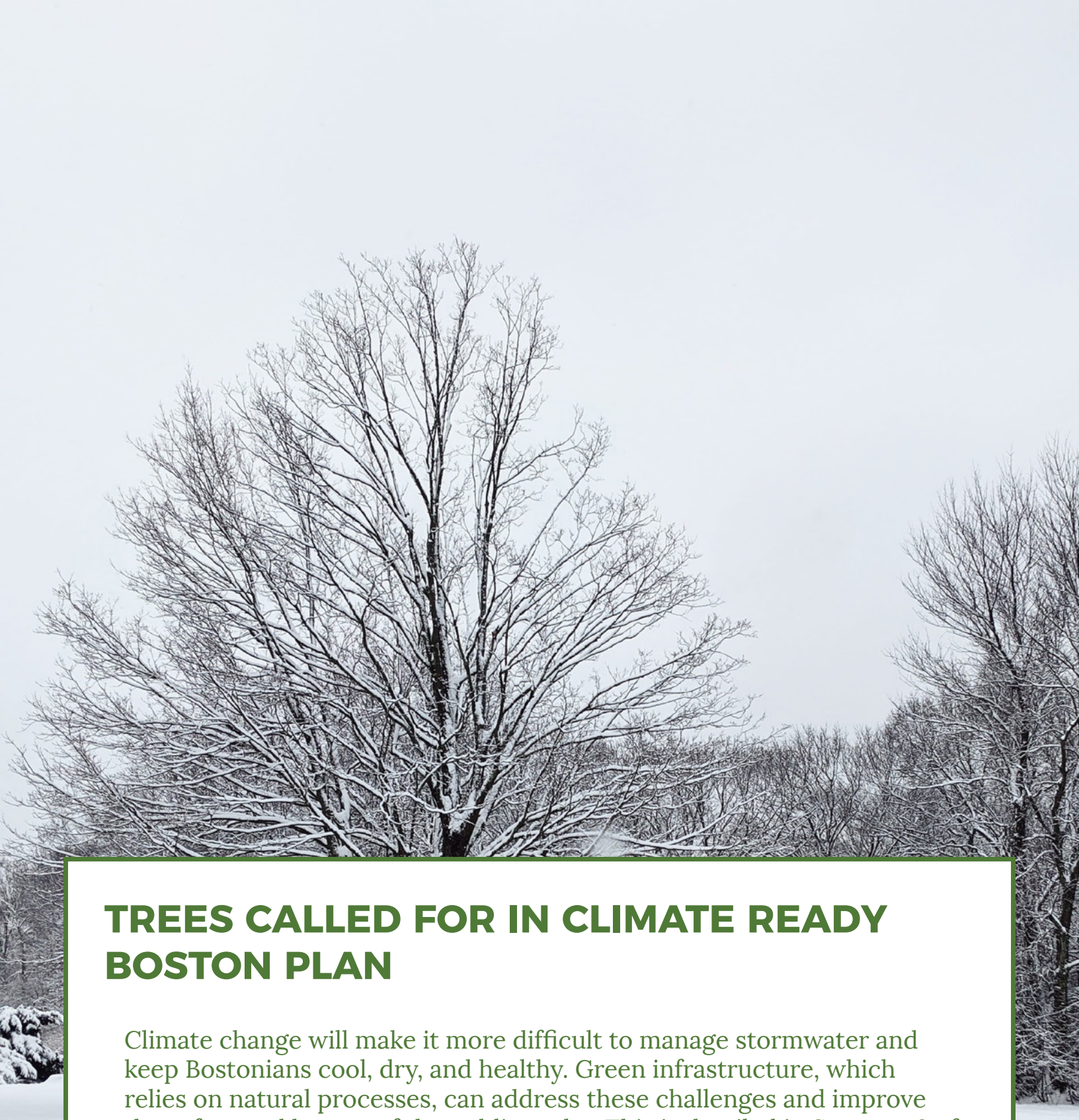
Now and over the coming decades, Boston is facing significant challenges including climate change, a rising cost of living, and development pressures that come with a growing population. Historic and ongoing practices of disinvestment and marginalization have left some of our neighborhoods and community members more vulnerable to these than others. These challenges and their relationship to the urban forest are outlined below. Boston is working hard to plan for the future and break down the social practices that create inequity. The Urban Forest Plan (UFP) is one of many efforts to support this change.

The UFP was called for by Climate Ready Boston, the City's initiative to prepare for the near- and long-term impacts of climate change. The UFP is also a part of the City of Boston's Healthy Places initiative, a coordinated effort between three plans, this UFP, Heat Resilience Solutions for Boston (the Heat Plan), and the Open Space and Recreation Plan, to build a safe, healthy, resilient, and accessible city for everyone in a changing climate.

Urban forests have never been more critical to cities than today, serving as city infrastructure that lowers temperatures and associated energy costs to cool our houses and buildings, reduces air and water pollution, and improves human physical and mental health. However, urban forests are often not fully recognized as critical infrastructure and are at risk due to development pressures and insufficient resources for proper care and management.

Climate Change and Related Stresses.
As a coastal city, Boston faces multiple climate hazards including extreme temperatures, sea level rise, and more precipitation from greater storm intensity. In the coming century, the impacts of natural hazards that Boston already faces are expected to increase. These include coastal and river flooding, stormwater flooding, and heat stress due to extreme heat.

These changes are already underway, according to the Climate Ready Boston plan. Over the past century, average temperatures have been rising with July 2019 setting a record as the hottest month to date in Boston and more change is anticipated. By the 2050s, Boston's summers may be as hot as Washington, DC's summers are today; by the end of the century, they may be hotter than summers in Birmingham, AL. By the 2070s, almost 90,000 residents and over $80 billion worth of existing buildings will face a 1% chance of coastal and river flooding in any given year. Residents will face higher average temperatures, as well as more hot days (as many as an additional 36 more days above 90 degrees), and more frequent, longer, and hotter heat waves, as we experienced in Boston during



TREES CALLED FOR IN CLIMATE READY BOSTON PLAN

Climate change will make it more difficult to manage stormwater and keep Bostonians cool, dry, and healthy. Green infrastructure, which relies on natural processes, can address these challenges and improve the safety and beauty of the public realm. This is detailed in Strategy 8 of the Climate Ready Boston plan, with Initiative 8-5 calling for this urban forest strategic plan.

Winter Trees | Erica Holm

the summer of 2021. Additionally, as soon as the 2050s 7% of the total land area in the city could be exposed to frequent stormwater flooding (City of Boston, 2016). Boston must continue to adapt and mitigate the worst impacts where possible, and support those who lack sufficient resources to prepare for changing conditions or recover from emergencies.

The urban forest can help us to live more comfortably with the impacts of climate change. However, these changes not only create more stressful city environments for humans, but also for the urban forest. Trees experiencing hotter temperatures and heat stress are more susceptible to pest and disease infestations, severe weather can cause more damage and loss of trees, and a warming climate inflicts greater pressures from invasive plant species outcompeting natives. Flooding also has negative impacts on trees, especially coastal flooding, as saline inundation can be deadly to trees.

Growing Population: Development Pressures and Rising Cost of Living. Boston has been growing steadily since 1980. According to the US Census Bureau, Boston's population has increased 21% since 1990. With population growth comes development pressure and an exponential growth in the already high cost of living in Boston. This, in turn, can result in gentrification-driven displacement of lower-income residents (Khan 2019). If unchecked, development can have a negative impact on the urban forest which, in turn, leads to increased concerns over extreme heat. The financial strain of cost of living increases are compounded by an increase in the overall number of hot days which can drive up energy costs.

History, Inequity and Environmental Justice. Every resident deserves to live in a vibrant and healthy community. In Boston, historic and ongoing disinvestment or neglect has contributed to racial disparities in health and wealth. Little has been done to rectify historic inequities, resulting in persistent conditions of marginalization that have compounded and expanded over time.

As a result, historically excluded and neglected neighborhoods today are burdened with a variety of environmental injustices. These include greater exposure to environmental pollutants and heat risks, as well as below-average access to open space and safe working environments, among many others. Climate change risks, particularly extreme weather, add yet another stressor to communities with the least resources to cope with or recover from emergencies.

While Boston is taking progressive strides to address these issues and start to correct past practices, there is still much to be done.

THE POWER OF TREES AND TREE CANOPY

Why is tree canopy important in Boston, especially in light of the challenges facing the city? Trees have proven time and time again to be one of the most effective tools in addressing a wide range of urban challenges. They are, in fact, the only infrastructure that grows stronger and more effective with age. Trees are now considered critical city infrastructure. Together, all the trees within Boston form an urban forest. The urban forest provides an even greater range of benefits and services than any one tree alone. Commonly understood positive effects of urban forests include the following:

MATURE TREES PROVIDE EXPONENTIALLY HIGHER BENEFITS.

It may not be surprising that mature trees provide higher levels of services to a community than younger trees do. They can intercept more stormwater, remove more air pollution, provide more energy savings, and absorb more carbon. However, it is critical to note that this increase in services is exponential. Consider the air pollution benefits alone of one large healthy tree (greater than 30" DBH , or diameter at breast height). This tree can remove 70 times more air pollution a year than a younger tree (less than 8" DBH) (Marritz 2012). This is one of the primary reasons to consider preservation of mature large trees a high priority.

Dorchester

- provide intergenerational ties to nature and neighborhoods
- play an important role in cultural and spiritual practices
- improve mental health
- provide essential wildlife habitat
- reduce heat and adverse health impacts of extreme heat
- reduce flooding due to excess rainfall (stormwater)
- improve water quality
- help reduce air pollution
- help communities save money via reduced energy costs
- can help lower carbon levels in the atmosphere to some extent, and promote walkable, bikeable communities

In Boston, residents depend on the many benefits provided by the trees in our urban forest. Many are easily quantifiable, others are harder to measure in numbers, but all are important and critical to a healthy, vibrant city. More information on each of these can be found in Appendix A.

The chapters that follow outline the planning process and the goals, recommendations and specific action items that emerged from it. Included are a variety of case studies from relevant cities, links to tools and sites that enhance understanding of what other cities are doing, and known best practices. Combined with the additional documents that accompany this document, this plan acts as a manual for collaborative implementation of the ambitious goals set out by City leaders and the Boston community.

Chapter 2: State of Boston's Urban Forest Today. *This chapter summarizes the process of discovery and data collection used to evaluate the existing conditions of the urban forest and outlines those findings.*

Chapter 3: Equity-Centered Goals. *This chapter describes the four distinct goals for Boston's urban forest, guided by the Equity Council.*

Chapter 4: Strategies and Recommendations *The path forward is laid out in a set of recommendations, spanning across seven strategies, all aimed at reaching the UFP goals. This chapter lays out each of these recommendations, and specific actions required for each.*

Chapter 5: A Roadmap for Implementation. *The actions outlined in the plan are compiled alongside suggested timelines, required leadership, and partnering structures.*

Bunker Hill,. Charlestown

Healy Playground, Roslindale

CHAPTER 2
State of Boston's Urban Forest Today

STATE OF BOSTON'S URBAN FOREST TODAY

Analyzing the state of Boston's existing urban forest is an important first step in planning for future improvements. That analysis resulted in 14 key findings. They were developed through the use of an assessment framework along with input from City staff, City partners, members from the broader community, and industry experts. The goals and actions recommended in this plan respond to these findings. More detailed information on the framework used and the findings outlined below can be found in Appendix D. Findings 1-4 were identified through the City's 2014-2019 Urban Tree Canopy Assessment conducted by the University of Vermont.

- ***Finding 1:*** Tree canopy is not equitably distributed across Boston.
- ***Finding 2:*** Tree canopy cover in Boston is 27% and has remained steady citywide since 2014.
- ***Finding 3:*** Despite steady citywide canopy cover, losses and gains are occurring.
- ***Finding 4:*** The majority of tree canopy is on private land.
- ***Finding 5:*** The urban forest is under the care of a large patchwork of managers.
- ***Finding 6:*** Boston has an active and engaged community that is seeking more opportunities to support the urban forest.
- ***Finding 7:*** Boston's history of exclusion of People of Color and low-income communities has resulted in a lack of trust in City processes and priorities.
- ***Finding 8:*** City staffing and funding resources dedicated to trees is limited, so planting and care are reactive.
- ***Finding 9:*** The urban forest is vulnerable to threats from climate change, development, disease/pests, lack of care, limited space, and growing conditions.
- ***Finding 10:*** Street tree data is now available to support better management of the urban forest.
- ***Finding 11:*** Data on the whole urban forest is incomplete.
- ***Finding 12:*** Trees must be treated as critical city infrastructure.
- ***Finding 13:*** Systems for protecting trees from removal are limited.
- ***Finding 14:*** Room and quality growing space for trees is limited in Boston.

DATA SOURCES

Multiple sources of data were utilized as part of this assessment process. Some of which were already existing, while others were collected during the UFP process.

Urban Tree Canopy (UTC) Assessment Data. The urban tree canopy in Boston was assessed in 2014 and again in 2019 by the University of Vermont's Spatial Analysis Laboratory.

Boston Street Tree Inventory. The first phase of this UFP process involved the collection of data on all publicly-owned street trees in Boston. Implemented by a contractor in the spring and summer of 2021, a team of four to eight arborists walked every city street to collect data on over 38,000 trees.

The Heat Resilience Solutions for Boston Temperature Data. The project team carrying out work on the Heat Resilience Solutions for Boston (Heat Plan) provided their heat modeling data to the UFP team. This data modeled and analyzed both land surface and air temperatures.

City of Boston GIS Data. The City of Boston provides and maintains a robust set of data sources on a variety of factors that were included in the analysis, this included sources from parcel-level land use data, to sidewalk width data, to open space ownership and classification data. Climate Ready Boston data was also a key source for assessing projected impacts of climate change and other environmental conditions. For each source, the most current data was used.

Community Input. Input from a wide range of stakeholders within Boston was collected as part of this plan development process, including from City staff, agencies, partners and community members. The goal of engagement was to start to define the community's priorities related to the urban forest, as well as understanding current challenges in Boston and potential solutions. The engagement process and findings are detailed in Chapter 3: Equity-Centered Goals.

A Note on Data Quality and Availability. There are some limitations in the data used that are worth noting. These include missing data, as well as areas where further analysis is needed. For example, while the UTC Assessment provides data on where canopy has been lost, this sort of analysis cannot provide information on why it was lost. Trees can be lost from drought, development, vandalism, storms, disease, as well as removal decisions by private homeowners. Further analysis is needed to really understand the exact causes of tree loss. Additionally, the UTC Assessment also only included changes in tree canopy over a five-year period. This is a short period of time to track change, making trend analysis challenging. In other cases, data is not available or is incomplete. For example, the public tree inventory does not yet include trees in parks and natural areas. Additionally, there is little to no inventory data on trees on private land or land managed by other caretakers.

COMMUNITY ENGAGEMENT

This plan represents and honors the views, needs, and desires of Boston residents and stakeholders. The goal of in-depth dialogue that was equity-focused and sought to engage residents and City employees in new ways guided the community engagement work.

Equity-Focused. The urban forest planning process represented an opportunity for Boston to begin to address historic exclusion, marginalization, and disparities, as well as foster equity to create a healthy environment for residents. The voices and concerns of historically excluded and currently marginalized communities are

often left outside formal public input and planning processes more broadly. Centering these perspectives in the process and recommendations of the Urban Forest Plan was a key aspect of UFP engagement.

In-Depth Dialogue. This project prioritized quality dialogue over mass engagement. This meant a focus on small group conversations that would allow for more in depth conversations and personal input. This approach enabled an equity focus by listening to the voices and input of representatives from priority populations and from key community-based organizations.

The path taken to collect the important input that drives this plan included the following, each described in more detail below:

- community advisory board- workshops, interviews
- small group meetings
- focus groups
- citywide events

Community Advisory Board. A Community Advisory Board of 71 people was created to guide the development of this work. This group was made up of three subgroups: an Equity Council, Intergovernmental Working Group, and the Collaborating Partners.

The Equity Council was composed of 24 representatives from grassroots community-based organizations working from/in historically excluded and marginalized communities. This council was formed to provide a structure that centered the voices of these communities. The project team met regularly with this group throughout the process and they have guided the plan's direction.

The Intergovernmental Working Group (IWG) brought together leaders and staff from various City departments and agencies. Members of the IWG were asked to provide their perspectives and expertise on current practices and challenges facing the management of Boston's urban forest, as well as goals, ideas, and feedback on specific strategies, policies, and proposals.

The Collaborating Partners group was made up of representatives from the broader community and key partners and players including non-profits, institutions, and engaged members of the general public. Through a series of three workshops and one-on-one interviews, the Community Advisory Board members reviewed data and findings, and worked through challenges and solutions in small groups.

The Equity Council then met to collaboratively develop the UFP's goals.

The Intergovernmental Working Group met multiple times (both in a full group, smaller topic-based groups, and individual interviews), reviewing and working through City operations and policy challenges that came up throughout the project.

Small Group Meetings. The UFP team made a concerted effort to meet residents where they were through meetings with neighborhood associations and other community groups, especially in priority areas. Project members presented to, and heard from a series of civic groups (neighborhood organizations, tenants associations, non-profits, etc.) throughout the city. This was intended to ease the burden of finding additional time for residents to attend

EQUITY is a context-dependent and complex aspiration aimed at redressing the impacts of historic and ongoing marginalization. Because different groups of people are marginalized differently, an equity focus requires collaboration with historically excluded and currently marginalized communities to determine what policies and actions are needed to redress historic and ongoing disinvestment or neglect.

The City of Boston uses the following statement to frame how equity informs City work:

The City of Boston has played a role in causing and perpetuating the inequities in our society. To break down these barriers, we are embedding equity and inclusion into everything we do.

We define equity as ensuring every community has the resources it needs to thrive in Boston. This requires the active process of meeting individuals where they are. Inclusion is engaging every resident to build a more welcoming and supportive city. We are building a city for everyone, where diversity makes us a more empowered collective.

UFP meetings on top of existing engagements and responsibilities. Given the sheer amount of ongoing planning efforts in the City of Boston, as well as the inequitable burden of the COVID-19 pandemic, these efforts aimed to reduce engagement fatigue while ensuring a broad range of voices were heard.

Presentations were made to multiple groups, including Boston Urban Forest Friends, Friends of Melnea Cass, Speak for the Trees, SPARK Council, Greater Mattapan Neighborhood Council, St. Mark's Civic Association, and the Boston Housing Authority REC (Tenants Association).

Focus Groups

Small focus groups were held on three topics that emerged that required more detailed and focused discussion - development, workforce development, and urban forest messaging.

- Development focus group: A conversation about the urban forest with the real estate and development community.
- Workforce development focus group: A conversation about the urban forestry workforce with those engaged in existing workforce development programs in Boston, as well as employers of tree-related workforce.

- Urban forest messaging and outreach focus group: Community Advisory Board members proposed messages that would best resonate with the community to convey the importance and role of trees in Boston.

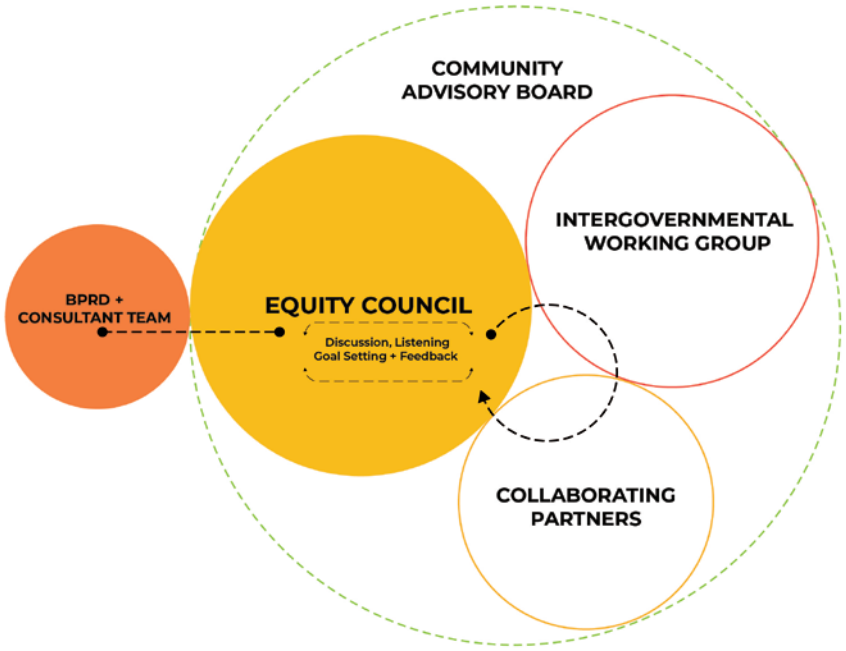
Citywide Events

A series of events made up a wide-reaching awareness/communications campaign about the project with the general public. These were held with the aim of reaching the broader Boston community and expanding opportunities for input to as wide a range of residents and interested individuals as possible. This included:

- Photovoice campaign, which asked residents to provide their stories on what the urban forest meant to them.

- Forest Stories, a series of short educational presentations and polls, each focusing on a specific topic relevant to the urban forest or trees. These were intended to convey key facts on the urban forest as well as serve as educational materials. Topics covered included: an overview of the urban forest and key findings; a dive into equity/inequity; the history of disinvestment/discrimination relative to the forest and key strategies for improving equity; and an overview of the projected impacts of climate change on the urban forest and trees in years to come.

- A citywide public open house held in March 2022. This virtual event included a short presentation on the plan, a question and answer session and polls to generate input on proposed strategies and recommendations. The event was attended by 166 people. Recording and presentation materials can be found on the UFP project website.



Community Advisory Board Structure

Frog Pond, Central Boston

Christian Herter Park, Allston-Brighton

CHAPTER 3
Equity-Centered Goals

EQUITY-CENTERED GOALS

The identification of the goals that guide this plan emerged through a process of answering the questions “What does success look like?” and “What will Boston look like or be like that day when we can say ‘we did it’?”

Multiple discussions followed, both within the Community Advisory Board and again with the Equity Council. Following the guiding principle of equity, the ultimate decision on plan goals was made by the UFP Equity Council.

At no point in the process of answering those questions did a tree canopy percentage target emerge as a determinant of success. What did emerge was a more substantive set of goals.

The community determined that success comes when equity guides action, when trees are proactively cared for and protected, when the community is involved in decisions made about their neighborhood, and when trees are prioritized and valued for their true and full role in the various benefits and values they provide to Boston and its residents.

This is a forward-thinking approach for urban forest plan goals. While measuring success or progress will not be as simple as meeting a tree canopy percentage goal, the outcome of working towards these four goals as a community will ultimately lead the City of Boston to a better, equitable, and more resilient city.

East Boston Tree Planting | Erica Holm

GOAL #1: EQUITY FIRST

Focus investments and improvements in under-canopied, historically excluded and socially vulnerable areas

A number of efforts, programs, policies and resources will be a part of the implementation of this plan. As Boston builds processes, seeks funding, and launches efforts, the time, resources, and priorities that will go into this work must be distributed equitably and begin to address historic exclusion and current social vulnerability.

"The goal captures the intent of an equitable solution by prioritizing resources where there haven't been previously. Those who would benefit the most and are the most vulnerable to the negative impacts are the first to be served."
- Equity Council Member

"We need to remember that we are not starting at an equal playing field and by prioritizing equity we can address racial, social, and economic injustice."
- Equity Council Member

"I think [this goal] addresses priority needs in historically excluded communities and encompasses the scope of both implementation and long-term care for tree canopies."
- Collaborating Partner

GOAL #2: PROACTIVE CARE AND PRESERVATION

Ensure trees/tree canopy are proactively cared for

Growing a healthy urban forest takes time; it must be planted and cared for on a long-term basis. Proactive care will improve the chances that trees in Boston reach maturity, the stage of life where the services the tree provides to the community is exponentially higher (i.e. removal of air pollution, cooling the city, etc.). Care and preservation of existing trees is a foundation to improving the urban forest in Boston, and something that must happen immediately.

"[I totally] buy into the proactive nature of this goal, particularly protecting our existing canopy. Heritage trees and trees on private property need to be protected."
- Equity Council Member

"I like the approach of being proactive and making sure we can maintain, sustain, and enhance."
- Equity Council Member

"The success and longevity of the Urban Forest Plan depends on this goal."
- Collaborating Partner

GOAL #3: COMMUNITY-LED

Ensure community priorities drive urban forest decisions and management

It is important to ensure the community has an active role in guiding and supporting tree canopy decisions and operations within their neighborhood, and sufficient City support to do so. Residents have asked for ways to easily provide input into decisions that impact their community, and ensure that their needs, goals, and aspirations are integrated into and prioritized in decisions made. This requires better communication, collaboration, and transparency between all members of the Boston community including City officials, residents, leaders of advocacy groups, and everyone in between.

"A community-driven process is important to create buy-in, trust, and cooperation."
- Equity Council Member

"I come from a belief system that if we can't get our communities engaged in this we will not see the budget priorities, implementation, and shift we aim to see."
- Equity Council Member

"Community-driven processes are cornerstones to the acceptability and success of its implementation."
- Collaborating Partner

GOAL #4: PRIORITIZE AND VALUE TREES

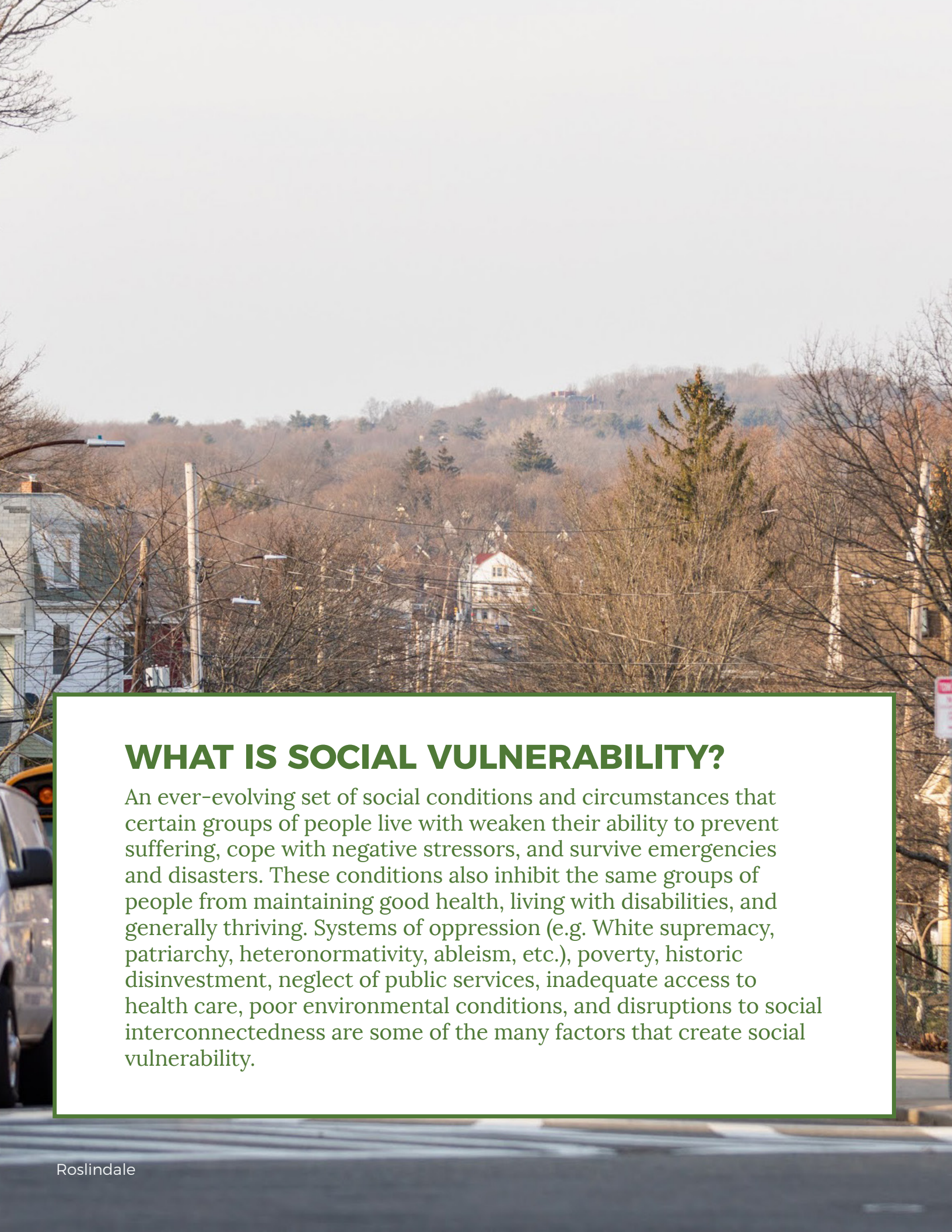
Increase awareness and buy-in regarding the importance of trees in Boston across the public and private sectors

It is important to have the urban forest considered as a priority in Boston, especially because of its role in adapting to climate change and improving environmental and public health conditions. The urban forest must be a priority and focus for the entire community, both public and private. It, therefore, needs to be factored into all decision making across all types of efforts pursued in the city. This means prioritizing the value of trees within other city priorities and needs, from streets to affordable housing and everything in between. Improving the urban forest isn't an either/or trade-off. Rather, we need to find ways to have opportunities to integrate trees in a mutually supportive way into other priorities.

"This is all about collaboration. No one entity should be responsible for doing it all. It can't just be "THE CITY"."
- Equity Council Member

"Breaking down City Hall silos is critical."
- Equity Council Member

"Aligning and not siloing the Urban Forest Plan is critical in making trees a default of City planning, development and climate resiliency."
- Collaborating Partner



WHAT IS SOCIAL VULNERABILITY?

An ever-evolving set of social conditions and circumstances that certain groups of people live with weaken their ability to prevent suffering, cope with negative stressors, and survive emergencies and disasters. These conditions also inhibit the same groups of people from maintaining good health, living with disabilities, and generally thriving. Systems of oppression (e.g. White supremacy, patriarchy, heteronormativity, ableism, etc.), poverty, historic disinvestment, neglect of public services, inadequate access to health care, poor environmental conditions, and disruptions to social interconnectedness are some of the many factors that create social vulnerability.

Roslindale

Tree Care + Appreciation | Erica Holm

CHAPTER 4
Strategies and Recommendations

STRATEGIES AND RECOMMENDATIONS

This is a plan for the urban forest across the entire community of Boston. While the City has taken a leadership role to fund and launch this effort, the following strategies and recommendations include work for the entire community of Boston, not just city government.

Achieving the four goals can be done by working through seven strategies. There are 30 recommendations, spanning across these strategies, each with multiple action items. All of the recommendations in this plan are aligned with Boston's ongoing planning efforts as outlined in the callout box on the following page. An implementation plan can be found in the next chapter.

Strategy #1: Expand and reorganize urban forestry management

Strategy #2: Proactively protect and care for existing trees

Strategy #3: Strategically and equitably expand tree canopy

Strategy #4: Make space and improve conditions for trees

Strategy #5: Improve communications-- both process and content

Strategy #6: Improve information collection and sharing

Strategy #7: Build and support a local tree workforce

HOW TO READ THIS CHAPTER

The seven strategies are supported by recommendations and action items. In the pages that follow each strategy is outlined according to the structure below:

Strategy X
Strategy overview and purpose

> **Recommendation X.1**
> *Overview of issues and challenges each recommendation seeks to address*
>
> > **Action Item X.1A**
> > *Specific Action that supports implementation of the recommendation*
> > *Timeline for implementation*
> >
> > **Action Item X.1B**
> > *Specific action that supports implementation of the recommendation*
> > *Timeline for implementation*
>
> ***Goals Supported:*** *describes which of the four goals are supported*
> ***Resources Needed:*** *describes critical resources needed to implement this recommendation and its supporting actions*

COORDINATION WITH CITY OF BOSTON PLANNING EFFORTS

Numerous ongoing or recently completed planning efforts address issues and/or provide strategies that are relevant to the Urban Forest Plan. Therefore, it's critical that the recommendations and actions in this plan align with other ongoing City of Boston efforts. The following plans have been referenced in developing recommendations. As investments are made to implement these plans, the recommendations of the UFP should be integrated into them.

Imagine Boston 2030:
www.boston.gov/civic-engagement/imagine-boston-2030

Climate Action Plan:
www.boston.gov/departments/environment/boston-climate-action

Climate Ready Boston:
www.boston.gov/departments/environment/preparing-climate-change

Carbon Free Boston:
www.boston.gov/environment-and-energy/reducing-emissions

Heat Resilience Solutions for Boston (Heat Plan):
www.boston.gov/departments/environment/preparing-heat

Open Space and Recreation Plan:
www.boston.gov/departments/parks-and-recreation/updating-seven-year-open-space-plan

Planning for Future Parks:
www.boston.gov/departments/parks-and-recreation/planning-for-future-parks

Go Boston 2030:
www.boston.gov/departments/transportation/go-boston-2030

Complete Streets:
www.boston.gov/departments/transportation/boston-complete-streets

STRATEGY #1: EXPAND AND REORGANIZE URBAN FOREST MANAGEMENT

There is so much involved in urban forestry work when it is approached comprehensively, progressively, and proactively. It requires workforce coordination across a wide array of areas, including:

- arboriculture,
- land use planning,
- public works and infrastructure management,
- natural areas management,
- parks, and
- other public services.

This means that it is important that all political, administrative, and private actors are aware and engaged in urban forestry matters. This often means that cities must reevaluate and/or reorganize the structure and organization of urban forest management so that real progress can be made. It is with this perspective that the following recommendations are made.

- ***Recommendation 1.1*** *– Establish an urban forest leadership position within the City*
- ***Recommendation 1.2*** *– Increase and sustain operational staffing resources for Parks Department urban forest management*
- ***Recommendation 1.3*** *– Improve collaboration between the City and community partners*
- ***Recommendation 1.4*** *– Promote formation of formal networking and advocacy bodies*

**As a result of the following research, the FY23 budget included 11 additional staff for the Tree Division, including a Director of Urban Forestry position.*

Recommendation 1.1 – Establish an urban forest leadership position within the City

Issue/Challenge: Urban forestry programs and priorities would be bolstered by the creation of a leadership position within the City of Boston dedicated to this work.

The Parks Department manages trees in cemeteries, parks, urban wilds, and streets. However, a dedicated program for tree planting, care and maintenance is only in place for street trees. Currently, existing operations staff are working in a reactive mode due to the extent of Boston's public urban forest, citizen's demand for services, and formerly inadequate staffing levels. The Tree Warden is primarily only focused on executing internal operations to plant and maintain street trees, and to comply with Massachusetts General Law Chapter 87 (MGL 87) Shade Tree Law. Other Parks Department staff members do support and supplement the program, but do so on a limited or situational basis. Consistent and proactive coordination with City leadership, other City departments, state agencies, nonprofits, and neighborhood groups is essential to making progress in Boston's urban forest. The current structure and limited resources make this extremely difficult.

Due to the importance of this recommendation in facilitating many of the action items in this plan, it is the first recommendation and the only recommendation that is itself the action item.

Action Item 1.1A – Establish a Director of Urban Forestry position.

A high ranking city forester officer position is a key piece of a solid urban forest program. This role works to ensure urban forestry principles and practices are incorporated into many public initiatives and plans and become integrated into citywide operations. This position would:

- operate and represent the urban forest priorities across citywide initiatives,
- work and communicate across departments to improve interdepartmental coordination,
- work and communicate more effectively with community groups,
- work with the Tree Warden to ensure city forestry efforts are equity-focused,
- provide information and resources to the Zoning Board of Appeals,
- advocate for trees via communication with the Boston City Council,
- support the work of the Boston Planning and Development Agency's landscape architects,
- advocate for tree canopy during land development, and
- provide guidance and a stronger voice in the development of policies, codes, and other requirements.

This position is common in cities across the US (see case studies below) and is a key role required to implement the work in this UFP.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 2, 3, 4
Resources Needed: *Political support for creation of this position, funding for personnel costs.*

Recommendation 1.2 – Increase and sustain operational staffing resources for Parks Department urban forest management

Issue/Challenge: The Parks Department's responsibilities are extensive. Staff must perform and/or manage contractors for woodland management, tree pruning, removal, stump grinding, planting, and storm response. Additionally, department staff must respond to and inspect requests from residents and other departments, address overhead and underground utility work in the rights-of-way, review site plans, issue permits, inspect tree damage, coordinate the work of nonprofits and program partners, manage fleet and personnel, and perform other administrative duties.

There is currently no Parks Department staff member available to fully manage and communicate with community groups on their 311 work requests or project requests.

Additionally, based on input from the community, there is reported to be little assistance provided or communications from the City when a neighborhood or other community group wants to implement a community project. This can also be attributed to the need for additional staffing.

CASE STUDY: URBAN FORESTRY LEADERSHIP ROLES IN CITIES

Charlotte, North Carolina, has two key urban forestry positions. The City Arborist manages all the daily operations from the City's Landscape Management Division. A Chief Urban Forester is housed in the City Planning Division, and plans citywide initiatives, partners with the local nonprofit (TreesCharlotte) advocates for canopy from the Planning Division, and leads the application/enforcement of development requirements for tree canopy policy. Both are ISA Certified Arborists. The city cited that "having the Chief Urban Forester in the Planning Division is critical for ensuring our urban forestry efforts span across all initiatives and plans within the City."

Similarly, the city of ***Tallahassee, Florida,*** also has a City Arborist who manages all the operations from the city's Community Beautification Division, as well as an Urban Forester who works on city-wide initiatives and advocates for canopy from the Planning Department. Having a leadership urban forester role in Planning is essential to ensure the three goals of the UFMP – canopy quality improvement, canopy level improvement and better engagement – are met. While cities have a great deal of control over tree management on their own property, this enables Tallahassee to incorporate policies and programs that achieve goals in private development, too. The urban forester was hired when the city acknowledged that population growth was driving development and tree loss, and they needed a long-term plan and leader to spearhead urban forest preservation.

Many other cities have this type of position, including: Ann Arbor, Michigan; Cincinnati, Ohio; Mountain View, California; Los Angeles, California and Philadelphia, Pennsylvania.

The Parks Department's Tree Division currently has a staff complement of six full-time employees, and often one or more positions are vacant. Additionally, within the Parks Department, there is no staff wholly dedicated to tree operations and management in the expansive municipal park and cemetery system. Urban wilds have two staff members for over 221 acres across 30 properties. The current staffing level has been insufficient to perform all of the duties and responsibilities of public urban forest management. Recruitment and retention of staff is challenging. The Tree Division has a high turnover rate for a number of reasons. Salaries do not align with the workload of being a municipal arborist, salaries are not competitive with the private sector, and the high cost of living in Boston exacerbates the difficulty of recruiting and retaining qualified staff.

Action Item 1.2A - Add additional staff positions for the park and street tree programs with defined responsibilities.

Expand staff capacity to better meet the demands of citywide urban forestry work. Once the staff positions are created and filled, there are two options recommended for the Tree Division to assign program responsibilities to staff:

- One full-time (FT) position in contract management. Role: to manage the street tree planting and young tree care contracts citywide.
- One FT position in maintenance and plant health care. Role: to manage street tree maintenance and future IPM (Integrated Pest Management and PHC (Plant Health Care) contracts citywide.
- One FT position in parks. Role: to manage park tree planting and maintenance, and to provide arboricultural support to the Cemetery Division and Urban Wilds Program.
- One FT position in community coordination. Role: to manage volunteer and community outreach and planting projects, and to act as liaison with nonprofits and civic groups for both park properties and streets.
- One part-time or FT position for administration, data entry, and general support would be needed.

As an alternative to assigning specific tasks for the new job positions in the Tree Division, the positions for the street tree program can be designated as having responsibility for all urban forest management programs and activities in a specified area/management unit of the city (e.g. north, central, south districts). Each position would perform all urban forest management operational and outreach duties in that district. In this scenario, staff would be able to develop stronger, direct relationships with neighborhoods and nonprofits that operate in that area.

The urban forest leadership role (described in Action Item 1.1A), would be required and key to real progress in Boston.

These additional staff members are not only critical to support a proactive tree program and improve the urban forest, but would ensure greater direct action in and service to historically excluded and currently marginalized communities specifically, and allow staff to have the time and ability to improve neighborhood relations and overall service.

Timeline/Priority: *Short-Term (first five years)*

Action Item 1.2B – Support and fund proactive care in urban wilds.

Currently, the Urban Wilds Program includes a total of 221 acres across 30 locations, with further land acquisitions planned. Urban wilds are home to many natural features including large tracts of mature woodland habitat and present opportunities to expand tree canopy through native tree reforestation.

To keep pace with current management needs, additional staff and budget allocation are needed. Expanding the Urban Wilds Program will require additional investment. Since its inception in the 1990s, the conservation land managed by the Urban Wilds Program has expanded considerably. In 2021 alone, 30 parcels were added to the program. One full-time position was added through funding approval in 2020, bringing staffing levels for the Urban Wilds Program to two full-time staff. Investing in additional staff and funding resources would enable the program to create land management plans for each parcel, perform more inventory and gather habitat quality data, and obtain and use software for better recordkeeping. A thriving urban wilds system and program in Boston's neighborhoods is an innovative way to provide all residents with access to tree canopy and the natural world within it.

Staff are needed for positions such as project managers for capital renovation projects, grant writers for ecological restoration and trail projects, field staff for volunteer recruitment and oversight, and staff for conservation education and outreach.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 1.2C – Perform a job analysis and salary study for current and future staff positions and review the residency requirement.

A salary study prior to the hiring process ensures compensation is commensurate with job responsibilities, risk exposure while performing tree work and other duties, and regional and peer city salaries. Create new job descriptions and revise current descriptions that incorporate arboricultural industry certifications, training, and standards based on this work.

Timeline/Priority: *Short-Term (first five years)*

Action Item 1.2D – Develop an urban forestry internship program.

The City's forest management program can also benefit from seasonal or part-time assistance from paid interns. Internships can be assigned to assist the Tree Warden with public works and utility inspections, perform data entry, facilitate neighborhood communication and education, and help field staff and volunteers with planting and minor tree maintenance.

To meet equity goals, interns can be recruited from existing "Green Corps" programs operated or managed by community based non-profit organizations serving historically excluded and currently marginalized communities (e.g. the environmental stewardship program at Codman Square Neighborhood Development Corporation).

Internships may also be structured to fulfill community service graduation requirements

for those Boston Public Schools located in or serving historically excluded and currently marginalized communities that have such requirements.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 1.2E - Institute a training program for Parks Department staff to support urban forestry work.

The work involved in urban forest management requires specific knowledge and skills. Create a training program for Park staff performing program management, maintenance or planting operations. More skilled hands and eyes can help bring issues to the attention of the Tree Warden and improve outcomes for trees with regular maintenance and construction activities.

Training can include:

- tree basics (how they work/grow),
- new and young tree care,
- pruning,
- planting,
- mowing techniques to prevent injury to trees,
- plant health care: fertilization, pest and disease ID,
- equity in general, and UFP goals in particular, with an emphasis on both fostering a sense of belonging for historically excluded and currently marginalized communities,
- tree protection in construction, and
- tree risk management.

Such training can be organized in coordination with existing efforts in Human Resources and with the departments under the Equity and Inclusion Cabinet.

A quality training program is integral to keeping workers safe, efficient in their work, and motivated about learning new skills. Training also provides clear direction and expected performance outcomes, and positively influences staff engagement levels, productivity, attitudes, and behaviors.

A workforce development program aimed at filling the industry-wide need for skilled workers in tree care from the general population is discussed further in Strategy 7.

Timeline/Priority: *Short-Term (first five years)*

Action Item 1.2F - Cross-train other departments' maintenance and field staff.

Existing City staff (e.g. Public Works and Inspectional Services) can become a resource for the urban forestry program if they are provided basic training as well (as described above for Parks Department staff).

More trained hands can maintain small diameter trees and assist with minor storm damage clean-up on streets, in parks, and other public lands. More trained eyes can report tree risks, insect and disease issues, and lack of protective measures for trees in construction areas if they had more basic arboricultural knowledge. This training could occur as monthly "tailgate" sessions, annual interdepartmental workshops, etc. and be led by the Tree Warden and Parks' arborist staff.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 2, 4
Resources Needed: *Funding for personnel and as-needed contractual costs; political support, facility, resources workforce development (included in Strategy 7).*

CASE STUDY: WORKING AND TRAINING ACROSS SILOED DEPARTMENTS IN DALLAS, TX

The City of Dallas is structured in a way that results in grounds and tree care staff spanning across multiple departments. These staff had varying levels of knowledge and training, as well as differing goals and job responsibilities. In order to ensure quality tree care for all public trees, Dallas developed an annual training program.

A staff arborist within the Dallas Water Utilities department started the training course in 2016 for their own grounds crews. The course covers a variety of arboricultural topics from tree identification and biology to insect/diseases to tree care and managing construction impacts.

After the first year, other departments requested this training for their own staff, which resulted in a larger citywide staff training effort. Since its inception, it has grown in popularity, and is now open to the public as well. Today it is attended by City staff across departments, community forestry volunteer stewards, as well as staff from private tree companies, airport grounds staff and interested citizens. Now called the Dallas Arborist School, this is an annual program that takes six months to complete, requiring one six-hour day-per-month time commitment, which includes both class time and fieldwork.

Recommendation 1.3 - Improve collaboration between the City and community partners

Issue/Challenge: Over 60% of the tree canopy in Boston is privately owned and controlled. For this reason, the City of Boston is only one manager among many that has a responsibility for the stewardship of the urban forest. All private property owners, businesses, nonprofits, civic groups, and residents can positively influence the urban forest. Each entity brings unique perspectives and strengths that can expand the reach of this effort.

The rate of success in achieving the goals of this plan to expand the urban forest and improve the quality of it is increased if there is a strong partnership and collaboration between the City and the broader community of Boston. However, the collaborations and cooperation between the public, community groups, and private organizations with an interest in urban trees in Boston is currently limited. Collaboration has been reported as minimal, and at times not productive or positive for a number of reasons revealed during the Discovery Process of this plan. These include:

- ***Staff capacity within the City.*** There is currently no staff person with the defined responsibility, time, or experience to effectively manage or coordinate ongoing partner activities relating to trees. Additionally, there is a significant quantity of active entities and organizations within Boston that approach City departments for help with small, one-off projects. The currently limited staff do not have the capacity to respond and/or support these small but worthy urban forest enhancement projects. The inability to provide assistance is often perceived as the City being uncooperative and unsupportive of the community.

- ***Need for technical and legal expertise.*** The City's permit requirements, bonding, and other bureaucratic processes can be burdensome on small community groups, often requiring technical and legal expertise that residents or groups don't have. This can discourage community initiation of and participation in urban forestry projects, such as planting trees in streets and parks, adding street tree fencing, etc.

- ***Post-project care.*** The City is often approached by groups enthusiastic about planting projects, but those projects often have no plan or resources to maintain the trees through the establishment period, and the City staff are underfunded to take over care themselves. This leads to poor rates of establishment for newly-planted trees.

- ***Need for citywide goals.*** There were no citywide central goals or initiatives to work toward before this plan, resulting in many entities focused on many different efforts and goals acting independently of each other. This lack of common goals can diminish the ability of each individual effort to preserve and improve the urban forest or ensure that resources are equitably distributed across Boston's neighborhoods. As a result of the absence of goals, efforts to make long-term

progress and significant positive impacts in the areas of greatest needs have been hampered.

- ***Coordination challenges.*** The limited number of community partners focused on historically excluded and currently marginalized communities creates challenges for coordination, collaboration, and support between the City and community based organizations. Limited staff capacity in the City means only the most visible, institutionalized, or formalized groups are given attention leaving smaller groups, often in historically excluded communities, continuing to be marginalized.

There are many actions that can be taken to improve collaboration between the City and its partners and neighborhood groups. Recommendation 1.2 indicated the need for a City staff position within the Parks Department focused on collaboration with the community and with the specific duty of coordinating community-based volunteer projects. This action supports this recommendation in addition to the following four action items:

Action Item 1.3A - Improve Boston's partnership approaches and structures.

Partnerships with community groups are key to creating positive changes in each neighborhood. Real co-stewardship of the urban forest in Boston depends on committed partnerships with the community.

There is not one central nonprofit partner for the City to effectively partner with like these case studies describe. Instead, there is a wide range and network of smaller active groups. Each of these organizations have varying focuses, including street trees, open spaces of different sizes and ownership, food resilience, neighborhood greening and community engagement. A more effective system would be to set up a system that allows partnership work with all organizations, leveraging the ability of existing leadership in historically excluded communities to more easily speak for themselves (see case study: urban forestry partnerships in cities).

A streamlined system for collaboration that includes clearly defined roles and division of labor will lower barriers for partnerships between the City and organizations. This can be accomplished through partnership agreements or a well-defined City program that groups can sign up to implement in their own neighborhoods. Roles and issues that may need attention in this work include:

- project planning (including City/partner design and review and coordination with other City departments),
- funding (sources, allocation per party per task),
- site work (hardscape work like sidewalk modifications, clean-up, debris management),
- materials acquisition (acquiring the trees, mulch, soil, tools),
- safety requirements (liability issues, project personnel, traffic control, adjacent property),
- post-project management (inspection, short and long-term maintenance),

- communication and outreach with all those involved, and
- administrative responsibilities (purchasing rules, permitting, agreement execution, volunteer recruitment and supervision, insurance or bonding, contract management, as needed).

Eventually, once the City develops staff capacity, the Parks Department can even take on complete project management for community-initiated projects by accepting funding and leveraging their wholesale contracts for labor and materials to maximize the investment made.

A guidebook or other resource may also be developed to ensure all tree projects in Boston are installed and cared for according to nationally accepted standards. This is another tool to help ensure that interactions and project work are as smooth and seamless as possible. This guide can include some of the technical information that community groups may struggle with, but be written specifically for volunteer projects in an easy-to-read, user-friendly format available in multiple languages. Information and instructions on topics can include planting instructions and standards, tree species selection, watering guidelines, young tree pruning practices, and future maintenance and replacement procedures. It can also detail the roles and responsibilities expected of each partner. This would ensure quality work across all projects, and remove some of the obstacles communities may face in creating their own community projects, especially in historically underserved areas of Boston.

Timeline/Priority: *Short-Term (first five years)*

Action Item 1.3B - Seek a champion from the community-at-large.

A non-City community champion is also very helpful in advancing the urban forestry movement overall. While at times hard to identify, and often emerging spontaneously, this person or organization provides a voice for trees in Boston, often from a non-tree person perspective, as the plan begins to be implemented.

They can serve a number of roles during plan implementation. They can advocate for trees through broadcast and social media, hold meetings with elected officials, and shine light on the need for equitable practices in Boston. They often have a hand in motivating neighborhood champions.

Champions can come and go over time, and there can be more than one (i.e. a respected individual from the medical community promoting tree health benefits; a faith leader promoting the social benefits of trees and equity needs, or a sports figure encouraging tree planting).

Watch for opportunities to engage well-known people within the community. Beyond celebrities and sports teams, other champions can include leaders from key institutions as well as media personalities.

Well-respected, influential individuals or organizations can provide access to resources, lend legitimacy and prestige, and attract public attention to the cause. They

CASE STUDY: URBAN FORESTRY PARTNERSHIPS IN CITIES

Pittsburgh, PA. Tree Pittsburgh and The Western Pennsylvania Conservancy (WPC) are the primary partners for the City of Pittsburgh that work to supplement the city's Forestry Division both in budget and in staffing. Tree Pittsburgh utilizes funds from the WPC to run all the street tree planting for the City. Trees are purchased and installed by Tree Pittsburgh volunteers, who then work for the next 3-5 years to get those trees established (water, mulch, weeding, young tree pruning). Once established, the trees are then incorporated into the ongoing cyclical care program run by the City. This arrangement has allowed the City to focus on mature tree care, tree protection, and risk reduction, with 100% of its budget dedicated to care of the existing urban forest. The nonprofit's clear role is to plant and maintain new trees and do so with neighborhood involvement.

Indianapolis, IN. The non-profit Keep Indianapolis Beautiful (KIB) partners with the City of Indianapolis to plant thousands of trees. KIB's agreement with the city to manage tree planting has been in place since 2011. KIB installs the trees and provides care for the first three to five years after installation. To date, KIB has planted over 10,000 trees, allowing the City to focus on mature tree care. KIB also runs a seven-week Youth Tree Team (YTT) for teens and young adults to plant and care for trees (with a YTT tree survival rate of 97%). This summer job program works to not only improve the community through tree care, but also provide readiness training, getting the high school employees ready for future jobs.

Washington, D.C. The DC metro community organized after a report showed significant canopy losses in DC since the 1970s (from 50% to 35% canopy cover). Casey Trees was started in 2001 after philanthropist Betty Brown Casey read about the losses in a Washington Post article. The organization initially started with the role of a watchdog organization to counter this trend of canopy loss, pushing to create and pass tree protection laws. Today, Casey Trees is a primary partner for the District of Columbia and supports DC's

municipal urban forestry department by planting trees on public and private lands not serviced by the City. Casey Trees provide the District a way to make a positive impact on private property which is the majority of the land within the municipal boundaries. The nonprofit also manages the District's in-lieu fees (over $1 million collected annually from fines for trees removed in development or in private yards), using the funds to run tree planting and care programs across the District. This includes running bus and Metro ads in communities of low canopy to increase awareness and participation.

Cincinnati, OH. The City of Cincinnati is focused on a program to rectify the inequities within the city while planning for climate resilience through a program called Climate Safe Neighborhoods. Though the effort was initiated by the City, the City staff recognized that they did not have the resources, network or levels of trust within these communities to start collaboration work, at least not in an effective and equitable way. To remedy this, the City partnered with Groundwork Ohio Valley, an environmental justice non-profit based in Cincinnati and part of the Groundwork USA network (www.groundworkorv.org), which has spent the last decade building a network of local institutions, families and community champions, as well as a level of trust and camaraderie in these neighborhoods. This partnership allows each neighborhood to have a voice in the effort, the City to have an avenue to convey the data on the challenges of climate change, and the two to work together mapping solutions that address the challenge and result in something not only that the community needs, but that it wants as well. Once a plan is developed with the community, the City staff also have been able to help navigate the bureaucratic process, bringing in multiple relevant City departments, effectively elevating the neighborhoods' voices to actionable use of public funds across public and private property. Collectively this team builds community trust and, by doing the necessary work required, ensures efficient practices with equitable community-driven results.

Community Volunteers | Speak For The Trees

COMMUNITY CHAMPION

The Cleveland Cavaliers and **Davey Tree Expert Co.** have a multi-year partnership that promotes tree growth throughout Northeast Ohio. This program was started in 2015 after the newly-released Cleveland Tree Plan showed a low tree canopy and more losses projected, also citing the roles trees play in reduction of air pollution, flooding, and water quality. The team has pledged to plant one tree for every three-pointer made during the season as part of the "Trees for Threes" program. Since its inception seven years ago, 2,100 trees have been planted in Northeast Ohio by the Cavaliers and their partners.

www.nba.com/cavaliers/community/trees

Bette Midler emerged as one of the most recognized proponents of trees in NYC after moving back to the city in 1995. She founded the nonprofit New York Restoration Project (NYRP) to improve open spaces within underserved communities. In 2007, during a celebration planting with Mayor Bloomberg planting 600 cherry and crabapple trees, she made the comment, "Why should we stop here? We should plant one million!" The MillionTreesNYC program was initiated at that point and completed in eight years. Midler's organization and resources were key to reaching this goal in such a short time. "Where the Parks Department lacked jurisdiction—such as in private yards, churches, cemeteries, and housing projects—NYRP filled the gap. Planting as many as 30,000 trees in a single day, the program ranged from vast reforestation efforts to providing single trees to schoolyards and private outdoor spaces" (Peregoy 2016).

CASE STUDY: SYSTEMS FOR CITIES WORKING WITH MANY COMMUNITY GROUPS

New York City has set up a streamlined system to allow many small neighborhood and community interest groups to build and create volunteer projects in their own neighborhoods, while minimizing workload for staff.

Super Steward Program for community leaders.
"Our Super Stewards work independently to make an impact on their neighborhoods. NYC Parks staff provide training, access to tools and other resources, and license individuals to work on their own, as well as to recruit and train their friends and neighbors."

www.nycgovparks.org/reg/stewardship

Ready built project structures for community groups.
NYCParks has also created a system for community groups to sign up for a project in their own neighborhoods. Groups can either sign up for a group project in street tree care, planting, wetland clean-up, invasive plant removal or trail work, through the Request a Project Tool:

www.nycgovparks.org/opportunities/volunteer/stewardship/request-a-project

"Request a group project with NYC Parks Stewardship! Work with us to explore and restore New York City's natural resources. Volunteers help to conserve and protect forests, wetlands, and local street trees. Projects include tree planting, invasive species removal, cleaning up street tree beds, wetland clean-ups, trail projects, and more! Groups can make a vital and significant impact on the restoration and management of nature in New York City. Nature-based projects are great opportunities for team-building, enjoying the unique landscapes of the city, and starting conversations, while making a real difference. "

It's **My Park Project.**
Another option for groups is to sign up to participate in an "It's My Park" project already running for a specific day and park across the city.

www.nycgovparks.org/events/its_my_park_day

Northwest Indiana CommuniTree.
The Northwest Indiana Regional Planning Commission's (NIRPC) serves five counties, with the goal to aid each community to improve land, water and air quality. NIRPC helps their communities plant and care for thousands of trees throughout the region by providing access to trees, tree care workshops, and technical support for any interested community. The goals of CommuniTree are to coordinate grant-funded and privately-funded urban forestry efforts in communities that would not otherwise be able to plant and care for trees. CommuniTree was created based on the Collective Impact model, meaning it is not an organization in and of itself, but a network of players with the same goal, metrics for success, and in consistent community. There is no administrative budget or permanent staff. "Their approach is a model for a community urban forestry partnership that engages in tree planting in underserved, post-industrial communities by implementing its proven strategy for developing a skilled and diverse local workforce."

nirpc.org/2040-plan/environment/communitree/

www.fs.fed.us/research/urban-webinars/communitree.php

Volunteer Tree Planting.
Source: Erika Rose Chicago Tribune.

also have access to networks, stakeholder relationship building skills, convening power, and can mobilize financial and non-financial resources to support urban forest initiatives. While not required, a champion opens doors for trees in Boston beyond what may currently seem possible.

Timeline/Priority: *Ongoing*

Goals Supported: 3
Resources Needed: *Additional City staff, as detailed in Action Item 1.2A, is critical to all action items within this recommendation.*

Recommendation 1.4 - Promote formation of formal networking and advocacy bodies

Issue/Challenge: There is currently no public representation body (board or commission) within the City's management structure to provide guidance to and advocate for tree efforts in Boston. This type of board is common both nationally and in Massachusetts (see case study: examples of city tree boards in Massachusetts). Specifically, they function as a way to work with public officials to improve the health of the urban forest through advocacy, education, management, plantings, and maintenance activities. They serve to complement, not replace, professional leadership.

Regular communication between practitioners of urban forestry is also valuable, especially when considering the impacts of climate change and future pests and diseases. These conversations and the information sharing they promote can help guide critical efforts and inform leadership and advocacy groups. In Boston, networking currently happens informally and is therefore not consistent, nor does it include all the potential practitioners that span the Boston area.

Action Item 1.4A - Institute a City tree board.

A community tree board can help ensure that the diversity of communities in Boston are incorporated into City tree initiatives.

An effective tree board can assist the Tree Warden and City arborists by serving as an advocate for trees, helping residents and businesses understand and value the benefits of maintaining trees, developing good public relations and giving citizen-based feedback on what is working or what needs to be changed. An active tree board is the keystone between the residents, elected officials, and City employees.

Tree boards also have an important role to play in fostering equity by bringing together efforts across individual organizations already working in historically marginalized communities to collaborate toward both their own goals and mutual support of shared objectives. A well-designed tree board can help these organizations gain access to resources and amplify their voice through their inclusion in formalized structures.

A tree board in Boston can also aid in the management of a tree fund, underwritten by "in lieu" payments, philanthropic funding, or other sources, that can be created to provide resources for tree planting on private property.

Legal recognition of a tree board as part of municipal government helps assure that trees will have standing in Boston and that the actions of the tree board will be taken more seriously. This is most commonly achieved through an ordinance, either a "standalone" ordinance that creates the tree board, or as part of a broader tree or community forestry ordinance (see Recommendation 2.7). Either way, the ordinance should clarify the role of the tree board, define its composition, describe how members are seated and term lengths, and provide guidelines for its operation (Fazio 2010).

Additional resources:

- *Arbor Day Foundation - More information on how to grow a great tree board: www.arborday.org/trees/bulletins/resources/054.cfm*

- *Massachusetts Department of Conservation & Recreation - Tree Boards and Committees Fact Sheet: www.mass.gov/doc/tree-boards-and-committees-fact-sheets/download*

Timeline/Priority: *Short-Term (first five years)*

Action Item 1.4B - Form a network for professional urban forestry managers.

There are many entities that have professionals managing their own urban forests. Beyond the City staff, these include arborists or grounds professionals working with the Emerald Necklace Conservancy, Friends of the Public Garden, Arnold Arboretum, and Massachusetts DCR, as well as the many universities, hospitals and other large campuses and private developments in Boston. This can also include nearby municipalities.

Because of the large number of urban forestry managers in and around Boston, a regular gathering of professional practitioners is recommended to learn from and assist each other as much as possible. Discussion topics can include sharing work plans, planned budgets, ways to work together, and plans to address upcoming threats (pests, floods, drought). This is also a way to bring in grounds managers that have not yet been included in the urban forestry movement within Boston to talk about implementing the new UFP. This can

Arbor Day | Matthew McNamara

CASE STUDY: EXAMPLES OF CITY TREE BOARDS IN MASSACHUSETTS

Excerpt from DCR Massachusetts' Tree Boards and Committees Fact Sheet

Town of Brookline: Established in 1886, the Brookline Tree Planting Committee is the oldest continuous tree planting committee in the nation. The Select Board appoints the three-member committee that advises the tree warden on tree selection and placement.

Town of Monson: This Committee formed following the tornado of June 1, 2011 and provides leadership, education, and resources for residents replanting trees following the tornado. The Committee meets once a month, and, in addition to replanting, works to advocate for trees in the community through development of a tree ordinance and management plan and through educational programming for residents.

Town of Amherst: The Amherst Public Shade Tree Committee works to preserve, protect, and promote the town's public shade trees and its urban forestry goals. Since 1978 the Committee has played a key role in the Town's successful application to state and national grants, run regular tree planting programs, and participates in the review of projects that impact the Town's urban forest. They work with the DPW, Conservation Commission, Planning Department and frequently support surrounding communities with their public shade tree programs.

City of Greenfield: The Greenfield Tree Committee is a non-profit, volunteer group of concerned citizens, operating under the umbrella organization, the Connecticut River Conservancy. The group's purpose is to promote a strong and resilient urban forest in the City of Greenfield by facilitating the planting of trees along public ways and by educating the public on the value of trees and the need for their care and maintenance. The Committee raises funds and works closely with the Greenfield Department of Public Works in an advisory and supportive capacity.

www.mass.gov/doc/tree-boards-and-committees-fact-sheets/download

CASE STUDY: REBUILDING TRUST THROUGH FULLY FUNDING PROACTIVE CARE IN WASHINGTON, DC.

One action that can begin to repair the lack of trust between historically excluded and currently marginalized communities and the City District is to ensure that all public trees existing and those that will be installed will be proactively cared for. The Urban Forester for the District of Columbia cited a major challenge for citizens rejecting trees or not wanting trees or to participate in canopy efforts (which generally shows up in lower-income areas) is a lack of trust between the community and the District. Residents in historically marginalized areas didn't believe the City would actually care for the trees in the long run, leading to problems for the residents. However, this relationship is being repaired by fully funding and implementing proactive tree care. In doing this, the District has shown they will always come out and plant, water, prune, and remove any public tree. This has, over time, started to rebuild trust and relationships. The push for better care and related necessary funding was made possible due in large part to the advocacy work of Casey Trees.

be an informal group spearheaded by any of the partner organizations.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 2, 3, 4
Resources Needed: *Political will for creating a board and potentially including the board in the City Code. Additionally, a City staff person will be needed to manage and administratively run the board. One person or entity would be required to recruit and set up regular meetings of a professional network.*

STRATEGY #2: PROACTIVELY PROTECT AND CARE FOR EXISTING TREES

One of the keys to maintaining and growing tree canopy in Boston is to care for and protect the trees that are already in place.

Proactive care increases an urban forest's ability to live longer and provide exponentially more of its many benefits to Boston residents. Proactive care involves a cyclical care program, a well-defined risk management approach, and is supported by City systems (policy, code, plans, and funding). When trees are well managed, their longevity increases because they are:

- healthier,
- more resilient and able to stand up to future threats, and
- less likely to fail due to risk and storm hazards.

Protections for existing trees prevent losses in tree canopy. New and young trees are crucial to the City's future forest, and large mature trees provide the highest level of benefits to Boston residents.

Recommendations to provide better care and protection for existing trees are as follows:

- **Recommendation 2.1** - *Develop and implement a proactive work plan for trees on public land*
- **Recommendation 2.2** - *Perform plant health care and integrated pest management*
- **Recommendation 2.3** - *Prioritize proactive tree care in areas of highest need*
- **Recommendation 2.4** - *Protect and better manage trees with clear policies*
- **Recommendation 2.5** - *Increase interdepartmental support of urban forestry efforts*
- **Recommendation 2.6** - *Consider new programs and changes in code to protect mature trees and enhance the urban forest*

Recommendation 2.1 - Develop and implement a proactive work plan for trees on public land

Issue/Challenge: Boston currently has a reactive, on-demand only maintenance system for street and park trees, as well as a lack of well-defined operations planning documents for the management of street, park, and other public trees. Additionally, the City does not have a written approach to tree risk management or for emergency response and recovery work. Without these systems in place, annual management work can be inefficient, ineffective, and not incorporate

CASE STUDY: IMPLEMENTATION AND RESULTS OF CYCLICAL TREE CARE IN CINCINNATI, OH

The City of Cincinnati's urban forest management program officially began in 1982. Prior to that, street tree maintenance was performed by the City only on a reactive basis. There were thousands of trees in need of maintenance and the backlog for resolving service requests was over two years.

While still responding to priority tree maintenance, resolving storm damage, and planting trees, the City began to perform inventory and cyclical, preventive maintenance tasks each year on a limited basis in six management units as the budget would allow. It took approximately 15 years to complete one cycle of preventive maintenance in the six units due to limited funding and the continued need for storm response and tree planting.

Cincinnati now has a firmly-established six-year cycle for its public tree inventory update and preventive maintenance program. The City's urban forestry staff report that the investment of time and funding for preventive tree maintenance has decreased tree-related risks and liability, decreased the incidences and severity of storm damage, improved response time for all tree maintenance requests, improved the health of public trees, and increased the benefits trees provide the City and residents. For instance, in the year following preventive maintenance, there is an 85% reduction in emergency and routine service requests.

Additionally, a cyclical cycle ensures the City provides equitable service delivery to all of its 52 neighborhoods. With a cyclical maintenance program, public trees receive care regardless of a resident's ability to use online, telephone, or in-person reporting and service request systems.

the UFP goals as guiding principles for ongoing work.

Reactive maintenance relies on residents reporting issues through the 311 system and is an ineffective method for managing the urban forest. Trees with the greatest need may not get reported, creating greater mortality and risk in the urban forest. Service delivery may be inequitable since it is provided only to those with the time and knowledge of how to use the reporting systems.

Moving to proactive maintenance has many advantages over on-demand maintenance, the most significant of which is reduced risk. In a proactive program, trees are regularly assessed and pruned, which helps detect and eliminate most defects before they escalate to a hazardous situation with an unacceptable level of risk.

Proactive systems ultimately reduce crisis situations in the urban forest because every public tree is visited, assessed, and maintained on a regular basis. Other benefits include more predictable budgets and projectable workloads; reduced long-term tree maintenance costs; increased environmental and economic benefits from trees as more reach maturity, and the elimination of inequitable service delivery to neighborhoods.

Action Item 2.1A - Develop and fund a proactive street and park tree work plan. An approach for annual maintenance, planting, young tree care, plant health care, and other important annual proactive care tasks should be well-defined in a 3-5 year written work plan. This is an important tool for the Tree Warden to project work priorities and related costs. It is also an important guiding document to ensure equitable tree care practices are in place. This plan of action can be implemented daily, monthly, or yearly by the Tree Division, Urban Wilds, Cemeteries, Park Maintenance, and third party managers of public green space.

These types of annual work plans factor in the most current tree inventory and canopy assessment data, existing levels of staff and financial resources, and can incorporate industry best practices, as well as the citywide goals of equity and community dialogue.

The work plan must involve the creation and funding of a cyclical care program for existing trees, as well as a program in place to care for and establish young newly-planted trees. Each is detailed below.

- ***Plan and implement a cyclical tree care program.*** It is a best management practice to care for public trees by inspecting and maintaining them on a 6-10 year cycle. Whether managed by Parks Department or other departments, this is an essential practice for proactive care. This involves the following steps:

    1. Creation of management units within the city. These can be defined by geography, neighborhood boundaries, districts used by other departments, etc. and should use the inventory data to achieve a relatively even distribution of the number of trees in each unit. Initially, subunits can also be created to facilitate implementation given any funding or resource limitations.

2. Create work orders for City staff, or contracts, to perform the needed maintenance work on each public tree in the first management unit or subunit. An up-to-date inventory of each zone, combined with field verification, is used to build the contract.

3. Monitor the work, and then update the inventory database with information on the maintenance performed (removal, crown raising, crown cleaning, etc.).

4. Prepare for work in the second unit or subunit the following year.

At the start of implementation, Environmental Justice communities, historically excluded neighborhoods, and areas where socially vulnerable people are concentrated will be prioritized.

A similar cyclical maintenance program for landscape trees in parks, cemeteries, and other open spaces should also be developed, no matter whether managed by Parks Department or other departments.

- ***Provide proper establishment care for all newly planted and young street and park trees.*** Newly planted and young trees are a significant financial and environmental investment in Boston's future urban forest. As such, they need proper care in the first six years after planting so they can survive and thrive to produce the needed benefits for residents.

Currently in Boston, almost 60% of the Tree Division's budget is allotted to street tree planting, yet young tree care work is largely unfunded (beyond contractor watering for the first two years). The responsibility for the care of newly planted trees in parks and cemeteries is variable and largely undefined.

Proper, timely, and cost-efficient young tree care can be informed by data such as overall and species-specific mortality rates, staff/contractor/volunteer costs per tree, the types and frequency of care and maintenance performed, nursery source, etc. These data do not currently exist for either street or park trees.

A young tree care program of work is essential to develop, and involves the following steps:

1. ***Develop contract specifications for young tree care.***
   Create specifications for young tree care that will be provided during the third and sixth years after planting. Utilize industry standards, consider the various planting site characteristics (tree well, tree lawn, open ground) to define such as structural pruning, watering, fertilization, mulching, staking, and insect and disease treatment. Share the specifications with 3rd party managers and present them as the standard of care for all newly planted public trees. These same specifications may be used to streamline the process with community partners wanting to assist with young tree care. An example of young tree care specifications has been drafted for the Parks Department's review.

2. ***Perform needed maintenance.***
   In the third and sixth year after planting, Parks Department arborists should inspect the new/young trees to determine what

care is needed and ensure young tree care maintenance is happening. This can be done by properly overseeing and holding accountable contractors the City pays to do maintenance, or by working with community partners. Inventory software can be used to create work orders at the appropriate times, which then ensure the inventory is updated after the young tree care work is completed.

3. ***Track young tree care data.*** Using the tree inventory database, or other data management system, Parks Department staff should record the nursery source, type of labor used for installation, mortality rates and the types and costs of young tree care for each new tree planted in streets and parks. After 3 years, trends should start becoming visible that will improve young tree management and the sustainability of the future public urban forest.

This is an opportunity to utilize a workforce development program or neighborhood volunteers to supplement new tree care. Young tree maintenance is well-suited for volunteer and entry-level green industry workers. This is an opportunity to utilize a program that encourages empowerment of local residents while building skills of in tree expertise. Strategy 7 explores workforce development opportunities for Boston in more detail.

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.1B - Create and adopt a tree risk management approach.

Developing and following a well-developed and accepted tree risk management plan can not only reduce City liability, but help control the actual risks trees pose to people and property. A written, well-defined approach is critical to have in place as it demonstrates that the City and staff are reasonably performing their required duty of care.

Developing a risk management plan requires the City of Boston to objectively consider risk and then adopt and implement a risk management policy and management process. These plans should be based on science, national arboricultural and safety standards, best practices, professional judgment, and risk tolerance levels.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.1C - Create an emergency response and recovery plan.

An emergency response plan related to trees ensures a proactive response to what we know to be effects of climate change on the urban forest - primarily more frequent and severe storms. Once in place, these plans improve the efficiency of storm response, ensure all efforts are coordinated with other City emergency services, and also decrease injury and liability from tree hazards.

An emergency response and recovery plan reviews the City's current state of readiness and makes recommendations for dealing

TOWARD PROACTIVE STREET TREE CARE

Providing proactive tree care will help grow healthier, longer-lived street trees. That will ultimately contribute to citywide urban forest canopy coverage, sustainability, and resiliency.

Transitioning to this sort of care will require additional staff to take on additional work. Under a proactive management program, the Tree Division will continue to plant new street trees, prune, remove dead, dying or dangerous trees, and provide the on-demand services that are routinely needed each year, but cyclical maintenance in defined management units of the city will be added to the Tree Division's responsibilities. In addition to more funding for this important work, the personnel complement will need to be expanded by adding three field arborists, one GIS/IT technician, and one administrative position.

Back Bay/Beacon Hill

with the results and impacts of severe and catastrophic weather events on the urban forest. A plan would address and define Boston's urban forestry program response tasks and procedures, as well as the role of other departments, and county, state, and federal government players. The plan would also set forth protocols for dealing with the pre- and post-storm issues of debris management, public safety, internal operations, interagency coordination, equitable response, and recovery strategies. Performing these operations in compliance with FEMA protocols is required to receive federal assistance in emergency situations.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.1D - Plan for regular updates and reporting on work plans.

All plans should be reviewed and updated every five years. When revisions are made, be sure to incorporate the most up-to-date tree data, staff, and funding levels, as well as interdepartmental input for continued internal coordination. In reviewing and updating these plans, the Parks Department should specifically engage and collaborate with the City tree board (see Recommendation 5.3) and other Environmental Justice communities to ensure work each year is equitable in nature.

Additionally, consider an annual report on the implementation results and accomplishments of the Tree Warden's work plan to be presented to department heads and elected officials, as well as to the neighborhoods (as included in Recommendation 5.2).

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 1, 2, 4
Resources Needed: *Staff time will be required for internal work plan creation, and possibly additional funding for plan assistance by consultant expertise, if needed. Funding will be needed to implement all plan implementation work referenced here as well.*

Recommendation 2.2 - Perform plant health care and integrated pest management

Issue/Challenge: Boston's urban forest is under threat from invasive insects and disease such as the emerald ash borer, Dutch elm disease, and spotted lantern fly. Trees in any urban setting are less resilient to these attacks due the stresses that come with living in an urban environment. Stress comes from the limited growing space, poor quality growing conditions, and high pollution and heat levels. And these stressors are predicted to increase with the varied impacts of climate change. For these reasons, plant health care is required to ensure the resilience of Boston's public trees. However, the only significant form of care on public trees in Boston currently is pruning.

Plant health care (also referred to as integrated pest management or IPM) is a holistic approach to maintaining tree health. An investment in plant health care practices results in healthier trees, and healthier trees grow longer, cost less to maintain, have less risk, and are less prone to insect and disease attacks.

Action Item 2.2A – Stay up-to-date on upcoming threats from pests and diseases.

The first step in an IPM program is to identify important pests of concern that pose the greatest threat to trees in Boston. This can be done by utilizing the street tree inventory data as well as general knowledge of trees in parks and open space. Additional investigation can be done by consulting with other experts and partners in the region, including the Massachusetts Department of Agricultural Resources, experts at Arnold Arboretum, ENC and other agencies with plant health care expertise. By regular networking with institutional and practitioner peers, Boston can stay on top of upcoming threats.

Once identified, Parks Department and third party management staff will benefit from training on how to recognize the signs and symptoms of major pests, in addition to best management practices to control such pests proactively.

The general public should also be informed about current and emerging pest threats to protect the entire urban forest. Local nonprofits, schools participating in Harvard Forest's Schoolyard Ecology Program, and other urban forest partners can help coordinate timely public outreach messages about insect and disease threats and potentially use the Massachusetts Introduced Pests Outreach Project tool as a resource for public information (see *massnrc.org/pests/report.aspx*).

T***imeline/Priority:*** *Short-Term (first five years)*

Action Item 2.2B – Create and implement an Integrated Pest Management (IPM) plan of action.

Develop an IPM plan and program to optimize pest management activities that target those of greatest potential risk to trees in Boston. The plan should use the inventory data as a guide, along with any pest surveys performed to focus on identifying and monitoring threats, understanding and establishing tolerance thresholds, selecting the correct and proper timing for treatments (mechanical, cultural, or chemical), and setting a standard for keeping records and evaluating results. The IPM plan should be regularly reviewed and updated as needed, and if chemical controls are needed, then the community should be made aware of the treatments selected.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.2C – Develop a process for tracking IPM activities and monitoring for future threats.

Use the inventory data and software to establish a pest monitoring and tracking system. It can aid in a better understanding of where susceptible trees are, allow tracking of species diversity and thus susceptibility to pathogens, create work plans, and monitor public trees to treat proactively and in a holistic manner.

Regular field scouting is required for a successful IPM program and collaborative inspections with allied organizations, and even trained volunteer efforts can be

integrated with the City's inventory databases to provide more accurate information on overall tree health and pest threats.

And again, regular networking with institutional and practitioner peers can aid in this effort as well.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.2D - Provide plant health care (PHC) to mature trees.

A healthy tree is one that is better able to fight diseases and pests. Beyond insects and diseases, Boston's mature trees are stressed by limited space to grow, poor nutrient and water access, pollution, and mechanical damage. Proactive plant health care techniques will help mature trees withstand many of these stressors and can extend their service lives on streets and in parks. PHC techniques that can be used to preserve mature trees include fertilization, plant growth regulators, cabling and bracing, soil aeration, and retrenchment pruning.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: *2, 4*
Resources Needed: *Additional staff and funding for IPM planning and implementation of PHC work, networking with partners to disseminate information to the community on pest and disease threats.*

Recommendation 2.3 - Prioritize proactive tree care in areas of highest need

Issue/Challenge: Proactive tree care should be prioritized based on an equity lens, especially because the loss of a single tree can be more impactful in historically excluded communities, State-defined Environmental Justice communities, and areas with low existing canopy coverage.

Action Item 2.3A - Initiate proactive mature and young tree care programs first in areas of highest need.

The first rounds of proactive care should occur in the areas of highest need, and that would start to undo the impacts of historic practices of marginalization. This is a guiding principle of this UFP, and should be the top deciding factor in where to start proactive care in the city. Comprehensive tree care should initially focus on Environmental Justice communities, historically excluded neighborhoods, and areas of low canopy (see Recommendations 2.1 and 2.2).

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.3B - Develop community outreach on the care and importance of trees in areas of highest need.

Alongside the City's proactive care activities, partners and neighborhood groups in these areas are encouraged to develop a community engagement and outreach process aimed at sharing in the care of these trees by

CASE STUDY: PRIVATE TREE CARE ASSISTANCE PILOT PROGRAM- CHARLOTTE, NC

The City of Charlotte initiated a pilot Large Tree Assistance program in 2018 in response to a number of neighborhoods having large old trees and no financial ability to care for them. Homeowners in the Wesley Heights neighborhood could apply for assistance with large trees on their private property.

Funds were gathered between the City and the neighborhood association. The division that cares for public trees (Landscape Division) set the criteria and income for the needs-based program and the neighborhood distributed flyers to residents about the opportunity. One tree company was hired to assess and determine the level of risk for the trees and work needed, while a separate company performed the work. Twelve households were selected, and 21 large trees were pruned at no cost to homeowners.

This program was able to bring attention to the value the community places on trees, while at the same time providing assistance for preservation and safety improvements. The program was so well received, that there are efforts in the works to continue and expand it.

Video: *youtu.be/Qmd-152uzws*

residents and property owners. This initiative should include learning opportunities on the importance of trees, how proper tree care maximizes the health and social benefits trees provide to the individual as well as the neighborhood. Collaboration with Parks Department and other City departments providing additional support for specific community residents (e.g. the Age Strong Commission supporting elders) can be included in this community-led engagement and outreach initiative.

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.3C - Consider a program or partnership to offer low-cost or free tree care services on private property to low-income residents.

Tree care can be expensive, and as such, when the need for work on a tree on private land arises (a fallen limb, storm damage), many without the financial means often opt for removing the tree instead of paying to preserve the tree long term.

However, there are opportunities to minimize these financial barriers to encourage tree preservation instead of removal of private property. This can range from the City, its partners, and green industry working together to create a network of experts to donate their skills or time, to a larger initiative to fund discounted or free tree work for those in need. Work provided could include: free private tree inspection and/or technical advice from Massachusetts Certified Arborists; materials, supplies, and supervision for new and young tree maintenance projects; and donations and grants secured from foundations that are specifically designated to fund tree maintenance on private property.

The Boston Tree Board, in collaboration with stakeholders in and serving these targeted areas, can develop the quality standards for this kind of assistance.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 1, 2, 3, 4
Resources Needed: *Funding for cyclical care from Action Item 2.2A is critical to serving the needs of these priority areas. Additionally, multiple partners within Boston will be needed to pursue both outreach and awareness work, as well as a financial assistance program.*

Recommendation 2.4 - Protect and better manage trees with clear policies

Issue/Challenge: Neither the City of Boston nor the Parks Department have formal policies regarding the management or protection of the public urban forest.

Having written policies in place is important for many reasons. First, they are avenues of communication that clearly convey to residents what the City is going to do, what it is not going to do, and what it aims to achieve for the community as a whole by following the policy. Policy statements also clarify standards and protocols for interdepartmental projects and issues, provide a framework for achieving long-term goals, and can lead to amended or new City Code and regulations.

Policies can be more easily amended when new information or science is available, or if political, financial, or environmental situations change in the future (unlike City Code).

Written policy documents also provide a high level of transparency, accountability, and equity regarding City actions in the urban forest.

Action Item 2.4A - Create policies for urban forest management to guide and influence equitable public urban forest sustainability.

Examples of urban forest management and operational issues that Boston should consider having written policies for are included in (but not limited to) the list below.

- ***Tree planting.*** Stating actions such as establishing a removal-to-replacement planting ratio goal, "right tree, right place" standards, planting well specifications and maintenance, creative design and installation alternatives, preference for large stature shade trees, native vs. non-native species, climate change resilience, new tree care requirements, no planting (volunteer or City) without maintenance guarantee, equity.
- ***Tree maintenance.*** Stating standards of care and proactive goals for public trees.
- ***Tree removal.*** Stating conditions for approved and disapproved removal of public trees, and setting standards for tree removal on various types of land uses.
- ***Tree risk.*** Stating risk tolerance level, risk reduction planning, risk reduction activities.
- ***Tree protection.*** Stating protection requirements for public trees and potentially private trees, during construction, repair, and land development projects, hardscape conflict resolution, mitigation requirements.
- ***Street trees.*** Stating that trees are considered assets and essential infrastructure to be accommodated in rights-of-way; and that they are a primary feature that make neighborhoods and pedestrian areas more walkable, safe, and attractive.
- ***Invasive/Undesirable trees.*** Stating prohibited species for planting, removal process, public education; collaboration with state and federal agencies.
- ***Utility coordination.*** Stating standards of care, expectations of tree protection during underground and overhead construction and repair work, communication goals.
- ***Equity.*** Establish prioritization standards that direct resources to Environmental Justice communities, historically excluded neighborhoods, or areas where socially vulnerable people are concentrated with flexibility to revise priority geographies as populations migrate.
- ***Trees and green stormwater infrastructure (GSI).*** Stating that trees are a green infrastructure asset and provide significant stormwater benefits to the city, and that stormwater management and tree canopy expansion goals generally support each other, but that coordination is required to make both efforts successful; trees should be properly maintained within GSI projects, and protected during routine maintenance and repair.
- ***Ecological/Natural assets protection.*** Stating that the City values these assets and will take action to promote and

protect the conservation and management of forest and other ecological assets which can be through tree protection and planting.
- ***Community engagement and outreach.*** Stating that the City is committed to transparency through open communication; will develop multiple avenues for communication with residents and other stakeholders; and will dedicate resources for public education about trees and the City's urban forest management program.

With policies and guidance statements in place, Parks Department can lead by example and inspire residents and other stakeholders to also practice good tree management. Written policies will also allow the Parks Department to better communicate with other departments, third party managers, business, utilities, and land developers about the expectations for their activities in the city that affect public trees and the tree canopy.

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.4B - Finalize policies with stakeholder involvement and make them readily available.

Refine the policies described above with stakeholder input, including the Boston Tree Board (Recommendation 1.4). Additionally, involve subject matter experts, other City department staff, and representatives from entities that will be affected by the policies. This will ensure that the resulting policies are fair and reasonable, understood, and accepted.

Once the policies are created, make them widely available electronically and/or in a printed compendium policy manual.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 2, 3, 4
Resources Needed: Staff time to develop the policies with broad stakeholder input, support for developing and implementing communications efforts.

Recommendation 2.5 - Increase interdepartmental support of urban forestry efforts

Issue/Challenge: Departments other than Parks Department have varying levels of influence on the quality of the urban forest. Through actions and inactions related to other City department missions and duties, public trees can either thrive, or be neglected or damaged.

Successful canopy expansion through planting and protection will require widespread buy-in on trees as a critical public asset, knowledge on how to support tree health, and the tools to mitigate the potential negative impacts of work on tree health.

Action Item 2.5A - Use education and communication for better internal collaboration.

Through knowledge and communication can come greater collaboration at all levels within the City of Boston. There must be efforts

CASE STUDY: CAGIS - AN EXAMPLE OF AN INTEGRATED IT/GIS SOLUTION

The Cincinnati Area Geographic Information System (CAGIS) is an enterprise-wide information consortium that provides Cincinnati and Hamilton County, OH government agencies and private utilities with access to real-time data for decision support, leading to improvements in the coordination, efficiency, and quality of public service. The system embeds existing business rules and the management of information resources directly into departmental workflows, all made possible through the innovative integration of geographic information system (GIS) technology with automated business-process workflow software.

CAGIS serves more than 2,000 employees of the City of Cincinnati, Hamilton County, and local utilities in mission-critical business operations. GIS is an integral component of the permitting and licensing operations and is maintained through technology embedded in the workflows themselves. It has become the means for integrating work order, customer service, and billing systems. CAGIS technology is now used by front-counter staff, plan examiners, planning, engineering, accounting, dispatch and field crews in many agencies.

between City department staff, management, and elected officials to understand the value of Boston's trees and to support the urban forestry program. Recommended actions include:

- ***Provide training programs.*** Parks Department arborist staff can provide training opportunities for other City department staff in basic tree function, tree protection techniques, and methods to address tree damage. Invitations are suggested for staff from Public Works, Water and Sewer, Inspectional Services, and other departmental field staff. Training can be done one-on-one or via small group field sessions, quarterly or twice a year classroom work, and by ensuring easy access to written instructions and diagrams (see case study: working and training across siloed departments in Dallas, TX).
- ***Coordination at leadership level.*** The Parks Department management staff should interact with leadership from other departments to review existing or updated procedures, contract specifications, and reveal how certain urban forest management tasks and programs align with their own departmental missions. These meetings can lead to discovery of shared resource opportunities, and to coordination on respective annual work plans/projects. Subsequently, departmental leadership should coordinate with staff to develop performance standards for contractors that include the protection of trees and communicates duties to not harm public trees. The urban forestry leadership position, described in Recommendation 1.1, would play a key role in this effort.
- ***Engage partners in the community.*** Often, voices from outside of City departments can influence City leadership to take action to improve interdepartmental coordination, thereby improving service delivery and the efficient use of resources.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.5B - Increase support for the urban forest by leveraging intergovernmental duties and resources.

Like signs, lights, fire hydrants, and water lines, trees are another valuable public infrastructure asset. As such, they need to be protected and repaired if damaged. The departments or commissions that most commonly encounter trees during the course of their work, such as Public Works, Transportation, and Water and Sewer Commission, do have inspection staff, specifications for tree protection, and methods of communication. These existing resources should be combined with Parks Department resources, and actively and regularly engaged to improve urban forest management. For instance:

- Engineers and designers can proactively consult with Parks Department arborists to ensure tree protection specifications for in-house and contracted projects meet current arboricultural industry and local standards.
- Inspectors can observe and report on the appropriateness and status of tree protection measures used on their projects.
- The contract requirement to have an independent Certified Arborist on the

project should be strictly enforced, and there should be requirements for direct and regular communication with Parks Department staff.
- All departments should be familiar with MGL 87 and comply with the law's requirements.
- If a department frequently encounters tree issues during their work, they should hire additional inspectors/arborists to facilitate tree protection and coordinate with the Parks Department for support in this process.
- Administrative support departments, such as the Department of Innovation and Technology (DoIT) and the Law Department, should have sufficient staff and resources to support the urban forestry program's needs. This might include:

    - Launching a citywide asset management software program that includes current tree inventory data, a permit tracking system with trees as a search category, and an online library of private agreements for tree planting and maintenance should be accessible to the Parks Department as well as all departments.
    - Increasing GIS/IT staffing levels for the Parks Department to perform the reporting, mapping, and data analysis needed for a proactive program.
    - Ensuring that Law Department staff increase support for the Parks Department staff with enforcement of MGL 87 fines, penalties, and mitigation requirements.

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.5C - Use technology to improve collaboration.

Using standardized software programs and hardware to access information before, during, and after projects can help minimize misunderstandings and miscommunication. Using technology and data leads to insights and urban forest managers can turn those insights into decisions and actions that improve the urban forest and customer service. With better use of technology, Boston's urban forestry program can begin to take a data-driven approach to management and use technology for better interdepartmental coordination and even for service to the public and engagement.

A fundamental requirement for collaboration is communication. Technology can improve communication by providing a variety of platforms to store data and reveal what actions and projects are proposed, what work has been completed, and what people are working on and thinking about. This is discussed in more detail in Recommendation 5.2.

Timeline/Priority: *Short-Term (first five years)*

***Goals Supported:* 2, 4**
Resources Needed: *Staff time to provide internal training and facilitate collaboration (both leadership and technical staff positions); community partner participation in the education process of elected officials and other allied groups; and financial and technical resources for field and office hardware, software, and training that can comprise a robust, citywide integrated asset management system.*

Recommendation 2.6 - Consider new programs and changes in code to protect mature trees and enhance the urban forest.

Issue/Challenge: Unlike most major cities in the United States, Boston does not have its own municipal tree ordinance addressing public trees. Instead, the City uses the authority and provisions made in MGL 87: Shade Trees.

In some instances, large mature trees are taken down without considering the value that they bring or the number of years that tree has been alive. This is typically done without the knowledge or awareness of the value of that mature tree. Improving the public's awareness of the value of trees is important, and is addressed in Strategy 5. However, it is valuable to note that there are no protections or incentives in place currently in Boston to encourage the preservation of large trees on private property.

Boston also does not have a municipal code or ordinance that protects private trees or requires tree planting during land development projects. The BPDA and design review boards provide input and encourage tree preservation and planting through the Article 80 review process but requirement and enforcement are limited.

Professional urban forest management best practices, scientific studies, and public sentiment all point to the need for and value of both public and private tree protection ordinances. This is a challenging task requiring an inclusive and thorough process to develop these ordinances, ensuring that they:

- have the support of entire community and reflect their goals,
- have the backing of political/elected officials,
- prioritize equity in applicability and enforcement,
- are understood by educating land developers and property owners,
- include both penalties and incentives, and
- have a sufficient number of trained municipal staff for: plan review, site inspection, monitoring, enforcement.

Action Item 2.6A - Create and enact tree protection regulations and hire requisite staff for implementation and enforcement.

The Parks Department should lead the effort to institute systems to protect existing trees in Boston. This can be done through a combination of regulations for trees located on public lands as well as protection for trees on private land during the development process. In addition, for any protection measures to be successful, available staff for enforcement is key.

- ***Tree protection regulations on public land.*** A new public tree protection ordinance is needed in Boston that expands on the minimum public tree planting and protection regulations found in MGL 87.

  The new ordinance should address any applicable code concepts related to the final policies adopted by the City. The tree board (see Recommendation 1.4) should also be codified in this process. This first draft should be officially shared with other City departments and community stakeholders for review and comment.

This review, refinement, and engagement process should continue until a final draft of the ordinance is supported by staff and the community and is ready to introduce to elected officials for consideration. At the appropriate time in the process, the Parks Department should seek legal review of the draft ordinance language.

- ***Tree protection regulations on private land.*** Studies and practice show that when trees are protected and preserved on private property, a city's overall tree canopy grows and is greater than other cities that do not have such regulations. Since the urban tree canopy provides many benefits and makes Boston a livable city in so many ways, and since the majority of Boston's canopy is on private property, it would be advisable to enact a private tree protection ordinance. Creating this ordinance will require significant investments in data gathering and analysis, public engagement, legal review, and gaining political support. The process used to produce the ordinance should be thorough and thoughtful and balance the many needs of sustainably growing Boston, addressing equity during land development, and the health of the tree canopy.

- ***Hire staff for management and enforcement.*** Tree regulations provide indirect influence on overall canopy density and health, but the most important factors in the success of any regulation in Boston will be the levels of enforcement and management. Specifically, time, energy, knowledge, support, politics, and interdepartmental cooperation are correlated with ordinance success, and those factors require adequate staffing levels and training. Any regulation will be ineffective, or could be inequitably applied, if there is not sufficient enforcement.

Timeline/Priority: *Short-Term (first five years)*

Action Item 2.6B – Establish a public engagement and education effort around new regulations and policies for tree protection.

Public engagement is critical to ensuring that regulations do not cause or exacerbate inequities and that they address the priorities and needs of the community. During the discussion and engagement process, the City should communicate the need for science behind the regulations, and how any new code will achieve citywide goals. When the community has a voice in the development of new regulations, compliance is higher which facilitates the administration and enforcement of the new laws, and ultimately more trees are protected, planted, and cared for.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 2.6C – Institute a "Heritage Tree" program in Boston

Develop a list of heritage/landmark tree species with minimum mature diameters or each species. Using this information, tree owners of all types across the city can then register their tree(s) as "heritage" trees. Signage can explain the value in large trees. Landowners with large diameter trees often do not recognize their value to their property

and their neighborhood. A program like this often instills pride and encourages greater stewardship of these trees, lessening the chance of removals later on. Additionally, the criteria used for a heritage tree program can be adapted for use in future private tree protection guidelines and regulations.

As a resource to create a Boston-specific heritage tree program, Massachusetts has a Legacy Tree Program in place. With this program, residents can submit a nomination for a legacy tree (defined as "a tree that is compelling for its size, historical or cultural value, or botanical interest"). More information can be found at: *www.mass.gov/guides/massachusetts-legacy-tree-program*

An allied nonprofit organization would be the best partner to spearhead the creation, promotion, and administration of an educational and outreach program like this for trees on private property.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 1, 2, 3, 4
Resources Needed: *Funding or partnership will be needed for the in-depth analysis of tree loss, and political will is required to pass regulations. Additionally, City staff will be needed to manage the process of drafting new regulations, as well as for later enforcement. Leadership of a community partner will be needed for Heritage Tree program development, outreach and administration, as well as funds for setting up the program, producing/installing signs, and other program expenses.*

There is currently limited outreach on the value of trees in Boston and tips on proper care and preservation of this resource. Knowledge of the important role trees play in Boston for our health and well-being, as well as care information, can promote preservation. Recommendations and required resources to improve communication are discussed further in Strategy 5.

STRATEGY #3: STRATEGICALLY AND EQUITABLY EXPAND TREE CANOPY

While tree canopy can be grown through proactive care and protection (described in Strategy 2), a significant effort to improve Boston's urban forest must involve adding more trees throughout the city.

However, this must be done in line with broader citywide goals of equity, resilience, public health and community well-being. It should also ensure the right trees are planted in the right places (ie. with regard to species diversity, climate adaptation, and urban conditions), and spaces are found or created to plant in.

Boston's overall canopy coverage has remained steady since 2014, however, change has occurred, especially at the neighborhood level. Between 2014 and 2019, a number of neighborhoods lost tree canopy. Additionally, canopy coverage remains inequitably distributed across the city. This means that the benefits that trees provide, which are so important for health and wellbeing, are not equitably distributed.

MORE ANALYSIS NEEDED ON TREE CANOPY LOSS SOURCES.

During the information gathering and discovery process of this plan, numerous concerns from the public were expressed on the loss of trees to development. While the 2014-2019 Urban Tree Canopy Assessment showed that losses are occurring, there is not currently data available on the exact sources or causes of tree loss. Any regulation requires accurate data as its basis. Without this, an ordinance may regulate activities that aren't causing significant losses, while allowing other impactful activities to continue unchecked. This is important information to have during creation of regulations, and is discussed further in Recommendation 6.3.

This set of recommendations focuses on adding more trees, but most importantly, doing it strategically, and through a priority lens of equity and public health.

- ***Recommendation 3.1*** – *Set up a process for neighborhood planting strategy implementation*
- ***Recommendation 3.2*** – *Expand canopy with resilience in mind*
- ***Recommendation 3.3*** – *Expand canopy through street tree planting*
- ***Recommendation 3.4*** – *Expand canopy in open spaces*
- ***Recommendation 3.5*** – *Expand canopy on residential land*

Recommendation 3.1 - Set up a process for neighborhood planting strategy implementation

Issue/Challenge: The goals of the UFP must be incorporated into all planting efforts across public and private property. To ensure this happens, the Neighborhood Strategies companion document accompanying this plan lays out a set of priority indicators and maps that identify where action is needed first in every neighborhood. The Neighborhood Strategies document is just the beginning. A model for implementing neighborhood planting is required and is detailed in the following action items.

Action Item 3.1A - Convene City and community to review strategies and define local priorities, challenges, opportunities and next steps.

The City should initiate a set of neighborhood-based community meetings in which neighborhood group(s) work together with City urban forestry staff to determine what they desire for their community, what their priorities are, and where resources should be directed first. From this gathering, partners can work together to create an action plan for next steps. These meetings should be one of the initial priority actions for the new City forester officer/commissioner (Action Item 1.1A).

The citywide priority area maps created in Recommendation 3.2 can guide the prioritization of neighborhood meetings, while the Neighborhood Strategies companion document should serve as a starting point for the community engagement process that will look to further define key sites and strategies. Appendix C: Species Guide, can also be used as a reference to help make planting decisions.

Timeline/Priority: *Short-Term (first five years)*

Action Item 3.1B - Create a structure for a City/community partnership planting program.

Create a structure in which the City can support any community group wanting to initiate a street or park tree planting project. This would include a clear definition and description of the roles and responsibilities of each partner, as well as any minimums for project size, timeline of process, project contacts, responsibility for young tree care for initial years of establishment, and City assistance in streamlining or easing the process on any technical/bureaucratic needs (i.e. when hardscape work or other construction is required). New York City Parks has created a program that can serve as a good example (see case study: urban forestry partnerships in cities).

Timeline/Priority: *Short-Term (first five years)*

Action Item 3.1C - Compile a toolkit for each neighborhood to utilize.

A toolkit to aid planning for each neighborhood can be compiled, including the initial mapping in the Neighborhood Strategies document, project structure for the city/community partnership (Action Item 3.1B), as well as any City pre-approved drawings on possible tree planting strategies and options to expand canopy. These materials should be provided to all groups involved in anticipated planting efforts in priority zones.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 3
Resources Required: *City staff bandwidth including hiring of leadership position (Action Item 1.1A)*

CASE STUDY: COMMUNITY PARKS INITIATIVE (CPI), NEW YORK, NY

In an effort to ensure park investment is more equitably distributed New York City's Parks Department created the Community Parks Initiative as a means of using data to guide investment in park initiatives in the communities of greatest need. The program was created in order to begin to remedy the historical disinvestment across the city and discretionary spending, which had led to many communities receiving diminished levels of investment. This process began with mapping demographic criteria and historic capital investments in order to identify areas in need and guide park investments. Since 2014, the program has invested over $318 million in areas of need.

IDENTIFYING PRIORITIES AND NEIGHBORHOOD-BASED STRATEGIES

Areas of the City that have historically experienced discrimination, marginalization and disinvestment have, on average, lower canopy than other areas of the City. Because of the impact of the urban forest on health and wellbeing, canopy expansion strategies should be designed to prioritize these areas as a step towards beginning to address these inequities. The Neighborhood Strategies document accompanying this plan lays out a set of priority indicators and maps that determine where actions are needed first in every neighborhood.

Priority zones for action have been defined by overlaying tree canopy levels, areas of extreme heat, environmental justice census blocks, and previously redlined districts. These factors, further defined below, were chosen based on feedback from the Community Advisory Board and community open house, as well as Equity Council input on plan goals and strategies.

Environmental Justice Census Blocks. In Massachusetts, a neighborhood is defined as an Environmental Justice population if one or more of the following four criteria apply:

- the annual median household income is not more than 65% of the statewide annual median household income;
- minorities comprise 40% or more of the population;
- 25% or more of households lack English language proficiency; or
- minorities comprise 25% or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150% of the statewide annual median household income.

The state's determination of environmental justice communities has been simplified here to highlight those census blocks which fulfill two or more criteria.

Low Canopy. Using 2019 Tree Canopy Coverage Assessment data, this map identifies census tracts with less than 10% tree canopy coverage.

Heat Event Hours. Using data produced by the City of Boston's Heat Plan, this map identifies areas exposed to the most heat impact (two upper quintiles), as defined by modeled urban hours.

Historic Marginalization (Red and yellow lining). This map shows areas that received 'C' or 'D' ratings from the 1938 HOLC 'Residential Security Map'. These areas were subject to housing discrimination, as well as often subject to other practices and policies of disinvestment. Data is provided by the University of Richmond's Mapping Inequality Project.

Priority Zones. Zones of highest priority are determined by overlapping prioritization indicators. Those areas with more than three overlapping indicators above are highlighted. This map should serve as a starting place for further analysis and community discussions and these zones should be given particular consideration for action in future planning and development proposals.

Priority zones should help weight planting canopy expansion focus and attention, but should not be indicative of overall resources and efforts needed. Many priority populations, for example, live in areas with relatively high overall canopy, but in which canopy cover is declining. These areas will need to continue to be monitored and should be prioritized through proactive care, preservation and expansion, as included in Strategies 2, 3 and 4.

Recommendation 3.2 - Expand canopy with resilience in mind

Issue/Challenge: All possible efforts to "future-proof" Boston and the urban forest in the face of climate change should be tackled. The urban forest should be used to help reduce the impacts of climate change, from extreme heat to flooding. This means that trees must be included in all City actions (planning, design and implementation of climate projects) and development activities on private lands that aim to lessen the impacts of climate change.

Climate change will also impact the urban forest itself, increasing various stressors that will impact plant health and mortality from increasing rainfall to coastal flooding and heat events. An urban forest that is capable of reducing the impact of climate change must also be resilient itself, which will take planning, care and investment.

Action Item 3.2A - Focus on resilient and diverse tree planting on a neighborhood-by-neighborhood basis.

Develop recommendations and guidelines for resilient, climate-adapted and diverse tree planting, on a neighborhood by neighborhood basis. Factor into planting decisions the following:

- ***Environmental Adaptability.*** Adaptability means selecting tree species that are able to survive and thrive in urban growing environments and conditions resulting from future climate changes. Appendix C: Species Guide includes an extensive list of tree species and cultivars for both public and private land that are urban tolerant, insect and disease resistant, low maintenance, and will increase the diversity of Boston's urban forest (see Appendix B).

- ***Adaptability to Climate Change Impacts.*** Different neighborhoods will also have different environmental challenges related to climate change. Planting locations and species selection should take both existing and future conditions into consideration. These include saltwater inundation from coastal flooding, drought and heat impact, as well as stormwater flooding and standing water from heavy rain.

  While the Species Guide already contains extensive descriptive information for each species, additional information on weather- and climate resilience-related characteristics can be included. These can include tolerance levels to salt, drought, extreme heat, and flooding, whether the species is native or non-native, and its shade capacity. Citywide data should help to guide the recommended species list, while site and neighborhood-specific data should then further refine species selection. All combined, a graphically-rich, user-friendly document can be created and made available to the public.

- ***Diversity.*** At the neighborhood level, inventory tree data should drive planting decisions around diversity and goals. These include no single species making up more than 10% of the population, no single genus making up more than 20%

URBAN HEAT ISLAND IMPACTS AND EXPANDED CANOPY

Urban heat island impacts can contribute to detrimental economic and health outcomes. Populations more vulnerable to extreme heat impacts, such as the elderly and young children, are more susceptible to serious health effects from heat. Additionally, energy costs can be higher during the extreme summer months with the use of active cooling resources, like air conditioners and fans. Energy demand and costs are anticipated to worsen as the climate warms. Through shade and evaporative cooling, trees can reduce the energy needs and costs of a household. These benefits from trees can be especially important for low-income households as they have a higher energy burden (where a larger portion of monthly household income is spent on energy costs).

In April, 2022, Boston completed the Heat Resilience Solutions for Boston (Heat Plan) (*www.boston.gov/departments/environment/preparing-heat*) This plan represents an important step towards addressing the impacts of heat in Boston. The Neighborhood Strategies document that accompanies this plan and will guide neighborhood-based canopy expansion (Recommendation 3.1) identifies heat as a priority indicator and outlines areas for initial actions to expand canopy and therefore reduce the impacts of heat on our most vulnerable communities. In addition to these priority areas, canopy expansion will look to support the strategies outlined by the Heat Plan, where possible, especially where these exist in equity-based focus areas.

A number of key findings and strategies align closely with the goals and strategies of the Urban Forest Plan. These include:

- Affordable Housing Resources and Retrofits (Heat Resilience Solutions for Boston 5.4),
- Cool Main Streets (Heat Resilience Solutions for Boston 7.3),
- Enhance Cooling in Pocket Greenspaces & Street-to-Green Conversions (Heat Resilience Solutions for Boston 6.1), and
- Cool Commutes (Heat Resilience Solutions for Boston 7.1).

These strategies may be accomplished through multiple means in addition to canopy expansion. However, given the public health and well-being impacts of trees, cooling strategies along cool main streets, at cool bus stops and transit stations and in multi-family affordable housing communities would benefit from canopy expansion as a key element of implementation.

of the population, and no single tree family making up more than 30% of the population.

- ***New Tree Sourcing.*** Work with local and regional tree nurseries to ensure the species and quantities of trees that will be needed in the coming years are available.

Neighborhood Strategies identifies neighborhood-specific recommendations and applies to new plantings by:

- Parks Department planting in public streets and parks,
- City partners planting on public lands, and
- All development planting efforts.

Additionally, this approach should be passed on to private landowners, including through collaboration with partners (institutions, other large landholders).

Timeline/Priority: *Short-Term (first five years)*

Action Item 3.2B - Ensure Climate Ready/sea level rise (SLR) mitigation efforts include tree canopy expansion.

Boston is already a national leader in climate mitigation and adaptation planning and projects (e.g. Climate Ready Boston, Healthy Places Initiative). As this work continues to move ahead, considerations of the impact of coastal flooding on tree canopy and the potential for these plans and projects to protect and/or replace canopy at risk must be incorporated.

Climate mitigation efforts in the form of planned capital investments should be integrated with tree canopy expansion in line with the UFP. Efforts should include:

- integration of planting into coastal infrastructure capital investments,
- promotion of tree preservation during coastal infrastructure investments, and
- consideration for species selection and planting design that prepares for rising sea levels and its impact on the urban forest (inundation, soil salinity, salt spray, etc.).

Implementation of climate-ready projects will also include developments on privately held properties. Resilience guidelines for new development should therefore include planting and tree canopy expansion. Requirements should include:

- Percent coverage, species diversity and climate adaptive capacity (based on site).
- Evaluation of tree planting impacts on solar gain/urban heat to ensure planting aims to maximize shade and reduce energy use.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: *1, 4*
Resources Required: *Coordination/ collaboration with other departments and agencies, mechanisms to incentivize private actors (developers, individual homeowners, etc.) and support implementation, and capital resources for priority projects in line with these recommendations.*

Recommendation 3.3 - Expand canopy through street tree planting

Issue/Challenge: Street trees serve as the most visible investment in a City's urban forest. Because they are located along dark, hardscape areas that collect and reflect heat, they have significant impact in reducing urban heat impacts, cooling the areas (sidewalks) where the community gathers, reducing energy costs in those areas, and improving public health.

Currently, due to staffing shortages and the challenges of planting in many of Boston's streets, there are a significant number of empty planting sites and streets with limited tree canopy. The staffing recommendations outlined in Strategy 1 are critical to the implementation of the following action items. These actions create an immediate impact and set a course for prioritizing investments in expanding canopy where it's needed the most.

Action Item 3.3A - Identify and plant in street tree sites that are available now for immediate impact.

While there are numerous challenges to planting in the right-of-way (see Strategy 4), there are existing street tree planting sites that are ready now for planting, including empty tree pits and parkways. These "shovel ready" sites represent a low-cost and low-barrier means of expanding canopy that will have an immediate visible impact for the public. Immediate impact is important for spreading the message of the importance of the urban forest and commitment to implementation of this plan. Start with the priority areas outlined in the Neighborhood Planting Strategies companion document and begin the process of working together with the community with the goal of ensuring planting work reflects the values and priorities of each unique neighborhood. Use the public street tree inventory as a starting place to field-verify and identify existing planting pits, and parkways ready for short-term planting.

Timeline/Priority: *Short-Term (first five years)*

Action Item 3.3B - Create a system for categorizing and prioritizing investments required to increase street tree planting opportunities.

Strategy 4 identifies a number of ways in which the public right-of-way can be altered in order to make room for planting within lands the City already owns and controls. These strategies involve varying levels of investment and barriers to completion. A tiered system that identifies the level of difficulty and/or number and type barriers, such as that created by the Los Angeles Tree Equity Collective may be a useful approach (see Action Item 3.1A). Specific input on this system of prioritization can be provided at the neighborhood level during neighborhood planting strategy community meetings.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 3, 4
Resources Required: *Staff to co-lead community engagement, and ground truth ready planting sites. Coordination/ collaboration with PWD, BWSC regarding concrete cuts, capital resources for planting in line with these recommendations.*

EXPANDING STREET TREE CANOPY IN LIMITED SPACES

Some neighborhoods and streets are in need of street trees but limited in space. Opportunities to plant in areas on and adjacent to City streets should be considered where possible. Setback planting programs and road re-design opportunities to help increase canopy along streets are discussed in Strategy 4.

Ringer Park, Allston-Brighton

CASE STUDY: LOS ANGELES TREE EQUITY COLLECTIVE

In April 2021, the Los Angeles Urban Forest Equity Collective, composed of Dr. Vivek Shandas and CAPA Strategies, with support from Cindy Chen, Stoss Landscape Urbanism, TreePeople, City Plants, and the California Climate Action Corps published a set of two reports aimed at identifying and supporting current and future actions to address historic policies and programs that have created a landscape of inequitable access to neighborhood trees, forests, and open spaces, along with the critical green-infrastructure/ecosystem services, such as public health and safety protections, they provide.

The second of these reports, The Los Angeles Urban Forest Equity Streets Guidebook offers a means for city planners, residents, urban forest managers, and policy makers to evaluate the opportunities that can improve the likelihood of achieving the goal of increasing tree canopy within the region, specifically through creation of a framework for stakeholders to examine the proportional investment required to achieve desired levels of greening.

This tiered approach model provides a common language to describe how easily new trees can be planted at a site. This helps decision-makers prioritize planting given current resources, policies, and infrastructure.

Tier 1: Available
No site modification is needed. Tree canopy goals can be achieved by planting existing vacant locations.

Tier 2: Moderate
Minimal site modifications needed. Tree canopy goals can be achieved with additional financial resources and possible site modifications within current City and County standards.

Tier 3: Hard
Drastic site modifications needed. Significant tree canopy increase cannot be achieved with existing infrastructure and policy modifications are needed to reach canopy equity and public health targets.

www.cityplants.org/wp-content/uploads/2021/05/LA-Urban-Forest_Streets-Guidebook_FINAL_REVISED.pdf

Recommendation 3.4 - Expand canopy in open spaces

Issue/Challenge: Expanding canopy through planting in open spaces represents another "low hanging fruit" for the Parks Department and other partners. Unlike in the public right-of-way, open spaces often have ample growing room and fewer conflicts meaning trees are more likely to live longer, grow larger, and provide a higher level of critical services to the community.

Currently, 39% of Boston's tree canopy is located in land classified as open space. The Parks Department owns ~35% of that open space, which represents opportunities for canopy expansion. The remainder is owned by Commonwealth of Massachusetts, MassDOT, BWSC, Massport, BRA/BPDA, BHA, Private, MBTA, Federal Government, Community Group/Non-profit, and Boston Natural Areas Reserve Network and the Trustees of Reservations who should partner in this effort.

Action Item 3.4A - Integrate canopy expansion into capital improvements.

If trees are understood as City infrastructure, all capital improvement projects – across departments– should incorporate an expansion of tree canopy and funding for sustained care. This effort of expansion should also play a part in overall Parks Department investment strategies.

Maximize Parks Department's existing capital improvement planning and capital budgeting to expand canopy on public lands (parks, cemeteries, urban wilds, other open space) in both landscape trees and reforestation projects.

Timeline/Priority: *Short-Term (first five years)*

Action Item 3.4B - Identify opportunities to create new park space, especially in priority areas.

New parks provide opportunities for significant canopy expansion overall, and are more likely to produce trees that live longer than street trees and provide more in services to communities. Moreover, new parks and urban wilds, especially those with permanent legal protection and public access, are key sites for residents to enjoy and engage with trees. They are also sites that can include larger clusters of trees, which can compound health benefits and create higher quality wildlife habitat.

Planning for Future Parks is a program that identifies areas for park system expansion and establishes a clear decision-making process for protecting or acquiring new parkland. The goal is to enhance and enlarge Boston's network of resilient community parks.

Expanding the park system will rely on acquisition or protection of land by the Parks Department as well as other departments, state agencies, non-profits, private landowners, and more.

Timeline/Priority: *Ongoing*

CASE STUDY: CREATING MICRO-FOREST USING THE MIYAWAKI METHOD

The City of Boston does not need hundreds of acres of open land to increase woodland and forested natural areas. Many cities around the world use the "Miyawaki Method" to create urban forests on vacant lots, pocket parks, school yards, and other urban lands. Over 2,000 new micro-forests have been successfully created using this innovative method.

Miyawaki urban forests are complex ecosystems, in balance with urban soils and changing climate conditions, that become functional native forests much faster than traditional reforestation methods. The method takes its inspiration directly from processes and diversity in nature: 15 to 30 different species of native trees and shrubs are planted very closely together. The habitat created is immediately diverse and will get more complex over time.

Vegetation becomes much denser than conventional tree plantations, but has the multi-storied structure of a mature natural forest. It would take about 200 years to let a forest recover on its own. With the Miyawaki method, a similar result is achieved in 20 years, which provides a city with more of the valuable benefits trees and forests provide.

urban-forests.com/miyawaki-method/

Action Item 3.4C - Expand canopy in open spaces not owned or managed by the Parks Department.

Using the tree canopy mapping data and any existing property-specific land management plans, additional areas may emerge that can be naturalized and reforested into native woodland habitats.

Property owners, third-party managers, and other partners should fundraise to secure the trees and materials for canopy expansion in parks and other open spaces within Boston. This can be done in collaboration with environmental and climate focused funders, as well as a team of volunteers and/or workforce development labor to handle tree planting and establishment.

Timeline/Priority: *Ongoing*

Goals Supported: 1, 3, 4
Resources Required: *Capital resources and political will for land acquisition, willing community partners and urban forest managers.*

Recommendation 3.5 - Expand canopy on residential land

Issue/Challenge: Residential land in Boston accounts for just over 30% of all land in Boston, and is the largest land use category. This land use type also houses over one-third (36.5%) of Boston's tree canopy. It is also where the most loss has occurred, with over 70 acres of net tree canopy lost between 2014 and 2019.

There is a gap in solid information on why those losses are occurring. This knowledge is key to reversing the trend of canopy loss on this type of land in Boston. Data can help fill a part of that knowledge gap and is addressed in Strategy 6.

Because residential land is the largest land group in Boston, strategies that successfully expand canopy here stand to have the most significant impact on overall canopy.

Residential lands represent a wide range of owners (private homeowners, businesses, campuses, etc.), can have varying levels of density, occupancy types (renters vs. owners), and fall under differing rules and regulations. This wide variety within this group requires a range of strategies to tackle different challenges and opportunities for tree canopy expansion.

Action Item 3.5A - Encourage canopy expansion on residential property.

Consider giveaways or incentives for private homeowners to add trees on their existing property. These can include:

- tree giveaway programs run by community-based partners initiatives can provide trees (and expertise on how to plant and care for them) to private homeowners,
- encouragement for planting in private yards through tree canopy awareness campaigns (see Strategy 5),
- tax credits or rebates to incentivize private planting, similar to stormwater credits or incentives. These can subsidize implementation costs by being tied proportionally to "services provided incentivize transfer of vacant or underutilized public land to be used for greening initiatives (see Recommendation 4.3),
- an aid program to help offset high costs of tree care and preservation services for low-income households (see Recommendation 2.3), and

- exploration of a setback tree planting program. Front yards of private residential property provide quality sites for potential tree plantings when sidewalks and rights-of-way in general may not be able to easily accommodate trees (see Recommendation 4.6).

Timeline/Priority: *Ongoing*

Action Item 3.5B - Ensure tree canopy is included in affordable housing.

Creating more stringent canopy and open space requirements for residential developments, especially those including affordable housing and in equity focus areas, is an important step to ensuring the goals of this plan are met. The need for more affordable housing is often seen as competing with trees for important space within the city. Finding ways to expand both housing opportunities and urban canopy is critical to making a commitment to equitable, healthy investment in our communities. Review of all residential development through Article 80, Zoning Board of Appeal (ZBA) and design review board hearings should work with developers and other private landowners to prioritize inclusion of new canopy as well as preservation of existing large trees where possible. See Recommendation 2.6.

Additionally, the Boston Housing Authority (BHA) is a semi-public entity with significant land holdings, including in equity focus areas. The Parks Department should work closely with the BHA to identify sites for canopy expansion within their existing property and site redevelopment projects.

Timeline/Priority: *Ongoing*

Goals Supported: 1, 2, 3, 4
Resources Required: *Public resources include staff time for data analysis to determine the reason(s) for canopy loss on private property, to provide inter-agency collaboration, and to support community led efforts. Private resources include funding, leadership, and labor for neighborhood education and implementation projects.*

CASE STUDY: ADDING CANOPY TO PRIVATE LAND

Tree Planting Programs for Private Land in Philadelphia. Since 2011 Philadelphia Parks and Recreation's TreePhilly program has been bringing the urban forest to the yards of its residents. Thanks to funding from TD Bank, TreePhilly is distributing trees through partnerships with community-based organizations around the city. TreePhilly has helped give away more than 22,000 free trees to city residents, which are planted in front yards, back yards, and private community spaces.

Private Tree Planting and Tree Rebates in Washington D.C. In the District, all funds that are collected as in-lieu fees for trees removed on private land (in development or in private yards) is earmarked to go back to planting on private land. The District has designated its non-profit partner, Casey Trees, as the administrator of the program, and managed over $1.8 million of in-lieu funds last year alone. These funds are used in multiple tree planting programs that occur at no cost to the homeowner. Bus and metro ads run through the communities of low canopy to increase awareness and participation. Free programs avoid barriers to entry for anyone wanting a tree planted on their land. Casey Trees also offers a tree rebate of $100 to District residents to offset the cost of planting large shade trees.

www.caseytrees.org/resources/tree-rebate/

Beacon Hill | Chloe Reeves

PUBLIC HEALTH AND THE URBAN FOREST

Urban forests have a significant impact on public health. Trees have been proven to provide several important environmental health benefits including removing pollutants from the air, soil, and water, as well as reducing urban heat and its related health impacts. Tree canopy has also been shown to reduce the severity of illnesses in respiratory health, cardiovascular health, mental health, obesity, and certain kinds of cancers. This is even more significant for the elderly and those living with chronic disease, for whom canopy coverage and the urban forest can have outsized impacts on quality of life and health (Vibrant Cities Lab n.d.).

While prioritizing canopy expansion efforts in areas of public health need aligns with the goals laid out in the UFP, data is often unreliable at the granular level needed to guide canopy expansion (e.g. neighborhood or sub-neighborhood level), including data from the CDC's PLACES data set. Development of a partnership to explore means to detect and relate the impact and success of the urban forest program with improvements in public health would be beneficial. Such a partnership could help guide future canopy expansion efforts and understand the specific causal relationships (or lack of) between urban canopy and health outcomes in Boston. Two potential studies can be explored and relevant outcomes built into long-term goals for canopy expansion.

In collaboration with the Boston Public Health Commission and an advocacy-based group focused on public health, community, or trees, the Parks Department can identify areas of existing public health need and where canopy expansion can improve health conditions or mitigate the impacts of sites detrimental to public health outcomes. This strategy can then help establish a benchmark for assessing the public health impact of the urban forest and ensure that canopy expansion efforts are in line with public health. Examples of conditions or areas that are detrimental to public outcomes include (but are not limited to):

- sources of air pollution,
- transportation corridors, highways, major roads, etc.,
- sites of soil contamination and pollution,
- current/former industrial land uses,
- sites of hazardous material storage,
- landfills,
- superfund sites,
- sources of sound pollution,
- industrial land uses, and
- airports.

CANOPY EXPANSION AND COMMUNITY WELL-BEING

The urban forest provides numerous benefits, some of which are hard to quantify but are nonetheless critical to community well-being. Trees can contribute to quality of life in meaningful ways for residents in their day-to-day lives, from the iconic (trees along a street can provide a distinct character and identity) to the practical (providing shade along frequented routes), to the spiritual (certain trees have deep meanings in certain cultures).

While ways to expand canopy in line with quality of life and residents' day-to-day activities may be harder to identify, it was a consistent theme heard from the community during the development of this plan. Throughout engagement, especially with the Equity Council, a call was made to identify actions that brought these diverse, and often more personal, benefits of trees to every community.

The following guiding principles for canopy expansion center on public health and well-being including the non-quantifiable benefits of the forest, from creating a sense of wonder and joy, to allowing for new connections to and experiences with the natural world. These principles should be followed wherever possible in all canopy expansion efforts and considered as other citywide improvements are made.

Trees have cultural and spiritual meaning. Communities should have input on species recommended for their streets, parks, and social centers.

Trees have positive mental health benefits. Look for opportunities to increase access to open space, improve canopy around areas of high mental health stress, and to expand canopy at community facilities such as hospitals, senior centers, social services, places of worship, and schools.

Trees can contribute to healthy, active lifestyles. Look for opportunities to create cool corridors and enhance canopy at bus stops to encourage more walking, biking and multi-modal transportation options that support carbon-zero goals.

Trees can help address food insecurity. Look for opportunities to expand the City's food forest through planting nut and fruit-bearing trees wherever possible. Community-based food programs across the city such as Boston Food Forest Coalition (BFFC), the Mayor's Office of Food Justice, and community gardens should be looked to as partners and guides to develop species selection and maintenance programs for food-bearing trees.

Trees can help reduce pollution. Look for opportunities to plant buffers between the community and known or suspected sources of pollution, including noise pollution.

Trees can help reduce inland flooding and improve water quality. Look for opportunities to expand canopy in key urban watersheds to reduce stormwater runoff, improve water quality and aquatic wildlife habitat, and help mitigate impacts of increased flooding.

Trees create habitat for wildlife. Look for opportunities to expand canopy with the aim of maintaining, preserving and creating new habitat for birds, pollinators, and other wildlife that feed on insects.

STRATEGY #4: MAKE SPACE AND IMPROVE CONDITIONS FOR TREES

Planting space is limited for trees in Boston, and quality planting space is even more limited.

Boston is an old city, with many streets designed to accommodate the transportation needs of the time from horses to cars. Given Boston's history and many neighborhoods dating to the colonial era with narrow streets and sidewalks, space is often limited. Planting space is frequently competing against space for cars, pedestrians, cyclists, and utilities.

Boston is a densely-populated and growing city, which can leave little room for trees, both in existing properties and as the density of development increases.

Creative solutions are needed to make space for trees in Boston, as well as improve quality of space (soil volume, issues due to gas, salt, compaction, etc.) to allow trees to thrive.

- ***Recommendation* 4.1** - *Recognize trees as critical infrastructure to be prioritized in right-of-way projects, and equivalent to utilities, sidewalks, bikeways and travel lanes*
- ***Recommendation* 4.2** - *Balance parking and room for planting*
- ***Recommendation* 4.3** - *Explore adding tree canopy to underutilized/vacant lands*
- ***Recommendation* 4.4** - *Implement updated planting standards*
- ***Recommendation* 4.5** - *Minimize above-grade conflicts*
- ***Recommendation* 4.6** - *Minimize at-or below-grade conflicts*
- ***Recommendation* 4.7** - *Take steps to improve soil quality for street and park trees*

Recommendation 4.1 - Recognize trees as critical infrastructure to be prioritized in right-of-way projects and equivalent to utilities, sidewalks, bikeways and travel lanes

***Issue/Challenge*:** Since the mid-20th century, cars and vehicular traffic have been prioritized over many other competing demands within the right-of-way. Together with its historically narrow streets, most streets in Boston were not designed to provide appropriate space for healthy tree growth.

The focus on priority areas for planting (described in Strategy 3) compounds the need to seek creative solutions to finding space for trees.

Expanding the canopy coverage along streets is also directly tied to citywide goals around improvements for pedestrians, bicyclists, and transit users throughout the city. Trees are key to walkability and bikeability, shading the public rights-of-way and reducing heat levels, which is especially impactful for pedestrians and cyclists.

Trees along streets without enough room to grow also create hazards and can limit access. When not given adequate room, trees can contribute to buckling sidewalks and upturned bricks. Active steps must be taken to reduce these conflicts and improve space

for both trees and people.
Taking another look at space allocation within streets and sidewalks is a critical step in creating space for trees and balancing myriad demands.

Action Item 4.1A – Work with BTD, PWD, BPDA, MassDOT and DCR to ensure that major corridor reconstruction projects consider trees as a critical component of transportation infrastructure.

Because mature, healthy street trees calm traffic and improve safety from excessive heat for pedestrians, they are essential to our transportation network. Coordination with key stakeholders to protect mature trees and include well-designed street tree plantings in major corridor reconstruction projects will serve to better include considerations of trees as a critical component of transportation infrastructure.

Timeline/Priority: *Ongoing*

Action Item 4.1B – Look for opportunities for trees in road network changes and traffic calming efforts.

While major corridor reconstruction projects represent a key opportunity to incorporate street tree planting, the Parks Department, PWD, and BTD will work closely to find opportunities to incorporate street trees in smaller-scale projects and other projects that expand sidewalks and reduce curb to curb widths.

For example, trees can be incorporated into curb extensions, pedestrian refuge islands, bus bulbs, and expanded sidewalks when streets are narrowed or made one-way, or when streets are closed to vehicular traffic. All of these changes can create new space for trees.

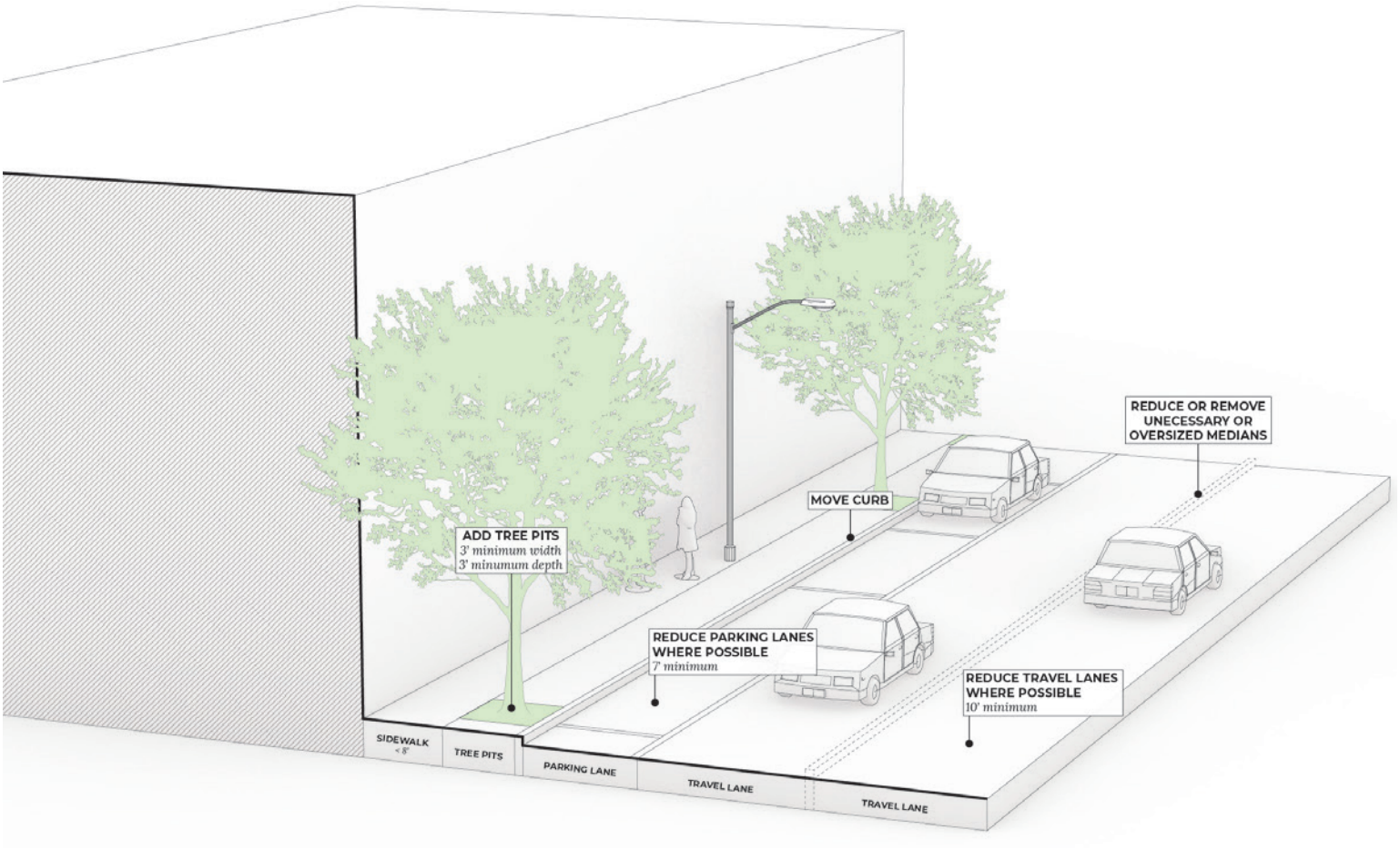
Timeline/Priority: *Ongoing*

Action Item 4.1C – Redesign streets with unnecessary or oversized medians to make room for larger sidewalks and street tree plantings.

Unplanted medians in streets are sometimes viewed as tree planting opportunities in Boston. However, plantings in medians have proven to be challenging for tree health and difficult to care for. Reorganization of streets with bare medians to shift the space taken up by the median to one or both sides of the street can be an effective way to create space for new street tree planting.

Streets with bare medians could be adapted with capital investment to add space to the sidewalks for street trees and a viable planting area. Street-by-street design approaches would need to be taken to ensure that lane alignment and safety are maintained. Medians would not need to be fully removed in all cases, but can be reduced and reorganized as part of an overall street redesign. Trees in newly created planting areas could significantly reduce heat stress during the hot summer months, due to both the reduction of heat absorbent surfaces through roadway reductions and the increased shade provided by the new plantings.

Timeline/Priority: *Ongoing*



Reduce Street Widths. *Multiple means to make space for street trees can be employed including; reducing the width of travel or parking lanes and removing or reducing the width of existing medians. Depending on exact site conditions these measures, alone or combined, can create sufficient space for planting street trees.*

Action Item 4.1D - Work with historic commissions to re-evaluate historic designations that discourage tree plantings.

The historic commissions of Boston have control and influence over what opportunities are made available for trees in select areas throughout the city. Work with commissions, like the Landmarks Commission (BLC), the nine local historic district commissions, and preservation groups to identify exceptions or proactive programs that enable/facilitate creative space making in highly constrained neighborhoods. This is especially important where this overlaps with other areas of prioritization.

Timeline/Priority: *Ongoing*

Goals Supported: 1, 4
Resources Required: *Political will to ensure trees are prioritized in infrastructure design, funding to include well-designed street tree plantings in capital budgets for street infrastructure improvements, staff time for coordination between PWD, BTD, BPDA, MassDOT, DCR, BWSC, and utilities.*

Recommendation 4.2 - Balance parking and room for planting

Issue/Challenge: Parking, both on and off-street, should balance with opportunities to make additional room for trees. On the whole, this requires creative exploration of approaches for opportunities in Boston where

select parking spaces can be converted into planting sites. This can also take the form of parking consolidation in some areas, or adding trees in existing parking areas (e.g. planting in a surface parking lot). This is often one of the only options available to neighborhoods with narrow streets and other space limitations.

Off-street parking, especially surface lots, represents 'low-social value' land use with potential for conversion to make space for planting.

This is an effective way to increase canopy and is aligned with Go Boston 2030 goals of reducing car trips and promoting multi-modal transportation.

Action Item 4.2A - Identify streets with areas that can be transformed into bump-outs or other planting sites.

The Parks Department, BTD, and Public Works will collaborate on identifying opportunities for planting sites on the narrow streets where more traditional street tree planting is not possible. On-street parking represents a significant amount of surface area that can be used for creation of bump-outs or other means of providing new planting sites or higher quality planting space for existing trees.

The City should create design standards and details for bump-outs and obtain approval for planter bump out installation specifications in advance. These specifications can be provided to communities as an option in the toolkit as they work with the City to plan their tree canopy at the neighborhood level (see Recommendation 3.1).

Changes to on-street parking through this action item will need to be balanced with community and business requirements, and bump-outs will need to be strategically located. As mentioned above, once sites are identified, the City should work with those neighborhoods directly when considering these locations.

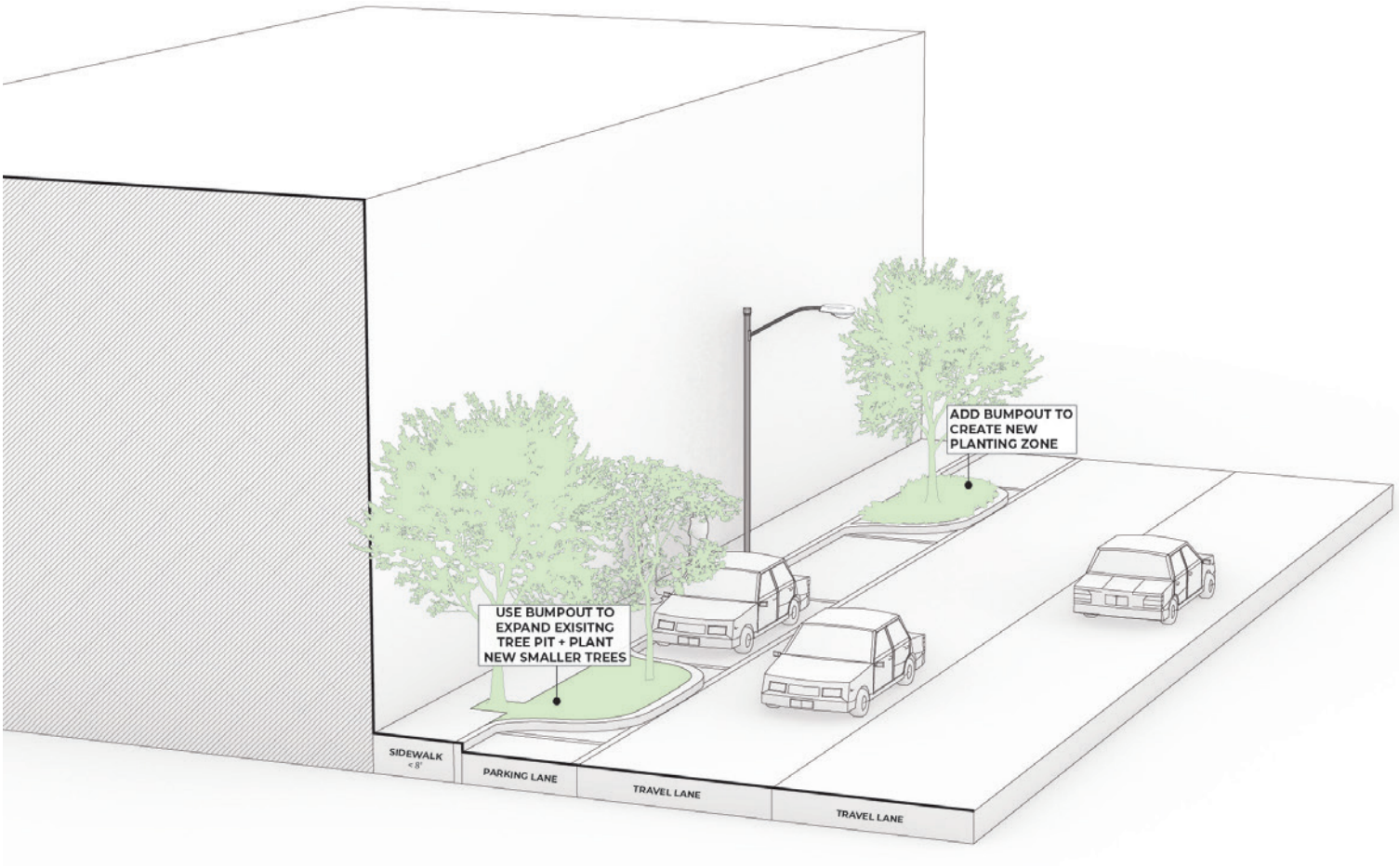
This effort is aligned with Go Boston 2030 recommendations on reducing driving citywide, coupled with the provision of good alternative transportation options.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 4.2B - Explore opportunities in off-street surface parking lots.

Surface parking lots are large sites of impermeable surfaces, with a single function of car storage. They contribute to urban heat conditions as well as stormwater management issues. The City should consider incentives for adding tree canopy to existing off-street surface parking lots, as well as minimums for newly constructed surface parking. Peripheral planting, as well as planting islands, bioswales with trees, permeable pavers, and other features can be designed to minimally impact parking capacity while expanding tree canopy. Canopy requirements can also be set in the zoning code for new parking lots, based on square footage. Additionally, consider the creation of a design guidebook to help guide interested private owners of surface lots and make visual the impact of such greening efforts.

Timeline/Priority: *Mid-Term (first 10 years)*



Bump-outs. *Where sidewalk space is insufficient to plant and reduction of travel and parking lane width is not possible, bumpouts can create space for street trees. Intermittent removal of parking spaces to allow for tree planting can provide for new tree planting and for additional soil space for existing trees with limited soil volume. Small trees at adequate distance from existing trees may also be added to create a biodiverse and layered canopy.*

Action Item 4.2C - Study programs to incentivize preservation of canopy instead of installation of off-street surface parking on private property.

Paving of front or rear yards to provide additional off-street parking often leads to tree loss, adds impervious areas, and contributes to the urban heat island. Programs that disincentivize the paving over of pervious areas could be combined with incentives for adding tree canopy on these same sites. Seek canopy preservation via subsidizing and incentivizing upkeep for private property owners, especially in equity focus areas. This practice is of particular note in Allston-Brighton and should be reviewed during Neighborhood Planting Strategy meetings with the Allston-Brighton community, as well as any others with a prevalence of this practice.

Timeline/Priority: *Mid-Term (first 10 years)*

CASE STUDY: SUSTAINABLE GREEN PARKING LOTS

Pennsylvania's Montgomery County has created a guidebook and policy around greening and sustainable parking lots. These aim to integrate criteria into surface parking lot design, including planting trees and shade to minimize the heat impacts of uncovered parking lots, as well as stormwater and other functions. These guidelines suggest standards and minimums for planting provided within these, including both for the periphery of the parking lot, islands, and based on overall area.

www.montcopa.org/DocumentCenter/View/9735/Green-Sustainable-Parking-Guide-2_10_2016-Web?bidId=

City of Toronto Manuals on Trees and Parking. The City of Toronto has a comprehensive manual "Tree Planting Solutions in Hard Boulevard Spaces," which provides guidelines for innovative tree planting approaches in urban areas. The City also has a "Design Guidelines for 'Greening' Surface Parking Lots" manual which provides specific strategies to integrate green infrastructure elements into parking lots (City of Toronto 2013).

Action Item 4.2D - Seek to minimize curb cuts and parking aprons in new construction and development.

Curb cuts and parking aprons can reduce the space available for street tree plantings due to minimum distances required between trees and curb cuts. Through the development review process, these disturbances should be minimized or a solution identified to incorporate potential space for street tree planting. Street trees (existing or additional) should factor into decisions by approval agencies. Off-street parking requirements for developments that lead to the addition of curb cuts permanently removing potential tree pit locations from the right-of-way should be specifically evaluated.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 3, 4
Resources Needed: *Prioritization of trees and collaboration between Parks Department, BTD, Public Works and elected officials. Capital budget for designing and installation.*

CASE STUDY: BUMP-OUTS IN DOWNTOWN PARKING IN LOUISVILLE

After being cited as one of the fastest growing heat islands in the United States, and a study released showing an average loss of 800 acres of tree canopy per year, Louisville has spent the last seven years working on boosting and preserving their tree canopy. Included in this work has been constant outreach and education efforts by both the City and the local nonprofit Trees Louisville. This has led to the addition of creative tree plantings in the urban core as part of a mass downtown effort to improve the downtown pedestrian experience. Tree bump outs were added throughout the downtown area as a key part of the city's walkability. Key to this effort has been the strong collaboration and support between the KY Department of Transportation, City planning, City public works and TreesLouisville.

Recommendation 4.3 - Explore adding tree canopy to underutilized/vacant lands

Issue/Challenge: Vacant land represents an opportunity to add tree canopy despite facing a number of technical and logistical challenges. With proper preparation, green vacant lots can have a positive effect on a neighborhood. These can be utilized for urban food forests, nurseries, neighborhood composting (which supports soil health), staging sites/grounds for projects, and urban wilds properties.

Action Item 4.3A - Support existing programs for food forests on vacant lands.

Food forests transform vacant, City-owned lots into locally-run, public edible parks. Some food forests in Boston are run by the Boston Food Forest Coalition (BFFC), a nonprofit land trust with a focus on community collaboration and the protection of local open space. Supporting this and similar efforts combines solutions to food insecurity and tree canopy expansion.

Timeline/Priority: *Short-Term (first five years)*

Action Item 4.3B- Identify new sites and opportunities for canopy expansion on vacant lands.

Identify appropriate City-owned lots and include them as an option in neighborhood planting plan discussions (see Strategy 3).

Caution should be given, however, on conversions that are temporary. The nature of these properties and possibility for future loss of those efforts when the property use changes can lead to loss of gained canopy and disruption of new community resources. Where possible, it would be important to seek out permanent conversion of these lands to uses that could accommodate increased canopy coverage.

Timeline/Priority: *Ongoing*

Goals Supported: 3, 4
Resources Required: *Initial research by the City, discussion on whether to pursue this during neighborhood planting strategy discussions.*

Recommendation 4.4 - Implement updated planting standards

Issue/Challenge: The specifications used for street tree planting in Boston are out of date and do not reflect best practices in urban forestry. Additionally, there are no written standards for park or other tree planting when performed by other City staff and third party managers of public property.

Improved city tree planting standards and contract specifications can ensure that public tree planting projects conform to industry best practices which will improve the long-term health of trees and increase the overall quality of the urban forest.

A City policy will also be key to ensuring the right tree is planted in the right place.

CASE STUDY: USING VACANT LOTS IN DETROIT, MI

The organization Keep it Growing in Detroit has developed a manual "Vacant Land Treatment Guide" on options for utilizing vacant lots for greening purposes. These include general clean up, creative mowing, cut flower stands, tree stands, tree nurseries, community garden, orchards, native plantings and pocket parks. Each use in this manual is described together with implementation steps, tips on working with landowners, most ideal locations with soil and water needs, as well as recommendations for supplies and equipment, and on-going care. Read the guide and more about Detroit's work in vacant lots:

www.greeningofdetroit.com/vacant-lots

City policy on tree planting is needed to support solutions to tree and overhead conflicts, as well as the City's approach to improving planting practices. This will result in a higher-quality, longer-lived tree canopy. This supports both this recommendation and Recommendation 4.5. It is described in more detail in the Tree Planting policy section of Recommendation 2.5.

Action Item 4.4A - Apply and regularly review updated tree planting specifications.

Tree planting specifications should be updated as science and horticultural standards change, and as experience (or lessons learned) is gained from past planting projects.

These specifications should be reviewed annually while new recommendations or applications are being tested and every five years thereafter to ensure compliance with up-to-date scientific and horticultural standards.

Timeline/Priority: *Ongoing*

Action Item 4.4B - Use the same planting standards and specifications for all public tree planting that anticipates long-term maintenance by Parks Department tree maintenance staff.

All City departments and third-party park managers should use the same set of planting standards and contract specifications to ensure consistency and clarity of quality expectations.

Timeline/Priority: *Short-Term (first five years)*

Action Item 4.4C - Create an easy-to-read (or watch) set of instructions for the community.

Most planting standards are very technical and difficult to absorb for the layperson. For this reason, a set of written, graphically rich instructions and/or short videos (available in multiple languages) would allow private property owners to take advantage of this knowledge and best practices as well. Once these are developed, they should be promoted to all City partners and to the general public for distribution and use. This can be done in collaboration with Tree Board members or neighborhood-based Tree Stewards.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 4
Resources Required: *City staff time to hone planting standards to ideal level, and time to create a layperson version of these standards. This is a possible partnership opportunity for a City partner.*

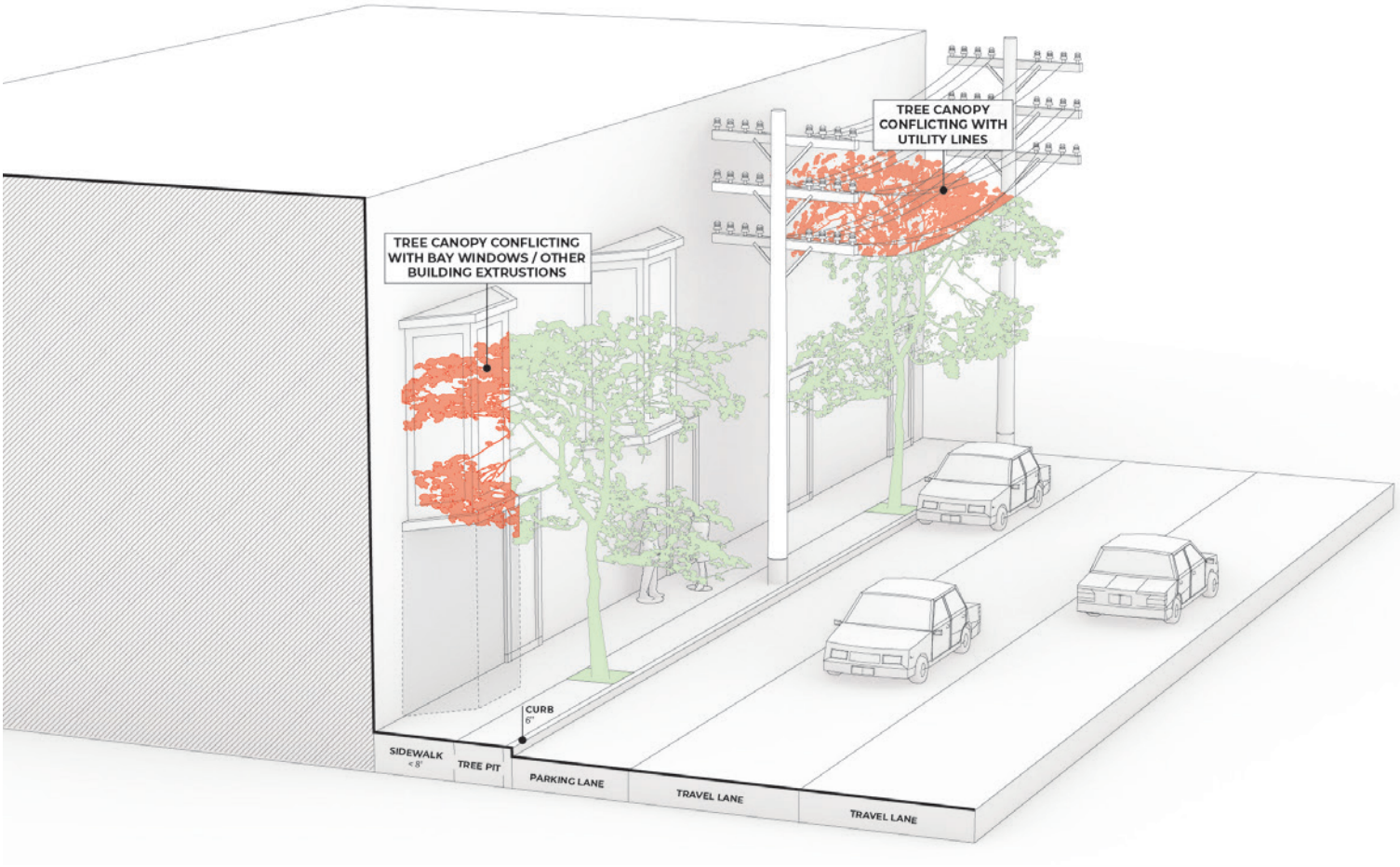
Recommendation 4.5 - Minimize above-grade conflicts

Issue/Challenge: There are a number of features in cities that interfere with the amount of overhead space needed for healthy and long-lived trees.

The primary above-grade conflict is with aerial utilities. Large trees that have grown up under overhead utility wires are severely pruned and leave the tree unsightly and prone to disease and decay. Repeated topping or utility clearance pruning will reduce the lives of street trees, potentially leading to a decline in canopy cover in the future. Smaller trees can be planted to reduce this conflict, but these species of trees don't provide nearly the benefits larger trees provide to residents, and even if trees are replaced, there will be a net loss of canopy in that neighborhood. During the 2021 street tree inventory, the following five neighborhoods were seen to have greater instances of street tree conflicts with above ground utilities: Allston-Brighton; East Boston; Hyde Park; Mattapan; and West Roxbury. These issues should be considered during neighborhood planting strategy community meetings.

Additionally, trees on narrow streets are often planted in a tree pit that is, by nature of the available space, planted too close to adjacent buildings. Over time, this results in trees leaning into the street, which can cause risk issues as the tree grows in size getting bigger and heavier. Additionally, it also creates clearance issues for trucks and other vehicles. Trees (and trucks) are often damaged when large vehicles drive by or park in areas with leaning trees.

There are a number of alternative planting locations that may be available in some sites to reduce the conflict with overhead obstacles, including setback planting on private property, and bump-outs. These are detailed in Recommendations 4.1, 4.2, and 4.6. However, further improvements can be made by ensuring the right tree is planted in the right place, and addressing lack of planting space through changes to the street or utilities. Minimizing these conflicts can allow for healthier, larger trees, as well as reduce maintenance and safety concerns.



Existing Overhead Conflicts. *Overhead conflicts such as bay windows or other extensions from buildings or overhead utility lines can cause numerous problems for trees and for utilities.*

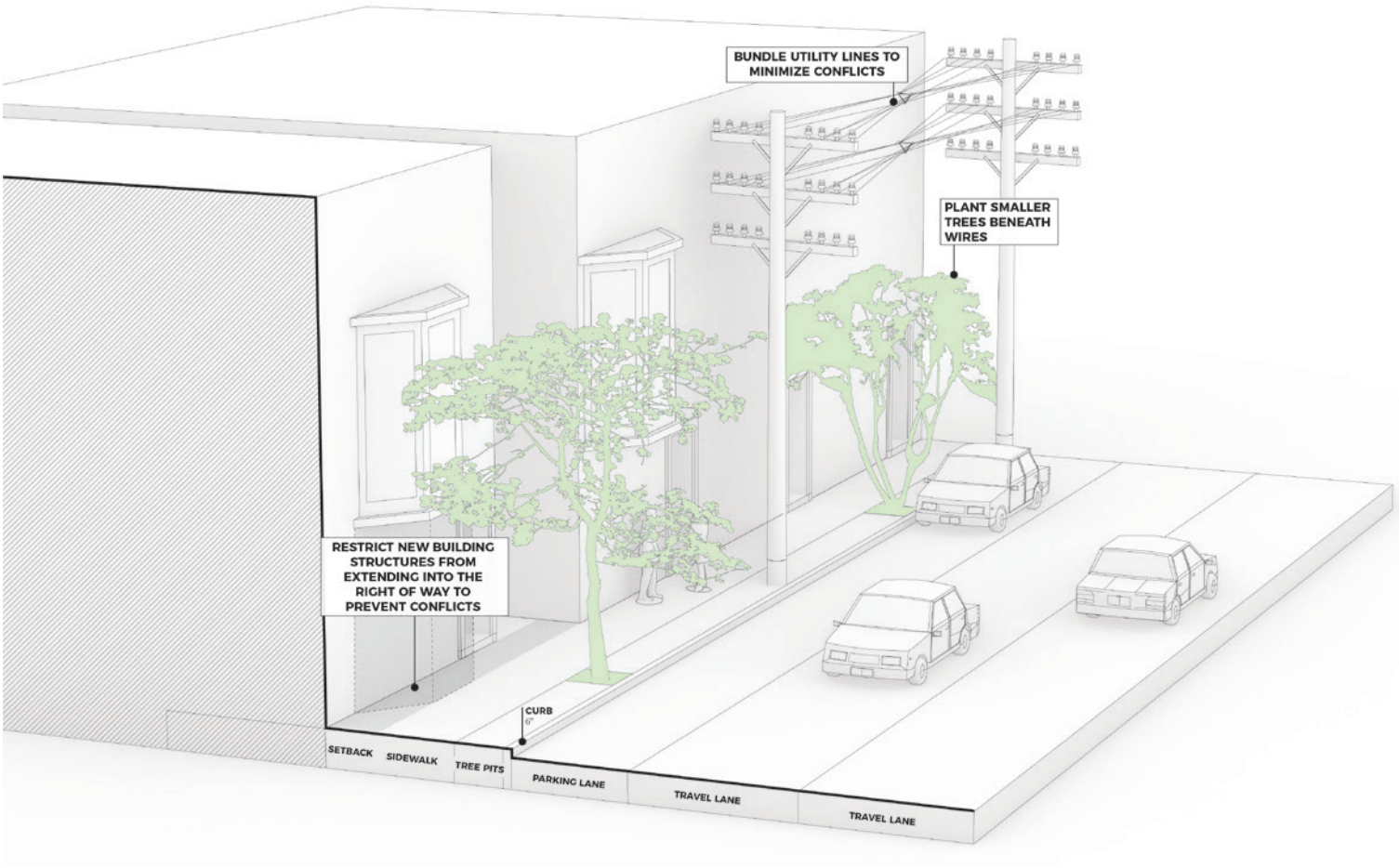
Action Item 4.5A - Restrict new building structures from extending into the right-of-way.

Existing regulations in Boston for buildings allow structures such as bay windows and covered or uncovered balconies to extend over the property line into the air space of the public right-of-way which can limit street tree planting opportunities. The increased shadows cast by these structures also negatively affect tree growth and health. Proposed building projections should be reviewed early in the design process to assess whether they will have any adverse impacts on existing trees or on the viability of new sidewalk trees in the future. Landscape plans that account for both on-site trees and street trees should be included as part of the standard Zoning Board of Appeals review process.

Timeline/Priority: *Short-Term (first five years)*

Action Item 4.5B - Work with utilities to coordinate alternatives where possible.

In new construction or major repair projects, the City or developer (depending on project type) should work with Boston's utilities to



Limit Overhead Conflicts. *Planting the right tree in the right place, such as choosing smaller trees in areas with overhead conflicts that can't be eliminated, can help to reduce conflicts. Additional measures such as bundling overhead wires and creating setbacks for buildings with overhangs will create space and reduce conflicts.*

explore ways to reduce canopy conflicts through wire bundling, varying utility pole architecture, or strategically burying utilities.

Timeline/Priority: *Ongoing*

Goals Supported: 1, 4
Resources Required: *The leadership City Forester position, as described in Recommendation 1.1 would play a significant role in this work, together with the Tree Warden and neighborhood groups.*

Recommendation 4.6 - Minimize at-or below-grade conflicts

Issue/Challenge: As with overhead conflicts, there are a number of other City infrastructures beyond trees that compete for space at or below grade, particularly in the right-of-way. Adequate space for growth is critical for trees anywhere and is a real limitation for trees in sidewalks, even in the most ideal settings.

At ground level, trees without enough room to grow can interfere with sidewalks, correlating with buckled concrete or brick pavers. It is not uncommon for private property owners, residents, and developers to seek to maximize

the footprint of development for construction projects to meet financial goals or capture market opportunities. However, this can result in loss of existing trees or lack of availability for new planting spaces within the property and on adjacent streets.

Below ground level, competition for space is fierce. There are a significant number of systems in place under or near sidewalks that utilize this space, including gas lines, water and sewer lines, intercommunications, human access points, and more. Tree roots make up a large proportion of a tree, and thus take up a significant amount of space in this competitive area.

Action Item 4.6A – Make soil volume a deciding factor in species selection.

A large species tree requires significantly more soil volume to grow long-term than a smaller species of tree. This should be taken into consideration as much as possible when selecting tree species, in order to minimize conflict. This is also referenced in the recommended City Tree Planting policy (see Recommendation 2.4).

Timeline/Priority: *Short-Term (first five years)*

Action Item 4.6B – Explore alternative sidewalk materials.

Allowing the use and testing of alternative sidewalk materials can allow for root growth, tree preservation, soil improvements, better access to water, and meeting ADA sidewalk width requirements, all while creating a safe walking environment. These materials are constantly evolving, so it is important for the City to continue to investigate and test alternative materials as they emerge.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 4.6C – Hold utilities accountable for mechanical tree damage from underground utilities.

There is currently no legal framework in Boston that clearly recognizes that public agencies, departments, and private utility companies that work in the public right-of-way are responsible for mitigating damage to trees; though there are policies that apply penalties for unauthorized tree removals or damage. A legal framework could provide clear and defined recourse for the Parks Department to require replacement or compensatory payment for damage or loss to public trees.

Establishing a Utilities and Trees policy is important to address issues like work standards and recourse if tree damage or loss occurs due to underground utility work. The City of Boston should explore regulatory options when a public tree framework is created (see Recommendations 2.4 and 2.6).

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 4.6D – Re-establish and implement a setback tree planting program.

MGL Chapter 87 allows for public shade trees to be planted on private property within 20 feet of the public right-of-way, provided that written permission from the adjoining property owner is obtained first. This option for alternative street tree planting locations should

be explored in Boston and could be work that is led by a non-profit partner in collaboration with the City.

Consider re-establishing and implementing a setback tree planting program similar to other municipalities in Massachusetts (see case study: setback tree planting programs in MA).

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: *2,4*
Resources Required: *City staff resources to re-establish and implement a setback program or partner with a non-profit to do so, assessment of legal requirements for implementation, and education/outreach to raise awareness of the program.*

**As a result of this research, funds from the American Recovery Protection Act have been allocated to establish a program for residents willing to plant trees on their private residential properties. The City will collaborate with a non-profit to pilot this initiative where residents will have a tree planted on their private property to help increase the overall canopy.*

Recommendation 4.7 - Take steps to improve soil quality for street and park trees

Issue/Challenge: Healthy soil is key to the longevity and well-being of trees. Urban soils, whether on the streets or in parks, often lack the nutrients and organic material that trees need, are heavily compacted by foot traffic which limits water and air movement, and can be polluted with salt, pet waste, coffee and food waste, and other chemicals. These conditions severely limit the long-term growth and health of trees.

In order to create the soil conditions that best support healthy trees, numerous steps must be taken to improve soil quality for new trees as well as prevent further decline of existing trees.

Action Item 4.7A - Create a soil management plan.

Identification and treatment of major soil health concerns will help improve growing conditions for existing trees and provide guidance on soil amendments that can be utilized at the time of planting for new trees.

A soil management plan can result in a guidebook for arborists and tree care professionals in the field as well as property owners to help them identify soil concerns and provide them with a set of simple actions to improve soil quality.

The City of Cambridge has recently completed a soil management plan which identifies critical factors for soil health and a set of guidelines to counteract their impacts. Initiating a dialogue with the City of Cambridge and other municipalities on the costs and benefits of their soil management programs will assist the development of a scope of work for a Boston-specific soil management plan.

Timeline/Priority: *Mid-Term (first 10 years)*

CASE STUDY: SETBACK TREE PLANTING PROGRAMS IN MA

Excerpt from the Massachusetts Department of Conservation and Recreation's (DCR) fact sheet on Setback Tree Plantings:

How does setback planting work in practice in different communities?

Brookline: The Town of Brookline has a formal setback planting program. Brookline actively advertises their "Back-of-Sidewalk" program. Property owners interested in a setback tree apply for a tree and sign a formal agreement. Under this program, the town (with input from the owner) will select, plant, and maintain the tree as a public tree for a period of five years. After the initial five-year period, the property owner assumes full ownership and stewardship of the tree. The town provides property owners with information on tree care during this initial period.

Concord: The Town of Concord engages in setback tree planting each spring and fall. Town tree managers have found that in most cases, the area beyond the public right-of-way provides the best conditions for trees to thrive. They work with property owners throughout the town to gain verbal permission for planting, or respond to requests from property owners, and together, Town tree managers and property owners select the appropriate location and species for tree plantings. The Town provides the property owner with educational materials on proper tree care, pruning standards, tips on hiring an arborist, and other issues regarding tree care, including avoiding mulch volcanoes, weed whip and lawn mower damage, and problems with compaction, etc. After two years, the tree is considered a private tree, property owners are expected to take on the ownership and stewardship of the tree, but they do need Town permission to remove the tree for any reason.

concordma.gov/2257/Setback-Tree-Planting-Program

Worcester: In 2010, the City of Worcester began its Adopt-a-Tree Program whereby residents could request a setback tree. Residents sign up for a tree and sign a consent form. Once that is approved, the Tree Warden will offer a species and recommend a location. When everyone agrees on species and location, the Department of Public Works and Parks comes to plant the tree. Following the planting, all maintenance is carried out by the resident.

Northampton: The City of Northampton began its Setback Tree Program in 2016 Property owners submit a request for a tree and the Tree Warden visits the site to discuss location, species, and maintenance. The property owner then signs a permission and agreement form that is notarized and filed at the Registry of Deeds. It states that the tree (s) shall be a protected public shade tree under the provisions of MGL Chapter 87. It also grants permission for the Tree Warden or their designee to enter the property to care for the tree. The local nonprofit Tree Northampton works with the resident to schedule the planting date and plant the tree.

Read the complete fact sheet at *://www.mass.gov/doc/setback-tree-plantings-fact-sheet*

Sidewalk damage observed during tree inventory

ANOTHER PERSPECTIVE ON TREES AND SIDEWALKS

In urban areas, there is rarely a lack of conflict between trees and sidewalks, and many lament the presence of urban trees based on this conflict. However, trees have been proven to be critical city infrastructure for healthy communities due to the benefits they provide.

Different Perspective: Causation vs Correlation. The presence of both a buckling sidewalk and nearby tree does not always mean tree roots are damaging the sidewalk. Engineering research from Ohio State University indicates there are other factors that can also be the primary reasons sidewalks fail (Sydnor et al 2000). For this reason, tree removal may not be the only or best solution. Other factors for sidewalk failure include:

- ***Time***. When evaluating sidewalk failure, time must be used as a reference. Concrete sidewalks are engineered to last 20-25 years (with standard construction methods using concrete over base material), so, it is not reasonable to blame the failure of a 30-year-old sidewalk entirely on the presence of a tree.
- ***Construction methods.*** Sidewalk design and construction methods and materials are additional factors that are commonly not considered when a tree is associated with a sidewalk failure. The thickness of the concrete and type of base material when the sidewalk was originally built can affect the failure rate more than the presence of tree roots.
- ***Soil characteristics.*** Soils affect not only tree growth and root development, they also have limitations that affect infrastructure such as sidewalks and roads. Depending on the region and characteristics of soils in place, concrete can shift over time affecting the integrity of sidewalks.

CASE STUDY: ONE CITY USES FLEXIBLE SIDEWALK MATERIAL

The District of Columbia has been using a porous flexible pavement (PFP) material for replacing damaged sidewalk areas around trees for almost a decade. When tree roots create dangerous tripping hazards and narrow sidewalks make it difficult to meet ADA requirements, the District uses a flexible and porous material that is installed around each tree. During this installation, the District also takes the opportunity to improve the growing conditions. After concrete is removed, compaction is addressed by aerating the soil with an air knife, and nutrient levels are increased by adding soil amendments. Then, the flexible porous paving material is installed over the entire area, which not only increases the tree's access to rainwater, but also reduces future compaction protecting the roots from heavy foot traffic (which is especially common near bus stops). It also reduces the amount of weeding needed over time. As the trunks continue to grow in diameter, the flexible material will self-adjust without damaging the tree. Another benefit of this type of material is that the tree well (growing area) can be doubled in size in some cases by extending the length of the pit along the street, and also extending the entire width of the sidewalk. In order to remain porous, this material does require maintenance over time. The frequency of this maintenance is variable depending upon specific location and climate. With this material, the District Department of Transportation (DDOT) that manages street trees can meet (if not exceed) ADA requirements.

The DDOT uses this material extensively to:

- protect rooting areas at bus stops and other high traffic pedestrian areas,
- effectively widen sidewalks in dense corridors, without increasing impervious surface coverage around trees, by covering parts of the tree space with PFP,
- install ADA accessible pathways through critical root zones during infill developments, particularly in park and school locations, and
- provide ADA accessible sidewalk repairs around mature trees, without damaging tree roots.

Source: Capitol Flexipave

Action Item 4.7B - Limit the degradation of healthy soils.

Prevention of further soil issues can be addressed through a combination of restricting access to the base of the tree, as well as an education effort or campaign on the impact of compaction and pollution on trees.

Access can be restricted by using low fencing or other barriers around tree pits, or use of permeable paving materials.

Factors that degrade soil condition and quality that should be addressed include salt, pet waste, and compaction. An educational effort on the negative impacts of these items, like installing signage, can encourage people from using street tree wells as a waste area. This is included in Recommendation 5.2.

Additionally, a public tree ordinance should include a section that states clearly that soil contamination of tree planting areas is prohibited, including work crews washing out concrete buckets into tree pits, dumping liquids into tree pits after street festivals, etc.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 4.7C - Form a task force to explore deicing alternatives.

Form a task force of Environment, Parks Department, and Public Works staff to discuss and experiment with options to reduce or eliminate the use of deicing salts, potentially conducting pilot projects in various locations, such as neighborhood sidewalks, particular roadways, and where wetlands, waterways, or green stormwater infrastructure facilities exist. Risk tolerance should be a prime factor in making the decision to experiment with or use alternatives deicing materials and techniques.

Timeline/Priority: *Short-Term (first five years)*

Action Item 4.7D - Address the impact of gas leaks on trees.

There is a growing body of information on the presence of natural gas leaks in Boston as well as work connecting street tree decline to the presence of high methane levels (the primary component of natural gas), each described below.

There have been prior studies identifying the abundance of natural gas leaks in Boston, D.C., and other east coast cities. In Boston, 3,356 leaks were found across 785 miles of road surveyed. That translates to 4.2 gas leaks per mile of road and increased methane concentrations (Phillips et al. 2013).

While methane does not directly kill plants, it does rob the soil of oxygen, in effect suffocating tree roots. Any gas leaks near tree wells would create a serious soil issue for tree growth. No proof, however, had yet been found that connected gas leaks with street tree decline until recently. A 2019 study in Chelsea, MA collected "soil methane concentrations in sidewalk tree pits of healthy and dying or dead trees throughout the city to determine the odds of soil gas exposure among dead or dying trees." The study found that the dead or dying trees were 30 times more likely to have elevated methane levels in the soil. In addition, the methane was concentrated on the side of the tree pit closest to the street where the gas lines were located (Schollaert 2020).

These studies strongly suggest that at least a portion of tree decline in trees in Boston can be attributed to methane from natural gas leaks. Not only are gas leaks a safety issue, but also an environmental justice issue as repairs are often not made for years in historically marginalized neighborhoods.

"Using recently available high resolution leak data, this analysis of natural gas leaks across the state of Massachusetts shows that people of color, limited English speaking households, renters, lower-income residents, and adults with lower levels of education are disproportionately exposed to natural gas leaks and that their leaks take longer to repair, as compared to the general population, and particularly as compared to White residents and to homeowners," (Luna & Nicholas 2022).

Consistent with recommendations from Carbon Free Boston, the City supports reduced use and dependence on natural gas. There are several steps that can be taken to combat the detrimental effects of gas leaks on the urban forest and on public safety:

- Test for gas leaks prior to planting a new street tree and/or when there is significant tree decline or death that does not appear to be from natural or mechanical causes.
- Minimize exposure to natural gas leaks by reducing dependence on natural gas. The City has several policies and programs that reduce natural gas consumption and encourage electrification:
    - Zero Net Carbon Building Zoning Initiative: An effort to identify green building zoning requirements to set a zero net carbon standard for new construction. This is a critical step for advancing practices to meet the City of Boston's goal for Boston to be carbon neutral by 2050.
    - Building Emissions Reduction and Disclosure Ordinance (BERDO 2.0): Buildings account for nearly 70% of greenhouse gas emissions in Boston. The 2021 amendment to BERDO gives the City authority to set emissions standards for large existing buildings. The emissions standards will decrease over time, with all buildings achieving net zero emissions by 2050. The ordinance requires large buildings to report their annual energy and water performance to the City, which then makes the information publicly available.
    - Municipal Energy Efficiency Upgrades: The City plans to convert all electric lighting to efficient LED fixtures. There are also 2,800 natural gas street lamps that will be evaluated for retrofits. Natural gas street lamps account for 4% of streetlights across the city, but account for 37% of the emissions from all streetlights.

The work of groups like Gas Leaks Allies brings important information to City and State elected officials and it benefits from the support of City partners.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 2,4
Resources Required: *Funding for staff (or contractors) to perform soil surveys, create a soil management plan and perform gas leak detection and mitigation and general soil contamination inspections. Staff time is also needed for internal and external collaboration and educational outreach.*

STRATEGY #5: IMPROVE COMMUNICATIONS - BOTH PROCESS AND CONTENT

There are multiple City departments, agencies, non-governmental organizations, residents and citizen groups that plant and care for trees within Boston. With so many in one area doing, thinking, and impacting work on the urban forest, it is essential that effective and frequent communication between all parties is in place.

Additionally, improving communications will result in much-needed transparency and collaboration between all players active in urban forest areas. This is a key step in addressing past inequitable practices and marginalization of areas in Boston. As one Equity Council member stated, better communications and transparency will "create buy-in, trust, and cooperation." Improvements are needed in communications between the City and its residents so that all residents have a voice and the City can provide effective service. More resources are needed for residents to learn about and engage in the urban forest, including information on why trees are important in cities, how to care for them, what the City's goals are, and how to get involved. Finally, improvements to internal City communications are required to improve collaboration and align missions across all City activities.

- ***Recommendation* 5.1 –** *Improve avenues of City communications*
- ***Recommendation* 5.2 –** *Promote awareness of the role of trees in Boston*

Recommendation 5.1 – Improve avenues of City communications

***Issue/Challenge*:** Information and resources on the urban forest provided by the City to residents is currently limited. During the development of this plan, the idea that the general population does not understand the role or importance of the trees in Boston, nor do they have the knowledge on how to plant or care for trees, emerged again and again. Additionally, most believed they are not likely aware of or connected to the trees in their neighborhood streets and parks. This awareness and understanding is critical for progress in tree canopy management.

While this lack of knowledge and awareness is something that the entire community must work on together, the City can also take a number of steps to improve and build on its current avenues of communication.

Action Item 5.1A – Expand urban forest-related content on the City of Boston website.

While there are many community organizations that provide residents with information on trees, the City is well-suited as a central information source. As a central hub, the City web pages can be enhanced with additional information on trees including data, explaining why trees are important, how to help, and sharing ways to get involved.

City web pages are an educational resource, but also greatly help provide a high level of transparency, accountability, and equity regarding City actions in the urban forest.

Timeline/Priority: *Short-Term (first five years)*

Action Item 5.1B – Produce an annual report

One way the City can provide progress reports and transparency on their work is to create an annual report that is published online each year. This does not require a lengthy document, but rather a summary of activities and an ongoing listing of annual statistics. This can be used for public consumption, but also to allow the Tree Warden's work plan to be presented to department heads and elected officials, as well as to the neighborhoods (see work plan in Recommendation 2.1).

Timeline/Priority: *Short-Term (first five years)*

Action Item 5.1C – Develop a Tree Manual.

A manual with specifications and standards on tree planting, maintenance, and protection would clarify the expected and best practices standards for tree activities in the city. For internal and external use, a comprehensive manual containing specifications, drawings, policy and code references, and descriptive graphics related to tree planting, maintenance, and protection should be compiled.
The existence and contents of this manual are a form of education, and it should be made freely available to the development and builder communities, as well as to other City departments. With greater access to industry standards and arboricultural best management practices should come a greater understanding of mature tree care and preservation, and more consistent compliance with policies and codes in Boston.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: *2, 3*
Resources Required: *Staff time and expertise to develop and distribute each item.*

Recommendation 5.2 – Promote awareness of the role of trees in Boston

Issue/Challenge: Based on input received from the community through the engagement process, there is an overall sense that many in Boston do not understand the value and role of tree canopy and how vital it is to addressing the challenges facing the city today. Additionally there is a lack of how-to knowledge on tree care in areas like tree species selection, tree planting, pruning, and other care practices. Based on the input received through the community engagement process it appears that there is tremendous interest in this kind of knowledge.

Increasing awareness and knowledge of the roles trees play in Boston is especially important as part of the effort to promote tree care and preservation on private property, which constitutes more than half of all the tree canopy in Boston.
All three of the following action items can also create an additional opportunity to incorporate workforce development into this effort.

Action Item 5.2A – Build an outreach campaign on the importance of trees in Boston.

A campaign of consistent messaging is critical for making progress in prioritizing trees in Boston. The community is encouraged to develop a campaign with branding, messaging, and graphics for all players to utilize. A subset of Community Advisory Board members was gathered through a focus group in the UFP planning process to start to hone the most effective options for tree messaging in Boston. Input from this session was incorporated into the following suggestions on messaging strategy.

A solid communications strategy limits the quantity of messages, and keeps the messaging simple and focused on the end game. Initial ideas from the focus group suggest that messaging in Boston be based on trees as a:

- Way to mitigate climate change.
  Example: "*Trees are a critical line of defense against climate change*"
- Critical factor in human health.
  Example: "*Did you know that trees in Boston have a direct impact on your physical and mental health*?"
- Asset vs. liability.
  Example: "*Tired of leaves, messy trees? While not maintenance-free, trees pay for themselves by providing clean air and lowering temperatures.*"
- Workhorse for the community (describing services they provide).
  Example: "*Trees are city infrastructure, like roads and sidewalks. Trees can help Boston deal with <insert challenge>.*" *Challenges can include climate change, keeping the Charles or Muddy Rivers clean, keeping our children healthy, etc.*

Successful messaging will require further refinement. Refining this messaging could include reconvening with a community network or group to review these action items and develop more specific language and strategies.

Timeline/Priority: *Short-Term (first five years)*

Action Item 5.2B – Tailor outreach and dissemination of the campaign to target audiences.

The next step is to take the messaging developed from the action item above, work to tailor it to each audience and distribute the message through the best channels available.

Message targeting. The overarching sentiment was that the entire community of Boston will benefit from engagement in tree messaging. However, audiences can receive and respond to campaigns differently, thanks to differences in group priorities, culture, languages, and more. A campaign will be most effective if targeted and adjusted based on each audience.

Audience groups identified by the focus group included elected officials, developers, hospitals, large employers, new residents, new homeowners, public transit riders, architects, landscape architects, planners, universities, large tree owners, dog walkers, engineers, returning residents, age groups, landscapers, health professionals, tenants, and landlords.

Avenues of dissemination. The avenue in which the message is distributed also has an impact on the effectiveness of the campaign. From the input received related to message

COMMUNICATION IS CRITICAL TO THE URBAN FOREST

The additional staff called for (Recommendation 1.2) to ensure enough arborists to each manage a specific area of the city not only supports proactive care, but also allows for the time and ability for those arborists to improve neighborhood relations and service in those areas. This would allow for greater direct action in and service to historically excluded and currently marginalized communities.

Additional forestry staff dedicated to customer service and community group coordination would include a staff person focused on customer service and office administration, as well as one to spearhead volunteer and community outreach and planting projects. This staff role would also be well suited to produce an annual report, described in Recommendation 5.1.

Data sharing is an important aspect of communication. With access to the right data, community members can be empowered to participate in the care of their own urban forest. Boston should explore more advanced systems for sharing and receiving City tree information (street tree inventory, tree canopy cover data). This is discussed further Recommendation 6.3.

Additional communications assistance could come from workforce development sources. This is described in Strategy 7.

dissemination, a number of suggested guidelines emerged. These include:

- ***Neighbors sharing with neighbors.*** Messaging that comes from a trusted source has always been effective. Community-based and citywide groups have the most intimate knowledge of their audiences, a sense of what will resonate and what will not, and networks in place to get the word out. This is also an opportunity to utilize local talent from a workforce development effort to engage each neighborhood at the grassroots level.

- ***Reaching the community via youth and schools.*** Trees exist on a longer timescale than human life. Youth can play a pivotal role in ensuring trees are valued and prioritized in Boston for decades to come. Additionally, children bring their learning home to the family and create another avenue of reach for this awareness effort. Consider collaborating with Boston Public Schools, including schools participating in the Harvard Forest Schoolyard Ecology programs. Grade-appropriate educational materials are available from many sources, such as Project Learning Tree. *www.plt.org/*

- ***Partner networks***. Partners throughout Boston can tailor the messaging created to their unique audiences, and easily reach them through already established avenues of communication.

Provide customizable outreach materials with the chosen messaging, but with options for each group or organization to tailor the message and method of outreach.

Timeline/Priority: *Short-Term (first five years)*

Action 5.2C - Incorporate tree messaging in other City and community initiatives.

The message on the role and value of trees in Boston should be consistently included in existing Boston programs and initiatives whenever feasible, both within the City, as well as in other community efforts.

Trees play a big role in public health. Who else is talking about public health issues like asthma and other respiratory problems? Are trees included in that dialogue?

Trees play a key role in keeping rivers and streams clean and healthy. Who else is talking about river health, and are trees included in that dialogue?

Continue to go through the long list of services that trees provide in Boston and find partner organizations or missions that are willing to help connect for their members the roles trees play in Boston.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 2, 3, 4
Resources Required: *A central entity to organize this effort, potential marketing partners, and political will to include trees in all relevant initiatives. All the action steps within this recommendation depend on the needed staff detailed in Recommendation 1.1.*

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PRINCIPLES OF EQUITABLE AND FAIR COMMUNICATION PRACTICES

All communication efforts within this strategy should be developed with a lens of equitable and fair communication practices. These include:

- Communication should be multilingual by default. Provide translated written materials and signage, plan for simultaneous interpretation in meetings.
- Options for written and visual communications (words vs. video) for all reading levels.
- Simple and readable writing style; e.g. short sentences, short videos.
- Direct outreach methods for those without adequate access to technology, including direct mail and distribution through public schools.
- Materials in locations where people are (e.g. salons and barber shops, corner store windows, public spaces, and MBTA signs).
- Screen-reader friendly websites and image description (alt text) in social media content.
- Closed captions on all videos on websites and social media.
- Transcripts for audio materials (e.g. podcasts) shared on websites.
- Closed captions always enabled during virtual meetings.
- Affirming, person-first language when referring to either people who are part of marginalized groups or people living with disabilities.

STRATEGY #6: IMPROVE INFORMATION COLLECTION AND SHARING

Trees in cities are now considered critical city infrastructure and thus an asset that must be proactively managed. Asset management of any kind requires knowledge and data to make efficient and data-driven decisions on care and management. There are a number of challenges related to Boston data currently:

- There are gaps in knowledge on public trees. There is no inventory for trees in city parks and no comprehensive understanding of trees in natural areas like urban wilds. This lack of information makes budgeting and work planning for care and maintenance at best inefficient, and at worst, results in failure to address serious issues that are not reported by the public.

- Reliance on issues reported by the public (reactive management) can create inequitable management practices, as it tends to result in more attention and work done in wealthier neighborhoods.

- Canopy coverage data provides limited information on the largest segment of trees in Boston: trees on private lands. Thoughtfully-collected information on the state of privately-owned trees can assist in planning for a more resilient urban forest.

- The data that does exist - tree canopy cover and public street tree inventory - requires further work to be fully accessible and easily understood by all user experience levels. It is important to provide clear and interactive access to existing neighborhood tree data to give local groups the tools to make decisions and improvements to their own communities.

Overall, these challenges mean that complete data for community-driven decisions is either missing or not easily accessible. There are a number of improvements that can change this:

- ***Recommendation 6.1:*** *Complete and sustain data sets on the entire urban forest*
- ***Recommendation 6.2:*** *Regularly assess canopy change patterns and causes*
- ***Recommendation 6.3:*** *Improve access to tree data for all residents*

Recommendation 6.1: Complete and sustain data sets on the entire urban forest

Issue/Challenge: Knowledge of the complete urban forest (spanning both public and private lands) is required for assessing urban forest diversity and preparing for responses to threats to trees from pests, disease, and climate change. A full inventory of publicly-owned street trees in Boston was completed in 2021. However, this data set of public trees is incomplete. There is currently no information on trees in city parks and natural areas like urban wilds. Natural areas require a different method of information collection given the vast quantity of trees and ecological functions.

Inventory data consists of information on each individual tree, including species, size, condition, etc., which is essential information used to create a plan of work to manage this city asset and a critical foundation for a proactive care program. Staffing levels, equipment, and other resources needed for proactive care can only be determined by an accurate inventory. It is not possible to effectively manage and budget for asset management without this information. Additionally it allows for management of upcoming challenges Boston faces (pests, diseases, climate change).

With 60% of Boston's urban forest on private property, understanding the private tree population can help manage pest and disease outbreaks across the entire city. To date, no information has been collected on trees across the entire city of Boston, including across privately-owned lands beyond the 2014 and 2019 tree canopy assessments. While these assessments provide an indication of where the urban forest covers private property, it does not provide information on individual trees, such as their size, species, or health.

This is an opportunity to increase knowledge of the entire urban forest. With this information, Boston can improve the resiliency and health of the entire urban forest.

Action Item 6.1A - Complete City tree inventory by including City-owned parks, open spaces, natural areas (as appropriate) and public facilities.

Currently the inventory in place only includes data on public trees along streets. However, the Parks Department is responsible for trees in parks and open spaces as well. This is a significant data set that is missing, and would have a significant impact on management planning, budget, and staffing needs. Additionally, lack of knowledge of these trees also has implications for risk and public safety.

Beyond streets, parks,and urban wilds, there are still additional trees that are City-owned but not inventoried, nor under the care of the Tree Warden, and there is not a staff person looking for opportunities at these locations to add tree canopy. These include trees on public housing properties, City-owned vacant lots, other departments' facilities, and other public lands.

There is currently no data on the trees and woodland make-up of any of the 200 acres of urban wilds within Boston nor other City-owned natural areas. As stated earlier, management of trees benefit from knowledge of what's in place currently. Natural area- and woodland-appropriate tree assessments should be completed.

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 6.1B - Explore iTree Eco or other sampling system to collect data on the entire urban forest.

Explore an i-Tree Eco assessment, where trees on both public and private property are assessed using a sampling method. The methodology, developed by the USDA Forest Service, is one way to glean important forestry data on both public and private property. It can reveal information on species diversity, tree condition, amount and types of tree benefits, insect and disease threats to the forest, and other valuable information. This information can then be shared with the community and stakeholders to determine plans of action and educational messaging for private property owners.

However, an iTree Eco project would need to be approached thoughtfully as it is a labor-intensive task and crowdsourced tree information can have a high level of error, resulting in difficult-to-use data. Consider as part of this effort, collaboration with many trained community partners, including owners or managers of existing privately-owned open spaces to have trees on those lands inventoried. For privately-owned open space created through development agreements, an inventory of trees should be submitted by the owner or manager of the land as part of their mitigation obligations

Timeline/Priority: *Mid-Term (first 10 years)*

Action Item 6.1C - Explore working with community groups to supplement data.

Collaborate with non-governmental organizations and community groups to monitor or add data to data repositories. This can be coordinated with a workforce development strategy. It can also be a mechanism for strengthening relationships between historically excluded communities and the City.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 1, 2, 3, 4
Resources Required: *Funding for collection of additional data, whether from a contractor, City staff, volunteers, or combination of such. A lead organization to run this study, as well as a number of staff or volunteers to collect the information on the ground.*

Recommendation 6.2: Regularly assess canopy change patterns and causes

Developing effective solutions to addressing tree canopy loss (and need for code changes) depends on knowledge and data on where losses are happening and why. In-depth knowledge of location and sources of tree canopy knowledge will be critical to making the case for stronger stricter regulations and policies on tree protection.

Tree canopy data is available in Boston using aerial imagery from 2014 and 2019. This is the primary source of knowledge on whether the city as a whole is gaining or losing tree canopy, however, it does not provide insights as to the causes of canopy change. Best practices suggest that it is updated every 5-10 years to continue to monitor the asset as a whole.

Action Item 6.2A - Perform more detailed analysis on locations and sources of tree canopy losses.

During the information gathering and discovery process of this plan, we heard numerous complaints and concerns from the public that development on private land is the primary reason for significant citywide tree loss. As a result there have been demands for strict regulations to prevent tree removal during the development process.

At a high-level these observations are supported by the 2014-2019 canopy change analysis, which identified residential land as having lost significant canopy over the study period. However, there is missing data that will be required to identify the exact causes of losses.

Only through thorough data analysis can the causes of tree canopy loss and their underlying dynamics be identified. Any regulation requires accurate data as its basis. Without this, an ordinance may regulate activities that aren't causing significant losses, while allowing other impactful activities to continue unchecked. Cities that have conducted these in-depth analyses have come to various conclusions. In some cities, the greatest sources of loss were associated with new development, in others they were tied to a combination of single-family, owner-occupied removals, the effects of emerald ash borer and other insects and disease, and severe weather events. Without accurate data, private tree protection ordinances are less defensible and more likely to be defeated.

Before considering enacting a moratorium on tree removal or creating a strict private property tree protection ordinance, it would be prudent and responsible for Boston to obtain more data to determine if and what legislative solutions are actually needed. Ways to discover the primary causes of tree loss are to perform UTC change analyses and then correlate losses with known permits and plans for developments, natural occurrences, and ground-truthing. As part of the data collection, the City should begin to require developers and institutions that are applying for development approval to provide tree inventories or canopy mapping for their sites so a baseline is established that can be compared to the finished project.

Timeline/Priority: *Short-Term (first five years) + Ongoing at regular intervals*

Action Item 6.2B - Budget for a canopy assessment update in 2024.

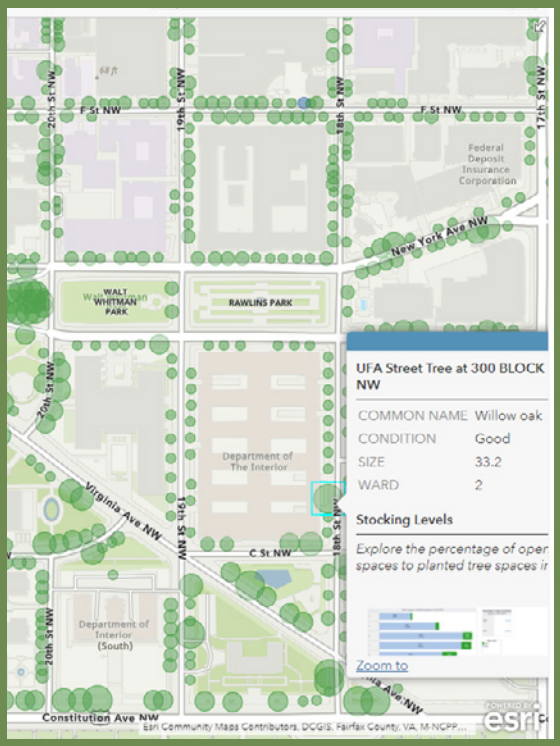
Regular updates every five to 10 years should be budgeted for on an ongoing basis. Explore costs with vendors or consider utilizing local talent from the vast university network in Boston.

Additionally, consider potential partnerships with the surrounding cities and counties to extend this analysis to the regional level. This may provide some cost savings, but will provide a broader perspective on changes in the urban forest on a broader scale.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 2, 3, 4
Resources Required: *Community partner able to perform this analysis of sources of canopy losses, funding or partners for an update to the canopy assessment.*

CASE STUDY: ENGAGING RESIDENTS WITH ACCESS TO TREE DATA



Washington DC's Urban Forestry Division maintains an online GIS-based system of their ~175,000 public street, park and school trees. Access to this system provides people and communities with the ability and knowledge to create their own projects and care for their city trees. Using NearMap, the District's online map and database of their for public engagement, work requests, and comments allow citizens to see overall canopy, specific street trees, register a request, note that they watered a new tree, and more. The aerial imagery for this is updated every couple of months. This system is also linked to nearly real time updates from arborists in the field performing more than 300 inspections a day. These maps share DC's Urban Forestry Division's removal and planting decisions, as they make them, and are quite popular with the public, providing transparent sharing of management decisions that develop trust with the community. It also improves information transfer, as well as helps residents see their tax dollars are being used efficiently.

www.arcgis.com/home/webmap/viewer.html?webmap=fea6079cf9bc4310a8b6c94f8c2bf1da

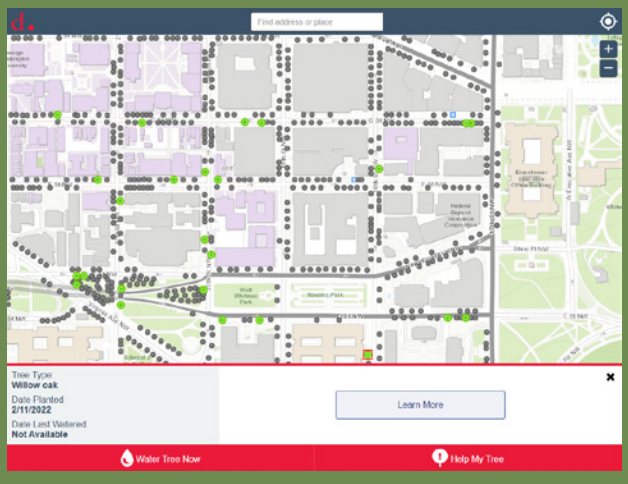
All DC maps hub: *ddot-urban-forestry-dcgis.hub.arcgis.com/*

Tree Watering App. Another app provides a way for the public to help establish newly planted trees in the District. People can locate newly planted trees near their home or work, and record their stewardship activities, can attach photos of themselves watering the trees and also report issues that require attention. Green dots are newly planted trees that will need water. Gray are established trees. There is also a "Learn More" button, which connects the user to an interactive storymap that provides photos and information on many of the most common street trees in DC.

treewatering.ddot.dc.gov/treewatering/

NYC Provides Access to Tree Data. NYC Parks provides access to its street and park tree map online, along with a way to request a variety of tree and sidewalk-related services including street tree planting, sidewalk repair, tree removal, and more. Additionally, residents can record any work done to a tree such as watering, removing litter, weeding or mulching. You can read about the benefits each tree provides, as well as create a list of your own favorite trees.

tree-map.nycgovparks.org



Washington, D.C. Tree Watering App

NYC Tree Data App

KEEPING UP WITH THE DATA

A data set is only valuable if the data contained is up-to-date. That requires adequate resources to plan a process of data management and sufficient staffing to sustain the data set. This includes work of data maintenance, updates, management, and reporting. Two actions outlined previously are critical to improving ongoing data management:

- Recommendation 1.2 outlines a new staff position dedicated to data upkeep, customer service and reporting.
- Recommendation 6.1 promotes collaboration with community groups or workforce development to aid in data upkeep. These partnerships can help monitor trees or add new data to the inventory.

Dorchester

Recommendation 6.3: Improve access to tree data for all residents

***Issue/Challenge*:** Currently there is no easy way for the public to access tree canopy data and no access at all to tree inventory data.

Action Item 6.3A – Explore more advanced systems for sharing and receiving City tree information or requests.

By providing access to information, community members can be empowered to participate in the care of their own urban forest. The following steps create a better connection between residents and their trees as well as a way to care for them if desired, and a better way to submit service requests.

- ***Improve access to tree canopy data.*** The other set of data that will be valuable to residents is the tree canopy cover data. While there is a link to tree canopy data currently on the website, it is via a storymap, and currently difficult to find on the website. Additionally, once in the viewer, it is likely not easy to navigate for the average citizen, showing canopy by hexagons and not neighborhoods.

- ***Explore a system for residents to submit requests or check status of requests via online inventory.*** Use the inventory as a way for residents to submit a request for a specific tree, check on the status of work requests, or submit questions. See the Washington, DC and New York, NY case studies.

- ***Develop a notification system for tree hearings.*** Consider a system where residents could sign up to receive a notification when tree hearings are scheduled in their neighborhood.

***Timeline/Priority*:** *Ongoing*

Action Item 6.3B – Provide improved public access to inventory and canopy data.

Not only is it important to have updated data on the urban forest, but to also provide access for all residents of Boston to understand and utilize this information for their own neighborhoods. Strategy 5 describes in more detail reasons for and methods to share this information. Ensure that the public street tree inventory and canopy data can be easily found and can be accessed by all skill levels and abilities. Data should be designed in a way that is interactive and informative.

***Timeline/Priority*:** *Short-Term (first five years)*

***Goals Supported*:** 3
***Resources Required*:** *A central entity to organize this effort and political will to include trees in all relevant initiatives. All the action steps within this recommendation depend on the needed staff detailed in Recommendation 1.1.*

STRATEGY #7: BUILD AND SUPPORT A LOCAL TREE WORKFORCE

There is a substantial amount of work detailed in this plan that will be needed in the coming years. There is also a real shortage of labor in the urban forest industry - both nationally and in Boston specifically. The consequences of this labor shortage can be seen in difficulty filling open forestry positions in the City, resulting in slower response times and a reactive approach to care. Trees on private property also benefit from proactive care and skilled maintenance. As discussed previously, proactive care has numerous advantages to tree health and social equity. A more robust local urban forestry workforce will aid the City in hiring qualified staff within the Tree Division and expand opportunities within the private sector as well. The work of Winn Constantini (2021) provides in-depth background on the potential for workforce development and green jobs in Boston. This material was used as a reference and supports the findings uncovered through the Urban Forest Plan discovery process.

The recommendations in this strategy are focused around filling this gap in the labor force to meet the goals of the Urban Forest Plan. Priorities for building a strong urban forestry workforce include expanding local skill sets, creating career pathways, diversifying the workforce, and improving job retention.

- **Recommendation 7.1 -** *Support existing and emerging workforce development opportunities*
- **Recommendation 7.2 -** *Establish an urban forestry career pathway program*
- **Recommendation 7.3 -** *Create and support forest-related entrepreneurial opportunities*

Recommendation 7.1 - Support existing and emerging workforce development opportunities

Issue/Challenge: There are numerous existing workforce development and educational programs in Boston, either directly engaged in training for the urban forestry sector, or related occupations. It will be important to support existing programs, especially those working with priority populations or in priority areas.

Action Item 7.1A - Support and coordinate with existing City-sponsored programs that prioritize historically excluded communities.

Existing City workforce development efforts should continue to be supported and analyzed for opportunities to include forestry-related skills and tasks such as tree care and planting.

Examples include, but are not limited to, programs such as the Building Pathways programs offered through the Boston Housing Authority, and SuccessLink Youth and Young Adult Jobs. These and similar programs play an important role in providing early training and experience for youth and others who may want to pursue a career pathway in urban forestry (see Recommendation 7.2). Where possible, City-sponsored programs should coordinate with existing non-profit and community-led programs to ensure access to forestry-related opportunities for individuals from historically marginalized populations.

Timeline/Priority: *Short-Term (first five years)*

Action Item 7.1B - Support and coordinate with existing non-profit and community-led programs.

Existing programs, led by non-profits, community/neighborhood development corporations and other community-based organizations, should be supported and opportunities to align with any new City program should be considered (see Action Item 7.1A). For organizations with existing "green" training or education programs which don't directly focus on urban forestry, the City should support the expansion of existing programs, where feasible.

Examples of organizations with existing programs include, but are not limited to, Southwest Boston CDC's Green Team, Codman Square Neighborhood Development Corporation's (CSNDC) Green Infrastructure Workforce Development Program, X-Cel Education's Conservation Corps, YouthBuild Boston, Asian American Civic Association Building Energy Efficient Maintenance Skills Program (AACA BEEMS), Speak for the Trees' Teen Urban Tree Corps (TUTC), the Emerald Necklace's Green Team, and Mass Audubon's Willow Tree Youth Leaders.

Timeline/Priority: *Short-Term (first five years)*

Action Item 7.1C - Explore development of an arboricultural training program at local vocational-technical high schools and community colleges.

An arboriculture program at one or more local schools would address the twin challenges of industry-wide labor shortages and attracting employees who meet the City's residency requirement. Cooperative education models such as that at Madison Park Vocational-Technical High School may also provide much-needed capacity for tree management. The primary responsibility for developing and managing this program would likely be that of the Boston Public Schools and the Boston School Committee, but the Mayor and City Council can also influence this initiative. The PowerCorpsBOS Director can also initiate conversations and begin the process. A training program through these schools could work in conjunction with a City-led career pathway program, offering ways for younger students to enter the workforce and/or offering continued educational opportunities for those who pursue the program.

Timeline/Priority: *Short-Term (first five years)*

Recommendation 7.2 - Establish an urban forestry career pathway program

Issue/Challenge: Career pathway programs combine education, training, and support (also known as wraparound) services to prepare an individual for work.

Additionally, career pathway programs are valuable because they meet the needs of both labor and employers. These types of programs structure intentional connections among employers, provide adult basic education, support service providers, occupational training, and postsecondary education programs. They can encourage employers to contribute to building a skilled workforce, and thus evolve into a community partner helping residents find employment.

Career pathway programs work best when they are partnership-based because they include a wide range of needs that existing organizations across public and private sectors are already engaged in. These include hiring from employers, training through educational institutions, and organizations that provide support services needed to make employment possible and sustainable for many. With this type of program in place, workers have a better chance of advancing over time to successively higher levels of employment in a given industry.

The City of Boston has recently developed PowerCorpsBOS, a career pathway program to support Mayor Michelle Wu's Green Jobs initiatives. This career pathway is open to people between 18 and 30 years of age. Urban forestry is one training track in PowerCorps.

The action items below are designed to work in alignment with the PowerCorps program and provide guidelines to programs that serve populations not covered by PowerCorps. Some may overlap with actions already underway and should be reviewed and taken into consideration with this in mind.

Action Item 7.2A – Create a staff position to lead the creation and coordination of the urban forestry career pathway program.

This leader should work across communities and City departments to define what a successful urban forestry career pathway would look like. The goals, strategies and recommendations included in this plan should inform that determination, along with further consultation with community groups, residents, and other key stakeholders (this could be led by the recently hired PowerCorps Director).

Timeline/Priority: *Short-Term (first five years)*

Action Item 7.2B – Design, fund, and implement an urban forestry career pathway program.

Work together with partners to develop a program, curriculum, and supporting services. This could include the State Department of Transitional Assistance and various City departments, such as the Mayor's Office of Workforce Development, Labor Relations, Youth Engagement and Employment, and other relevant neighborhood organizations and programs.

Some key considerations include:

- Hire a Culture and Climate Director charged with creating an equitable and inclusive workplace, advocating for women and people of color in upper management positions, and setting up systems so the workplace culture feels safe for all individuals. PowerCorps Culture and Climate Director would create a relationship with the BPDA Diversity, Equity, and Inclusion Director for policy creation and support on all levels.
- Be intentional about recruiting talent from historically excluded and currently marginalized communities including priority populations and residents of areas prioritized by this plan. Partner with community organizations to help recruit talent from the communities where work needs to be done.

- Budget for comprehensive translation and interpretation services throughout the program. Translate outreach and learning materials into primary languages in priority areas and provide interpretation services throughout program participation to improve language access.
- Offer alternative education and training times to ensure access for those with other commitments.
- Ensure wraparound services are provided to support new workers including but not limited to social services such as help with obtaining affordable housing, providing transportation or stipends for the MBTA, offering healthcare resources, and childcare services.
- Ensure that education and training include careful discussion of outreach and communication, especially for tree work in priority areas. Developing appropriate communication skills should be prioritized.
- Early in the process, establish measures of progress to benchmark successes and impacts of the program.
- Ensure adequate ongoing funding.

Timeline/Priority: *Short-Term (first five years)*

Action Item 7.2C - Build a regional cross-sector network of partners and employers.

Comprehensive career pathway programs incorporate partners across sectors: state, local, nonprofit, public agencies, private. This coalition should be focused on partners who are working in and with priority populations and priority areas as identified in this plan. The City and a local community partner willing to lead this effort, ideally an existing community group or non-profit, should build from and add to the list of potential stakeholders, partners. and employees to build a network. The inclusion of the private sector (e.g. tree care companies and regional gardens) will be critical both to help build relationships that can lead to future employment but also so that these employers can help inform the career pathways program design.

After bringing partners on board with the program, it is important to solidify each career pathway partnership to provide program continuity and help measure program impact. Through regular coordination, this coalition should be a resource for ongoing information sharing on trends, opportunities, and challenges in urban forest career pathways, and a resource to ensure that citywide opportunities are well distributed and offer a diversity of services reaching the populations that would benefit most from those opportunities.

Timeline/Priority: *Short-Term (first five years)*

Goals Supported: 1, 2
Resources Required: *Ongoing funding to support career pathways program development, community leaders to organize and support ongoing partnerships and coordination.*

Recommendation 7.3: Create and support forest-related entrepreneurial opportunities

Issue/Challenge: While education, training and employment are critical, this plan can also provide opportunities for Boston residents to benefit from the economic impacts of the urban forest and a number of the strategies and recommendations included in this plan (ex: expanded proactive tree care). This priority was clearly articulated throughout engagement, including with the CAB's Equity Council.

Action Item 7.3A - Identify existing opportunities for City and community-based organizations to support urban forestry-related entrepreneurial initiatives, especially those serving priority populations or in priority areas.

The City and other community-based organizations provide numerous support services around entrepreneurial and economic development needs. These should seek to assist residents to launch and sustain businesses that tie in directly to the urban forestry economy. Examples could include businesses that provide tree care service, as well as those that make secondary products tied to the urban forest. Partners that could be engaged to identify such opportunities include the Black Economic Council of Massachusetts and Ujima Boston.

Timeline/Priority: *Short-Term (first five years)*

Action Item 7.3B - Explore establishing a City-run nursery

The City, community-based organizations, and PowerCorpsBOS could aid in the implementation of a City-run nursery. Funding would have to be identified for land acquisition or a proper plot of land owned by a government or non-profit entity would have to be identified. One acre of land could grow approximately 1,000 trees at six foot spacing between rows and five foot spacing between trees. PowerCorpBOS could take ownership of the nursery and provide job training to the Foundations and Urban Forestry program participants to care for trees.

Timeline/Priority: *Mid-Term (first 10 years)*

Goals Supported: 1, 2
Resources Required: *Ongoing staff commitment to PowerCorps Program with expansion of resources over time. Community leadership.*

View to Central Boston

CHAPTER 5
A Roadmap For Implementation

A ROADMAP FOR IMPLEMENTATION

Successful implementation of the actions outlined in this plan will require commitment from the entire community. Everyone benefits from a healthy urban forest; therefore, we all share in the responsibility for its care and management. The Parks Department will take the lead on many of the actions, but they will depend upon the support of partners who act as both collaborators and leaders as necessary. Partners include other City of Boston and State departments and agencies, residents, non-profits, community groups, private landowners, institutions, developers, infrastructure providers, and businesses.

The table that follows lists all actions in the plan along with indication of the timeline on which they should be implemented, who should take the lead (City or community partners) and when collaboration with other entities is required. Critical Actions, those which are important to implementation of all other actions, and Early Actions, those which can be initiated within the first year, are indicated.

The City and its partners should use this table as a checklist to guide action. Over time, implementation of these actions will begin to improve the quality and quantity of Boston's urban forest, especially in areas with low canopy, high risk for excess heat, and high levels of social vulnerability or historic marginalization. Following this guide should also improve collaboration among the community of caregivers that ensure the health and resilience of the urban forest and thus the health and well-being of the community.

Implementation Table				
Action Item		**CA/EA**	**Timeline**	**Leads/Partners**
Strategy #1: Expand and reorganize urban forest management				
1.1A	*Establish a Director of Urban Forestry position.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
1.2A	*Add additional staff positions for the park and street tree programs with defined responsibilities.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept)*
1.2B	*Support and fund proactive care in urban wilds.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
1.2C	*Perform a job analysis and salary study for current and future staff positions and review the residency requirement.*	CA	*Short-Term (first five years)*	*City-led*
1.2D	*Develop an urban forestry internship program.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
1.2E	*Institute a training program for Parks Department staff to support urban forestry work.*	EA	*Short-Term (first five years)*	*City-led*
1.2F	*Cross-train other departments' maintenance and field staff.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept)*
1.3A	*Improve Boston's partnership approaches and structures.*		*Short-Term (first five years)*	*Partner-led with City assistance*
1.3B	*Seek a champion from the community-at-large.*		*Ongoing*	*City + partner co-led*
1.4A	*Institute a City tree board.*		*Short-Term (first five years)*	*City-led (Parks Dept)*
1.4B	*Form a network for professional urban forestry managers.*		*Mid-Term (first 10 years)*	*Partner-led with City assistance*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Implementation Table				
Action Item		**CA/EA**	**Timeline**	**Leads/Partners**
Strategy #2: Proactively protect and care for existing trees				
2.1A	*Develop and fund a proactive street and park tree work plan.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
2.1B	*Create and adopt a tree risk management approach.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
2.1C	*Create an emergency response and recovery plan.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept with other City agency support)*
2.1D	*Plan for regular updates and reporting on work plans.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
2.2A	*Stay up-to-date on upcoming threats from pests and diseases.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
2.2B	*Create and implement an Integrated Pest Management (IPM) plan of action.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
2.2C	*Develop a process for tracking IPM activities and monitoring for future threats.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
2.2D	*Provide plant health care (PHC) to mature trees.*		*Short-Term (first five years)*	*City-led (Parks Dept)*
2.3A	*Initiate proactive mature and young tree care programs first in areas of highest need.*		*Short-Term (first five years)*	*City-led (Parks Dept)*
2.3B	*Develop community outreach on the care and importance of trees in areas of highest need.*		*Short-Term (first five years)*	*City-led (Parks Dept) with partners*
2.3C	*Consider a program or partnership to offer low-cost or free tree care services on private property to low-income residents.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept with other City agency support)*
2.4A	*Create policies for urban forest management to guide and influence equitable public urban forest sustainability.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept)*
2.4B	*Finalize policies with stakeholder involvement and make them readily available.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
2.5A	*Use education and communication for better internal collaboration.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Implementation Table				
	Action Item	**CA/EA**	**Timeline**	**Leads/Partners**
	...Strategy #2: Proactively protect and care for existing trees			
2.5B	*Increase support for the urban forest by leveraging intergovernmental duties and resources.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
2.5C	*Use technology to improve collaboration.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
2.6A	*Create and enact tree protection regulations and hire requisite staff for implementation and enforcement.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
2.6B	*Establish a public engagement and education effort around new regulations and policies for tree protection.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept) with partners*
2.6C	*Institute a "Heritage Tree" program in Boston.*	EA	*Mid-Term (first 10 years)*	*Partner-led with City assistance*
	Strategy #3: Strategically and equitably expand tree canopy			
3.1A	*Convene City and community to review strategies and define local priorities, challenges, opportunities and next steps.*	CA	*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
3.1B	*Create a structure for a City/community partnership planting program.*	CA	*Short-Term (first five years)*	*Partner-led with City assistance*
3.1C	*Compile a toolkit for each neighborhood to utilize.*		*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
3.2A	*Focus on resilient and diverse tree planting on a neighborhood-by-neighborhood basis.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept) with partners*
3.2B	*Ensure Climate Ready/sea level rise (SLR) mitigation efforts include tree canopy expansion.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept)*
3.3A	*Identify and plant in street tree sites that are available now for immediate impact.*	EA	*Short-Term (first five years)*	*City-led (outside Parks Dept) with Parks Dept support*
3.3B	*Create a system for categorizing and prioritizing investments required to increase street tree planting opportunities.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Implementation Table				
	Action Item	**CA/EA**	**Timeline**	**Leads/Partners**
	...Strategy #3: Strategically and equitably expand tree canopy			
3.4A	*Integrate canopy expansion into capital improvements.*	EA	*Short-Term (first five years)*	*City-led (outside Parks Dept) with Parks Dept support*
3.4B	*Identify opportunities to create new park space, especially in priority areas.*		*Ongoing*	*City-led (Parks Dept with other City agency support)*
3.4C	*Expand canopy in open spaces not owned or managed by the Parks Department.*		*Ongoing*	*City-led (outside Parks Dept) with support of Parks Dept + partners*
3.5A	*Encourage canopy expansion on residential property.*		*Ongoing*	*Partner-led with City assistance*
3.5B	*Ensure tree canopy is included in affordable housing.*		*Ongoing*	*City-led (outside Parks Dept)*
	Strategy #4: Make space and improve conditions for trees			
4.1A	*Work with BTD, PWD, BPDA, MassDOT and DCR to ensure that major corridor reconstruction projects consider trees as a critical component of transportation infrastructure.*		*Ongoing*	*City-led (Parks Dept with other City agency support)*
4.1B	*Look for opportunities for trees in road network changes and traffic calming efforts.*		*Ongoing*	*City-led (outside Parks Dept) with Parks Dept support*
4.1C	*Redesign streets with unnecessary or oversized medians to make room for larger sidewalks and street tree plantings.*		*Ongoing*	*City-led (outside Parks Dept with Parks Dept support)*
4.1D	*Work with historic commissions to re-evaluate historic designations that discourage tree plantings.*		*Ongoing*	*City-led (outside Parks Dept with Parks Dept support)*
4.2A	*Identify streets with areas that can be transformed into bump-outs or other planting sites.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.2B	*Explore opportunities in off-street surface parking lots.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.2C	*Study programs to incentivize preservation of canopy instead of installation of off-street surface parking on private property.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.2D	*Seek to minimize curb cuts and parking aprons in new construction and development.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Implementation Table				
Action Item		**CA/EA**	**Timeline**	**Leads/Partners**
...Strategy #4: Make space and improve conditions for trees				
4.3A	*Support existing programs for food forests on vacant lands.*	EA	*Short-Term (first five years)*	*City-led with partners*
4.3B	*Identify new sites and opportunities for canopy expansion on vacant lands.*		*Ongoing*	*Partner-led with City assistance*
4.4A	*Apply and regularly review updated tree planting specifications.*	EA	*Ongoing*	*City-led (Parks Dept)*
4.4B	*Use the same planting standards and specifications for all public tree planting that anticipates long term maintenance by Parks Department tree maintenance staff.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
4.4C	*Create an easy-to-read (or watch) set of instructions for the community.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept) with other City + partners*
4.5A	*Restrict new building structures from extending into the right-of-way.*	CA	*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.5B	*Work with utilities to coordinate alternatives where possible.*		*Ongoing*	*City-led (Parks Dept with other City support)*
4.6A	*Make soil volume a deciding factor in species selection.*		*Short-Term (first five years)*	*City-led (Parks Dept)*
4.6B	*Explore alternative sidewalk materials.*		*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.6C	*Hold utilities accountable for mechanical tree damage from underground utilities.*	CA	*Mid-Term (first 10 years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.6D	*Re-establish and implement a setback tree planting program.*		*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
4.7A	*Create a soil management plan.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept)*
4.7B	*Limit the degradation of healthy soils.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept with other City agency support)*
4.7C	*Form a task force to explore deicing alternatives.*		*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
4.7D	*Address the impact of gas leaks on trees.*		*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

	Implementation Table			
	Action Item	**CA/EA**	**Timeline**	**Leads/Partners**
	Strategy #5: Improve communications - both process and content			
5.1A	*Expand urban forest-related content on the City of Boston website.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept with other City agency support)*
5.1B	*Produce an annual report.*		*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
5.1C	*Develop a Tree Manual.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept with other City agency support)*
5.2A	*Build an outreach campaign on the importance of trees in Boston.*	EA	*Short-Term (first five years)*	*Partner-led with City assistance*
5.2B	*Tailor outreach and dissemination of the campaign to target audiences*		*Short-Term (first five years)*	*Partner-led with City assistance*
5.2C	*Incorporate tree messaging in other City and community initiatives.*		*Short-Term (first five years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
	Strategy #6: Improve information collection and sharing			
6.1A	*Complete City tree inventory by including City-owned parks, open spaces, natural areas (as appropriate) and public facilities.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept) with support from other City agencies + outside partners*
6.1B	*Explore iTree Eco or other sampling system to collect data on the entire urban forest.*		*Mid-Term (first 10 years)*	*Partner-led with City assistance*
6.1C	*Explore working with community groups to supplement data.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept) with partners*
6.2A	*Perform more detailed analysis on locations and sources of tree canopy losses.*		*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
6.2B	*Budget for a canopy assessment update in 2024.*		*Short-Term (first five years)*	*City-led (Parks Dept)*
6.3A	*Explore more advanced systems for sharing and receiving City tree information or requests.*		*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
6.3B	*Provide improved public access to inventory and canopy data.*	EA	*Short-Term (first five years)*	*City-led (Parks Dept)*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Implementation Table				
Action Item		**CA/EA**	**Timeline**	**Leads/Partners**
Strategy #7: Utilize and develop local talent				
7.1A	*Support and coordinate with existing City-sponsored programs that prioritize historically excluded communities.*	EA	*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
7.1B	*Support and coordinate with existing non-profit and community-led programs.*		*Short-Term (first five years)*	*City-led (outside Parks Dept) with partners*
7.1C	*Explore development of an arboricultural training program at local vocational-technical high schools and community colleges.*		*Short-Term (first five years)*	*Partner-led with City assistance*
7.2A	*Create a staff position to lead the creation and coordination of the urban forestry career pathway program.*		*Short-Term (first five years)*	*City-led (outside Parks Dept with Parks Dept support)*
7.2B	*Design, fund and implement an urban forestry career pathway program.*		*Short-Term (first five years)*	*City-led (outside Parks Dept) with Parks Dept + partners' support*
7.2C	*Build a regional cross-sector network of partners and employers.*	CA	*Short-Term (first five years)*	*Partner-led with City assistance*
7.3A	*Identify existing opportunities for City and community-based organizations to support urban forestry-related entrepreneurial initiatives, especially those serving priority populations or in priority areas.*		*Short-Term (first five years)*	*City-led (outside Parks Dept) with partners*
7.3B	*Explore establishing a City-run nursery.*		*Mid-Term (first 10 years)*	*City-led (Parks Dept) with partners*

Table Legend

CA *Critical Action Item*

EA *Early Action Item*

Castle Island

APPENDICES

APPENDIX A: TREES AND TREE CANOPY BENEFITS

URBAN FOREST IMPACT ON PUBLIC HEALTH

Air pollution creates health issues. Trees reduce air pollution.

According to the American Lung Association, air pollution like chemicals or dust, ash, dirt, pollen, and smoke (also called particulate matter, or PM) can cause or worsen human health. Air pollution can aggravate asthma and other existing respiratory conditions and create long-term chronic health problems (ALA 2020).

Trees reduce or can completely remove many components of street-level air pollution by lowering temperatures (extreme temperatures worsen air quality) or capturing pollutants including carbon dioxide, ozone, nitrogen dioxide, sulfur dioxide (a component of smog), and small particulate matter. This has been shown to have an impact on respiratory conditions in humans. One study, focused on New York City, showed a significant decrease of asthma in young children (-29%) after increasing its tree canopy through the planting of only 777 trees per square mile (Lovasi et al. 2008).

Higher heat creates health issues. Trees reduce heat levels.

Heat stress has been proven to cause significant public health problems and even mortality. In fact, each year, more Americans die from extreme heat than all other natural disasters combined (e.g.. hurricanes, floods, tornadoes, lightning). Those with chronic health conditions, children and youth, and older adults are especially vulnerable to heat-related health problems (City of Boston 2022). Urban areas without trees often experience temperatures 15° to 25°F hotter than nearby, more rural areas.

Boston is already experiencing increased temperatures and extreme heat events due to climate change. The Heat Plan cites 50-100 heat-attributable deaths for an average Boston summer. To combat this, it identifies strategies to address future impacts of extreme heat and increase citywide resilience, including through trees.

Urban trees are widely accepted as one of the most effective long-term solutions to reducing the effects of urban heat islands. A properly placed mature tree canopy can lower temperatures within its shade by 20° to 45°F, and overall ambient temperatures near trees (thanks to evapotranspiration) by 4° to 9°F ,directly impacting human health (EPA 2015). In Toronto, Canada, a study found that in neighborhoods with less than 5% canopy cover, there were approximately five times as many heat-related ambulance calls as those with greater than 5% canopy cover (Graham 2016). Another 2020 study of Philadelphia published in the journal Lancet Planetary Health showed that a 30% tree canopy coverage (up from 20% currently in Philadelphia) would result in a 3% reduction

TREES ARE NOW CONSIDERED CRITICAL CITY INFRASTRUCTURE.

They are, in fact, the only infrastructure that increases in value over time. Urban trees have also been shown to pay for themselves, consistently providing benefits valued at three times more than the cost to maintain them (Peper et. al. 2009).

of the current resident mortality rates (Kondo 2020).

Tree canopy has additional health implications.

There have been several studies over many decades on the health related impacts of tree canopies. These studies examine impact of trees on a variety of outcomes including:

Mental health. Trees provide a myriad of mental health benefits. Trees have been shown to have a calming and healing effect on adults and teens (Burden 2008). Many studies show that increased access to greenspace is associated with reduced stress, with one showing that increased greenspace around a person's home is associated with lower levels of cortisol, a stress hormone (Thompson 2012). Another study showed that when adults were exposed to 30% or more tree canopy, compared to 0-9% tree canopy, they were associated with 31% lower odds of psychological distress. In contrast, exposure to 20% or more grassy land cover, without canopy, was associated with 71% higher odds of psychological distress. This shows that the protection and restoration of tree canopy rather than other forms of urban greening (installation of grass or the presence of grass or parks in general) may be a more beneficial way to improve community mental health (Astell-Burt 2019- JAMA Network Open). Another study in London found an inverse association between tree canopy and antidepressant prescriptions, "with a decrease of 1.18 prescriptions per thousand population per unit increase in trees per km of street" (Taylor 2015). Research has also found that there are higher levels of classroom engagement after children have lessons in nature, as opposed to lessons within a classroom. In fact, teachers were able to teach for almost twice as long without having to stop instruction to redirect students' attention (Kuo 2018).

Infant birth weights. A study from 2004 to 2015 in New York City examined the effects of urban afforestation on infant health. They found that an approximately 20% increase in urban forest cover decreased prematurity and low birth weight in mothers by 2.1 and 0.24 percentage points respectively, in comparison to mothers outside of the study zone. This impact is equivalent to getting a mother who smokes two cigarettes a day during her pregnancy to quit (Jones 2019).

Faster recovery to health. Studies have also shown that individuals with views or access to greenspace tend to be healthier; employees experience 23% less sick time and greater job satisfaction, and hospital patients recover faster with fewer drugs (Ulrich 1984).

Noise and highway pollution. Pollution and noise from busy roadways and rail lines can create unhealthy and undesirable conditions for those living nearby (ALA 2020). Dense buffers of trees can significantly reduce both noise and pollution. A 100-foot-wide, 45-foot-high densely-planted tree buffer can reduce highway noise by 50% (NC State 2012), as well as the air pollution benefits already described.

URBAN FORESTS REDUCE FLOODING DUE TO EXCESS RAINFALL (STORMWATER)

Flooding from storms is already an issue in Boston and is anticipated to worsen. Trees can reduce large quantities of stormwater to reduce flooding.

As cities grow, the amount of land that naturally absorbs rainwater (e.g. lawns, parks, fields, woods) shrinks, while hard surfaces that cause rain to runoff (e.g. roads, buildings, parking lots) increase. With more hard surfaces, stormwater runoff can cause flooding. Rising incidences of flash floods in cities is a grave public health and safety concern.

According to Climate Ready Boston, 7% of Boston could be exposed to stormwater flooding from more frequent and severe rain storms by the 2050s. By 2060, heavy precipitation events could result in six inches of rain within 24 hours, which is the height of an average city curb, and 20% more than today's levels. At the end of the century, 10-20% of Charlestown, East Boston, Downtown, and South Boston will face flooding at high tide, even when there is no storm. While every neighborhood will be impacted by increased stormwater, these impacts are anticipated to be most severe in West Roxbury, Allston-Brighton, East Boston, and Dorchester. The South End and South Boston are expected to have the greatest increase in land area exposed to stormwater flooding.

Trees in Boston can retain a sizable volume of annual rainfall in three ways: they can hold rainwater in their leaves and branches,substantially increase the ability of the soil to absorb water (via root growth and breakdown of plant litter which improves soil structure), and process some of that water by releasing it back into the air through a process called transpiration. These services result in less stormwater runoff, which results in less flooding. An urban tree canopy can retain anywhere from 20-80% of the annual rainfall, depending on the climate of an area (Vibrant Cities Lab, n.d.).

URBAN FORESTS CAN IMPROVE WATER QUALITY

Runoff after rains can be polluted. Trees can filter out those pollutants.

According to the Boston Water and Sewer Commission (BWSC), the Boston stormwater system collects stormwater runoff (rain and snowmelt) and discharges it into receiving waters around the city. Runoff is transported through almost 600 miles of pipes and carried to one of the 207 stormwater outfalls where it discharges into one of several Boston water bodies.

This system, while common in cities nationally, can be problematic in that after storms, as the rainwater described above flows over roads, parking lots, and lawns, it picks up fertilizers, oil, chemicals, grass clippings, litter, pet waste, and other pollutants. This contaminated stormwater ends up flowing untreated into local watersheds including the Charles, Neponset, and Mystic.

Polluted water has been a major cause of human health issues and has degraded the local environment and wildlife habitat. Nutrients (primarily phosphorus) are one of the primary causes for the blue-green algae blooms that occur in both the Charles and Mystic Rivers during the summer months. These algae blooms come from a form of bacteria (cyanobacteria) that releases a toxin. Exposure to the toxin can cause skin rashes and irritate the nose, eyes or throat, and can lead to serious liver and nervous system damage if ingested. Algae blooms also starve fish and other living creatures and plants of oxygen, degrading the habitat, reducing water clarity and creating a film of scum on the water's surface (EPA 2020). Both the Mystic River Watershed and Charles River Watershed Association cite that polluted stormwater runoff is one of the biggest sources of pollution to these rivers.

Trees have the ability to not just absorb stormwater, but also to filter that water as well. They increase the infiltration of pollutants by slowing runoff, capturing pollutants on leaves or aiding absorption in the soil (as discussed above). Contaminants in the soil are then used by microbes in the soil or taken up by plants via phytoremediation (the process of using plants to remove pollutants from water and soil). Larger, mature trees do most of the work to take up pollutants from both the soil and nearby streams and aquifers (USDA 2021).

SAVING MONEY VIA REDUCED ENERGY COSTS

Energy costs are rising and present a higher burden for low-income households. Trees can reduce energy needs throughout the year.

Both demands and costs for energy are rising across the United States, with heating and cooling accounting for approximately half of residential energy bills (DOE 2015).

Trees provide energy savings by reducing cooling and heating costs, both through their shade as well as the release of moisture

through transpiration. When well-placed, trees can cut annual air-conditioning costs in half (USDA Forest Service 2022). In winter, blocking cold winds is the biggest contribution trees can make towards energy conservation.

While a benefit to all residents, energy savings are even more critical in low-income households. Nationally, low-income households spend a larger portion of their income on home energy costs (e.g. electricity, natural gas, and other home heating fuels) than other households spend. This measure is often referred to as a household's "energy burden." One recent study found that low-income households face an energy burden three times higher than other households. High energy burdens can threaten a household's ability to pay for energy, and force tough choices between paying energy bills and paying rent or buying food, medicine, or other essentials (DOE 2018).

Beyond monetary savings, the cooling effect provided by trees is an important benefit for any resident of Boston, and a health issue for those prone to heat related illnesses and those in lower-income areas (as described in section on health benefits of trees).

URBAN FORESTS ARE NEEDED FOR WALKABLE AND BIKEABLE CITIES

High heat and safety impact walking/biking activity. Trees are a critical part of a walkable/bikeable city.

Improving Boston's walkability, pedestrian-friendly areas, and bikeability are all integral to achieving a number of the goals in other citywide plans, including Go Boston 2030 and Imagine Boston 2030. Walkability can also improve quality of life and access to key resources, as well as play a part in revitalizing business districts and neighborhoods. High temperatures and high traffic demand are obstacles to creating walkable/bikeable areas.

Cooling. High temperatures without shade are a significant deterrent to residents walking or cycling during the summer months. Properly placed, mature tree canopy can lower temperatures within its shade by 20° to 45°F, and overall ambient temperatures near trees (through evapotranspiration) by 4° to 9°F (EPA 2015).

Safety. Trees have a role to play in creating safer streets as well. According to the Federal Highway Administration, urban tree canopy along streets have been shown to slow traffic, helping ensure safe, walkable streets in communities. The buffers between walking areas and driving lanes created by trees make streets feel safer for pedestrians and cyclists (U.S. Department of Transportation 2015). Increased tree canopy coverage in Denver, CO, was associated with fewer car crashes, finding that a 10% decrease of tree canopy was associated with 24.5% increase in car crashes (Coppola 2018). Driver stress levels have also been reported to be lower on tree-lined streets, contributing to a reduction in road rage and aggressive driving (Wolf 1998a, Kuo and Sullivan 2001).

URBAN FORESTS CONTRIBUTE TO STRONGER COMMUNITIES

While less quantifiable, the tree benefits related to their contribution to building community are no less important than other services provided. One study showed that residents of apartment buildings surrounded by trees reported knowing their neighbors better, socializing with them more often, having a stronger community, and feeling safer and better adjusted than did residents of more barren, but otherwise identical areas (Kuo and Sullivan 2001).

URBAN FORESTS CREATE MORE LIVELY BUSINESS DISTRICTS

It has been shown that tree-covered shopping districts are more successful than those without canopy. In multiple studies, consumers spent more time and money in shaded and landscaped business districts (Wolf 1998b, 1999, and 2003). Increased activity can promote livelier street life and support businesses of all types.

URBAN FORESTS CAN HELP LOWER CARBON LEVELS IN THE ATMOSPHERE

Most of the carbon dioxide (CO2) in the atmosphere comes from human activities that involve the burning of fossil fuels. High levels of CO2 result in climate issues, which has resulted in more frequent and severe storms, droughts, and other natural stresses across the world in recent decades.

Trees are constantly removing and storing CO2 from the atmosphere. In fact, one single large tree is able to absorb as much as 48 pounds of CO2 per year, while one acre of trees stores the same amount of CO2 released by driving an average car for 26,000 miles (Megalos 2015). The City of Boston has committed to becoming carbon neutral by 2050 (City of Boston 2017a). A healthy urban forest is in alignment with this goal.

URBAN FORESTS PROVIDE ESSENTIAL WILDLIFE HABITAT

Trees are an essential component to habitat and conservation in urban areas. They intercept and clean large quantities of polluted stormwater (as already described), preventing further degradation to vital aquatic and terrestrial habitats. Additionally, as smaller forests are connected through planned or informal urban greenways, trees provide essential habitat to a range of birds, pollinators, and other wildlife that feed on insects (Dolan 2015).

APPENDIX B: GLOSSARY

Afforestation: The act or process of establishing a forest especially on land not previously forested.

Arboriculture: The art, science, technology, and business of tree care.

Career pathway program: A job training program that focuses on basic skills instruction and occupational training that leads to credentials for in-demand jobs. Programs often emphasize both academic and non-academic support that is needed by adults in order to complete programs. Support is often known as 'wraparound services' and can involve a wide range of social and financial support systems that provide for life needs. Programs can vary greatly in type and level of credentials offered and typically provide multiple steps that build upon one another leading to higher levels of training and allow students to enter and exit at different points.

Cooperative education model: A model for education that combines both school-based and work-based learning. Often these are connected through activities that align school-based and work-based experience.

Cultivar: A variation of a plant that people have bred for desired traits.

DBH = diameter at breast height: The way an individual tree's size is measured. The width of the trunk at breast height (4.5' above the ground).

Drought: A prolonged period of low rainfall leading to a shortage of water and dry conditions for plants and animals.

Equity: The concept of equity is synonymous with fairness and justice, and of being free from bias. Equity needs to be thought of as a structural and systemic concept in order to make change in historic and ongoing practices that favor some groups over others. Equity differs from equality in that historic conditions may mean that providing 'equal' opportunity or access does not in fact lead to a condition of full fairness due to unequal starting points.

Greenspace: According to the EPA, the term greenspace is a type of open space (see definition below) that is partly or completely covered with grass, trees, shrubs, or other vegetation, including parks, community gardens, and cemeteries.

Heat resilience: Efforts to curb rising temperatures and prepare for extreme heat events.

Heritage tree: Typically a large, individual tree with unique value which is considered irreplaceable. Other similar names for these types of trees: specimen tree, landmark tree.

Invasive species: A tree species that is introduced to the region and ends up negatively affecting the habitat, commonly through aggressive growth that pushes out other species.

Heat event hours: A sum of all the hours during the analysis week that the local modeled Heat Index is above 95 degree heat, for days that the nighttime temperature does not drop below 75 degrees. This is based on the definition of the Heat Alert level for Boston with its high and low thresholds set at 95 degrees Fahrenheit and 75 degrees Fahrenheit, respectively (City of Boston 2021). Heat Index is defined as per NOAA National Weather Service procedure.

Infrastructure: The underlying foundation or basic framework of a system or organization. Commonly referring to the systems of public works of a country, state, or region including the resources (such as personnel, buildings, or equipment) required for societal activity.

Open space: This term is used interchangeably with "parks." It can describe permanently protected and publicly accessible: conservation lands, plazas, places with sports and other recreational opportunities, and landscape areas with seating.

Open space acquisition and protection: Expanding the park system will rely on acquisition or protection by the Parks Department as well as other departments, state agencies, nonprofits, private landowners, and more. Acquisition is the purchase of land for the purpose of expansion of the open space network. Information on this program and the Parcel Priority Plan can be found on the City of Boston website:
www.boston.gov/environment-and-energy/open-space-acquisition-program

Pest vulnerability: Determining how likely it is that a tree species will be affected by bugs or diseases (e.g. ash trees and emerald ash borer).

Street right-of-way (ROW): A strip of land generally owned by a public entity over which facilities, such as sidewalks, roads, highways, railroads, or power lines, are built.

Street tree: A street tree is defined as a tree within the right-of-way.

Social vulnerability: The susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Climate Ready Boston defines the following factors as potentially increasing social vulnerability: elderly, children, medical illness, disability, limited English, people of color, and low-income.

Stormwater runoff: Rainfall that flows over the ground surface. It is created when rain falls on roads, driveways, parking lots, rooftops and other paved surfaces that do not allow water to soak into the ground.

Sustainable: Work is sustainable if we can meet our needs today without compromising the ability of future generations to meet their own needs as well.

Tree: A long-lived woody plant that has a single usually tall main stem (trunk), with branches on upper sections.

Tree (mature): A tree that has reached its largest size range, usually associated with age.

Tree (large): A tree that will be large in size at maturity.

Tree canopy: Branches and leaves that make up a tree's crown (upper sections).

Tree canopy cover: The amount of land, usually expressed in a percentage of all land, that is covered by tree canopy when viewed from above when leaves are on the trees (e.g. Google aerial view).

Tree genus: A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature, the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.

Tree inventory: Comprehensive database containing information or records about individual trees typically collected by an arborist.

Tree ordinance and policies: Tree ordinances are policy tools used by communities striving to attain a healthy, vigorous, and well-managed urban forest. Tree ordinances simply provide the authorization and standards for management activities.

Tree species: Fundamental category of taxonomic classification, ranking below a genus or subgenus, and consisting of related organisms capable of interbreeding.

Urban forest: All of the trees within a municipality or a community boundary, this can be trees along streets, in parks, in forests, and on private lands.

Urban heat island: An urban heat island is an urban area or metropolitan area that is significantly warmer than surrounding rural areas due to human activities.

Urban tree canopy (UTC) assessment: A study performed of land cover classes to gain an understanding of the tree canopy coverage, particularly as it relates to the amount of tree canopy that currently exists and the amount of tree canopy that could exist. Typically performed using aerial photographs, GIS data, or LiDAR.

Urban wilds: This is conservation land that is permanently protected and owned/managed by the Parks Department and the Conservation Commission for conservation and some passive recreation. These properties typically contain discernable remnant fragments of once larger natural systems (marshes, beaches, ponds, riparian areas, etc.) or have unique indigenous geology. Urban wilds are not highly designed or intensively managed like traditional parks. However, considerable work can go into restoring urban wilds that have been degraded over time. Urban wilds are generally open for public access. In some cases, however, these properties may have partially restricted access due to very sensitive environmental conditions. Please note a very small exception to this category: private land subject to a conservation restriction which does not allow for public access and is not managed by the City is not considered an urban wild. However, this type of land is still important as conservation land in perpetuity.

Workforce development: Initiatives that educate and train people in skills that allow them to work in current and future business and industry. Initiatives are often aimed at both individual skills development and support of employer and labor market needs.

APPENDIX C: SPECIES GUIDE

This species list is intended to be a guide and is anticipated to be changed as new cultivars are developed, as horticultural science and industry practices advance, and as climate and growing conditions change and evolve. Recommended species are based on the following criteria: hardiness zone, urban tolerance, insect and disease resistance, low maintenance, native, non-invasive, attractive, various growth habits, unrepresented species or genera in the inventory, suitability for street, park, or natural area use. Nursery availability is not a factor. The list was also reviewed by senior staff from Arnold Arboretum and Polly Hill Arboretum.

*An asterisk (*) after the species scientific name indicates that the species may be considered a "fall dig hazard".*

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Abies concolor White fir	Medium	30' to 50'	15' to 30'	Pyramidal	Coniferous evergreen that can be used in screening or as a single specimen. Resembles blue spruce in form and texture. Requires a well drained soil.
Abies cilicica Cilician fir	Large	60' to 80'	20' to 30'	Narrow Pyramidal	Appears to be well adapted to local extremes of climate. Beautiful dense growth and soft texture. Great for screening or specimen plantings.
Abies homolepis Nikko fir	Large	80' to 100'	15' to 20'	Pyramidal	Moderately fast growing, cone-shaped conifer. Ability to grow on a wide variety of sites, combined with its resistance to air pollution makes it appropriate for urban parks.
Abies nordmanniana Caucasian fir	Large	40' to 60'	15' to 25'	Pyramidal	It is easy to transplant and is one of the easier *Abies* sp. to grow. Dislikes hot, dry summers, and exposure to air pollution.
Acer buergerianum Trident maple	Medium	25' to 35'	20' to 30'	Rounded	A small- to medium-sized, deciduous tree with exfoliating bark revealing an orange-brown inner bark, which adds interest. The fall color is usually reds and oranges. Prefers full sun and average well- drained acidic soils; however, it is tolerant of a range of soil moistures and textures. It is also tolerant of wind, salt, drought, air pollution, and soil compaction.
Acer campestre Hedge maple	Medium	25' to 35'	25' to 35'	Rounded	Excellent medium-sized tree; useful in areas where space is limited; attractive dark green foliage. Extremely tolerant to drought and poor soil conditions.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	No	-	Abies concolor White fir
Yes	Yes	No	No	-	Abies cilicica Cilician fir
Yes	Yes	No	No	-	Abies homolepis Nikko fir
Yes	Yes	No	No	-	Abies nordmanniana Caucasian fir
Yes	Yes	No	No	-	Acer buergerianum Trident maple
Yes	Yes	Yes	No	-	Acer campestre Hedge maple

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Acer cissifolium Ivy-leaved maple	Small	20' to 30'	20' to 30'	Upright- Oval	Young trees are upright-oval in outline but with age may become distinctly mushroom-like and broad spreading. Adaptable to tough conditions, rare. Yellow-red fall color.
Acer griseum Paperbark Maple	Small	25' to 30'	15' to 20'	Oval	Beautiful slow growing, pH adaptable tree. Young stems are rich brown; older wood has a beautiful exfoliating cinnamon, red-brown bark.
Acer griseum x nikoense Girard's hybrid maple	Small	20' to 30'	15 to 20'	Oval	Highly ornamental bark, blue-green, trifoliate foliage; excellent fall color. Adaptable, more vigorous than Paperbark maple.
Acer miyabei 'State Street'	Large	40' to 50'	30' to 40'	Oval	Has shown excellent heat, drought and alkaline soil tolerance. Miyabe's maple has dark green leaves then rapidly changes to a pale golden-yellow fall color. It is more branched than other maple varieties which makes it a good shade tree.
Acer mono	Large	30' to 40'	25' to 35'	Rounded-Upright	Prefers well-drained soil but can grow in heavy clay soil, as well as in semi-shade or no shade. It prefers moist soil.
Acer nigrum Black maple	Large	60' to 75'	50' to 60'	Rounded- Oval	More tolerant of environmental extremes and poor soil than Sugar Maple, yellow-orange fall color.
Acer palmatum Japanese maple 'Atropurpureum' 'Bloodgood' 'Burgundy Lace' 'Dissectum'	Small	15' to 25'	15' to 25'	Rounded	Excellent small ornamental tree; perhaps best reserved for smaller sites and new development. Prone to damage from late spring frost and freezes; grows best in sheltered locations.
Acer rubrum* Red maple 'Autumn Flame' 'Bowhall' 'Columnare' 'October Glory' 'Redpoint' 'Red Sunset' 'Shlesingeri' 'Somerset' 'Summer Red'	Large	40' to 60'	40' to 60'	Oval	Excellent tree but requires room to develop; numerous cultivars are superior to the straight species and should be considered for use. Seedling trees often have inconsistent fall color and inferior form.
Acer saccharum Sugar maple 'Apollo' 'Fall Fiesta' 'Legacy' 'Green Mountain' 'Majesty' 'Powderkeg' 'Sweet Shadow' 'Wright Brothers'	Large	60' to 75'	50' to 60'	Rounded	One of the best larger shade trees; but not for crowded areas. Use only the improved cultivars for better growth rate, and improved tolerance to environmental conditions.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Acer cissifolium Ivy-leaved maple
Yes	Yes	Yes	No	-	Acer griseum Paperbark Maple
Yes	Yes	Yes	No	-	Acer griseum x nikoense Girard's hybrid maple
Yes	Yes	Yes	No	-	Acer miyabei 'State Street'
Yes	Yes	Yes	No	-	Acer mono
Yes	Yes	Yes	Yes	-	Acer nigrum Black maple
Yes	Yes	No	No	-	Acer palmatum Japanese maple 'Atropurpureum' 'Bloodgood' 'Burgundy Lace' 'Dissectum'
Yes	Yes	Yes	Yes Species, not cultivars	Expected to fare worse	Acer rubrum* Red maple 'Autumn Flame' 'Bowhall' 'Columnare' 'October Glory' 'Redpoint' 'Red Sunset' 'Shlesingeri' 'Somerset' 'Summer Red'
Yes	Yes	Yes	Yes Species, not cultivars	Expected to fare better	Acer saccharum Sugar maple 'Apollo' 'Fall Fiesta' 'Legacy' 'Green Mountain' 'Majesty' 'Powderkeg' 'Sweet Shadow' 'Wright Brothers'

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Acer triflorum Three flower maple	Small	20' to 30'	20 to 30'	Rounded	Excellent small specimen tree, lovely foliage, exfoliating gold bark on young stems, mature bark is ash-brown, loose and vertically fissured. Rarely seen adaptable tree that deserves more use. Tolerant of drought and clay soils.
Acer truncatum Shantung maple 'Urban Sunset'	Small	20' to 30'	15' to 20'	Rounded	Good shade tree for smaller spaces. It is heat and drought tolerant once established and grows in average well-drained soils in full sun to partial shade.
Acer x freemanii Freeman maple 'Armstrong' 'Autumn Blaze' 'Celebration' 'Sienna Glen'	Large	40' to 60'	20' to 40'	Oval, columnar, or pyramidal	Hybrid of the red and silver maples (A. rubrum x A. saccharinum) that combines the best of both species: good form and excellent red autumn color from the red maple; fast growth and tolerance to adverse climatic and soil conditions from the silver maple.
Acer x 'White Tigress' White tigress maple	Medium	20' to 30'	15' to 20'	Rounded	Exceedingly beautiful snake bark maple with green and white striped bark, which becomes almost totally white in older trunks and branches. Perhaps the most easily grown of the snakebark group, but does best with afternoon shade and consistently moist well drained soil.
Aesculus pavia Red buckeye	Small	10' to 20'	10' to 20'	Rounded	Small buckeye. Prune to form single trunk. Showy, erect, 4-10" long panicles of red to orange-red flowers appear in spring. Has a tendency to lose leaves earlier than most trees in the fall, rarely used, but tough small tree.
Aesculus x arnoldiana 'Arnold Buckeye' 'Autumn Splendor'	Medium	35' to 40'	30' to 40'	Rounded	Interesting new buckeye selection with scorch resistant foliage that remains dark green all summer, turning brilliant purple-red in fall. This hybrid blooms in spring, producing erect clusters of yellow flowers with orange and red markings.
Aesculus x carnea Red horsechestnut 'Briotii' 'Fort McNair' 'O'Neill'	Medium	35' to 45'	20' to 35'	Rounded	A hybrid between Red Buckeye and European Horse Chestnut, this tree is grown for its stunning displays of dark pink spikes in late spring. Only named cultivars should be used for improved bright red flowers, and resistance to leaf scorch and improved disease resistance.
Aesculus hippocastanum Common horsechestnut	Medium	35' to 40'	30' to 40'	Rounded	A non-native tree that is most known for its showy white flowers in the spring. The flowers provide a rich source of nectar and pollen for insects, particularly bees.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	No	Yes	No	-	Acer triflorum Three flower maple
Yes	Yes	Yes	No	-	Acer truncatum Shantung maple 'Urban Sunset'
Yes	Yes	Yes	No	-	Acer x freemanii Freeman maple 'Armstrong' 'Autumn Blaze' 'Celebration' 'Sienna Glen'
Yes	Yes	No	No	-	Acer x 'White Tigress' White tigress maple
Yes	Yes	No	No	-	Aesculus pavia Red buckeye
Yes	No	No	No	-	Aesculus x arnoldiana 'Arnold Buckeye' 'Autumn Splendor'
Yes	No	No	No	-	Aesculus x carnea Red horsechestnut 'Briotii' 'Fort McNair' 'O'Neill'
Yes	No	No	No	-	Aesculus hippocastanum Common horsechestnut

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Abelia x grandiflora Glossy abelia	Small	3' to 5'	3' to 5'	Rounded to Wide-spreading	Handsome shrub with deciduous to semi evergreen glossy foliage and pink spring flowers. Great hedge plant, or en masse.
Alnus cordata Italian alder	Medium	30' to 50'	20' to 25'	Pyramidal	Performs well in infertile, dry, high pH soils making this one of the best Alders for urban conditions. This tree is also tolerant of wet sites and soil compaction. Beautiful heart shaped glossy foliage, and fast growth make this an excellent little known tree for street use.
Alnus serrulata Tag alder	Small	15' to 20'	10 to 20'	Rounded	The only native alder to most of the East, this small multi stemmed tree is found on stream banks, and other wetland areas. A great small tree or large shrub for similar situations in natural areas or restoration work.
Amelanchier arborea Downy serviceberry	Small	15' to 25'	15' to 25'	Upright-rounded	Excellent small tree. Early spring white flowers and excellent food source for wildlife as small fruits ripen in midsummer. Very adaptable.
Amelanchier canadensis Shadblow serviceberry	Small	20' to 25'	15' to 20'	Upright-rounded	Dense upright multi-stemmed tree to very large shrub. Tolerates wet soil better than other Serviceberries. Difficult to maintain as a single trunk because of profuse suckering, makes a good screen plant.
Amelanchier x grandiflora 'Autumn Brilliance'	Small	20' to 25'	15' to 20'	Upright-rounded	This native tree is disease resistant and known to be hardy and vigorous with exceptional autumn color. The berries are edible for humans and vital to wildlife and bird gardens. Use single trunk forms for street use.
Amelanchier laevis Allegheny serviceberry 'Cumulus'- single trunk	Small	15' to 25'	15' to 25'	Rounded	Attractive tree often must be limbed up to meet requirements, use only single trunk forms.
Aronia arbutifolia Red chokeberry	Large Shrub	6' to 10'	3' to 5'	Oval to Columnar	Stunning ornamental display of red fruit in fall and early winter. White flowers in spring. Tends to have long thin stems which can create a leggy appearance. Useful as a screen or background planting.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	No	-	Abelia x grandiflora Glossy abelia
Yes	Yes	Yes	No	-	Alnus cordata Italian alder
Yes	Yes	No	Yes	-	Alnus serrulata Tag alder
Yes	Yes	No	No	Expected to fare worse	Amelanchier arborea Downy serviceberry
Yes	Yes	No	No	Expected to fare worse	Amelanchier canadensis Shadblow serviceberry
Yes	Yes	Yes	Yes	Expected to fare worse	Amelanchier x grandiflora 'Autumn Brilliance'
Yes	Yes	Yes	No	Expected to fare worse	Amelanchier laevis Allegheny serviceberry 'Cumulus'- single trunk
Yes	Yes	No	No	-	Aronia arbutifolia Red chokeberry

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Aronia melanocarpa Black chokeberry 'Viking'	Large Shrub	6' to 10'	3' to 5'	Oval to Columnar	Stunning ornamental display of black fruit in fall and early winter. White flowers in spring. Useful as a screen or background planting. Foliage is more attractive than that of Red Chokeberry. The cultivar 'Viking' is the best to use for landscapes.
Asimina triloba Pawpaw	Small / Medium	15' to 30'	15' to 30'	Pyramidal	Grove forming understory species known for its edible fruit. Performs equally well in open areas when used as a landscape plant.
Betula alleghaniensis* Yellow birch	Large	70' to 100'	50' to 60'	Wide spreading	Does not perform well in hot, dry climates. Very long-lived for a birch, often reaching beyond 100 years. Trees planted in grove fashion form a pleasing, natural effect.
Betula lenta* Sweet birch	Medium	40' to 50'	35' to 45'	Rounded	Sun to partial shade; prefers moist, well drained soil but does well in dry, sandy and clay soils
Betula papyrifera Paper Birch	Medium	50' to 70'	35' to 40'	Open spreading	It is one of the best-loved trees of the New England landscape, planted often for the beauty of its distinctive bark and golden fall color. The paper birch grows well in acidic, loamy, moist, sandy, well-drained and clay soils. While it prefers normal moisture, the tree has some drought tolerance.
Betula populifolia Gray birch	Small to Medium	35' to 40'	35' to 40'	Columnar- Oval	Gray Birch grows rapidly but is short-lived. The white, non-peeling bark becomes darker with age. Dark-green leaves turn yellow in fall.
Betula nigra* River birch 'Fox Valley' 'Dura Heat' 'Heritage'	Large	40' to 70'	40' to 60'	Oval to Rounded	More adaptable and disease resistant than other birch trees; handsome tree; good for wet areas. Select cultivars for improved ornamental qualities, or different growth forms.
Carya cordiformis Bitternut hickory	Large	50' to 75'	30' to 40'	Cylindrical-Rounded	Tall and narrow growing hickory common in forested areas. Does best in deep, well drained soils. Has outstanding gold fall color, the best of all hickories.
Carya glabra Pignut hickory	Large	50' to 65'	30' to 40'	Oval	Excellent native hickory known for its exceptionally strong branching, resulting in storm breakage resistance. Fall color is an outstanding bright yellow, fruit limits use around parking lots or where pedestrians could slip over nuts.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	No	-	Aronia melanocarpa Black chokeberry 'Viking'
Yes	Yes	No	Yes	-	Asimina triloba Pawpaw
Yes	Yes	Yes	Yes	Expected to fare better	Betula alleghaniensis* Yellow birch
Yes	Yes	No	No	Expected to fare worse	Betula lenta* Sweet birch
Yes	Yes	No	Yes	Expected to fare worse	Betula papyrifera Paper Birch
Yes	Yes	No	Yes	Expected to fare better	Betula populifolia Gray birch
Yes	Yes	Yes	Yes species, not cultivars	-	Betula nigra* River birch 'Fox Valley' 'Dura Heat' 'Heritage'
Yes	Yes	No	Yes	Expected to fare better	Carya cordiformis Bitternut hickory
Yes	Yes	No	Yes	Expected to fare better	Carya glabra Pignut hickory

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Carya laciniosa Shellbark hickory	Large	80' to 100'	40' to 60'	Oval	Best grown in humusy, rich, medium to wet soils in full sun to part shade. In the wild, it grows in areas that are periodically flooded. Slow growing with a narrow crown, and shaggy peeling bark, though less so at the base of old trunks.
Carya ovata Shagbark hickory	Large	70' to 90'	30' to 40'	Rounded- Oval	Tall growing native hickory known for its bark which peels in long shaggy strips, up to a foot long. The best of the group for ornamental use, especially in large park like settings.
Carya tomentosa Mockernut Hickory	Large	60' to 80'	30' to 40'	Oval- rounded	Similar to shagbark and shellbark hickories, but differing in having tight bark with diamond shaped furrows at maturity. Narrow – oval crown, very long lived (to 500 years).
Carpinus betulus Columnar European hornbeam 'Fastigiata' 'Frans Fontaine'	Medium	30' to 50'	20' to 30'	Columnar- Oval	Very densely-foliated, columnar or oval shaped tree. Grows successfully in urban areas where air pollution, poor drainage, compacted soil, and/or drought are common.
Carpinus caroliniana American hornbeam	Medium	20 to 35'	20 to 35'	Globular	American hornbeam is a slow-growing, deciduous, small to medium-sized understory tree with an attractive globular form. Although naturally found in shady sites, tolerates sunny locations equally well. The smooth, gray trunk and larger branches of a mature tree exhibit a distinctive muscle-like fluting.
Catalpa speciosa Northern catalpa	Large	40' to 60'	20' to 30'	Irregular-rounded	A mature, symmetrically rounded catalpa tree can be a tree of great beauty, particularly in spring when the foliage is young and the flowers are in bloom. It has been widely planted in urban areas as a street tree and lawn tree, and can also be effectively used in the landscape for difficult areas such as moist low spots or dry areas with poor soils. Good for parks.
Cedrus libani var. stenocoma Hardy cedar of Lebanon	Large	40' to 60'	20' to 30'	Pyramidal	A needled evergreen conifer that is native to the Taurus Mountains of southwestern Turkey. A subspecies of Cedrus libani, this form is more columnar in growth than the species, and is particularly noted for having better winter hardiness than all other forms of cedar of Lebanon. Lower branches typically remain on the tree as it ages, often touching the ground.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	Yes	-	Carya laciniosa Shellbark hickory
Yes	Yes	No	Yes	No changes expected	Carya ovata Shagbark hickory
Yes	Yes	No	Yes	Expected to fare better	Carya tomentosa Mockernut Hickory
Yes	No	Yes	No	-	Carpinus betulus Columnar European hornbeam 'Fastigiata' 'Frans Fontaine'
Yes	Yes	Yes	Yes	Expected to fare better	Carpinus caroliniana American hornbeam
Yes	Yes	Yes	Yes	-	Catalpa speciosa Northern catalpa
Yes	Yes	No	No	-	Cedrus libani var. stenocoma Hardy cedar of Lebanon

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Cedrus deodara 'Shalimar'	Medium	40' to 50'	30' to 40'	Conical	A vigorous, exceptionally hardy, tree form of Himalayan cedar with long, arched primary branching, pendulous secondary branching; and soft blue-green foliage. This cultivar was introduced by the Arnold Arboretum.
Celtis occidentalis* Common hackberry 'Chicagoland' 'Prairie Pride'	Large	40' to 60'	40' to 60'	Rounded vase	Extremely urban tolerant native tree. New cultivars have been recently introduced to the market and offer improved form, less fruit production, and resistance to witches broom growth. Avoid transplanting in fall.
Cercidiphyllum japonicum Katsura tree	Large	40' to 60'	30' to 50'	Oval- columnar	Extremely variable in spread and form: handsome tree; must be limbed up for street tree use.
Cercis canadensis* Eastern redbud 'Alba' 'Appalachian Red' 'Flame' 'Forest Pansy' 'Royal White' 'Tennessee Pink'	Small	20 ' to 25'	20' to 30'	Rounded	Excellent native tree; graceful ascending branches, normally must be limbed up to meet requirements; showy pink-purple flowers. Prune to form strong scaffold branching in youth to avoid weak crotches.
Chamaecyparis nootkatensis Alaska-cedar	Medium	30' to 45'	10' to 15'	Conical	Dense dark green weeping conifer. Outstanding as a specimen tree where a large but narrow evergreen tree is needed. Performs best in rich, well drained soils. Avoid poorly draining sites. Deserves wider use.
Chamaecyparis obtusa Hinoki falsecypress	Large	50' to 75'	10' to 20'	Pyramidal	Very dense evergreen that requires moist, humid conditions and protection from wind. There are various cultivars, and most mature at much smaller sizes.
Chamaecyparis thyoides Atlantic white cedar	Large	60' to 70'	40' to 50'	Conical	The Atlantic white cedar is a tall evergreen tree with scaly, fan-shaped foliage and a cone-like shape. It grows in swamps, marshes and other wet areas. Its leaves are very aromatic, with a distinct, cedar-like scent. Songbirds and white-tailed deer use Atlantic white cedars as food.
Chionanthus virginicus Fringetree	Small	15' to 20'	15' to 20'	Rounded	Native adaptable small tree with white spring flowers and purple fruit on female trees. Tolerant to air pollution, flowers at an early age. Slow growing.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	No	-	Cedrus deodara 'Shalimar'
Yes	Yes	Yes	Yes Species, not cultivars	-	Celtis occidentalis* Common hackberry 'Chicagoland' 'Prairie Pride'
Yes	Yes	Yes	No	-	Cercidiphyllum japonicum Katsura tree
Yes	Yes	Yes	Yes Species, not cultivars	-	Cercis canadensis* Eastern redbud 'Alba' 'Appalachian Red' 'Flame' 'Forest Pansy' 'Royal White' 'Tennessee Pink'
Yes	Yes	No	No	-	Chamaecyparis nootkatensis Alaska-cedar
Yes	Yes	No	No	-	Chamaecyparis obtusa Hinoki falsecypress
Yes	Yes	No	Yes	-	Chamaecyparis thyoides Atlantic white cedar
Yes	Yes	Yes	No	-	Chionanthus virginicus Fringetree

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Chionanthus retusus Arnolds fringetree 'Arnold's Pride'	Small	15' to 20'	15' to 20'	Rounded	A fast-growing selection from the Arnold Arboretum that showcases an abundance of fragrant white flowers and blue fruit. Plants are vigorous growers forming a central leader and rounded crown in time. The original is still on the grounds of the Arnold Arboretum.
Cladrastis kentukea American yellowood 'Perkins Pink'	Medium	30' to 50'	40' to 55'	Rounded	Beautiful tree with distinct smooth beech-like bark and hanging white clusters of flowers in late spring. Tolerant of dry sites, and high soil pH. Prune to remove narrow crotch angles in youth for strong form.
Cornus alternifolia* Pagoda dogwood	Small	15' to 25'	20' to 30'	Rounded	Low branched tree with interesting horizontal branching; white flowers in late spring.
Cornus drummondii* Rough-leaf dogwood	Small	10' to 15'	10 to 15'	Rounded	Small native dogwood that grows as a small tree or large shrub (must be trained somewhat to maintain a tree). Extremely adaptable and food source for wildlife. Often found at the edge of wooded areas and in fencerows.
Cornus florida* Flowering dogwood Appalachian series and anthracnose tolerant selections	Small	20' to 25'	20'to 25'	Rounded- flat topped	Excellent native species for naturalizing at the edge of woods or in wooded areas as an understory plant. Avoid hot afternoon sun and droughty locations. Prefers moist, well drained soils.
Cornus kousa* Kousa dogwood var. chinensis 'Green Leaves' 'Milky Way Select'	Small	15' to 20'	15' to 20'	Rounded	Possible to use if limbed up, but naturally develops a low branching structure. More tolerant of environmental extremes than Flowering dogwood, and blooms several weeks later in spring.
Cornus mas* Corneliancherry dogwood 'Golden Glory'	Small	20' to 25'	15' to 20'	Oval - rounded	One of the first plants to bloom in spring often starts blooming in mid to late March. If limbed up makes an outstanding small tree with attractive exfoliating bark. Tolerant to adverse conditions.
Cornus racemosa* Gray Dogwood	Small Tree / large Shrub	10' to 15'	10' to 15'	Irregular	Large native suckering shrub / small tree with white clusters of flowers in late spring followed by interesting white fruit. Fall color is often an outstanding rich reddish purple.
Corylus colurna Turkish filbert	Large	40' to 50'	20' to 25'	Pyramidal	A large shade tree noted for its bold texture, pyramidal form, ornamental winter bark/stems/catkins, dense shade from dark green shiny foliage, and urban tolerance.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Chionanthus retusus Arnolds fringetree 'Arnold's Pride'
Yes	Yes	Yes	No	-	Cladrastis kentukea American yellowood 'Perkins Pink'
Yes	Yes	Yes	Yes	-	Cornus alternifolia* Pagoda dogwood
Yes	Yes	Yes	Yes	-	Cornus drummondii* Rough-leaf dogwood
Yes	Yes	Yes	Yes (species only)	-	Cornus florida* Flowering dogwood Appalachian series and anthracnose tolerant selections
Yes	No	Yes	No	-	Cornus kousa* Kousa dogwood var. chinensis 'Green Leaves' 'Milky Way Select'
Yes	Yes	Yes	No	-	Cornus mas* Corneliancherry dogwood 'Golden Glory'
Yes	Yes	Yes	Yes	-	Cornus racemosa* Gray Dogwood
Yes	Yes	Yes	No	-	Corylus colurna Turkish filbert

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Cotinus obovatus American smoketree	Small	15' to 20'	15' to 20'	Oval- rounded	Small native tree tolerant of clay soils, drought, and high soil pH. Known for its amazing orange-red fall color and summer flowers that resemble smoke like puffs.
Crataegus crus-galli* Cockspur hawthorn	Small	15' to 20'	15' to 20'	Horizontal spreading / flat topped	A small tree with horizontal, spreading branches and a flat-topped shape at maturity, good for its showy white flowers, brick-red fruits, glossy summer and vibrantly multicolored Autumn foliage, and bold Winter texture. Extremely well armed with formidable thorns, a thornless variety occurs naturally, and should be used outside of reforestation areas. Native
Crataegus phaenopyrum* Washington hawthorn	Small	20' to 30'	20' to 25'	Oval to Rounded	Dense, thorny tree, acceptable as a street tree but thorns can limit use, often must be limbed up.
Crataegus viridis* Green hawthorn 'Winter King'	Small	20' to 30'	20' to 30'	Rounded	Dense thorny tree, v-shaped branching; occasionally must be limbed up; excellent small specimen tree. Use should be limited to 'Winter King', which is largely thornless.
Diospyros virginiana Persimmon	Large	35' to 60'	25' to 35'	Rounded- Oval	Native tree known for its edible fruit, attractive form, foliage, and distinctive bark that is broken into rectangular blocks. Fruit drop precludes its use as a street tree.
Eucommia ulmoides Hardy rubber tree	Large	40' to 60'	40' to 50'	Rounded	Virtually problem free tree with outstanding dark green foliage. Excellent street tree.
Euonymus atropurpureus Eastern wahoo	Small	15' to 20'	15' to 25'	Irregular spreading	Eastern wahoo is a deciduous, native shrub or small tree which is most often grown for its attractive red berries and fall color. Occurs in the wild in open woods and thickets, near streams and on wooded slopes.
Fagus grandifolia* American beech	Large	50' to 70'	50' to 70'	Rounded spreading	A large slow growing stately tree with smooth silvery gray bark, and a dense spreading crown. Extremely sensitive to root disturbance, and very intolerant of soil compaction. Fall color is a pleasing golden bronze.
Fagus sylvatica* European beech	Large	50' to 60'	35' to 45'	Oval- rounded	Large spreading tree with attractive smooth dark grey bark. Needs room to develop, hates root disturbance and is highly sensitive to soil compaction.
Ginkgo biloba* (Male) Ginkgo 'Autumn Gold' 'Fastigiata' 'Princeton Sentry'	Large	50' to 80'	30' to 50'	Pyramidal to Rounded	Tolerates adverse conditions; excellent tree for streets and other urban areas; outstanding ornamental qualities.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Cotinus obovatus American smoketree
Yes	Yes	Yes	Yes	-	Crataegus crus-galli* Cockspur hawthorn
Yes	Yes	Yes	Yes	-	Crataegus phaenopyrum* Washington hawthorn
Yes	Yes	Yes	No	-	Crataegus viridis* Green hawthorn 'Winter King'
Yes	Yes	No	Yes	-	Diospyros virginiana Persimmon
Yes	Yes	Yes	No	-	Eucommia ulmoides Hardy rubber tree
Yes	Yes	No	Yes	-	Euonymus atropurpureus Eastern wahoo
Yes	Yes	Yes	Yes	Expected to fare better	Fagus grandifolia* American beech
Yes	Yes	Yes	No	-	Fagus sylvatica* European beech
Yes	Yes	Yes	No	-	Ginkgo biloba* (Male) Ginkgo 'Autumn Gold' 'Fastigiata' 'Princeton Sentry'

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Gleditsia triacanthos var. inermis Thornless honeylocust 'Moriane' 'Shademaster' 'Skyline' 'Sunburst' 'Imperial'	Medium	30' to 50'	30' to 50'	Rounded	Only cultivars are acceptable for street, and park use; cultivars have less disease and insect problems than straight species; provides a light, filtered shade, widely used.
Gymnocladus dioicus Kentucky Coffeetree 'Espresso' 'Prairie Titan' 'Stately Manor'	Large	60' to 75'	40' to 50'	Upright oval	A large tree that gives semi-filtered shade, good for its very bold texture, rapid growth, and excellent urban tolerance. To avoid seed pods, plant only male cultivars.
Halesia tetraptera* Carolina silverbell	Medium	30' to 40'	20' to 35'	Oval- rounded	Prefers rich, well-drained acid soils; intolerant of adverse conditions. Must be limbed up for clearance.
Hamamelis vernalis Vernal witchhazel	Small	6' to 10'	6' to 10'	Rounded	Large multi stemmed shrub, smallest growing of the witchhazels, flowers in late winter to early spring.
Hamamelis virginiana Witchhazel	Small	20' to 30'	20' to 30'	Rounded	Witch hazel is a fall-blooming, deciduous shrub or small tree that is native to woodlands, forest margins and stream banks in eastern North America. Can be limbed up to make a multi-stemmed small tree.
Heptacodium miconioides Seven sons tree	Small	15' to 25'	10' to 15'	Rounded	Outstanding late season flowering; plants have proven to be cold hardy to temperatures as low as minus 30 degrees below zero while still maintaining superior flower and fruit displays.
Ilex opaca* American holly	Medium	30' to 50'	25' to 35'	Pyramidal	Dark green, non-glossy, spine-tipped leaves. New growth pushes off the old leaves in spring. Bright red berries occur on the female plants. A shorter, multi-trunked form may grow in lower-light situations.
Ilex pedunculosa Longstalk holly	Small	10' to 15'	10' to 15'	Oval- rounded	Relatively unknown evergreen holly, known for unusually long stalked fruit. Foliage resembles that of an indoor ficus plant. Avoid areas with known verticillium wilt present in the soil, as this species is highly susceptible.
Juniperus virginiana* Eastern redcedar	Medium	40' to 50'	15' to 20'	Oval	Native; good for screening; attracts birds; easy to transplant; tough, dependable tree but considered weedy by many gardeners; drought and heat tolerant; host plant for cedar apple rust. Improved cultivars exist for landscape uses.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes Reserve planting more on streets until greater species diversity is reached	Yes species, not cultivars	-	Gleditsia triacanthos var. inermis Thornless honeylocust 'Moriane' 'Shademaster' 'Skyline' 'Sunburst' 'Imperial'
Yes	Yes	Yes Non-seed bearing varieties	Yes Species, not cultivars	-	Gymnocladus dioicus Kentucky Coffeetree 'Espresso' 'Prairie Titan' 'Stately Manor'
Yes	Yes	Yes	No	-	Halesia tetraptera* Carolina silverbell
Yes	Yes	No	No	-	Hamamelis vernalis Vernal witchhazel
Yes	Yes	No	Yes	-	Hamamelis virginiana Witchhazel
Yes	Yes	No	No	-	Heptacodium miconioides Seven sons tree
Yes	Yes	No	Yes	Expected to fare better	Ilex opaca* American holly
Yes	Yes	No	No	-	Ilex pedunculosa Longstalk holly
Yes	Yes	Yes	Yes	Expected to fare better	Juniperus virginiana* Eastern redcedar

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Juglans nigra Black walnut	Large	50' to 70'	50' to 70'	Oval /open	Excellent large shade tree for parks and wide open spaces. Avoid planting where fruit drop will be a nuisance. Roots exude a toxic substance that can stunt the growth of other plants growing nearby.
Koelreuteria paniculata Golden-raintree	Medium	30' to 40'	30' to 40'	Rounded	Beautiful dense tree; tolerates most adverse conditions; excellent late yellow flowers; somewhat weak-wooded but can be used as a street tree. Can be invasive.
Larix decidua European larch	Large	70' to 75'	25' to 30'	Pyramidal	Nice specimen tree for large areas. Golden fall color, and light gray bark are the best ornamental features on this deciduous conifer. Needs a moist location and can tolerate wet sites. Susceptible to severe droughts.
Larix laricina American larch, tamarack	Large	50' to 80'	50' to 60'	Conical	Larch is a deciduous conifer. They are valued for their soft foliage, uniform growth habit, and brilliant golden foliage in the fall.
Lindera benzoin Spicebush	Large Shrub	6' to 12'	6' to 12'	Rounded	Spicebush is a native deciduous shrub with elegant tiered branching structure. Often found in moist locations in bottomlands, woods, ravines, valleys and along streams. Clusters of tiny,aromatic, greenish-yellow flowers bloom along the branches in early spring before the foliage emerges.
Liquidambar styraciflua Sweetgum 'Grazam' 'Happidaze' 'Moraine' 'Rotundiloba' 'Slender Silhouette'	Large	60' to 80'	40' to 60'	Rounded	Tolerant of urban conditions with fast growth, and excellent fall color. Gumball production can be a deterrent to planting this species in areas where litter may be a concern. Few trees can rival the fall color display of this native tree. 'Rotundiloba' is virtually seedless.
Liriodendron tulipifera* Tuliptree 'Emerald City'	Large	75' to 100'	35' to 50'	Rounded pyramidal	Tuliptrees grow to be one of the largest tree species in the eastern USA. Tree grows with a strong central leader and is pyramidal in youth, gradually developing a more rounded pyramidal crown with age. Greenish yellow flowers with orange centers are produced in spring on older trees.
Maackia amurensis Amur maackia 'Starburst' 'Summertime'	Small	20' to 30'	20' to 30'	Rounded- vase	A very hardy and urban tolerant slow growing tree, amur maackia is recommended for buffer strips around parking lots or for median strip plantings in the highway. The rich foliage, bronze-colored bark, and white flowers in late summer make for an interesting tree.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	Yes	Expected to fare worse	Juglans nigra Black walnut
Yes	May be	Yes	No	-	Koelreuteria paniculata Golden-raintree
Yes	Yes	Nos	No	-	Larix decidua European larch
Yes	Yes	No	No	Expected to fare worse	Larix laricina American larch, tamarack
Yes	Yes	No	Yes	-	Lindera benzoin Spicebush
Yes	Yes	Yes	Yes Species, not cultivars	-	Liquidambar styraciflua Sweetgum 'Grazam' 'Happidaze' 'Moraine' 'Rotundiloba' 'Slender Silhouette'
Yes	Yes	Yes	Yes	-	Liriodendron tulipifera* Tuliptree 'Emerald City'
Yes	Yes	Yes	No	-	Maackia amurensis Amur maackia 'Starburst' 'Summertime'

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Maclura pomifera Osage orange 'White Shield' 'Wichita'	Medium	20' to 40'	20' to 40'	Rounded-spreading	Extremely tough, environmentally tolerant tree. Only thornless and fruitless male cultivars should be used. Such cultivars possess attractive glossy foliage that turns a pleasing bright yellow in fall.
Magnolia acuminata Cucumbertree magnolia	Large	50' to 80'	50' to 80'	Rounded pyramidal	Excellent tree for a large property or a park; trees appear pyramidal and compact in youth, but spread out dramatically as they age. Greenish yellow flowers followed by cucumber shaped fruit give this tree its name. Native.
Magnolia stellata Star magnolia	Small	10' to 20'	10' to 15'	Upright-rounded	Dense shrub-like form if not limbed up. Good screen but needs ample room. Best used as a small specimen tree. Avoid southern exposures to delay flowering and help avoid late frost damage.
Magnolia virginiana Sweetbay magnolia 'Green Mile' 'Moonglow' ' Northern Belle' var. australis 'Henry Hicks' 'Satellite'	Small-Med	10' to 45'	10' to 45'	Rounded, varies	Native tree in Massachusetss. Depending on selections may range from a large multi-stemmed shrub to small tree, or with the newer cultivars selections may be upright and tall tree forms.
Magnolia x soulangiana Saucer magnolia 'Lennei'	Small	20' to 20'	20' to 30'	Rounded	Low branching tree, often heralds the arrival of springtime with stunning floral display. Very prone to late frost and freeze damage to flowers. The cultivar Lennei blooms much later than most other cultivars and should be used to avoid frost damage.
Malus* (varieties) Crabapple (varieties) 'Bob White' 'Coral Burst' 'Donald Wyman' 'Harvest Gold' 'Prairiefire' 'Red Swan' 'Sugar Tyme' 'White Angel'	Small	10' to 25'	10' to 30'	Varied	Only disease and insect resistant cultivars are acceptable; possible use depends on branching height; often must be limbed up; valued for foliage; fruit, flowers and variations in size and form.
Metasequoia glyptostroboides Dawn redwood 'National' 'Sheridan Spire'	Large	75' to 100'	15' to 25'	Pyramidal	Very large and fast growing tree that could be used in limited urban applications. Requires substantial space, but is fairly tolerant of wide ranging conditions. Will become an imposing and dominant focal point with time anywhere this species is planted. Narrow columnar selections have recently become available and will make the tree more useful in street tree plantings.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Maclura pomifera Osage orange 'White Shield' 'Wichita'
Yes	Yes	No	No	-	Magnolia acuminata Cucumbertree magnolia
Yes	Yes	No	No	-	Magnolia stellata Star magnolia
Yes	Yes	Yes	Yes (straight species)	-	Magnolia virginiana Sweetbay magnolia 'Green Mile' 'Moonglow' ' Northern Belle' var. australis 'Henry Hicks' 'Satellite'
Yes	Yes	Yes	No	-	Magnolia x soulangiana Saucer magnolia 'Lennei'
Yes	Yes	Yes	No	-	Malus* (varieties) Crabapple (varieties) 'Bob White' 'Coral Burst' 'Donald Wyman' 'Harvest Gold' 'Prairiefire' 'Red Swan' 'Sugar Tyme' 'White Angel'
Yes	Yes	Yes	No	-	Metasequoia glyptostroboides Dawn redwood 'National' 'Sheridan Spire'

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Morus rubra Red mulberry	Medium	40' to 50'	40' to 50'	Rounded vase	Excellent medium native tree often found at the edges of forested areas or in fencerows. Fruit mature red. Threatened in the wild by extensive hybridization of white mulberry in the wild.
Nyssa sylvatica* Black gum	Large	50' to 75'	35' to 50'	Rounded to Pyramidal	This species is known for its brilliant red Fall color (one of the best) and voted as one of the top 25 trees to plant in Northern Kentucky. Dig in the spring. Abundant blue fruit ripens in fall.
Ostrya virginiana* Hophornbeam	Medium	25' to 40'	20' to 30'	Rounded	Good tree where space is limited occasionally must be limbed up. Pleasing orange fall color.
Oxydendrum arboreum Sourwood	Medium	20' to 30'	15' to 20'	Oval	White fragrant flowers in early summer. Leaves are rich green, turning yellow, red and purple in fall. Prefers full sun.
Parrotia persica Persian parrotia	Medium	20' to 40'	15' to 30'	Oval	Outstanding bark and foliage color; excellent for a variety of uses although not very well known.
Picea glauca White spruce var. densata or 'Densata'	Large	40' to 60'	10' to 20'	Pyramidal	Slower growing that Norway Spruce, but more tolerant of drought and adverse conditions. The natural variety 'Densata' or Black Hills Spruce is the most commonly used selection and perfered over the straight species for dense growth and excellent tolerance to extreme conditions.
Picea omorika Serbian spruce	Large	50' to 60'	15' to 20'	Narrow pyramidal	A medium sized, slow-growing, evergreen conifer with a narrow, conical crown. The narrow form of this spruce allows for use in more crowded conditions than most other spruce. Tolerant of urban conditions. Like all spruce, needs well drained soils.
Picea orientalis Oriental spruce	Large	50' to 60'	20' to 30'	Narrow pyramidal	Outstanding ornamental spruce. Small soft dark green needles provide a very fine texture compared to other spruce. Slower growing and more narrow than Norway Spruce, but more tolerant of environmental extremes. A good substitute for Norway Spruce.
Pinus bungeana Lacebark pine 'Silver Ghost'	Medium	35' to 50'	30' to 40'	Pyramidal	This slow growing pine has striking mottled white bark. Tolerates high soil pH, and is drought tolerant for a pine. Usually likes to grow in a multi trunked form. Several improved cultivars are now available in the trade.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	Yes	-	Morus rubra Red mulberry
Yes	Yes	Yes	Yes	Expected to fare better	Nyssa sylvatica* Black gum
Yes	Yes	Yes	Yes	Expected to fare better	Ostrya virginiana* Hophornbeam
Yes	Yes	Yes	Yes	-	Oxydendrum arboreum Sourwood
Yes	Yes	Yes	No	-	Parrotia persica Persian parrotia
Yes	Yes	No	No	-	Picea glauca White spruce var. densata or 'Densata'
Yes	Yes	No	No	-	Picea omorika Serbian spruce
Yes	Yes	No	No	-	Picea orientalis Oriental spruce
Yes	Yes	No	No	-	Pinus bungeana Lacebark pine 'Silver Ghost'

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Pinus cembra Swiss stone pine	Medium	30' to 40'	15' to 25'	Pyramidal	Under-utilized slow-growing evergreen; transplants well and is more drought-tolerant than most of the White Pine group. May be difficult to find in the trade.
Pinus densiflora Japanese red pine 'Oculus-draconis' 'Umbraculifera'	Small	10' to 15'	10' to 15'	Rounded-spreading	Interesting slow growing small specimen tree. Tolerant to various soil types except for poor drainage. Only use listed cultivars.
Pinus flexilis 'Vanderwolf's Pyramid'	Medium	20' to 25'	10' to 15'	Pyramidal	Distinctive, pyramid-shaped pine with long, twisted, silvery blue-green needles covering the dense branches. A superior selection for use as a lawn specimen or landscape accent. Excellent pest and disease resistance.
Pinus parviflora Japanese white pine	Medium	25' to 50'	25' to 50'	Rounded	This beautiful mid-sized pine develops a wide-spreading, picturesque form; tolerant to a wide range of conditions but requires good soil drainage. Excellent tree for small spaces; slow-growing. Deer are highly attracted to this tree during the fall rut; provide protection of trunks on young trees.
Pinus rigida Pitch pine	Meduim	30' to 50'	30' to 40'	Irregular	The tree has rich, dark green needles, and new growth that comes in as a bright, yellowish-green. The small 2-inch cones grow in clusters of three to five. Its irregular mature form can make it a feature or a distraction.
Pinus strobus White pine (species) 'Fastigiata'	Large	50' to 80'	20' to 40'	Pyramidal	Soft textured appearance with picturesque branching habit. Extremely intolerant of air pollution and demands well-drained, rich soils for best growth. Does poorly in heavy clay soil.
Platanus x acerifolia* London planetree 'Bloodgood' 'Yarwood' 'Suttneri'	Large	60' to 85'	50' to 70'	Pyramidal to oval	Tolerates dry soil and is resistant to anthracnose that afflicts sycamore. Ornamental patchy bark that ranges from creamy-white to olive green.
Platanus occidentalis* American sycamore	Large	75' to 100'	75' to 100'	Rounded / spreading	Native in bottomlands, along river and stream banks: grows best in deep, moist, rich soils with good ground water in full sun. Transplants easily. Moderately drought and salt tolerant with beautiful exfoliating white bark.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	No	No	-	Pinus cembra Swiss stone pine
Yes	Yes	No	No	Expected to fare worse	Pinus densiflora Japanese red pine 'Oculus-draconis' 'Umbraculifera'
Yes	Yes	No	No	-	Pinus flexilis 'Vanderwolf's Pyramid'
Yes	Yes	No	No	-	Pinus parviflora Japanese white pine
No	No	No	Yes	Expected to fare worse	Pinus rigida Pitch pine
Yes	Yes	No	No	Expected to fare worse	Pinus strobus White pine (species) 'Fastigiata'
Yes	Yes	Yes	No	-	Platanus x acerifolia* London planetree 'Bloodgood' 'Yarwood' 'Suttneri'
Yes	Yes	No	Yes	-	Platanus occidentalis* American sycamore

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Populus deltoides Eastern cottonwood 'Colmar'	Large	75' to 100'	50' to 75'	Rounded / Spreading	Fast growing tree of floodplains and bottomlands, useful in large parks in wet areas that mimic its native habitat. Leaves flutter in the slightest of breezes creating a pleasant clattering sound. Use male selections like 'Colmar' to avoid "cottony" seed masses present on female trees. Very tolerant to prolonged flooding.
Populus grandidentata Bigtooth aspen	Large	50' to 75'	20' to 35'	Upright rounded	Leaves shimmer and flutter with the slightest of breezes. Rapid growing with smooth silvery gray- green bark, and attractive golden fall color. Capable of forming groves of trees through suckering, but makes a good specimen park tree as well.
Populus pensylvanica Pin Cherry	Small	20' to 30'	20' to 25'	Round	A native tree that grows as a shrub or small tree, usually with a straight trunk and a narrow, round-topped crown. Its is rather short-lived.
Populus tremuloides Quaking aspen	Large	50' to 60'	40' to 50'	Spreading	A native, fast-growing tree known for its leaf movement in the wind. The glossy green leaves, dull beneath, become golden to yellow, rarely red, in autumn.
Prunus sargentii Sargent cherry 'Columnaris' 'Pink Flare'	Medium	40' to 50'	30' to 50'	Rounded	One of the best large cherries for ornamental use; more tolerant of adverse conditions than most other cherries. Avoid using in areas where fruit drop can cause problems.
Prunus serotina Black cherry	Medium	40' to 50'	35' to 40'	Oval-spreading	A native species found throughout New England. Can be prone to cankers and can develop sturctural issues. The cherries produced by this species are an important mast food source for numerous bird species.
Prunus serrulatac Oriental cherry 'Kwanzan' 'Shirofugen'	Small	15' to 20'	15' to 20'	Vase- shaped	Outstanding flowering tree; not tolerant of poorly-drained clay soil. Tends to have problems with borers in stressful locations.
Prunus subhirtella Higan cherry 'Autumnalis' var. pendula	Medium	20' to 40'	15'to 30'	Rounded	Numerous cultivars in the trade; striking when in flower. One of the most widely planted cherries.
Prunus x 'Hally Jolivette' Hally Jolivette cherry	Small	10' to 15'	10' to 15'	Rounded	One of the nicest flowering cherries; densely fine-branched large shrub. Attractive pinkish-white flowers; wide-spreading and requires ample room. Often grafted on a standard trunk to form a small tree.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
No	Yes	No	Yes Species, not cultivars	Expected to fare worse	Populus deltoides Eastern cottonwood 'Colmar'
Yes	Yes	No	Yes	Expected to fare worse	Populus grandidentata Bigtooth aspen
No	No	No	Yes	Expected to fare worse	Populus pensylvanica Pin Cherry
No	No	No	Yes	Expected to fare worse	Populus tremuloides Quaking aspen
Yes	Yes	Yes	No	-	Prunus sargentii Sargent cherry 'Columnaris' 'Pink Flare'
Yes	No	No	Yes	Expected to fare better	Prunus serotina Black cherry
Yes	Yes	No	No	-	Prunus serrulatac Oriental cherry 'Kwanzan' 'Shirofugen'
Yes	Yes	Yes	No	-	Prunus subhirtella Higan cherry 'Autumnalis' var. pendula
Yes	Yes	No	No	-	Prunus x 'Hally Jolivette' Hally Jolivette cherry

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Prunus yedoensis Yoshino cherry 'Akebono'	Medium	20' to 40'	20' to 40'	Rounded	Outstanding pinkish-white flowers; not common. Fast growing and rather tolerant of urban conditions compared to other cherries.
Pseudotsuga menziesii Douglas Fir 'Glauca'	Large	40' to 80'	10' to 20'	Pyramidal	Good substitute for blue spruce or any other spruces. Bluish-green foliage makes for nice contrast. Drought tolerant, good for screening.
Pseudolarix amabilis Golden larch	Large	60' to 80'	20' to 40'	Rounded	A deciduous conifer. The needles emerge as light green umbrella-like structures turning gold or deep bronze in the fall. Lime green fruit tends to appear en masse and adds to the appeal of the tree.
Ptelea trifoliata Wafer-ash, hoptree	Small	15' to 20'	15' to 20'	Rounded	Small durable native tree easily grown in average, dry to medium, well-drained soils in part shade to full shade. Tolerates full sun. Adaptable to wide range of growing conditions.
Quercus alba* White oak	Large	60' to 80'	60' to 80'	Rounded	A large deciduous native tree typically occuring in dry upland slopes and ledges as well as lowland valleys and ravines. Pyramidal when young, but matures into a substantial tree with a wide- spreading, rounded crown. Flaky light gray bark, and reddish-purple fall color are key ornamental features.
Quercus acutissima* Sawtooth oak	Large	40' to 50'	35' to 50'	Rounded	Excellent choice for a quick growing, adaptable, and pest free tree. It is becoming a lot better known and used. Can give one shade in a relatively short time frame without the brittleness and breakage which is usually associated with such trees.
Quercus bicolor* Swamp white oak 'American Dream' 'Beacon'	Large	50' to 60'	50' to 60'	Upright Oval	Generally, a durable and long-lived tree, good tree for wet ground and low spots. Attractive silvery gray undersides to leaves and fast growth rate for a white oak makes this under used species stand out.
Quercus coccinea* Scarlet oak	Large	60' to 75'	40' to 50'	Rounded	Beautiful red fall leaf color and tolerant to tough dry sites. Less prone to chlorosis than pin oak.
Quercus imbricaria* Shingle oak	Large	40' to 60'	40' to 60'	Conical	A medium sized deciduous oak of the red oak group Narrow, oblong, smooth-margined, glossy dark green leaves are pale and pubescent beneath. Fall color is variable, sometimes producing attractive shades of yellow-brown to red-brown. Old leaves tend to persist on the tree throughout most of the winter. Wood was once used by early settlers in the midwest for shingles, hence the common name.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Prunus yedoensis Yoshino cherry 'Akebono'
Yes	Yes	No	No	-	Pseudotsuga menziesii Douglas Fir 'Glauca'
Yes	Yes	No	No	-	Pseudolarix amabilis Golden larch
Yes	Yes	No	Yes	-	Ptelea trifoliata Wafer-ash, hoptree
Yes	Yes	Yes	Yes	Expected to fare better	Quercus alba* White oak
Yes	Yes	Yes	No	-	Quercus acutissima* Sawtooth oak
Yes	Yes	Yes	Yes	Expected to fare worse	Quercus bicolor* Swamp white oak 'American Dream' 'Beacon'
Yes	Yes	Yes	Yes	No changes expected	Quercus coccinea* Scarlet oak
Yes	Yes	Yes	Yes	-	Quercus imbricaria* Shingle oak

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Quercus macrocarpa* Bur oak 'Urban Pinnacle' 'Cobblestone'	Large	70' to 90'	60' to 80'	Rounded	The most drought resistant of American oaks, and usually the largest growing species of oak in a given area. If given plenty of room, makes an excellent street tree, and is very tolerant of tough conditions.
Quercus montana* Chestnut oak	Large	50' to 70'	50' to 70'	Rounded	Large acorns have high wildlife value for many birds and mammals. The mature bark is distinctive with tight ridges and is similar to the chestnut tree.
Quercus michauxii* Swamp chestnut oak	Large	40' to 50'	30' to 40'	Rounded	The shiny, oval, unlobed leaves have large, rounded teeth and turn yellow to vibrant red in the fall. Large tree with compact, rounded crown and chestnut-like foliage. No major pest issues.
Quercus muehlenbergii* Chinquapin oak	Large	50' to 80'	50' to 60'	Globular	A medium sized deciduous oak typically found on dry upland sites often in rocky, alkaline soils. Leaves somewhat resemble the leaves of chestnut (Castanea) whose nut is sometimes called a chinquapin, hence the common name of this oak whose acorn is sweet and edible. A great tree for parks and open areas.
Quercus palustris* Pin oak	Large	50' to 70'	40' to 60'	Rounded pyramidal	Fast growing native oak with sweeping branches. Sensitivity to alkaline soils limits use in urban areas. Bacterial leaf scorch is rendering this tree an increasingly poor choice in the landscape as this disease continues to spread northward.
Quercus robur* Columnar English oak 'Fastigiata'	Large	50' to 60'	10' to 18'	Upright-columnar	Tolerant of tough urban soil conditions and long lived. Trees often retain leaves late.
Quercus rubra* Red oak	Large	60' to 75'	40' to 50'	Rounded	Widely used, fast growing oak; transplants easily; valuable for a variety of landscape uses.
Quercus shumardii* Shumard oak	Large	40' to 60'	40' to 50'	Rounded	Not widely known, native, fast growing, and long lived oak. Showy orange-red fall color.
Quercus velutina* Black oak	Large	60' to 70'	30' to 40'	Rounded-irregular	A common, medium-sized to large oak of the eastern and Midwestern United States. It grows best on moist, rich, well-drained soils, but it is often found on poor, dry sandy or heavy glacial clay hillsides. Adaptable for many uses, drought tolerant.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	Yes	-	Quercus macrocarpa* Bur oak 'Urban Pinnacle' 'Cobblestone'
Yes	Yes	Yes	Yes	-	Quercus montana* Chestnut oak
Yes	Yes	Yes	No	-	Quercus michauxii* Swamp chestnut oak
Yes	Yes	Yes	Yes	-	Quercus muehlenbergii* Chinquapin oak
Yes	Yes	No	Yes	Expected to fare better	Quercus palustris* Pin oak
Yes	Yes	Yes	No	-	Quercus robur* Columnar English oak 'Fastigiata'
Yes	Yes	Yes	Yes	Expected to fare worse	Quercus rubra* Red oak
Yes	Yes	Yes	Yes	Expected to fare better	Quercus shumardii* Shumard oak
Yes	Yes	Yes	Yes	-	Quercus velutina* Black oak

Table continued from previous page.

Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Salix exigua Sandbar willow	Small	15' to 25'	10'to 15'	Ovate- rounded	Thicket forming riparian species of willow. Leaves are very narrow and have a grayish green color. Useful in wetland restoration projects, or constantly moist natural areas.
Salix nigra Black willow	Large	30' to 60'	20' to 30'	Rounded	Riparian species frequently found around rivers, streams, lakes and ponds. The largest growing of the native willows, and most likely species to attain tree size.
Sassafras albidum Sassafras	Large	30' to 60'	25' to 40'	Narrow-rounded	Colony forming native tree of fencerows and old fields. Rarely used in today's landscape but deserves wider consideration. Outstanding fall color of orange to red, and beautiful tiered branching make this tree stand out.
Sophora japonicum (Styphnolobium japonicum) Japanese pagoda tree 'Regent'	Large	50' to 70'	40' to 60'	Rounded	Excellent flowers and foliage; last of large trees to glower; adaptable to moist conditions; good tree for a variety of uses.
Stewartia pseudocamellia Japanese stewartia	Medium	20' to 35'	20' to 30'	Oval	Excellent specimen tree; requires rich, moist, well-drained soils. May be difficult to transplant; hardiest of the Stewartias. Often difficult to find in the trade.
Taxodium ascendens* Pond cypress 'Prairie Sentinel'	Large	50' to 60'	10' to 15'	Narrow columnar	Similar to baldcypress, pondcypress has a narrower crown, is smaller, and has a more open habit. Very tolerant to both wet and dry sites and poor soils. Wind and ice storm resistant. Highly underused.
Taxodium distichum* Bald cypress 'Shawnee Brave'	Large	60' to 80'	25' to 35'	Pyramidal	Extremely adaptable and fast growing tree. Excellent in wet sites, but also tolerant of poor, dry soils.
Thuja occidentialis American arborvitae	Large	40' to 60'	10' to 15'	Rounded-Pyramidal	Dense evergreen; excellent for screening. Prone to bagworm infestations; requires a consistently moist soil. Not tolerant to extreme drought. Numerous cultivars available.
Tilia americana American basswood	Large	60' to 80'	30' to 60'	Oval / irregular	A large growing handsome native forest tree. Prefers well drained moist soils typical of wooded areas. Does well in open park settings as well.
Tilia cordata Littleleaf linden 'Chancellor' 'Greenspire' 'June Bride'	Large	60' to 70'	30' to 50'	Oval	Tough adaptable tree, excellent choice for street or urban use; most popular Linden for landscape.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
No	Yes	No	Yes	-	Salix exigua Sandbar willow
No	Yes	No	Yes	Expected to fare worse	Salix nigra Black willow
Yes	Yes	No	Yes	Expected to fare better	Sassafras albidum Sassafras
Yes	Yes	Yes	No	-	Sophora japonicum (Styphnolobium japonicum) Japanese pagoda tree 'Regent'
Yes	Yes	No	No	-	Stewartia pseudocamellia Japanese stewartia
Yes	Yes	Yes	No	-	Taxodium ascendens* Pond cypress 'Prairie Sentinel'
Yes	Yes	Yes	No	-	Taxodium distichum* Bald cypress 'Shawnee Brave'
Yes	Yes	No	No	-	Thuja occidentialis American arborvitae
No	Yes	No	Yes	Expected to fare worse	Tilia americana American basswood
Yes	Yes	Yes	No	-	Tilia cordata Littleleaf linden 'Chancellor' 'Greenspire' 'June Bride'

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Scientific Name Common Name 'Cultivar'	Size	Height	Spread	Form	Comments
Tilia tomentosa* Silver Linden 'Sashazam' 'Sterling Silver'	Large	50' to 70'	30' to 50'	Oval to Rounded	Tolerates heat and drought, better than other Lindens, beautiful ornamental tree.
Tilia x euchlora Crimean linden 'Redmond'	Large	40' to 60'	20' to 30'	Oval	Best foliage of any Linden, a grafted hybrid.
Tilia mongolica 'Harvest Gold'	Medium	25' to 45'	10' to 15'	Upright	Harvest Gold' is a hybrid, selected in Canada from a cross between littleleaf linden and Mongolian linden. Hardy to Zone 2. It has an intermediate growth rate and flowers are fragrant.
Tsuga canadensis Canadian Hemlock Eastern Hemlock	Large	40' to 70'	25' to 35'	Pyramidal	Dense, low-branched evergreen; sensitive to drought and pollution. Requires rich, well-drained soil that stays consistently moist.
Tsuga chinensis Chinese hemlock	Large	60' to 70'	35' to 45'	Open pyramidal	Evergreen tree that can grow in full shade (deep woodland), semi-shade (light woodland), or no shade. It prefers moist soil. Must be treated for hemlock wooly adelgid.
Ulmus americana American elm 'Princeton' 'Valley Forge'	Large	70' to 90'	50' to 70'	Rounded vase	The tree is renowned for its vase-like form. Even more common before Dutch Elm Disease wiped out many large trees, it was frequently used as a street tree. Use should be strictly limited to proven disease resistant cultivars.
Ulmus parvifolia Lacebark elm 'Frontier' 'Allee'	Large	40' to 50'	40' to 50'	Rounded	Resistant to Dutch Elm disease, is a superior ornamental tree with small leaves, and beautiful exfoliating mottled bark. Trees are highly resistant to tough urban conditions.
Ulmus x 'Patriot' Patriot hybrid elm	Large	50' to 60'	40' to 50'	Vase	Hybrid elm selected for excellent resistance to Dutch Elm disease. Rapid growth with trees achieving 43 feet tall with a crown spread of 25 feet in 13 years.
Ulmus rubra Red elm	Large	40' to 60'	30' to 50'	Vase- rounded	Slippery elm is a medium sized, coarse-textured, deciduous tree. It is distinguished by its downy twigs, red-hairy buds and slimy red inner bark. Susceptible to Dutch Elm Disease.
Zelkova serrata* Japanese zelkova 'Green Vase' 'Village Green' 'Spring Grove' 'Green Veil'	Large	50' to 80'	40' to 70'	Vase	Outstanding ornamental tree, has been used as a replacement for American Elm; tolerates wind and drought' excellent street tree.

Recommended Uses				Known Climate Response (USFS Climate Atlas)	Scientific Name Common Name 'Cultivar'
Private Property	Parks	Streets	Reforestation		
Yes	Yes	Yes	No	-	Tilia tomentosa* Silver Linden 'Sashazam' 'Sterling Silver'
Yes	Yes	Yes	No	-	Tilia x euchlora Crimean linden 'Redmond'
Yes	Yes	Yes	No	-	Tilia mongolica 'Harvest Gold'
Yes	Yes	No	No	Expected to fare worse	Tsuga canadensis Canadian Hemlock Eastern Hemlock
Yes	Yes	No	No	-	Tsuga chinensis Chinese hemlock
Yes	Yes	Yes	No	No changes expected	Ulmus americana American elm 'Princeton' 'Valley Forge'
Yes	Yes	Yes	No	-	Ulmus parvifolia Lacebark elm 'Frontier' 'Allee'
Yes	Yes	Yes	No	-	Ulmus x 'Patriot' Patriot hybrid elm
No	Yes	No	Yes	-	Ulmus rubra Red elm
Yes	Yes	Yes	No	-	Zelkova serrata* Japanese zelkova 'Green Vase' 'Village Green' 'Spring Grove' 'Green Veil'

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UNDESIRABLE SPECIES

Scientific Name ***Common Name*** ***'Cultivar'***	***Comments***
Euonymus alatus (Thunb.) Sieb. Burning bush	Popular landscape shrub capable of germinating prolifically in many different habitats. It grows in full sun to full shade. Escaping from cultivation and can form dense thickets and dominate the understory; seeds are dispersed by birds.
Fraxinus (all species)	Target of emerald ash borer.
Fraxinus americana White ash	Target of emerald ash borer.
Fraxinus nigra Black ash	Target of emerald ash borer.
Fraxinus pennsylvanica Green ash	Target of emerald ash borer.
Acer platanoides Norway maple	Invasive; illegal to import, propagate, or sell in Massachusetts (authorized under General Laws Chapter 128).
Acer pseudoplatanus Sycamore maple	Invasive; not recommended in or near coastal natural areas.
Acer ginnala Amur maple	Invasive and not recommended in or near natural areas; prohibited in CT and VT.
Syringa reticulata Japanese tree lilac	Instances of naturalization in riparian areas in MA.
Ailanthus altissima Tree of Heaven	Invasive; illegal to import, propagate, or sell in Massachusetts (authorized under General Laws Chapter 128).
Phellodendron amurense Amur corktree	Invasive; illegal to import, propagate, or sell in Massachusetts (authorized under General Laws Chapter 128).
Robinia pseudoacacia Black locust	Invasive; illegal to import, propagate, or sell in Massachusetts (authorized under General Laws Chapter 128).
Populus (all species) Poplars	Susceptible to many diseases and insect pests. and are short-lived. Branches are structurally weak and break when stressed by wind or snow. Roots are aggressive.
Paulownia tomentosa Princess tree	Invasive tendencies in natural and unmaintained areas.
Pyrus calleryana Callery pear	Invasive tendencies near open spaces; structural weakness for use as a street or park tree.
Gleditsia triacanthos Thornless honeylocust	Overabundance in street tree inventory; limit use as street tree; may be used in parks and other open spaces.
Acer Saccharinum Silver maple	Structural weakness for use as a street or park tree.
Ulmus pumila Siberian elm	Structural weakness for use as a street or park tree.
Salix atrocinerea/Salix cinerea Large gray willow/Rusty willow	Large shrub/small tree that forms dense stands and can out-compete native species along the shores of coastal plain ponds as designated by the Massachusetts Invasive Plants Advisory Group.

Note: *Undesirable species are defined as those that are exotic and known to be invasive, are designated illegal by the Commonwealth, are native or naturalized but are not urban tolerant and/or known to be invasive; are risk-prone due to poor tree architecture or weak wood; and/or are over-represented in Boston's public urban forest.*

Arnold Arboretum, Jamaica Plain

APPENDIX D: UFP ASSESSMENT FRAMEWORK AND EXTENDED FINDINGS

FRAMEWORK FOR ASSESSMENT

In 2021 Boston's existing urban forest was assessed through a structure termed Indicators of a Sustainable Urban Forest. It is a self assessment tool that ensures the urban forest is thoroughly examined, going beyond just the standard tree data and analysis. This framework also incorporates how the urban forest is managed, and the network of stakeholders that influence and impact it.

This framework was initially developed by university researchers James Clark and later Andrew Kenney, and has been continuously refined by Urban Canopy Works over years of on-the-ground urban forestry strategic planning with communities across the United States (Clark 1997) (Kenney 2011).

There is a set of 46 indicators, grouped into one of three categories (trees, players, management approach). Each indicator has metrics for assessing Boston's current performance level in that area and determining the sustainability of their urban forest. The table <right> shows the summary of results for the full assessment process.

The Trees: LOW
Overall, Boston's trees scored low in the performance level for the Indicators of a Sustainable Urban Forest. Primarily, this is because of a relatively low citywide canopy cover that is not equitably distributed in all neighborhoods, and the lack of data for park, open space, and private property trees.

The Players: LOW-MODERATE
Overall, Boston falls in the middle between low and moderate performance levels in the indicators related to the people and organizations active in urban forestry. These may include neighborhood groups, landowners, utilities, municipal and county staff, the development community, and others. While there is relatively good level of involvement in the urban forest at the neighborhood level and with green industry professionals, the engagement levels from utilities, land developers, and large landowners engagement was low, interdepartmental coordination within the City was low, and public awareness of the urban forest and its benefits and management issues was lacking.

The Management Approach: LOW
This category applied to City-managed properties only. Boston scored in the low performance level in indicators of a sustainable forest related to management and care activities. While urban forest data for street trees and the citywide canopy exists, the management structure to make data-driven decisions and take meaningful actions is inadequate. The primary reasons for this area insufficient staffing and funding for a proactive public tree program, as well as little or no urban forest management planning, guidelines, or regulations for tree protection, risk reduction, disaster response, and communication and transparency.

The **Indicators of a Sustainable Urban Forest** framework is particularly valuable because it ensures the urban forest is assessed comprehensively, examining both data on the trees themselves and human practices. Additionally, this framework is a helpful tool to utilize when updating the plan, as progress can also be measured by the change in performance levels for each indicator.

The results of the assessment were used to develop the recommendations within this plan.

BOSTON, MA Indicators of a Sustainable Urban Forest			Assessed Performance Level		
			Low	**Mod.**	**Good**
The Trees	Urban Tree Canopy Cover		■		
	Equitable Distribution		■		
	Size Distribution	Public - Street Trees			■
		Public - Open Space		■	
		Private Land	No Data		
	Condition	Public - Street Trees			■
		Public - Open Space		■	
		Private Land	No Data		
	Diversity / Pest Vulnerability	Public - Street Trees		■	
		Public - Open Space		■	
		Private Land	No Data		
	Suitability - Street Trees	Overhead			■
		Ground Level		■	
		Soil Conditions	No Data		
		Invasives			■
		Climate Adaptability			■
	Suitability - Open Space	Overhead			■
		Ground Level			■
		Soil Conditions	■		
		Invasives			■
		Climate Adaptability		■	
	Suitability - Private Land	Overhead	No Data		
		Ground Level	No Data		
		Soil Conditions	No Data		
		Invasives	No Data		
		Climate Adaptability	No Data		
The Players	Neighborhood Action		20	■ 26	3
	Public Awareness		■ 30	18	1
	Large Landholder Involvement		■ 31	15	2
	Regional Collaboration		■ 34	13	1
	Green Industry Involvement		22	■ 23	1
	Funder Engagement		■ 26	20	0
	Utility Engagement		■ 36	9	1
	Developer Engagement		■ 27	18	0
	City Department/Agency Cooperation		■ 40	5	0
The Management Approach	Tree Inventory			■	
	Canopy Assessment				■
	Management Plan		■		
	Staffing and Equipment		■		
	Funding		■		
	Risk Management Program		■		
	Maintenance Program		■		
	Planting Program			■	
	Tree Protection Policy			■	
	Disaster Preparedness & Response		■		
	Communication			■	

WHAT DID WE LEARN ABOUT BOSTON'S URBAN FOREST?

Examination of the existing urban forest includes looking at the overall tree canopy, as well as any other available data on trees in Boston. In this case, data on public trees as well as the process in place for management of those trees has also been examined. The findings are summarized below.

Finding 1: Tree canopy is not equitably distributed across Boston.

Tree canopy cover should be equitable and available to all Boston residents. This is important because of the critical services it provides to residents, primarily for its role in public health. Neighborhoods with higher tree canopy cover receive more of the direct benefits trees provide, including cleaner air to breathe, less heat stress, shading and cooling homes, and slowing down and absorbing rainwater to reduce flooding. Tree canopy is critical to all neighborhoods and has a significant impact on how healthy and prosperous a community is.

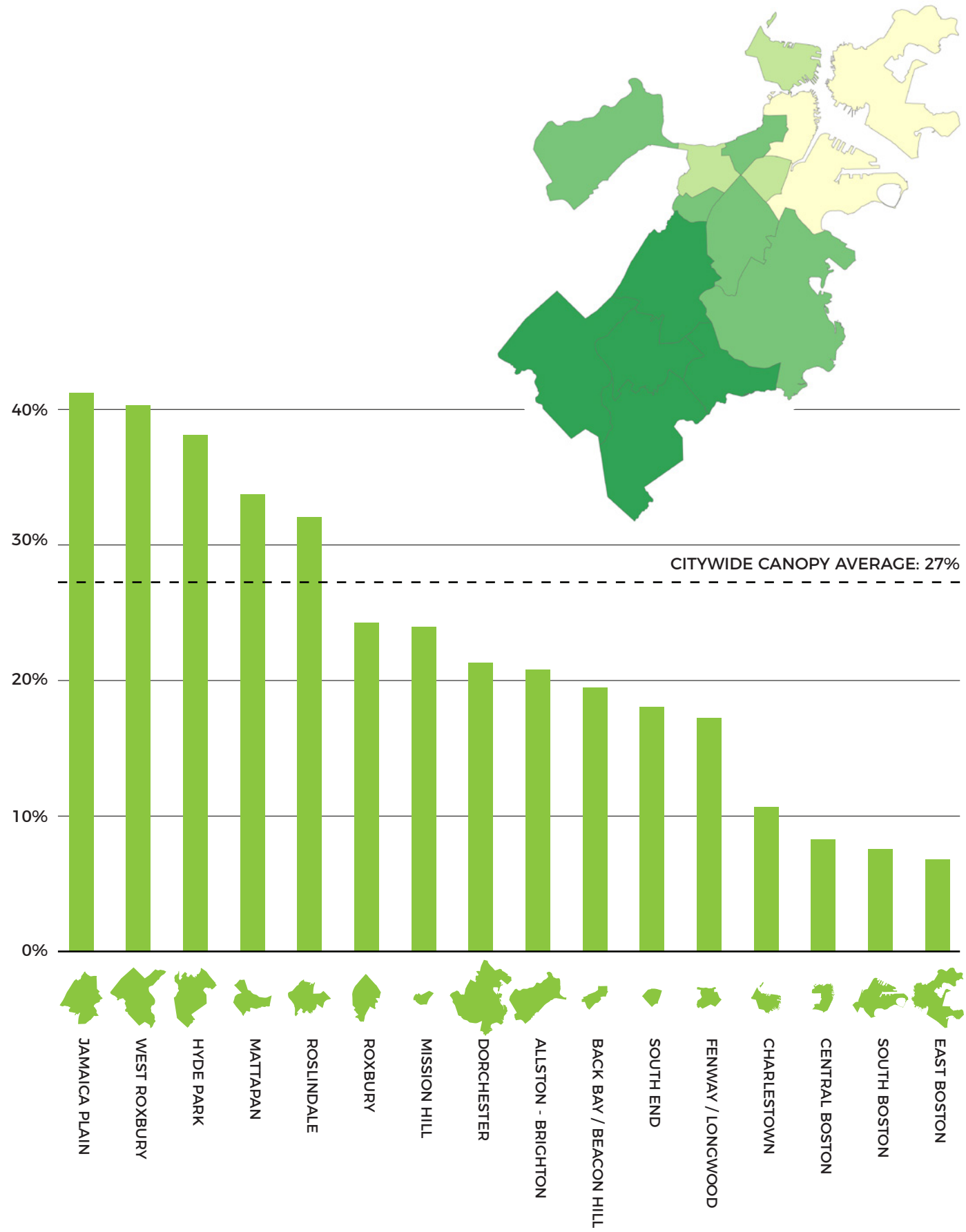
When looking at canopy by neighborhood, there is a range of canopy cover from 7% to 43%, indicating that tree canopy cover is not equitably distributed across Boston. However, there are factors that dictate differences in tree canopy between neighborhoods. Every neighborhood has a different history, different built environment, and thus different capacity for tree canopy. Some neighborhoods are much denser than others. Data can also be distorted by large variations in land uses, like the presence of large parks, industrial or institutional lands like universities or cemeteries.

There is a citywide pattern of north-south and east-west gradient in canopy coverage. Neighborhoods in the south and west of the city (Roslindale, West Roxbury, Jamaica Plain and parts of Hyde Park, and Mattapan) have more canopy, on average, than neighborhoods in the north and east (Central Boston, East Boston, Charlestown, South Boston).

Formerly redlined and marginalized areas have, on average, less canopy coverage than other areas. Another significant factor in canopy differences between neighborhoods is the result of decades of marginalization by redlining practices, disinvestment, and other policies and practices of racial exclusion. Persistent exclusionary practices and disinvestment need to be acknowledged and actively addressed.

For areas of the city that fell under the 1936 HOLC grading of 'D' ("Hazardous" for mortgage investment), average canopy coverage is 18% compared to 54% for those that fell under the HOLC grading of 'A' ("Best" for mortgage investment), a difference of 36%. Even for those areas of the city that fell under the HOLC grading of 'C' ("Definitely declining"), with an average canopy coverage today of 26%, they continue to have 5% lower canopy on average than those with a grade of 'B' ("Still desirable").

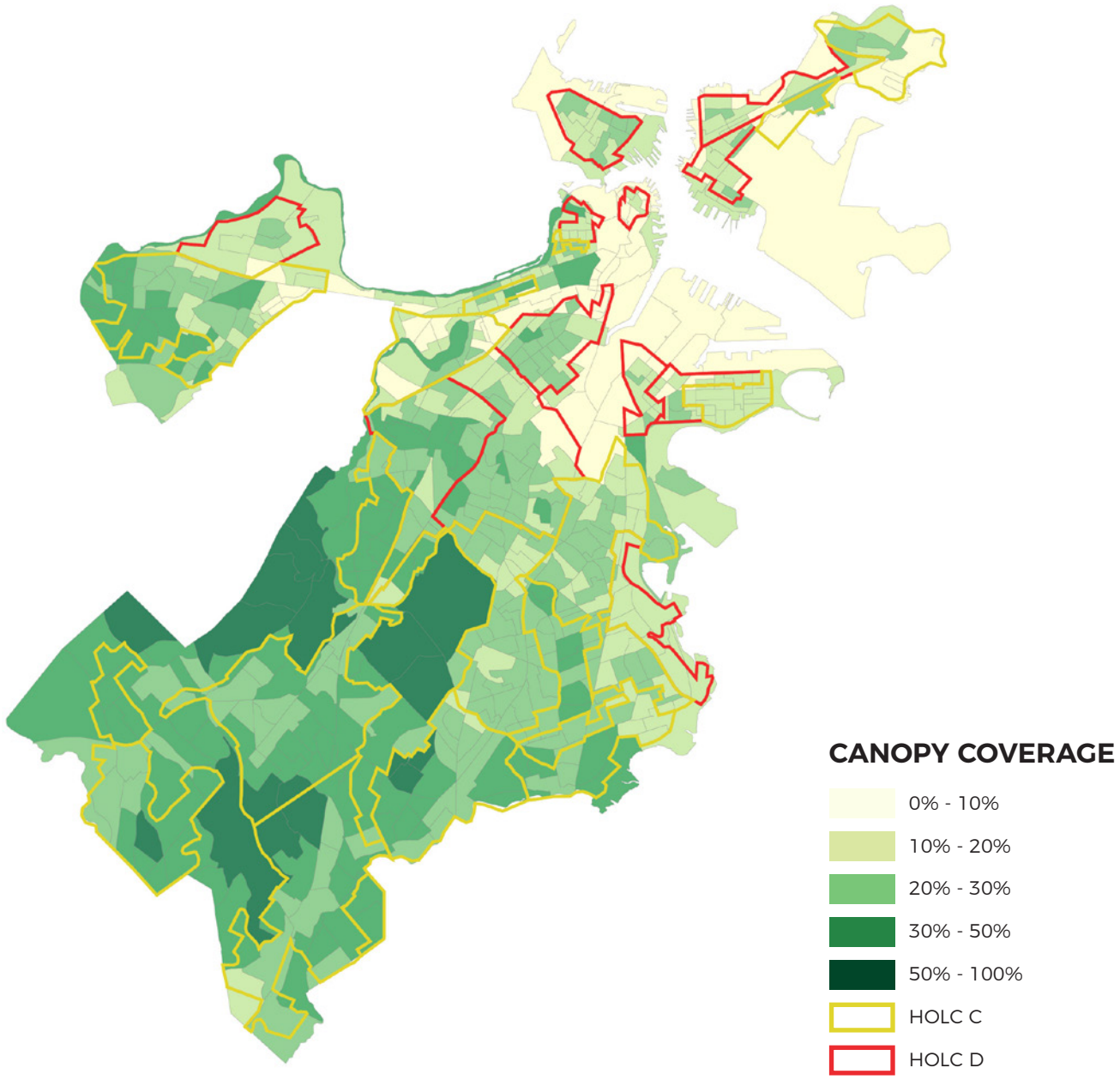
The relationship between canopy cover and social vulnerability is complex and there isn't one single clear story. On the one hand, a number of areas with Environmental Justice populations today have low canopy. This includes large portions of neighborhoods that date back to the colonial era, with East Boston, Charlestown, and Chinatown coming into focus as places of both high social vulnerability and low canopy. Additionally, census tracts within Roxbury, the South End, Dorchester, Mattapan, and parts of Allston-Brighton also



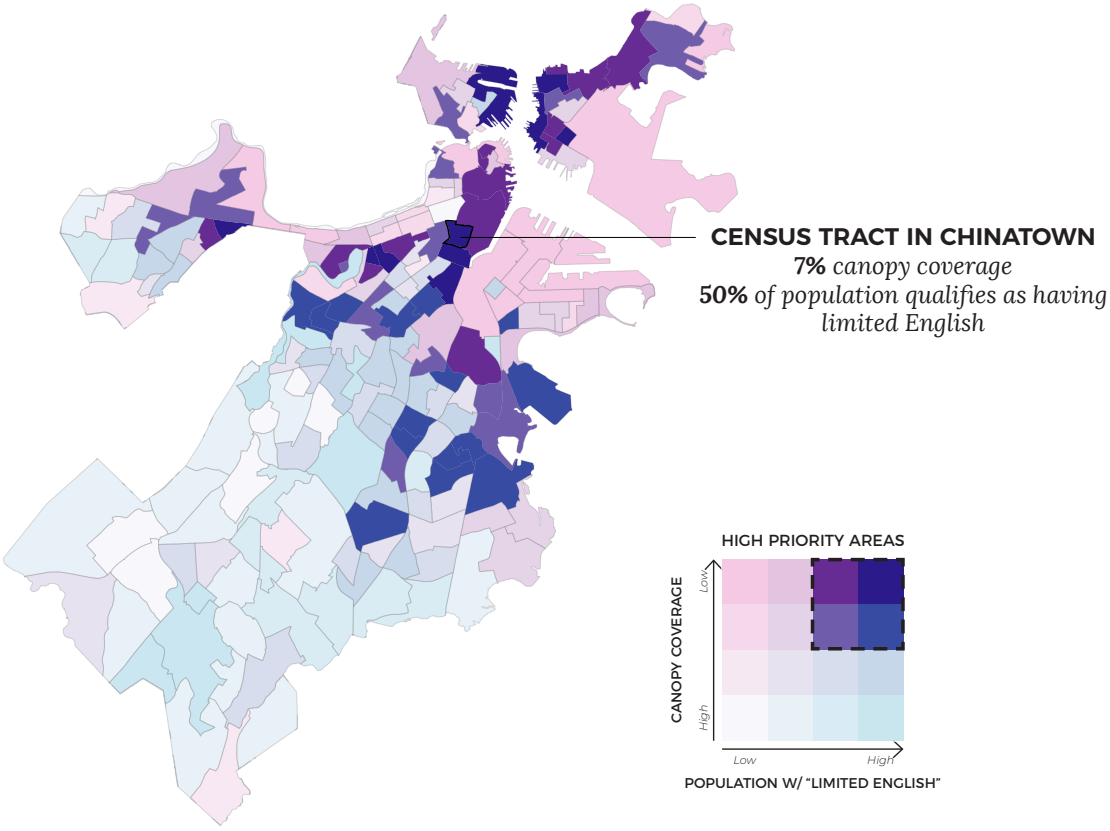
Canopy Coverage by Neighborhood

THE HOME OWNERS LOAN CORPORATION

The Home Owners' Loan Corporation (HOLC) was a federal agency that developed the method and maps that led to redlining practices. Redlining is the discriminatory practice of withholding mortgages or property insurance from neighborhoods with undesirable numbers of people of color or low-income people living in them.



HOLC Boundaries with canopy coverage by census block



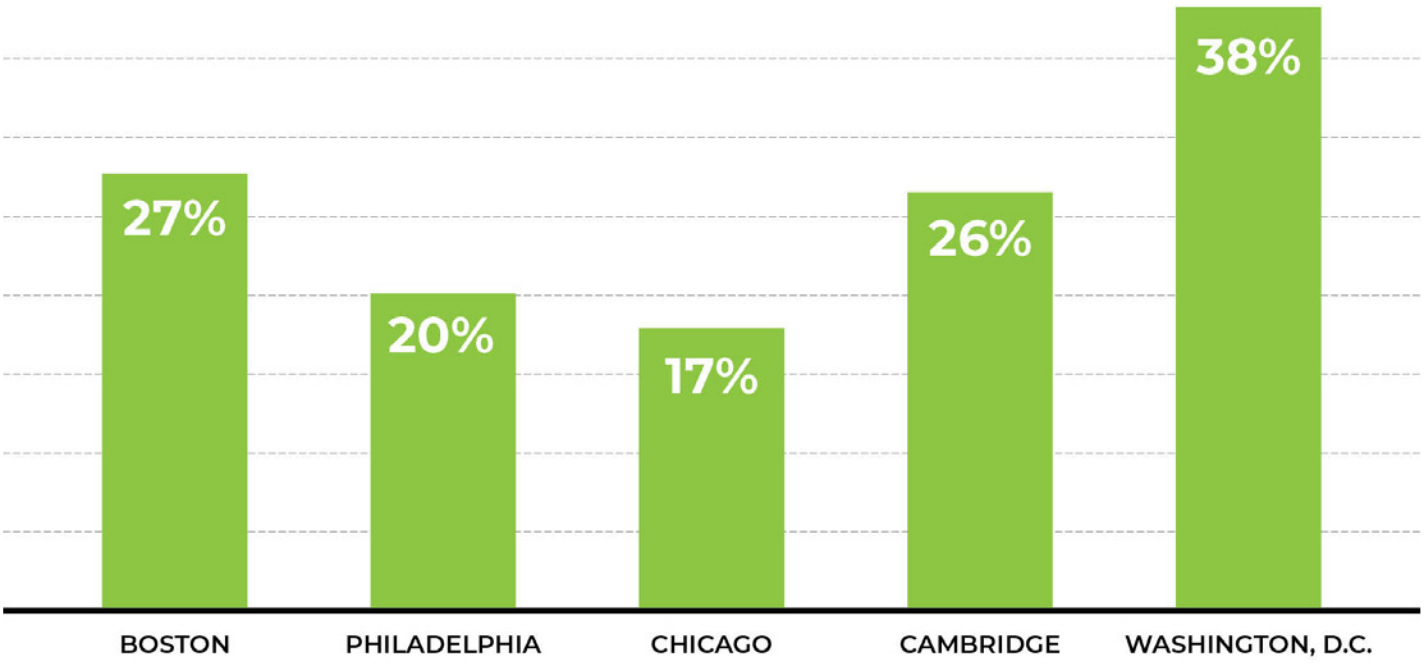
Social vulnerability highlighting areas with low canopy and a large population with "limited English"

suffer from both low canopy and high social vulnerability indicators. On the other hand, it's important to keep in mind that several areas with Environmental Justice populations with higher canopy are now losing canopy at a rapid rate. This includes parts of Hyde Park, Roxbury, Mattapan, Allston-Brighton, and Dorchester. Social vulnerability indicators used in the map on the map above come from Climate Ready Boston data.

Every neighborhood also has a different breakdown of land uses, a reflection of its history, topography, and planning and policy choices. These mixes create different sets of constraints between neighborhoods. This means that there is no single citywide solution for canopy growth for all neighborhoods, but rather strategies that target certain land uses will be more impactful in some neighborhoods than others.

FROM THE COMMUNITY

There is a clear desire to focus on equity and environmental justice. *Specific comments centered on the need for trees especially in under-canopied areas, communities of color and historically marginalized areas surrounding highways that face increased air and noise pollution, and those facing more extreme heat island effects. This included a repeated desire to see all neighborhoods – and especially those that have been historically excluded – achieve the levels of canopy, open space, and environmental health that higher-income parts of the city already have.*



Percent canopy coverage in other cities

Finding 2: Tree canopy cover in Boston is 27% and has remained steady citywide since 2014.

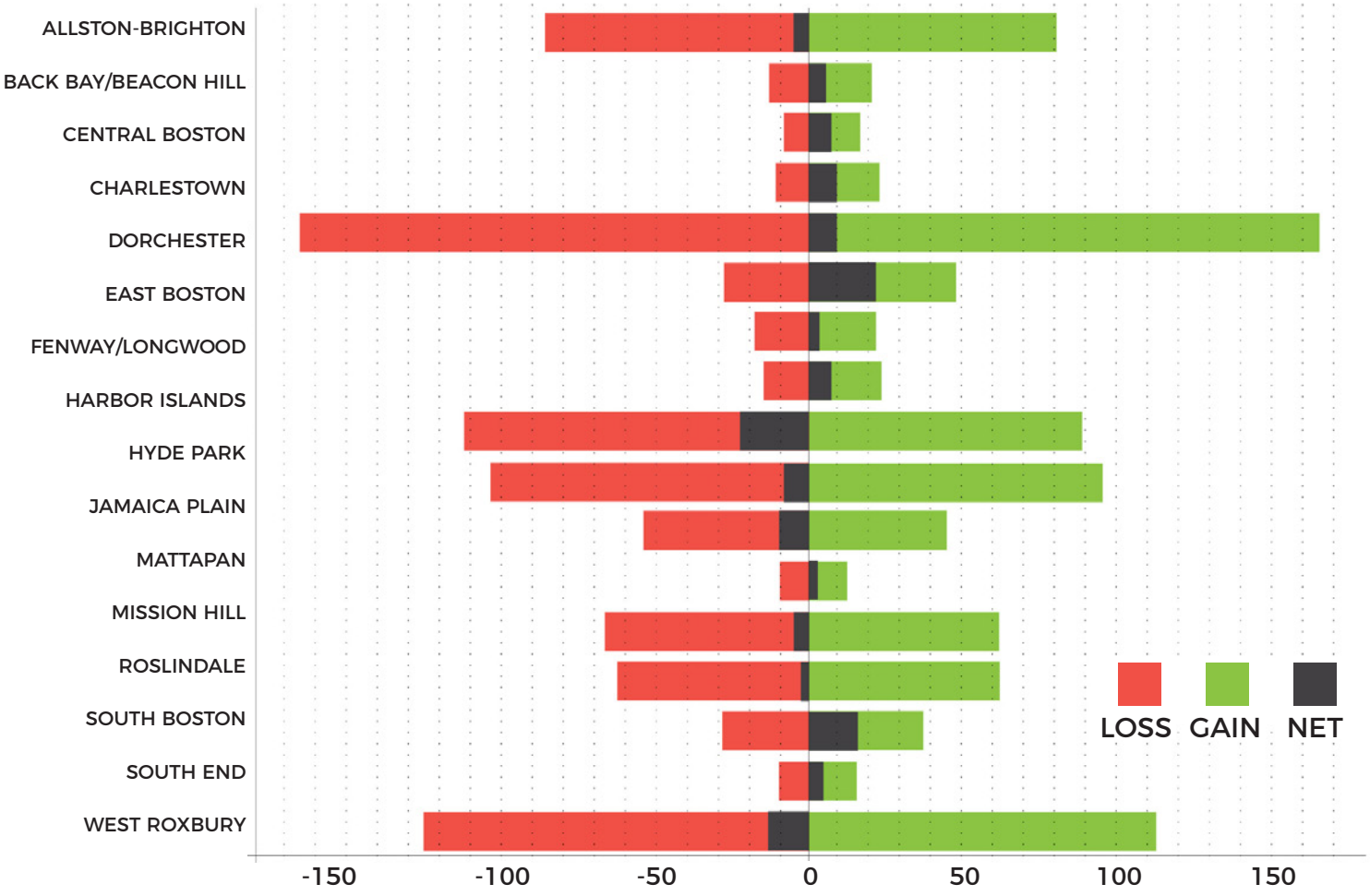
The Tree Canopy Assessments in 2014 and 2019 were used to understand Boston's overall canopy and change in canopy in recent years. No assessments were made prior to 2014. As of 2019, 27% of the entire city is covered by tree canopy, when viewed from above. This coverage level has remained consistent since 2014. The remaining land is covered by one of four other categories of land cover:

- Hard surfaces like roads, parking lots, and buildings (also called impervious surfaces (53%)
- Grass, shrubs and other low-lying vegetation (18%)
- Water (1%)
- Exposed soil covered - typically construction sites (1%)

How does this compare to other cities? What should Boston's tree canopy be? There is no recommended tree canopy cover range for communities. Existing coverages for other cities are highly influenced by multiple factors, including population density, types of land uses, natural features, area history, and native environment characteristics. The chart below highlights a few other cities for comparison.

FROM THE COMMUNITY

More trees. *The overarching theme was the need for more trees overall. Suggestions ranged from raising all neighborhoods to the citywide average of 27%, to developing a per capita planting goal, to filling all empty tree pits along streets, to focusing on trees for planting on private land.*



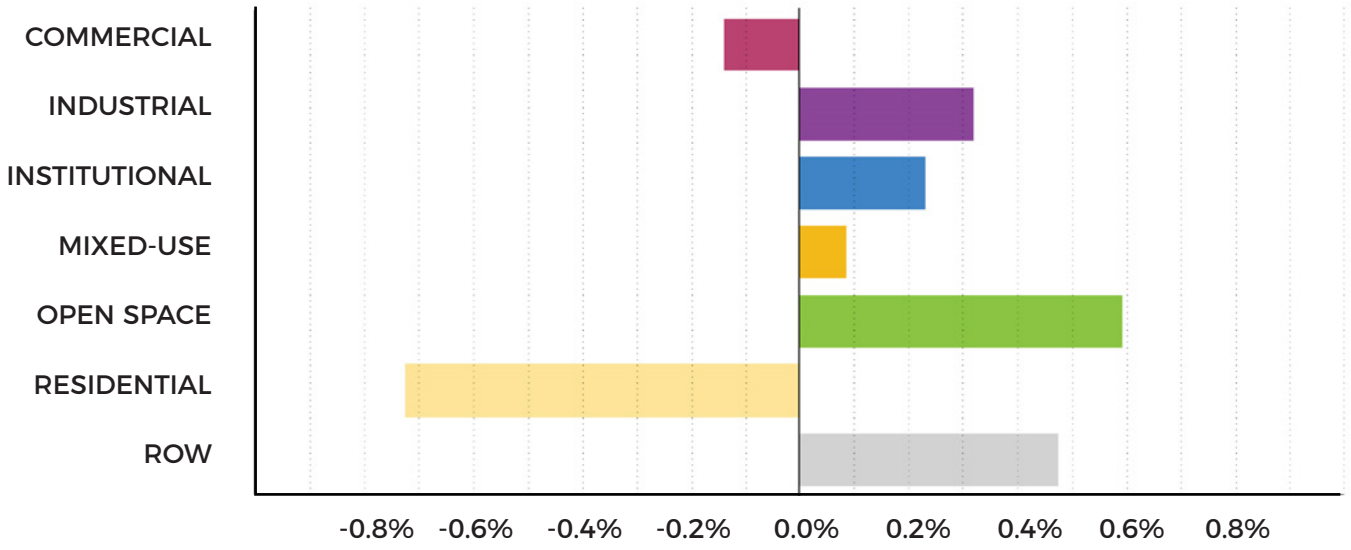
Canopy Coverage Change between 2014 - 2019

Finding 3: Despite steady citywide canopy cover, losses and gains are occurring.

At the citywide scale, tree canopy cover has remained steady at 27% from 2014 to 2019. Zooming in to the neighborhood level, the data reveals that every neighborhood has experienced both losses and growth of tree canopy over this five-year period. An understanding of why these changes are happening is important, as expanding the urban forest requires minimizing canopy loss and growing new canopy.

- Net growth of tree canopy: South Boston, East Boston, Dorchester, Charlestown
- Net loss of tree canopy: Hyde Park, West Roxbury, Mattapan.

Between 2014 and 2019, losses in tree canopy slightly outpaced gains leading to a decline from 8,210 acres of tree canopy in 2014 to 8,199 acres in 2019. Most canopy loss is occurring on



% Tree Canopy Change by Land Use (absolute change)

residential land, though the cause or source of this loss is not currently known. Smaller but notable losses have been occurring on commercial lands. Net tree canopy growth was seen in all other land use types. Data on the causes of loss within the residential land use category is not currently available. Further analysis will be needed to determine which losses are the result of individual homeowner removals (e.g. taking down a tree in their backyard) or trees removed by grounds management staff or contractors, or the product of development (e.g. large apartment or condominium building).

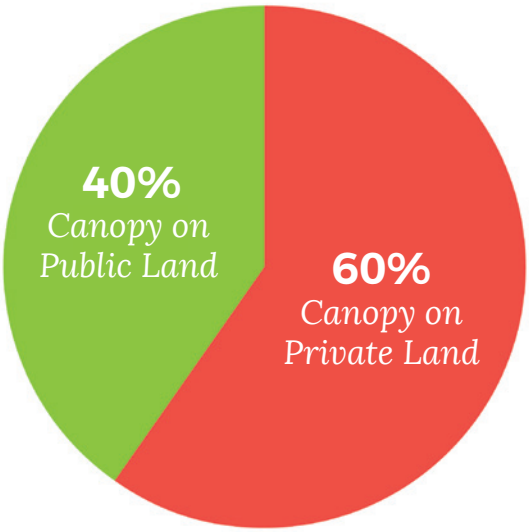
FROM THE COMMUNITY

Concern for losses to development. *Significant concern was raised about trees lost to development, including large forested parcels. Comments were made on the power and influence developers hold in Boston, and many believe that development is a primary source of tree loss within the city.*

Few believe the tree protections now in place are adequate to prevent trees being lost to development. Questions were also raised about the replacement process for trees lost within current development policy and code. There were repeated requests for a tree ordinance that includes stronger and more explicit policy and regulations for trees on both public and private land.

Finding 4: The majority of tree canopy is on private land.

In Boston, 60% of the existing tree canopy is located on private land, which is common in most cities. Owners of private tree canopy can span a wide range of types, often with varying levels of tree care knowledge. These include owners of homes and apartments (residential land), business owners both small and large (commercial and industrial properties), as well as larger properties like universities, cemeteries, and churches (community and institutional properties).



Distribution of Canopy Coverage between Private and Public Land

Finding 5: The urban forest is under the care of a large patchwork of managers.

One important piece to developing a long-term plan for the urban forest is to start to identify the many managers and owners of trees in Boston. These owners make up a wide range of types and management, all with varying levels of knowledge of the trees on the property as well as care practices. They can be classified into groups of managers that care for street trees, trees in city parks and natural areas, trees on public facility grounds, and trees on private land.

Street trees. Trees on public sidewalks are managed by the City or the states' Department of Conservation and Recreation. They play a special role in the feel of a neighborhood and provide important shading and cooling for the public realm, thus improving the experience of moving through the neighborhood. They are often the toughest locations for trees to grow, so they need a high level of care to flourish long term. In Boston, the majority of street trees are publicly-owned, however there is a small subset of street trees located on private streets that are privately managed.

Trees in parks. Parks are home to large tracts of the urban forest. There is also a patchwork of managers for parks. Some are managed by the City, some by partner organizations, and others are privately managed.

- ***City-Managed.*** There are parks dotted throughout the city that contain large segments of Boston's urban forest. These are under the care and responsibility of the Parks Department.
- ***Partner-Supported.*** A number of large parks receive additional maintenance support from partner organizations. These include sites like Boston Common and the Commonwealth Avenue Mall, managed by Friends of the Public Garden; a large network of parks receive assistance from the Emerald Necklace Conservancy (ENC); and the Arnold Arboretum is leased from the City and managed by Harvard University.
- ***Privately-Owned or Managed.*** There are a number of privately-owned and managed open space areas that are accessible to the public, including Rose Kennedy Greenway.
- ***State Park System.*** The State's Department of Conservation and Recreation manages more than 2,500 acres across the state made up of forests, parks, greenways, historic sites and landscapes, seashores, lakes, ponds, reservoirs, and watersheds. Properties within the Boston city limits include sites like Roxbury Heritage State Park, Castle Island, Carson Beach, Charles River Reservation, and Stony Brook Reservation.

Trees on Public-Owned Infrastructure/ Facilities/Grounds. Trees located on grounds of public facilities and other public entity properties. These include:

- ***Airports and Maritime Ports.*** The MA Port Authority (MassPort) manages more than 1,600 acres of land within Boston.
- ***Public Schools.*** Boston Public Schools manages more than 380 acres of land within Boston.
- ***Public Housing.*** The Boston Housing Authority manages a number of public housing properties accounting for over 200 acres within city limits.
- ***Utility and Transportation Properties***. There are a number of utilities in Boston that own and manage parcels of land and/ or land easements. These include Boston Edison Company / Eversource (just under 100 acres), MA Water Resource Authority (approximately 25 acres), National Grid, Boston Water and Sewer Commission (approximately 25 acres), and State transportation agencies (DOT, MDC, Turnpike Authority among others).

Trees on Private Land. In Boston, 60% of the tree canopy is located on private land. These include (but are not limited to):

- ***Residential properties.*** This group includes single family residential homes, apartments, condominiums, and townhouses. Management is typically handled by the homeowner or ground management service.
- ***Commercial properties.*** These types of properties cover a large variety of properties - as small as a single building garage or as large as a retail supercenter.
- ***Industrial properties.*** Industrial properties often constitute large one-story buildings and large sections of paved land.
- ***Institutional properties.*** These properties include a wide range of campus-type properties, including hospitals, universities, private cemeteries, faith-based entities, and more.

FROM THE COMMUNITY

More transparency needed. *The community felt that there is a need for increased public-facing information so that all can understand how the City works and how they can be involved with increasing tree canopy. There is a feeling that the development process is often unknown to the public. Many changes occur through smaller projects on privately-held land that don't fall under Article 80 development review. The public is often unaware of how to become involved in these smaller project discussions.*

Help needed with maintenance for low-income households. *Many low-income homeowners can't afford tree maintenance. Ideas were proposed for helping low/ moderate-income families to pay for tree pruning.*

Finding 6: Boston has an active and engaged community that is seeking more opportunities to support the urban forest.

One thing that became very clear from the beginning was the presence of a high number of active neighborhood, community, and other interested groups of residents. These organizations have many different missions and structures but all are working to improve

Boston together. This is something to be proud of, and a real resource and opportunity for making progress in tree canopy efforts.

FROM THE COMMUNITY

Every neighborhood is different. *Each neighborhood has different demographics and character that can play a role in determining their levels of action or engagement. Some households have limited resources and certain neighborhoods experience higher rates of temporary housing. Typically, renters have less power to be involved in and often have only short-term ties to the neighborhood.*

Utilize coalitions/partnerships. *Many called for the need to leverage partnerships and create coalitions between active groups, integrating other initiatives like those focused on public health, walk/bike efforts, etc. Develop an organizational structure to centralize the advocacy and volunteer work done by community groups. Identify block leaders who could be involved with tree projects on their streets.*

Lack of unified goals/plan. *There are many concerned residents, but no unified citywide end goals or plans have been made. So no one is working toward the same vision.*

Engagement challenges. *Language barriers need to be addressed to expand access to engagement opportunities. Neighborhoods with a high number of renters vs. owners can also complicate outreach efforts. On a neighborhood level, there isn't always an umbrella organization to provide structure for community members and groups to get together. City tree work is reactive rather than proactive. Establishing priorities for each neighborhood will help partner organizations know how they can get involved and be supportive of urban forestry efforts. Having such a vision and a coalition of neighborhood groups to guide its implementation would provide support for residents to come together around trees.*

Engage youth. *Incorporate education on trees into the school curriculum so that children bring information back to their parents and learn about the value of trees from an early age.*

Finding 7: Boston's history of exclusion of people of color and low-income communities has resulted in a lack of trust in City processes and priorities.

While there are many active neighborhood and advocacy groups in communities of color, low-income communities, and other environmental justice communities, there is not a consistent sense of support from the City. Because of decades of marginalization by redlining practices, disinvestment, and other policies and practices of racial exclusion, there appears to be a breakdown in trust between the City and some communities. This emerged as a theme during many discussions with both the community and City departments. Adding to this, efforts to support canopy expansion by these groups do not always align with City priorities and capacity (due to limited City resources) and are therefore not easily adopted and implemented, leading to some frustration on both sides.

FROM THE COMMUNITY

Many community members are skeptical. *Communities of color, immigrant communities and low-income communities currently experience exclusion and neglect that is added to the history of disinvestment that is widely known. It is experienced as a lack of clear response to community opposition of development plans that build out the entire lot; stands of healthy, mature trees being cut down in public housing developments; and difficulty in getting a street tree planted. Between the long history of marginalization and modern experience of neglect, community members are skeptical that the City will do the right thing.*

Finding 8: City staffing and funding resources dedicated to trees is limited, so planting and care are reactive.

Historically, public tree care has been underfunded and understaffed. That resulted in tree care that was reactive only, reduced tree planting, and limited capacity for community partnerships. Successfully filling tree care positions and retaining staff can be a challenge and is affected by compensation levels, City employment requirements, and the difficult nature of the work. The staff in place are highly skilled, knowledgeable, and dedicated, but have almost overwhelming responsibilities and workloads that prevent the program from advancing and hinders engagement efforts.

Since the Urban Forest Plan planning process began, Mayor Michelle Wu has launched PowerCorpsBOS, a workforce development program with an urban forestry track, and has secured funding for increased street tree care through the fiscal year 2023 budget and the American Recovery Protection Act. These resources are a critical step in transitioning to a proactive tree program.

Proactive care and adequate staffing levels are discussed in detail in Recommendation 2.1.

Street tree planting funds are underutilized and provide minimal initial care. Historically, 60% of the Tree Division's funding is dedicated to planting street trees. However, much of this has gone unused due to the lack of staffing and resources to install the maximum number of street trees. Additionally, there is no comprehensive young tree care program for new street and park trees after planting, which is crucial for their initial establishment in the first five years and their long-term health in maturity.

Reactive tree maintenance is performed due to lack of resources. Trees require routine maintenance just as roads require occasional resurfacing to maintain optimal condition. Public tree maintenance in Boston is primarily performed on a reactive basis triggered by resident requests through 311, damage from severe weather and accidents, third party manager requests, and as determined by Parks Department arborist staff. A reactive urban forestry program leads to inefficient service delivery, low resident satisfaction and negatively impacts the overall condition, value, and sustainability of Boston's trees.

Proactive, cyclical tree maintenance is important to equitably and sustainably manage Boston's urban forest. Trees maintained in a preventive maintenance cycle are safer, develop better form, and are healthier, leading to:

- Lower maintenance costs through lower per tree pruning costs compared to reactive pruning done in response to storm damage, sight clearance, or immediate hazards.
- Earlier identification and correction of insect/disease problems.
- Less damage due to reduction in storm-related tree damage.
- More equitably distributed work and resources.
- Satisfied residents thanks to a reduction in tree-related service requests and improved resident service.

Additionally, relying on issues reported by the public (reactive management) can create inequitable management practices as it can result in more attention and work done in well-resourced neighborhoods.

Tree care for parks, cemeteries, and urban wilds is largely unfunded. Boston's parks, cemeteries, and urban wilds are a large and essential part of the City's open space and comprise a significant portion of the public tree canopy. Thousands of residents and visitors enjoy the benefits from these trees. Despite this, dedicated funding for tree planting and maintenance in these spaces are almost nonexistent. This is a missed opportunity for expanding Boston's tree canopy and insufficient maintenance decreases the quality of the urban tree canopy and increases safety risks to the public. This also means that parks and urban wilds do not have the benefit of qualified arborist staff to perform work and other important management duties, nor is there tree inventory data available to support management decisions.

Opportunities for collaboration and advocacy are limited due to lack of staff. The important work of advocating for trees within the City, as well as improving communication, transparency and building partnerships with community groups is difficult because of the lack of staff. Issues related to this are:

Leadership. There is no higher leadership or upper management position for the urban forestry program, which leads to a lack of long-range planning, interdepartmental collaboration, and community engagement.
Support personnel. The lack of support personnel for the Tree Division such as administrative, communication, and GIS/IT specialists hinders City arborists from engaging with the public directly during tree care and planting projects.

Communication and partnership capability. There is little opportunity or time for urban forestry staff to interact with residents, neighborhood groups, and non-profits in a meaningful or sustainable way.
Lost opportunities. Limited staff precludes advancing volunteer and workforce development programs that support and perform tree planting and maintenance. Grant or cost-share programs to aid low-income property owners with tree maintenance needs cannot be considered. Limited staff also hinders outreach and education to help property owners plant and care for trees on private property.

Poor outcomes. Contracted tree planting and maintenance work is rarely inspected after being completed by City contractors. Contractors often find it less expensive to replace trees that die than to maintain them during the warranty period. Invasive plant removal and insect and disease issues cannot be monitored or controlled without proper staffing levels.

FROM THE COMMUNITY

Lack of City funding. *The Parks Department is in need of funds to hire more staff and increase capacity to care for the trees on streets and in parks. There currently seems to be a lack of concerted commitment within the City for a large-scale vision around tree equity.*

More resources for better maintenance of public trees. In addition to the call for more trees, there were also multiple calls for better maintenance of existing trees. Community members cited the lack of resources in the City dedicated to care of existing trees. Maintenance and the nuances of tree care are not often accounted for in the City's budget.

Finding 9: Urban forest is vulnerable to threats from climate change, development, disease/pests, lack of care, limited space, and growing conditions.

There are a number of factors that are expected to impact Boston's tree canopy in the coming decades, many stemming from the impacts expected from climate change. These include more frequent and severe weather events, coastal flooding, heat stress, and more severe pests and disease infestations. Continued growth and development in the city will also result in the loss of existing mature trees as sites are cleared for development, footprints expanded into open spaces, and construction activities bring stresses like soil compaction to existing trees.

More frequent and severe storms. Changes in the climate are causing storms that are both more severe and more frequent. This leads to tree damage from wind, rain, snow and ice, especially for trees that aren't cared for proactively or have experienced drought stress in recent years. Proactive tree care has been proven to reduce a tree's susceptibility to storm damage.

Coastal flooding. Sea level rise and increased risk of flooding also threaten the health of Boston's urban forest. Coastal flooding can be catastrophic for trees not just due to the lack of oxygen that trees need, but more critically from the toxic effect of salt. Models and maps created by Climate Ready Boston have predicted the amount of land in Boston that will flood with seawater from 100-year storm events in 2030, 2050 and 2070. This information can be used to estimate the portion of the urban forest in Boston that will be vulnerable to coastal flooding.

Habitat changes for trees. A warming climate means that the habitat and climate trees experience today will be changing. Some tree species will thrive with these changes, others will languish. The U.S. Forest Service's Climate Change Tree Atlas (www.fs.fed.us/nrs/atlas/tree) uses climate models to predict expected changes to tree species habitat. Below is a summary of the changes expected over the next 100 years on species in the Boston region.

Increased pressure from pests and diseases. A changing climate means potentially higher pest and disease pressures for trees. As climate change continues to bring warmer and wetter winters and warmer, drier summers, pest and disease issues are expected to increase. This is due to the fact that higher temperatures

Year	Acres of canopy vulnerable to coastal flooding	Number of street trees vulnerable to coastal flooding
2030	125 acres (1.5% of all tree canopy in Boston)	888 street trees (2.4% of all street trees in Boston)
2050	282 acres (3.4% of all tree canopy in Boston)	1,944 street trees (5.1% of all street trees in Boston)
2070	560 acres (6.8% of all tree canopy in Boston)	6,060 street trees (15.8% of all street trees in Boston)

Street trees that fall within coastal flooding projection boundaries

Anticipated changes to species in Boston as climate warms			
Predicted changes from climate change	***Tree species (common name)***	***% of Boston street trees today****	***Tree species <u>not</u> currently on Boston streets***
Trees expected to fare better as climate warms	Green ash	4.09%	American beech Blackgum Eastern Red Cedar Mockernut hickory American holly Bitternut hickory Sassafras Pignut hickory Gray birch Yellow birch
	Pin oak	3.54%	
	Silver maple	0.24%	
	Eastern hophornbeam; ironwood	0.23%	
	American hornbeam; musclewood	0.22%	
	Sugar maple	0.14%	
	White oak	0.10%	
	Black locust	0.03%	
	Black cherry	0.02%	
	Black oak	0.02%	
No changes expected	American elm	1.10%	Atlantic white-cedar
	White ash	0.16%	
	Scarlet oak	0.08%	
	Shagbark hickory	0.01%	
Trees expected to fare worse as climate warms	Red maple	5.01%	Sweet birch Pitch pine Bigtooth aspen Quaking aspen Black willow Eastern cottonwood Tamarack (native) Paper birch Red pine Eastern hemlock Pin cherry Black ash
	Northern red oak	2.05%	
	American basswood / linden	1.12%	
	Swamp white oak	1.08%	
	Serviceberry	0.39%	
	Eastern white pine	0.04%	

**Percentages shown refer to that species' as a percentage of all Boston street trees. Example: green ash represents 4.09% of all Boston street trees."*

can play a role in insect population success and potential range expansion. Additionally, climate changes will impact a tree's ability to manage any type of stress (Frankel 2012). The resilience and health of trees to fend off attacks by insects or pathogens (fungi, bacteria, virus) will be reduced greatly for many tree species. The most damaging insects facing Boston in the near term include the emerald ash borer, the spotted lanternfly, and the Asian longhorned beetle. Without proactive plant health care treatments, 5% of Boston street trees are at risk of infestation and death from emerald ash borer, 23% from spotted lanternfly, and 29% from Asian longhorn beetles. A significant, but unquantified, percentage of trees in parks and on other public and private properties are also at risk from increased insect and disease infestations.

Continued development and construction activities. Boston's population is projected to continue to grow and with this growth comes pressure on trees from development and construction activities. Trees are lost in development not just through site clearance/removals, but also over time, as those trees preserved in site preparation often decline over time due to loss of root structure and soil compaction from construction. In historically marginalized neighborhoods, ongoing development pressures will continue to threaten canopy. In these areas, as well as those identified for future canopy expansion, it will be critical to ensure canopy losses are minimized and any new development provides expanded canopy.

Insufficient care. The lack of available resources means that currently the level of care, at least for public trees, is insufficient. Poor care results in short lived trees and higher safety risks for the public. This is detailed in Finding 7.

Lack of space and good growing conditions. Space to grow and quality soil is a challenge in any city. The low quality growing space for Boston trees, detailed in Finding 14, is a threat to Boston's trees.

FROM THE COMMUNITY

More awareness of trees' role in social and climate resilience is needed*. Community members strongly communicated that there is a need for an increased awareness regarding the benefits/role of trees. They expressed concern that many do not understand the value of tree canopy and how vital it is to addressing the challenges facing Boston today. Trees will be needed in particular to address heat impacts as well as minimize flood risk. The role of trees in creating climate resilience isn't as widely understood. The City needs to do more to help connect trees directly to people's lives and their priorities and help people understand that trees, too, can be harmed by a changing climate.*

Concerns with pests and disease. *Numerous concerns with pests and disease were raised, both in terms of those already present (ex: emerald ash borer, or EAB) as well as those that may arrive, especially given climate change projections.*

Emerald Ash Borer
5% Of Boston's inventoried street trees are at risk

Spotted Lanternfly
23% of Boston's inventoried street trees are at risk

Asian Longhorned Beetle
29% Of Boston's inventoried street trees are at risk

Finding 10: Street trees data now available to support better management of the urban forest.

The City of Boston manages over 38,000 public street trees. These trees were recently inventoried (2021) as part of the UFP effort. This is critical information to have, as it conveys the composition, condition, risk and maintenance needs of public trees, which is tied directly to required maintenance funding, as well as reducing risk to the public and being proactive about care and potential upcoming threats to the urban forest. Highlights on the makeup of Boston street trees based on this new inventory data follows.

Size/age composition of street trees. To maintain a sustainable urban forest, it is important for Boston to have trees of all ages. Information on ages of trees provides insights into longevity of existing trees and future planting needs, and can help indicate future tree maintenance needs.

A tree population with an ideal distribution of ages would have an abundance of newly planted and young trees, which would allow for significant numbers of established, maturing, and mature trees in later years. This is conveyed in an industry standard that suggests that the largest portion (approximately 40%) of trees should be young (less than 6 inches DBH), while the smallest portion (approximately 10%) should be in the large-diameter size class (greater than 24 inches DBH). The goal is to have a solid quantity of trees reach the maturing (20%) and mature (10%) stages, as these trees provide exponentially higher benefits to the community. To do this, a higher number of younger trees are needed to account for inevitable future tree losses due to storms, vandalism, and other sources of early tree loss.

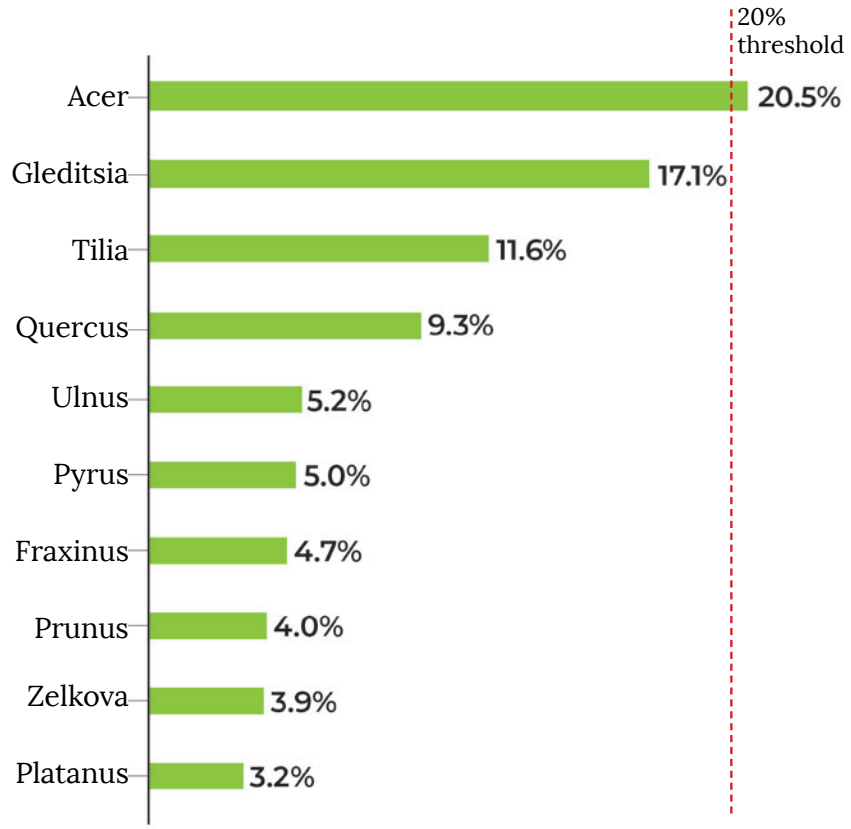
In Boston, 84% of the public street tree population is made up of young (0-6" DBH) and establishing (7-17" DBH) trees. This demonstrates a significant amount of street tree planting that has been funded in the recent past. However, minimal funding has been allotted to the care and maintenance (young tree establishment, proactive ongoing pruning, and plant health care) of existing trees. This, along with the poor soil quality and restrictive growing conditions found in the street environment, are the likely factors for the high mortality of street trees, and thus low percentages of the maturing and mature tree groups in Boston.

Boston Street Tree Diversity

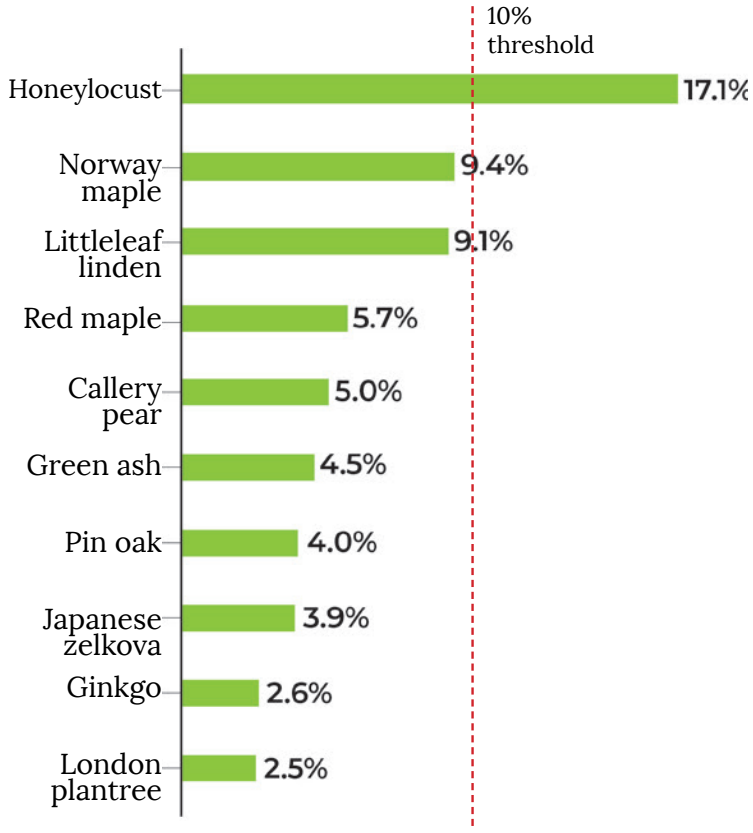
The 2021 street tree inventory measured species diversity across all Boston neighborhoods. The 10 most common trees by genus and species are shown here with indicators for those species that exceed or near the recommended thresholds of 20% by genus and 10% by species.

Information on diversity by neighborhood as well as age and size data is provided in the accompanying Neighborhood Strategies document.

10 MOST COMMON BOSTON STREET TREES BY GENUS



10 MOST COMMON BOSTON STREET TREES BY SPECIES



Diversity of street trees. Diversity of the types of trees (referred to here as genus and species) safeguards the urban forest from significant losses at any one time from pests, diseases, and extreme weather events. Pests and diseases often attack an entire genus of trees, not just one species. To lessen the impact of these issues, best management practices recommend that no one species makes up more than 10% of the urban forest, and no one genus (grouping of species) makes up more than 20% of the urban forest.

In Boston overall, street trees are relatively diverse with a few species overused. There are 209 different species/cultivars in Boston's street population. Three species exceed the 10% threshold - honeylocusts make up 20% of all street trees, Norway maples 17%, and littleleaf linden accounts for 12%. Red maples are approaching the threshold, at 9%. When looking at tree genus, which are in essence scientific groupings of tree species, only the Acer genus - maples - has reached the 20% threshold.

Finding 11: Data on the whole urban forest is incomplete.

While a full inventory of public street trees was just completed in 2021, and partners like the Emerald Necklace Conservancy, the Friends of the Public Garden, and the Arnold Arboretum work to maintain inventory data, there are currently significant gaps in urban forest data.

Missing public tree inventory data. Tree inventory data has not yet been collected on the parks and urban wilds that the Parks Department is responsible for managing. Without this data, it is not possible to effectively plan work and budgets effectively, and care practices remain reactive in nature. This results in poor conditions, shortened life spans for the trees, and higher risks to the public.

Insufficient resources for data upkeep. It is also important to note that existing Parks Department staff do not have the bandwidth with existing funding levels to maintain and update tree inventory data.

Little-to-no data on trees on private land. No data is available on trees across private lands, which make up 60% of the urban forest. Limited tree canopy cover data. Boston has relatively recent canopy change assessment data (2019) and has information and mapping from two different time periods (2014 and 2019). While it is valuable to have two sets of data to analyze change over time, this is only a short five-year period of change. The Parks Department will repeat the analysis every five years in order to map longer-term trends.

FROM THE COMMUNITY

Data: Sharing, better system. *Many comments focused on how data on canopy can be open sourced and is important to keep up to date. There are many sources of data now, none of which are centralized or easily shared/utilized. The lack of data on private trees, which make up the majority of tree canopy, is a big gap.*

Finding 12: Trees must be treated as critical city infrastructure.

Based on community input as well as through interaction and interviews with multiple City departments, trees appear to not be fully embraced as important city infrastructure in Boston. This emerged both in past instances of City decisions as well as in public opinions.

In City decisions. When faced with competing priorities, departments within the City of Boston haven't historically considered trees as a critical piece of city infrastructure. Examples of this emerged in examples of trees losing out to transportation requirements such as: sidewalk widths, the under-utilization of materials and designs that are more compatible with trees; parking or drop-off and pick-up areas; housing projects consuming entire sites and not providing any space for trees; and a historic lack of funding for arboricultural staff to properly inspect and maintain street and other public trees.

In public opinion. Many also cited a lack of awareness overall from the broader public on importance or roles of trees. This becomes especially apparent in face of health issues (asthma, pollen), construction and development decisions, and complaints of trees as a nuisance (too much work, messy, requires a lot of work and resources without return value).

FROM THE COMMUNITY

Lack of political will to prioritize. *Awareness stretches beyond the general public and into elected officials and high-level City staff. Trees are not recognized (and thus not prioritized) as city infrastructure and are often undervalued in comparison to other needs.*

Competing priorities shouldn't be competing. *There appear to be competing interests with other City priorities: renewable energy such as solar companies may suggest cutting trees; transportation planning that appears to take space away from potential tree planting areas; affordable housing projects that propose to consume entire sites; and relief from parking requirements that adds parking to neighborhoods often at the expense of private and street trees. Landholders tend to think of trees in terms of decoration before their function as shade and stormwater mitigation. Parking is often prioritized before trees. Community members argue that we need to dismantle framing that pits other public goods (e.g. housing, solar installations) against trees.*

continued on next page

Focus on public health/promoting health-related impacts. *To help people understand the importance of trees requires making the connection between trees and respiratory health, heat islands, and other climate change impacts. Public parks should also be primarily heat sanctuaries for those heat emergencies. If the priority for parks was shade and cooling relief for Boston residents, this would change the number of trees on every park. Gas leaks were also cited as a major problem in relation to street trees, as well as public health in general.*

Lack of cooperation/integration/central leadership within the City. *Trees are not prioritized on every level/department. Operations happening in silos means competing priorities of staff. Trees are not viewed or funded as a piece of critical city infrastructure. Education, coordination, and collaboration is critical. Ensure that trees are recognized within both citywide and neighborhood initiatives and plans in place.*

Finding 13: Systems for protecting trees from removal are limited.

The City does not have its own public tree ordinance to provide basic protections for public trees. Instead, it uses the authority and provisions given by MGL Chapter 87: Shade Trees. While Chapter 87 provides basic authority to Boston to control, protect, and manage public trees, it is outdated, not comprehensive, and does not address important issues such as establishing performance standards for tree maintenance and planting, establishing effective penalties for tree damage and illegal removal, establishing a resident-based tree advisory board, and more effectively dealing with tree and utility issues.

The City does not have a tree protection ordinance for private property. Typically, these ordinances are in place to regulate tree removal, tree protection, and tree replacement planting during land development projects. Even if Boston had stronger public and private tree protection ordinances, more staff would be needed for plan review, pre- and post-project inspections, and enforcement.

FROM THE COMMUNITY

Need to preserve existing trees. *Larger trees can't be replaced. Multiple calls were made for tree preservation across all land in Boston, and in particular the need for a wide range of tree protection measures. There needs to be a balance between providing incentives as well as support to help low-income and elderly property owners maintain and plant additional trees while imposing penalties for unnecessarily removing trees.*

Finding 14: Room and quality growing space for trees is limited in Boston.

Finding room for trees in any urban area is always a challenge. The historic and dense nature of Boston means many neighborhoods have narrow streets and sidewalks making it difficult to create space for new trees on existing streets. Houses are frequently built to the edge or close to the edge of lots, leaving little room for planting. And, in many areas there is also pressure on parks to accommodate recreational uses which can limit planting capacity in parks.

Not only is planting space limited in Boston, but quality planting space is even more limited. Soils that trees grow in are often poor in quality, due to compaction and significant amounts of pollutants that enter the growing area from salt, pet waste, and gas leaks.

FROM THE COMMUNITY

Find space for trees - get creative. *Finding space for trees in a dense city like Boston will be challenging. Multiple calls were made for creativity and to broaden our horizons when finding space. Beyond parks and street trees, we should be considering green roofs with trees, food forests, green walls, semi-permeable surfaces, and other alternatives.*

Tree Planting East Boston | Erica Holm

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