Cities Need Trees:
A Report on the Urban Forest Initiative and Heat Waves
By: Natalia Karadimitriou

This past semester I investigated the relationship between urban trees and city heat waves. I was curious to see if there were any natural solutions that Boston could focus their efforts on when combating the rising presence of heat waves. This report will first discuss climate change and rising temperatures for the city of Boston, the urban tree canopy and its benefits, why it's an environmental justice issue, and finally, what Massachusetts is doing about it. I will then end with different options that residents can do for this issue.

I. Climate Change and Rising Temperatures for Boston

Over the last one hundred years, average temperatures in the Northeast region have risen by two degrees. Current climate projections suggest that average temperatures can increase by more than 10 degrees in this next century (*Climate Projection Consensus* 2022). There will also be more days of extreme heat: from 1971 to 2000, only 11 days per year above 90 degrees. Climate projections warn that at least 40 days in a year will be above 90 degrees by 2030 (only 8 years away!) and by 2090, there will be 90 days in a year above 90ºF –almost the entire summer! (*Climate Projection Consensus* 2022). These periods of extreme heat are known as heat waves –the city of Boston has defined "heat waves as periods of three or more days above 90 degrees" (*Climate Projection Consensus* 2022).

Boston is a bit hotter than its neighboring suburban and urban communities (*Climate Projection Consensus* 2022). This is because Boston is a **heat island:** areas with generally more concrete, buildings, and steel that absorb and trap the sun's rays (Dwyer, 2022). Heat islands are also areas with less trees and green space (as these would help reflect the sun's rays). The absorption of heat by concrete and buildings (and then the re-emitting into the atmosphere) is known as the "urban heat island effect." This effect can cause daytime temperatures to be 1-7 degrees higher, and nighttime temperatures 2-5 degrees warmer than spots with more green areas (Dwyer, 2022). The urban heat island effect is exacerbated by our climate crisis, and overall rising temperatures –residents will be dealing with longer and hotter heat waves.

Some may think, "Great! I'm tired of Boston's cold and windy weather!" but it's important to acknowledge the concerning impacts that arise with increased temperatures. Extreme heat is deadly for residents; people the most from heat waves in the United States than any other weather-related phenomenon –that's more than hurricanes, floods, tornadoes, and other natural disasters combined (*Climate Projection Consensus* 2022). The average Boston already sees about 50 to 100 heat-attributable deaths –think of how much higher this number will be with more frequent and intense heat waves! (*Urban Forest Plan* 2022). Extreme heat also leads to

frequent power failures, a worsening in air and water quality, a slow or disrupted transportation infrastructure, and a bigger strain on healthcare systems (Gambill, 2022).

The rising prevalence of oppressive heat waves have "prompted officials to declare heat emergencies, urging residents to seek relief from sweltering temperatures by staying indoors with fans or air conditioning - or by seeking shade, out of the blistering rays of the sun" (Dwyer, 2022). Heat waves have ultimately become a public health issue –and preparing for hotter summers is essential for the wellbeing of residents. Not only will the risk of health issues increase, those able to have air conditioning will see a much higher electricity bill –turning this inot an economic and environmental issue (Dwyer, 2022).

Boston has been drafting a heat resilience plan, with three goals in mind: 1. Reduce heat exposure, 2. Adapt to heat, and 3. Reduce sensitivity and support healthy communities (Davis & Nakagawa, 2022). Boston is trying to find ways to reduce the indoor and outdoor urban heat exposure and intensity by creating an infrastructure that will allow the built environment to recover from daytime heat. Cities that invest in a heat resilience plan will enjoy many benefits, including "lower greenhouse gas emissions, less air pollution, healthier residents, safer communities and workplaces, and a greater quality of life" (Davis & Nakagawa, 2022).

II. Why an Urban Tree Canopy?

A. Benefits and Purposes

One of the most effective long-term solutions in reducing the effects of urban heat islands are urban trees (*Urban Forest Plan* 2022). Along with providing shade, trees establish a natural cooling effect in their environment through a process called evapotranspiration (Dwyer, 2022). For example: urban areas without green spaces are estimated to experience temperatures 15° to 25°F hotter than nearby, rural areas. (*Urban Forest Plan* 2022).

"A properly placed mature tree canopy can lower temperatures within its shade by 20° to 45°F, and overall ambient temperatures near trees by 4° to 9°F ,directly impacting human health (EPA 2015)" - (*Urban Forest Plan* 2022).

Massachusetts' Greening the Gateway Cities Program has identified many benefits to having trees in your neighborhood and living spaces:

1. Cleaner Air - trees filter the air by removing dust and absorbing air pollutants.
2. Cooler Temperatures - the net cooling effect of a healthy tree is equivalent to 10 room size air conditioners operating 20 hours a day.
3. Higher Property Value - trees and landscaping can raise property values by up to 20%
4. Lower Noise Pollution - tree-lined streets reduce noise pollution by absorbing sounds and slowing down traffic.

5. Higher Quality of Life - Trees beautify neighborhoods and reduce crime, improving the quality of life

(*Greening the Gateway Cities* 2022)

The air quality and carbon mitigation will improve as well –trees help filter out particulate matter (i.e. organic chemicals, metals, ash, and dust) out of the air through their leaves (Speak for the Trees, 2021). Their leaves can also absorb pollutant gasses through their pores, and often help clear gasses like nitrogen, ammonia, oxides, and ozone out of the air (Speak for the Trees, 2021).

If all of these benefits are not enough, the city of Boston has released a few more for residents:

1. "Provide intergenerational ties to nature and neighborhoods
2. Play an important role in cultural and spiritual practices
3. Improve mental health
4. Provide essential wildlife habitat
5. Reduce heat and adverse health impacts of extreme heat
6. Reduce flooding due to excess rainfall (stormwater)
7. Improve water quality
8. Help communities save money via reduced energy costs
9. Can help lower carbon levels in the atmosphere to some extent, and promote walkable, bikeable communities"

(*Urban Forest Plan* 2022)

When looking at other cities, a 2020 study from Philadelphia from the journal Lancet Planetary Health found that a 30% tree canopy coverage results in a 3% reduction of current resident mortality rates (*Urban Forest Plan* 2022). Trees are the infrastructure that continue to "get better with age," and while it's clear they deeply improve the livelihood of residents, not everyone gets to experience these benefits. So far, about 27% of the land in Boston is covered by a tree canopy ("leaves and branches covering the ground from an aerial view"), and about 1/3 of that is on private property (*Urban Forest Plan* 2022). To go even further, there is an uneven distribution of this tree canopy throughout the Boston area.

III. We cannot have climate justice without environmental justice!

"The cool offered by the shade of trees is not always so easily, or equitably found in Boston" - (Dwyer, 2022)

Extreme heat in Massachusetts will disproportionately affect some communities and residents more than others. In Boston, some areas enter high-heat conditions sooner, reach higher air temperatures, and remain in heat waves longer (Davis & Nakagawa, 2022).

Boston has identified Chinatown, Dorchester, East Boston, Mattapan, and Roxbury as neighborhoods of their city most vulnerable to extreme heat waves with the least amount of tree canopy (Gambill, 2022). These areas severely experience the urban heat island effect, as they have little green space and retain a lot of heat in their pavement and buildings. This has already increased the risk of heat-related illness, and will only continue to worsen.

As shown, residential heat burden is not felt equitably across the city! As I was doing my research on the benefits of urban trees against extreme heat waves, I realized how much of an environmental justice issue the urban forest initiative is. The way in which the city and overall state builds climate resilience matters, and most tree groups seem to have recognized this:

"By centering people and personal experiences alongside policies focused on infrastructure and buildings, we can deliver a wider range of strategies that can better address individual and systemic injustice and inequality" - (Davis & Nakagawa, 2022)

Communities with historically more disinvestment and marginalization often experience the heat island effect more intensely –low-income and communities of color constitute historically underserved communities in Boston and Massachusetts as a whole (Gambill, 2022). Unlike neighborhoods subject to redlining and disinvestment, wealthier communities already tend to have a larger tree canopy, resulting in cooler summer temperatures for them. Boston needs to create an urban forest initiative that will address vulnerable communities and also integrate public health and racial equity initiatives.

"Equitably expanding canopy throughout the city will mean expanding the benefits they provide in areas that are historically marginalized and currently excluded communities that tend to have higher temperatures" - (Dwyer, 2022)

(For additional information, you can go to: https://www.abettercity.org/news-and-events/blog/addressing-extreme-heat-in-boston-heat-resilience-study to learn more about the legacy of redlining and extreme heat in boston)

IV. The Current Urban Forest and Heat Resilient Initiatives

Massachusetts Department of Conservation and Recreation has long since established a program to increase the tree canopy in vulnerable towns. Boston has released their own urban forest plan report this past September (2022), where they outlined the necessity of an increased urban forest in the city, and the steps they will take to accomplish this.

Boston has acknowledged that increasing the tree canopy in vulnerable heat islands (by planting and maintaining the new trees) is one of the best long term and natural ways to decrease the

urban heat island effect. Along their heat resilience study, Boston has drafted and published a 20-year Urban Forest and an Open Space and Recreation Plan - which in combination with address extreme heat and establish greener infrastructure to combat the rising temperatures that Boston will face in the next 50 years (Gambill, 2022). Addressing tree canopy equity so all communities in Boston have an equal distribution of trees is an essential part of the city's heat resilience plan against the rising effects of climate change.

"Social equity and environmental justice are key to long-term resilience and therefore at the heart of the Urban Forest Plan" - (*Urban Forest Plan* 2022)

Among other things, the current state of Boston's Urban Forest is this: (as found on *Urban Forest Plan* 2022)

- Tree canopy is not equitably distributed in Boston.
    - Tree canopy coverage has been steady at 27% since 2014.
    - A majority of the current tree canopy is on private land.
- As will be outlined later in this report, Boston has an established community seeking more ways to support the urban forest.
- The city's history of exclusion for people of color and low-income communities has resulted in a lack of trust for city efforts and processes.
- The urban forest will also be vulnerable to climate change threats, and need constant support and care.
    - Funding for the care and maintenance of urban trees is low.
- Trees must be treated as critical city infrastructure.
- Based on inventory data, there is currently a big opportunity for planting trees in Boston
    - With limited availability on city sidewalks, Boston will focus efforts at private property as the place to continue growing the city's canopy (Dwyer, 2022)

Boston wants to establish a bigger network of trees to control flooding and drainage, cool and purify our air, and mitigate the dangers of extreme heat (*Urban Forest Plan* 2022). Boston's Urban Forest Plan's main goal is to ensure that Boston's tree canopy is not only resilient against extreme heat waves and climate change but are equitably distributed and improves the quality of life for all residents in the area. Unfortunately, the larger issue stands that about 30 to 40% of the street trees planted in Boston cannot survive past their seventh year (Dwyer, 2022). After speaking with Douglas Hutcheson (*Program Forester, DCR*) and Ahron (*Urban Forester, DCR*), I've been taught that the key to a successful urban tree initiative is not planting many trees, but making sure to sustain the ones currently planted. Trees need constant care their first two years of being planted, and continued upkeep for the ones following. Trees <u>are</u> living beings that need our help to survive. Time will only tell how effective Boston's plan is, but one thing is certain: no plan will be 100% successful without residential, public support and commitment.

V. Ways to Help

"How do you develop a system that allows these trees to not only survive, but thrive?"
- (Dwyer, 2022)

The city of Boston's Urban Forest Plan does a good job at outlining their goals, any issues that may exist in achieving the goals, and action items for solving these issues and achieving the goals. On top of that, they list the timeline/priority of each action item, whether or not it is ongoing, and the resources required to achieve that goal. The plan also asserts that some government funds will be set aside for residents willing to plant trees on their private property–allowing for an increase in the overall canopy (*Urban Forest Plan* 2022). This is not the only group in Boston investing in this green infrastructure. *Speak for the Trees* is a local organization that I had the pleasure of speaking to about their initiative. They work in partnership with the city and various other tree groups to plant trees in the local area and also provide education to local residents on the importance of an urban forest. *A Better City* is another environmental organization that works to make a green infrastructure so Boston is resilient to climate change hazards like extreme temperatures, and works with "multiple stakeholders to monitor climate change projections, educate constituents, and provide adaptation tools and resources for decisions and planning around development" (Gambill, 2022).

Ultimately, the goals for all of these groups are to: (as found on *Urban Forest Plan* 2022)

1. Focus the tree initiative in "under-canopied, historically excluded and socially vulnerable areas"
2. Ensure that the trees are maintained and cared for in the years to come
3. Any urban forest decisions are made with community prioritizations
4. Increase the overall awareness around the importance of trees in Boston and the broader Massachusetts area for residents.

Unfortunately, city's street trees only have contractors obligated to water them for the first two years after being planted. After that, they are left largely on their own, and some do not survive (Dwyer, 2022). After speaking with David Meshoulam, founder of *Speak for the Trees*, it was made clear to me that care of urban trees relies on residents and community partnerships during the years after as trees are being established in a new home –especially with the incoming heat waves over the summer.

Getting involved with any one of these groups (and the many other tree and environmental groups that exist in Boston) is easier than it looks. Most of these groups host many tree planting events in the fall that you can volunteer at and help plant trees. *Speak for the Trees* hosted a free "adopt-a-tree" event in Allston this past November, allowing residents to bring a tree home with them (after being properly educated on its care, of course). Your support is free and makes a

world of a difference –public support will also show government officials that the community cares about urban trees, and wants this initiative to continue to be prioritized in the years to come.

How can you help expand Massachusetts' tree canopy living outside of Boston?

As mentioned earlier, Greening the Gateway Cities Program is the statewide urban forest initiative that works to provide and plant free trees for residents in vulnerable, low-tree canopy towns outside of Boston. I met with Program Forester of DCR Douglas Hutcheson and had the opportunity to tour some of their planting zones with Larissa Parse and Ahron Lerman (*Urban Foresters, DCR*) to learn more about their program. In the early 2000s, the state recognized that residents deserved a higher and more successful quality of life, which would boost overall the economy. After undertaking studies, the legislature designated 26 communities in Massachusetts as "Gateway Communities." The program has since then been planting trees in these communities, and have so far planted trees in 22 out of the 26 identified communities. The program's ultimate goal is to "plant 80% of trees on private property and 20% on municipal property" (Douglas Hutcheson, *GGCP*). The trees have been planted by foresters from the Department of Conservation and Recreation (DCR) Urban and Community Forestry Program (*Greening the Gateway Cities* 2022). Go to their website: https://www.maurbancanopy.org/ to see if you live in one of these communities. Residents and business owners can order free trees, delivered and planted on their properties with a 2-year commitment of consistently watering them. A DCR forester will visit your home to determine the best location and species of trees to provide ultimate energy efficiency and benefits for the residents, and are also available year-round for any advice or help if necessary.

The urban forest exists on both private and public property–we need the entire community's participation and support in the care and management of our trees to enjoy the full benefits that trees can give us.

A minimal cost of watering once a week will lead to a lifetime of health benefits for you and your loved ones.

Cities need trees, but trees need you!

Works Referenced:

Davis, Z., & Nakagawa, A. (2022, April 19). Heat resilience solutions for Boston. Boston.gov. Retrieved September 19, 2022, from https://www.boston.gov/environment-and-energy/heat-resilience-solutions-boston

Dwyer, D. (2022, August 29). Trees are key to address Boston's Heat Islands. but it's more

complicated than just planting new ones. Boston.com. Retrieved December 19, 2022, from https://www.boston.com/news/local-news/2022/08/29/boston-heat-islands-trees-climate-change/

Gambill, I. (2022). Addressing extreme heat in Boston: Heat resilience study. A Better City. Retrieved December 19, 2022, from https://www.abettercity.org/news-and-events/blog/addressing-extreme-heat-in-boston-heat-resilience-study

Hutcheson, D. (2022). Greening the Gateway Cities. Retrieved October 28, 2022, from https://www.maurbancanopy.org/

Meshoulam, D. (2021, December 20). BranchingOut Tree Inventory. Speak for the Trees, Boston. Retrieved September 10, 2022, from https://treeboston.org/get-involved/tree-inventory-program/

Walsh, M. J. (2022). Climate Projection Consensus. Retrieved November 12, 2022, from https://www.boston.gov/sites/default/files/file/2019/12/03_climate_ready_boston_digital_climateprojectionconsensus.pdf

Wu, M., Ford-Diamond, M., Sutton, P., Meyer, L., Owens, M., & Woods, R. (2022, September). Urban Forest Plan. City of Boston. Retrieved October 3, 2022, from https://www.boston.gov/sites/default/files/file/2022/09/2022%20Urban%20Forest%20Plan%20-%20single%20page-2.pdf