CHAPTER 7

Structural Inequalities and Extreme Heat in the Boston Region

SAJANI KANDEL AND ANTONIO RACITI

EXTREME HEAT AND UNDERSERVED COMMUNITIES IN DORCHESTER

The latest National Climate Assessment reports an increase in the annual average temperature in every region in the United States.[1] The yearly average temperature over the contiguous United States has increased by 1.2 degrees Fahrenheit (0.7 degrees Celsius) over the last few decades and by 1.8 degrees Fahrenheit (1 degrees Celsius) in the previous century.[2] Additionally, an increase of about 2.5 degrees Fahrenheit (1.4 degrees Celsius) in the annual average temperature is expected over the next few decades regardless of future emissions.[3] Given projected future population increases, extreme heat will continue to be a substantial public health policy issue in the United States for decades to come.[4]

The impact of extreme heat is evident in medium- to large-size cities worldwide.[5] Central city temperatures are higher than their nearby suburban and ex-urban areas due to the differences between their environments, a well-documented phenomenon known as the urban heat island effect (UHI).[6] The UHI effect is caused by high concentrations of dark, heat-retaining surfaces such as asphalt and concrete on paved roads, parking lots, tall buildings, anthropogenic heat waste, land cover, vegetation, and other morphological features commonly present in urban environments.[7] The temperatures in urban areas due to UHI can be 0.9 to 7.2 degrees Fahrenheit (0.5 to 4 degrees Celsius) higher during the day and 1.8 to 4.5 degrees Fahrenheit (1 to 2.5 degrees Celsius) higher during the night depending on the climate, city size, population density, urban forms, and method of measurement.[8] The combined effect of urban heat islands and increasing extreme heat events due to climate change significantly increases heat exposure in cities.

Considerable research evidence worldwide has identified the disproportionate impact of extreme heat exposure on residents of low-income

communities. Tirthankar Chakraborty and colleagues found that urban heat exposure in 88 percent of US cities correlates negatively with income.[9] Another study on 175 metropolitan areas in the United States found that over 70 percent of people with incomes below the poverty line have a higher heat exposure than those with incomes twice above the poverty line.[10] The relationship between extreme heat and poverty also involves a more complex relationship with racial identity. While people of color tend to have lower incomes than White populations in the United States, it is hard to isolate economic factors to explain the unequal distribution of urban heat island intensity exposure. Angel Hsu and colleagues found that the average person of color lives in a census tract with higher summer daytime surface urban heat island intensity than non-Hispanic White in all but six of the 175 largest urbanized areas.[11] Susanne Benz and Jennifer Burney also found that neighborhoods with higher Black, Hispanic, and Asian populations shares are hotter than the more White, non-Hispanic areas in 1,056 US counties, even when controlling for income.[12] Recent evidence identifies the effect of historic urban planning policies and practices that promoted segregation in the distribution of heat across communities. For example, previously redlined neighborhoods categorized as "D" areas are now an average of 2.6 degrees Celsius warmer than "A"-coded residential areas in 108 studied cities in the United States.[13] Seventy-four percent of the neighborhoods graded as "high-risk" or "hazardous" eight decades ago are low-to-moderate income today, and 64 percent are currently minority neighborhoods.[14]

This chapter explores how extreme heat has become an important concern for Boston communities and what types of planning initiatives have been implemented to address this issue. We are interested in heat planning initiatives undertaken in historically disenfranchised communities. Our aim is to understand how these communities respond to ongoing heat planning initiatives and what type of work still needs to be done to strengthen, expand, or reinvent current efforts. We focus on the Dorchester neighborhood in Boston, which is home to many socially vulnerable residents and where a series of heat planning initiatives have been implemented. The chapter begins with an introduction to the problem of extreme heat in Boston, paying particular attention to disenfranchised groups. Drawing on interviews with Dorchester residents and community leaders, the chapter highlights the strengths and limitations of the city's current efforts from the residents' perspective. The chapter concludes with

a few reflections regarding the nature of these initiatives and insights for enhancing the impact of the city's extreme heat initiatives.

PLANNING PRACTICES ADDRESSING PUBLIC HEALTH CONCERNS

Heat is the leading cause of death across all-natural disasters in the United States.[15] Between 1986 and 2020, severe heat events have claimed 127 lives per year in the United States (see figure 7.1).[16] According to the US Centers for Disease Control and Prevention, an average of 702 heat-related deaths (415 with heat as the underlying cause, and 287 as a contributing cause) occurred in the United States annually between 2004 and 2018, and 90 percent of these fatalities occurred between May and September.[17]

The effects of extreme heat can range from dizziness, muscle cramps, fainting, and heatstroke and, if untreated, can lead to death. Elderly and very young residents, those homebound or confined to bed or unable to care for themselves, socially isolated individuals, those lacking access to

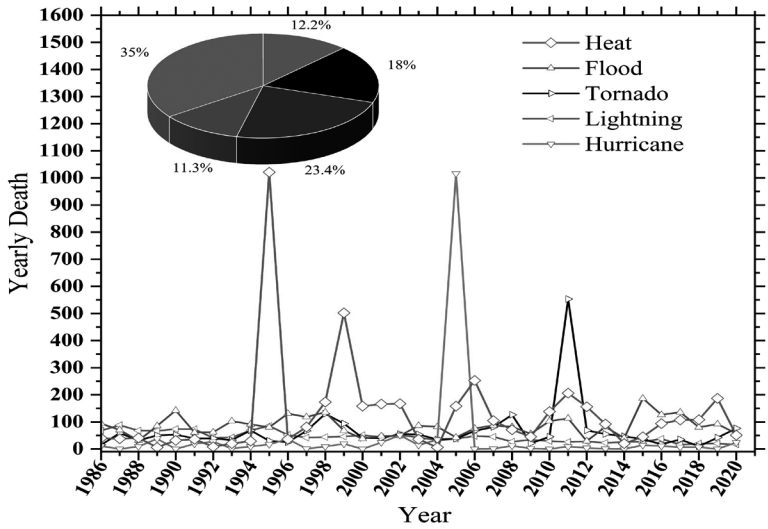

FIGURE 7.1. Annual deaths of different disaster events between 1986 and 2020 (Line graph). The pie chart shows the percentage of fatalities between 1986 and 2020 in each disaster category. Data source: (NOAA, 2021). Graphic re-elaboration by the authors.

air conditioning, outdoor workers, low-income residents, homeless individuals, and those with preexisting illness or medical conditions are more vulnerable to extreme heat and its associated health impact.[18] Older adults, young people, and individuals with disabilities do not adjust to sudden changes in temperature and are more likely to have chronic conditions that undermine normal body responses to heat.[19]

Extreme heat morbidity and mortality are often much higher among racial minorities and low-income groups.[20] During the 1995 Chicago heat wave, 49 percent of decedents were Black; 46 percent were White; and 5 percent were from other racial/ethnic groups.[21] Between 2004 and 2018, among all race/ethnicity groups, non-Hispanic American Indian/Alaska Natives (0.3 perone hundred thousand) and non-Hispanic Blacks had the highest death rate (0.3 perone hundred thousand) of heat-related deaths, respectively. The disparities in heat-related impacts across racial and ethnic groups are associated with social vulnerability. For instance, low-income populations (1) often do not have the financial means to adequately cool their living space using air conditioners,[22] (2) may be less likely to participate in help-seeking behaviors during heat events, such as making health-related calls, or (3) may have health risks that manifest during extreme heat events leading to an elevated risk of life-threatening illnesses.[23] Social factors—including living in isolation, secluded living due to fear of crime, or even social isolation stemming from health and mental illness increase the probability of many minority group members remaining unnoticed during heat emergencies.[24] The Chicago heat wave taught the important lesson that socially cohesive and less segregated communities enabled coping mechanisms to face similar heat events that ultimately reduced associated deaths.

Planning Response

Urban heat planning has been driven by a conceptual vulnerability model as measured by exposure, sensitivity, and adaptive capacity.[25] Exposure indicates how "humans, natural assets, and material goods located in endangered places under climatic changes" are directly or indirectly affected by climate-driven effects.[26] Sensitivity is the degree to which exposed populations react to climatic changes.[27] Finally, adaptive capacity describes a population's ability to handle adversity through anticipatory and preventive actions.[28] While these three dimensions can be measured and analyzed separately, their interconnection defines the community's resiliency to heat

within most vulnerability models. Most heat preparedness plans and vulnerability assessments involve data-driven geographic analysis using Census-based demographic and socioeconomic characteristics to understand vulnerability to heat.[29] This conceptual model of vulnerability has shaped municipal actions to address extreme heat issues by encouraging efforts to physically reduce the intensity and duration of heat exposure both during and after periods of extreme heat.[30]

While many communities have implemented heat action plans to reduce the health impacts of extreme heat, assessing the role of municipal heat-related interventions remains unexplored in practice.[31] Literature suggests that effective heat action plans reduce health risks if these include education and awareness strategies;[32] surveillance and impacts monitoring;[33] access to cooling centers, green spaces; and design and modifications of existing infrastructure.[34] Some studies have found that public cooling centers tend to be underutilized in communities experiencing heat events.[35] This underutilization was attributed to socioeconomic barriers for those most in need of such centers, lack of knowledge of facilities, poor transportation access, fear of crime at and near these centers, the inability of vulnerable populations to leave home or travel, and negative associations with cooling centers.[36] Additionally, even though urban greening projects decrease air temperatures by lowering solar radiation and increasing evapotranspiration of warm air,[37] it remains less clear how evenly distributed these positive impacts are across populations within marginalized communities.[38]

Heat Planning in Boston

In the northeast region of the United States, the average temperature increased by almost 2 degrees Fahrenheit (0.16 degrees Fahrenheit per decade) between 1895 and 2011.[39] While the average summer temperature in Boston from 1981 to 2010 was 69 degrees Fahrenheit, it may rise as high as 76 degrees Fahrenheit by 2050, and 84 degrees Fahrenheit by 2100.[40] Based on city projections, there were eleven days per year over 90 degrees Fahrenheit between 1971 to 2000, but the may be as many as forty days over 90 degrees Fahrenheit by 2030, and ninety days over 90 degrees Fahrenheit by 2070.[41] The Climate Central Report ranks Boston as the sixth-worst heat island among the 159 cities in the United States based on its UHI Index.[42] In Boston, "high-risk"–graded neighborhoods during redlining now have longer heat event duration than other parts of the city (see figure 7.2). The "high-risk" or category "D" neighborhoods are 7.5 degrees Fahrenheit hotter

in the day, 3.6 degrees Fahrenheit hotter at night, and have 20 percent less parkland and 40 percent less tree canopy than highest-graded areas "A."[43]

In Boston, preparing for extreme temperatures related to climate change can be traced back to 2009. At that time, the Commonwealth of Massachusetts' Executive Office of Energy and Environmental Affairs organized the Climate Change Adaptation Advisory Committee to assess the impacts and mitigation strategies needed to combat climate change. One year later, the Commonwealth's Department of Environment partnered with Tufts University to publish a report titled "Preparing for Heatwaves in Boston" as part of an integrated plan that outlined necessary actions to reduce the risk of predicted effects of climate change.[44]

Climate Ready Boston (CRB), a primary document for climate change adaptation and preparedness, was finalized in 2016 to operationalize the city's high-level climate preparedness goals identified in its first comprehensive plan after fifty years, Imagine Boston 2030. *Climate Ready Boston* incorporated a climate vulnerability assessment for extreme heat events, identified potential health impacts, and extrapolated future local mortality rates based on climate projections.[45] It includes a small chapter that features the most recommended urban heat management strategies, such as green spaces, street tree canopies, and access to open spaces. The 2021 Natural Hazard Mitigation Plan 2021 (a updated version of the 2015 plan) is a plan by the Office of Emergency Management to identify the risks and

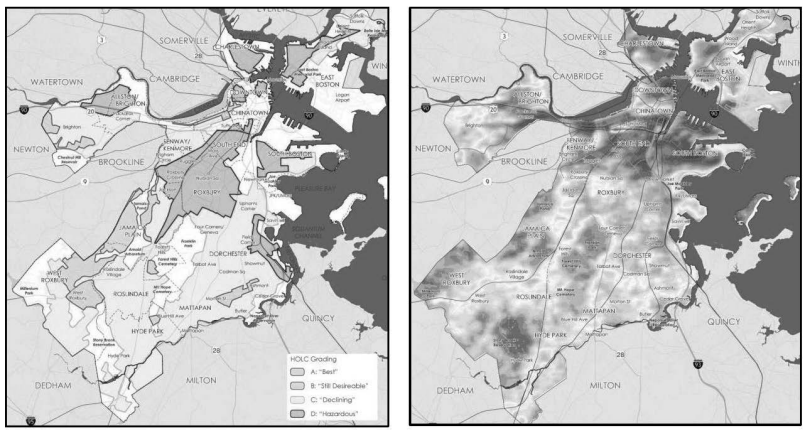

FIGURE 7.2. On the left: redlined neighborhoods in Boston. Source: City of Boston, city-wide analysis (2021). On the right: Daytime summer air temperature distribution. Source: City of Boston. Heat vulnerability analysis (2021).

vulnerabilities associated with natural disasters for home, business, and critical infrastructure and develops strategies to mitigate damages. It is not a part of CRB but a coordinated effort that includes climate change projection and strategies for extreme weather events. The Open Space Plan 2020–2025 and the twenty-year Urban Forestry Plan present recommendations for increasing green spaces and tree canopies for urban heat reduction, with a high focus on a marginalized neighborhood that lacks such amenities.

The City of Boston's Department of Environment currently provides fifteen pages of informational materials and guidelines for minimizing the environmental impacts of proposed projects.[46] Some recommended heat mitigation strategies include green roofs or eco-roofs, cool roofs, and reflective pavements as well as information on improved insulation techniques, weatherization programs, and sustainable building products and design.[47]

To advance the city's climate resiliency and carbon reduction goals, Boston Zoning Code Article 37[48] and the Climate Resiliency Review Policy ensure that all major building projects must be planned, designed, constructed, and managed to minimize adverse environmental impacts.[49] Article 37 also requires all major projects to achieve a minimum "certifiable" level of the US Green Building Council Leadership in Environmental and Energy Design (LEED) Rating System. There are no regulations to enhance the extreme heat performance of existing residential and nonresidential buildings.

Regarding Boston's response to heatwaves, the Boston Public Health Commission's Department of Emergency Management sends out emergency temperature alerts to preregistered residents through its Alert Boston System.[50] In addition, local television channels, radio stations, and emergency alert system provide information regarding the high temperature forecasts. The City of Boston's Emergency Management website lists all the cooling and emergency centers, along with multilingual education materials on personal heat safety tips.[51]

EXPLORING (EXTREME) HEAT PLANNING IN DORCHESTER

Climate Ready Boston identifies Dorchester residents as one of the most vulnerable groups to extreme heat events due to the large share of socially vulnerable individuals, chronically ill residents, and older individuals residing in the community. Dorchester is the largest and one of the most

diverse neighborhoods in Boston, and comprises 18 percent of Boston's population.[52] As of 2019, 56.2 percent of Dorchester residents were foreign-born, of which 40 percent are from the Caribbean, 23 percent Asian, and 21 percent African. In Dorchester 33.5 percent of residents are non–English speakers. Seventy-two percent identify as people of color (compared to 52 percent citywide);[53] 35 percent identify themselves as Black; Dorchester's median income is 23 percent lower than the city average; and 18.2 percent of the community's population makes less than fifteen thousand dollars.[54] In Dorchester 23.7 percent of residents live in poverty, giving this neighborhood the highest poverty rate of any Boston neighborhood.[55]

Dorchester has an aging housing stock and many heat-trapping surfaces, including highways, arteries, and parking lots that add to the community's urban heat footprint.[56] The modeled surface temperature collected by the Wicked Hot Boston Project in 2019 reported a high difference in ambient air temperatures within different subareas of the neighborhood. The Ashmont T station in Dorchester recorded one of the most elevated temperatures, 102.6 degrees Fahrenheit , in Boston.[57] In addition, the neighborhood lacks quality green spaces.[58] It has less than 10 percent tree cover, which is much less than the city average of 27 percent.[59] Understandably, the area has many vulnerable individuals and does not have any amenities to provide cooling benefits to reduce the urban heat island effect that amplifies heat exposure.

In the following section, we draw on interviews with residents and leaders to illuminate their perceptions of extreme heat and the city's recent heat planning interventions. We interviewed members and leaders of local community associations, nonprofit organizations, senior centers, churches, and other social service institutions working in the neighborhood. One of the authors also participated in participatory observation during community meetings, nonprofit town halls, civic associations, and tenant organization forums in the summer of 2021. We sought to understand how local leaders report residents' extreme heat experiences, coping mechanisms during heat events, and opportunities to access local services. Neighborhood residents were briefed about this study and invited to participate in a follow-up research phase, which is not discussed in this chapter. This chapter's reflections and highlights are based on ten interviews. While we do not claim the number of interviews to be exhaustive,

we believe they are representative of the views of most Dorchester community leaders regarding local heat planning.[60] All interviewees identified themselves as BIPOC (Black, Indigenous, People of Color) individuals and are residents of the two neighborhoods shown in Figure 7.3.

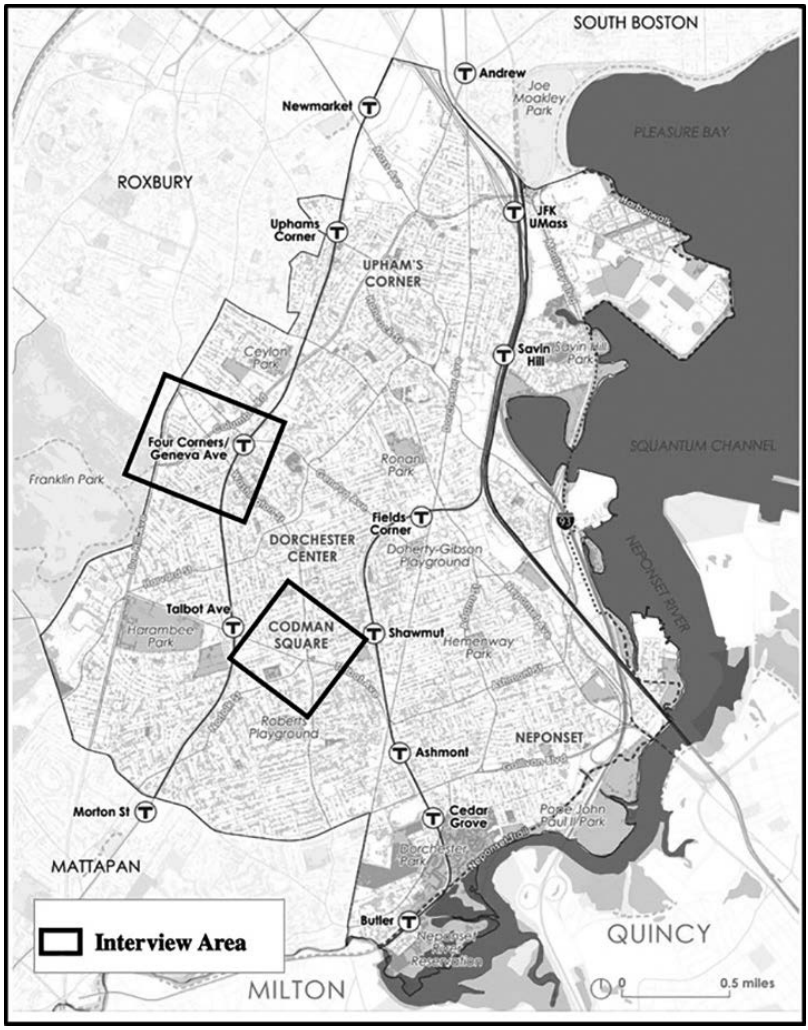

FIGURE 7.3. Dorchester District, Boston. The boxes identify Four Corners and Codman Square Neighborhoods, where the authors conducted resident interviews, participant observation, and community meetings. The area is home to most of Dorchester's African American residents. Map source: Climate Ready Explorer (2021).

Flags on Heat Strategies

The interview campaign findings highlighted extreme heat as an increasingly serious concern for Dorchester residents. Social, economic, and environmental factors exacerbate underserved residents' heat exposure and limit their adaptative capacity to safeguard individuals and their families. The listed "red flags" concisely summarize major concerns community members shared and highlight useful insights to improve heat planning practices in Boston.

Cost of Cooling

Nationwide, about one fifth of households below the poverty line do not have air conditioning equipment. However, 80 percent of Boston homes have either room or window air-conditioning units.[61] Compared to other midsized cities, a higher percentage of Boston residents have cooling units; however, there is little information on how many residents use this equipment. By participating in community meetings we learned that many residents could not take advantage of air conditioners in their homes because of the high electric service costs. Overall, the financial cost of cooling units is the barrier most community members face that limits their usage during the summer months. A woman living in Dorchester explained, "Our winter bills are high . . . very high. We must stick with the heat for winter, and in summer, we try to save as much as possible."[62]

According to the American Council Energy-Efficient Economy, a quarter of low-income households in Boston spend more than 19 percent of their income on energy bills, making them significantly energy burdened.[63] During community meetings, interviewees described how they struggle to pay winter heating bills and prefer to decrease their electric charges in the summer months. One resident living in a traditional Dorchester triple-decker mentioned, "I live on the third floor of the triple-decker. My apartment is overheated during the summer months. I have a window unit, but it's not enough to cool down. Using AC all day does not help. It feels like living in a sauna."[64]

To address such concerns, the federally funded Low-Income Home Energy Assistance Program seeks to help low-income households cover heating and cooling costs. This funding is primarily designated for the winter months to help with heating costs in northern cities. However,

the program does not aid low-income families facing the cooling charges associated with the summer months. Limited programs by local community-based organizations and nonprofits, in partnership with the city and private foundations, have been providing aid to purchase and install air conditioning units for low-income residents with documented medical issues. On this point, one of the local nonprofit representatives commented, "There is a need for more innovative and longer-term solutions for energy and cooling. I wish the city would put more on its own 'skin in the game.' The city needs to commit long-term investments in this realm."[65]

The City of Boston provides a weatherization program via Action for Boston Community Development in cooperation with National Grid and Eversource to help low-income residents become more energy-efficient and comfortable while lowering their energy costs and helping the environment. Both renters and homeowners are provided with assistance through this program. However, some have concerns regarding the limited capacity of this initiative to address an increasingly chronic structural problem. One of the interviewees commented, "Boston currently helps residents by offering no-cost home energy audits and recommendations for home energy improvements. Many absentee landlords in the area and low-income renters cannot benefit from these programs. Unless these programs become regulated, poor residents, rent-burdened tenants, immigrants, etc., will not benefit. And these are the people who are most impacted by climate change, including heat."[66]

The Boston Housing Authority provides residents with energy assistance and manages cooling units and services for public housing tenants. Massachusetts state regulations require property owners to provide heat from September 15 to June 15 in all residential buildings. Historically, July is the hottest month in Boston. However, in recent years, the metro area has been getting early high-temperature days. One of the public housing residents reported, "All these windows were shut airtight and couldn't be opened if we wanted to install a window unit. I live on the top floor of the housing; with heat on, it is unsafe and unhealthy conditions for us."[67]

This issue was reported several times in community meetings not only in public housing complexes but also in private residential neighborhoods. The state sanitation code requires property owners to make heat available until June 15. Some landlords opt to keep it on, making apartments

unbearable to live in for the residents, especially for seniors. The state sanitary code is silent on air conditioners. This void often prevents housing managers from switching on central air conditioning before June 15. The state issued an additional guideline (105 Code of Massachusetts Regulations CMR 410.201) in 2018 to clarify that the code does not prevent any property owner (including local housing authorities) from turning on air conditioners before June 15, if the minimum temperature is maintained in each dwelling. However, it is hard to implement these guidelines effectively. For example, many buildings are not equipped with cooling systems; others with complex heating, ventilation, and air conditioning systems need several days to switch between heating and cooling. Additionally, window-only air conditioning units are not necessarily efficient in lowering the apartment's temperature when temperatures are very high outside. With changing climate, advocacy groups have been pushing to change the decade-old state sanitary code and revise the end of heat month to May 30. However, substantial changes have yet to happen.

HOW USEFUL ARE COOLING CENTERS?

Cooling centers are primarily opened to provide relief to families without air conditioning during heatwaves across many communities in the United States.[68] In Boston, for instance, Boston Centers for Youth and Families opens their community centers from 9 a.m. to 5 p.m. to help residents during heat emergencies. These might often not be helpful for residents living in urban heat islands facing prolonged heat exposure. Community meetings and interviews have repeatedly raised the issue of lack of permanent infrastructure investments to reduce heat peaks. One resident explained, "We do not have any community cooling centers nearby—the nearest one closed at 5 p.m. There are summer days when the apartment is unbearable, and it does not have to be a heatwave. Also, this past year there were many high-temperature days in early May, and most cooling centers opened only after June 15th. These centers were not helpful even though we wanted to use them. I think about elderly and disabled people . . . what would they do? With so many early heat waves, perhaps these centers should revise their timings and schedule."[69]

Transportation was raised as both a resource and a barrier for people trying to travel to cooler places during heat events. Cooling centers are not easily accessible to Dorchester residents whose travel to these facilities requires walking to nearby bus or train facilities and subsequently waiting at an overheated bus stop or on a subway platform during high-temperature days. This may limit access to these centers during heat events for residents, older adults, and people with disabilities. While some community members positively referenced transportation programs for seniors or paratransit for individuals with disabilities, an underlying concern across a diversity of participants reported either not having awareness of these centers or not being comfortable visiting the centers for heat relief.[70]

Tree Equity and Green Gentrification

Several planning documents have frequently referenced the positive effects of tree canopies on reducing urban heat island footprint.[71] Currently, 28 percent of Boston's land area is covered by trees. This percentage is significantly less than other urban areas in Massachusetts state, which have about 65 percent of land covered by trees.[72] Neighborhoods such as Chinatown and Dorchester have a significantly lower proportion of tree canopies. Boston has made little progress in increasing tree canopies as recommended in its most recent Open Space Plan.[73] The number of roads, sidewalks, and other impermeable surfaces and the demand for more housing reduce the space available to plant trees. One resident commented, "There is not a single tree in our area. Walking around the neighborhood and to the transit is hard during the summer months. The streets feel boiling!"[74]

While there are significant disparities in shaded green spaces and tree cover in the areas experiencing increasing heat issues, the fear of green gentrification is also apparent within the community. "Green infrastructure" has been used as a primary urban planning intervention for mitigating climate change impacts (such as flooding, heat, etc.) in Boston.[75] However, there is growing anxiety among residents who associate green spaces with gentrification. Some community leaders fear that green spaces designed to combat different forms of climate change, including extreme heat, may push out the poor and working-class residents. Interviewees emphasized public decisions that had disadvantaged their communities over many generations, from redlining that led to years of disinvestment to interstate highway projects that demolished several Black neighborhoods.

One resident expressed their displacement concerns in the following way: "Many residents in the area are already concerned about 'gentrification' in the neighborhood. Rents are rising, and many of our friends' families are displaced. Plans to create parks and green spaces without consideration around the area may foster the problem. There is widespread fear among communities of being pushed out."[76]

The theory of green gentrification is an emerging concept in peer-reviewed literature as well as in popular discourse. It is based on the idea that adaptation projects through green infrastructures contribute to differences in property value and thus contribute to the displacement of former residents searching for more affordable housing and neighborhood options elsewhere. Some of the recent scholarly work highlights the strong association between green spaces and displacement in cities such as Atlanta (Fourth Ward), Austin, and Boston (East Boston).[77] In particular, East Boston has become one of the most gentrifying areas of the city largely experiencing this phenomenon.[78] While the literature on green gentrification suggests looking at just planning to help prevent green gentrification, not many development projects have been inspired by those lessons.[79]

DISCUSSION

Over the years, urban heat research has affected two central areas of planning: heat risk response and urban heat management. Heat risk response refers to an emergency dimension of planning, emphasizing municipal strategies focusing on short-term strategies during extreme heat events.[80] Examples of this type of planning include improved forecasting, early heat warning system, emergency shelters, and cooling stations. In contrast, urban heat management refers to municipal heat management strategies designed to reduce heat exposure, intensity, and duration during and after periods of extreme heat events.[81] Examples include urban greening and albedo modification using reflective and lighter-color materials in urban infrastructures such as streets and parking lots.[82]

From the onset of heat planning in the 1970s, heat has been understood as an "emergency" issue. It is the primary reason extreme heat issues are typically categorized under public health and emergency management issues.[83] Scholars in disaster management believe that heat should not be recognized only as an "emergency" issue but should also have a "chronic"

challenge to be managed. For some scholars, defining heat as an emergency issue reflects a reactive approach to this problem that fails to consider the extreme vulnerability of marginalized populations to this aspect of climate change.[84] However, scholars in the natural hazard mitigation planning paradigm seek to integrate both approaches by defining urban heat management as "local planning actions to lessen the exposure to the risk through mitigation and recovery action."[85] Boston's extreme heat planning approach is ahead of state-wide adaptation planning efforts because it is crafting planning, regulatory, and management measures explicitly dealing with expected heat waves. However, the effectiveness of its efforts may be undermined by the limited effort it has made, in neighborhoods such as Dorchester, to engage those directly affected by extreme heat and heatwaves in the planning process.

Boston's extreme heat planning approach's effectiveness may also be limited by the lack of a comprehensive extreme heat mitigation and management plan. This issue is even more relevant to environmental justice communities such as Dorchester, where the disconnection between residents' needs and concerns and provided programs appears problematic. While the piecemeal approach versus a more comprehensive approach has been assessed as problematic in this research, it also is an issue that the city is currently trying to address. As we are writing this chapter, the City of Boston published its first "heat resiliency study." The analysis of this recent study was not part of the research scope presented in this chapter, and additional work is needed to understand its impacts in local communities such as Dorchester. Our preliminary set of community interviews and participant observations in Dorchester surfaced a few constructive recommendations designed to strengthen heat planning practices in Dorchester:

- **RECONSIDER PRIORITIES.** The first recommendation acknowledges the need to bring heat planning to the forefront of climate change policy making. Since Boston is considered one of the cities most vulnerable to sea level rise and coastal and inland flooding, it is challenging to prioritize extreme heat.[86] At the moment, extreme heat planning advocates must compete for limited time and resources to secure the attention of important public and private sector development actors who are focused on other climate change priorities.

Technical assessments determining what should be considered a climate change priority need to be revisited and reevaluated to include issues such as extreme heat often overlooked within the mainstream climate change agenda. Most importantly, community needs, struggles, values, and experiences need to be studied and prioritized in decision making to create socially sensible adaptation actions.

- **LEARN THROUGH PRACTICE.** The second recommendation is to use the heat planning process as an immediate testing ground for true inclusive and equitable processes. Heat can be an inconvenience for some individuals and communities, but it can also be lethal for the vulnerable and marginalized. Our research shows that increasing heat exposure deeply impacts the daily lives of poor and working-class communities. It shows that the current heat management strategies are driven by approaches grounded in knowledge generated through expert-driven vulnerability assessments and are often translated from contexts where climate, weather, and microclimatic variation are different. Additionally, questions on the wide applicability of concrete strategies for cooling emerged. These are related, for instance, to the accessibility of cooling centers, the high energy burdens that residents must sustain for air conditioners, and the creeping fear of being displaced in the name of landscape upgrades for resilience planning. Those flags push for a renovated research agenda focused on reevaluating the understanding of heat issues among different demographics to generate new pathways to make heat planning more effective and equitable.
- **LOOK BACK TO LOOK FORWARD.** A third recommendation is to look critically at the existing old infrastructural system. Like many cities in New England, Boston has a very old infrastructural system that is often taken for granted in adaptation planning. In the context of our research, this topic is relevant because many of the neighborhoods historically neglected from public investments have suffered from a lack of infrastructure upkeep. In these neighborhoods, a careful and detailed restoration planning and design approach should be

undertaken to upgrade existing and deteriorated public infrastructures to address climate change concerns. In recentering the focus of adaptation to forms of rehabilitation of the built environment in disenfranchised communities, it is crucial to experiment with new forms of community-led planning processes. Such processes would guarantee an upgrade of those infrastructures so that communities have power in the decisions affecting their living environment and control the management of newly established projects/programs. On the one side, this approach will foster enhanced initiatives for heat planning and bring much-needed public attention to long-forgotten areas of the city; on the other, it will advance concrete examples of community-led development that would foster social cohesion in those neighborhoods. Such efforts are long overdue in these contexts where skepticism toward government-led initiatives on resilience keeps ramping up, and genuinely community-sensitive approaches are needed to address serious climate concerns.

CONCLUSIONS: WHAT FORM OF HEAT PLANNING SHOULD BE FOSTERED?

In Boston, the overall planning response to extreme heat impacts across the city has relied on efforts that parallel the national trend. On the one hand, there is a stark separation in approaches between "emergency" and "chronic" planning objectives and strategies; on the other hand, there is little overall clarity about who is responsible for specific kinds of initiatives. This latter issue results in a scattered approach inconsistent with a potential comprehensive planning process. The shortcomings of our existing approaches to extreme heat planning are currently emerging from the voices of those who experience firsthand adaptation management and emergency measures for heat and call for alternative adaptation planning strategies.

The previous reflections on preliminary participant observation and resident interview data presented in this chapter offer a cautionary tale for climate change planning in Dorchester and, more generally, in Boston. These

data suggest that engagement processes focused on climate change planning need to take a two-pronged approach. They must combine collective reflections on the meaning of technology and technical solutions to climate change with research focused on local concerns not directly related to climate. In other words, there is an urgent need to have planning processes in place that, while continuing to look at technical innovations, need deeper engagement with communities to reflect on the effect of those innovations and collectively decide what actions need to be prioritized and fostered.

As researchers within the Department of Urban Planning and Community Development (UPCD) at the University of Massachusetts Boston, we seek to make concrete, more inclusive approaches to planning for resilience. The Summer Immersion in Community Resiliency Planning Program has been developed by UPCD in partnership with the Boston Planning and Development Agency (BPDA), Boston Public Schools, and Madison Park Technical Vocational High School to design a summer "immersion" program. The pilot program in summer 2022 establishes a four-week experiential class for fifteen high school students of Madison Park Vocational Technical School in collaborative research with residents and leaders to determine the nature, extent, and impact of extreme heat on current residents. This experience constitutes an innovative community/university partnership experiment to collectively reflect on dealing with a critical climate-related issue affecting one of the most underserved communities and then explore community-led urban planning, policy, and design mitigation strategies. While its results are yet to come, it is relevant in this context to share its launch as a concrete example in the effort to implement new forms of collaboration between local communities and long-term established institutions (such as the BPDA) to shape better approaches to heat planning.[87]

NOTES

1 David Reidmiller, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, et al., Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, vol. 2 (Washington DC: US Global Change Research Program, 2018), https://nca2018.globalchange.gov/.

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