

Background Report: Extreme Heat Policy Review

Prepared on behalf of A Better City



Authors:

Tanya Stasio, PhD

Elisabeth Seliga

Jordan Burt

Lila McNamee

Elizabeth A. Stanton, PhD

Applied Economics Clinic

December 2024



Applied Economics Clinic

Economic and Policy Analysis of Energy, Environment and Equity



Table of Contents

I. Introduction	1
II. Disparate extreme heat impacts in Massachusetts.....	4
III. Massachusetts’ Extreme Heat Policy Landscape	10
IV. Extreme Heat Policy Best Practices in the United States.....	19
V. Recommendations for Massachusetts Policymakers to Address Extreme Heat	30

I. Introduction

Extreme heat—a stretch of two or more days with high humidity and temperatures above 90 degrees Fahrenheit—is becoming more common across the United States due to climate change.¹ The 10 hottest years on record since 1850 have all occurred since 2013, and more than half of U.S. states experienced a top-10 warmest year in 2023.² In Massachusetts, the number of days with temperatures above 90 degrees has remained above the 1950 to 2020 average in every year since 2010.³ According to the Massachusetts Department of Energy and Environmental Affairs’ (EEA’s) *2022 Massachusetts Climate Assessment*, the Commonwealth’s summers are expected to be warmer on average, with more frequent periods of extreme heat.⁴ For example, by 2050 Massachusetts residents are expected to experience 19 to 25 more extreme heat days annually.⁵ On behalf of A Better City, this background report (1) provides a discussion of extreme heat in Massachusetts and the disproportionate impact on low-income and Black, Indigenous, and People of Color (BIPOC) communities, (2) reviews policies to address extreme heat in the Commonwealth and across the United States, and (3) makes recommendations to Massachusetts policymakers for further actions to address extreme heat. This background report supports an accompanying policy brief, *Tackling Extreme Heat: Recommendations for Strengthening Massachusetts Policy*.⁶

For people living in urban areas, the effects of extreme heat are especially severe due to the urban heat island effect, a phenomena that occurs in city areas with more structures (i.e. buildings and roads) that re-emit heat absorbed from the sun more than natural landscapes.⁷ In 2019, heat mapping as part of the Museum of Science’s Wicked Hot Boston project revealed that lacking shade from trees and with more heat-absorbing surfaces like concrete streets, urban areas can become 10 to 15 degrees Fahrenheit warmer than suburban areas.⁸ Similar findings were made in multiple publications including *Heat Resilience Solutions for Boston* and the Metropolitan Area Planning Council’s (MAPC) Wicked Hot Boston heat index analysis.⁹ As a result of the urban heat island effect, the hottest areas within each

¹ World Health Organization. May 28, 2024. “Heat and Health.” Available at: <https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health>

² Cybersecurity & Infrastructure Security Agency. n.d. “Extreme Heat.”

³ NOAA. 2022. *State Climate Summaries – Massachusetts*. National Center Centers for Environmental Information. Available at: <https://statesummaries.ncics.org/downloads/Massachusetts-StateClimateSummary2022.pdf>

⁴ Massachusetts EEA. 2022. *Massachusetts Climate Change Assessment*. Available at: <https://www.mass.gov/doc/2022-massachusetts-climate-change-assessment-december-2022-volume-ii-statewide-report/download>. p. 18.

⁵ Ibid. p. 19

⁶ Stasio, T., Seliga, E., Burt, J. McNamee, L., and Stanton, E.A. 2024. *Tackling Extreme Heat: Recommendations for Strengthening Massachusetts Policy*. Applied Economics Clinic. Prepared on behalf of A Better City. Available at: <https://aeclinic.org/publicationpages/12/2024/tackling-extreme-heat-recommendations-for-strengthening-massachusetts-policy>

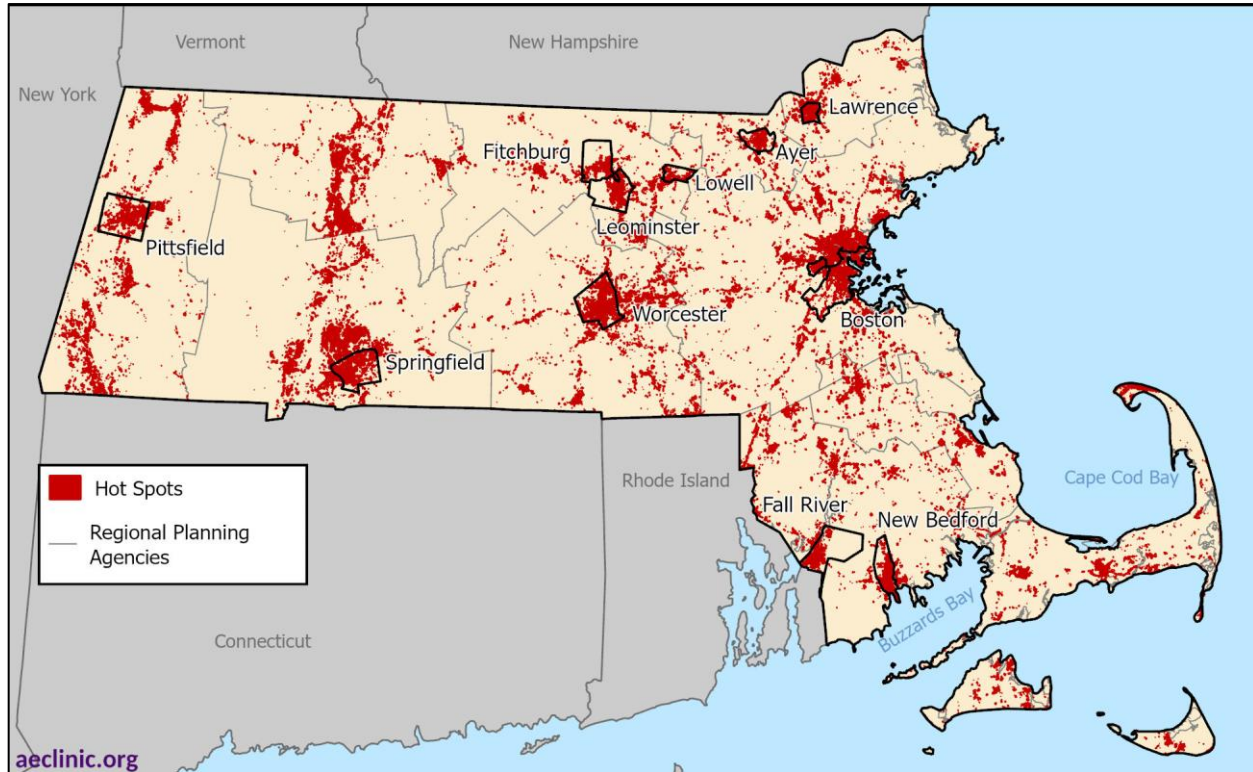
⁷ U.S. EPA. n.d. “Learn About Heat Islands.” Available at: <https://www.epa.gov/heatislands/learn-about-heat-islands>

⁸ (1) Museum of Science. July 30, 2019. “Wicked Hot Boston.” Available at: <https://www.mos.org/case-study/wicked-hot-boston>; (2) Gambill, I. May 2023. *Addressing Extreme Heat in Boston: Engaging the Business Community in Heat Resilience Solutions*. A Better City. Available at: <https://www.abettercity.org/docs-new/extreme%20heat%20primer%2051123.pdf>

⁹ (1) City of Boston. 2022. *Heat Resilience Solutions for Boston*. Available at:

Massachusetts Regional Planning Agency (RPA) region (defined as “hot spots”) are clustered around cities including: Ayer, Boston, Fall River, Fitchburg, Lawrence, Lowell, Leominster, New Bedford, Pittsfield, Springfield, and Worcester (see Figure 1).¹⁰

Figure 1. Massachusetts hot spots



Note: The 5 percent of surface area with the highest Land Surface Temperature (LST) Index in each RPA region is designated as “hot spots”. The LST Index is based on surface temperature from days in 2018 – 2020 when the high temperature exceeded 70 degrees Fahrenheit. For more information, see data source.

Data source: Massachusetts Executive Office of Energy and Environmental Affairs (MA EEA). 2022. “Hot Spots” [Shapefile]. ResilientMass Maps and Data Center. Available at: <https://resilientma-mapcenter-mass-eoea.hub.arcgis.com/datasets/Mass-EOEFA::hot-spots/about>

In addition to the urban heat island effect, low-income communities and BIPOC neighborhoods across the Commonwealth face a disproportionate risk of extreme heat in part due to lack of community investment

https://www.boston.gov/sites/default/files/file/2022/04/04212022_Boston%20Heat%20Resilience%20Plan_highres-with%20Appendix%20%281%29.pdf; (2) Shyduroff, S. 2019. “Wicked Hot Boston: Documenting Extreme Heat in the Greater Boston Area.” MAPC. Available at: <https://www.mapc.org/planning101/wicked-hot-boston-documenting-extreme-heat-in-the-greater-boston-area/>

¹⁰ RPA hot spots were determined based on land surface temperature data and do not account for humidity or other heat-exacerbating weather conditions that may make it feel hotter. Statewide data on the heat index—a measure that considers both air temperature and humidity—is not publicly available online. See: Massachusetts Emergency Management Agency. n.d. “Extreme Heat Safety Tips.” Available at: <https://www.mass.gov/info-details/extreme-heat-safety-tips>

from historical discrimination (i.e., redlining practices¹¹). In particular, redlining practices have left low-income and BIPOC communities in hot spot areas less equipped to handle extreme heat events; for example, these communities are more likely to live in neighborhoods that lack green spaces and in homes that have inefficient heating and cooling systems. Low-income and BIPOC communities are more likely to live in dense urban areas and are, therefore, disparately exposed to the urban heat island effect compared to neighborhoods that are less densely populated and have not been impacted by redlining.¹² For example, the Wicked Hot Boston project¹³ found previously redlined neighborhoods in the Greater Boston Area tend to experience higher temperatures compared to non-redlined neighborhoods.¹⁴

In addition to increased risk of heat stress or stroke, extreme heat can exacerbate pre-existing health conditions including cardiovascular disease, diabetes, mental illnesses, asthma, and other chronic illnesses.¹⁵ Older adults, infants and children, people with disabilities, workers without reliable access to cooling, unhoused people, incarcerated people, low-income communities, pregnant people, people using substances, and communities of color are most at risk for heat-related illnesses like heat exhaustion or heat stroke.¹⁶ Certain medications can also increase vulnerability to extreme heat; these include diuretic, antihistamine, and antipsychotic medicines which hinder the body's ability to cool itself.¹⁷

Due to the health risks posed by high temperatures and the increased incidence of heat-related illnesses across the United States, the U.S. Senate Joint Economic Committee reports that the economic costs of extreme heat are rising.¹⁸ In addition, the Federal Emergency Management Agency (FEMA) recently held the 2024 Federal Heat Summit that focused on strategies to combat extreme heat and prepare for increasing risks nationwide.¹⁹ A 2021 study supported by the Adrienne Arsht-Rockefeller Foundation

¹¹ Redlining is a discriminatory practice whereby particular areas or households are denied access to services (e.g., mortgages, loans, etc.) solely based on their racial or ethnic demographics. See: Cornell Law School. "Redlining." *Legal Information Institute*. Available at: <https://www.law.cornell.edu/wex/redlining>

¹² (1) Hsu, A., Shandas, V., Manya, A., Vecellio, D. J. 2023. "Urban Heat Hot Spots." Climate Central. Available at: <https://www.climatecentral.org/climate-matters/urban-heat-islands-2023>; (2) Hoffman, J. S., Shandas, V., and Pendleton, N. 2020. "The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas." *Climate* 2020, 8(1), 12. <https://doi.org/10.3390/cli8010012>; (3) EPA. N.d. "Heat Islands and Equity." Available at: <https://www.epa.gov/heatislands/heat-islands-and-equity#selected-bibliography>

¹³ Museum of Science. July 30, 2019. "Wicked Hot Boston." Available at: <https://www.mos.org/case-study/wicked-hot-boston>;

¹⁴ (1) Gambill, I. May 2023. *Case Studies: How Boston Organizations and Institutions Can Engage in Community Heat Resilience Initiatives*. A Better City. Available at: <https://www.abettercity.org/docs-new/extreme%20heat%20case%20studies%2051123.pdf>;

(2) Gambill, I. May 2023. *Addressing Extreme Heat in Boston: Engaging the Business Community in Heat Resilience Solutions*.

¹⁵ World Health Organization. May 28, 2024. "Heat and Health."

¹⁶ (1) National Integrated Heat Health Information System. n.d. "Who Is Most At Risk To Extreme Heat?" Available at:

<https://www.heat.gov/pages/who-is-at-risk-to-extreme-heat>; (2) U.S. CDC. June 21, 2024. "Extreme Heat and Your Health."

Available at: https://www.cdc.gov/extreme-heat/about/?CDC_AAref_Val=https://www.cdc.gov/disasters/extremeheat/heat_guide.html

¹⁷ U.S. Department of Health and Human Services (HHS). N.d. "Extreme Heat." <https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/climate-health-outlook/extreme-heat/>

¹⁸ Joint Economic Committee. August 10, 2023. "The Mounting Costs of Extreme Heat." Available at:

<https://www.jec.senate.gov/public/index.cfm/democrats/2023/8/the-mounting-costs-of-extreme-heat>

¹⁹ FEMA. 2024. "Biden-Harris Administration Announced Extreme Heat Summit Series to Advance Nationwide Climate Resilience Goals." Available at: <https://www.fema.gov/press-release/20240419/biden-harris-administration-announces-extreme-heat-summit-series-advance>

Resilience Center found that around \$100 billion is lost each year from lower labor productivity due to extreme heat.²⁰

This Applied Economics Clinic background report prepared on behalf of A Better City examines the disproportionate impact of extreme heat on Massachusetts' low-income and BIPOC communities and reviews policies to address extreme heat in the Commonwealth and across the United States to inform recommendations to Massachusetts policymakers. The remainder of this report is organized as follows: Section II summarizes the existing distribution of extreme heat vulnerability in the Commonwealth. Section III outlines the existing Massachusetts extreme heat policy landscape. Section IV discusses short- and long-term extreme heat best practices seen across the United States. Finally, Section V provides recommendations to support the Commonwealth's efforts to combat extreme heat. This background report supports an accompanying policy brief, *Tackling Extreme Heat: Recommendations for Strengthening Massachusetts Policy*.²¹

II. Disparate Extreme Heat Impacts in Massachusetts

To assess which Massachusetts populations are most vulnerable to climate hazards including extreme heat, MAPC created the *Climate Vulnerability in Greater Boston* tool.²² The tool combines indices of heat island exposure with indicators of sensitivity to extreme heat and adaptive capacity to produce a heat vulnerability index. Specifically, MAPC assigns a heat vulnerability score and subsequent category (e.g., “Moderately High Risk”) according to heat island exposure²³ and a series of sensitivity and adaptive capacity indicators that consider characteristics that make residents more vulnerable to heat (e.g., overcrowding, building age, outdoor and indoor work environments with high heat exposure, health risks, and myriad socioeconomic characteristics).²⁴ Greater Boston municipalities with the largest number of neighborhoods—geographically defined using census tract²⁵ boundaries—at Moderately High or Extremely High Risk for extreme heat are Boston, Chelsea, Everett, Lynn, Malden, and Revere (see the left panel of Figure 2 below).

²⁰ Atlantic Council and Vivid Economics. 2021. *Extreme Heat: The Economic and Social Consequences in the United States*. Prepared for the Adrienne-Arsht Rockefeller Foundation Resilience Center. Available at: <https://www.atlanticcouncil.org/wp-content/uploads/2021/08/Extreme-Heat-Report-2021.pdf>

²¹ Stasio, T., Seliga, E., Burt, J. McNamee, L., and Stanton, E.A. 2024. *Tackling Extreme Heat: Recommendations for Strengthening Massachusetts Policy*. Applied Economics Clinic. Prepared on behalf of A Better City. Available at:

<https://aeclinic.org/publicationpages/12/2024/tackling-extreme-heat-recommendations-for-strengthening-massachusetts-policy>.

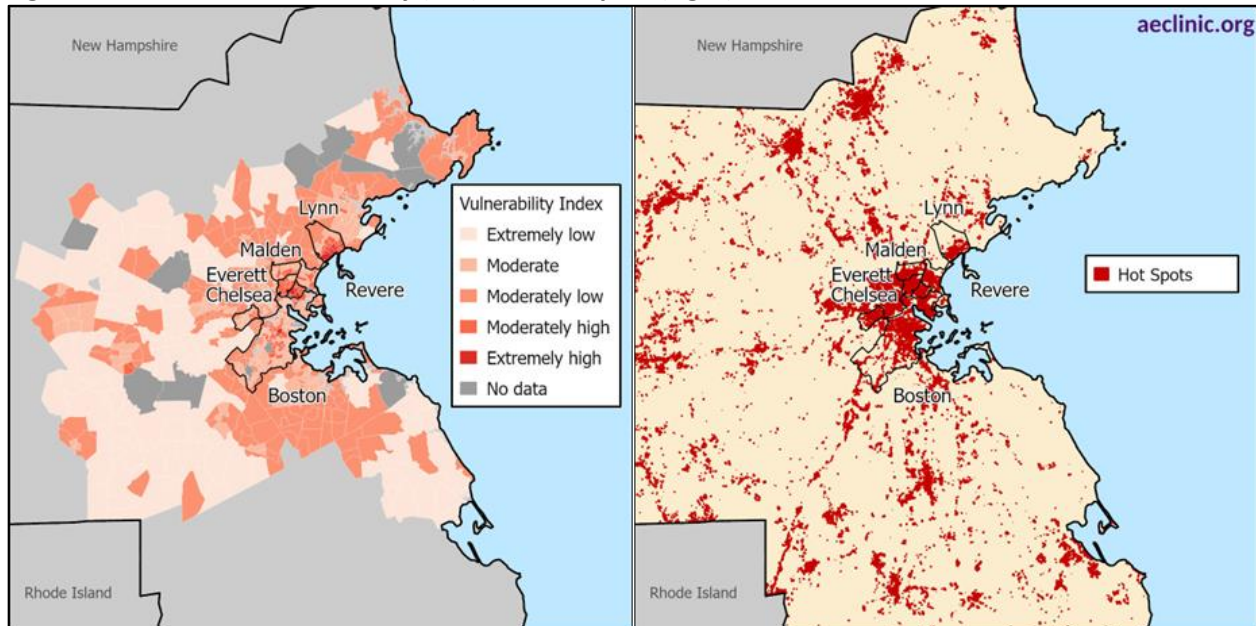
²² MAPC. 2019. “Climate Vulnerability in Greater Boston.” Available at: <https://climate-vulnerability.mapc.org/>

²³ MAPC estimates heat island exposure using land cover data, land parcel data and satellite imagery. The measure estimates the degree at which surface properties result in a local temperature increase. For more information see: MAPC. 2019. *Climate Vulnerability in Greater Boston Technical Documentation*. Available at: https://climate-vulnerability.mapc.org/assets/data/MAPC_ClimateVulnerability_Technical-Documentation_2019-12-10.pdf

²⁴ MAPC. 2019. *Climate Vulnerability in Greater Boston Technical Documentation*.

²⁵ Census tracts have a population size of 1,200 to 8,000 people. For more information see: U.S. Census. n.d. “Glossary.” Available at: <https://www.census.gov/programs-surveys/geography/about/glossary.html>

Figure 2. MAPC heat vulnerability (left) and hot spots (right)



Data sources: (1) MAPC. 2019. *Climate Vulnerability Dataset [Workbook]*. Available at: <https://climate-vulnerability.mapc.org/>; (2) MA EEA. 2022. "Hot Spots" [Shapefile]. ResilientMass Maps and Data Center.

Residents of municipalities facing high heat vulnerability also have higher than average shares of limited-English speaking households and BIPOC residents. These areas also have lower median incomes, a higher share of renter-occupied households, and a higher share of households living below 150 percent of the poverty line than Massachusetts statewide (see Table 1 below). As a result, Boston, Chelsea, and Lynn—the cities with the largest number of MAPC-identified high heat vulnerability census tracts—are composed largely of Massachusetts Environmental Justice communities (see Figure 3, Figure 4, and Figure 5 below). The Massachusetts EEA defines Environmental Justice populations as census block groups in which:

- “The annual median household income is 65 percent or less of the statewide annual median household income and minorities make up 40 percent or more of the population;
- 25 percent or more of households identify as speaking English less than "very well"; and/or
- Minorities make up 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.”²⁶

A 2020 article published in *Science of the Total Environment* found that the physical housing characteristics (e.g., building age, cooling systems) of a particular neighborhood can make it more difficult for residents to

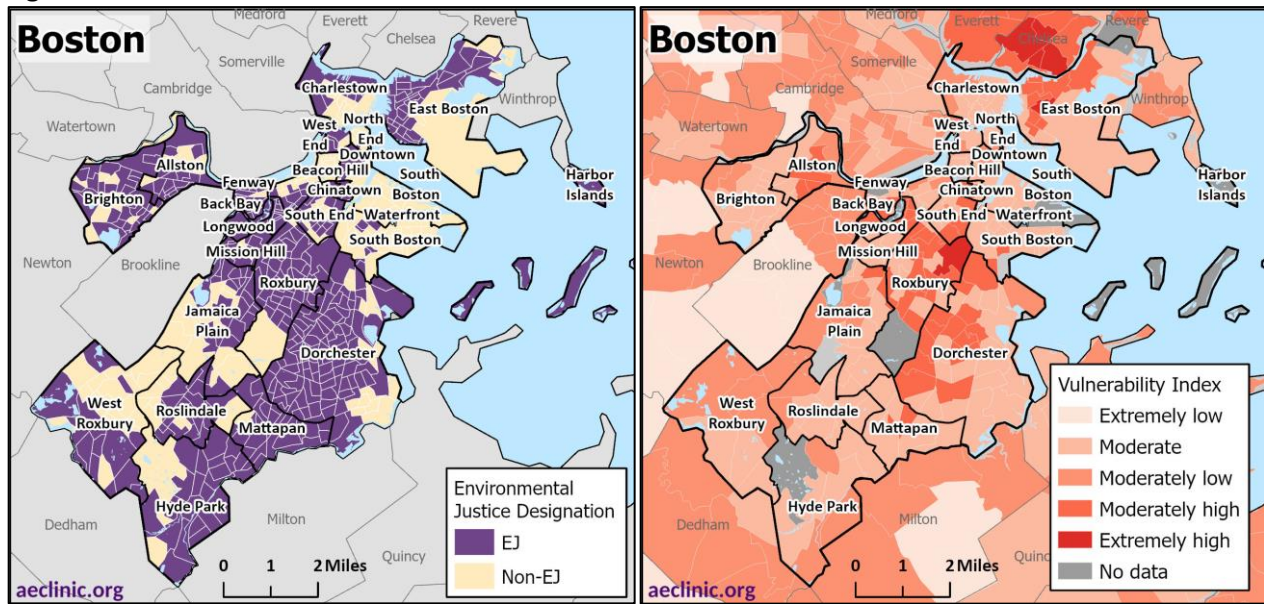
²⁶ Massachusetts EEA. 2022. “Environmental Justice Populations in Massachusetts.” Available at: <https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts>

Table 1. Demographics of MAPC high-heat vulnerability cities in the Greater Boston Area

City	Total Population	Median Household Income (\$)	Below 150% of the Poverty Line (%)	Limited English-speaking (%)	BIPOC (%)	Children (%)	Older Adults (%)	Disabled (%)	Renters (%)
Boston	665,945	\$89,212	11%	11%	56%	16%	12%	12%	65%
Chelsea	39,890	\$71,051	15%	27%	80%	23%	10%	14%	72%
Everett	48,685	\$77,796	16%	19%	60%	22%	11%	12%	64%
Lynn	100,653	\$70,046	12%	18%	64%	24%	13%	14%	51%
Malden	65,463	\$90,295	9%	17%	56%	18%	13%	10%	57%
Revere	60,577	\$78,968	8%	16%	53%	20%	15%	13%	49%
MA Statewide	6,984,205	\$79,561	7%	6%	31%	20%	17%	12%	38%

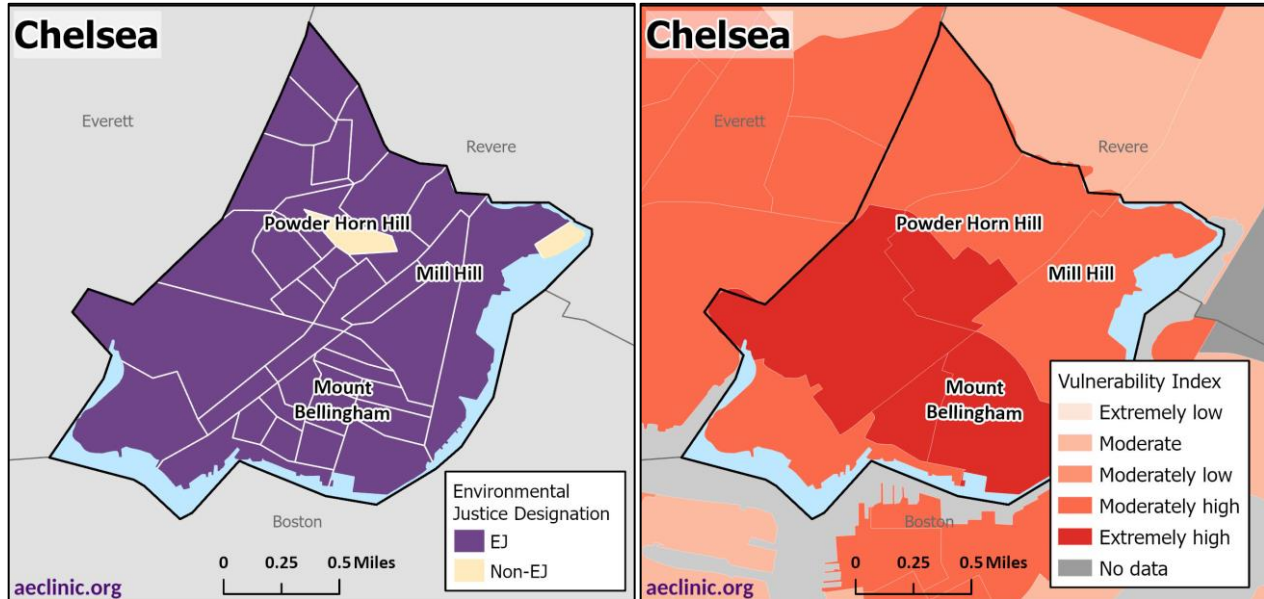
Data source: U.S. Census. 2022 ACS 5-Year Estimates [Tables: B03002, B19013 S1701, C16002, B03002 S0101 and S1810].

Figure 3. Massachusetts Environmental Justice communities in Boston



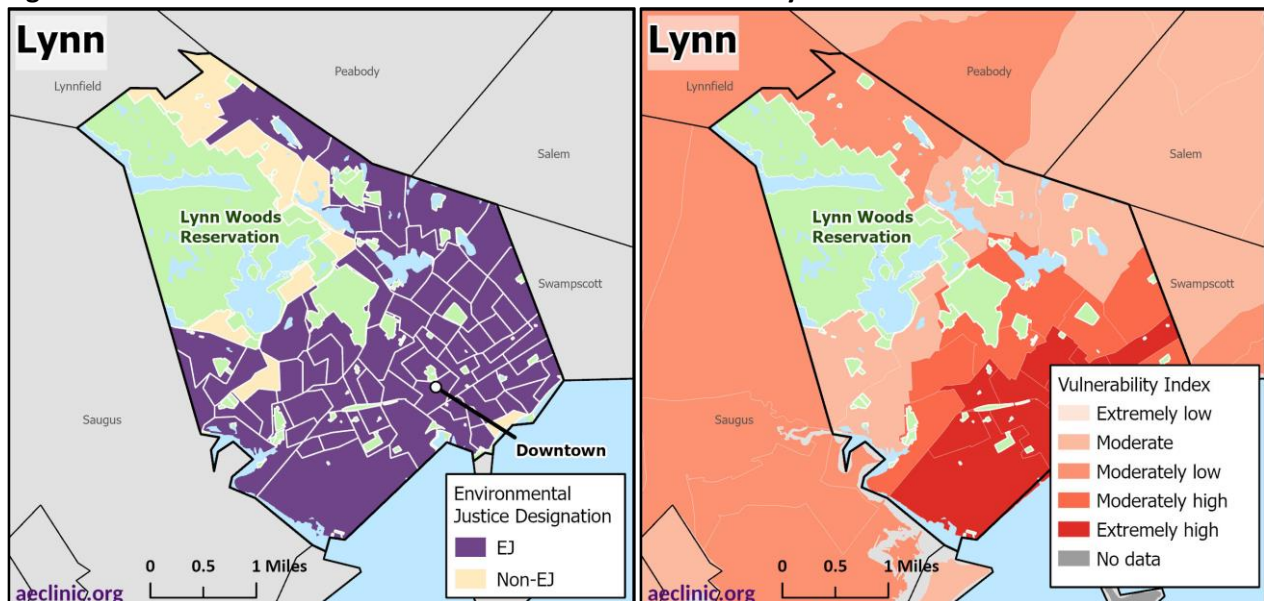
Data sources: (1) U.S. Census. 2022 ACS 5-Year Estimates [Tables: B19013, C16002, and B03002]; (2) MAPC. 2019. Climate Vulnerability Dataset [Workbook].

Figure 4. Massachusetts Environmental Justice communities in Chelsea



Data sources: U.S. Census. 2022 ACS 5-Year Estimates [Tables: B19013, C16002, and B03002]; (2) MAPC. 2019. Climate Vulnerability Dataset [Workbook].

Figure 5. Massachusetts Environmental Justice communities in Lynn



Data sources: (1) U.S. Census. 2022 ACS 5-Year Estimates [Tables: B19013, C16002, and B03002]; (2) MAPC. 2019. Climate Vulnerability Dataset [Workbook].



cool down during extreme heat events.²⁷ Moreover, despite access to cooling systems, some households may struggle to afford the cost of using them. In Massachusetts, low-income households face a higher average energy burden—the share of a household’s income spent on energy bills—compared to wealthier households.²⁸ A 2022 multistate study found that housing age, housing crowding ratio, and roof condition play a significant role in predicting risk of heat-related illnesses in a particular area.²⁹ Boston, Chelsea, Everett, Lynn, Malden, and Revere each have a higher share of households living in housing units with 1.5 or more occupants per room compared to Massachusetts statewide (see Table 2).

Table 2. Occupancy in MAPC high-heat vulnerability cities

City	Occupants per Room (%)		
	1.00 or less	1.01 to 1.50	1.51 or more
Boston	96%	2%	2%
Chelsea	91%	6%	4%
Everett	93%	6%	1%
Lynn	91%	5%	4%
Malden	94%	4%	2%
Revere	94%	4%	3%
MA Statewide	98%	1%	1%

Data source: U.S. Census. 2022 ACS 5-Year Estimates [Table: DP04].

According to the U.S. Occupational Safety and Health Administration (OSHA), industries in which workers have suffered heat-related illnesses include agriculture, construction, landscaping, mail and package delivery, and oil and gas well operations.³⁰ Compared to Massachusetts as a whole, in Chelsea, Everett, Lynn, and Revere, a larger share of workers are employed in natural resources, construction, and maintenance (see Table 3 below),³¹ putting these communities at higher risk for extreme heat exposure and heat-related illnesses.

²⁷ Samuelson, H., Baniassadi, A., Lin, A., Gonzalez, P. I., Brawley, T., and Narula, T. 2020. “Housing as a critical determinant of heat vulnerability and health.” *Science of the Total Environment, Volume 720*. Available at:

<https://www.sciencedirect.com/science/article/abs/pii/S0048969720308068>

²⁸ Clark, K. 2022. “Reducing Energy Burden: Resources for Low-Income Residents.” *MAPC*. Available at:

<https://www.mapc.org/planning101/reducing-energy-burden-resources-for-low-income-residents/>

²⁹ Hu, M., Zhang, K., Nguyen, Q.C., Tasdizen, T., Krusche, K.U. 2022. “A Multistate Study on Housing Factors Influential to Heat-Related Illness in the United States.” *International Journal of Environmental Research and Public Health, 19(23):15762*. Available at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9741268/>

³⁰ U.S. Occupational Safety and Health Administration. n.d. “Heat.” Available at: <https://www.osha.gov/heat-exposure>

³¹ U.S. Census. 2022 ACS 5-Year Estimates [Tables: S0802].



Table 3. Workers in occupations associated with heat-related illness

City	Workers in natural resources, construction, and maintenance occupations (%)
Boston	3%
Chelsea	12%
Everett	13%
Lynn	9%
Malden	7%
Revere	12%
MA Statewide	7%

Data source: U.S. Census. 2022 ACS 5-Year Estimates [Table: S0802].

Extreme heat acts as a threat multiplier, with cascading effects impacting not only individuals, but also critical facilities and infrastructure, including transportation, power lines, medical facilities, and more, affecting the broader regional economy and electric grid.³² The federal Cybersecurity & Infrastructure Security Agency notes that infrastructure built in the 1900s and early 2000s was not designed to withstand the impacts of the extreme heat felt today, inflicting approximately \$100 billion annually in costs to the U.S. economy.³³ The U.S. Joint Economic Committee emphasizes the impact that extreme heat can have on the electric grid (largely the capacity of transmission lines) especially given the increase in demand for air conditioning, sometimes resulting in regional blackouts that can be a threat to numerous other critical facilities and emergency services.³⁴ Excessive heat can buckle or warp railway tracks (called “sun kinks”), cause transportation signal systems to malfunction, melt asphalt, and create dangerous working conditions for transportation and utility workers, leading to delays, derailments, and shutdowns for a variety of forms of public transportation.³⁵

Heat-related illnesses also tend to increase hospitalization rates, thereby straining hospital capacity,

³² Cybersecurity and Infrastructure Security Agency (CISA). N.d. “Extreme Heat.” Available at: <https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-heat>

³³ (1) CISA. N.d. “Extreme Weather and Climate Change.” Available at: <https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change>; (2) Cybersecurity and Infrastructure Security Agency (CISA). N.d. “Extreme Heat.” Available at: <https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-heat>

³⁴ Joint Economic Committee. 2023. “The Mounting Costs of Extreme Heat.” Available at: <https://www.jec.senate.gov/public/index.cfm/democrats/2023/8/the-mounting-costs-of-extreme-heat>

³⁵ (1) Ibid; (2) Coalition for Disaster Resilient Infrastructure. “Risks to Critical Infrastructure due to Extreme Heat.” Available at: <https://ndma.gov.in/sites/default/files/PDF/Heatwave-workshop/13012024/session3/CDRI.pdf>



emergency services, and impacting the level of care.³⁶ As a result of the multiple layers of threats posed by extreme heat to communities, critical infrastructure, and regional economies, states across the United States, including Massachusetts, are employing short- and long-term policy interventions for heat resilience.

III. Massachusetts' Extreme Heat Policy Landscape

As discussed in the Commonwealth's *2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan*, Massachusetts is committed to addressing climate change impacts, including extreme heat.³⁷ In addition, the Commonwealth provides several publicly available, online guidance materials to inform the public on extreme heat risks and short-term extreme heat mitigation strategies, but does not require its municipalities to employ these strategies, nor has the Commonwealth published a statewide heat resiliency plan or heat emergency response plan.

Though limited in its scope, the 2020 Massachusetts Department of Conservation *State Forest Action Plan* does identify the expansion of tree cover, particularly in urban areas, as one of three strategies to increase the resistance and resilience of trees and forests to mitigate and adapt to the effects of climate change, such as more frequent and severe extreme heat events.³⁸

Massachusetts' short-term policy solutions to protect workers and residents from extreme heat

Massachusetts' statewide short-term policy solutions to protect workers and residents from extreme heat include: heat warnings and advisories, local cooling centers, online guidance and data tracking tools (see Table 4 below).

Heat warning systems

Heat warning systems alert the public of potentially dangerous weather conditions—like extreme heat—based on climate and weather forecasts.³⁹ These systems can help reduce the impacts of extreme heat by alerting residents and employers to avoid prolonged heat exposure and employ any emergency heat protocols put in place.

³⁶ Center for American Progress. September 2022. "The Health Care Consequences of Extreme Heat are Just the Tip of the Iceberg." Available at: <https://www.americanprogress.org/article/the-health-care-consequences-of-extreme-heat-are-just-the-tip-of-the-iceberg/>

³⁷ Commonwealth of Massachusetts. 2023. *ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan*. Available at: <https://www.mass.gov/doc/resilientmass-plan-2023/download>

³⁸ Massachusetts Department of Conservation and Recreation. 2020. *Massachusetts State Forest Action Plan*. Available at: <https://www.mass.gov/doc/massachusetts-forest-action-plan/download>, p. 88

³⁹ Global Heat Health Information Network. 2022. Health and Climate - Heat Preparedness through Early Warning Systems. Available at: <https://ghhin.org/wp-content/uploads/G7-report-heat-EWS.pdf>



Table 4. Massachusetts’ short-term policy solutions

Policy Solution	Geographic Area	Agency	Description
Heat warning systems	Massachusetts	Massachusetts Emergency Management Agency	Statewide excessive heat watches, heat advisories, and excessive heat warnings based on temperature thresholds
	Boston	Boston Emergency Management Department	Heat emergencies in the City of Boston
Cooling resources	Massachusetts	Massachusetts Bureau of Climate and Environmental Health	Local cooling center locations and guidance for the implementation of new centers
	Boston	City of Boston Emergency Management Department	City of Boston Cooling Resources Map
	Brewster	Town of Brewster Water Department	The Town of Brewster online map of 11 hydration stations
	Cambridge	City of Cambridge Community Development Department	The City of Cambridge Waterplay Map
Worker safety education and guidance	Massachusetts	Massachusetts Department of Labor Standards	Guidance for employers to encourage short term solutions for heat risks
	Massachusetts	Massachusetts Department of Public Health	<i>Heat Illness and Heat Stress and Hydration</i> factsheets guidance for workers
Resident safety education and guidance	Bourne, Littleton, and Plymouth	Massachusetts Coalition of Occupations Safety and Health	Heat illness prevention pilot program to help educate public service workers on heat safety
	Massachusetts	Massachusetts Department of Public Health	<i>Massachusetts Extreme Heat Resource Guide and Extreme Heat Events and Heat and Drought</i> factsheets
Heat illness data tracking	Massachusetts	Massachusetts Department of Public Health	Environmental Public Health Tracking system

During extreme heat events, Massachusetts relies on the U.S. National Weather Service (NWS) warning system at Boston Logan Airport, along with active stations in Bourne/Hyannis, Gloucester, atop Mount Greylock in the northern Berkshires, Worcester, and Leyden to alert workers and residents of dangerously high temperatures.⁴⁰ The Massachusetts Emergency Management Agency monitors three types of heat warnings and advisories issued by the NWS:

- Excessive heat watches are issued when there are favorable conditions for a potential excessive heat warning within 24-72 hours.⁴¹

⁴⁰ (1) Massachusetts Emergency Management Agency. n.d. “Extreme Heat Safety Tips.” Available at: <https://www.mass.gov/info-details/extreme-heat-safety-tips>; (2) National Weather Service. n.d. “Heat.” Available at: <https://www.weather.gov/bgm/heat>

⁴¹ Massachusetts Emergency Management Agency. n.d. “Extreme Heat Safety Tips.”



- Heat advisories are issued when the heat index—a measure of heat that considers both air temperature and humidity⁴²—ranges from 100 to 104 degrees Fahrenheit for two or more hours. (Note: In the City of Boston, heat advisories are issued when the heat index is greater than 90 degrees for 3 days or more, sustained for at least 2 hours each day.⁴³)
- Excessive heat warnings are issued when daytime heat indices exceed 105 degrees Fahrenheit for two or more hours.⁴⁴

When a statewide heat warning, advisory, or watch is issued, it is typically posted on the NWS website as well as reported on local television and radio stations.⁴⁵ The Massachusetts Emergency Management Agency suggests remaining informed of potential events by listening to the National Oceanic and Atmospheric Administration’s Weather Radio for weather-related announcements.⁴⁶ In Boston, heat emergencies are declared when the temperature is greater than 95 degrees for 2 days or more, when the nighttime temperature does not fall below 75 degrees.⁴⁷

Massachusetts Emergency Management Agency lacks an internal extreme weather alert system or emergency preparedness plan; however, Massachusetts residents are able to access the National Integrated Heat Health Information System (NIHHIS) that lists all active NWS alerts and information on extreme heat vulnerability and risk across the nation.⁴⁸

Cooling resources

The Massachusetts Bureau of Climate and Environmental Health (BCEH) collects information on local cooling centers—public air-conditioned buildings like libraries and senior centers—and provides guidance on the implementation of new cooling centers.⁴⁹ These cooling centers can provide relief to individuals during extreme heat events and greatly benefit those who do not have ready access to cooling systems. Despite data collection regarding cooling centers, most major cities in Massachusetts lack accessible online, statewide maps for residents to locate water stations, cooling stations, or other public services in the event of extreme heat. No public maps are available from the BCEH. Municipal resources available

⁴² National Weather Service. n.d. “Heat Forecast Tools.” Available at: <https://www.weather.gov/safety/heat-index>

⁴³ City of Boston Office of Emergency Management. July 9, 2024. “Mayor Wu urges caution as warm weather forecasted throughout week.” Available at: <https://www.boston.gov/news/mayor-wu-urges-caution-warm-weather-forecasted-throughout-week>

⁴⁴ Massachusetts Emergency Management Agency. n.d. “Extreme Heat Safety Tips.”

⁴⁵ National Weather Service. n.d. “Severe Weather Awareness - Heat Waves.” Available at: <https://www.weather.gov/mkx/heatwaves#:~:text=As%20with%20any%20severe%20weather,forecast%20and%20heat%20index%20values>

⁴⁶ Massachusetts Emergency Management Agency. n.d. “Be Informed and Receive Emergency Alerts.” Available at: <https://www.mass.gov/info-details/be-informed-and-receive-emergency-alerts#noaa-weather-radio->

⁴⁷ City of Boston. N.d. “Mayor Wu Declares Heat Emergency July 15-17; Opens Cooling Centers to all Residents.” Available at: <https://www.boston.gov/news/mayor-wu-declares-heat-emergency-july-15-17-opens-cooling-centers-all-residents>

⁴⁸ U.S. National Oceanic and Atmospheric Administration. n.d. *National Integrated Heat Health Information System*. Available at: <https://www.heat.gov/>

⁴⁹ Massachusetts Department of Public Health. 2024. “Cooling Centers Guidance.” Available at: <https://www.mass.gov/info-details/cooling-centers-guidance>

online are very limited:

- The City of Boston’s Cooling Resources Map shows the location of all spray play locations, community center pools, public libraries, cooling centers, and other cooling resources.⁵⁰
- The Town of Brewster provides an online map of 11 hydration stations throughout the Town, which were installed through the Town’s Hydration Station Initiative.⁵¹
- The City of Cambridge Waterplay Map shows residents the location of waterplay features in the area.⁵²

Worker safety, education, and guidance

The Massachusetts Department of Health currently has no statewide mandated standards to protect workers or residents during extreme heat events. In July 2024, a bill before the Massachusetts Legislature that proposed to establish a statewide standard for the prevention of heat illness in outdoor public sector workers was sent to the House Committee on Rules for further study.⁵³ To protect Massachusetts workers, the Massachusetts Department of Labor Standards (DLS) provides guidance to employers to encourage short-term solutions for heat risks. These solutions include providing adequate ventilation, hydration stations, flexible work hours (e.g., shifting to cooler periods of the day), and developing an emergency response plan.⁵⁴ DLS also offers a free consulting program designed to help employers improve worksite safety and health programs more generally in light of potential safety and hazard concerns in high-hazard industries. This program is primarily geared toward smaller businesses in industries such as manufacturing, healthcare, and construction, which are considered high-hazard.⁵⁵ To participate in the program, businesses must have fewer than 250 employees per establishment or 500 employees nationwide.⁵⁶ In addition to state-led health and safety improvement initiatives, the Massachusetts Coalition of Occupational Safety and Health—a nonprofit worker’s rights group—is currently piloting a heat illness prevention program to help educate public service workers on heat safety in the Massachusetts

⁵⁰ City of Boston. 2024. “Keeping Cool in the Heat.” Available at: <https://www.boston.gov/departments/emergency-management/keeping-cool-heat>

⁵¹ Town of Brewster. April 25, 2023. “Hydration Station Initiative Hailed as Success.” Available at: <https://www.brewster-ma.gov/home/news/hydration-station-initiative-hailed-success>

⁵² City of Cambridge. 2023. “Waterplay Map.” Available at: https://www.cambridgema.gov/CDD/parks/waterplaymap?utm_campaign=sproutsocial&utm_medium=social&utm_source=sprout&utm_content=1530370840

⁵³ Massachusetts House No. 4873 (2024). *Order authorizing the committee on Labor and Workforce Development to make an investigation and study of certain Senate documents relative to job training and heat illness.* Available at: <https://malegislature.gov/Bills/193/H4873>

⁵⁴ MA Department of Labor Standards. August 2023. “Preventing Indoor Heat Illness at Work.” [Blog]. Available at: <https://www.mass.gov/news/preventing-indoor-heat-illness-at-work>

⁵⁵ Executive Office of Labor and Workforce Development. 2024. “On-site Consultation Program Summary.” Department of Labor Standards. Available at: <https://www.mass.gov/info-details/on-site-consultation-program-summary>

⁵⁶ Executive Office of Labor and Workforce Development. 2024. “On-site Consultation Program Summary.” Department of Labor Standards.

municipalities of Bourne, Littleton, and Plymouth.⁵⁷

Resident safety, education, and guidance

The Massachusetts Department of Health does not require municipalities to create emergency heat preparedness and response plans, and no statewide plan exists.⁵⁸ The Massachusetts Department of Public Health (DPH) encourages municipalities to create individual emergency heat preparedness and response plans and supports the development by providing online guidance materials, data, and tools.⁵⁹ For example, the *Massachusetts Extreme Heat Resource Guide*⁶⁰ provides educational resources, including fact sheets for residents (Extreme Heat Events,⁶¹ Heat and Drought⁶²) and workers (Heat Illness,⁶³ Heat Stress and Hydration⁶⁴) to help protect themselves from heat-related illnesses.

Despite the Commonwealth's lack of statewide short-term solutions for extreme heat events, some municipalities have identified tailored mitigation strategies to protect their communities during extreme heat events. In 2022, the City of Boston released its *Heat Resilience Solutions for Boston* report, identifying 26 strategies for addressing extreme heat.⁶⁵ Of these 26 strategies, 11 were short-term strategies and focused on improved operations and communications, short-term heat relief, improving local community plans, and increasing education and training around extreme heat:⁶⁶

- **Operations and Communications:** Boston Extreme Temperatures Response Task Force, pre-heat wave resources mobilization, heat sensor networks.
- **Cooling during Heat Waves:** Pop-up heat relief, enhanced and expanded city-run cooling centers, citywide cooling network.

⁵⁷ Enwemeka, Z. July 17, 2024. "Workers struggle to stay cool as summer heat continues to worsen." *Wbur*. Available at: <https://www.wbur.org/news/2024/07/17/massachusetts-heat-and-worker-safety>

⁵⁸ Massachusetts Department of Public Health. 2024. "Climate and Health." Available at: <https://www.mass.gov/climate-and-health>

⁵⁹ Ibid.

⁶⁰ Massachusetts Department of Public Health. July 19, 2024. *Massachusetts Extreme Heat Resource Guide*. Available at: <https://www.mass.gov/doc/extreme-heat-resource-guide-pdf/download>

⁶¹ Massachusetts Department of Public Health. n.d. *Extreme Heat Events*. Available at: <https://www.mass.gov/doc/extreme-heat-events-pdf/download>

⁶² Massachusetts Department of Public Health. n.d. *Heat and Drought*. Available at: <https://www.mass.gov/doc/heat-and-drought-pdf/download>

⁶³ (1) Massachusetts Department of Labor Standards. n.d. *Heat Illness*. Available at: <https://www.mass.gov/doc/heat-illness-prevention-for-employees/download>; (2) Massachusetts Department of Labor Standards. n.d. *Heat Exhaustion Versus Heat Stroke*. Available at: <https://www.mass.gov/doc/heat-exhaustion-versus-stroke/download>; (3) Massachusetts Department of Labor Standards. n.d. *Heat Illness Prevention for Employers*. Available at: <https://www.mass.gov/doc/heat-illness-prevention-for-employees/download>

⁶⁴ U.S. CDC. 2017. *Heat Stress: Hydration*. Available at: <https://www.cdc.gov/niosh/mining/userfiles/works/pdfs/2017-126.pdf>

⁶⁵ City of Boston. April 2022. *Heat Resilience Solutions for Boston*. Available at: <https://www.boston.gov/departments/climate-resilience/heat-resilience-solutions-boston>

⁶⁶ Ibid.

- **Looking out for Neighbors:** Expanded community climate leadership, extreme temperature plans for outdoor workers.
- **Awareness, Education, and Training:** Heat resilience public education campaign, heat survey, expansion of green workforce development for heat resilience.⁶⁷

Heat illness data tracking

DPH also maintains the Environmental Public Health Tracking program, which provides community-level data on expected climate change impacts and extreme heat-related events for each municipality.⁶⁸ These data can be used to inform municipal policymakers and lead to the creation of community-tailored extreme heat solutions. The data are collected from a variety of sources, including, the U.S. Census Bureau American Community Survey, the Massachusetts Office of Geographic Information, the Massachusetts Department of Public Health, the Massachusetts Center for Health Information and Analysis, the Massachusetts Department of Environmental Protection, the U.S. Center for Disease Control (CDC), and the Massachusetts Climate Change Clearinghouse.⁶⁹

Massachusetts' long-term policy solutions for heat resilience

Massachusetts' long-term policy solutions for reducing the impact of extreme heat include broad climate resiliency plans, heat vulnerability data tracking tools, and forestry action plans (see Table 5 below).

Climate Resiliency Plans

Massachusetts' most recent State Hazard Mitigation and Climate Adaption Plan (SHMCAP), called ResilientMass,⁷⁰ was released in 2023 and has six main goals:

- Collaborate and partner with local, regional, and community-based organizations,
- Implement science-based decision-making,
- Ensure Massachusetts has resilient state assets and services,
- Execute adaptive actions to climate change,

⁶⁷ Ibid, p. 197

⁶⁸ Massachusetts Department of Public Health. n.d. "Climate-Enhanced Community Profile." *Massachusetts Environmental Public Health Tracking (EPHT)*. Available at: https://matracking.ehs.state.ma.us/Climate-Change/conceptual-pathways.html?utm_source=mass.gov&utm_medium=webpage&utm_campaign=CCHEALTH

⁶⁹ See for example, the Chelsea community profile: Massachusetts Department of Public Health. 2024. "Community Profile For: Chelsea." https://matracking.ehs.state.ma.us/Climate-Change/conceptual-pathways.html?utm_source=mass.gov&utm_medium=webpage&utm_campaign=CCHEALTH

⁷⁰ Gambill, I. 2023. "Healey-Driscoll Administration Releases ResilientMass, 5-Year Update to the State Hazard Mitigations and Climate Adaptation Program." *A Better City*. Available at: <https://www.abettercity.org/news-and-events/blog/healey-driscoll-administration-releases-resilientmass,-5-year-update-to-the-state-hazard-mitigation-and-climate-adaptation-program>



- Mitigate further negative environmental impacts, and
- Create resilient and equitable infrastructure, ecosystems, and communities.⁷¹

Table 5. Massachusetts’ long-term policy solutions for heat resilience

Policy Solution	Geographic Area	Agency	Description
Climate resiliency plans	Massachusetts	Massachusetts Executive Office of Energy and Environmental Affairs	ResilientMass Plan extreme heat strategies: Heat Flag warning system, improved cooling standards in buildings, and outreach
	Boston	City of Boston Climate Resilience Department	<i>Heat Resilience Solutions for Boston</i> report
	Greater Boston Area	Massachusetts Executive Office of Energy and Environmental Affairs, Metropolitan Area Planning Council, and Pioneer Valley Planning	<i>Climate Resilience Playbook</i>
Heat vulnerability data tracking	Massachusetts	Massachusetts Department of Public Health	Environmental Public Health Tracking system
	Massachusetts	Massachusetts Executive Office of Energy and Environmental Affairs	ResilientMass Climate Resilience Design Standards Tool
	Massachusetts	Metropolitan Area Planning Council	Climate Vulnerability Analysis
Forestry action plans	Massachusetts	Massachusetts Department of Conservation and Recreation	<i>State Forest Action Plan</i>
	Boston	City of Boston Parks and Recreation Department	<i>Urban Forest Plan</i>
	Cambridge	City of Cambridge Public Works Department	<i>Healthy Forest, Healthy City</i>

The ResilientMass Plan identifies a Heat Flag warning system, improved cooling standards in buildings, and targeted environmental justice community outreach as strategies for addressing extreme heat in the Commonwealth.⁷² MAPC, together with the Massachusetts EEA, and Pioneer Valley Planning Commission, is developing a Climate Resilience Playbook, an online interactive tool that policymakers can use to identify

⁷¹ Ibid.

⁷² Ibid.

resilience actions.⁷³

Heat vulnerability data tracking

Beyond the recommendations set forth in ResilientMass and MAPC, Massachusetts does not currently have detailed long-term policy solutions for the impacts of extreme heat or a specific heat resiliency plan. However, like heat preparedness and emergency response plans, the Commonwealth provides online tools to support the development of municipal heat resiliency plans. DPH’s Environmental Public Health Tracking system can be used to support the development of municipality-level heat resiliency plans.⁷⁴ The ResilientMass Climate Resilience Design Standards Tool provides municipal risk ratings, standards for climate resiliency projects, and implementation guidelines for climate-resilient design and development.⁷⁵ Lastly, the MAPC Climate Vulnerability Analysis allows decisionmakers to explore extreme heat vulnerability across different neighborhoods in the Greater Boston Area.⁷⁶

While the Commonwealth has provided statewide guidance materials, some municipalities have taken the initiative to identify tailored long-term mitigation strategies to build more heat-resilient communities. The City of Boston’s 2022 *Heat Resilience Solutions for Boston* report identified 15 long-term strategies in addition to the 11 short-term strategies mentioned above. These long-term strategies were aimed at improving building cooling systems, green spaces, transportation cooling, and planning:⁷⁷

- **Buildings:** Home cooling resources distribution, cool roofs program, home energy retrofits, affordable housing resources and retrofits, and cool schools.
- **Parks, Trees, and Outdoor Spaces:** Enhanced cooling in pocket green spaces and street-to-green conversions, increased shade on municipal sites, expanded drinking fountain network, and planning for future parks.
- **Transportation and Infrastructure:** Cool commutes, energy resilience upgrades and microgrids, cool main streets.
- **Planning, Zoning, and Permitting:** Updated climate resiliency checklist, heat resilience best practice design guidelines, zoning revisions to support cooler neighborhoods.⁷⁸

The Commonwealth has made progress in addressing extreme heat through the recommendations noted in its ResilientMA Plan, but still lacks a statewide heat resiliency plan and only a handful of municipalities

⁷³ MAPC. N.d. “Climate Resilience Playbook.” Available at: <https://www.mapc.org/resource-library/climate-resilience-playbook/>

⁷⁴ Massachusetts Department of Public Health. n.d. “Climate-Enhanced Community Profile.” *Massachusetts Environmental Public Health Tracking (EPHT)*. Available at: https://matracking.ehs.state.ma.us/Climate-Change/conceptual-pathways.html?utm_source=mass.gov&utm_medium=webpage&utm_campaign=CCHEALTH

⁷⁵ ResilientMass. N.d. “Climate Resilience Design Standards & Guidance.” Available at: https://resilient.mass.gov/rmat_home/designstandards/

⁷⁶ MAPC. 2019. “Climate Vulnerability in Greater Boston.” Available at: <https://climate-vulnerability.mapc.org/>

⁷⁷ City of Boston. April 2022. *Heat Resilience Solutions for Boston*.

⁷⁸ Ibid, p. 197

have created their own plans.

Forestry action plans

The Commonwealth of Massachusetts has published a forestry action plan that prioritizes the expansion of urban tree canopy, a key long-term strategy to reduce the impact of the urban heat island effect.⁷⁹ In 2020, the Massachusetts Department of Conservation and Recreation published the statewide forestry plan, the *State Forest Action Plan*, which identifies the expansion of tree cover, particularly in urban areas, as one of three strategies to increase trees' and forests' resistance and resilience to mitigate and adapt to the effects of climate change.⁸⁰

A handful of municipalities, such as Boston and Cambridge, have developed forestry plans to manage extreme heat but several other major cities (e.g., Everett, Lowell, Leominster, New Bedford, Pittsfield, Revere, and Springfield) lack any plans to expand tree canopy coverage. In 2020, the City of Cambridge published the *Healthy Forest, Healthy City* report, which sets several tree canopy expansion goals, including establishing “cool corridors” that are expected to result in a 50 percent reduction of heat island hot spots in the City and requiring a 25 percent minimum canopy coverage for every neighborhood.⁸¹ In 2022, Cambridge planted 837 street trees, increasing the canopy cover around the city and creating more shade.⁸² In 2023, Cambridge announced a goal of 1,000 street trees planted by 2025 and planned to provide an update to the *Healthy Forest, Healthy City report*.⁸³ In 2022, the City of Boston released its *20-Year Urban Forest Plan* identifying tree canopy expansion as a strategy to reduce heat exposure, particularly by shading streets/sidewalks, public rights-of-way, and off-street surface parking lots.⁸⁴

It should be noted that tree planting efforts are limited in their capacity to reduce extreme heat impacts due to high mortality of newly planted trees and constrained funding for tree planting efforts. For example, the City of Boston failed to meet its 2007 goal of planting 100,000 trees and current efforts are being challenged by high tree mortality and limited maintenance.⁸⁵

⁷⁹ Massachusetts Department of Conservation and Recreation. 2020. *Massachusetts State Forest Action Plan*. Available at: <https://www.mass.gov/doc/massachusetts-forest-action-plan/download>

⁸⁰ Ibid, p. 88

⁸¹ City of Cambridge. 2020. *Healthy Forest, Healthy City*. Available at: <https://www.cambridgema.gov/-/media/Files/publicworksdepartment/Forestry/healthyforesthealthycity.pdf>

⁸² City of Cambridge. September 25, 2023. “City's Urban Forestry Efforts are Making Cambridge a Greener and more Resilient Community.” Available at:

<https://www.cambridgema.gov/digital/Stories/thecambridgelifefsummer2023/cityurbanforestryeffortsaremakingcambridgeagreenerandmoreresilientcommunity>

⁸³ Ibid.

⁸⁴ City of Boston. 2022. *Urban Forest Plan*. Available at: <https://www.boston.gov/departments/parks-and-recreation/urban-forest-plan>

⁸⁵(1) City of Boston. N.d. *Open Space Plan 2015-2021: Section 7 Analysis of Needs*. Available at:

https://www.cityofboston.gov/images_documents/Section%207.3.4%20OSP1521%20PublicShadeTrees_tcm3-48300.pdf; (2)

Werbin, Z.R., Heidari, L., Buckley, S., Brochu, P., Butler, L.J., Connolly, C., Houttuijn, Bloemendaal, L., McCabe, T.D., Miller T.K., Hutyra, L.R. 2020. “A tree-planting decision support tool for urban heat mitigation.” *PLoS One*, 15(10). Available at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7544061/>

IV. Extreme Heat Policy Best Practices in the United States

Short-term policy interventions to address extreme heat include the protocols and benchmarks used in advance of and during declared heat emergencies and heat advisories to safeguard workers, maintain emergency services, and ensure grid reliability in the context of peak demand as more residents and businesses turn on air conditioning. Five U.S. states have established heat safety standards (Washington, Oregon, California, Minnesota, Colorado).⁸⁶ In addition, Texas, and New York have active legislation for heat safety standards, and legislation in Delaware and Nevada is under development.⁸⁷

Federal guidance from the CDC and U.S. Environmental Protection Agency (EPA) is available to help inform state and local policymakers on heat emergency preparedness and extreme heat resilience strategies. In 2020, the CDC published *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*. The CDC report highlights several short-term policy solutions employed nationwide to protect workers and residents from exposure to extreme heat, including , cooling services such as cooling centers and water play areas, heat-related illness tracking, community assistance programs and outreach, energy assistance, warning systems, workplace heat alert programs, and emergency response plans.⁸⁸ The CDC also provides a publicly accessible Heat Risk tool, which allows users to input their zip code to view forecasted heat risk and health information such as available healthcare professionals, heat illness information, and local air quality.⁸⁹

The Department of Health and Human Services' *National Heat Strategy for 2024-2030* (Strategy) promotes taking proactive steps to address heat planning, response, and resilience.⁹⁰ The Strategy encompasses efforts from 29 federal departments including the CDC, the National Oceanic and Atmospheric Administration (NOAA), the Health and Human Services' Office of Climate Change and Health Equity (OCCHE), and Federal Emergency Management Agency (FEMA).⁹¹ The primary goals of the Strategy are increasing awareness, using science-based services and solutions, developing an integrated approach, and supporting agencies working to tackle extreme heat.⁹²

OSHA requires that employers provide a workplace setting that is “free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees,” which includes the risks associated with extreme heat.⁹³ In 2016, the National Institute for Occupational Safety and Health (NIOSH) published *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*

⁸⁶ Gallo, A. November 9, 2023. “State Action on Extreme Heat and Worker Protections.” NCEL. Available at: <https://www.ncelenviro.org/articles/state-action-on-extreme-heat-and-worker-protections/>

⁸⁷ Gallo, A. November 9, 2023. “State Action on Extreme Heat and Worker Protections.” NCEL.

⁸⁸ U.S. CDC. 2020. *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*. Available at: <https://stacks.cdc.gov/view/cdc/93705>

⁸⁹ U.S. CDC. n.d. “Heat Risk.” Available at: <https://ephracking.cdc.gov/Applications/HeatRisk/>

⁹⁰ U.S. Department of Health and Human Services. 2024. “Biden-Harris Administration Unveils National Heat Strategy to Protect Community Health from Extreme Heat.” Available at: <https://www.hhs.gov/about/news/2024/08/14/biden-harris-administration-unveils-national-heat-strategy-protect-community-health-extreme-heat.html>

⁹¹ Ibid.

⁹² National Integrated Heat Health Information System and Interagency Working Group on Extreme Heat. N.d. *2024-2030 National Heat Strategy*. Available at: https://cpo.noaa.gov/wp-content/uploads/2024/07/National_Heat_Strategy-2024-2030.pdf

⁹³ U.S. OSHA. n.d. “Heat.” Available at: <https://www.osha.gov/heat-exposure>

that provided eight recommendations for an occupational standard for workers exposed to heat and hot environments, including workplace limits and surveillance, medical monitoring, surveillance of heat-related health events, posting of hazardous areas, protective clothing and equipment, worker information and training, control of heat stress, and recordkeeping.⁹⁴

Long-term policy interventions include policies and programs that are focused on how to promote cooler neighborhoods overtime, by seeking to increase forestry and shade canopy, building decarbonization and building cooling interventions (ex. reflective white roofs, green roofs, passive house design, etc.), and proactive heat-related health treatment through the identification of heat-vulnerable patients. These long-term solutions are designed to provide more permanent heat mitigation by reducing the incidence of hot spots, heat-related illnesses, and exposure to extreme temperatures. They also seek to make residents, businesses, critical infrastructure, communities, and the regional economy more resilient and adaptive to more intense, longer lasting, and consistent heat events over time. As discussed earlier in this report, extreme heat is a threat multiplier with far-reaching ripple effects that affect the local economy, agricultural production, public transportation, and critical infrastructure.⁹⁵ Long-term policy solutions recognize the burden that heat events may place on local communities (through, for example, delays to public transit, altered construction schedules, and/or brownouts or blackouts of the grid) and aim to mitigate or prevent these impacts.

EPA provides a set of long-term strategies to promote heat resilience in communities, including improving the resilience of urban infrastructure by using heat-tolerant materials for bridges, roads, and roofs, encouraging energy efficiency and conservation efforts to reduce stress on the electric grid during extreme heat events, and increasing tree canopy coverage.⁹⁶ Lastly, EPA provides funding opportunities and guidance materials to support communities in preparation for extreme heat and climate-related hazards.⁹⁷ The recommendations from the CDC and EPA align with recommendations made by the Federation of American Scientists, particularly those regarding investment in heat-resilient infrastructure and communities.⁹⁸

With these guidance materials in mind and based on a review of short- and long-term extreme heat policies being employed in states and municipalities across the United States, AEC identifies six best practices for Massachusetts policymakers to look toward in informing extreme heat policies in the

⁹⁴ U.S. CDC and NIOSH. 2016. *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*. Available at: <https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf?id=10.26616/NIOSH PUB2016106>

⁹⁵ McLeod, K. 2021. "Heat is killing us- and the economy too." *Atlantic Council*. Available at: <https://www.atlanticcouncil.org/content-series/the-big-story/heat-is-killing-us-and-the-economy-too/>; Corkery, A. and Yang, J.

2024. "How extreme heat is damaging American transportation infrastructure." *PBS*. Available at: <https://www.pbs.org/newshour/show/how-extreme-heat-is-damaging-american-transportation-infrastructure#:~:text=For%20our%20cars%20and%20trucks,as%20well%20when%20it's%20hot.>; Earth Scan. 2024. "How heatwaves impact infrastructures and ecosystems." Available at: <https://www.earth-scan.com/blog/heatwaves-impact>

⁹⁶ U.S. EPA. n.d. "Adapting to Heat." Available at: <https://www.epa.gov/heatislands/adapting-heat>

⁹⁷ U.S. EPA. April 24, 2024. "EPA's Programs and Actions to Address Extreme Heat." Available at: <https://www.epa.gov/climate-adaptation/epas-programs-and-actions-address-extreme-heat>

⁹⁸ Updike, Bill, Miller, Jacob, Rao, Rhea, and Metzger, Dan. April 1, 2024. *Shifting Federal Investments to Address Extreme Heat Through Green and Resilient Infrastructure*. Federation of American Scientists Available at: <https://fas.org/publication/shifting-to-resilient-infrastructure/>



Commonwealth (see Table 6).

Table 6. Extreme heat policy best practices

Short-term policy solutions	Best Practice #1: Create heat emergency preparedness and response plans and heat resiliency plans informed by temperature monitoring data
	<i>Arizona statewide Extreme Heat Preparedness Plan and Extreme Heat Annex; North Carolina Triangle Regional Resilience Partnership Resilience Assessment</i>
	Best Practice #2: Create and maintain publicly available online data tracking systems on heat-related risk and health impacts
	<i>New York State Department of Health and Maine Department of Health online data tracking systems on heat-related risks and impacts</i>
Short-term policy solutions	Best Practice #3: Establish electric disconnection bans for customers during extreme heat events
	<i>Arizona, the District of Columbia, Georgia, Illinois, Maryland, Missouri, New Jersey, and Oklahoma utility disconnection bans</i>
	Best Practice #4: Provide access to cooling services, distribution of fans, AC units, water and energy subsidies, and enlist community groups to support local residents
Long-term policy solutions	<i>Arizona appointed statewide cooling center coordinator; Ohio "Beat the Heat Fan Campaign"; New York City "Be A Buddy" program; Salvation Army (Arizona) water distribution</i>
	Best Practice #5: Evaluate data-driven state and municipal heat emergency protocols and assess heat advisory thresholds
Long-term policy solutions	<i>Arizona, New York State and New York City, New England, and Arizona heat-health assessments</i>
	Best Practice #6: Invest in critical and green infrastructure to help reduce the impact of extreme heat
Long-term policy solutions	<i>Georgetown Climate Center Green Infrastructure Toolkit; Detroit Climate Action Plan; Atlanta Community School Park Initiative; California Extreme Heat State Action Plan</i>

Best practice #1: Create heat emergency preparedness and response plans and heat resiliency plans informed by temperature monitoring data

Heat emergency preparedness and response plans provide actionable strategies for preventing heat-related illnesses during periods of extreme heat, primarily through the use of short-term policy solutions. These plans can be standalone or an annex to a broader hazard response plan and can be statewide or

specifically for a major city.⁹⁹ In addition, the use of temperature thresholds or triggers for emergency heat response should be based on live temperature monitoring data whenever possible (e.g., temperature sensor data).

Arizona has adopted a statewide *Extreme Heat Preparedness Plan*¹⁰⁰ and *Extreme Heat Incident Annex*,¹⁰¹ and a *2023 City of Phoenix Heat Response Plan*.¹⁰² Along with the release of these plans, Arizona also appointed the nation's first Chief Heat Officer David Hondula.¹⁰³ Each plan details short- and long-term solutions for heat resiliency. For example, the *Extreme Heat Preparedness Plan* notes that the 2025 Executive Budget for the State of Arizona will allocate more money than prior years to hazard mitigation and emergency response efforts, including coverage of upfront emergency response costs.¹⁰⁴ In addition, the *Extreme Heat Preparedness Plan* identifies several approaches to promote resiliency to upcoming extreme heat events, such as:

- Arizona's Department of Health aims to provide more daytime cooling centers and better access to overnight cooling shelters in collaboration with existing community groups that address extreme heat risk in unhoused populations.¹⁰⁵
- Arizona agencies are working together to develop temperature thresholds which trigger heat response activities (e.g., opening cooling centers) based on live temperature monitoring and create an online tool with state and county heat-related illness and death data.¹⁰⁶

A 2024 study in the *International Journal of Disaster Risk Reduction* reviewed and summarized short-term responses to heat in the 25 most populous U.S. states, and highlighted major cities, including Boston, New York, San Diego, Dallas, Columbus, Indianapolis, San Francisco, and Washington, D.C., all of which have developed publicly available heat response plans. The study notes that 10 of the 25 municipalities' studies have heat or social vulnerability indices to identify populations at increased risk for extreme heat impacts.¹⁰⁷ The *2023 City of Phoenix Heat Response Plan* identifies 31 heat response programs and services offered in 2023 that prioritize educational awareness, emergency response, public outreach, access to cool

⁹⁹ U.S. CDC. 2020. *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*. Available at: <https://stacks.cdc.gov/view/cdc/93705>

¹⁰⁰ Arizona Office of the Governor Katie Hobbs. March 1, 2024. *Arizona's Extreme Heat Preparedness Plan*. Available at:

<https://azgovernor.gov/office-arizona-governor/news/2024/03/governor-hobbs-announces-extreme-heat-preparedness-plan>

¹⁰¹ Arizona Department of Health Services. 2021. *Arizona Extreme Heat Incident Annex*. Available at:

<https://www.azdhs.gov/documents/preparedness/emergency-preparedness/response-plans/extreme-heat-incident-annex.pdf>

¹⁰² HeatReadyPHX. April 2023. *Summer 2023 Heat Response Plan*. Available at:

<https://www.phoenix.gov/heatsite/Documents/Heat%20Response%20Plan%202023%20-%20For%20Gen%20Info%20Packet%20Apr19.pdf>

¹⁰³ Arizona Office of the Governor Katie Hobbs. March 1, 2024. *Arizona's Extreme Heat Preparedness Plan*. Available at:

<https://azgovernor.gov/office-arizona-governor/news/2024/03/governor-hobbs-announces-extreme-heat-preparedness-plan>

¹⁰⁴ *Ibid*, p. 14

¹⁰⁵ *Ibid*, p. 15

¹⁰⁶ *Ibid*, p. 17

¹⁰⁷ Kimutis, N., Wall, T., and Darrow, L. January 2024. "Emergency Management Short-term Response to Extreme Heat on the 25 most populated U.S. Cities." *International Journal of Disaster and Risk Reduction*, Volume 100, 104097. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S2212420923005770>. [Table 1].

spaces and drinking water, and that support cool and safe homes, mobility and recreation, and workplaces and schools in the City. For each of these 31 programs, the City of Phoenix identifies the target population for the program and lead departments in charge of its facilitation.¹⁰⁸

Arizona, New York, and North Carolina have published heat resiliency plans and supporting studies to reduce the impact of extreme heat events. The Arizona Department of Health Services published the *ADHS Recommendations and Findings for the Arizona Extreme Heat Preparedness Plan* in 2024, outlining how state and community efforts can be better coordinated and how heat mitigation approaches can be better tailored to meet the needs of communities and individuals, among other things.¹⁰⁹ The 12 recommendations in this plan aim to meet four goals: drive heat relief activities, reduce heat-related illnesses and deaths, prepare for extreme heat, and foster innovative solutions to extreme heat. Some examples of the proposed recommendations include investing in heat mitigation efforts through grants and other funding opportunities, creating a better communication plan to inform the public on resources, improving data systems to better manage resources and promote data-driven decision making, and increasing stakeholder input.¹¹⁰

In 2018, a North Carolina cooperative initiative referred to as the Triangle Regional Resilience Partnership, comprised of a few counties and towns within the state, published a technical report, the *Triangle Regional Resilience Partnership Resilience Assessment* that provides a framework to inform local plans and investments to address vulnerability and risk from extreme heat impacts and other climate threats.¹¹¹ In addition, the Triangle Regional Resilience Partnership offers three recommendations to address extreme heat in North Carolina: (1) establish extreme heat “resilience centers” in collaboration with community groups, (2) enact cool roof standards, and (3) implement urban forestry plans to expand tree canopy.¹¹²

New York State’s *2024 Extreme Heat Action Plan* identifies four extreme heat adaptation actions, including:

- Adaptation planning and implementation (e.g., build administrative capacity and promote research),
- Preparedness, communication, and workers’ safety (e.g., worker protections),
- Built environment, infrastructure, and managed spaces (e.g., development of resilient and equitable infrastructure), and

¹⁰⁸ HeatReadyPHX. April 2023. *Summer 2023 Heat Response Plan*. Available at:

<https://www.phoenix.gov/heatsite/Documents/Heat%20Response%20Plan%202023%20-%20For%20Gen%20Info%20Packet%20Apr19.pdf>

¹⁰⁹ Arizona Department of Health Services. 2024. *ADHS Recommendations and Findings for the Arizona Extreme Heat Preparedness Plan*. Available at: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat-preparedness/azdhs-recommendations-and-findings.pdf>

¹¹⁰ Ibid, p. 22.

¹¹¹ Triangle Regional Resilience Partnership. 2018. *Triangle Regional Resilience Partnership Resilience Assessment*. Available at: https://www.centralpinesnc.gov/sites/default/files/uploads/trrp_report_technicalreport_102418.pdf

¹¹² Ibid, p. 178-180.

- Ecosystem-based adaptation (e.g., green infrastructure).¹¹³

In addition to the CDC and EPA resources available to states and municipalities developing heat response and resiliency plans, the Arshnt-Rock Center Heat Action Platform, developed by Adrienne Arshnt-Rockefeller Foundation Resilience Center was launched in 2019 to find immediate, scalable solutions to address the widespread consequences of climate change and extreme heat.¹¹⁴ Lastly, the U.S. Climate Resilience Toolkit offers 65 different resilience-building solutions to improve local resilience to extreme heat.¹¹⁵ For example, the City of Asheville, North Carolina developed a report in 2018 titled *Planning for Climate Resilience City of Asheville, North Carolina*, identifying their “steps to resilience” on the framework set out by the U.S. Climate Resilience Toolkit.¹¹⁶ These steps were to explore possible climate threats and existing community assets, identify impact, vulnerability and conduct risk assessments, develop options to improve resilience, and to prioritize previously identified actions.¹¹⁷

Best practice #2: Create and maintain publicly available online data tracking systems on heat-related risk and health impacts

Establishing and maintaining publicly available online data tracking systems on heat-related risks and health impacts is a vital tool for improving community resilience to extreme heat.

The New York State Department of Health hosts multiple online dashboards to provide information on county-level exposure and sensitivity to heat, adaptive capacity (i.e., the community’s ability to reduce the impact of extreme heat events through access to cooling resources for example), and municipality-level socio-economic vulnerabilities.¹¹⁸ To assess county-level exposure to extreme heat, New York State reviews the following statistics over time: days with a maximum temperature above 90 degrees Fahrenheit, summer temperature anomalies (departure from the 30-year average), monthly average of daily maximum temperatures, and future temperature projections. To assess sensitivity to extreme heat, New York State reviews heat-related illness rates and renal and cardiovascular illness rates (both of which can be exacerbated by extreme heat) by monthly maximum temperatures.¹¹⁹

Similarly, the Maine Department of Public Health tracks four different measures on heat-related illness including: daily emergency department visits, annual emergency department visits, hospitalizations, and air-conditioning access.¹²⁰ Data systems such as the ones developed in New York and Maine that track both

¹¹³ New York State Department of Environmental Conservation. *Extreme Heat Action Plan*. Available at: <https://dec.ny.gov/environmental-protection/climate-change/effects-impacts/extreme-heat> p. 33

¹¹⁴ Adrienne Arshnt-Rockefeller Foundation Resilience Center. *Our Story*. Available at: <https://onebillionresilient.org/who-we-are/>.

¹¹⁵ National Oceanic and Atmospheric Administration. n.d. “U.S. Climate Resilience Toolkit.” Available at: <https://toolkit.climate.gov/content/options-database>

¹¹⁶ City of Asheville. 2018. *Planning for Climate Resilience City of Asheville, North Carolina*. Available at: https://drive.google.com/file/d/1X_Gr4eUCmkXP0zAcvvyCe-uZPkX84Byz/view

¹¹⁷ Ibid.

¹¹⁸ New York State Department of Health. n.d. “County Heat and Health Profile Reports.” Available at: <https://www.health.ny.gov/environmental/weather/profiles/>

¹¹⁹ Ibid.

¹²⁰ Maine Tracking Network. n.d. “Heat-related Illness.” Available at: <https://data.mainepublichealth.gov/tracking/heat>



community exposure to heat and related health impacts from heat exposure, are a helpful tool for informing the public, as well as policymakers and employers, to promote more effective responses and planning around extreme heat events.

Best practice #3: Establish electric disconnection bans for customers during extreme heat events

Electric disconnection bans during extreme heat events are a key tool to protect communities, and more specifically, vulnerable populations suffering from high energy burden (disproportionately high energy bills relative to income), from the dangers of exposure to extreme heat. These bans can help ensure that individuals are able to maintain safe indoor conditions during heat events by preventing electric distribution companies from shutting off electric services for any reason (including bill arrears).

In 2022, 3 million customers saw their electricity turned off across the country with 30 percent of these shutoffs occurring in the summer months.¹²¹ Extreme heat events can cause a spike in energy prices, driven by the increased demand in energy consumption for cooling, making it even more difficult for customers to pay their energy bills. In Arizona, regulated electric utilities are not legally permitted to disconnect residential customers during extreme heat events. Specifically, utilities can choose whether to adopt a disconnection moratorium from June 1 to October 15 or suspend disconnections when the forecasted temperature is greater than 95 degrees Fahrenheit.¹²² In addition to Arizona, the District of Columbia, Georgia, Illinois, Maryland, Missouri, New Jersey, and Oklahoma also have utility disconnection bans during periods of extreme temperature.¹²³ Massachusetts does not have an electric disconnection ban for extreme heat events, however, the Commonwealth's winter moratorium prohibits utilities from disconnecting electricity or gas between November 15 and March 15 for lack of payment.¹²⁴

Best practice #4: Provide access to cooling services, distribution of fans, AC units, water and energy subsidies, and enlist community groups to support local residents

Ensuring that residents and communities have access to services and necessary items at a local level is a crucial step in mitigating the effects of extreme heat events. In addition, it is important that lower income households are able to use cooling items, like fans and AC units, without fear of falling behind on their energy bills.

The federal Low Income Home Energy Assistance Program (LIHEAP) offers several recommendations for

¹²¹ The Conversation. 2024. "America faces a power disconnection crisis amid dangerous heat: In 27 states, utilities can shut off electricity for nonpayment even in a heat wave." Available at: <https://theconversation.com/america-faces-a-power-disconnection-crisis-amid-dangerous-heat-in-27-states-utilities-can-shut-off-electricity-for-nonpayment-even-in-a-heat-wave-234865>

¹²² Arizona Corporation Commission. June 2024. "ACC Reminds Ratepayers of Utility Disconnection Ban During Extreme Heat." Available at: <https://www.azcc.gov/news/2024/06/03/acc-reminds-ratepayers-of-utility-disconnection-ban-during-extreme-heat>

¹²³ LIHEAP. n.d. "Seasonal Termination Protection Regulations." Available at: <https://liheapch.acf.hhs.gov/Disconnect/SeasonalDisconnect.htm>

¹²⁴ Massachusetts DPU 220 CMR 25.00, (2009). *Billing and termination procedures of the Department of Public Utilities*. Available at: <https://www.mass.gov/regulations/220-CMR-2500-billing-and-termination-procedures-of-the-department-of-public-utilities>

assistance including loaning/giving AC units and providing higher crisis or cooling benefit payments for electric bills to offset high demand.¹²⁵ In Massachusetts, income-qualifying households are eligible for an estimated \$884 per year to offset home heating costs in the wintertime through LIHEAP.¹²⁶ In 2024, the Massachusetts Senate passed *An Act Upgrading the Grid and Protecting Ratepayers* without previously included language that would have expanded LIHEAP to provide financial support to eligible households struggling to pay for cooling methods (AC units and summertime electric bills).¹²⁷ Other local options may also be available for reducing energy bills, for example, Boston Medical Center’s (BMC’s) *Clean Power Prescription* pilot program allows providers to reduce utility bills for about 80 select low-income households by allocating BMC community solar credits to energy burdened patients.¹²⁸

Beyond financial support, community information sharing and support programs are valuable tools for promoting climate resilience. The Urban Sustainability Directors Network—a nonprofit organization that works toward equitable, resilient, and sustainable communities—supports the creation of resilience hubs, or locally run neighborhood centers available to the public that provide year-round community support through multiple programs. Community resilience hubs serve as a place for communication, distribution of resources, and more.¹²⁹ Resilience hubs can also provide services during climate emergencies, such as a space for cooling during extreme heat. These locations are not designed for the purpose of being emergency centers, but as supports in creating a climate resilient ecosystem.¹³⁰ The District of Columbia’s climate planning documents, *Climate Ready DC* and *Resilient DC*, both call for the creation of resilience hubs to complement the District’s existing emergency response services by “promoting health, providing meeting spaces, educating the community about risks and emergency preparedness, and supporting workforce development.”¹³¹

Arizona hired a statewide cooling center coordinator in early 2024 to improve cooling areas in the State. This past year, Arizona’s cooling center coordinator deployed at least six solar-powered mobile cooling centers made from shipping containers.¹³² Soliciting support from the community can also be an

¹²⁵ Administration for Children and Families Office of Community Services. n.d. “Stay Safe and Healthy This Summer with the Low Income Home Energy Assistance Program (LIHEAP).” Available at:

https://www.acf.hhs.gov/sites/default/files/documents/ocs/LIHEAP_Cooling-Safety-Flyer_FY2024_English.pdf

¹²⁶ (1) National Council on Aging. 2024. “Fuel Assistance/Low Income Home Energy Assistance Program (LIHEAP).” Benefits CheckUp. Available at: https://benefitscheckup.org/program/utility_ma_liheap; (2) Massachusetts Department of Energy Resources (DOER). n.d. “Learn about Home Energy Assistance – HEAP.” Available at: <https://www.mass.gov/info-details/learn-about-home-energy-assistance-heap>

¹²⁷ Massachusetts Legislature. 2024. *Bill S.2829 An Act Upgrading the Grid and Protecting Ratepayers*. Available at: <https://malegislature.gov/Bills/193/S2829/BillHistory4>

¹²⁸ Boston Medical Center. n.d. “What is Clean Power Prescription?” Available at: <https://www.bmc.org/clean-power-prescription-program>

¹²⁹ Urban Sustainability Directors Network. n.d. “Resilience Hubs.” Available at: <https://resilience-hub.org/what-are-hubs/>

¹³⁰ Perez, Y. 2024. “What’s all the Hub About? How Community Resilience Hubs can Bridge Gaps in Social Connection, Wellness and Transportation.” Available at: <https://greenlining.org/2024/whats-all-the-hub-about-how-community-resilience-hubs-can-bridge-gaps-in-social-connection-wellness-and-transportation/>

¹³¹ District of Columbia Department of Energy and Environment. n.d. “Community Resilience Hubs.” Available at: <https://doee.dc.gov/service/community-resilience-hubs>

¹³² Kempe, Y. 2024. “Arizona names US’ first state chief heat officer, unveils summer 2024 plans.” *Smart Cities Dive*. Available at: <https://www.smartcitiesdive.com/news/arizona-first-state-chief-heat-officer-cooling-centers-summer-2024/709618/>

inexpensive method to obtain crucial items such as fans and air conditioning units:

- The Fire and EMS departments in Worthington, Ohio host an annual “Beat the Heat Fan Campaign” during which residents drop off fans that are distributed to vulnerable populations. Since the drive started, they have collected over 22,000 fans.¹³³
- The Salvation Army in Phoenix, Arizona hosts water drives to collect cases of 16.9 oz water bottles to then pass out to those in need.¹³⁴
- New York City’s “Be A Buddy” program enlists community volunteers to check on vulnerable residents during extreme heat events. This is an easily scalable/adoptable program that can be used by a variety of community groups (faith-based, youth groups, etc.).¹³⁵

Best practice #5: Evaluate data-driven state and municipal heat emergency protocols and assess heat advisory thresholds

Regularly evaluating state and municipal heat emergency protocols and assessing heat advisory thresholds are essential steps in protecting public health during extreme heat events. The current heat emergency threshold for the City of Boston, determined by a live temperature sensor at the National Weather Service Station at Logan Airport, is two or more days with a heat index of 95 degrees, where the nighttime temperature does not fall below 75 degrees.¹³⁶

New York City assessed public health risks from extreme heat events to identify criteria for heat alerts. In this assessment, City officials found that heat-related illnesses were occurring at lower temperature thresholds than those used by the NWS and subsequently lowered the City’s heat warning threshold from 105 degrees Fahrenheit for one day to 100 degrees Fahrenheit for any period of time or 95 degrees Fahrenheit for two consecutive days.¹³⁷ A 2019 study the University of Albany, and officials from the New York Department of Health, NASA, and the NWS, found that in New York State rural and urban areas’ high risk for heat-related illnesses begins at lower temperatures than the current heat advisory threshold. From this discovery, it was recommended that the NWS advisory threshold should be lowered.¹³⁸

¹³³ Worthington. n.d. “Fan Collection.” Available at: <https://www.worthington.org/2209/Fan-Collection>

¹³⁴ Salvation Army. n.d. “Emergency Heat Relief.” Available at: <https://www.salvationarmyphoenix.org/az-extreme-heat-relief>

¹³⁵ Erett, N., et al. 2023. “Survey of extreme heat public health preparedness plans and response activities in the most populous jurisdictions in the United States.” *BMC Public Health*, 23(1), 811. Available at:

<https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-15757-x>

¹³⁶ City of Boston. N.d. “Mayor Wu Declares Heat Emergency July 15-17; Opens Cooling Centers to all Residents.” Available at: <https://www.boston.gov/news/mayor-wu-declares-heat-emergency-july-15-17-opens-cooling-centers-all-residents>

¹³⁷ (1) U.S. CDC. 2020. *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*. Available at: <https://stacks.cdc.gov/view/cdc/93705>, p. 21; (2) Benmarhnia, T., Schwarz, L., Nor-Sarma, A., and Bell, M. L. 2019. “Quantifying the impact of changing the threshold of New York City heat emergency plan in reducing heat-related illnesses.” *Environmental Research Letters*, 14. Available at: <https://iopscience.iop.org/article/10.1088/1748-9326/ab402e>

¹³⁸ Adeyeye, T. 2019. “Estimating policy-relevant health effects of ambient heat exposures using spatially contiguous reanalysis data.” *Environmental Health*, 18 (35). Available at: <https://ehjournal.biomedcentral.com/articles/10.1186/s12940-019-0467-5#author-information>

A similar 2017 study conducted in New England by academics from Brown University, the New Hampshire Department of Health and Human Services, the Maine Department of Health and Human Services, and the Rhode Island Department of Health analyzed data on maximum daily heat index, emergency department visits, and deaths in 15 New England communities.¹³⁹ Results from this study suggest that adverse health impacts occur at heat indices equal to or greater than 95 degrees Fahrenheit, 5 degrees lower than the current heat index of greater than 100 degrees Fahrenheit used to issue heat advisories.¹⁴⁰

An Arizona State University study of heat-related illness in Maricopa County (which includes the City of Phoenix) found that risk for heat-related deaths occurred when temperatures were at or above 91.4 degrees Fahrenheit, reinforcing the importance of identifying accurate heat advisory thresholds.¹⁴¹ In line with ensuring accurate thresholds, Virginia utilizes a state-level heat alert program,¹⁴² following OSHA's heat safety guidelines,¹⁴³ that alerts residents and workers when a heat wave is likely to occur; heat alert programs like this supersede heat advisories issued by the NWS.¹⁴⁴

In Los Angeles County, California, a recent study analyzed the relationship between heat events issued by the NWS and a set of adverse health outcomes (emergency medical services, emergency room visits, deaths investigated by the medical examiner, and bookings for violent offenses) and found that a higher risk of extreme heat was associated with increases in all previously listed health outcomes.¹⁴⁵

Best practice #6: Invest in critical and green infrastructure to help reduce the impact of extreme heat

Investment in critical and green infrastructure can play a substantial role in mitigating effects felt from extreme heat. Several state- and city-wide climate and heat plans incorporate aspects of green

¹³⁹ These communities included seven New Hampshire municipalities (Concord, Keene, Laconia, Lebanon, Manchester, Nashua, and Portsmouth), seven Maine municipalities (Auburn-Lewiston, Augusta, Bangor, Portland, Sanford, Waterville, and Wiscasset), and Providence, Rhode Island.

¹⁴⁰ Wellenius, G.A., Eliot, M. N., Bush, K. F., Holt, D., Lincoln, R. A., Smith, A. E., Gold, J. 2017. "Heat-related morbidity and mortality in New England: Evidence for local policy." *Environmental Research*, 156, 845 – 853. Available at:

<https://www.sciencedirect.com/science/article/abs/pii/S0013935116312609?via%3Dihub>

¹⁴¹ Petitti, D. B., Hondula, D. M., Yang, S., Harlan, S. L., Chowell, G. 2016. "Multiple Trigger Points for Quantifying Heat-Health Impacts: New Evidence from a Hot Climate." *Environmental Health Perspectives*, 124(2), 176-183. Available at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4749077/>

¹⁴² (1) Virginia Department of Public Health. 2023. "Extreme Heat and Heat-Related Illness." Available at:

<https://www.vdh.virginia.gov/news/extreme-heat-and-heat-related-illnesses/>; (2) Virginia Occupational Safety and Health 09-052E, (2018). *OSHA Technical Manual (OTM)*. Available at: <https://doli.virginia.gov/wp-content/uploads/2023/12/Program-Directive-09052E.pdf>; (3) Virginia Occupational Safety and Health 14-442, (2022). *National Emphasis Program on Outdoor and Indoor Heat-Related Hazards*. Virginia Department of Labor and Industry. Available at: <https://doli.virginia.gov/wp-content/uploads/2023/12/Program-Directive-14442.pdf>

¹⁴³ OSHA. N.d. "OSHA Technical Manual (OTM)." Available at: <https://www.osha.gov/otm>

¹⁴⁴ OSHA. N.d. "OSHA Technical Manual (OTM) Section III: Chapter 4." Available at: <https://www.osha.gov/otm/section-3-health-hazards/chapter-4>

¹⁴⁵ Sturm, R., Baker, L., Krovetz, A. September 2024. *Health and Social Services During Heat Events*. Prepared on behalf of Los Angeles County Chief Sustainability Office. RAND Social and Economic Well-Being. Available at: https://www.rand.org/pubs/research_reports/RRA3406-1.html

infrastructure, such as parks, tree canopy, wetlands and salt marshes, bioswales, and increased vegetation and critical infrastructure investments, such as heat-tolerant materials and energy efficiency and conservation efforts to reduce stress on the electric grid.¹⁴⁶ A 2024 review of urban heat mitigation using green, blue, or grey infrastructure identified street trees, green walls, and botanical gardens as the highest cooling efficiency infrastructure types.¹⁴⁷ The Georgetown Climate Center *Green Infrastructure Toolkit* provides a set of green infrastructure strategies, including green roofs and urban forests, that can be employed to reduce the impact of extreme heat.¹⁴⁸ In addition, the *Detroit Climate Action Plan* includes a goal to develop a green infrastructure plan to mitigate effects of extreme heat.¹⁴⁹ One example of a strategy being set in motion is illustrated by the Atlanta Community School Park Initiative, a plan to ensure every public school is home to a Community School Park.¹⁵⁰

To enhance critical infrastructure in rural areas, in 2024, Arizona’s Governor’s Office of Resiliency and Residential Utility Consumer Office (RUCO) noted that it will issue a Request for Proposals for \$13 million in grant funding for grid improvements in rural areas to improve the resiliency of these communities to extreme heat.¹⁵¹ According to Arizona’s 2024 *Extreme Heat Preparedness Plan*, early discussions of grid improvements amongst utilities included:

*...transmission line and system checks using helicopters and drones; site-specific interventions like vegetation control and smoke detectors in areas particularly vulnerable to wildfire; increased energy reserves to ensure electricity generation is available when customers need it the most; and equipment designed to withstand extreme heat. Utilities also discussed summertime customer protections such as transportation to cooling centers in outage areas.*¹⁵²

Similarly, California’s 2022 extreme heat action plan, *Protecting Californians From Extreme Heat: A State Action Plan to Build Community Resilience*, identifies several rulemakings and programs to protect its energy systems from the impacts of extreme heat, including requiring regular vulnerability assessments from energy utilities, policies and financial incentive programs to support microgrid deployment, and risk-based decision-making and utility rate cases that require utilities to identify risks associated with increased

¹⁴⁶ U.S. Department of Housing and Urban Development. 2024. *Extreme Heat Quick Guide*. Available at: <https://files.hudexchange.info/resources/documents/Extreme-Heat-Quick-Guide.pdf>

¹⁴⁷ Kumar et al. March 2024. “Urban heat mitigation by green and blue infrastructure: Drivers, effectiveness, and future needs.” *The Innovation*, 5(2). Available at: <https://www.sciencedirect.com/science/article/pii/S2666675824000262>

¹⁴⁸ Georgetown Climate Center. n.d. “Green Infrastructure Toolkit.” Available at: <https://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/introduction.html?full>

¹⁴⁹ City of Detroit. 2017. *Detroit Climate Action Plan*. Available at: https://detroitenvironmentaljustice.org/wp-content/uploads/2017/10/CAP_WEB.pdf

¹⁵⁰ National League of Cities. 2024. *Investing in Atlanta’s Kids: Atlanta Community School Park Initiative*. Available at: <https://drive.google.com/file/d/1Qau1UZAmAT6DyKyilnF0iFK-nUU0Sbg9/view>

¹⁵¹ Arizona Office of the Governor Katie Hobbs. March 1, 2024. *Arizona’s Extreme Heat Preparedness Plan*. p. 16

¹⁵² Ibid.

temperatures and frequency of heatwaves.¹⁵³

V. Recommendations for Massachusetts Policymakers to Address Extreme Heat

Based on the best practices discussed above, AEC developed six recommendations for Massachusetts policymakers to address both short-term extreme heat emergency preparedness and long-term heat resiliency in the Commonwealth, supporting cooler neighborhoods, cooler buildings and homes, and cooler commutes (see Table 7).

Table 7. Recommendations for Massachusetts policymakers

Short-term policy solutions	Recommendation #1: Require municipalities to develop data-driven community heat emergency preparedness and response plans in partnership with local community
	Recommendation #2: Improve heat-related illness, temperature, and humidity record keeping and data tracking and provide real time heat exposure metrics
	Recommendation #3: Provide easily accessible online maps for residents to locate water stations, cooling stations, or other public services to aid in the event of extreme heat
	Recommendation #4: Take advantage of federal support for extreme heat preparedness and response
Long-term policy solutions	Recommendation #5: Launch partnership with local healthcare and academic institutions in extreme heat research and policy assessment
	Recommendation #6: Expand critical and green infrastructure investments in Massachusetts municipalities disparately impacted by extreme heat

Recommendation #1: Require municipalities to develop data-driven community heat emergency preparedness and response plans in partnership with local community

Require Massachusetts municipalities to develop city- or town-wide heat emergency preparedness and response plans. Made in partnership with local organizations and employers, these plans should outline

¹⁵³ State of California. April 2022. *Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience*. Available at: <https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Climate-Resilience/2022-Final-Extreme-Heat-Action-Plan.pdf>



actions that each municipality will take in the event of an extreme heat event to protect workers and residents, especially those most vulnerable to heat-related illness. These plans should also consider heat emergency preparedness planning for the protection of vulnerable residents and workers, as well as vulnerable critical infrastructure systems and facilities, and seek to foster community partnership and involvement. If possible, such plans would be strengthened by the inclusion of estimates for the financial implications of heat on the municipality.

Recommendation #2: Improve heat-related illness temperature, and humidity record keeping and data tracking and provide real time heat-related metrics

Improve heat-related illness record keeping and data tracking by providing up-to-date historical and real-time data on emergency medical services (EMS) calls, emergency room visits, heat-related illnesses and deaths, and heat-related metrics (e.g., air and surface temperature, humidity levels, and heat index calculations via temperature sensor monitoring) across the Commonwealth's municipalities and major cities. To support these efforts, it is important to foster coordination and data sharing between the Massachusetts DPH and key entities including hospitals, community healthcare centers, municipal public health departments, academic institutions, and organizations serving heat-vulnerable patients like older adults or unhoused populations.

At present, publicly available online data on heat-related illnesses in Massachusetts are limited to the Massachusetts DPH's Environmental Public Health Tracking tool, which reports heat stress emergency room visits and admissions by county over time. The most recent year of data available is 2021 and there is no information available at the municipal or neighborhood level.¹⁵⁴

Recommendation #3: Provide easily accessible online maps for residents to locate statewide water stations, cooling centers, or other public services to aid in the event of extreme heat

Provide an online, easily accessible and interactive mapping tool that allows residents to identify nearby water stations, splash pads and spray structures, cooling centers, or other public cooling services to help residents and workers find relief during extreme heat events. In addition to an online map dashboard or landing page for these resources, ensure sufficient accessibility is provided (access in multiple languages, digital equity, consideration of transportation services support, etc.).

Recommendation #4: Take advantage of federal support for extreme heat preparedness and response

Take advantage of federal momentum and support available from the U.S. Department of Energy¹⁵⁵ and

¹⁵⁴ Massachusetts Department of Public Health. n.d. "Heat Stress Hospitalization." *Massachusetts Environmental Public Health Tracking*. Available at: <https://matracking.ehs.state.ma.us/Health-Data/heat-stress-hospitalization.html>

¹⁵⁵ U.S. Department of Energy. n.d. "Home Electrification and Appliance Rebates." Available at: <https://www.energy.gov/scep/home-electrification-and-appliance-rebates>

U.S. Department of Housing and Urban Development¹⁵⁶ to retrofit homes to improve energy efficiency, and access to cooling. In addition, there is support available from EPA to develop statewide and municipal programs to promote heat preparedness or resiliency. In addition to the previously mentioned *National Heat Strategy for 2024-2030*,¹⁵⁷ OSHA is proposing a new heat standard entitled *Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings* that will require employers to protect employees from hazardous heat.¹⁵⁸ Lastly, the National Integrated Heat Health Information System (NIHHIS) provides a data hub of various heat-related statistics including heat and health indices and historical temperature data by county.¹⁵⁹

Moreover, federal financing may be used to provide increased access to cooling services, to fund programs to distribute fans, AC units, and water, to support local community groups, or subsize energy bills for overburdened residents. For example, EPA Community Change Grants Program provides funding for activities that address environmental and climate justice challenges, including inequitable exposure to extreme heat.¹⁶⁰ In addition, the 2022 Inflation Reduction Act includes several programs that aim to support home weatherization and efficiency upgrades (e.g., replacing an old air conditioner).¹⁶¹

Recommendation #5: Launch partnership with local healthcare and academic institutions in extreme heat research and policy assessment

Launch partnership with local healthcare and academic institutions in extreme heat research and policy assessment to inform policy actions. For example, starting with Massachusetts' largest cities and in partnership with institutions specializing in temperature monitoring and extreme heat research, study the relationship between heat-related illnesses, emergency department visits, and mortalities with heat metrics (for example, daytime and nighttime maximum and minimum air and surface temperatures, and heat index). Findings from these studies may suggest that the heat advisory threshold should be lowered in major cities or statewide. Examples of institutions specializing in extreme heat research include, for example, the Boston University School of Public Health,¹⁶² Harvard C-Change,¹⁶³ and MIT Office of

¹⁵⁶ U.S. Department of Housing and Urban Development. n.d. "The Green and Resilient Retrofit Program (GRRP)." Available at: <https://www.hud.gov/GRRP>

¹⁵⁷ U.S. Department of Health and Human Services. 2024. "Biden-Harris Administration Unveils National Heat Strategy to Protect Community Health from Extreme Heat." Available at: <https://www.hhs.gov/about/news/2024/08/14/biden-harris-administration-unveils-national-heat-strategy-protect-community-health-extreme-heat.html>

¹⁵⁸ OSHA. 2024. "Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings Rulemaking." Available at: <https://www.osha.gov/heat-exposure/rulemaking>

¹⁵⁹ NIHHIS. N.d. "Welcome to Heat.gov." Available at: <https://www.heat.gov/>

¹⁶⁰ U.S. EPA. April 24, 2024. "EPA's Programs and Actions to Address Extreme Heat." Available at: <https://www.epa.gov/climate-adaptation/epas-programs-and-actions-address-extreme-heat#fundingTA>

¹⁶¹ The White House. n.d. "Investing in America." Available at: <https://www.whitehouse.gov/cleanenergy>

¹⁶² Fabian, M.P., Goldman, A. and Herst, R. 2024. "Thinking Climate Change? Think Exposure to Extreme Heat." BU School of Public Health. Available at: <https://www.bu.edu/sph/news/articles/2024/patricia-fabian-op-ed-on-extreme-heat/>

¹⁶³ Harvard C-Change. 2024. *Preterm and early-term birth, heat waves, and our changing climate*. JAMA Network. Available at: <https://www.hsph.harvard.edu/c-change/news/preterm-and-early-term-birth-heat-waves-and-our-changing-climate/>



Sustainability.¹⁶⁴

Recommendation #6: Expand critical and green infrastructure investments in Massachusetts municipalities disparately impacted by extreme heat

Identify communities where current tree canopy coverage is lacking and vulnerable communities are disproportionately exposed (for example, environmental justice communities and Gateway Cities¹⁶⁵) to the urban heat island effect in Massachusetts. Expand community-led urban forestry in these areas, working in collaboration with community groups to identify priority tree planting locations, opportunities for tree stewardship, and long-term care. For example, AEC's *2022 Boston Tree Equity Analysis* examines the distribution of tree coverage, pollution, high temperatures, and socioeconomic disparities in the City of Boston to identify the locations where tree planting efforts would be most equitable.¹⁶⁶

In addition, starting with communities that lack critical infrastructure to withstand extreme heat impacts, invest in energy efficiency retrofits for existing buildings and in heat-tolerant materials, passive solar design, and conductive and internal heat gain mitigation¹⁶⁷ as recommended by the U.S. Department of Housing and Urban Development.¹⁶⁸

¹⁶⁴ Eltahir, E. and Krol, A. 2022. "Extreme Heat." MIT Climate Portal. Available at: <https://climate.mit.edu/explainers/extreme-heat>

¹⁶⁵ Gateway cities are midsize urban centers that anchor regional economies around the state. For generations, these communities were home to industry that offered residents good jobs and a "Gateway" to the American Dream. Over the past several decades, manufacturing jobs slowly disappeared. Lacking resources and capacity to rebuild and reposition, Gateway Cities have been slow to draw new economy investment." See: MassINC. n.d. "About the Gateway Cities." Available at: <https://massinc.org/our-work/policy-center/gateway-cities/about-the-gateway-cities/>

¹⁶⁶ Stasio, T., Seliga, E., and Stanton, E. A. October 2024. *Boston Tree Equity Analysis*. Prepared on behalf of Speak for the Trees. Applied Economics Clinic. Available at: <https://aeclinic.org/publicationpages/2022/10/11/boston-tree-equity-analysis>

¹⁶⁷ Conductive heat travels through solid material, such as through roofs, windows, and walls. To mitigate this temperature increase, it is recommended that buildings should install light colored roofs and energy efficient windows. Internal heat results from sources inside a building such as kitchen equipment, appliances, and occupants. To lessen the impact of internal heat it is recommended that households install high-efficiency appliances and lighting. See: (1) Energy Saver. n.d. "Principles of Heating and Cooling." Available at: <https://www.energy.gov/energysaver/principles-heating-and-cooling> (2) Office of Energy Efficiency and Renewable Energy. 2022. "Design for Extreme Heat." Available at: <https://basc.pnnl.gov/information/design-extreme-heat>

¹⁶⁸ U.S. Department of Housing and Urban Development. 2024. *Extreme Heat Quick Guide*. Available at: <https://files.hudexchange.info/resources/documents/Extreme-Heat-Quick-Guide.pdf>