

WICKED HOT



Mystic River
WATERSHED ASSOCIATION

MYSTIC

EXECUTIVE SUMMARY

It's Wicked Hot! Volunteer scientists study extreme heat in Greater Boston.

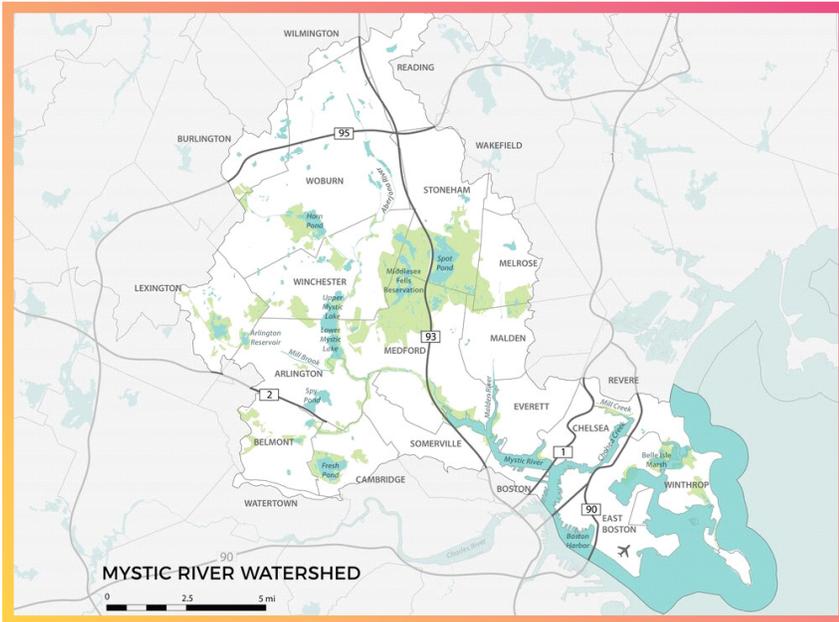
The Greater Boston Area is known for its cold winters, snowy city streets, and coastal Nor'easters. Municipalities know to budget for salt on our roads and residents know how to hunker down during blizzards. When it comes to staying cool during heat waves, however, Bostonians have much less experience. As Greater Boston's summers become longer, hotter, and more humid, our residents, businesses, and municipal governments need to get as savvy in preparing for summer heat as we are in preparing for winter cold.

Surprisingly, extreme heat, sometimes known as the “silent storm of extreme weather,” causes more deaths in the US than all other weather hazards combined. Some neighborhoods and entire municipalities in the Greater Boston area are hotter than others because of the **Urban Heat Island** effect. Due to the legacy of historically discriminatory policies such as redlining, these neighborhoods are overwhelmingly low-income communities of color and disproportionately suffer from extreme heat and poor air quality.



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To help communities identify and prioritize dangerously hot neighborhoods, the Museum of Science, Boston (MOS), **Mystic River Watershed Association (MyRWA)**, **Resilient Mystic Collaborative (RMC)**, and the **Metropolitan Area Planning Council (MAPC)** worked with volunteers to measure air temperature, humidity, and particulate matter across the 76-square-mile Mystic River Watershed. 'Wicked Hot Mystic' used the data collected to create watershed-wide relative heat maps. These maps will be used to develop and implement extreme heat resilience strategies.



Where is the Mystic River Watershed?

The Mystic River Watershed includes all the land area that drains into the Mystic River and out into Boston Harbor. Representing one percent of Massachusetts by size and ten percent by population, the Mystic River Watershed is the most urban watershed in New England.

Volunteer Scientists Making a Difference

On August 12 and 13, 2021, over 80 volunteers joined MOS and MyRWA in measuring ambient air temperature, humidity, and air particulate matter using special sensors mounted on cars and bikes. They traveled along 19 predetermined transects at 6:00 a.m., 3:00 p.m., 7:00 p.m., and 6:00 a.m. the next morning.

Volunteers mounted two types of sensors on their car windows or bicycles (see photo): 1) a CAPA temperature sensor, which records the ambient air temperature and humidity once per second, and 2) an AirBeam air quality sensor, which measures particulate matter (PM2.5). This method of sampling was developed with partners from CAPA Strategies, HabitatMap, Portland State University, and the Science Museum of Virginia.



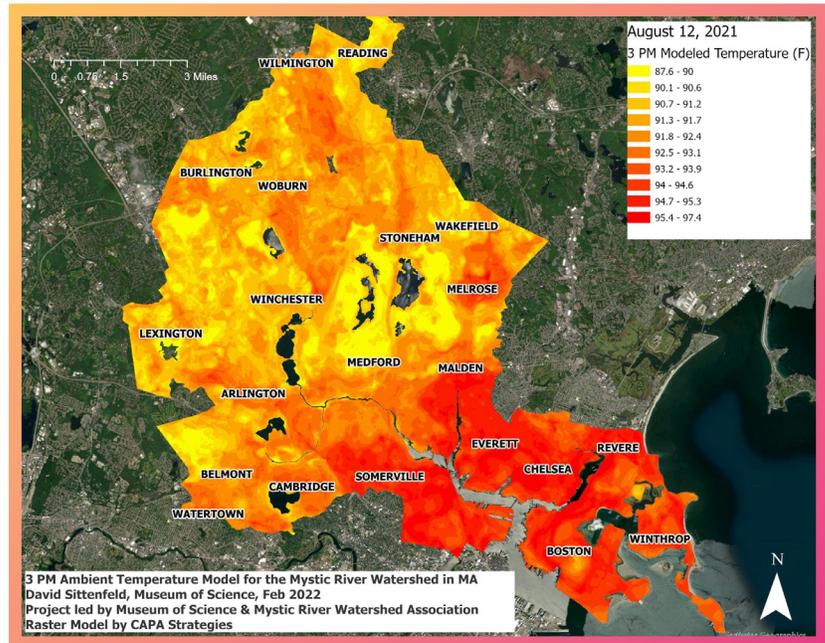
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Findings: Air Temperature

Note that these findings are preliminary, have not been subjected to peer review, and may change over time as the data analysis is done more fully.

CAPA Strategies combined transect data with existing information from aerial surface temperature surveys, land use, land cover, and building height to extrapolate conditions across areas where volunteers did not directly collect sensor data. Watershed-wide maps generated for the four data collection times (6:00 a.m., 3:00 p.m., 7:00 p.m., and 6:00 a.m.) are publicly available [here](#). Note that the temperature scales are different across the four time periods.

This map shows the modeled ambient air temperature for the Mystic River Watershed at 3:00 p.m. on August 12. The highest modeled air temperature value was 97.4 F, with a heat index of 100.7 F, along Mystic Avenue in Somerville.



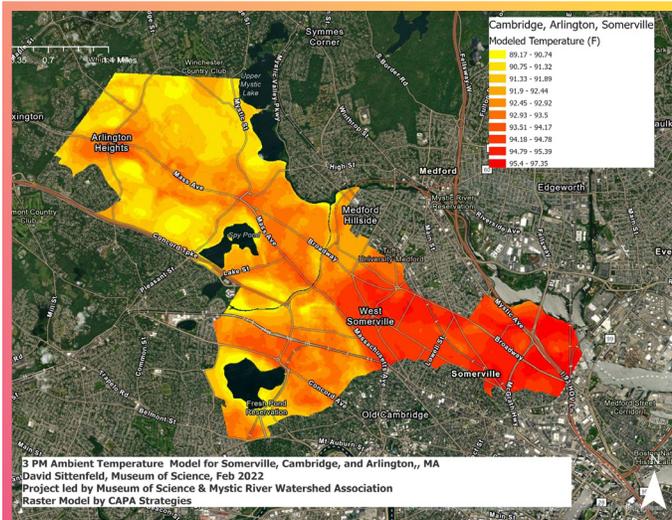
The warmest and coolest temperatures (degrees Fahrenheit) across the watershed were:

The hottest mid-afternoon neighborhoods were 10 degrees F higher than the coolest areas at 3:00 p.m. Some of the hottest neighborhoods included Chelsea, Somerville, East Boston, Everett, Revere, and Charlestown. This range in temperature can make an enormous difference to public health outcomes, especially among people living with respiratory and cardiac illnesses, and people unable to escape the heat.

Time	Highest Temperature (location)	Lowest Temperature (location)	Mean Watershed Temperature	Biggest Temperature Difference
6 AM	78.2 F <i>Beacham St, Chelsea</i>	72.6 F <i>Deer Island, Boston</i>	75.5 F	5.6 F
3 PM	97.4 F <i>Mystic Avenue, Somerville</i>	87.5 F <i>Audubon Sanctuary, Belmont</i>	92.3 F	9.9 F
7 PM	92.8 F <i>Broadway Street, Everett</i>	82.8 F <i>Audubon Sanctuary, Belmont</i>	87.4 F	10 F
6 AM <i>Following Day</i>	79.8 F <i>Logan Airport, East Boston</i>	70.8 F <i>Middlesex Fells</i>	74.7 F	10 F

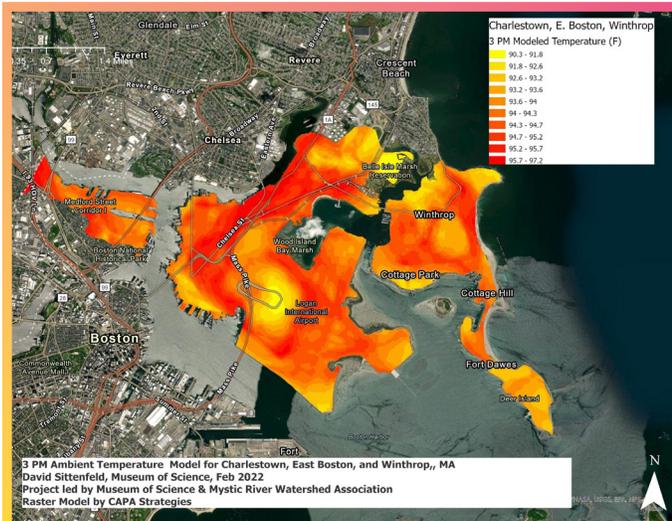
Urban Heat Islands in the Mystic Watershed

The high-resolution maps allow for closer investigation of the hottest neighborhoods in the watershed. Here we present geospatially modeled 3:00 p.m. temperature estimates for three of the warmest zones within the Mystic River Watershed. Note that these temperature models are confined to the areas within these municipalities that lie within the Mystic River Watershed boundary.



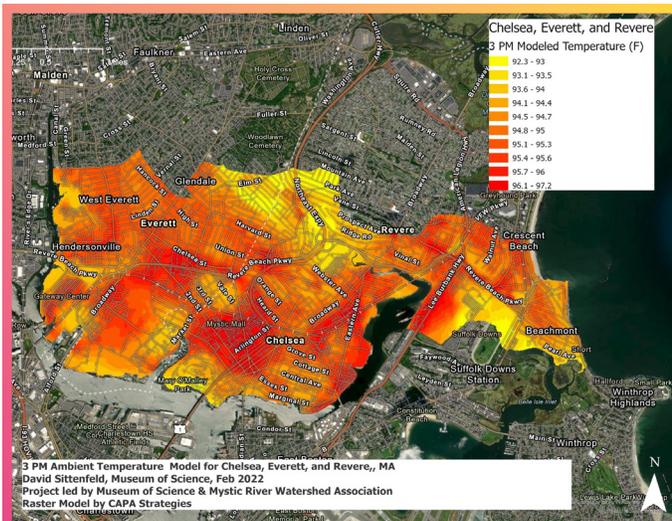
Cambridge, Somerville, and Arlington

The highest modeled air temperature in this area was **97.4 degrees F** in Somerville on Mystic Avenue near the I-93 interchange. This temperature was **4.6 degrees warmer** than the mean temperature for this region and **8.2 degrees warmer** than the coolest temperature modeled across the region at the same time in Arlington Heights.



Charlestown, East Boston, and Winthrop

The highest modeled air temperature in this area was **97.2 degrees F** in East Boston between Saratoga and Bennington Streets near the Wood Island MBTA station. This temperature was **three degrees warmer than the mean** temperature for this region and **6.9 degrees warmer** than the coolest temperature modeled across the region at the same time at an unpaved area of Logan Airport.



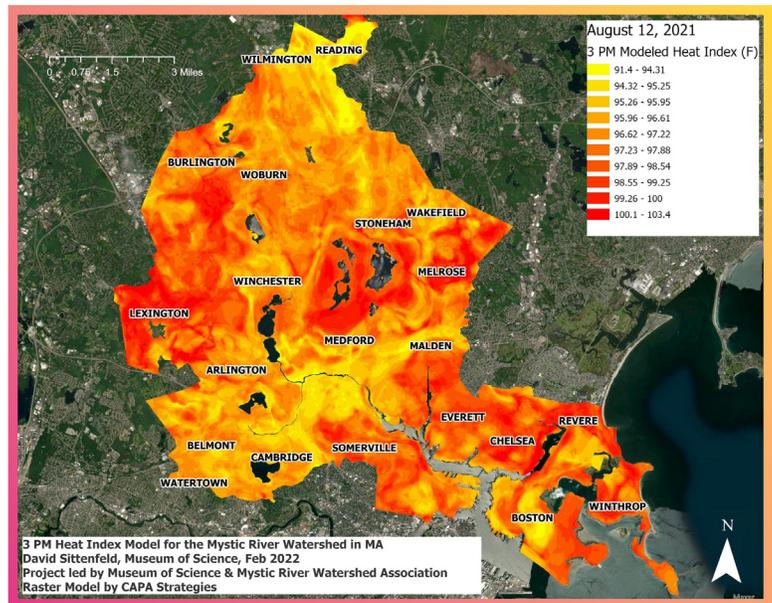
Chelsea, Everett, and Revere

The highest modeled air temperature in this area was **97.2 degrees F** in Revere on Winthrop Avenue near Revere Beach Parkway. This temperature was **2.5 degrees warmer** than the mean temperature for this region and **five degrees warmer than the coolest temperature modeled** across the region at the same time along Mountain Avenue in Revere.

Heat Index

The data here are presented as **heat index values**. Heat index includes the air temperature and relative humidity, to give you the “real feel” temperature. Heat index is important to human health since it is a better estimate of how our bodies feel during a heat wave.

This map shows the modeled heat index (temperature and humidity) for the Mystic River Watershed at 3:00 p.m. on August 12. The highest modeled heat index value was 103.4 F, with an air temperature of 96.9 F, along Eastern Avenue in Chelsea at 3:00 p.m. on August 12.



Next Steps

Air Quality

Extreme heat has been shown to **exacerbate the health effects of inhaled fine particle pollution**. To begin exploring air quality across the Mystic River Watershed, we provided the community volunteers who drove or cycled their transects with a paired AirBeam 3 particle sensor to collect fine particle (PM_{2.5}) concentrations during each of the four data collection times. We are excited by the preliminary data collected and are working with CAPA strategies to refine our analysis.

Turning Data into Action

These findings are beginning to document what residents of urban environments already know: extended periods of extreme heat are increasing and pose significant health risks to vulnerable people. With these data, the Wicked Hot Mystic team will work with local partners to prioritize and pursue opportunities to bring down temperatures in the hottest neighborhoods.

Partners

Museum of Science, Mystic River Watershed Association, Resilient Mystic Collaborative, CAPA Strategies, ISeeChange, MAPC, and GreenRoots. Thank you to the volunteers and community partners who helped to collect this data!

This project was generously supported by Massachusetts' **Municipal Vulnerability Preparedness Program** and the **National League of Cities** awarded to the Town of Arlington, in partnership with the Museum of Science, Mystic River Watershed Association, Resilient Mystic Collaborative, and Metropolitan Area Planning Council.

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For detailed maps of the research area and more resources from this study, visit <https://www.mos.org/wickedhot>