The Chelsea and East Boston Heat Study (C-HEAT): Hot Spots and Cool Places in Urban Heat Islands Over Three Years of Temperature Monitoring*

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Background. Extreme heat events can have profound impacts on human health and well-being. The City of Chelsea and neighborhood of East Boston experience the urban heat island effect, where buildings, roads and other surfaces absorb and re-emit the sun's heat with greater intensity than in more rural areas. Satellite data indicate land surface temperatures are higher in these communities compared to outlying areas. We investigated ambient and surface temperatures to identify variation within these areas and target interventions. We also engaged residents in identifying heat-related concerns and coping strategies.

Methods. Through a longstanding partnership between researchers at Boston University School of Public Health (BUSPH) and the grassroots environmental justice organization, GreenRoots, Inc, we partnered over three summers (2020-2022) to monitor urban heat in various locations using HOBO temperature sensors in sidewalk trees, and surface temperatures using EnvLoggers sensors in 2021 and 2022. We compared ambient temperature measurements with the National Weather Station at Logan Airport in East Boston. We also recruited 12 residents to participate in a photovoice project over five weeks in 2021, culminating in photo exhibits and public showings in 2022.

Results. Average ambient temperatures measured in Chelsea and East Boston during hot weeks in 2020 and 2021 were higher by six degrees Fahrenheit on average compared with the National Weather Station monitor. Within Chelsea, over all three years the consistently coolest temperatures were measured at Island End Park on the mouth of the Island End River. The hottest spots were measured at locations downtown, with a maximum recorded difference of nine degrees Fahrenheit between cool places and hot spots during heat waves. Ambient temperature measurements were used to validate predictive temperature models. Surface temperatures showed large variation depending on proximity to greenspace, with temperatures on unshaded tennis courts measuring 115-130 degrees Fahrenheit on days when ambient temperatures were in the low nineties. Photovoice participants highlighted themes of environmental equity specifically related to lack of shade trees, vulnerable populations, the need to be creative when cooling, and issues related to water (i.e., hydration concerns, drinking water quality questions, and flooding during high rains).

Conclusions. Within urban heat islands, temperatures vary considerably between hot spots and cool places. Proximity to shade trees and greenspaces increases cooling. Residents identified living in areas lacking trees and greenspace as a reason for being vulnerable to extreme heat, as well as working in high heat (e.g., house cleaners, roofers, and in kitchens). Our findings inform partners including city officials, academic researchers and community organizations, by raising awareness, driving local-level policy change, and informing future heat mitigation and resilience efforts in Chelsea.

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