Municipal Vulnerability Preparedness Program Action Grant Case Study

Municipality: City of Chelsea
Project Title: Urban Heat Mitigation Project
Award Year (FY): 21-22
Grant Award: $ 262,996
Match: $ 98,950
Match Source: Local funds (DPW Streets/Sidewalks, H+CD operations funding)
One or Two Year Project: Two Year Project
Municipal Department Leading Project: Department of Housing & Community Development, City of Chelsea
Project Website URL: https://www.chelseama.gov/housing-and-community-development-department/pages/environment-and-climate-resilience

Community Overview:

The City of Chelsea, an Environmental Justice community, is located north of the City of Boston and part of Suffolk County. The City has experienced a population growth of 15.95% between 2010-2020[1], becoming more diverse as non-white residents grew by 61.37% and Hispanic or Latino residents grew by 22.75%. Housing units in the City grew by 15.32% while median income grew by 24% as show in the table below.

Chelsea is a remarkably diverse municipality. It's home to thriving neighborhoods, an array of small businesses, multiple public transportation options, and a range of cultural and civic resources. Due to its geography, coastal orientation, and legacy of industrialization, the City has been disproportionately affected by environmental racism and injustice. The City is composed of intense commercial and industrial land uses, hosts an inordinate share of regional infrastructure, and sustains the economy of the Greater Boston area. The City serves as a hub for regional food distribution with the siting and operation of the New England Produce Center, generating a high level of freight traffic alongside other business, while Route 1 effectively splits the municipality in half, affecting the air quality of communities adjacent to the highway and freight transportation routes.

Given these sociodemographic trends, environmental racism, and land uses, the Commonwealth of Massachusetts considers Chelsea an Environmental Justice community in its entirety[2]. Climate risks affecting communities include sea-level rise, due to roughly ¾ of its area bordering the Chelsea Creek and Mystic River. High impervious surface cover due to past land use policies have made Chelsea one of the hottest areas in the Great Boston region[3], exposing residents and businesses to heat-related illnesses.

[1] US Census Bureau, DEC Redistricting Data (PL 94-171)
[2] https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts
[3] https://web.tplgis.org/metromayors_csc/

City of Chelsea

	Population	Non-White	Hispanic/Latino	Housing Units	Median Income*
2020	40,787	29,604	26,826	14,554	$60,370
2010	35,177	18,345	21,855	12,621	$48,668
% Change	15.95%	61.37%	22.75%	15.32%	24.04%

* 2010 median income adjusted to 2020 dollars.

Project Description and Goals:

The Urban Heat Mitigation Project encompasses a multi-phase approach to deepening community understanding of climate impacts, health risks, and effective adaptation strategies. The goal of this project was to analyze ambient air & land surface temperatures throughout Chelsea, perform a social vulnerability assessment, prioritize corridors for public and private heat mitigation strategies and devise and carry out heat mitigation projects in identified heat islands.

The project was carried out in partnership with GreenRoots, the BU School of Public Health, and C-HEAT. Supporting C-HEAT's efforts, the project procured, deployed, and monitored a network of remote temperature sensors throughout the City. Gleaning data regularly throughout spring, summer, and fall months enabled the establishment of baseline ambient air and land surface temperature data. Data was analyzed to compute the relative heat index, which sought to quantify the extreme heat experienced by residents. Hot spots, commonly areas with large concentrations of parking lots, buildings, and other impervious surfaces, compounded by a scarcity of green space, were identified. Subsequently, socioeconomic, demographic, and public health variables were superimposed to visualize the spatial characteristics of the populations residing within or proximate to these hot spots. As documented during the first phase of the project, numerous heat islands impact residents throughout the City. Exacerbated by co-morbidities, vulnerability to extreme temperatures is especially pronounced in residents with no access to indoor cooling, underlying health conditions, limited social networks, and constrained mobility.

The analysis performed during the first phase of the project informed the prioritization of areas for intervention, culminating in the selection of the Cool Block, bounded by Congress Ave., Willow St., and Maverick St. The project area chosen is located on Willow St and Maverick St in Chelsea. This block was identified in the aforementioned recent urban heat island assessment, as a location that suffers from extreme heat in the warmer months. The urban heat island effect plagues many environmental justice communities, often due to lower tree canopy present, higher amounts of air pollution, and large amounts of existing impervious surface. Additionally, this project sought to mitigate excessive storm-water run-off and aid in retention and filtration of storm-water. As one of the two hottest areas in the City, the project area encompasses a significant concentration of Environmental Justice populations and residents with underlying health conditions, coupled with notable impervious surface area and sources of

air pollution. Furthermore, the project area contains the Boys & Girls Club, a popular institutional destination for residents, and is in the vicinity of Highland Park, a nursing home, a public housing complex, and local industries that employ residents. Collectively, these land uses induce pedestrian activity across the project area, heightening risks to residents during periods of extreme heat.

This block has been identified in a recent urban heat island assessment, as a location that suffers from extreme heat in the warmer months. This project addresses the extreme urban heat island effects that the entirety of Chelsea suffers with. The urban heat island effect plagues many environmental justice communities, often due to lower tree canopy present, higher amounts of air pollution, and large amounts of existing impervious surface.

This project sought to provide environmental equity to a neighborhood within Chelsea that suffers from extreme urban heat. The installation of green infrastructure and implementation of lightly colored sidewalks and roadways will mitigate extreme heat during the warmest months of the year. Green infrastructure, overtime will provide an increase of shade which will allow for refuge from the heat, but additionally aid in decreasing energy usage. This will inherently provide health benefits to local residents, as well as potential financial savings from decreased energy usage. These forecasted benefits will hopefully improve the quality of life for the residents of this environmental justice community. Additionally, the city implemented the Urban Heat Mitigation Project outside of a local Boys & Girls Club. The city and GreenRoots prioritized fostering a strong partnership with the Boys and Girls Club, in order to obtain equitable results for the young people that use this location the most. Many neighborhood children utilize this space for recreational activities during the school year and throughout the summer, and will benefit from the mitigation efforts put into place. This project is nearly completed, with all green infrastructure installed and sidewalks and roadways renovated. The blast treatment to lighten the roadway is a remaining item that will be completed within the next week. Also, vitality of the green infrastructure will be monitored, and will subsequently be replanted if tree/plant mortality occurs.

The City has prioritized involving the public in planning, design, and implementation projects that are centered on their neighborhoods and affect their daily lives. The City of Chelsea and GreenRoots developed a meaningful strategy for civic engagement, modeled after ongoing initiatives, such as the Island End River Flood Resilience Project, so that the community was equitably and meaningfully represented in the project. Community engagement was conducted in a bilingual, culturally competent manner. Media content and meeting materials were highly visual and translated into English and Spanish. Interpretation services and refreshments were provided at public meetings. Public meetings were hosted at accessible venues in the community, as opposed to City Hall.

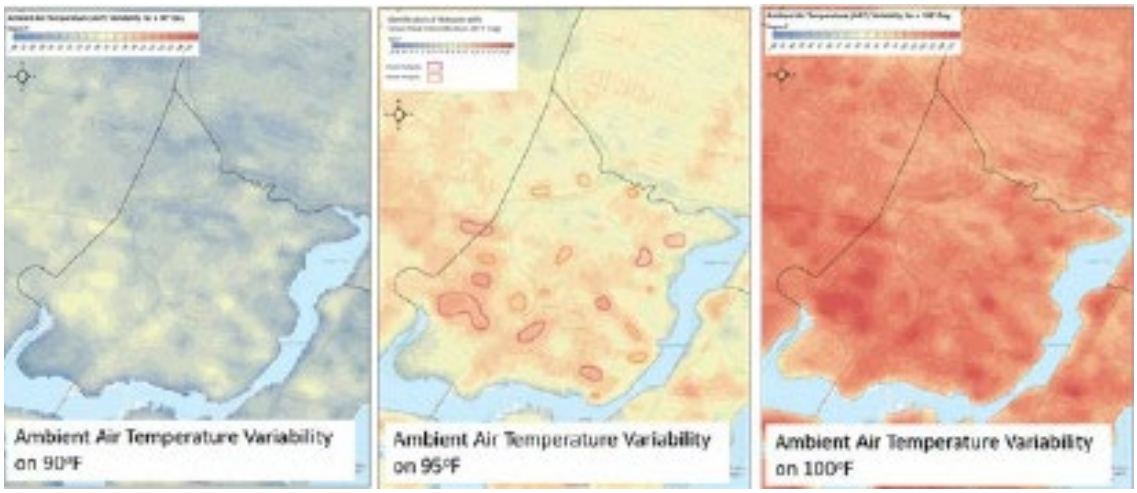
The urban heat mitigation project may serve as a proof-of-concept for modeling urban heat and identifying heat mitigation strategies that may be utilize on a regional scale. The urban heat island effect is not a localized problem just in Chelsea, but plagues many environmental justice communities throughout the Commonwealth. As we continue to witness the impacts of

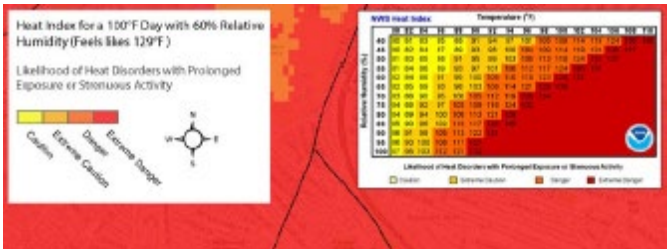
climate change, it is imperative to have proven strategies to monitor and mitigate extreme heat, especially within vulnerable environmental justice communities.

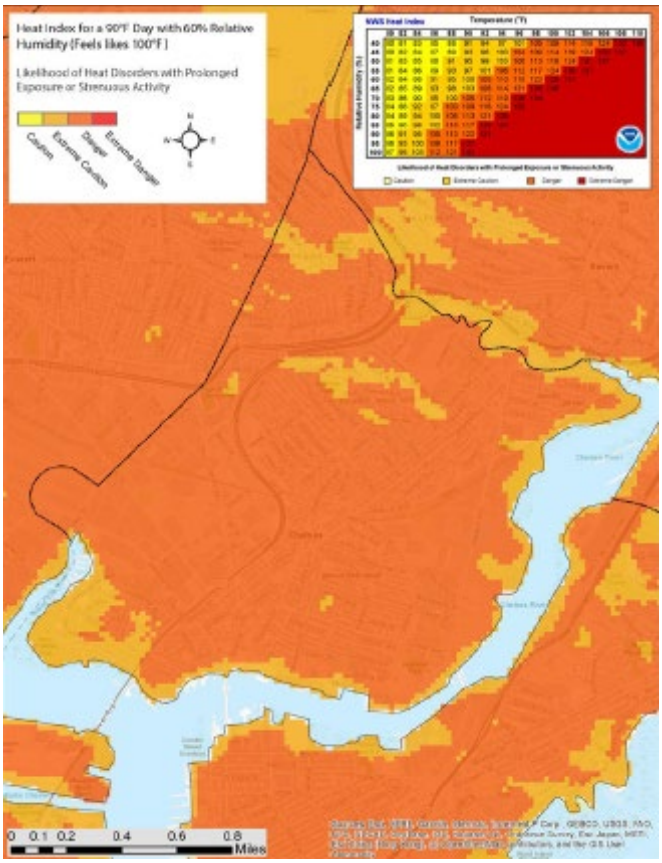
Results and Deliverables:

Through the implementation of the Urban Heat Mitigation Project, the city was able to identify extreme heat islands throughout the area that need to be targeted for mitigation strategies in the future.

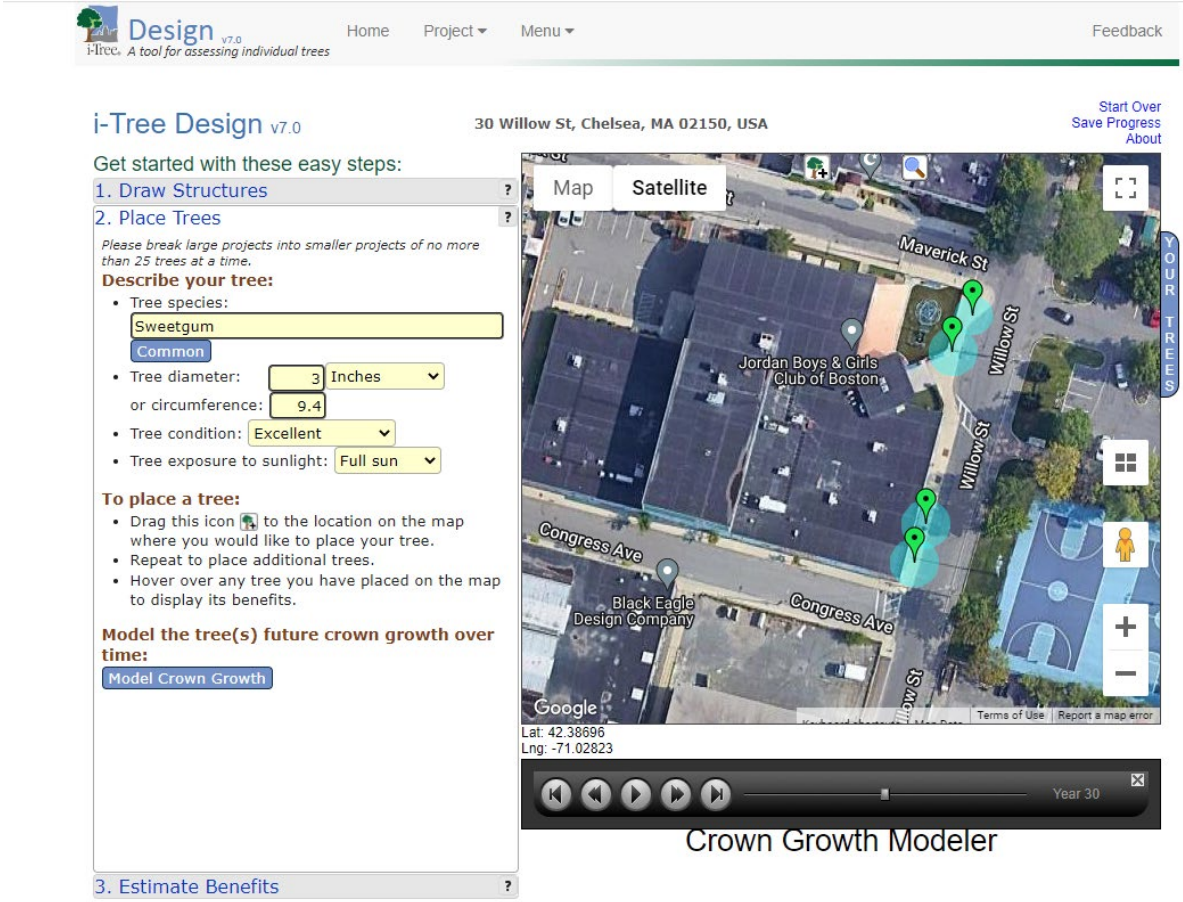
Ambient air temperature variability was assessed and heat index maps were created. This data analysis will be a valuable tool for the City of Chelsea, as we continue to seek mitigation strategies to combat rising temperature throughout the city. These analyses are crucial to assisting the city in creating a healthier and cooler climate for our vulnerable community.







Additionally, 5 trees and several native shrugs and grasses were installed within the ‘Cool Block’ area, which will increase tree canopy and shade in this neighborhood over time. The iTree Design model below demonstrates the canopy coverage that will be created over the next 30 years, by 4 of the trees that were installed in this project. The combination of increased tree canopy, light reflective cement and asphalt and bio swale plants should aid in decreasing the ambient land and air temperature of this neighborhood over time. Additionally, this green infrastructure will assist in storm-water retention and filtration, combat air pollution within the microclimate, and create a healthier and more aesthetically pleasing built environment for the community.



Link to deliverables of the entire project, hosted by the City's consultant, Weston and Sampson:

https://sharefile.wseinc.com/message/NHxijGYT46vKlXd2ppFqdd

Lessons Learned:

- What lessons were learned as a result of the project? Focus on both the technical matter of the project and process-oriented lessons learned.

  The multi-year urban heat mitigation project revealed a variety of lessons learned. Applying these takeaways will increase the efficacy, equity, and accessibility of future projects.

  1.) **Forming diverse project management groups with residents, community based organizations, and technical consultants.**
      a. Through the collaboration with C-HEAT, GreenRoots, and BU School of Public Health, a variety of residents, community leaders, and subject matter experts supported the project. Critical to ensuring Environmental Justice residents are represented in the project. The project team included engineers and

public health academics and practitioners, contributed to the planning, site selection, design and engineering, and construction phases of this project. Ultimately, this co-project management approached strengthened the technical aspects of the project, deepened opportunities for civic engagement, and guided the site selection, design, and implementation of heat mitigation measures.

2.) **The importance of data collection and analysis systems at the local level**

Relying upon a network of remote temperature sensors instituted by the C-HEAT team and augmented by the City, the first phase of the project collected, characterized, and analyzed ambient air and land surface temperatures throughout the City. Visualizing the data collected, overlaying the temperature maps with socioeconomic, demographic, and public health variables, and spatially analyzed trends provided a granular understanding of existing conditions. As a result, vulnerability to extreme heat could be inferred at a localized level. By producing heat islands maps capturing land surface and ambient air temperatures at a fine grained scale, priority locations were identified by assessing socioeconomic and demographic characteristics, land use composition, transportation and mobility networks, and environmental factors. Additionally, this allowed for the collection of baseline temperature data that will be utilized to gauge the impact, efficacy, and reach of Phase 2 of the project, involving the installation of various urban heat mitigation techniques. Without this dense network of heat sensors, coupled with the organizational infrastructure provided by GreenRoots, B.U. School of Public Health, and C-HEAT, the collection of localized data would've been impractical. Maintaining and growing this data collection and analysis infrastructure by securing funding for C-HEAT will be key.

3.) **Design and implementation lessons regarding heat mitigation techniques in dense, urban environments.** Despite the extensive research, design, and implementation activities surrounding nature based solutions, a myriad of constraints exist in urban areas warranting novel approaches. Under Phase 2 of the project, the project team identified a neighborhood block with the highest ambient air and land surface temperatures during the summertime. Situated adjacent to the Boys & Girls Club, Highland Park athletic field and playground, and public housing complex, the project area is traversed by countless residents each day. Compounded by air pollution associated with Logan Airport and regional industry, the project area is representative of the grave determinants of public health faced by residents. In terms of land use, the project area was bounded by a former factory, dense residential homes (generally three family buildings, interspersed with higher density apartments), parks, and light industrial uses.

Former industrial Gateway Cities, such as Chelsea, encompass significant impervious surface, former industrial sites, structurally unsuitable geophysical conditions, and significant environmental contamination. Furthermore, operations and maintenance

capabilities in smaller Gateway Cities vary, a facet of the longevity of nature based solutions. As a result, the exploration of different approaches is imperative. Through the proposed project, a variety of heat mitigation techniques were examined for efficacy, feasibility, durability, and performance, informed by the planning phase. The existing conditions narrowed the universe of appropriate provisions to certain nature based solutions compatible with subsurface conditions prevalent in coastal Gateway Cities, particularly areas with peat, clay, and other organic materials that diminish infiltration capabilities of nature based solutions. Environmental conditions necessitated careful investigation, as the excavation, management, and disposal costs associated with unsuitable materials presented a program risk. Engineered subsurface features, especially the presence of aging gas mains and underground utility conflicts, required consideration, in order to prevent the premature mortality of green infrastructure installed during the project. Given the spatial constraints of urban areas, interventions necessitating large swaths of undeveloped surface area were infeasible. Therefore, the project critically analyzed the impact of smaller scale interventions that could be inserted in right-of-way areas, while preserving operational characteristics.

Through the collection of baseline data, the project team will evaluate the efficacy of the measures installed during this project by periodically monitoring ambient air temperatures in the project area. This evaluation will highlight what's successful, what has failed, and what requires modifications moving forward. Cumulatively, these takeaways will provide a basis of knowledge to inform future planning, design, and implementation efforts with regards to heat mitigation.

- What is the best way for other communities to learn from your project/process?

Partners and Other Support:

The City of Chelsea prioritizes collaboration and community involvement when developing and implementing city wide projects. Employing a model of compensating residents and Environmental Justice organizations for their contributions, lived experience, and time, the City partnered with GreenRoots, an Environmental Justice organization in Chelsea, and B.U. School of Public Health. Together, B.U. School of Public Health and GreenRoots coordinate the C-HEAT initiative for urban heat mapping and mitigation. Through this partnership, the City sought to effectively engage the community and to obtain and include input from a diverse group of Chelsea residents. This collaborative team has sought to utilize ambient temperature data collected, to implement mitigation strategies to lessen the health and economic impacts that extreme heat can have on environmental justice communities, like Chelsea. The City has also partnered with the Boys and Girls Club in Chelsea, which is centrally located within the implemented project, to advance the design and implementation of a white roof. On Maverick Street in the project area, the City partnered with GreenRoots and the DCR Greening the Gateway Cities Program to oversee the planting of over 50 public trees along Maverick and Willow Sts.

Project Photos:

- Please find available through the link above a compilation of photos chronicling the project, which are available for public use. For the use and/or reproduction of these photos, we kindly ask that the City of Chelsea Department of Housing & Community Development is credited.