

“Silent Killers”

Madeleine K. Scammell, DSc.
Associate Professor of Environmental Health



MesoAmerican Nephropathy Occupational Study
Estudio de Salud Ocupacional de Nefropatía Mesoamericana

Chelsea East Boston Heat Study (C-HEAT)

Boston University School of Public Health
Department of Environmental Health



Celebrating **25** Years
of Fighting for Social and
Environmental Justice!
GreenRoots



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Excess

Heat exhaust

Weather | sun safety

CHRONIC KIDNEY DISEASE... A SILENT KILLER

1 in 10
CHRONIC KIDNEY DISEASE
AFFECTS 10% OF
THE POPULATION.

WHO IS AFFECTED?

10%

of the population
worldwide is
affected by CKD.



Kidney disease
can affect people
of all ages and
races.

Half of people
aged

75

or more have some
degree of CKD

1 in 5 **MEN**
and 1 in 4
WOMEN
between the ages
of 65 and 74 have
CKD

High blood pressure
and diabetes are
the most common CKD
causes in adults

HOW TO DETECT CKD?



Early CKD often has no sign or symptoms. A person can lose up to 90% of their kidney function before experiencing any signs.



But it can be detected by simple tests:

- a urine test to check if there is any protein in your urine, or
- a blood test to measure the level of creatinine in your blood



Signs of advancing CKD include: swollen ankles, fatigue, difficulty concentrating, decreased appetite, and foamy urine.

ARE YOU AT RISK?

- Do you have high blood pressure?
- Do you suffer from diabetes?
- Do you have a family history of kidney disease?
- Are you overweight?
- Do you smoke?
- Are you over 50 years?
- Are you of African, Hispanic, Aboriginal or Asian origin?



IF YOU HAVE ANSWERED
YES TO ONE OR MORE OF

DID YOU KNOW
THAT YOUR KIDNEYS...

and climate change is

earth/silent-killer



information about your use of our site

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The 'silent massacre' killing El Salvador's sugarcane workers

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<https://www.pbs.org/newshour/show/the-silent-massacre-killing-el-salvadors-sugarcane-workers>

[Fred de Sam Lazaro](#)

Feb 2018

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HEAT STRESS HYPOTHESIS

Lucas et al. *Extreme Physiology & Medicine* 2015, **4**(Suppl 1):A23
<http://www.extremephysiolmed.com/content/4/S1/A23>



MEETING ABSTRACT

Open Access

Heat stress and workload associated with sugarcane cutting - an excessively strenuous occupation!

Rebekah Al Lucas^{1*}, Theo Bodin², Ramon García-Trabanino³, Catharina Wesseling², Jason Glaser⁴, Ilana Weiss⁴, Emmanuel Jarquin⁵, Kristina Jakobsson⁶, David H Wegman⁷



ELSEVIER

Environmental Research

Volume 142, October 2015, Pages 746-755

Heat stress, dehydration, and kidney function in sugarcane cutters in El Salvador – A cross-shift study of workers at risk of Mesoamerican nephropathy

Ramón García-Trabanino^a, Emmanuel Jarquín^b, Catharina Wesseling^c, Richard J Johnson^d, Marvin González-Quiroz^{e,f}, Ilana Weiss^g, Jason Glaser^g, Juan José Vindell^h, Leo Stockfeltⁱ, Carlos Roncal^d, Tamara Harra^d, Lars Barregard^j

Annals of Nutrition and Metabolism

OPEN ACCESS

Proceedings

Mechanisms by Which Dehydration May Lead to Chronic Kidney Disease

Roncal-Jimenez C.^a, Lanaspá M.A.^a, Jensen T.^a, Sanchez-Lozada L.G.^b, Johnson R.J.^a



International Journal of
Environmental Research
and Public Health



Article

Climate Trends at a Hotspot of Chronic Kidney Disease of Unknown Causes in Nicaragua, 1973–2014

Zoe E. Petropoulos^{1,*}, Oriana Ramirez-Rubio^{2,3,†}, Madeleine K. Scammell¹, Rebecca L. Laws¹, Damaris Lopez-Pilar³, Juan José Amador³, Joan Ballester², Cristina O'Callaghan-Gordo^{2,4,5,6} and Daniel R. Brooks³



Journal of Pharmacological Sciences

Volume 141, Issue 1, September 2019, Pages 49-55



Full Paper

A novel rat model of contrast-induced nephropathy based on dehydration

Kun Liu^a, Ling-yun Zhou^a, Dai-yang Li^a, Wen-jing Cheng^b, Wen-jun Yin^a, Can Hu^a, Yue-liang Xie^a, Jiang-lin Wang^a, Shan-ru Zuo^a, Lin-hua Chen^a, Ge Zhou^a, Xiao-cong Zuo^{a,c}

Prevalence and Risk Factors for CKD Among Brickmaking Workers in La Paz Centro, Nicaragua

Lyanne Gallo-Ruiz,* Caryn M. Sennett,* Mauricio Sánchez-Delgado, Ana García-Urbina, Tania Gámez-Altamirano, Komal Basra, Rebecca L. Laws, Juan José Amador, Damaris Lopez-Pilarte, Yorghos Tripodis, Daniel R. Brooks, Michael D. McClean, Joseph Kupferman, David Friedman, Aurora Aragón, Marvin González-Quiroz, and Madeleine K. Scammell

Rationale & Objective: In Central America, there is a high prevalence of chronic kidney disease (CKD) of nontraditional etiology often observed among agricultural workers. Few studies have assessed CKD prevalence among workers in nonagricultural occupations, which was the objective of this investigation.

Study Design: Prospective cohort study.

Setting & Participants: Male and female workers (n = 224) employed by artisanal brickmaking facilities in La Paz Centro, Nicaragua.

Predictors: Age, sex, education, smoking status, body mass index, alcohol consumption, water consumption, first-degree relative(s) with CKD, years worked, hours worked per week, job category, study visit (baseline and follow-up), and self-reported

factors and time with change in eGFR was also evaluated. Multivariable logistic regression models were used to evaluate predictors of CKD.

Results: The CKD prevalence was 12.1% (n = 27), 100% of cases were male, 30% had stage 5 CKD (eGFR < 15 mL/min/1.73 m²), and 22% were younger than 35 years. Proportions of participants with eGFRs < 60 mL/min/1.73 m² at baseline and follow-up were 13.8% and 15.2%, respectively. Linear regression analysis demonstrated significant predictors of lower kidney function at baseline including oven work, older age, lack of education, and having an immediate family member with CKD. Predictors of CKD identified using logistic regression analysis included oven work and lack of education.

Complete author and article information provided before references.

Correspondence to M. González-Quiroz (marvin99_00@yahoo.es)

*L.G.R. and C.M.S. contributed equally to this work.

Am J Kidney Dis. XX(XX): 1-9. Published online Month X, XXXX.

doi: 10.1053/j.ajkd.2019.01.017

© 2019 by the National Kidney Foundation, Inc.

Table 3. Linear Regression Models of eGFR

Variable	eGFR, mL/min/1.73 m ²		Coefficient From Time Interaction (95% CI)	
	Mean Difference (95% CI)	P		P
Age, per 1 y older	-0.95 (-1.42 to -0.47) ^a	<0.001 ^a	0.07 (-0.27 to 0.41)	0.7
Male sex	-5.24 (-17.02 to 6.54)	0.4	-2.22 (-10.88 to 6.45)	0.6
BMI ≥ 30 vs <30 kg/m ²	-2.28 (-12.85 to 8.29)	0.7	-0.77 (-9.38 to 7.85)	0.9
Education				
No formal education	-14.17 (-24.30 to -4.05) ^a	0.006 ^a	-1.98 (-9.29 to 5.32)	0.6
Primary	-3.9 (-12.50 to 4.69)	0.2	-5.70 (-11.88 to 0.47)	0.07
Secondary/university	1.00 (reference)	—	1.00 (reference)	—
Immediate family member with CKD (Y vs N)	-7.66 (-15.17 to -0.32) ^a	0.05 ^a	-1.64 (-7.14 to 3.86)	0.6
F/U study visit (vs BL)	3.34 (-11.07 to 18.88)	0.6		
Job				
Oven work at both visits	-15.52 (-26.02 to -5.01) ^a	0.004 ^a	7.10 (-0.59 to 14.79)	0.07



El Salvador:

Dr. Emmanuel Jarquin

Dr. Ramon Trabanino

Nicaragua:

Dr. Juan Jose Amador

Lic. Damaris Lopez

Boston University School of Public Health
Department of Environmental Health



MANOS

MesoAmerican Nephropathy Occupational Study

Estudio de Salud Ocupacional de Nefropatía Mesoamericana



R01ES027584



Research Group for the Study of Chronic Kidney Disease in Central America.



Longitudinal Investigation of Chronic Kidney Disease among Workers in El Salvador (Outstanding New Environmental Scientist (ONES) Award)
PI: Madeleine Scammell

This longitudinal investigation of Mesoamerican Nephropathy in El Salvador will allow us to address multiple pressing research questions in an attempt to further elucidate the cause(s) of the epidemic while simultaneously developing a repository of data and biological samples in order to quickly and efficiently address new hypotheses as they emerge.

About

Senior Leadership

COVID-19 Response

SPH at a Glance

Strategy Map

Diversity, Equity, Inclusion, and Justice

Accreditation

Visit SPH

Partnerships

Academic Departments

Biostatistics

Community Health Sciences

Environmental Health

Epidemiology

Faculty & Staff

Epidemiology Doctoral Student
Alumni

Courses

Degrees & Programs

Research

Research Areas

Research Group for the Study of
Chronic Kidney Disease in
Central America

Our Team

Our Projects

Publications

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Contact:

Global Health

Health Law, Policy & Management

Offices & Centers

Committees

SPH45

MANOS BU Team

- Dan Brooks
- Jessica Leibler
- Sinead Keogh
- Zoe Petropolous
- Iris Delgado
- Erin Polka
- David Friedman (Harvard/BIDMC)
- Yorghos Tripodis
- Mike McClean

Collaborators:

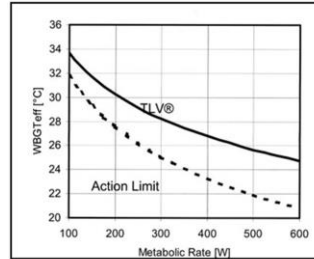
- Linda McCauley, Emory University
- Ana Navas-Acien, Columbia University
- Patrick Parsons, State University of New York
- Kannan Kurunthachalam, New York University
- Chirag Parikh, Johns Hopkins University

Characterizing Heat Exposure & Heat Stress

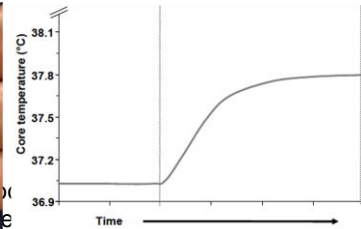


Zoe Petropoulos, PhD
NIEHS F31 ES030974

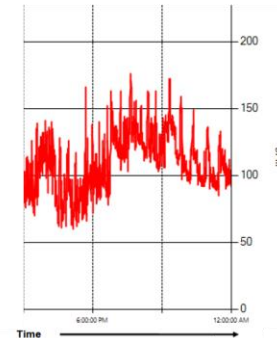
Wet Bulb Globe Temperature



Core Body Temperature

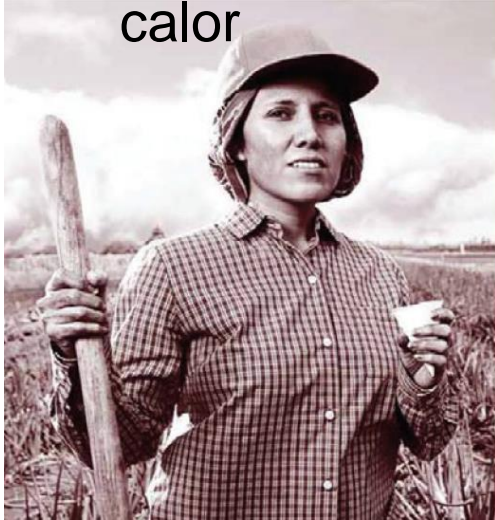


Heart Rate and Accelerometry



HEAT STRESS HYPOTHESIS

- Prevencción de enfermedades a caus calor



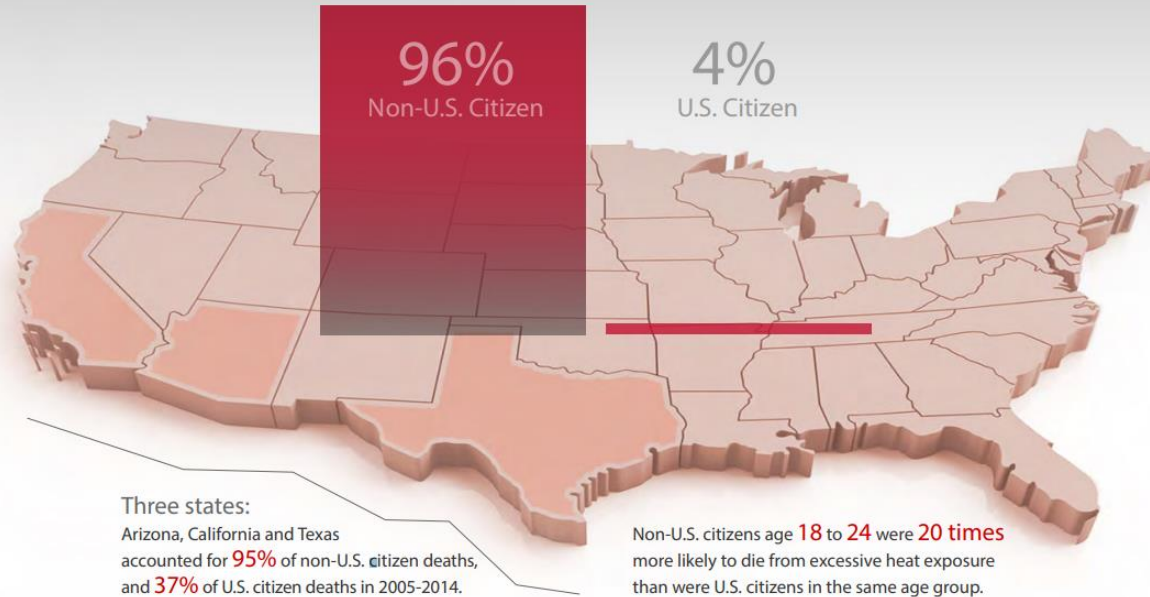
HEAT STRESS HYPOTHESIS



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Department of Environmental Health

Differences in Heat-related Mortality by Citizenship Status: United States 2005-2014

Estimated Percentage of Heat-related Deaths by Citizenship (2005-2014)



Heat-related deaths accounted for 999 (2.23%) deaths among non-U.S. citizens compared with 4,196 (0.02%) deaths among U.S. citizens.

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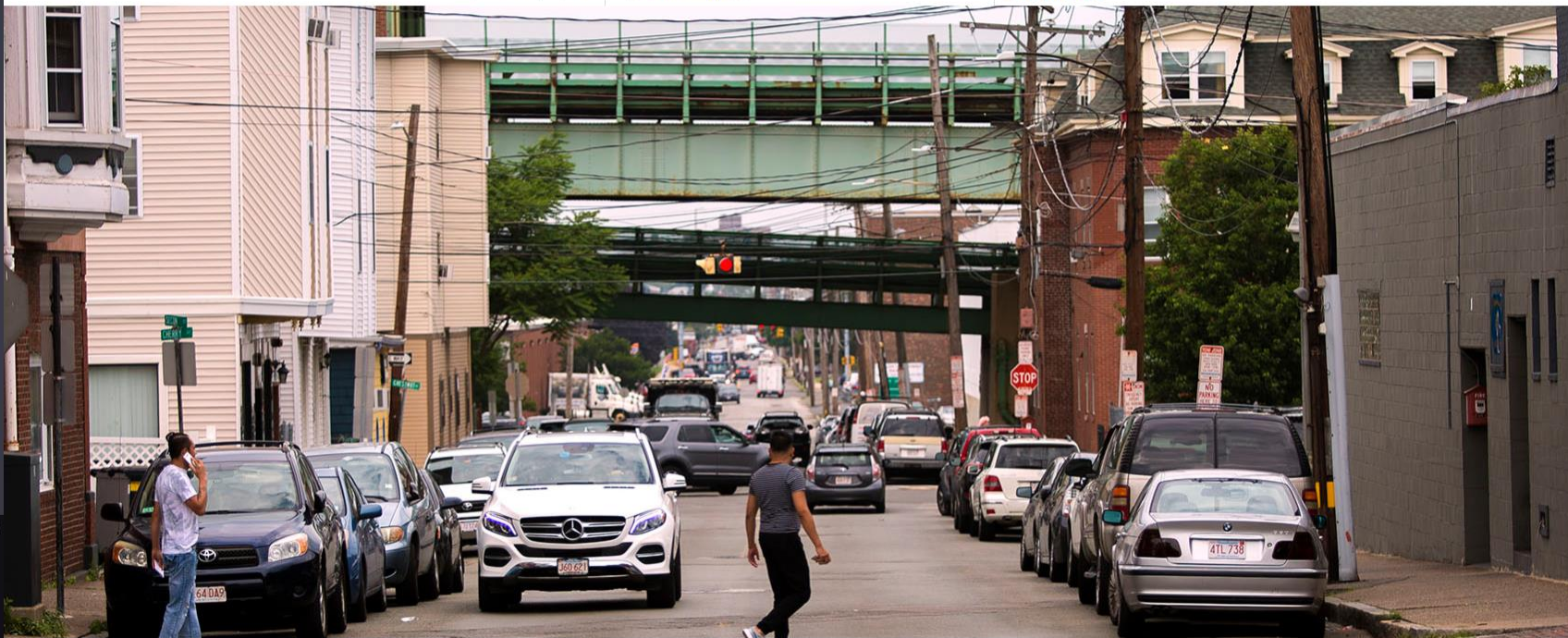
06:41

⌵ ⌵

No Tropical Paradise: Urban 'Heat Islands' Are Hotbeds For Health Problems

Updated July 07, 2017

By [Martha Bebinger](#)



10:15 AM

[Data Dashboard](#)[City Heat Plans](#)[Temperature Sampling](#)[Photovoice](#)[About Us](#)

C-HEAT:

A study of heat exposure in Chelsea and East Boston, Massachusetts

A collaborative research project between [GreenRoots](#) and the [Boston University School of Public Health](#).

The main goal of the project is to build the capacity for these communities to respond to extreme heat events. Our research considers heat exposure and related health concerns among the most vulnerable populations in the Chelsea Creek communities.

c-heatproject.org

Twitter: [@C_HEATProject](#)

Funded: Barr Foundation

GreenRoots

- Roseann Bongiovanni
- Bianca Bowman
- Ibrahim Lopez-Hernandez

Boston University

- Patricia Fabian
- Flannery Black-Ingersoll
- Pilar Botana
- Leila Heidari
- Patrick Kinney
- Julie de Lange
- Hannah Levine
- Jonathan Levy
- Alina McIntyre
- Chad Milando
- Abgel Negassa
- Ameera & Alex Saba

Thank you to C-HEAT Study participants

City of Chelsea

- Victor Tiernan and Ben Cares

Advisory team

- Zoe Davis City of Boston, Climate Resilience Program
- Matt Frank Chelsea Housing Authority
- Melanie Gárate Mystic River Watershed Association/Mystic Resilience Collaborative
- Indrani Ghosh Weston & Sampson
- Rafael Mares The Neighborhood Developers
- Fidel Maltez City of Chelsea, Department of Public Works



Barr
Foundation

- Kalila Barnett



Goal and Objectives

- **Build capacity to respond to extreme heat events:**
 - **Map.** Characterize high-risk locations and populations AND mitigating community assets via participatory mapping and monitoring.
 - **Measure.** Analyze personal and home temperature exposure patterns via field measurements
 - **Listen.** Learn about barriers and opportunities to maintain temperature control among vulnerable residents via Photovoice, surveys, and questionnaires
 - **Translate.** Key findings from our studies into intervention strategies at individual, community and city level



Data Dashboard City Heat Plans Temp
Photovoice Community Resources Pre
Data Applications About Us

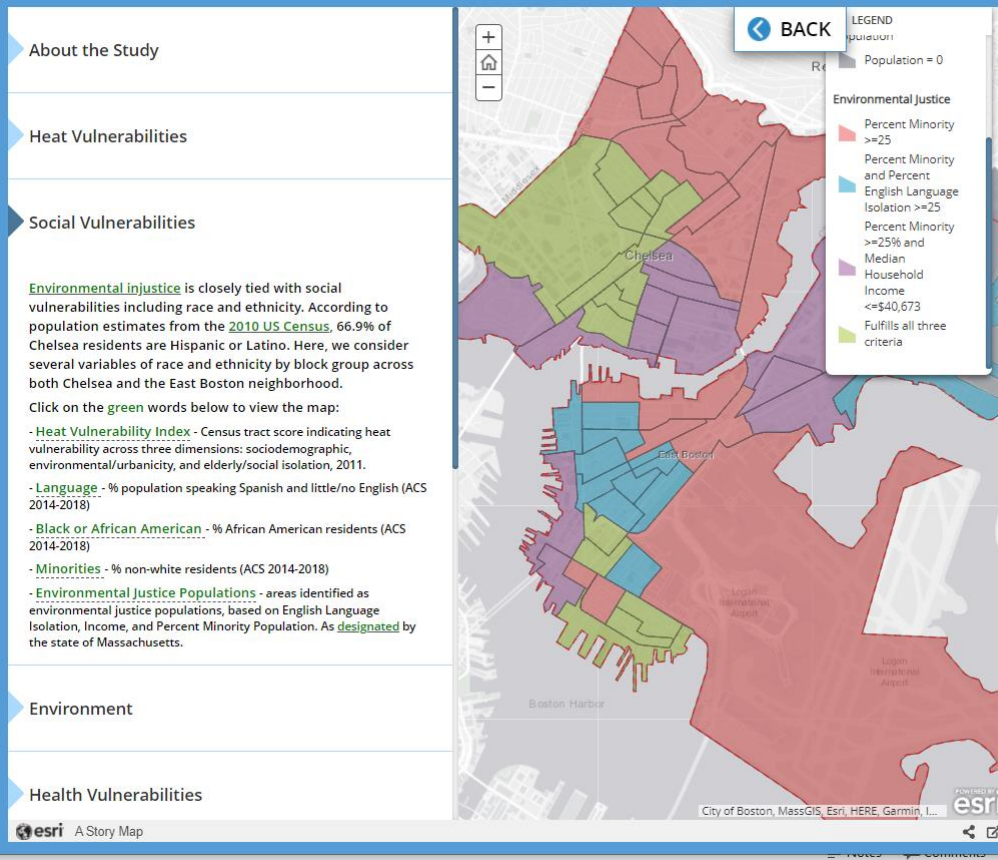
Do you worry about extreme heat?
Are you concerned about your community's health?

C-HEAT:

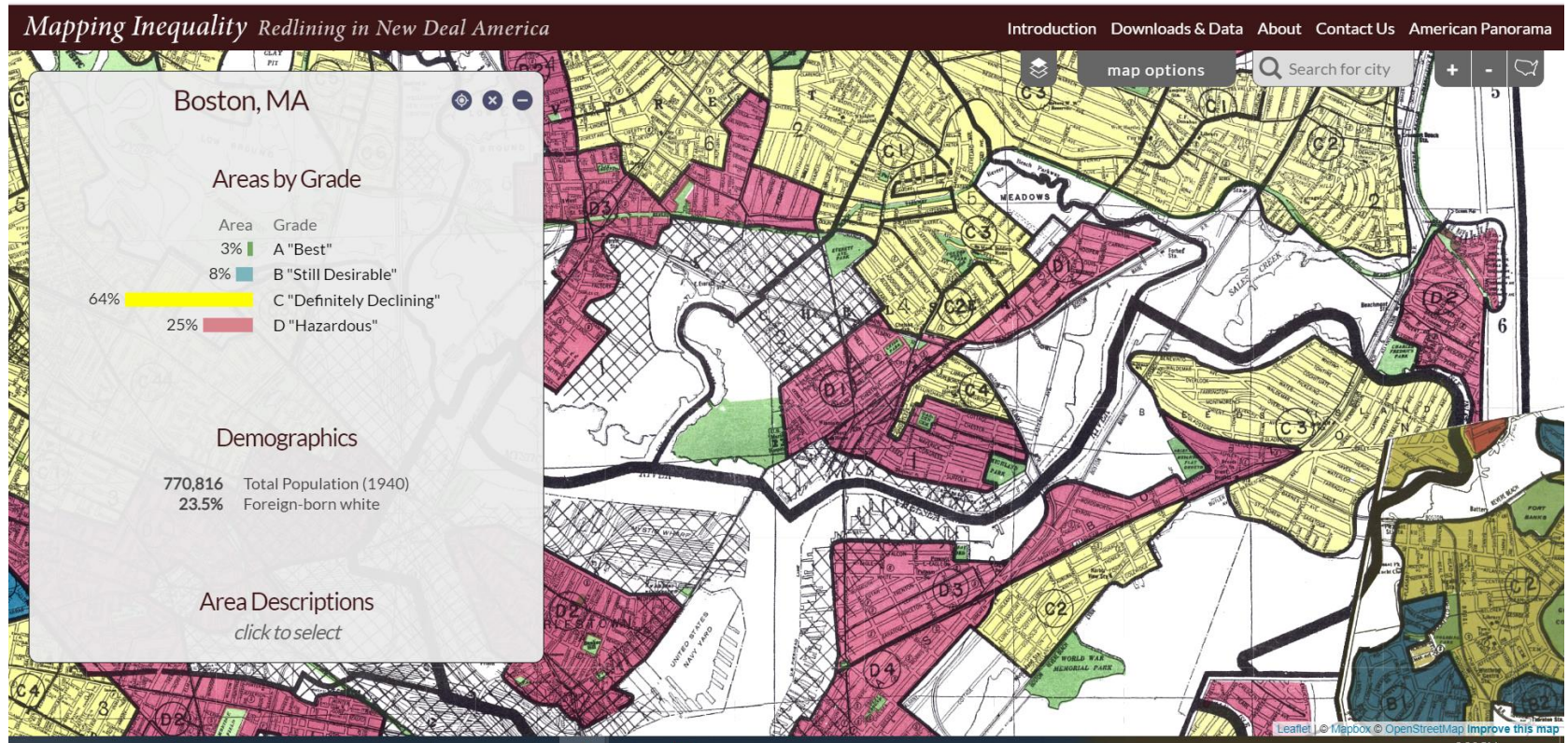
A study of heat exposure in Boston, Massachusetts

A collaborative research
project between
GreenRoots and the
Boston University School of
Public Health.

Boston University
Department of Environmental Health



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Department of Environmental Health

Chelsea and East Boston Redlining Map



About the Study

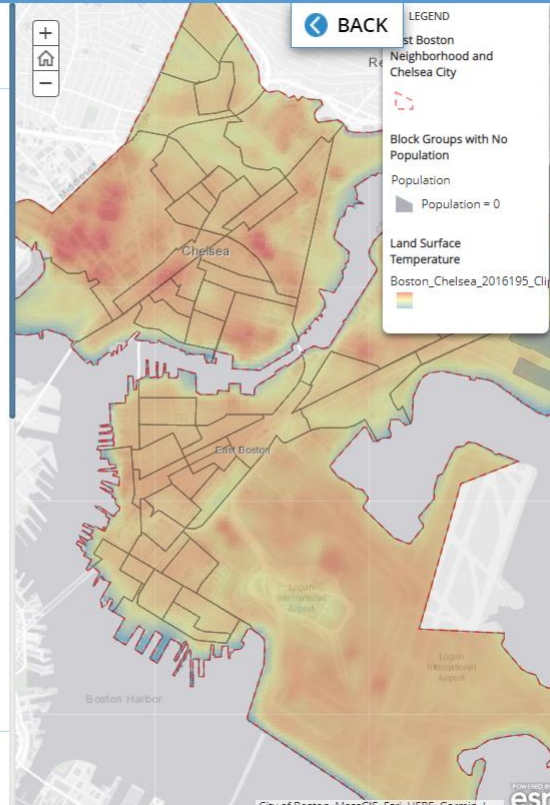
Heat Vulnerabilities

Looking at heat requires understanding areas and populations that are most vulnerable and/or susceptible to the increasing temperatures associated with a [warming climate](#). In this and the following tabs, explore datasets for Chelsea and East Boston areas related to environmental, health, economic, social, and housing factors of the urban heat island effect.

Click on the [green](#) words below to view the map:

- [Heat Vulnerability Index](#) - Census tract score indicating heat vulnerability across three dimensions: sociodemographic, environmental/urbanicity, and elderly/social isolation (2011).
- [Vulnerability Index](#) - Vulnerability Index Score for heat climate impacts, higher score indicates higher vulnerability. Averages across heat, adaptive, and sensitive indices (MAPC 2019)
- [Adaptive Capacity Index](#) - Adaptive Capacity Index Score for heat climate impacts, higher score indicates higher adaptive capacity. Indicators include: renter-occupied units, mobile housing units, vehicle status, internet access, education, employment, median household income, poverty rate, Latinx population, Black population, Asian population, Indigenous, multiracial, senior living alone, single-parent families, linguistic isolation, population with no health insurance, population in different residence (MAPC 2019)
- [Sensitivity Index](#) - Sensitivity Index Score for heat climate impacts, higher score indicates higher sensitivity. Indicators include: overcrowding, population in group quarters, age 5 or below, age 65 and older, central A/C, basement flood risk, disability prevalence, cardiovascular disease prevalence, asthma hospitalization rate, diabetes prevalence, and exposed workers (MAPC 2019)
- [Land Surface Temperature](#) - Land surface temperature, ranging from blue to red, with red representing 34 degrees celsius and blue representative 18 degrees celsius.

Social Vulnerabilities



City Heat Plans: Urban Heat Island Mitigation and Adaptation in the United States

Last Updated 8/12/2020



START HERE

City Heat Plans: About this Story Map



Chicago: Climate Action Plan Impacts Report (2010)



Los Angeles: Increased Vegetation and Albedo...



Philadelphia: Low Income Home Energy Assistance...



Boston: Update City Heat Emergency Action Plan...



Dallas: Adopt-a-Tree-Median (2009-present)



New York City: Public Cooling Areas (2020)



Philadelphia: Beat the Heat Hunting Park - Heat...



Boston: Developing a heat plan (2010)



Dallas: Dallas Comprehensive...



New York City: Get Cool NYC (2020)



Phoenix: Reinvent Phoenix Project (2012-present)



Los Angeles

City Heat Plans: Urban Heat Island Mitigation and Adaptation in the United States

Last Updated 8/12/2020



New York City: Get Cool NYC (2020) < > X



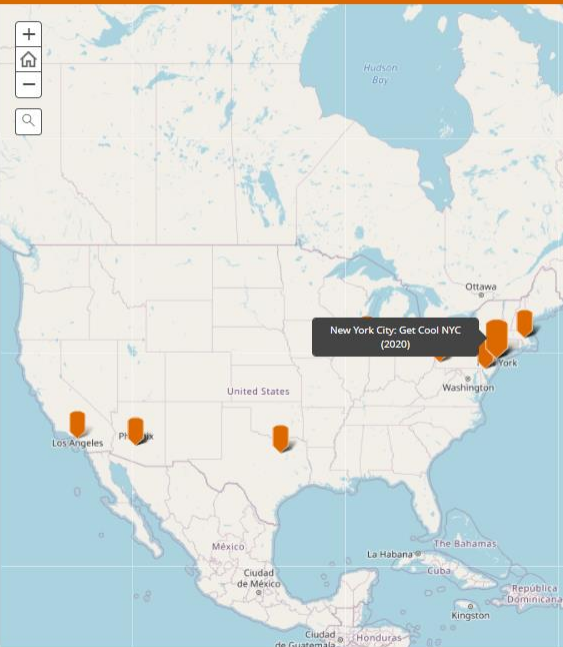
Image: Eastnewyork.com, 2020

New York City is providing up to 74,000 air conditioning units for low-income seniors this summer. 4,500 units have been installed as of June 12, 2020.

References:

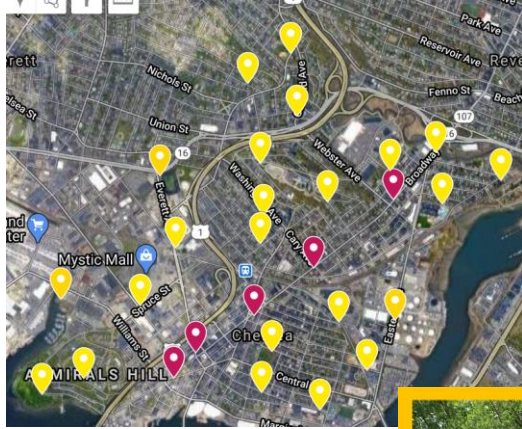
Get Cool NYC: Mayor de Blasio Updates New Yorkers on COVID-19 Summer Heat Plan, (2020, June 12). The Official Website of the City of New York. <http://www1.nyc.gov/office-of-the-mayor/news/433-20/get-cool-nyc-mayor-de-blasio-new-yorkers-covid-19-summer-heat-plan>

NYC Providing Free Air Conditioners To Help Eligible Households Stay Cool for the Hot Summer Months, (2020, June 15). East New York News. <https://eastnewyork.com/nyc-providing-free-air-conditioners-to-help-eligible-households-stay-cool-for-the-hot-summer-months/>



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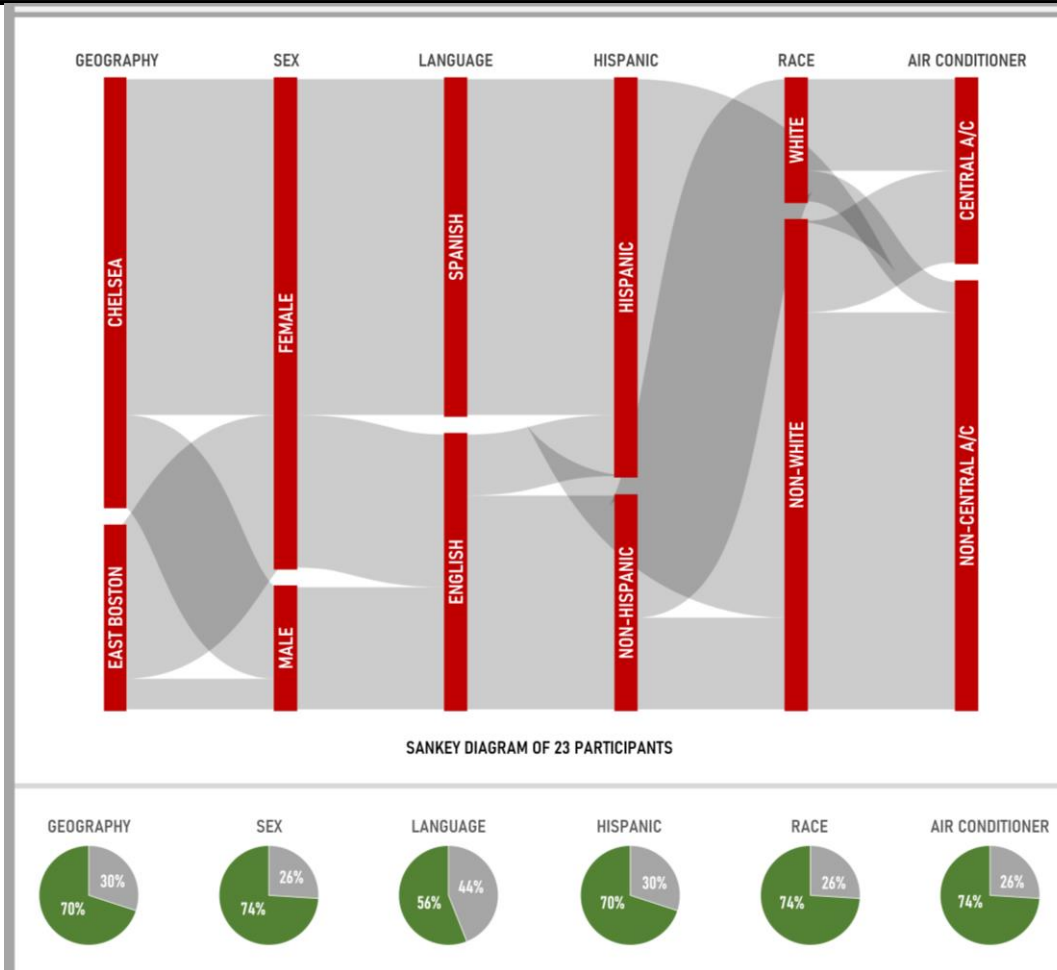
Outdoor temperature



- Partnered with City of Chelsea
- Municipal Vulnerabilities Planning grant

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- 24 households
- Recruited via email list serv, member mtgs, word of mouth




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of Fighting for Social and
Environmental Justice!

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Indoor and personal data collection

Phone data connects to a cloud database 

Azure function  (Microsoft service available at BU) requests (1) and receives (2) data, and uploads (3) to the HIPAA Sharepoint database **every 10 minutes**

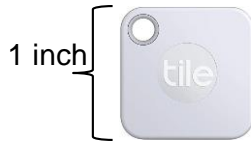
Biometric data:

(heart rate, step count, sleep)



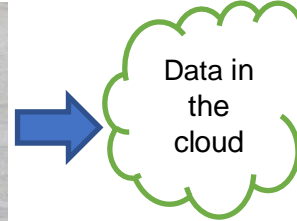
Location data:

(Latitude, Longitude) * 1 inch



Temp / Relative Humidity:

1.5 inch



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Where is it hot?



- **20 ambient sensors** on trees in Chelsea and East Boston
- **Installed** between May 21 and June 17
- As of August 31, we collected on average **~69 days of data** per sensor

Where is it hot?

Hourly outdoor temperatures...

Ranged: 55°F to 101°F

**Hottest sensor on average: 7 °F higher than
coolest sensor**

Mary C. Burke Elementary Complex

Washington & Cherry

Broadway & Fourth

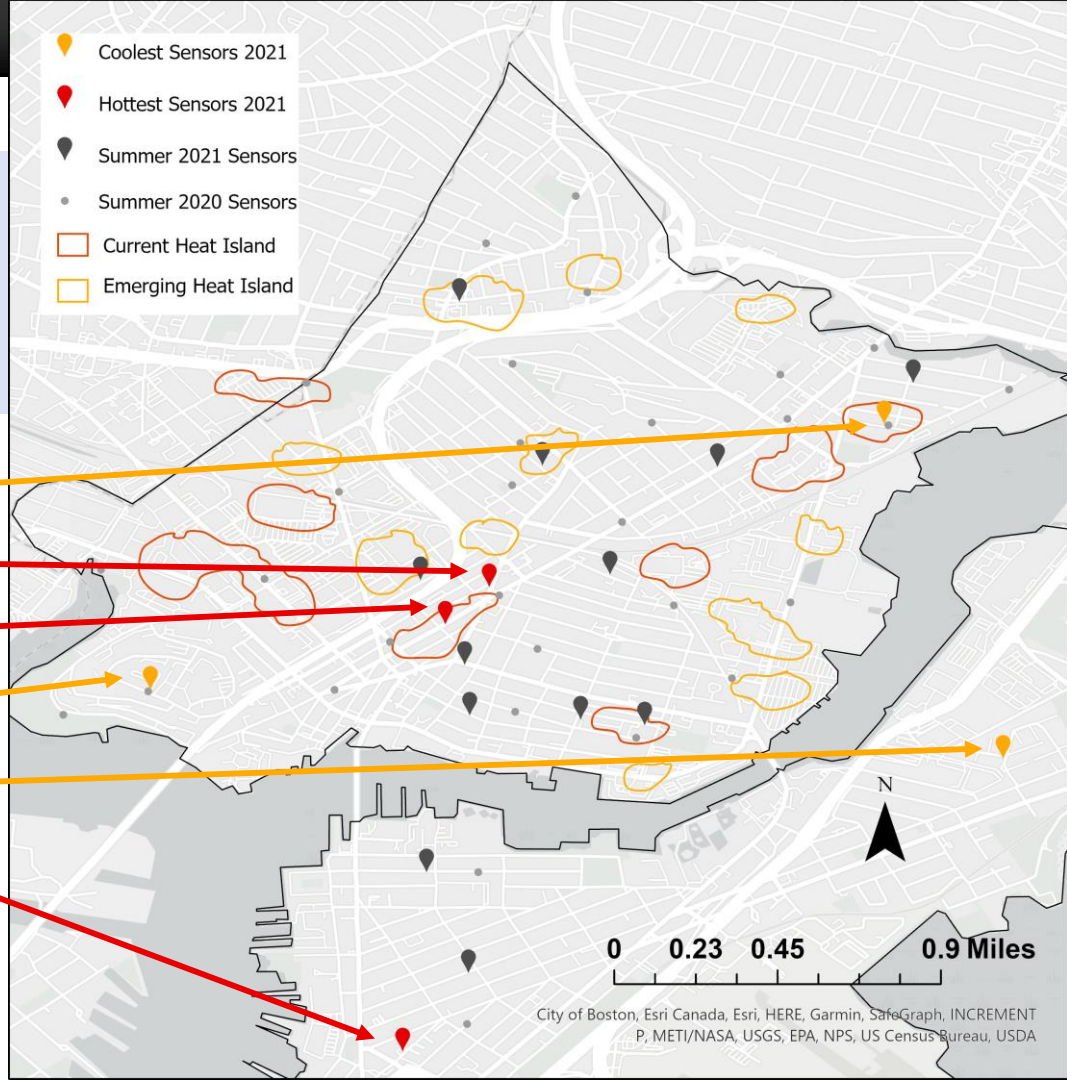
Boatswains Way

Trustman & Brandywyne

London & Porter

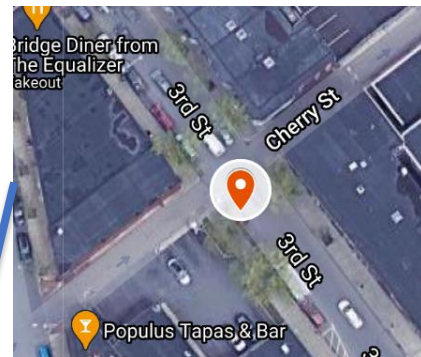
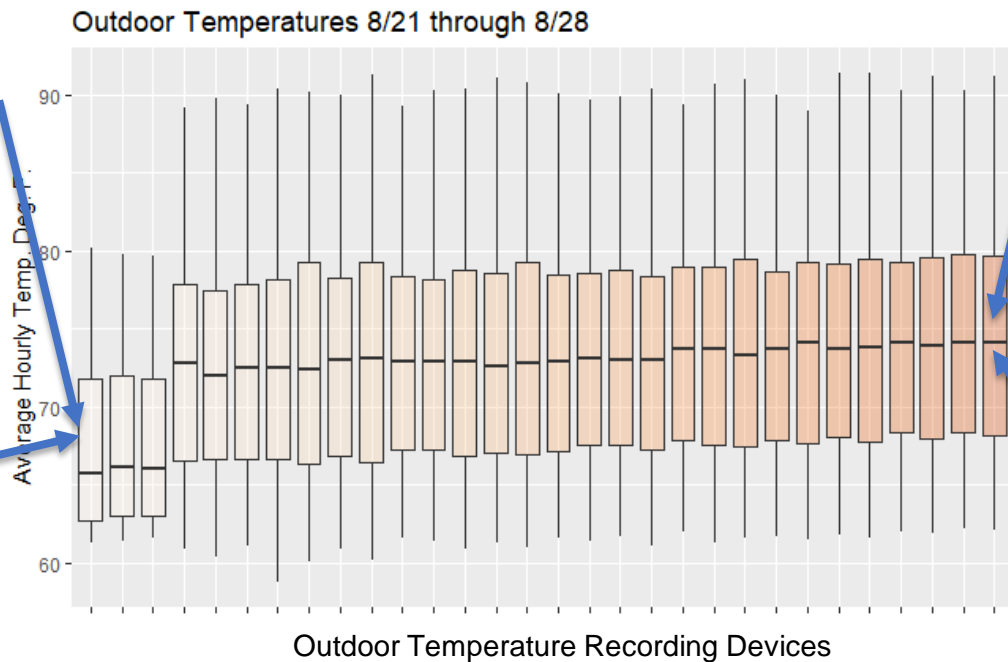
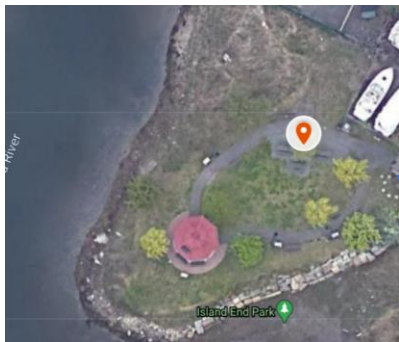
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-  Coolest Sensors 2021
-  Hottest Sensors 2021
-  Summer 2021 Sensors
-  Summer 2020 Sensors
-  Current Heat Island
-  Emerging Heat Island



City of Boston, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT
P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

On a hot week: *Outdoor* Temperatures



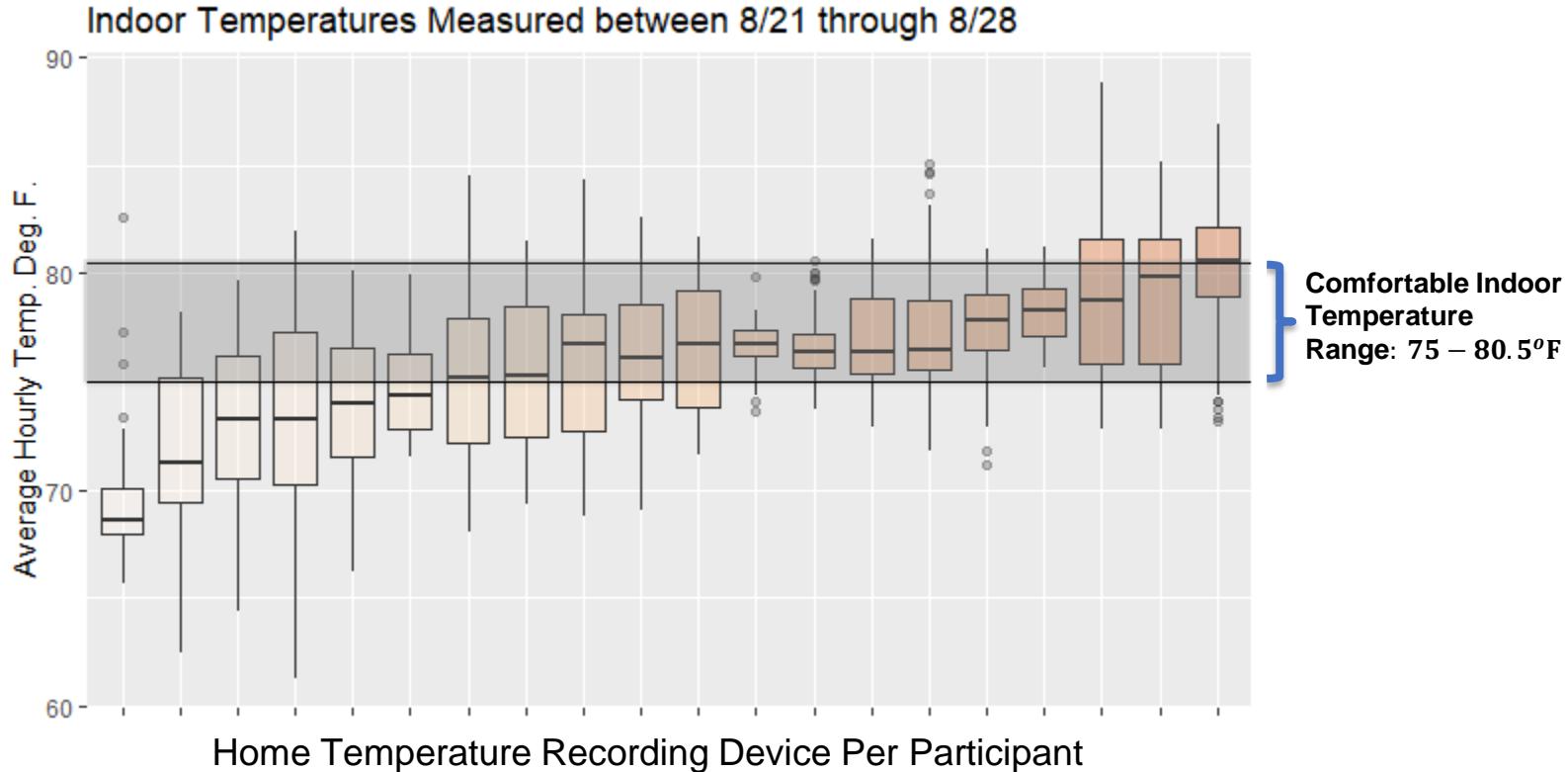
What makes homes hot?



Variables Considered:

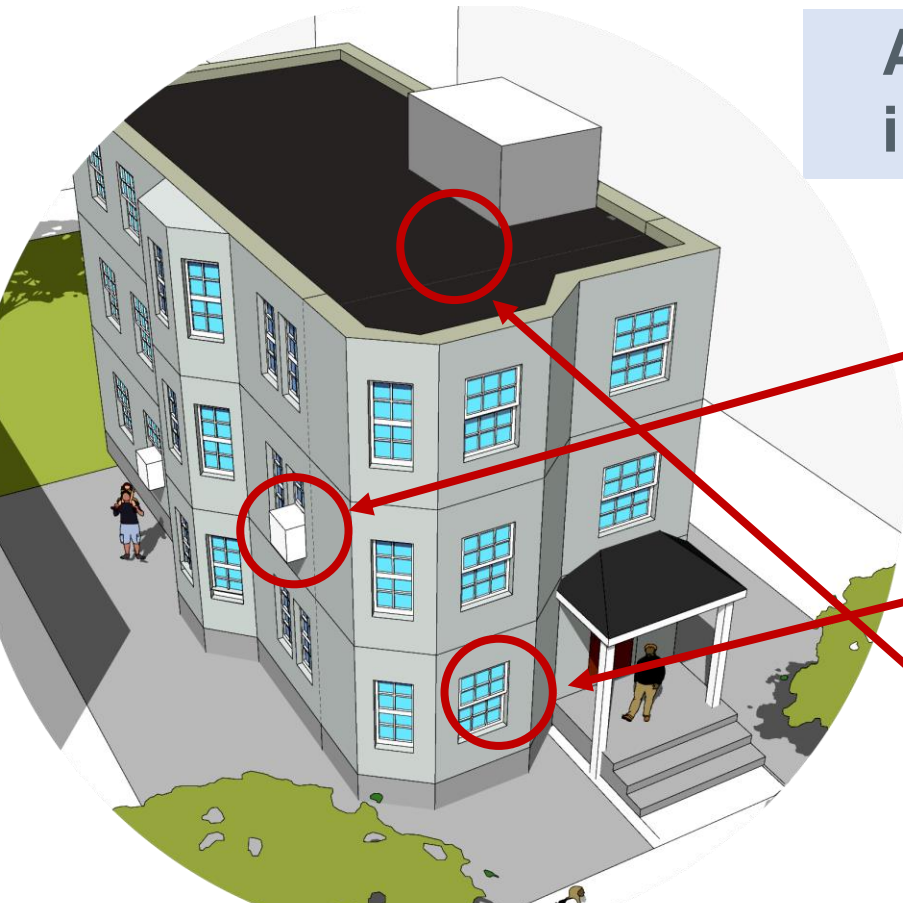
- **Roof tone**
- Façade tone
- Façade type
- Window-wall ratio
- **AC type**
- Shade tree
- **Floor**
- Roof shape
- % Impervious
- % Pavement
- Direction
- % Trees
- Year Built
- Stories
- Style
- Value

On a hot week: *Indoor* Temperatures



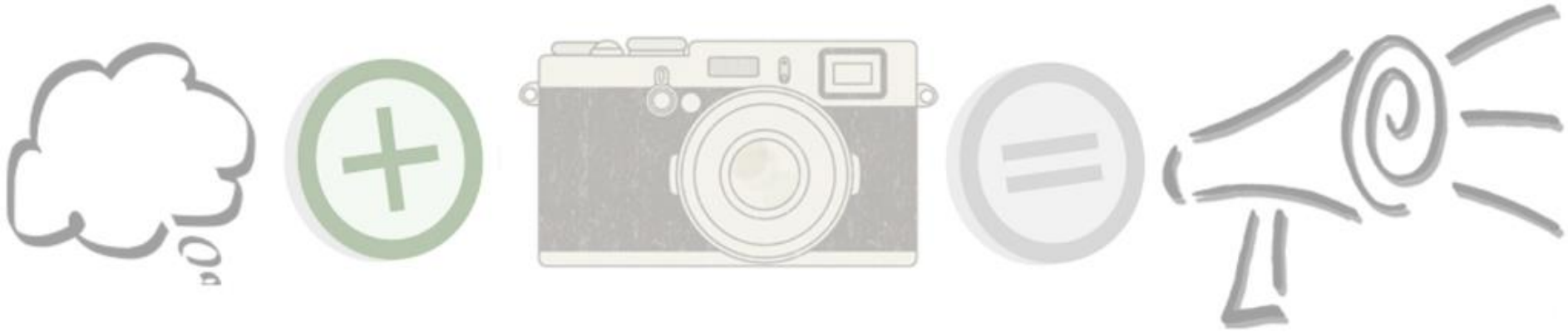
What makes homes hotter or cooler?

Among our participants, cooler indoor temperatures for those...



- **Using AC** in a given week (as indicated by weekly check-ins)
- With **Central AC** (compared to other AC)
- Living **below floor 2** (compared to on/above floor 2)
- With **lighter-colored roofs** (at midday, compared to darker roof tones)

Photovoice



A **participatory action research** method that engages participants in the use of **photography** to represent their **experience and perspectives** on a certain topic.

Budig K, Diez J, Conde P, Sastre M, Hernán M, Franco M. Photovoice and empowerment: evaluating the transformative potential of a participatory action research project. BMC Public Health 2018 vol: 18 (1)

Goals of Photovoice

- 1) to enable people to record and reflect their community's strengths and concerns
- 2) to promote critical dialogue and knowledge about important issue through small group discussions of photographs
- 3) to reach policy makers

Results

- Where are the trees? / Here are the trees!
 - Tree (in)equity: there is unequal distribution and access to green space and parks. The quality, utility, and accessibility of green spaces matters.
 - When we feel the heat: in transit! Feeling the lack of shade and the heat from the pavement while walking, at bus stops, and MBTA stations.
 - Compounded problems: Where there is a lack of trees, there are also other exposures: noise, air pollution from cars and buses.
- Populations vulnerable to heat
- Water: the good, the bad and the ugly
- Keeping it cool, creatively



Where are the trees?

This is the industrial side of Chelsea which impacts the microclimate. Both factory and truck exhaust surrounding concrete adds to the heat island effect.

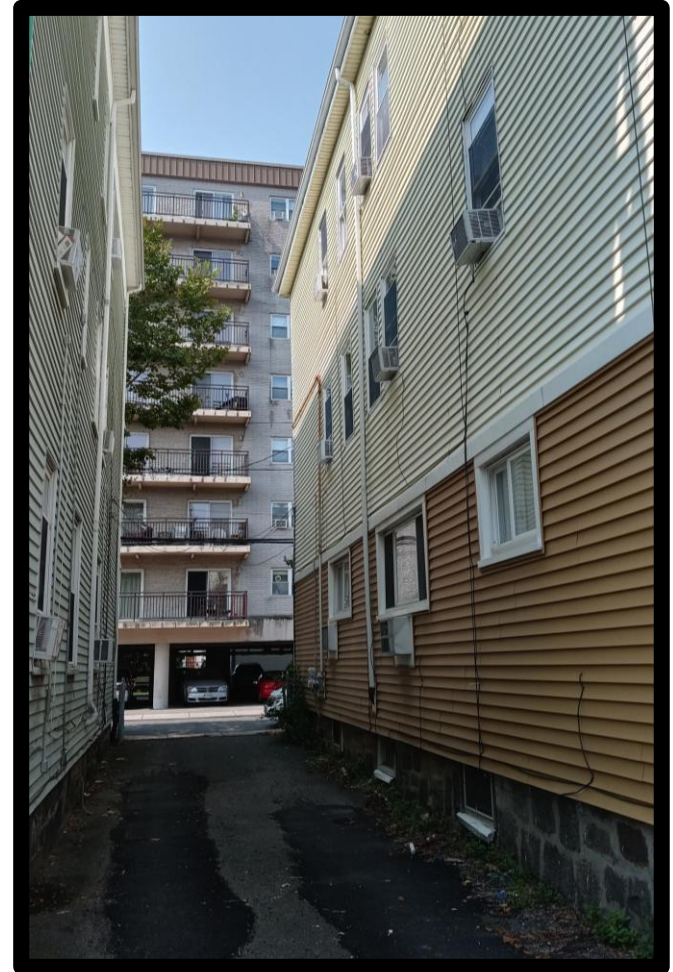


Here are the trees!

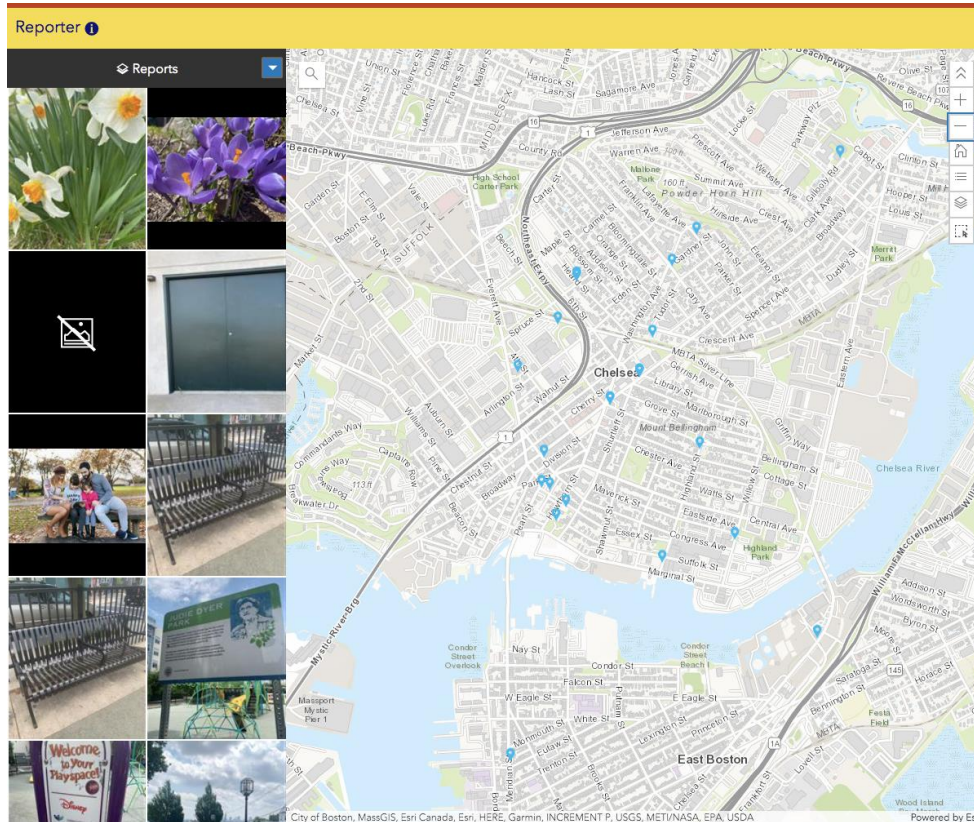
This street, and the rest of Admiral's Hill, has an abundance of trees and vegetation that offer protection from the heat as well as the air and noise pollution of the Tobin Bridge. I am hopeful that when city officials see these photos, they'll see how much inequity is present.

Keeping it cool

Cuando sales y miras a tu alrededor, ves muchos aires acondicionados en las ventanas. La mayoría de ellos son viejos, poco eficientes, y ruidosos. En nuestra comunidad, hay mucha gente que no se puede permitir comprar un aparato de aire nuevo. Muchos de ellos, tampoco tienen donde almacenarlo, así que los deben dejar en las ventanas todo el invierno.



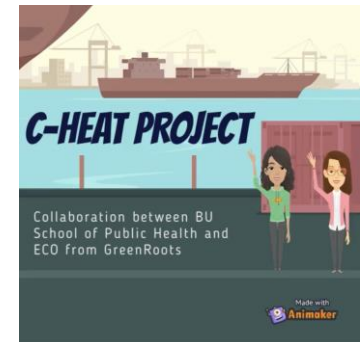
Youth Engagement and Social Media



<https://storymaps.arcgis.com/stories/b2678cc9407c446e8bcfe7be184dccac>



TikTok



Opportunity: Evaluate use of **Drinking Water & Misting** Stations



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2021-2022 Interventions & Future Analyses

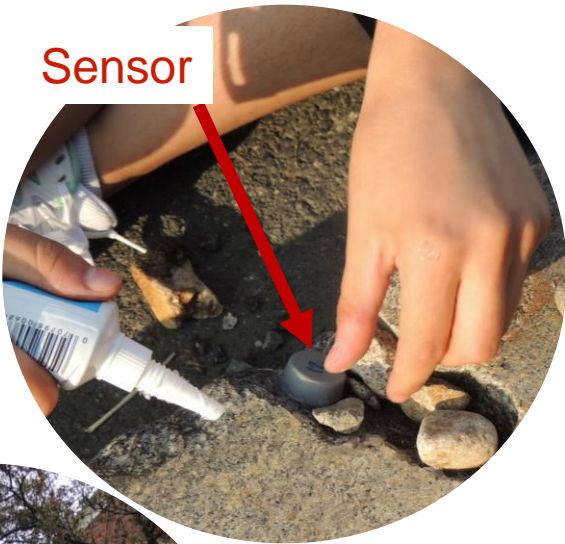


White roofs

Williams Jr. High School



Playgrounds & parks



Sensor



Burke Elementary
Complex



Bus stops

Analyze data from “Cool block interventions”

Other City MVP interventions

- Street reflective murals
- Sidewalk pavers
- Greenspace





FOLLOW



PHPOD



THE
TURNING
POINT



MENU



SEARCH

Climate Disease and Kidney Injustice

By Madeleine K. Scammell

November 6, 2017

RESEARCH



<https://www.publichealthpost.org/research/climate-chronic-kidney-disease/>

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