

# BUILDING EQUITABLE RESILIENCE TO CLIMATE EVENTS

*Moderated by:*

**Gregory Wellenius**

Professor of Environmental Health &  
Director, Center for Climate and Health,  
Boston University School of Public Health

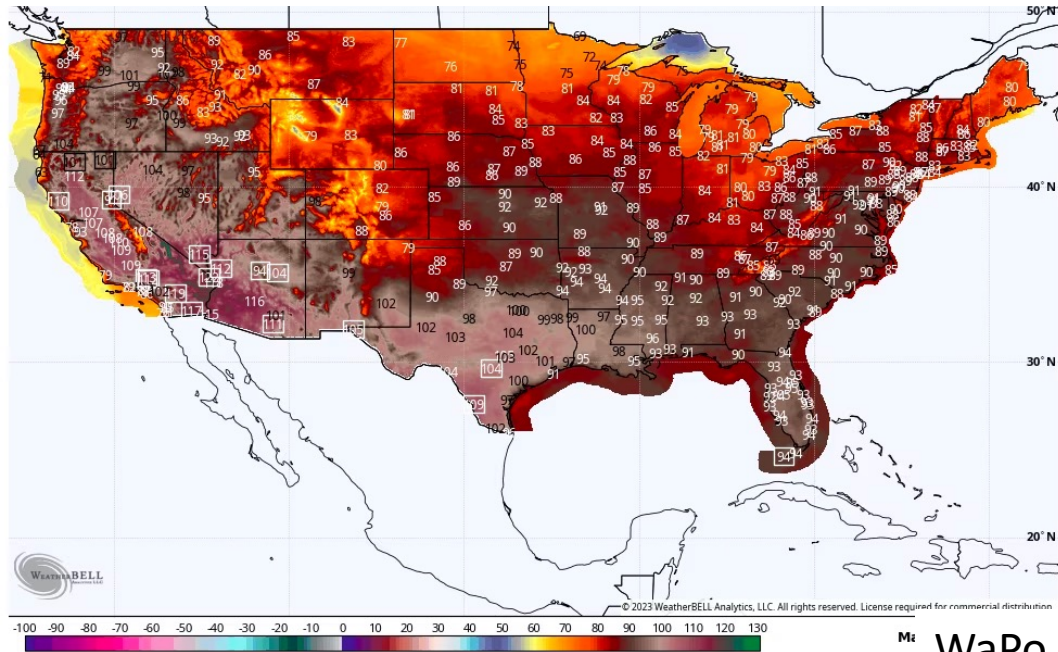




NPR



CNN



Mt WaPo

# Phoenix Breaks Heat Record Set in 1974

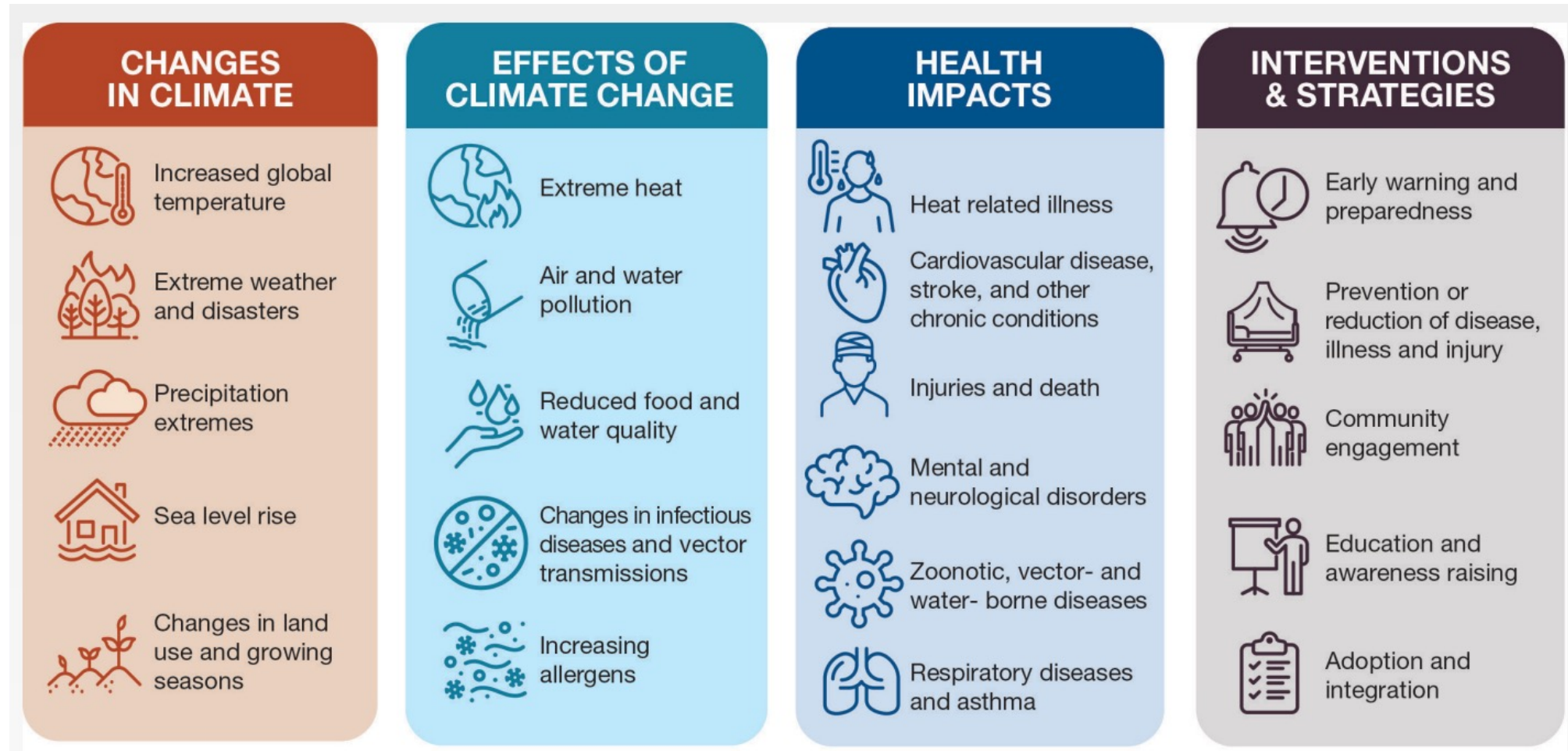
As much of the South bakes, Phoenix blazed past a milestone set half a century ago for consecutive days with 110-degree or higher temperatures.

NYT

# What you need to know about climate change:

- It's real
- It's us (caused by humans)
- Experts agree
- It affects all of us
- There's hope (it's solvable)

# Impacts of Climate Change on Human Health



# Today's Discussion



**Amruta Nori-Sarma**

Assistant Professor of  
Environmental Health,  
Boston University School of  
Public Health



**Leticia Nogueira**

Scientific Director  
Health Services Research,  
American Cancer Society



**Marissa Zampino**

Community Organizer  
Mystic River Watershed  
Association

# BUSPH-HSPH Climate Change and Health Research Coordinating Center



**Greg Wellenius**  
(BU)



**Francesca Dominici**  
(Harvard)



**Amruta Nori-Sarma**  
(BU)



**Danielle Braun**  
(Harvard)



**Kevin Lane**  
(BU)



**Leila Kamarredine**  
(Harvard)



**Rebecca Pearl-Martinez**  
(BU)



**Benjamin Sovacool**  
(BU)



**Pat Kinney**  
(BU)



**Rachel Nethery**  
(Harvard)



**Jon Levy**  
(BU)

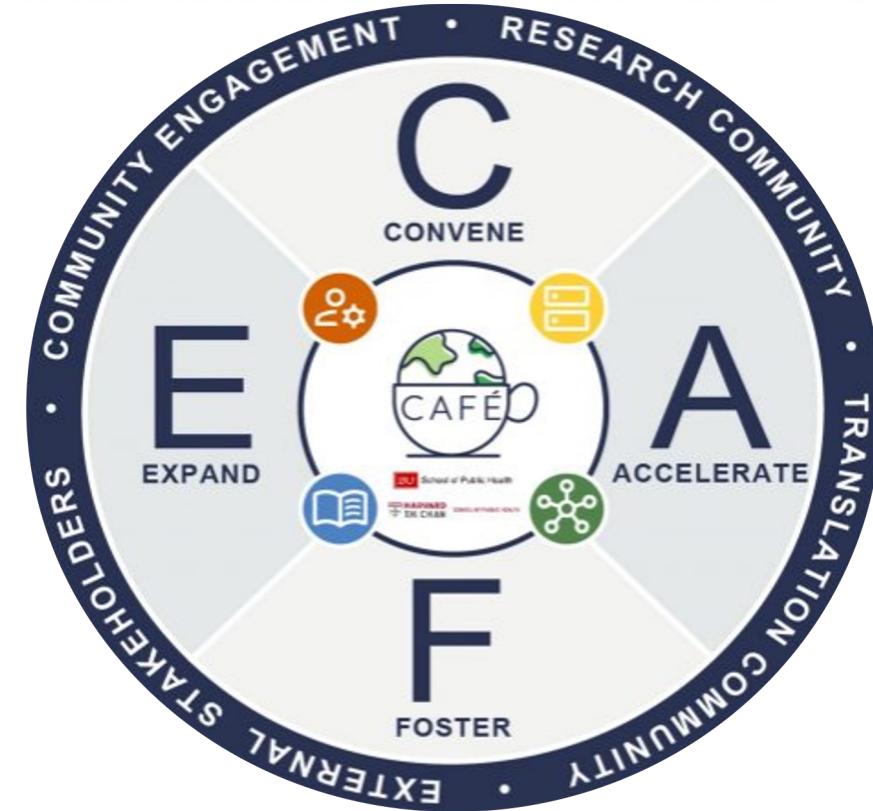


**Pam Templar**  
(BU)

**BU** School of Public Health  
Center for Climate & Health



**HARVARD**  
**T.H. CHAN**  
SCHOOL OF PUBLIC HEALTH



Administrative Function



Data Management Function



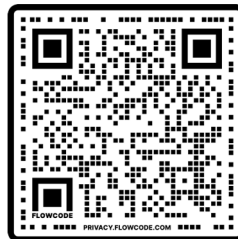
Resource Function



Capacity Building Function

## COMMITTED SUPPORTERS:

Harvard Data Science Institute, Harvard Climate Change Institute, BUSPH Center for Climate and Health, Microsoft, AWS, ESRI, Google, BU Events Planning, UMass Boston, Meharry Medical College, PHFI, C40 Cities, EHRA



- **Medically Vulnerable Populations**

Leticia M. Nogueira, PhD MPH

American Cancer Society

Emory University

National Institutes of Health

# American Cancer Society



## ACS exists because the burden of cancer is unacceptably high

*Our mission is to improve the lives of people with cancer and their families through advocacy, research, and patient support, to ensure everyone has an opportunity to prevent, detect, treat, and survive cancer.*

Action  
through  
advocacy



American  
Cancer  
Society  
Cancer  
Action  
Network™

Advancing  
discovery



Patient  
Support

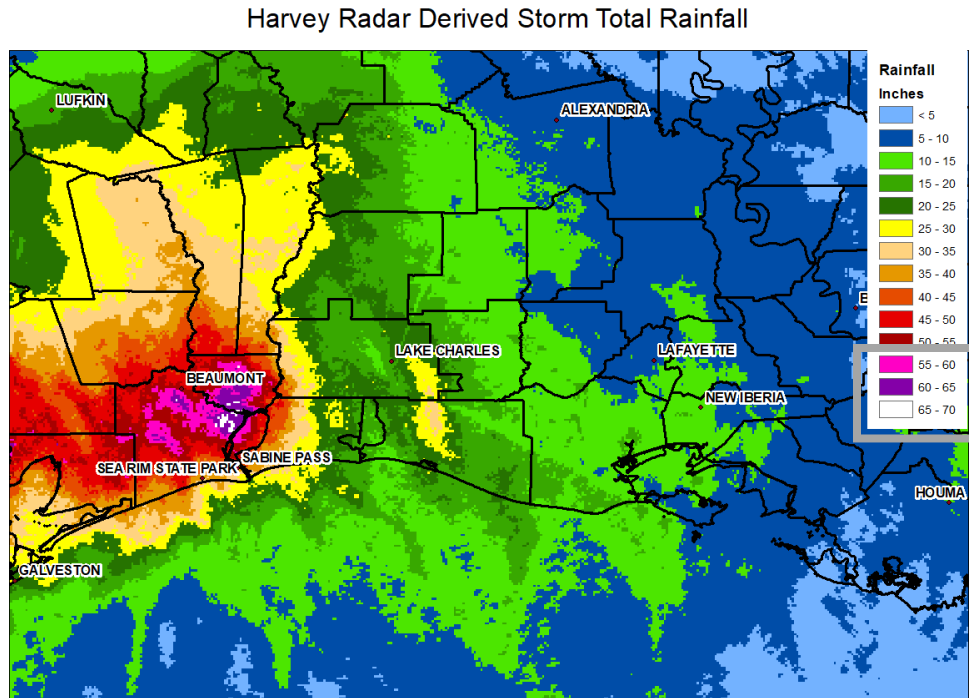


**Vision:** End cancer as we know it, for everyone.



# • Climate Change

Alters the behavior of extreme weather events



Rainfall over Houston during Hurricane Harvey  
National Oceanic and Atmospheric Administration (NOAA)



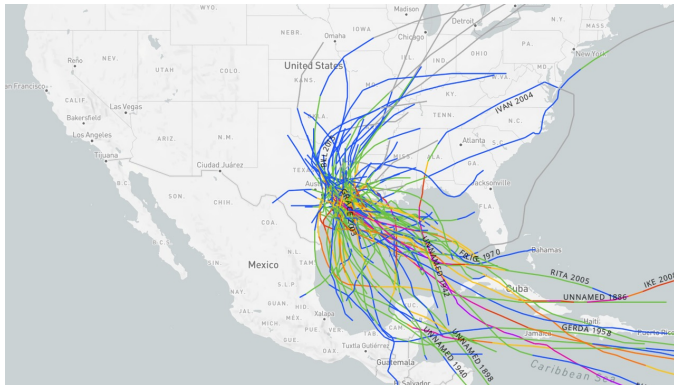
Extreme Weather Events

Warmer air holds more water vapor, which increases the water capacity of hurricanes

Kossin JP. A global slowdown of tropical-cyclone translation speed. *Nature*. 2018;558:104-107 | Emanuel K. Assessing the present and future probability of Hurricane Harvey's rainfall. *Proc Natl Acad Sci U S A*. 2017;114:12681-12684

# • Disruptions in Access to Care

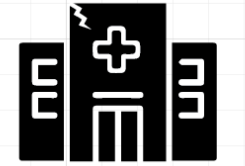
Climate-driven disasters



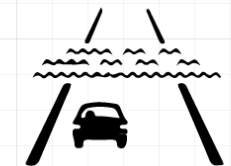
<https://coast.noaa.gov/hurricanes/#map=4/32/-80>



Extreme Weather Events



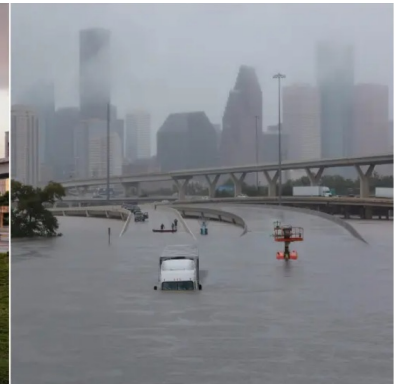
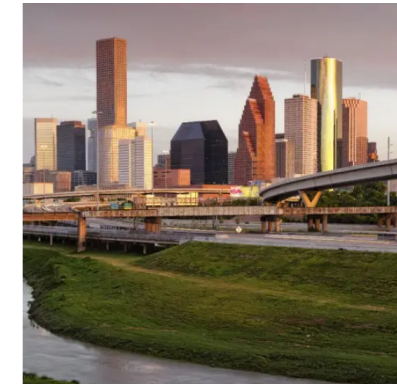
Medical Infrastructure



Transportation Links



Supply Chain



Hurricane Harvey

Changing frequency and behavior of extreme weather events makes it harder for communities to prepare and respond to increasingly unpredictable circumstances

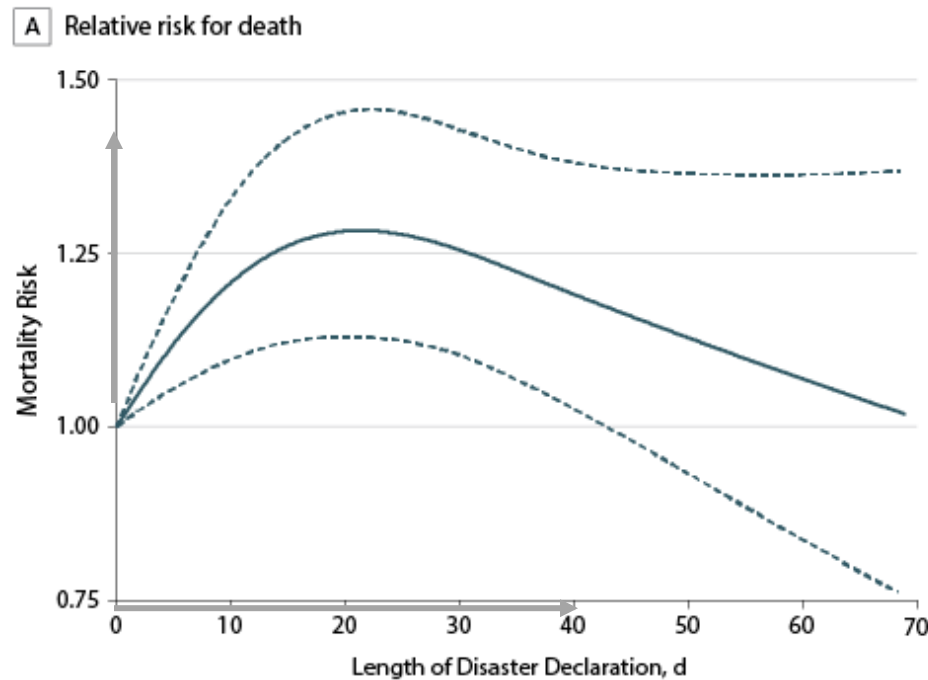


Especially concerning for medically vulnerable populations

# Impact of Hurricanes on Cancer Patients

## Disruptions in access to care and worse survival

Figure. Association Between Length of Hurricane Disaster Declaration and Risk of Death in Patients With Lung Cancer Undergoing Radiation



Worse overall survival

HR (95% CI)  
1.19 (1.07, 1.32)

Nogueira LM, Sahar L, Efstathiou JA, Jemal A, Yabroff KR. Association Between Declared Hurricane Disasters and Survival of Patients With Lung Cancer Undergoing Radiation Treatment. *JAMA*. 2019;322: 269-271.

# • Facilities Impacted by Hurricanes

American Hospital Association (AHA) + FEMA (2016-2020)



<https://www.ahadata.com/>

# • Facilities Impacted by Extreme Weather Events

American Hospital Association (AHA) + FEMA (2016-2020)

Severe Storm (37%)



Flood (28%)



Severe Ice Storm (17%)



# • Facilities Impacted by Extreme Weather Events

American Hospital Association (AHA) + FEMA (2016-2020)

All types of disasters (99%)

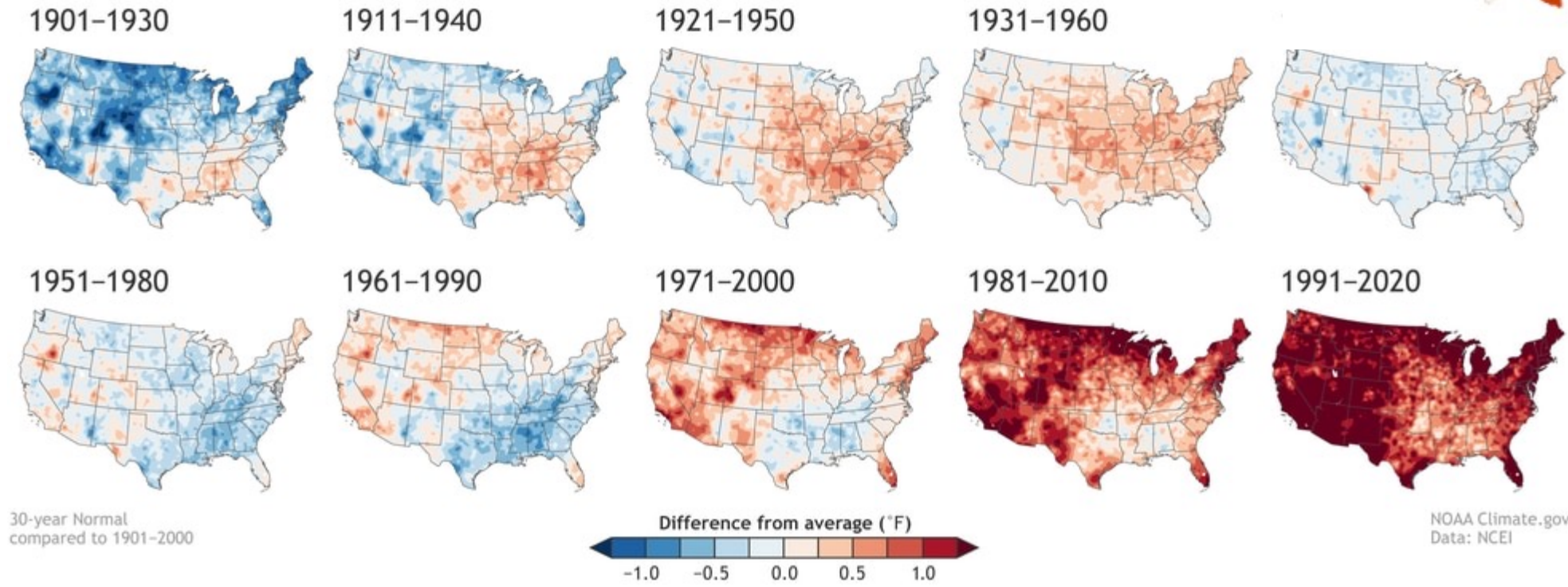


Espinel Z, Nogueira LM, Gay HA, Bryant JM, Hamilton W, Trapido EJ, Shepherd JM, Galea S, Shultz JM. *Climate-driven Atlantic hurricanes create complex challenges for cancer care.* [Lancet Oncol.](#) 2022 Oct 18:S1470-2045(22)00635-0.

# • Broken-Record Record-Breaking

Today's temperatures are the highest they have ever been

## U.S. ANNUAL TEMPERATURE COMPARED TO 20<sup>th</sup>-CENTURY AVERAGE



NOAA Climate.gov  
Data: NCEI

# • Health Hazards of Climate Change

Medically vulnerable populations

- Consequences of cancer diagnosis and treatment
  - Physical
  - Psychological
  - Socioeconomic
- Individuals diagnosed with cancer are a vulnerable population to the health hazards of climate change



# • Individuals with chronic health conditions

Vulnerable population to the health hazards of climate change

- Physical consequences

- Organ Damage
- Weakened Immune System
- Anemia
- Fatigue
- Dehydration

- Psychological consequences

- Depression
- Cognitive impairment



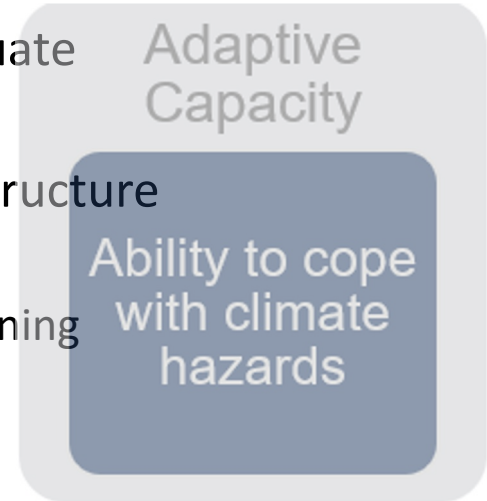
- Increased sensitivity to climate hazards

- Heat waves
  - Chronic kidney disease
- Infections during floods
  - Immunocompromised patients
- Respiratory issues during wildfires

# • Individuals diagnosed with cancer

Vulnerable population to the health hazards of climate change

- Socioeconomic consequences
- Financial Hardship
  - Out-of-pocket expenses
  - Ability to remain employed
- Harder to prepare and respond to disasters
  - Ability to evacuate
  - Stockpile food
  - Housing infrastructure
    - Insulation
    - Air conditioning
    - Air filters



Altice CK, Banegas MP, Tucker-Seeley RD, Yabroff KR. *Financial Hardships Experienced by Cancer Survivors: A Systematic Review*. J Natl Cancer Inst. 2016 Oct 20;109(2):djw205

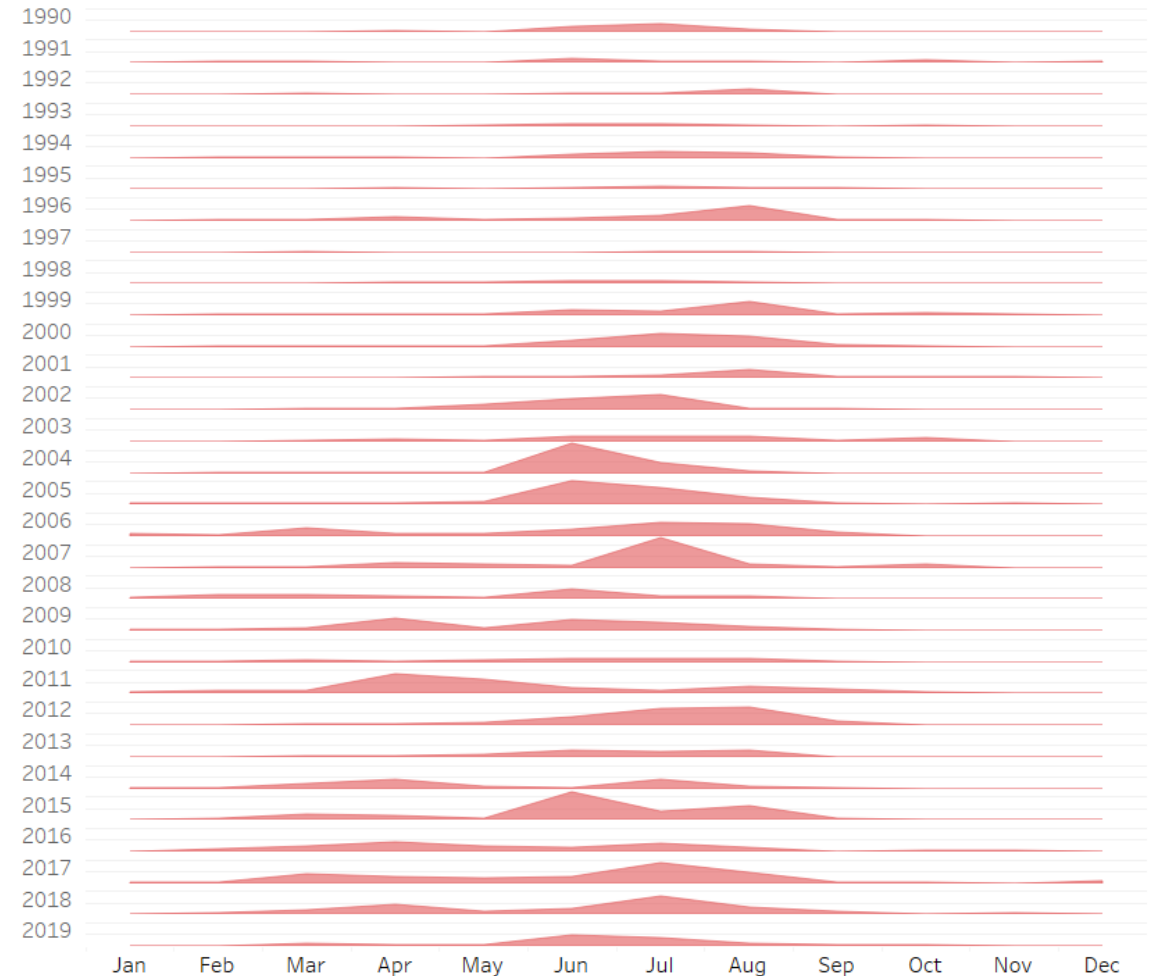
**Nogueira LM**, Crane TE, Ortiz AP, D'Angelo H, Neta G. *Climate Change and Cancer*. Cancer Epidemiol Biomarkers Prev. 2023 May 15:OF1-OF7.

# • Wildfire Activity

Closely tied to temperature and drought

- Increase in wildfire activity in the US
  - Area burned
  - Number of large fires
  - Fire season length

Wildfires Since 1990



# • Wildfire Exposure and Lung Cancer Survival



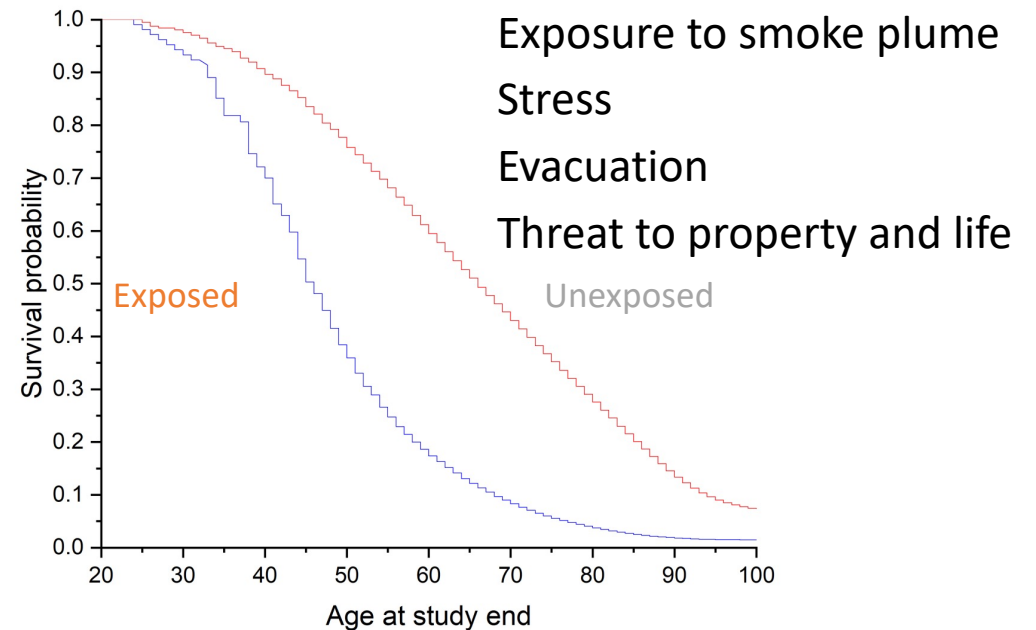
Among individuals discharged from the hospital following lung cancer surgery



NASA HEALTH AND AIR QUALITY  
APPLIED SCIENCES TEAM  
Connecting NASA Data and Tools with Health and Air Quality Stakeholders



National Aeronautic and Space Agency  
<https://appliedsciences.nasa.gov/what-we-do/disasters/fires>



Zhang D, Xi Y, Boffa D, Liu Y, Nogueira LM. *Wildfire exposure while recovering from lung cancer surgery decreases long-term survival.* JAMA Oncology. Accepted

- **What can we do?**

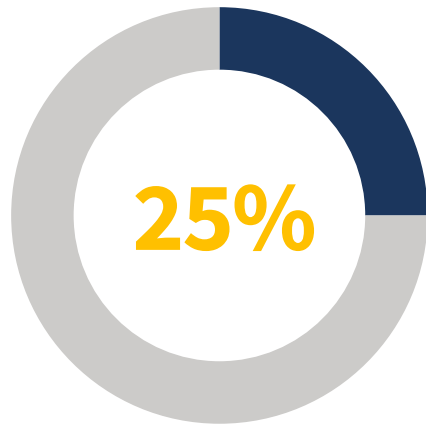
# • Emergency Preparedness Plan

Information available on cancer centers' websites

- Nationally distributed
- Trusted source of information in communities



- Climate-driven disasters
- Between 2015 and 2022



## Steps individuals can take

- How to create a portable medical card
- How to pre-register for special needs shelters
- Additional items to be included in the emergency supply kit
- How to request additional medication

# • Emergency Preparedness Plans

Burden on the individual



<https://www.washingtonpost.com/weather/2021/05/02/california-wildfire-season-growing/>

# • Disaster Preparedness

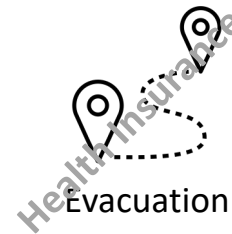
Protecting the health and safety of medically vulnerable populations



<https://www.nytimes.com/2023/07/11/us/vermont-flooding-damage-rescues.html?action=click&module=RelatedLinks&pgtype=Article>



Emergency Preparedness Plan



Medicaid coverage in another state

Private health insurance coverage and out of network costs

Espinell Z, Shultz JM, Aubry VP, Abraham OM, fan Q, Sahar L, Nogueira LM. *Protecting Vulnerable Patient Populations from Climate Hazards: The Role of the Nations' Cancer Centers*. Journal of the National Cancer Institute. Accepted



# • Disaster Preparedness

Strategies for improving resilience

## Microgrid system in Puerto Rico



<https://grist.org/solutions/puerto-rico-town-celebrates-first-of-its-kind-solar-microgrid/>

Microgrid systems don't rely on diesel, which needs to be transported and can become scarce due to disruptions in the supply chain



Emergency Preparedness Plan



Infrastructure  
Loss of power

Decreases exposure of surrounding communities to toxic air pollution during emergencies



Diesel-powered emergency generators

**CMS.gov**

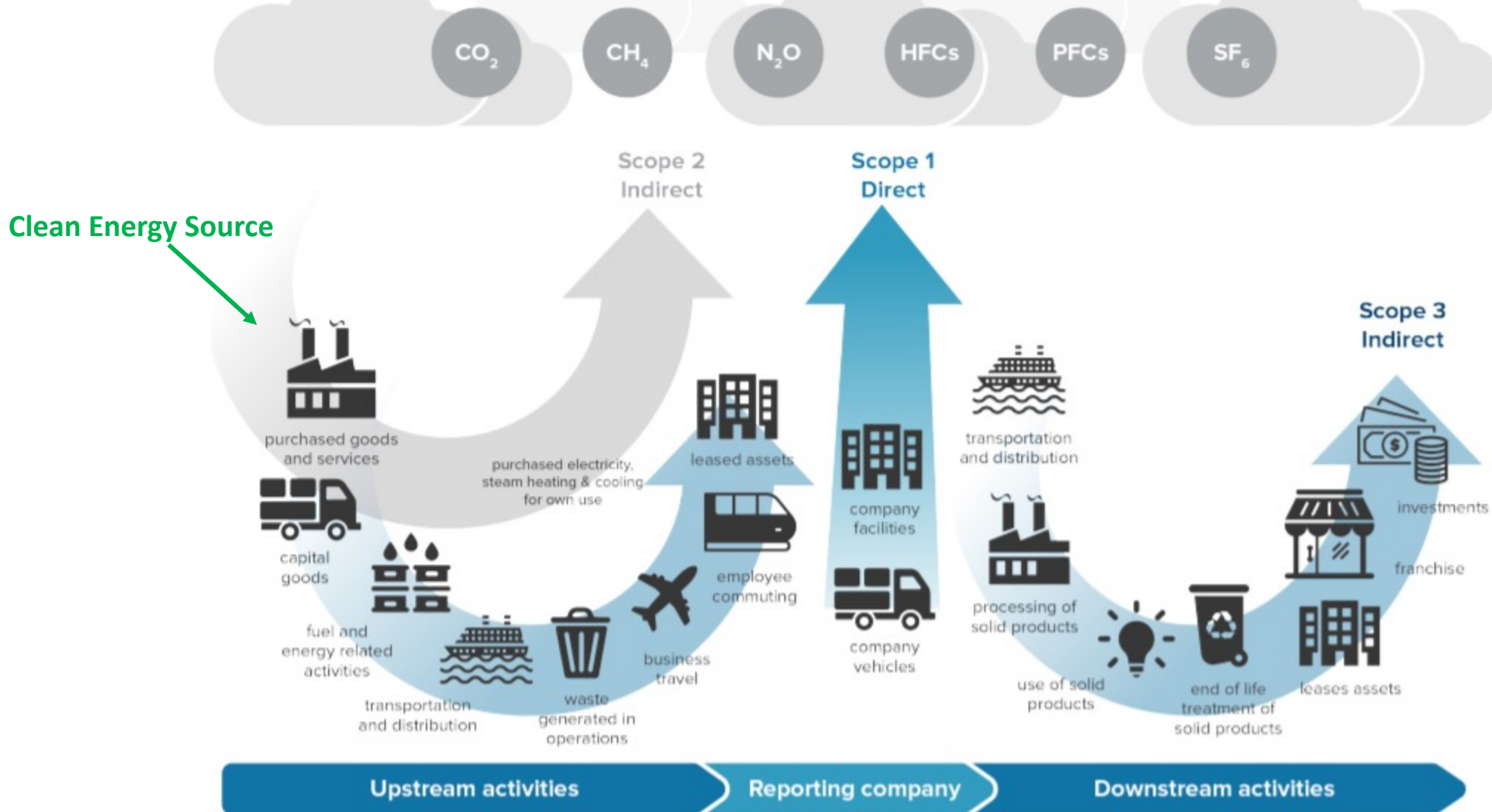
**Categorical Waiver – Health Care Microgrid Systems (HCMSs)**

<https://www.cms.gov/medicare/provider-enrollment-and-certification/surveycertificationgeninfo/policy-and-memos-states/categorical-waiver-health-care-microgrid-systems-hcmss>

Espinell Z, Shultz JM, Aubry VP, Abraham OM, fan Q, Sahar L, Nogueira LM. *Protecting Vulnerable Patient Populations from Climate Hazards: The Role of the Nations' Cancer Centers*. *Journal of the National Cancer Institute*. Accepted

# • Healthcare System Emissions

Emissions from US healthcare system exceed emissions from the entire United Kingdom



# • 3 Choices with Climate Change

We all can contribute to solutions

**Mitigation**



**Adaptation**



**Suffering**



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“

• Give me a lever long enough, and I shall move the world.

• Archimedes

”

---

• Thank you!




[cancer.org](https://cancer.org) | 1.800.227.2345



# Heat Resilience and Environmental Justice

*Marissa Zampino, Community Organizer*

*Lands of Massachusetts, Nipmuc and Pawtucket tribes*


A scenic view of a lake with autumn foliage reflected in the water. The sky is blue with light clouds. The trees on the left are in full autumn colors, while the trees on the right are mostly green. The water is calm and reflects the surrounding landscape.

**MyRWA wishes to honor and acknowledge the indigenous communities native to this region and its past, present, and future. The watershed is on the colonized lands of the Massachusett, Nipmuc, and Pawtucket tribes.**

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**As you explore the watershed, we encourage you to learn with us about its past and current indigenous heritage.**





**The Mystic River watershed is a network of streams, rivers, and lakes, all draining into the Mystic River.**

**76**  
SQUARE MILES

**44**  
LAKES & PONDS

**21**  
COMMUNITIES

**600,000**  
PEOPLE

LEARN MORE  
[MYSTICRIVER.ORG](http://MYSTICRIVER.ORG)



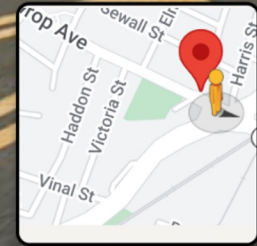
August 12 3 PM Modeled Air Temperature

- ▶ Base Layers
- ▼ Heat Vulnerability Risk Factors
  - ▲ Increase transparency
  - ▼ Decrease transparency
  - MA Environmental Justice Community
  - Heat Vulnerability Index
  - Percent Black Population
  - Median Household Income
  - English Language Isolation
- ▶ Land Cover Characteristics
- Wicked Hours Afternoon Model

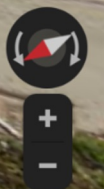
**213 Winthrop Ave**  
Revere, Massachusetts

Google

Street View - Nov 2020

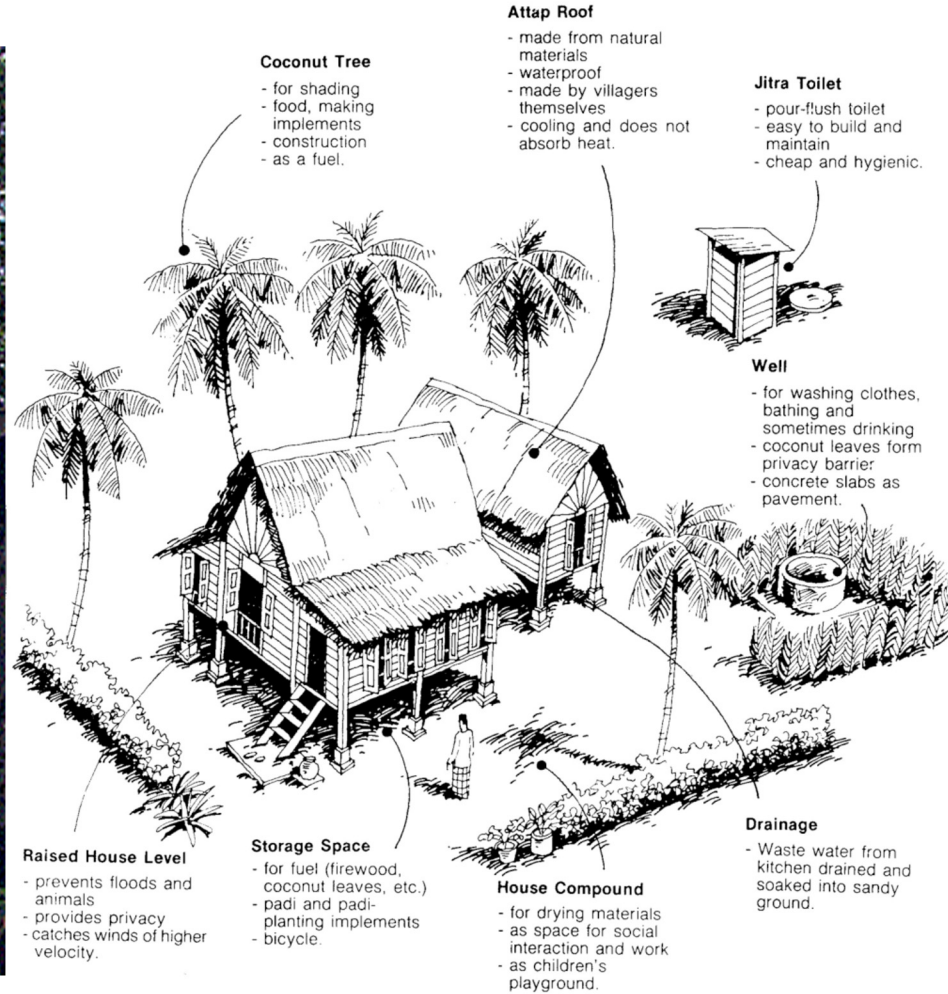


About this project





**Boston is a blizzard culture.**



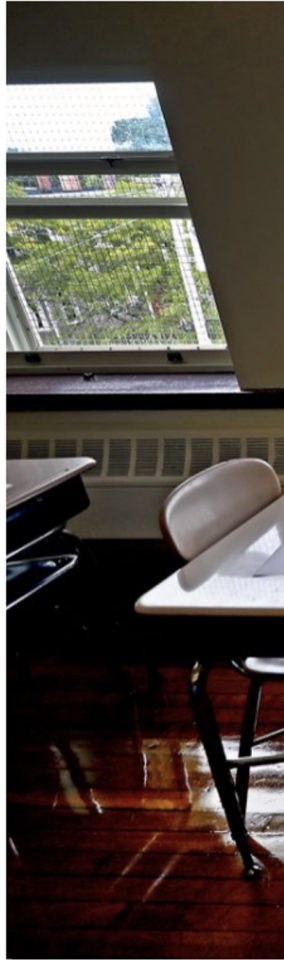
Source

# What can we learn from heat cultures?

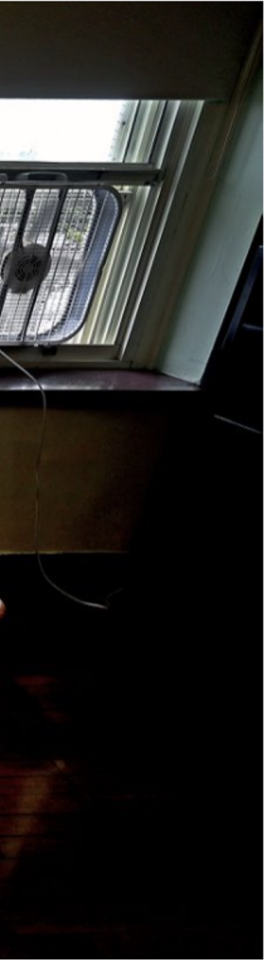
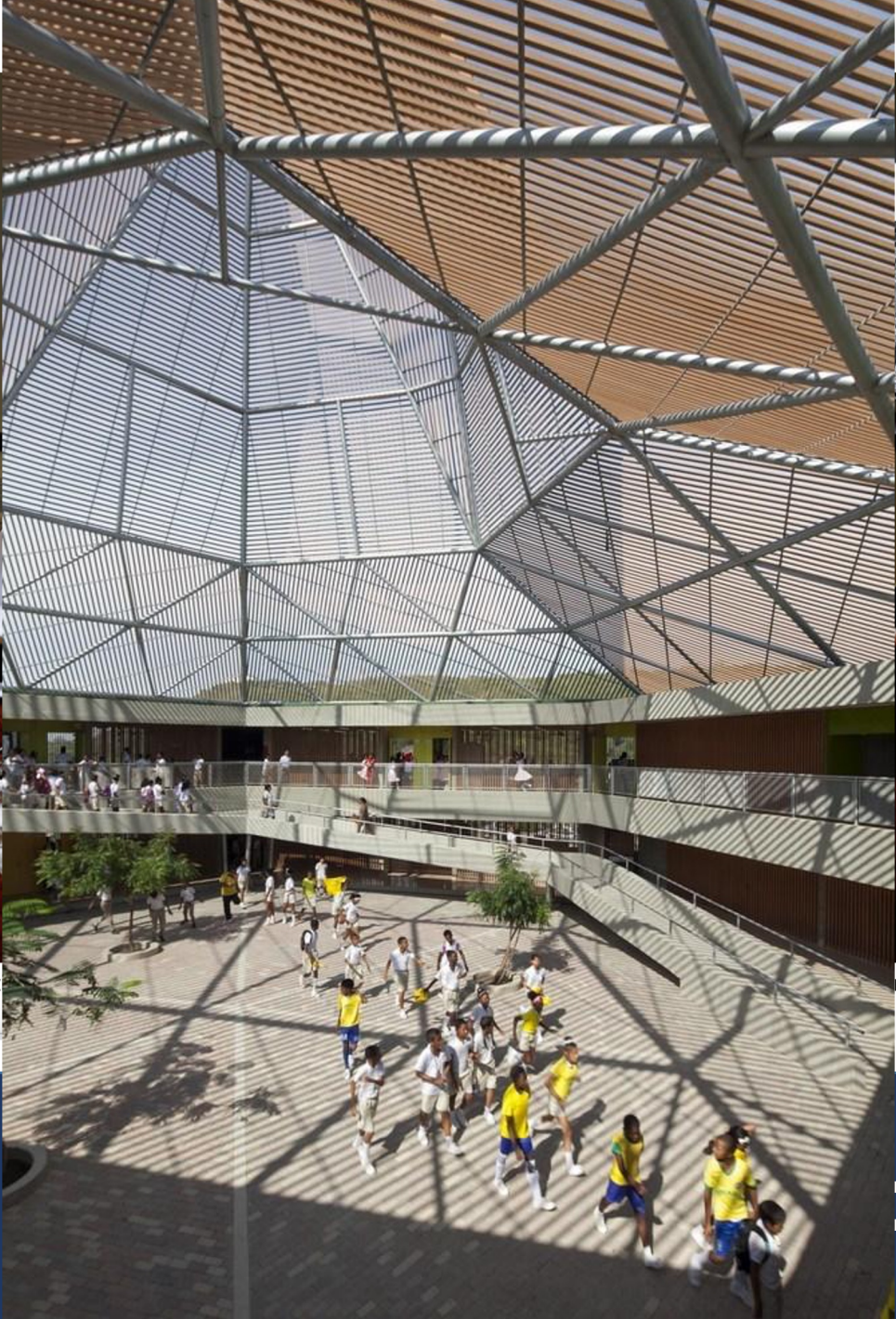


Felisa Benitez, 86, wipes the sweat from her brow while taking a break from cleaning her stand-up electrical fan on the porch of her home at San Fernando Gardens Public Housing in Pacoima, California, where temperatures reached 99 degrees on August 4, 2021. Benitez spends a great deal of her day seated in the shade of her porch and tries only to use a fan to cool herself even though she has an AC unit, which she uses sparingly as she is on a limited budget. | Genaro Molina/Los Angeles Times via Getty Images

# How can we learn and adapt?



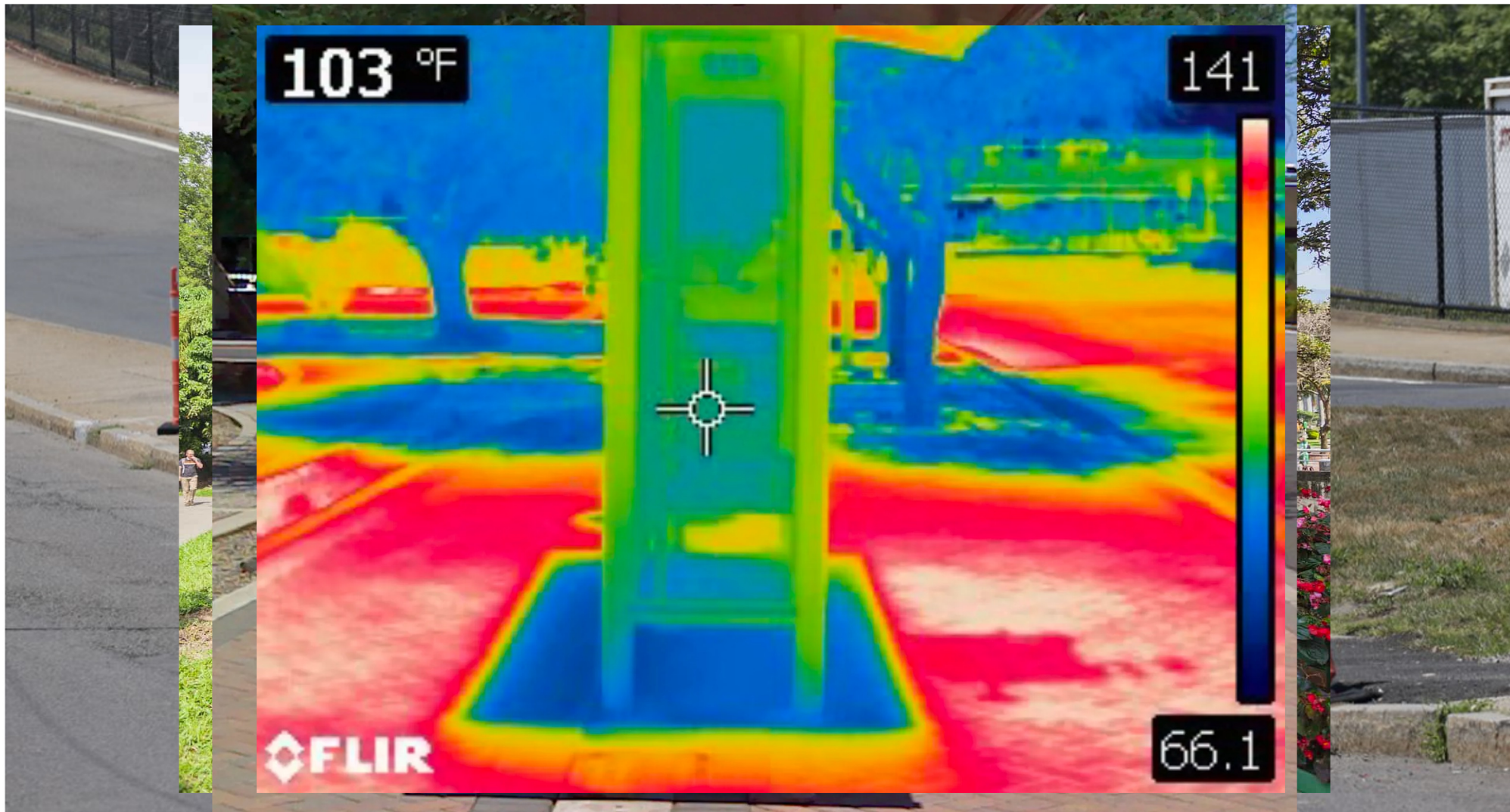
Classrooms without air conditioning. L. RYAN/GLOBE STAFF



...nts, the district says. DAVID

Safe p

ork



**Safe housing, safe transportation**





- **Heat kills. Especially if you are a person with low income.**
- **People need safe places to live, work, to get around, and to take refuge from the heat.**
- **Federal funding does not cover these necessities.**

**3 takeaways.**

A blue and white bird with a long beak and a speech bubble above it. The bird is standing on its legs, facing right. The speech bubble is blue and contains the text "THANK YOU!".

**THANK  
YOU!**

**Marissa Zampino, Community Organizer**  
**[marissa.zampino@mysticriver.org](mailto:marissa.zampino@mysticriver.org)**

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*Thank you for joining us!*

Use the QR code for a copy of today's presentations and a recording of the briefing

