

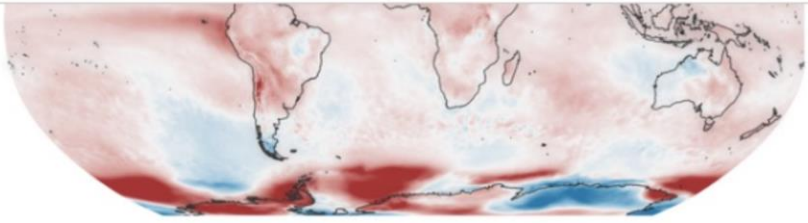
**campus
climate
action**

MIT

MIT Campus as a Test Bed: Climate Resiliency

 **Brian Goldberg**
Assistant Director
MIT Office of Sustainability

6.900
February, 6, 2025



Earth Just Had Its Hottest Month Ever.

**Heat Will Likely
Soar to Record
Levels in Next 5
Years, New
Analysis Says**

Human-caused climate change is making high temperatures more common and intensifying the dryness that fuels catastrophic wildfires.

How Extreme Heat Causes Cascading Crises

How extreme heat takes a toll on the mind and body, according to experts

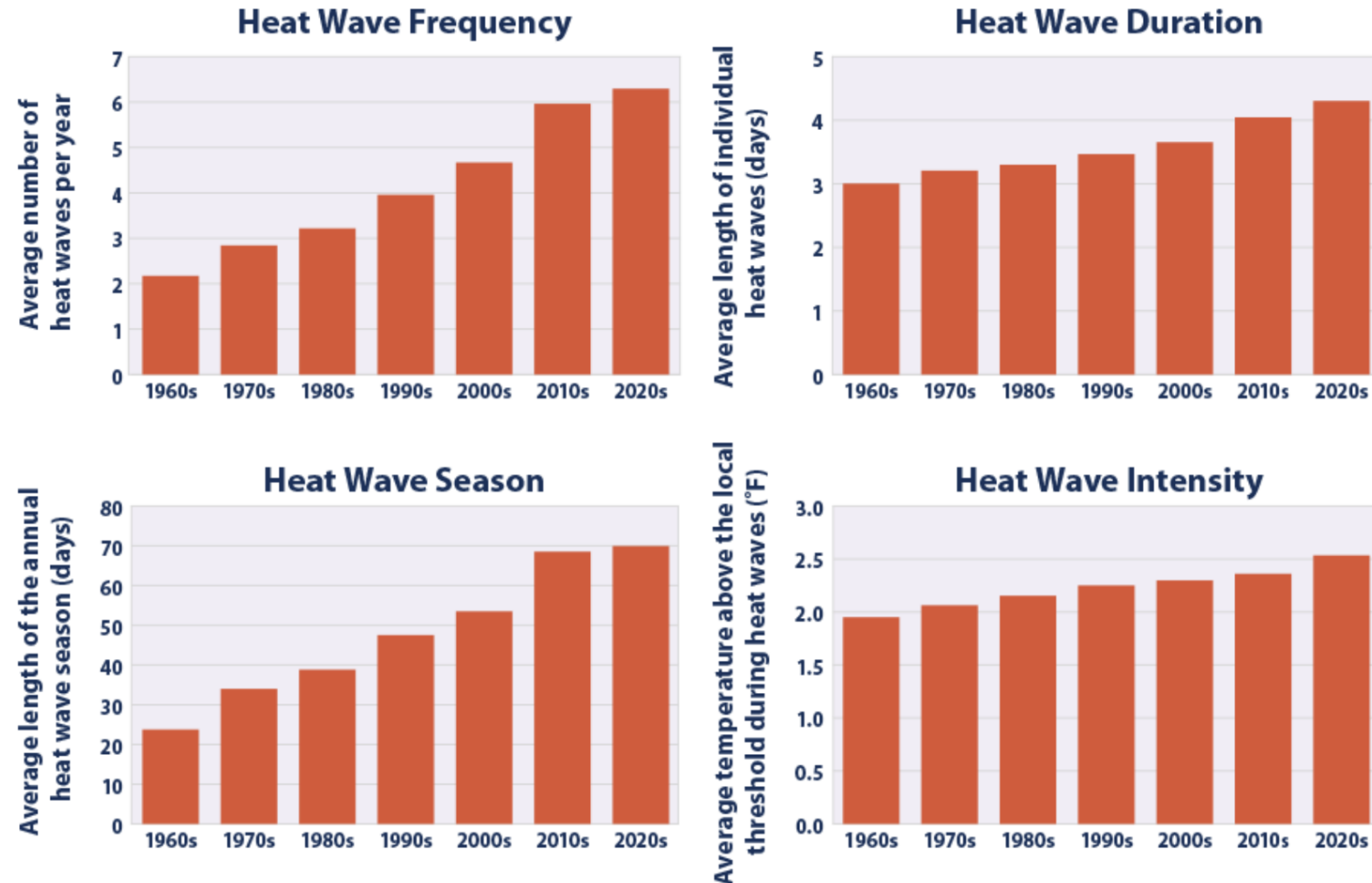
**Burning pavement, scalding water hoses:
Perils of a Phoenix heat wave**

**It's so hot in Arizona, doctors are treating a
spike of patients who were burned by falling
on the ground**

Haze From Canada Fires Spreads to New York Area

By Jen Christensen, CNN
Published 7:03 AM EDT, Mon July 24, 2023

Changing climate brings more heat risk

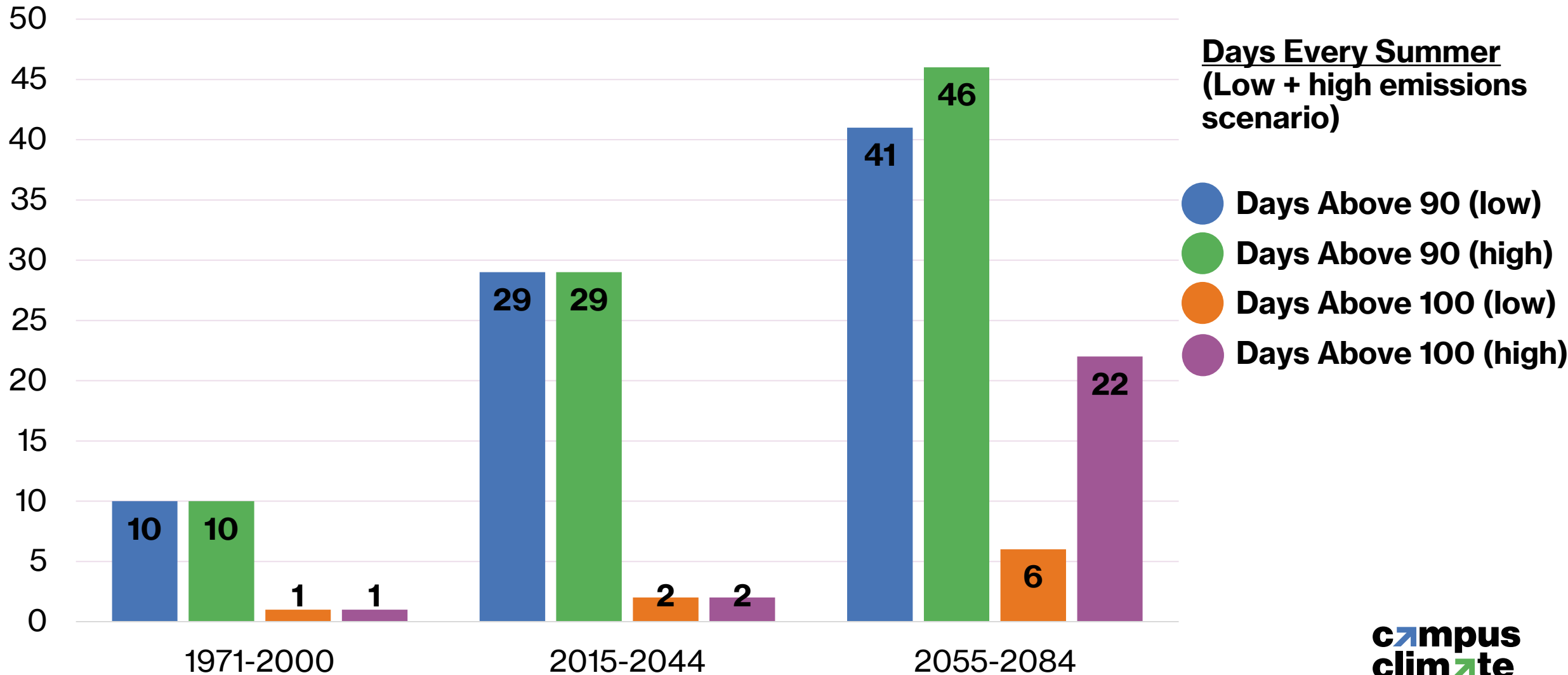


High public demand for heat information



Google trends;
News (global) 2024

Locally changing climate for heat risk



What impacts local air temp on a 90 deg F day?



A.

98 °F



B.

90 °F



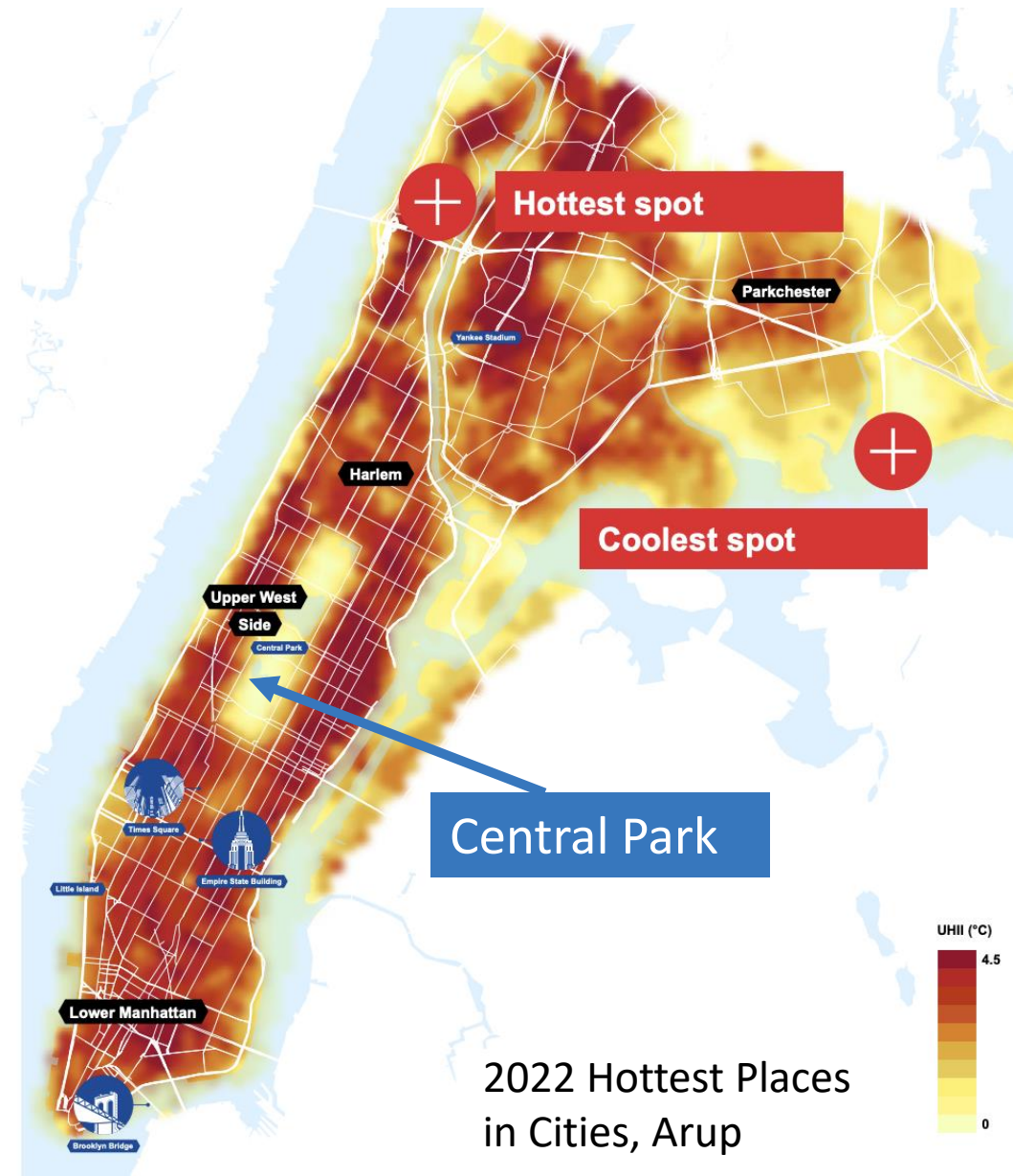
C.

88 °F

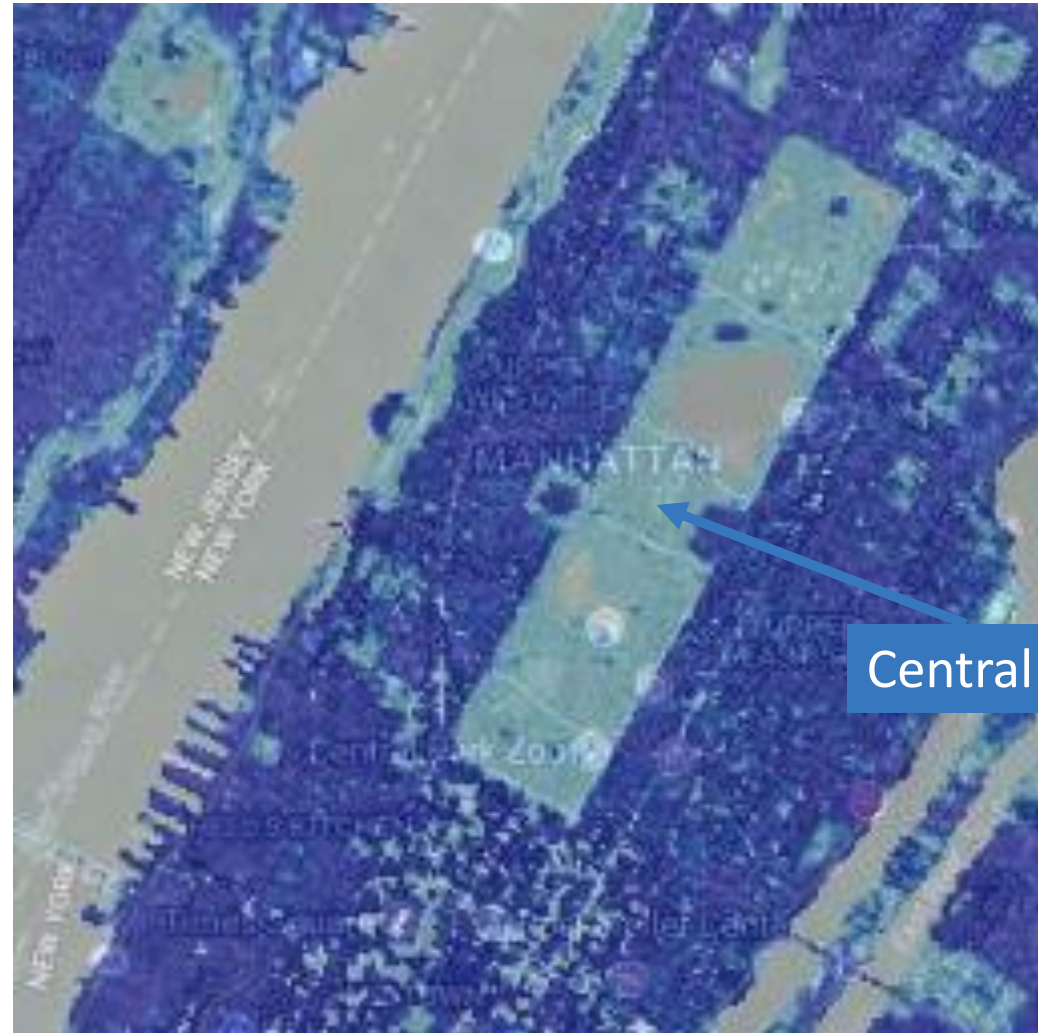
13

City of Cambridge Urban Forest Master Plan, 2021

In summer, what causes hot or cool places?

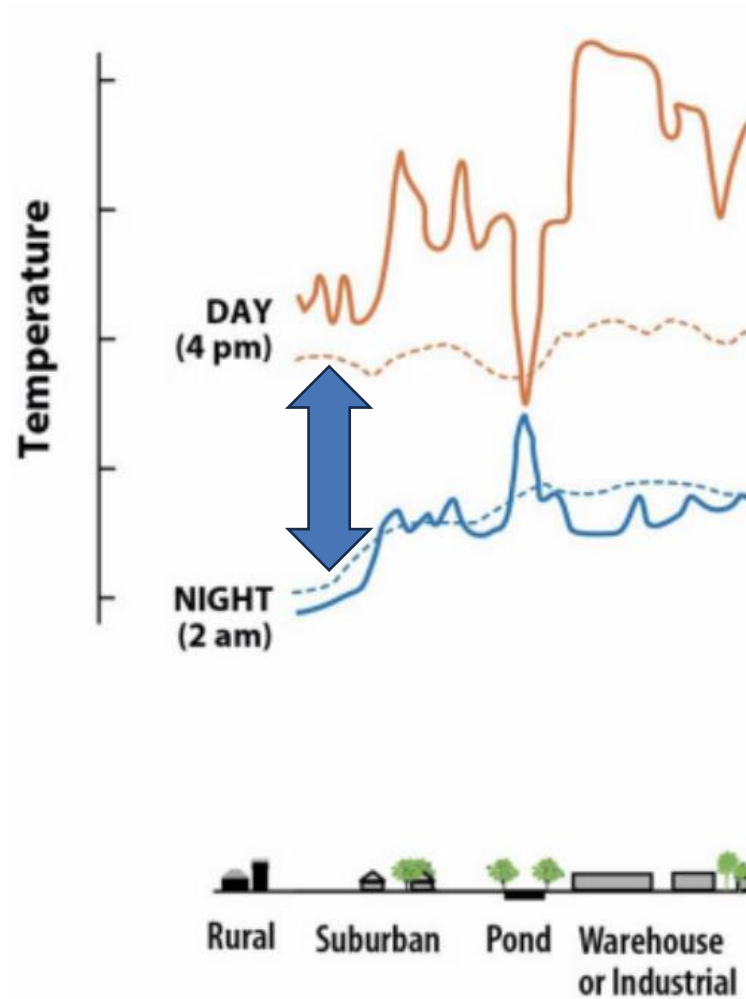


Impervious surfaces + buildings absorb heat; vegetation reflects



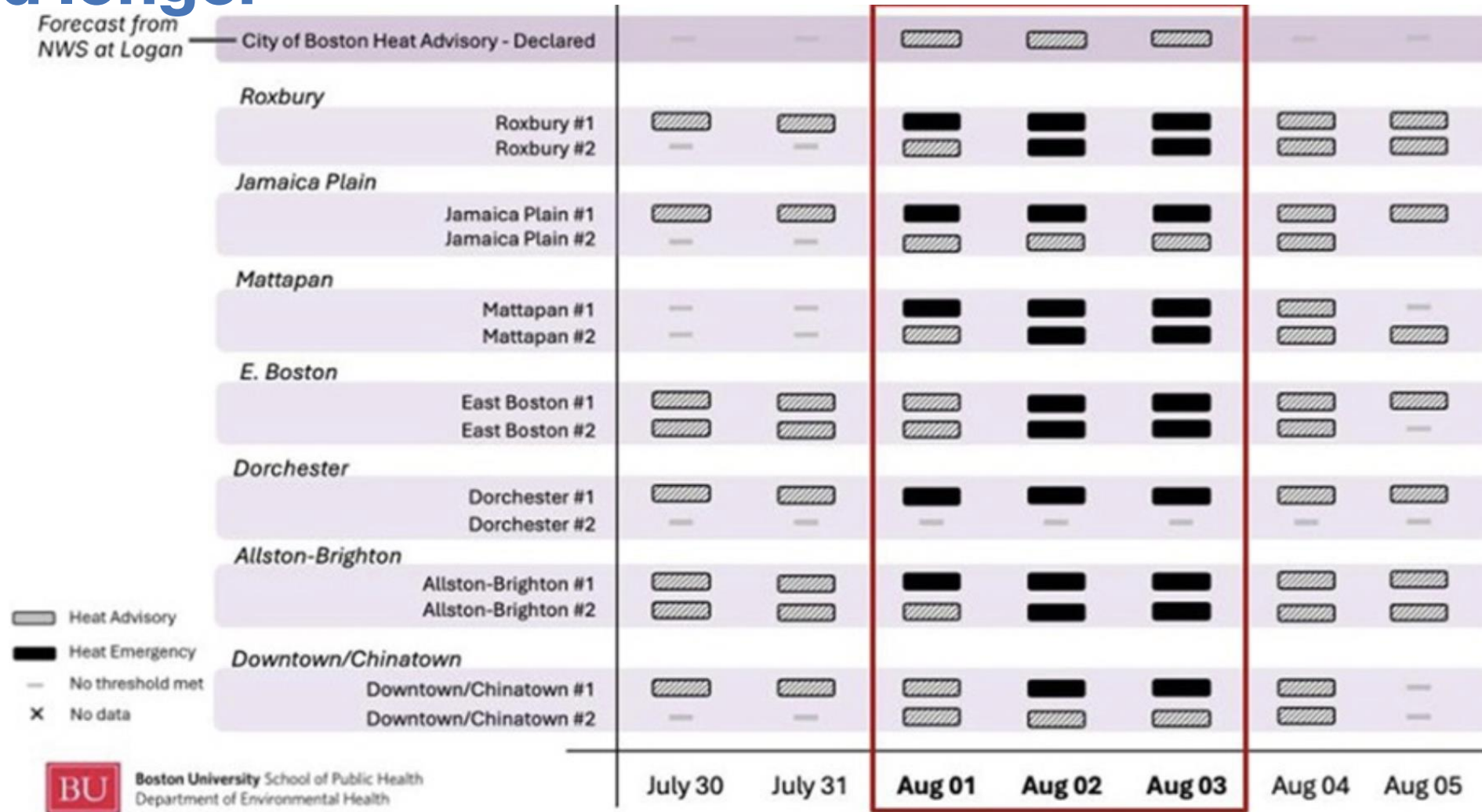
Central Park

Urban heat island effect

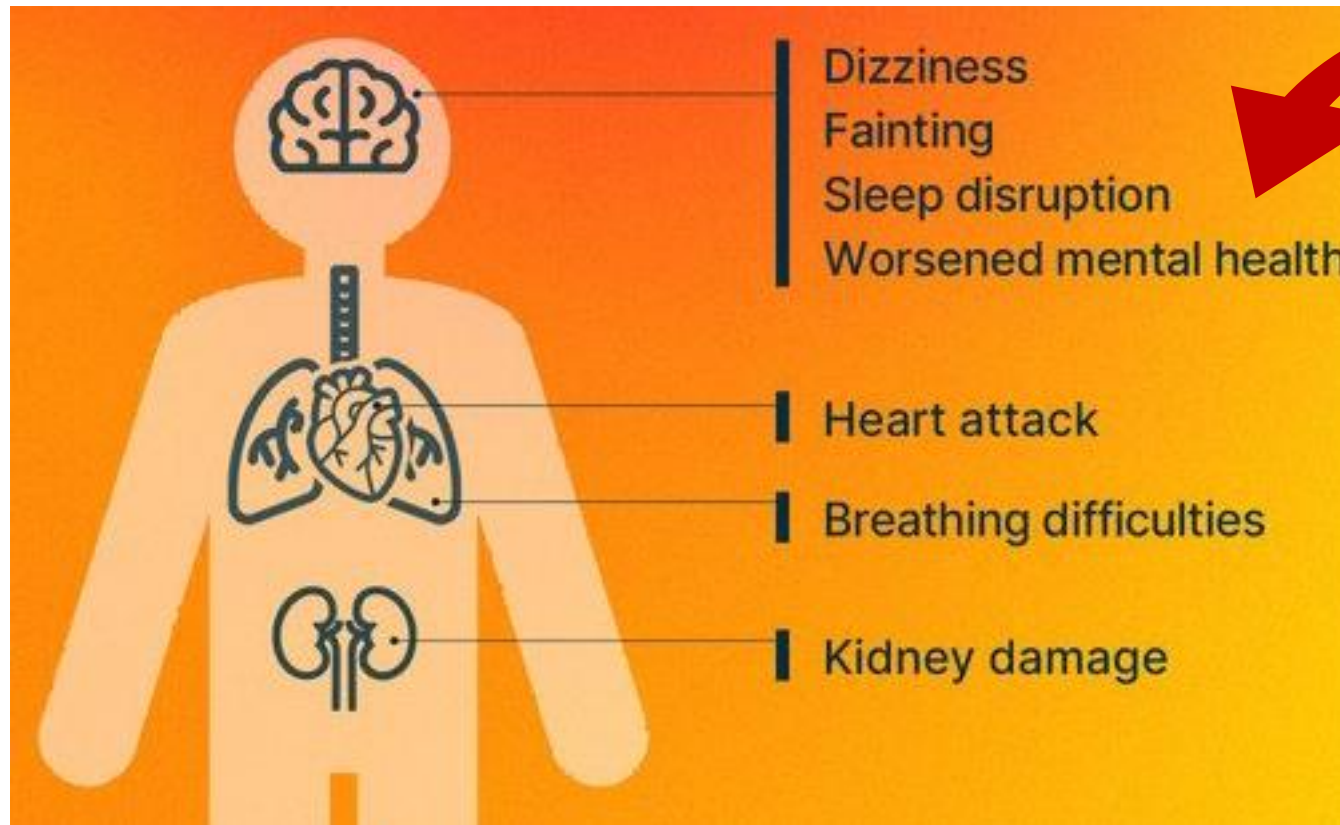


We Act, *Urban Heat Island Report*, 2022

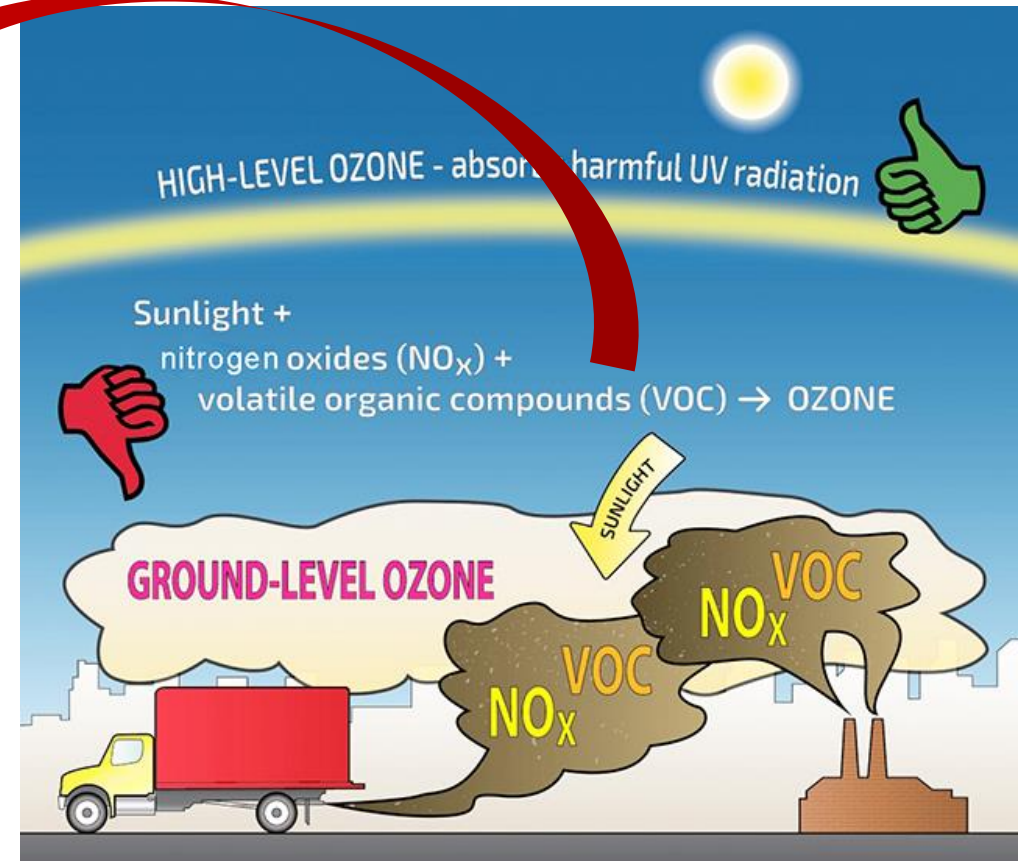
Environmental Justice: Some areas heat up sooner and longer



Problem: Elevated temps impact people; environment + drive climate change



Health Impacts of Extreme Heat, Wellcome



Ground Level Ozone Explained, State of WA, Dept. of Ecology,

Office of Sustainability Mission... and your opportunity this semester

...to transform MIT into a replicable model that generates just, equitable, applicable, and scalable solutions for responding to the unprecedented challenges of a changing planet.

Scales of Impact



You

Campus

City

State

Globe

←→

We start with you to find solutions at the campus level to serve both the institution's needs as well as to incubate new and big ideas.

←→

Seeking solutions to common challenges with the cities of Cambridge, Boston and beyond. We recognize and the deep interconnectivity between our urban campus and the city and seek to operate at both scales.

←→

Making structures, processes, and solutions developed at MIT accessible for reapplication and scaling across the globe.

MIT Campus: Planning for Today and Next 100 years



24,000 faculty, research scientists, students, staff

450+ labs, depts, centers

170 buildings, 13 million sq ft²

168 acres campus in Cambridge, MA



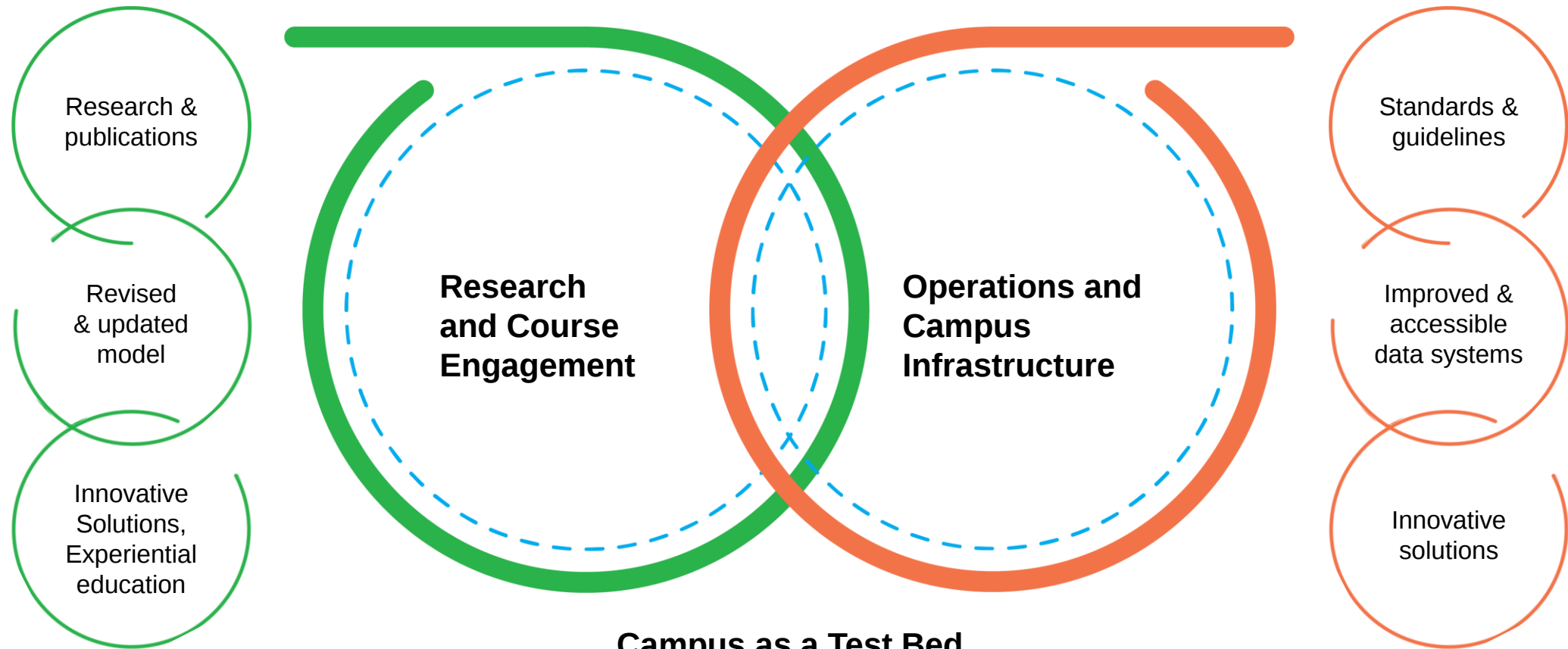
Resiliency and Adaptation Mission

An aerial, black and white photograph of the MIT campus. The central feature is the large, circular building with a prominent dome, surrounded by several rectangular buildings with classical architectural elements like columns. The surrounding area includes parking lots and other campus infrastructure.

Ensure MIT campus continues to fulfill MIT's mission amidst disruptions from climate-driven flood and heat risks.

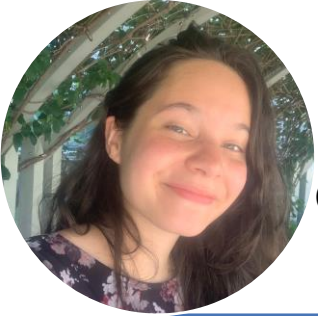
campus
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How campus as test bed supports MIT



Campus as a Test Bed

MITOS Student Cohort Summer 2024



Ananda Santos Figueiredo

Senior, Climate Systems
Campus Heat Risk Monitoring, Menus of
Change Research, Garden Steward



Dylan Cook

Sophomore, Chemical Engineering
Instagram Reels, Lifecycle Analysis of
Reusables, Garden Steward



Sawyer Garrett

Sophomore, Economics
Scope 3 Purchased Goods & Services
Greenhouse Gas Emissions Inventory;
Green Revolving Fund Research



Jordyn Goldson

Sophomore, Civil & Environmental
Engineering
Basement Flood Risk, Instagram Reels,
Campus Landscape Biodiversity



Megan Lim

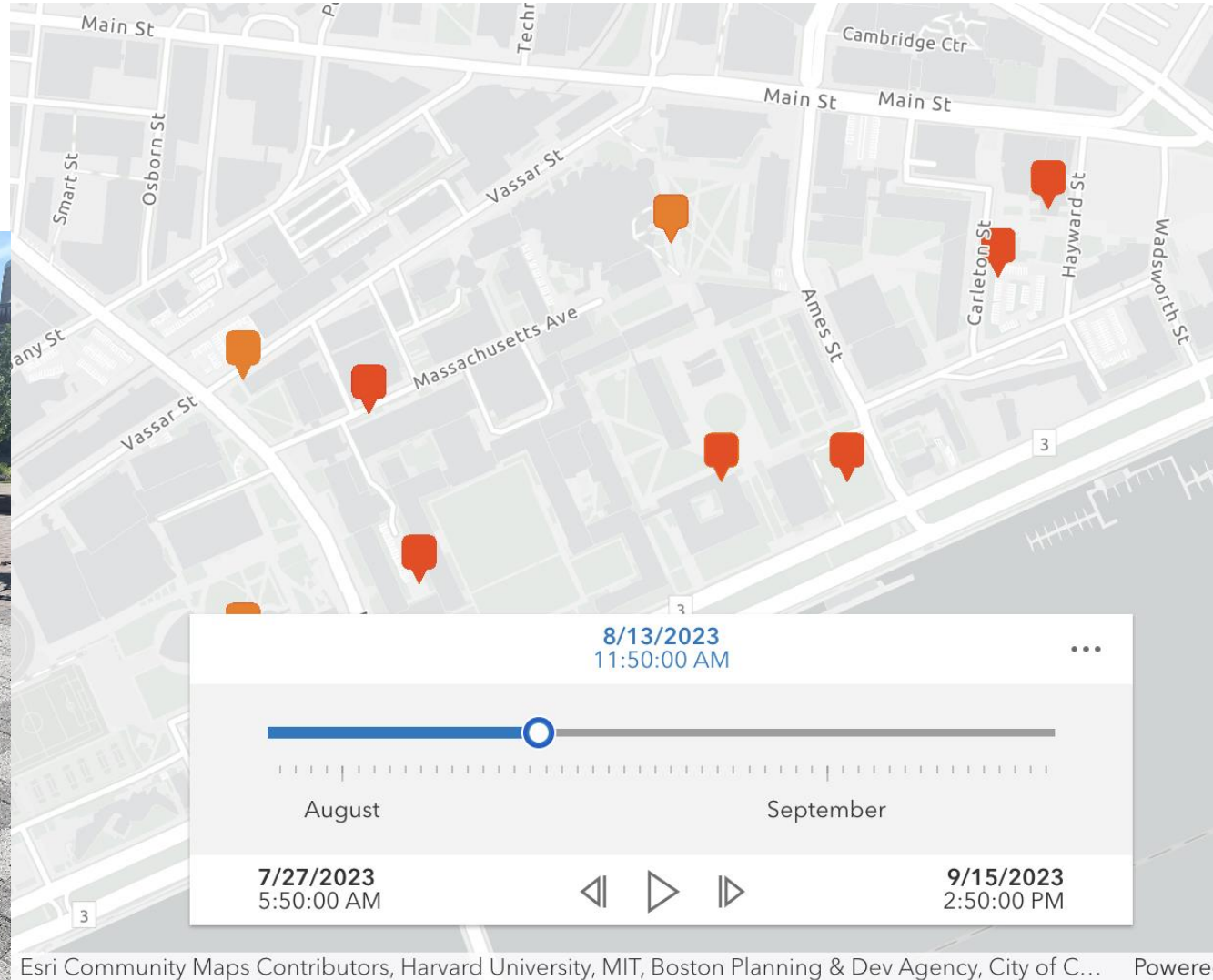
Senior, Management
Student Engagement Strategy,
Data Collection for Zero Waste
Certification



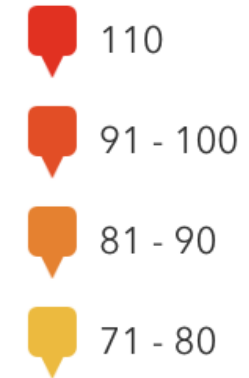
Rudiba Laiba

Senior, Computer Science & Molecular Bio
Scope 3 Food Greenhouse Gas Emissions
Inventory, Dashboard Support

MIT Campus Heat Risk Monitoring (2023)



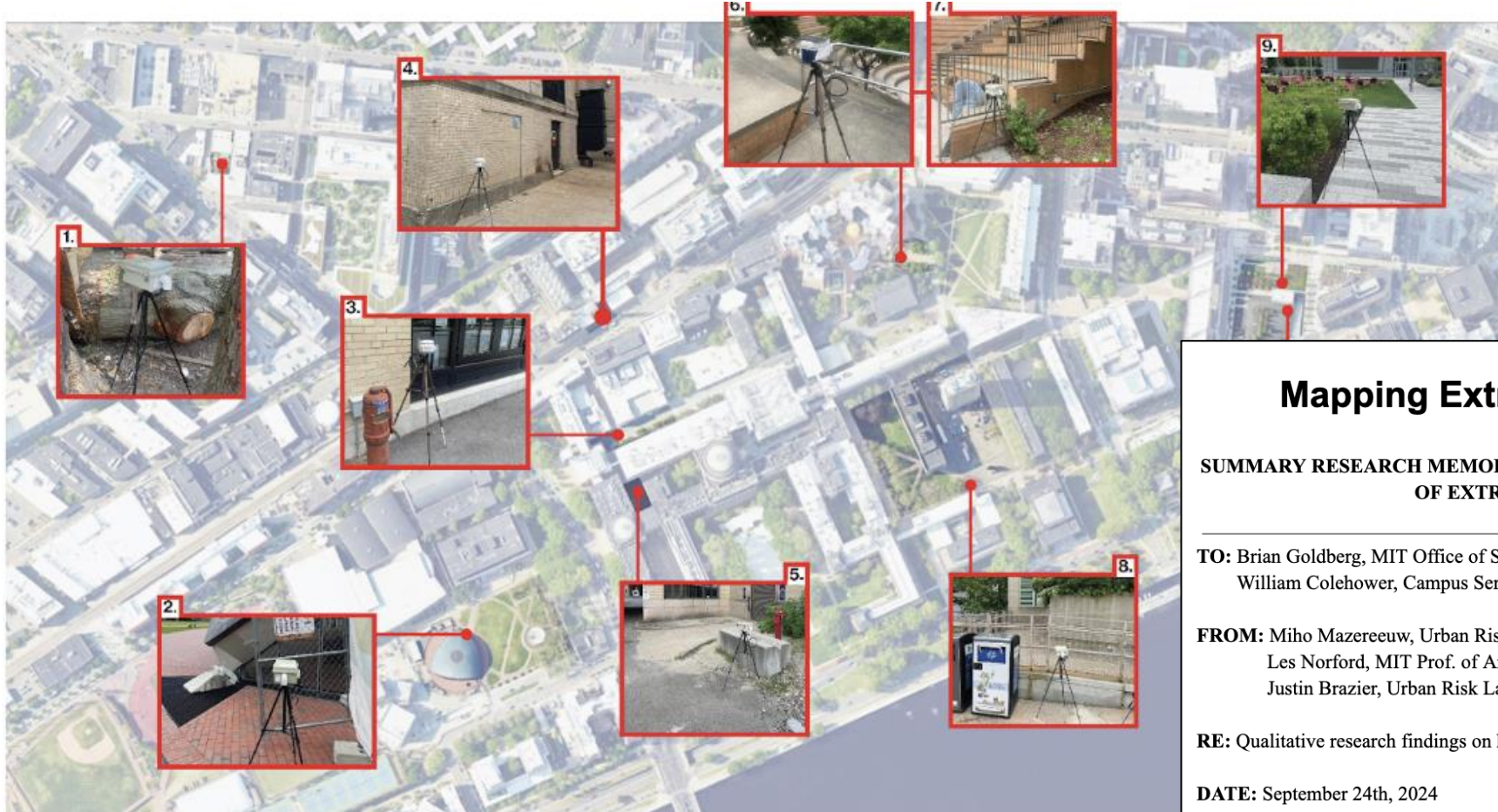
Temperature (°F)



- Eastman McDermott Court
- The Hive
- Outfinite Corridor
- Central Parking Lot
- Kendall Open Space
- Stata Center Amphitheater
- Kresge Lawn Area
- MIT Medical Parking Lot
- Vassar Street Locations



Mapping Extreme Heat on campus (2024)



Mapping Extreme Heat on MIT Campus:

SUMMARY RESEARCH MEMORANDUM: QUANTITATIVE RESEARCH ON THE EFFECTS OF EXTREME HEAT AT MIT, SUMMER 2024

TO: Brian Goldberg, MIT Office of Sustainability
William Colehower, Campus Services & Stewardship

FROM: Miho Mazereeuw, Urban Risk Lab Director, MIT Associate Prof. of Architecture and Urbanism
Les Norford, MIT Prof. of Architecture and Urbanism
Justin Brazier, Urban Risk Lab Researcher

RE: Qualitative research findings on how extreme heat impacts members of our MIT community

DATE: September 24th, 2024

Heat Study on campus (2024): Draft Findings



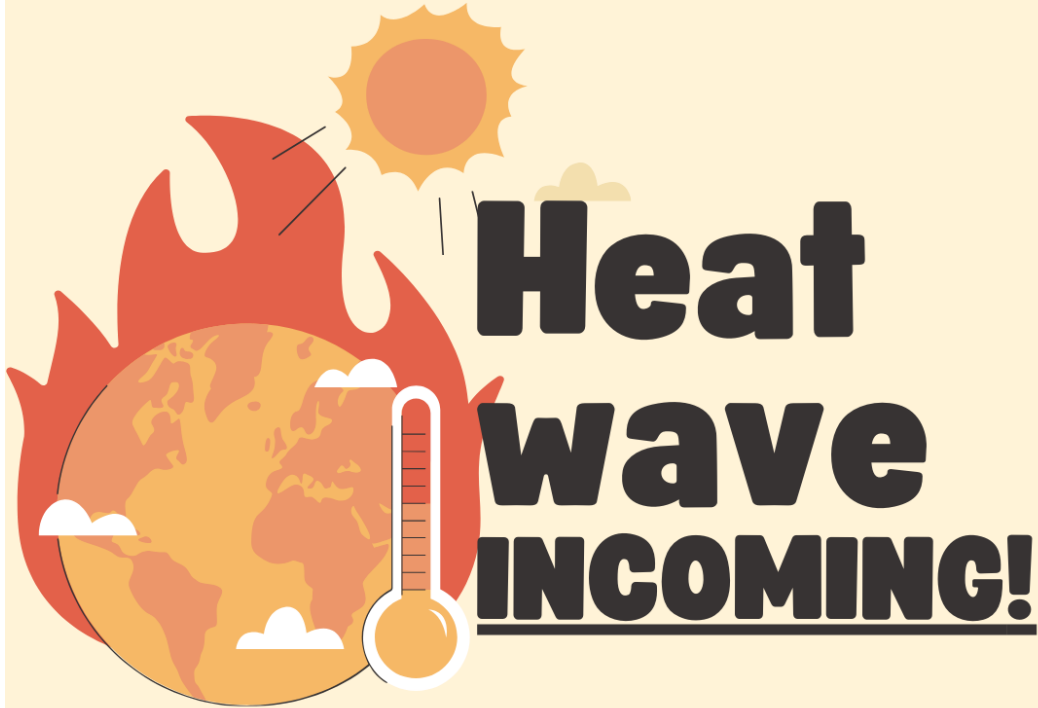
- On hot days, some locations were hotter than NWS Logan
 - Up to 15 degree F difference during day
 - Up to 5 degree F difference at night
- Some locations were clearly warmer (Outfinite)
- Some places emerged as cool spots (Eastman Court)
- Sensors have been a visible engagement tool for raising awareness about local extreme heat
- Heat Index (temp + relative humidity) is key indicator of extreme heat, yet not often communicated or understood

Check out dashboard from IAP
2025 Winter Warm-up student
cohort

Heat Relief: Communicating Across MIT + City

 **Emergency Management**
Massachusetts Institute of Technology

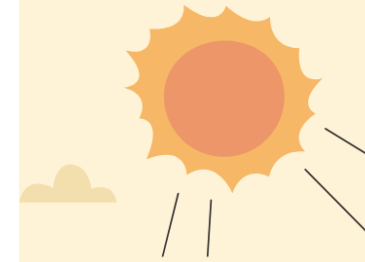
 **Office of Sustainability**



Stay cool with our MIT Cool Spots!

 **Emergency Management**
Massachusetts Institute of Technology

 **Office of Sustainability**



MIT Cool Spots are a great way to stay **cool** and have **fun** during the increased frequency of high temperatures. These are **open** and **accessible** to the public:

MIT Cool Spots

- MIT Museum
- MIT Welcome Center
- MIT List Visual Arts Center
- Koch Institute Public Galleries
- Broad Discovery Center

Campus + City Outreach

**campus
climate
action**

City of Cambridge: Shade is Social Justice



MIT students
assisting an
installation in 2025

Central Square; Russell Field;
Donnelly Fields; in
Cambridge, 2024

Learning so far to inform upcoming summer...



- Community interest in real time/near real time viewing of temps in a dashboard
- Need to communicate in heat index and temp
- Could sensor trigger a warning in dashboard when temp + relative humidity exceeds heat advisory standard?
 - Daytime heat indices (plural of index) of 100°F–104°F for two or more hours
- What average night time outdoor temps by location are concerning? (some locations hovering just around 80)
- Extend season – May through September
- How can the sensor itself look interesting/raise awareness?

MITOS Campus Heat Monitor

1. It should accurately measure the air temperature and humidity, with dynamics appropriate for the use case.***
2. It should measure ground surface temperature, with dynamics appropriate for the use case.*
3. It should operate without being connected to line voltage.***
4. It should be portable and able to be set up by an average person in a variety of outdoor environments on the MIT campus, including on a tripod or attached to poles of various dimensions.***
5. It should be able to be physically attached to a HOBO MX2302A data logger.*
6. It should report faults, such as battery failure, falling, vandalism, etc.**
7. It should be as inexpensive as possible.***
8. Data from a sensor node should be able to be tied to a location.***
9. It should maintain privacy. ***
10. It should operate independently without user intervention for 3+ months.***
11. It should be rugged and able to withstand a summertime Boston-area environment (heat, rain, wind and curious people). ***
12. Multiple systems should be able to be used simultaneously. ***
13. The system should present the information on a dashboard (with real-time data outputs to a dashboard if possible), and also allow downloading of raw data.***

* → ***: level of importance