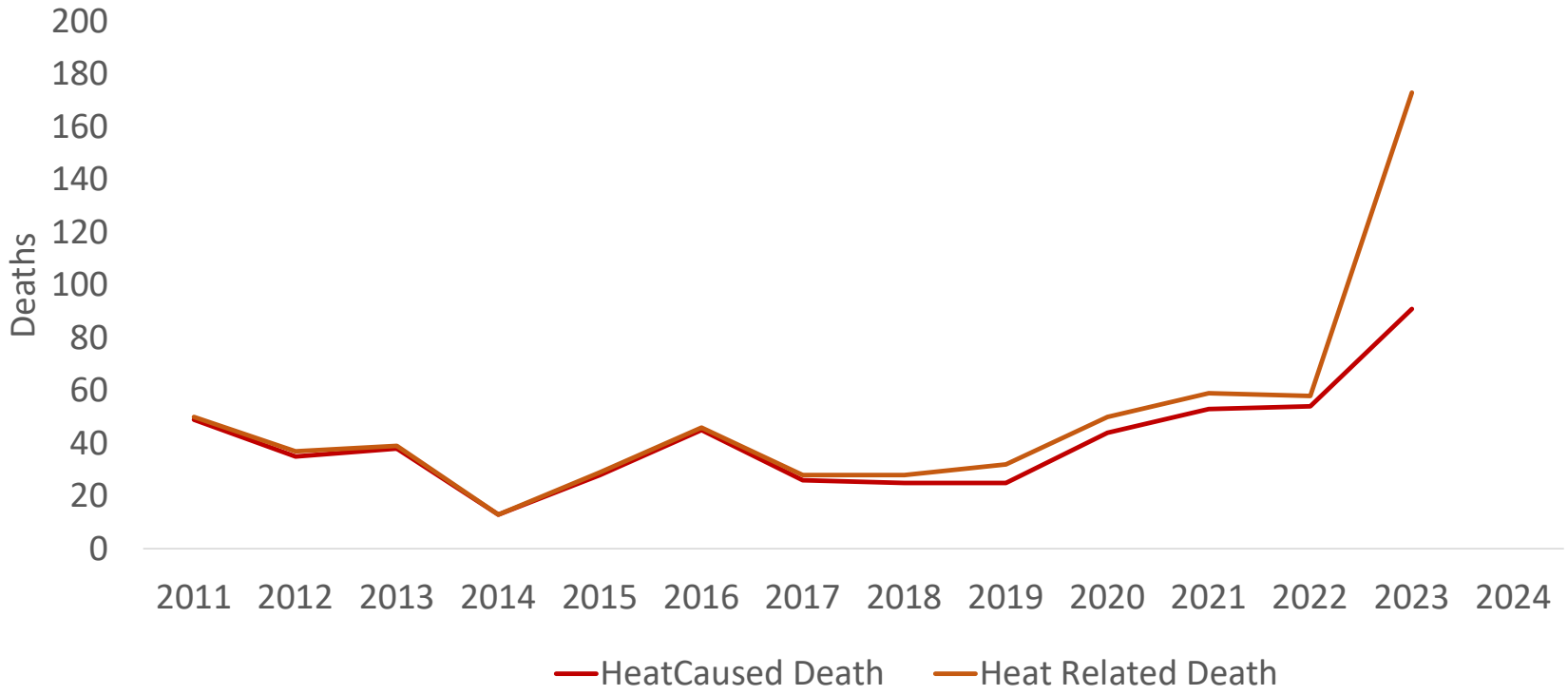
# Supporting Heat Resilience in Pima County

Heidi E Brown, MPH, PhD

18 Sept 2024

# Pima County




https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/pubs/heat-related-mortality-year-2012-2023.pdf

# Heat-Caused Deaths

Heat-caused includes deaths where environmental heat exposure is the primary cause of death. Historical data on heat-caused deaths is available in the PCOME Annual Reports.
Data includes undocumented border crosser (UBC) deaths and non-UBC deaths. Cases pending certification are excluded.

Filter by County:

Pima | Cochise | La Paz | Graham | Santa Cruz | Clear all filters

**58**
Cases

Filter by:

**Year**

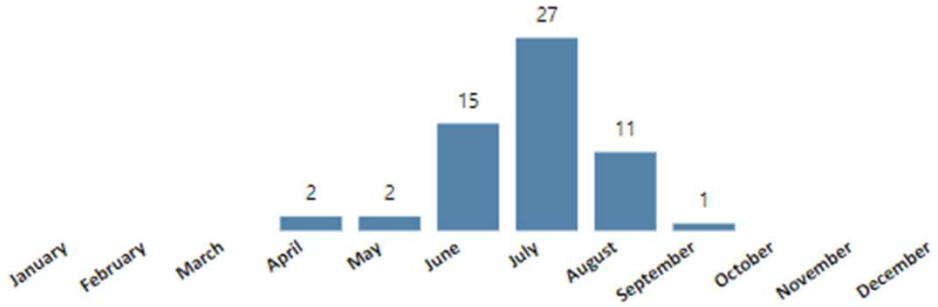
- 2023
- 2024

**Case Type**

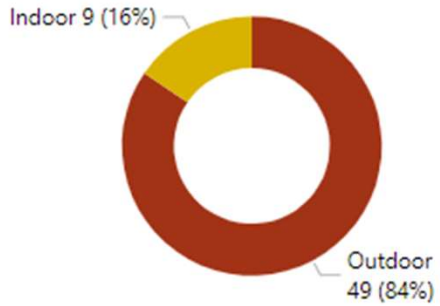
- Undocumented Border Crosser (UBC) deaths
- Non-UBC deaths
- Deaths in persons experiencing homelessness

CTRL + left click within visuals to filter by selection(s)

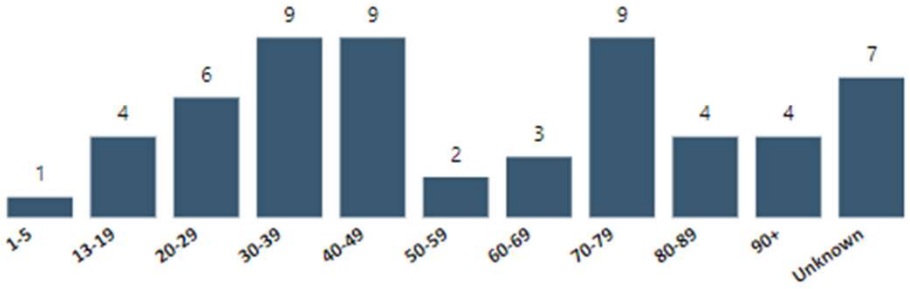
## Heat-Caused Deaths by Month



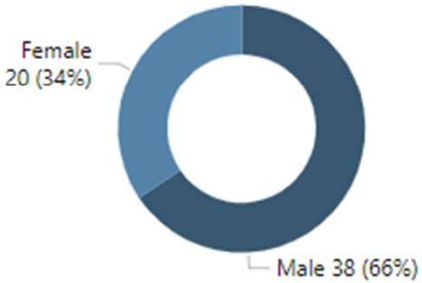

## Place of Injury




## Decedent Age Group




## Decedent Sex



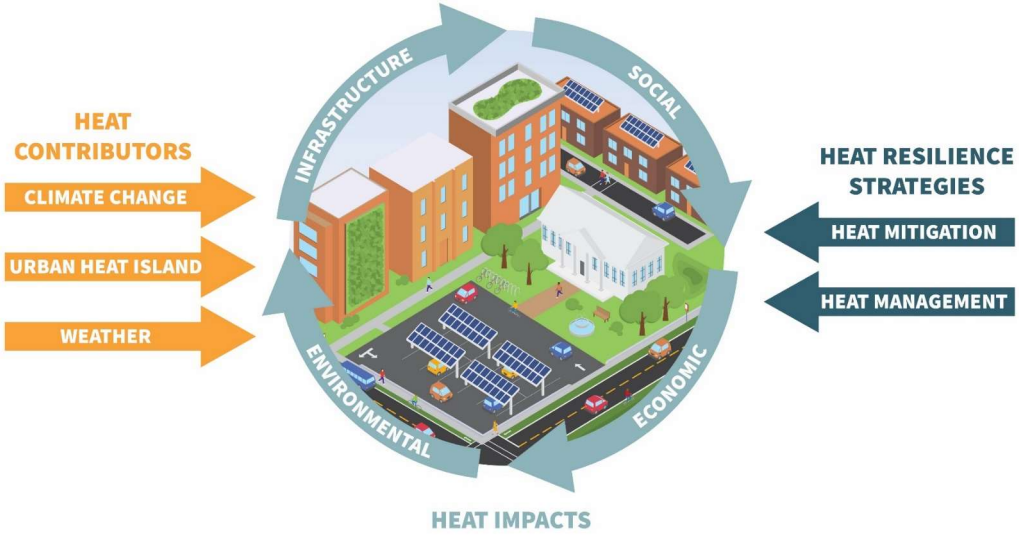

Last Updated on 9/4/2024

Data Dashboard from Pima Co Medical Examiner
https://www.pima.gov/216/Data-Dashboards-Reports

# Planning for Urban Heat Resilience

## Urban heat resilience

"Proactively mitigating and managing urban heat across the many systems and sectors it affects."





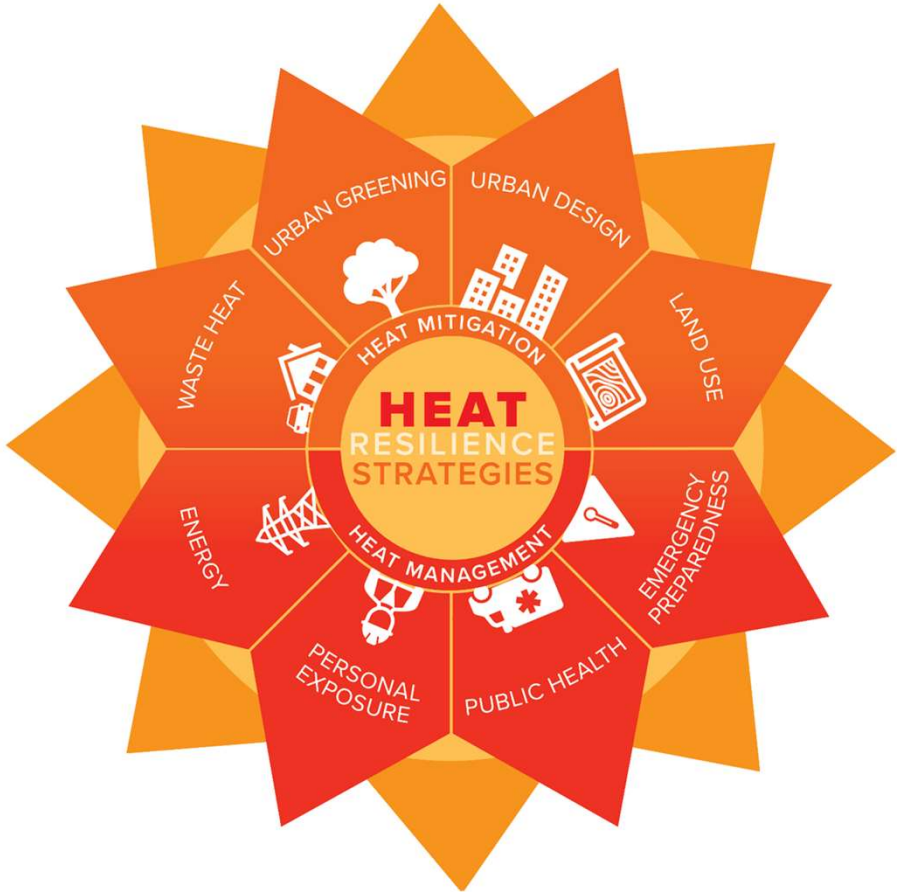
(Keith & Meerow, 2022)

# Planning for Urban Heat Resilience

**Heat governance**
The actors, strategies, processes, and institutions that guide decision-making for mitigating and managing heat as a hazard. (Keith et al., 2021)

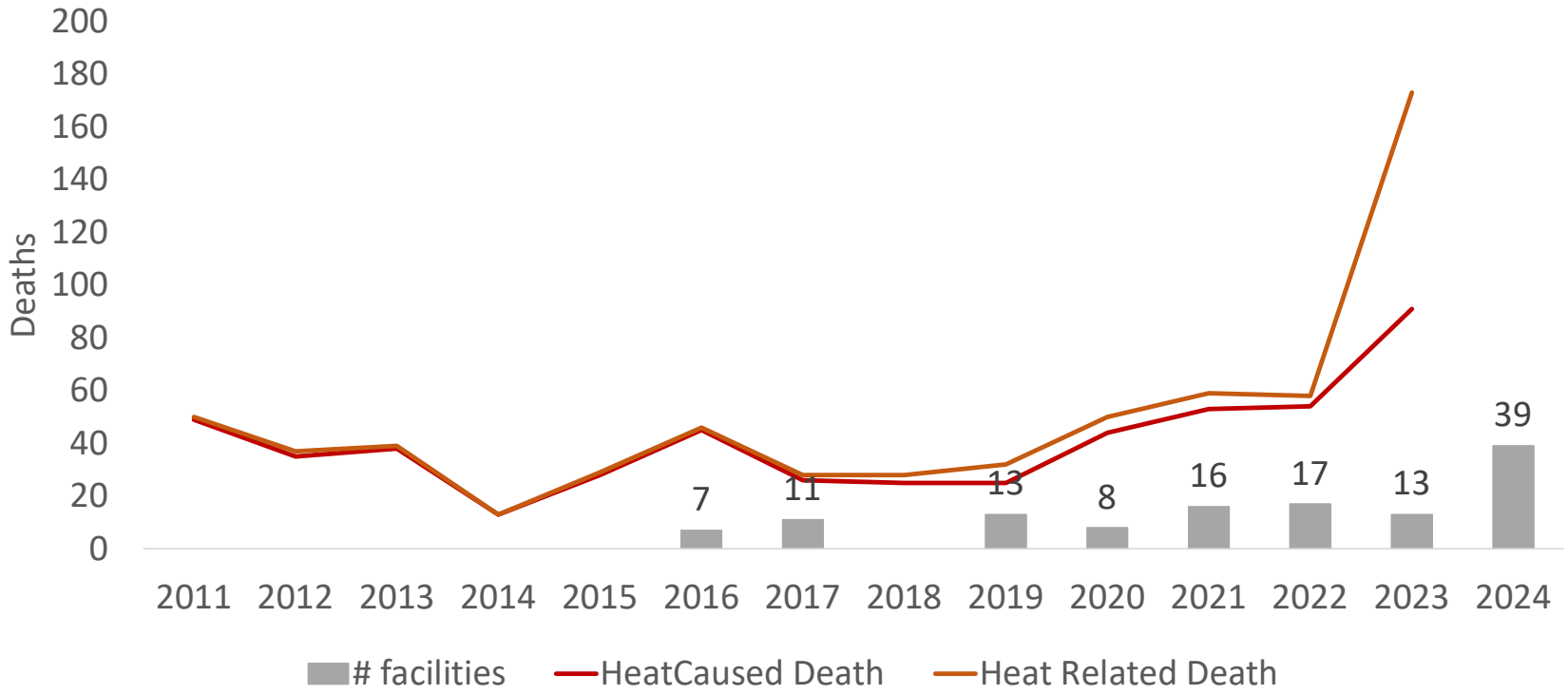
**Heat mitigation**
Strategies that reduce the built environment's contribution to urban heat. (Keith & Meerow, 2022)

**Heat management**
Strategies that prepare and respond to chronic and acute heat risk. (Keith & Meerow, 2022)




(Keith & Meerow, 2022)

# Pima County, Cooling Centers



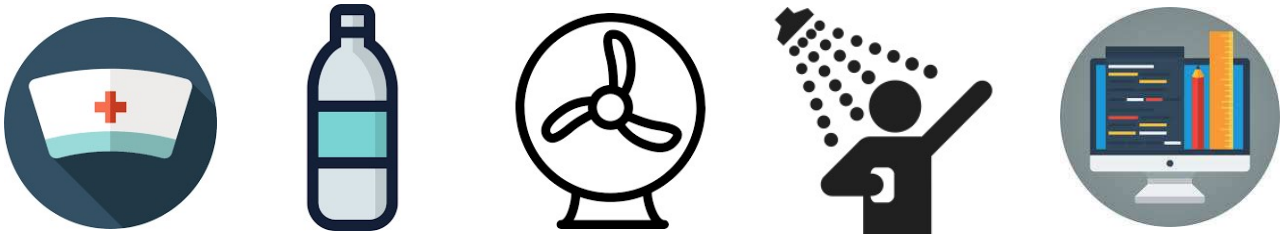

https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/pubs/heat-related-mortality-year-2012-2023.pdf

# Talk Outline

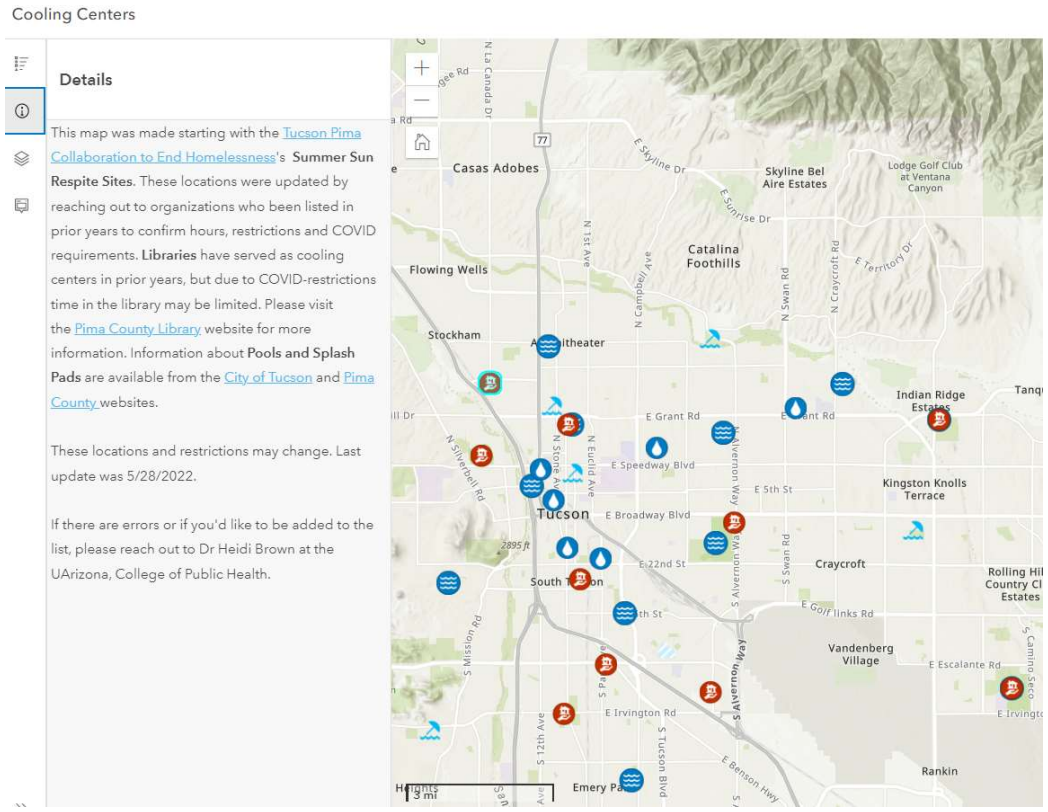
- Heat Respite Access
  - Mapping locations
  - Using *Spatial Optimization* to find potential new locations
  - Evaluation of Access
- Exposure
  - Body Heat Storage as a novel means to assess access

# Tucson Pima Collaboration to End Homelessness Summer Sun Respite Centers

- 11 sites in 2019 39!! in 2024
- Donations needed: bottled water, bug repellant, flip flops, sunglasses, sunscreen, white t-shirts, hats, backpacks
- Varying services

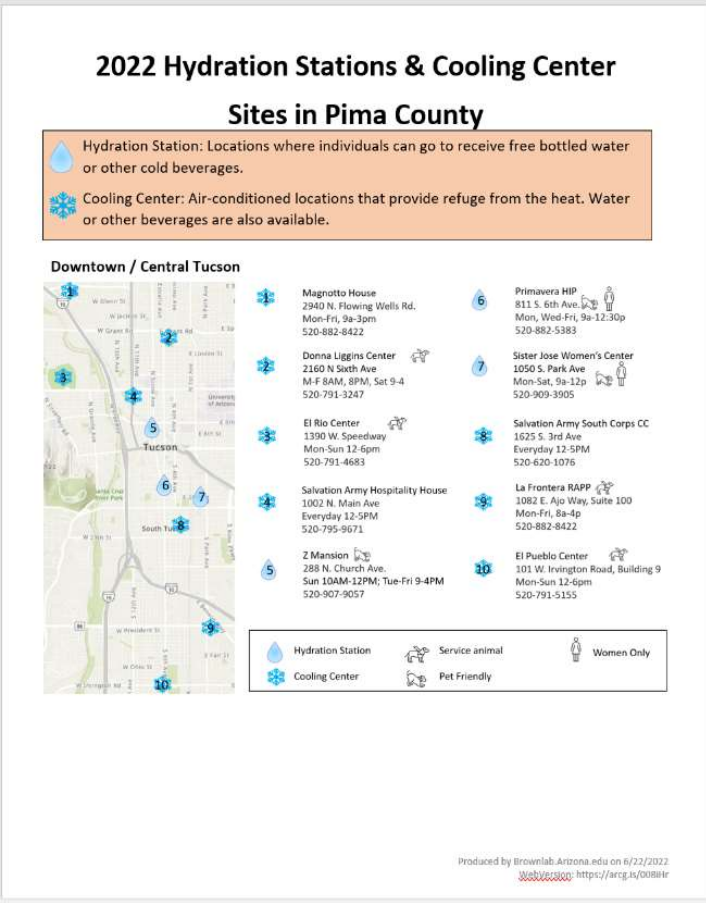


# 2020-2022 Mapping




- Identifying heat respite locations
  - Splash pads, pools (City of Tucson and Pima Co websites)
  - Cooling centers (Tucson Pima Collab to End homelessness) & libraries
- Contacted each organization
- Added question about **pet policy** when contacting organizations
- Pima Association of Governments, & ADHS pulled link from Brownlab.Arizona.edu so as we update, they update
- 2022 TPCH links to our map
- PDF version created for distribution

# PDF Versions for Dissemination



## 2022 Hydration Stations & Cooling Center Sites in Pima County

Hydration Station: Locations where individuals can go to receive free bottled water or other cold beverages.

Cooling Center: Air-conditioned locations that provide refuge from the heat. Water or other beverages are also available.

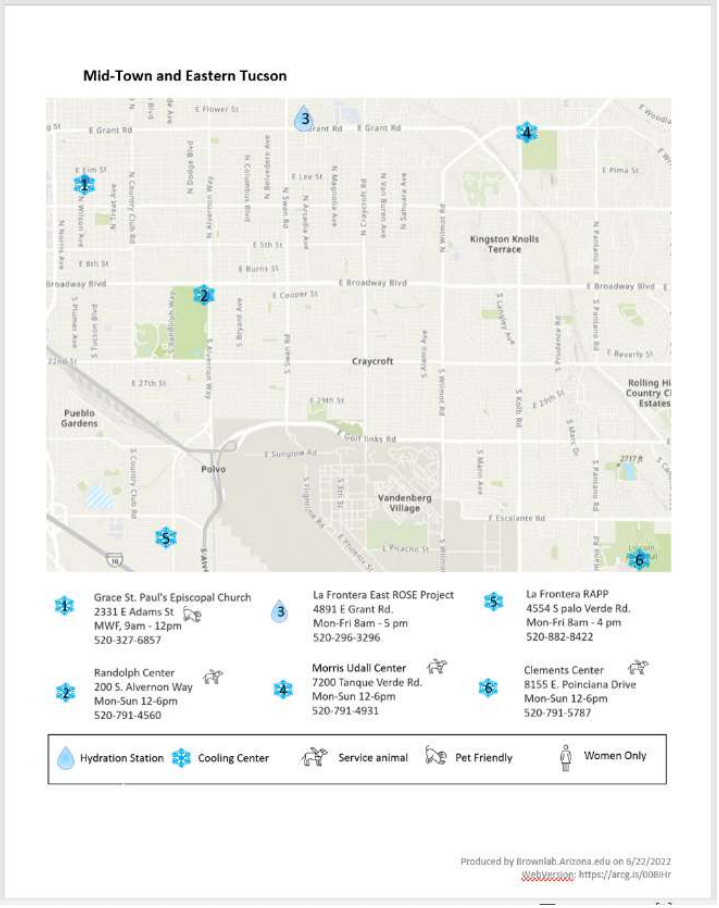
### Downtown / Central Tucson



1. Magnotto House
2940 N. Flowing Wells Rd.
Mon-Fri, 9a-3pm
520-882-8422
2. Donna Liggins Center
2160 N Sixth Ave
M-F 8AM, 8PM, Sat 9-4
520-791-3247
3. El Rio Center
1390 W. Speedway
Mon-Sun 12-6pm
520-791-4683
4. Salvation Army Hospitality House
1002 N. Main Ave
Everyday 12-5PM
520-795-9671
5. Z Mansion
288 N. Church Ave.
Sun 10AM-12PM; Tue-Fri 9-4PM
520-907-9057
6. Primavera HIP
811 S. 6th Ave.
Mon, Wed-Fri, 9a-12:30p
520-882-5383
7. Sister Jose Women's Center
1050 S. Park Ave
Mon-Sat, 9a-12p
520-909-3905
8. Salvation Army South Corps CC
1625 S. 3rd Ave
Everyday 12-5PM
520-620-1076
9. La Frontera RAPP
1082 E. Ajo Way, Suite 100
Mon-Fri, 8a-4p
520-882-8422
10. El Pueblo Center
101 W. Irvington Road, Building 9
Mon-Sun 12-6pm
520-791-5155

Hydration Station · Cooling Center · Service animal · Pet Friendly · Women Only

Produced by Brownlab.Arizona.edu on 6/22/2022
Webversion: https://arcg.is/0088Hr



### Mid-Town and Eastern Tucson



1. Grace St. Paul's Episcopal Church
2331 E Adams St
MWF, 9am - 12pm
520-327-6857
2. Randolph Center
200 S. Alvernon Way
Mon-Sun 12-6pm
520-791-4560
3. La Frontera East ROSE Project
4891 E Grant Rd.
Mon-Fri 8am - 5 pm
520-296-3296
4. Morris Udall Center
7200 Tanque Verde Rd.
Mon-Sun 12-6pm
520-791-4931
5. La Frontera RAPP
4554 S palo Verde Rd.
Mon-Fri 8am - 4 pm
520-882-8422
6. Clements Center
8155 E. Poinciana Drive
Mon-Sun 12-6pm
520-791-5787

Hydration Station · Cooling Center · Service animal · Pet Friendly · Women Only

Produced by Brownlab.Arizona.edu on 6/22/2022
Webversion: https://arcg.is/0088Hr

Hydration Station
Cooling Center
Service animal
Pet Friendly
Women Only

# Standardization of Icons

**Cooling Centers**

Cooled indoor locations that provide refuge from the heat during the day. Drinking fountains or bottled water are available.

**Respite Centers**

Indoor, air-conditioned locations that offer hydration and allow for uninterrupted rest, sitting, or lying down (depending on each facility) during hours of operation.

**Hydration Stations**

Locations where individuals can go to receive bottled water and other collected donated items. Can be indoors or outdoors.

**Collection Sites**

Water bottles can be donated here for use at hydration and cooling locations. Some sites also accept other donations, such as cash; light colored, long-sleeved T-shirts; socks; underwear; hats; lip balm; sun block; and pre-packaged snacks.

# Evaluation

- Who
  - Administrators (7)
  - Staff (7)
  - Users/Clients (n=142)
- What
  - Challenges/Needs
  - Access

PIMA COUNTY

Cooling Center Evaluation Pilot
A Summary Report

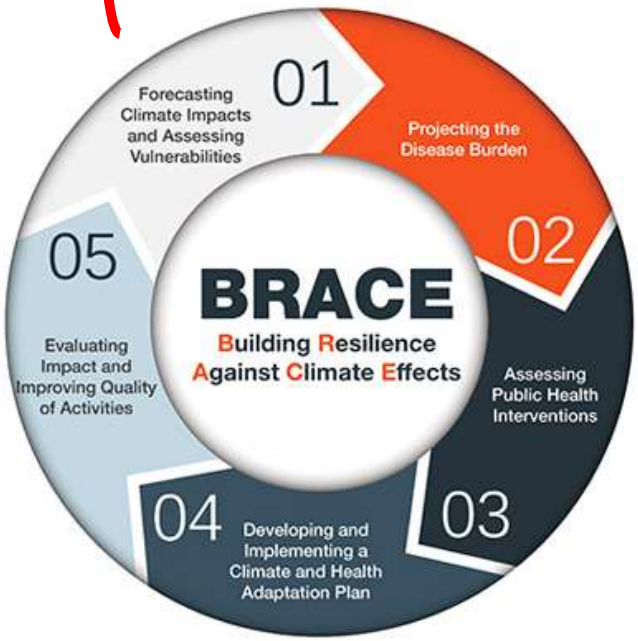

July 2024

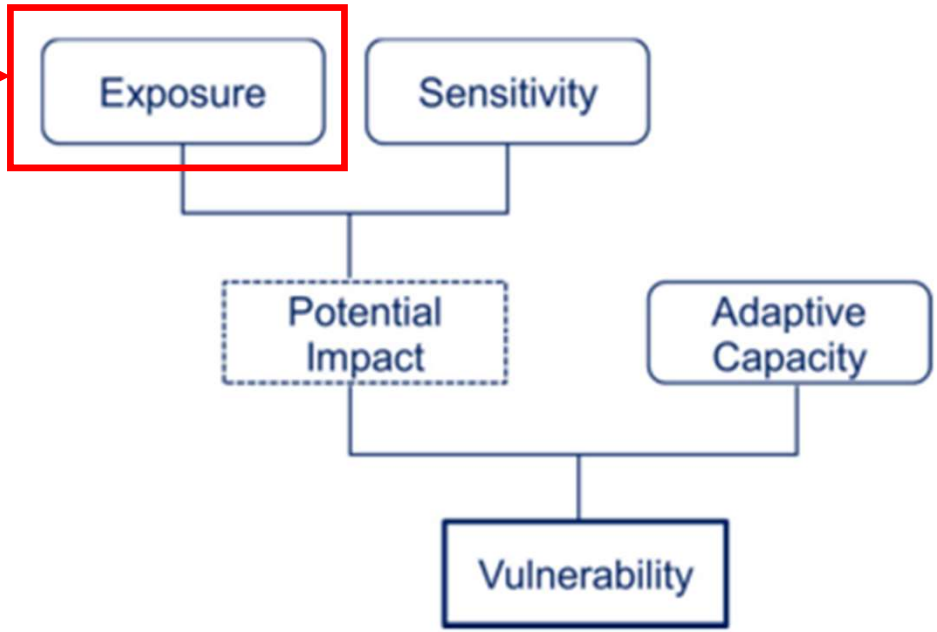
Prepared by Heidi E. Brown, PhD, MPH, Julia Jernberg MD, MBA, and Jennifer Wishnie, DVM, MSc, MPH, DACVPM

# Talk Outline

- Heat Respite Locations
  - Mapping Cooling Centers locations
  - Using Spatial Optimization to find potential new locations
  - Evaluation of Access
- Exposure
  - Body Heat Storage as a novel means to assess access

# Vulnerability Assessment

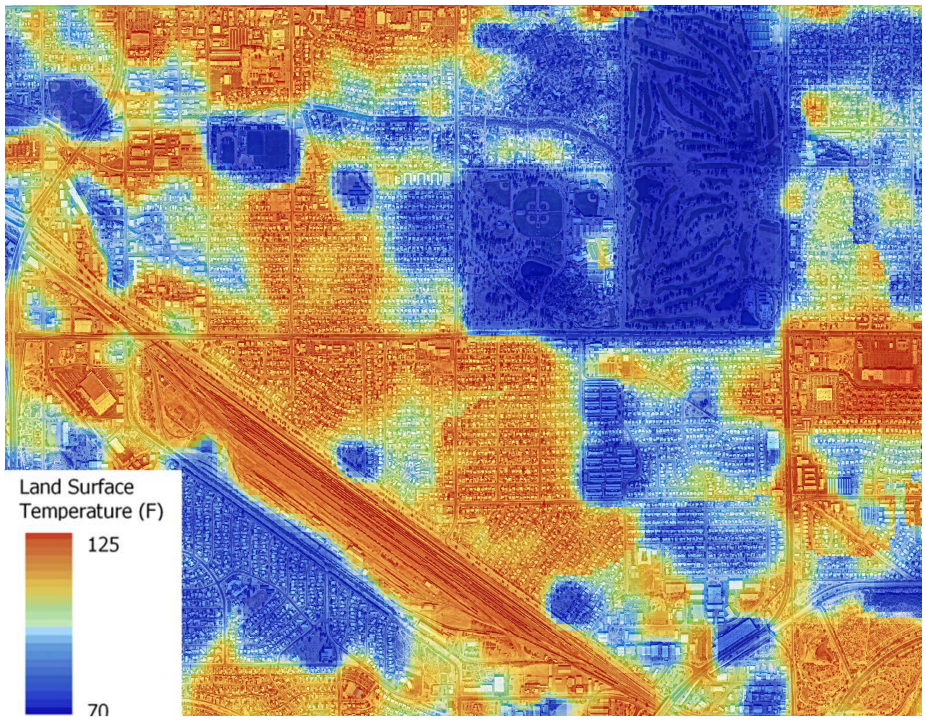


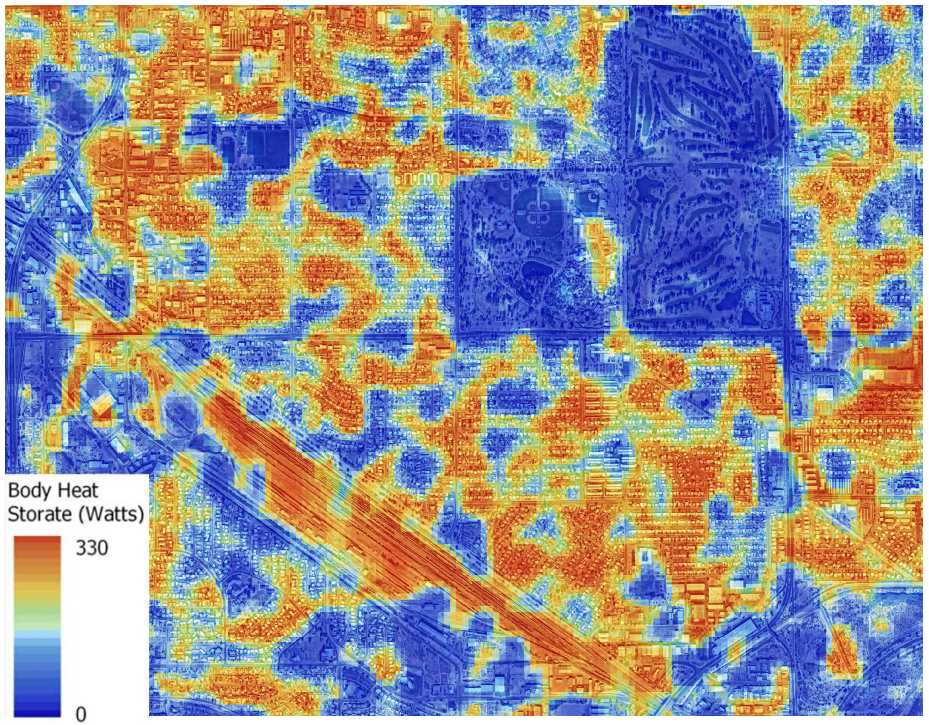
# Heat Indices

- Land Surface Temperature (LST)
  - Degrees F (or C)
  - From satellite imagery
  - Maps ‘heat islands’ by showing where it is hottest on the Earth’s surface
  - Often used in regional/local vulnerability analysis, landscape architecture, and urban planning
- Body Heat Storage (BHS)
  - Measured in Watts
  - From satellite imagery, topography and radiation estimates, local climate data, and human physiology
  - Maps of where the human body will absorb and conduct the most heat
  - Based on human heat balance equation often calculated for work safety planning, sports medicine, health risk estimates, forensic science, etc.

## LST



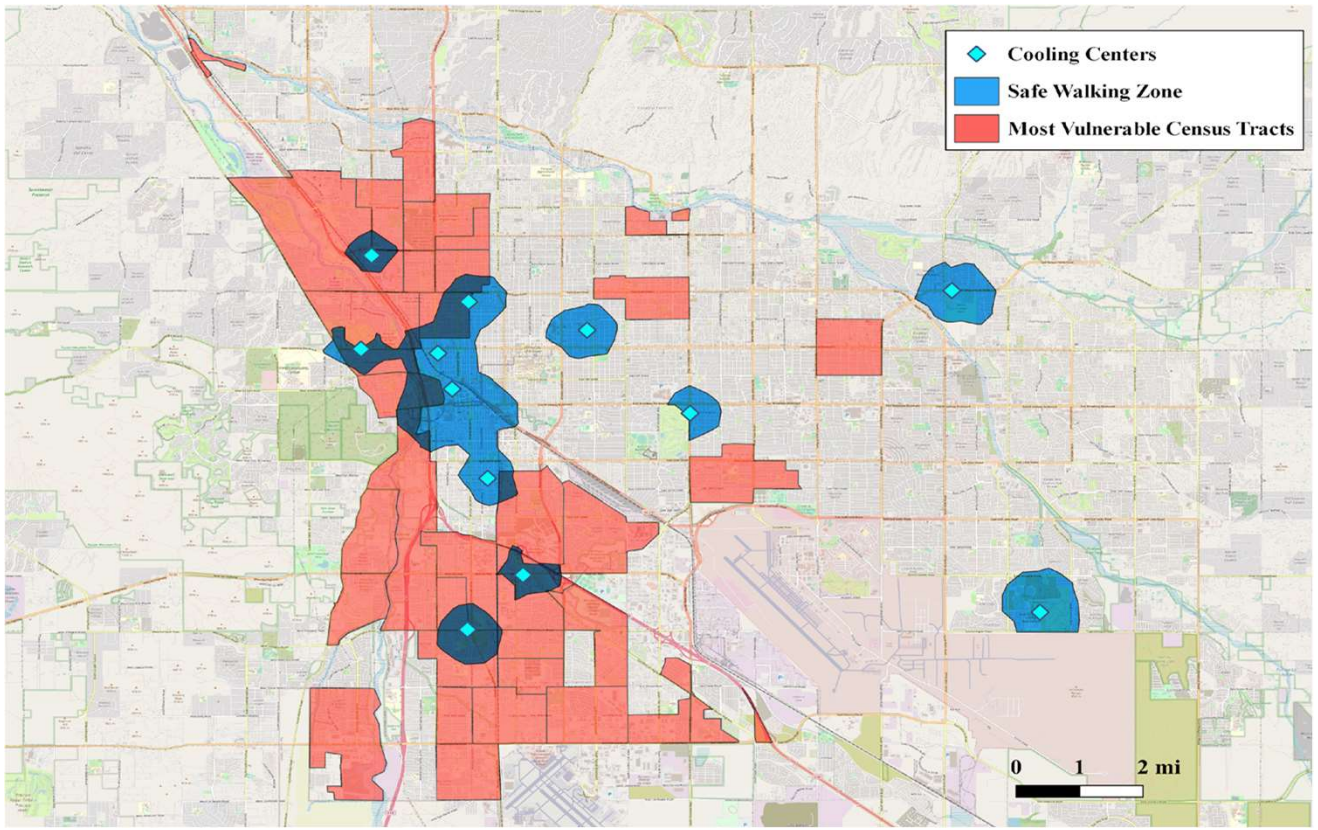

## BHS




- Why are they different?
  - Airflow?
  - Diffuse and direct solar radiation?
  - Landcover/surface/building differences?

Chambers et al., Remote Sens Env 2023

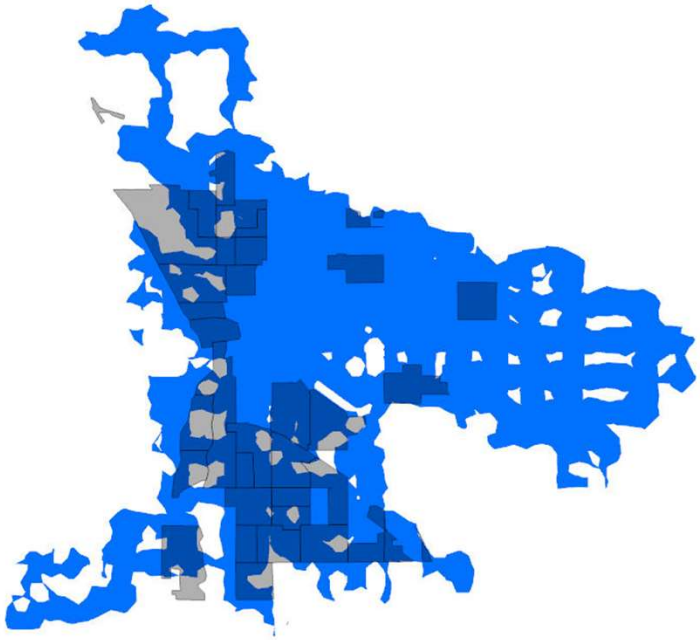
# Tucson population served by cooling centers




NOTE: Cooling centers have been added

# Better Coverage and Redundancy with Transit

- Increase in vulnerable population served
  - 26 of 29 bus routes intersect walksheds
- Most reach 1 or 3 cooling centers
- Most cooling centers reached by ≤3 routes
  - 3 reached by ≥ 7

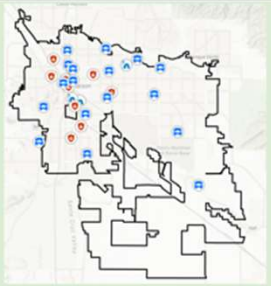


Keith et al., *in Prep*

# Spatial Optimization

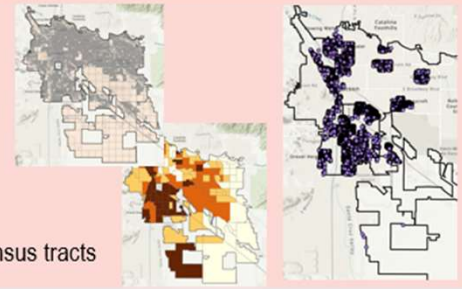
## Existing Locations

- 12 Heat Refuges
- 3 Hydration Stations



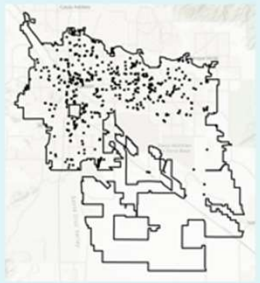
## Demand Locations

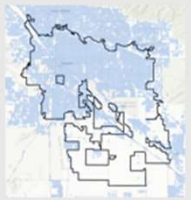
- ~ 178,000 unique parcels
  - Used to ID Residences
- CDC SVI
  - 25% most vulnerable census tracts



## Candidate Locations

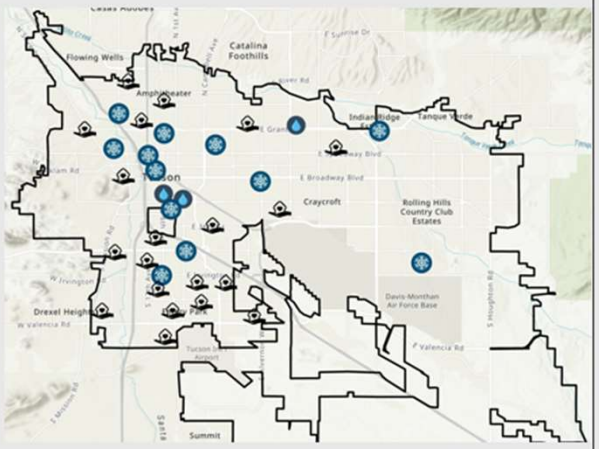
- ~ 178,000 unique parcels, id'd by key word
  - Church, Iglesia, Buddha, Islam, Jewish, Temple, Chapel, Evangelical, Methodist, Parish, Catholic
  - commercial nursing homes / adult care facilities, public schools, & hospitals



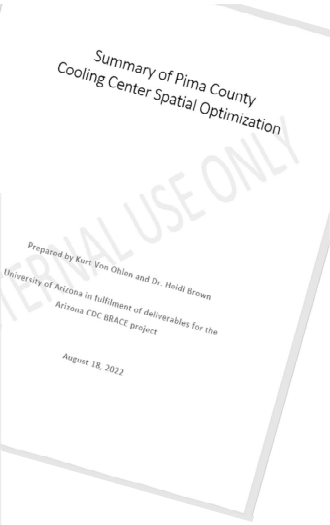


City Street Network

## Optimized Candidate Locations



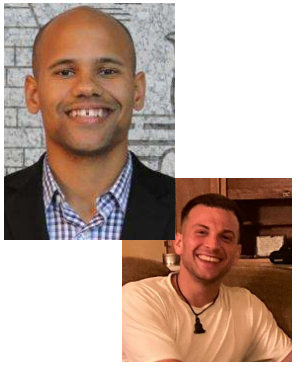

| | |
|---|---|
| Schools | 10 |
| Misc Commercial (Place of Worship) | 9 |
| Assisted Living facility Licensed | 1 |
| | |
| Average Alt locations nearby | 2-4 |


Summary of Pima County Cooling Center Spatial Optimization

INTERNAL USE ONLY

Prepared by Kurt Von Ohlen and Dr. Heidi Brown
University of Arizona in fulfilment of deliverables for the Arizona CDC BRACE project

August 18, 2022

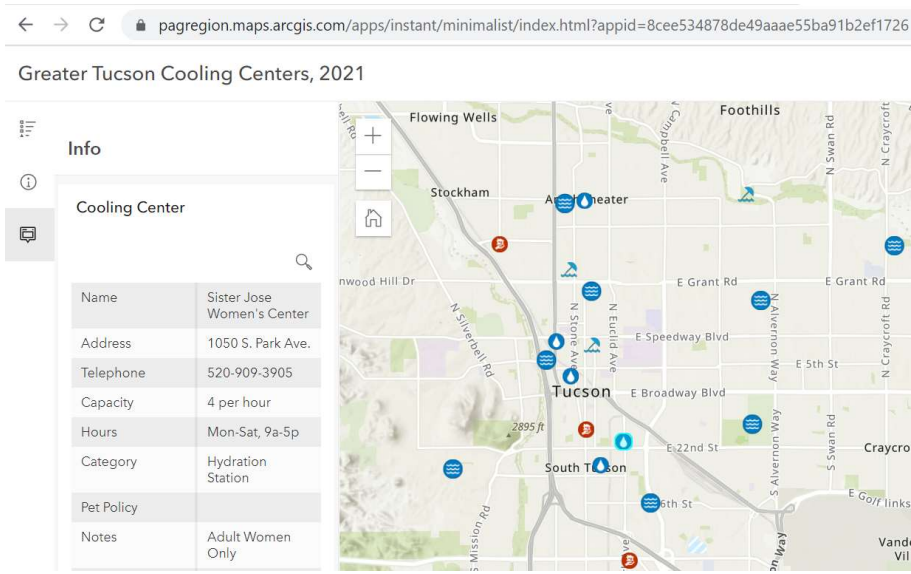


Watkins et al., Submitted

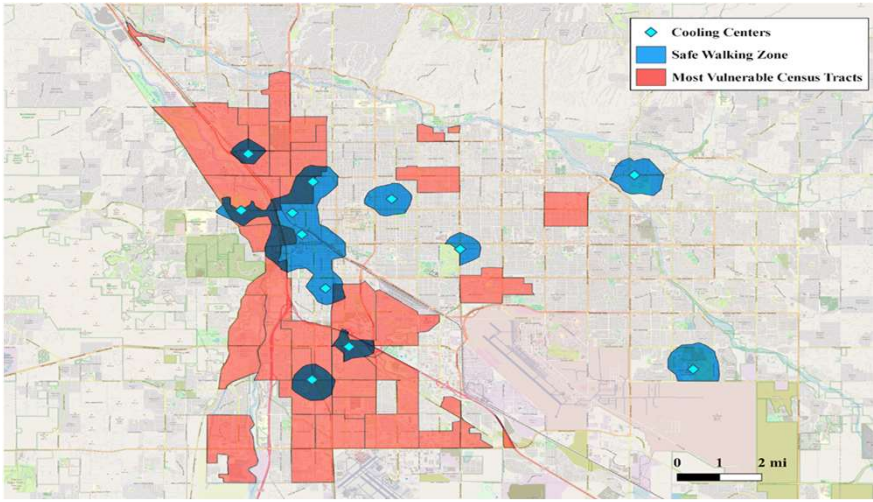
# Conclusions

- Building a Heat Resilient AZ
- BRACE
  - Academic/Local Govt Collab
  - Local Problems/Local Solutions
  - Student Involvement
- Outcomes
  - Resources for Public
  - Support to HDs
  - Academic Publications

Locations




Access



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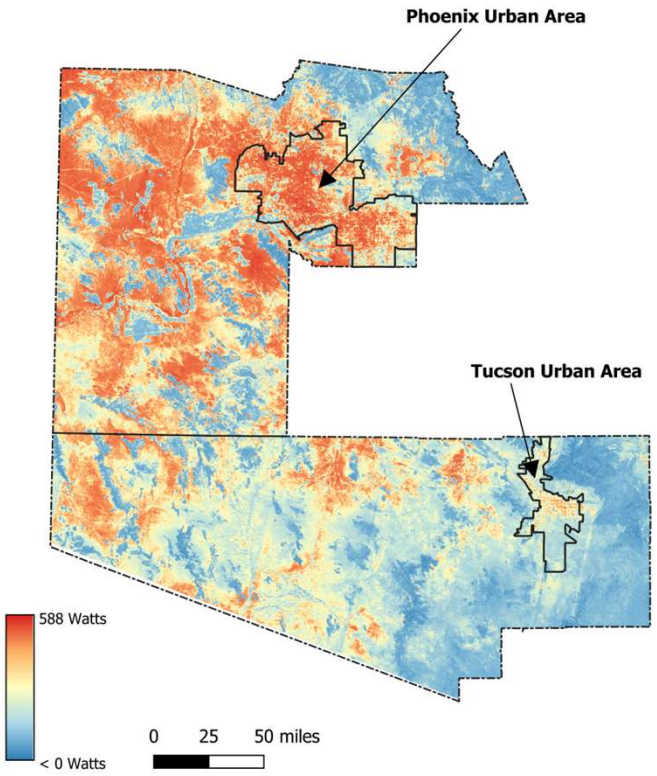
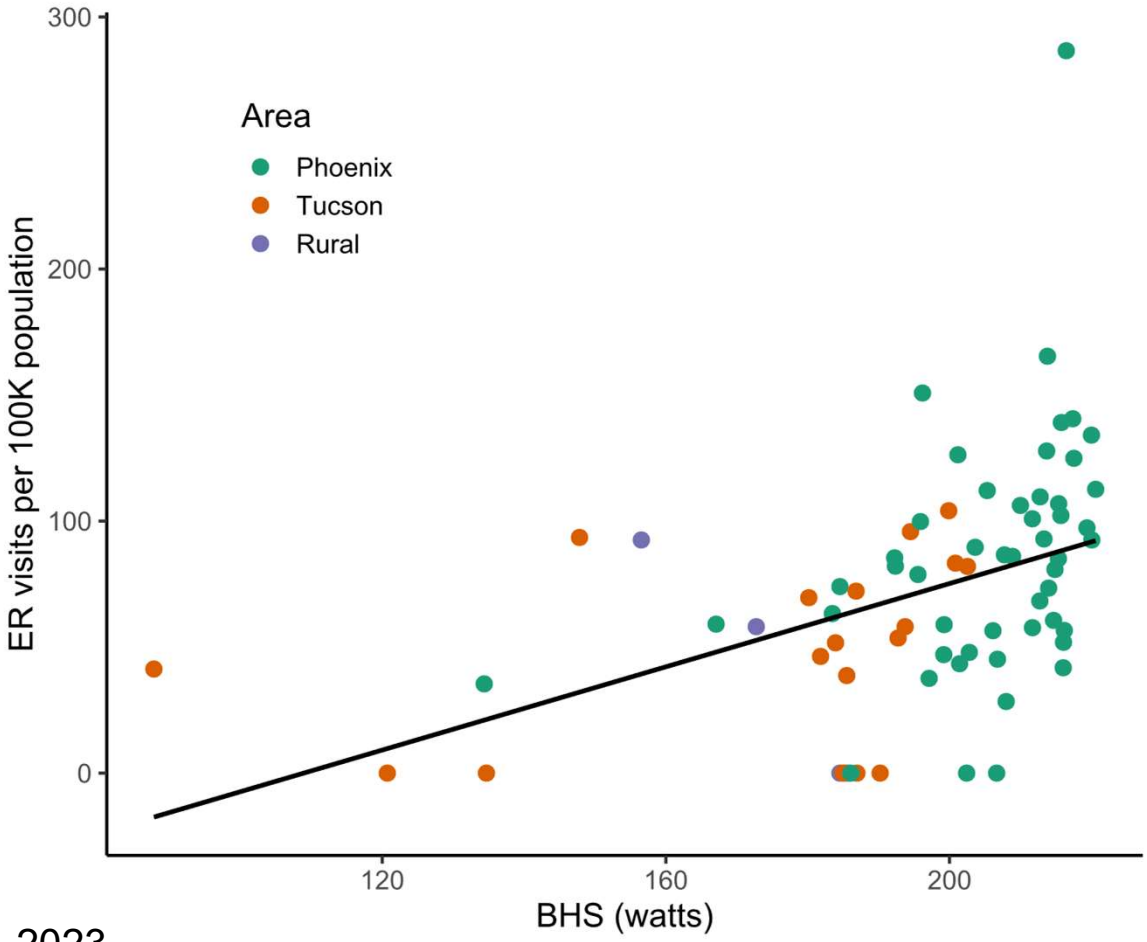
AZClimateHealth.Arizona.edu
https://sites.arizona.edu/spatialepi-lab/

CDC Centers for Disease Control and Prevention
CLIMAS Climate Assessment for the Southwest
NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

# Body Heat Storage (BHS) Index




Chambers et al., Remote Sensing Applications, 2023