

COMMUNITIES OF COLOR

Some communities of color living in risk-prone areas face cumulative exposure to multiple pollutants.

Adaptation plans that consider these communities and improve access to healthcare help address social inequities.

OLDER ADULTS

Older adults are vulnerable to extreme events that cause power outages or require evacuation.



Checking on elderly neighbors and proper emergency communication can save lives.

CHILDREN

Children have higher risk of heat stroke and illness than adults.



Adults can lessen risk by monitoring exertion and hydration.

LOW INCOME COMMUNITIES

Low income families are at risk of physical and mental illnesses during flooding and in crowded shelter conditions.



Comprehensive disaster management can improve resiliency for people with limited resources.

The Extreme Weather-Climate Gap

Dr. Marshall Shepherd
University of Georgia

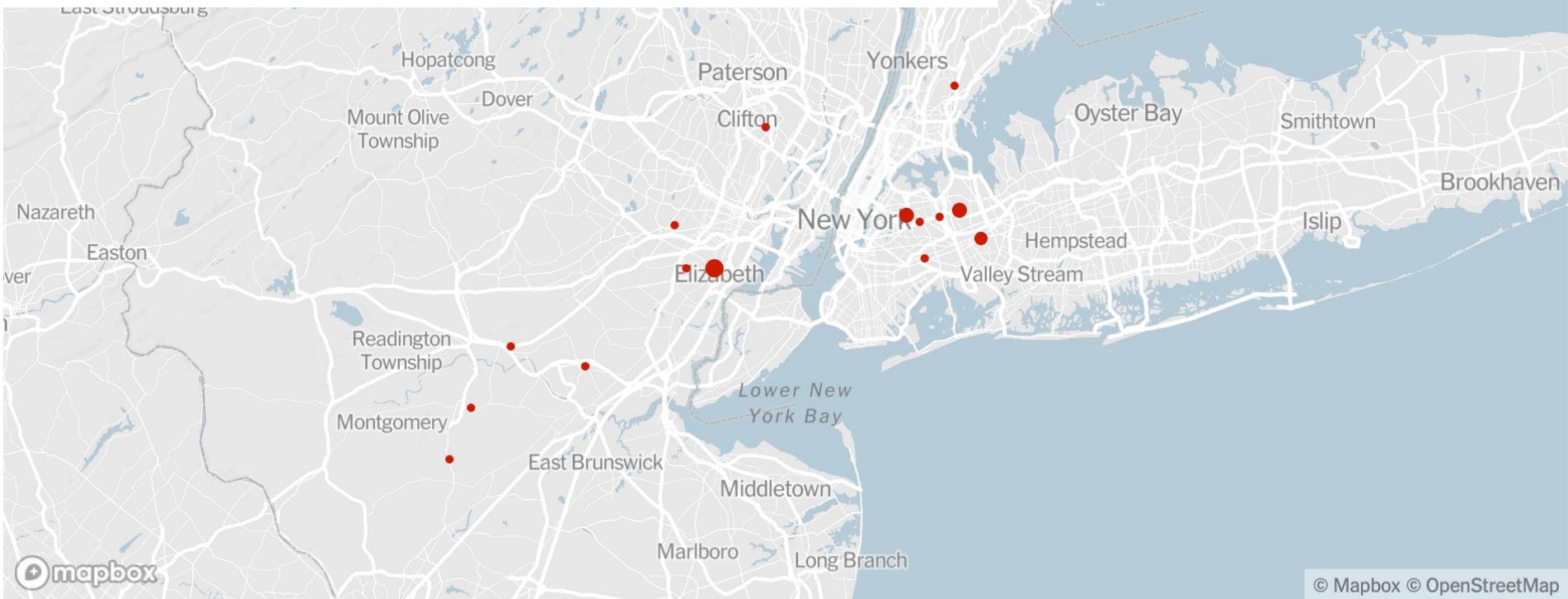
Director, Atmospheric Sciences Program
Georgia Athletic Association Distinguished Professor
Host, Weather Channel's Weather Geeks
Contributor, Forbes Magazine
Twitter: @DrShepherd2013



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How the Storm Turned Basement Apartments Into Death Traps

At least 11 people were found dead in basements after torrential rains flooded New York City — nearly as many as those killed by Hurricane Ida in Louisiana, where the storm made landfall.



Larger circles indicate more than one death in a location. • By Matthew Bloch and Charlie Smart

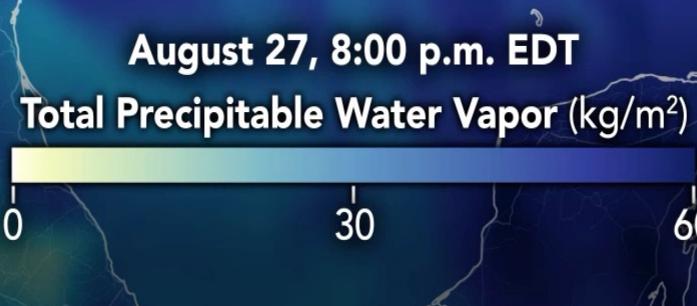


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That people living in illegal basement apartments face danger is not new. But while the worry has traditionally focused on fires or, to a lesser degree, carbon monoxide poisoning, climate change has now made these low-lying homes increasingly treacherous for a different reason: the likelihood of deadly flooding, when a wall of water blocks what is often the only means of escape.

“If there was ever proof that we need to address this basement issue, this is it,” said Annetta Seecharran, the executive director of the Chhaya Community Development Corporation, a group that works on housing issues for low-income South Asian and Indo-Caribbean New Yorkers. “We’re going to continue to have these climate-related issues.”

NY Times,
Zaveri et al.



Watershed Social Vulnerability to Flooding Athens-Clarke County, GA

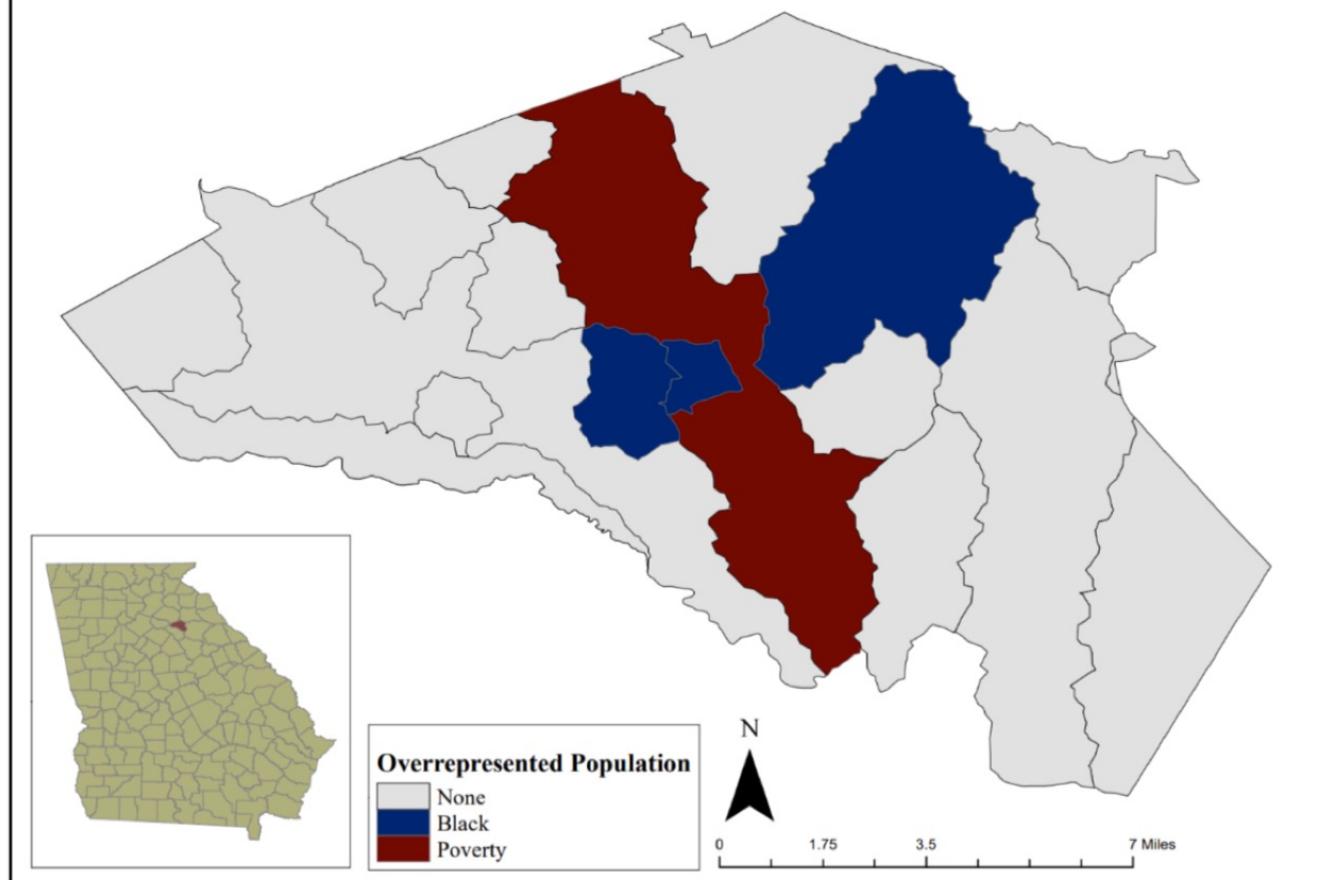
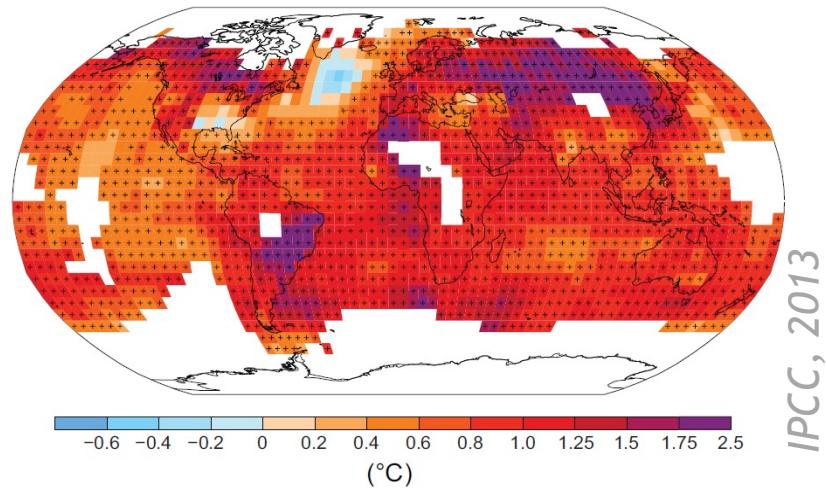


Figure 5 - Social vulnerability in Athens-Clarke County by watershed. Colored watersheds represent statistically significant risk ratios indicating Black populations or those in poverty are over-represented in flood prone areas for the 100-year flood event.

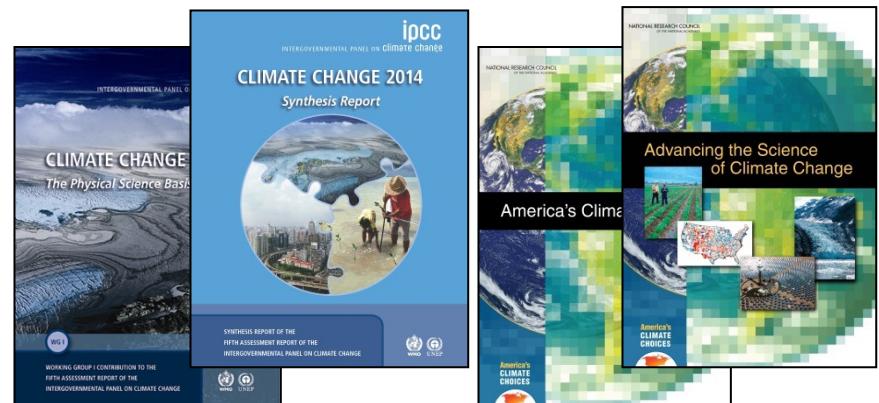
Climate is Changing

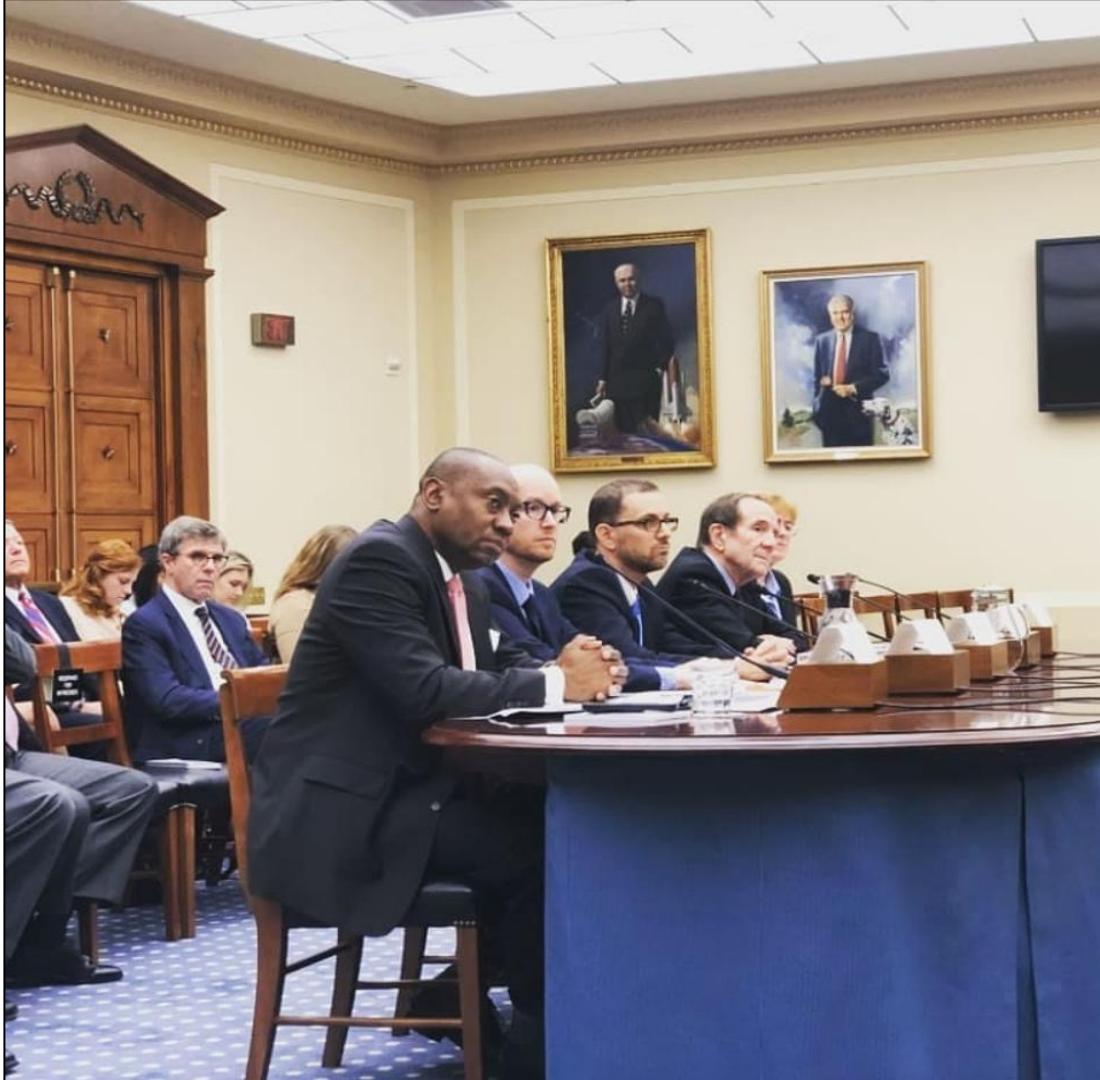
- The signs of changing climate are all around us:
 - Greenhouse gases are increasing
 - Sea level is rising
 - Ice sheets and glaciers are melting
 - Global temperatures are increasing
- Climate change impacts people, ecosystems, and the economy

Observed Change in Surface Temperature



IPCC, 2013

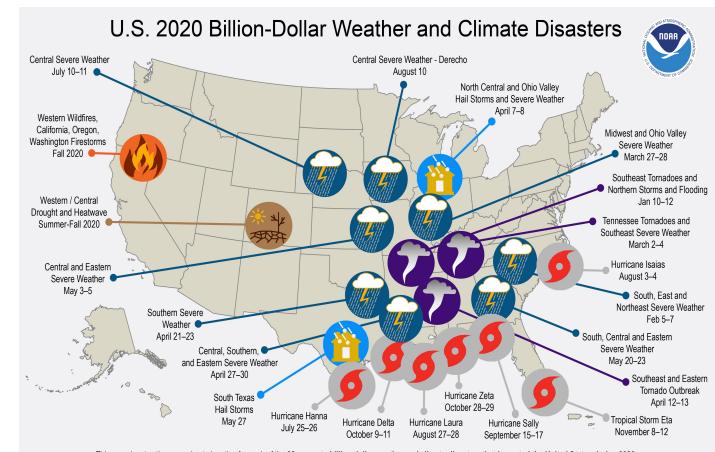


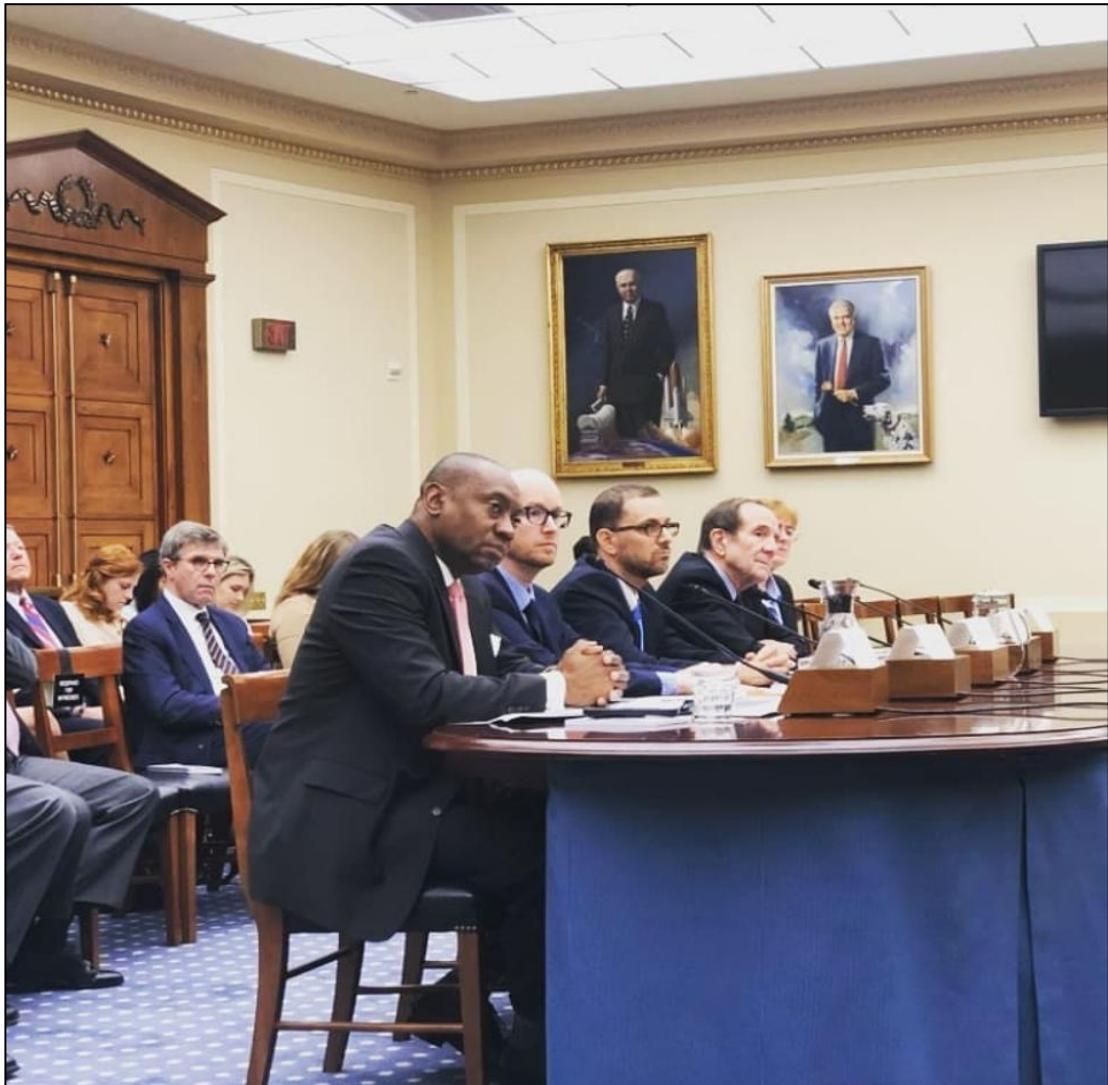


The Extremes are becoming more extreme, and people feel them far more than “averages”

--Dr. Marshall Shepherd

Testifying Before The U.S. House of Representatives Science Committee in October 2019





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- The **hazards** presented by extreme weather and climate events (e.g. UHIs + **extreme heat**).
- The **exposure** of people, infrastructure, and cultural, social and economic assets to personal or systematic harm.
- The **vulnerability** of people and places in the urban setting that result in increased sensitivity or differentiated exposure to the hazard.
- **Resilience** is not simply the inverse of vulnerability. Rather it is the capacity for the community and individuals within it to mitigate the impacts of the disaster through strengths, attributes and resources.

(e.g. Brooks 2003, World Risk Report 2013).

$$Risk = \frac{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}{\text{Resilience}}$$

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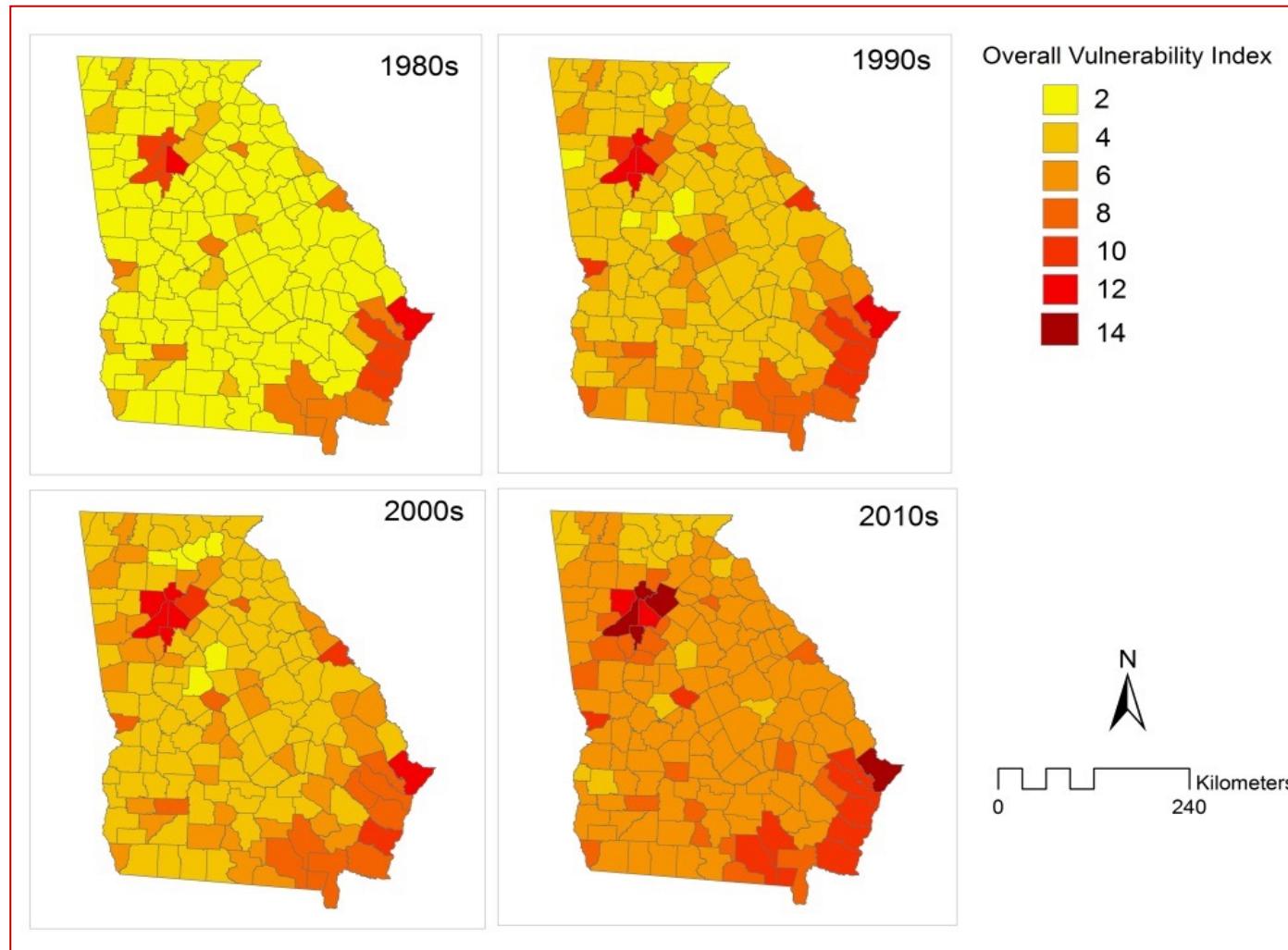
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Georgia's Climate Vulnerability

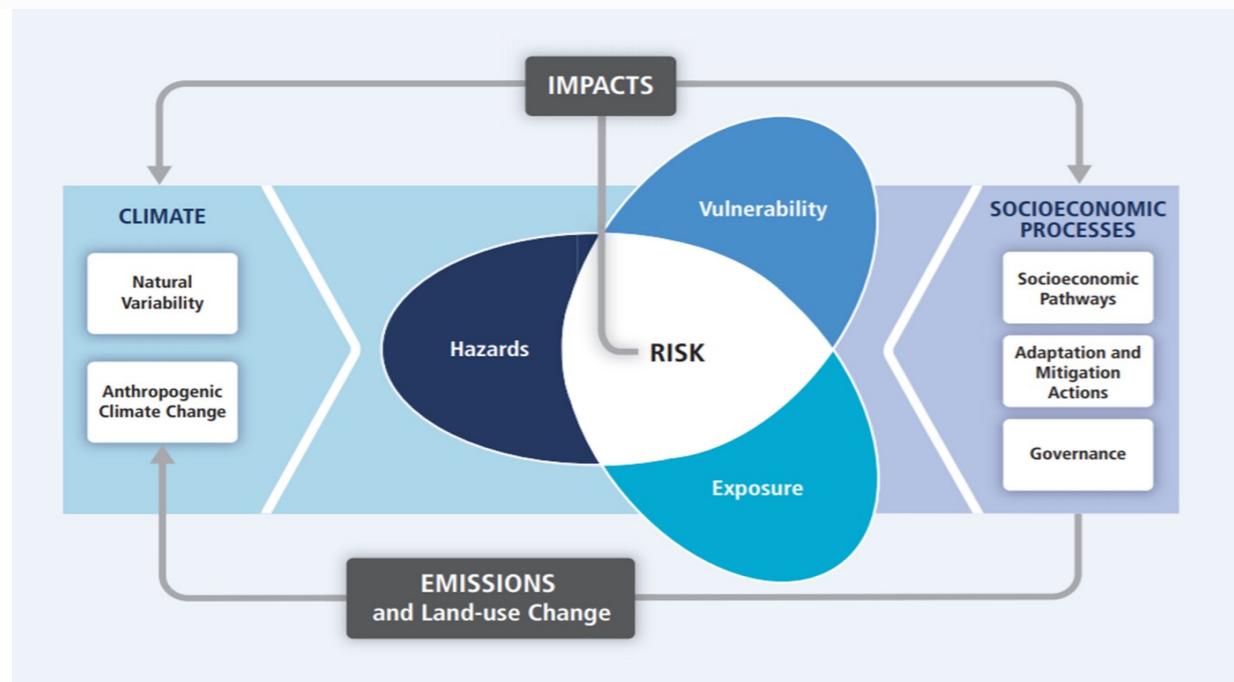


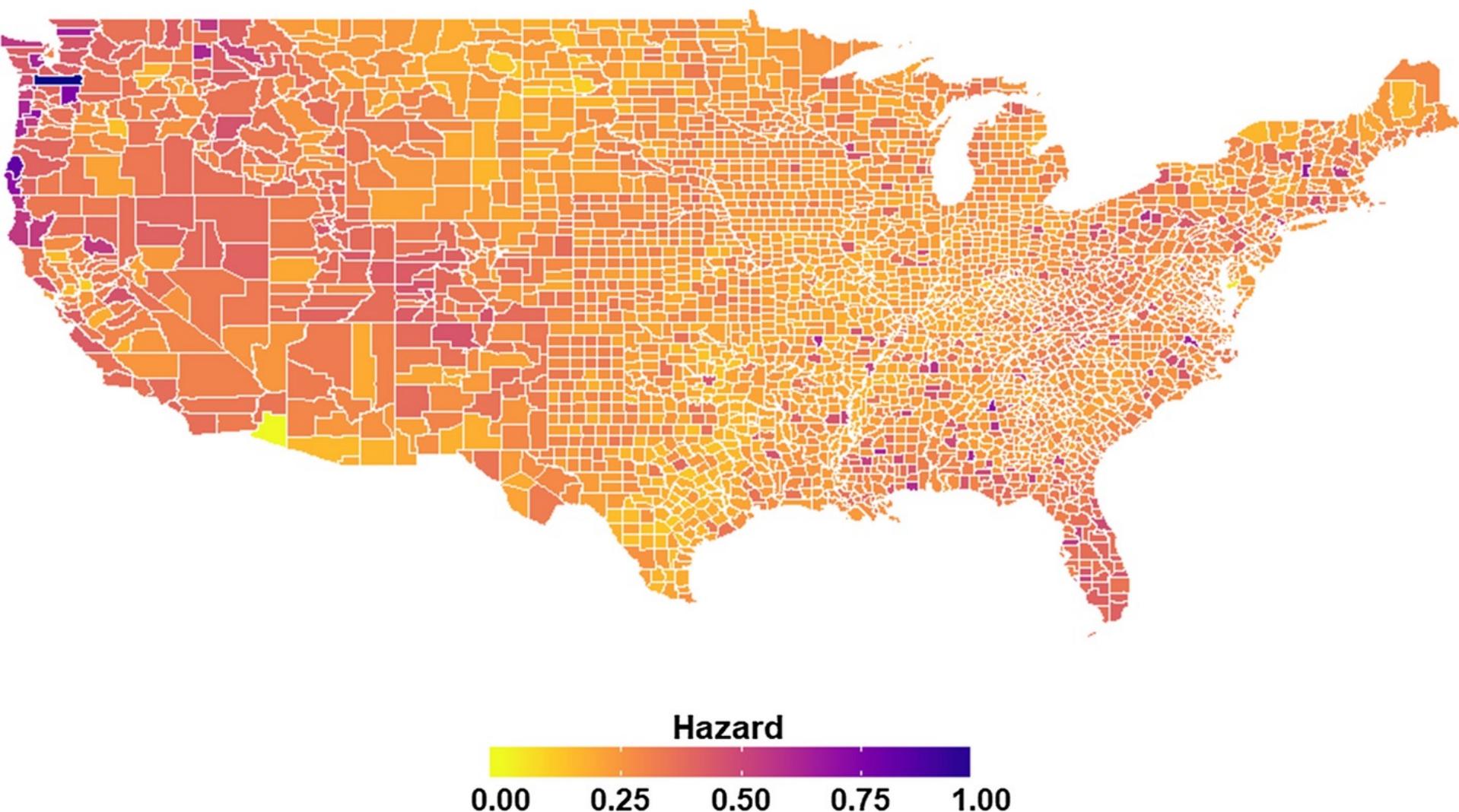
Multi-hazard climate risk projections for the United States

[Binita KC](#) , [J. M. Shepherd](#), [Anthony W. King](#) & [Cassandra Johnson Gaither](#)

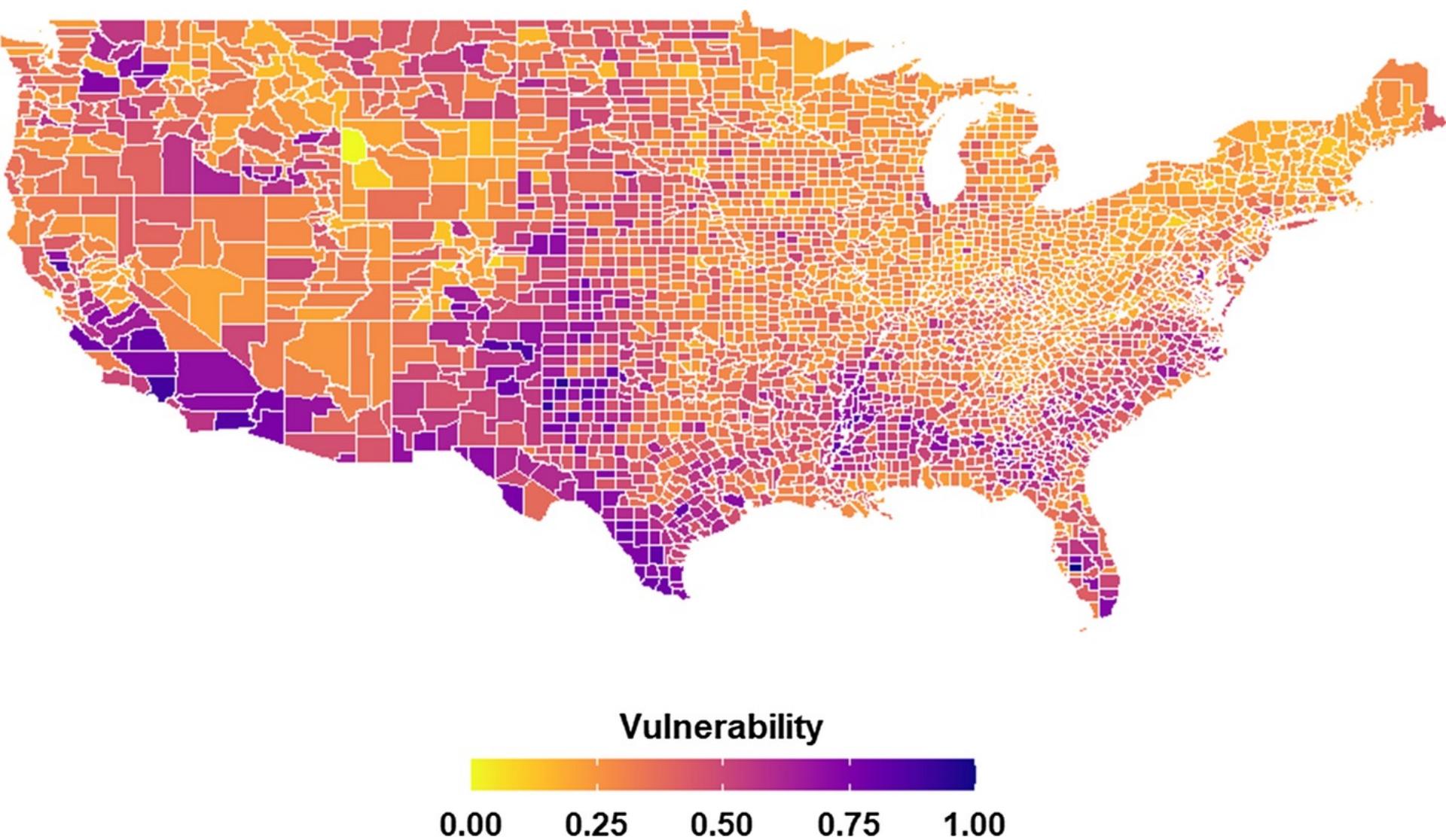
[Natural Hazards](#) **105**, 1963–1976(2021) | [Cite this article](#)

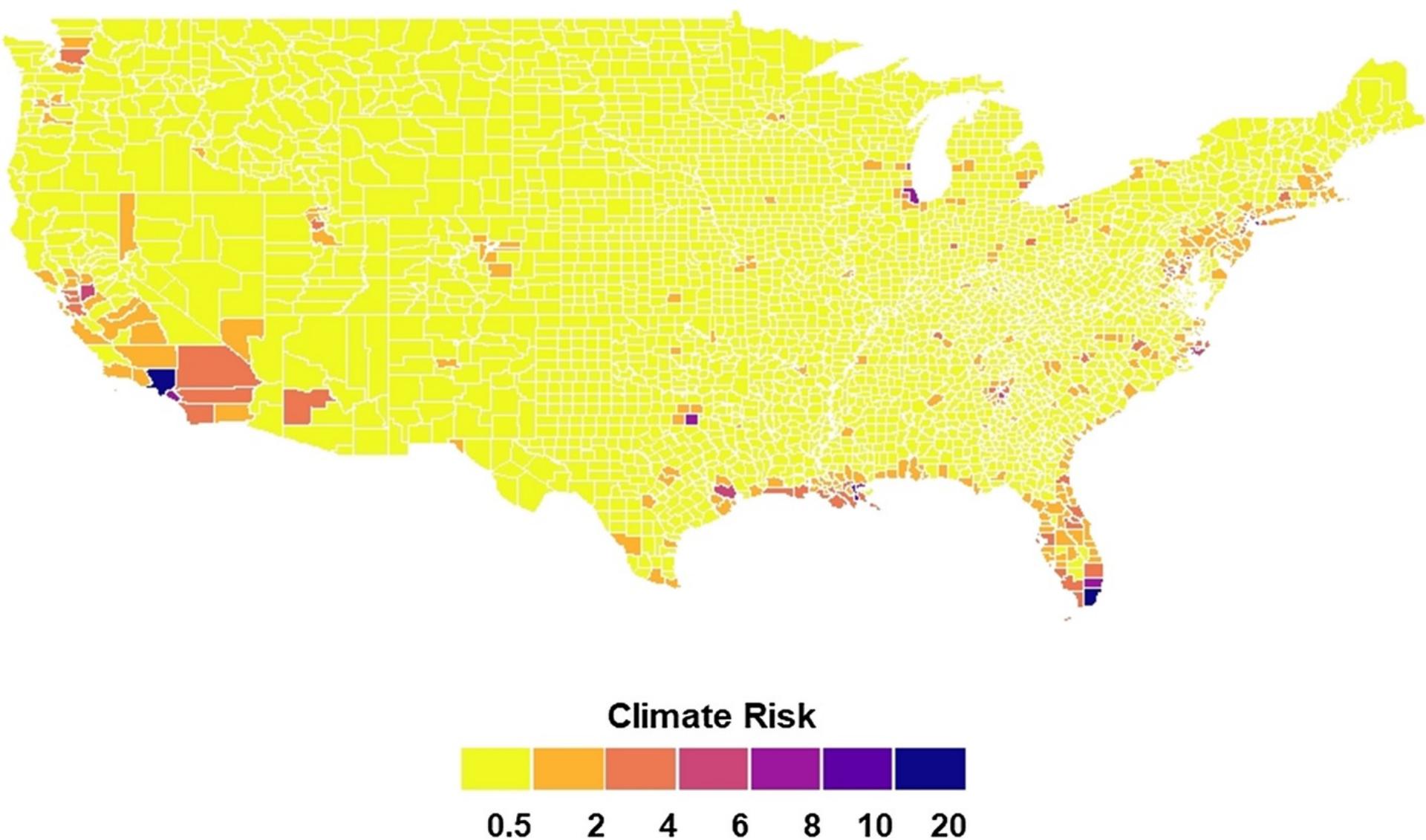
2122 Accesses | **2** Citations | **23** Altmetric | [Metrics](#)





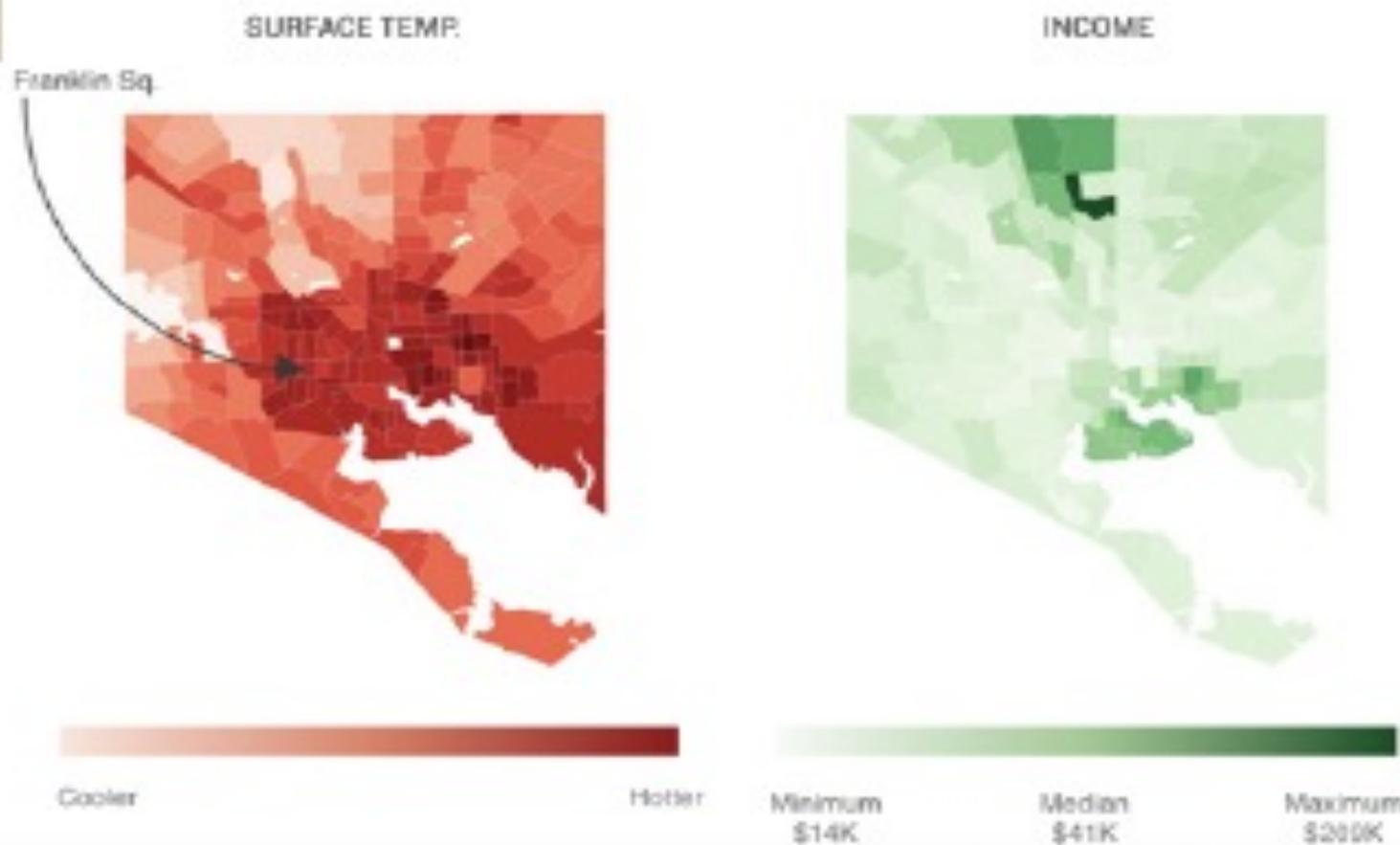
Climate hazard in the 2040s obtained by merging the anomalies in temperature and precipitation and extreme events measured as—heat wave, cold spells, dry conditions, and extreme precipitation days (see Methods). The hazard index is rescaled 0 to 1





Heat And Income In Baltimore

Fig. 3



N. Eckert, N. Underwood, S. Mussenden, R. Ready and T. Diffendal, "As Rising Heat Bakes U.S. Cities, The Poor Often Feel It Most", *npr.org*, 2019. [Online]. Available: <https://www.npr.org/2019/09/03/754044732/as-rising-heat-bakes-u-s-cities-the-poor-often-feel-it-most>. [Accessed: 13- Nov- 2019].



Urban Heat.....

ASSESSING THE PERFORMANCE OF A VULNERABILITY INDEX DURING OPPRESSIVE HEAT ACROSS GEORGIA, U.S.

George Maier, Andrew
Grundstein, Woncheol Jang,
Chao L, Luke P. Naeher and
Marshall Shepherd, 2014
Weather, Climate and Society,

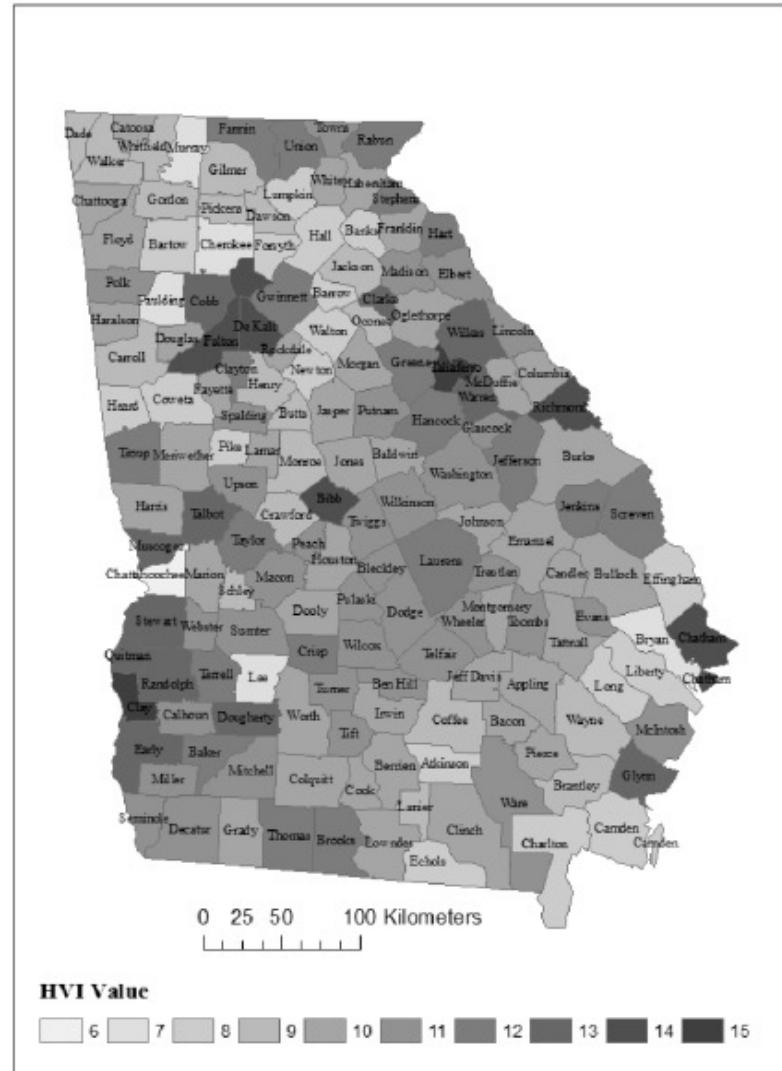
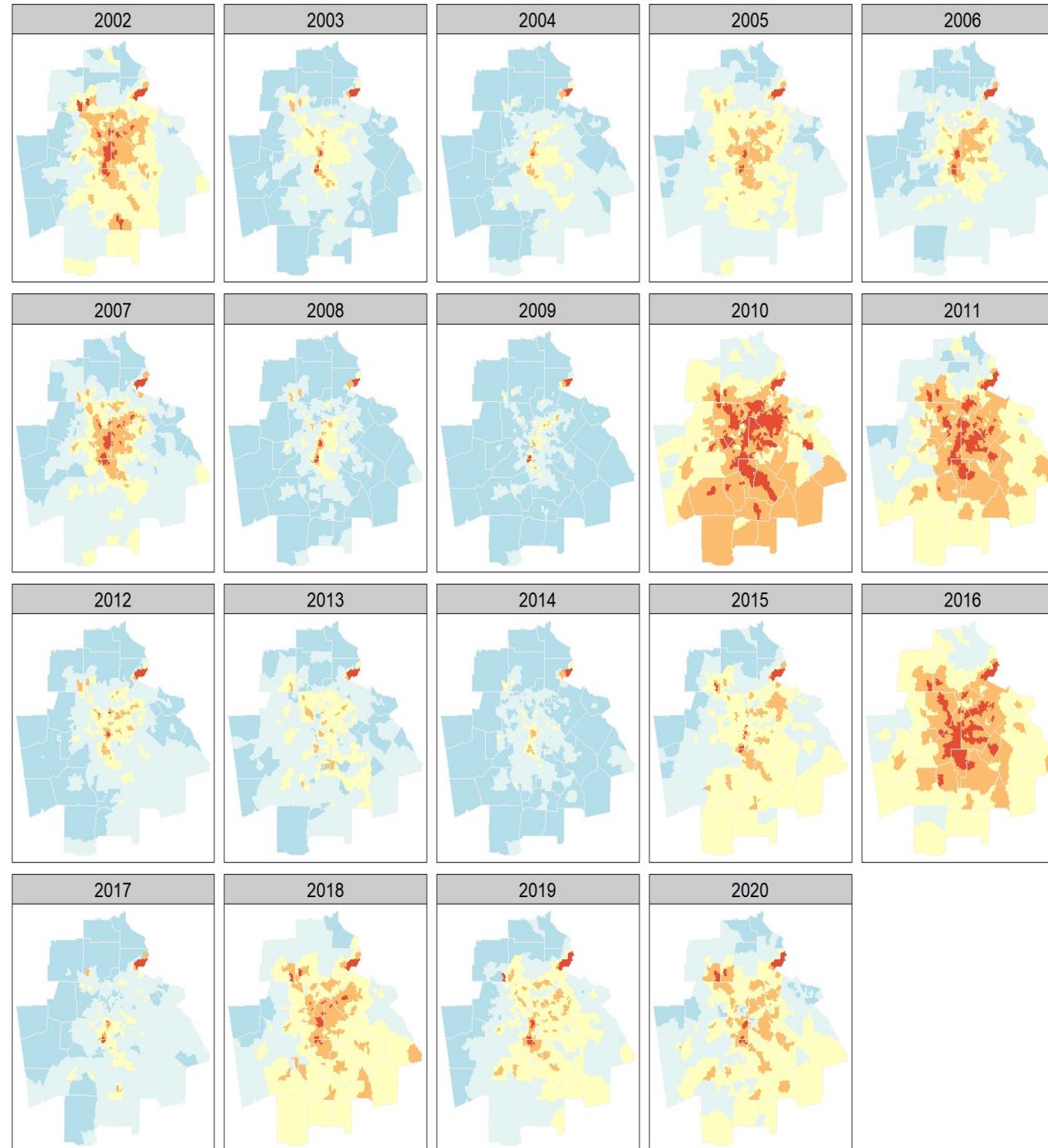


Figure 2. Total vulnerability level by county as indicated by the HVI. Greater values indicate increased vulnerability to heat.

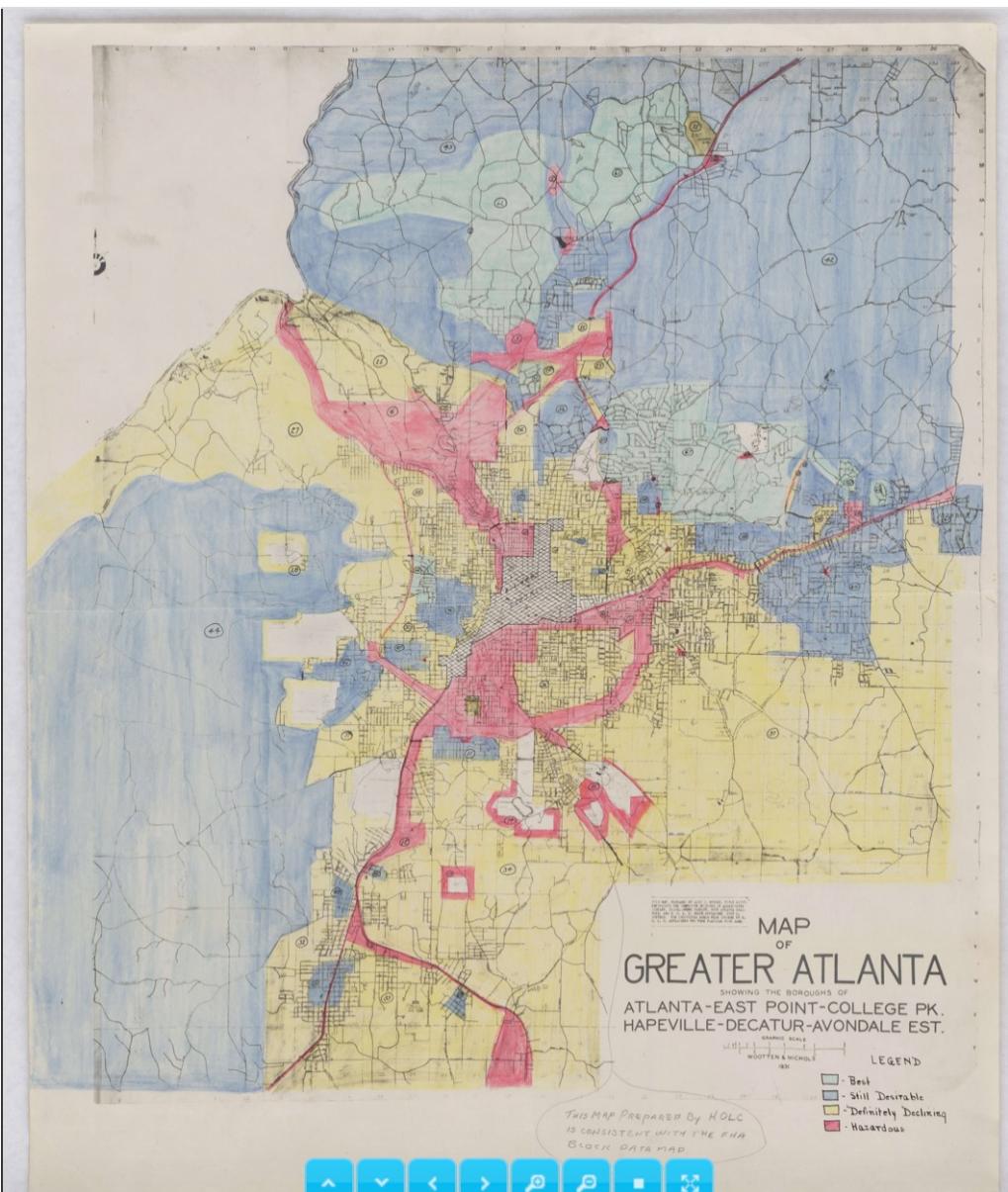




Mean summer nighttime temperature (K), 2003-2021

| Temperature Range (K) |
|-----------------------|
| 290.9 to 293.6 |
| 293.6 to 294.6 |
| 294.6 to 295.6 |
| 295.6 to 296.7 |
| 296.7 to 303.4 |

This is a redlining map for Atlanta, Georgia.



These maps were created and annotated to show mortgage lending risk by neighborhood type, including residential, commercial and industrial areas. Residential districts are marked by different colors related to the level of risk in lending in those neighborhoods.

These types of maps were later known as redlining maps related to the color given to the neighborhoods that were measured as most risky for loans.

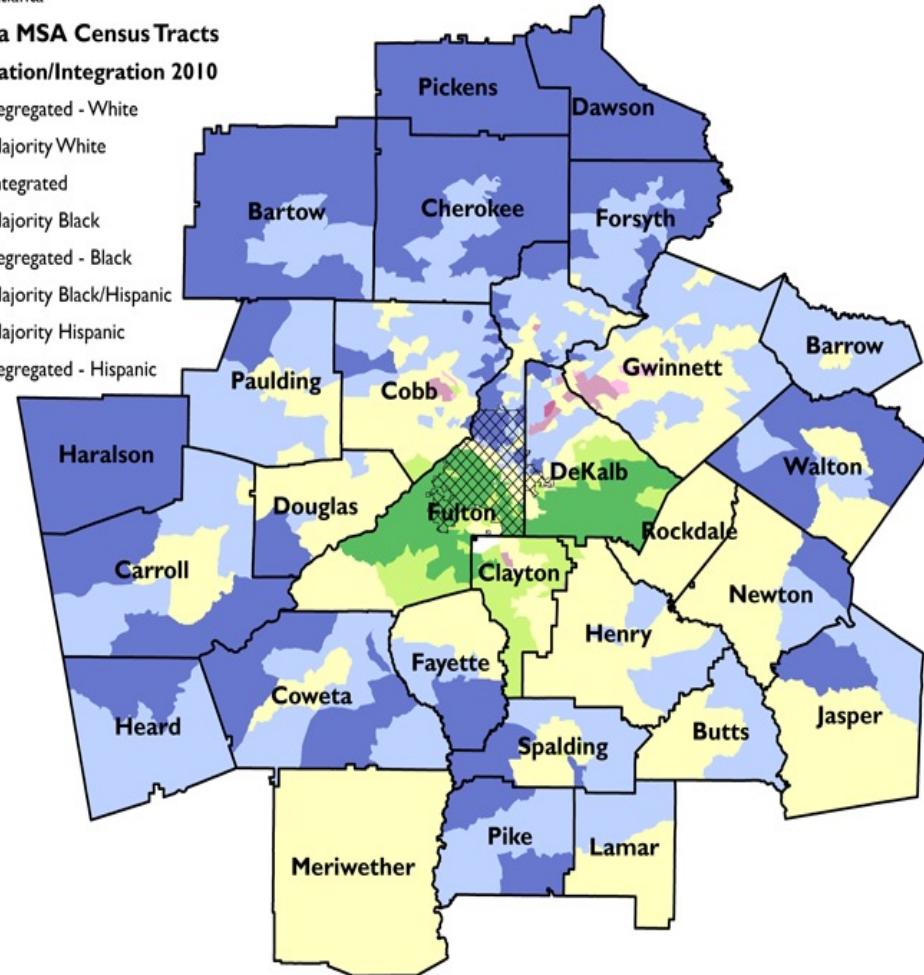
Atlanta Heat Island

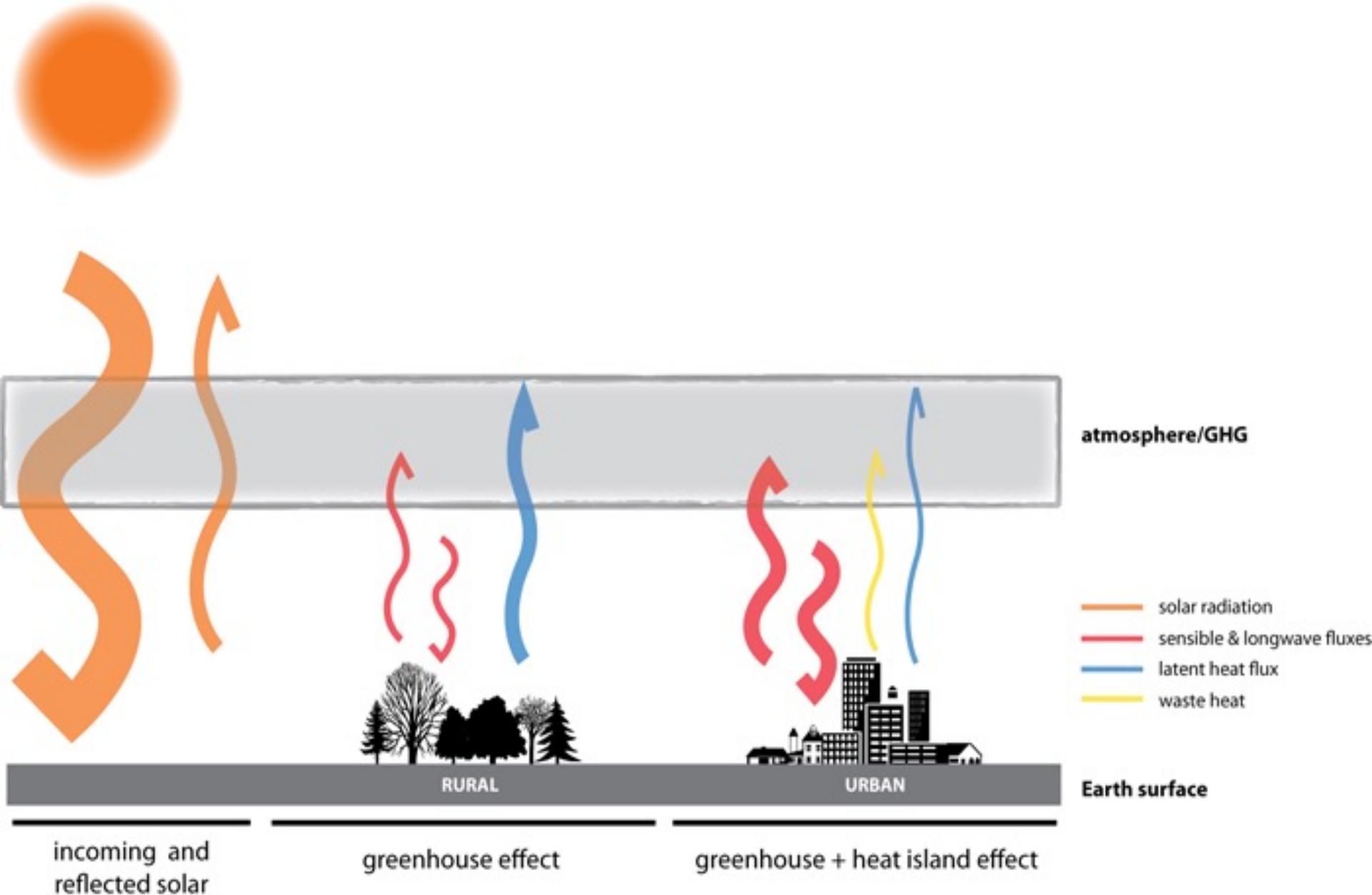


Atlanta MSA Census Tracts

Segregation/Integration 2010

- Segregated - White
- Majority White
- Integrated
- Majority Black
- Segregated - Black
- Majority Black/Hispanic
- Majority Hispanic
- Segregated - Hispanic





Work of Brian Stone, Georgia Tech

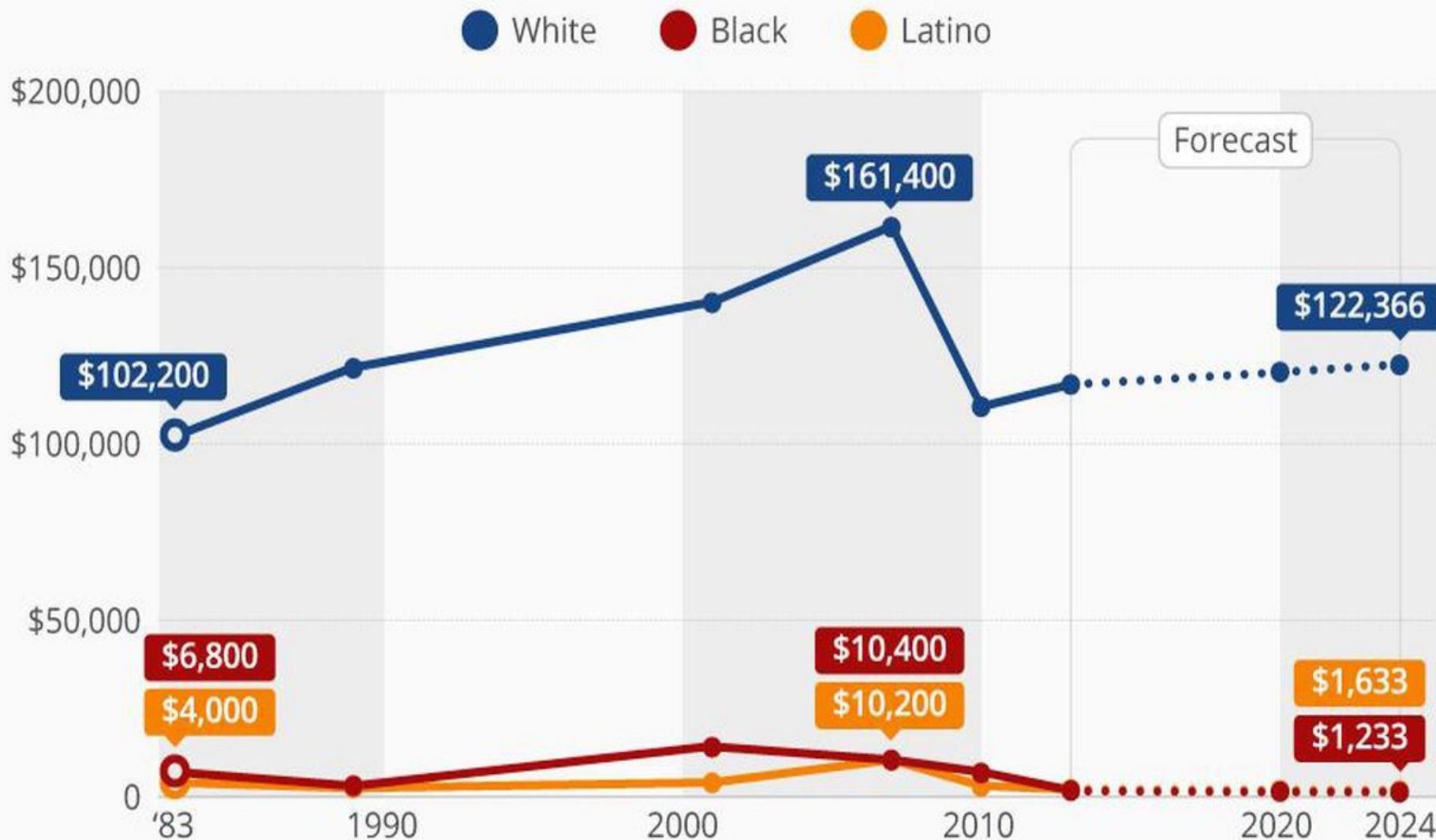
Weather-Climate Gap - A disproportionate sensitivity to extreme weather-climate events and a delay in the ability to bounce back



Shepherd and KC 2015

Racial Wealth Inequality Is Rampant In The U.S.

Median household wealth by race/ethnicity in the United States (1983–2024)



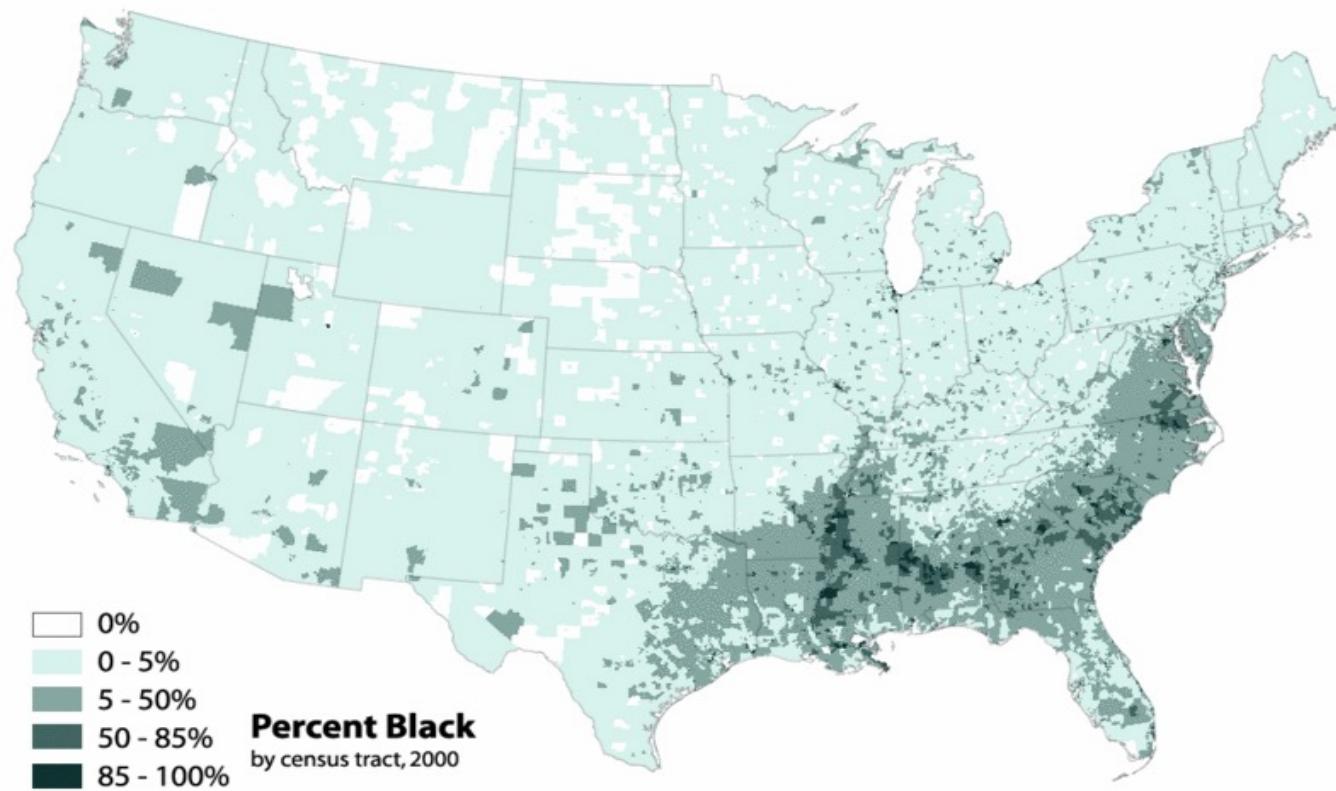
@StatistaCharts

Source: Prosperity Now & Institute For Policy Studies

African American Vulnerability: Place

“55% percent of African-Americans live in the Southern United States.”
Robert Bullard.

“The South is prone to more climate-related disasters in both scale and magnitude by a ratio of almost 4:1.





A Year After Hurricane Harvey, Houston's Poorest Neighborhoods Are Slowest to Recover

Texas has made progress recuperating from Hurricane Harvey, but low-income and minority residents have had a much harder time.

Hurricane Katrina: Poster Child for African American Vulnerability to a weather/climate event.....

But It was also an Episodic Event, what about creeping, long term climate change?



White New Orleans Has Recovered from Hurricane Katrina. Black New Orleans Has Not.

August 29, 2016 | Gary Rivlin 



Flooding and Marginalized Communities

African Americans were **44% more likely** to reside in areas at risk for flooding than Whites when considering the Charlotte to Atlanta (Char-Lanta) Mega-region as a whole.

At the MSA scale, Greenville-Spartanburg exhibited the largest flood risk inequities, as African Americans were **80% more likely** to reside in the 500-year flood zone. (Debbage 2020)



“ Environmental justice embraces the principle that all people and communities have a right to equal protection and equal enforcement of environmental laws and regulations....Today, zip code is still the most potent predictor of an individual’s health and well-being. Individuals who physically live on the “wrong side of the tracks” are subjected to elevated environmental health threats and more than their fair share of preventable diseases....Reducing environmental, health, economic and racial disparities is a major priority of the Environmental Justice Movement.



How Do We Close The Gap?

- Reduce emissions and increase adaptation
- Erode the “Income Gap”
- Ensure mitigation and other policies/strategies benefit all, not a select or advantaged few
- Educate marginal populations about their vulnerabilities
- Increase climate literacy at the community level and “make it plain”!

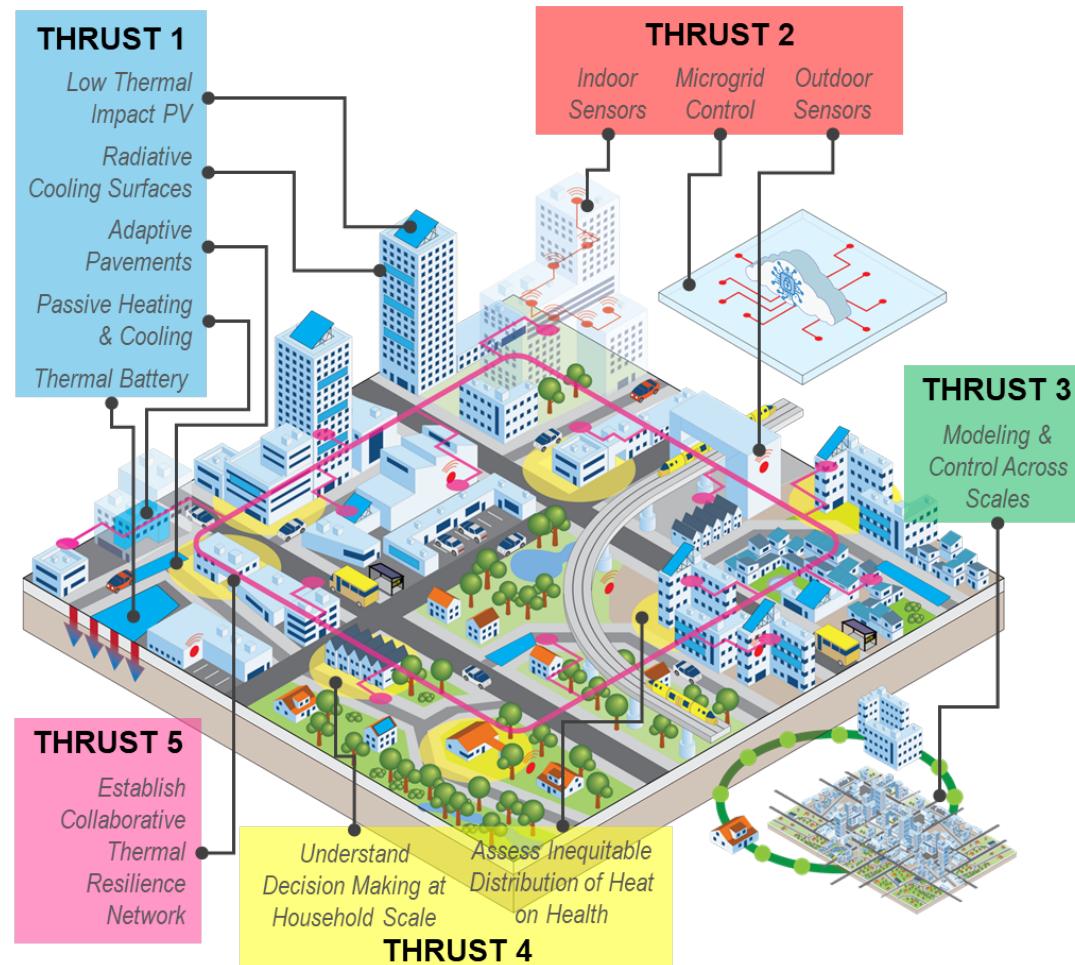
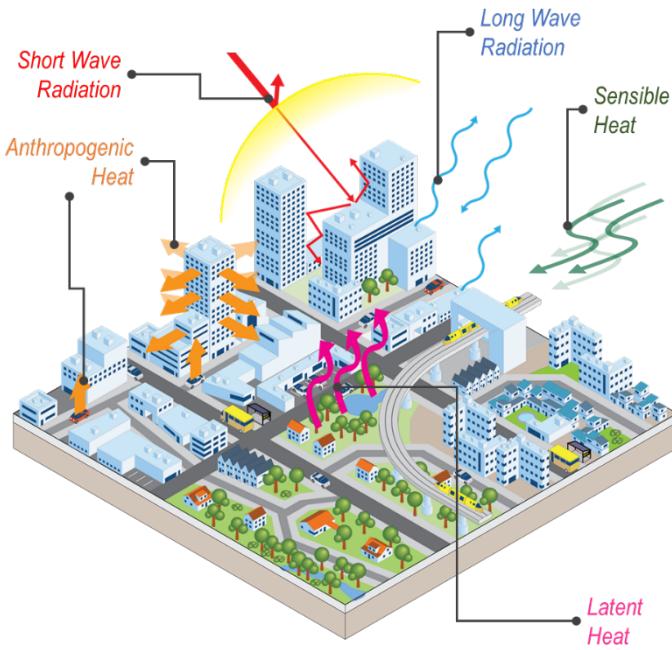


Where I Think We Are Headed?



- There is Optimism: Science is respected again
- There will be climate **across** the Agencies and Disciplines. This can help with justice/equity issue
 - We are back in the **Paris Agreement**
- The Principles of the **Green New Deal** will be relevant even if the Deal never becomes law (renewable energy, equity, and justice). New Infrastructure Plan is a Climate Plan too.

Engineering for Thermal Justice



Shameless Plug....But It Is Important

- An inflection point in society may have finally been reached. Meaningful discussions are being had about race.
- Marshall Shepherd **offers 6 practical steps that we can all do to move the needle beyond social media activism, anger, apologies, and superficial activities.**
- Shepherd uses a series of events that played out in the Spring 2020 and his own personal journey as a black scientist to advance meaningful actions that you can do right now in your homes, local communities and beyond.

