

# Concrete Heat: Characterising Heatwave Changes Over 30 Years of Urbanisation

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Urban heatwaves: rising risk for cities



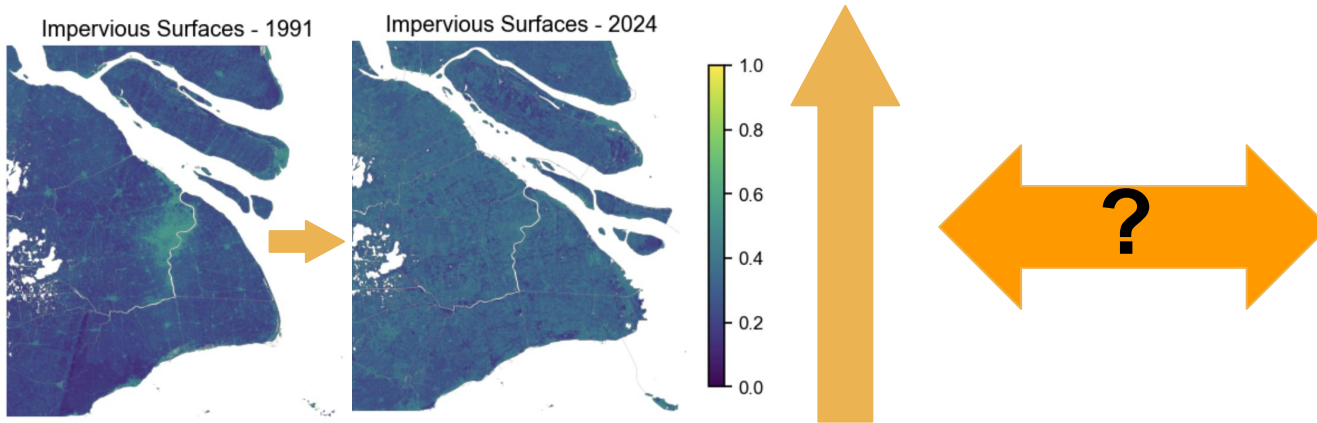
Concrete & rooftops = more trapped heat

Shanghai: expanding upward and outward

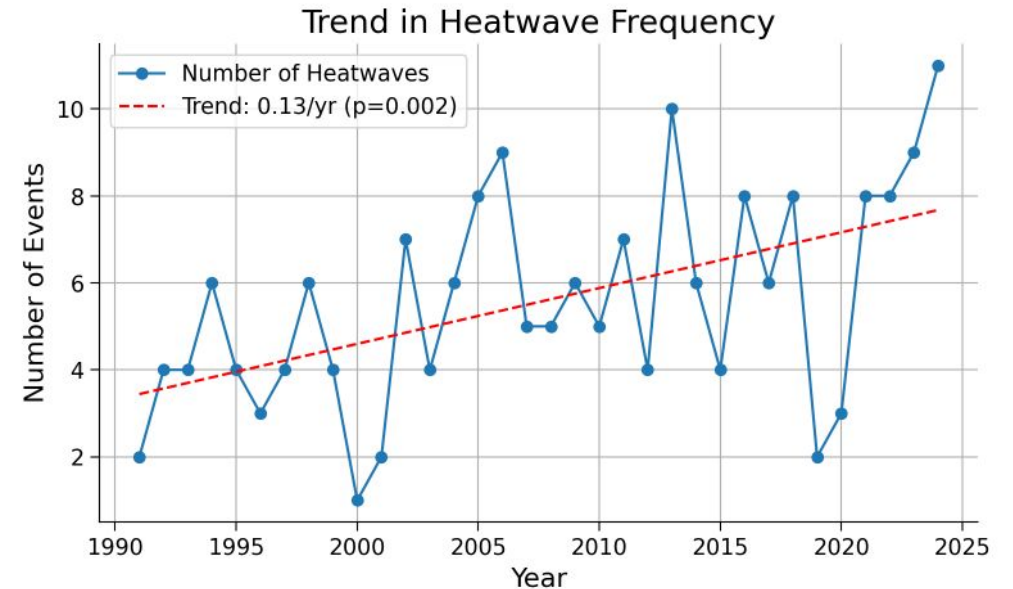


What is the relationship between changing urban land use and heatwave characteristics in rapidly expanding cities such as Shanghai?

# Method - Correlation Urban Land Use & Heatwave Characteristics 1991-2024



Landsat data

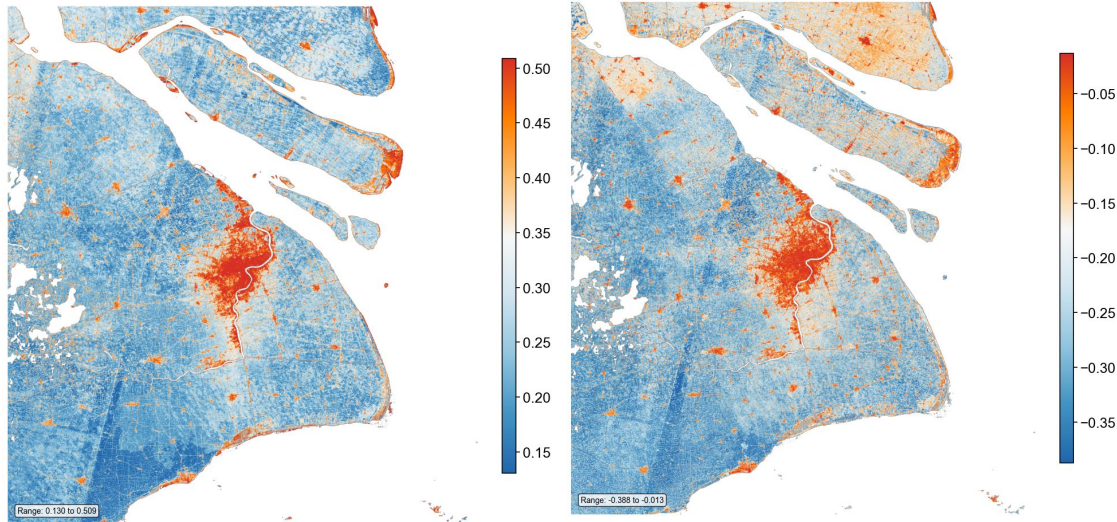


Copernicus Era 5-Land, 2m daily maximum data

How do different measures of urban growth relate to heatwave dynamics?

# Method - Measurements more in depth

## Urbanization



Impervious Surfaces (1991)

Normalized Difference Built-Up Index (NDBI) (1991)

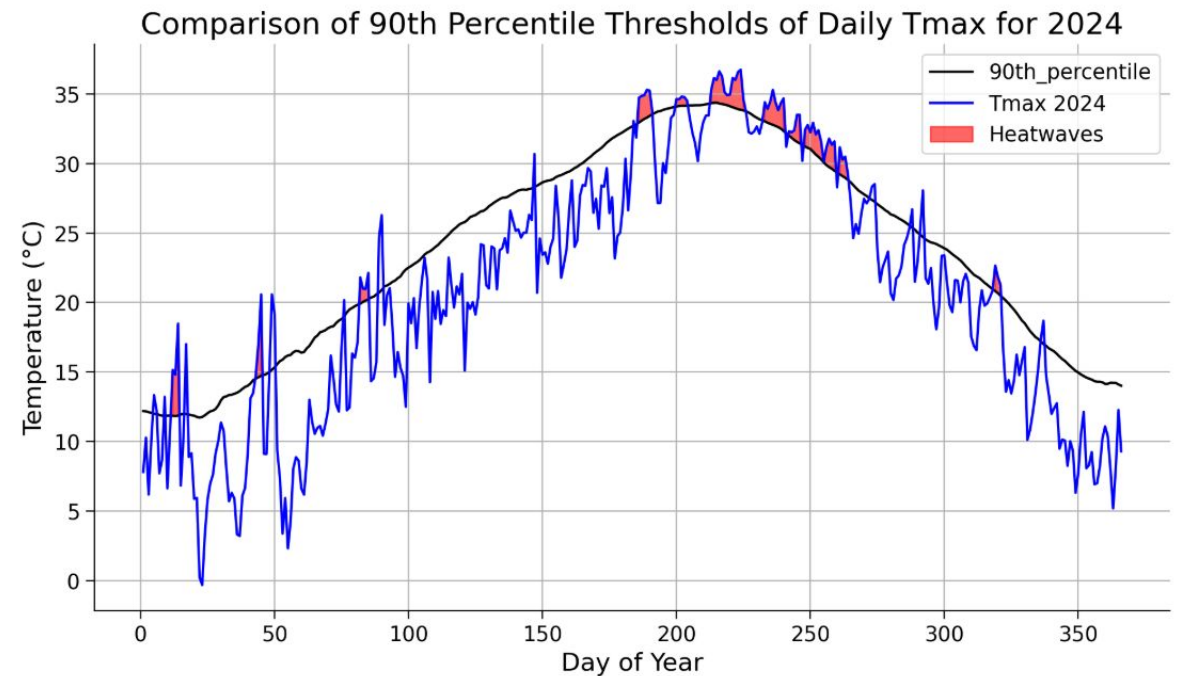


Captures ground sealing (concrete)  
Absorbs/radiates heat



Built-up density  
Traps heat + blocks wind

## Heatwaves

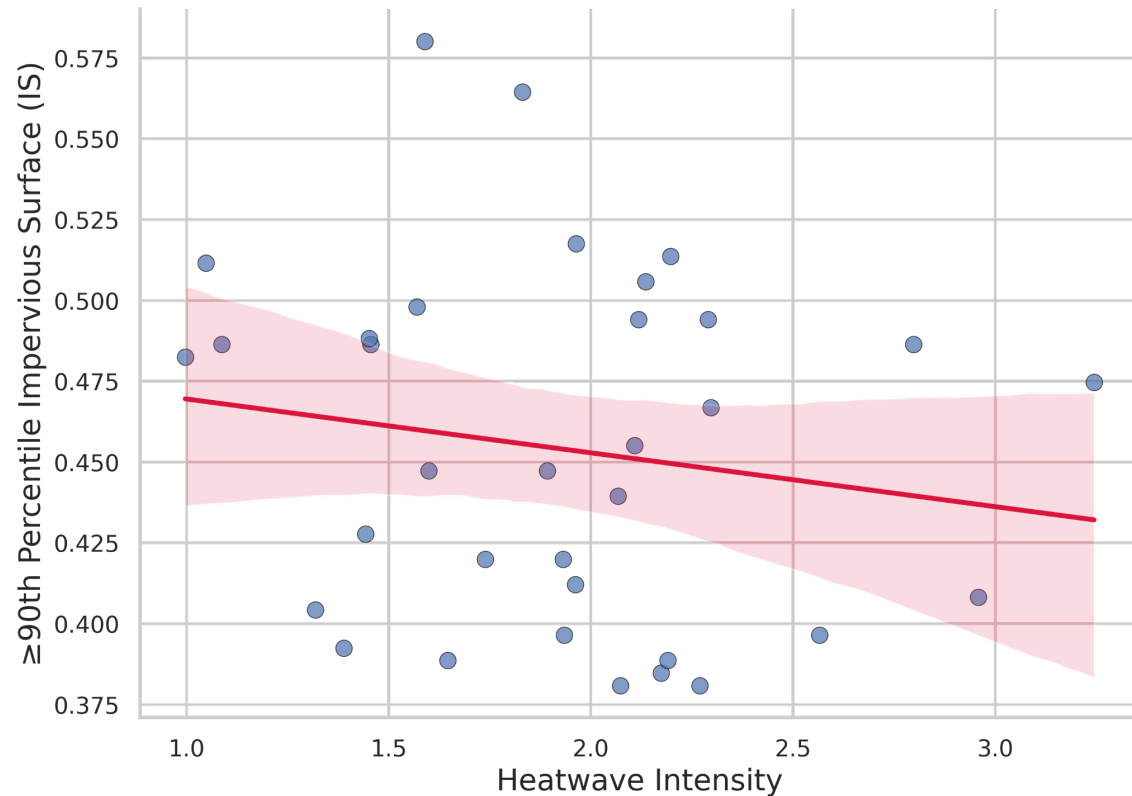


Copernicus Era 5 Land, 2m daily maximum data

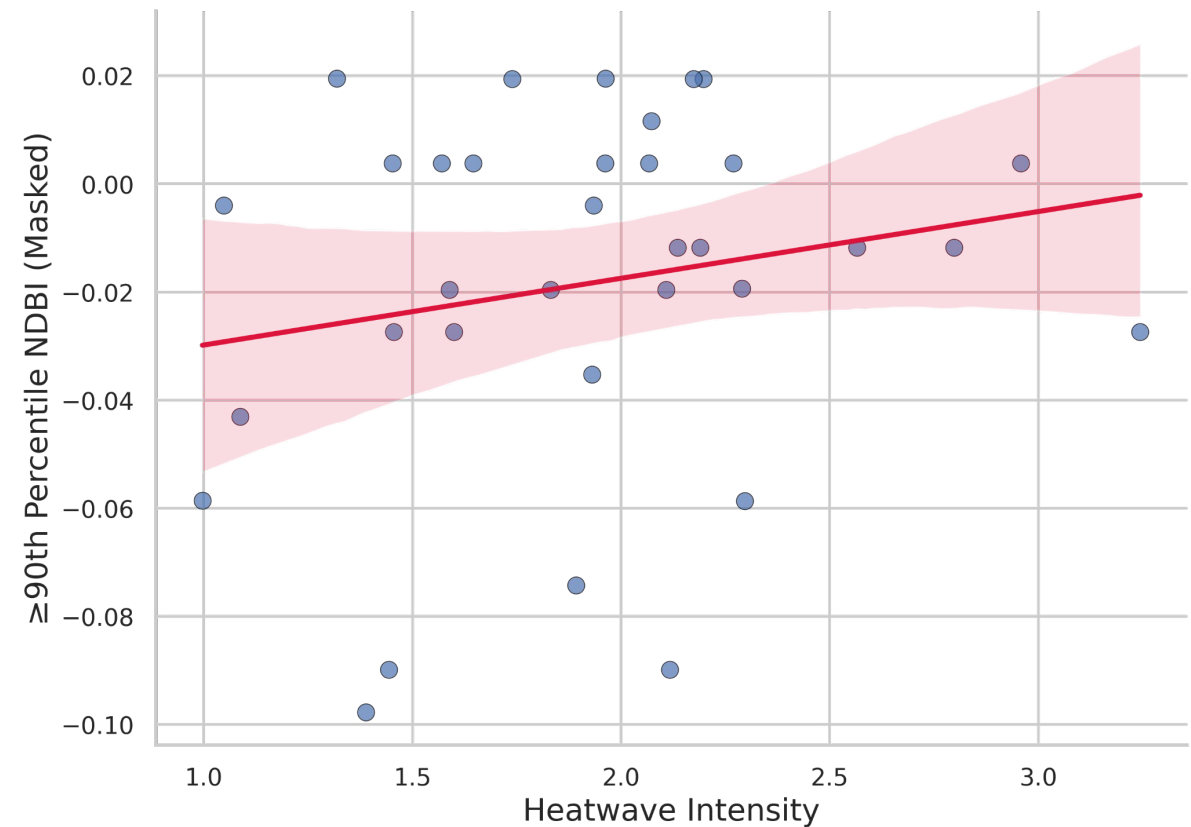


# Results - No Correlation between IS & NDBI and Heatwave Intensity

Impervious Surfaces vs. Heatwave Intensity  
 $r = -0.16$ ,  $p = 0.367$

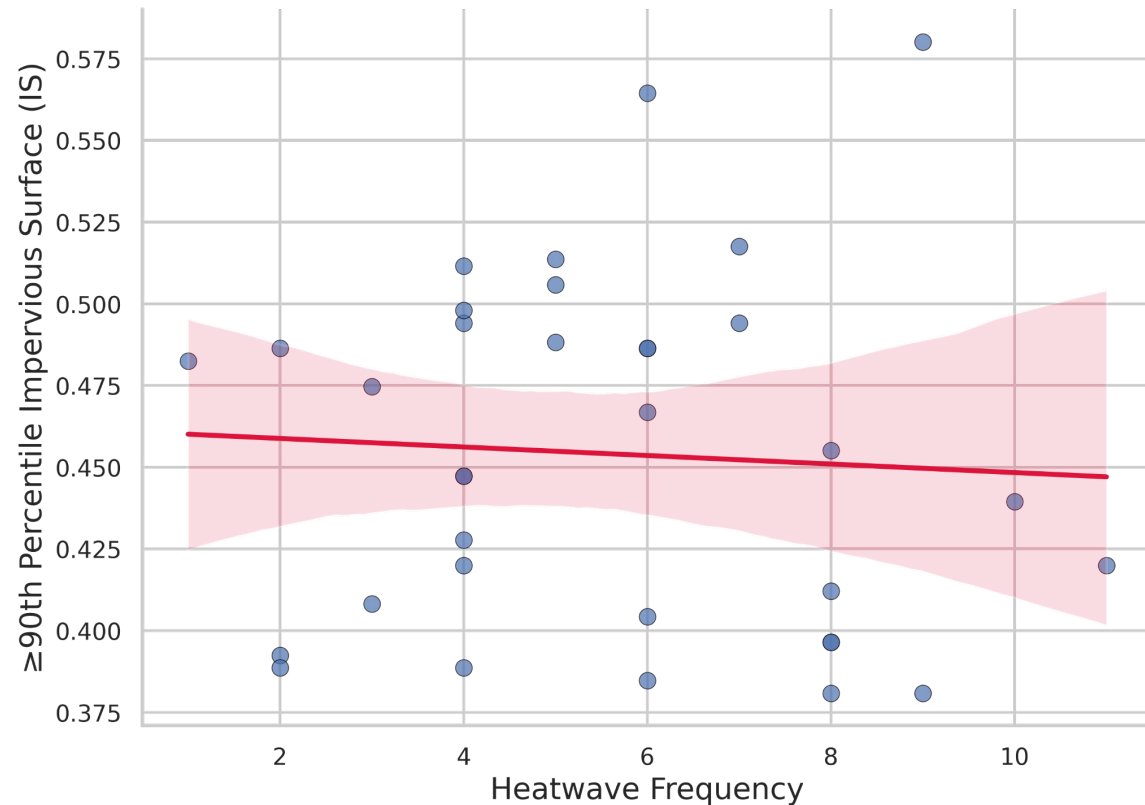


NDBI vs. Heatwave Intensity  
 $r = 0.19$ ,  $p = 0.273$

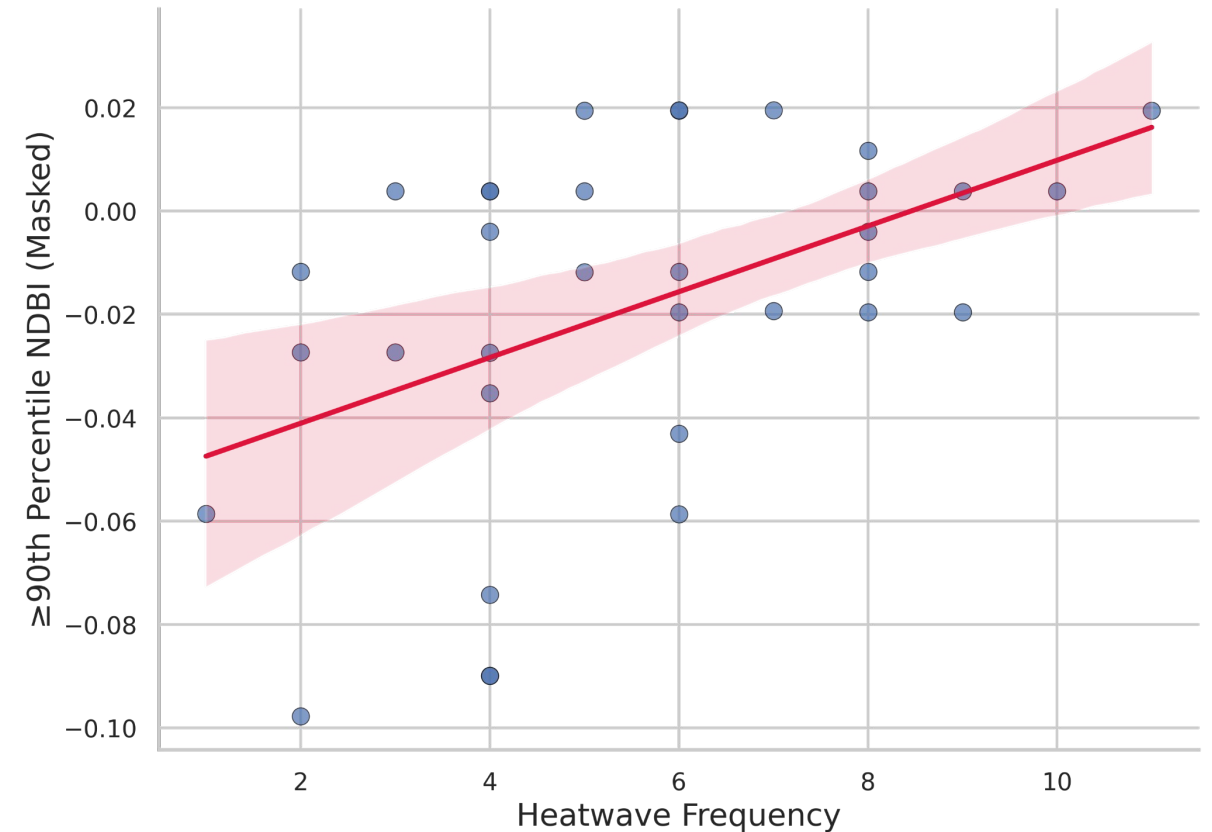


# Results - Correlation between NDBI and Heatwave Frequency

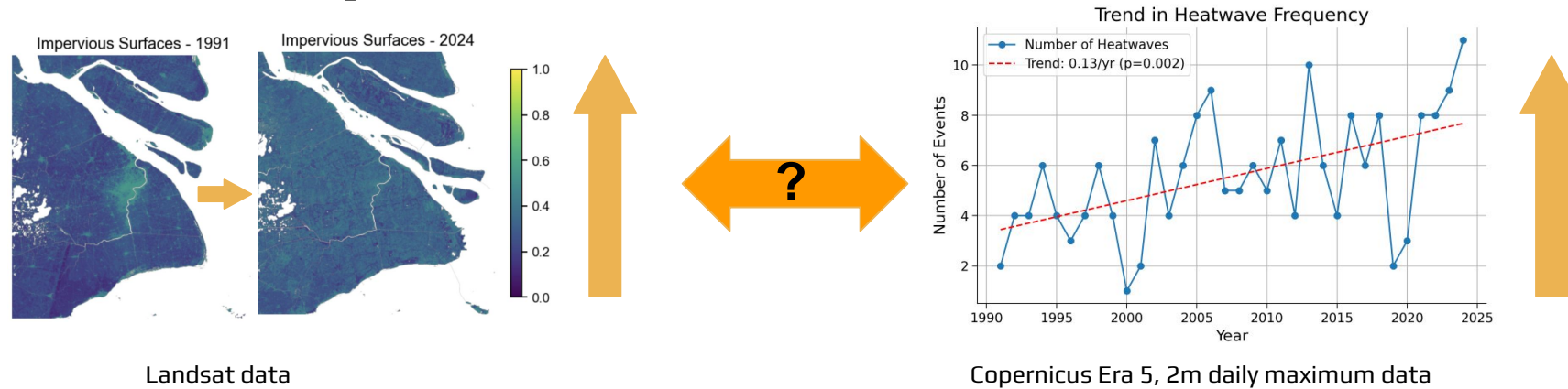
**Impervious Surfaces vs. Heatwave Frequency**  
 $r = -0.06$ ,  $p = 0.739$



**NDBI vs. Heatwave Frequency**  
 $r = 0.47$ ,  $p = 0.005$



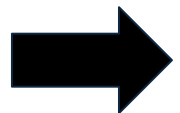
# Conclusion - Urbanisation partly correlates positively with heatwaves



Partly!

Heatwave Intensity ✗

Heatwave Frequency ✓



As heatwave frequency increases, urban planning must evolve to protect public health.

# Future Research



## Spatial analysis of heatwaves

- Connected component labeling approach



## Compare heatwave dynamics across different megacities

- For example, Delhi (landlocked) vs. Shanghai (coastal)



## Urban vs. suburban effects

- Are effects of heat unique to urban area?



## Vulnerability analysis

- Including population demographics & health statistics



# Thank you!