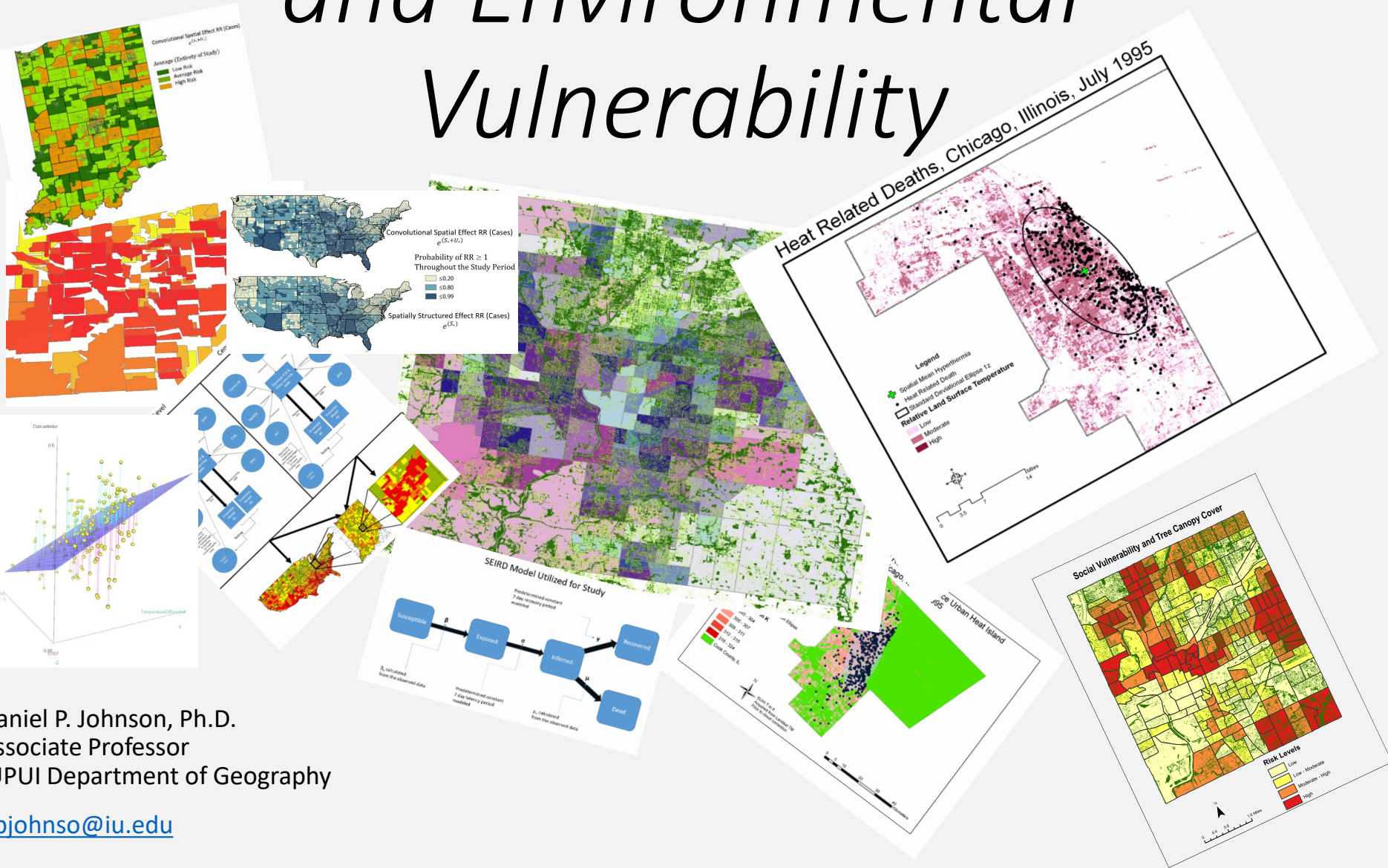


# Interactions Between Social and Environmental Vulnerability



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# Hazard - Vulnerability – Exposure Interactions



# Social Vulnerability

*“I don’t have air conditioning and I don’t have a vehicle!! How can I drive to the cooling center 5 miles away? Do you want me to die on the walk there?”* (Philadelphia resident, 2010)



## Social Vulnerability



## Environmental Vulnerability

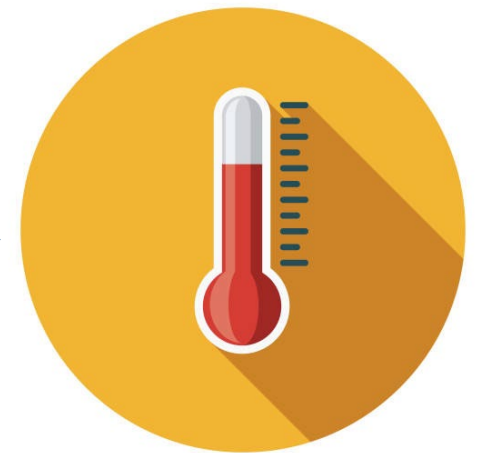
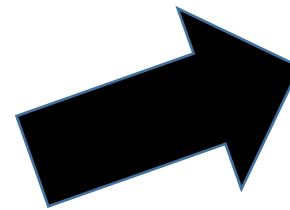
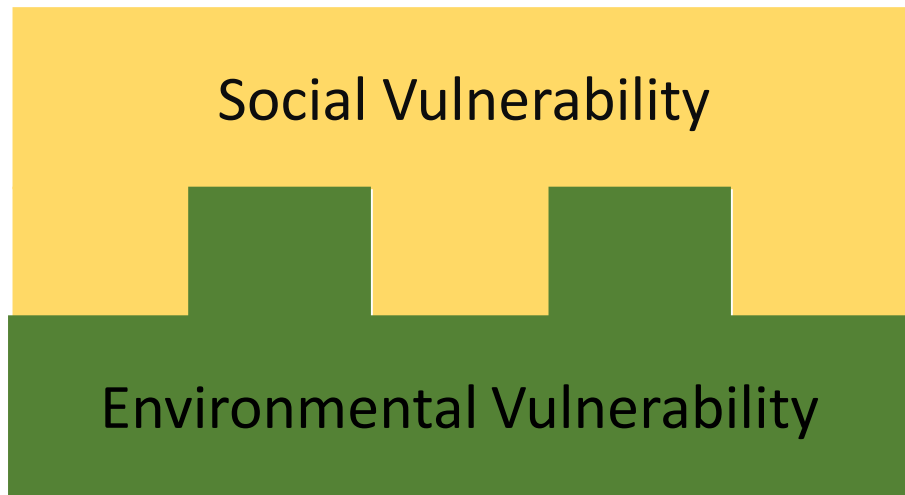
### What is Social Vulnerability?

**Social vulnerability** refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss. **IMPORTANTLY**, it is not the inverse of resiliency.

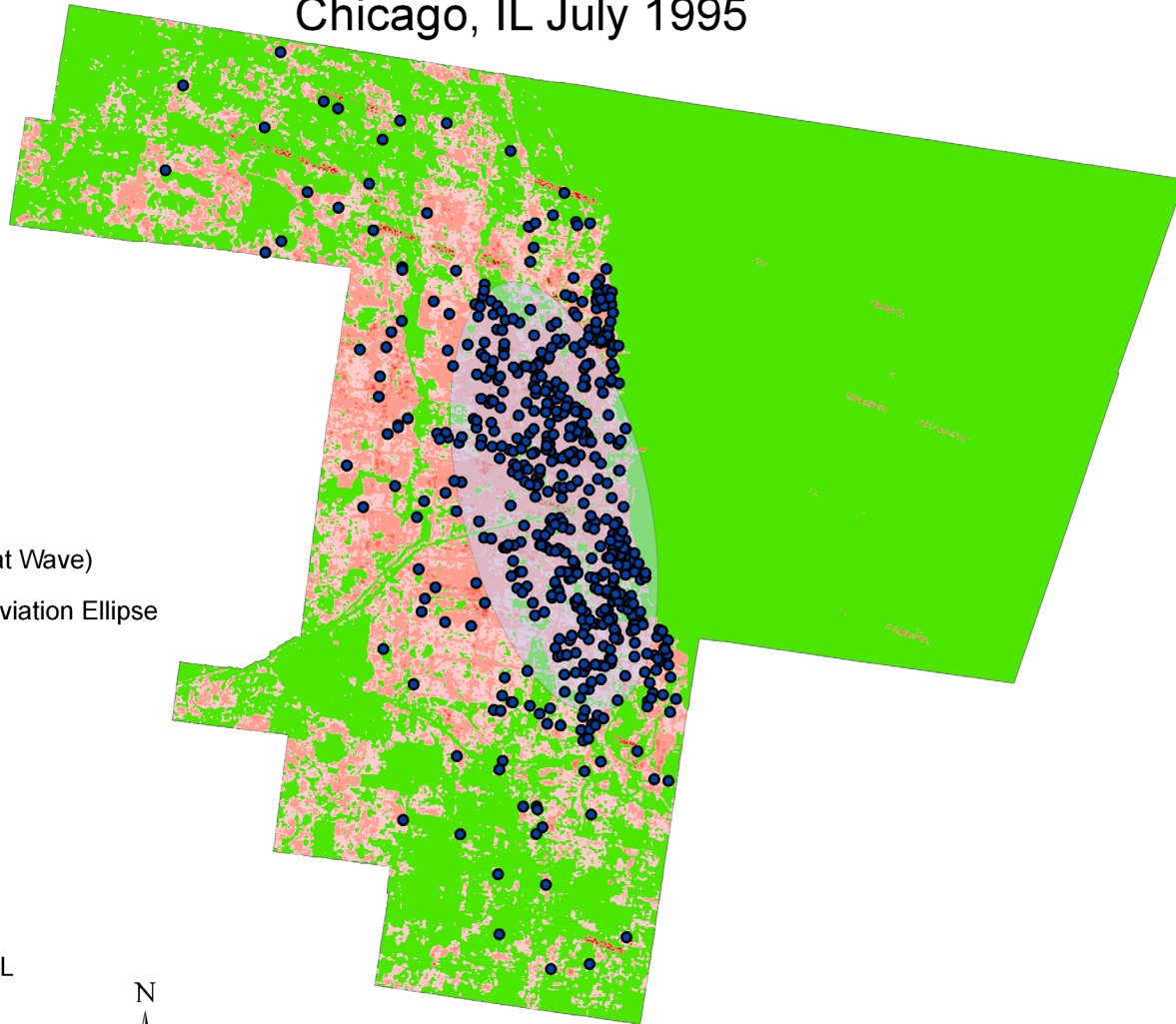
Both are spatially and often temporally variable...

### What is Environmental Vulnerability?

**Environmental vulnerability** refers to the likelihood, or tendency, for the environment to produce harmful impacts on human health.



# Heat Wave Deaths in Relation to Surface Urban Heat Island Chicago, IL July 1995



## Legend

- Decedent (Heat Wave)
- 1 Standard Deviation Ellipse

## Temperature in K

- 303 - 304
- 305 - 307
- 308 - 311
- 312 - 315
- 316 - 324
- Cook County, IL

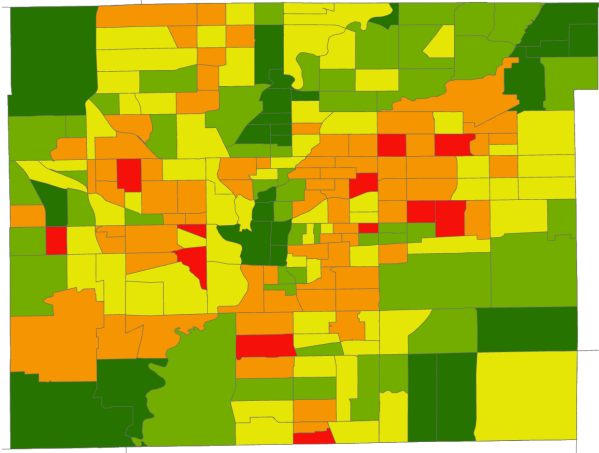


SUHI T in K  
Acquired from Landsat TM  
Prior to cloud correction

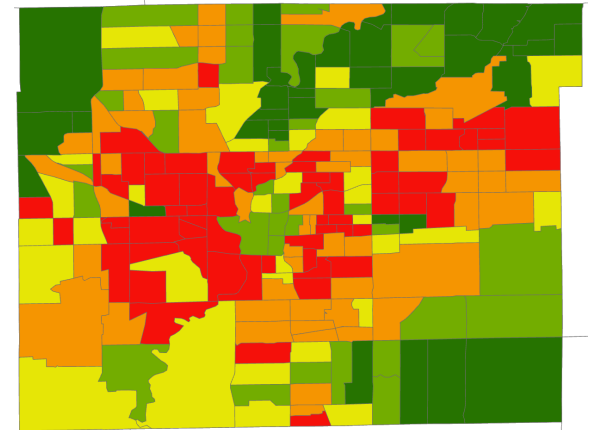
0 5 10 20 30 40  
Kilometers

# Measuring Social Vulnerability ...

SoVI

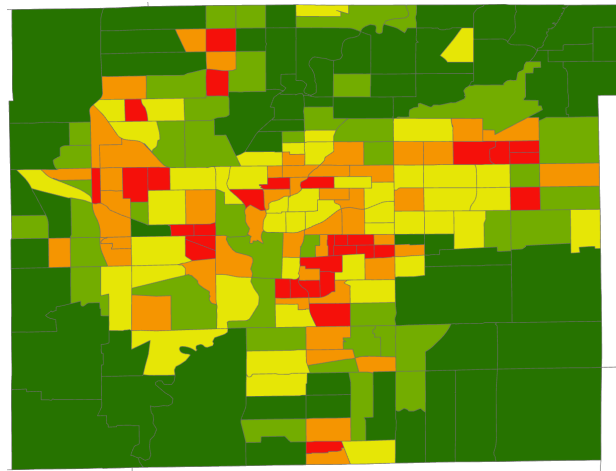


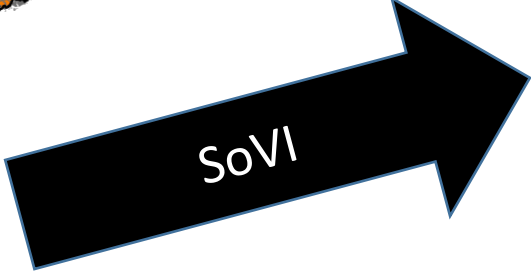
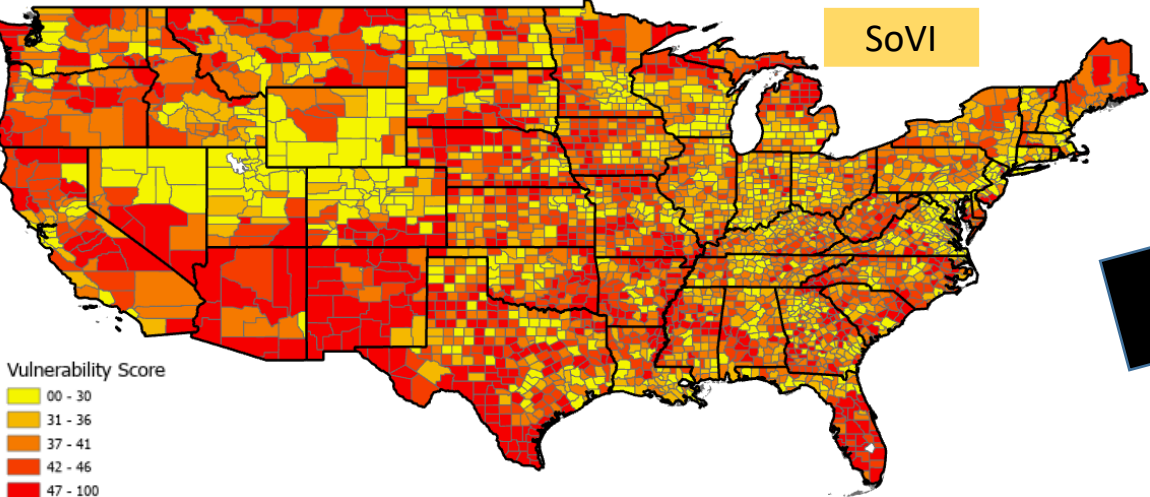
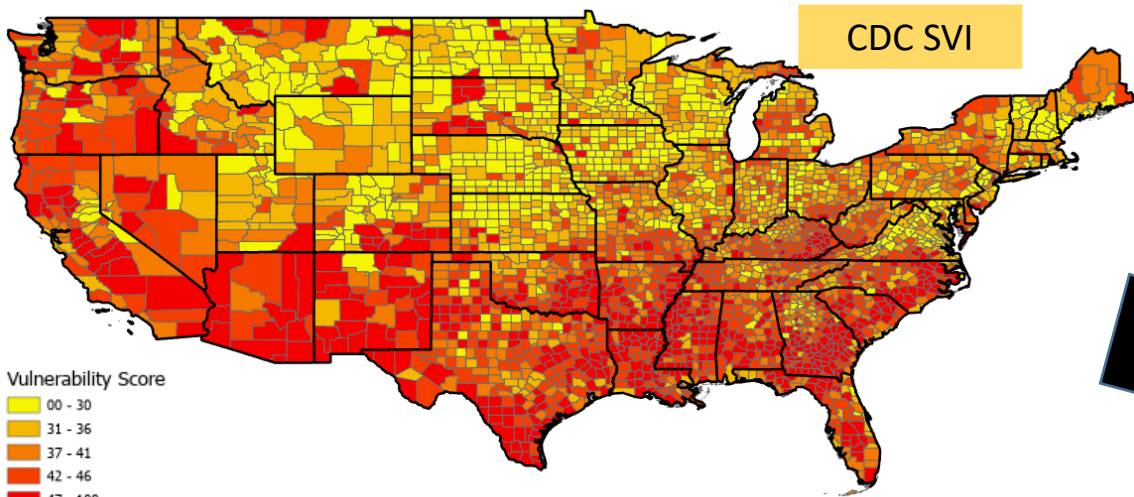
CDC SVI



Oh... the confusion!!!

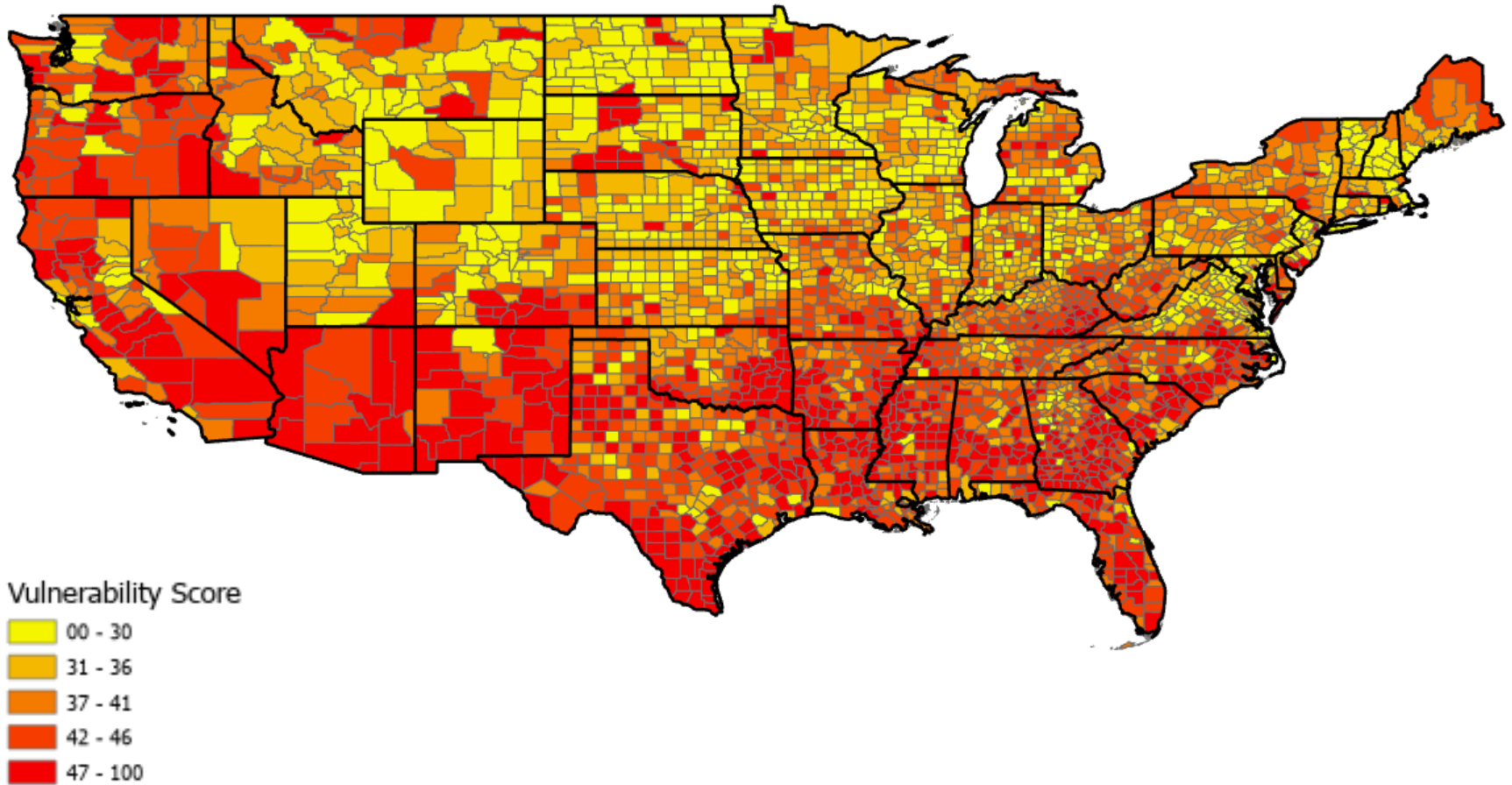
THRIVE



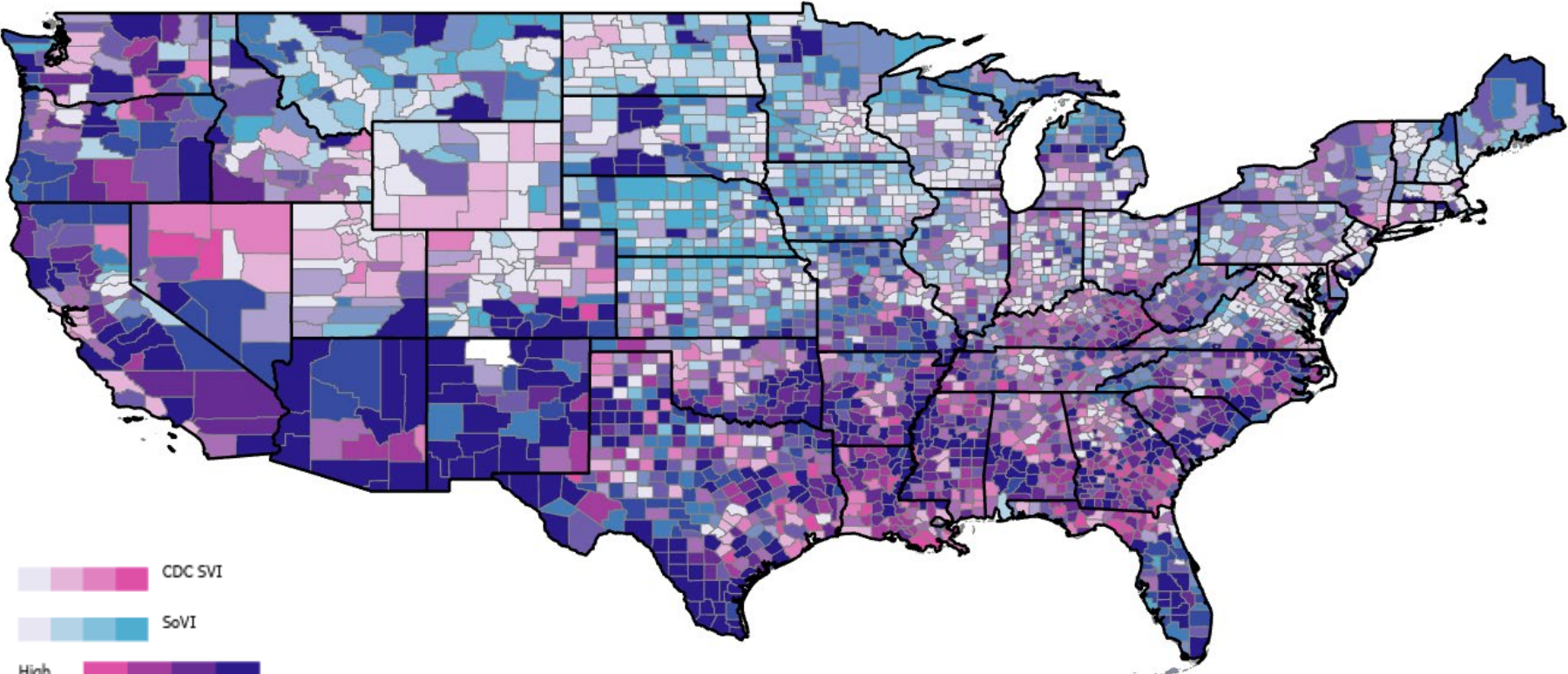




# CDC SVI + SoVI Composite

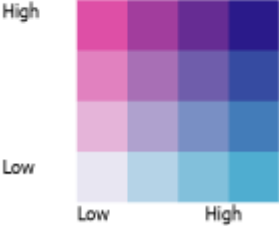


# CDC SVI + SoVI Composite

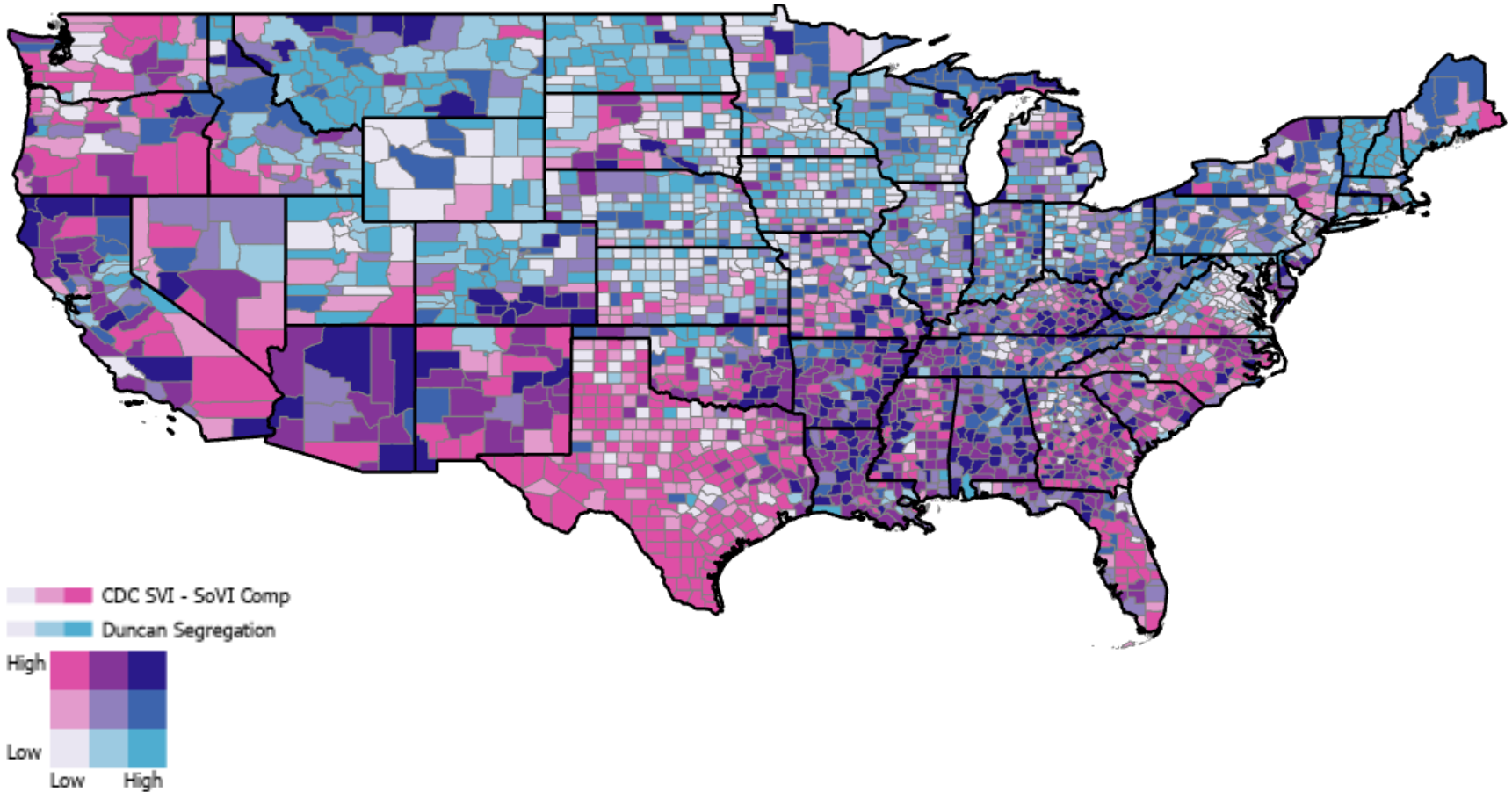


CDC SVI

SoVI



# Social Vulnerability and Segregation

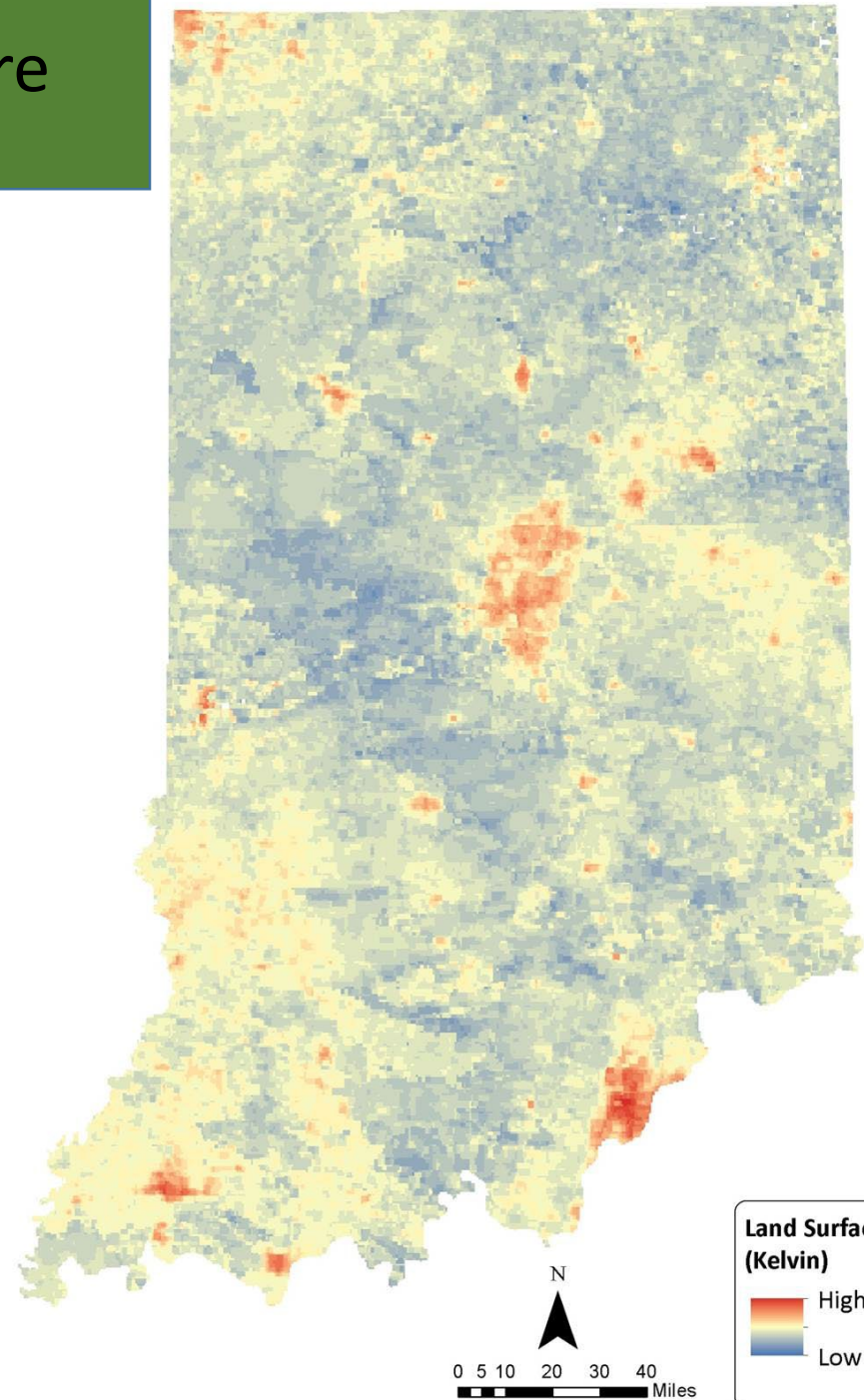


# Environmental Vulnerability

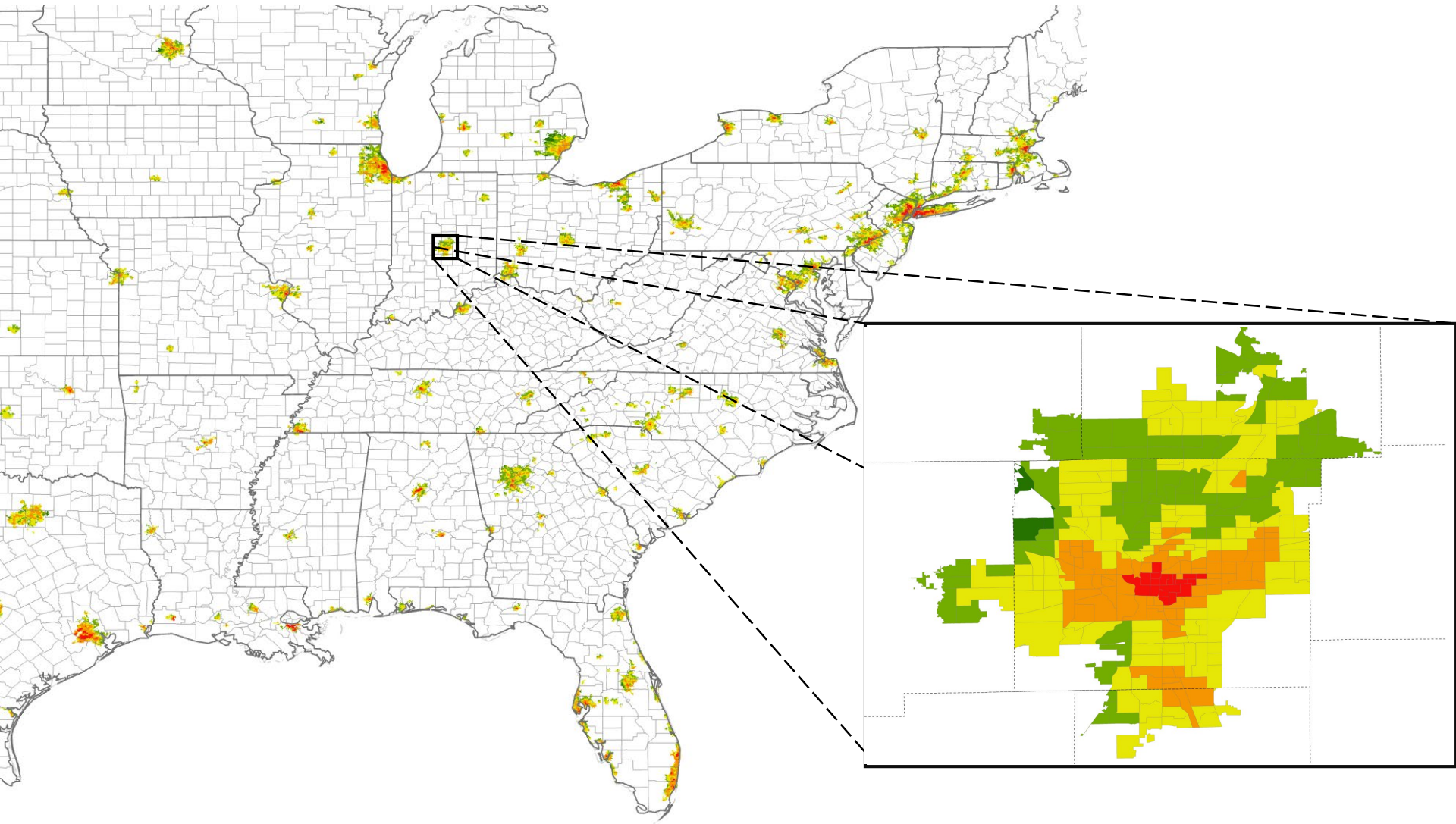
“Sometimes it takes a natural disaster to reveal a social disaster” – Jim Wallis

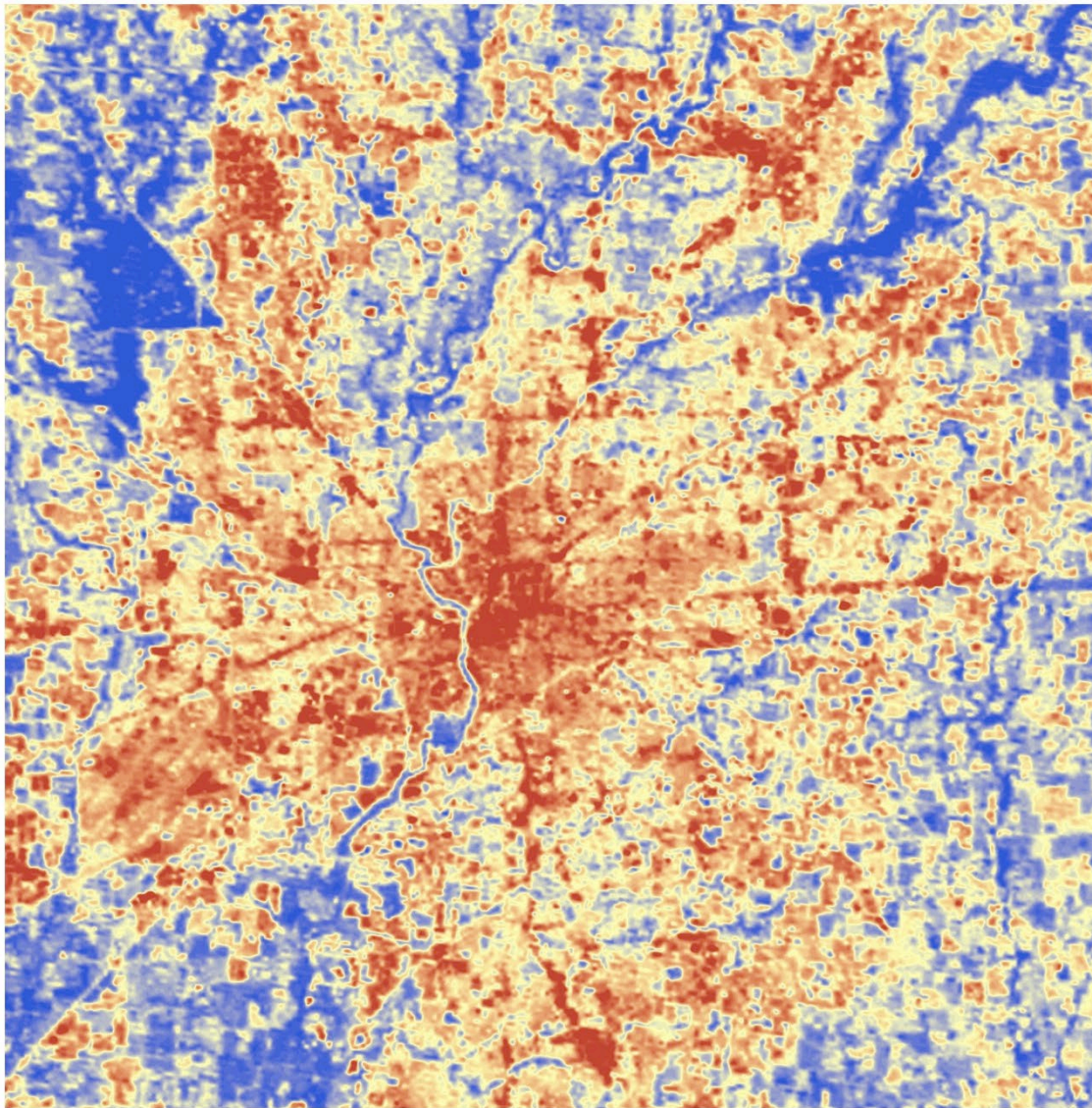
# Land Surface Temperature

Summer time average in K



# Surface Urban Heat Island





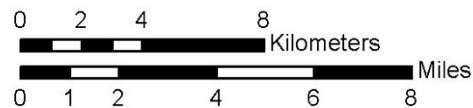
### Land Surface Temperature

Kelvin

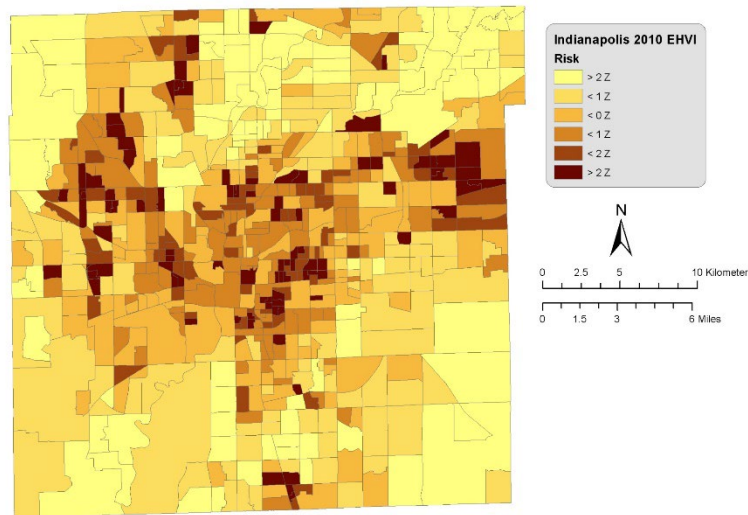
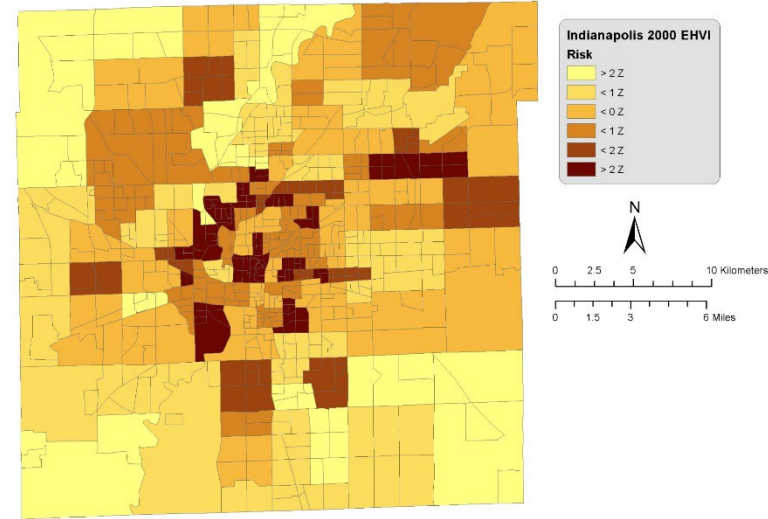
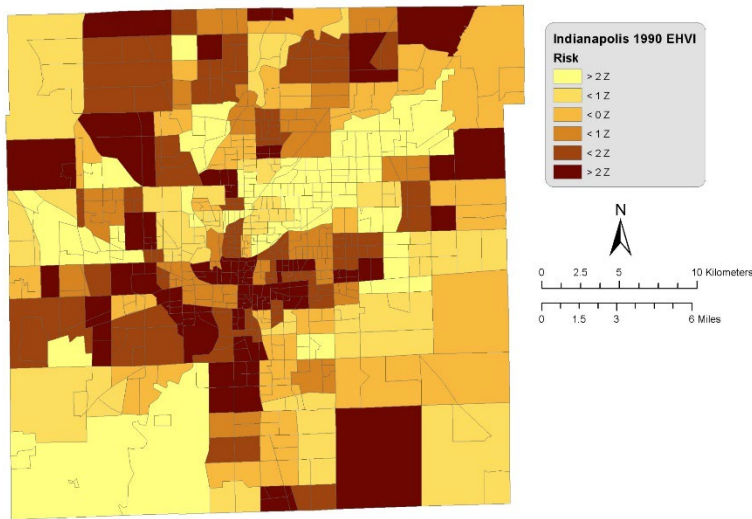


### Landsat 5 LST (30M Resolution) - Indianapolis, IN

Department of Geography ~ IUPUI  
Institute for Research on Social Issues  
<http://liberalarts.iupui.edu/directory/role/IRSI>



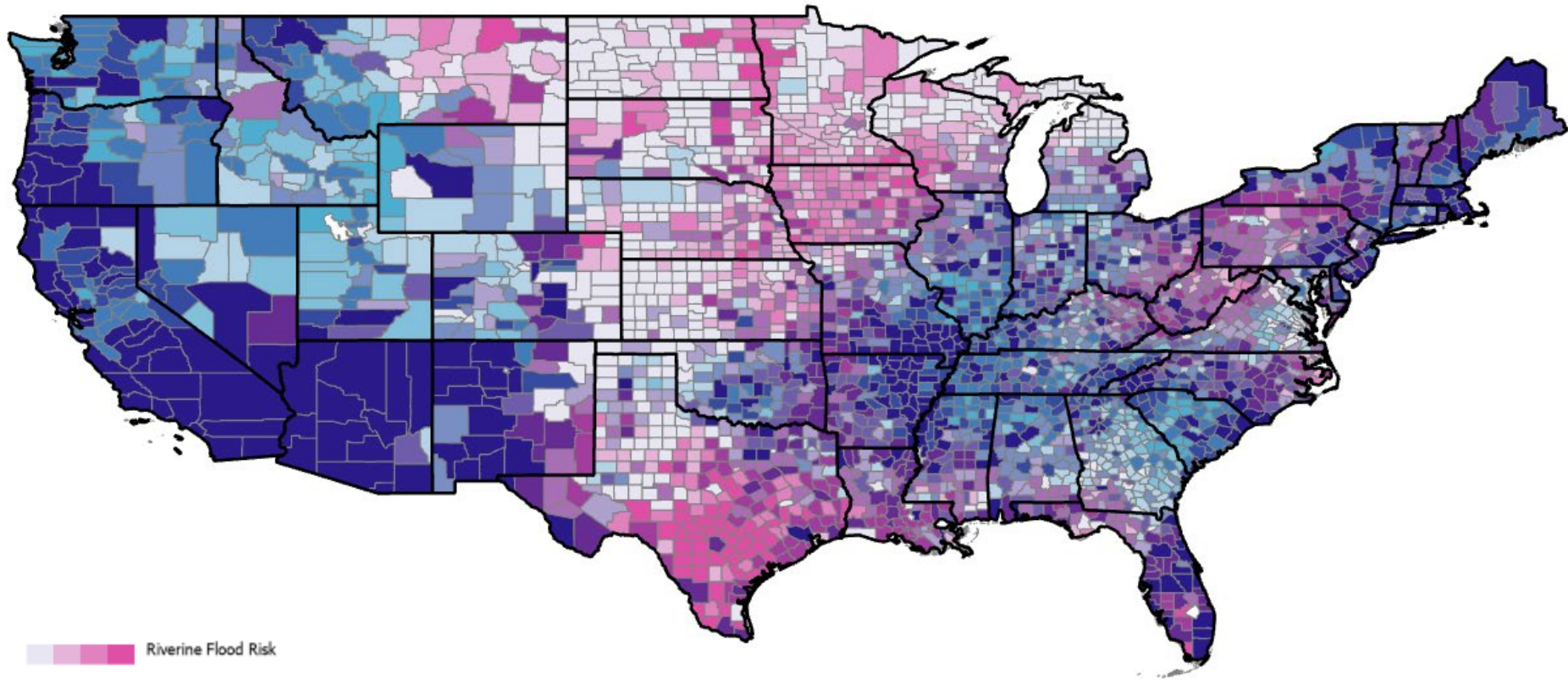
# Extreme Heat Vulnerability in Indianapolis from 1990 to 2010





# Convolutional Environmental Vulnerability

Riverine Flooding and Earthquakes



Riverine Flood Risk

Earthquake Risk

High

Low



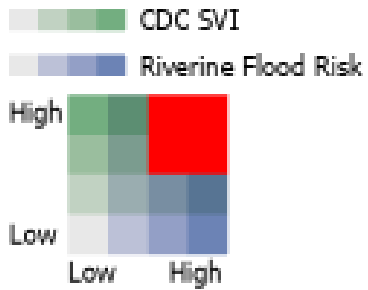
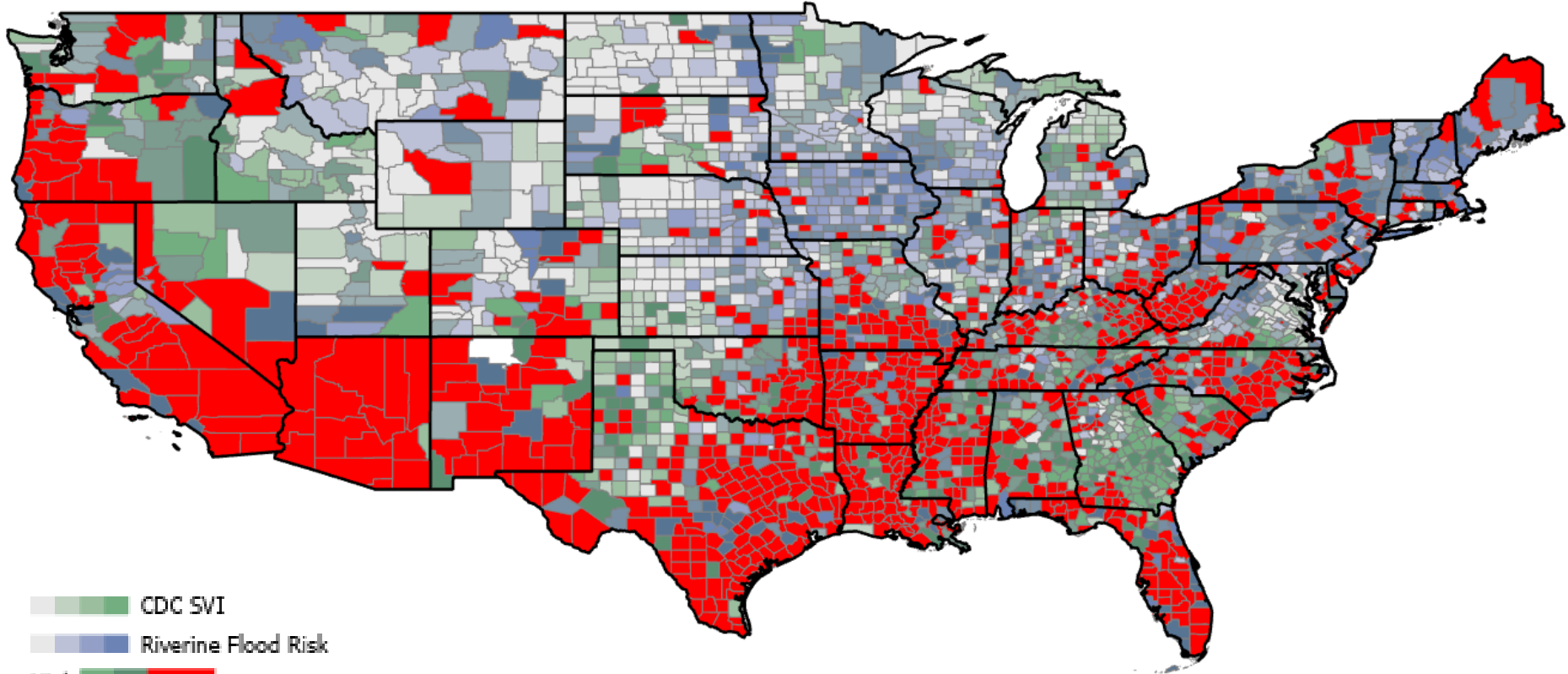
Low High

# Environmental Vulnerability

Riverine Flood Risk

# Social Vulnerability

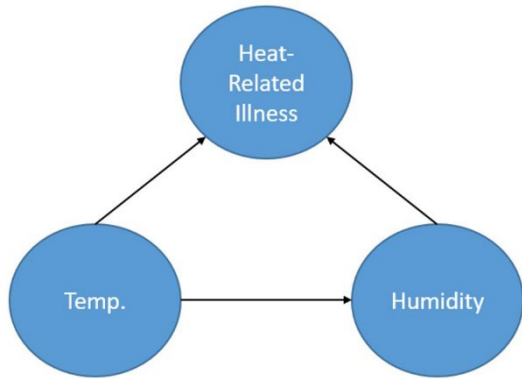
CDC SVI



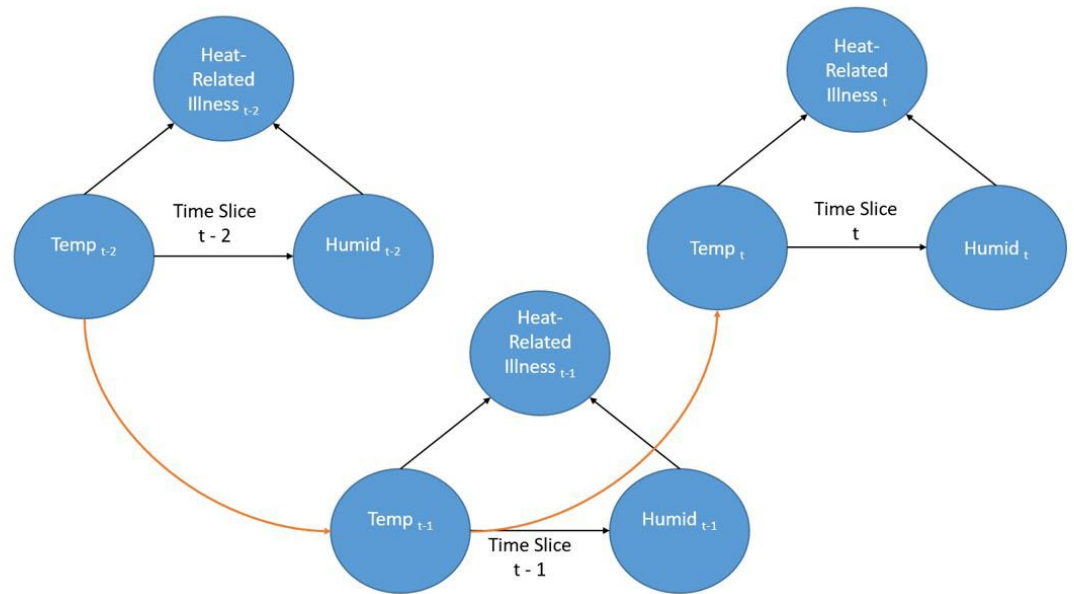
# Predicting of COVID-19 Relative Risk with a Dynamic Bayesian Network

Forecasting with social and environmental determinants.

# Simple vs Dynamic Bayesian Network



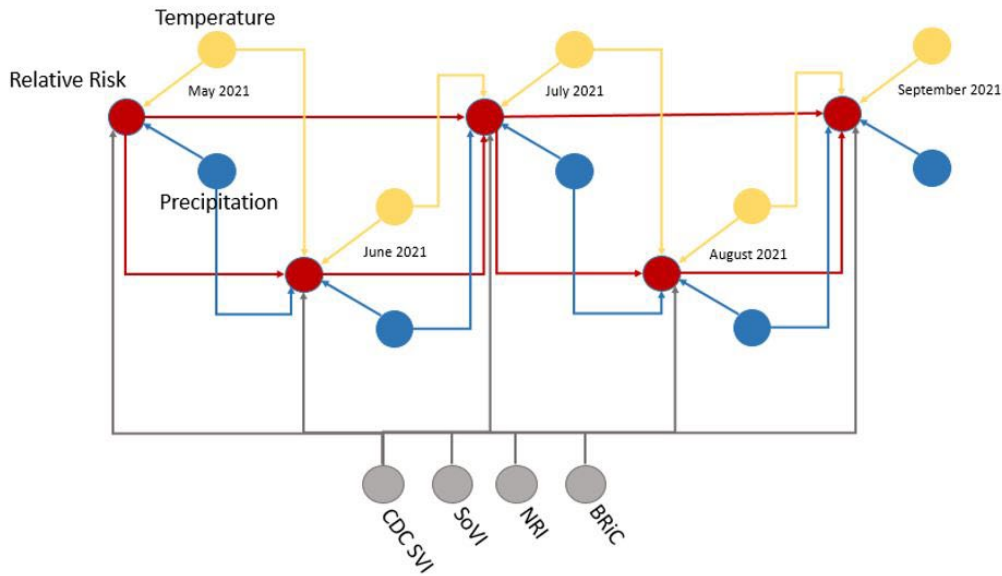
Simple



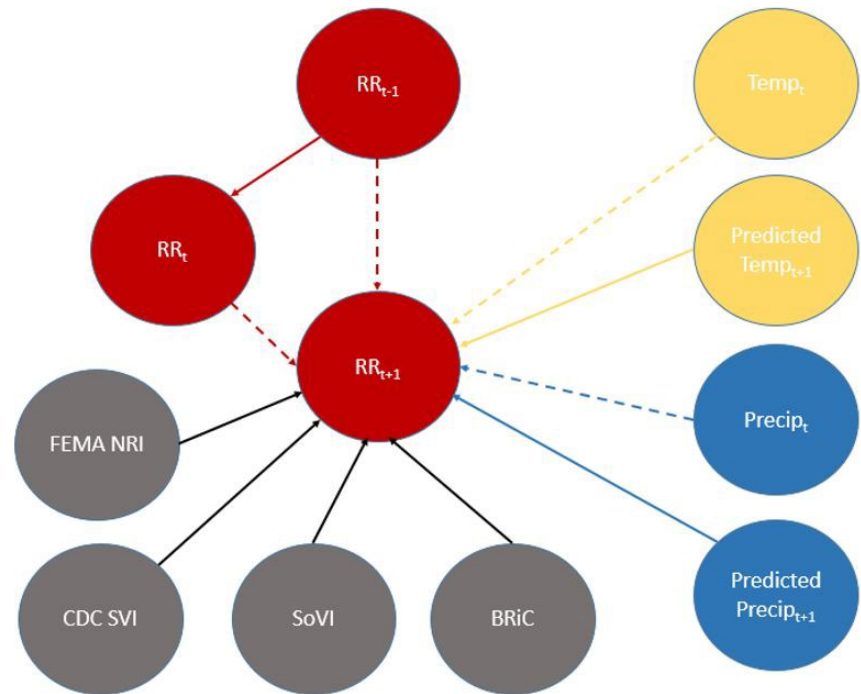
Dynamic

# Dynamic BayesNet Structure

## Structural Overview

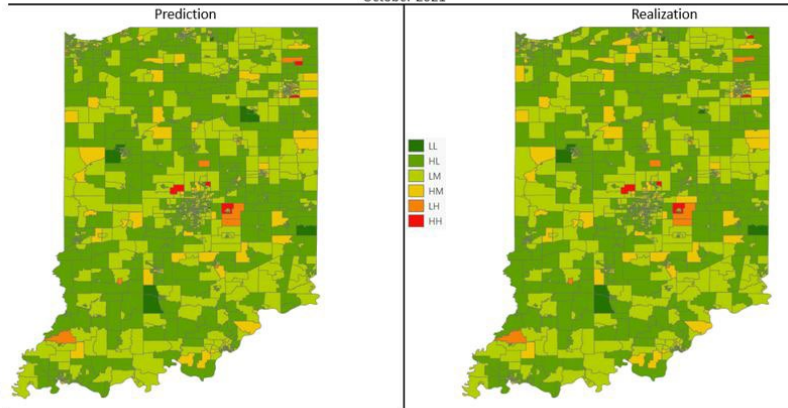


## Increment $t + 1$

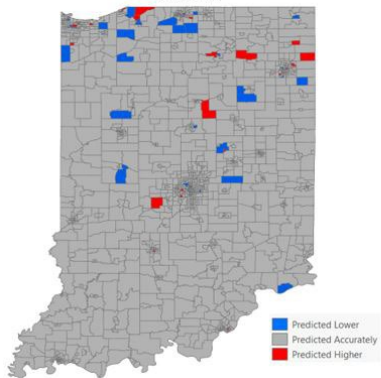


# Example Output

COVID-19 Relative Risk of Infection  
October 2021

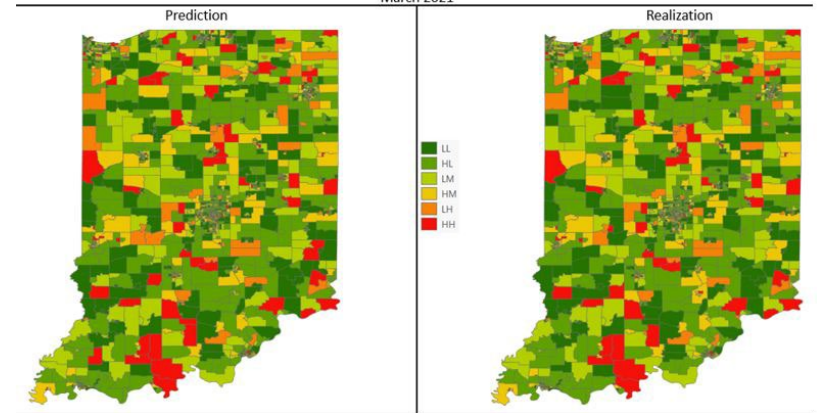


Difference

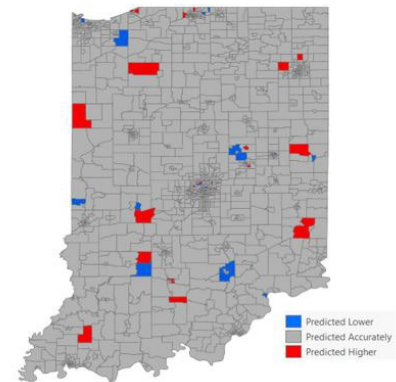


October 2021

COVID-19 Relative Risk of Infection  
March 2021



Difference



March 2021

# Resiliency

“I am so sick and tired of hearing that our community is ‘socially vulnerable’!! What are you going to do about it?” – Anonymous New York City resident

## Discussion

Thank you!