

The Social Vulnerability Index: A County-Level Assessment of Communities and Implications for Preparedness Planning

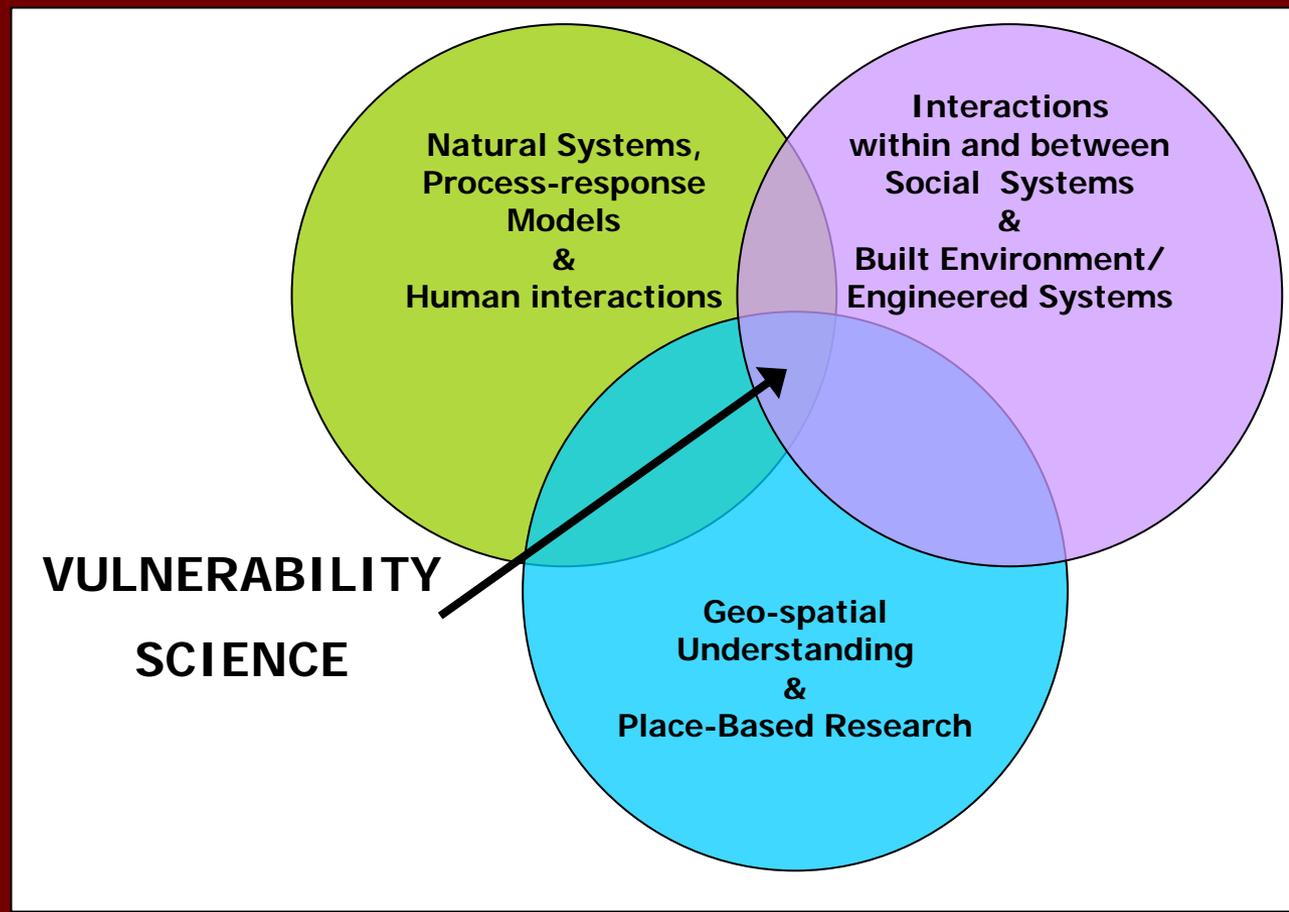
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Vulnerability Science

Development of methods and metrics for analyzing societal vulnerability and resilience to environmental hazards and extreme events



Social Vulnerability

- Identification of population characteristics that influence the social burdens of risks
- How those factors affect the distribution of risks and losses
- Based on extensive post-disaster field work monitoring the location of losses including surveys of affected populations as well as pre-impact studies



Some examples:

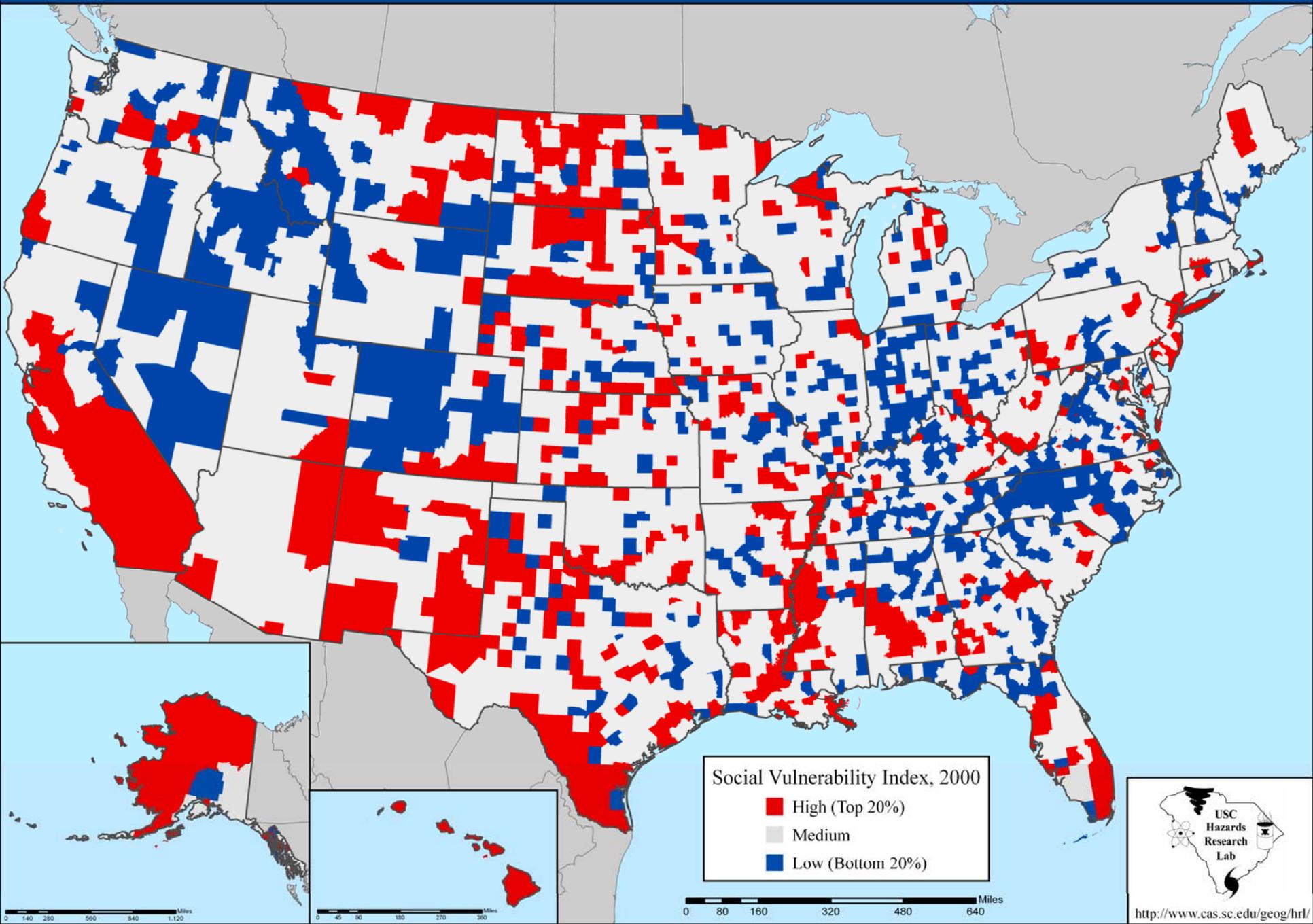
- Special Needs Populations
 - Difficult to identify (infirm, transient) let alone measure; invariably left out of recovery efforts; often invisible in communities
- Age (Elderly and Children)
 - Affect mobility out of harm's way; need special care; more susceptible to harm
- Socioeconomic Status (Rich, Poor)
 - Ability to absorb losses and recover (insurance, social safety nets), but more material goods to lose
- Race and Ethnicity (Non-white, Non-Anglo)
 - Impose language and cultural barriers; affect access to post-disaster recovery funding; tend to occupy high hazard zones
- Gender (Women)
 - gender-specific employment, lower wages, care-giving role



Mapping Social Vulnerability: The Social Vulnerability Index (SoVI)

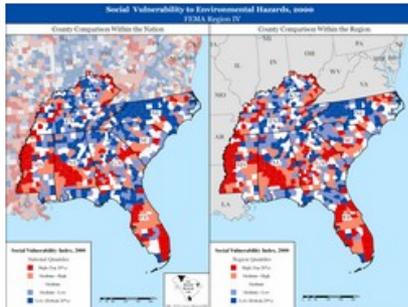
- County level socioeconomic profiles based on decennial census 1960-2000
- 42 variables reduced to factors (~11)
- Summed to create index score
- Explains 74% to 78% of variance in data
- Dominant factors:
 - Socioeconomic status
 - Development density
 - Age

Social Vulnerability to Environmental Hazards, 2000



Social Vulnerability Index, 2000

Social Vulnerability Maps and Data



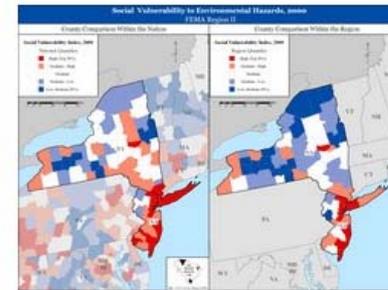
Click on the image above to open a pdf version of the map
Click on column headers to sort table

Click to download data

County	State	SOVI 2000	National Percentile Ranking
Issaquena County	Mississippi	12.70	99.4
Wilcox County	Alabama	11.43	99.2
Jefferson County	Mississippi	10.54	98.8
Clayton County	Georgia	9.99	98.6

FEMA Region 4

FEMA Region 2



Click on the image above to open a pdf version of the map
Click on column headers to sort table

Click to download data

County	State	SOVI 2000	National Percentile Ranking
New York County	New York	43.14	100.0
Bronx County	New York	18.38	99.9
Kings County	New York	15.55	99.7
Queens County	New York	12.42	99.3
Hudson County	New Jersey	12.19	99.2
Essex County	New Jersey	9.51	98.4
Richmond County	New York	8.30	97.6

Hazard Exposure: Intersection of physical and social vulnerability

USGS Coastal
Vulnerability Index

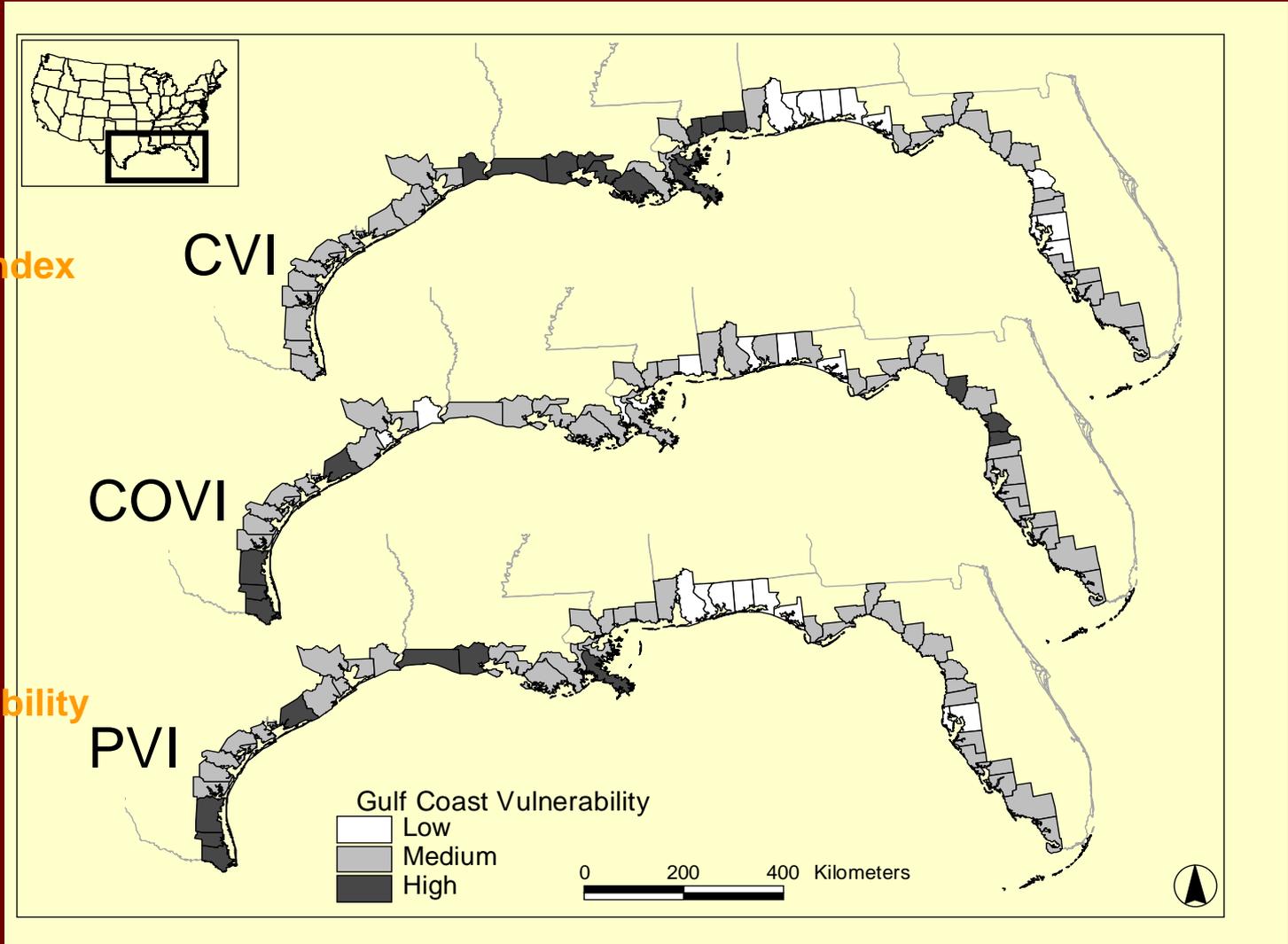
CVI

Social
Vulnerability
Index

COVI

Place Vulnerability
Index

PVI



Boruff, B. J., C. Emrich, and S. L. Cutter, 2005. "Hazard Vulnerability of U.S. Coastal Counties", *Journal of Coastal Research* 21(5): 932-942.

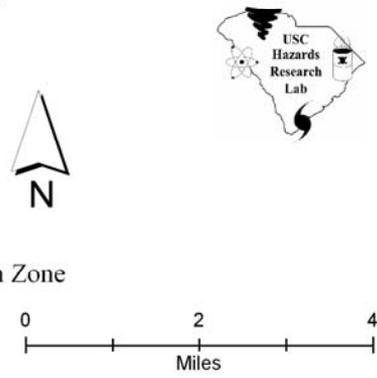
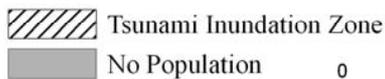
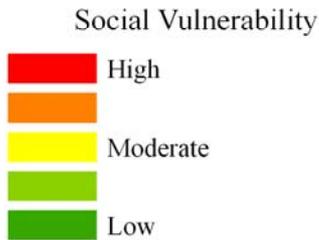
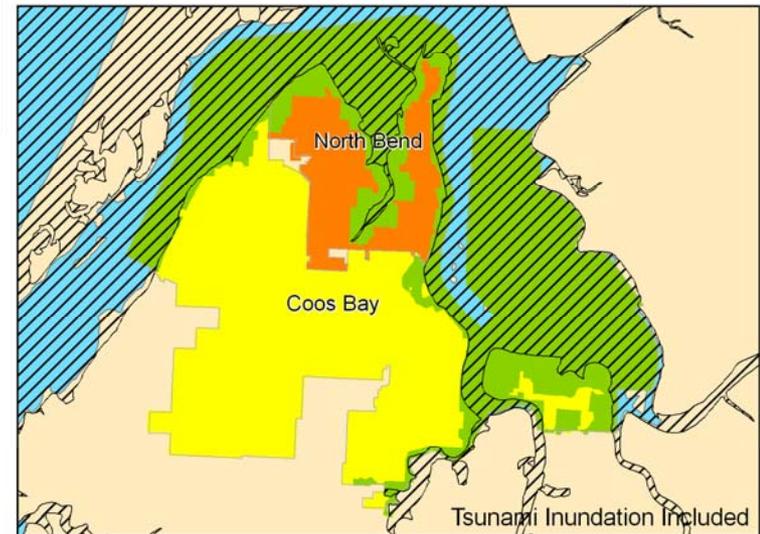
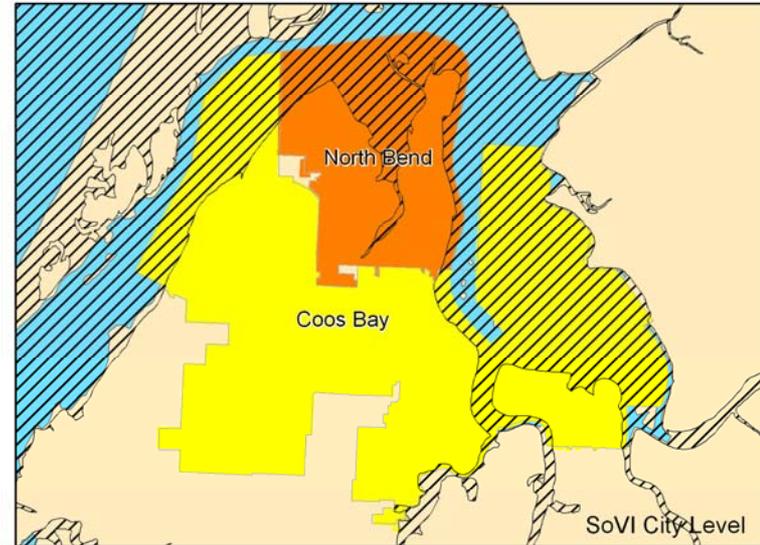
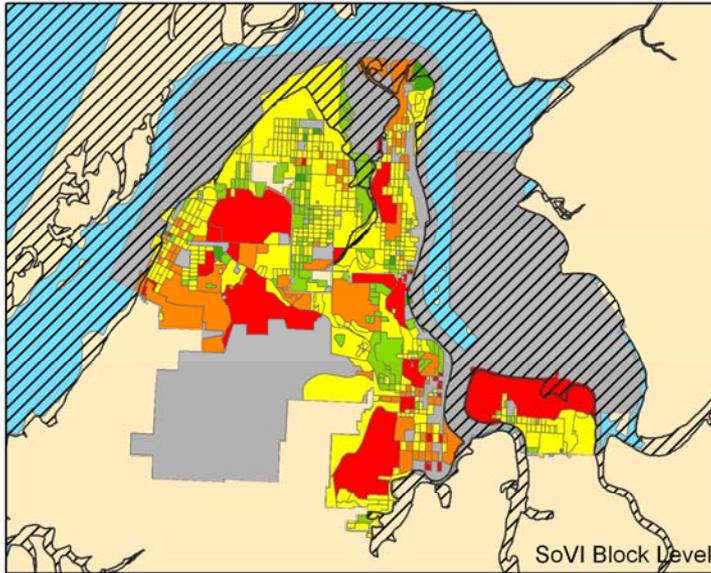
What's driving the erosion hazard vulnerability in US coastal counties?

- All coasts: sea level rise, slope, mean wave height
- Atlantic: density of commercial development, slope, sea level rise
- Gulf: % over 65, birth rate, sea level rise
- Pacific: % Asian, housing unit density, erosion/accretion rate

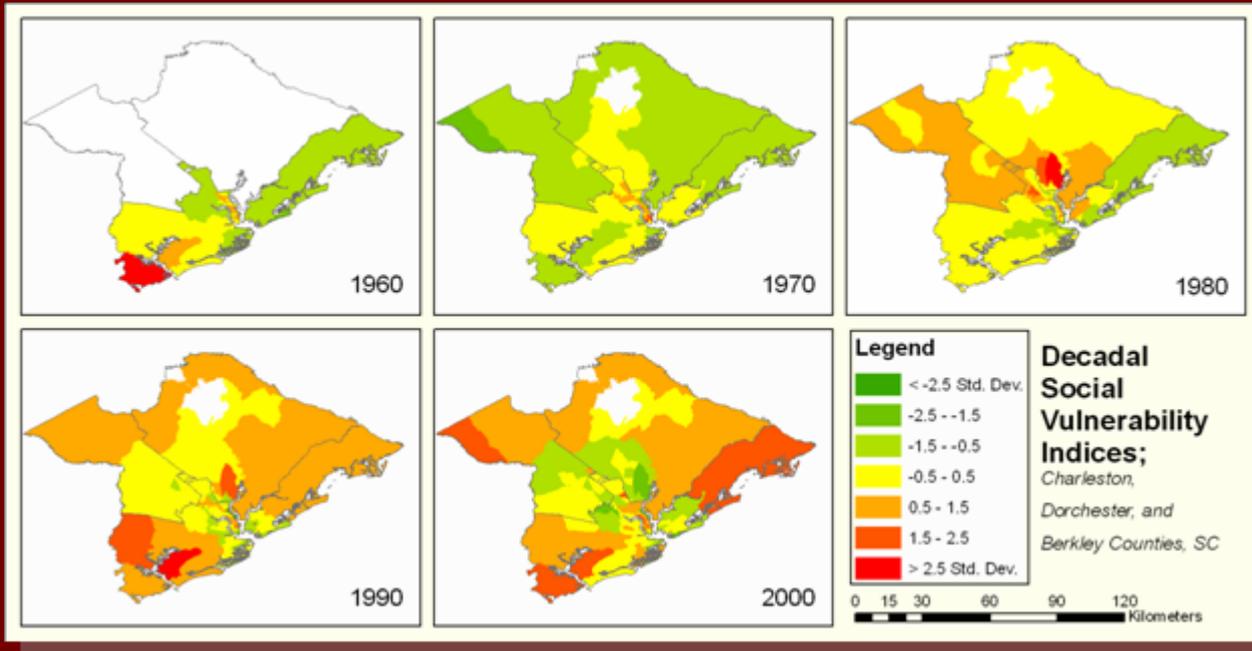
	Physical	Social
All coasts	0.24	0.05
Atlantic	0.24	0.03
Gulf	0.36	0.41
Pacific	0.18	0.15

Community Level Aggregation

Social Vulnerability Coos Bay / North Bend, Oregon



Changes in Social Vulnerability, 1960-2000

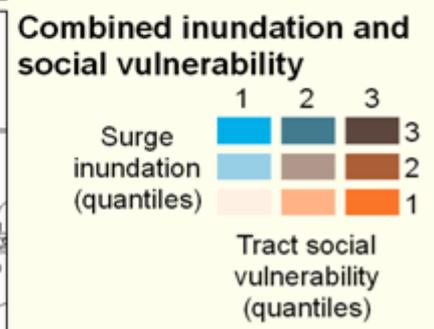
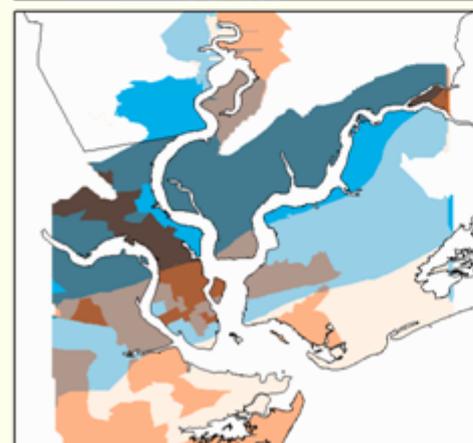
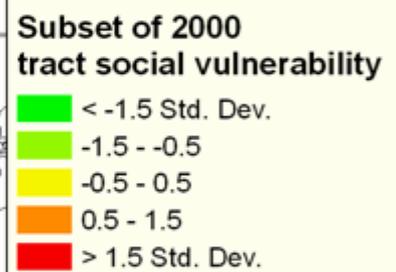
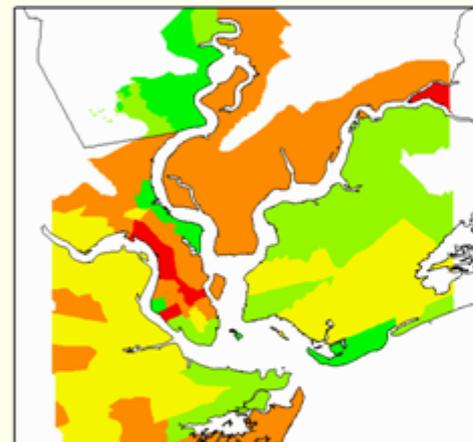
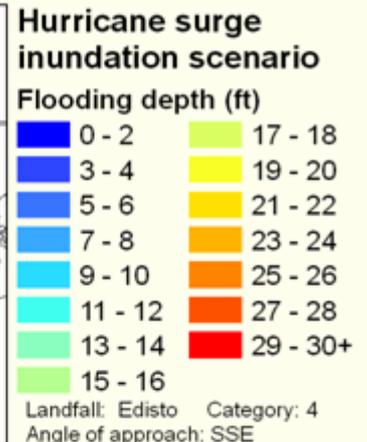
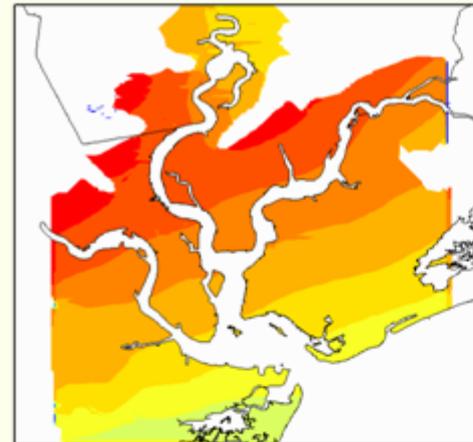


	Factors	% Var. Exp.
1960	6	84.2
1970	7	83.1
1980	6	74.2
1990	6	80.2
2000	6	74.1

Recurrent Factors
Race (Black) and socioeconomic status
Gender, Families
Ethnicity, Immigration
Rural / Urban
Age, Nursing Home Residents
Gendered Labor
Occupation

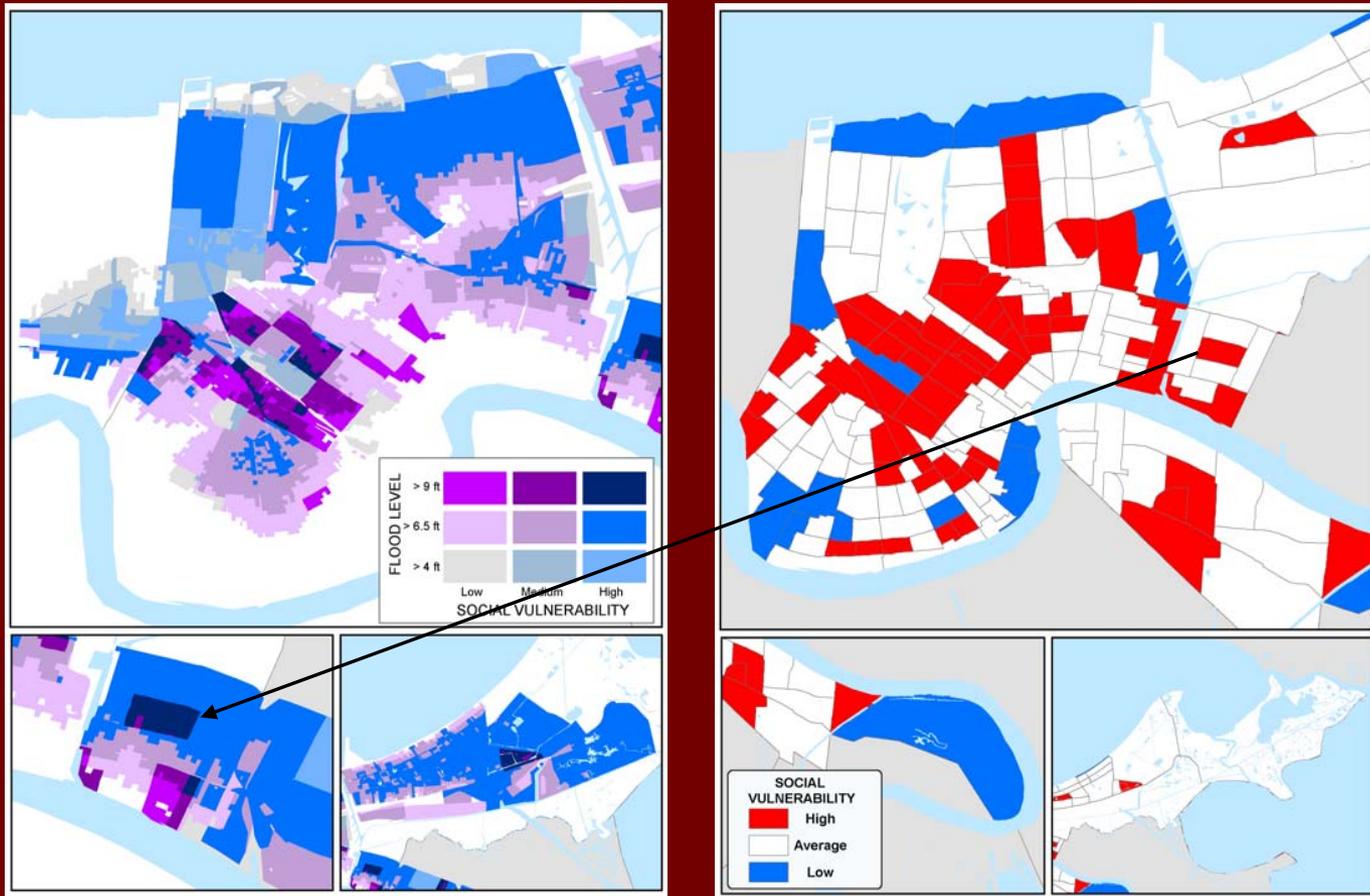
Modeling for Scenario Development

- Category 4 Hurricane
- Landfall: Beaufort, SC

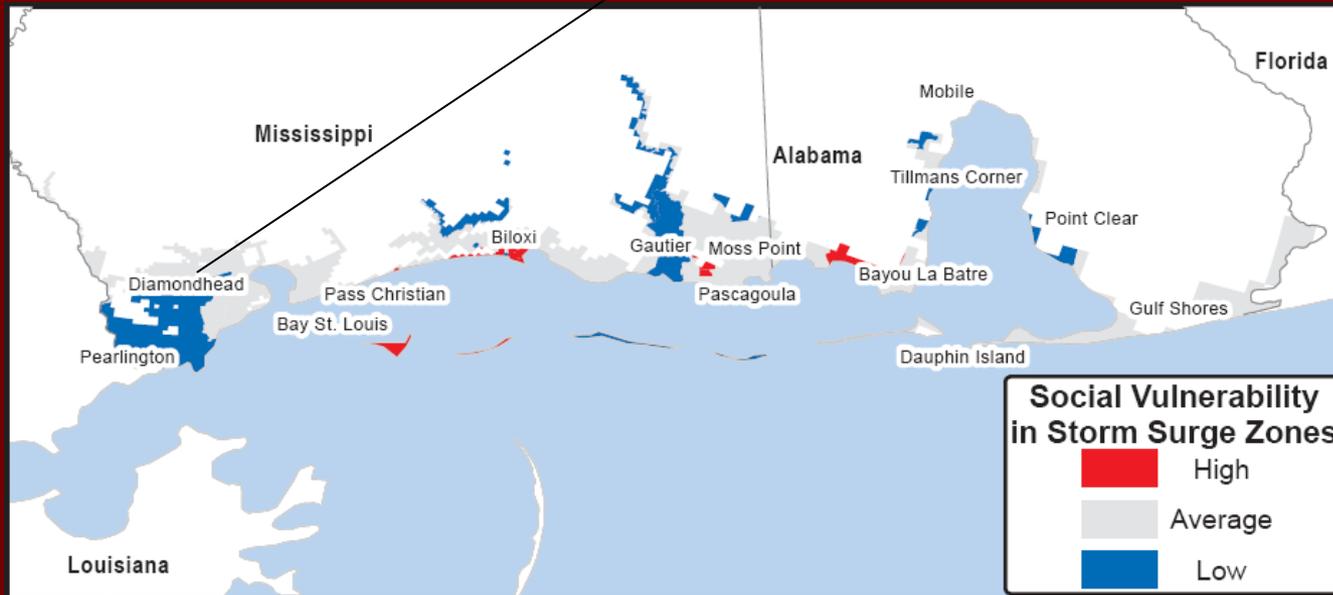


Post Event Assessment

Disproportionate impacts based on pre-existing vulnerabilities means uneven recovery



Uneven Impact, Recovery Disparities



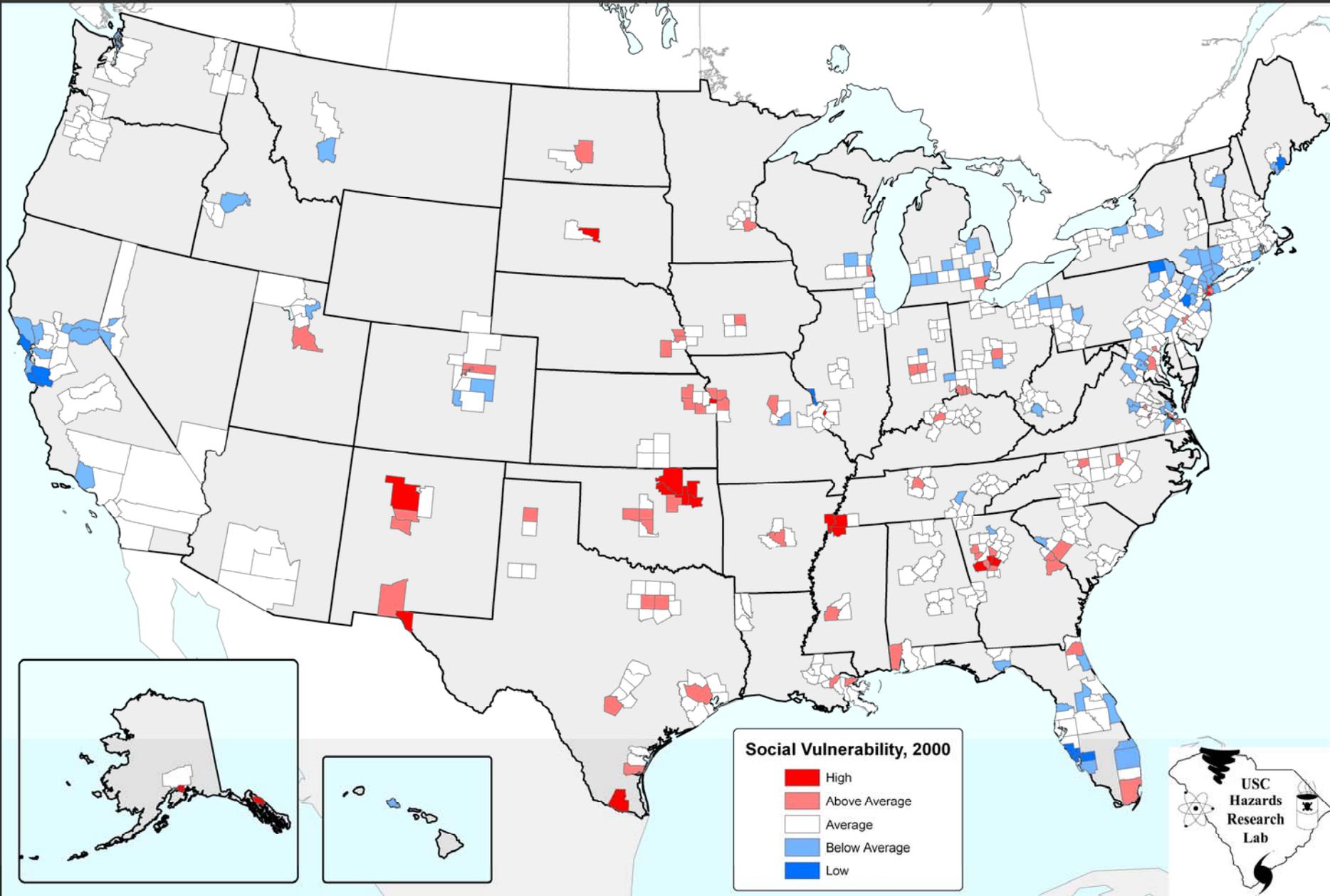
Pre-Impact Preparedness



Relationship between vulnerability, threat source, and preparedness expenditures



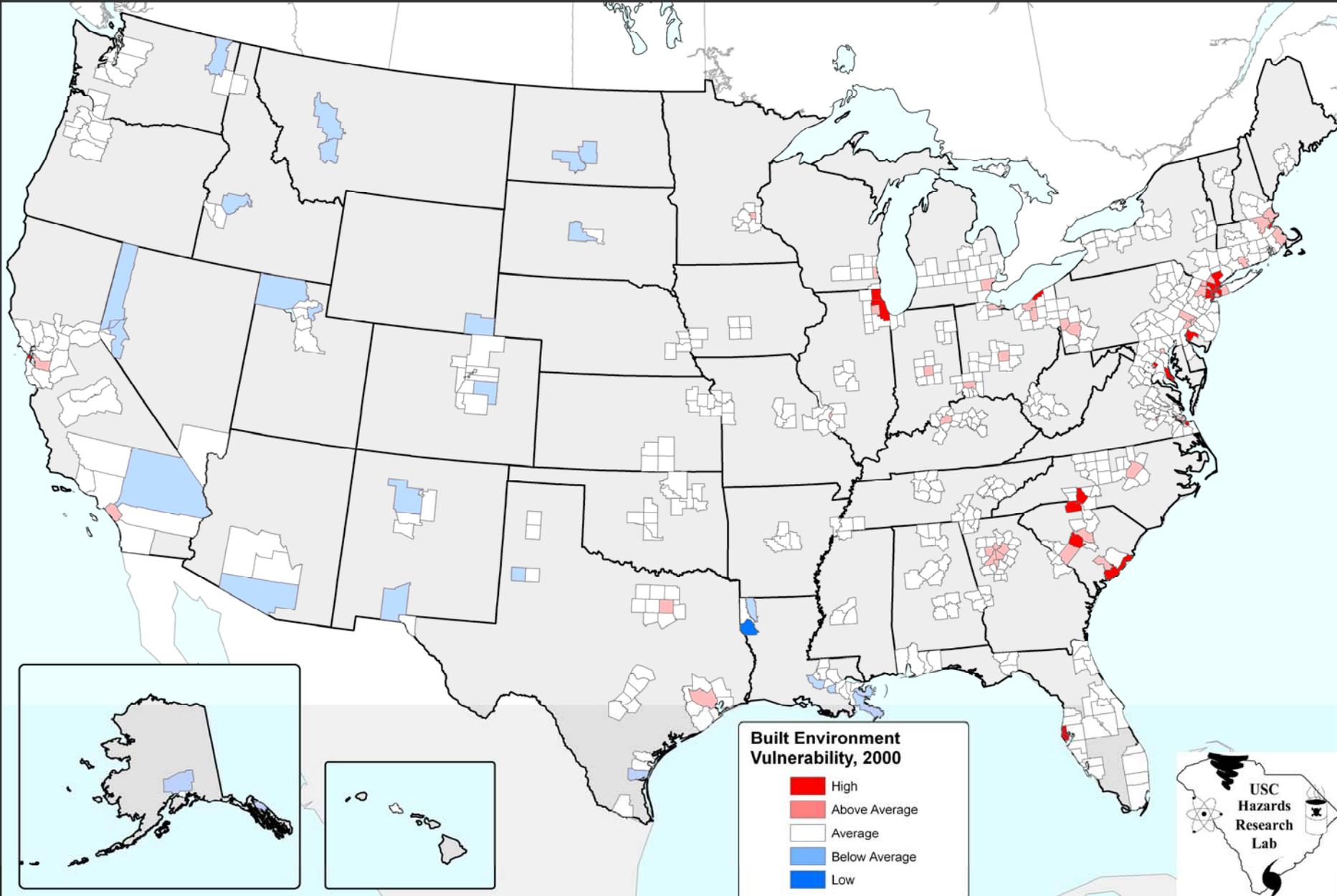
Social Vulnerability Index (SoVI) Urban Area Counties United States



Built Environment Index (BEVI)

- 40 variables indicating characteristics of the built environment such as transportation infrastructure (road miles, rail miles, bridges), residential property, commercial and industrial development, lifelines (hospitals, schools), monuments (churches, landmark buildings)
- Reduced to 7 factors
 - Urban density
 - Landmarks
 - Housing age
 - Residential property values
 - Water infrastructure
 - Oil and gas infrastructure
 - Nuclear facilities
- Explain 83% variability in data

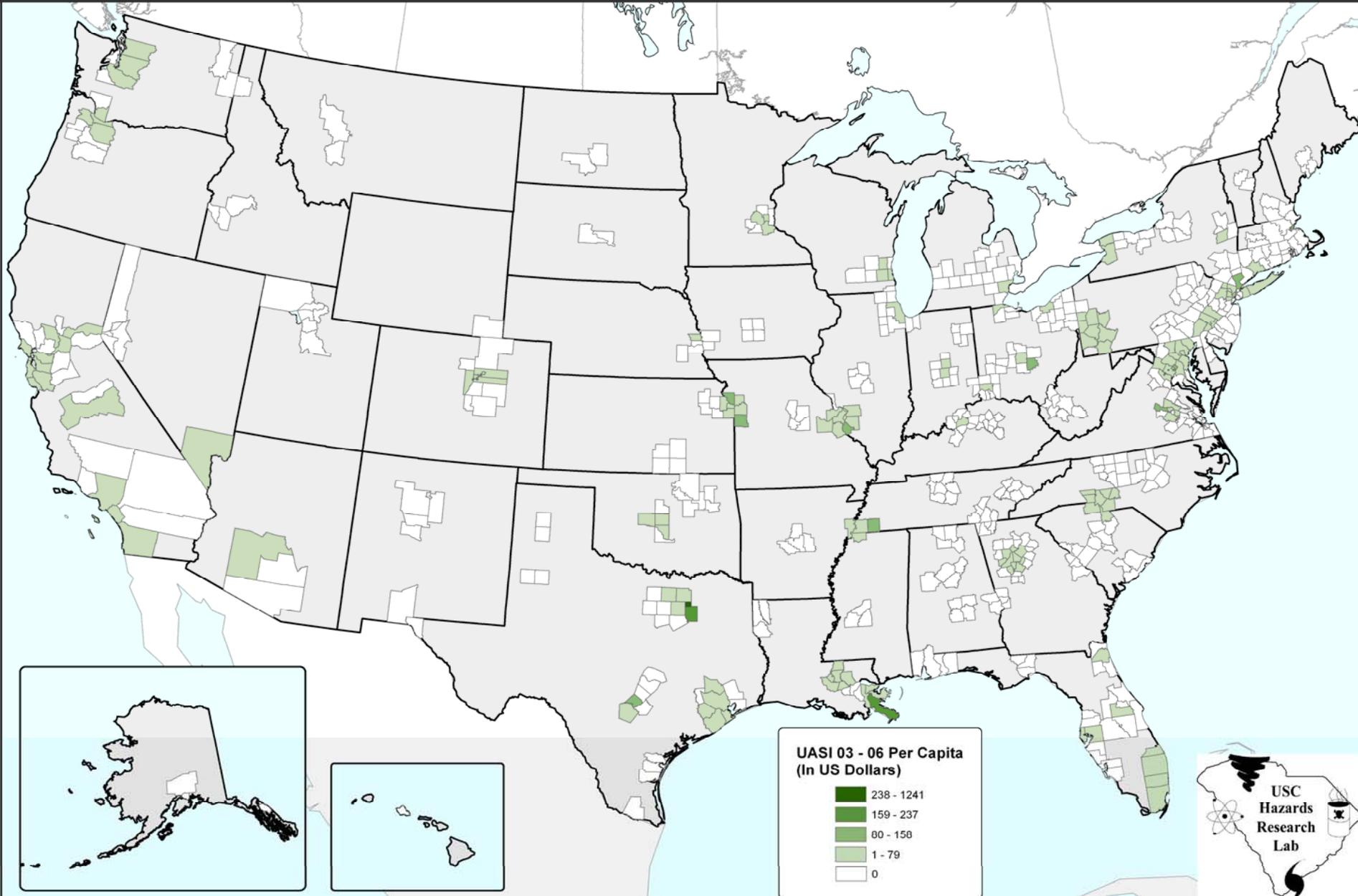
Built Environment Vulnerability Index (BEVI) Urban Area Counties United States



Per Capita UASI Funding 2003 - 2006

Urban Area Counties

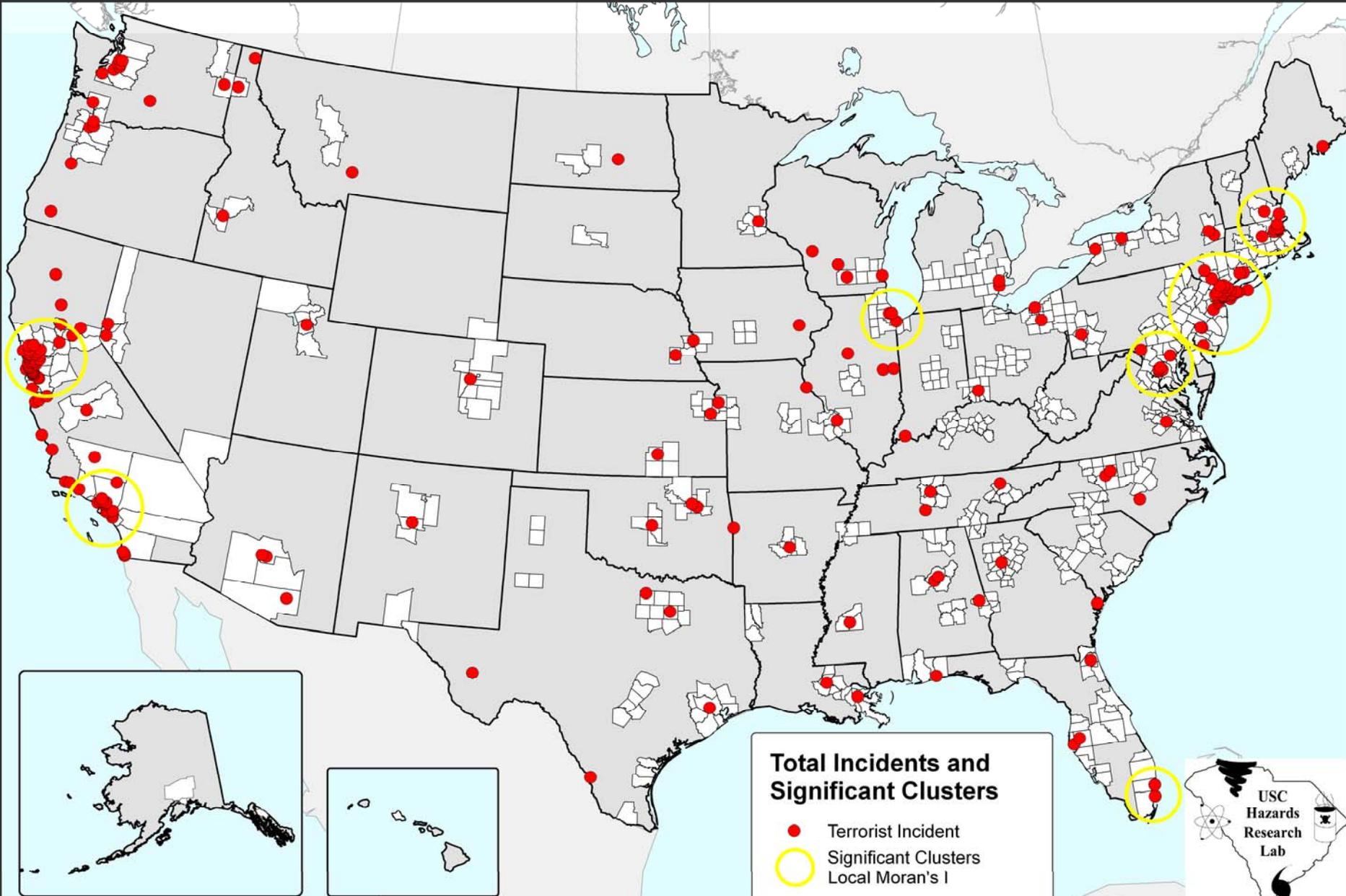
United States



Terrorist Incidents and Clusters 1970 - 2005

Urban Area Counties

United States



	Total UASI funding (2003-2006)	Total UASI funding (2006)
Total US Terrorist Events 1970-2005 (GTD/ MIPT)	0.727**	0.432**
Total Population, 2000	0.640**	0.451**

Indices	SoVI	BEVI
Total US Terrorist Events 1970-2005 (GTD/MIPT)	-0.103	0.333**
Total UASI Funding 2003-2006 (per capita in US Dollars)	-0.037*	0.399**

* Significant at 0.05; ** Significant at 0.01

Concluding Thoughts

- SoVI is a robust and scalable metric for comparing places on their social vulnerability
- BEVI shows more correlation with UASI expenditures and terrorist incidents
- Need more integration between physical process, threat assessments, and social process models and metrics
- Need to consider the spatial variability in preparedness planning and spatial disparities in the allocation preparedness and recovery resources



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- Social Vulnerability Index
(<http://www.cas.sc.edu/geog/hri/sovi.html>)

