Social Vulnerability Index

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HVRI
HAZARDS & VULNERABILITY RESEARCH INSTITUTE
University of South Carolina

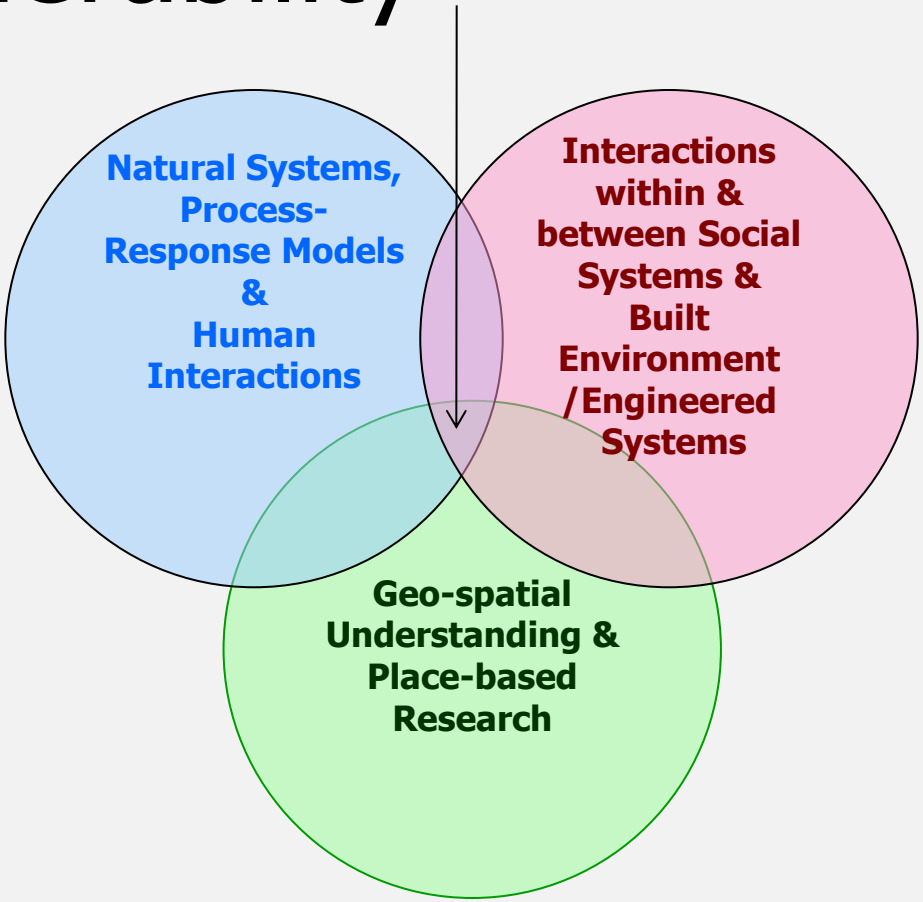
Vulnerability

The potential for loss or some adverse impact, or the capacity to suffer harm.

What circumstances place people and localities at risk?

What enhances or reduces the ability to respond and recover from environmental threats?

What are the geographic patterns between and among places



Goal: Provide scientific basis for disaster and hazard reduction policies through the 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

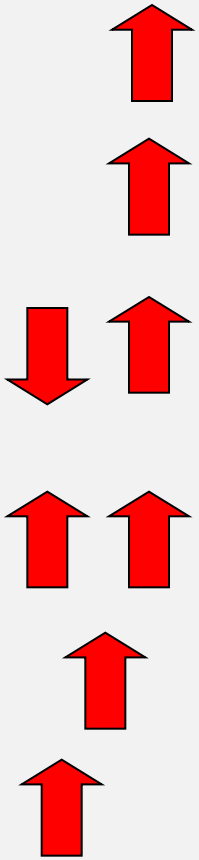
Race and ethnicity (non-white; non-Anglo)

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

Housing type and tenure (mobile homes, renters)



Heinz Center, 2002. *Human Links to Coastal Disasters*. Washington D.C.: The H. John Heinz III Center for Science, Economics and the Environment.

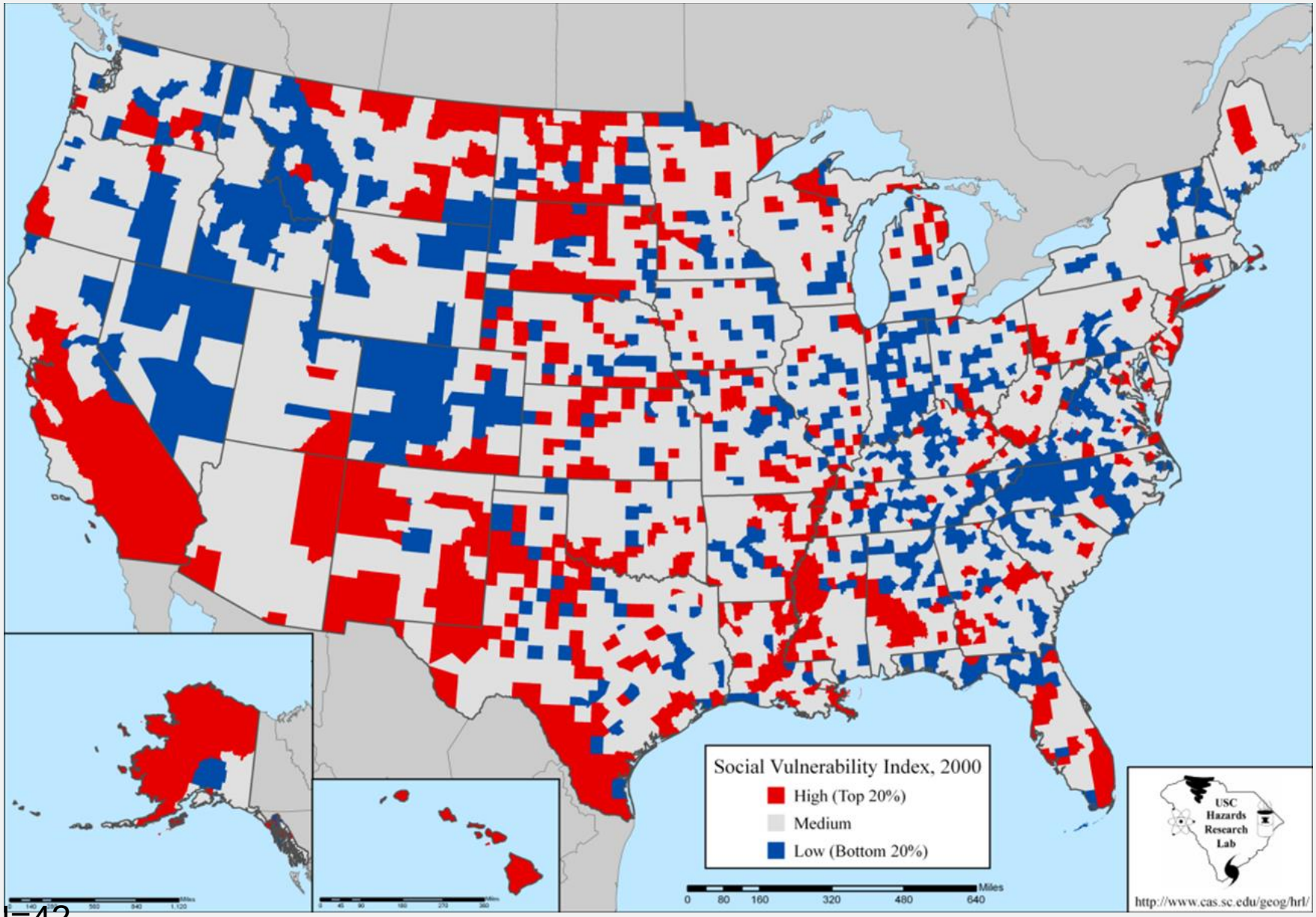
Creating the metric: The Social Vulnerability Index (SoVI)

County level socioeconomic profiles based on decennial census—place based index

- 1960-2000
- 42 variables reduced to factors (~11)
- Explains 74% to 76% of variance in data
- Factors: socioeconomic status, development density, age, race and gender, rural, race (Asian), economic dependence, ethnicity (Hispanic), migration, gendered employment

See Cutter et al. 2003. "Social Vulnerability to Environmental Hazards," *Social Science Quarterly* 84 (1): 242-261; Cutter, S. L. and D.P. Morath, 2013. "The evolution of the Social Vulnerability Index," in J. Birkmann (ed.), *Measuring Vulnerability to Natural Hazards, 2nd Edition*. Bonn: United Nations University Press, forthcoming.

Mapping Social Vulnerability



N=42

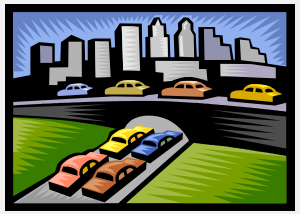
Social Vulnerability Index

- Composite place-based metric for understanding the ***DYNAMIC*** multidimensional nature of baseline socio-economic and demographic characteristics that make people less able (or more able) to adequately prepare for, respond to, and rebound from environmental hazards (irrespective of cause).
- It is more than just poverty, or just race, or just gender!
- Permits comparisons between places
- Allows for examining factors that produce the vulnerability and how they differ from place to place

What improvements have occurred in the SoVI metric?

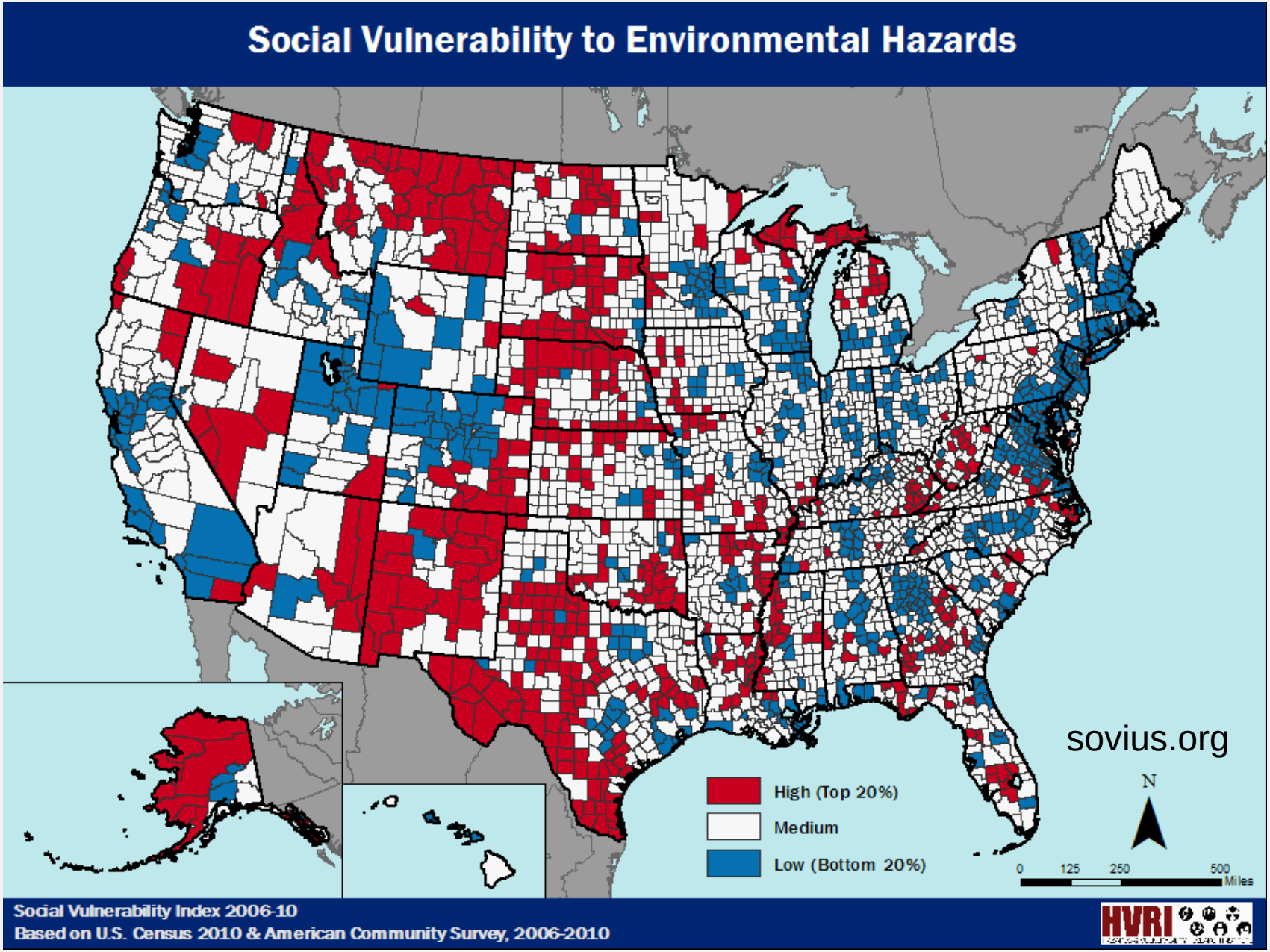
Reformulation in 2005:

- only measure social characteristics (critique from sociologists)
- built environment variables hard to get at sub-county scale (N=32 instead of N=42)
- Reduce the urban/high density built environment bias
- 9 components, 76% variance, socioeconomic status, age, rural agriculture



New census, new SoVI?

- Changes in counting procedures (some variables changed in census; some not included for all households)
- New variables warrant inclusion (family structure, vehicle availability, healthcare access, language barriers, medical disabilities)
- Need for more frequent updates rather than every 10 years



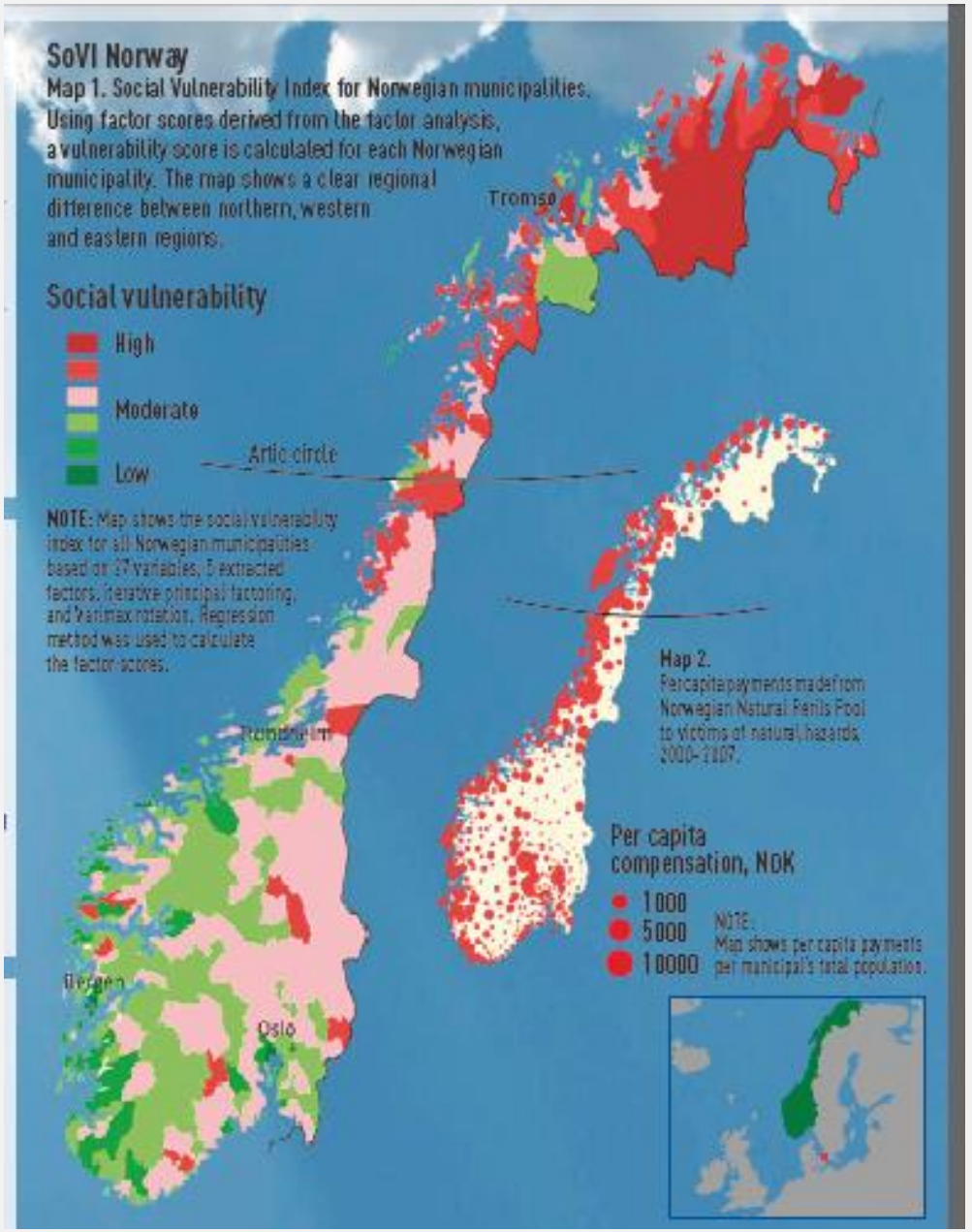
72% variance, 7 factors (race and class; wealth; elderly; Hispanic, special needs, Native American ethnicity, service industry employment)

Can SoVI be translated to other cultural contexts?

- Are the concepts and techniques transferable to other countries?
- Does SoVI methodology work in data poor environments?
- Does SoVI work in homogenous populations?

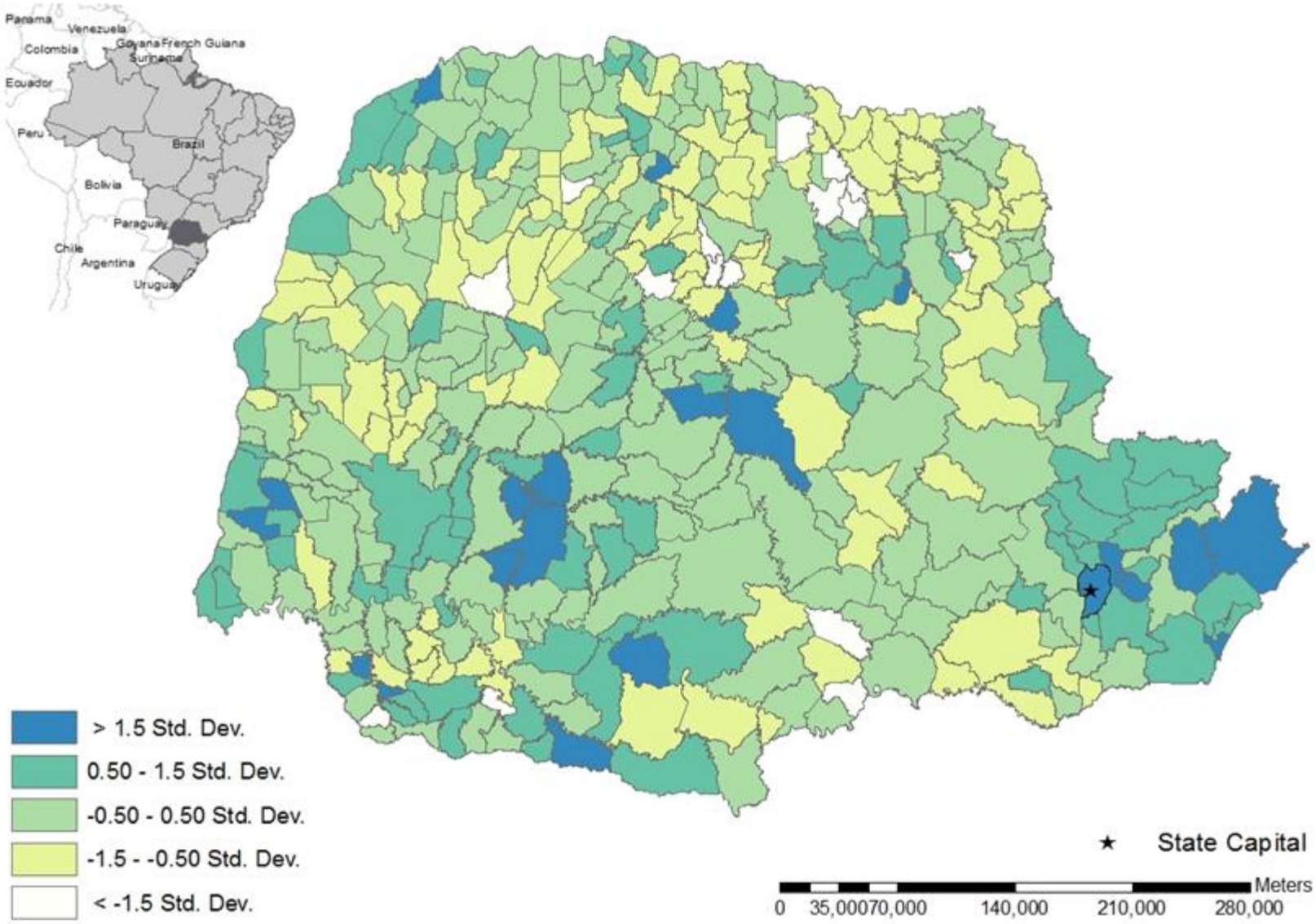
YES

SoVI Norway

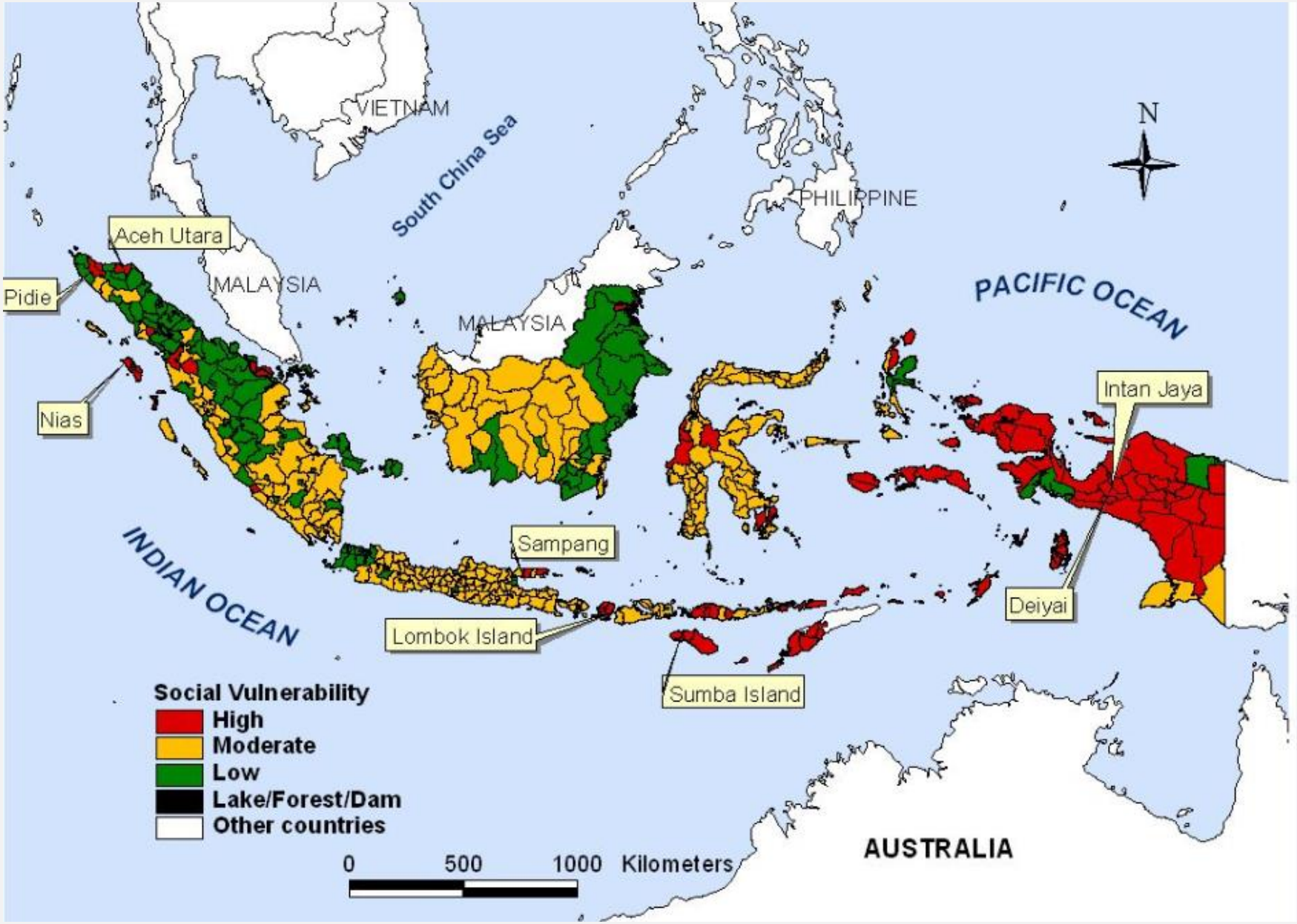


http://www.svt.ntnu.no/geo/Doklager/Projects/SoVI_Norway.pdf

Figure 5 Comparative Vulnerability of State of Paraná cities on the Social Vulnerability Index (SoVI)

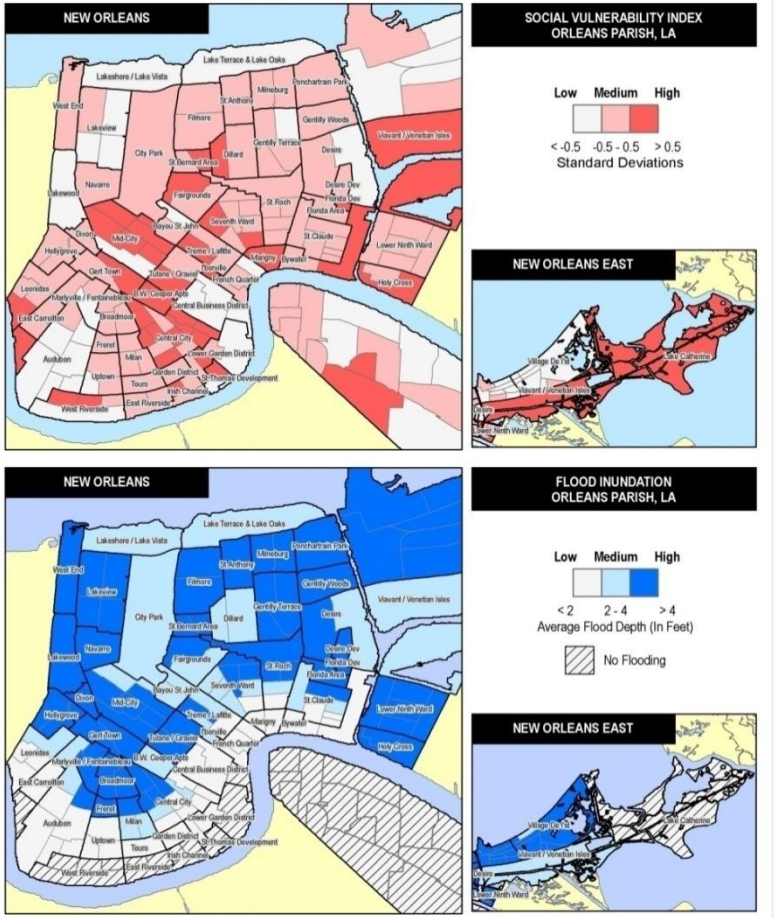


Source: B. L. Hummell, 2013. Hazards, Social Vulnerability and Resilience in Brazil: An Assessment of Data Availability and Related Research, in S. L. Cutter and C. Corendea (eds.), From Social Vulnerability to Resilience: Measuring Progress toward Disaster Risk Reduction, Source 17/2013, Bonn: United Nations University, Institute for Environment and Human Security, pp. 44-63. Online: www.ehs.unu.edu/file/get/11051.pdf

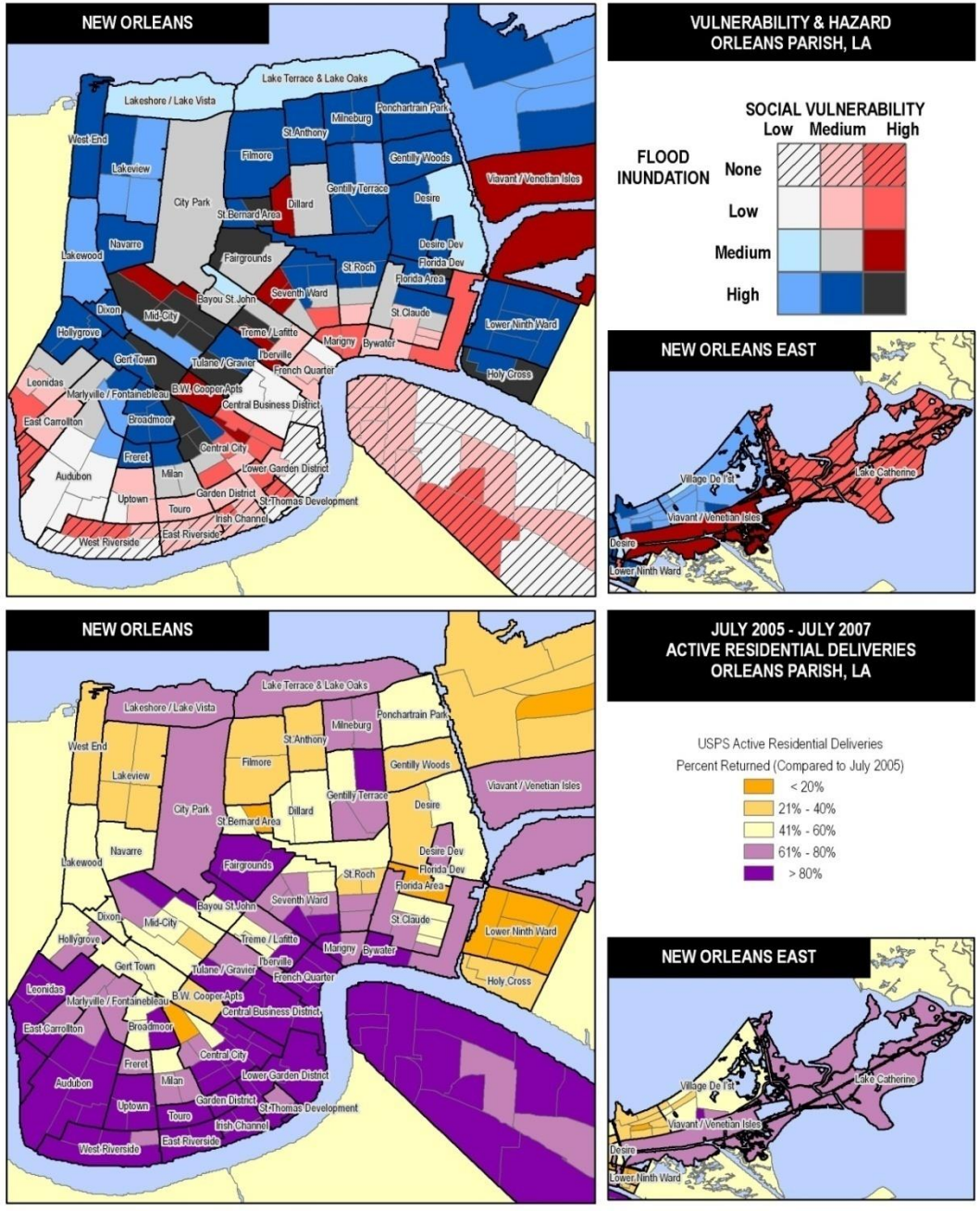


T. H. Siagian, P. Suhartono, and H. Ritonga, 2013. Social Vulnerability Assessment to Natural Hazards in Indonesia, in S. L. Cutter and C. Corendea (eds.), From Social Vulnerability to Resilience: Measuring Progress toward Disaster Risk Reduction, Source 17/2013, Bonn: United Nations University, Institute for Environment and Human Security, pp. 120-136. Online: www.ehs.unu.edu/file/get/11051.pdf

How do we make outputs useful to policy and practice?

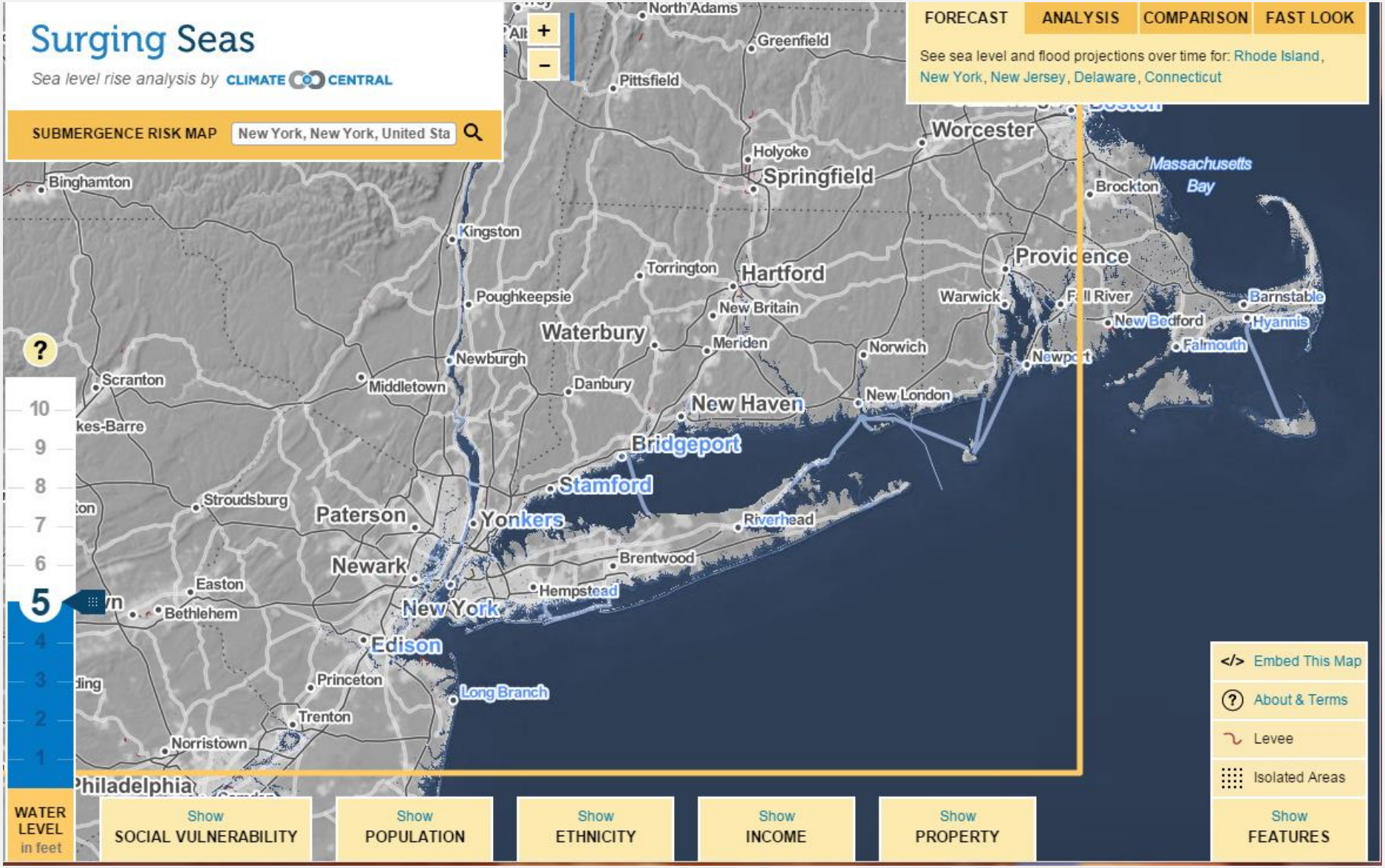


9 factors, 78% explained variance
Race & class, female-headed working families, renters & poverty (housing projects); elderly



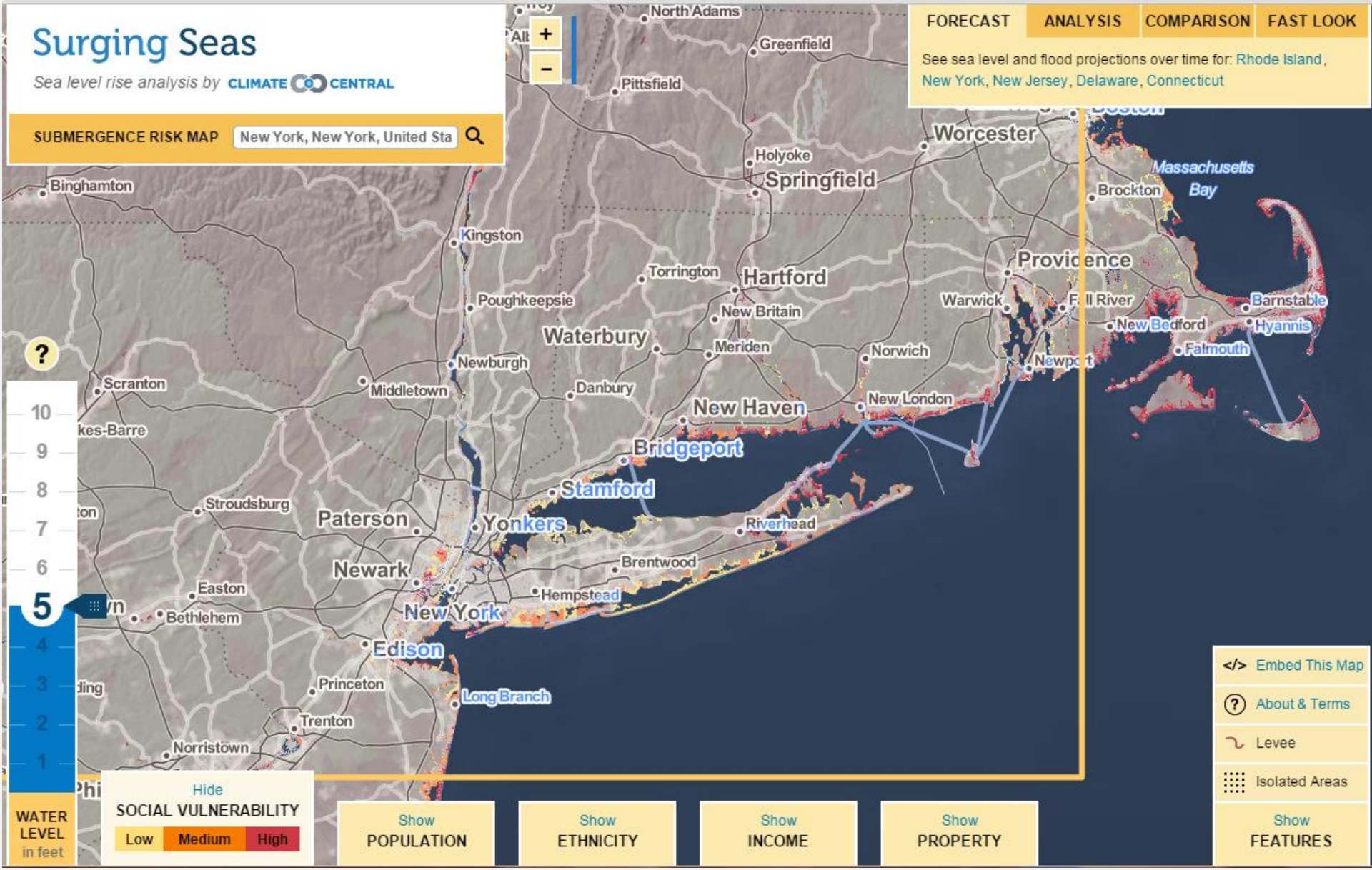
Finch, C., C. T. Emrich, and S. L. Cutter, 2010. Disaster disparities and differential recovery in New Orleans, Population & Environment 31:179-202.

Exposure



http://sealevel.climatecentral.org/

Exposure and Social Vulnerability



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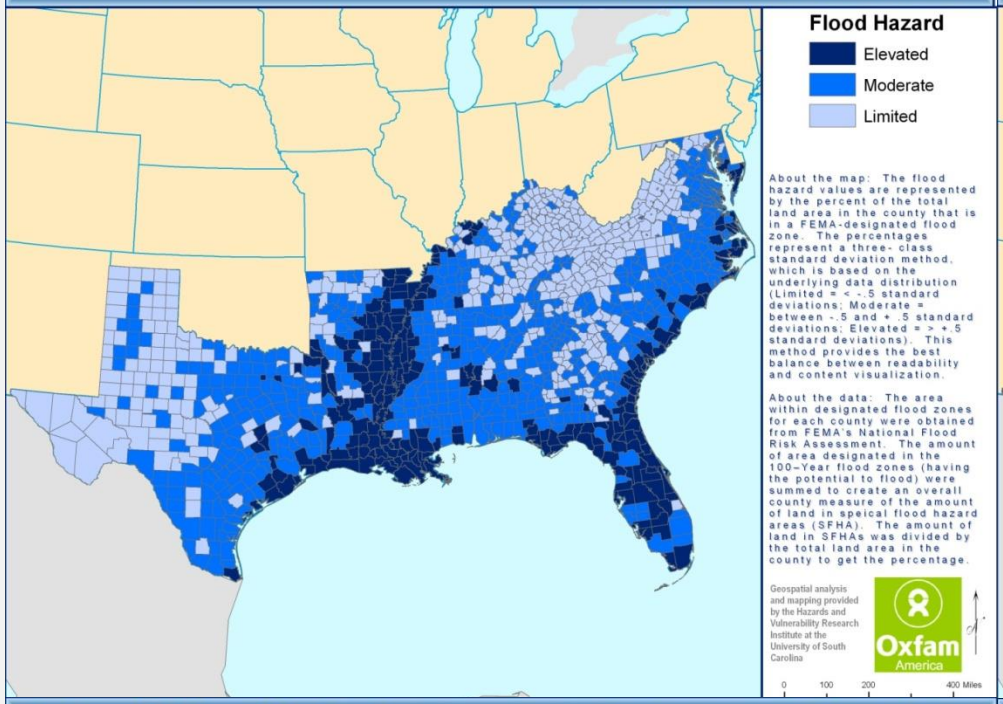
Flood Hazard Identification

Southeastern and Gulf Border States



Flood Hazard

- Elevated
- Moderate
- Limited

About the map: The flood hazard values are represented by the percent of the total land area in the county that is in a FEMA-designated flood zone. The percentages represent a three- class standard deviation method, which is based on the underlying data distribution (Limited = < -.5 standard deviations; Moderate = between -.5 and + .5 standard deviations; Elevated = > +.5 standard deviations). This method provides the best balance between readability and content visualization.

About the data: The area within designated flood zones for each county were obtained from FEMA's National Flood Risk Assessment. The amount of area designated in the 100-Year flood zones (having the potential to flood) were summed to create an overall county measure of the amount of land in speical flood hazard areas (SFHA). The amount of land in SFHAs was divided by the total land area in the county to get the percentage.

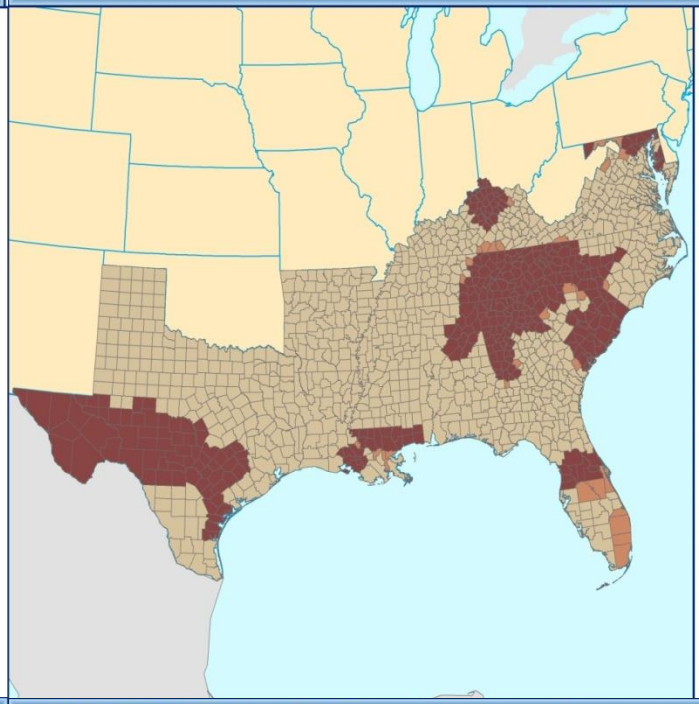
Geospatial analysis and mapping provided by the Hazards and Vulnerability Research Institute at the University of South Carolina

Oxfam America

0 100 200 400 Miles

Drought Hazard Identification

Southeastern and Gulf Border States



Drought Hazard

- Elevated
- Moderate
- Limited

About the map: The drought hazard values represent the percent of the total land area in the county that was in a drought hazard zone. The percentages are represented by a three- class standard deviation method, which is based on the underlying data distribution (Limited = < -.5 standard deviations; Moderate = between -.5 and + .5 standard deviations; Elevated = > +.5 standard deviations). This method provides the best balance between readability and content visualization.

About the data: The area within extreme drought zones for each county were culled from monthly PDSI values available from the U.S. Climate Data Center. The area designated in extreme drought zones was summed to create an overall county measure of the amount of land in extreme drought areas. The amount of land in extreme drought areas was divided by the total land area in the county to get the percentage.

Geospatial analysis and mapping provided by the Hazards and Vulnerability Research Institute at the University of South Carolina

Oxfam America

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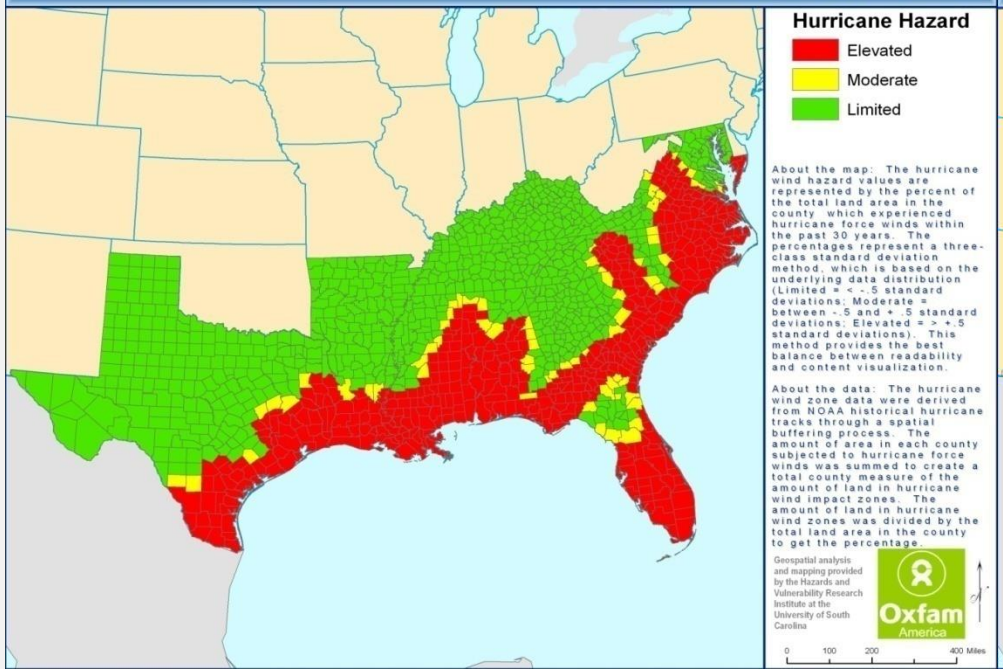
Hurricane Wind Hazard Identification

Southeastern and Gulf Border States



Hurricane Hazard

- Elevated
- Moderate
- Limited

About the map: The hurricane wind hazard values are represented by the percent of the total land area in the county which experienced hurricane force winds within the past 30 years. The percentages represent a three-class standard deviation method, which is based on the underlying data distribution (Limited = < -.5 standard deviations; Moderate = between -.5 and + .5 standard deviations; Elevated = > +.5 standard deviations). This method provides the best balance between readability and content visualization.

About the data: The hurricane wind zone data were derived from NOAA historical hurricane tracks through a spatial buffering process. The amount of area in each county subjected to hurricane force winds was summed to create a total county measure of the amount of land in hurricane wind impact zones. The amount of land in hurricane wind zones was divided by the total land area in the county to get the percentage.

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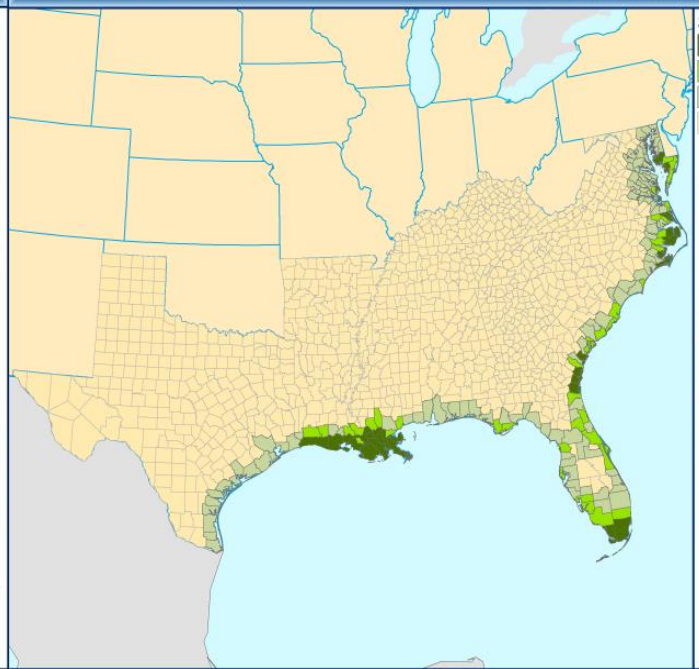
Sea-level Rise Hazard Identification

Southeastern and Gulf Border States



Sea-level Rise Hazard

- Elevated
- Moderate
- Limited
- No Impact

About the map: This map represents the percent of land area in each county inundated by a projected 120 cm increase in sea-level. The percentages are represented by a three-class standard deviation method, which is based on the underlying data distribution (Limited = < -.5 standard deviations; Moderate = between -.5 and +.5 standard deviations; Elevated = > +.5 standard deviations). This method provides the best balance between readability and content visualization.

About the data: The sea-level rise zones for each county were generated using spatial analysis processes applied to a USGS National Elevation Dataset. The areas in each county identified as sea-level rise impact zones (places currently less than 120 cm above sea-level) were summed to create an overall county measure of the amount of land subject to inundation. The amount of land in these zones was divided by the total land area in each county to get the percentage of area in elevated sea-level rise zones.

Geospatial analysis and mapping provided by the Hazards and Vulnerability Research Institute at the University of South Carolina

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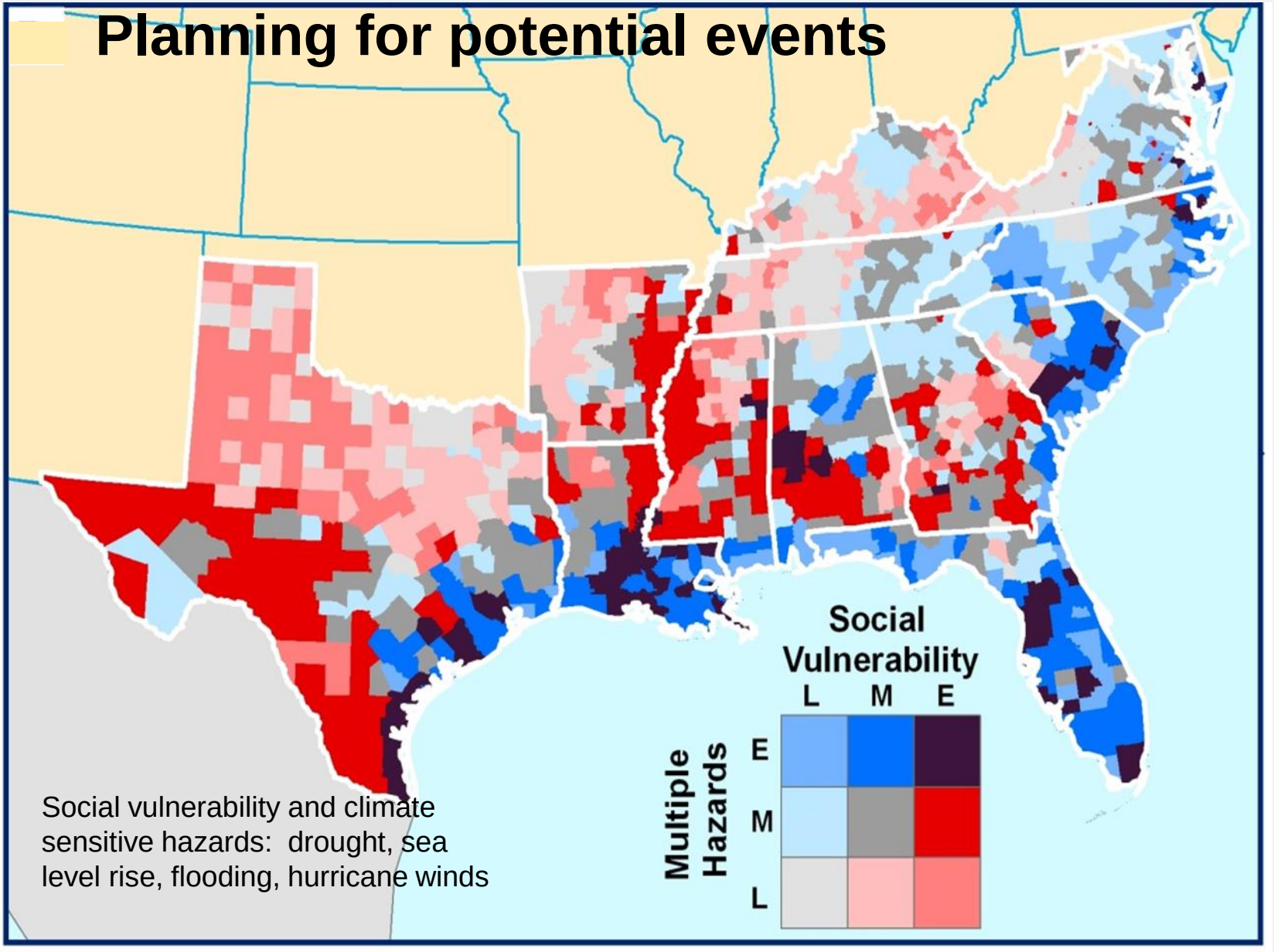
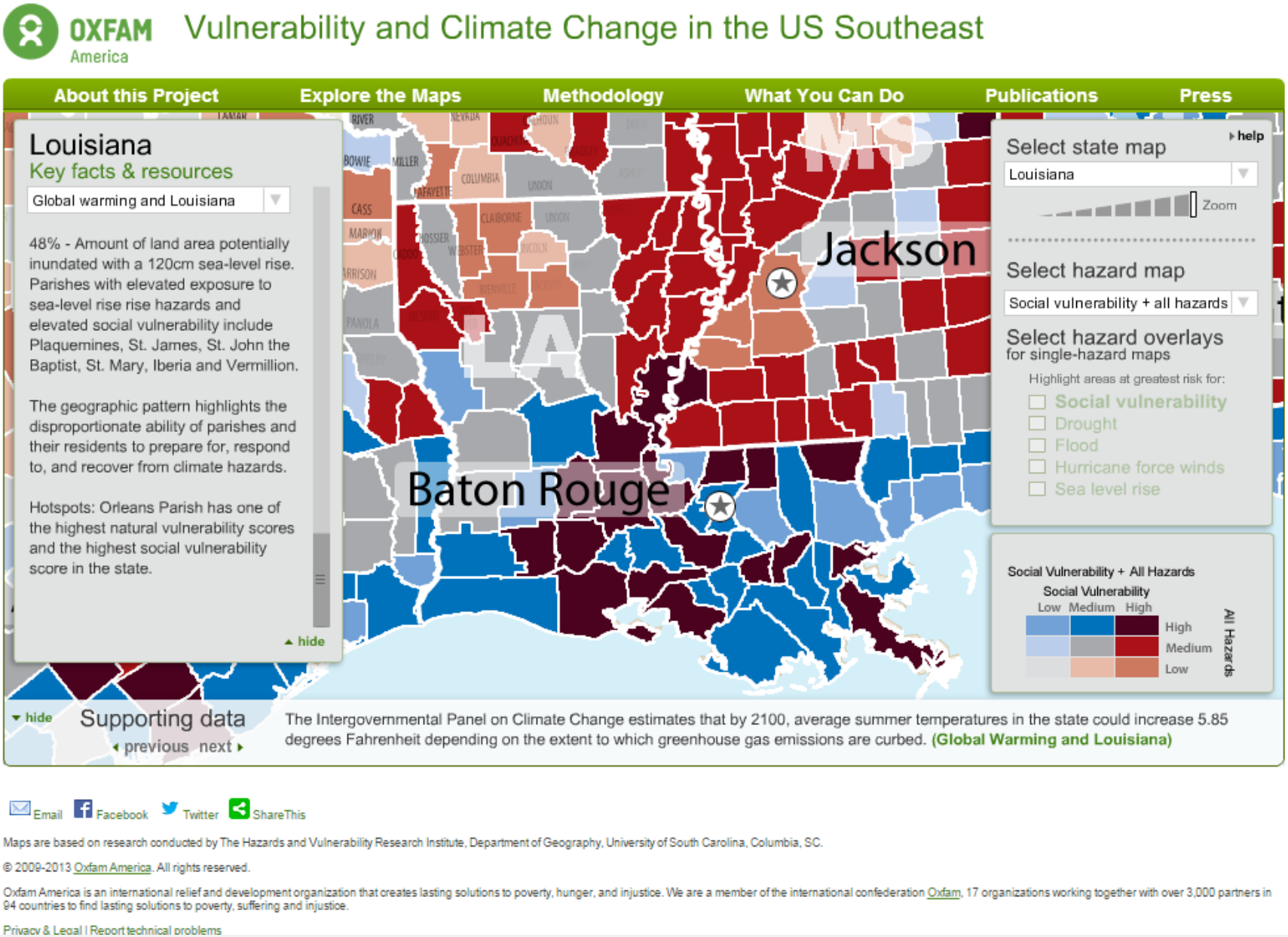
Planning for potential events

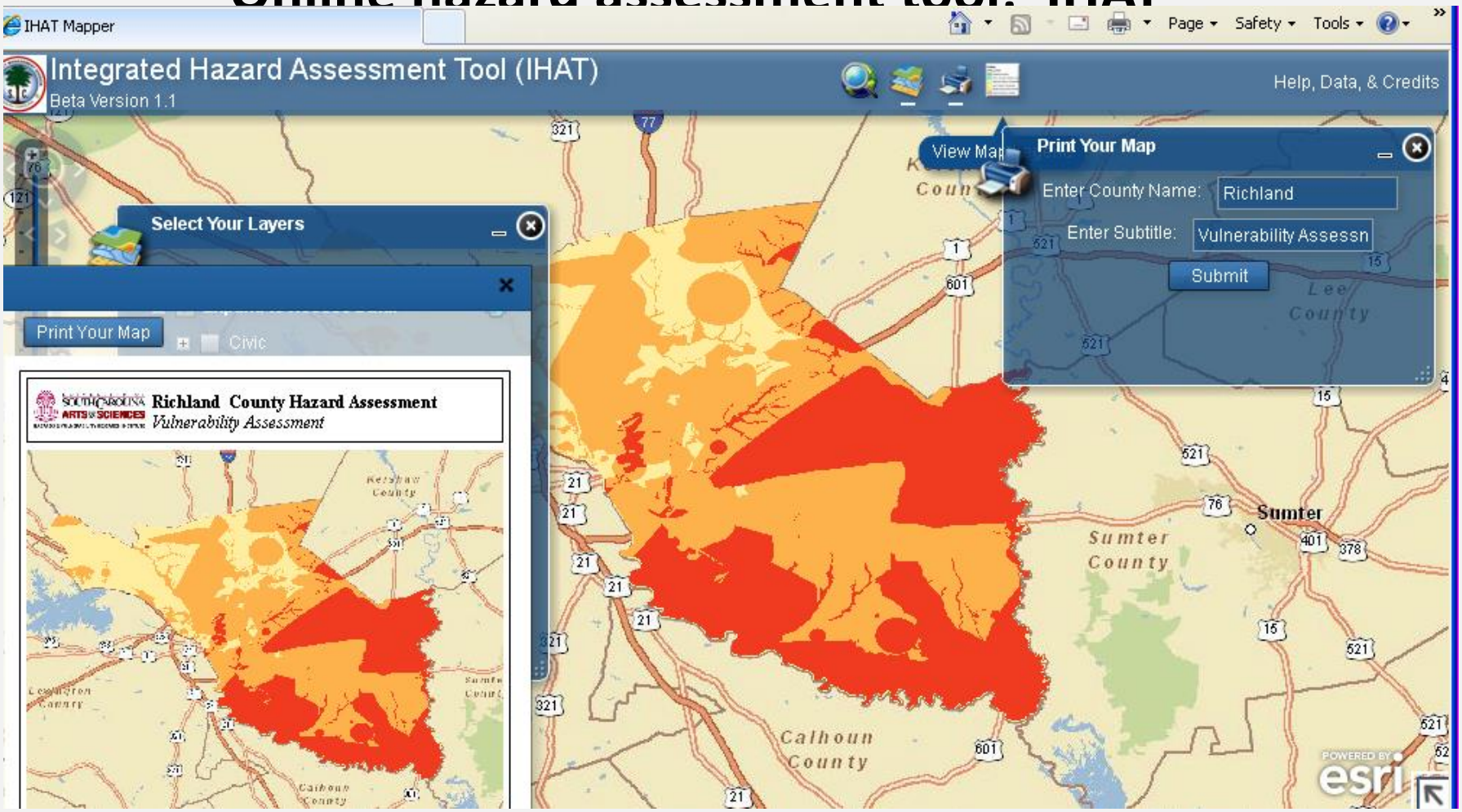


C. Emrich and S. L. Cutter, 2011. Social vulnerability to climate-sensitive hazards in the southern United States, *Weather, Climate, and Society* 3(3): 193-208.



http://adapt.oxfamamerica.org/

Online hazard assessment tool: IHAT



http://webra.cas.sc.edu/hvri/ihat/index.html

Tate, E., C.G. Burton, M. Berry, C.T. Emrich, and S.L. Cutter, 2011. Integrated Hazards Mapping Tool, *Transactions in GIS*, 15(5): 689-706; Tate E., S.L. Cutter, and M. Berry, 2010. Integrated multihazard mapping, *Environment and Planning B: Planning and Design*, 37(4): 646–663.

Social Vulnerability and Hurricane Isaac

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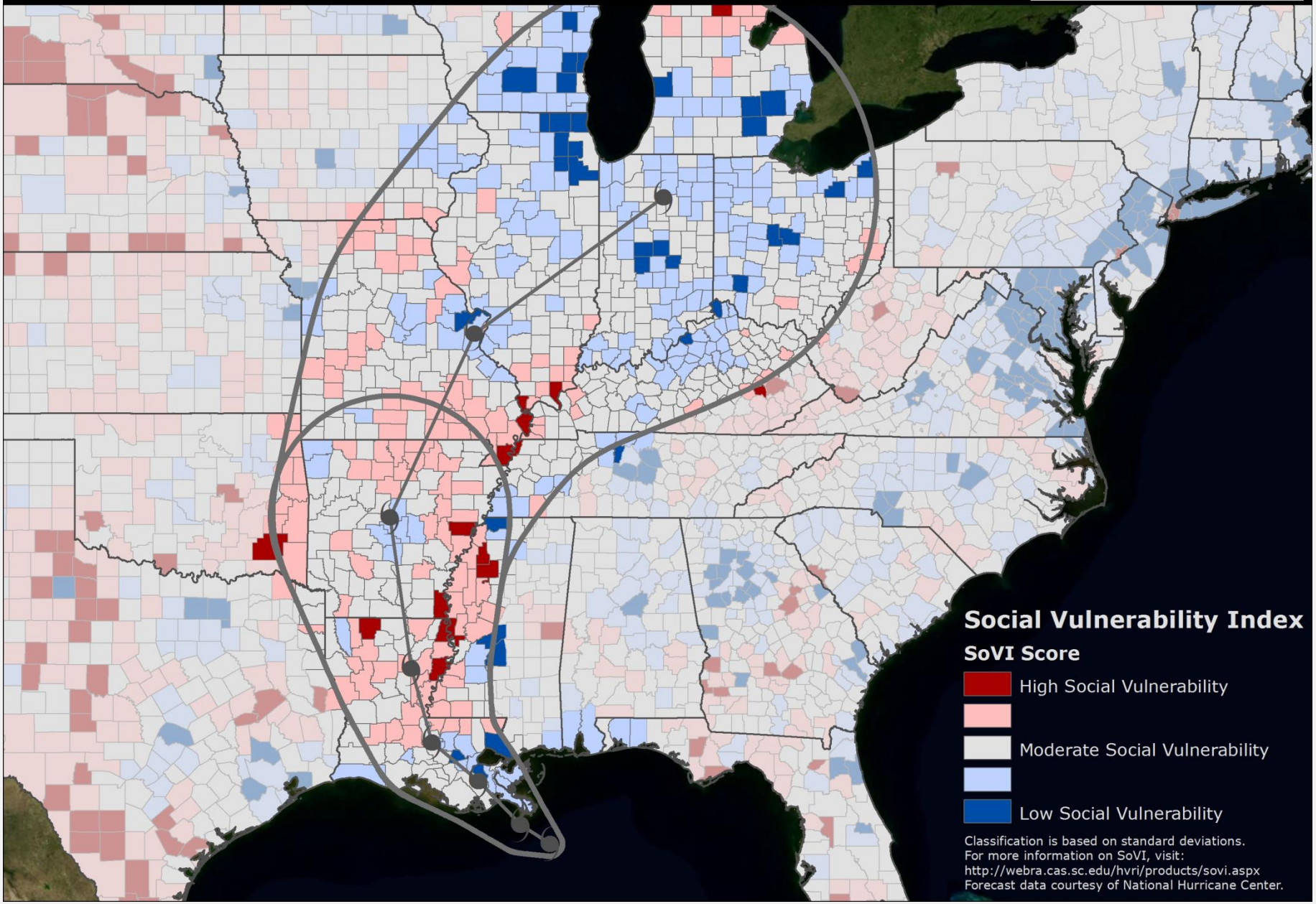
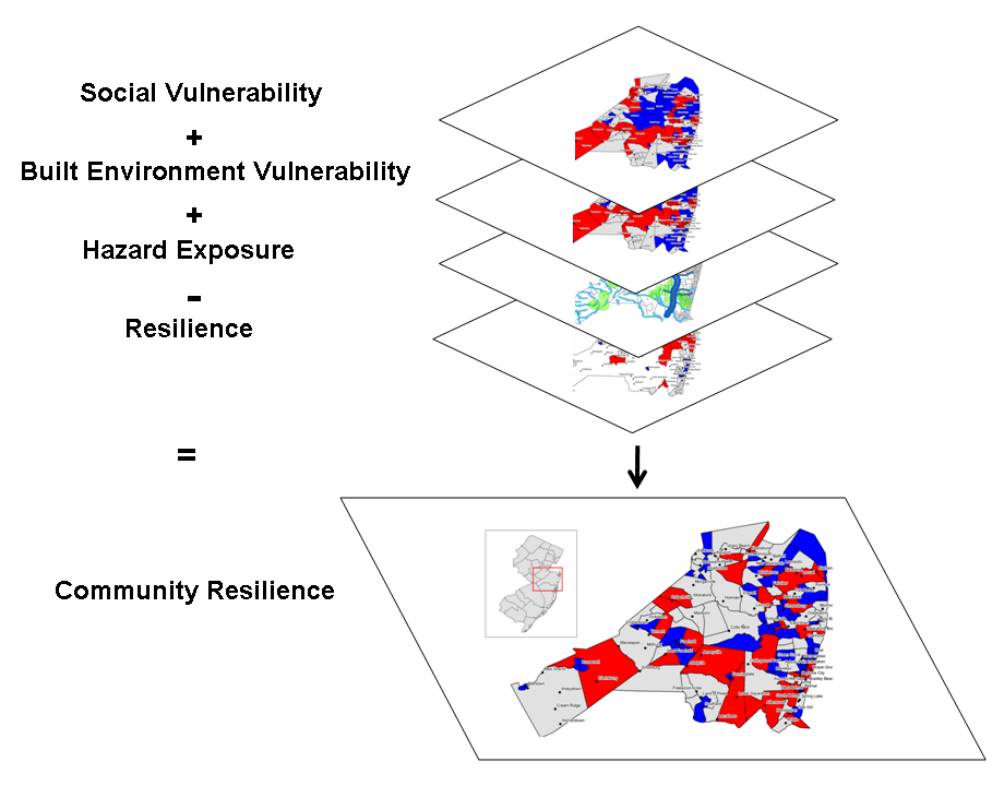


Summary



- Social metrics possible to construct and scale
- Intersection of social and physical process possible within a geospatial framework
- More work on social resilience (or adaptive capacity) within a geospatial environment
- Need for better measurement

Space and Place matter: One size fits all hazard risk reduction strategy ignores the reality of social inequality and differential social burdens.

SoVI

- Robust algorithm, can be improved and modified for social resilience applications
- Evidence of disparities in potential impacts and ability to recover from catastrophic failures
- Vulnerability science--improved understanding of social systems, built environment, and physical processes in creating hazardscapes
- Policy—prioritize recovery and mitigation efforts, prioritize preparedness resources, understand where enhancements in disaster risk reduction would be most beneficial

For more info see http://sovius.org

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