

SoVI lite: Reducing the Complexity of the Social Vulnerability Index



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Background

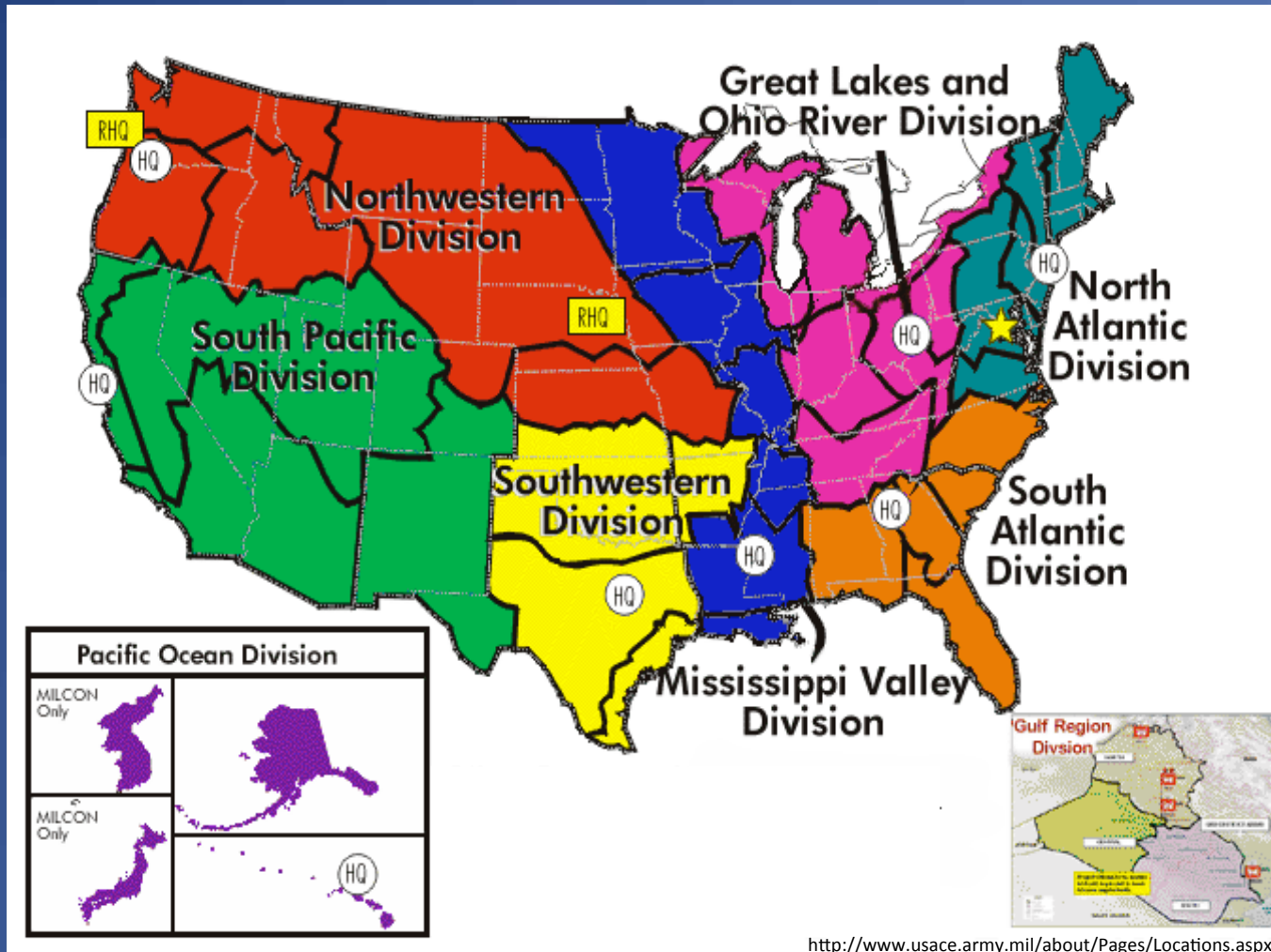
- Social vulnerability describes demographic conditions that influence both natural processes and the built environment in the redistribution of risks and impacts
 - Different social burdens
 - Explains why some communities experience the hazard differently though they are equally exposed
- Understanding differential impacts is a critical element in formulating comprehensive place-based emergency management plans



Purpose of this Research

- Problem:
 - Many Federal, State, and local agencies recognize the value of social vulnerability
 - Current social vulnerability metrics reduce the likelihood of replication
- SoVI Requires:
 - Technical and Statistical Proficiency
 - Access to GIS software
 - Expertise in Geography, Hazards, and Social Vulnerability
- Solution:
 - Reduce the complexity of SoVI for increased accessibility: SoVI lite
 - A simple additive model that can be incorporated into existing agency plans
- Case study: USACE South Atlantic Civilian Division

Study Area: USACE South Atlantic Civilian Division

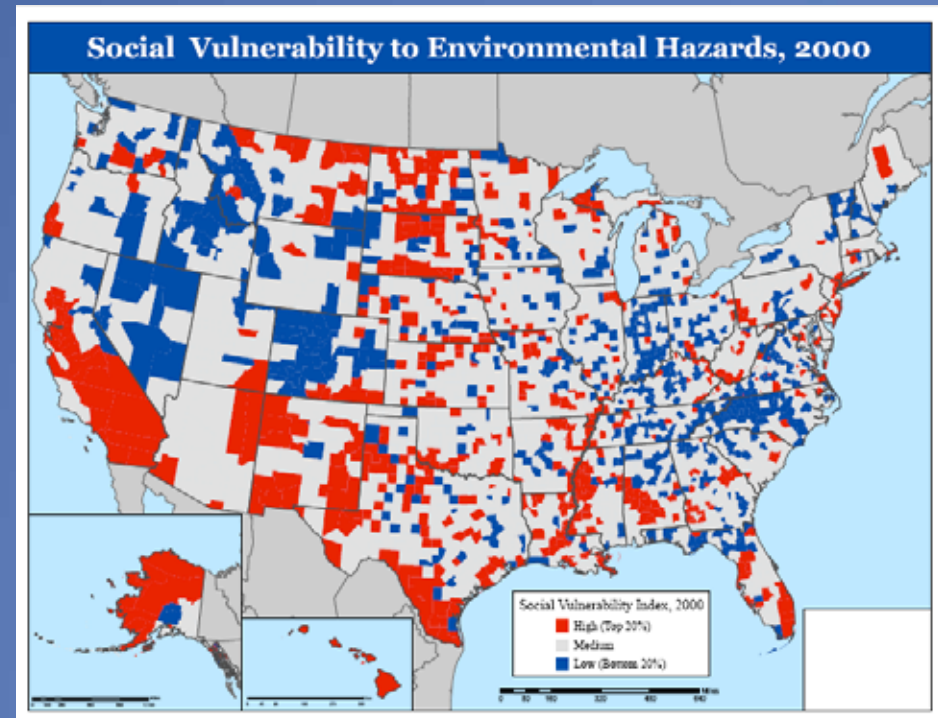


Quantifying Social Vulnerability: The Social Vulnerability Index (SoVI) (2003)

- A scale-dependent comparative metric for examining the differences in social vulnerability among counties

Method

- Factor Analysis: Reduces 42 indicators to a smaller set of factors
- Components are summed based on the tendency to increase or decrease vulnerability, yielding an aggregate SoVI score
- Mapped SoVI scores using objective classification

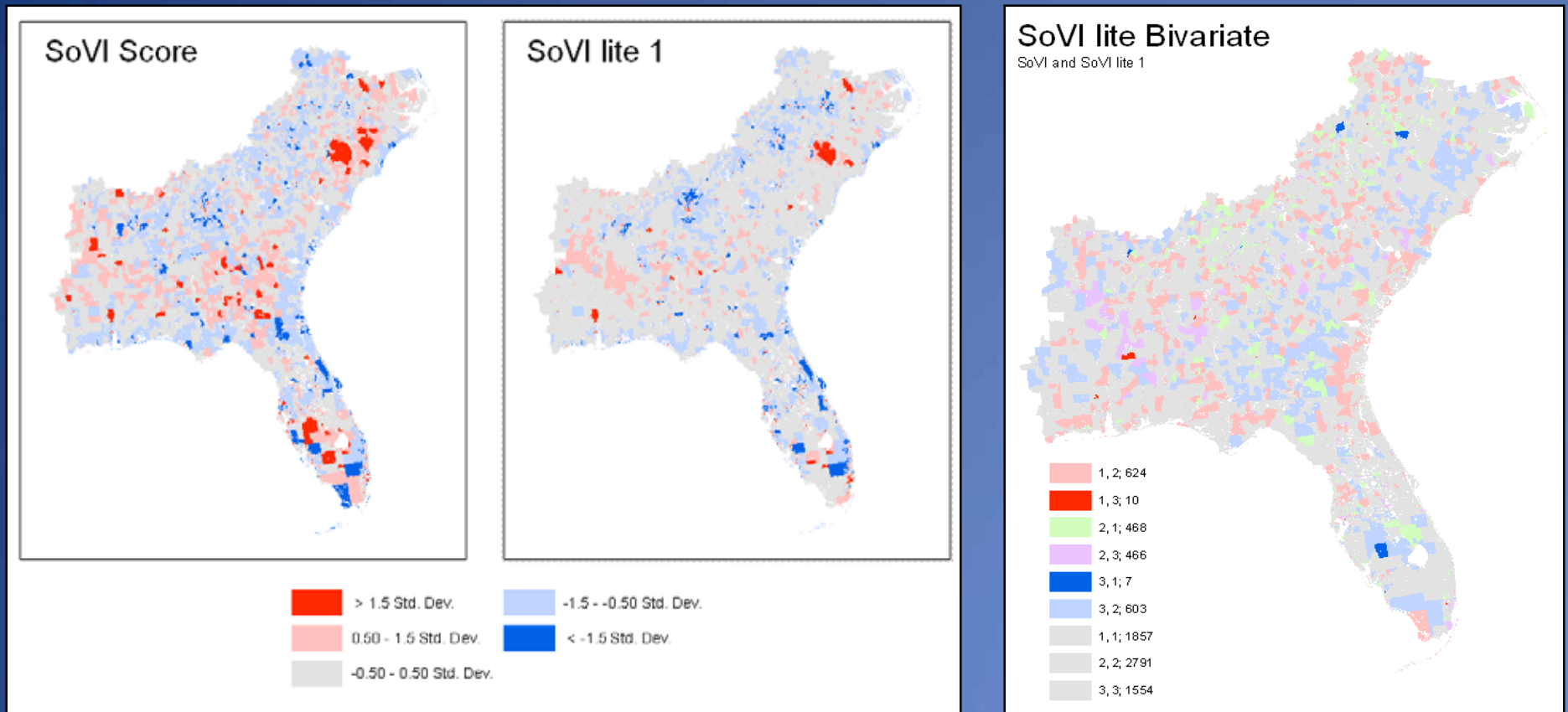


Methods: Reducing the Complexity

- Used only census variables available at county and sub-county level (32 total)
- Calculated tract-level SoVI Score for South Atlantic as test statistic
- 2 main methods for creating SoVI lite versions
 - Statistical reductions:
 - Variable selection based on correlation coefficient from factor analysis (SoVI lite 1, 7)
 - Reductions based on regression analysis (SoVI lite 2, 3, 6)
 - Theoretical reductions:
 - 8 inputs deduced from the Hazards of Place model of vulnerability(Cutter et al. 2000) implemented for Georgetown County, SC (SoVI lite 4, 5)
 - 14 variables derived from the social vulnerability literature (Heinz Center 2002) (SoVI lite 8)
- 8 SoVI lite versions tested

Choosing the 'lite' Version

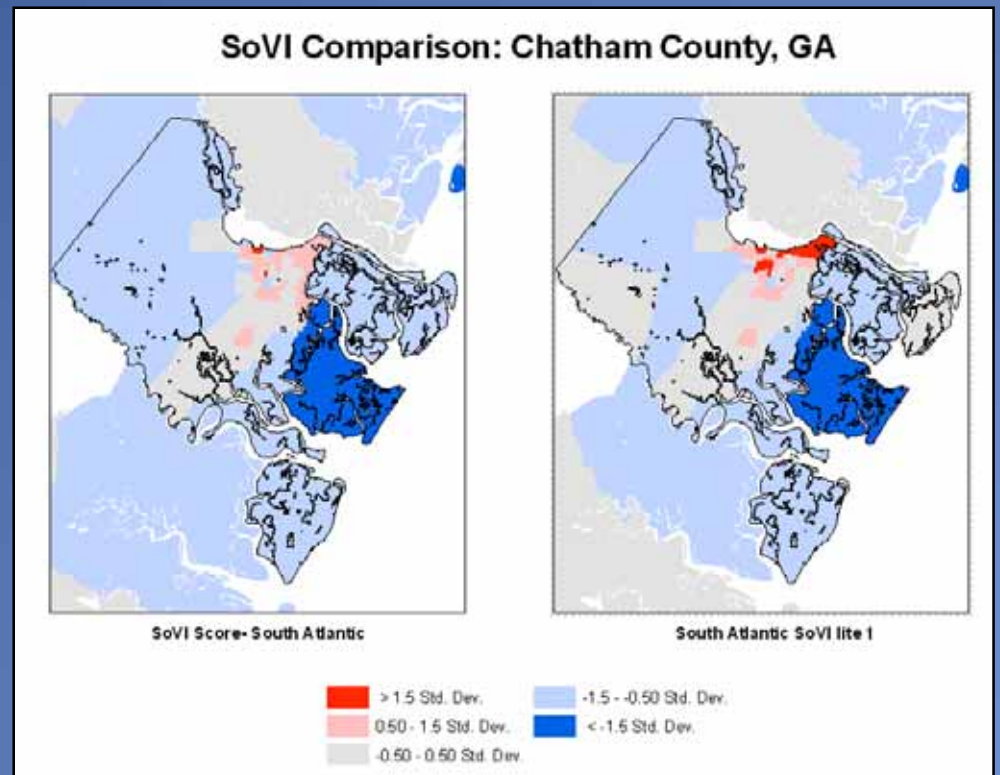
- Statistical correlation-Pearson R > 0.850
- Visual Interpretation- >75% of the spatial units in same mapped category
- Ease of use and replication



- R=0.889
- 74% units same category
- Simple additive model

Test of Robustness

- Can you go from region to a specific county or vice versa?
 - Test 1: scaling South Atlantic to Chatham County, GA
 - Test 2: using Chatham County to show regional
 - Works when scaled down; does not work as well when scaled up
- Can you take a regional SoVI and export to a different region?
 - Test 1: take South Atlantic SoVI lite and test in Mississippi
 - Does not work



Conclusions

- The Social Vulnerability Index (SoVI) is spatially dependent; Calibrated for the local differences in social vulnerability within the region
- Downscaling works, however, up-scaling was not robust
- Transporting customized regional metrics to other regions did not work
- What does this mean for USACE?
 - The SoVI lite metric produced for the South Atlantic region *should not* be universally applied across all regions
 - To achieve a universal SoVI Lite for use in **all** USACE Divisions for planning and emergency management requires:
 - 1) Develop regional SoVI Lite metric (a regional “recipe”) for each USACE civilian planning division
 - 2) Improved social science expertise within USACE

Questions?

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Uncovering Social Vulnerability: Indicators

- Special needs populations
 - difficult to identify (infirm, transient) and measure; often overlooked as they are '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, financial safety), but more material goods to lose
- Race and ethnicity (minorities)
 - 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

Test of Robustness: Scalability

- Tests of down-scalability:
 1. Subset the regional SoVI Lite 1-8 and the regional SoVI score to Chatham County, Georgia.
 - SoVI Lite 1 correlated best with SoVI subset for Chatham ($R=0.866$)
 2. Recalculated SoVI Lite 1 for Chatham County census tracts using the South Atlantic Region equation.
 - Again, there is a good correlation between the Regional SoVI and SoVI lite 1 for Chatham ($R=0.640$)
- Tests of up-scalability:
 1. First calculated SoVI for Chatham County census tracts alone, then created SoVI lite for Chatham
 2. Transferred Chatham equation to the region.
 - County Indicators were less indicative of regional trends, with the correlation between the Chatham SoVI lite and Regional SoVI lite at $R=0.478$.
 - Additionally, comparing Chatham SoVI lite with the original SoVI score for the South Atlantic Region we see a moderate correlation ($R=0.568$)

Test of Robustness: Transportability

- Transported Using South Atlantic SoVI and SoVI Lite equations to Mississippi Valley Region
- Same procedure yielded different indicators
 - population over 25 with no high school diploma *instead of* poverty
 - Percent rural farm populations *instead of* Urban
 - Percent of the population collecting social security benefits *instead of* Elderly
- Correlations:
 - MS Valley SoVI and South Atlantic SoVI lite 1: $R=0.609$
 - MS Valley SoVI and MS Valley SoVI lite 1: $R=0.739$
 - Different SoVI lite methods more suitable for this region
- Proof of Concept: social vulnerability indicators vary spatially.