Assessing Social Vulnerability to Biophysical Hazards

Dr. Jasmine Waddell

Oxfam America

About the Project

- Built on a need to understand:
  - The pre-disposition of the populations in the SE to adverse impacts from disaster events
  - The types and places where one might expect to see higher incidence of hazard events
  - The product of a combination of these two things across space

- This work focuses on the identification of:
  - Social vulnerability (pre-event conditions of the population that either exacerbate or attenuate impacts from hazards and disasters).
  - Biophysical vulnerability (places threatened by climate change related hazards)

Vulnerability Science

- Aimed at identifying and analyzing
  - The circumstances that place people and localities at risk?
  - The drivers of enhanced or reduced ability to respond to and recover from environmental threats?
  - The geographic patterns between and among places?

Natural Systems, Process-Response Models & Human Interactions

Interactions within & between Social Systems & Built Environment /Engineered Systems

Geo-spatial Understanding & Place-based Research

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
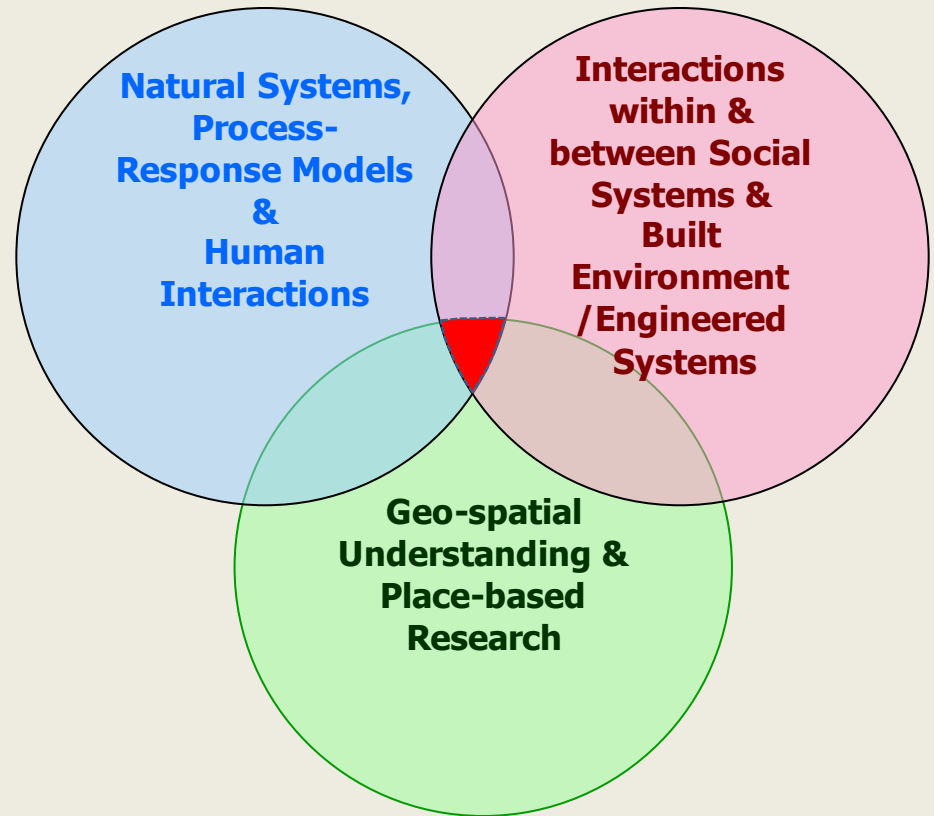
Oxfam America Exposed! Report
http://adapt.oxfamamerica.org

- Exposed! is based on research by HVRI is an improvement on previous vulnerability work
  - Uses a robust algorithm to determine SoVI
  - Utilizes current science related to hazards identification
    - 30 years of hurricane information create a hurricane climatology
    - 30 years of drought information to create a historical extreme drought climatology
    - NFIP flood insurance information to create reliable flood zone areas
    - Peer reviewed sea-level rise estimation methodologies to create a useful measure of potential sea-level rise impacts
  - Covers a broad geographic area rather than a specific narrow focus

What makes you vulnerable?

- Wealthy communities are able to respond and recover most quickly

- Women have a more difficult time recovering

- Hispanic and black populations, in particular, are more vulnerable

- The very old and young are more vulnerable

Population Characteristic and Specific Variable	Influence on social vulnerability
Race & ethnicity	Non-white and non-Anglo populations more vulnerable
Socioeconomic Status	Poverty makes communities less able to respond and recover quickly
Gender	Women often have more difficult time recovering quickly
Age	Age extremes (elderly and very young) increase vulnerability
Rural/Urban	Both rural and urban communities have challenges which make them vulnerable to disaster and quick recover
Renters	Renters face challenges which make them more vulnerable to disaster and recovery
Residential property	Value, quality, and density of residential construction affects disaster losses and recovery
Occupation	Jobs directly affected by disasters
Family Structure	Families rely on paid caregivers are more vulnerable
Employment	Communities with high numbers of unemployed workers are vulnerable because jobs are already difficult to obtain
Education	Limited education levels influence vulnerability to disaster and recovery
Population Growth	New immigrants face challenges which make them more vulnerable to disaster and recovery
Access to medical services	Lack of access to medical services lengthens recovery time
Social dependency and special needs populations	Residents totally dependent on social services are more vulnerable

Table 2: Social Vulnerability Index-Southeast (SOVI-SE)

Component	Label	% Variance Explained	Most Influential Variable/Correlation
1	Wealth	23.09	Per capita income (0.93), median rent (0.90), % poverty (-0.67)
2	Age	14.64	People per housing unit (0.84), pop over 65 (-0.88), median age (-0.89)
3	Race	10.79	% African American (0.87), % female headed household (0.84)
4	Ethnicity	6.56	% Hispanic (0.72)
5	Rural	5.1	% employed in natural resources extraction (0.55), % rural farm residents (0.50)
6	Special Needs Population	5.0	Hospitals per capita (0.70); Nursing home residents (0.62)
7	Gender	4.6	% females (0.91)
8	Employment	4.6	% employed in utilities, transportation, or communications (0.73)
Total Variance Explained		**74.40**	*Equation for SoVI-SE= (−) Factor 1 + (ll) Factor 2 + Factor 3 + Factor 4 + Factor 5 + Factor 6 + Factor 7 + (−)Factor 8*

Who is Vulnerable?

- SoVI data outputs become part of a toolset used to identify underlying aspects of populations which influence hazard impacts
  - This information helps to identify populations based on the dynamic interplay between a broad array socio-economic and demographic characteristics

- Specifically, this work provides multiple perspectives of social vulnerability:
  - Macro level comparative visualizations
  - Tabluar sub-component characterization for a higher level understanding of drivers at more localized levels

Location of vulnerability

- Hazard assessments (biophysical vulnerability) provide knowledge about potential threat levels for particular areas
  - Data identifies places based on historical incidence or modeled future impacts
  - Information enables users to understand threats specific to place

- Coupled with SoVI indicators, we can start to understand the spatial nature inherent in the southeastern US
  - Not every place has the same level of vulnerability
  - Hazardousness varies across space
  - Together, these provide an additional level of understanding

Why are communities vulnerable?

- Analyzing the underlying circumstances and situations (biophysically and socially) provides detail about the root causes and dynamic pressures that are present
  - In a certain place
  - In relation to individual or combined threats from climate change

- Once we grasp the reasons for increased vulnerability and identify specific threats to lives and livelihoods we can
  - Start to formulate focused action items
  - Foster a spirit of adaptation and community cohesion
  - Provide scientific support for policy decisions aimed at decreasing vulnerability

Regional Social Vulnerability Map

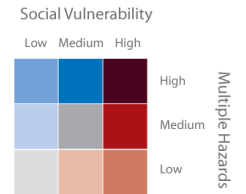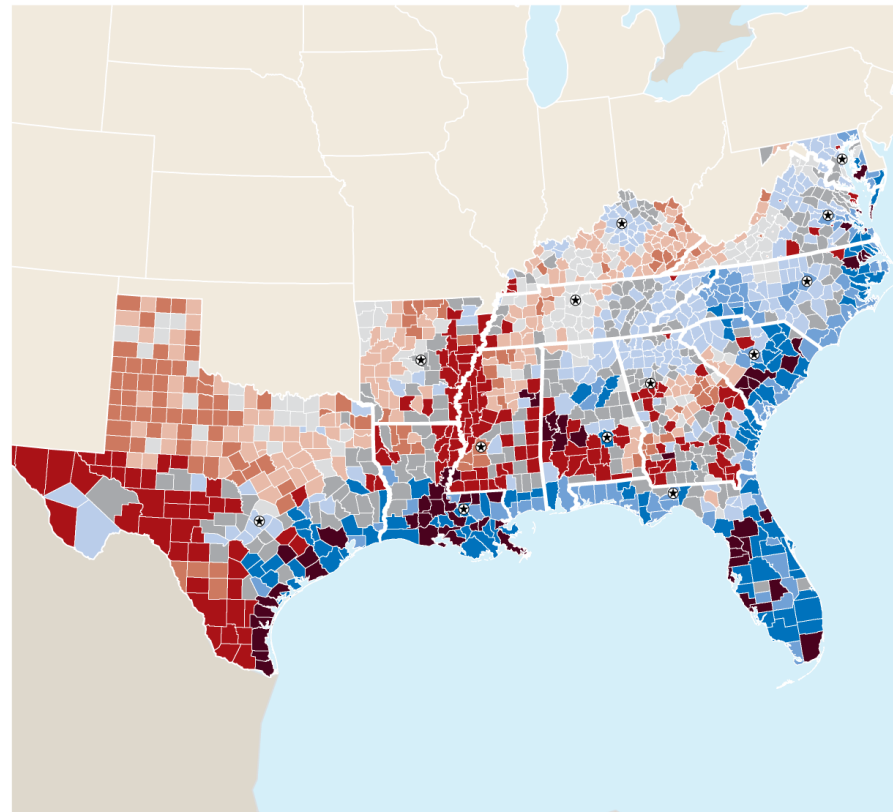Social Vulnerability Identification | Southeastern and Gulf Border States
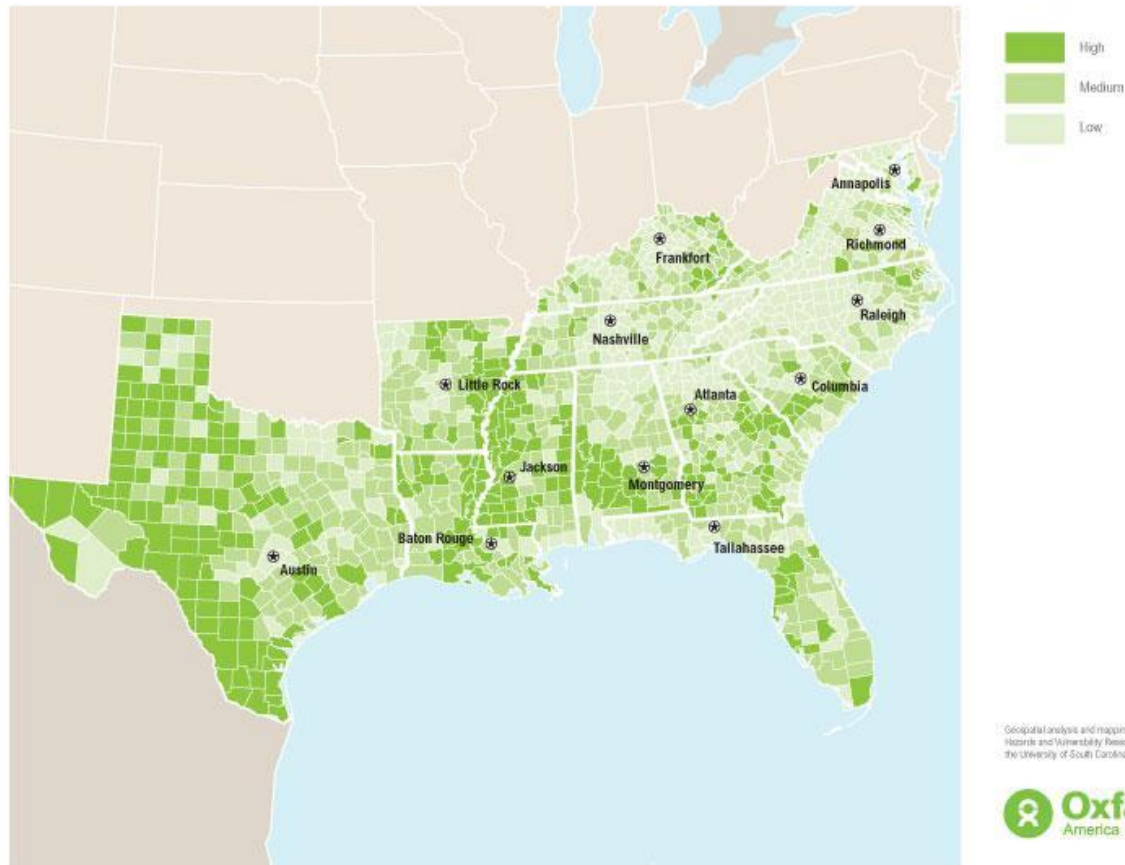
Regional SoVI by Multi-hazard map

Areas of Interest

- West Texas

- Mississippi Delta Region

- Coastal Communities

Social Vulnerability to Multiple Hazards | Southeastern and Gulf Border States
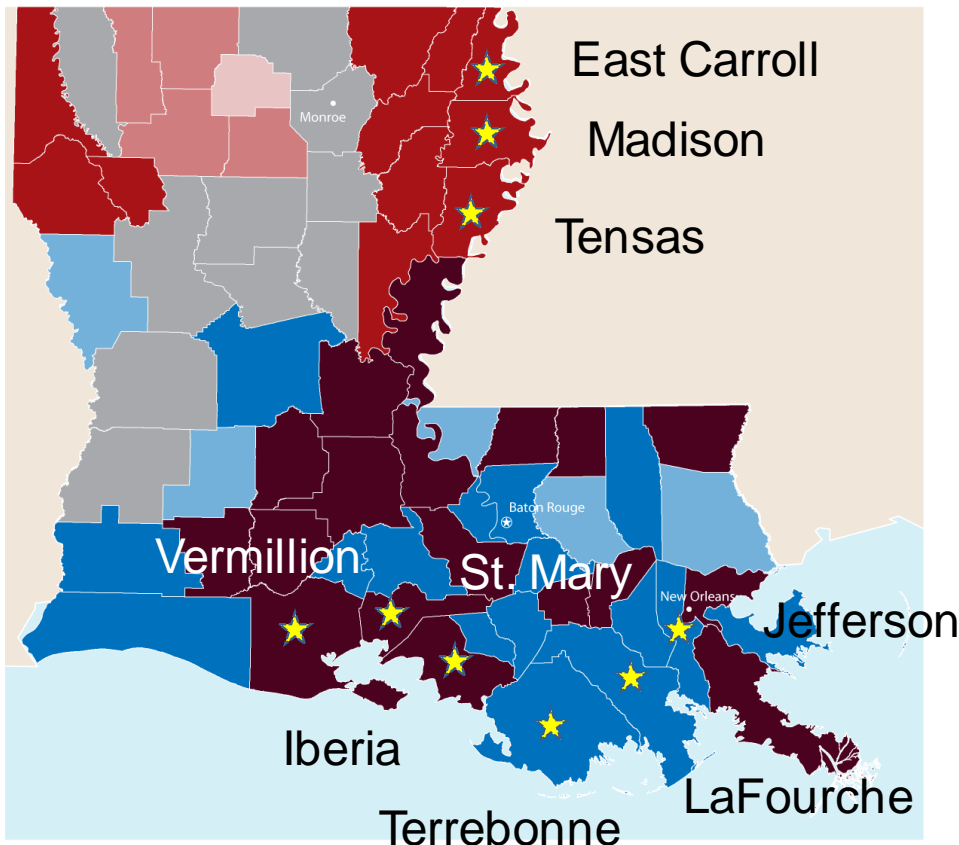
Geospatial analysis and mapping provided by the Hazards and Vulnerability Research Institute at the University of South Carolina
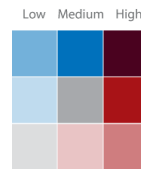
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LA SoVI by Multi-hazard

Social Vulnerability to Multiple Hazards | Louisiana

East Carroll

Madison

Tensas

Vermillion

St. Mary

Jefferson

Iberia

Terrebonne

LaFourche

Monroe

Baton Rouge

New Orleans

Social Vulnerability

Low   Medium   High

High

Medium

Low

Multiple Hazards

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

Areas of Interest

South Central Area
- High Hazard & High SoVI (HOTSPOTS)

Southern Louisiana
- High Hazard and Medium SoVI

Upper MS Delta
- High SoVI & Medium Hazard

MS SoVI by Multi-hazard

Areas of Interest

### MS River Valley

- High Hazard and Medium SoVI

Coastal

- High SoVI & Medium Hazard

Social Vulnerability to Multiple Hazards | Mississippi

Washington

Warren

Greenville

Issaquena

Jackson

Pearl River

Biloxi

George

Stone

Social Vulnerability

Low Medium High

High
Medium
Low

Multiple Hazards

Geospatial analysis and mapping provided by the Hazards and Vulnerability Research Institute at the University of South Carolina
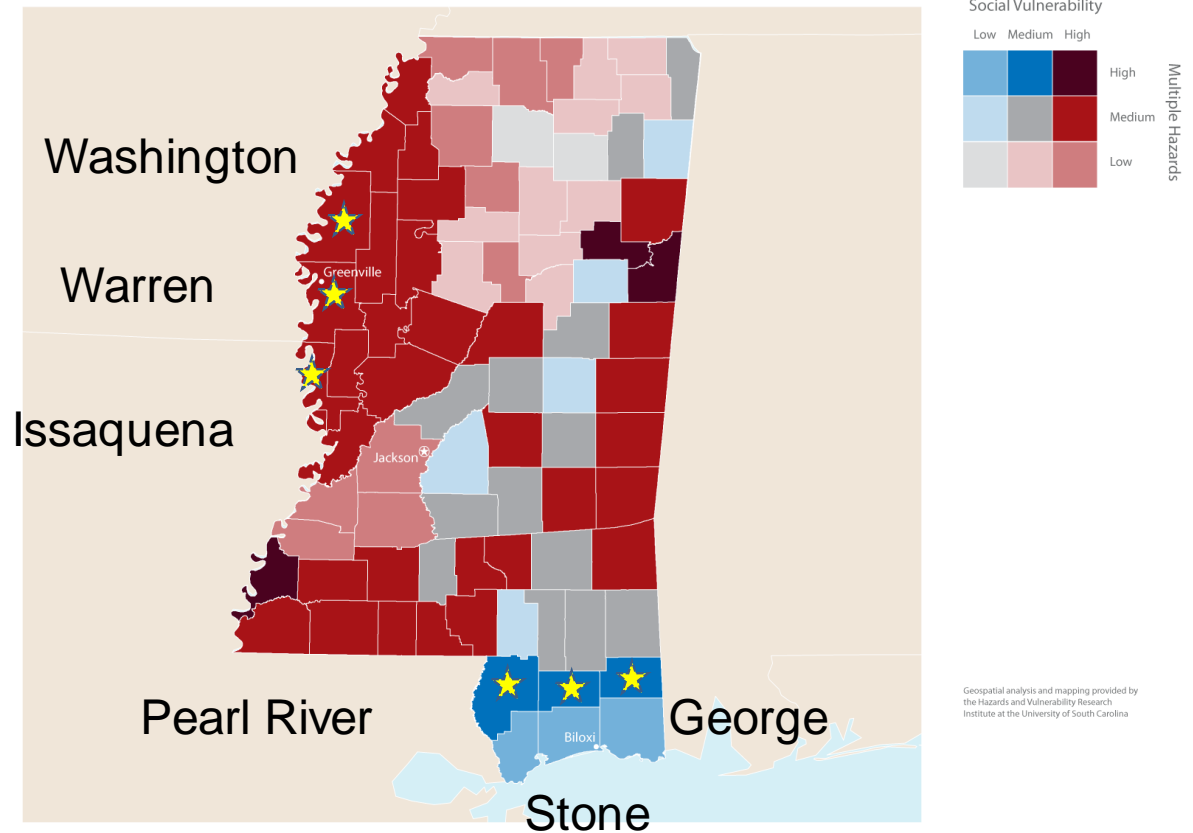
Scaling Down for Additional Detail
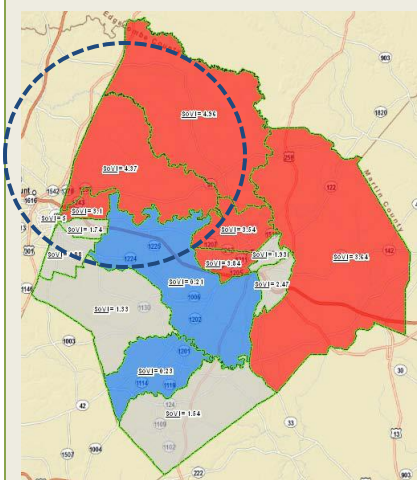
Vulnerable populations using the SoVI index downscaled to the census tract level (red symbolizes elevated levels of social vulnerability, dark blue equal low levels

1% chance flood zone (or more commonly called the 100-year floodplain).
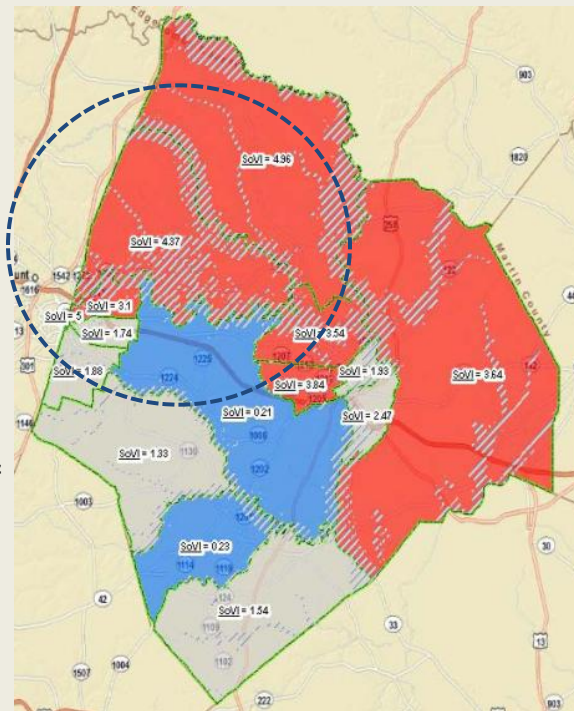
The bottom map shows a detailed geospatial analysis of the intersection of the flood zones and vulnerable populations with the actual numbers of residents in a specific census tract provided in the chart.
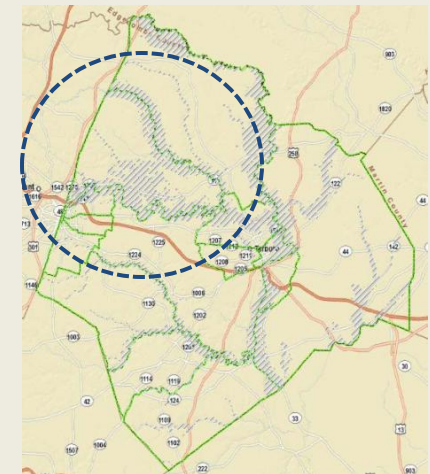
Socioeconomic and Demographic Characteristics (2000)	Value in Tract
Total population	3,944
# of persons under 5	275
# persons over 65	318
Number living below poverty	666
Number of African Americans	2,830
Number of renters	365
Number of Female Headed Households	325

Recap

- Identifying socially vulnerable populations in relation to physical threats can provide insight for the following areas:

  - Research
    - Helps us to shift us from "business as normal" to developing real tools and solutions to influence policy decisions and planning

  - Advocates
    - Understanding specifics about who is threatened by which hazard enables more focused efforts at change

  - Governments
    - Detailed knowledge at the county level provides decision makers at all levels (federal, state, local) with a decision support tool

About Oxfam America US Program

- **Oxfam mission:** To create lasting solutions to poverty, hunger, and social injustice.
- Originally located in Washington, DC, Oxfam America relocated to Boston in 1973
- Oxfam America is an international relief and development organization that creates lasting solutions to poverty, hunger, and injustice. Together with individuals and local groups in more than 100 countries, Oxfam saves lives, helps people overcome poverty, and fights for social justice.

Why Oxfam is commissioned this research

- To strengthen disaster preparedness plans by prioritizing assistance to those least able to cope when disaster strikes.
- To promote coastal restoration, rebuilding projects that create more resilience to high winds and flooding, water efficiency projects, and early warning programs— all of which can also create jobs.
- To support legislation that reduces greenhouse gas emissions and provides resources for poor people here and abroad to build their resilience.

Contact information

Thank You

Dr. Jasmine Waddell
Senior Officer for Research
US Regional Office
Oxfam America
226 Causeway Street, 5th Floor
Boston, MA 02114
617.728.2437
jwaddell@oxfamamerica.org

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Social Vulnerability Index
http://sovius.org