

Social Vulnerability and the Texas Coast: Extending the Notion of Vulnerability to Promote Resilient Coastal Communities

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Hazard Reduction and Recovery Center

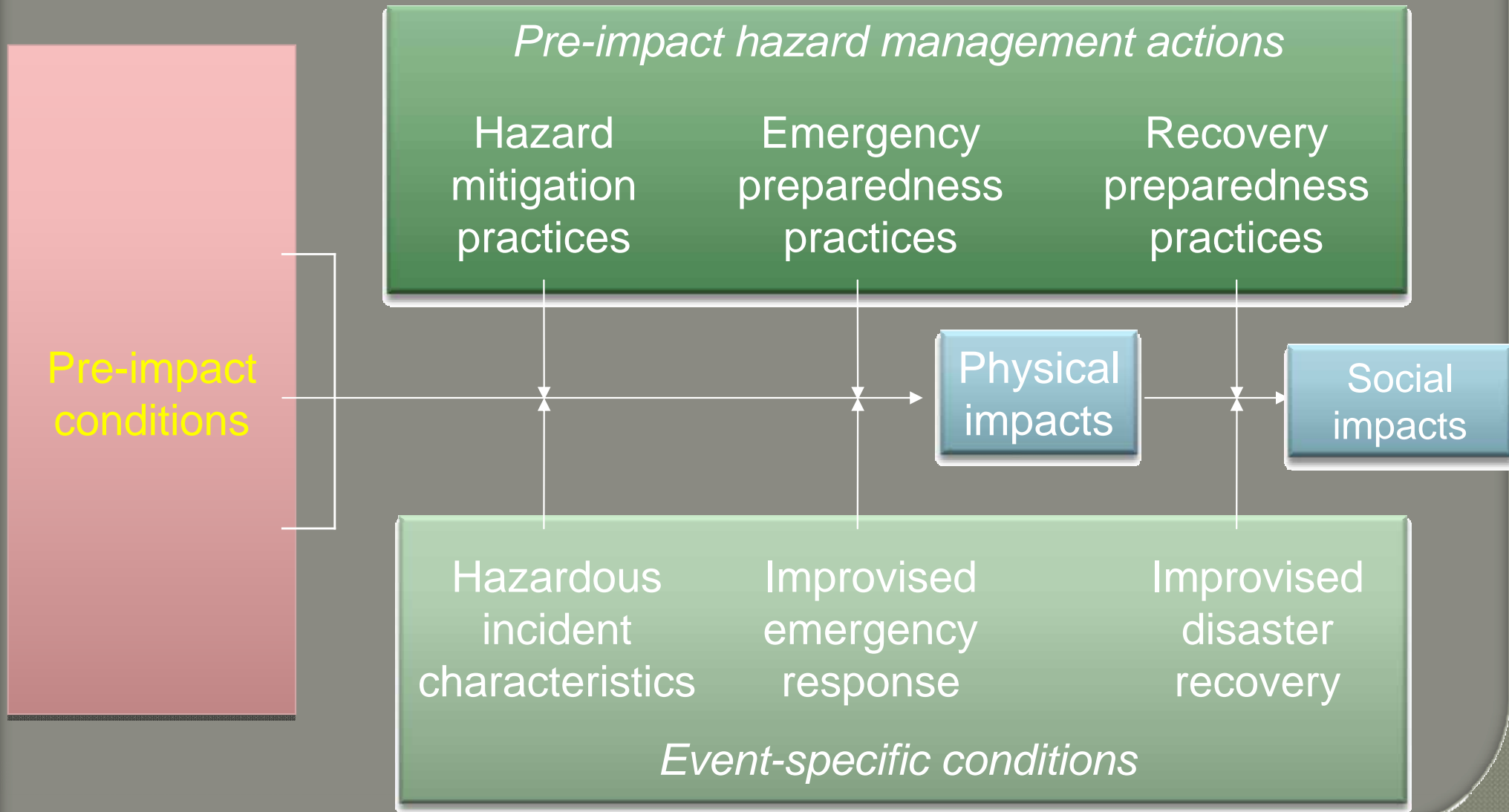
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A Model of Disaster Impacts*



* Modified from Lindell, Prater, and Perry, 2007

Hazard Management Interventions

● Hazard Mitigation

- Actions taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects” (FEMA, 2009)
- “pre-impact actions that provide passive protection at the time of disaster impact” (Lindell, Prater, Perry)
- (Will come back to this in a moment)

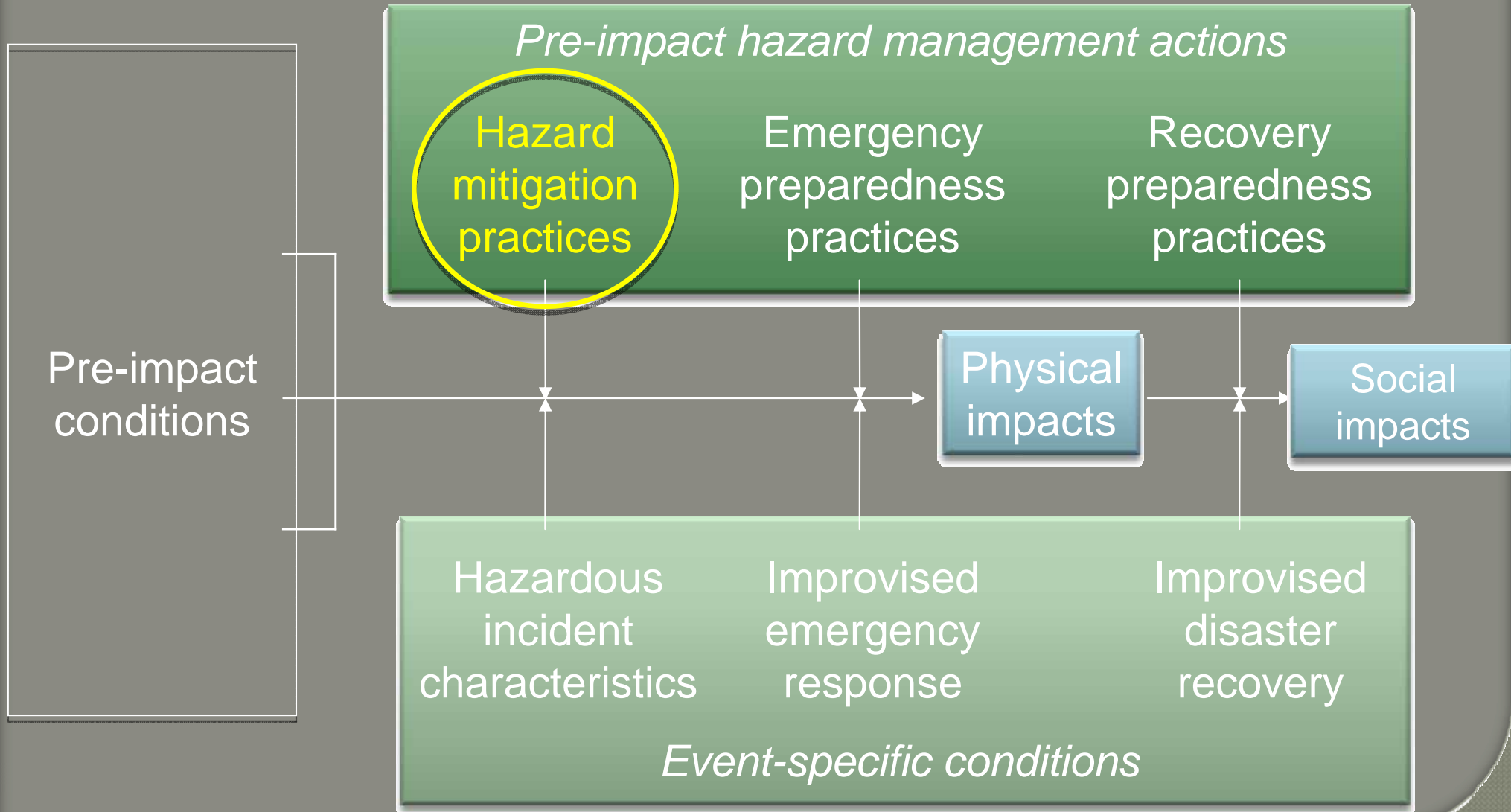
● Emergency Preparedness Practices

- Pre-impact actions that provide the human and material resources needed to support active responses at the time of hazard impact (Lindell and Perry 2000)
- Emergency assessment actions (forecast), hazard operations (short term actions taken to protect), population protection (evacuation/warning), incident management actions.

● Recovery Preparedness practices

- Pre disaster recovery planning for coordinated effective recovery actions.

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● Forms of Mitigation:

- Structural vs Non structural
 - Structural: Engineering solutions (dams, levees, etc)
 - Non-structural: policy related solutions, land-use planning
 - But these distinctions can be arbitrary and confusing.
 - Building Codes are a policy distinction, yet can refer to “structural” changes in the way our homes and buildings are constructed

Types of Mitigation Actions

① Hazard Source Control

- Generally refers to technological hazards
 - Controlling & suppressing fire, fuel controls, spill controls
 - chemical (using non-toxic chemicals, preventing leaks, reducing quantities, etc.).

② Community Protection works

- Usually refers to major public safety works: Dams, levees, river channelization, canals, landslide control, industrial hazard controls

③ Land-Use Practices

- Implemented through: risk communication, incentives, and sanctions
- Acquisition of land/development rights, zoning, subdivision regulation, tax incentives, density bonuses, etc.

Types of Mitigation Actions

⊙ Building Construction practices

- Building codes and strengthening components
- Structural protections from flood, wind, seismic, etc.
- Retro-fitting programs

⊙ Natural Resource preservation and restoration

- Preserving and restoring "natural" resources and the services they provide
 - Wetlands
 - re-vegetation and reforestation
 - dune protection

Types of Mitigation Actions

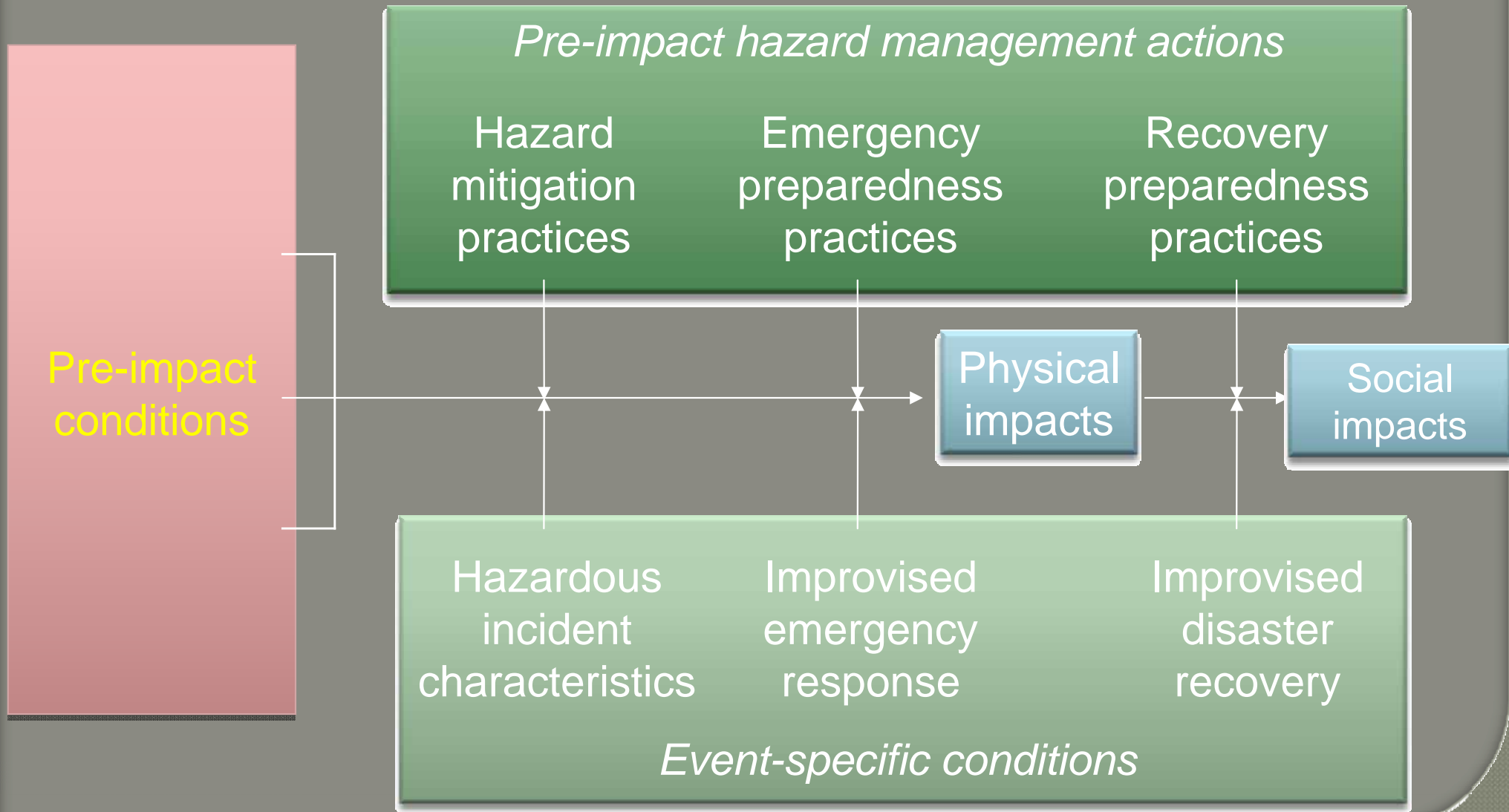
● Risk communication, education, and outreach

- Targeting accurate risk and vulnerability assessment
- Signage to educate the public on different hazard exposure
- Hazard disclosure for property
- Comprehensive education programs within schools

● Social infrastructure development

- community and neighborhood based organizations, vulnerable population organizations
- Promoting non-profits and other community based organizations that address chronic vulnerability issues (food banks, women's shelters, etc.)
- Partnerships and reciprocal agreements (intra and inter community)

A Model of Disaster Impacts*



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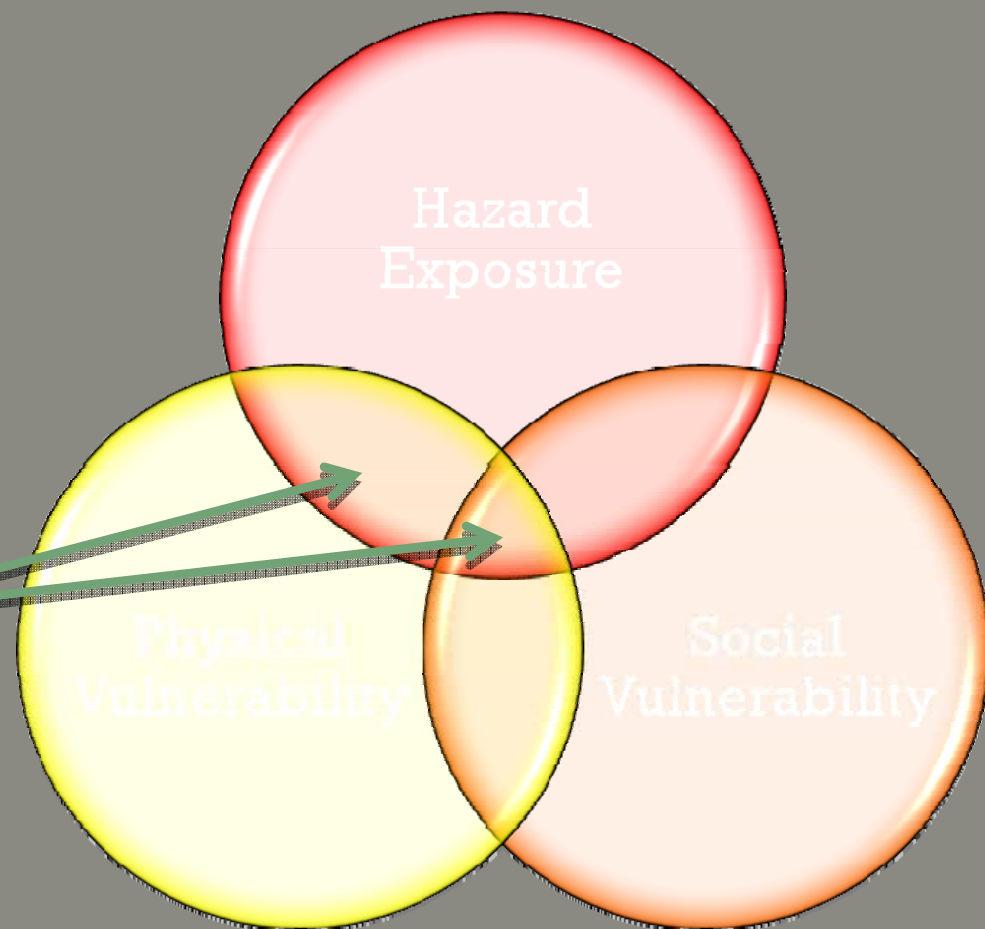
Pre-impact Conditions

- The pre-existing conditions that shape the specific impacts of disasters
 - Hazard exposure
 - Physical vulnerability
 - **Social Vulnerability**
- These are to a large extent knowable and potentially predictable
 - Unfortunately they are often ignored
 - And yet, the basis for effective pre-impact hazard management planning – **mitigation**, **preparedness**, and **recovery** planning -- should be based on a understanding and assessment of these pre-existing conditions.

Pre-impact Conditions

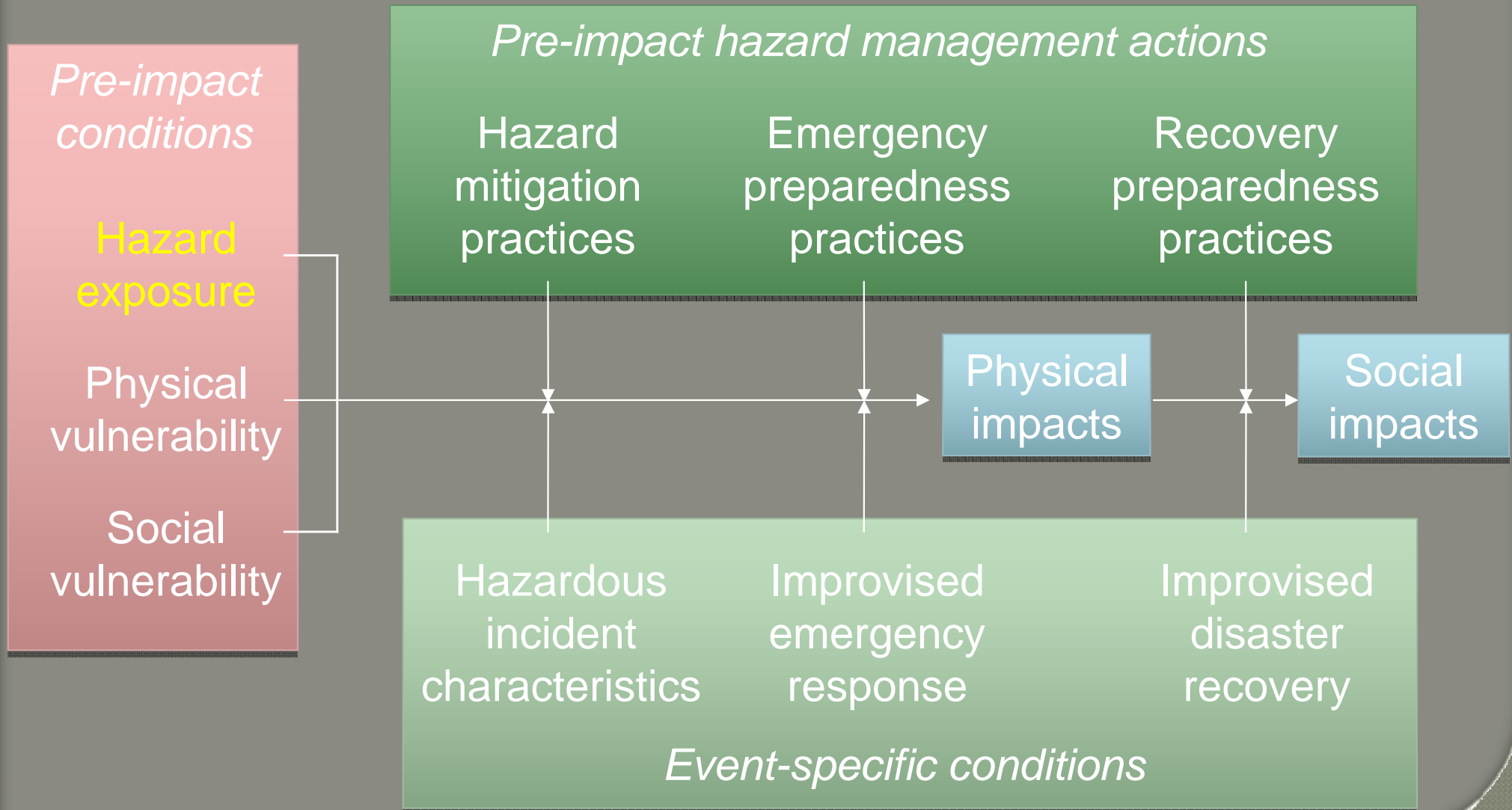
- A critical element guiding hazard management planning should be the convergence or overlap among:

- Hazard exposure
- Physical vulnerability
- Social Vulnerability



These overlap represent hotspots that are prime targets for pre-impact hazard management actions related to mitigation, preparation, and **recovery planning**

A Model of Disaster Impacts*

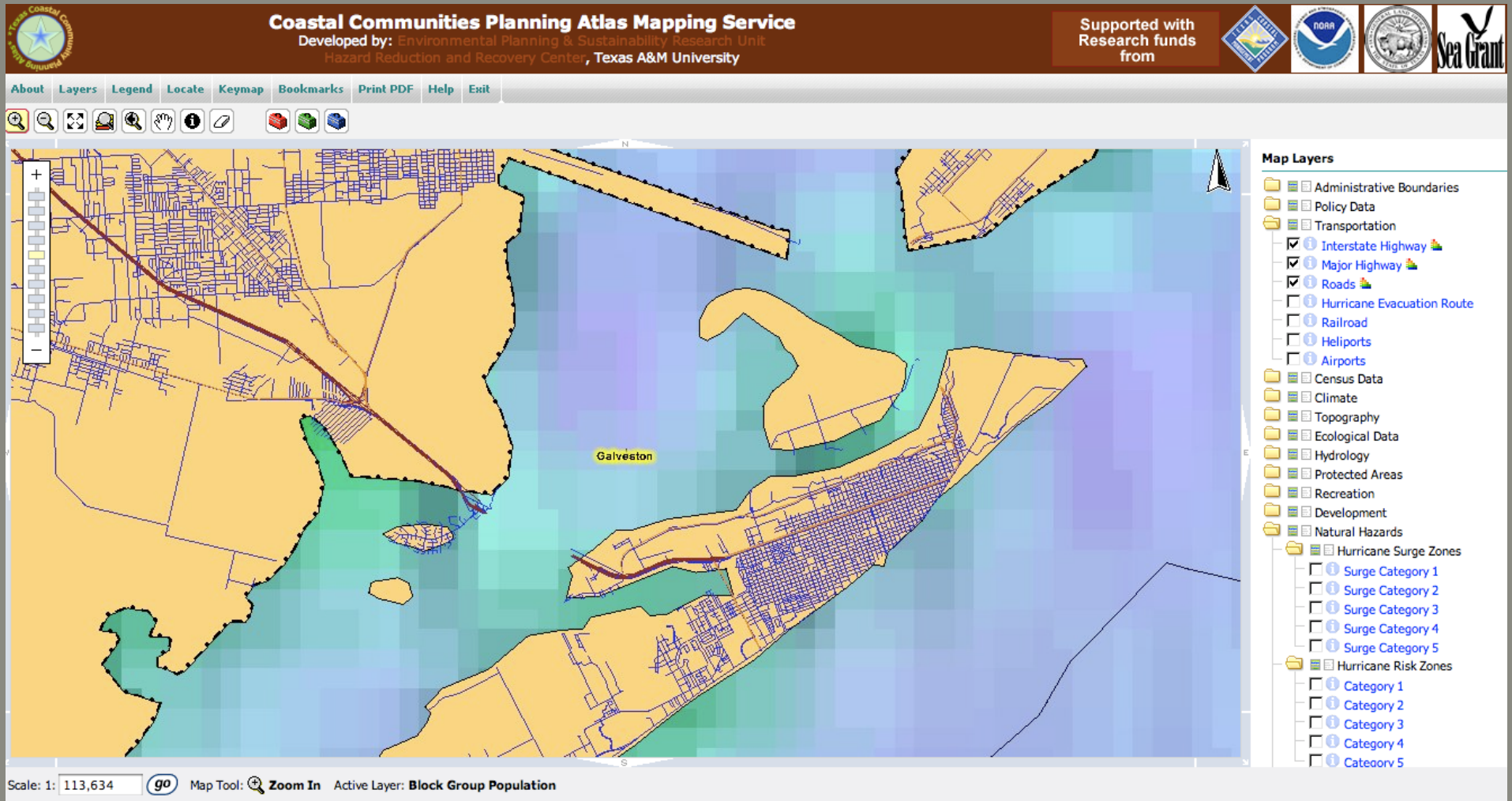


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Hazard Exposure

- Geographical areas can be affected by disaster impact in part because of their exposure to hazard agents
 - Flood
 - Wind
 - Surge
 - Earthquake
 - Technological or man-made hazards

Hazard Exposure*



* From: coastalatlasmapping.tamu.edu or coastalatlasmapping.tamug.edu

Hazard Exposure

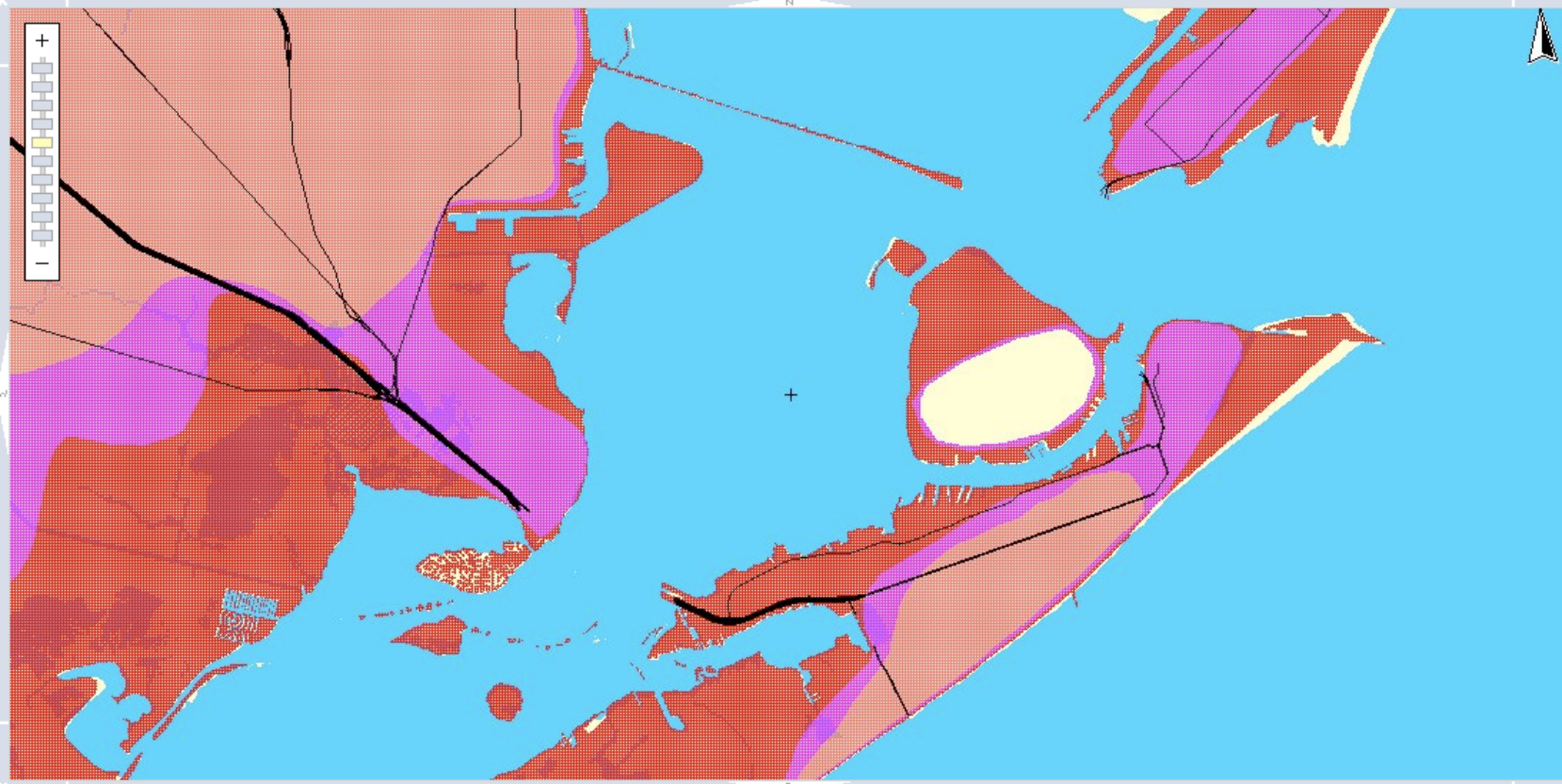
Coastal Communities Planning Atlas Mapping Service

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Map Layers

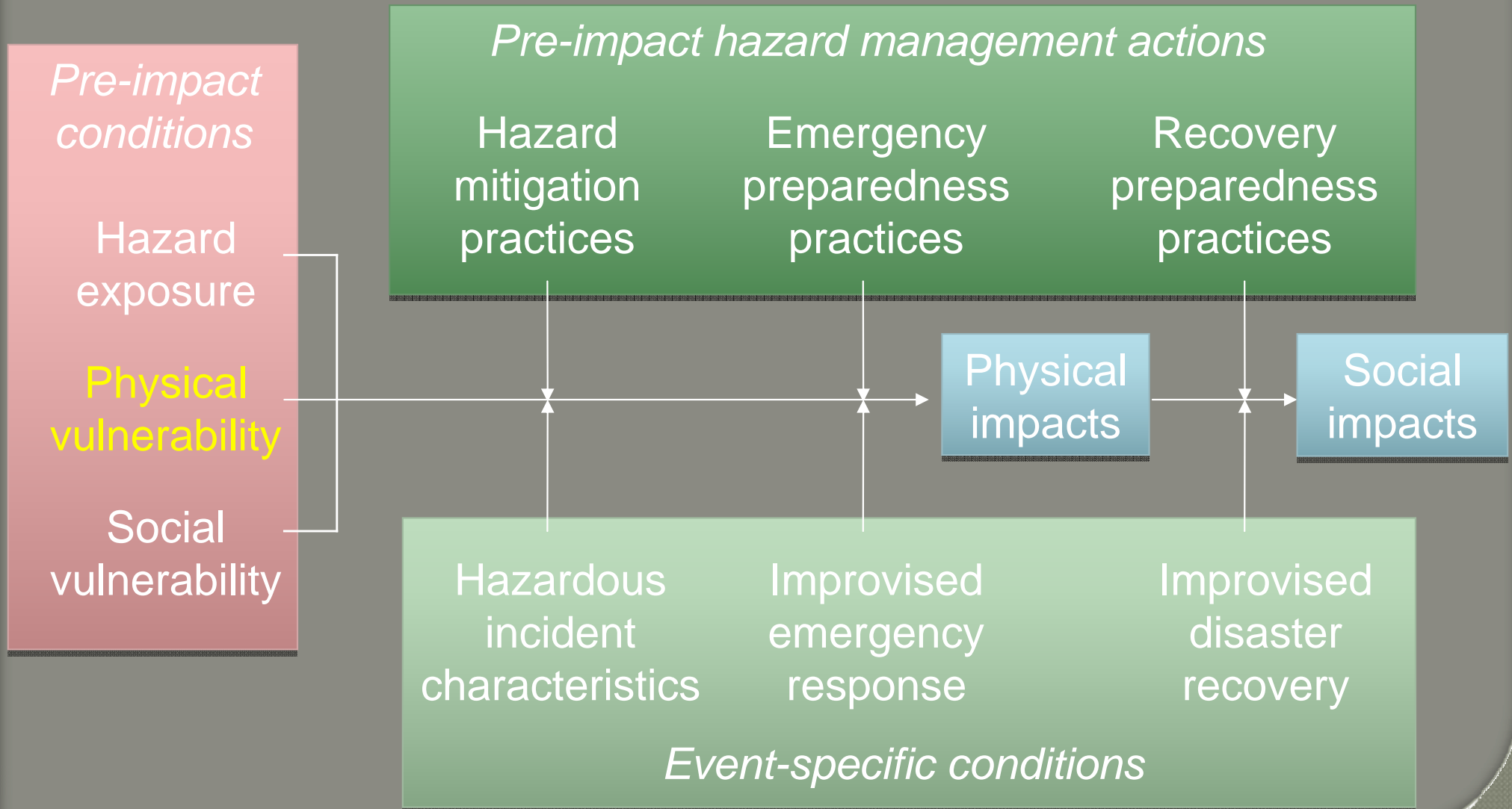
- Political & Administrative Boundaries
- Transportation
 - Interstates
 - Major Highways
 - Hazardous Cargo Routes
 - Hurricane Evacuation Routes
- Demographic Data (2000)
 - County
 - Census Tracts
 - Census Blockgroups
 - Census Blocks
- Natural Hazards
 - Hurricanes
 - Surge Zones
 - Category 5
 - Category 4
 - Category 3
 - Category 2
 - Category 1
 - New Risk Zones
 - Hurricane Tracks (1851-2005)
 - Flooding
 - FEMA Floodplains
- Ecosystem Criticality Measure (ECM)
- Social Vulnerability Assessment
- Location Quotient Analysis
- Land Cover Data

Automatically Refresh Map

[\[Search for layers\]](#)

Scale: 1: 111,020 [go](#) Map Tool: Pan Active Layer: Baselandbay

A Model of Disaster Impacts*



Physical Vulnerability

- Susceptibility to physical impacts
 - Buildings
 - Various building codes (existing and future)
 - Critical facilities/evacuations/shelters
 - Infrastructure
 - Vulnerabilities due to location and other characteristics
 - Natural environment
 - Population (concentrations/densities)
 - Animals
 - Crops

Physical vulnerabilities

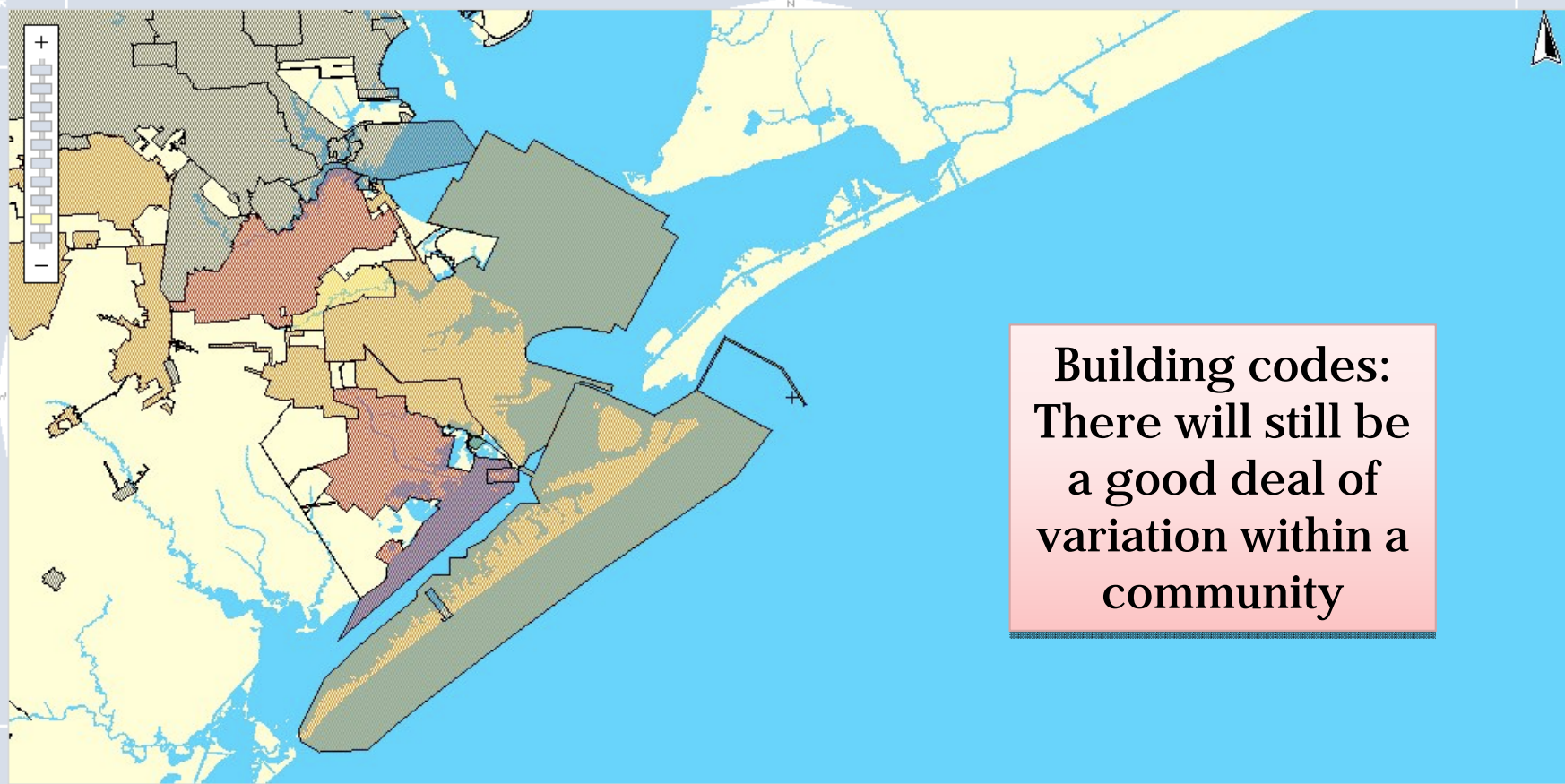
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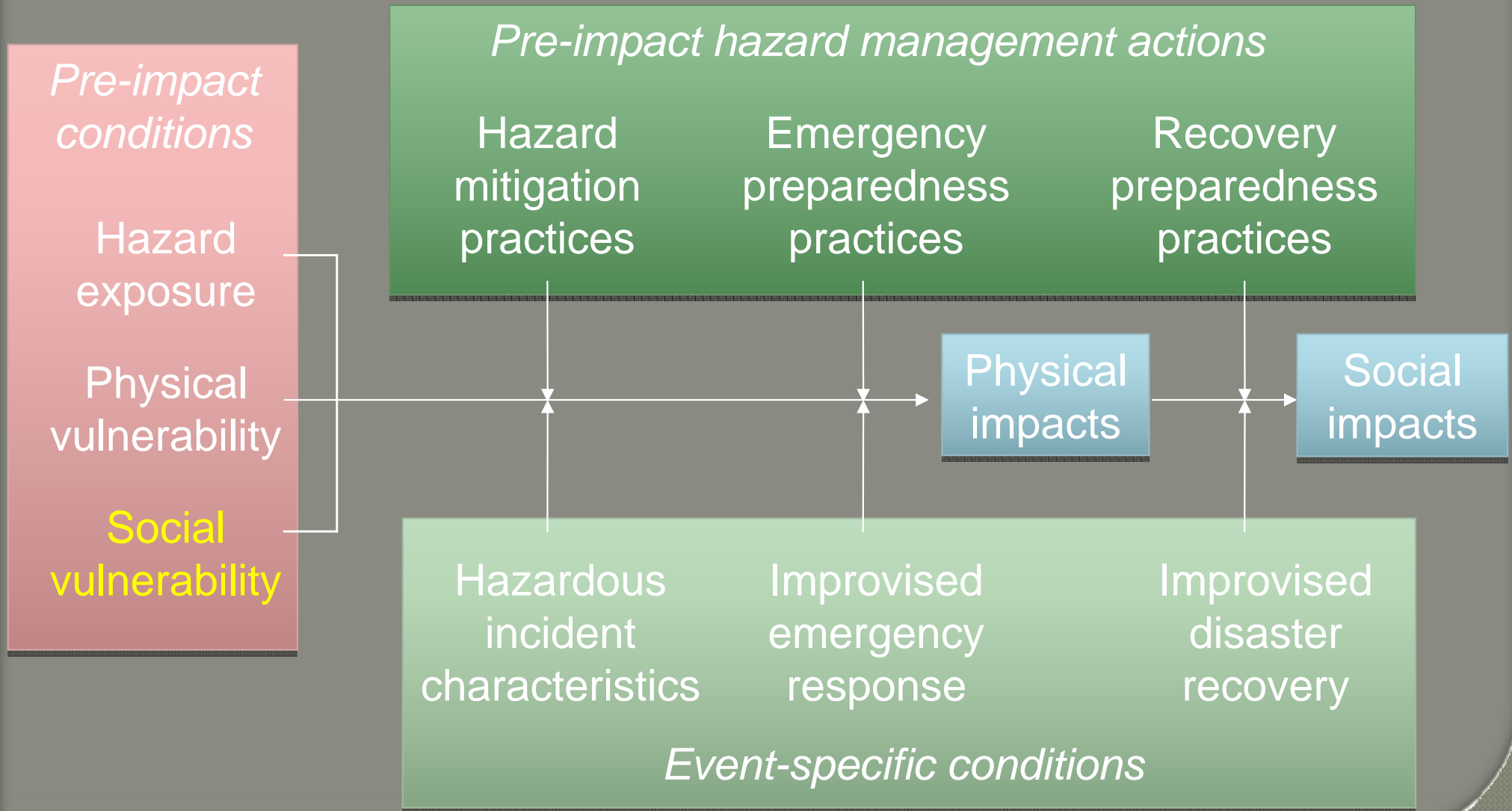


Map Legend

- Buildingcodes**
- 2000 IRC
 - 2000 IRC/IBC
 - 2003 IRC
 - 2003 IRC/IBC
 - Data-NA
 - No Code
- Baselandbay**
- Texas
 - Bay/Gulf of Mexico
 - Louisiana

**Building codes:
There will still be
a good deal of
variation within a
community**

A Model of Disaster Impacts*



Social Vulnerability...

- A characteristic of individuals or groups in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard
- involves a combination of factors that determine the degree to which a person or group is at risk to discrete and identifiable events in nature or society
- By group, we could mean any form of social system, such as a household, family, business, etc., although it generally refers to household.

Social Vulnerability...

- Social vulnerability will rarely be uniformly distributed among the individuals, groups, or various populations comprising social systems
- It will vary both within communities and across and communities.
- Hence, the risk to disaster impact, even if we hold the hazard and physical vulnerability constant, will not be uniformly distributed.

Social Vulnerability...

- Focus is on social factors and processes that generate vulnerability in terms of a person's or group's capacity to anticipate, cope with, resist and recover from the impact of a natural hazard
- These capacities will be contingent upon a host of factors, particularly those factors determining access to societies scarce resources.
 - Economic status
 - Race and ethnicity
 - Gender & Age

A few examples of social vulnerability measures

Household structure	Larger families, particularly those with high number of dependents, relative to wage/salary earners are more vulnerable, as are single parent, particularly female headed households.
Socioeconomic Status	Higher levels of wealth, income, prestige, and political power insures enhanced ability to ability to prepare for, mitigate against and cope with physical impacts. Often have much higher resources base to draw from to mitigation, respond and recover.
Gender	Women have more difficult time in recovery because of constrained employment opportunities and lower wages; often must take primary responsibility for child care and households activities.
Race/ethnicity	Language, culture, and discrimination
Age (elderly and children)	Both young and old are at higher risk due to reduce mobility, economic constraints, legal constraints. Households with these higher risk groups can be limited due to time and resource constraints.
Tenure	Renters more transient, fewer resources, less-control, more dependent on owner for improvements, repair, mitigation, etc.
Urban/Rural	Rural residents are more vulnerable due to isolation, tend to have fewer employment opportunities, are poorer, etc.
Special Needs populations	Sick, infirmed, disabled, etc.
Employment status	Those who are un- or under-employed have reduced resources from which to draw from.

Example: Race/Ethnicity in the U.S. with a focus on Housing issues in the United States

- Housing markets systematically fail when it comes to providing low-income quality housing which disproportionately impacts racial and ethnic minorities. (Lake 1980; Bratt et al. 1986; Horton 1992; Alba and Logan 1992; Gyourko and Linneman 1993).
- Racial and ethnic minorities: tend to have poorer quality of housing and that housing is often segregated into low-valued neighborhoods creating “communities of fate.” (Stinchcomb 1965; Logan and Molotch; 1987; South and Crowder 1997, 2004)
- The US still has major problems with discrimination against minorities in buying, selling and renting housing due to racial steering, redlining, attitudes and lender discrimination. (Guy et al. 1982; Sagalyn 1983; Horton 1992; Feagin and Silkes 1994; Oliver and Shapiro 1997; Holloway and Wyly 2001; Shapiro 2004; Holloway and Wyly 2001; Squires and Kim 1995);

Example: Race/Ethnicity in the U.S. with a focus on Housing issues in the United States

- Blacks experience higher mortgage rejection rates, pay higher interest rates including sub-prime, are more likely to be subject to predatory lending practices, and, after buying a home, experience lower appreciation rates. (Oliver and Shapiro 1997; Flippen 2004; HUD 2008)
- Minorities, particularly Blacks, also find major problems with procuring insurance, in general, and quality insurance in particular. (Squires and Velez 1987; Squires 1998; Squires et al. 2001)

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Levels of Social Vulnerability Analysis

Social Vulnerability mapping

Coastal Atlas uses Block-group data for counties along the Texas Coast

13 different measures of social vulnerability are employed

these are combined to capture 4 dimensions of social impacts or consequences

Furthermore, the entire set can be combined to capture hyper-vulnerability or to identify social vulnerability hotspots.

First order	Second-Order	Third-order
Poverty (persons below poverty)	Potential Child Care Needs	Combined Vulnerability Hot-spots
Gender/household structure (female Headed households)		
Children (persons below 17)		
Elders (persons above 65)	Elder Care Needs	
Elder Poverty (Elders below poverty level)	Public Transportation needs	
Public Transportation dependency (workers using Pub.Transportation)		
Travel Time (Aggregate travel time by Public Transportation)		
Public Transportation. Accessibility (Distance to nearest Public transportation facility)	Temporary Shelter and housing Recover Needs	
Employment (unemployed over 16)		
Vacant Housing (vacant housing units)		
Housing Tenure (renters)		
Race/Ethnicity (black)		
Income (Per-capita income)		

Social vulnerabilities



Coastal Communities Planning Atlas Mapping Service

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- [-] Social Vulnerability Assessment
 - [-] Base Proportions 2000 (Click info for details)
 - Population Age < 5 yrs.
 - Single Parent HHs with Children
 - Population Age >65 yrs.
 - Population Age >65 yrs. below Poverty Line
 - Workers using Public Transportation
 - Households without Vehicle
 - Occupies Housing Units
 - Renters
 - Race (Non-whites)
 - Persons in Group Quarters
 - Housing Units >20 yrs. Old
 - Mobile Homes
 - Persons in Poverty
 - Occupied Housing Units without Telephone
 - Education less than HS for Age > 25 yrs.

Poverty: Note, these appear to be concentrated in more high hazard areas.

Scale: 1: 111,020 Map Tool: Pan Active Layer: Baselandbay

* From: coastalatlus.tamu.edu or coastalatlus.tamug.edu

Social vulnerabilities

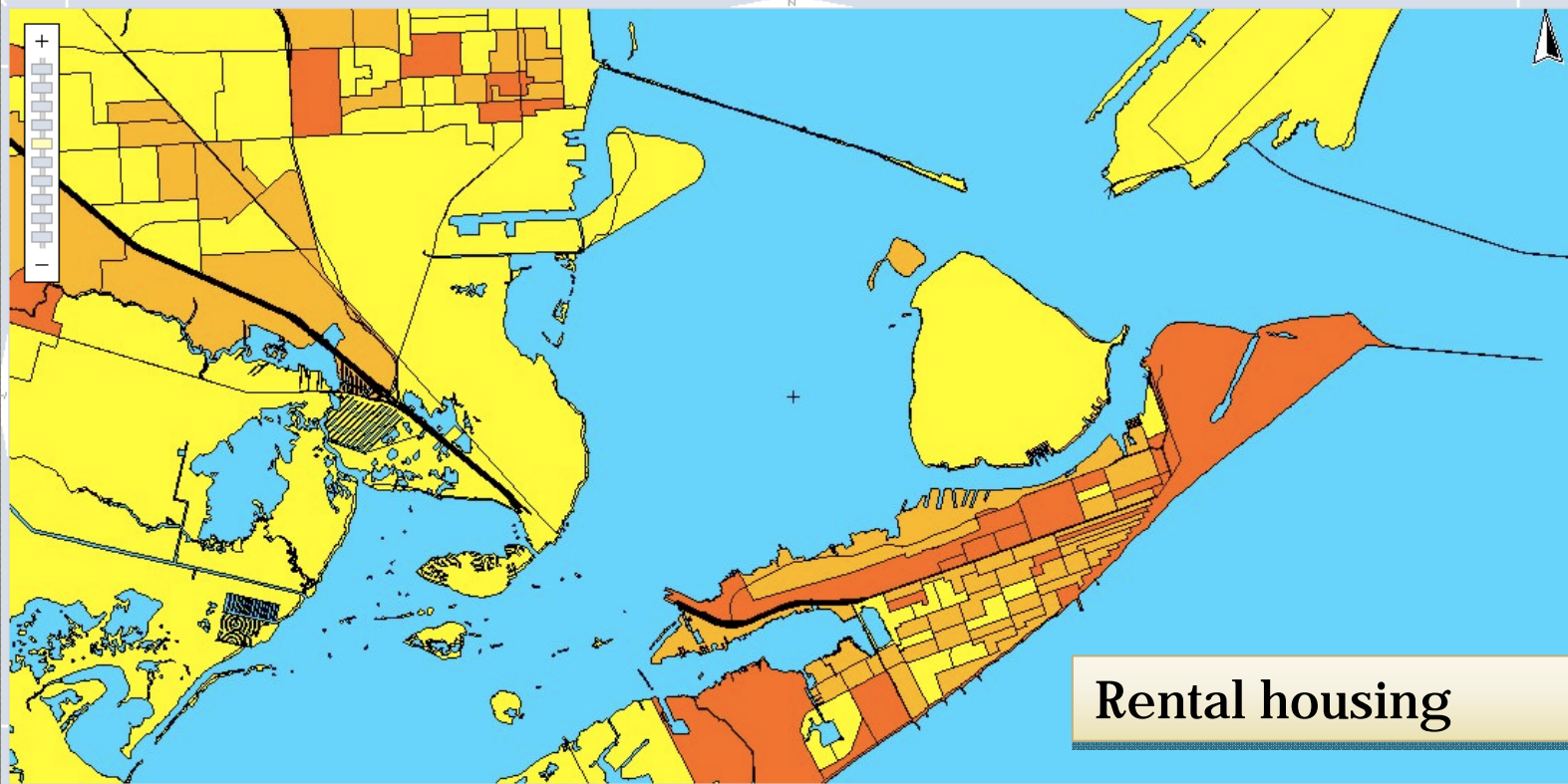
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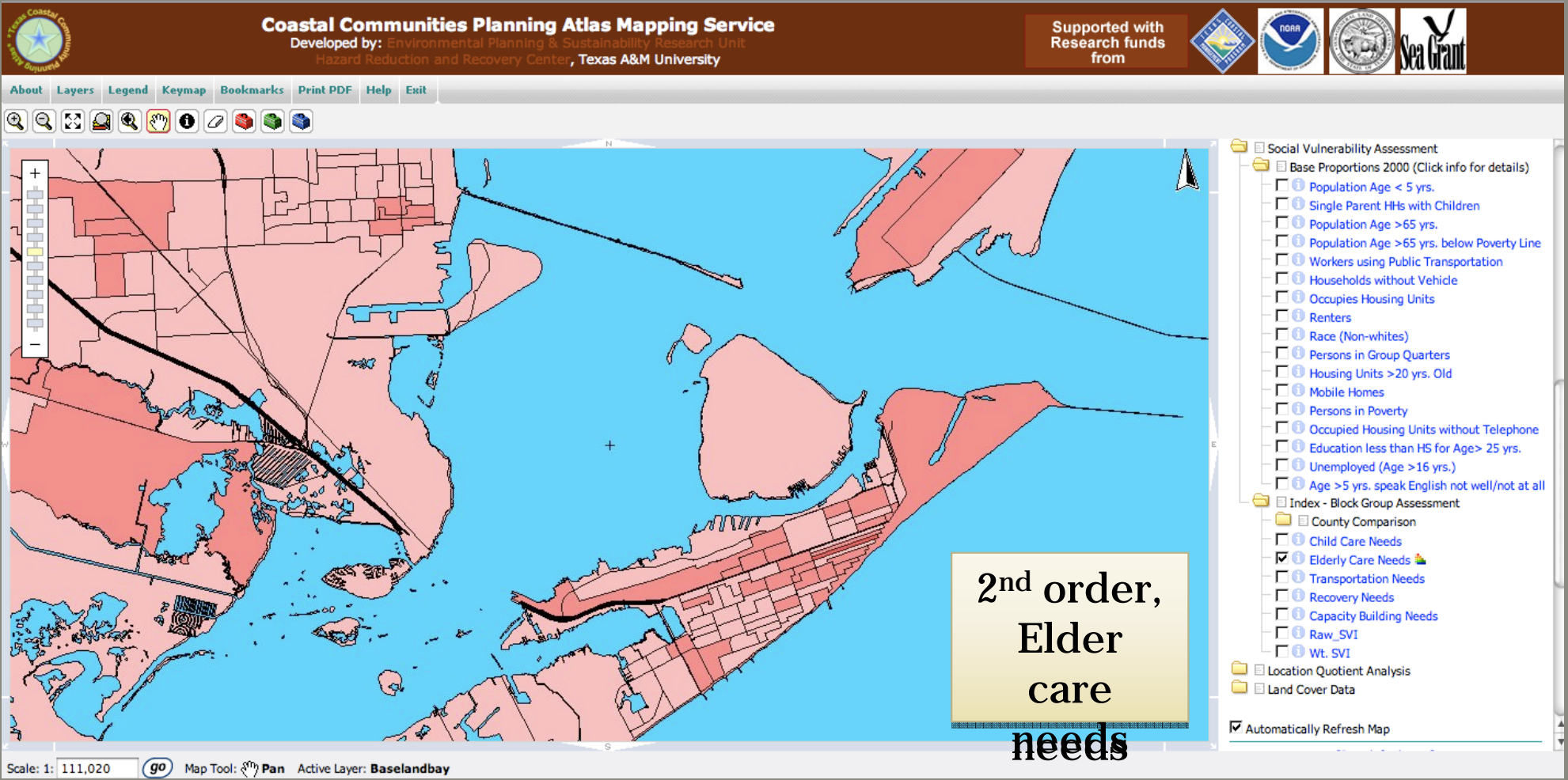


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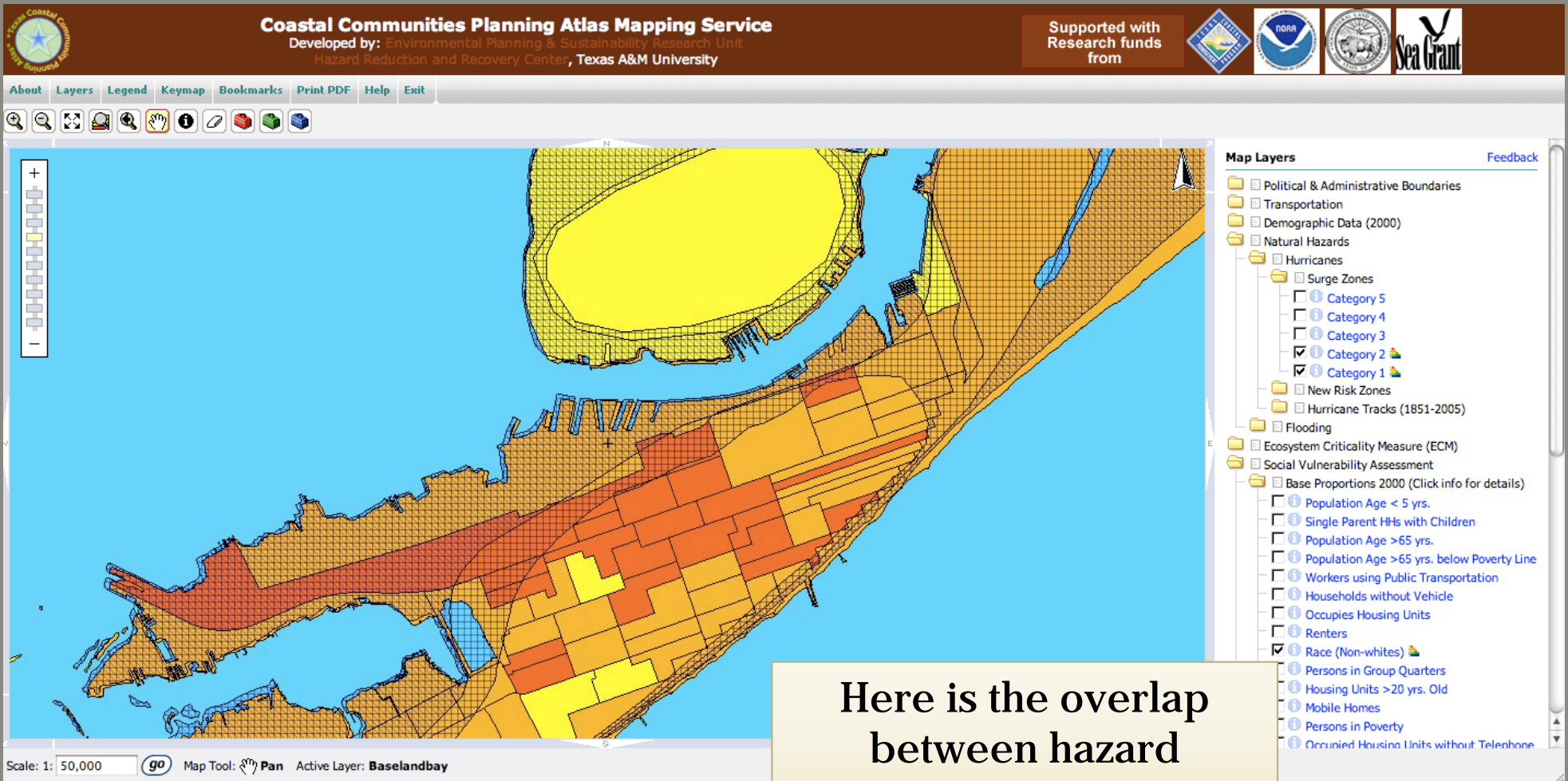


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 - Education less than HS for Age > 25 yrs.
 - Unemployed (Age >16 yrs.)
 - Age >5 yrs. speak English not well/not at all
 - Index - Block Group Assessment
 - County Comparison
 - Child Care Needs
 - Elderly Care Needs
 - Transportation Needs
 - Recovery Needs
 - Capacity Building Needs
 - Raw_SVI
 - Wt. SVI
 - Location Quotient Analysis
 - Land Cover Data
- Automatically Refresh Map

Social vulnerabilities

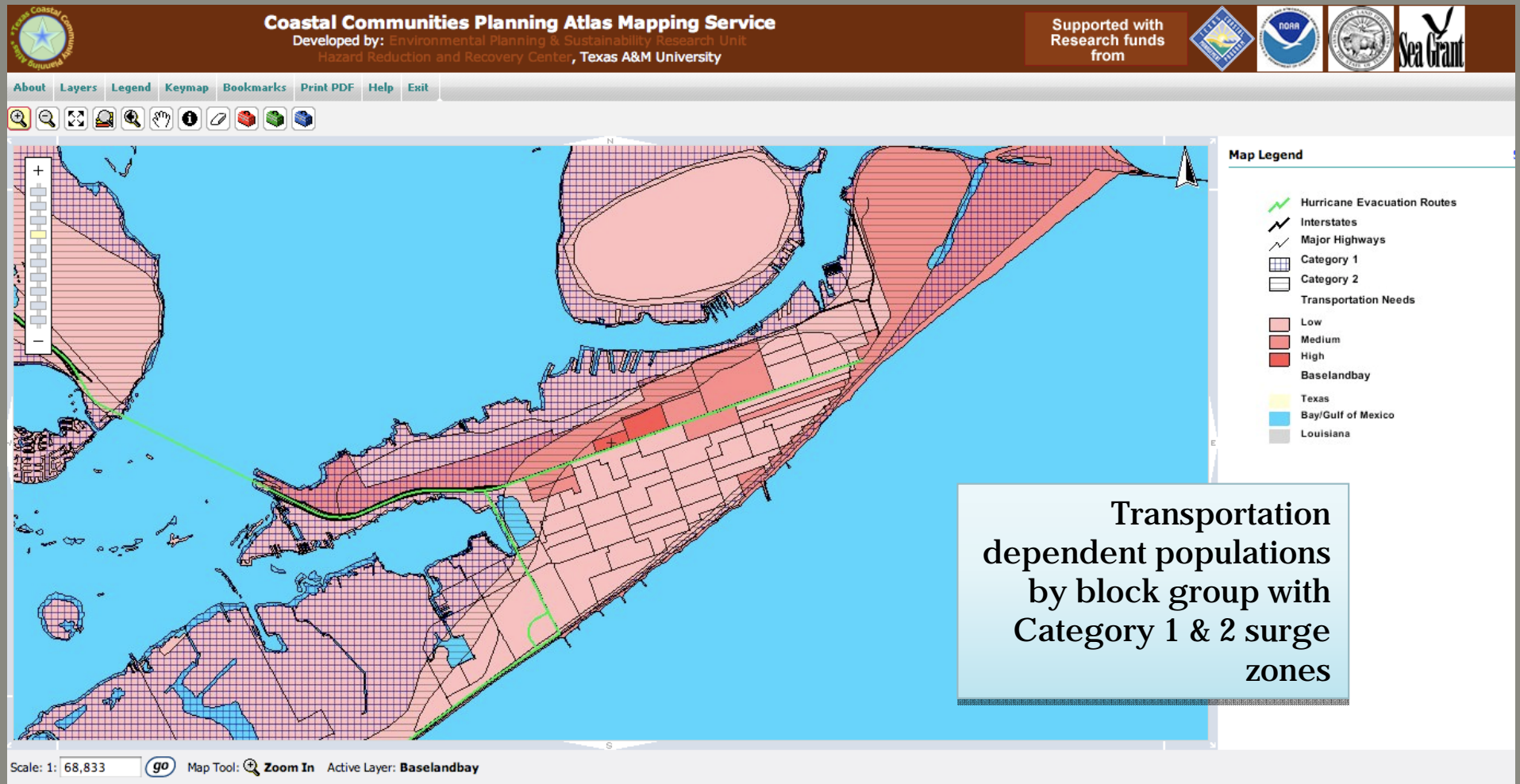


Social vulnerabilities

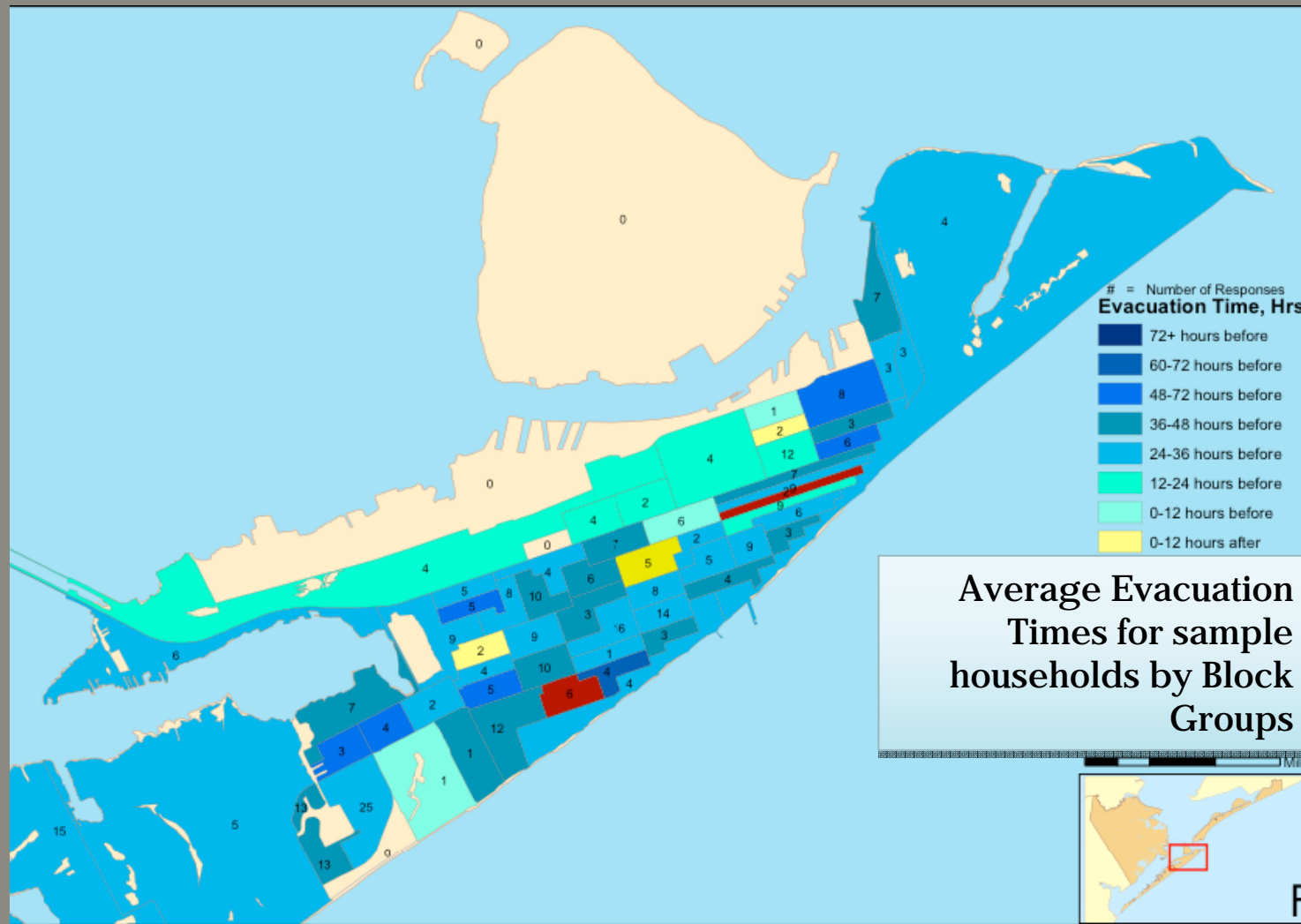


Here is the overlap between hazard exposure and one dimension of SV, race

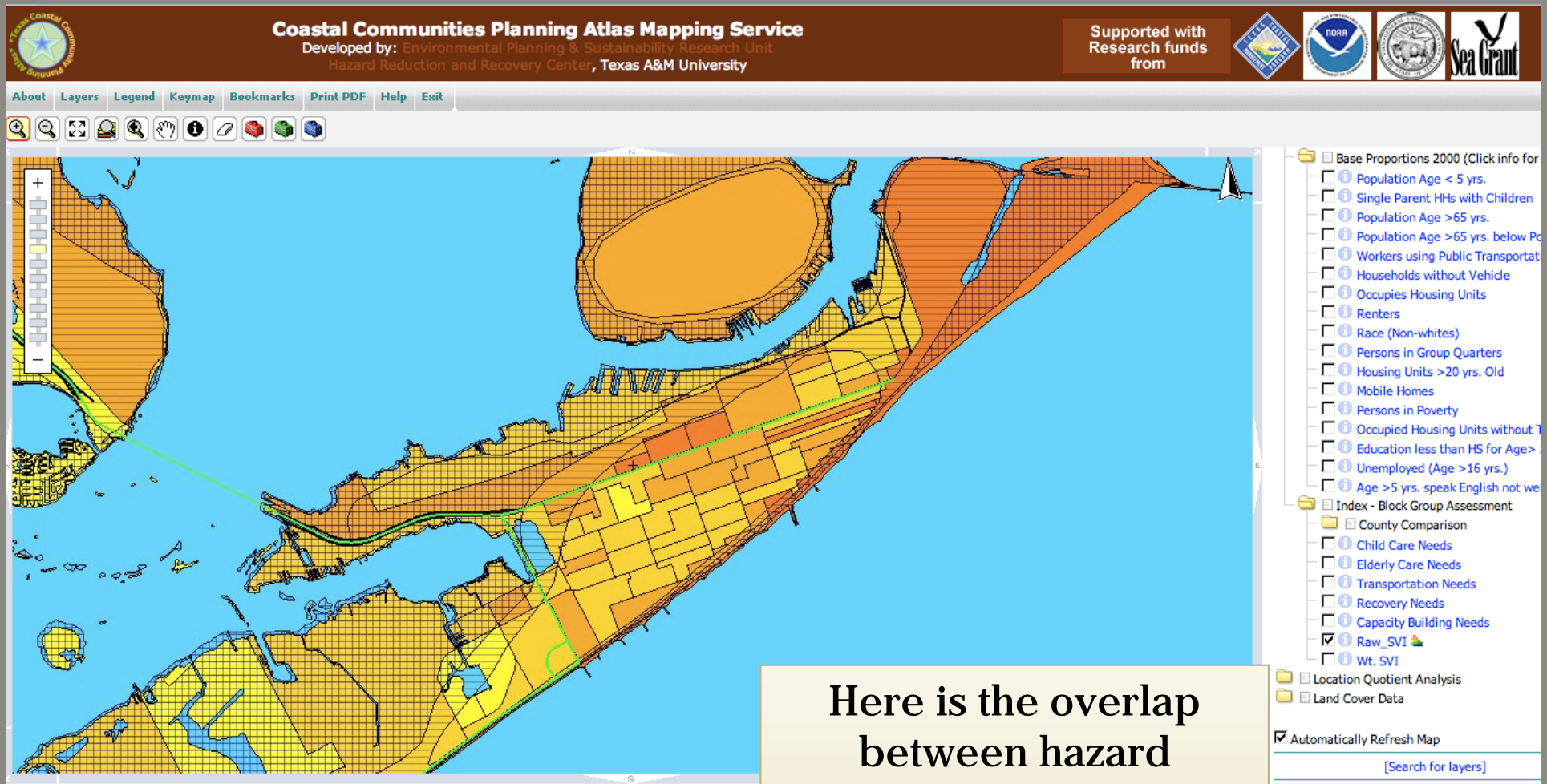
Social and Physical Vulnerability



Hurricane Ike Evacuation Times

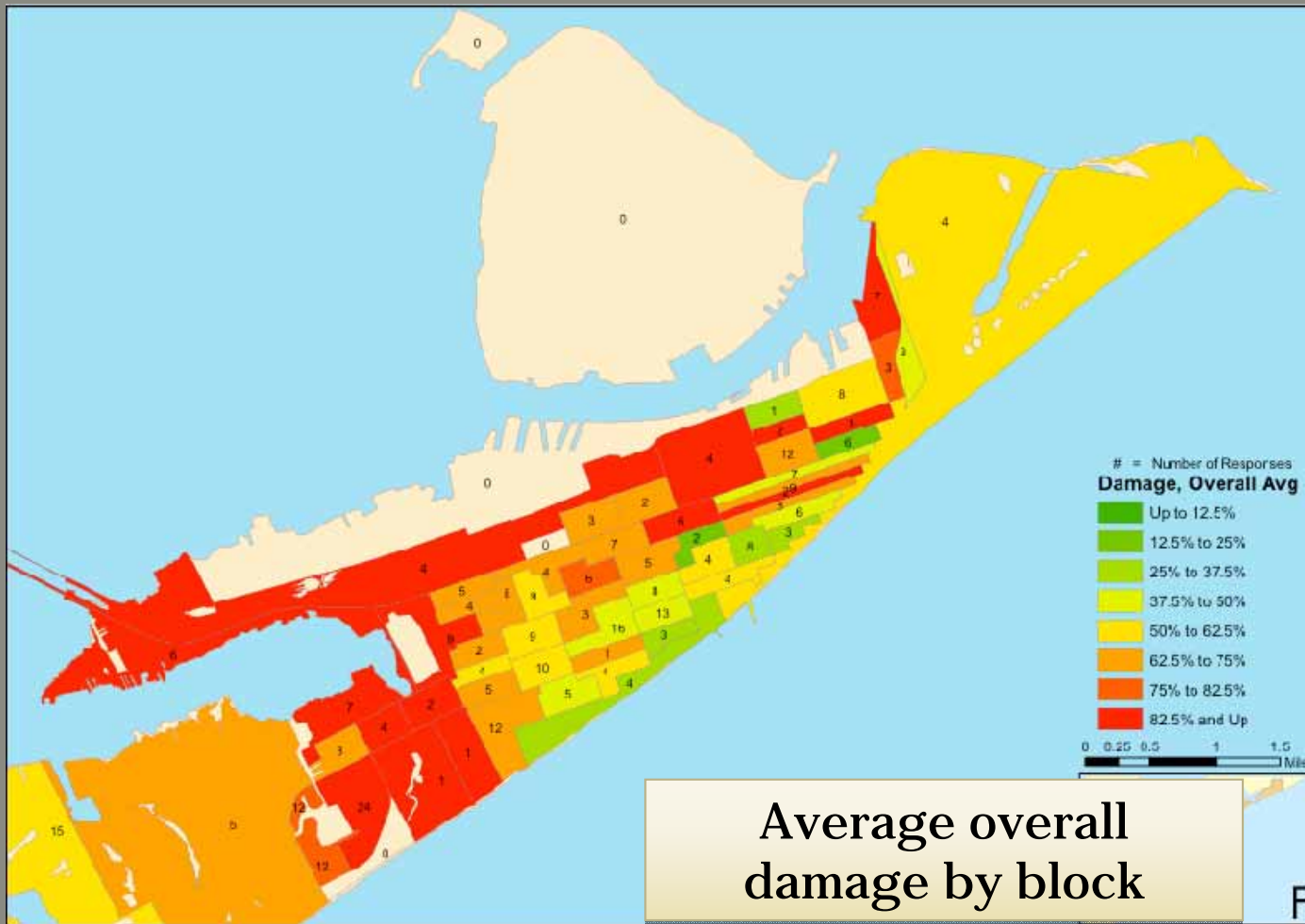


Social vulnerabilities



Here is the overlap
between hazard
exposure (surge) and
SV-hotspot (wtd).

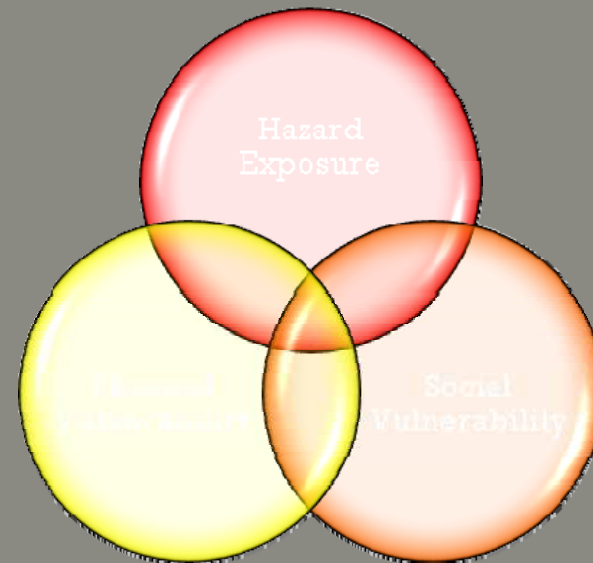
Social vulnerabilities



Average overall
damage by block
groups

In summary

- Hazard mitigation, emergency preparedness, and recovery planning needs to be based on sound sound community vulnerability analysis.
- That vulnerability analysis should be based on assessments
 - Hazard Exposure
 - Physical vulnerability &
 - Social Vulnerability



- The overlaps define target areas and populations for *Pre-impact hazard management actions*