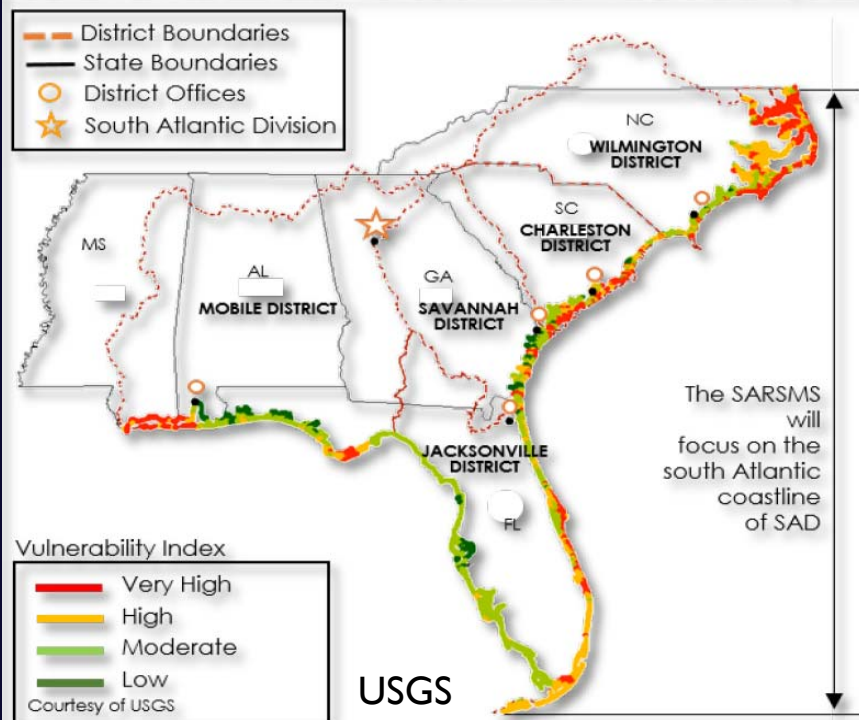


**USACE  
SOUTH ATLANTIC  
COASTAL STUDY  
TIER 1 RISK**

**BROWARD COUNTY  
ENVIRONMENTAL PLANNING & COMMUNITY RESILIENCE  
DIVISION**

# SOUTH ATLANTIC COASTAL STUDY, \$16M

## COASTAL VULNERABILITY IN SOUTH ATLANTIC DIVISION (SAD)



**10,000 miles of vulnerable coastline in the South Atlantic Division:** The USGS vulnerability index is based on a combined relative score of several natural factors including tidal range, wave height, coastal slope, shoreline change, geomorphology, and historical rate of relative sea level change.

- WRDA 2016, Section 1204
- Coastal risk and vulnerabilities due to **sea level rise**
- Measures/ costs for coastal storm risk management
  - Solutions to be studied in more detail in future by appropriate agencies
  - Actions to be undertaken under current authorities
- 3 year study

# COMPONENTS

## Tier 1 Analysis

- Coastal Hazard System Grid for east coast
- Framework to assess risk

## Tier 2 Focus Areas

- State Appendices
- Damage Estimation
- Sand Availability and Needs Determination
- Regional Sediment Management Optimization

## Technical Reports and Data

# DRAFT SACS Tier 1 Risk Assessment Viewer

Tier 1 Risk Assessment Overview

Population & Infrastructure

Environment, Culture, & Habitat

Social Vulnerability

Hazards

South Atlantic Coastal Study



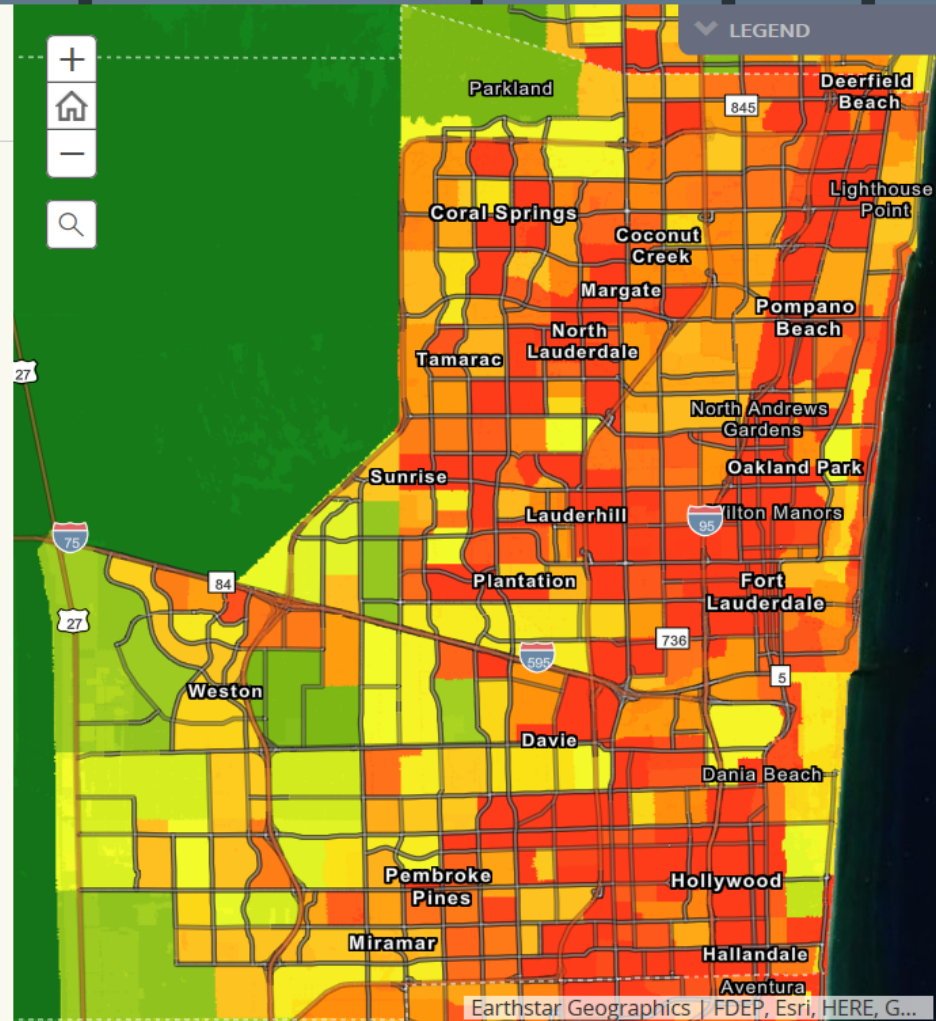
## Tier 1 Risk Assessment

### Composite Exposure Index

60% Population Infrastructure Index  
+  
30% Environmental, Cultural, Habitat Index  
+  
10% Social Vulnerability Index



<https://www.aoml.noaa.gov/outreach/photogallery/>



Earthstar Geographics | FDEP, Esri, HERE, G...

# Composite Risk Index

# DRAFT SACS Tier 1 Risk Assessment Viewer



Tier 1 Risk Assessment Overview

Population & Infrastructure

Environment, Culture, & Habitat

Social Vulnerability

Hazards



South Atlantic Coastal Study



## Tier 1 Risk Assessment

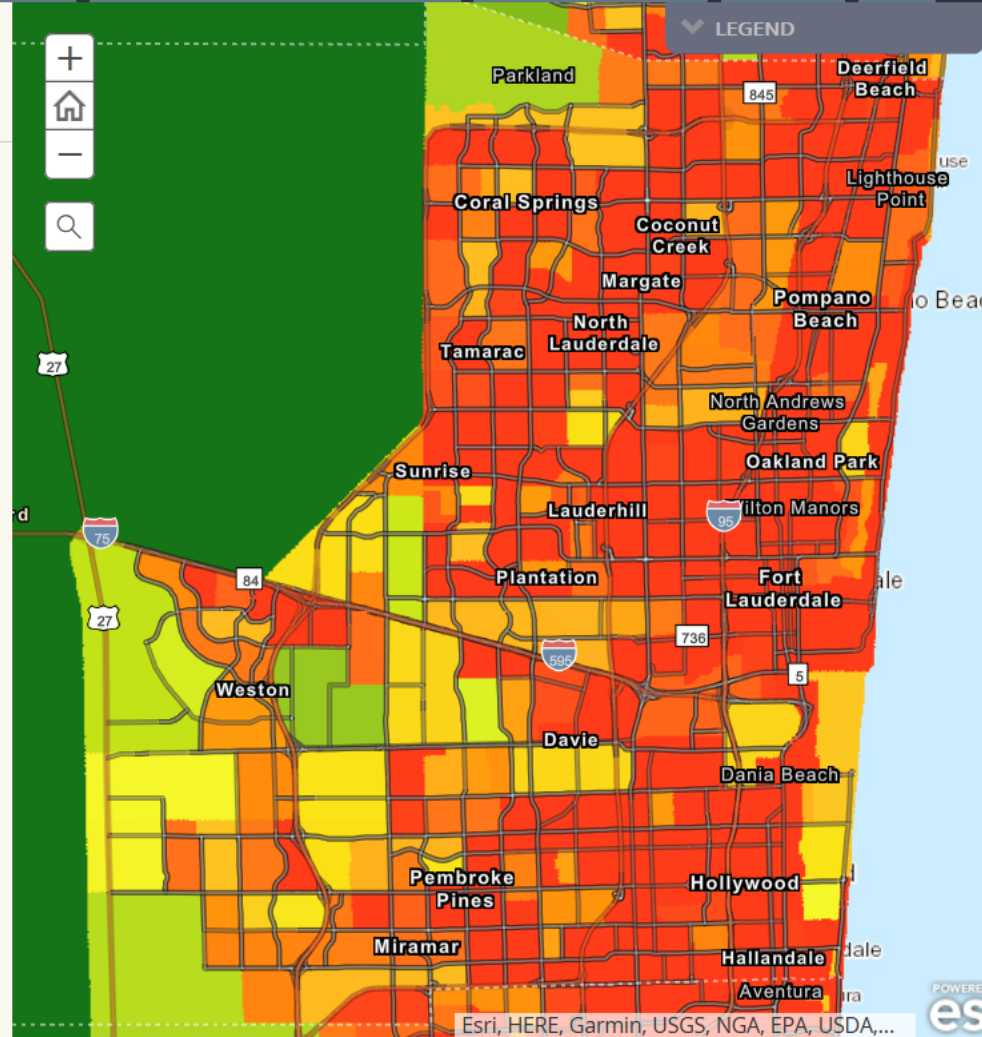
### Population Infrastructure Index - 60%

#### Population Index

- 2015 Census - American Community Survey
- Population Density calculated at the Tract Level
- Percentile Index Ranking of census tracts across Study Area, normalizing values 0 to 1.

#### Infrastructure Index

- Infrastructure Datasets - Department of Homeland Security - Homeland Infrastructure Foundation Level Data (HIFLD)
- Density at the Tract Level
- Percentile Index Ranking across Study Area
- Infrastructure Elements Weighted



Esri, HERE, Garmin, USGS, NGA, EPA, USDA,...

# Population Infrastructure Index

# DRAFT SACS Tier 1 Risk Assessment Viewer

- Tier 1 Risk Assessment Overview
- Population & Infrastructure
- Environment, Culture, & Habitat
- Social Vulnerability
- Hazards

South Atlantic Coastal Study



## Tier 1 Risk Assessment

### Environmental Cultural Habitat Index - 30%

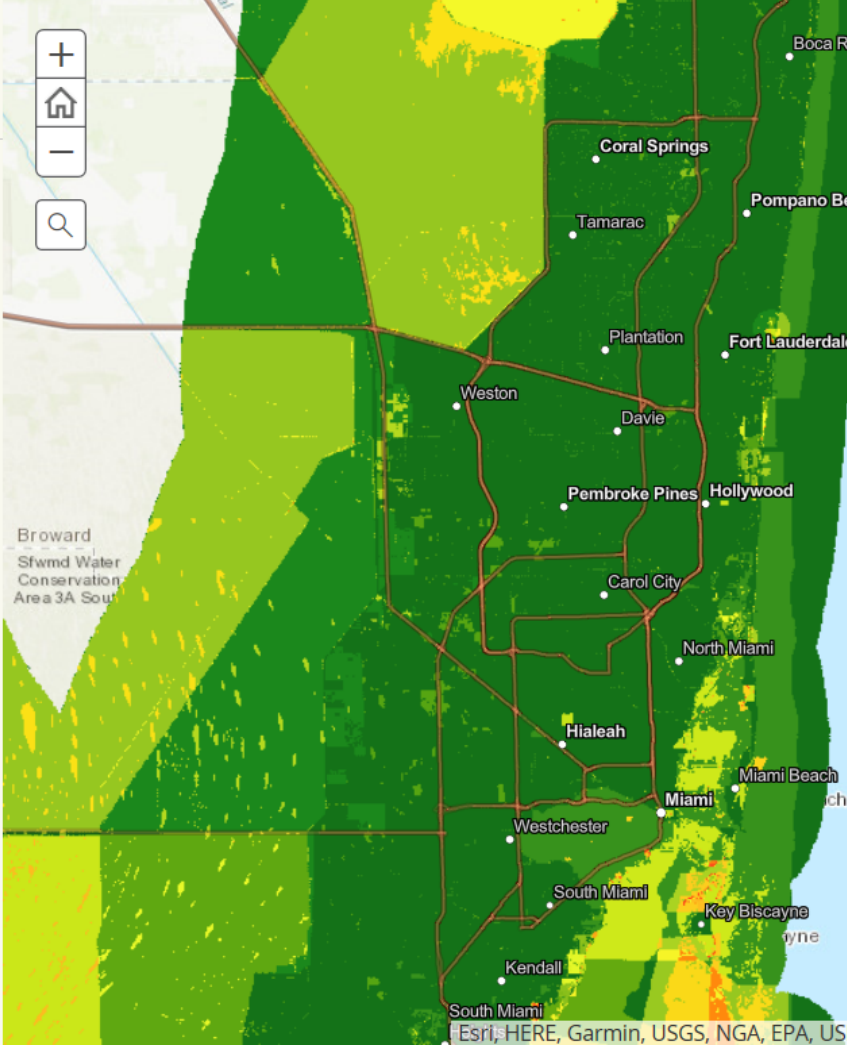
$$\begin{aligned} &30\% \text{ Environmental Index} \\ &+ \\ &30\% \text{ Habitat Index} \\ &+ \\ &40\% \text{ Cultural Resources Index} \end{aligned}$$

#### Methodology

- Apply NACCS weighting to various datasets
- Convert datasets to a common spatial grid, aggregate grids.
- Normalize the grid across the study Area

#### Environmental Datasets

- USFWS - CBRA Zones, NWR's, Critical Habitat



Environmental,  
Cultural, Habitat  
Index



# DRAFT SACS Tier 1 Risk Assessment Viewer

Tier 1 Risk Assessment Overview

Population & Infrastructure

Environment, Culture, & Habitat

Social Vulnerability

Hazards

☰

South Atlantic Coastal Study



## Tier 1 Risk Assessment

• USGS - Protected Area Dataset

### Social Vulnerability Index - 10%

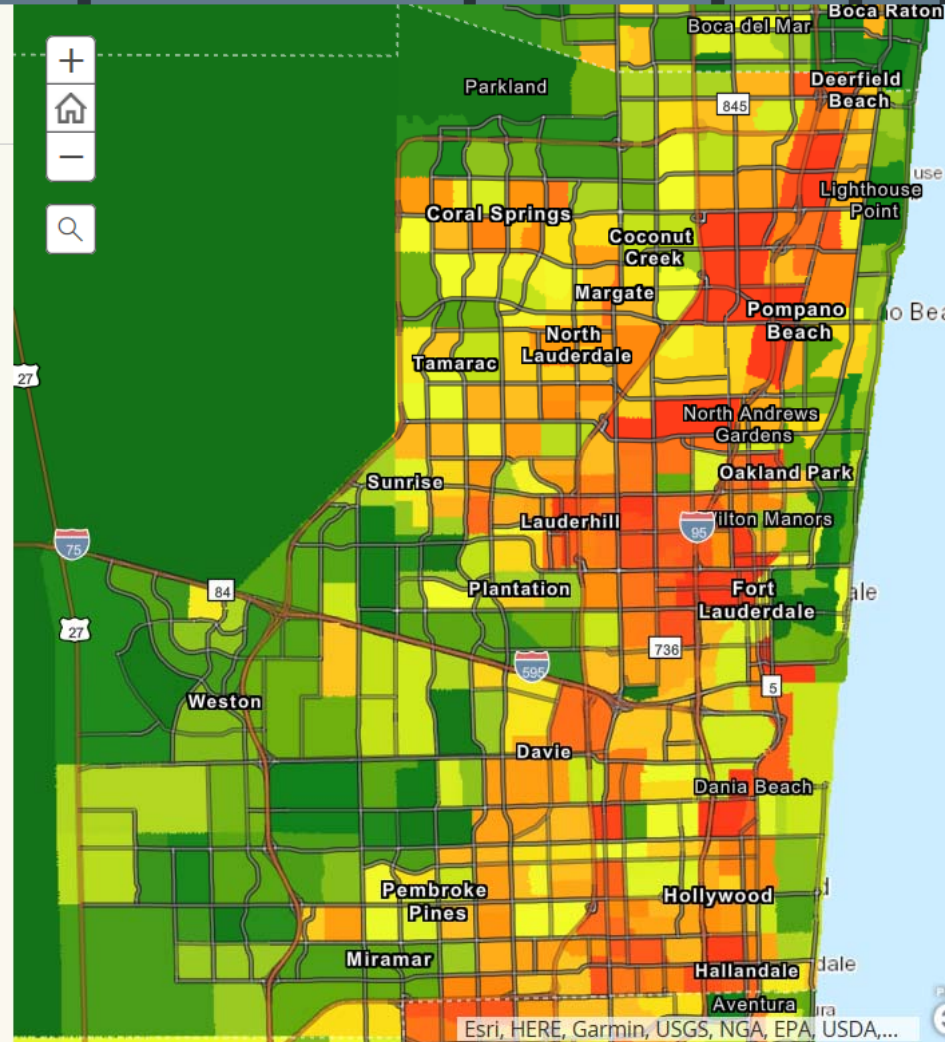
- CDC - Published Methodology - <https://svi.cdc.gov/>
- Ranks 15 themes on a percentile index to create a generalized Social Vulnerability Index at the Census Tract Level

#### 1. Socioeconomic Status (ST)

1. Below Poverty
2. Unemployed
3. Income
4. No High School Diploma

#### 2. Household Composition and Disability (HCD)

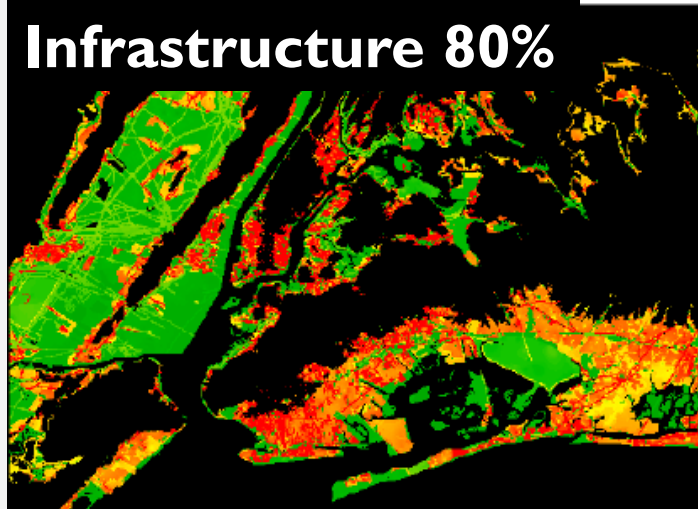
1. Aged 65 or Older
2. Aged 17 or Younger
3. Civilian with a Disability



# Social Vulnerability Index

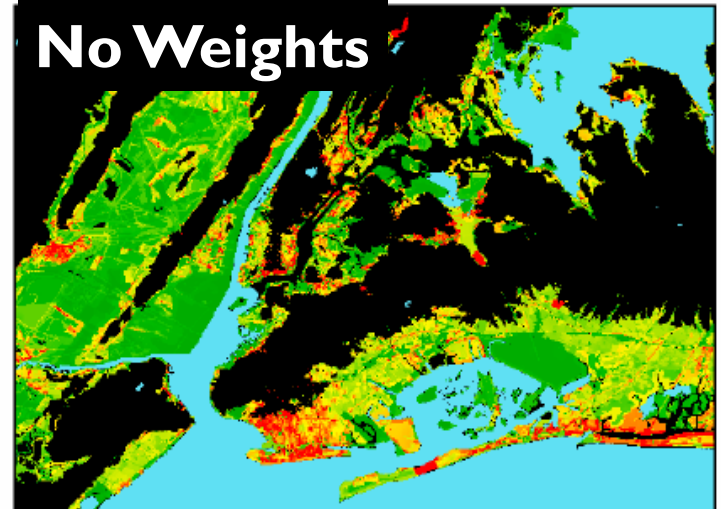
# WEIGHTING

## Infrastructure 80%



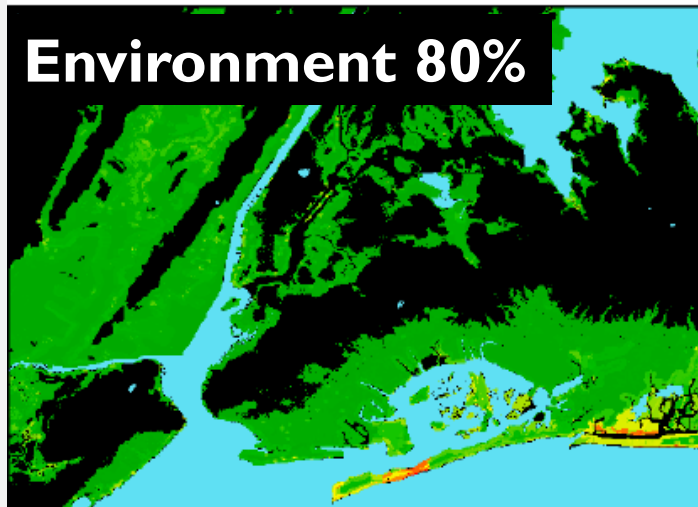
Infrastructure and Population (80%) + Social Vulnerability (10%)  
+ Environmental and Cultural (10%)

## No Weights



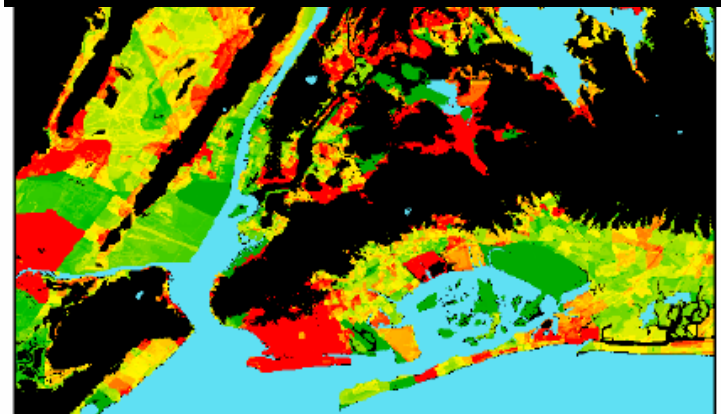
No Weights / Equal Weights

## Environment 80%



Infrastructure and Population (10%) + Social Vulnerability (10%)  
+ Environmental and Cultural (80%)

## Social Vulnerability 80%

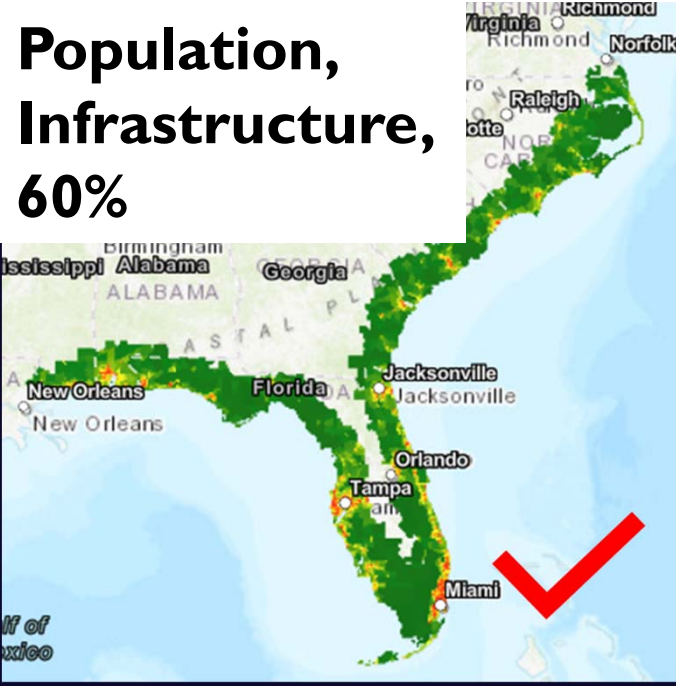


Infrastructure and Population (10%) + Social Vulnerability (80%)  
+ Environmental and Cultural (10%)

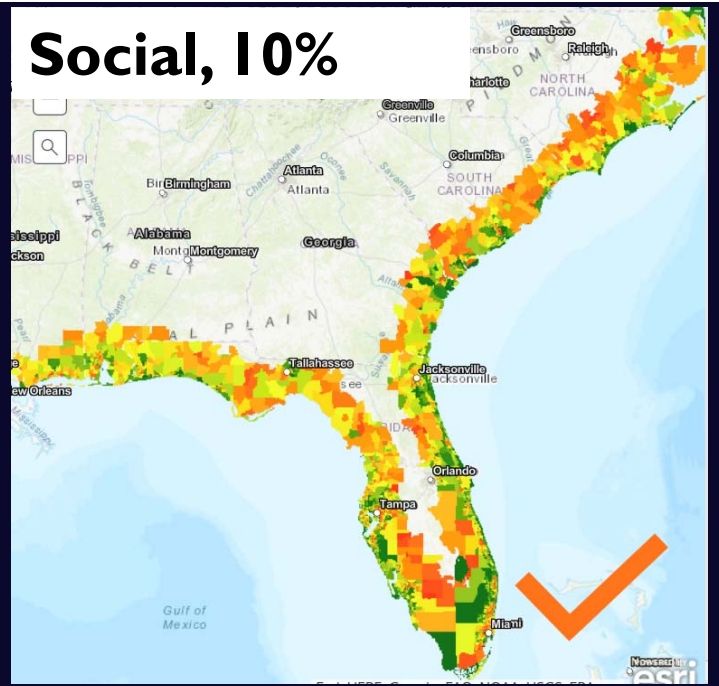
[https://www.nad.usace.army.mil/Portals/40/docs/NA\\_CCS/NACCS\\_Appendix\\_C.pdf](https://www.nad.usace.army.mil/Portals/40/docs/NA_CCS/NACCS_Appendix_C.pdf)



**Population,  
Infrastructure,  
60%**



**Social, 10%**



**Environmental, 30%**





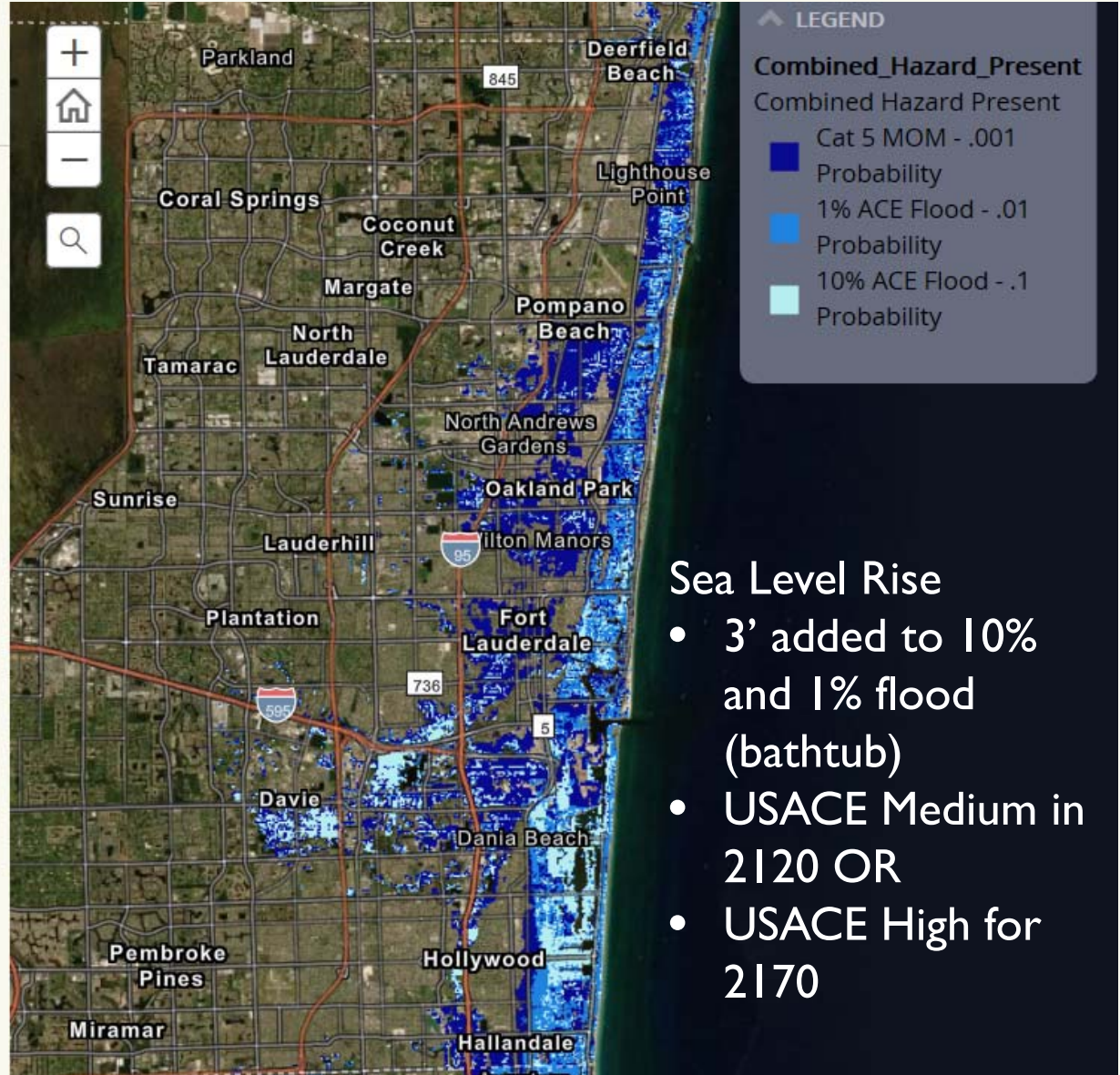
COMPOSITE RISK=  
60% Population and  
Infrastructure Density  
+  
30% Environmental  
+  
10% Social Vulnerability



## Tier 1 Risk Assessment

### Hazard Index

- **10% Annual Chance Water Levels** - USACE Engineering Research and Development Center (ERDC) - Statistical analysis of Tide Gauge Data
  - Probability .1
- **1% Annual Chance Water Levels** - FEMA National Flood Hazard Layer (NFHL)
  - Probability .01
- **Category 5 Maximum of Maximums (MOM)** - NOAA National Storm Surge Hazard Maps, SLOSH Model.
  - Probability .001

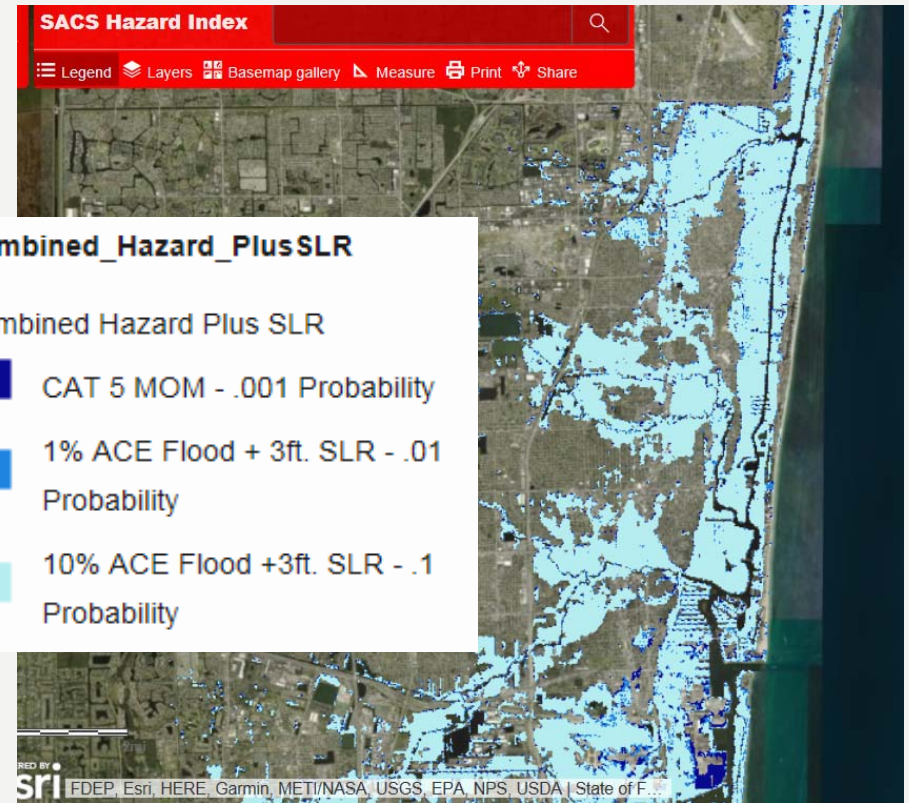
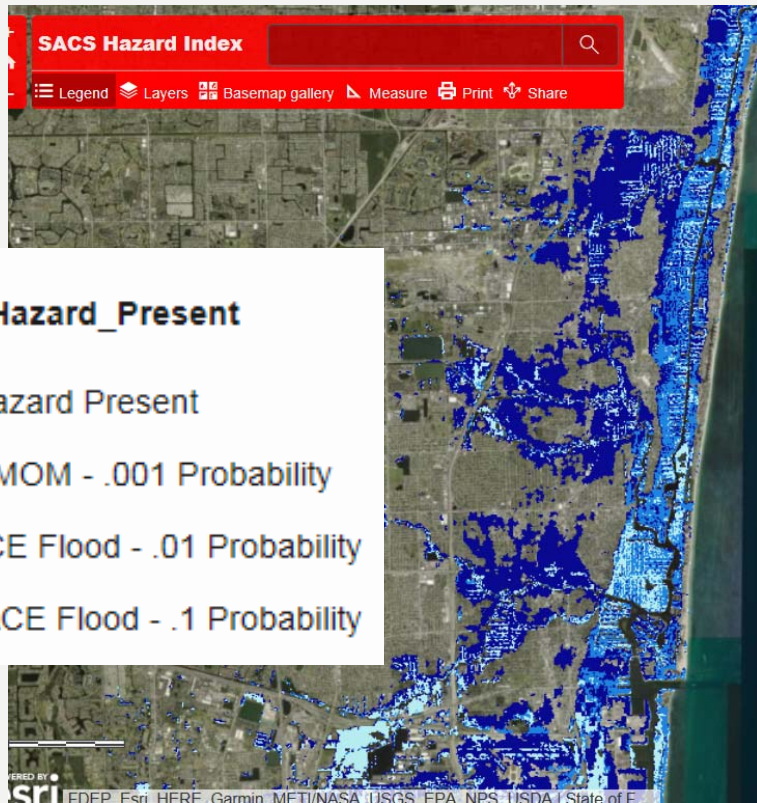


### Sea Level Rise

- 3' added to 10% and 1% flood (bathtub)
- USACE Medium in 2120 OR
- USACE High for 2170



# FUTURE HAZARD



# PRELIMINARY REVIEW

- Areas where tidal flooding occurring, not ranked as high composite risk
  - Address in Tier 2
- Need modeling or enhanced bathtub approach for future hazard index
  - Tier 2 could be hydrodynamic, but may use existing FEMA modeling
- Infrastructure density should reflect critical infrastructure and review skew of parcel size (Airport)
- Justify change to NAACS weighting of datasets if necessary locally
- Environmental Sensitivity Index updates underway could update risk assessment



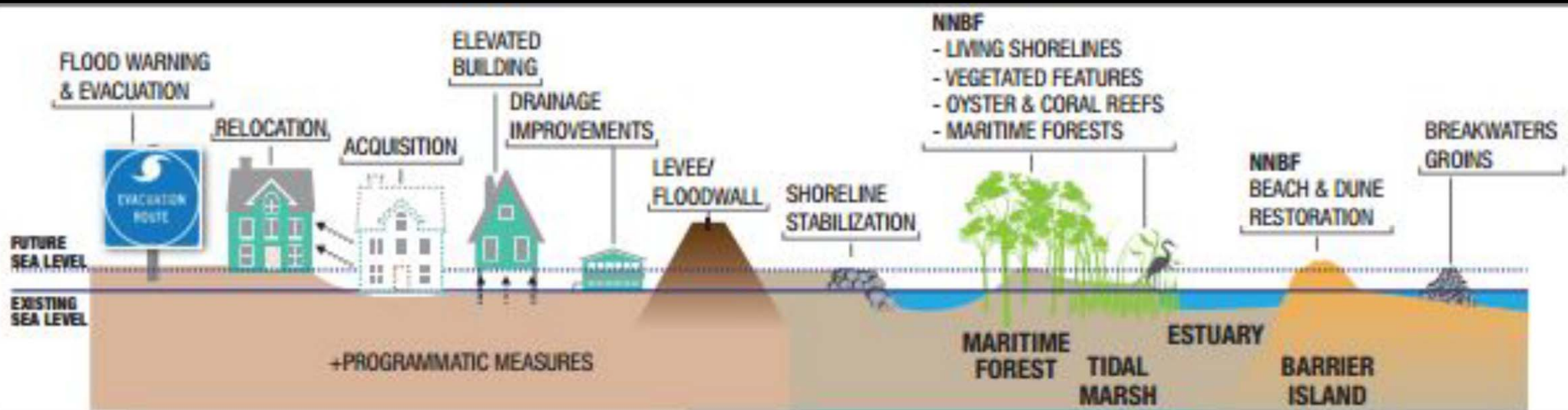
# COMPARISON TO NACCS

- NACCS used future population projections and land use,
  - SACS Tier 1 uses 2015 population
- Using CDC (2016) Social Vulnerability maps rather than weighting
- Population density is normalized not weighted
- Infrastructure selected based on basic services after disaster
  - Sewage, water electricity, academics, trash, medical, safety, communications, energy, transportation (5 to 30 points)

## Preview to potential Tier 2 Methodology

- Defined planning reaches, 39 reaches for 10 states, 31,000 miles of shoreline
  - 6 states, 18,000 miles
  - Existing federal projects, floodplain extent

# COMMON MITIGATION MEASURES



**Table VIII-1. Storm Damage Reduction and Resilience Attributes Associated with the Full Array of Measures**

Aggregated Measure Type <sup>1</sup>	Category <sup>2</sup>	Storm Damage Reduction Function			Multi-Benefits <sup>3</sup>	Resilience
		Flooding	Wave Attenuation	Erosion		Adaptive Capacity <sup>4</sup>
Acquisition (building removal) and relocation <sup>5</sup>	Non-STR	High	High	High	High	High
Building retrofit (e.g., floodproofing, elevating structures, relocating structures, ringwalls)	Non-STR	High	Low	Low	Low	Low
Enhanced flood warning and evacuation planning (early warning systems, emergency response systems, emergency access routes)	Non-STR	Low	None	None	Low	High
Land use management/conservation and preservation of undeveloped land, zoning and flood insurance	Non-STR	Medium	None	None	High	Medium
Deployable floodwalls	STR	Medium	None	None	None	Low

# NACCS MITIGATION MEASURES

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Regional Storm Surge Barriers: \$50M  
to \$35B

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Beach Restoration:  
~\$600/ foot/ year \*50 years

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Living Shorelines:  
\$67/foot/year

---

Wetlands/Reef/ Seagrass Restoration:  
~\$100-200/ foot/ year



Regional Surge Barrier (Fox Point, RI)

# NEXT STEPS

- September
  - Participate in USACE Field Workshop and Provide Comments
- Tier 2
  - Identify Southeast Florida, Broward or reaches in Broward as Focus Areas
  - Recommend mitigation measures (TBD)
    - Review of Local Mitigation Strategy Project List
    - Submittals from municipalities