

# COASTAL RESILIENCE

Adapting Natural and Human Communities to  
Sea Level Rise and Coastal Hazards



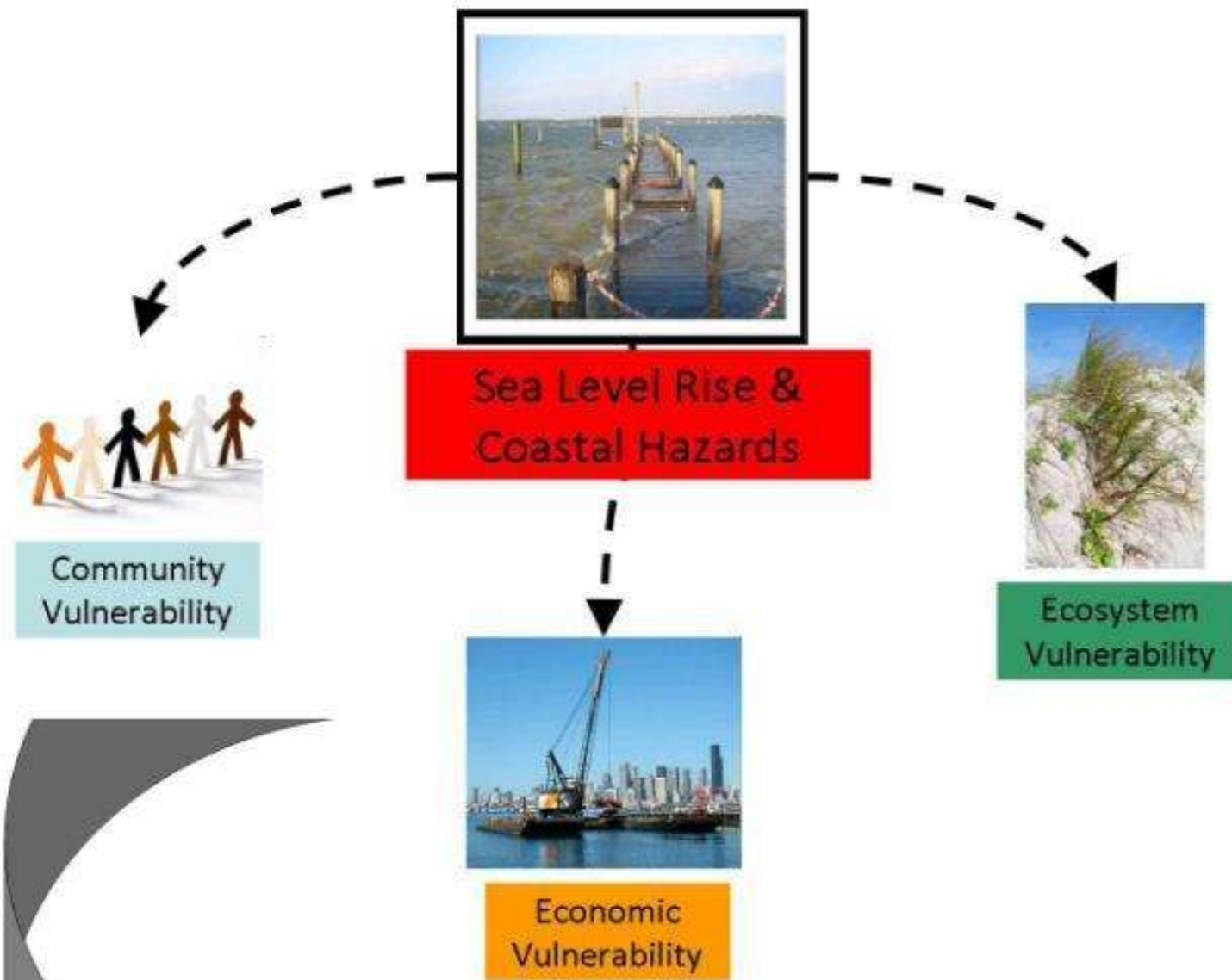
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Global Marine Program

Rio + 20

[coastalresilience.org](http://coastalresilience.org)

# Meeting Multiple Management Objectives

## Assess Risk to Human and Natural Communities



## Visualize Potential Impacts



**Plan and Adapt to Minimize Losses to Human and Natural Communities**



## Coastal Climate Change:

It's more than sea level rise . . .

- storm severity
- storm frequency
- combined effects

*Photo: Kevin  
Magee*

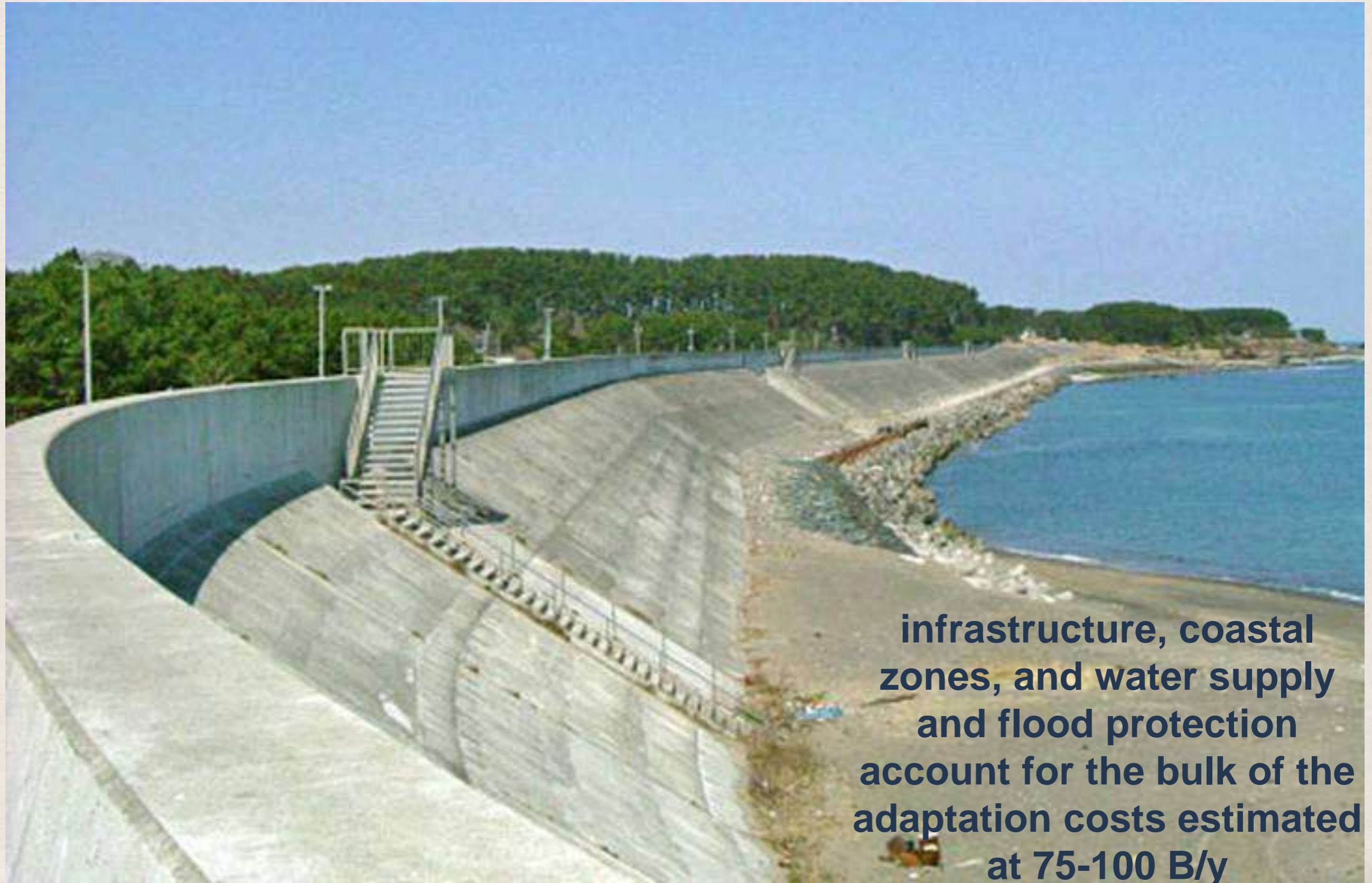
# Scenario 2050 SLR-No storm



# Scenario SLR 2050-High + Cat 2 storm



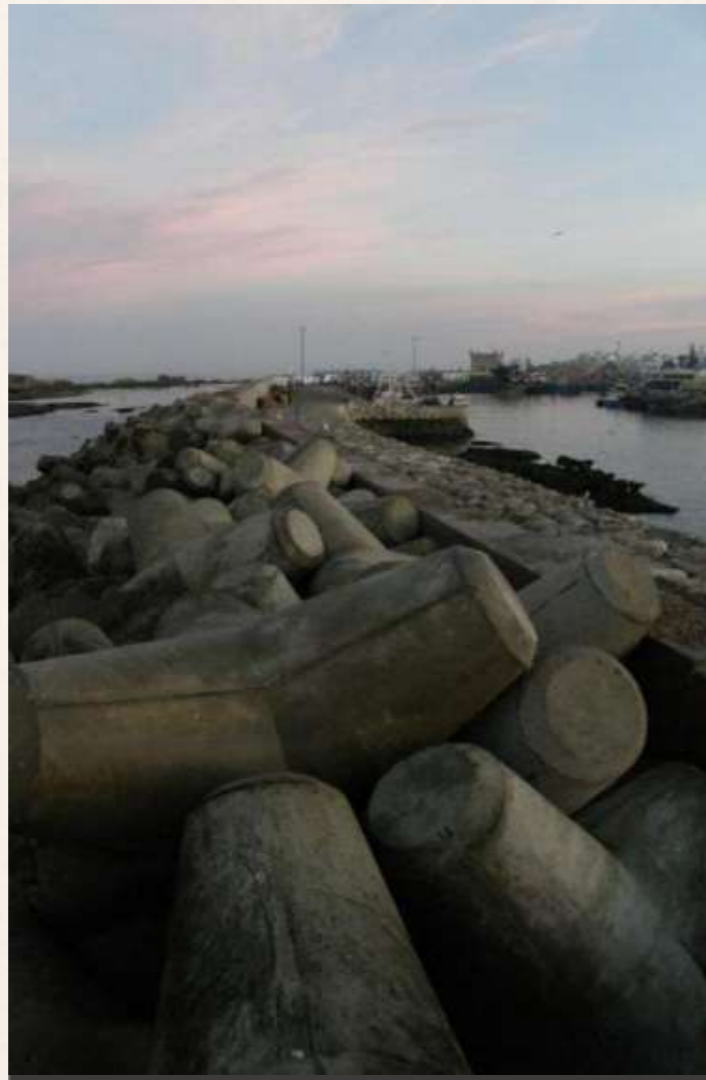
# Options for adaptation



**infrastructure, coastal zones, and water supply and flood protection account for the bulk of the adaptation costs estimated at 75-100 B/y**

# Scientific and socio-economic rational for included ecosystem-based adaptation in integrated adaptation plans in coastal areas

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# Protective services of coastal wetlands

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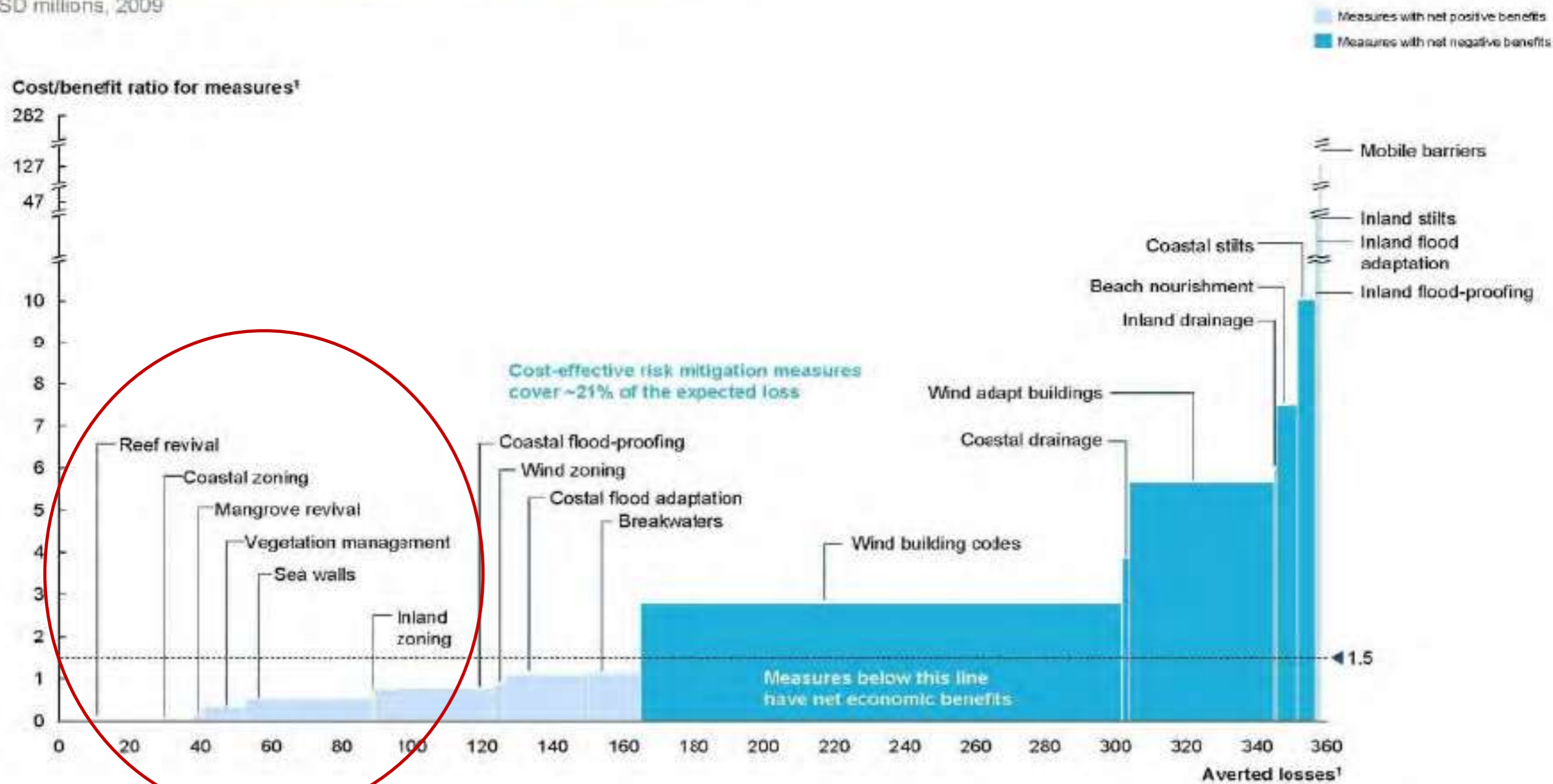
- ❖ Erosion resistance
- ❖ Storm defense
- ❖ Vertical accretion
  - ❖ Through sediment capture and biomass accretion
  - ❖ Can mitigate SLR, or slow rate of loss
- ❖ Wave attenuation
- ❖ Flood attenuation



## Cost-benefit ratio and loss avoidance potential for adaptation measures

USD millions, 2009

2030 HIGH CHANGE



<sup>1</sup> Does not account for synergies and dis-synergies between measures (e.g., building seawall behind a breakwater)

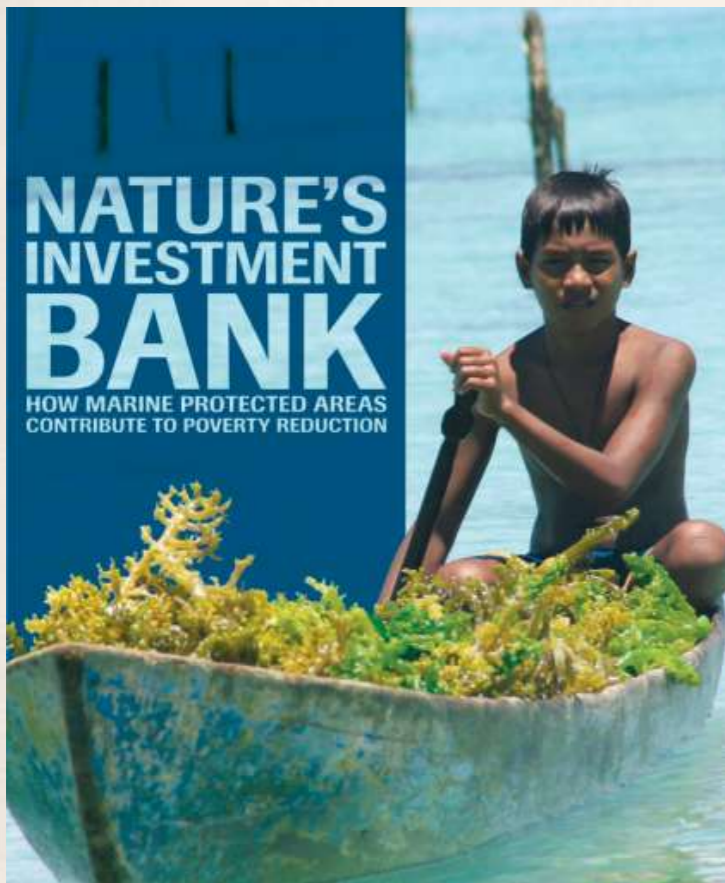
Source CCRIF's Economics of Climate Adaptation/Jamaica case



# Important co-benefits

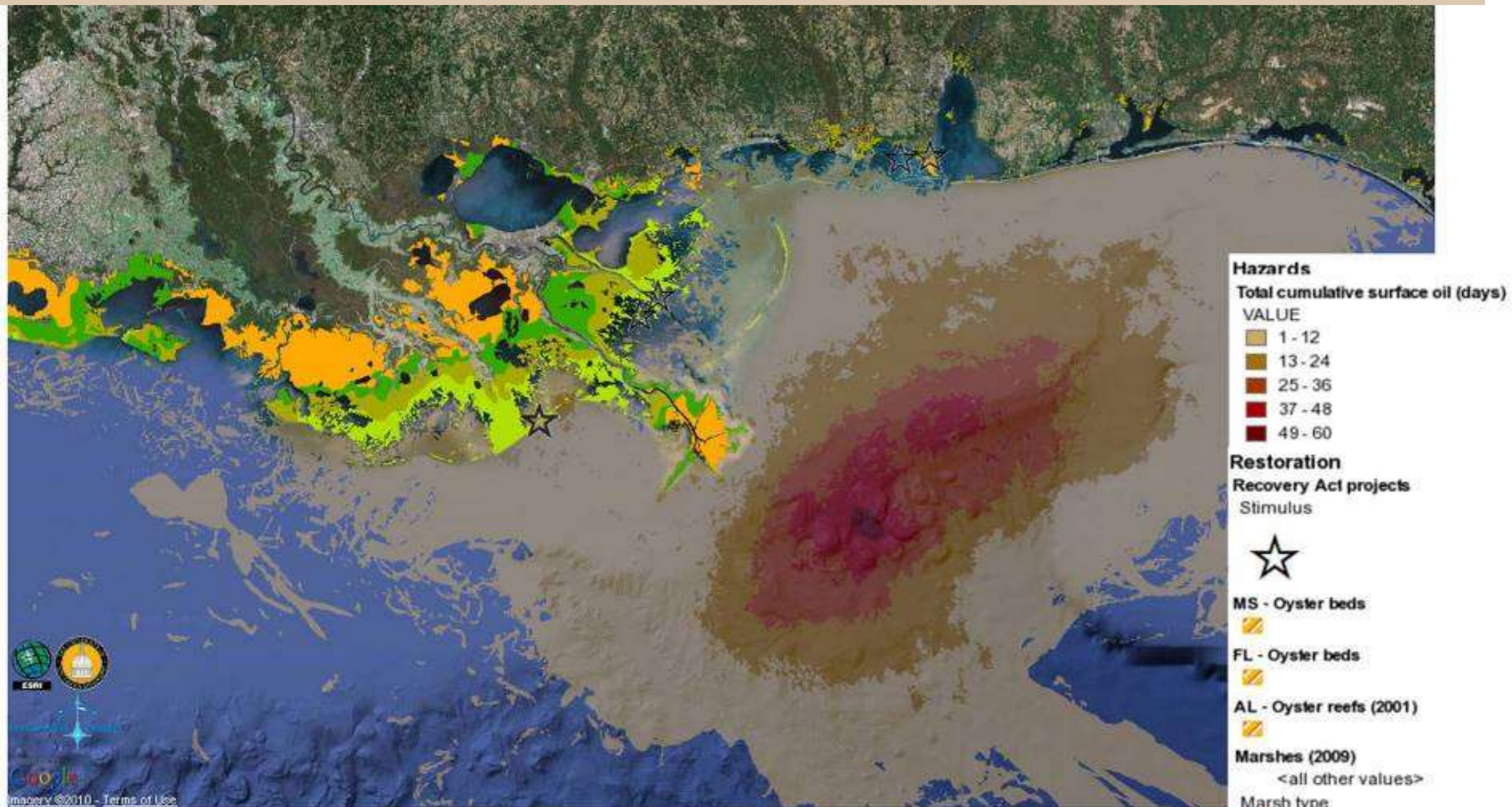


- ❖ Maintaining important food sources/fisheries (WRI-Belize: Economic benefits from reef- and mangrove-dependent commercial fisheries are estimated at between US\$14–\$16 million per year)
- ❖ Tourism/recreation (WRI-Belize, reef- and mangrove-associated tourists spent an estimated US\$150–\$196 million equal to 12–15 percent of GDP).
- ❖ Water filtration
- ❖ Livelihoods
- ❖ Contributing to social resilience
- ❖ Carbon sequestration



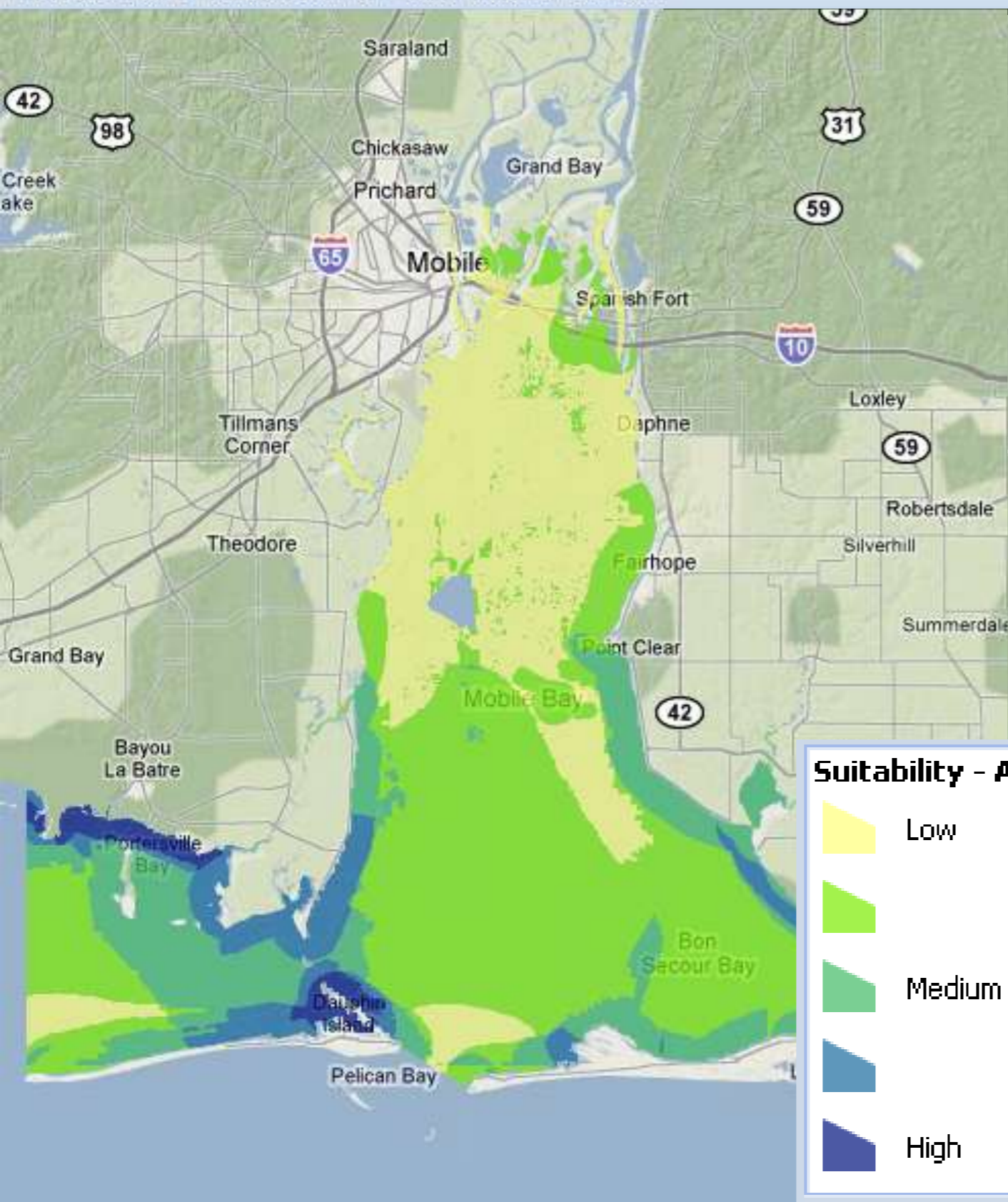
# Restoration Decision Support

## Ecological, Social and Economic



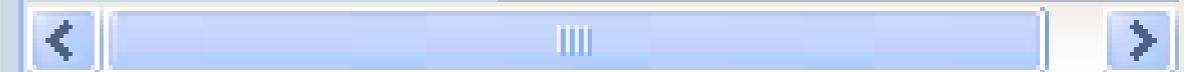
# Gulf of Mexico Restoration Decision Support

Map Layers Legend Change to Split View Guide Restoration Dashboard



## Oyster Restoration Dashboard

Choose an area: Alabama



Depth Score



Salinity Score



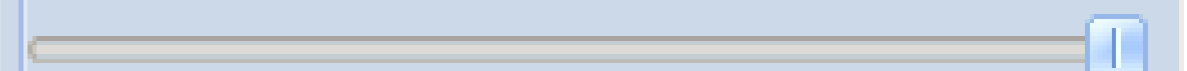
Historic Reefs



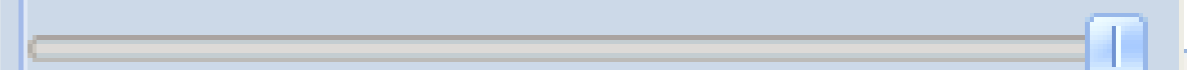
Spat Settlement Score



Shoreline Erosion Score



Nat Resource Job Dependence Score



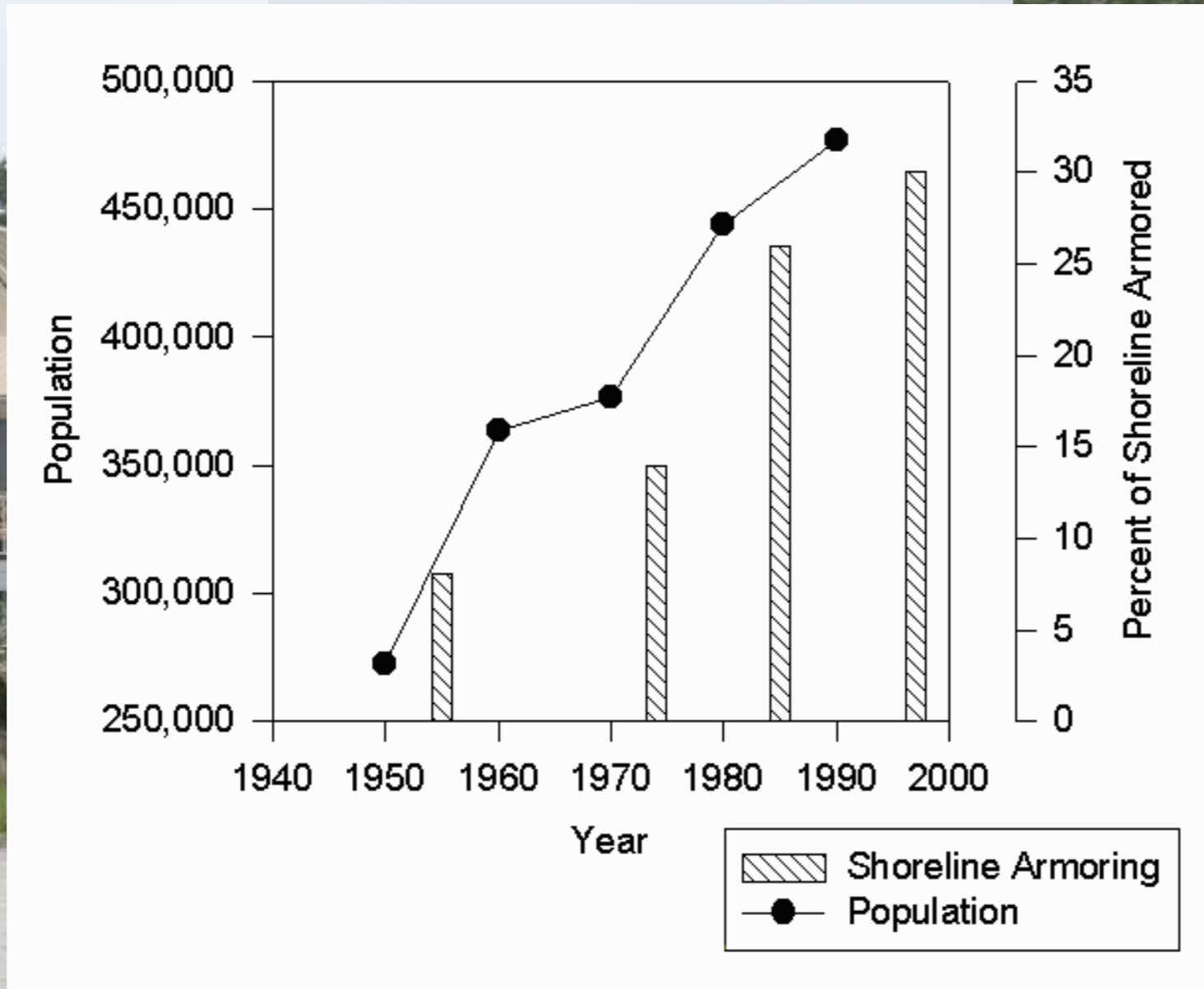
Project Permit Feasibility Score



Methods

Export Scenario

# Mobile Bay Shorelines

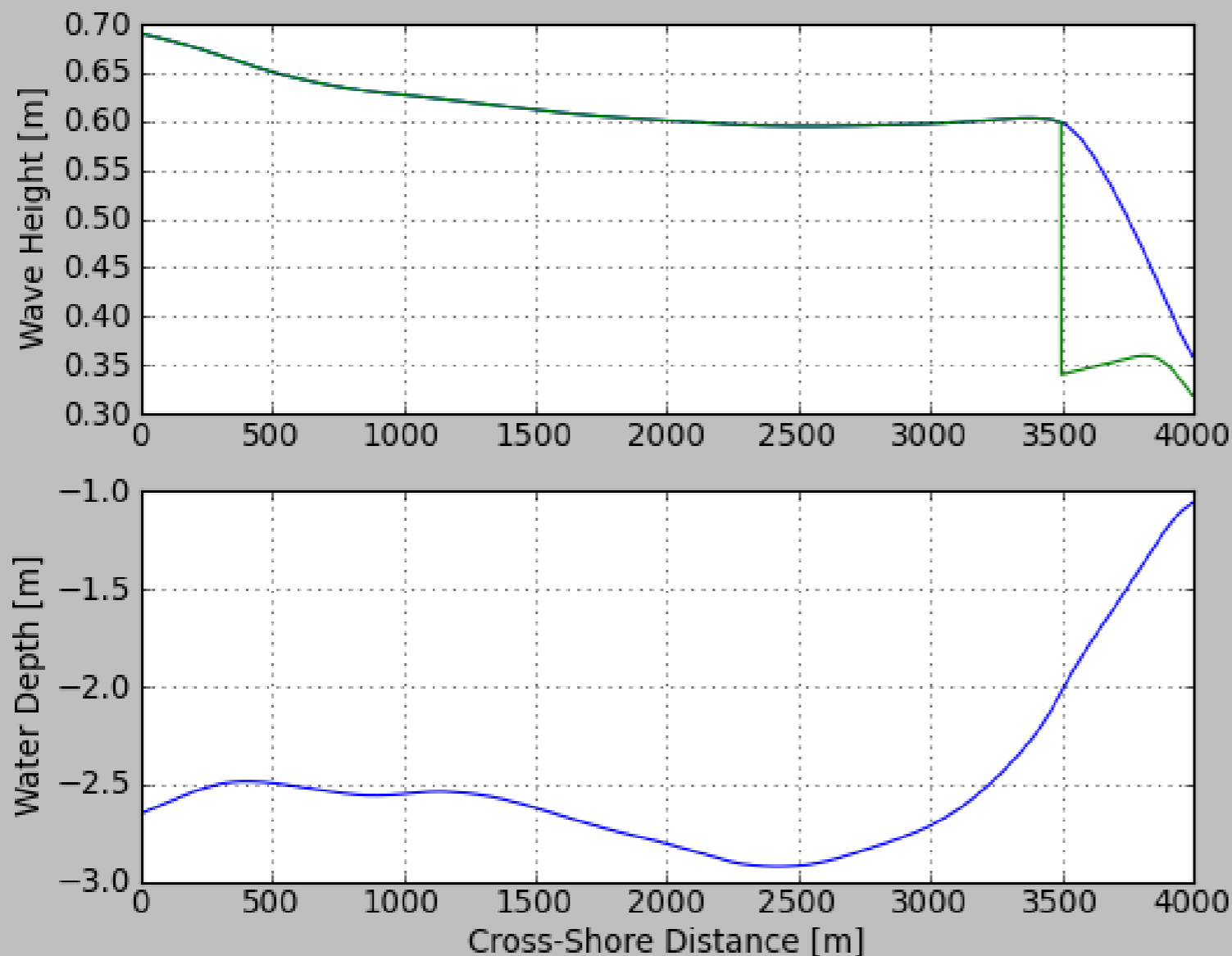


Graph from Douglass & Pickel (1999)



# Example Outputs: Oyster Reefs

Design Wave  
 $H=1\text{m}$ ;  $T=5\text{s}$

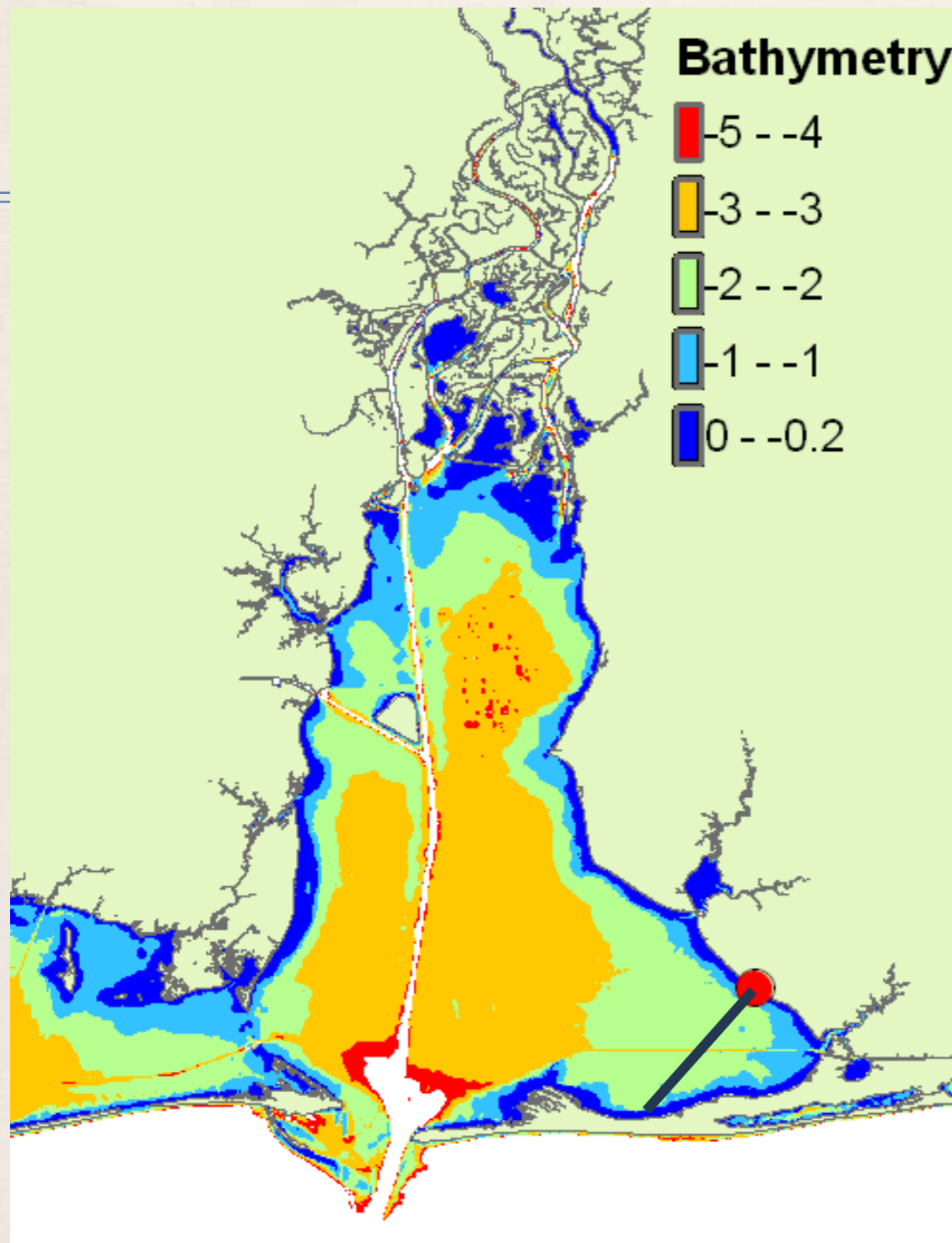


# 100/1000 Partnership: Proof of Concept - Methods

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- ❖ Several types of natural and artificial reefs have been tested. Selected methods will be based on:
    - goal (shoreline stabilization, spat settlement, fish habitat)
    - location
    - cost/benefits



# Assessing Wave Attenuation Benefits: For Selecting Oyster Reef Projects



Bathymetry Cross-  
Section



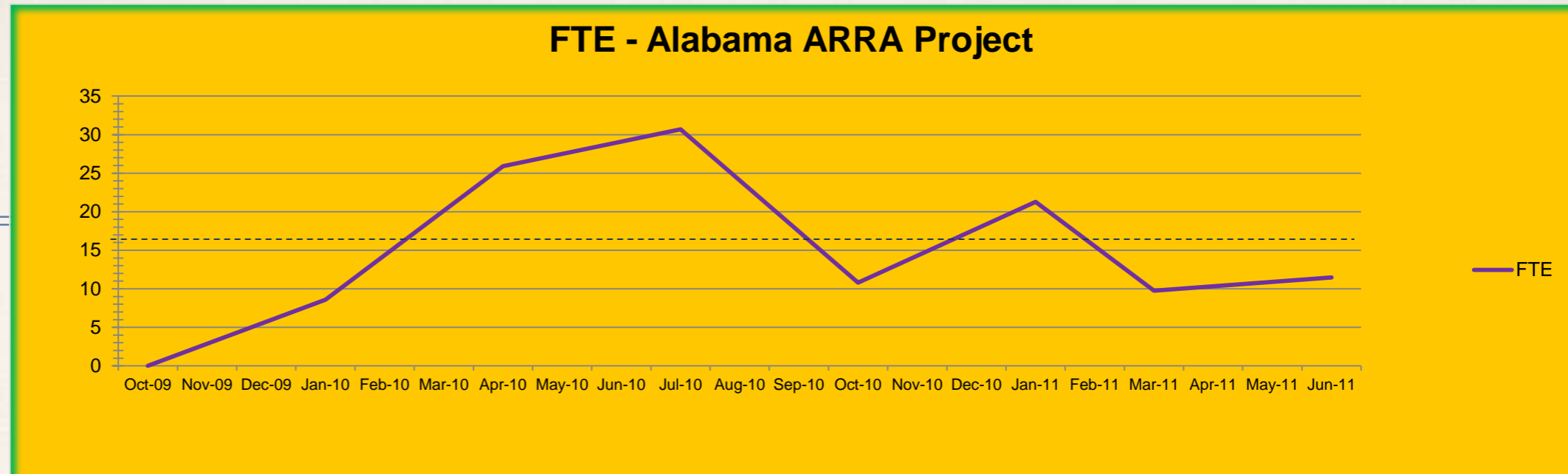
Fetch  
Distances

# Socio-economics of the ARRA Project in Alabama

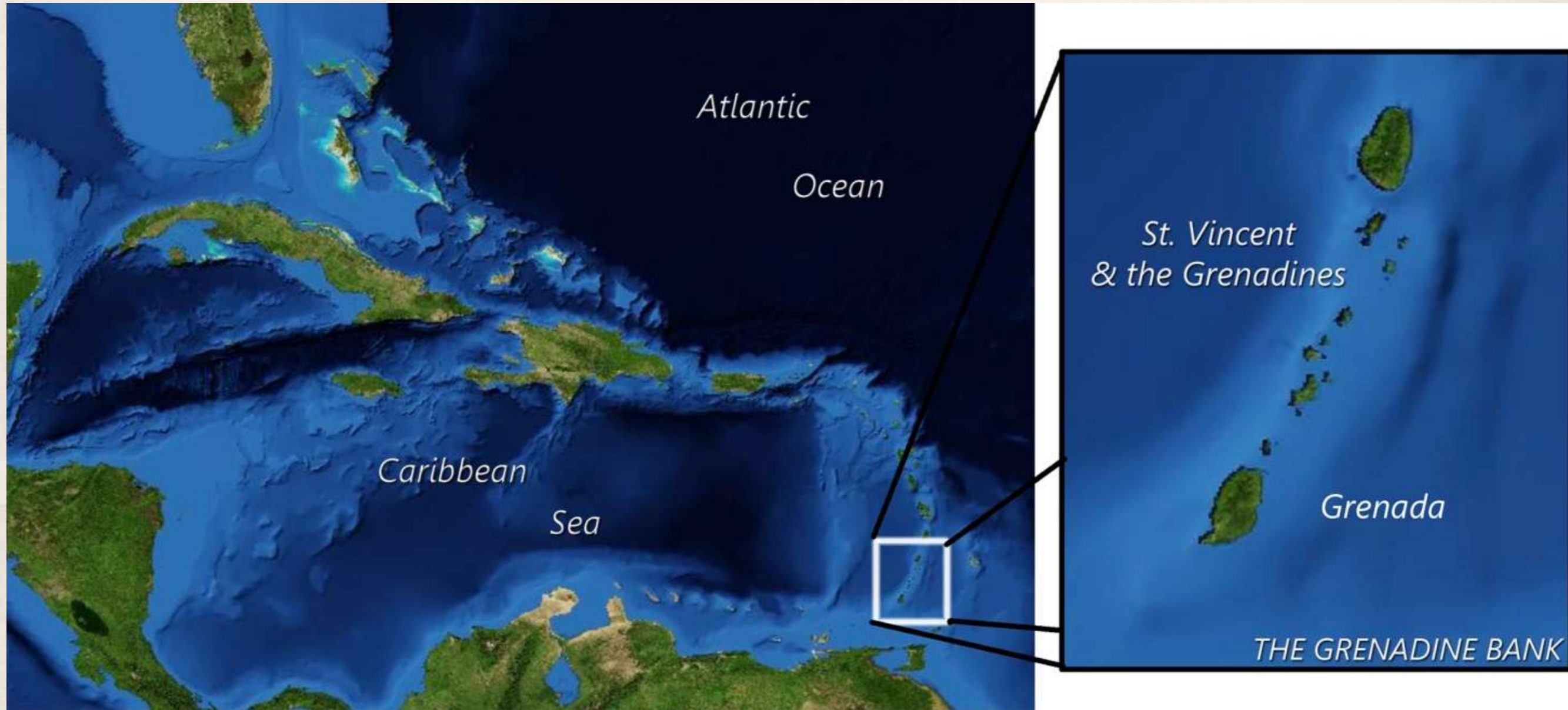
Full Time Employees:

FTE at **Height** of the Project  
**30.68 FTE = 83 positions**

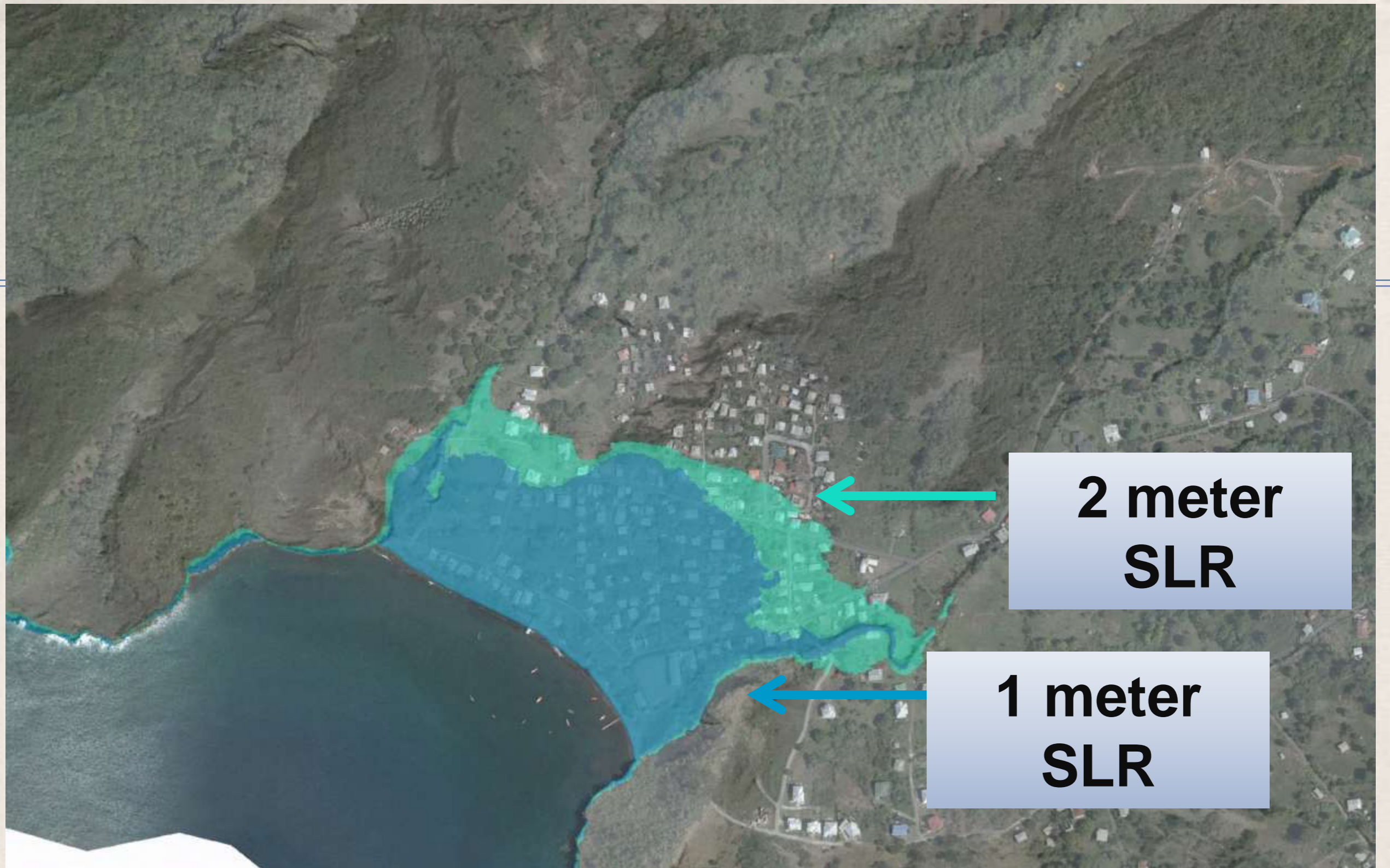
**Average FTE for the Project**  
(20 months)  
**16.93 FTE = 44.14 positions**



# Grenadine Bank At Waters Edge (AWE) Coastal Resilience







**2 meter  
SLR**

**1 meter  
SLR**

# Grenada, St. Vincent & the Grenadines



Beaches

Mangroves



o Petit Saint Vincent

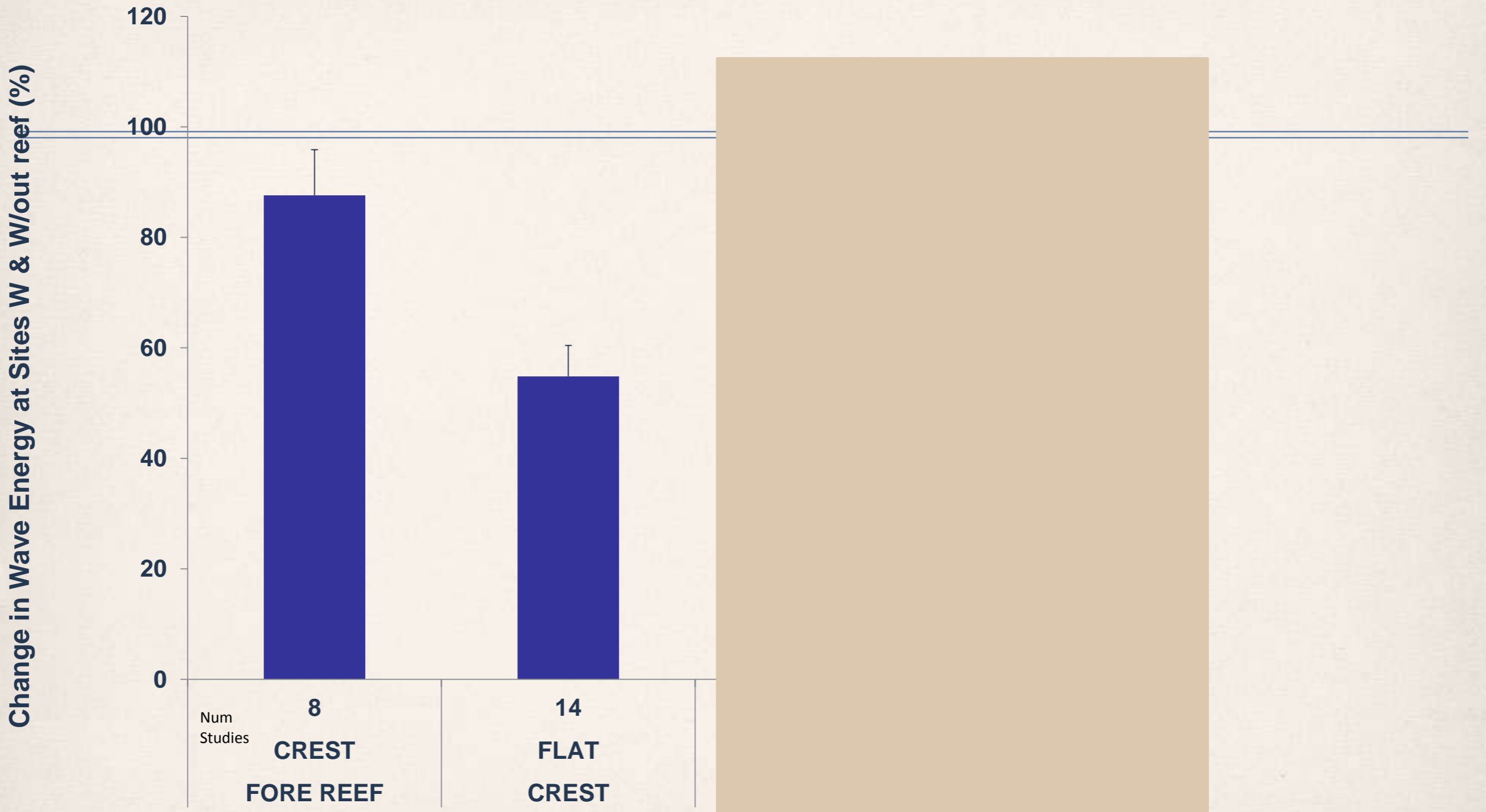
o Petite Martinique





# Wave Energy Reduced by Coral Reefs

## Global Meta-analysis



-In Prep.

# Manage Coastal Ecosystems

- ❖ Protected areas
- ❖ Spatial planning
- ❖ Resilience frameworks



# Managed systems

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- ❖ Active interventions – silviculture, drainage, restoration, creation
- ❖ Managed realignment
- ❖ Combining with engineering – grey-green or living shorelines





# Recommended Actions to mainstream coastal ecosystem conservation and restoration as central to Adaptation Plans

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- ❖ Demonstrate and document that natural solutions work and are cost effective
- ❖ Influence Public Policy and National Adaptation Plans
- ❖ Increase financial resources for adaptation and climate smart development
- ❖ Change Private-Sector Incentives