

# COASTAL RESILIENCE

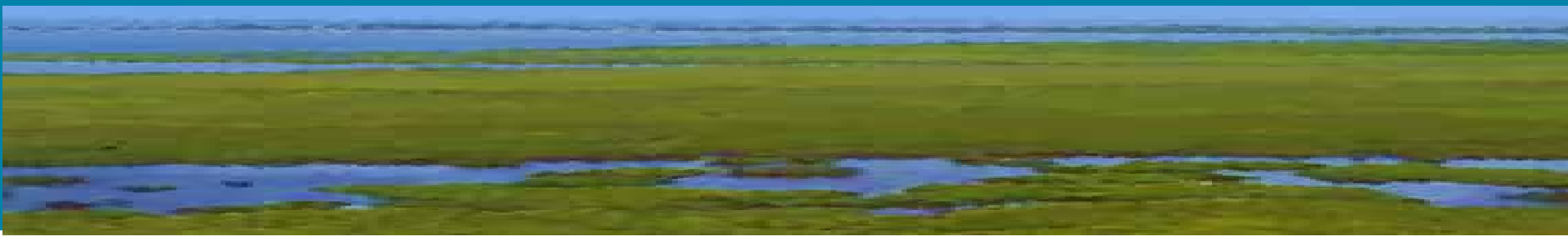
Adapting Natural and Human Communities to  
Sea Level Rise and Coastal Hazards

## GIS modeling of ecosystem services to evaluate climate-induced impacts

ESRI Users Conference 2014 – San Diego, CA

## TNC and Resiliency – 2011

- Ø Identified need to develop tools for policy makers allowing them to incorporate future SLR into decision making
- Ø Design analyses to assess the potential impacts of SLR on coastal habitats and communities
- Ø Focus on natural habitats and the ecosystem services they provide
- Ø Produce a set of conservation/resiliency indices and ecosystem service models for planning and resource management
- Ø Provide open access to the tools and results through online data portals and visualization applications



## Collaboratively Designed

- Ø TNC, local government, planners, resource managers and stakeholder input
- Ø Scoping processes identified four initial questions to address during analyses:
  1. What are the potential impacts of a 1 meter sea level rise to marshes in the study area?
  2. Which communities are potentially most at risk to hurricane storm surge, and how might sea-level rise increase that risk?
  3. Which communities might be most or least resilient to these future changes?
  4. How might SLR impacts and future marsh habitat distribution inform land acquisition and habitat conservation planning?
- Ø **Incorporate ecosystem service models to quantify (\$) potential impacts**

## Conservation and Resiliency Analyses

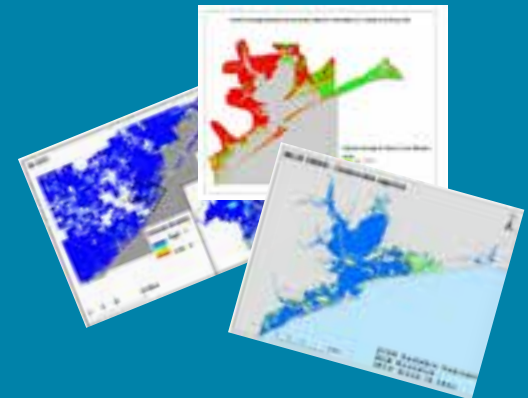
Ø Series of inter-connected analyses to assess SLR and storm surge impacts which include:

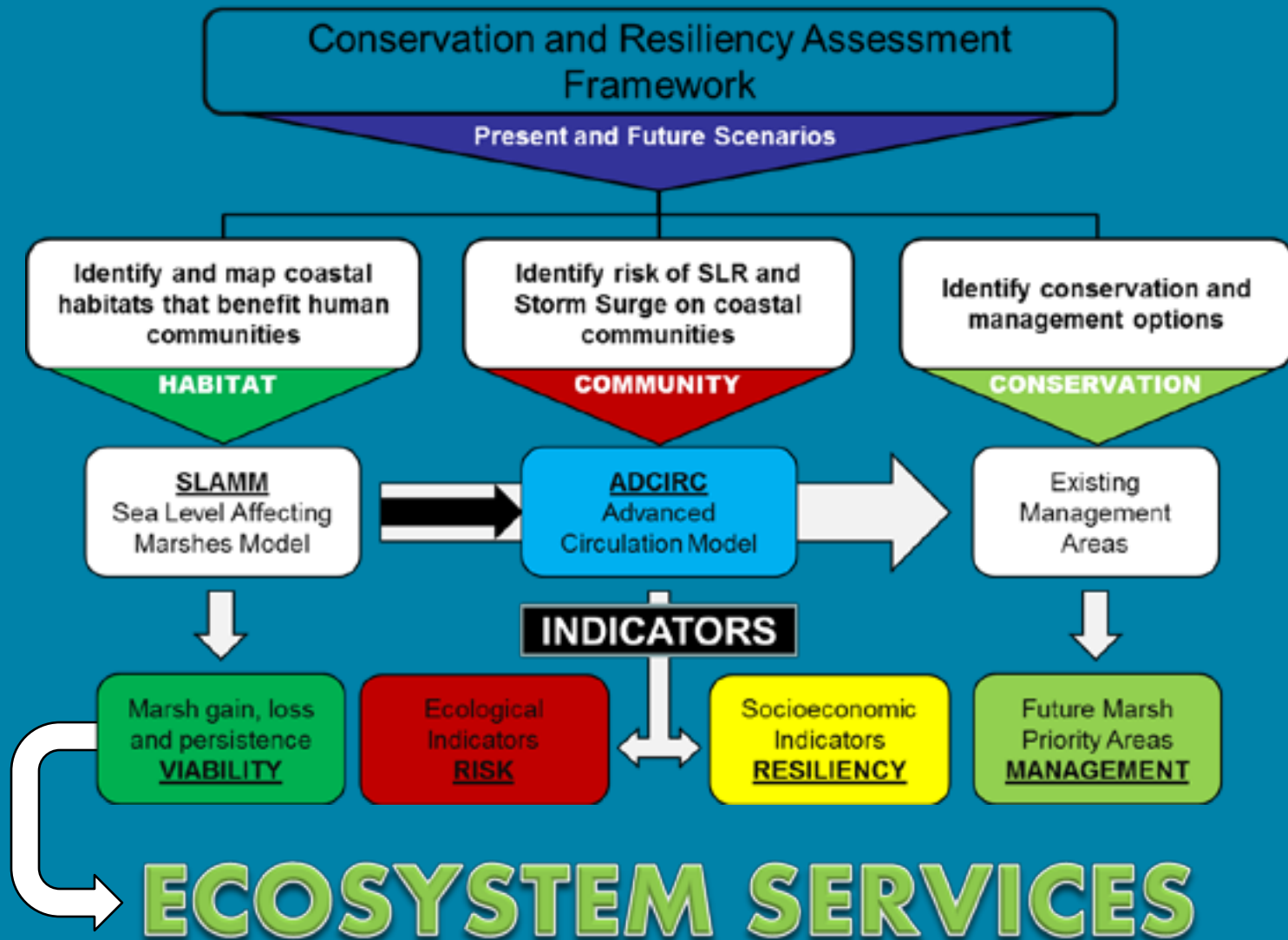
1. Marsh Viability
2. Community Risk
3. Community Resiliency
4. Marsh Conservation and Management



Ø Ecosystem Services Modeling – Natural Capital Project (NATCAP)  
InVest Models

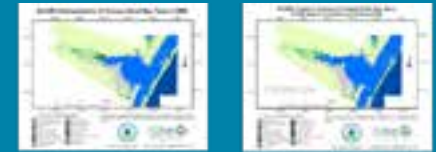
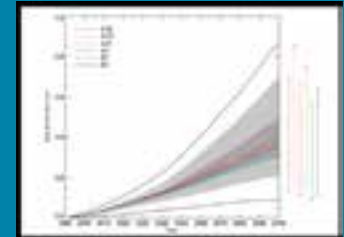
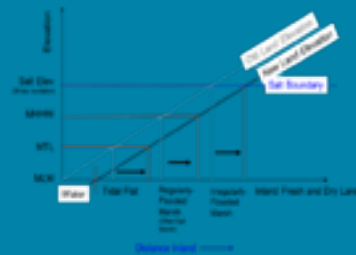
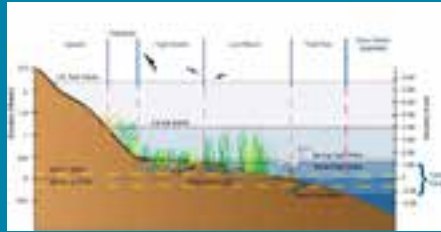
- Carbon Storage / Sequestration
- Fisheries
- Coastal Protection
- Biodiversity.....



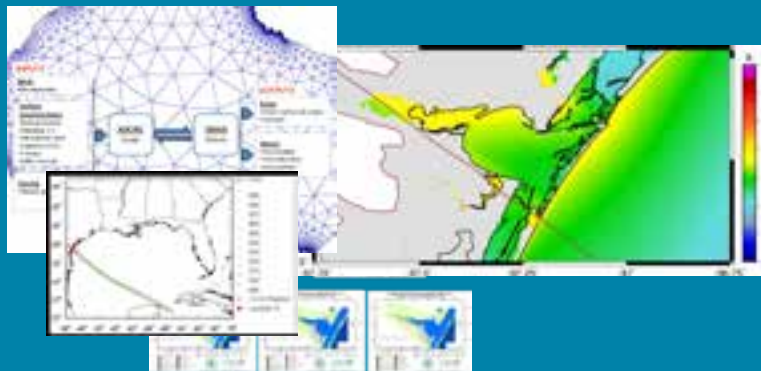


## Spatial Model Inputs – SLR and SS Scenarios

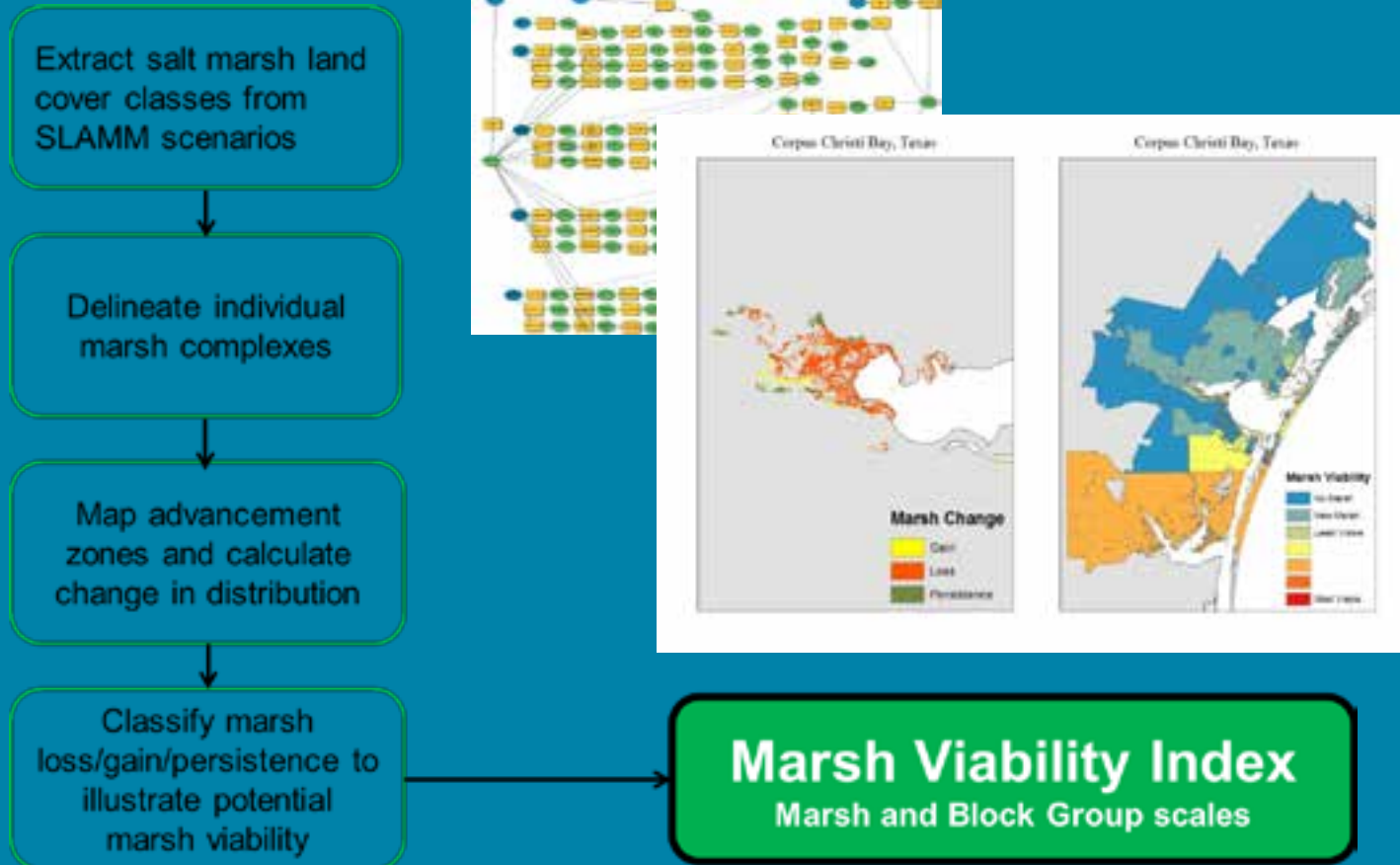
∅ Sea-Level Affecting Marsh Model (SLAMM)



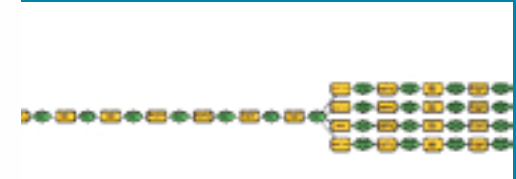
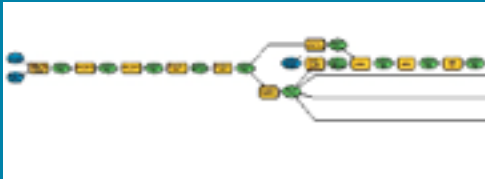
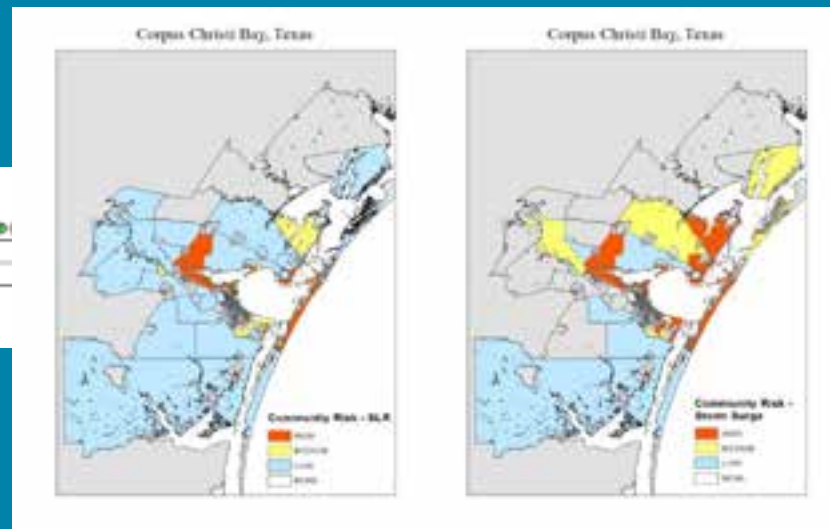
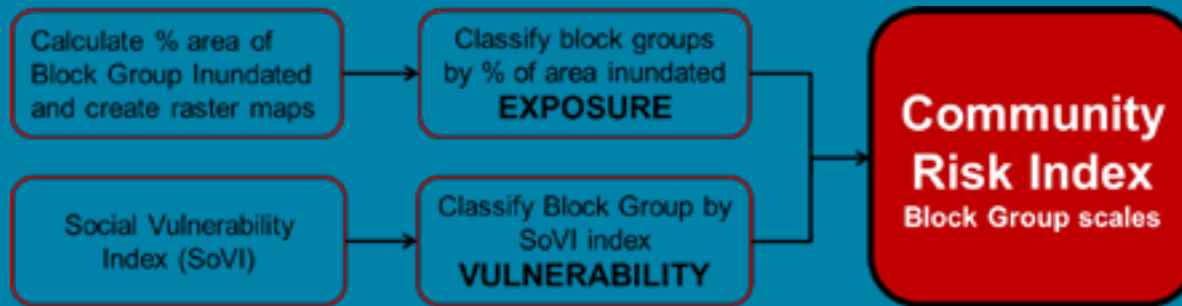
∅ ADvanced CIRCulation Model (ADCIRC)



## Marsh Viability Analyses

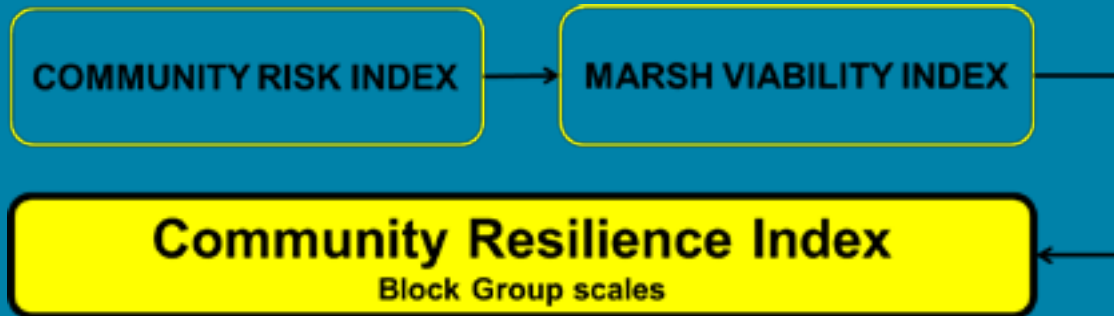


## Community Risk Analysis

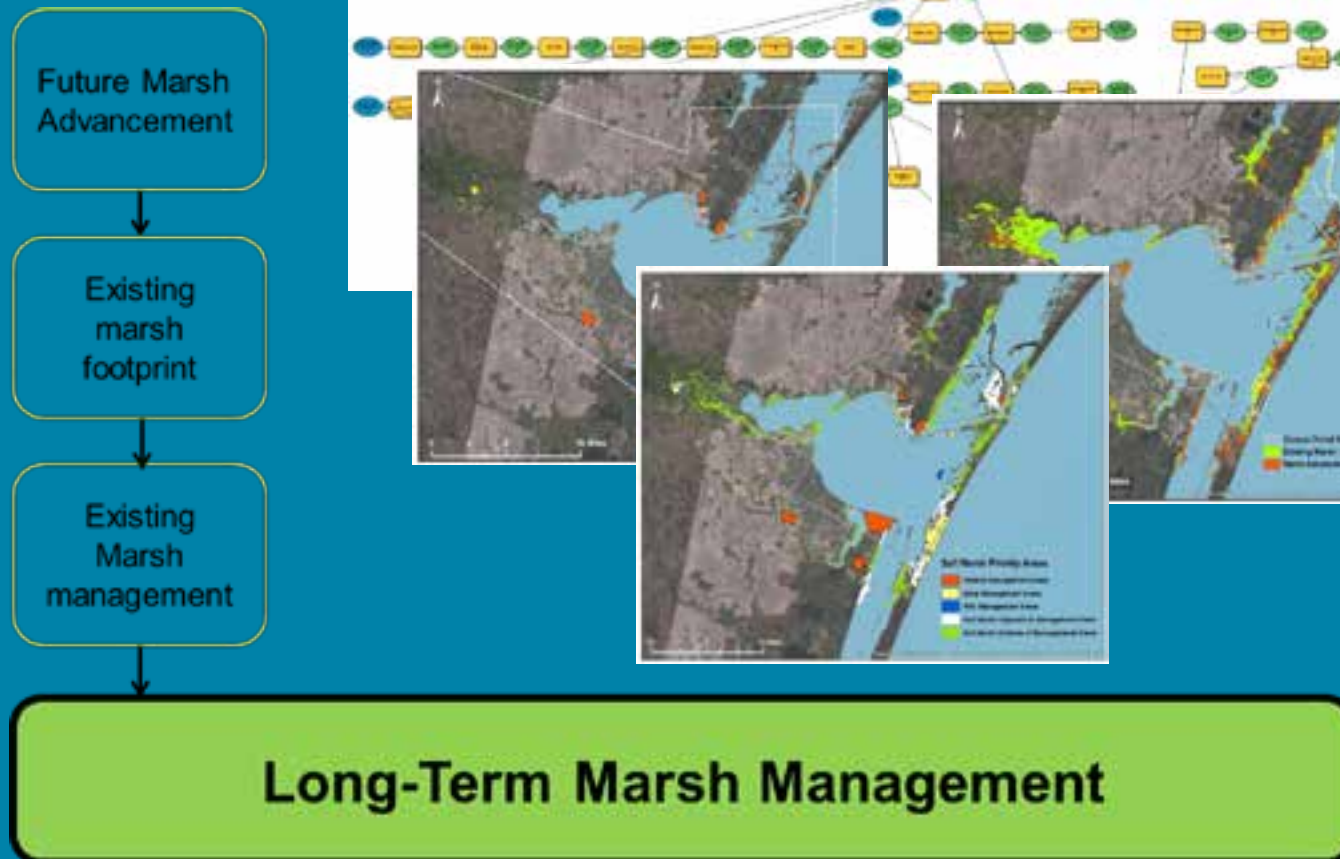




## Community Resiliency Analysis



## Marsh Conservation and Management



## TNC Texas and Ecosystem Services

- ∅ Identified need to incorporate ecosystem services into conservation and restoration
- ∅ Healthy and intact ecosystems provide valuable services to society but most lack a formal market for evaluation of the their services
- ∅ Ecosystem services are the benefits provided by nature to society. Examples include:

- Carbon sequestration
- Coastal protection
- Habitat for fish and wildlife
- Water filtration
- Recreation – and more...

Habitat	Beaches	Wetlands	Seagrass Beds	Oyster Reefs
Service				
Blue Carbon		Storage and sequestration		
Fisheries		Habitat for blue crabs, clumps, j		Food+ Habitat
Coastal Protection	Erosion	Accumulation of sediment; minor		Wave surge; Sediment loss
Recreation	All around	Boating, Rec. fishing, bird watching		

## TNC and the Natural Capital Project

TNC partnered with organizations and scientists from around the country to develop ecosystem service models

- Stanford University
- University of Minnesota
- World Wildlife Fund
- And collaborators..

## InVest Models

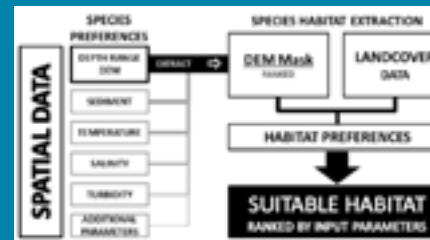
- GIS - Spatial models to evaluate a range of ecosystem services
- Open access and user friendly
- Scenario-based (future impacts)



## Fisheries Model – Galveston Bay Region, Texas

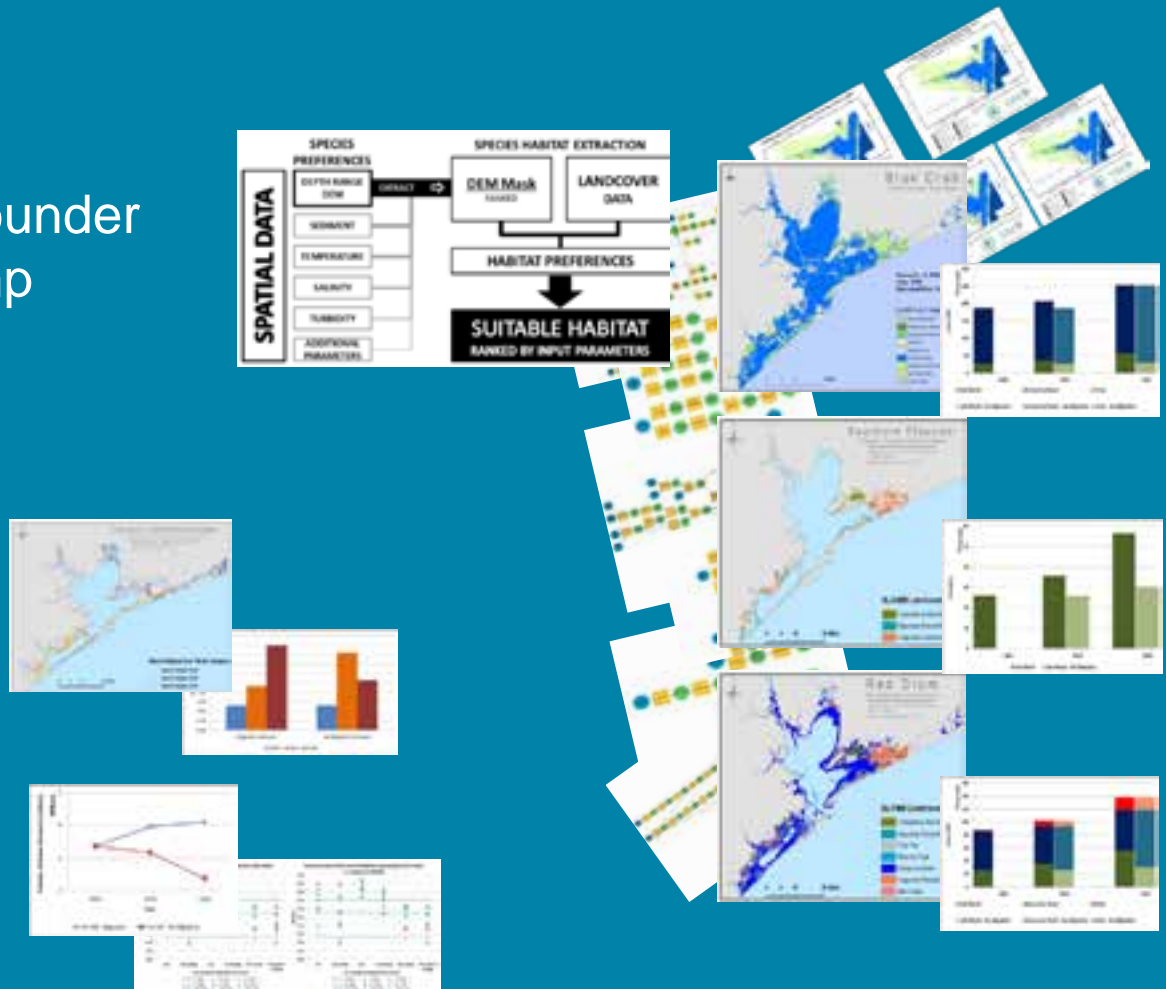
### ∅ Species

- Blue Crab
- Southern Flounder
- Brown Shrimp
- Red Drum



### ∅ Marsh Edge

### ∅ Marsh Volume



## Carbon Sequestration – Galveston Bay region, Texas



# The Complete Picture

## Toolkit for Planning and Management

### TOOLBOX

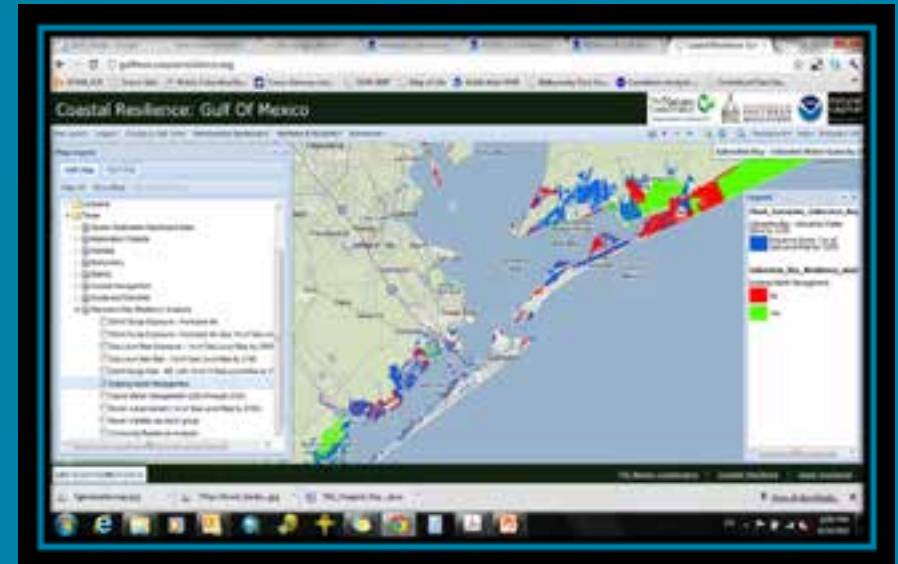


## Sea-Level Rise Research and Scenarios for a Changing Coast



[www.sealevelrise.org](http://www.sealevelrise.org)  
[www.slrportal.org](http://www.slrportal.org)

## Coastal Resilience Decision Support Tool



<http://maps.coastalresilience.org/gulfmex/>



## The Nature Conservancy InVesting in our Future – Nature's Way

Questions?????

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