

# Investigating the Resiliency of Ecosystem Services to Climate Change in south Florida coastal ecosystems

Christopher Kelble  
*December 8, 2016*  
*ACES*





# Outline

- How have we used ecosystem services in conjunction with coastal and marine resource managers in south Florida
- Two methodologies to investigate ecosystem service resiliency
- Preliminary results examining ecosystem service resiliency and management actions
- Lessons Learned // Path Forward

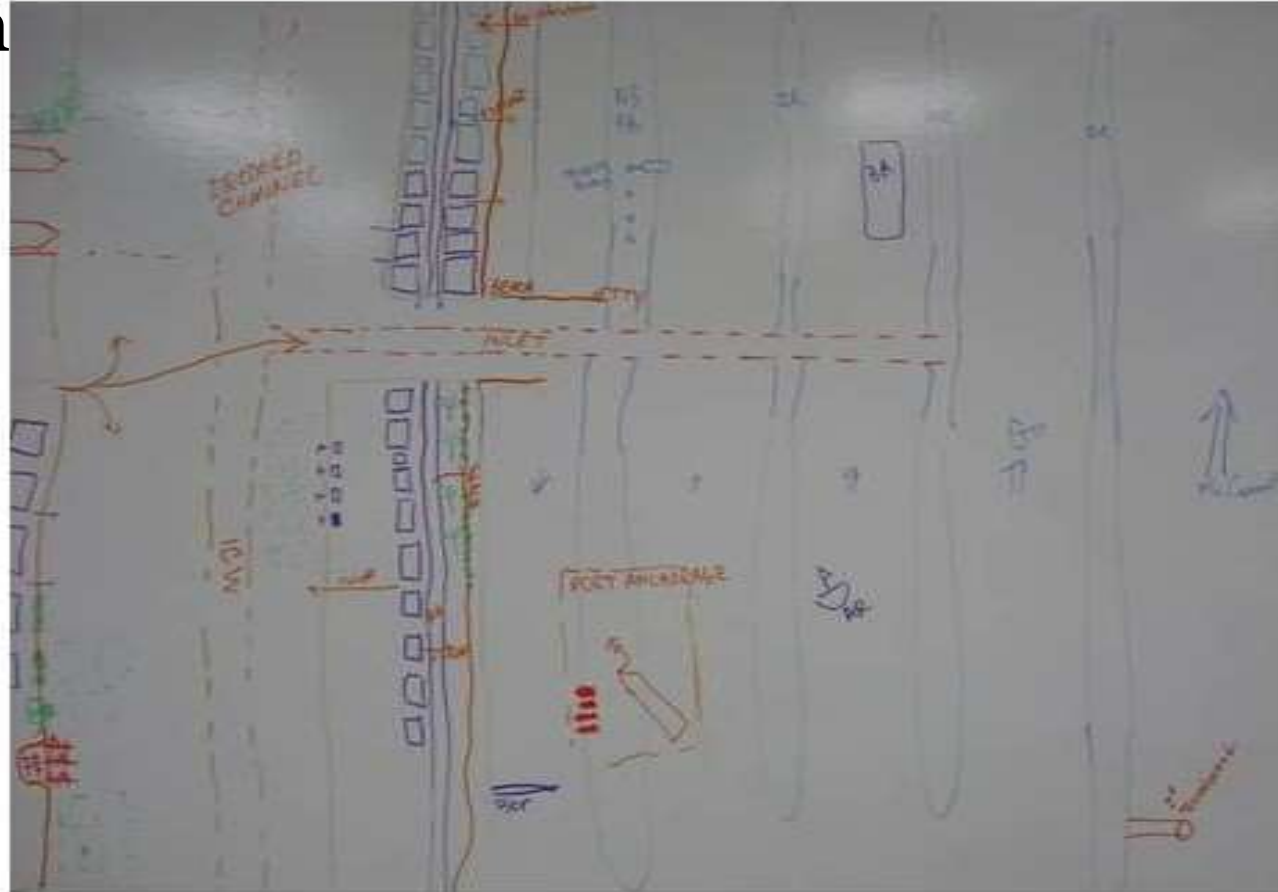
# MARES (2009-2012)

***“reach a science-based consensus about the defining characteristics and fundamental regulating processes of a South Florida coastal marine ecosystem that is both sustainable and capable of providing the diverse ecosystem services upon which our society depends”***

- Who?
  - >100 participants
  - >40 authors
- What? Consensus!
  1. Conceptual diagrams
  2. iCEMs > EBM-DPSER
  3. Indicators > Indices
  4. Risk & Trade-off analysis
- Where?
  - 3 “new” marine regions
  - + CERP estuaries



A hand-drawn map of a coastal area. A dashed line represents a 'TIDYED CHANNEL' running horizontally. To the left of the channel is a row of rectangular buildings. To the right is a 'PORT' area with a dashed line labeled 'PORT' and a small structure labeled 'PORT ANCHORAGE'. A compass rose indicates North (N) is towards the top right. A scale bar shows distances of 0, 20, 40, and 60 meters. A north arrow points towards the top right.



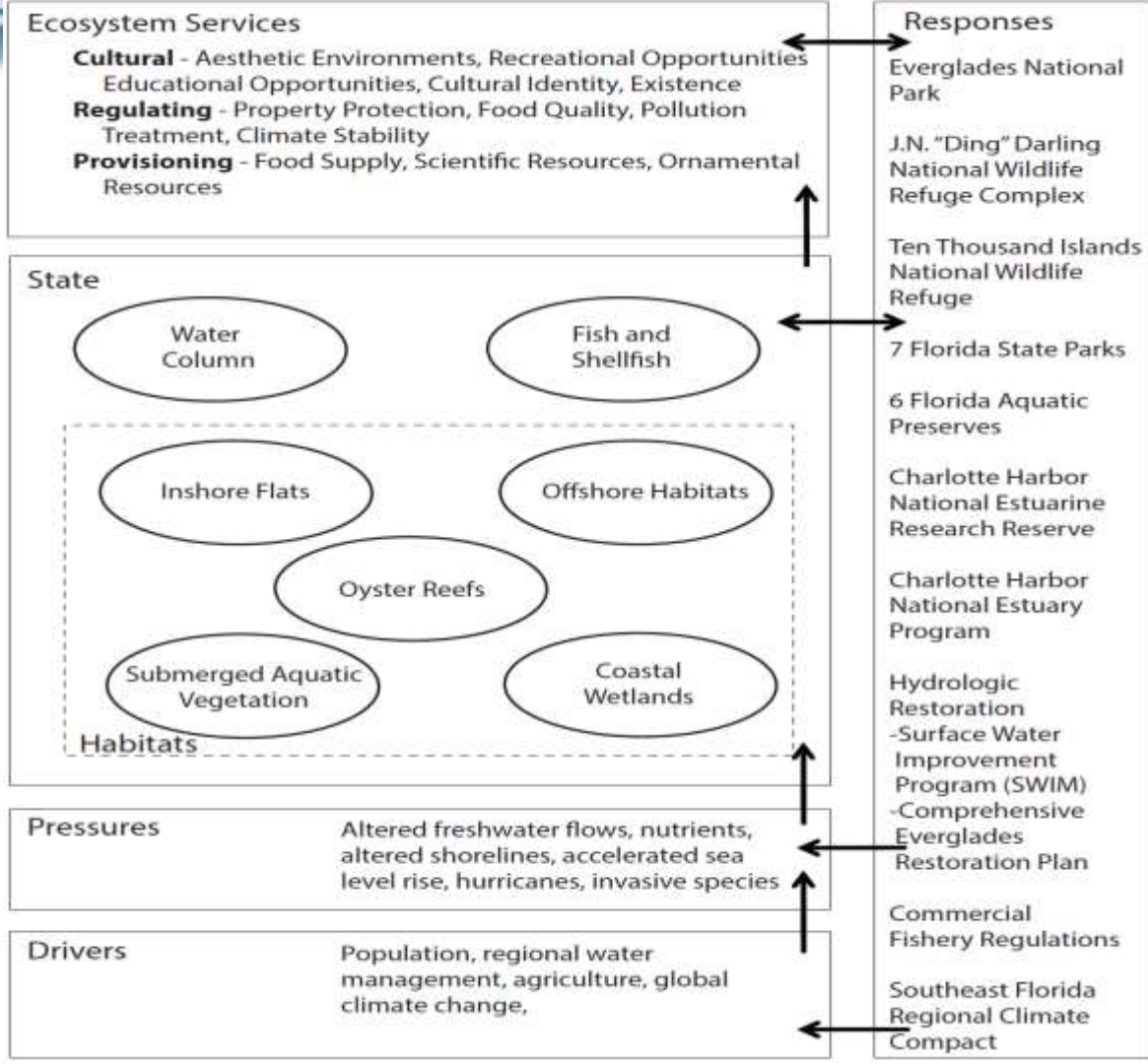
# Communication and Consensus- Building

Marine and Estuarine Goal Setting for South Florida  
Characterization of the Southeast Florida Shelf Subregion: Plan View Diagram



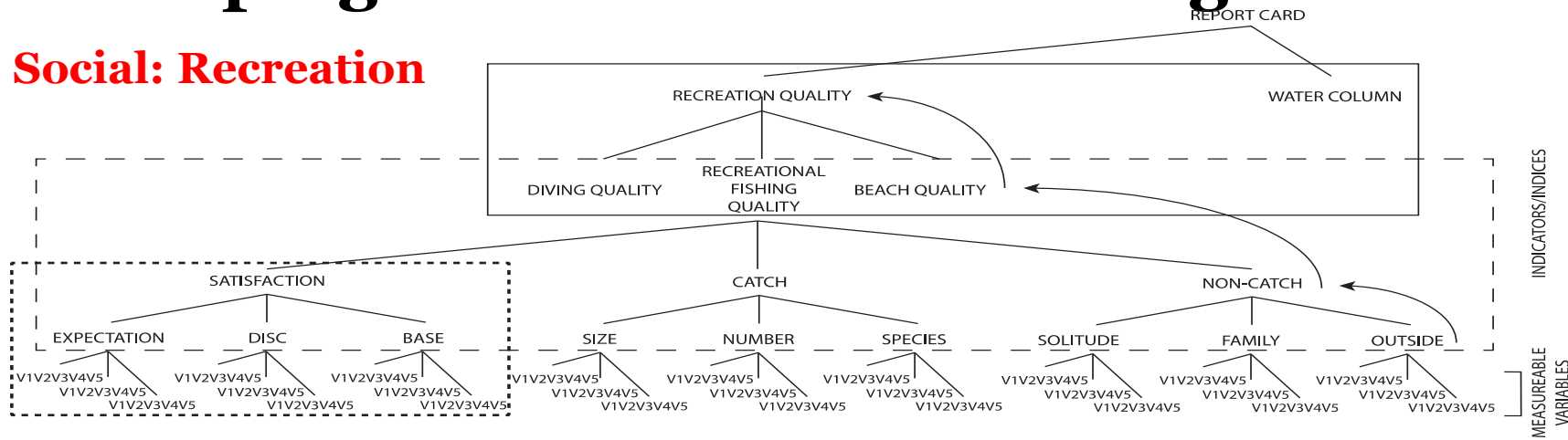


# EBM-DPSEER Model for Southwest Florida Shelf

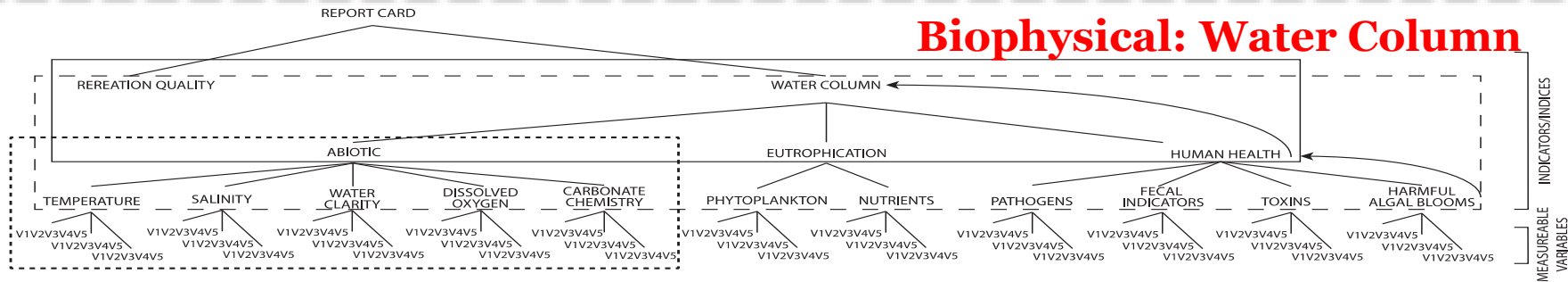


# Developing Consistent Socio-ecological Indices

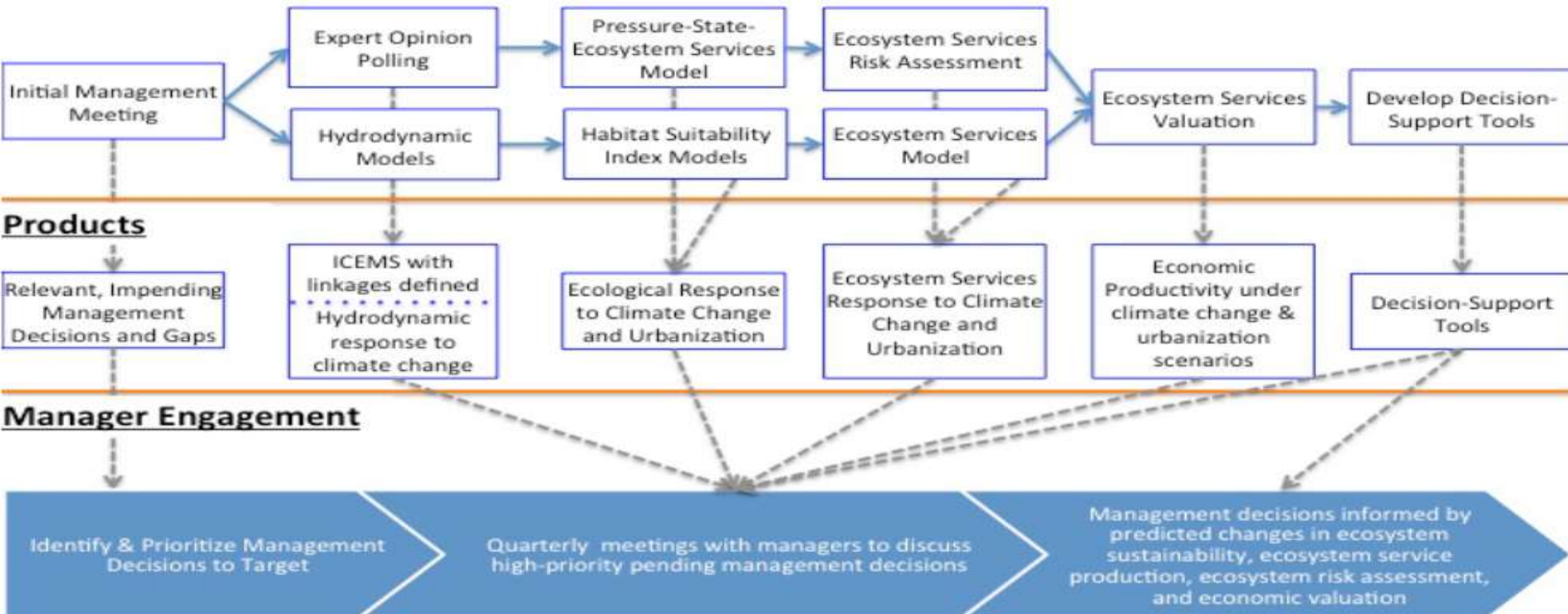
## Social: Recreation



## Biophysical: Water Column



# Ecosystem Service Resiliency Investigations



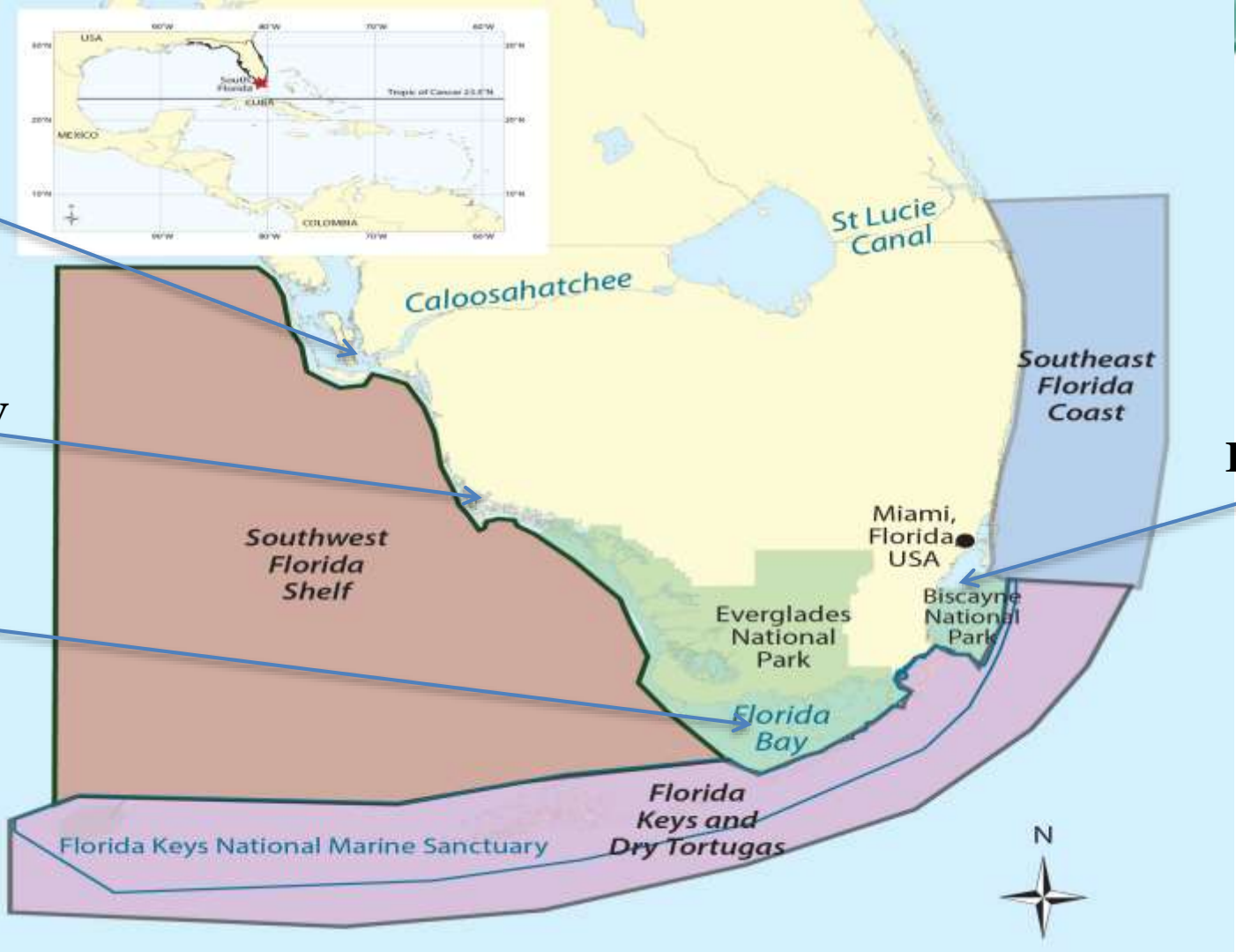


**Charlotte Harbor**

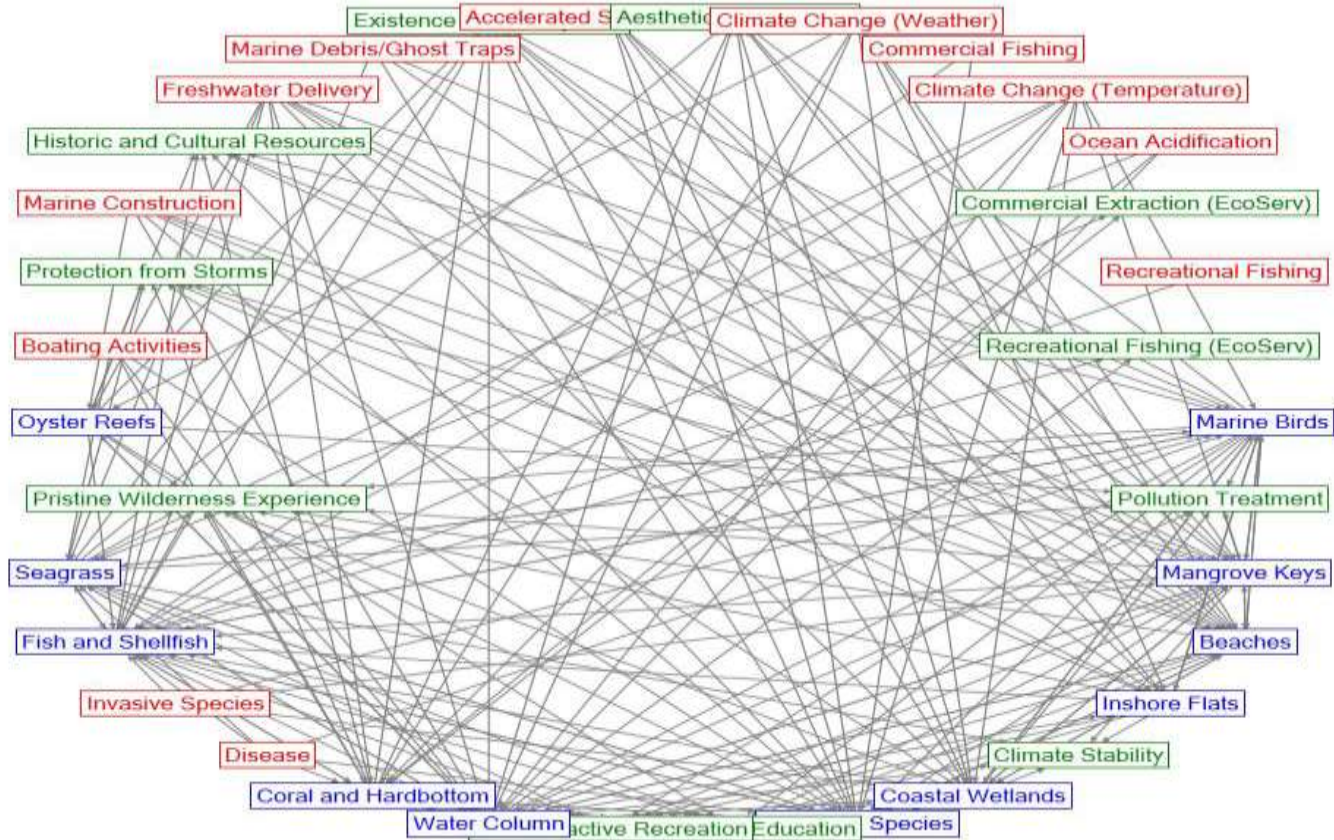
**Rookery Bay**

**Florida Bay & Florida Keys**

**Biscayne Bay**



# Pressure-State-Ecosystem Service Network model

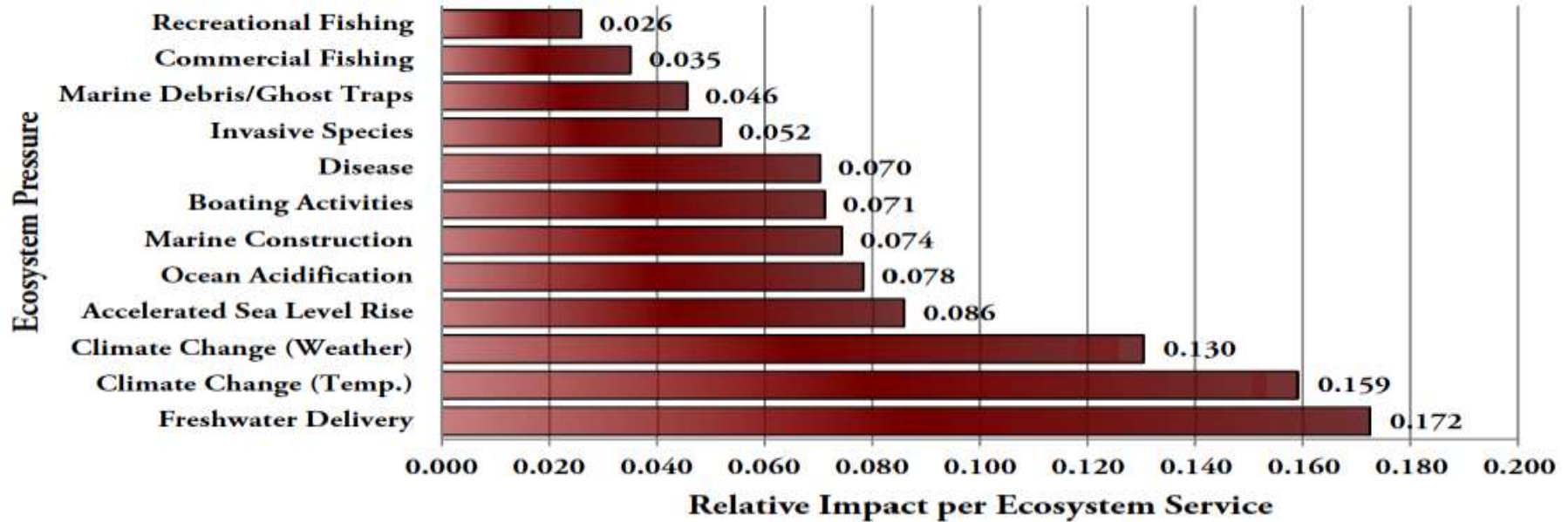


# Pressure-State-Ecosystem Service Network Model



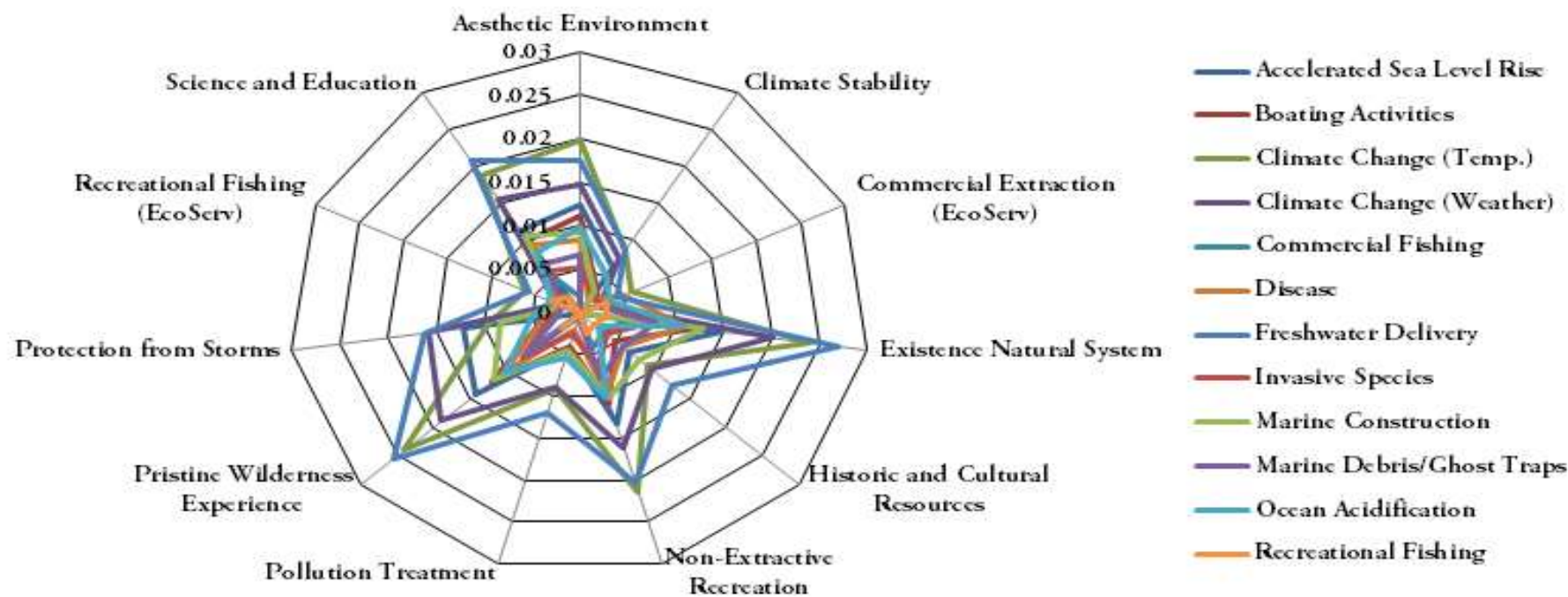


### Direct Impact of MARES Ecosystem Pressures on Ecosystem Services



1. Determines pressures that have the greatest effect on ecosystem services (Freshwater Delivery)
2. Determines ecosystem services under the greatest amount of

## Relative Impact of Pressures to Ecosystem Services





# How are we putting in climate change and mitigation strategies? Scenario Analysis

Pole and Troll zone put into place in 2011; bans combustion engines



## POLE/TROLL ZONE



USE OF COMBUSTION  
MOTORS PROHIBITED

## IDLE SPEED



NO WAKE

## Pole/Troll Zone

- Use of internal combustion motors is prohibited (except in marked channels and in Jimmy's Lake).
- Boats may operate under power in marked channels and at idle speed in Jimmy's Lake.
- Electric trolling motors and non-motorized power sources, such as oars, push poles, and paddles, are permitted.

Restoring resources and improving visitor experiences in Everglades National Park

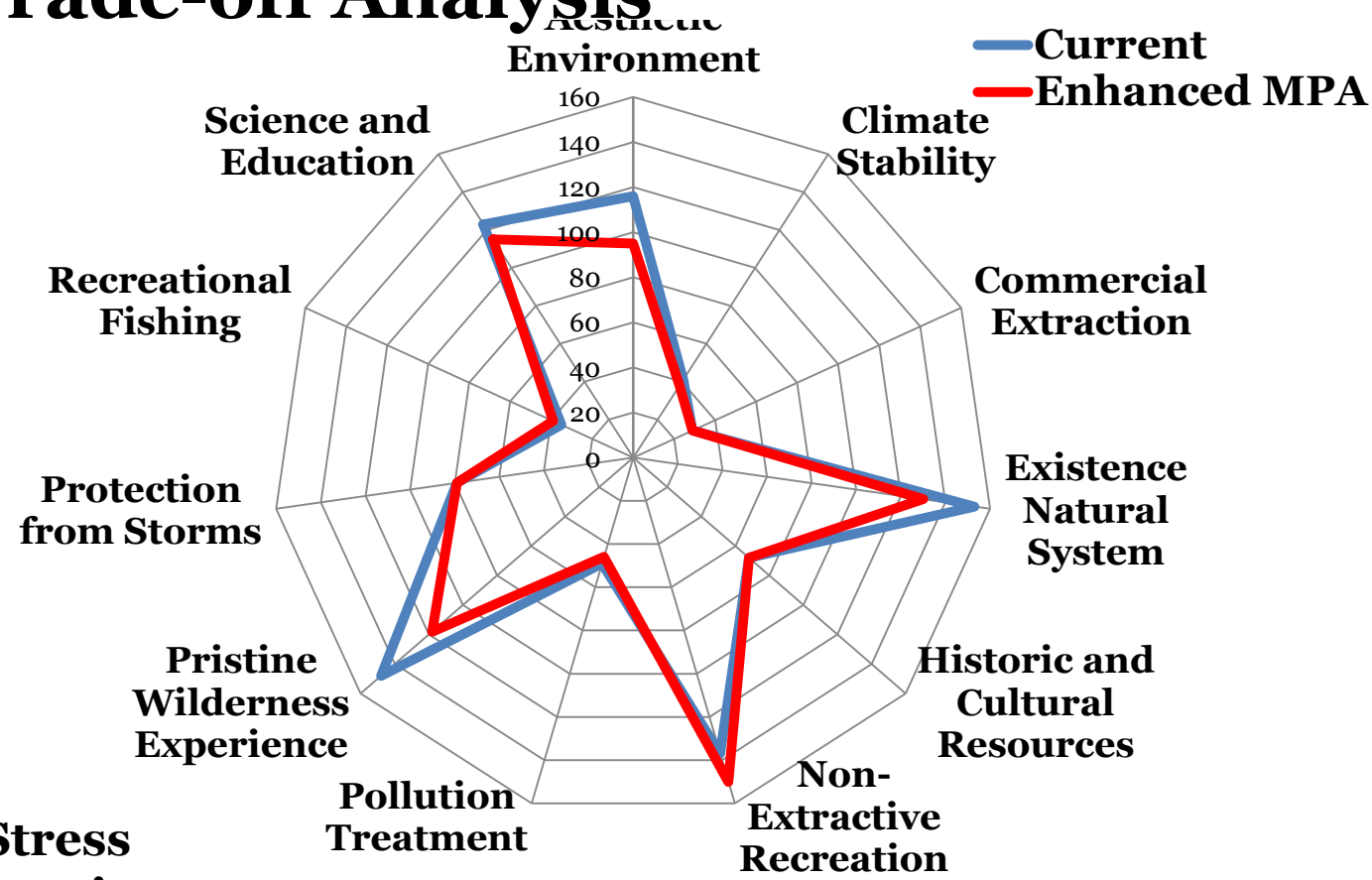
# Scenario Analysis

- Use scoring from Risk Analysis to determine the impact of the expanded pole and troll zone on ecosystem services and ecosystem sustainability
- Quantify tradeoffs among ecosystem services

**OBJECTIVE:** Provide unbiased, integrated social and ecological scientific information to the decision-making process

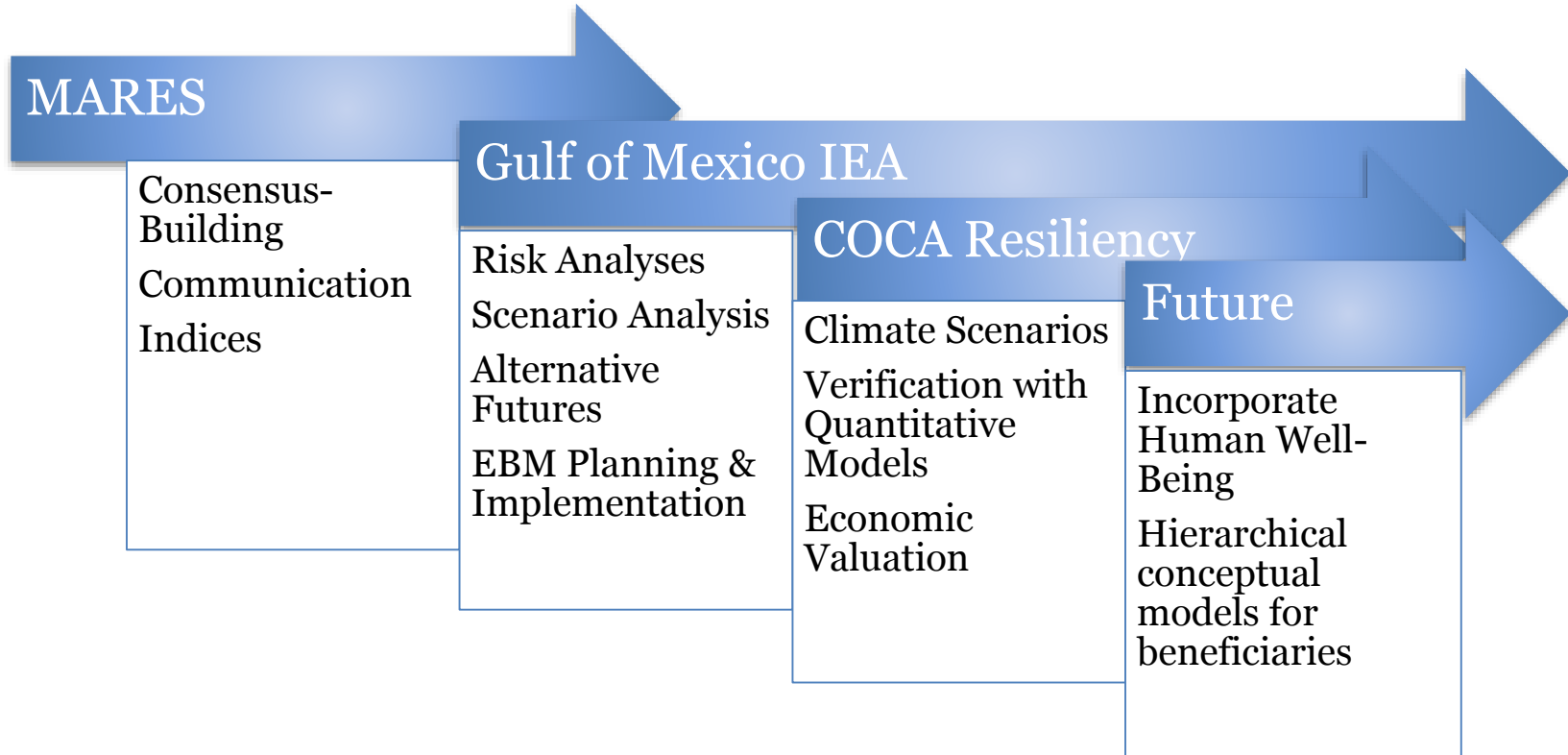


# Scenario/Trade-off Analysis



Cumulative Stress  
on Ecosystem Services

# The evolution of Ecosystem Services for marine EBM in South Florida



# Looking Ahead

- Valuation of outcomes
- Implementing FEGS approach (Boyd and Banzhaf 2007)
- Demonstrating alternative futures, providing decision options
- Use for EBM plans





***“Great challenges are only overcome through effective collaboration”***

Questions???

More Information:  
*Chris.Kelble@noaa.gov*

***Funding Provided By:***



**CLIMATE PROGRAM OFFICE**

Advancing scientific understanding of climate, improving society's ability to plan and respond



National Centers for Coastal Ocean Science  
...science serving coastal communities

Center for Sponsored Coastal Ocean Research



**INTEGRATED ECOSYSTEM ASSESSMENT**