Threats to Habitats:

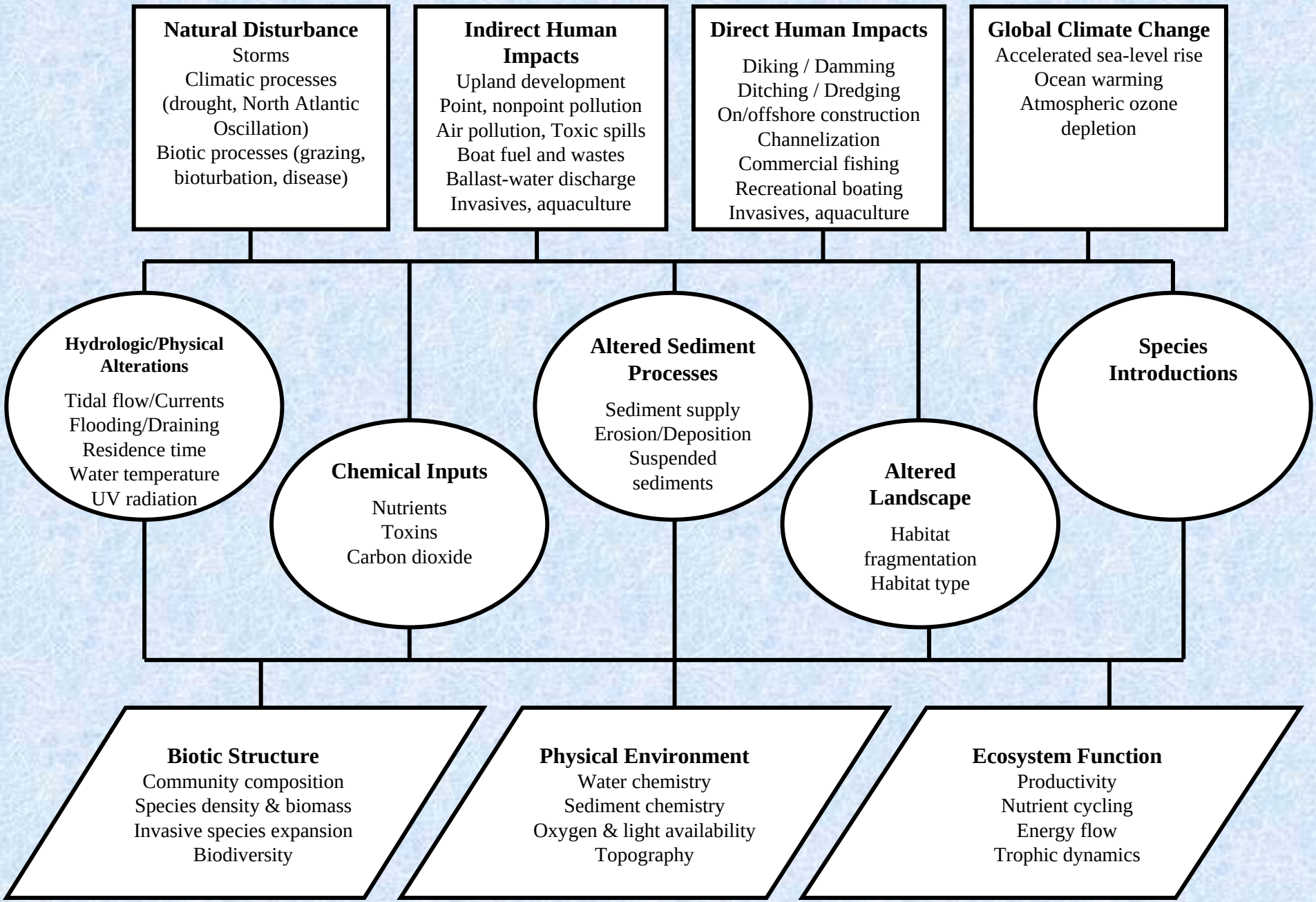
Science for Monitoring and Managing Coastal and Wetland Ecosystems

Document status and trends

Understand causal relationships

Evaluate options and outcomes

Coastal & Wetland Ecosystem Model



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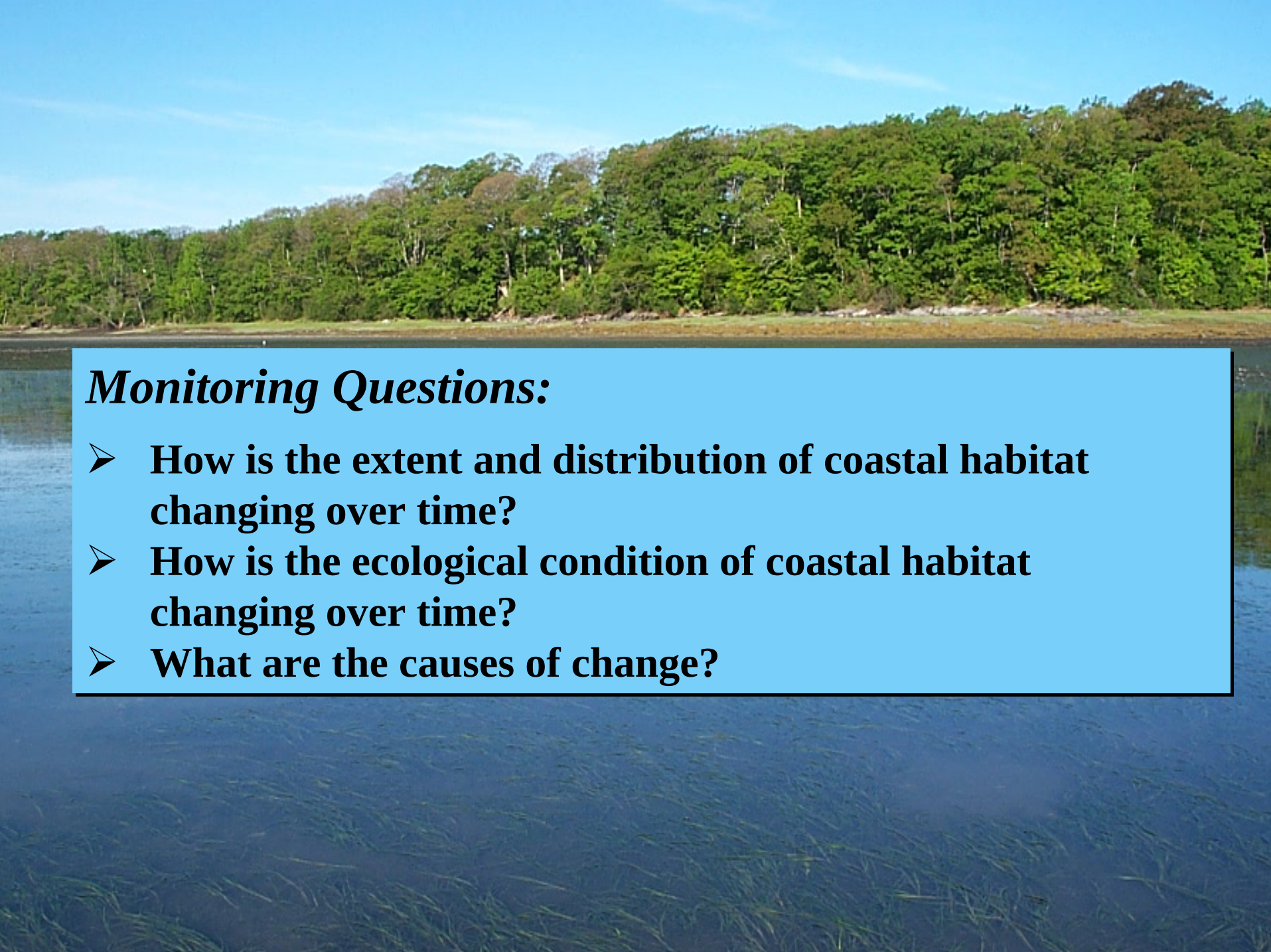
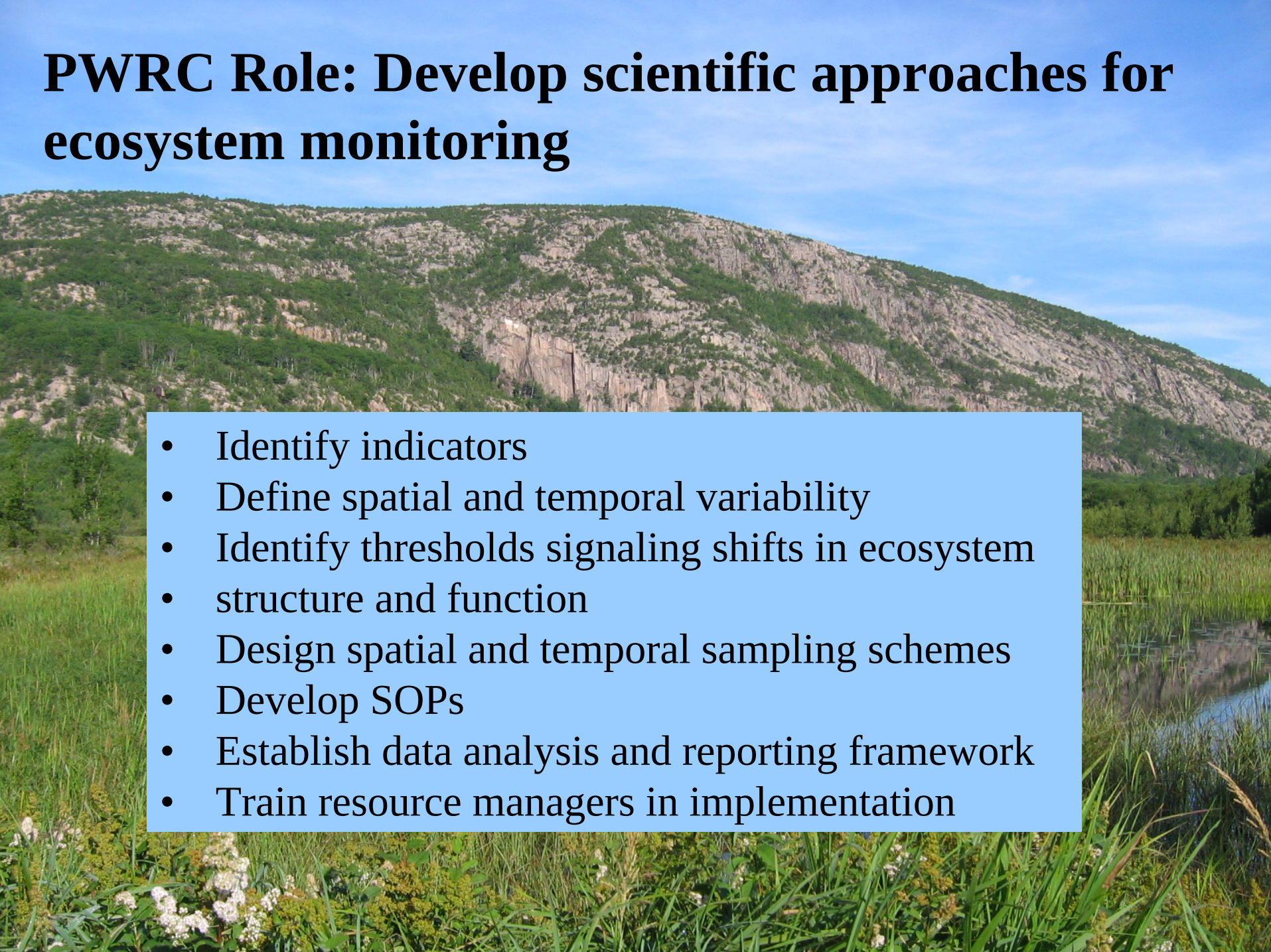


Monitoring Questions:

- **How is the extent and distribution of coastal habitat changing over time?**
- **How is the ecological condition of coastal habitat changing over time?**
- **What are the causes of change?**

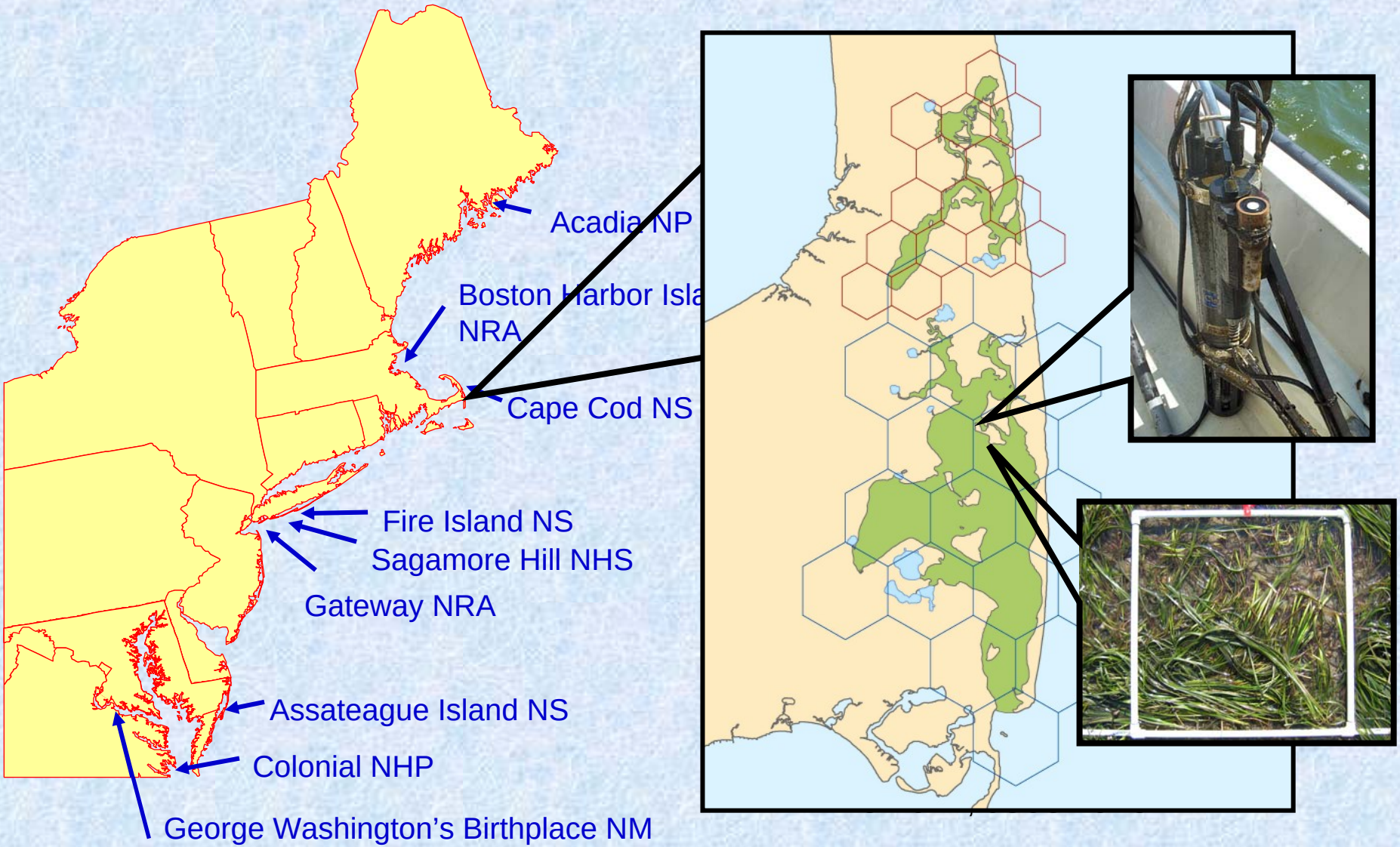
PWRC Role: Develop scientific approaches for ecosystem monitoring



- Identify indicators
- Define spatial and temporal variability
- Identify thresholds signaling shifts in ecosystem
- structure and function
- Design spatial and temporal sampling schemes
- Develop SOPs
- Establish data analysis and reporting framework
- Train resource managers in implementation

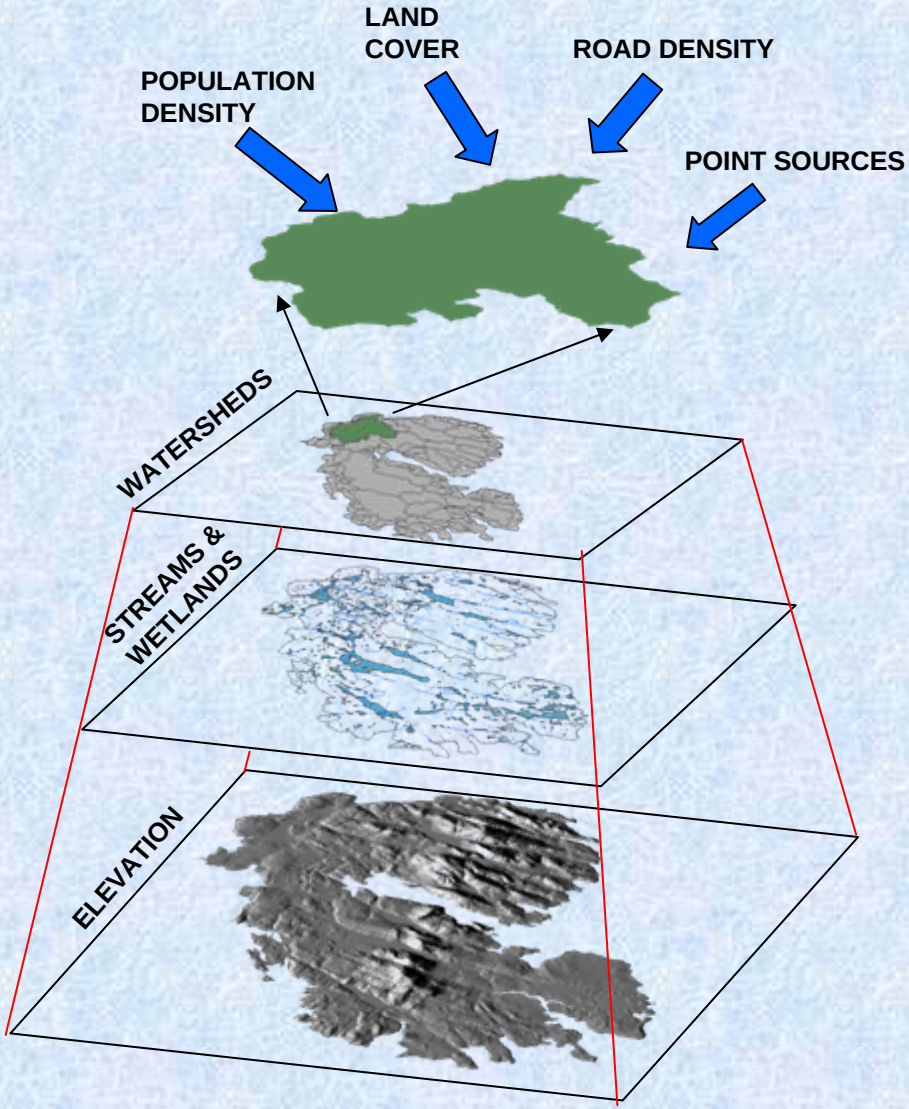
Example: Protocols to Monitor Estuarine Nutrient Enrichment

NPS Vital Signs Monitoring Program - Northeast Coastal and Barrier Network



Example: Protocols to Monitor Freshwater Wetlands

NPS Vital Signs Monitoring Program - Northeast Temperate Network



Within-Wetland Ecosystem Response Indicators

- Groundwater and surface water level
- Groundwater and surface water chemistry
  conductivity, pH
- Vegetation
  species richness
  community composition

Collaborators

- H. Neckles, G. Guntenspergen, A. Gilbert, USGS PWRC
- M. Nielsen, USGS MWSC
- A. Little, Univ. of Minnesota
- NETN Vital Signs Program
- Acadia National Park resource managers

Funding

- USGS POBS, NRPP; NPS-NETN

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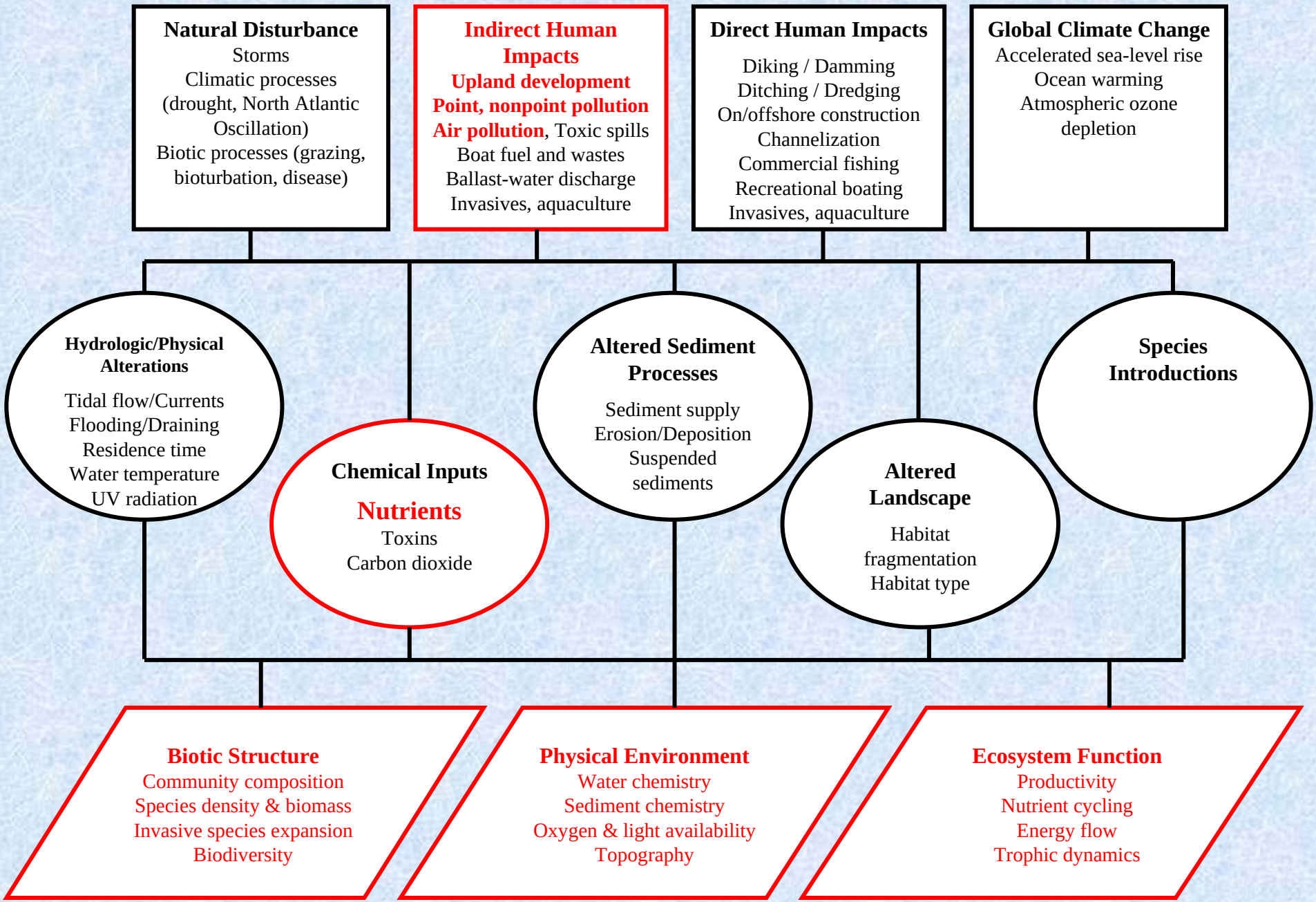
PWRC Role: Determine causal relationships among natural and anthropogenic stressors and the structure and function of coastal and wetland ecosystems

- Relate ecosystem status and trends to human and natural causes and consequences
- Identify mechanisms underlying causes and effects
- Predict future trajectories and rates of change
- Assess uncertainties
- Identify information needed to reduce future uncertainties
- Transfer information to scientific and management communities

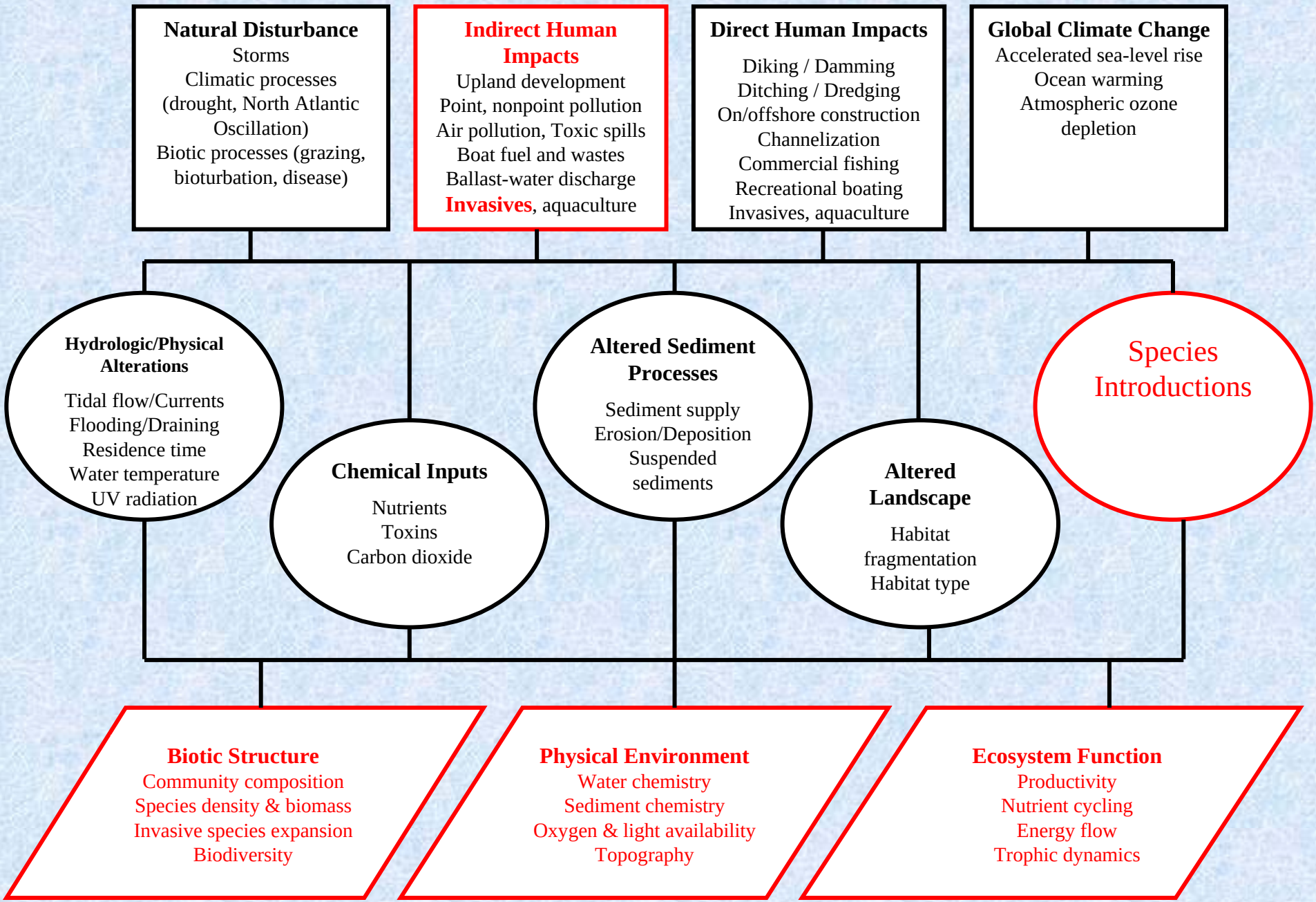
Coastal & Wetland Ecosystem Model



Indirect Human Impacts: Define threshold relationships between nitrogen load and seagrass ecosystem response

Ecosystem Parameter	mmol m^{-2} d^{-1}
Phytoplankton	7.7
Epiphytes	8.0
Ruppia Percent Cover	3.8
Ruppia Biomass	1.9

Coastal & Wetland Ecosystem Model



Indirect Human Impacts: Define the role of invasive plant species in changing the face of wetland ecosystems

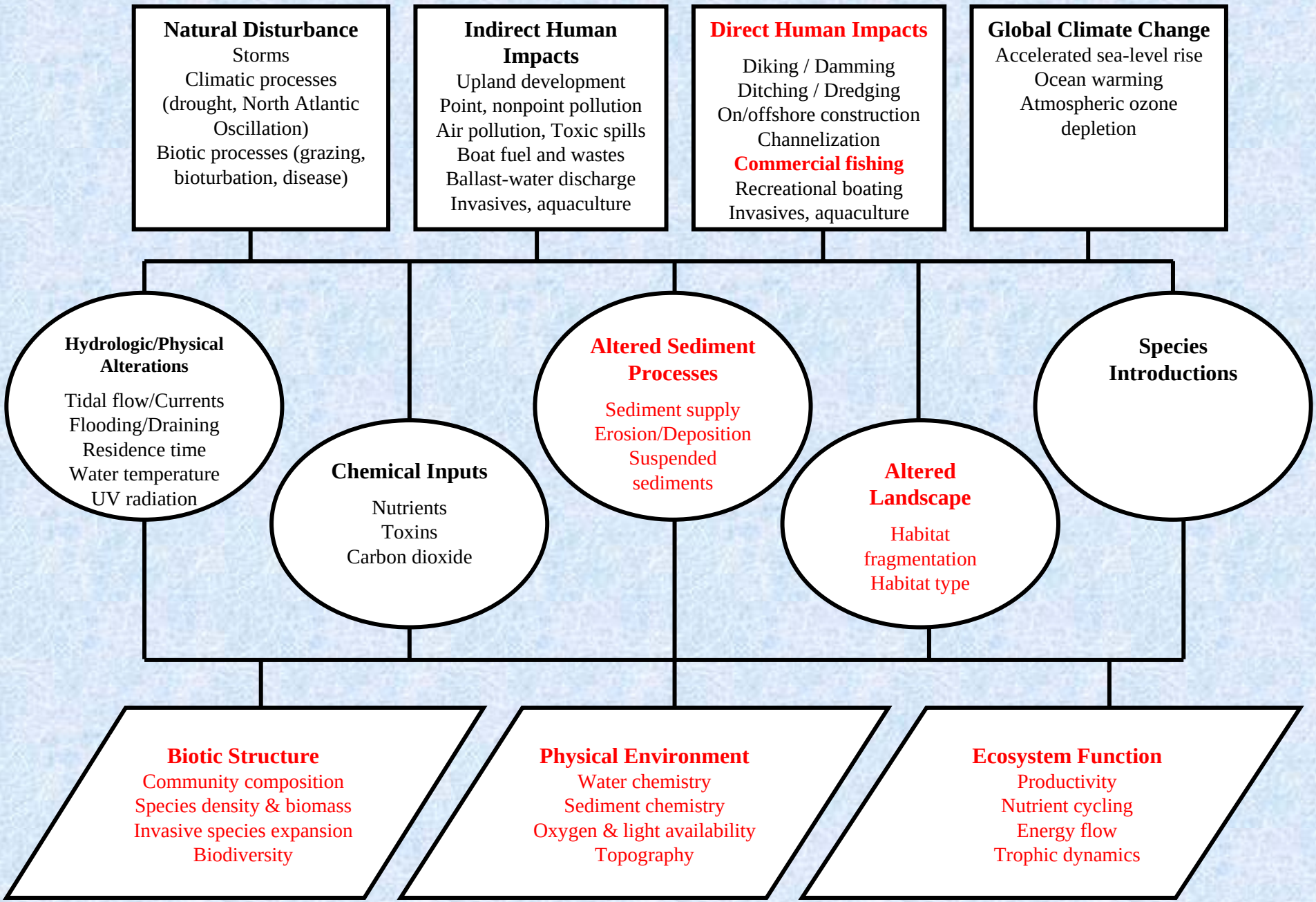
Phragmites australis invading coastal wetlands in the Chesapeake Bay

PHYSIOLOGICAL CHARACTERISTICS OF NATIVE AND NON-NATIVE CULTIVARS OF PHRAGMITES AUSTRALIS

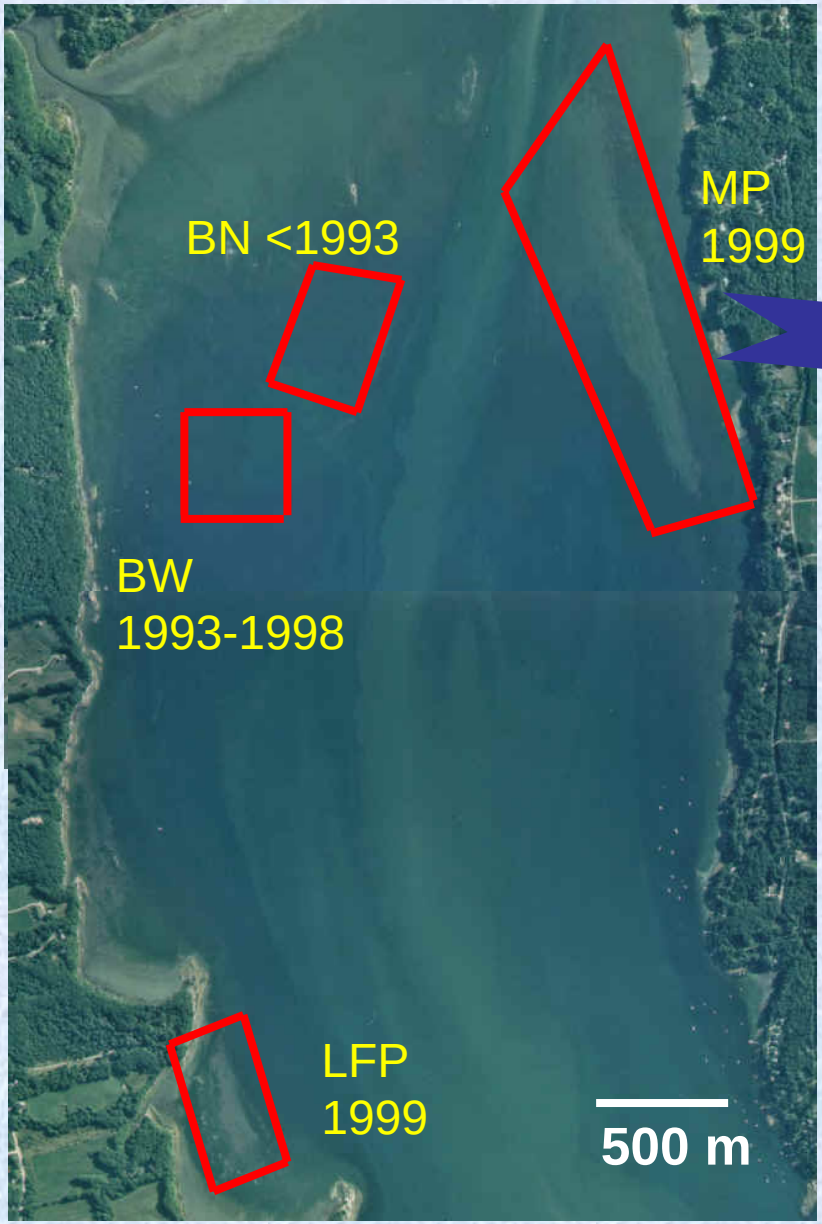
Collaborators:
G. Guntenspergen – USGS PWRC
E. Glenn – Univ. of Arizona
J. Brown – USFWS

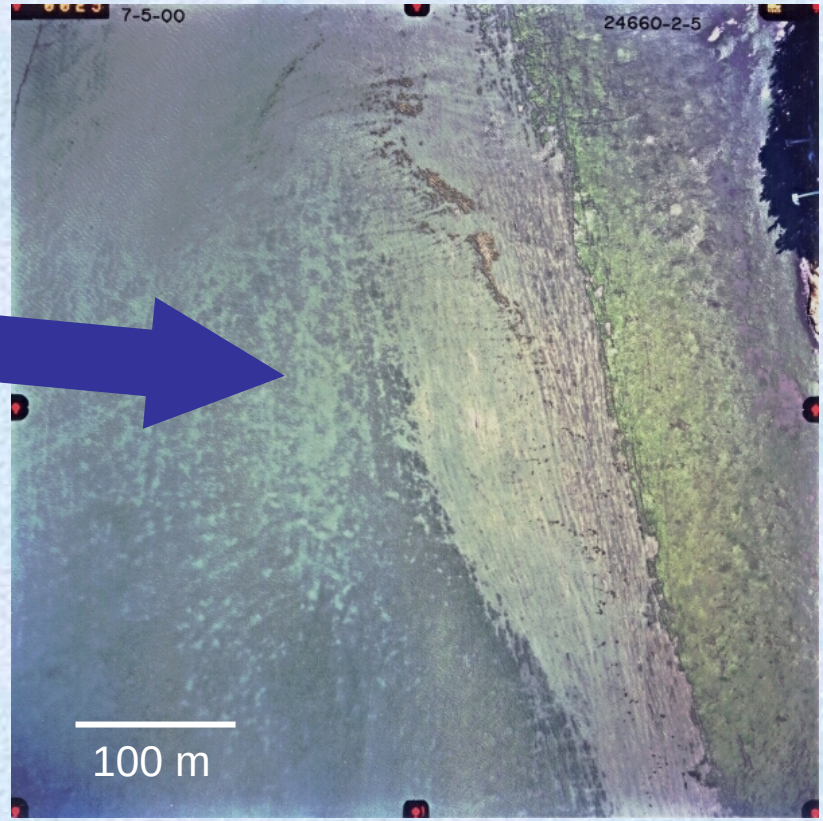
Funding:
USGS SSP

Coastal & Wetland Ecosystem Model



Direct Human Impacts: Determine effects of commercial mussel dragging on eelgrass and predict recovery time



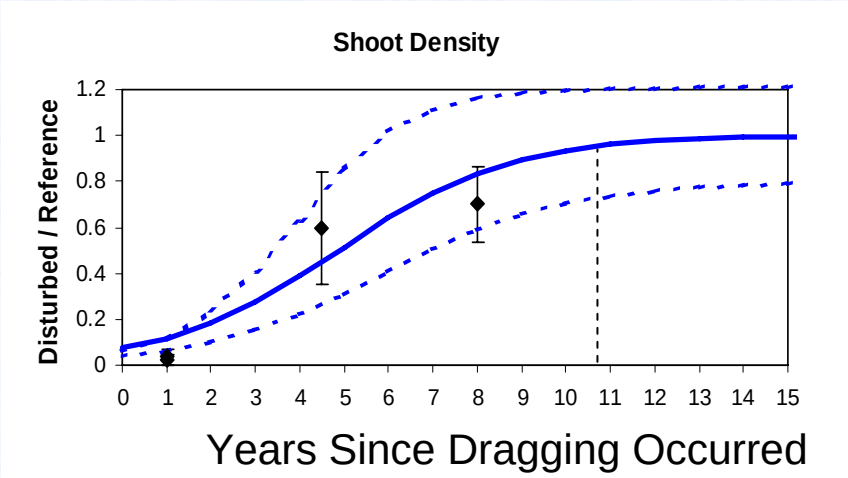


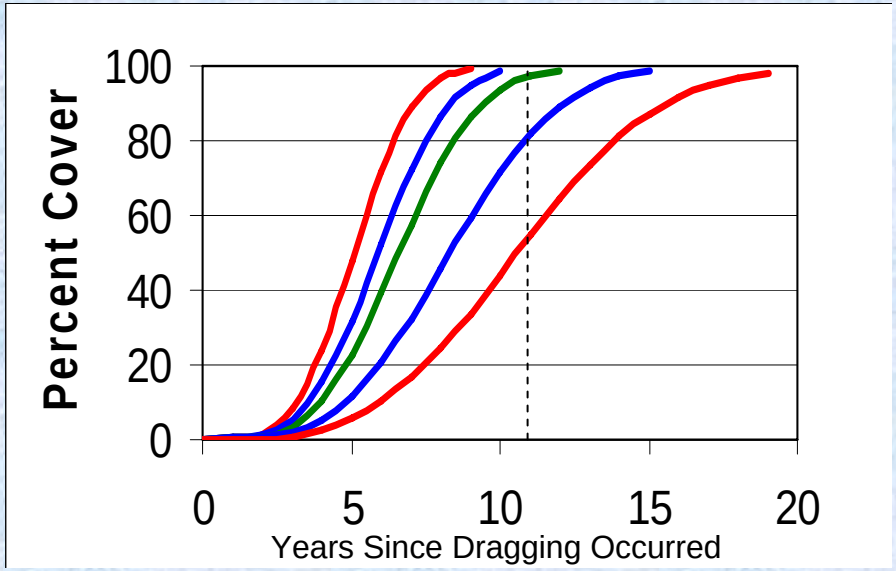
Collaborators:
H. Neckles, B. Kopp – USGS PWRC
S. Barker – ME Dept. Mar. Resources
F. Short – Univ. of New Hampshire
Town of Brunswick, ME
Funding:
USGS State Partnership Program

How long will it take the eelgrass bed to recover?

1. "Space-for-time substitution" based on measurements made at the scale of the eelgrass beds

2. Computer model of eelgrass revegetation based on field measurements at the scale of individual shoots





Independent methods led to same prediction: complete revegetation of a dragged area will require an average of **11 years**

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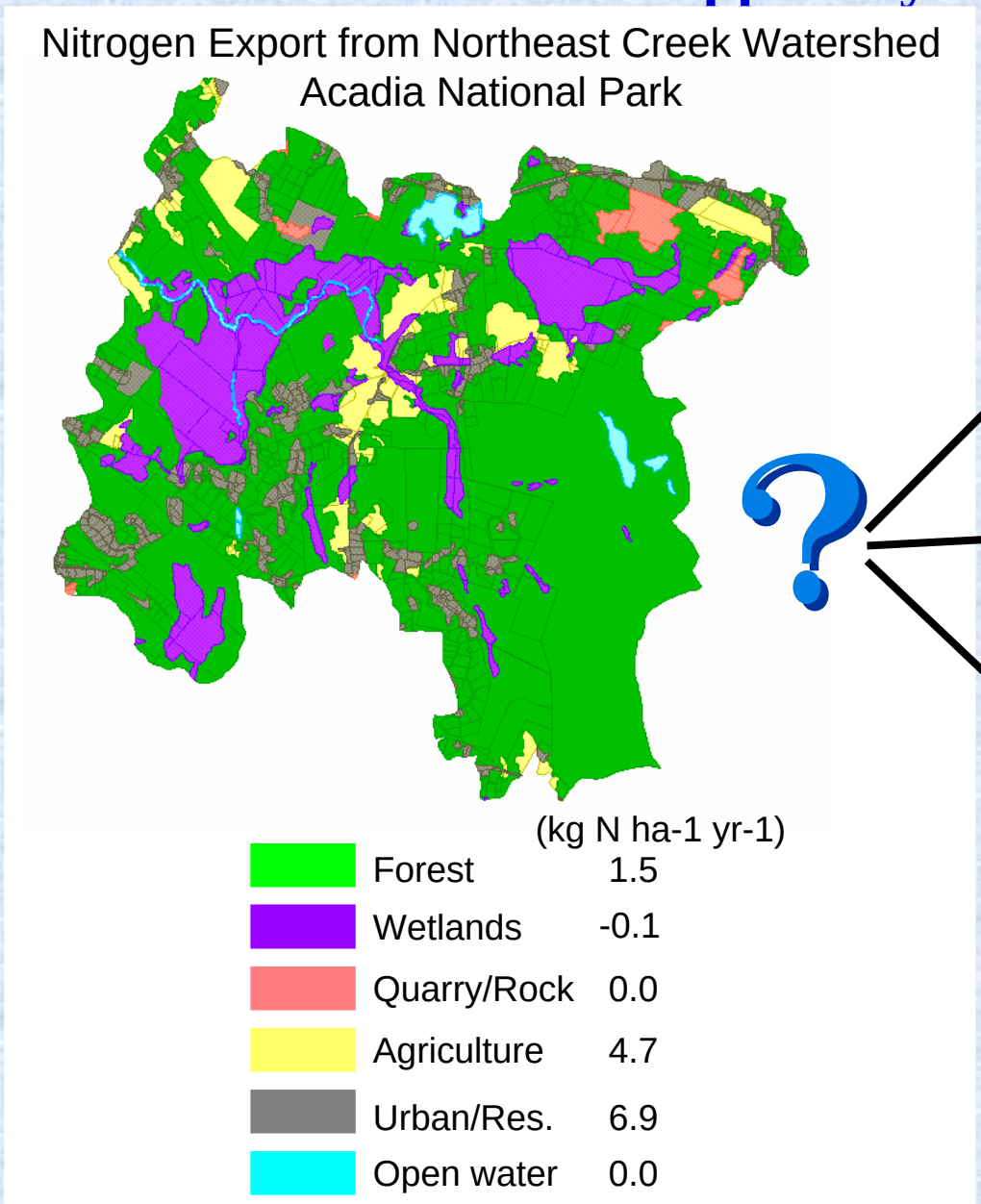
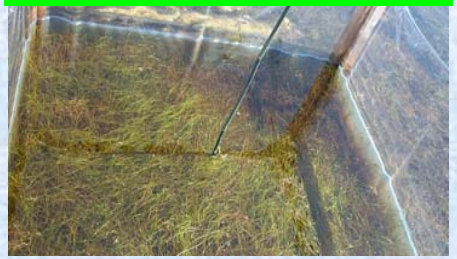
Example: Link land use to estuarine response in a Decision Support System



< 2.2 kg TN ha^{-1} yr^{-1}

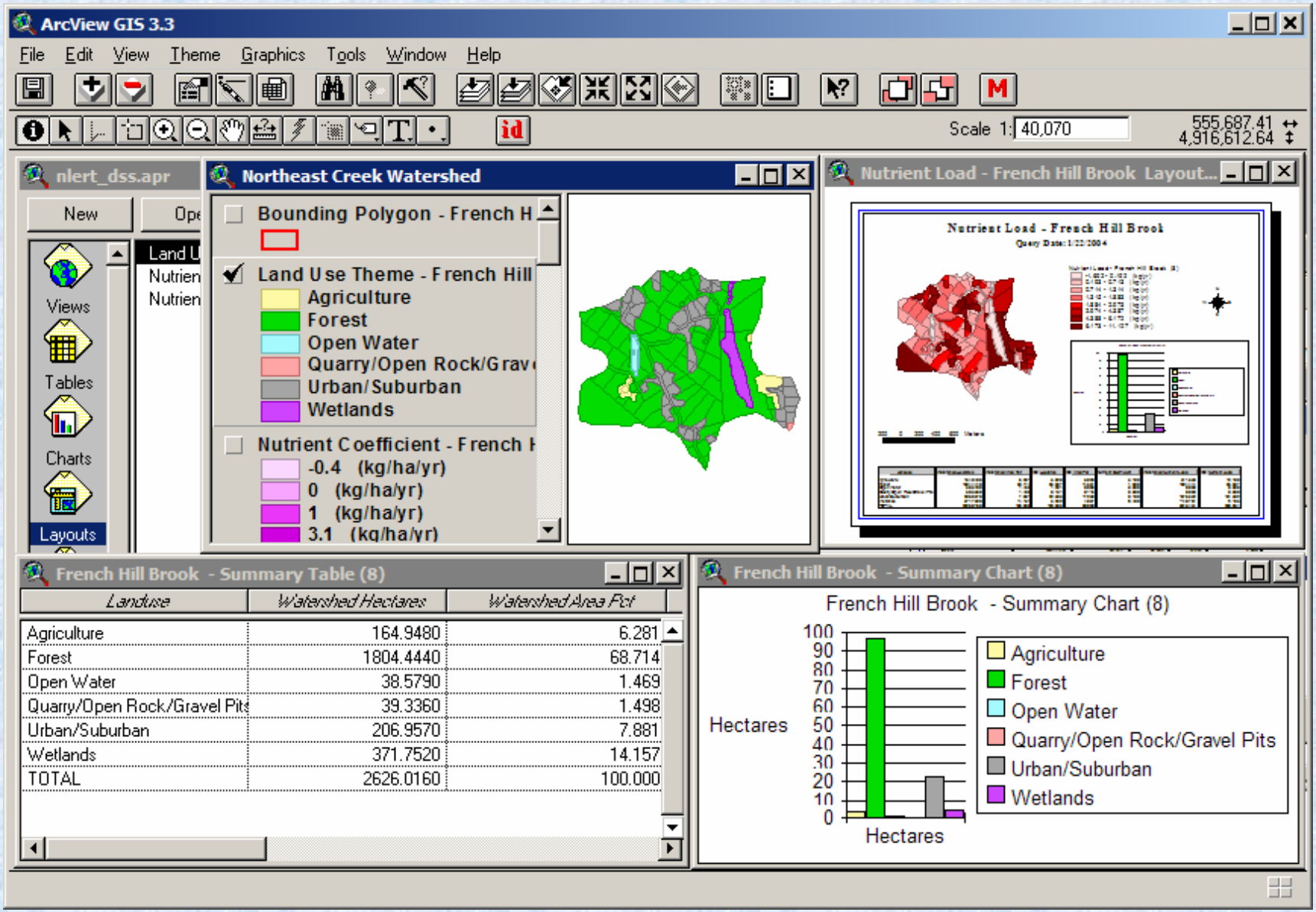


2.2 – 4.4 kg TN ha^{-1} yr^{-1}

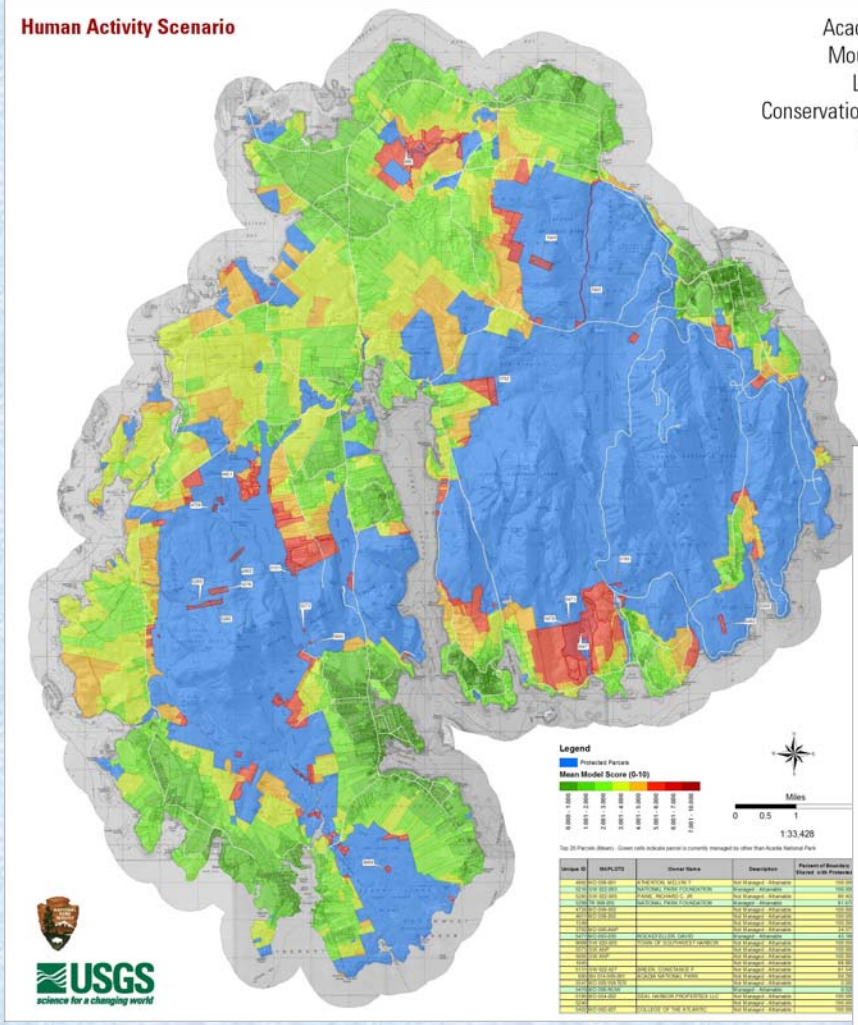
>4.4 kg TN ha^{-1} yr^{-1}

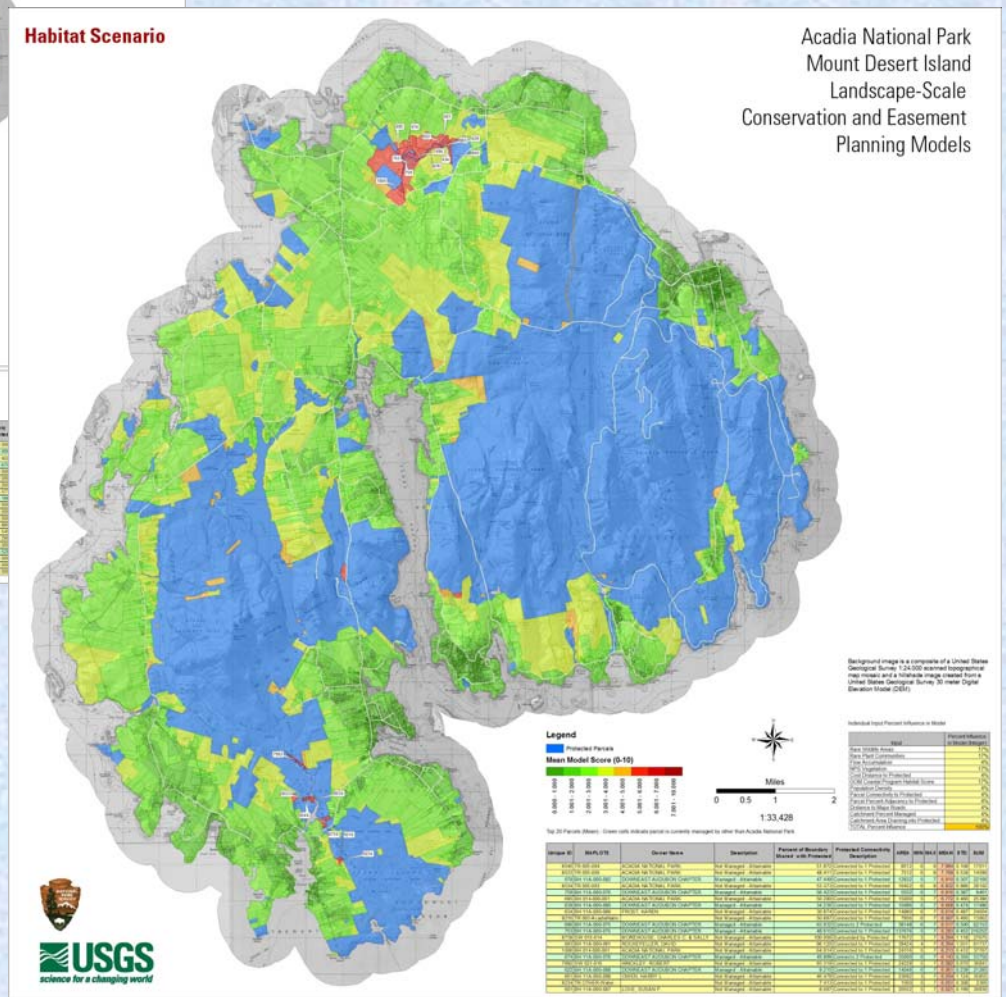
Collaborators:
G. Guntenspergen, H. Neckles, B. Kopp – PWRC
M. Nielsen – USGS MWSC
Acadia National Park resource managers
Funding: USGS NRPP

DECISION SUPPORT SYSTEM



Acadia National Park Landscape Scale Conservation and Easement Planning





Collaborators:

G. Guntenspergen – USGS PWRC

Acadia National Park

Maine Coast Heritage Trust

Funding:

USGS POBS