Integrating an Estuarine Research & Monitoring Program (DCERP) into Coastal Decision Making

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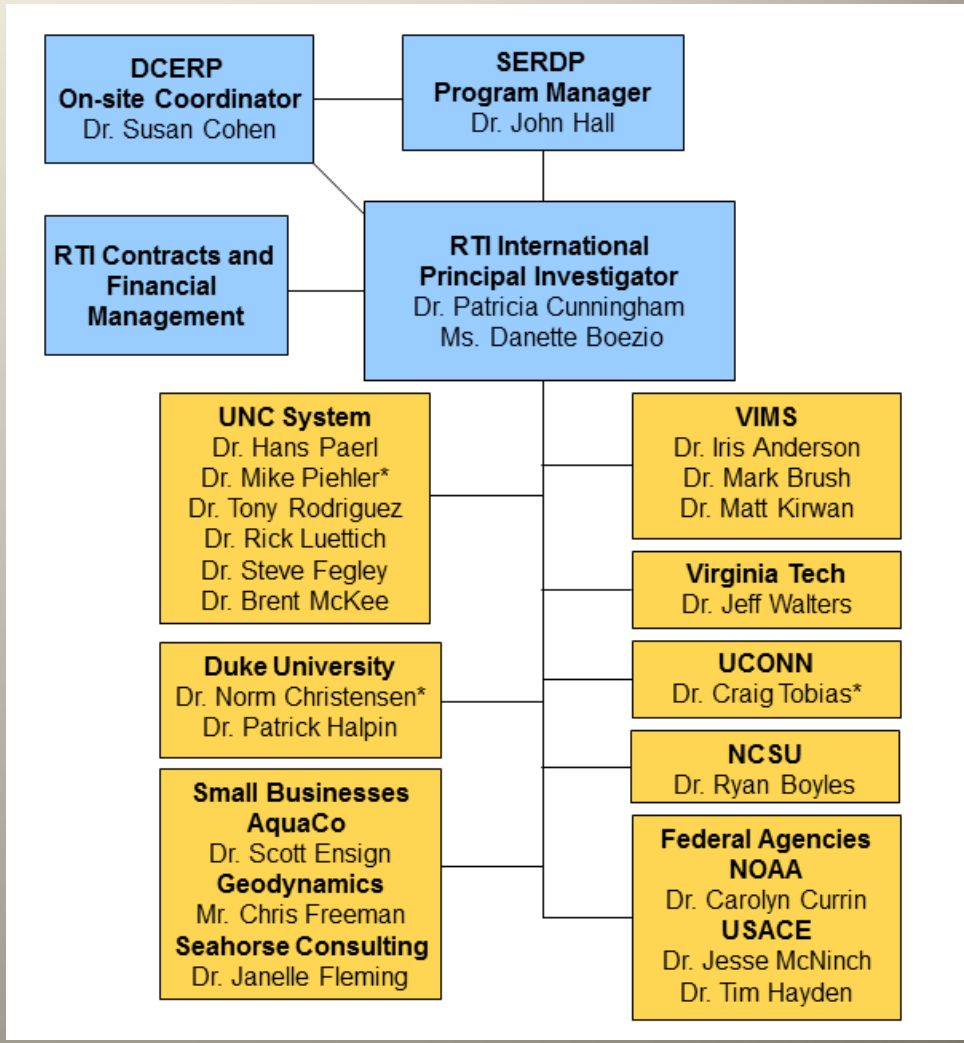
Identify Track
Ballroom C
3:445-4:15pm

Albemarle-Pamlico Ecosystem Symposium
Embarking on a New Voyage

Integrating an estuarine research and monitoring program (DCERP) into coastal decision making



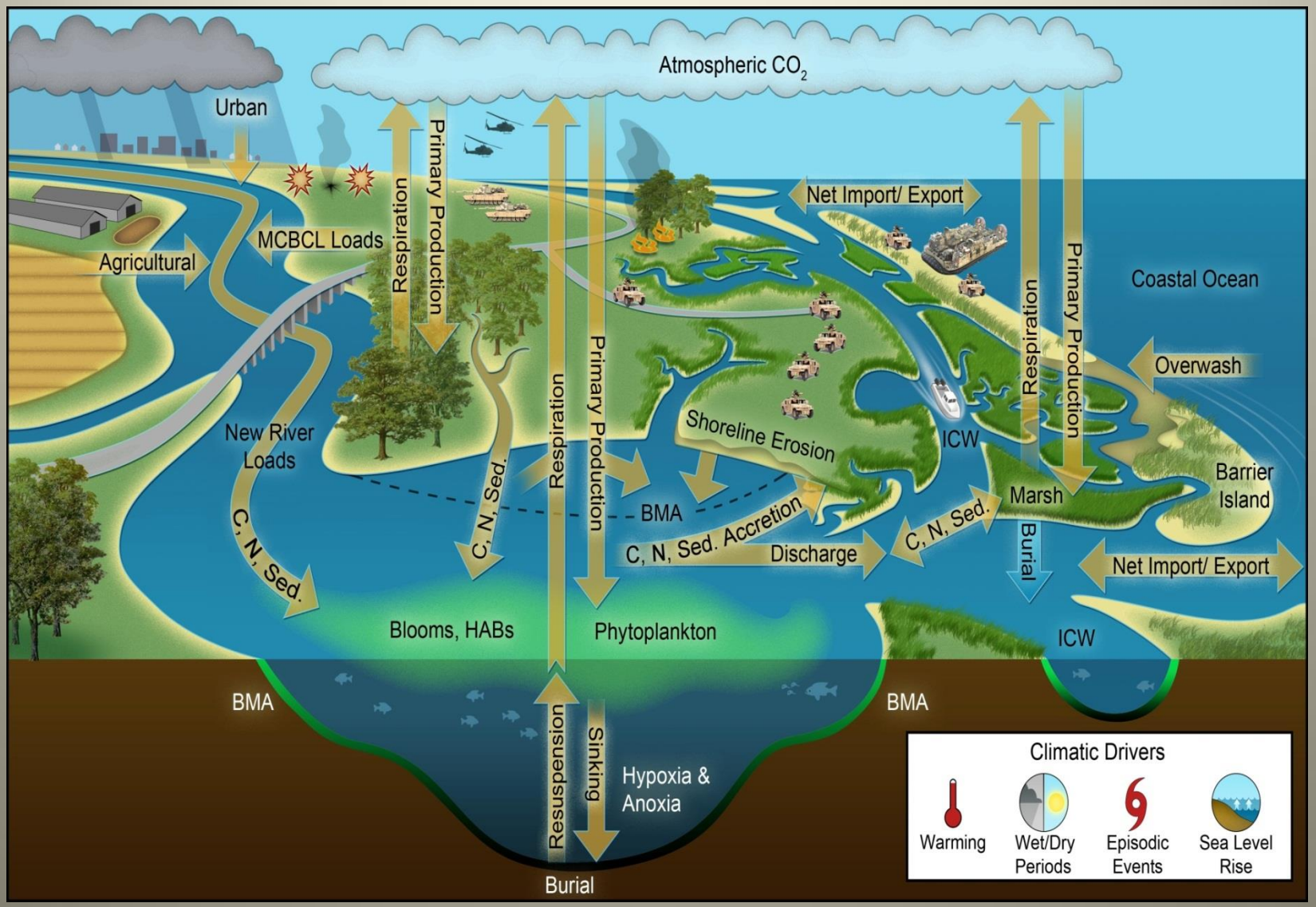
Problem Statement – DCERP2

- DoD managers need easy to use decision support tools to balance military training needs and compliance with environmental regulations.
- DoD facilities in estuarine/coastal areas are at risk from climate change including changes in extreme weather and rising sea level.
- DoD managers need to understand the trade-offs between carbon management and other adaptive management decisions to reach carbon goals.

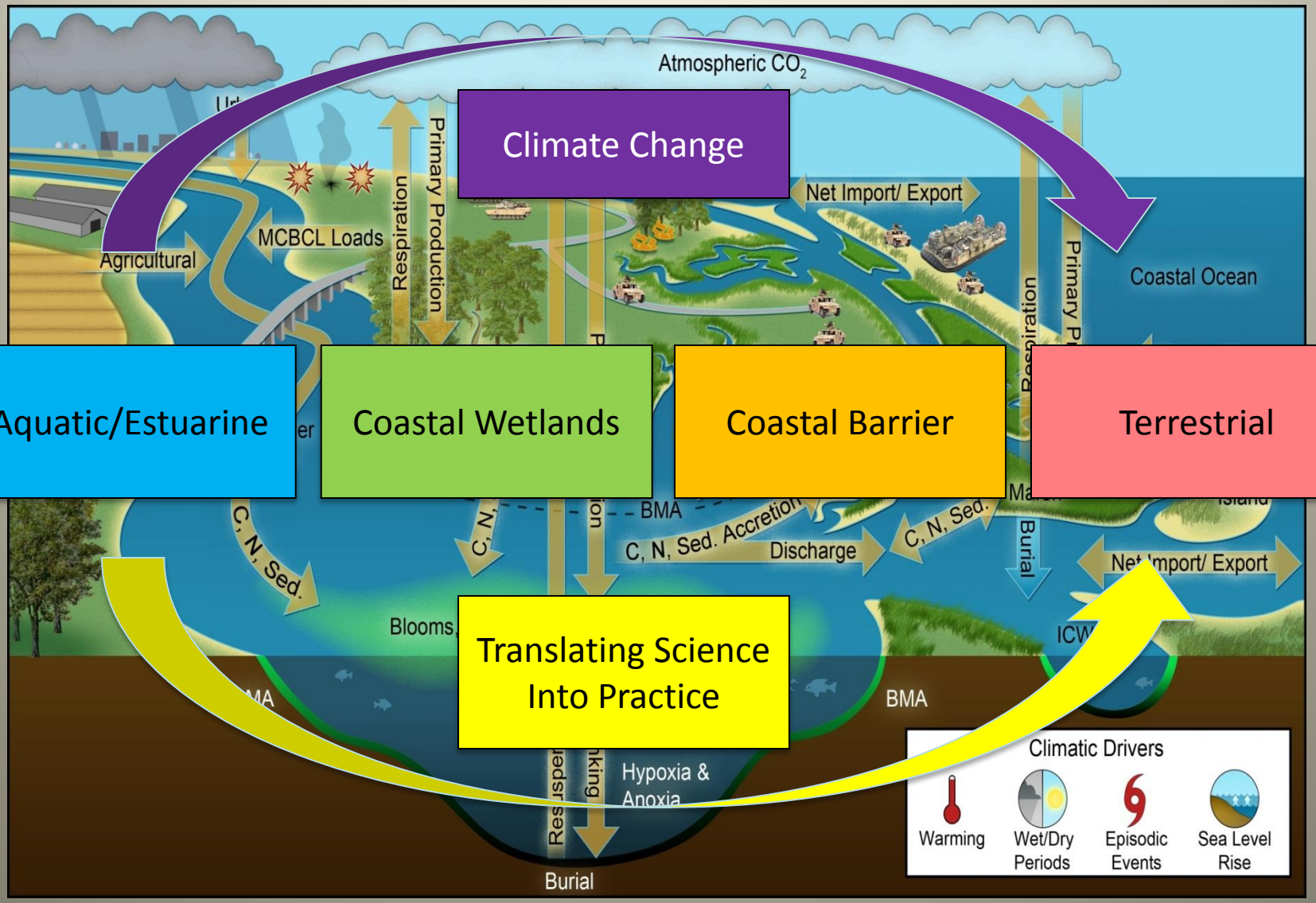
Integrative Themes for DCERP2

1. **Climate Change** – improved understanding of how ecosystems may respond to climate change and climate variability including inherent resiliency to environmental stressors and opportunities for managed adaptation.
2. **Carbon Cycle** – improved understanding of the carbon cycle and management implications for estuarine/coastal and terrestrial systems.
3. **Translate Scientific Information into Practice** – improved communication of scientific information to various audiences and accessibility of DCERP decision support tools and models to other DoD users

DCERP2 Overarching Conceptual Model



DCERP2 Modules



Thematic Overview

Climate Change

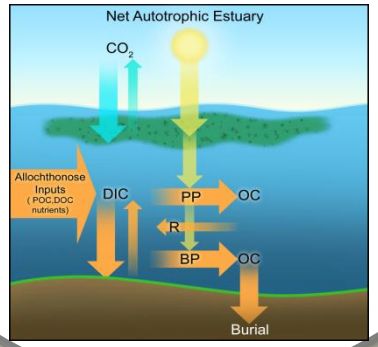
Warming

Wet/Dry Periods

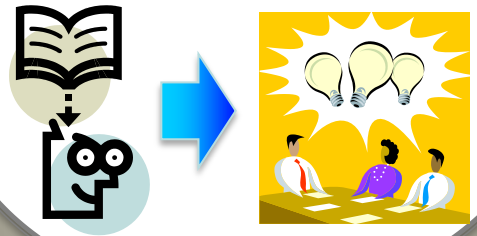
Episodic Events

Sea Level Rise

Carbon Cycle



Translating Science Into Practice



Climate Change

Objective: Determine how ecosystem processes respond to climate change to understand the resiliency and adaptive capacity of the ecosystem.

Warming

Wet/Dry Periods

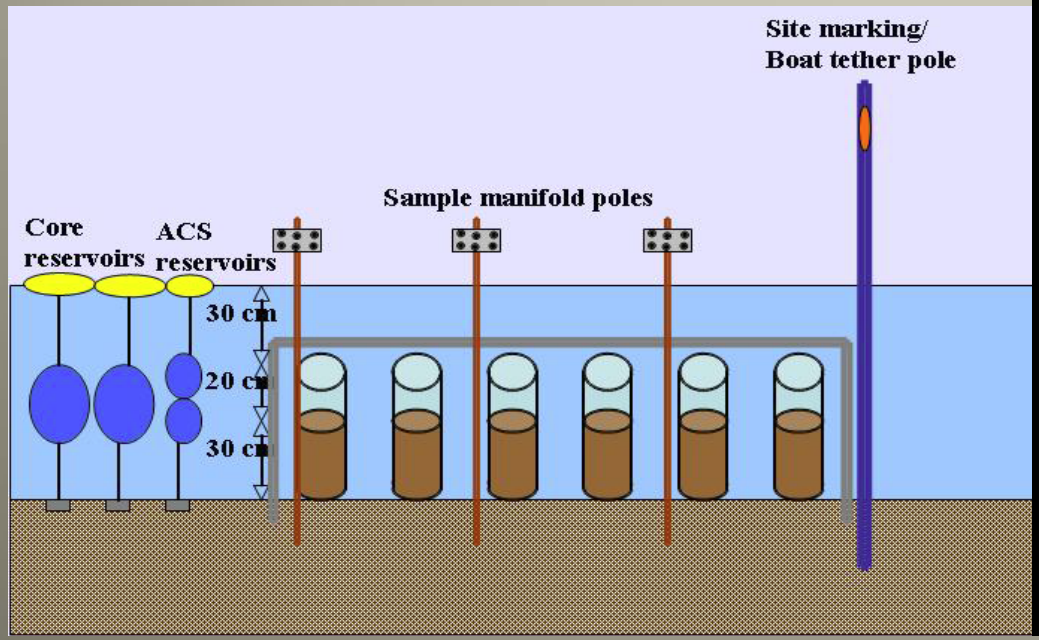
Sea Level Rise

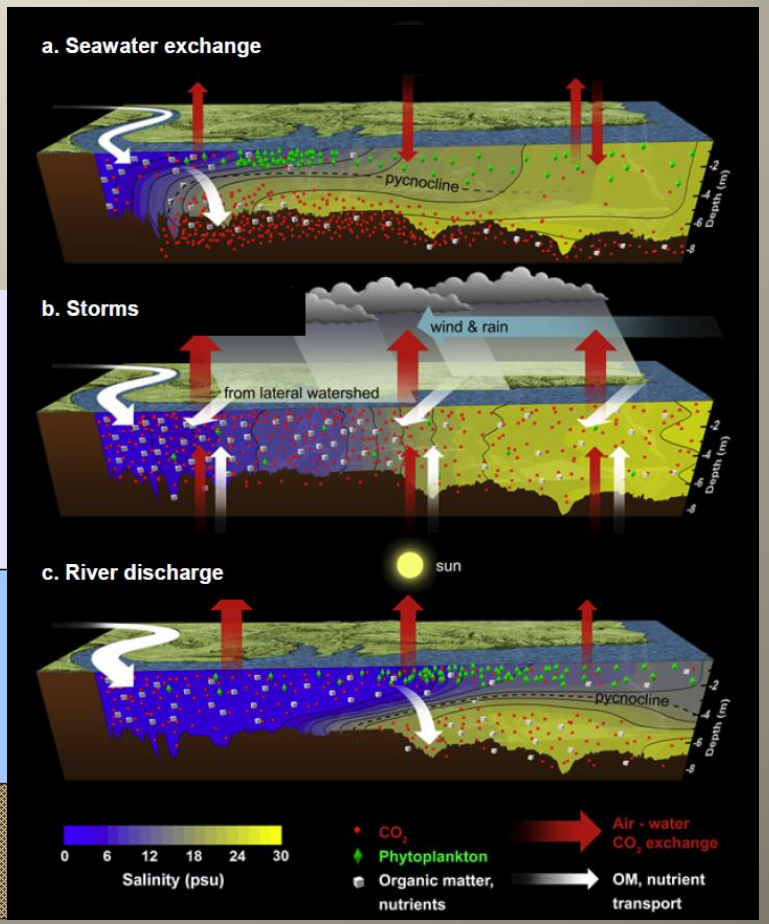
Episodic Events

Climate-related research

Aquatic/Estuarine Module

- Changes to phytoplankton production and respiration and pCO_2 flux between water and air under different salinity conditions
- Determine impact from different land uses on creek thermal loading
- Assess changes in benthic microalgal production under different temperature and salinity regimes using mesocosm studies.





Climate-related research
Coastal Wetlands Module

- Assess historic marsh response to SLR over last 100 years using sediment core geochronology
- Assess impacts of SLR on marsh sustainability by developing a Geospatial Marsh Model that incorporates sediment transport processes and influence of marsh vegetation
- Adaptive management pilot study – (1) thin layer disposal of 10-20 cm of dredge material added to marsh surface at two marsh elevations and (2) shoreline stabilization by planting "living shoreline" of *Spartina*
- Work on other DoD installation - Determine *Juncus* biomass to marsh elevation relationship at Eglin AFB and predict marsh response to SLR.

Sediment Coring

Living Shoreline, NC

Climate-related research
Coastal Barrier Module

- Predict impacts of SLR and storminess on barrier island shoreline position and coastal landforms (dune, beach and backbarrier)
- Determine how these geomorphic changes may affect carbon flux as well as island flora, nesting sea turtles, and shorebirds.

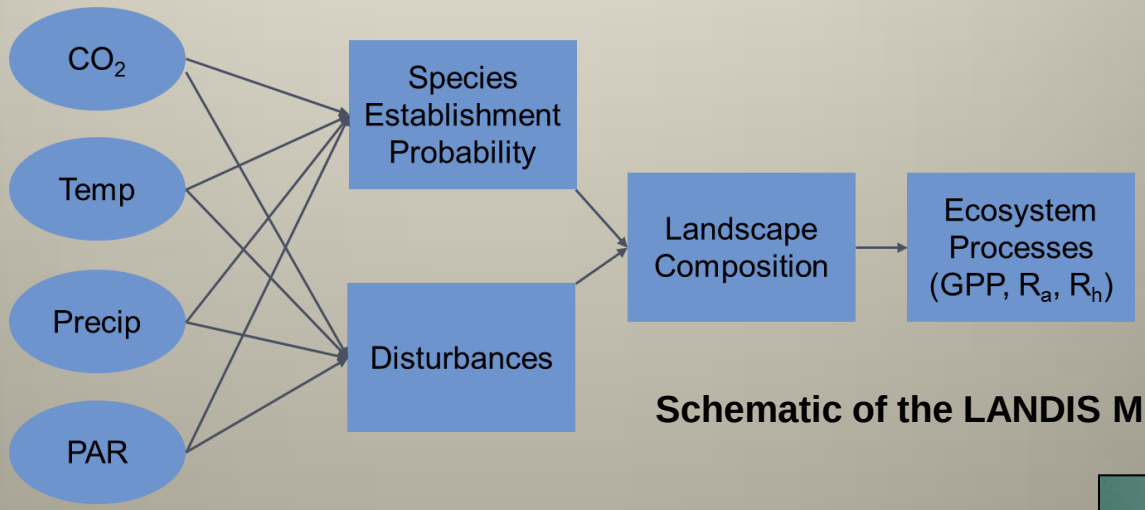
Shorebird eggs.

Sea turtle nests.

Aerial photo of washover fans (Hurricane Irene).

Climate-related research
Terrestrial Module

- LANDIS will be used to model changes in tree species composition and growth that may occur under future climate scenarios
- Local climate data will drive model simulations which accounts for species-specific parameters for drought tolerance, growth rates, and germination

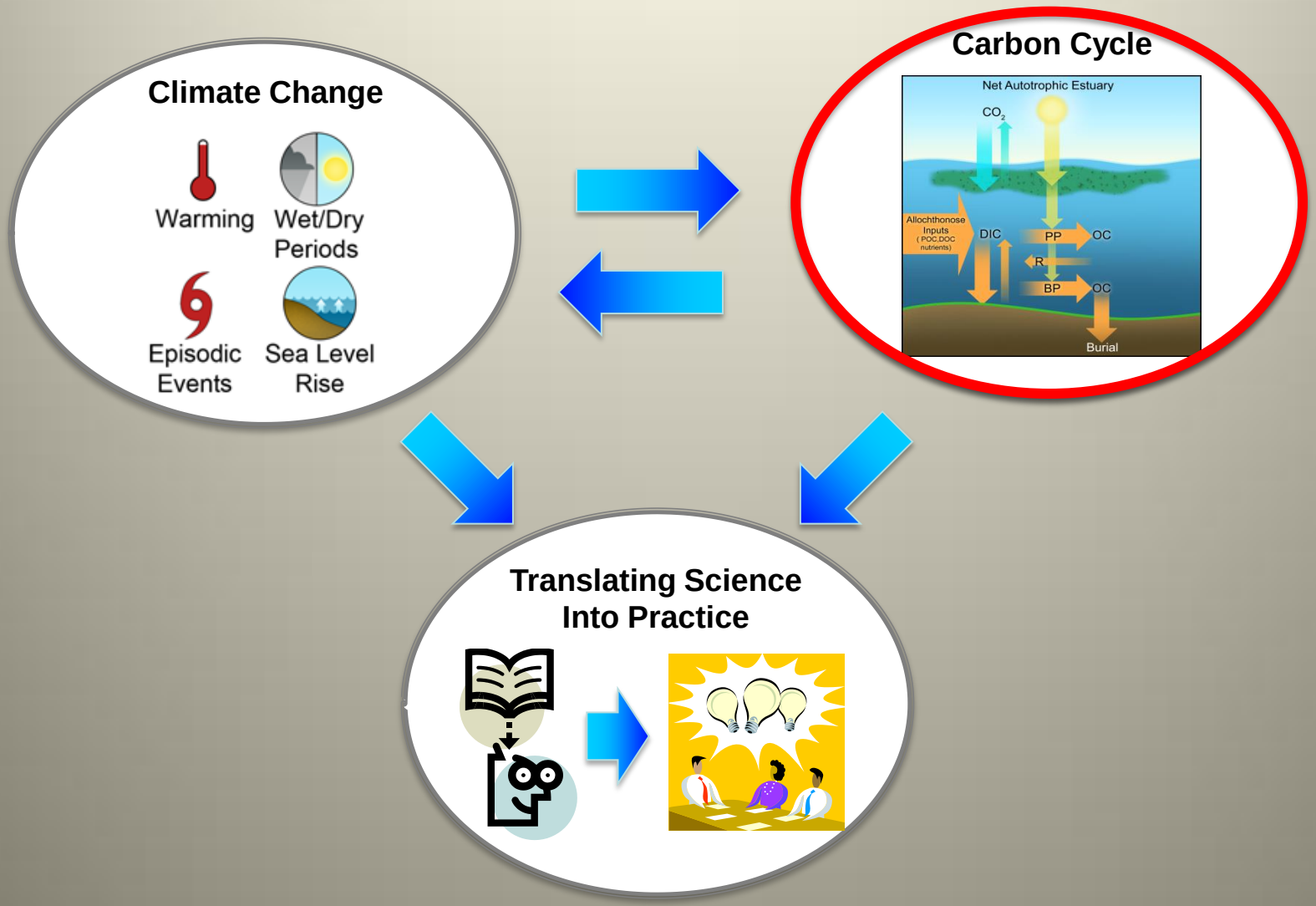


Schematic of the LANDIS Model

- Apply RCW DSS Tool to MCBCL and Fort Bragg which will improve the understanding of likely changes in RCW population dynamics in response to climate change.

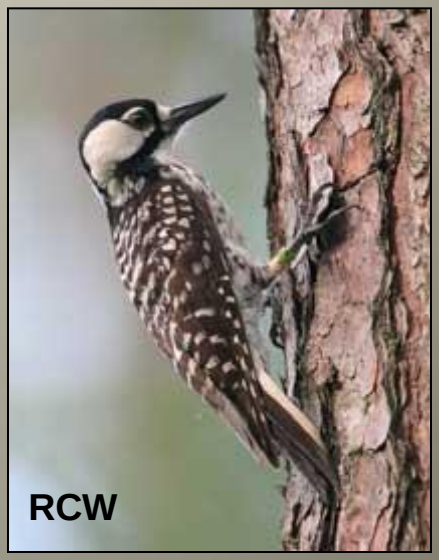
RCW

Carbon Cycle

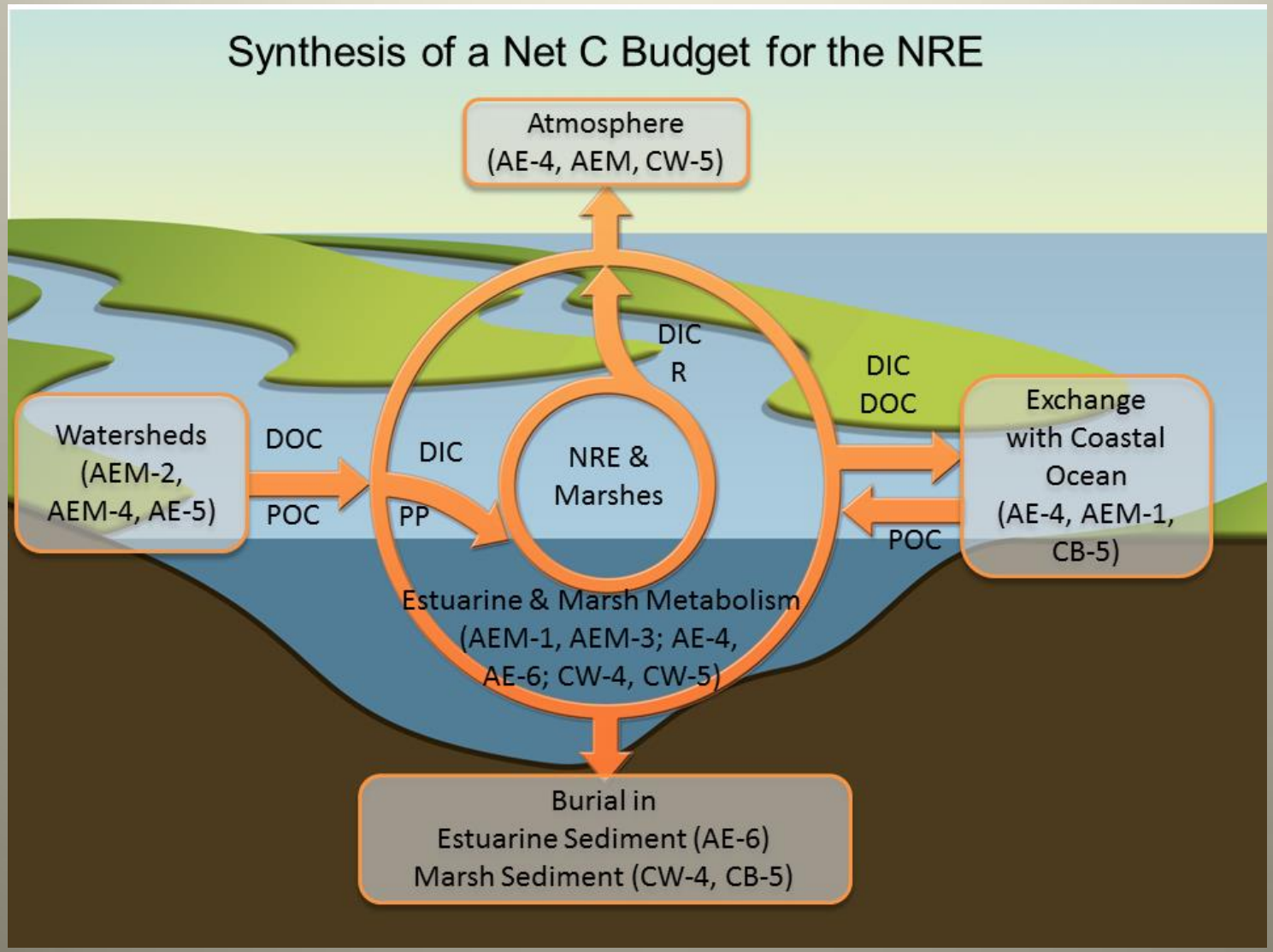


Carbon Cycle

- Carbon management on the regulatory horizon?
- Uncertainty, opportunity, and challenges
- Tradeoffs among ecosystem carbon management, other mission priorities, or other regulatory mandates
  - ➢Training/ Base Operations
  - ➢Endangered Species Act
  - ➢Clean Water Act



Carbon Cycle
Technical Approach



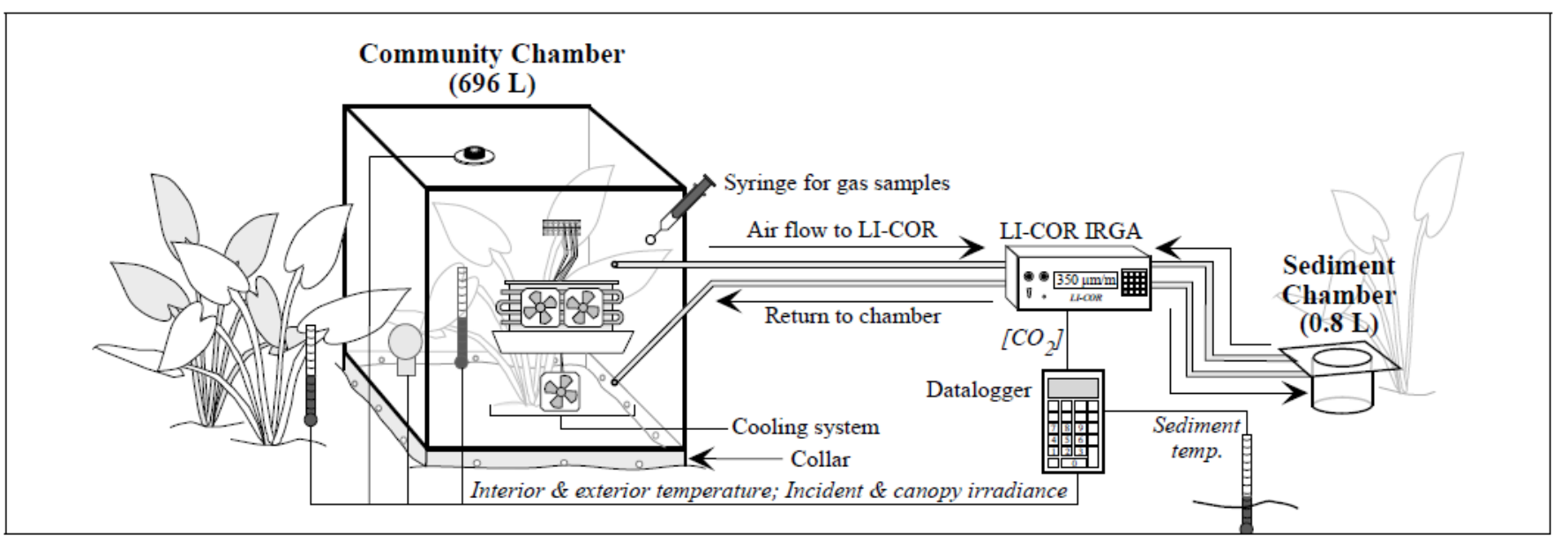
Carbon Cycle

Aquatic/Estuarine Module

- Quantify amount of C loading from MCBCL lands and identify terrestrial sources of carbon
- Determine linkages between C fluxes and NRE water quality conditions under variable freshwater flows
- Determine magnitude of phytoplankton C - fixation
- Measure annual net benthic-pelagic flux of C
- Determine how air-water CO_2 exchanges in NRE vary spatially and temporally
- Develop carbon budget for the estuary.

Carbon Cycle
Coastal Wetlands Module

- Determine exchanges of carbon (as methane & CO_2) between the marsh surface, the atmosphere, overlying water, and adjacent creek under various environmental conditions
- Develop carbon budget for the coastal marshes

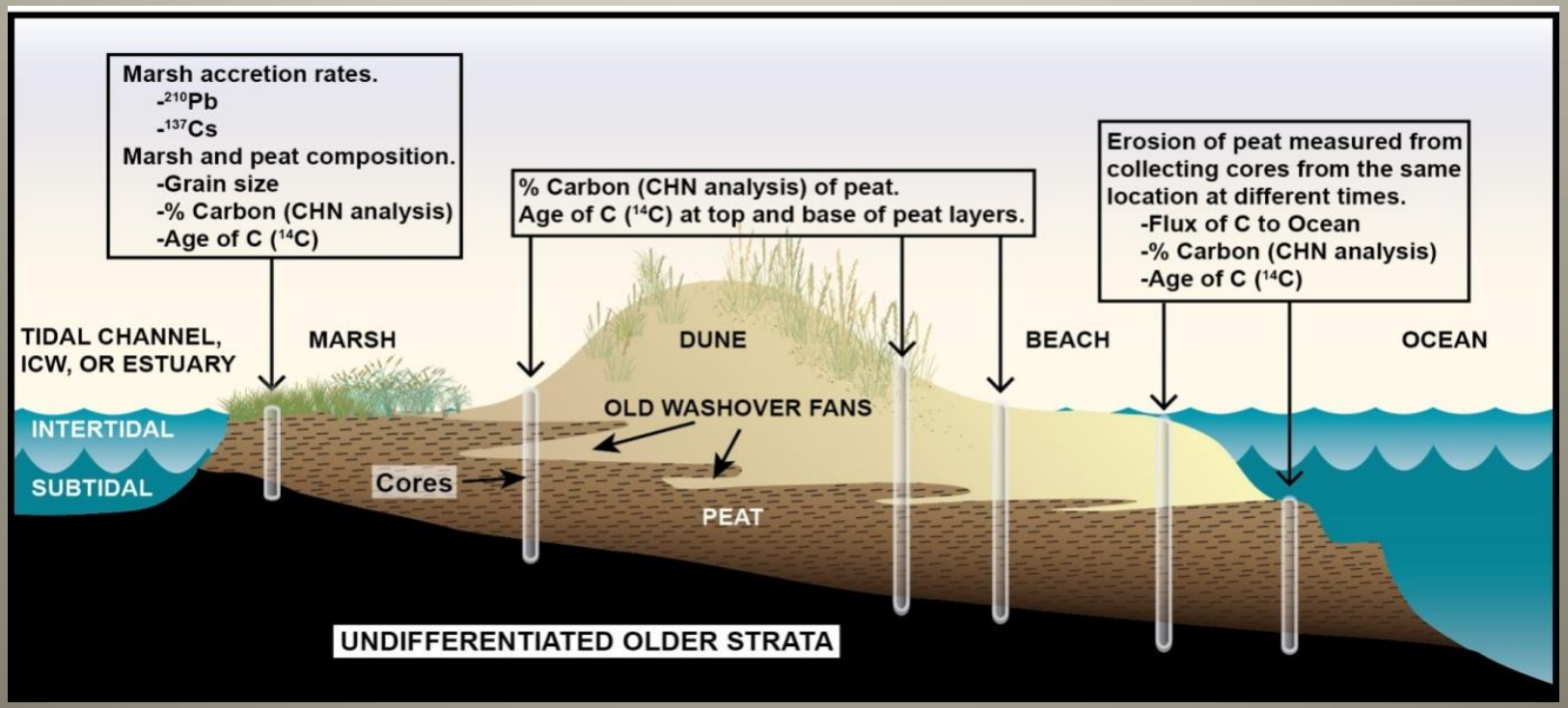


Experimental Design for Research Project CW-5

Carbon Cycle

Coastal Barrier Module

- Determine role of barrier island migration on coastal C dynamics.
- Determine exposure and oxidation of C (peat deposits) on the beachfront
- Measure sediment accretion and C burial in the back barrier marsh
- Develop carbon budget for the coastal barrier



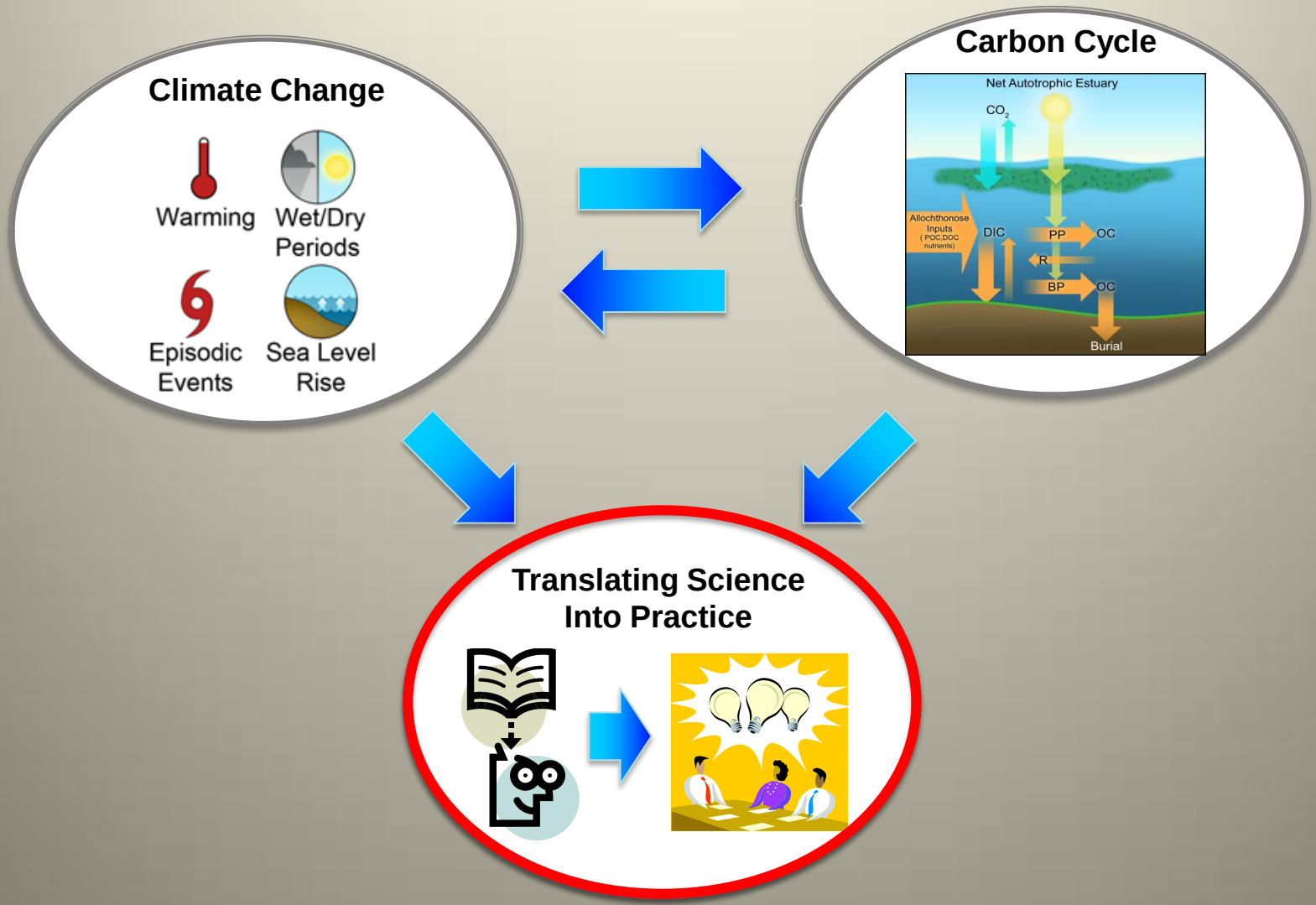
Carbon Cycle

Terrestrial Module

- Evaluate forest management practices and their impacts on **carbon storage** now through management actions toward an end state (and under future climate conditions).

Management Treatment	Impact on Carbon Stores
No Management	Carbon accumulates in both live and dead pools. Increase wildfire risk.
Commercial Harvest Cycle	Significant amounts of carbon are removed from site with harvest, leaving much to decay, but carbon accumulates on site with post-harvest regrowth.
Loblolly Pine – understory/ midstory thinning	Net effect on carbon storage through time is unclear.
Loblolly Pine – clear-cut and longleaf restoration	Net effect on carbon storage through time is unclear.
Mature Longleaf Pine Savanna	Significant transfer of carbon from live to dead pools associated with episodic disturbances such as hurricanes.

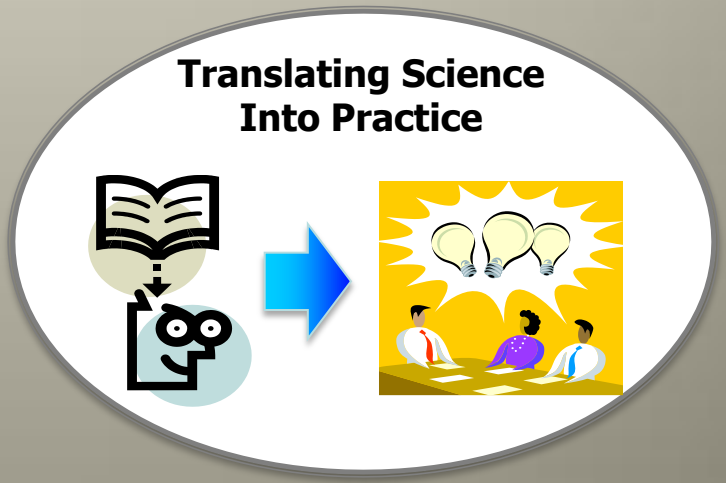
Translating Science Into Practice

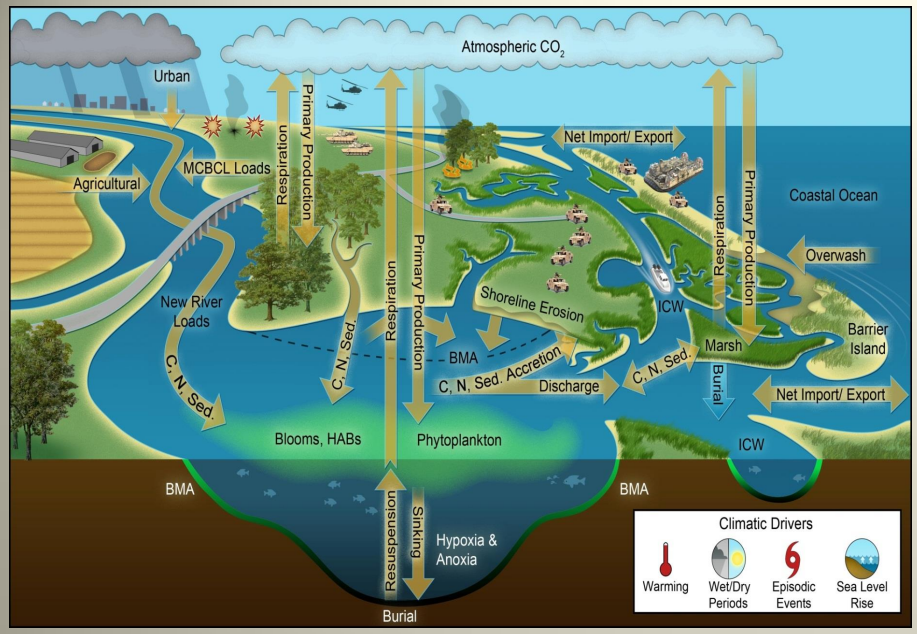


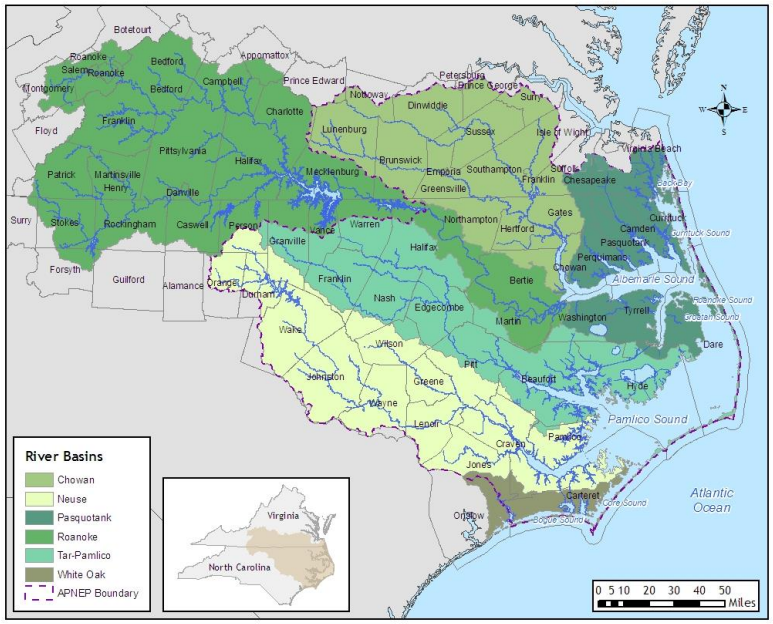
Translating Science Into Practice

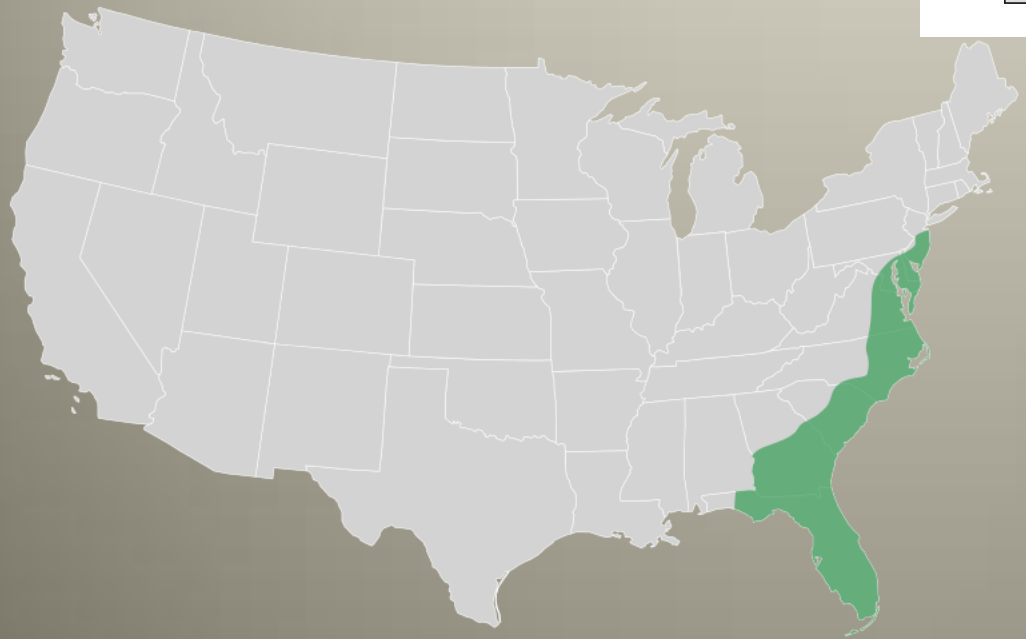
Overall Objectives

- Translate scientific results into clear and easy-to-understand concepts and into actionable information for DoD managers to assist them in decision-making
- Develop easy-to-use tools and models - discuss limitations of the tools and models and context in which these limitations apply.




Atmospheric CO_2
Urban
Agricultural
MCBCL Loads
New River Loads
Respiration
Primary Production
Net Import/ Export
Coastal Ocean
Overwash
Shoreline Erosion
ICW
Barrier Island
Marsh
BMA
C, N, Sed. Accretion
Discharge
C, N, Sed.
Burial
Net Import/ Export
Blooms, HABs
Phytoplankton
ICW
BMA
BMA
Resuspension
Sinking
Hypoxia & Anoxia
Burial
Climatic Drivers
Warming
Wet/Dry Periods
Episodic Events
Sea Level Rise


River Basins
Chowan
Neuse
Pasquotank
Roanoke
Tar-Pamlico
White Oak
APNEP Boundary
Virginia
North Carolina
Albemarle Sound
Pamlico Sound
Atlantic Ocean
0 5 10 20 30 40 50
Miles




Thank you!