AN ADAPTIVE MANAGEMENT FRAMEWORK DRIVEN BY COMPREHENSIVE MONITORING AND MODELING INVESTMENTS

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Outline

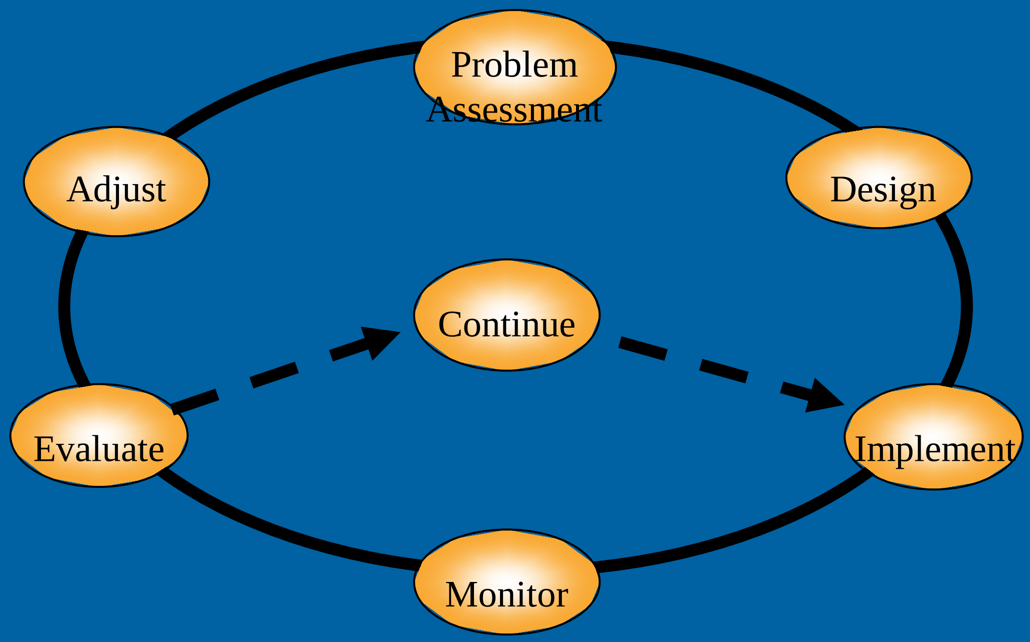
- Introduction to Adaptive Management (AM)
- Adaptive Management Framework
- Monitoring and Modeling Advancements
- Investing in an Adaptive Management Strategy

What is Adaptive Management?

- Adaptive management is an organized and documented undertaking of goal-directed actions, while evaluating their results to determine future actions.

- Simply stated, adaptive management is doing, while learning in the face of uncertain outcomes.

According to the National Research Council's 2004 Adaptive Management for Water Resources Project Planning, "Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.



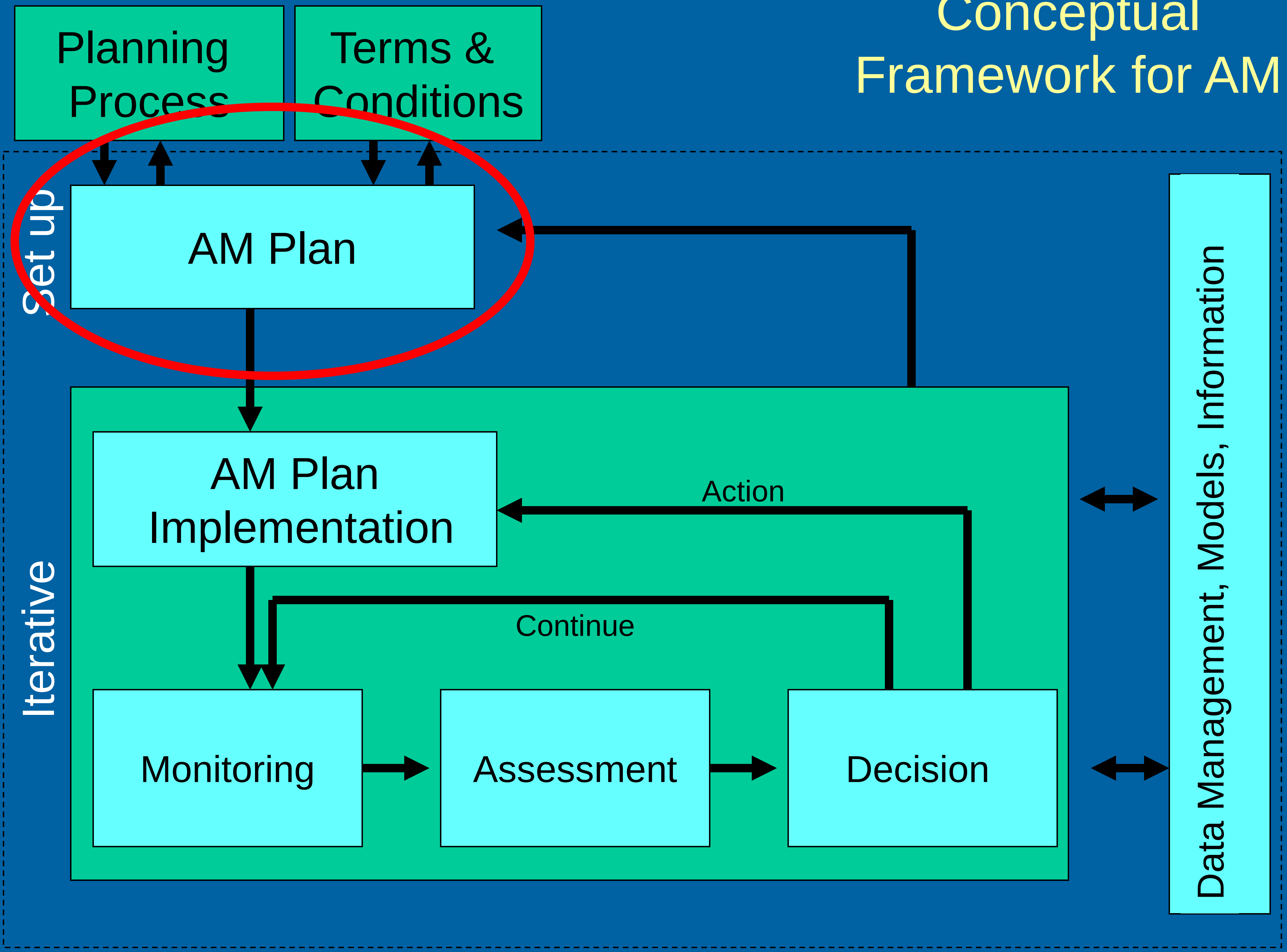
Adaptive Management Involves

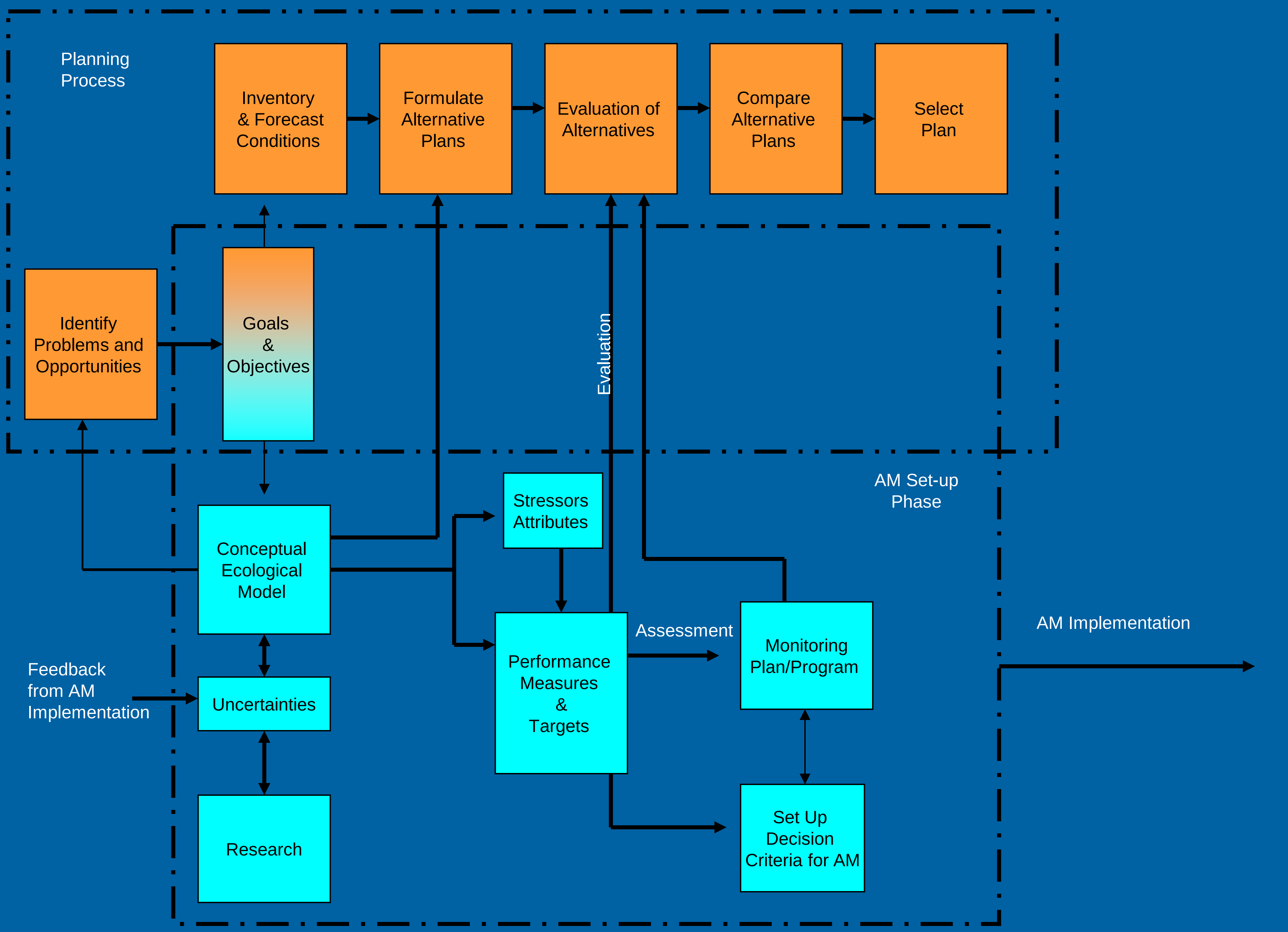
- Exploring alternative ways to meet management objectives
- Identifying uncertainties
- Predicting the outcomes of alternatives based on current state of knowledge
- Implementing one or more of these alternatives
- Monitoring to learn about impacts of management actions
- Using monitoring results to update knowledge and adjust management actions

Adaptive Management Framework

Set-up and Implementation

Conceptual Framework for AM





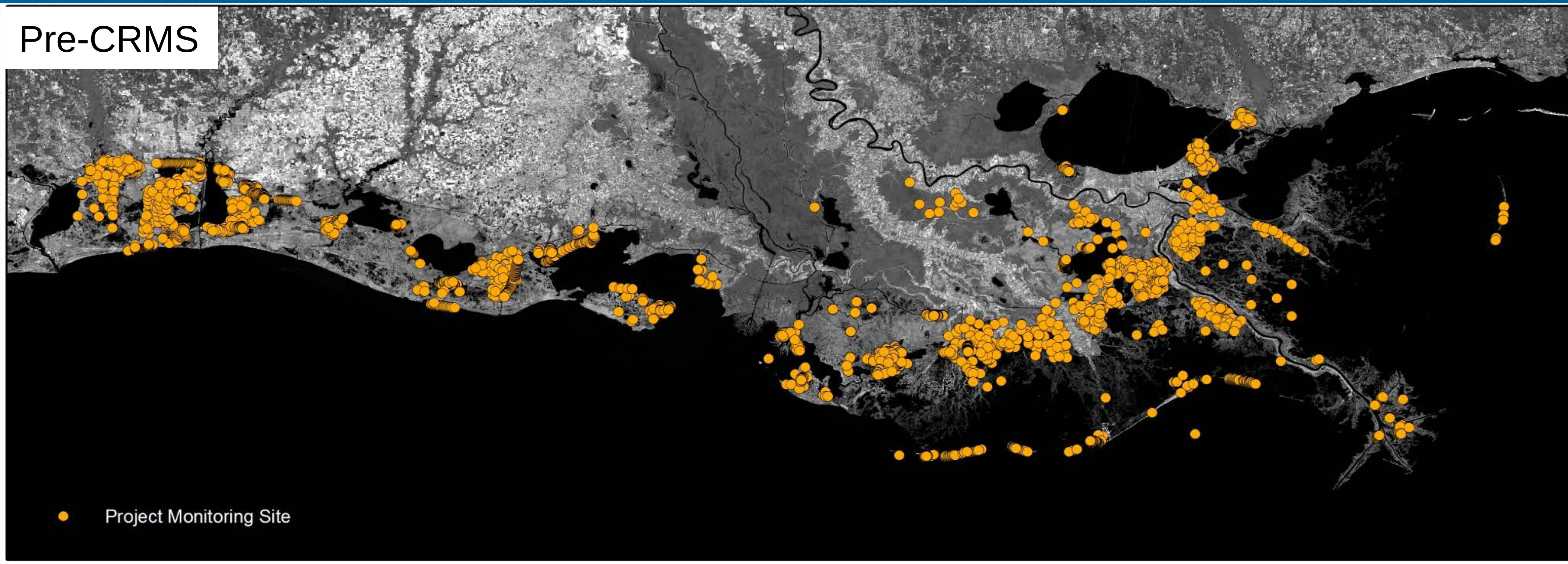
Planning Process
Inventory & Forecast Conditions
Formulate Alternative Plans
Evaluation of Alternatives
Compare Alternative Plans
Select Plan
Identify Problems and Opportunities
Goals & Objectives
Evaluation
AM Set-up Phase
Stressors Attributes
Conceptual Ecological Model
Assessment
Monitoring Plan/Program
AM Implementation
Performance Measures & Targets
Feedback from AM Implementation
Uncertainties
Set Up Decision Criteria for AM
Research

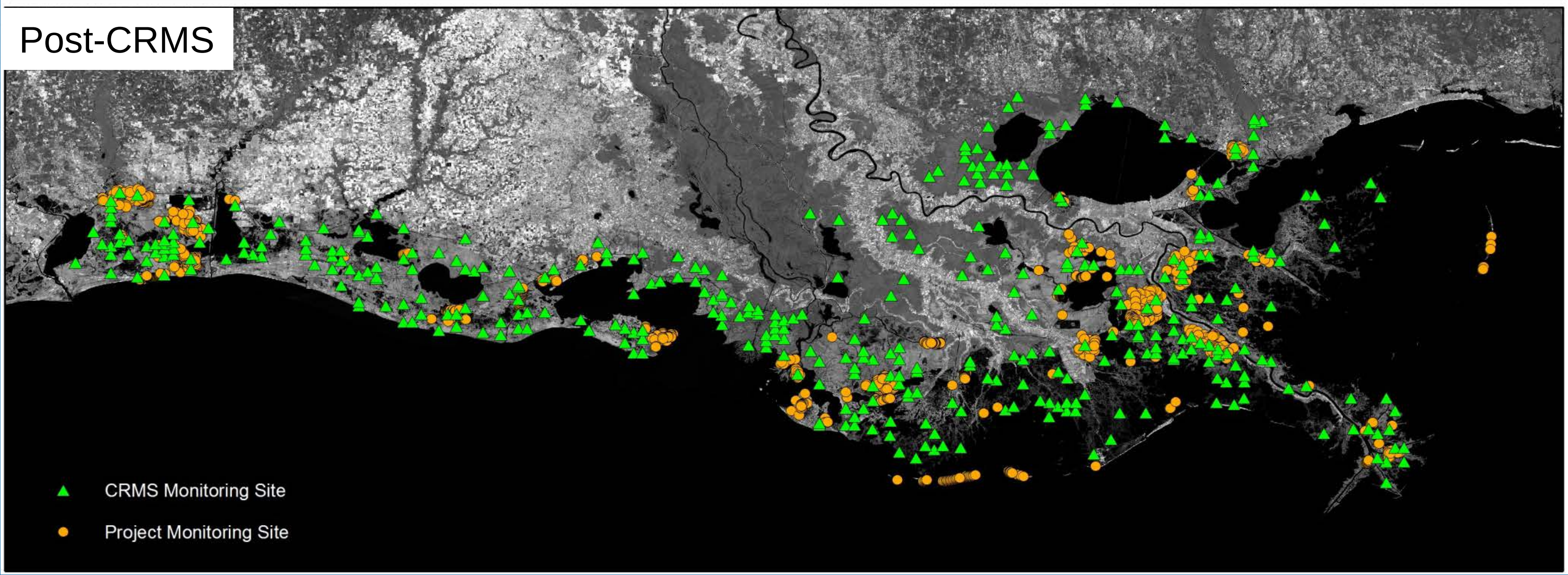
So How Do You Manage Uncertainty through an AM Framework?

- ❑Conceptual Models
- ❑Monitoring Programs
- ❑Hydrological and Ecological Forecasting Models
- ❑Research
- ❑Demonstration projects
- ❑Decision Support Tools
- ❑Assessment Process

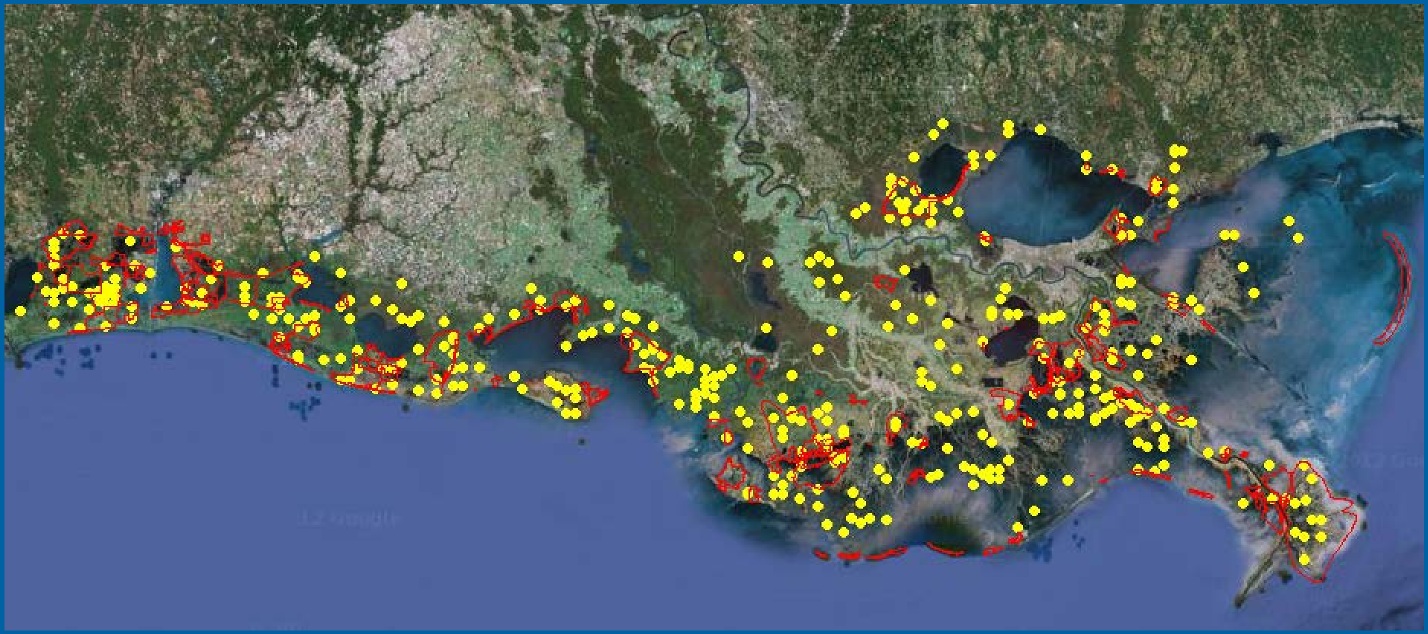
Monitoring & Modeling Advancements

Monitoring in a Systems Context





Monitoring Advancements



- 390 CRMS sites – 2006 data collection began
- Project and reference network
- Sites in swamp, fresh, intermediate, brackish, and salt marsh
- Consistent suite of sampling: landscape, vegetation, hydrology, soils at each site
- Assess at site, project, basin and coastwide scales
- Optimize monitoring network to support model development and validation
- Assess system variability

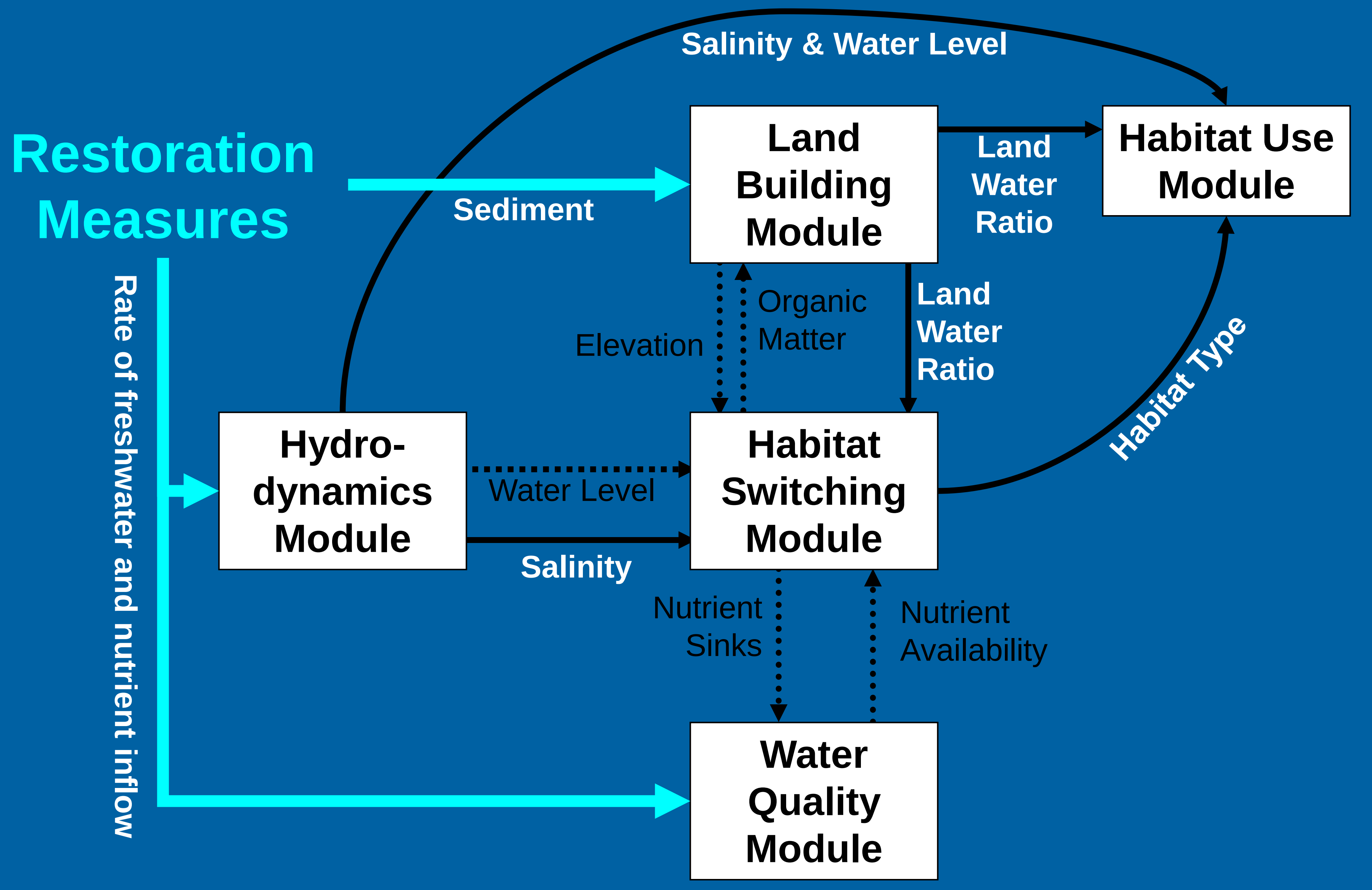
Questions to address through CRMS:

Did the restoration program:

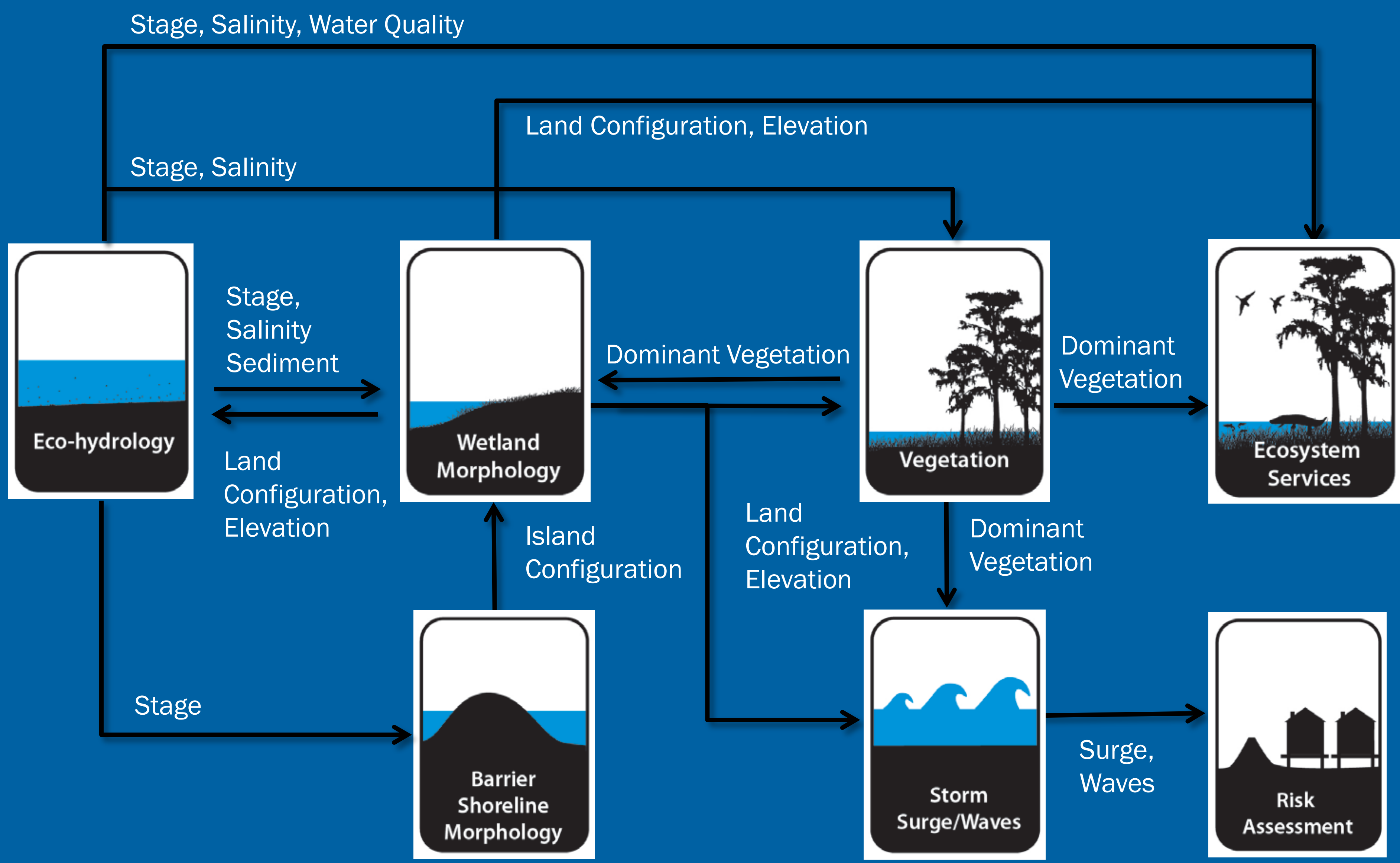
reduce coastal wetland loss?
sustain a diversity of vegetation types within basins?
reduce major stressors on wetlands?

Which project types are the most effective in creating, restoring, protecting and enhancing wetlands?

Modeling in a Systems Context – LCA/CLEAR 2003

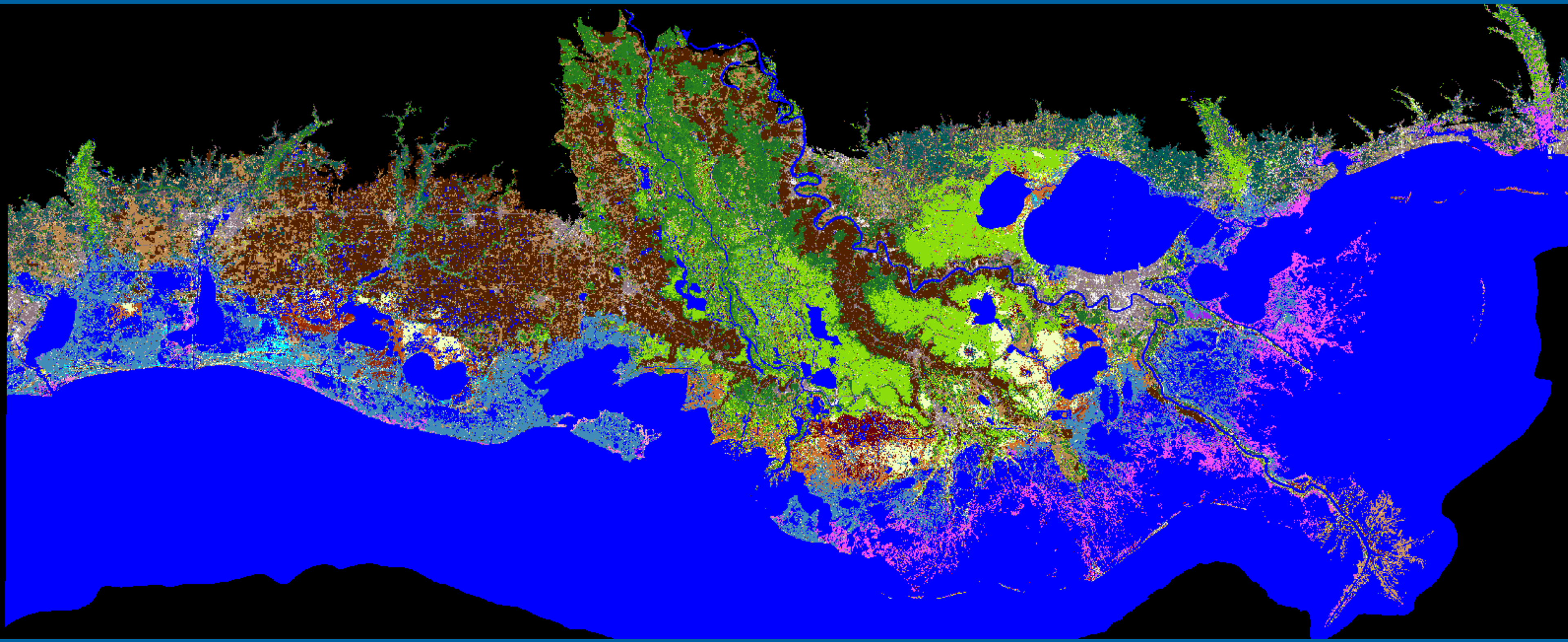


Modeling in a Systems Context - 2012



Input Source	2003 Scientific Rigor	Confidence in Input Source	2012 Status
Salinity	Low	Moderate	↑
Water Levels	High	Moderate	↑
Water Velocities	High	Moderate	→
Water Temperature	Low	Moderate	↗
Flooding Frequency	Low	Low	↗
Sediment Transport	Low	Low	→
Water Residence Time	Moderate	Low	↗
Sediment Input	Moderate	Moderate	↗
Sediment Retention	Low	Moderate	↗
Bulk Density of Deposited Sediment	High	Moderate	↗
Volume of Receiving Basin	Moderate	Low	↑
Nutrient Input	Low	Low	→
Historic Land Change	Moderate	Moderate	↑
Wetland Area	High	Moderate	↑
Vegetation Habitat	High	Moderate	↗

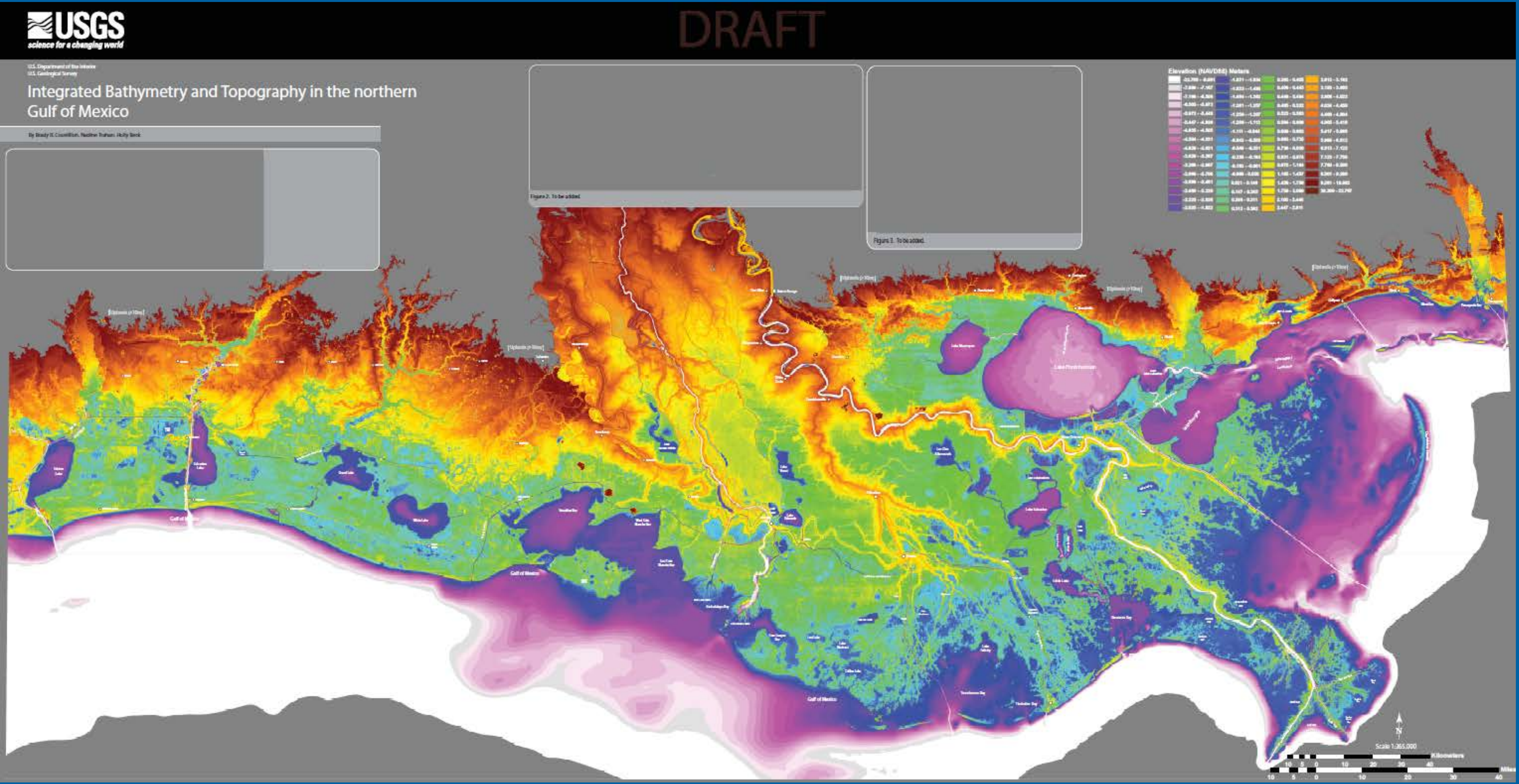
Vegetation Classification



Used CRMS and remote sensed data to classify 19 dominant species classes: Mangrove, Oystergrass, Saltgrass, Needlerush, Brackish mix, Wiregrass, Paspalum, Bullwhip, Roseau cane, Shrub-scrub, Swamp forest, Delta splay, Bulltongue, Thin mat, Maidencane, Sawgrass, Cattail, Cutgrass, Wax myrtle

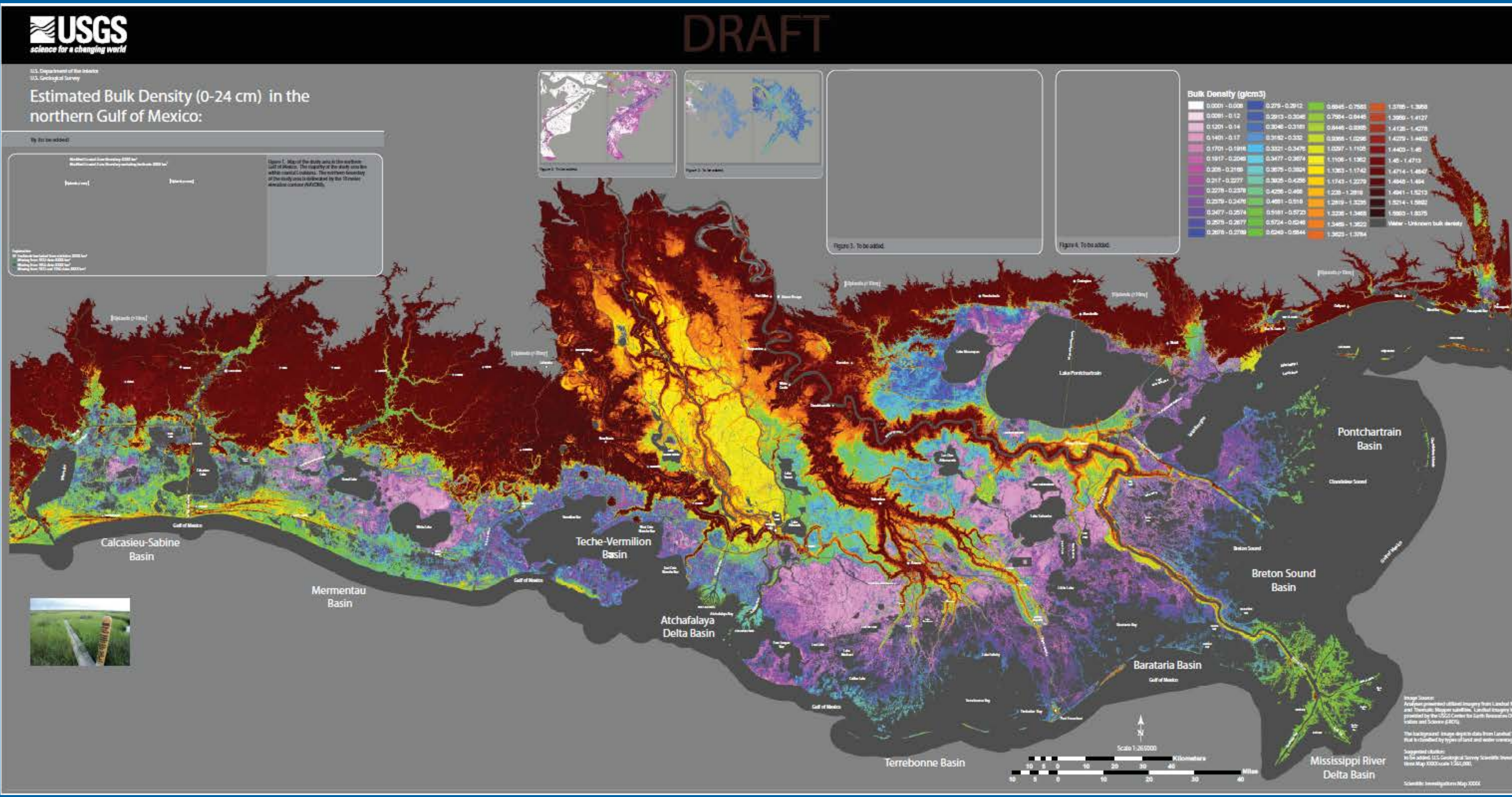
Previously was only able to classify by habitat types such as fresh, intermediate, brackish and saline marsh, swamp, bottomland hardwood

Bathymetry/Topography



Used updated Lidar and bathymetry data to classify landscape. In 2003, an assumption was made that all interior water depths were 0.5m and all coastal nearshore waters were 1.5m – affects volume of receiving basin

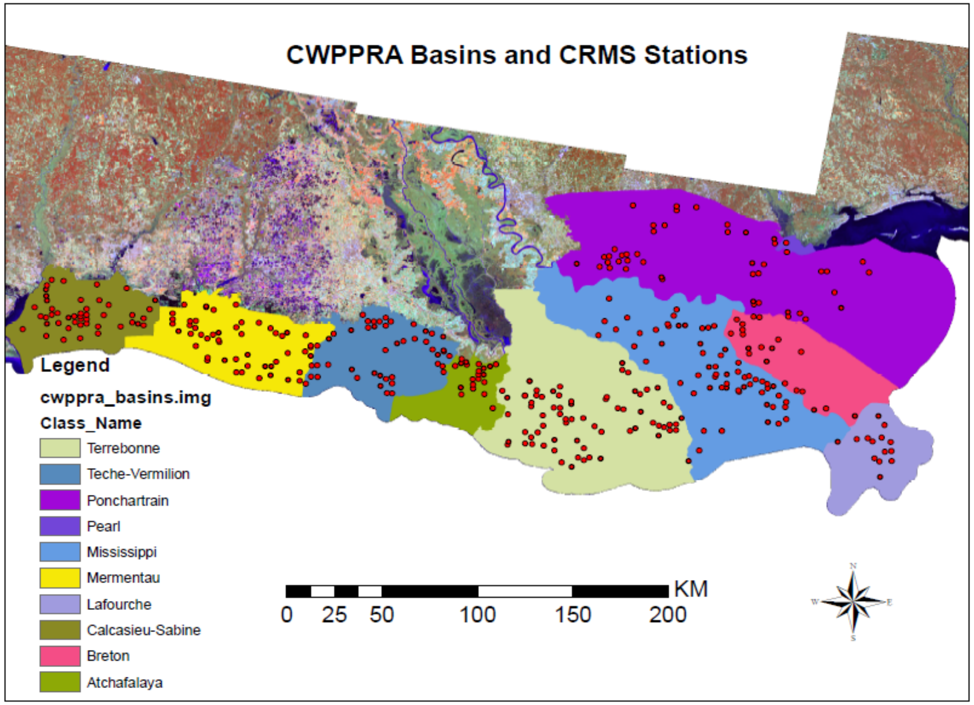
Bulk Density

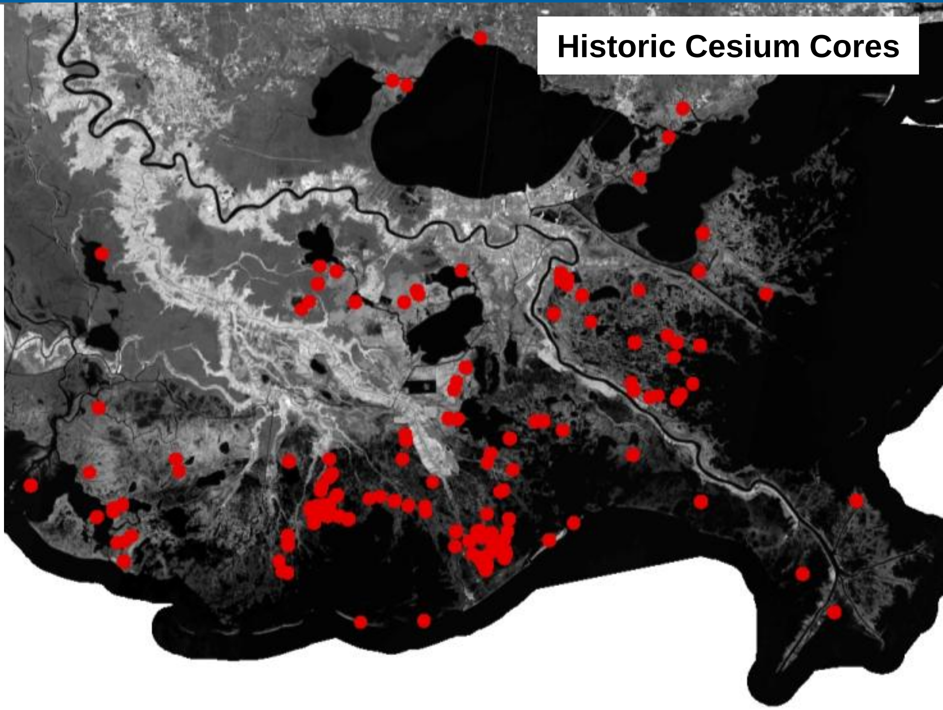


Bulk Density layer developed from a combination of CRMS core data for wetlands, and SSURGO bulk density data for areas not represented by CRMS. Tested against calibrated OM%/BD layer.

Calibration and Validation Data

- CRMS 2006-2010 soil data (to 24 cm depth): bulk density, OM%, mineral matter %, pore space;
- CRMS 2006-2010 soil data: accretion (feldspar) and elevation (SET)
- CRMS 2007-2010 hydrology data (salinity and inundation)
- CRMS 2007 marsh type classification and dominant species
- USDA SURRGO Soils (Soil type, bulk density and OM%)
- LCA S&T Task II 2006-2007 data (~50cm depth): BD, OM%, OC%, accretion
- Historic Cesium cores (accretion since 1963)

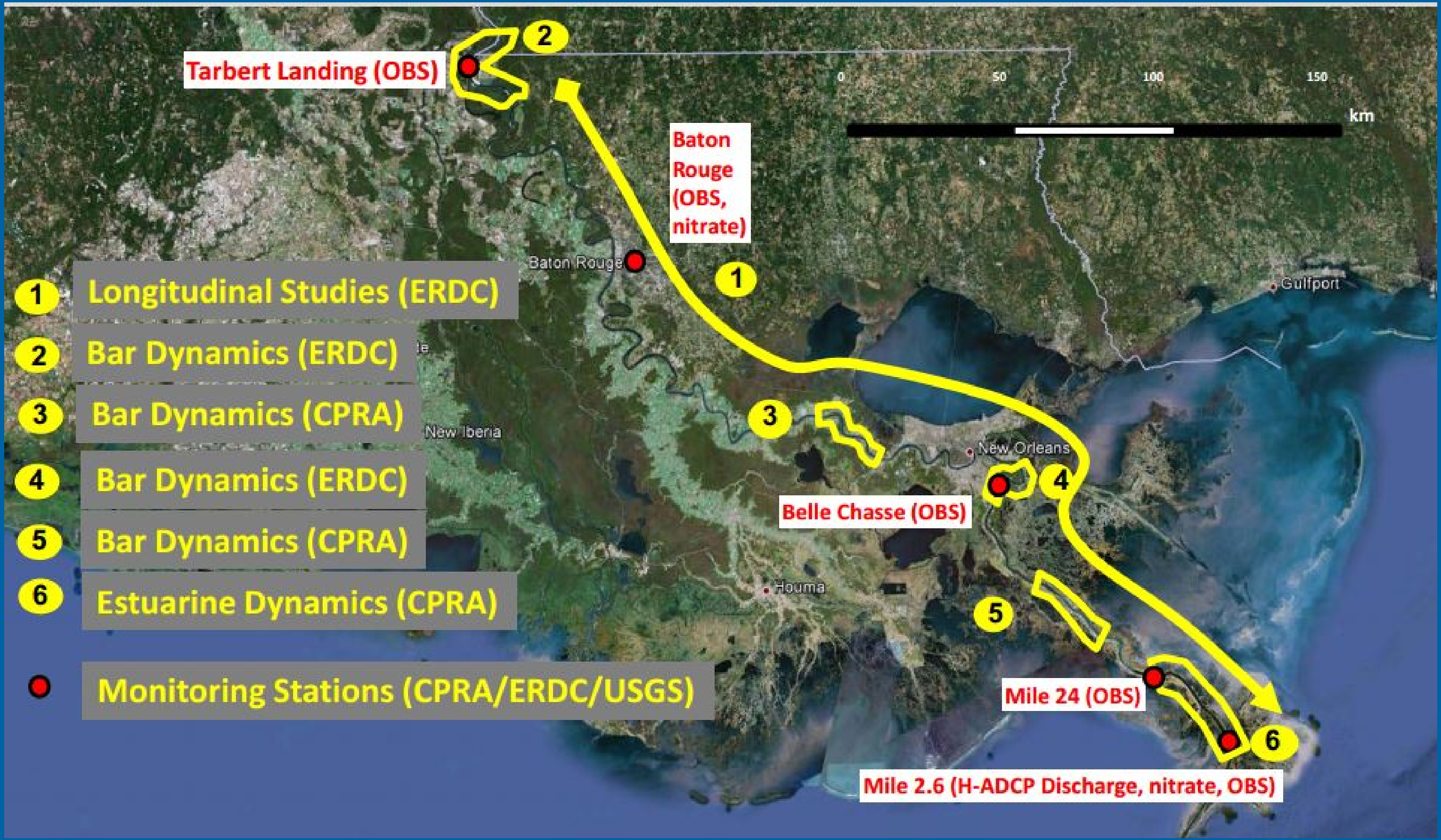




Targeted Research to Address Critical Uncertainties & Advance Models

How much sediment delivered by freshwater diversions will accrete on marsh surfaces and will it be sufficient to keep pace with rising sea levels?

MS River Hydrodynamic Study
Allison etal.
Collaborators: (Water Institute of the Gulf, ERDC, USGS)



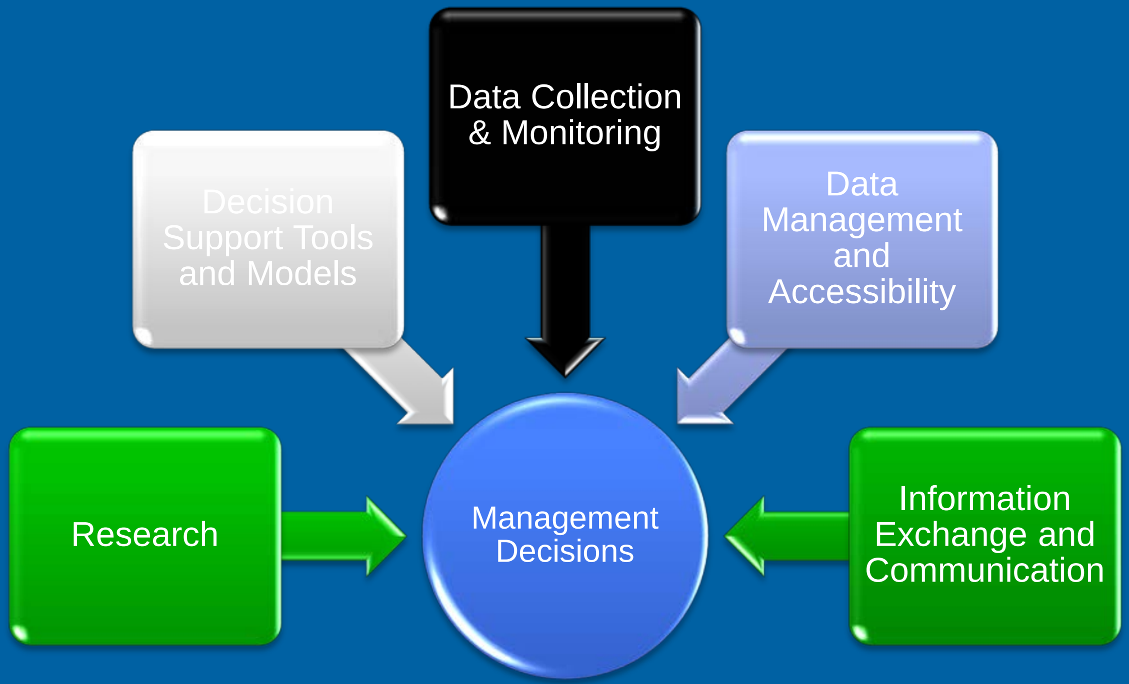
Better understand hydrodynamic & sediment transport processes in river to address questions such as “At what discharge do sands stay in suspension and are they available for restoration?

Sediment Deposition and Trapping Efficiency Study
Snedden etal.
Collaborators: (ERDC, Univ. of Texas, LSU)

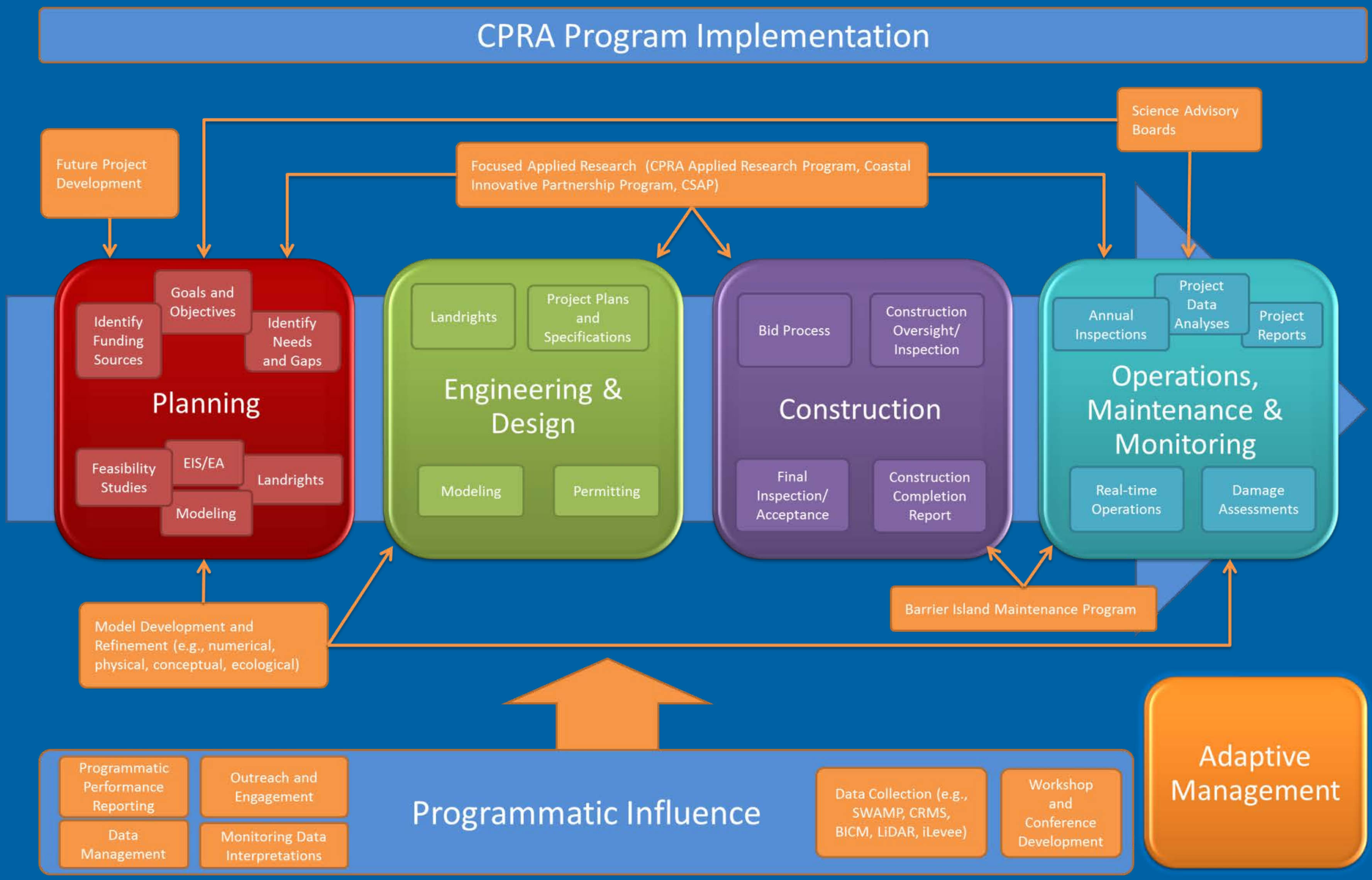
1) How do canopy hydrodynamics and particle characteristics interact to determine if conditions are favorable for deposition, transport or erosion, and how do these conditions vary in time (hours to weeks to months) and space (tens of meters)?

2) Are inundation events driven by certain processes more prone to promote deposition and accretion than others (river vs. tidal vs. meteorological)? Are some more prone to promote erosion?

Putting the Pieces Together to make informed decisions



CPRA Adaptive Management Strategy



Questions