



APNEP Human Dimensions Monitoring Meeting

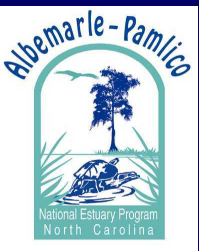
- Develop a **monitoring strategy** for the proposed Human Dimensions indicators within the APNEP region
- Indicator-specific monitoring **proposals**
- Regional ecosystem **test** module

APNEP Monitoring Plan Timeline

- APNEP staff adopt indicators in late 2007
- Plan to develop an integrated monitoring strategy for those indicators in 2008-2009
- In concert with APNEP revising its Comprehensive Conservation & Management Plan (CCMP)
- "Living Aquatic Resources" goal first, monitoring design development address LAR indicators first

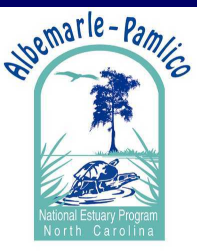
Human Dimension Monitoring Invitees

- **APNEP**
- **NC-DAQ**
- **NC-DCM**
- **NC-DEH**
- **NC-DFR**
- **NC-DLR**
- **NC-DPR**
- **NC-DSWC**
- **NC-DWM**
- **NC-DWQ**
- **NC-EEP**
- **NC-NHP**
- **NC-OEE**
- **NC-WRC**
- **NC-DACS**
- **NC-DOT**
- **EPA**
- **FWS**
- **NPS**
- **USGS**
- **STAC**



Ecosystem-Based Management

- Tenet: EBM improves natural resource management by forging more effective political connections among humans, nature, science, and government.*
- Alternative terminology: Landscape-/Waterscape-Based Management



*Cortner & Moote. 1999. The Politics of Ecosystem Management. Page 1.

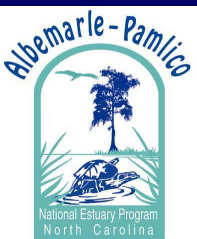
Information to Evaluate Natural Resource Policy

- Evaluation of the impact of conservation policy intervention lags other policy fields
- Paucity of data on the response of the species to which the intervention is targeted
- Poor understanding of the cost effectiveness of the relevant policy instruments
- Reduced opportunities for policy improvement
- Exposure of policy to criticism

APNEP Accepts Challenge?

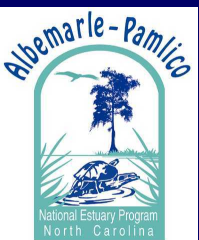
- How can today's operational systems for monitoring and reporting on environmental and social conditions be **integrated** or extended to provide more useful guidance for efforts to navigate a transition toward sustainability?
- How can today's relatively independent activities of research planning, monitoring, assessment, and decision support be better **integrated** into systems for adaptive management and societal learning?

Source: Kates et al. 2000. Sustainability science. Science 292(5517):641-642.



APNEP Ecosystem Assessment

- **Who** will contribute?
 - APNEP federal, state, local partners
- **What** will the assessment contain?
 - Timely technical information within a decision support system to help answer seven policy-based questions: magnitude, extent, trend, cause, source, risk, and solutions
- **When** is the target date for the DSS?
 - ASAP! Last assessment was 1991



APNEP Ecosystem Assessment

- **Where** are the areas to be assessed?
 - Region and sub-regions
- **Why** will the assessment be developed?
 - To support the APNEP-CCMP, NC-CHPP, NC/VA basinwide planning
 - To evaluate restoration success, APNEP must have a reliable pre-restoration baseline for ecosystem condition
- **How** will the assessment be constructed?
 - Plan and implement a regional ecosystem assessment infrastructure. The “engine” of this infrastructure would be a long-term ambient monitoring program.



Spatial Assessment Continuum

- 
- Global
 - Sub Global: North America
 - Regional: South Atlantic Large Marine Ecosystem
 - **Basin: APES**
 - Watershed
 - Local

APNEP Ecoregions EPA Level IV in NC and TNC in VA



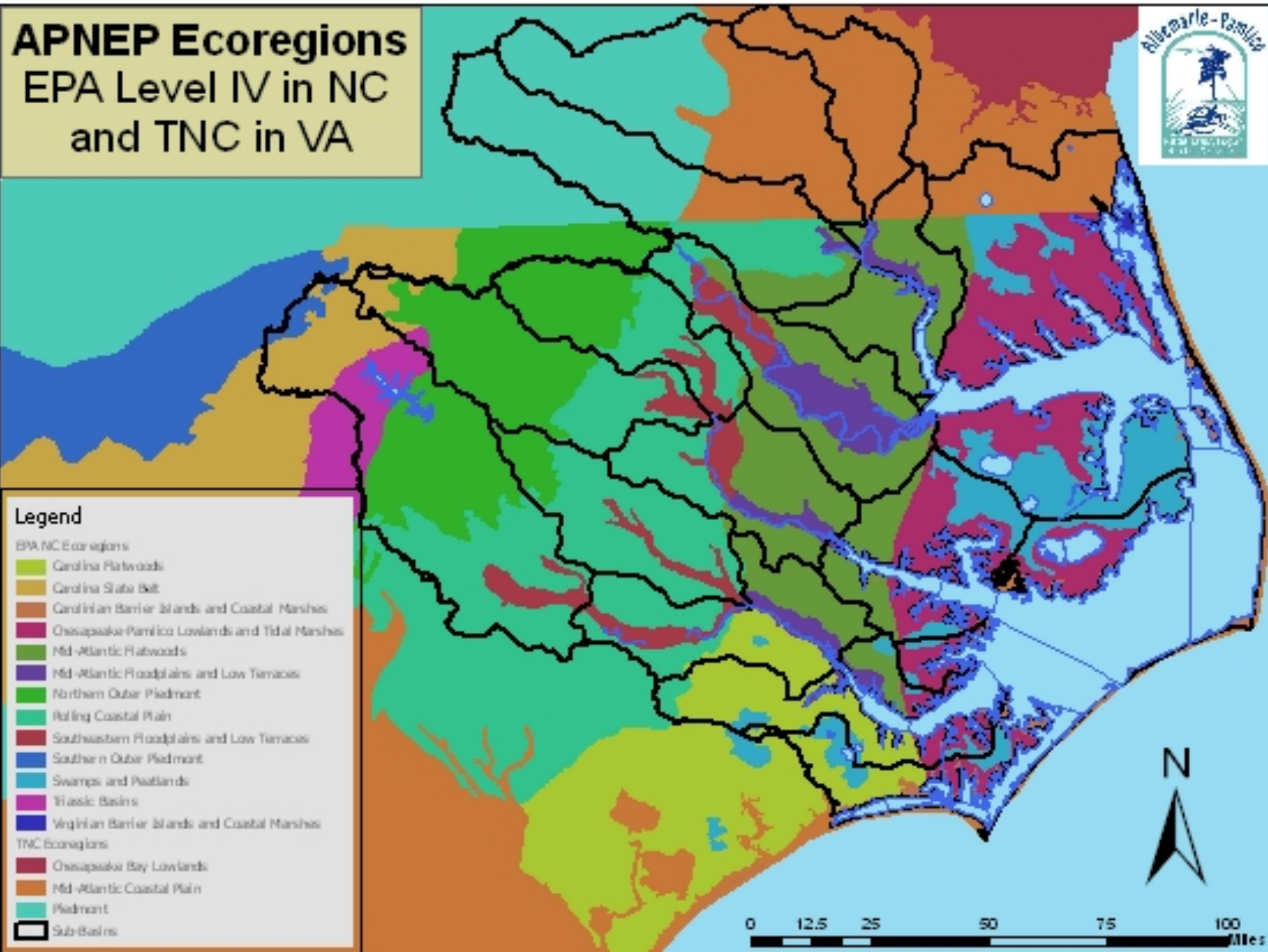
Legend

EPA NC Ecoregions

- Carolina Flatwoods
- Carolina State Belt
- Carolinian Barrier Islands and Coastal Marshes
- Chesapeake-Pamlico Lowlands and Tidal Marshes
- Mid-Atlantic Flatwoods
- Mid-Atlantic Floodplains and Low Terraces
- Northern Outer Piedmont
- Rolling Coastal Plain
- Southeastern Floodplains and Low Terraces
- Southern Outer Piedmont
- Swamps and Pastlands
- Triassic Basins
- Virginian Barrier Islands and Coastal Marshes

TNC Ecoregions

- Chesapeake Bay Lowlands
- Mid-Atlantic Coastal Plain
- Piedmont
- Sub-Basins





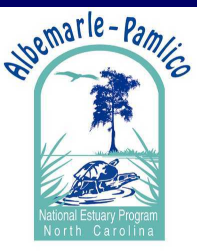
Temporal Assessment Continuum

- Century
- Decade
- Annual
- Monthly
- Daily



Governance Assessment Continuum

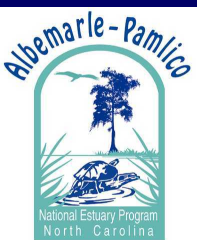
- Global
- National
- **Regional: North Carolina and Virginia**
- State
- County
- Municipalities





Ecosystem Science

- 
- Tenet: Integrated and comprehensive nature of ecosystem science is critical to ecosystem management at the landscape scale.

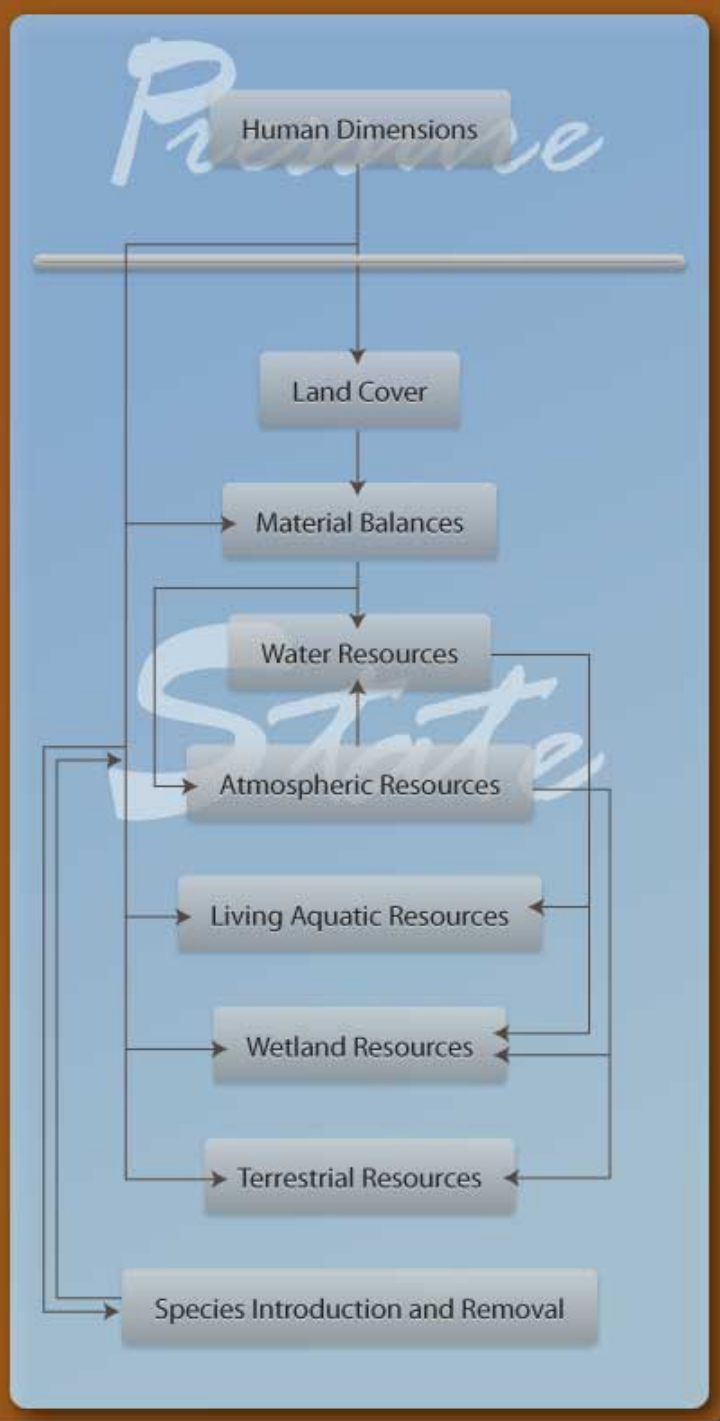


Cortner & Moots. 1999. The Politics of Ecosystem Management.
Page 25.

EPA Indicator Development for Estuaries

- Program Planning
- Conceptual Model Development
- Indicator Specification
- Monitoring Program Development
- Implementation
- Reassessment

Regional Ecosystem Model



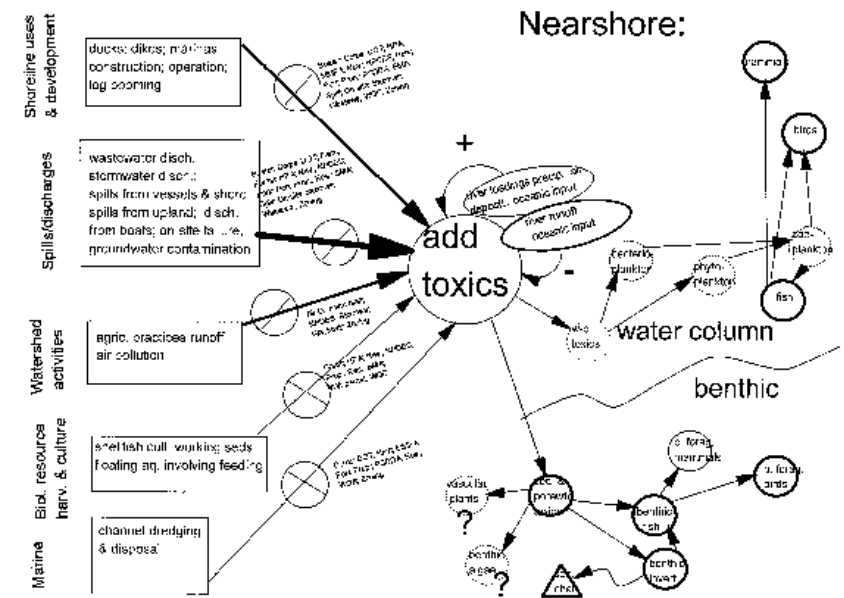


Figure 3. Stressor-based conceptual sub-model for toxics in the nearshore environment. Weighting of line around ecosystem component circles indicates amount of monitoring data available.

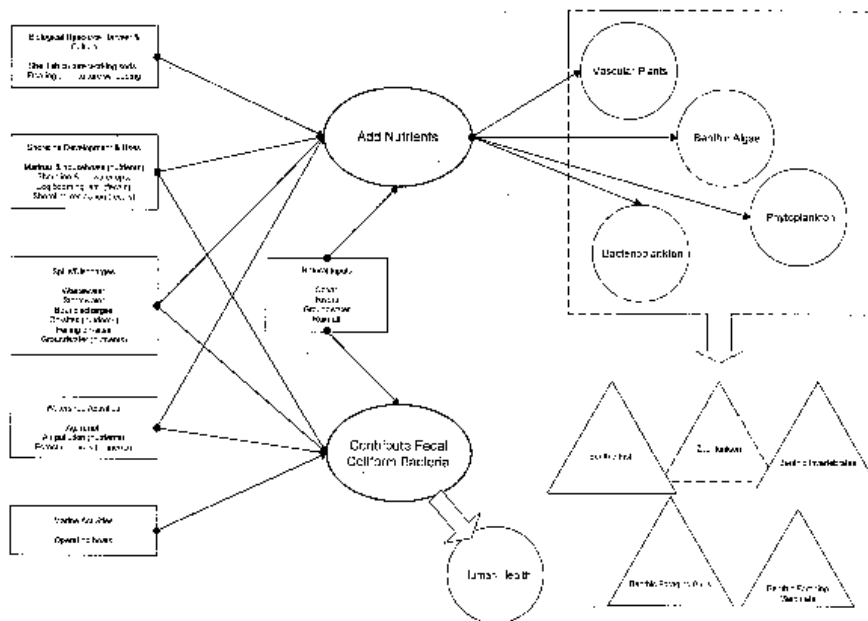
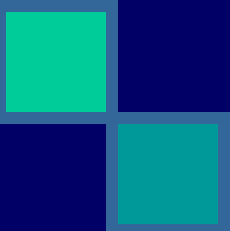


Figure 6. Conceptual model of nutrient and pathogen stresses in Puget Sound.



APNEP Indicator Definition



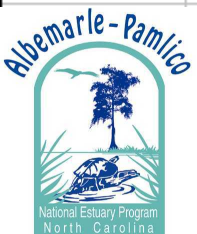
“A **numerical value** derived from actual measurements of a pressure, state or ambient condition, exposure, ecological condition, or measure of human health or wellbeing over a specified **geographic domain**, whose trends over time represent or draw attention to underlying **trends** in the condition of the environment in the A-P region.”

APNEP Indicator Criteria

- **Utilization:** Address a key process or property, and answers (or makes an important contribution toward answering) an important question about conditions in the A-P region
- **Objectivity:** Developed and presented in an accurate, clear, complete, and unbiased manner
- **Integrity:** Underlying data should be characterized by sound collection methodologies and data management systems adequate to protect its integrity, and to comply with quality assurance procedures
- **Availability:** Data should be available and timely, or will likely be available in the future, to maintain the indicator's utility
- **Representation:** Trends should accurately represent the underlying trends in the target population
- **Clarity:** The indicator should be clearly defined and reproducible. The specific data used and the specific assumptions, analytical methods, and statistical procedures employed are clearly stated

A-P INDICATORS: LINKS TO REGIONAL ECOSYSTEM MODEL

| Module | Category | Dimension | Indicator | CCMP Indicator | STAC Indicator | ASC Indicator | ACE-INC Indicator | |
|----------------------------|---------------------|---------------------------------|---------------------------|----------------|---|---------------|-------------------|--|
| 1: Human Population | Regional Population | Human Presence | Total population in basin | | Demographic Structure Human Presence | | | |
| | | Human Urban Presence | Total urban population | | Human Presence | | | |
| | | Population by demographic class | | | Demographic Structure | | | |
| | | Localized population change | | | Human Presence | | | |
| | | Human waste production | | | | | | |
| | | | | | | | | |
| 2: Human Needs | Food Water | Drinking water uses | | | | | | |
| | | Water supply infrastructure | | | | | | |
| | Fiber | Housing | | | Housing Price & Affordability | | | |
| | | Energy supply infrastructure | | | | | | |
| | Health Economy | | | | | | | |
| | | | | | | | | |
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APNEP Objectives-Metrics Hierarchy

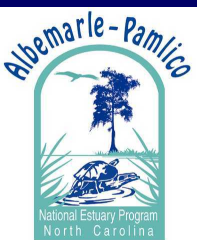
- Modules
- Categories
- Dimensions
- Indicators



Framework for Monitoring

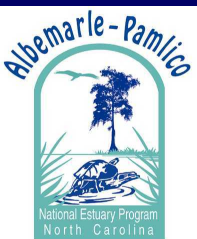
NEP Monitoring Plan Outline

- Define monitoring objectives & performance criteria
- Identify testable hypotheses
- Specify monitoring variables, including sampling locations, monitoring frequency, field and laboratory methods and QA/QC procedures
- Specify data management system and statistical tests to analyze the monitoring data
- Describe the expected performance of the initial sampling design
- Provide a timetable for analyzing data and assessing program performance



Initial APNEP Indicator-Metric Proposal

- Monitoring objective
- Measurable goals
- Data quality objectives
- Data analysis, statistical methods and hypothesis
- Data Source



APNEP Indicator Proposal

- Justification for sampling/monitoring program
- Goal of sampling/monitoring program
 - What the optimum sampling/monitoring program will achieve and why that is important
- Existing sampling/monitoring program
 - Objectives - What the existing program is designed to measure.
 - Example: *Conduct periodic aerial mapping to monitor dramatic change of SAV presence over 5-year increments in four of six APES regions*
 - Methods
 - Costs
 - Data quality control (data quality objective)
 - Data analysis, statistical methods and hypotheses

APNEP Indicator Proposal

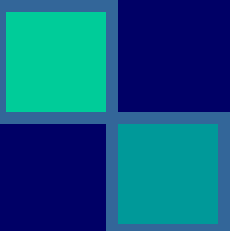
- **Enhanced sampling/monitoring program**
 - Objectives - what the enhanced sampling/monitoring program is designed to measure.
 - Example: *Estimate the areal distribution and abundance of SAV along the western shorelines of APES and be capable of detecting significant change in SAV distribution and abundance*
 - Methods
 - Costs
 - Data quality control (data quality objective)
 - Data analysis, statistical methods and hypotheses
- **Reference(s)**
- **Contact Person**

A-P Ambient Monitoring Program

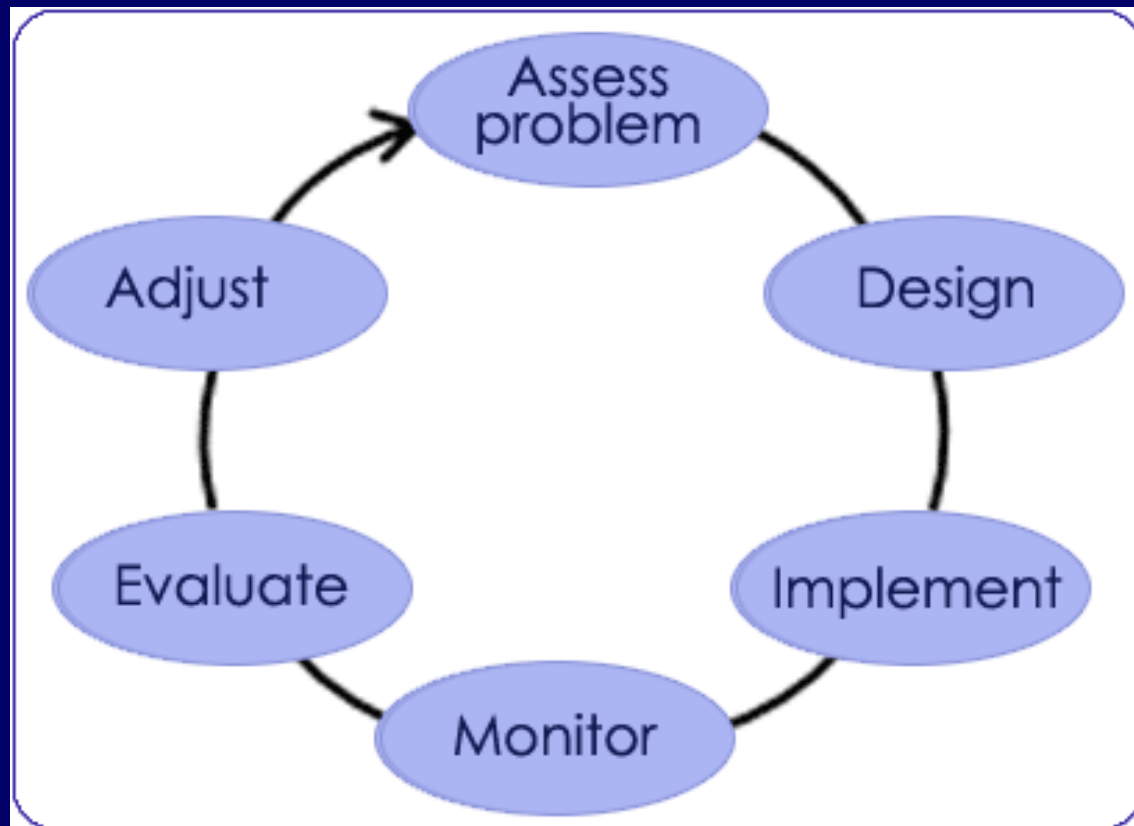
- Precise goals and specific measures for monitoring policy effectiveness should be designed and tested at the time that a policy is implemented
- Status Quo: APNEP 2000 monitoring survey update



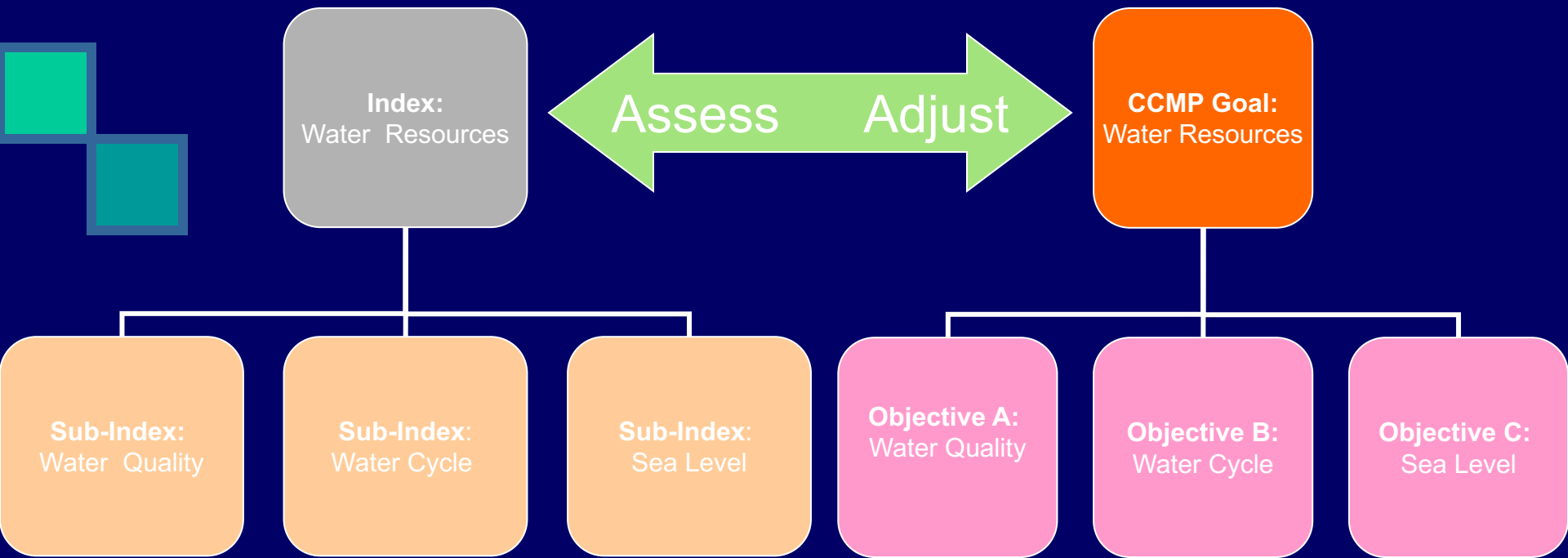
Monitoring Integration Continuum

- 
- Independence: Knowledge of partners monitoring strategies
 - Cooperation: Taking advantage of common geography, timing
 - Collaboration: Opportunities to leverage partners' monitoring networks
 - Integration: Working toward a common set of regional ecosystem objectives

APNEP CCMP 2010: A New Paradigm of *Adaptive* Ecosystem-Based Management

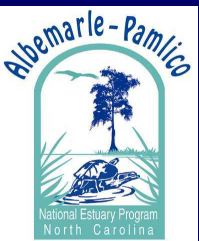


An Integrated Framework



**Indicators
Framework**

**CCMP
Framework**



Regional Ecosystem Services

- Provisioning (e.g., food, water, timber, fiber)
- Regulating (climate, floods, disease, wastes)
- Cultural (recreational, aesthetic, spiritual)
- Supporting (e.g., soil formation, photosynthesis, nutrient cycling)

DSS Construction Phase I

- Initial Objective: An integrated GIS environmental database portal
- IT Objective: Spatially-enabled content management system
 - First compilation: NC-DENR- and VA-DEQ/DCR/DFG/DF- sponsored environmental data
 - Second compilation: environmental databases from other North Carolina and Virginia agencies
 - Third compilation: federal, university (non-DENR funded), local databases

DSS = Digital Basin (Landscape-Waterscape)

■ Ecosystem State

- Land Cover
- Material Balance
- Atmospheric
- Water Quality
- Living Aquatic Resources
- Wetlands
- Terrestrial
- Species Introductions & Removals

■ Human Dimensions

■ Management Actions

■ Uncertainty