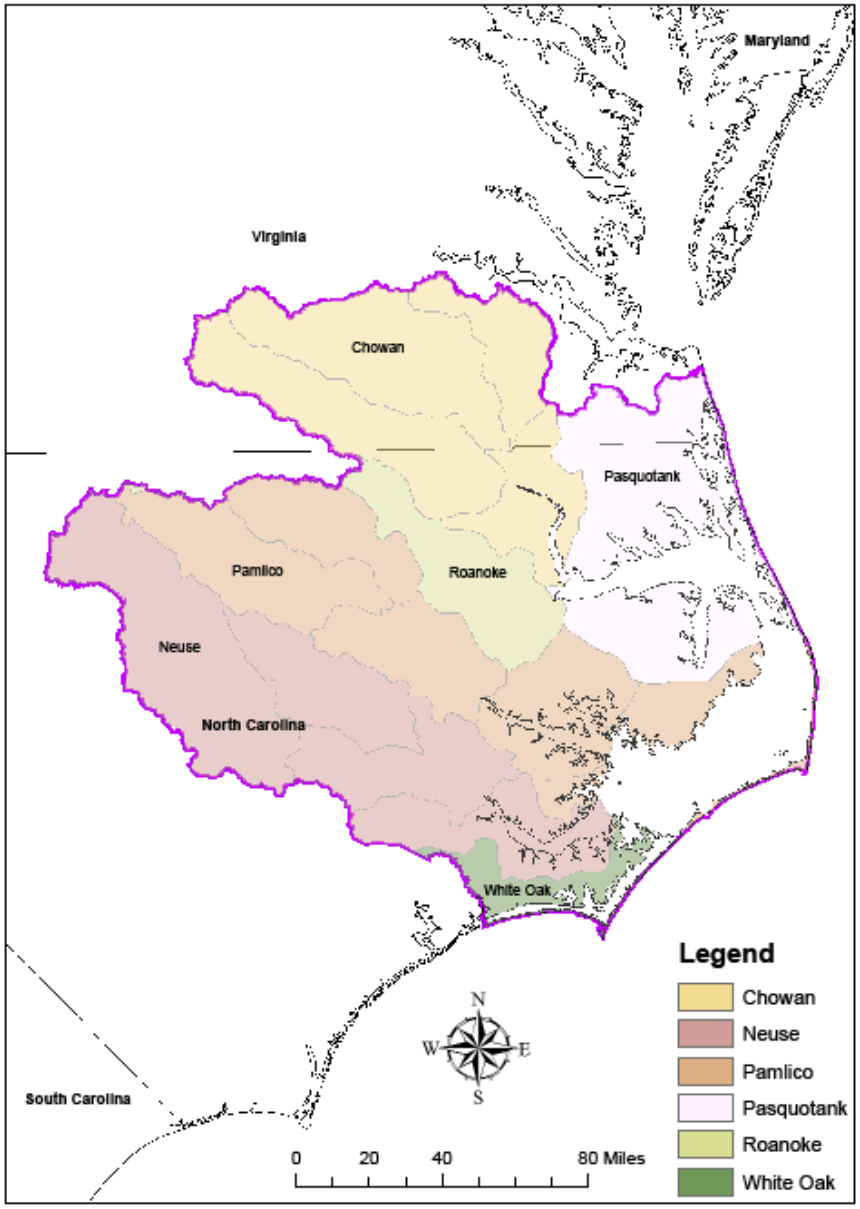
APNEP Wetland Resources Monitoring & Assessment

- Develop a monitoring strategy for Wetland Resource metrics within the APNEP region
- Metric-specific monitoring proposals
- Indicators to be featured in the 2010 APNEP Regional Ecosystem Assessment

River Basins in the APNEP Region



Map Created By Lori Brinn, 2010

APNEP's Transition to Ecosystem-Based Management

- A holistic vision and plan that includes a comprehensive description of the A-P system and articulation of multiple management objectives.
- A community that has effective engagement of policy makers, managers, scientists, & stakeholders.
- A process that includes effective adaptive management to address a changing system.
- A framework that includes appropriate authority, implementation area, management institutions, financial resources, and effective communications.

APNEP "Human" Goals (Draft)

- **Healthy human communities that are not threatened by changes in the A-P ecosystem.**
  - *Fish and game are safe for human consumption*
  - *Air is safe for people to breathe*
  - *Freshwaters are clean and available for drinking*
  - *Waters are safe and clean for personal contact*
- **A quality of human life that is sustained by a functioning A-P regional ecosystem.**
  - *Opportunities for recreation, and access to landscapes and waterscapes are continued and preserved*
  - *An ecosystem that supports thriving natural resources and uses such as agriculture, aquaculture, fisheries, forestry, and tourism*

APNEP "Flora & Fauna" Goal 1 (Draft)

- **Viable populations of native species in A-P Region**
  - *Viable aquatic, wetland, and upland communities exist into the future and biodiversity and function is maintained*
  - *Populations of aquatic, wetland, and upland species are viable into the future and biodiversity is maintained*
  - *Non-native species do not significantly reduce native species' viability or function*
  - *Biological harvests are balanced, viable, and ecosystem-based*

APNEP "Flora & Fauna" Goal 2 (Draft)

- **A region where aquatic, wetland, and upland habitats are protected or restored**
  - *Estuarine habitats that sustain diverse species so that ecosystem functions are maintained*
  - *Freshwater habitats that sustain diverse species so that ecosystem functions are maintained*
  - *Upland habitats that sustain diverse species so that ecosystem functions are maintained*
  - *Non-native species do not significantly impair habitat quality, quantity, or the processes that form and maintain habitats*

Albemarle-Pamlico National Estuary Program North Carolina

APNEP "Water" Goals (Draft)

- **An ecosystem that is supported by hydrologic regimes sufficient to sustain people and the ecological integrity of the system.**
  - *Water quantity is sufficient to support ecological integrity*
  - *Water quantity supports human activities*
- **Waters of a sufficient quality to maintain ecological integrity.**
  - *Loadings of nutrients, pathogens, and toxics do not impair ecosystem functions*
  - *Nutrients and pathogens do not harm the species that depend on the waters*
  - *Toxics in waters and sediments, and in plants and animals in these waters, do not harm the persistence of these species*

Source: US Clean Water Action Plan Partners. 2000. Clean Water Action Plan: Coastal Research and Monitoring Strategy.

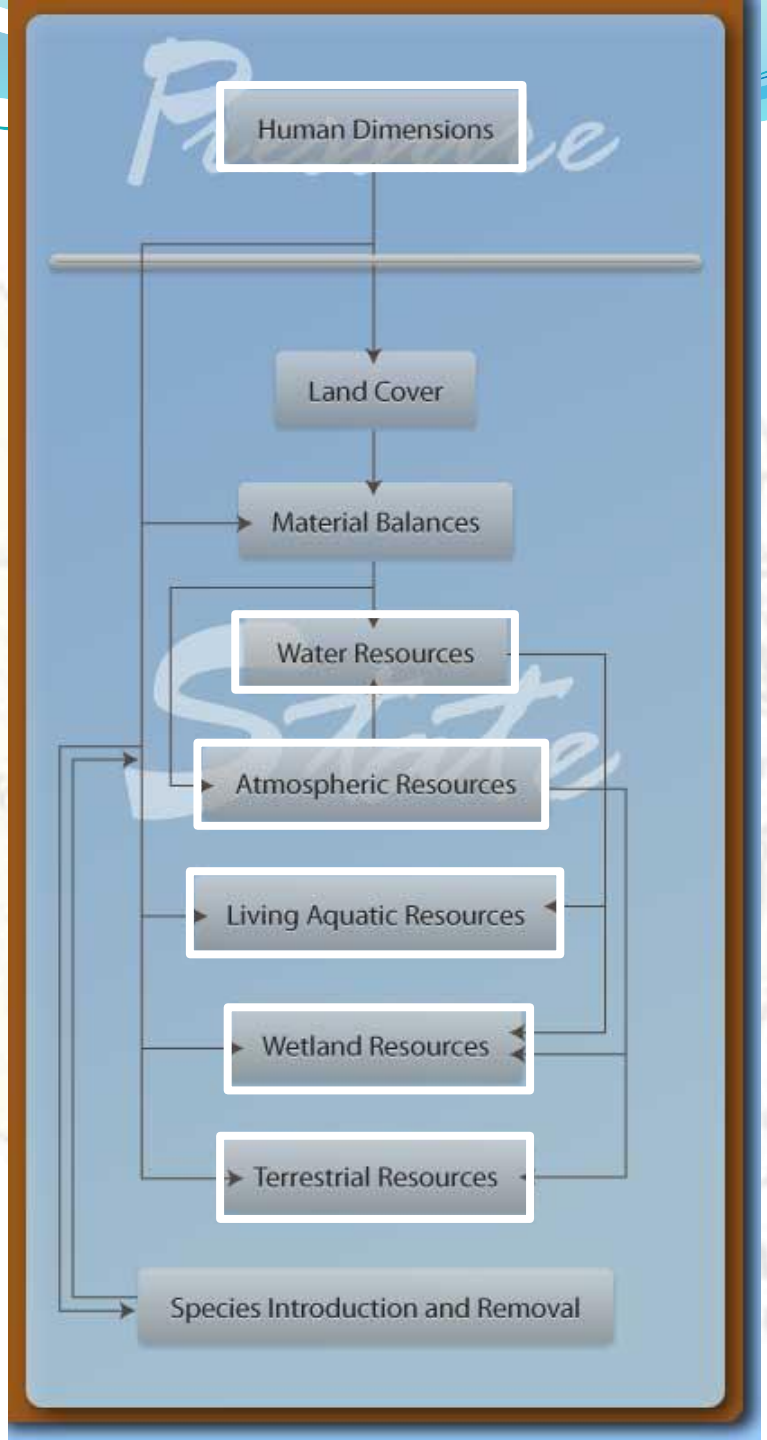
APNEP Targets 2010-2011

- Regional Ecosystem Assessment 1.0
  - Indicator Specification 1.1
- Comprehensive Conservation & Management Plan (CCMP) 2.0
  - Ecosystem-Based Management (EBM) Plan 1.0
- Integrated Monitoring Strategy 1.0
  - Indicator Specification 1.1

APNEP Monitoring & Assessment

- APNEP staff adopt indicators/metrics in 2007
- Plan in 2008 to develop an integrated monitoring strategy for those indicators
- In concert with APNEP revising its Comprehensive Conservation & Management Plan (CCMP)
- Six APNEP resource monitoring & assessment teams

Regional Ecosystem Model



Wetland Resources Monitoring & Assessment Team Representation

- APNEP
- NC-DENR
  - DCM
  - DFR
  - DMF
  - DWQ
  - DWR
  - EEP
  - NERR
- NC-WRC
- ACE
- EPA
- FWS
- NOAA
- NPS
- USGS
- STAC/ Ex-STAC

EPA Indicator Development for Estuaries

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

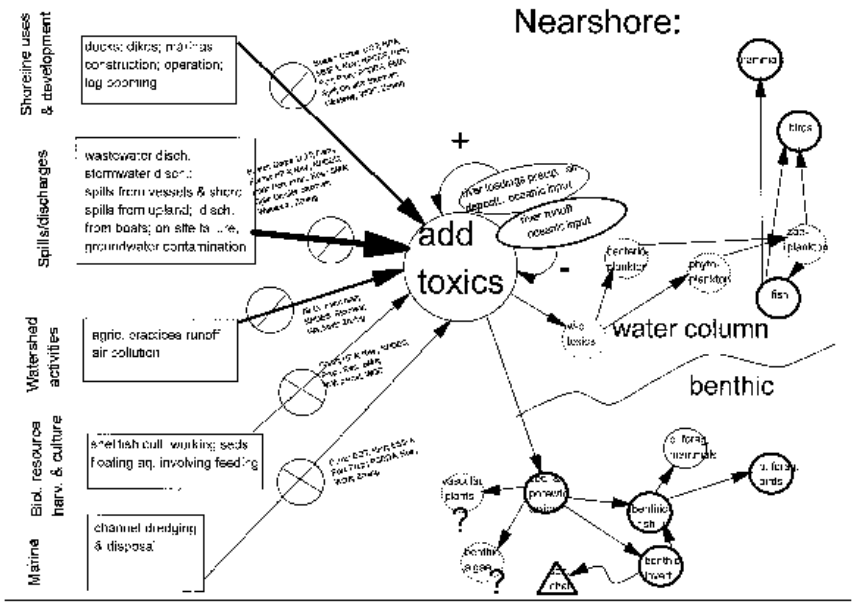


Figure 3. Stressor-based conceptual sub-model for toxics in the nearshore environment. Weighting of line around ecosystem component circles indicates amount of monitoring data available.

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

APNEP Objectives-Metrics Hierarchy

- Modules
- Categories
- Dimensions
- Metrics

Candidate Wetland Resource Indicators

Module	Category	Dimension	Indicator	
VII: Wetland Resources	VII-A: Wetland Incidents of Concern	VII-A-1: Altered Fire Regime in Wetlands	VII-A-1-a	Fire Severity, Frequency, and Extent in Wetlands
		VII-A-2: Wetland Vegetation Diebacks	VII-A-2-a	Saltmarsh Diebacks
			VII-A-2-b	Estuarine Shorezone Area and Composition
		VII-A-3: Amphibian Deformities in Wetlands	VII-A-3-a	Amphibian Deformity Incidences in Wetlands
		VII-A-4: Bioaccumulation in Wetlands	VII-A-4-a	Wetland Bird Egg Contamination
	VII-B: Wetland Habitat	VII-B-1: General Wetland Habitat Condition	VII-B-1-a	Rare Wetland Organism Presence
			VII-B-1-b	Rare Wetland Community Presence
			VII-B-1-c	Wetland Community Representation
			VII-B-1-d	Wetland Plant Condition
			VII-B-1-e	Permitted Wetland Losses
			VII-B-1-f	Wetland Restoration
		VII-B-2: Hydrologic Integrity in Wetlands	VII-B-2-a	Hydrogeomorphic & Condition Modification in Wetlands
	VII-C: Living Resource Populations in Wetlands	VII-C-1: Wetland Mammals	VII-C-1-a	Black Bear Populations in Wetlands & Uplands
			VII-C-1-b	Bobcat Populations in Wetlands
		VII-C-2: Wetland Birds	VII-C-2-a	Waterbird Community Structure
			VII-C-2-b	Shorebird Community Structure
			VII-C-2-c	Landbird Community Structure
			VII-C-2-d	Waterfowl Community Structure
		VII-C-3: Wetland Amphibians	VII-C-3-a	Ephemeral Pool Breeders
	VII-D: Wetland Soil/Sediment Condition	VII-D-1: Wetland Soil Condition/ Oxidation	VII-D-1-a	Subsidence in Wetland Soils
II: Land Cover	II-A: Wetland Cover Type Extent	II-A-3: Wetlands	II-A-3-a	Area by Wetland Class
	II-B: Spatial Relationships in Wetlands	II-B-1: Wetland Connectivity	II-B-1-a	Wetland Connectivity Index
		II-B-2: Wetland Patchiness	II-B-2-a	Wetland Complexity Index
		II-B-3: Wetland Proximity	II-B-3-a	Wetland Proximity Index
	II-C: Future Wetland Landscapes	II-C-1: Tomorrow's Riparian Zones	II-C-1-a	Land Use/Land Cover Under 5' Elevation
		II-C-2: Tomorrow's Shorelines	II-C-2-a	Impaired Landward Migration of Coastal Wetlands
III: Material Balances	III-B: Wetland Element of Carbon Cycle	III-B-2: Sequestered Carbon	III-B-2-a	Stored Carbon in Wetland Soils & Vegetation
	III-C: Wetland Element of Nutrient Cycle	III-C-1: Nitrogen	III-C-1-a	Stored Nitrogen in Wetland Soils & Vegetation
		III-C-2: Phosphorus	III-C-2-a	Stored Phosphorus in Wetland Soils & Vegetation
		III-C-3: Sulfur	III-C-3-a	Stored Sulfur in Wetland Soils & Vegetation
	III-D: Wetland Element of Sediment Cycle	III-D-1: Sedimentation	III-D-1-a	Sedimentation in Wetlands
	III-E: Wetland Element of Toxicants Cycle	III-E-1: Metals Contaminants	III-E-1-b	Mercury Prevalence in Wetland Biota
		III-E-2: Non-Metals Contaminants	III-E-2-a	Toxicant (TBD) Prevalence in Wetland Biota
IX: Species Introductions & Removals	IX-A: Invasive Wetland Species	IX-A-1: Invasive Wetland Mammals	IX-A-1-a	Nutria Population Estimates, Notable Local Populations
		IX-A-2: Invasive Wetland Birds	IX-A-2-a	Brown-headed cowbird, European starling (Invasiv. Comm)
		IX-A-3: Invasive Wetland Reptiles	IX-A-3-a	Invasive Wetland Reptile TBD Species Population Status/Occurrences
		IX-A-4: Invasive Wetland Amphibians	IX-A-4-a	Invasive Wetland Amphibian TBD Species Population Status/Occurrences
		IX-A-9: Invasive Wetland Arachnids	IX-A-9-a	Invasive Wetland Arachnid TBD Species Population Status/Occurrences
		IX-A-10: Invasive Wetland Crustaceans	IX-A-10-a	Invasive Wetland Crustacean TBD Species Population Status/Occurrences
		IX-A-11: Invasive Wetland Insects	IX-A-11-a	Invasive Wetland Insect TBD Species Population Status/Occurrences
		IX-A-13: Invasive Wetland Flora	IX-A-13-a	Phragmites australis Population Status/Occurrences, Alligator Weed (Invasive Comm)
	IX-B: Vulnerable Wetland Species	IX-B-1: Vulnerable Wetland Mammals	IX-B-1-a	River Otter Species Population Status/Occurrences
		IX-B-2: Vulnerable Wetland Birds	IX-B-2-a	King rail, Piping plover, Swainson's warbler, Black duck Population Status/Occurrences
		IX-B-3: Vulnerable Wetland Reptiles	IX-B-3-a	Vulnerable Wetland Reptile Species Population Status/Occurrences
		IX-B-4: Vulnerable Wetland Amphibians	IX-B-4-a	Vulnerable Wetland Amphibian TBD Species Population Status/Occurrences
		IX-B-9: Vulnerable Wetland Arachnids	IX-B-9-a	Vulnerable Wetland Arachnid TBD Species Population Status/Occurrences
		IX-B-10: Vulnerable Wetland Crustaceans	IX-B-10-a	Vulnerable Wetland Crustacean TBD Species Population Status/Occurrences
		IX-B-11: Vulnerable Wetland Insects	IX-B-11-a	Vulnerable Wetland Insect TBD Species Population Status/Occurrences
		IX-B-13: Vulnerable Wetland Flora	IX-B-13-a	Vulnerable Wetland Flora TBD Species Population Status/Occurrences

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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

APNEP Monitoring Proposal

- Justification for indictor
- 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 Monitoring 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

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

Heinz Center's State of the Ecosystem Assessment Format

- Summation Table: What do the most recent data show? Have data values changed over time?
- Part 1: Why is the indicator important?
- Part 2: What does this indicator report?
- Part 3: What do the data show?
- Part 4: Understanding the data (or discussion)
- Part 5: Why can't the entire indicator be reported at this time?
- Technical note (appendix)

System-Wide Indicators Proposed for 2010 APNEP Assessment

- Climate change
  - *Metrics*: relative sea level, storm frequency**, storm intensity**, average salinity across the estuarine system*
- Air quality
  - *Metrics*: wet nitrate deposition, wet ammonia deposition, tropospheric ozone concentration (secondary standard), total nitrate air concentration
- Unusual mortalities/disease*
  - *Metrics*: instances of mass, or otherwise unusual, deaths of marine mammals**, fishes*, birds, and turtles**; instances of disease in marine mammals**, fishes*, birds, and turtles
- Economic productivity*
  - *Metrics:* major yields and monetary value of agricultural, silvicultural, and fisheries* products
- Species diversity*
  - *Metrics:* areal extent of high biological diversity (natural heritage index)**, number of threatened and endangered species (aquatic and terrestrial)

Land-Based Indicators Proposed for 2010 APNEP Assessment

- Land cover*
  - *Metrics*: areal extent of wetlands*, urban areas*, agricultural land*, forests*, and silvicultural land; number of controlled animal feeding operations (CAFOs)
- Population**
  - *Metrics*: human population by county**, river basin**, and entire AP system**

Water-Based Indicators Proposed for 2010 APNEP Assessment

- Water quality*
  - *Metrics*: instances of violations of Clean Water Act 303(d) criteria including chemical and dissolved metal concentrations*, bacterial counts*, dissolved oxygen*, total phosphorus*, total nitrogen*, chlorophyll *a**, suspended solids* and turbidity*
- Extent of living habitat*
  - *Metrics*: areal extent of submerged aquatic vegetation* and areal extent of oyster beds*
- Fish populations*
  - *Metrics*: stock statuses of choice species* (these were commercial species in the last assessment)
- Economic productivity*
  - *Metrics:* major yields and monetary value of agricultural, silvicultural, and fisheries* products
- Riverine Inputs*
  - *Metrics:* freshwater flow rates*, number and type of point source polluters*, nutrients*, total suspended solids*

Regional Ecosystem Services

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