Adaptive Management in an Ecosystem-based Management Program

Dr. Carl Hershner, Director
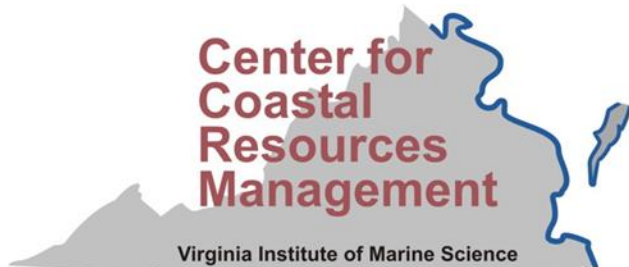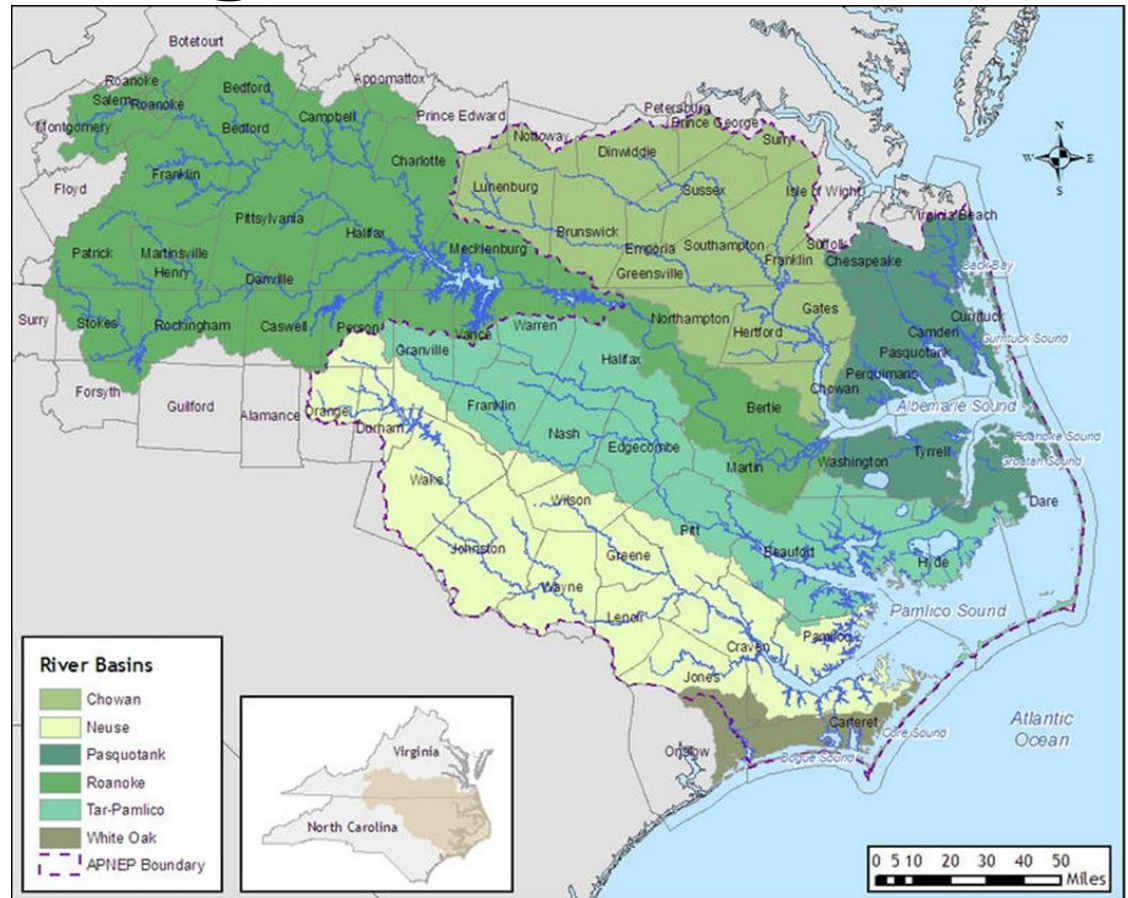
Dr. Kirk Havens, Director, Coastal Watersheds Program

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ALBEMARLE-PAMLICO
ECOSYSTEM
SYMPOSIUM
Embarking on a New Voyage

Adaptive Management in an Ecosystem Based Management Program

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Center for Coastal Resources Management

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River Basins
- Chowan
- Neuse
- Pasquotank
- Roanoke
- Tar-Pamlico
- White Oak
- APNEP Boundary

managing under uncertainty

- coastal ecosystems are complex
- our understanding is good but imperfect
- perfect understanding is unlikely
- doing nothing has consequences

learning by doing is essential
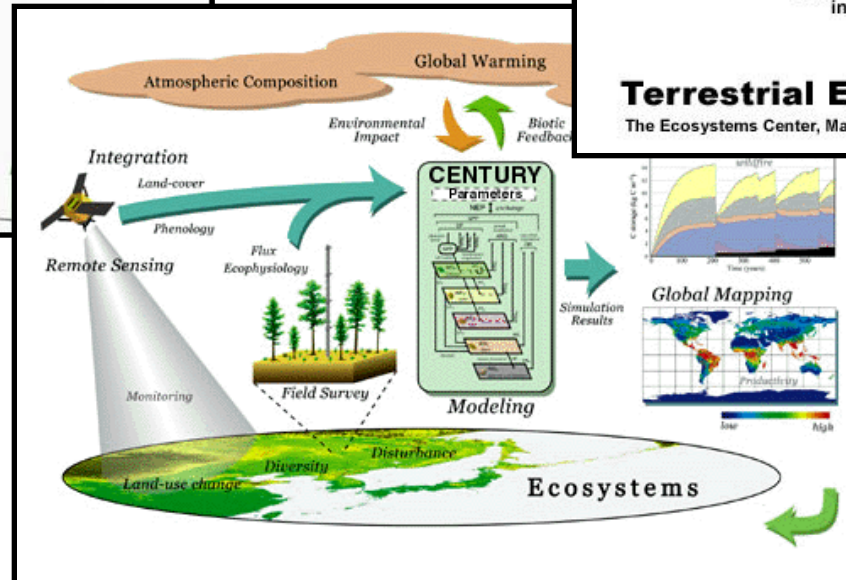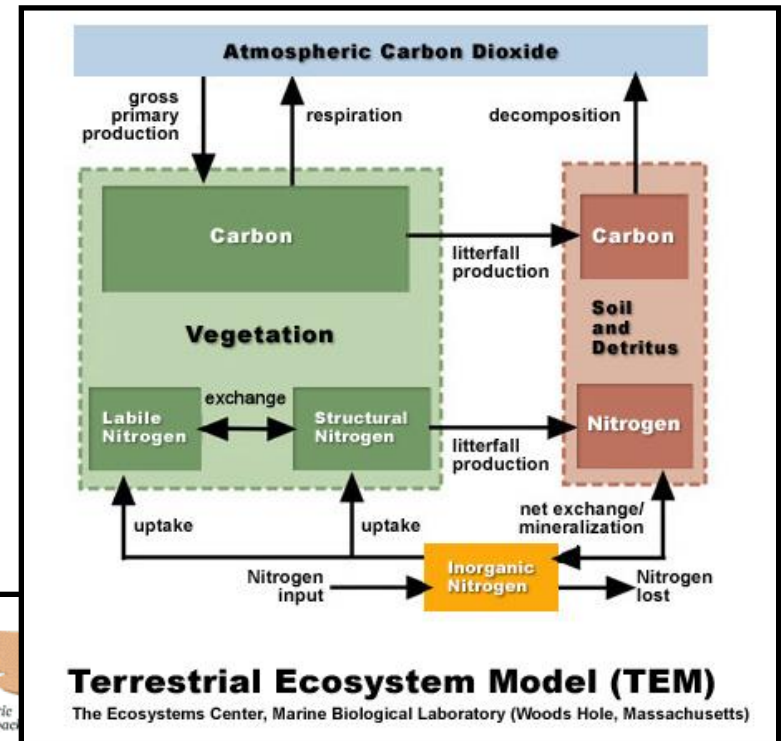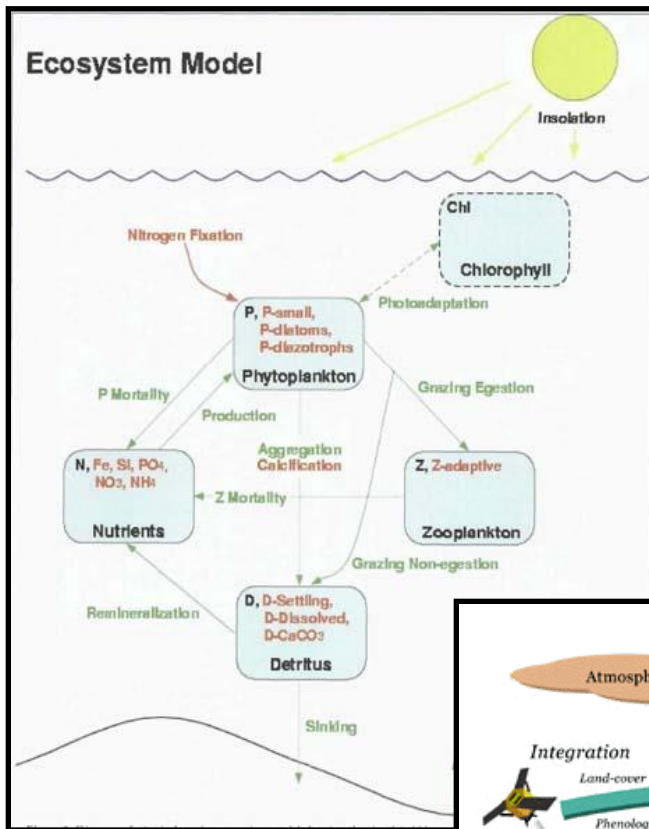**adaptive management**

adaptive management framework

1. articulate program goals
2. develop system level model
3. assess current management efforts
4. develop management strategy
5. develop monitoring program
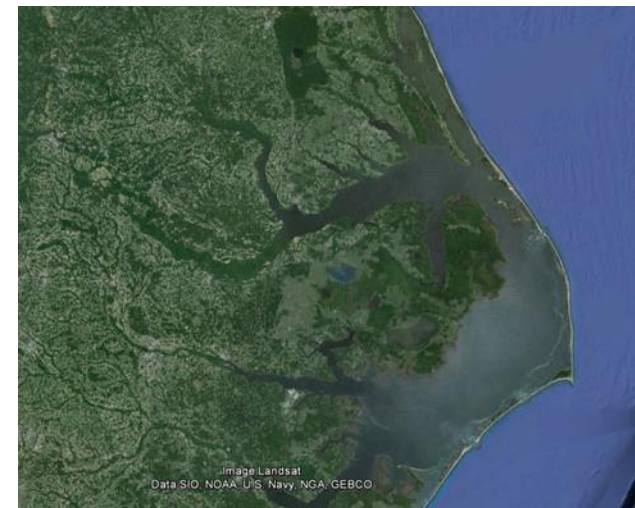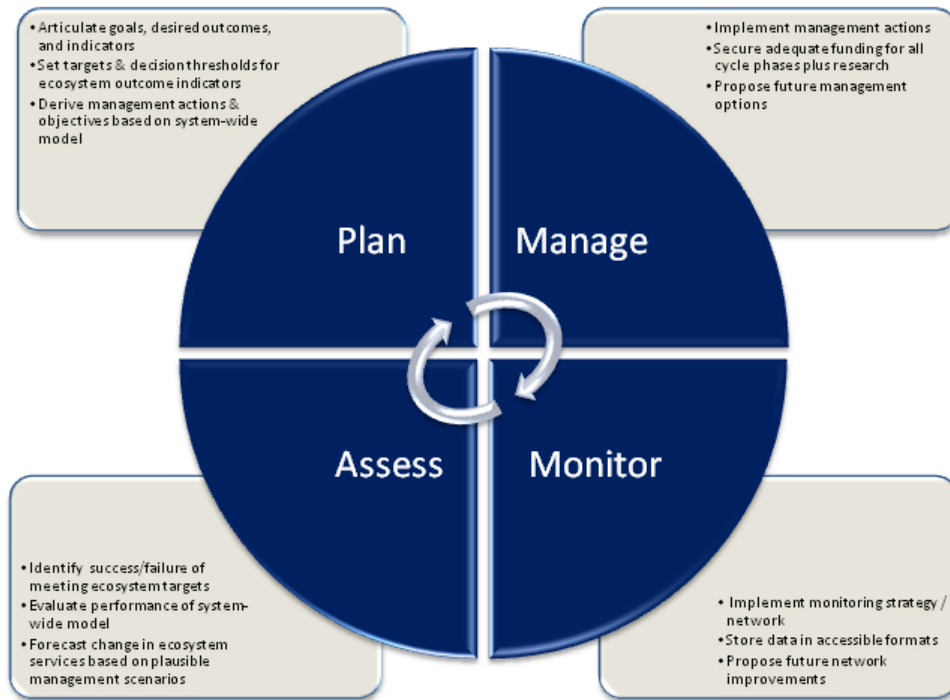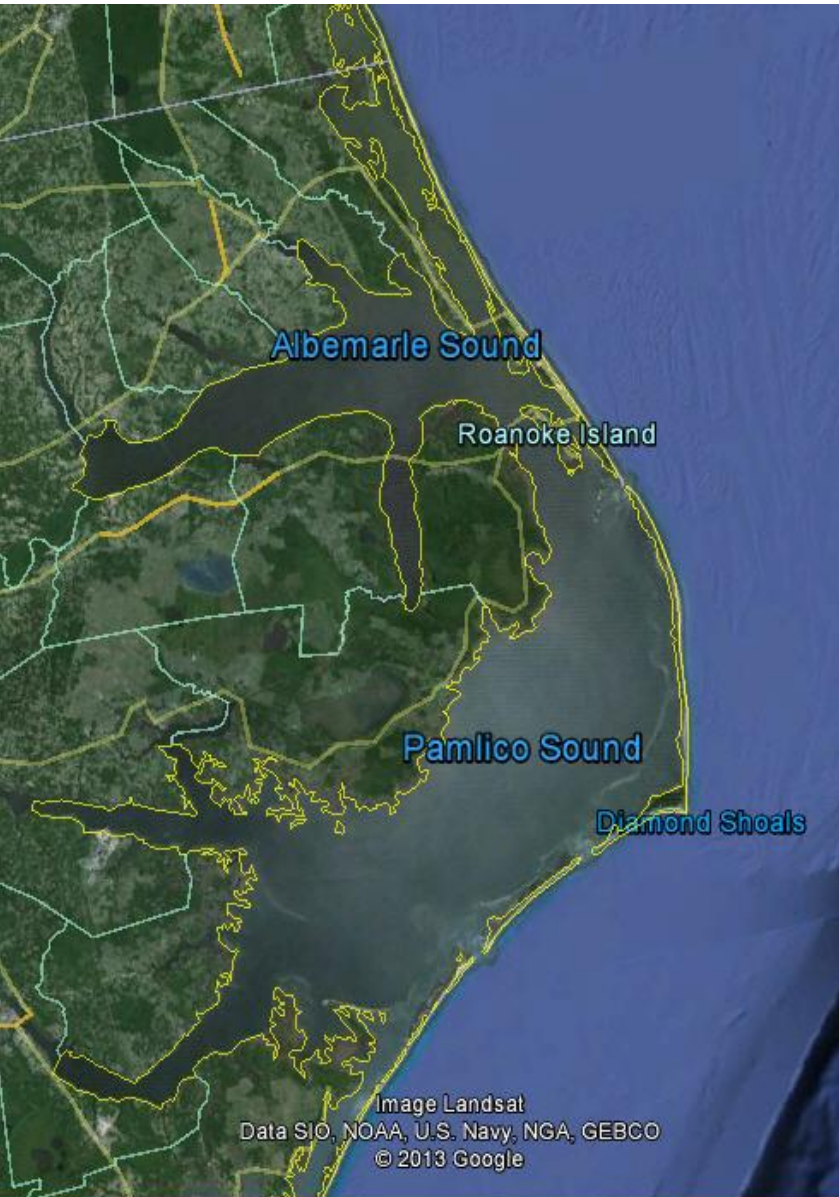6. assess performance
7. manage adaptively

conceptual model of system

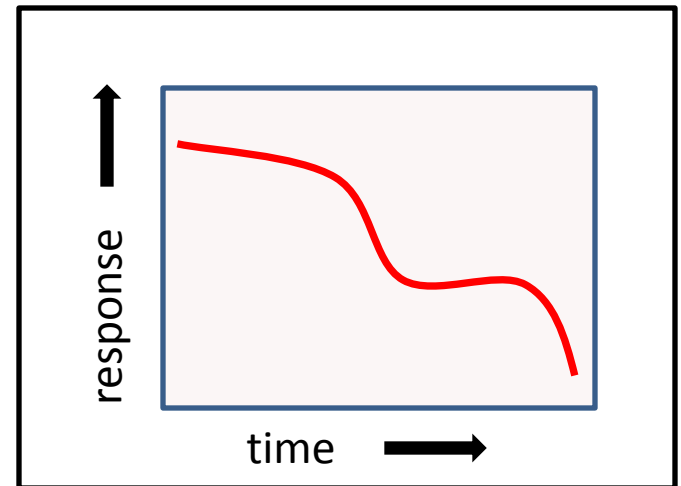# adaptive management

adaptive management

monitoring must

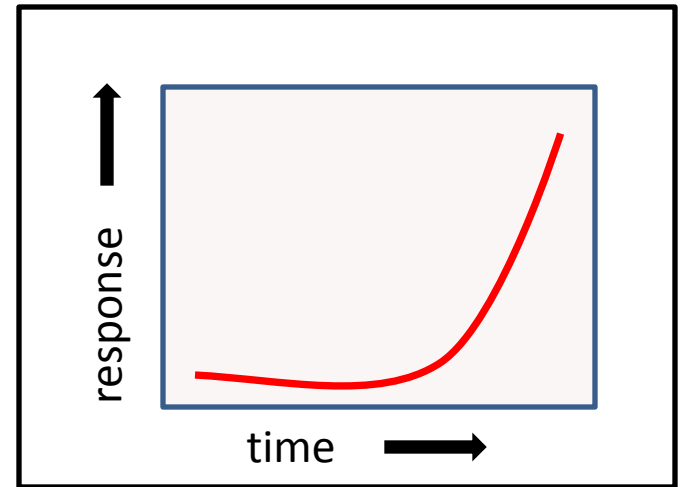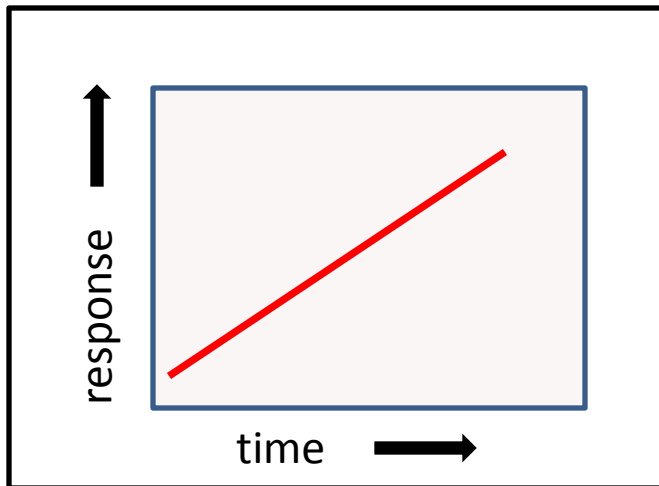1. document conditions

    • status and trends

2. document interventions

    • track implementation of management strategies

3. reduce uncertainty

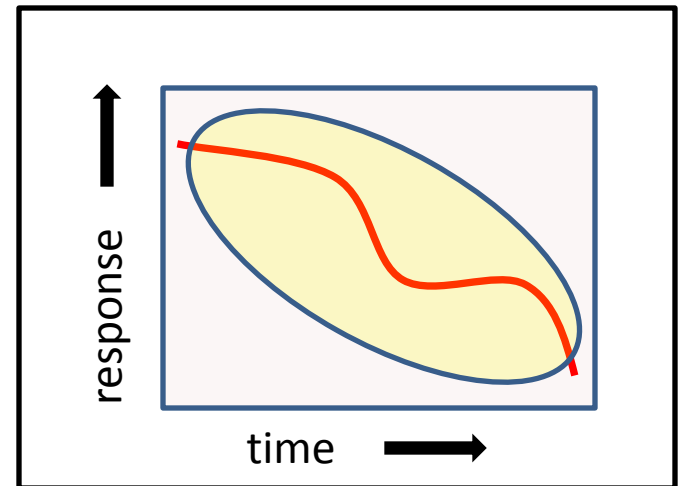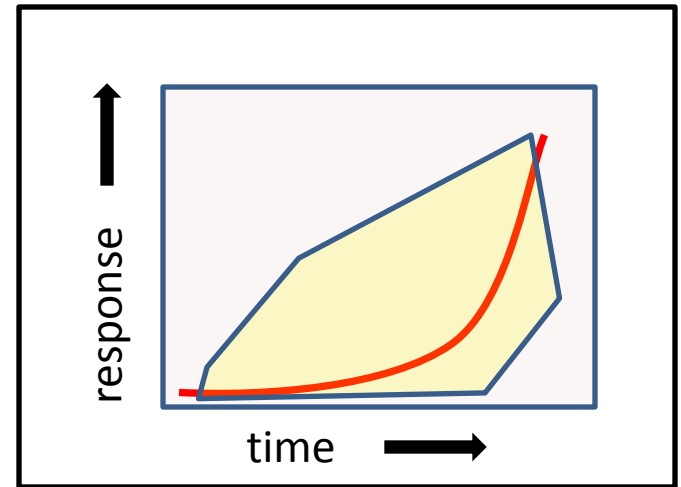   • validate assumptions about system behavior
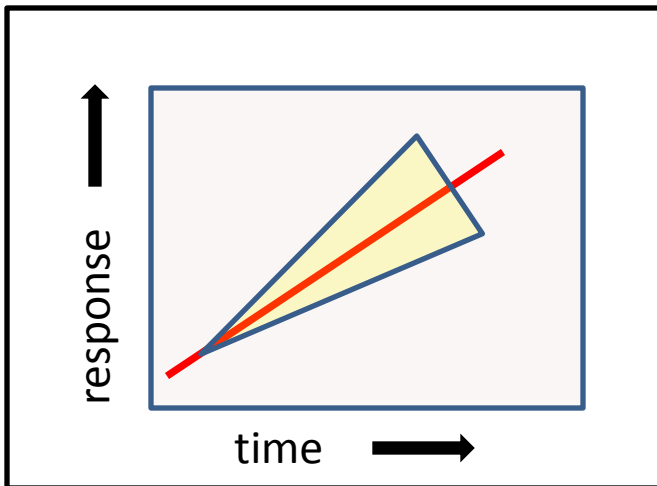
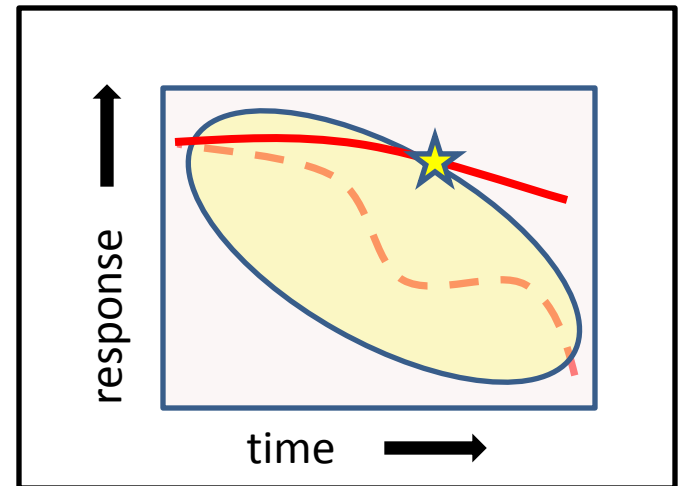# establishing performance expectations

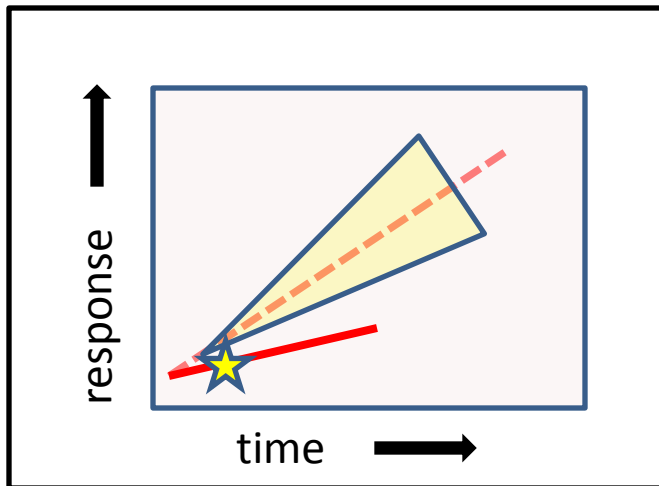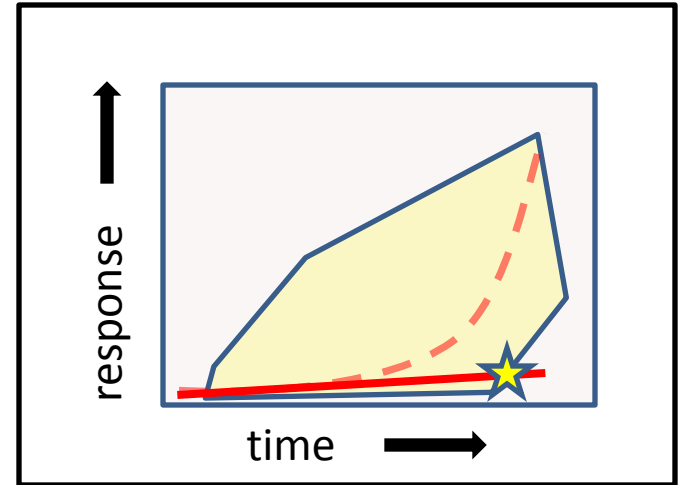anticipated system response

establishing performance expectations

identifying uncertainty

establishing performance expectations

⭐ decision threshold

apnep outcomes

| Goal	Ecosystem Outcome	CCMP Supporting Actions	Candidate Indicator
1: Human Communities A region where human communities are sustained by a functioning ecosystem	1a: Waters are safe for personal contact.	A1.1, 1.2, 2.3, 3.3; B1.2; C1.1,1.2, 1.4; D1.1, 1.2, 2.3,3.1,3.3; E1.1, 1.2, 2.1, 2.2	Beach action days/closings by water body type (sounds, freshwater river, lake, brackish river)
	1b: Designated surface and ground water supplies are safe for human consumption.	A1.1, 1.2, 2.3, 3.3; B1.2; C1.1,1.2, 1.4; D1.1, 1.2, 2.3,3.1,3.3; E1.1, 1.2 , 2.1, 2.2	WQ standard violations (surface waters)
			Drinking water standard violations (aquifers)
	1c: Surface hydrologic regimes sustain regulated human uses.	A 1.1, 1.2, 1.2, 2.3, 3.4; D 1.2, 2.2, 3.2; E1.1, 1.2, 2.1 2.2	Severity and frequency of droughts
	1d: Fish and game are safe for human consumption.	A1.1, 1.2, 2.3, 3.3; B1.2; C1.1,1.2; D 1.1, 1.2, 2.3,3.1,3.3; E1.1, 1.2, 2.1, 2.2	Fish consumption advisories
			Shellfish area closures
	1e: Opportunities for recreation and access to public lands and waters are protected and enhanced.	A 1.1, 1.2, 2.3; D 1.1, 1.2, 1.5, 2.2, 3.3; E1.1, 1.2, 2.1 2.2	Total distance of land and paddle trails
			Water access points: number & location
2: Native Species A region where aquatic, wetland, and upland habitats support viable populations of native species	2a: The biodiversity, function, and populations of species in aquatic, wetland, and upland communities are protected, restored, or enhanced.	A1.1, 1.2, 2.2, 3.1, 3.4: B 1.3, 2.1, 2.3, 2.4, 2.5, 3.3; C 1.3, 1.4, 2.2, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4; D1.1, 1.2, 1.4, 2.1, 2.2, 3.1, 3.3; E 1.1, 1.2, 2.1, 2.2	Oyster bed extent
			River herring abundance
			King rail, Swainson's warbler population /occurrences
			Box Turtle population /occurrences
			Longleaf Pine extent, location
			Firefly population
	2b: The extent and quality of upland, freshwater, estuarine and near-shore marine habitats fully support biodiversity and ecosystem function.	A 1.1, 1.2, 2.3, 3.1, 3.2, 3.4; B 1.1, 1.2, 1.3, 1.4, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.2, 3.3; C 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3; D 1.2, 1.4, 2.2, 3.1, 3.3; E1.1, 1.2, 2.1, 2.2	SAV extent and composition
			Quality & extent of anadromous fish spawning/nursery areas
	2c: Non-native invasive species do not significantly impair native species' viability or function, nor impair habitat quality, quantity, and the processes that form and maintain habitats.	A 1.2, 2.1, 2.3; B 2.6; C 3.1; D 1.2, 1.3, 2.2, 3.3; E 1.1, 1.2, 2.1, 2.2	Hydrilla population status/occurrences
			Phragmites australis extent (common reed)
			Kudzu population status/occurrences
3: Water Quantity & Quality A region where water quantity and quality maintain ecological integrity	3a: Appropriate hydrologic regimes support ecological integrity.	A 1.2, 2.1, 2.3; B 2.6; C 3.1; D 1.2, 1.3, 2.2, 3.3; E 1.1, 1.2, 2.1, 2.2	Dissolved oxygen concentration
			Major river flows
	3b: Nutrients and pathogens do not harm species that depend on the waters.	A 1.1, 1.2, 2.3; B 1.2, 1.3, 1.4, 1.5; C 1.2, 2.1, 2.3, 2.4; D 1.1,1.2, 1.4, 2.1,2.2, 3.3, E1.1, 1.2, 2.1, 2.2	Amount and extent of impaired waters
			Chlorophyll-a concentration
	3c: Toxics in waters and sediments do not harm species that depend on the waters.	A 1.1, 1.2, 2.3, 2.4; B 1.1; C 1.2; D 1.2, 3.1, 3.3; E 1.1, 1.2, 2.1, 2.2	Amount and extent of impaired waters
			Dissolved metals concentrations
	3d: Sediments do not harm species that depend on the waters.	A 1.1, 1.2, 2.3; B 1.3, 1.4, 1.5, 2.3, 2.6, 3.1, 3.2; C 1.3, 1.5, 2.1, 2.3, 3.1, 3.2; D 1.2, 3.1, 3.3; E 1.1, 1.2, 2.1, 2.2	Amount and extent of impaired waters
			Average secchi disk depth

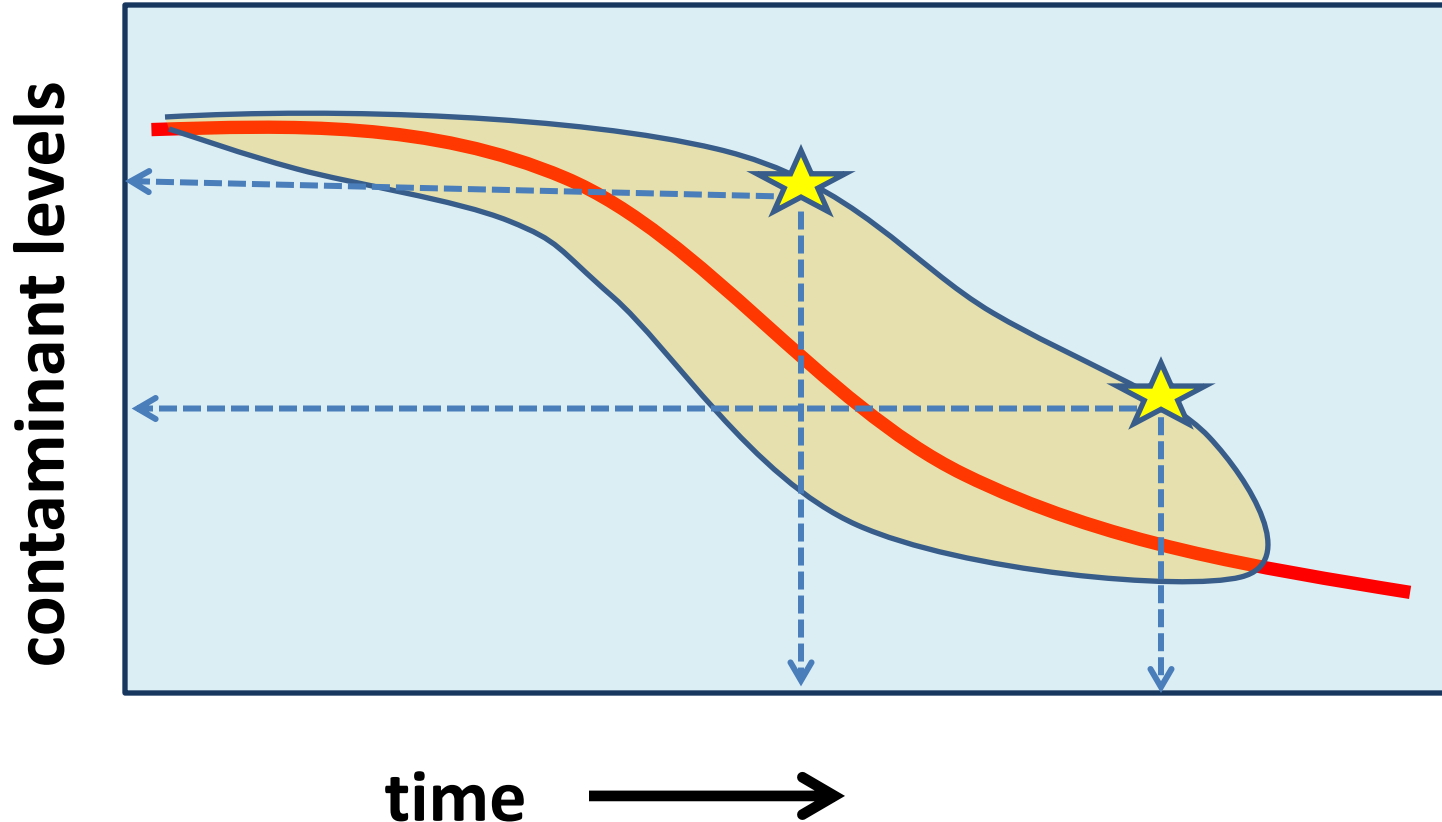# conceptual model of outcome 1a
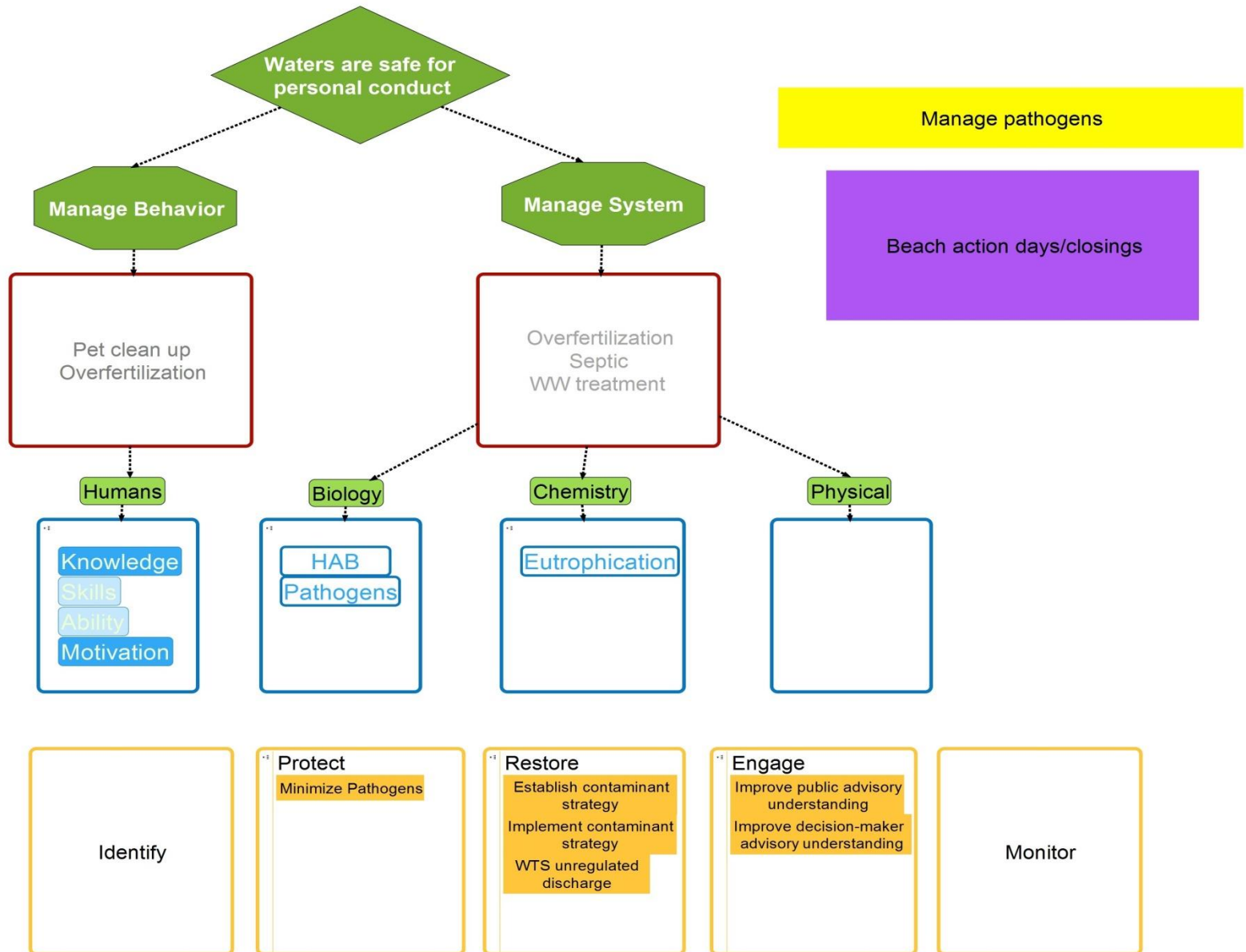
expected response

action: implement contaminant strategy
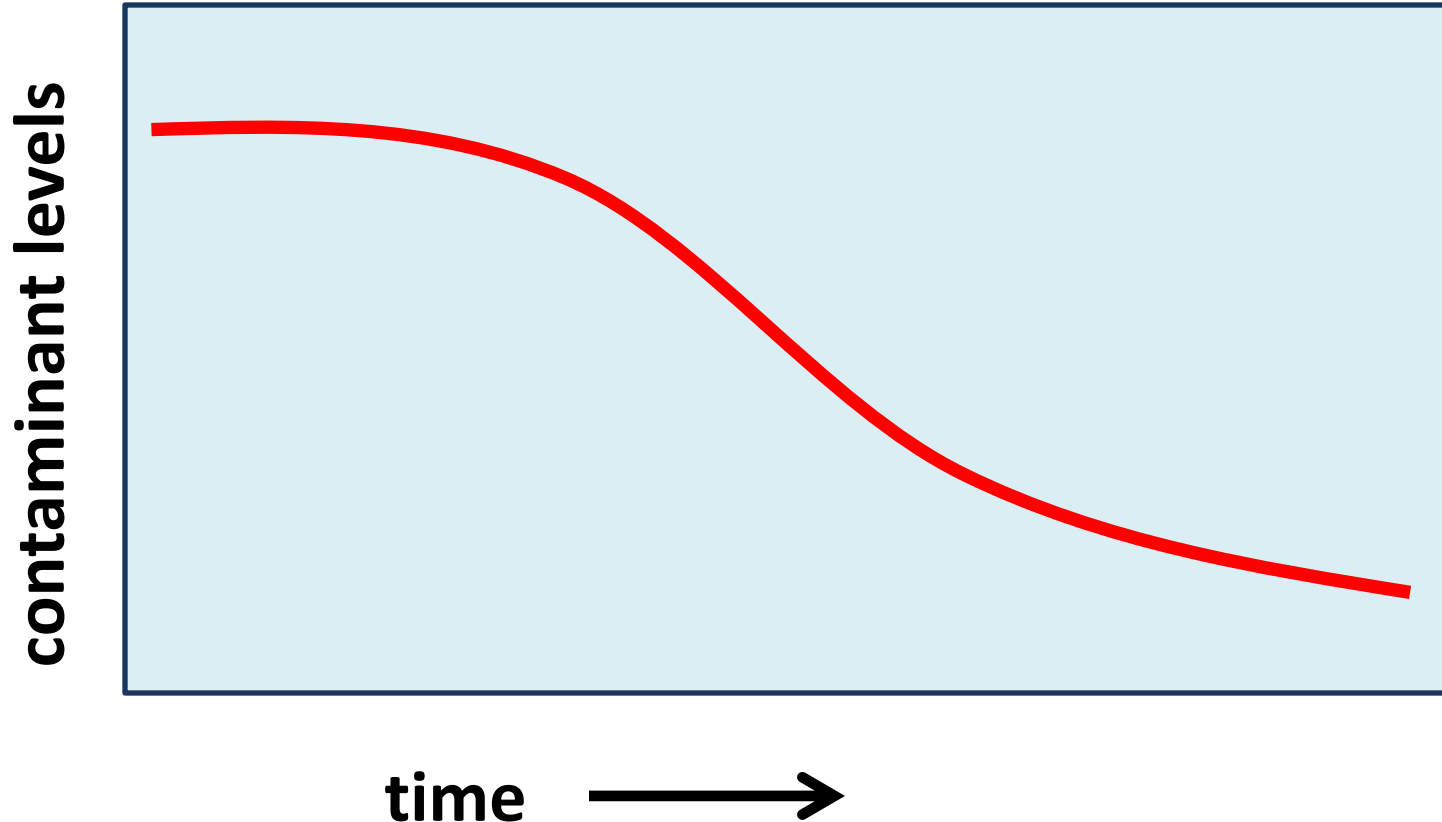
uncertainty and decision thresholds

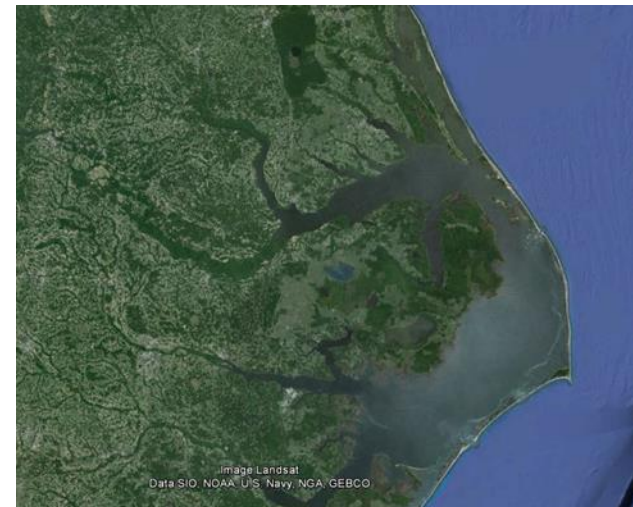action: implement contaminant strategy

potential adaptations

goal: waters are safe for personal contact

action: implement contaminant strategy

- strengthen enforcement
- increase discharge limitations
- improve public outreach
- change WQ standards

real
adaptive management

every iteration of the adaptive management cycle should **improve** the conceptual model of system behavior