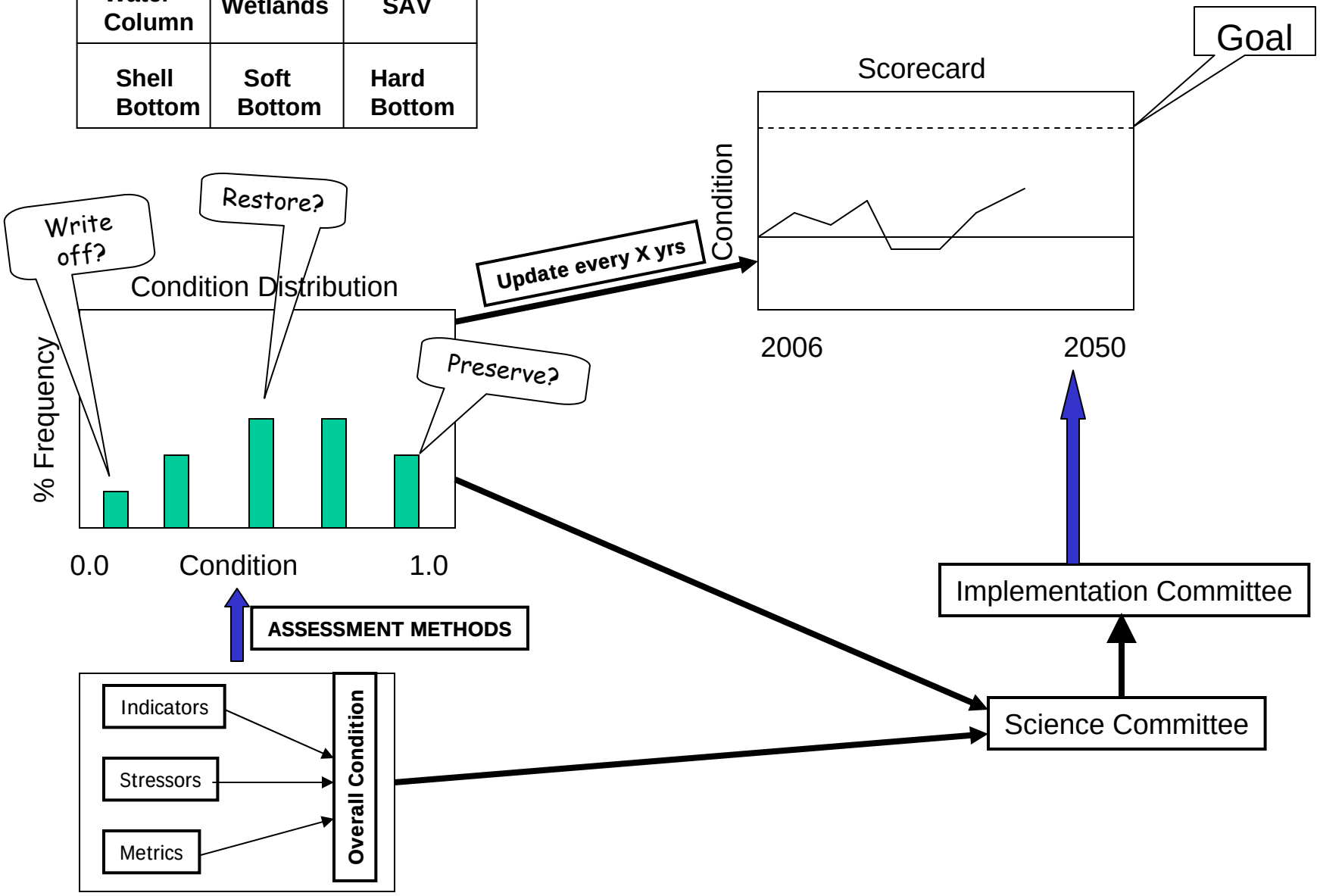
CHPP Habitats (and subhabitats)

Water Column	**Wetlands**	**SAV**
Shell Bottom	**Soft Bottom**	**Hard Bottom**



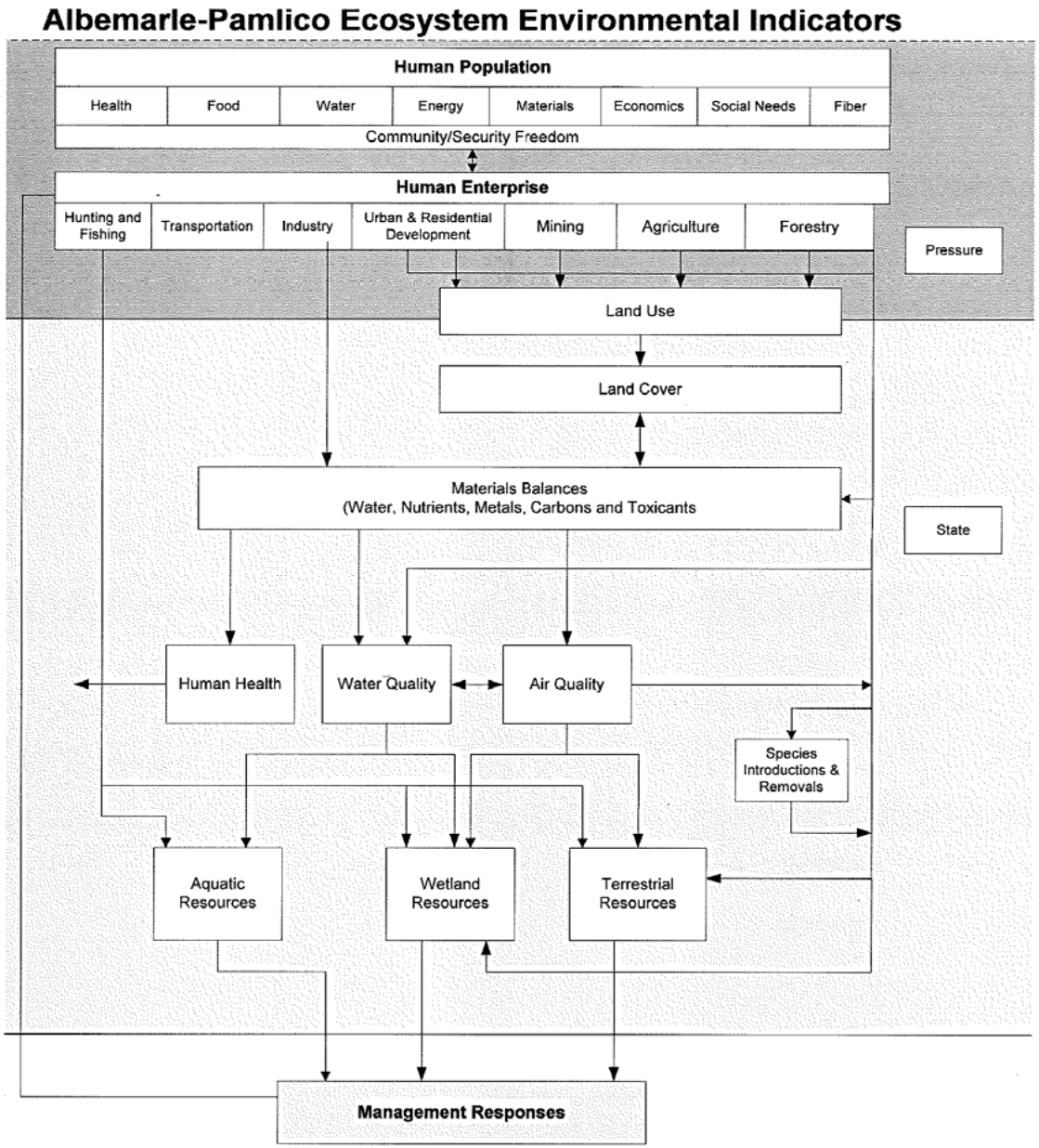
Questions

- Do we have the technical tools and capacity to support a scorecard approach?
- Given SHA, CHPP, ASC, APNEP, white papers, etc., are agencies prepared to implement?

Initiatives

- APNEP output
- Atlantic Slope Consortium
- Strategic Habitat Areas (Marine Fisheries Commission - CHPP)
- Shoreline management - CRC
- Restoration – EEP nontraditional (CHPP)

APNEP


Albemarle-Pamlico Ecosystem Environmental Indicators
Human Population
Health
Food
Water
Energy
Materials
Economics
Social Needs
Fiber
Community/Security Freedom
Human Enterprise
Hunting and Fishing
Transportation
Industry
Urban & Residential Development
Mining
Agriculture
Forestry
Pressure
Land Use
Land Cover
Materials Balances
(Water, Nutrients, Metals, Carbons and Toxicants
State
Human Health
Water Quality
Air Quality
Species Introductions & Removals
Aquatic Resources
Wetland Resources
Terrestrial Resources
Management Responses

ATLANIC SLOPE CONSORTIUM

LIST OF ASC INDICATORS

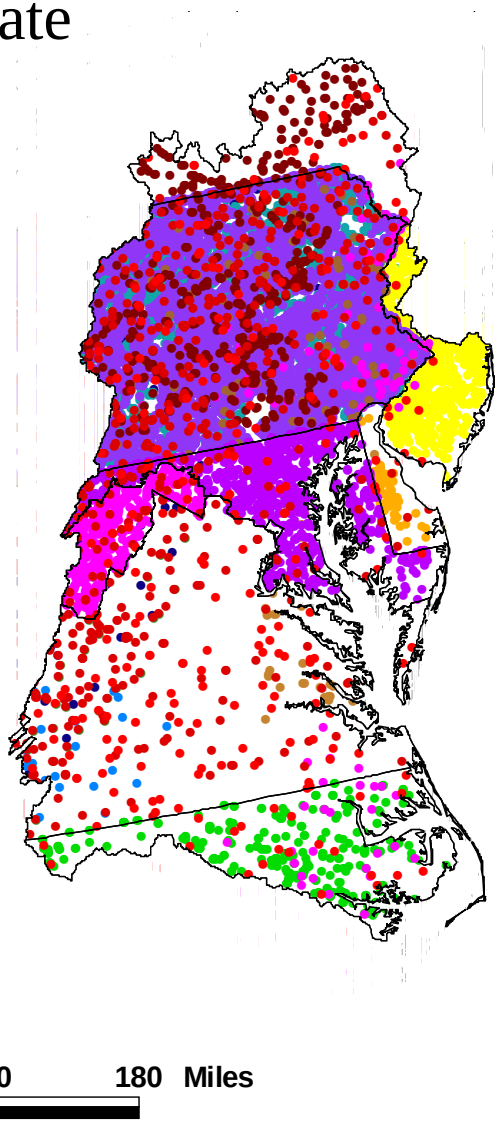
Message 2 – Estuarine Indicators

1. Bio-optical model of habitat suitability for submerged aquatic vegetation (SAV)
2. Abundance of common reed (*Phragmites australis*)
3. Polychlorinated biphenyls (PCBs) in white perch
4. Blue crab (*Callinectes sapidus*) abundance
5. Nitrate, total N and total P concentrations
6. Index of marsh bird community integrity
7. Index of waterbird community integrity
8. Fish community index
9. Macrobenthic community indices
10. Estuarine shoreline condition

Message 3 – Watershed Indicators

11. Spot-sampled average stream nitrate concentration in watersheds
12. Nitrate concentration in streams
13. Macroinvertebrate assemblage composition
14. Stream–wetland–riparian (SWR) index
15. SWR landscape index
16. Inverse-distance weighted land cover metrics
    a. Inverse-distance weighted impervious cover
    b. Inverse-distance weighted developed land
    c. Inverse-distance weighted cropland
17. Riparian buffer-related metrics
    a. Source land proportion weighted by inverse riparian buffer width
    b. Source-specific mean riparian buffer width
    c. Percent source to buffer
18. Metrics of channel/riparian condition for Coastal Plain streams
    a. Near-stream cover
    b. Riparian zone cover
    c. Instream woody structure
    d. Sediment regime
    e. Channel-riparian zone connection
    f. Pollution affecting stream
    g. Factors affecting riparian zone
    h. Habitat quality of riparian zone
    i. Stream bank stability
    j. Beaver impoundment presence

Penn State
VIMS
SERC
ECU



ATLANIC SLOPE CONSORTIUM

- Indicator 1
- Indicator 2…..
- For fish, birds, IBI, riparian forests, etc.
- Are the indicators hierarchical (how are they classified)?
- Social choice concept

Effect of shoreline stabilization on shoreline habitat (nutrient cycling and hydrology)

Table 6-3: Plant and animal community functions of natural shoreline types.

Shoreline Type	Biodiversity/ Community Structure	Habitat Structure/ Refuge	Filtering (active)	Foraging/ Nursery	Habitat Diversity/ Connectivity	Unique Habitat
High Sediment Bank	0	0	0	1	1	2 (swallows)
Swamp Forest	2	2	1	2	2	0
Marsh	2	2	2	2	2	0
Marsh with Oysters	2	2	2	2	2	0
Low Sediment Bank with Swamp	2	2	1	2	2	0
Low Sediment Bank with Marsh	2	2	1	2	2	0
Low Sediment Bank with Oyster/SAV	2	2	2	2	2	0
Low Sediment Bank with Woody Debris	2	2	0	2	2	0
Low Sediment Bank with Sand	1	0	0	1	1	0
Marsh with Mudflats	2	1	1	2	1	0
Overwash Barrier/Inlet Areas	1	0	0	1	1	2 (shorebirds)

Structure Type	Aliases	Typical Construction Materials	Characteristics	Erosion Control Purpose
Vegetation Control	Wetland or upland plantings	Wetland or upland vegetation	Planting, replanting, or conserving existing vegetation	Creates a buffer to dissipate wave energy.
Beach Fill	Beach nourishment	Sediment/sand similar to the native beach	Placing sand on the shoreline	Acts as a sacrificial erosive barrier.
Sill	Marsh sill, wooden breakwater, wave board timber	Rock, concrete pieces, vinyl	Parallel and close to shore, low elevation, usually to protect wetland vegetation	Reduces wave energy on the shoreline. Traps sediment landward to rebuild/protect wetlands.
Groin/jetty	Groin: designed to trap sand to build a beach Jetty: usually longer than groin, designed to prevent infilling of a channel	Timber, rock, concrete, vinyl	Solid or permeable. Perpendicular to shore	Designed to trap sand on the updrift side to build out a beach.
Breakwater	Wave attenuator	Timber, concrete, rock	Parallel to shore, larger and further offshore than sills, floating or fixed	Reduces wave energy on the shoreline. Traps sand between the shore and breakwater.
Sloped Structure	Riprap, revetment, sloped seawall	Concrete, rock	Watertight or porous, sloped against a bank	Protect land from erosion and absorb wave energy without reflecting waves.
Vertical Structure	Bulkhead, seawall, gravity wall	Timber, steel, vinyl, rock, concrete	Watertight, vertical, parallel to shore	Designed to hold back land.

NCWAM Implementation (DWQ)

- Used for determining degree of alteration of wetlands in the 404/401 process
- Reference-based functional assessment approach (ecological condition)
- Differs in classification from that used by EEP
- Is there any congruence between APNEP indicators and assessment methods of NCWAM?

EEP White Papers

- A better restoration approach (Ron Ferrell)
- Science advisory committee
- Policy and implementation committee

Habitat Priorities Advisory Committee

Committee Member	Affiliation
Dr. Emily Bernhardt	Duke University Wetland Center
Dr. Mark Brinson	East Carolina University
Dr. Jeff Buckel	NC State University
Dr. Robert Christian	East Carolina University
Dr. BJ Copeland	NC Marine Fisheries Commission
Ms. Anne Deaton	NC Division of Marine Fisheries
Dr. Jud Kenworthy	National Oceanic and Atmospheric Administration
Dr. William Kirby-Smith	Duke Marine Lab
Dr. Wilson Laney	US Fish and Wildlife Service
Dr. Mike Mallin	University of North Carolina at Wilmington
Mr. Kevin Miller	NC Ecosystem Enhancement Program
Dr. Sam Pearsall	The Nature Conservancy
Mr. J.D. Potts	NC Department of Environment and Natural Resources
Dr. Doug Rader	Environmental Defense
Dr. Curtis Richardson	Duke University Wetland Center
Dr. Roger Rulifson	East Carolina University
Dr. Nancy White	University of North Carolina Coastal Studies Institute

Implementation Advisory Committee White Paper – November 2006

Committee Member	Affiliation
Mr. Pete Benjamin	US Fish and Wildlife Service
Dr. Bob Brumbaugh	US Army Corps of Engineers, Institute for Water Resources
Mr. Derb Carter	Southern Environmental Law Center
Dr. David Cobb	NC Wildlife Resources Commission
Mr. Mac Currin	Marine Fisheries Commission
Dr. Courtney Hackney	Coastal Resources Commission/University of North Carolina – Wilmington
Mr. Palmer Hough	US Environmental Protection Agency – Headquarters
Mr. Charles Jones	Division of Coastal Management
Dr. David McNaught	Environmental Defense
Mr. Scott McClendon	US Army Corps of Engineers – Wilmington
Mr. Kevin Miller	NC Ecosystem Enhancement Program
Mr. Todd Miller	NC Coastal Federation
Dr. Pete Peterson	Environmental Management Commission/University of North Carolina – Chapel Hill
Mr. Ron Sechler	National Marine Fisheries Services
Dr. Leonard Shabman	Resources for the Future

Recommendations - four estuarine regions

Albemarle
Western Pamlico Sound
Eastern Pamlico Sound
Southern Estuaries

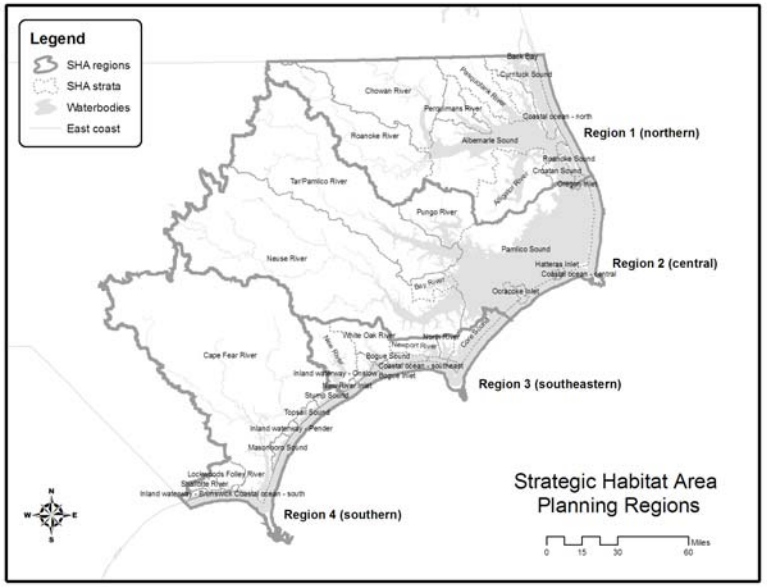


Table 1: Albemarle Sound Alterations and Restoration and Mitigation Opportunities

Ecosystem Component	Alterations	Restoration and Mitigation Opportunities
Hydrologic regime	Stream channelization alters storm hydrograph (e.g., flow velocity) and streambed characteristics	Reestablish storm hydrograph and structure of headwater channels
	Decoupling of streams from adjacent floodplain forest as a consequence of stream channelization	Reconnect stream channel and its floodplain- allow beaver activity
	Desnagging and channel maintenance	Establish large wood component in channel and reestablish channel grade and bankfull cross section
	Ditching and drainage networks that remove sheet flow, reduce soil moisture and increase soil oxidation and potential for combustion	Install water control structures (i.e., flashboard risers or ditch plugs) that increase the residence time of water in ditches and raises the local water table
	Water releases from large upstream dams change seasonal flow dynamics	Establish release schedules to coincide with natural flow regimes
Material fluxes/ pollution	Water and material flows from forestry and agricultural operations	Implement practices to reduce sediments and nutrients in runoff -restore wetland vegetation and hydrology to floodplain acreage now in agricultural use
	Large-basin water quality degradation resulting in reduced light penetration from turbidity and eutrophication	Large-basin nutrient reduction and sediment pollution control practices
	New and existing development and other intensive uses of local watersheds that increase stormwater runoff; including intensive agriculture and forestry operations	Use of engineered systems to trap sediments in built-upon or agricultural areas-wetland restoration to maximize denitrification potential
	Increasing discharges from reverse osmosis plants	Eliminate salt stress and water column stratification through engineered methods
Habitat	Road culverts and other impediments to upstream and downstream diadromous fish migration	Remove obstructions and install fish passages
	Reduced populations of river herring and other species due to commercial and recreational fishing	Evaluate and regulate and appropriate commercial and recreational herring harvests
	Fragmentation associated with changing land uses and public infrastructure installation	Consolidate preservation and restoration plans
	Upstream ditching that alters salinity, water quality and flow regime	• Water management (i.e. retrofitting of existing drainage systems such as floodgates, flashboard systems, etc.) • Delaying or ceasing ditch maintenance operations including desnagging
	Bulkheading and back-filling along shorelines or other activities of shore-	Limitations on shoreline hardening-replacement of hardened shorelines with more natural energy dissipa-

Strategic Habitat Areas

- Goal #2 of the CHPP is to "Identify, designate, and protect Strategic Habitat Areas" (SHAs). **SHAs are defined as *"specific locations of individual fish habitats or systems of habitats that have been identified to provide exceptional habitat functions or that are particularly at risk due to imminent threats, vulnerability, or rarity."***

Step 2. Ecological evaluation of potential SHA units to refine boundaries of most strategic locations

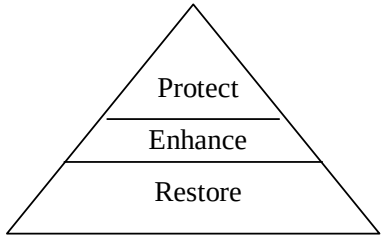
Geographic area of focus

Natural resource targets*
•Habitats
•Species
*Target representation levels determined by experts and taking into account vulnerability, rarity, and known habitat loss

Alteration Factors*
•Water based
•Land based
*Determined and weighted by experts

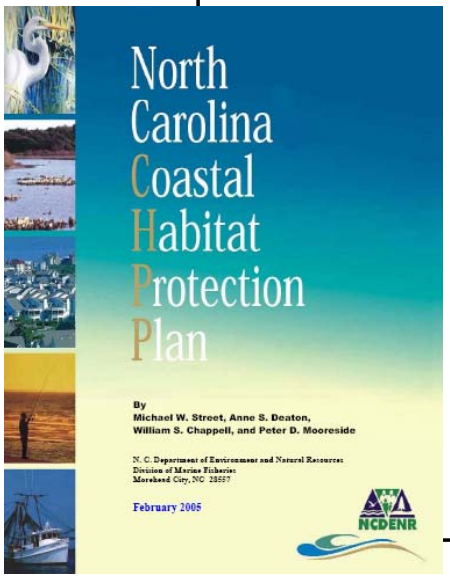
Least altered

More altered



Revise parameters and re-evaluate as needed

Corroboration and final identification of SHAs



Evolution of Initiatives

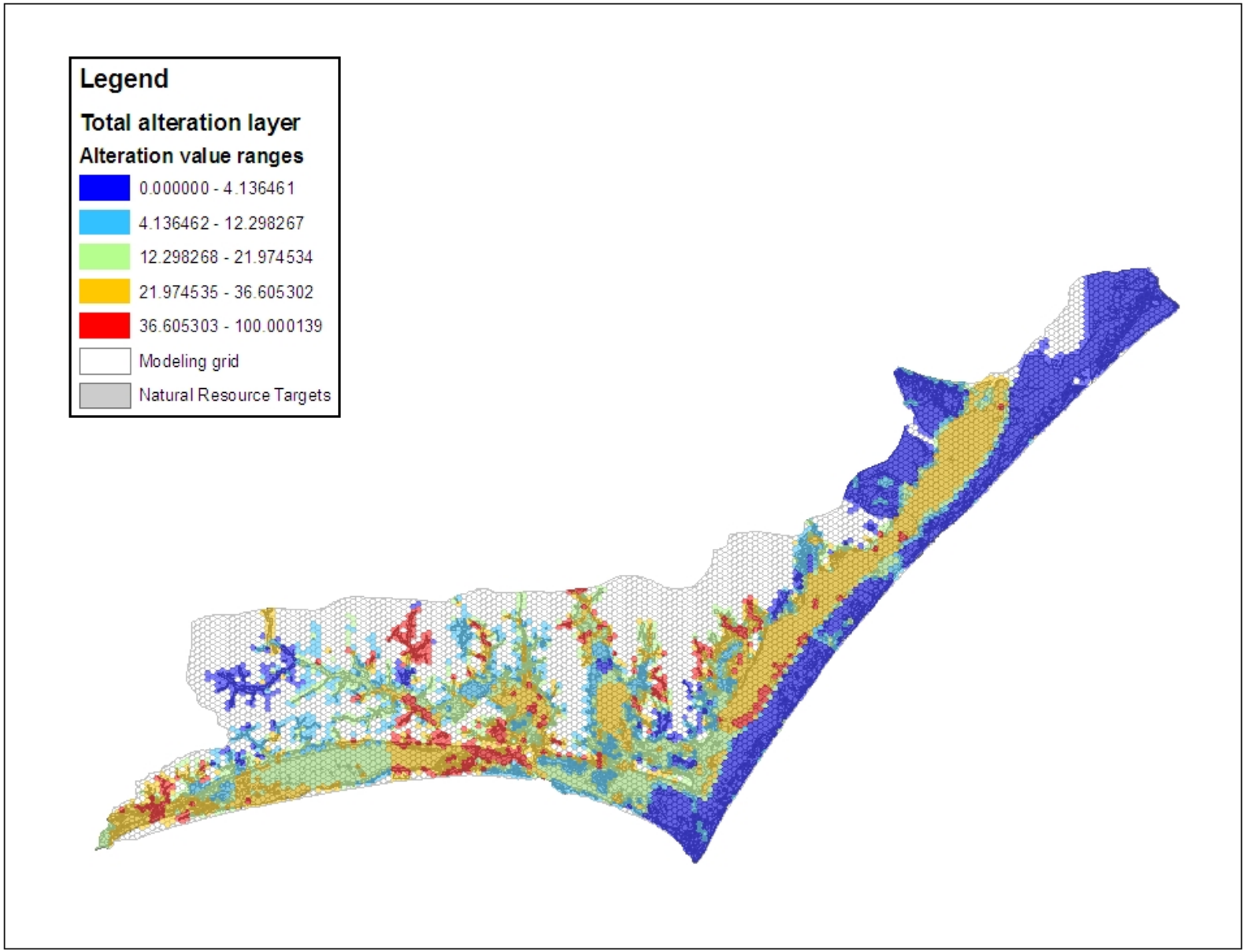
Fish Habitat Areas

- 1. Anadromous Fish Spawning Areas - MFC designation and rules pending
- 2. Anadromous Fish Nursery Areas – not currently designated in rule
- 3. Submerged Aquatic Vegetation– not currently designated in rule
- 4. Shellfish Producing Habitat – not currently designated in rule
- 5. Crab Spawning Sanctuaries - MFC rules already in place
- 6. Primary Nursery Areas - MFC, EMC, CRC rules already in place
- 7. Strategic Habitat Areas – MFC, CRC, and EMC rules to be established - may include habitat complexes consisting of any combination of the above, as well as other habitats.

Table 4. Potential types of biological/ecological data for use in validating selected SHAs.

Data type	Data source/availability*
Ecological / Functional Designations	
Anadromous fish spawning areas	MFC rule definition
Anadromous fish nursery areas	MFC rule definition
Estuarine fish nursery areas - PNAs	MFC rule definition and designation
Freshwater nursery areas - Inland PNAs	WRC designation
Blue crab-spawning areas - Crab Spawning Sanctuaries	MFC designation
Designated Significant Natural Heritage Areas	Natural Heritage Program designation
Special water quality designations (ORW, etc.)	EMC rule definition and designation
Species / Productivity Data	
Natural Heritage Element Occurrence	Natural Heritage Program data
Blue crab-nursery	Prg 120, 510, 195
Bay scallop	Prg 635, 697
Clams	Prg. 635, 640 (1 yr in Core Sound)
Oysters	Prg 635, 610; old DMF shellfish maps, and Gene Balance's historical shellfish bed maps
Red drum-spawning	Joe Luczkovich's auditory spawning survey, Prg 310, 360
Red drum-nursery	Prg 120, 123
River herring-spawning	Prg 150, 160
River herring-nursery	Prg 100
Southern flounder-nursery	Prg 120, 100, 195, 915
Shrimp-nursery	Prg 120, 510, 195
Sturgeon-spawning	Prg 150, 160, observer program
Sturgeon-nursery	Prg 100, 135, observer program

* Prg = DMF data program number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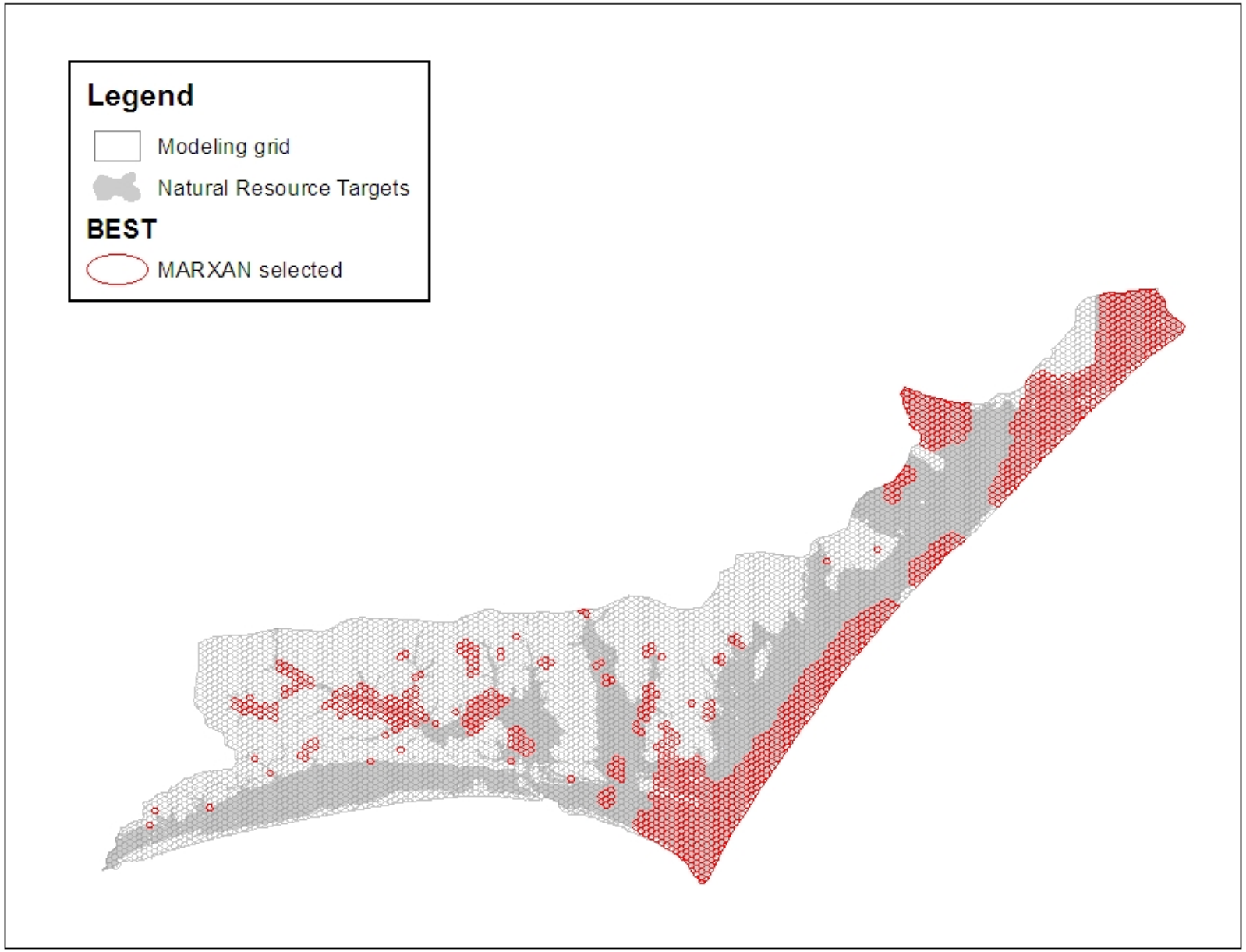
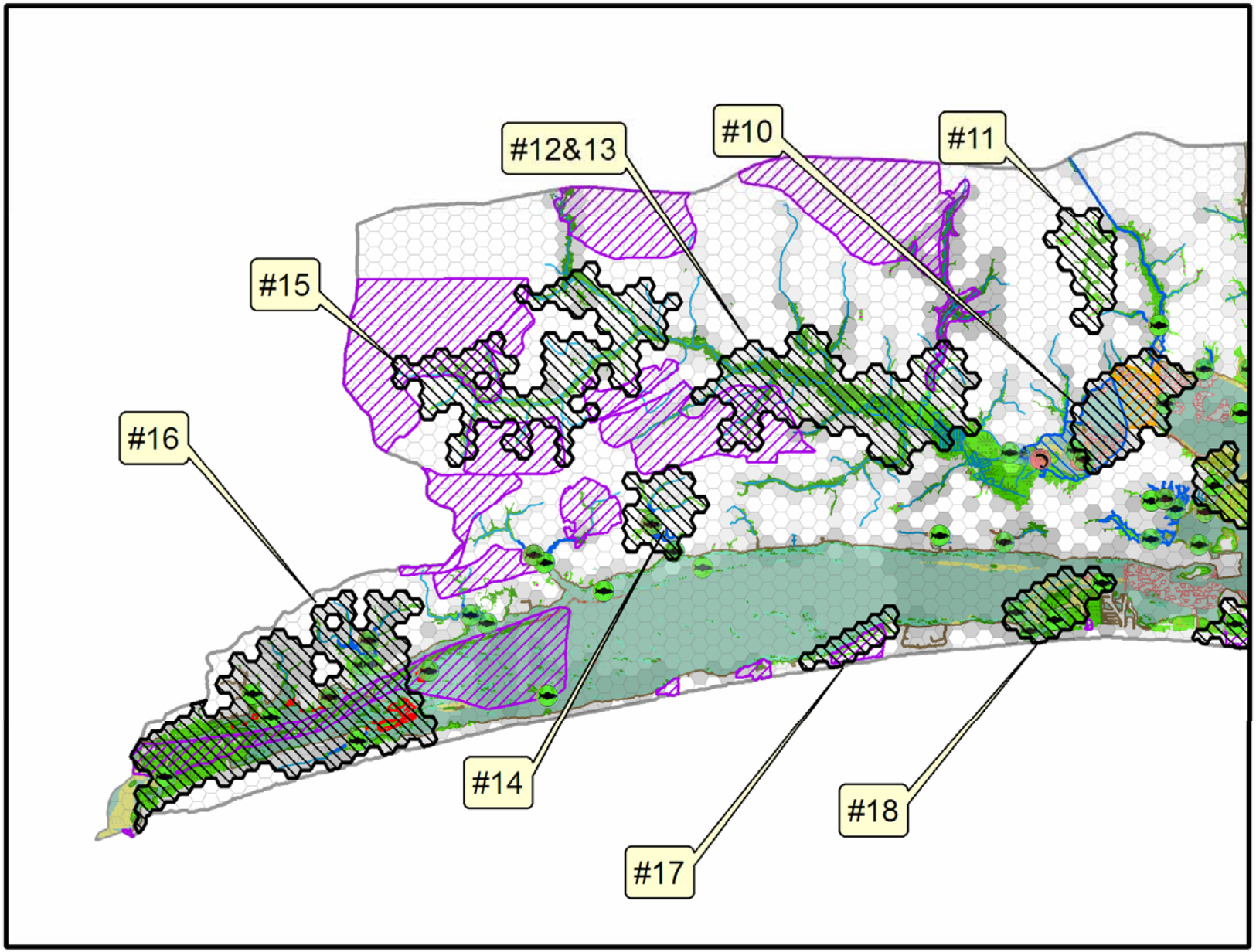
Total alteration layer
Alteration value ranges
0.000000 - 4.136461
4.136462 - 12.298267
12.298268 - 21.974534
21.974535 - 36.605302
36.605303 - 100.000139
Modeling grid
Natural Resource Targets


Legend
Modeling grid
Natural Resource Targets
BEST
MARXAN selected

Designated SHAs



		Risk/Alteration Level**	
		Lower	**Higher**
Ecological function *	**High**	MEASURES TO CONSERVE AND PROTECT SELECT AS “EXCEPTIONAL” SHA	ADDITIONAL MEASURES TO PROTECT AND ENHANCE SELECT AS “AT RISK” SHA
	Low	MAINTAIN, RESTORE – USE EXISTING PROTECTIONS, EVALUATE FOR RESTORATION CURRENTLY NOT SELECTED AS A CANDIDATE SHA	

Table 1. Relationship among ecological function, alteration (risk) level, SHA designation and potential management measures needed.

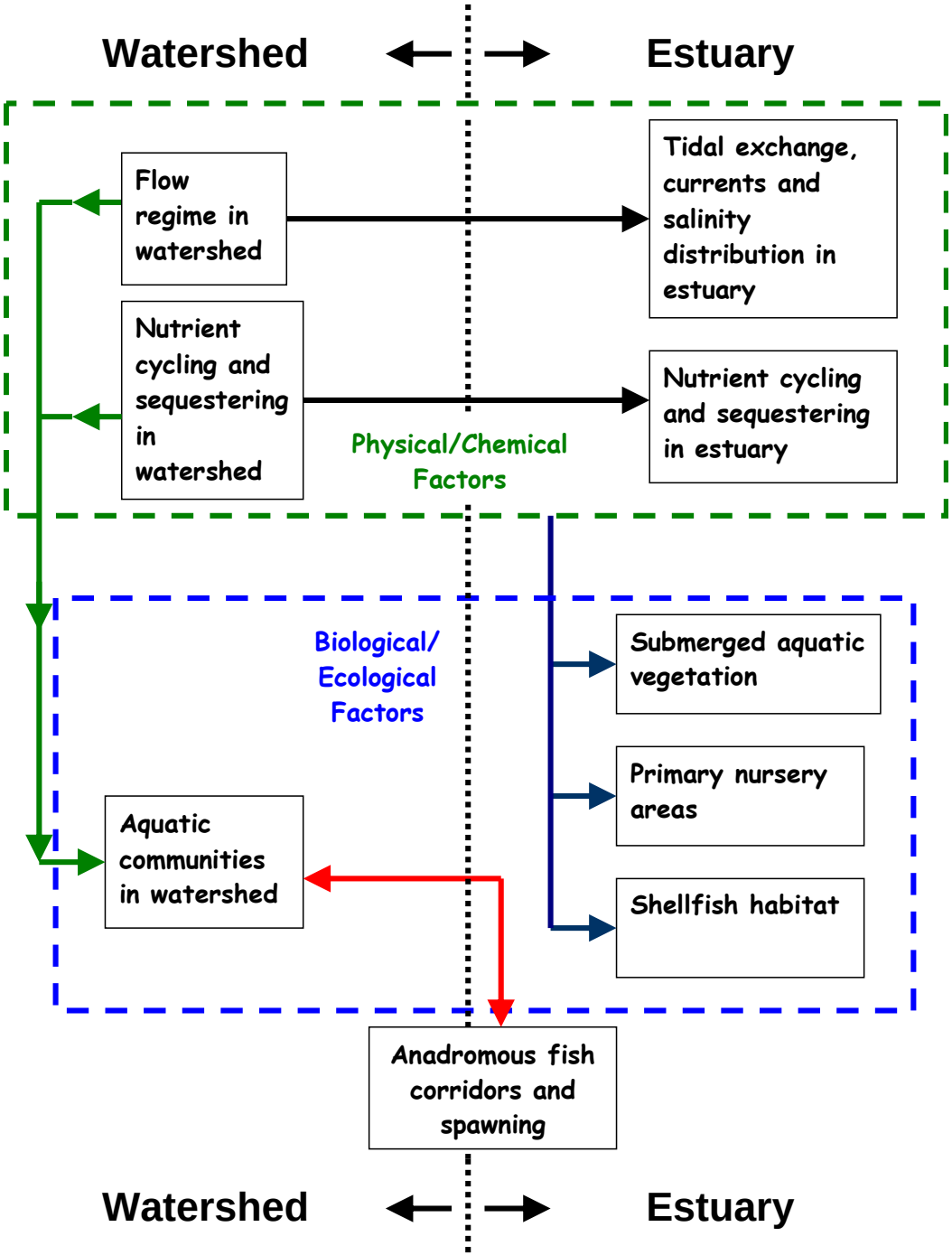
* Represented by co-occurrence of relatively unaltered natural resource targets in an area

** Determined by alteration factors

White Oak Watershed (NE Creek, Jacksonville and Newport River)

- 1. Rural riparian condition
- 2. Watershed impervious area
- 3. Urban riparian condition
- 4. Ratio of mapped wetland to hydric soil area
- 5. Array of land use types
- 6. Culverts, bridges, spoil disposal, or other impediments to circulation
- 7. Land use effects on nutrient loading
- 8. NPDES discharges, swine operations, etc.
- 9. Near-shore stormwater inputs, impervious surfaces, marinas/docks
- 10. Closure of shellfish beds
- 11. Anomalous water quality characteristics (nutrient imbalance or toxicants, chl a, N/P, etc.)
- 12. Water column transparency
- 13. Dams, culverts, pound nets, or other impediments to migration
- 14. Prop or trawling scars in SAV beds

Hydrologic, Biogeochemical, and Habitat Functions



White Oak Watershed (NE Creek, Jacksonville and Newport River)

Table 2

INDICATORS OF ALTERATIONS	FUNCTIONS								
	Watershed			Estuary					
	Flow regime in watershed (Section 1.3.1)	Nutrient cycling and sequestering in watershed (Section 1.4.1)	Aquatic communities in watershed (Section 1.5.1)	Tidal exchange, currents, and salinity distribution (Section 1.3.2)	Nutrient cycling and sequestering in estuary (Section 1.4.2)	Submerged aquatic vegetation (Section 1.5.2)	Primary nursery areas (Section 1.5.3)	Shellfish habitat (Section 1.5.4)	Anadromous fish corridors and spawning areas (Section 1.5.5)
1. Rural riparian condition	X	X	X	X	X	X	X	X	X
2. Watershed impervious area	X	X	X	X	X	X	X	X	X
3. Urban riparian condition	X	X	X	X	X	X	X	X	X
4. Ratio of mapped wetland to hydric soil area	X	X	X	X	X	X	X	X	X
5. Array of land use types	X	X	X	X	X	X	X	X	X
6. Culverts, bridges, spoil disposal, or other impediments to circulation				X					
7. Land use effects on nutrient loading		X	X		X	X	X	X	
8. NPDES discharges, swine operations, etc.		X	X		X	X	X	X	
9. Near-shore stormwater inputs, impervious surfaces, marinas/docks				X	X	X	X	X	
10. Closure of shellfish beds							X	X	
11. Anomalous water quality characteristics (nutrient imbalance or toxicants, chl *a* , N/P, etc.)					X	X	X	X	X
12. Water column transparency						X	X		
13. Dams, culverts, pound nets, or other impediments to									

Types of Alterations for Estuarine Zones

Hydrologic alterations (modifications that reduce the ability of the shoreline to trap sediments)

Cutting of living cypress trees (loss of knees)
Removal of LDW and wrack
Removal of trees along bank (eliminates the main source for LDW)
Construction of a bulkhead or revetment along the shoreline
Construction of groins up current
Excavation to construct navigation channels or mosquito ditching
Diking to retain water (e.g., for rice cultivation)

Biogeochemical alterations

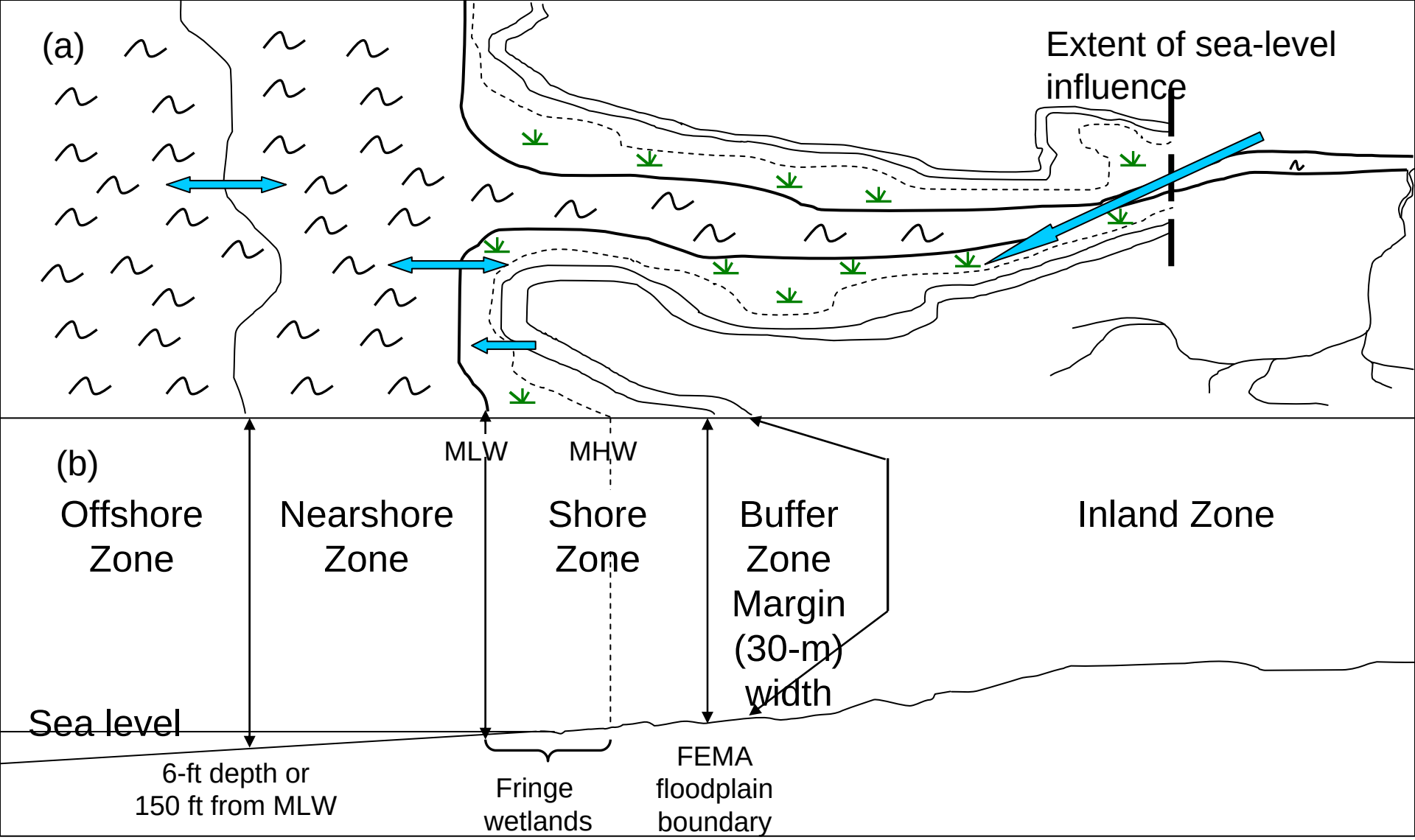
Removal of wrack
Removal of LDW
Filling of wetlands or benthos
Removal or cutting of wetland vegetation
Diking to retain water (e.g., for rice cultivation)

Habitat alterations

Mowing of SAV
Thinning or clearing of understory along shoreline
Cutting or removal of trees or snags onshore and offshore
Removal of LDW on shore and offshore
Filling of wetlands or benthos
Excavation to construct navigation channels or mosquito ditching
Diking to retain water (e.g., for rice cultivation)

Modifications to upland buffer

Impervious surface
Rowcrop
Managed lawn
Fallow field
Man-made structure (pier, deck, building)


(a)
Extent of sea-level influence
(b)
MLW
MHW
Offshore Zone
Nearshore Zone
Shore Zone
Buffer Zone Margin (30-m) width
Inland Zone
Sea level
6-ft depth or 150 ft from MLW
Fringe wetlands
FEMA floodplain boundary

14 indicators of estuarine watersheds appropriate for rapid assessment

- 1. Rural riparian condition
- 2. Watershed impervious area
- 3. Urban riparian condition
- 4. Ratio of mapped wetland to hydric soil area
- 5. Array of land use types
- 6. Culverts, bridges, spoil disposal, or other impediments to circulation
- 7. Land use effects on nutrient loading
- 8. NPDES discharges, swine operations, etc.
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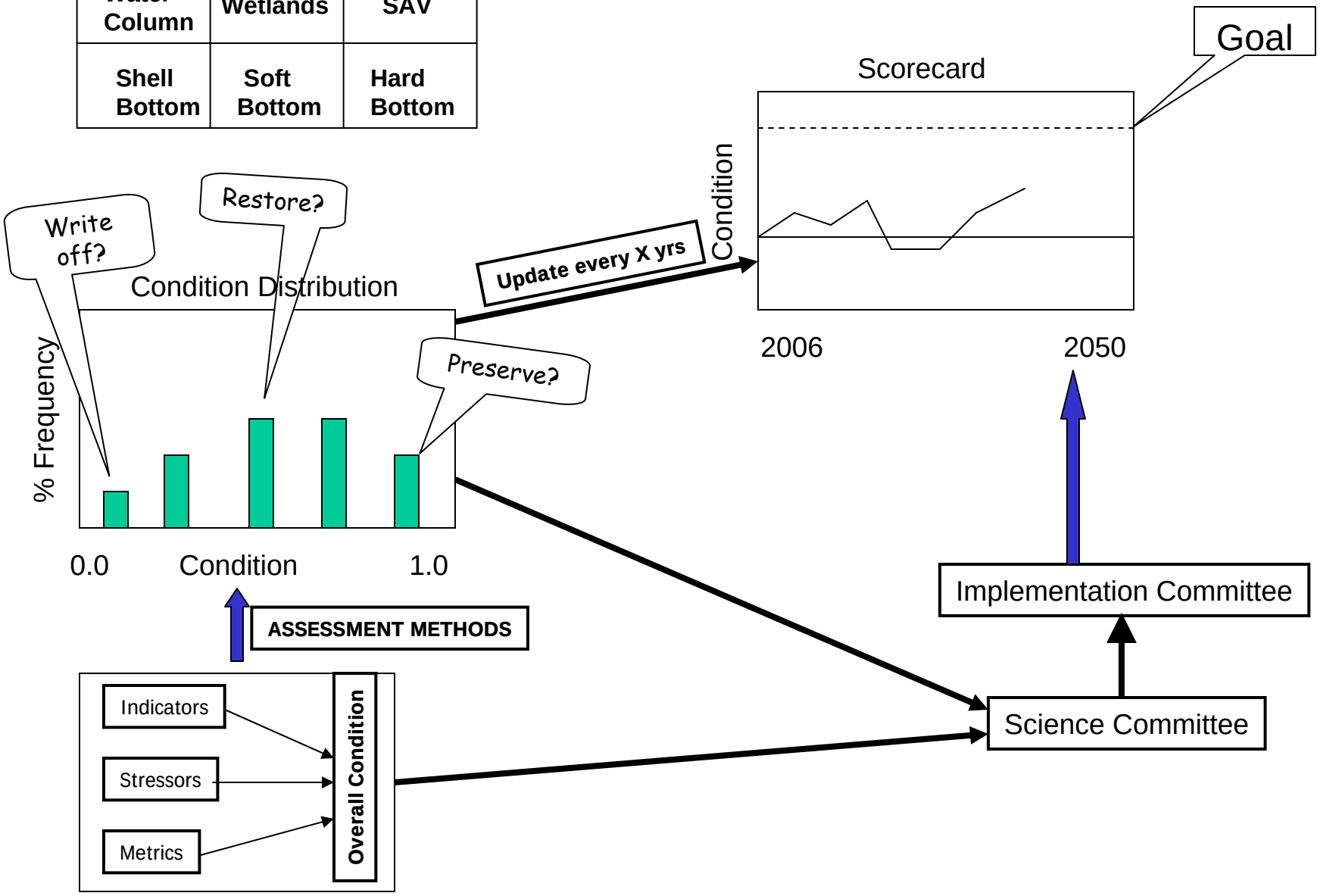
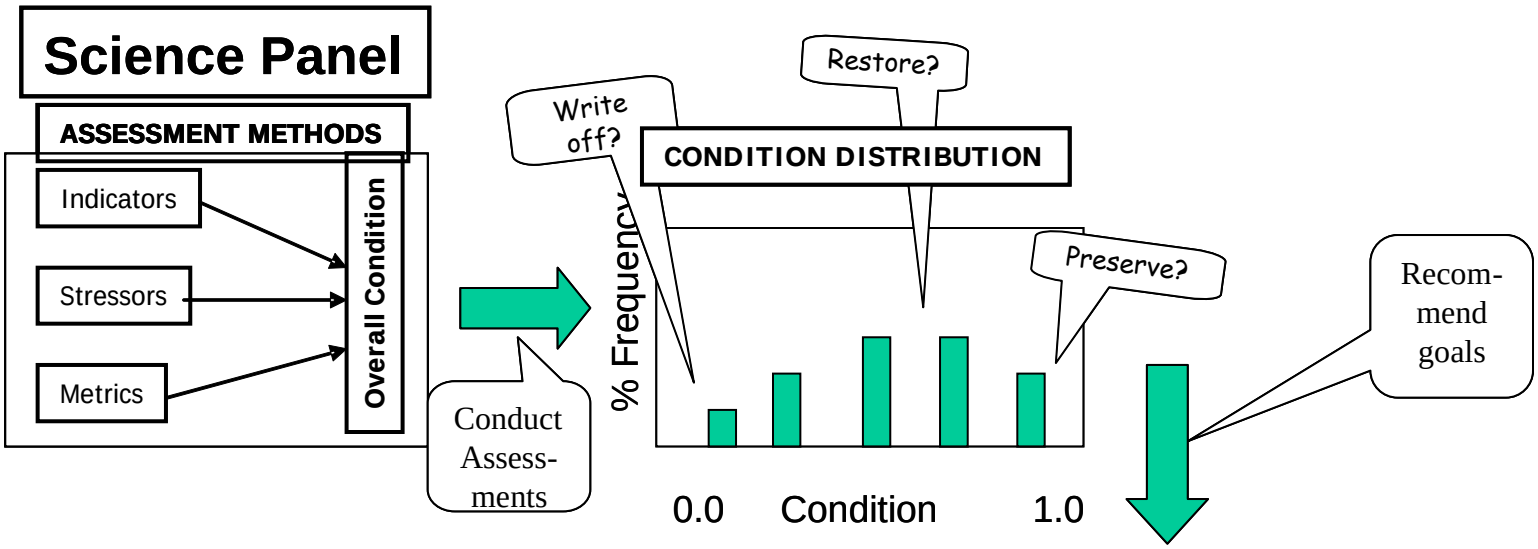
CHPP Habitats (and subhabitats)

Water Column	**Wetlands**	**SAV**
Shell Bottom	**Soft Bottom**	**Hard Bottom**





CHPP Habitats

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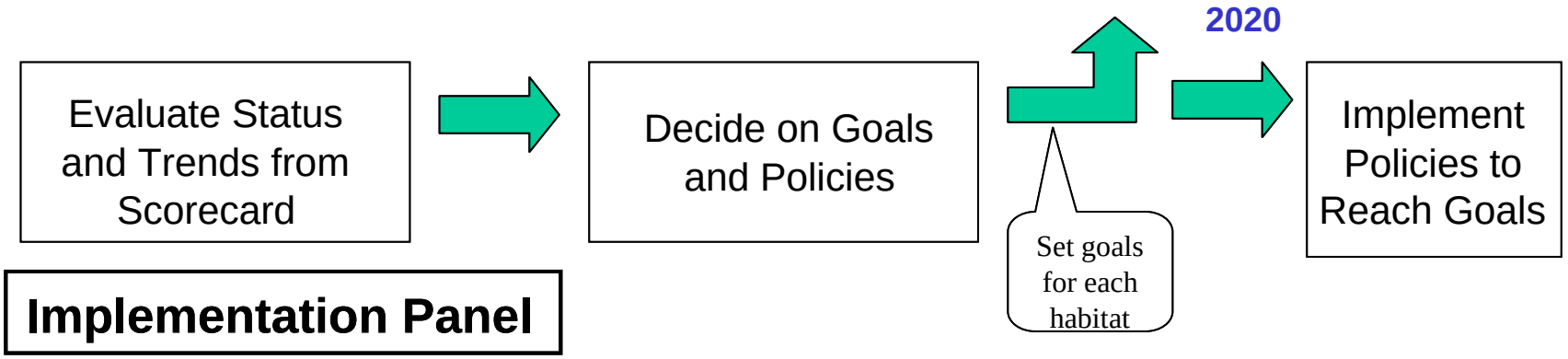
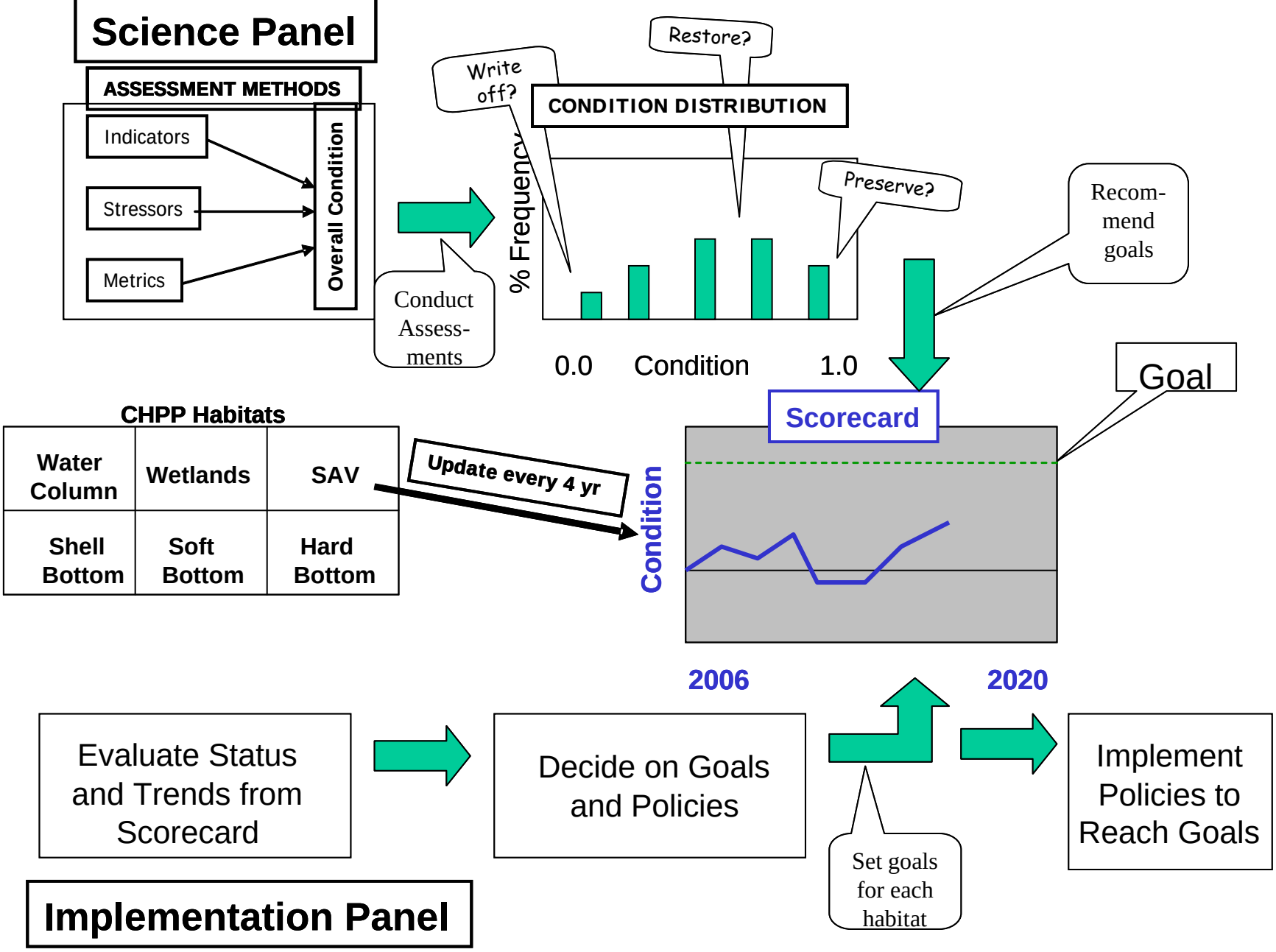

Evaluate Status and Trends from Scorecard
Decide on Goals and Policies
2020
Set goals for each habitat
Implement Policies to Reach Goals
Implementation Panel


Science Panel
ASSESSMENT METHODS
Indicators
Stressors
Metrics
Overall Condition
Conduct Assess-ments
Write off?
Restore?
CONDITION DISTRIBUTION
Preserve?
% Frequency
0.0
Condition
1.0
Recom-mend goals
Goal
Scorecard
CHPP Habitats
Water Column
Wetlands
SAV
Shell Bottom
Soft Bottom
Hard Bottom
Update every 4 yr
Condition
2006
2020
Evaluate Status and Trends from Scorecard
Decide on Goals and Policies
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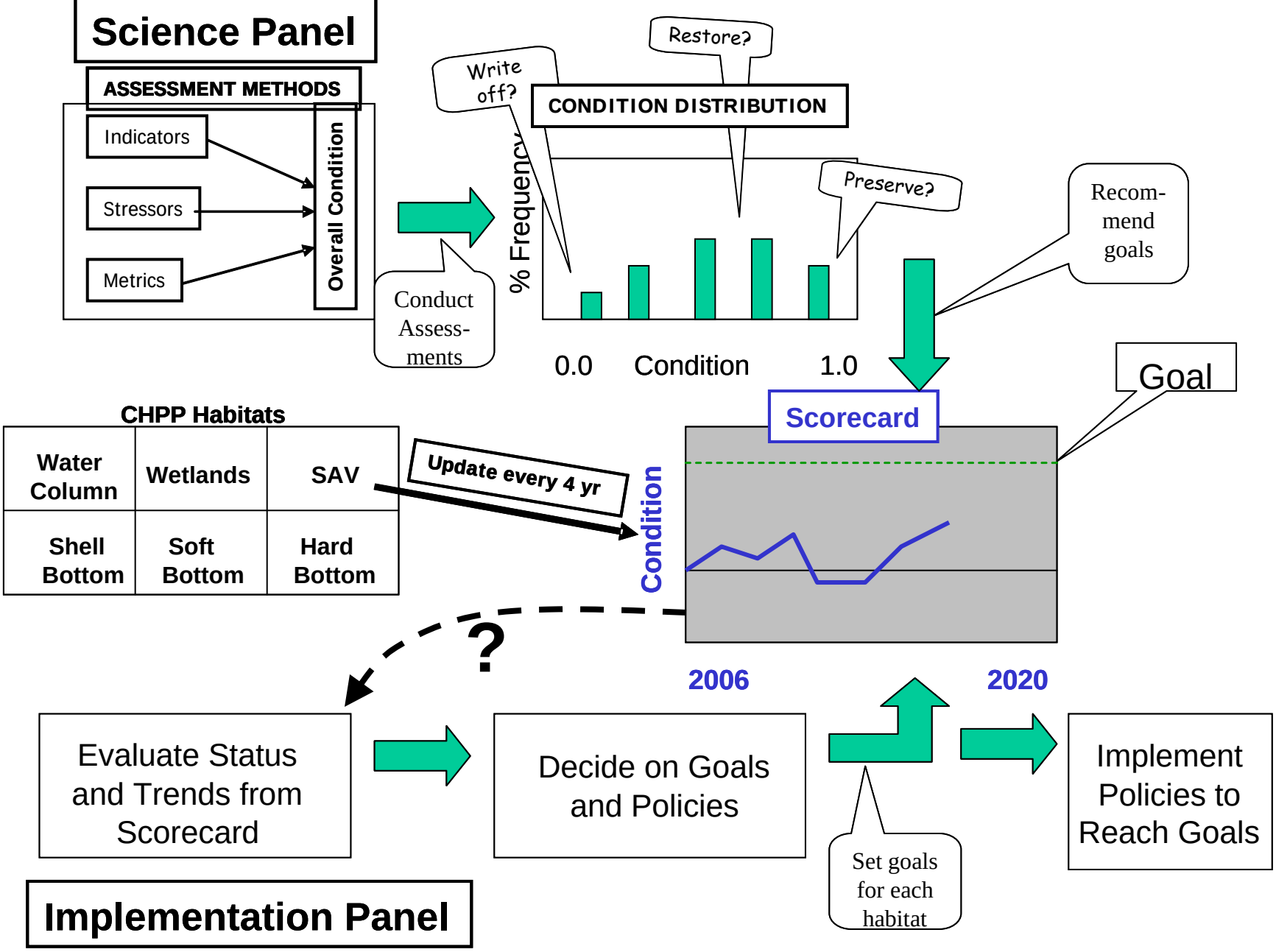
Implementation Panel


Science Panel
ASSESSMENT METHODS
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0.0
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SAV
Shell Bottom
Soft Bottom
Hard Bottom
Update every 4 yr
Condition
?
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Implementation Panel

Questions

- Do we have the technical tools and capacity to support a scorecard approach?
- Given SHA, CHPP, ASC, APNEP, white papers, etc., are agencies prepared to implement?