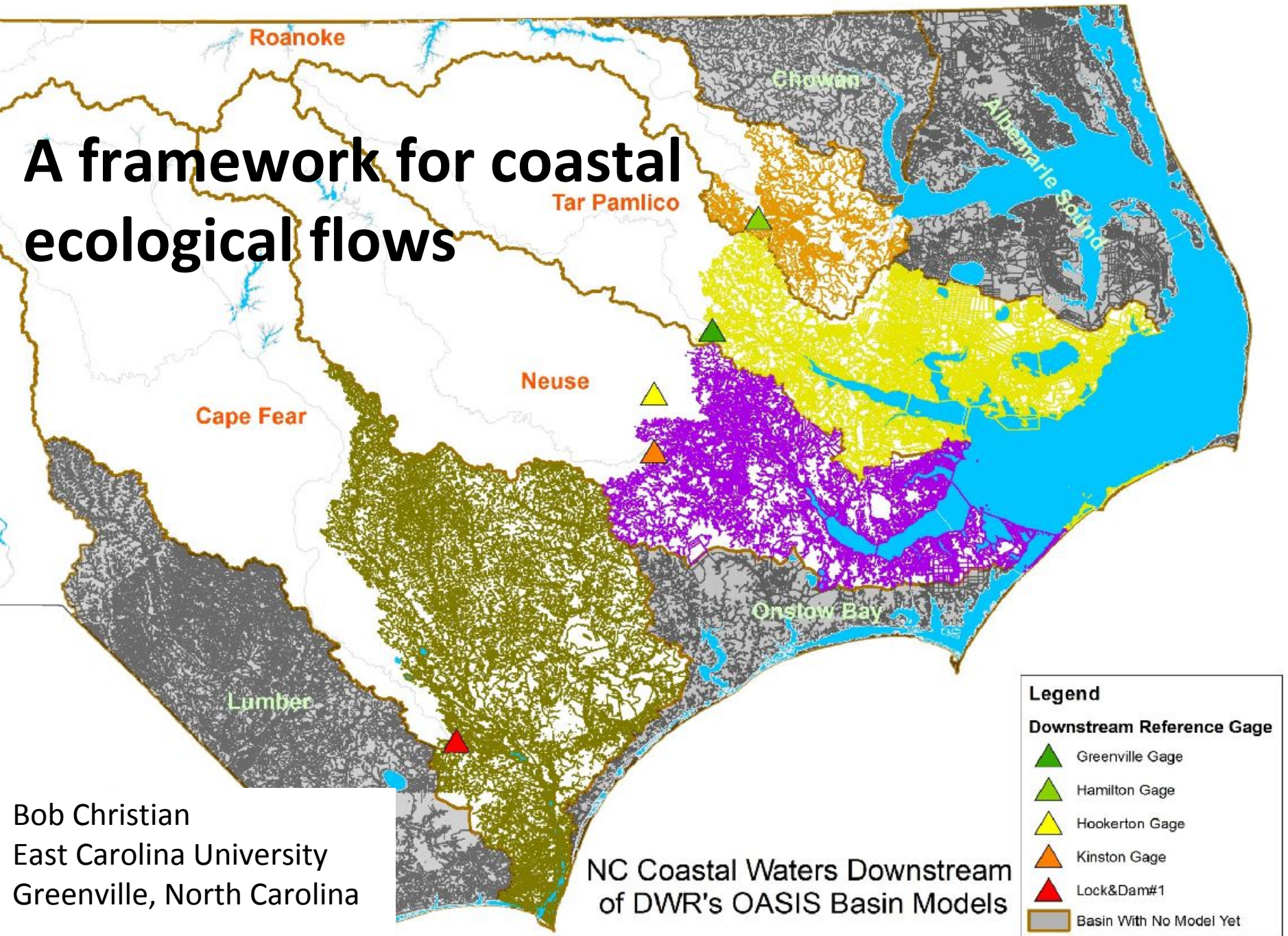


A framework for coastal ecological flows



Bob Christian
East Carolina University
Greenville, North Carolina

NC Coastal Waters Downstream
of DWR's OASIS Basin Models

Ecological Flows Science Advisory Board (2010-2013)

- Help NC DENR with planning efforts on future water flow modifications and impact.
- For state-wide, decadal-scale, and basin-level planning
- Designed to tie ecology to hydrologic modeling



Legislation defined **ecological flows**

- A flow regime that protects ecological integrity is often referred to as an **ecological flow**
- Target flows may vary across seasons and are designed to minimally disturb aquatic populations, communities and ecosystems.



Final Report

(<http://www.ncwater.org/?page=366>)

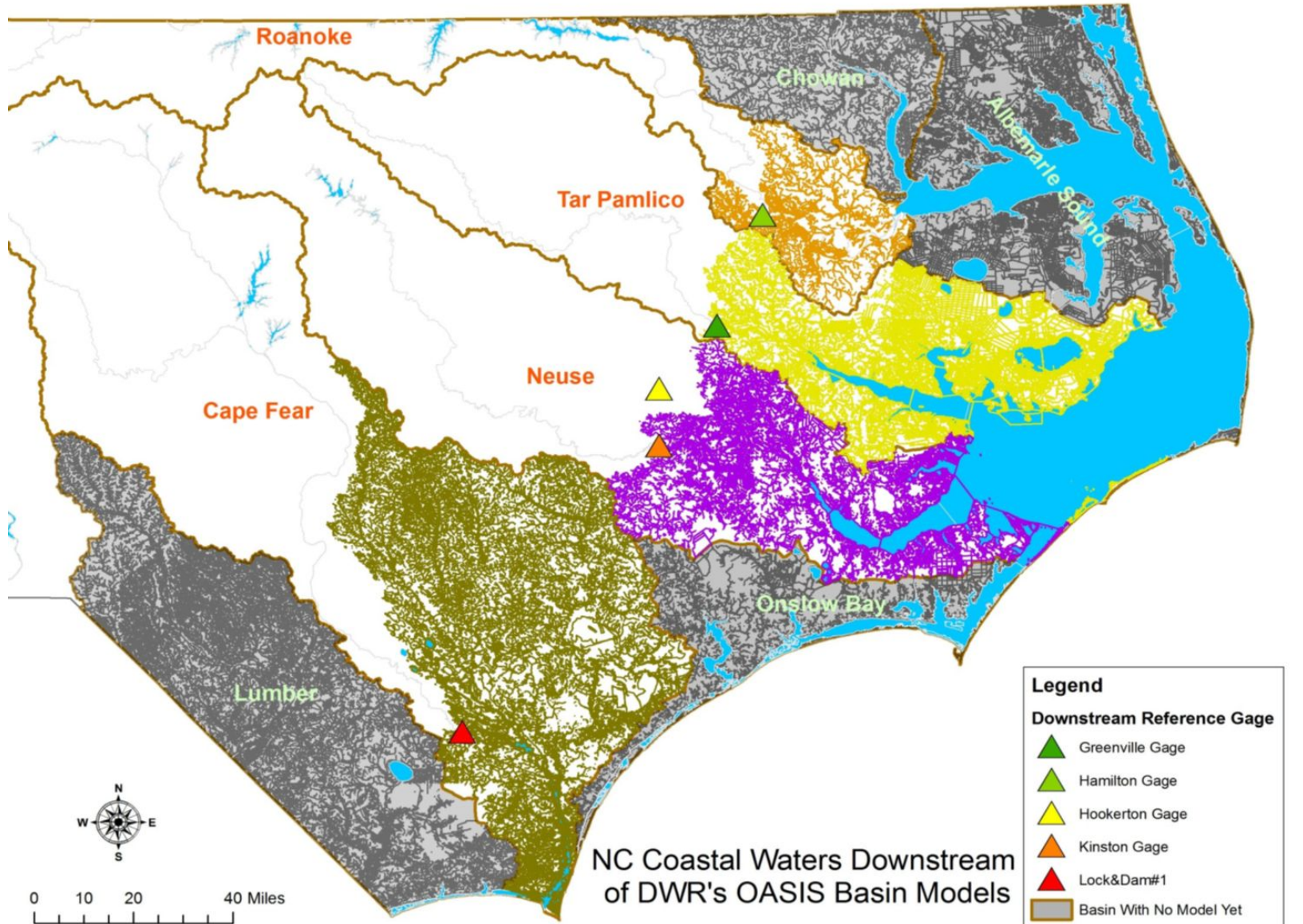
Recommendations for
Estimating Flows to
Maintain Ecological Integrity in
Streams and Rivers in North Carolina



Submitted to the
North Carolina Department of
Environment and Natural Resources
by the
North Carolina Ecological Flows
Science Advisory Board

November 2013

Challenges of Coastal Waterways



Summary of Challenges

- Coastal plain waterways are potentially different:
 - Hydrogeomorphological issues influencing modeling
 - Ecological issues influencing ecological integrity choices
 - Kinds of water withdrawals
- All of these contribute to the challenge of applying procedures from inland to the coastal plain.
- We formed a Coastal Ecological Flows Working Group to contribute to the EF SAB.

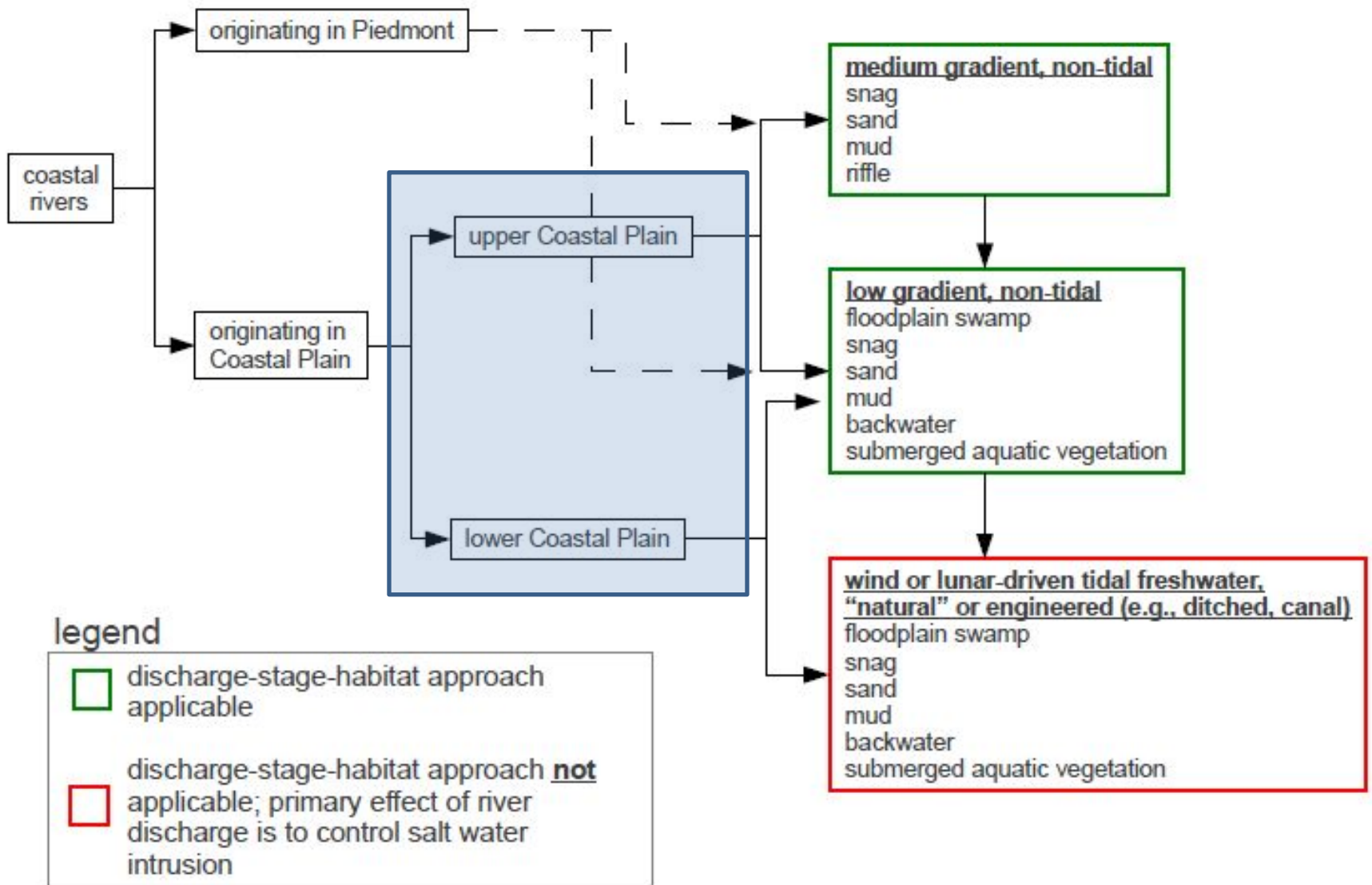


Overall Objectives

- Identify
 - factors limiting EF protocols
 - needed research within coastal systems
- Assess applicability of previous coastal work
- Develop stream typology
- Advance spatial modeling & mapping
- Establish relevant ecological & biological variables dependent on flow
- Develop frameworks for potential coastal EF criteria & protocols if possible

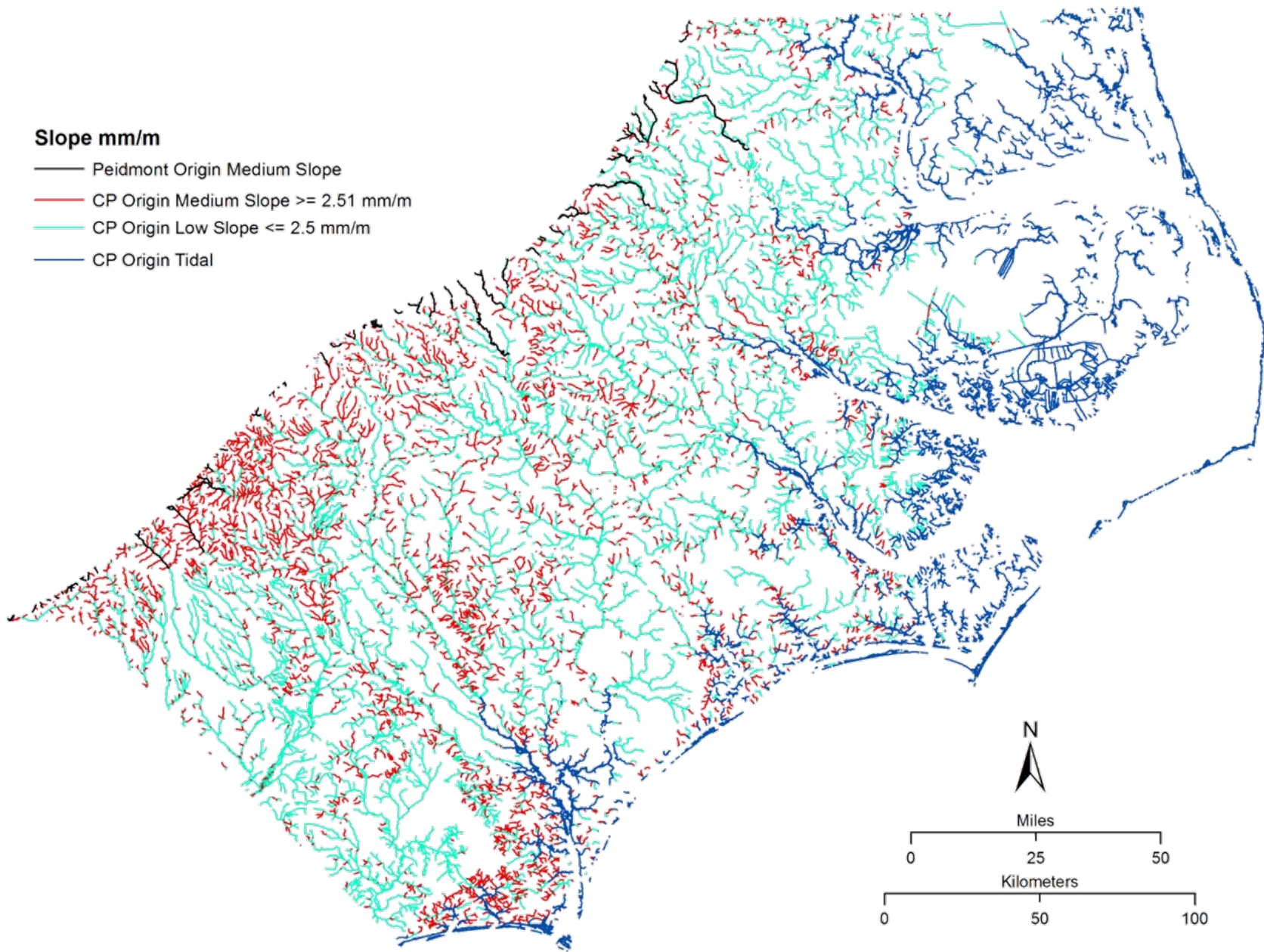


GEOMORPHIC TYPOLOGY AND ASSOCIATED IN-STREAM HABITATS



Slope mm/m

- Peidmont Origin Medium Slope
- CP Origin Medium Slope ≥ 2.51 mm/m
- CP Origin Low Slope ≤ 2.5 mm/m
- CP Origin Tidal



from Eban Bean and Mike Griffin

Link between waterway category and key assemblages that could be used for ecological flow assessment.

Origin	Slope	Assemblage		
		Anadromous Fish	Resident fish	Vegetation (Foundation species)
Piedmont	Medium gradient	X		
Upper Coastal Plain	Medium gradient	X		
Upper Coastal Plain	Low gradient	X		X
Lower Coastal Plain	Low gradient	X		X
Lower Coastal Plain	Wind or tidal driven flow		X	X

Link of Stream Typology & Potential EF Determination

Origin	Slope	EF determinant			
		EFSAB extension	Discharge & Habitat	Downstream Salinity	Overbank Flow
Piedmont	Medium gradient	X	X	X	
Coastal Plain	Medium gradient	X	X	X	
Coastal Plain	Low gradient		X	X	X
Coastal Plain	Wind or tidal driven flow			X	X

Ecological flows in APES

- The EF SAB and coastal EF working group efforts provided frameworks for future development
- APNEP has this issue as part of their Comprehensive Conservation Management Plan. It has formed a working group to continue work.



APNEP's Flows Workgroup Charge within the CCMP

- **Action A3.3: Develop and refine ecological flow requirements for each major river.** Many of the fish, aquatic plants, and other species that live within the estuarine system depend on flowing water to survive. Identifying these ecological flows will help ensure that these species and ecosystems are protected.
- **Action D3.2: Facilitate the development and implementation of basinwide water management plans to ensure no less than minimum in-stream flows are maintained.** APNEP will work to provide scientific information and engage regional stakeholders to develop and implement water management plans that fully account for both human and ecological demands

