Freshwater Tidal Streams: An Integral Component of the Coastal Landscape

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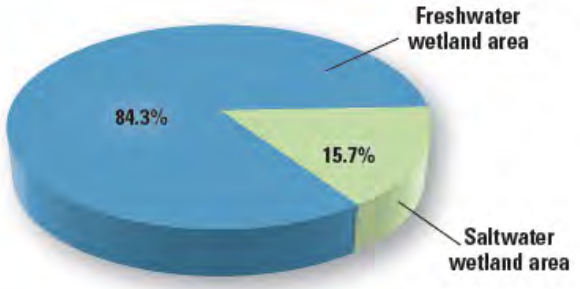
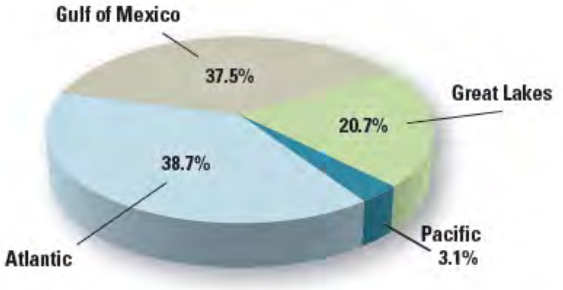
Coastal Wetlands Comprise 37 % of the Conterminous Wetlands





Coastal Watershed	Area of Coastal Watersheds (acres)	Coastline (miles)	Tidal Shoreline (miles)
Atlantic Coast	89,096,000	2,070	28,670
Gulf Coast	67,562,000	1,630	17,140
Great Lakes (United States only)	55,869,000	5,180 (including connecting rivers)	NA
Pacific Coast	34,372,000	1,290	7,860
Total	246,899,000	10,170	53,670

From: Dahl and Stedman 2013

Coastal Wetlands

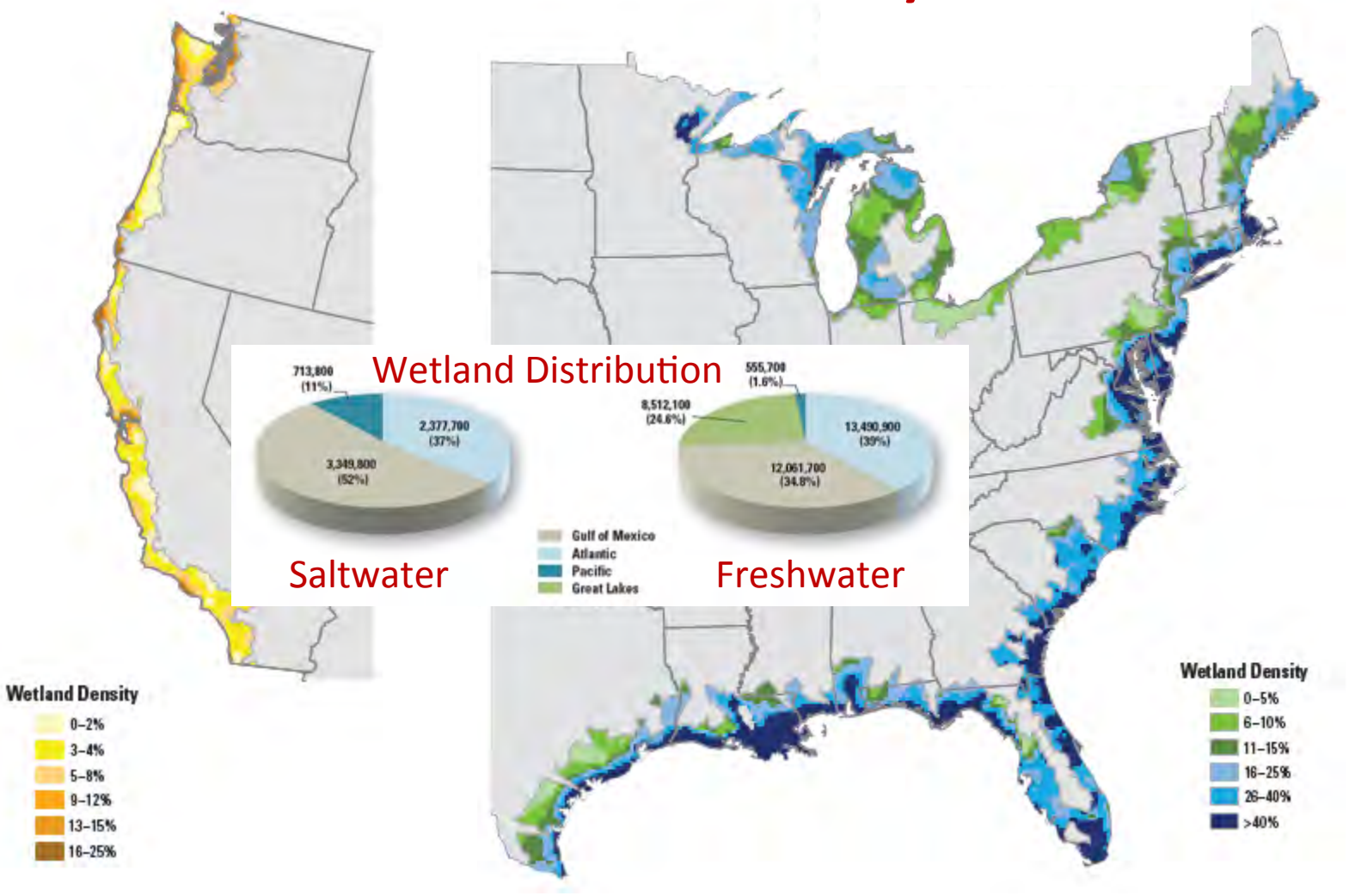
Wetlands in watersheds that drain into the Atlantic Ocean, Gulf of Mexico or Pacific Ocean, and contain a tidal water body; as well as wetlands that drain to one of the Great Lakes.

Classifications:

- Saltwater Habitats:
  - Marine: subtidal, interdidal
  - Estuarine: subtidal, intertidal
  - Riverine: tidal, non-tidal
- Freshwater:
  - Palustrine: forested, shrub, emergent, unconsolidated bottom
  - Lacustrine
- Uplands:

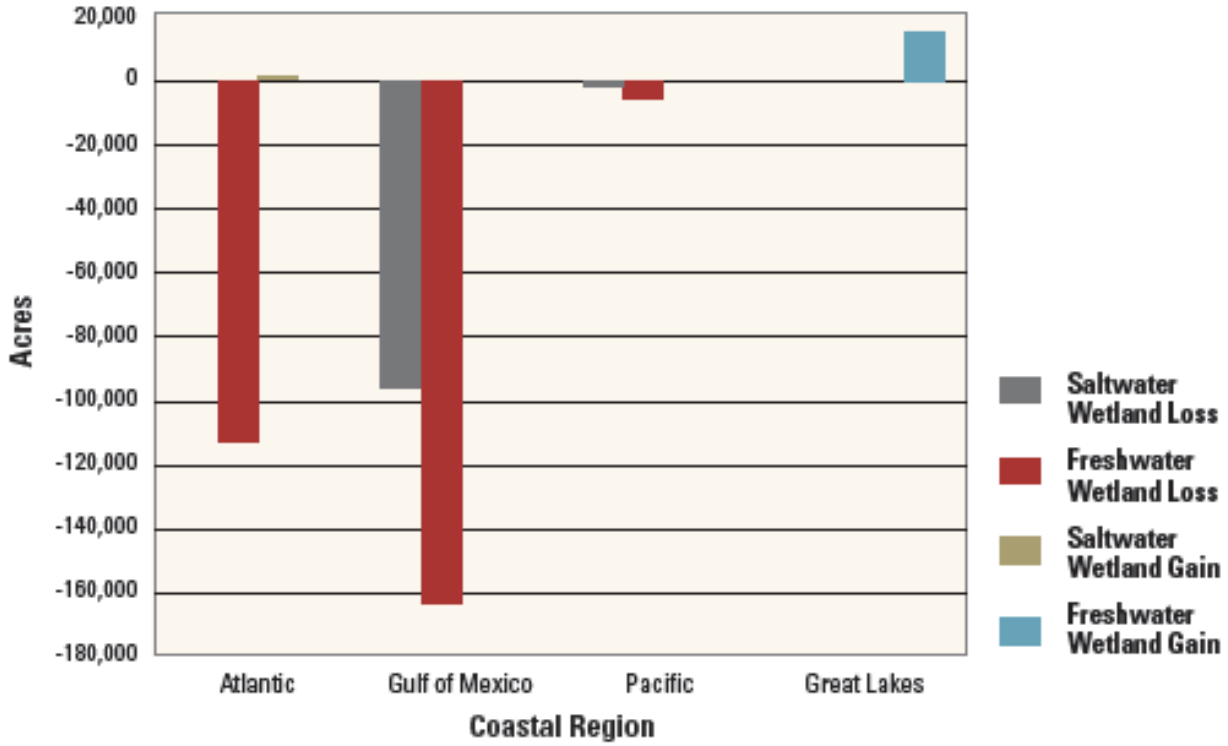
From: Dahl and Stedman 2013

Wetland Density



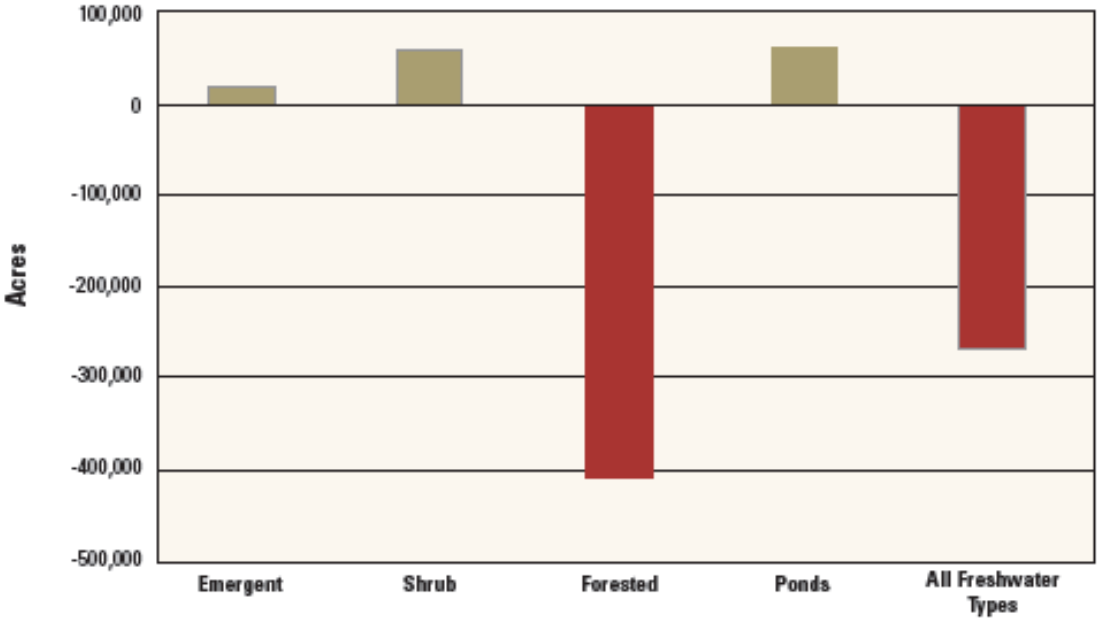
From: Dahl and Stedman 2013.

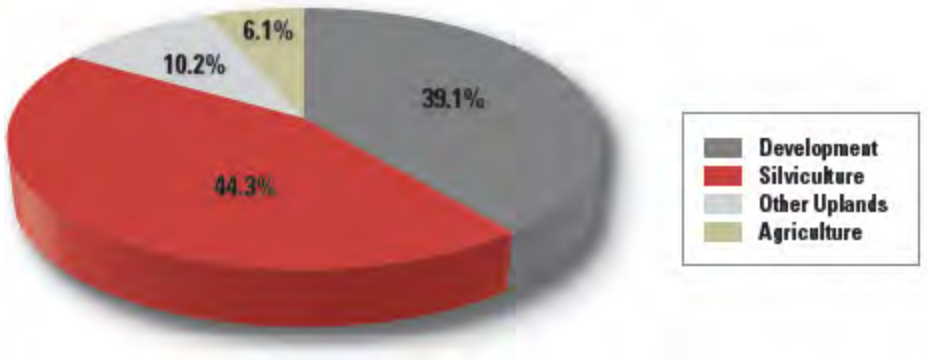
Change in Coastal Wetland Area: 2004 - 2009



From: Dahl and Stedman 2013

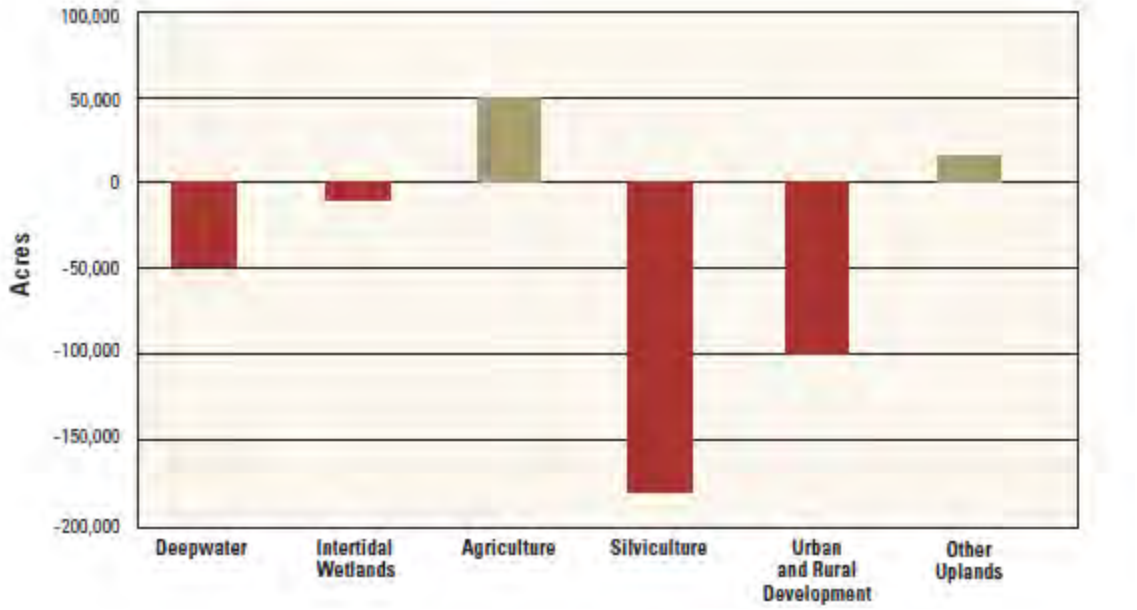
Change in Coastal Wetlands Types: 2004 - 2009





From: Dahl and Stedman 2013

Cause of Freshwater Coastal Wetland Loss 2004 - 2009

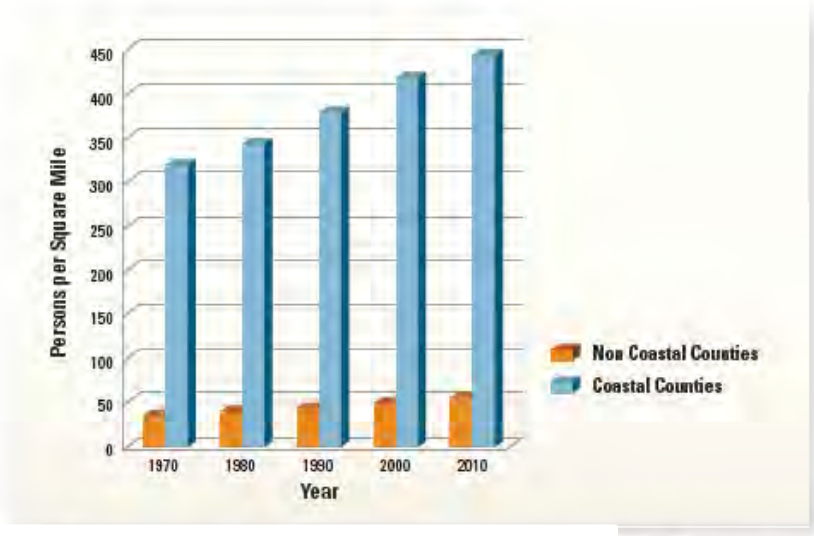


From: Dahl and Stedman 2013

Coastal Wetlands

- Under increasing pressure associated with development in the coastal plain
- Predominantly freshwater systems
- The occurrence of freshwater tidal wetlands is undetermined
  - BUT likely large??

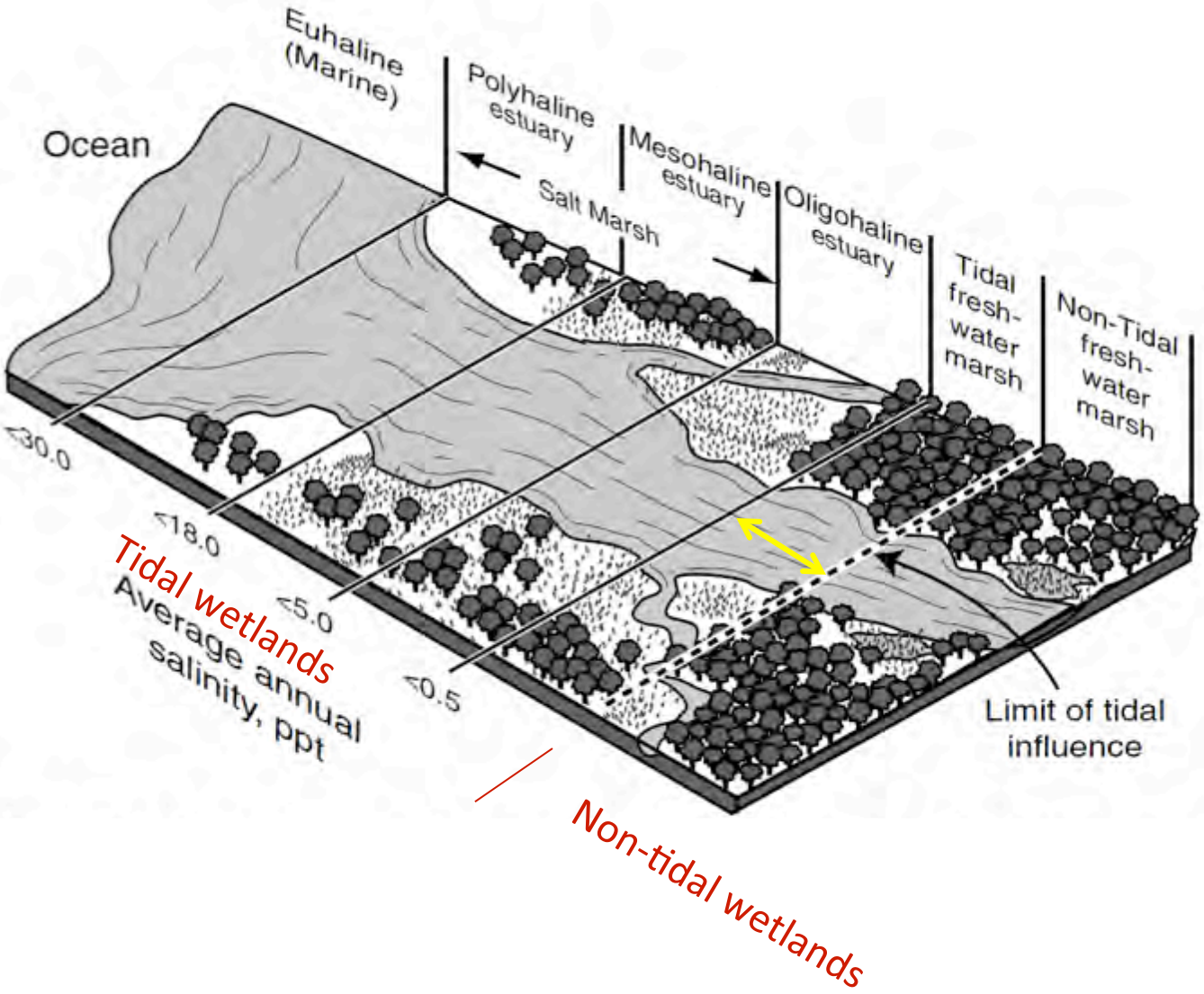
Change in Population Density 1970 - 2010



2010. Data adapted from NOAA

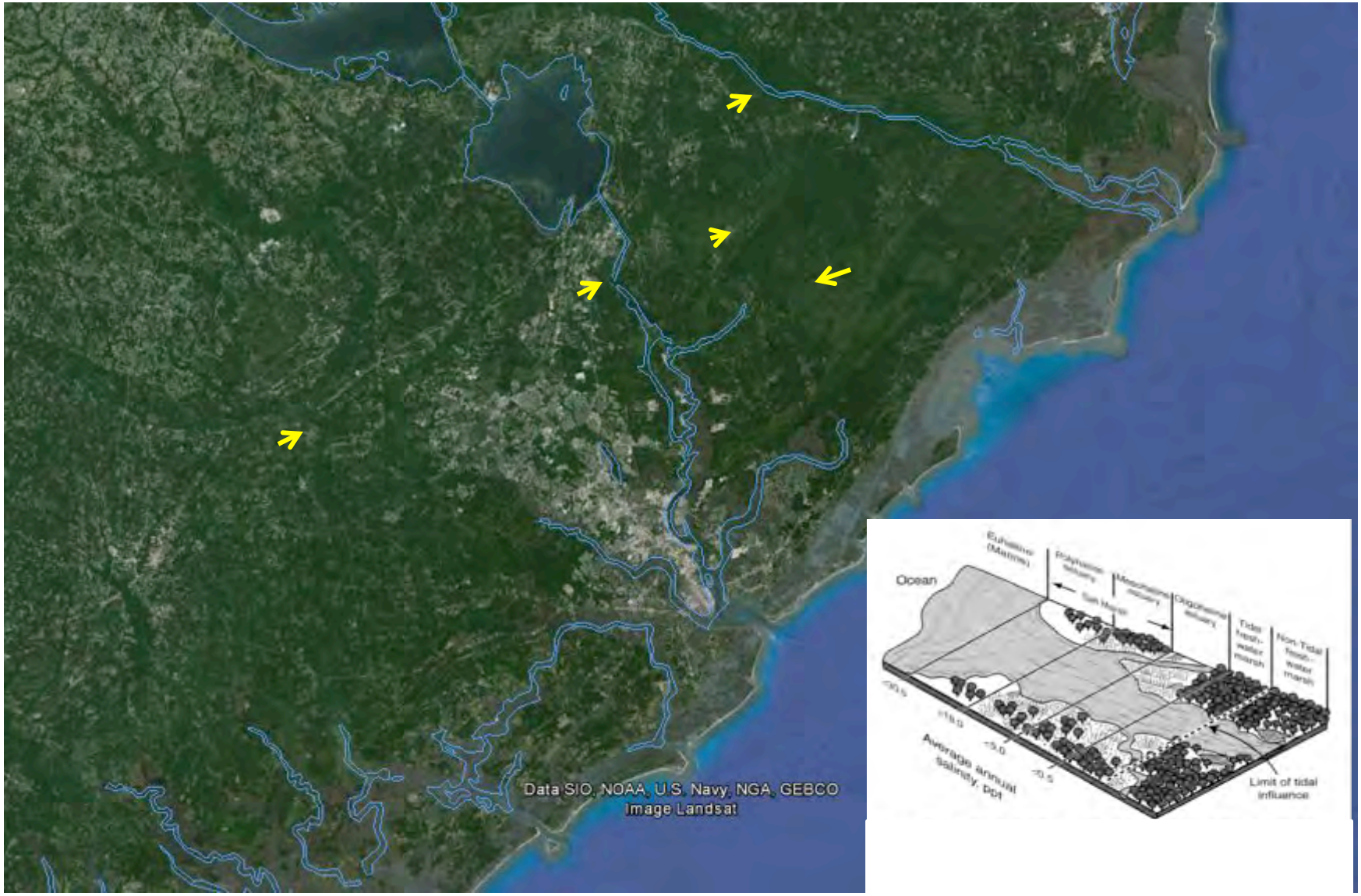
From: Dahl and Stedman 2013

The Tidal Gradient (Salinity & Stage) in Coastal Wetlands



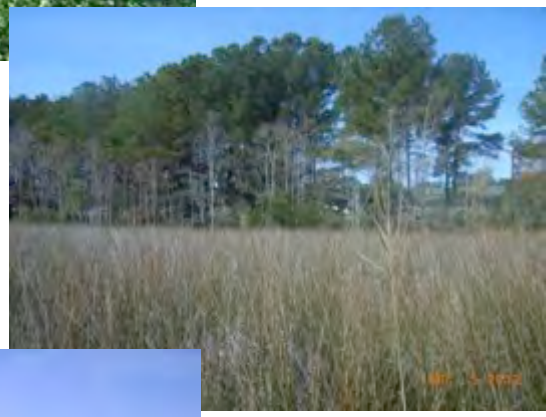
From Odum 1988

The Extent of Freshwater – Tidal Systems is Considerable , and typically disproportional to the stereotypic salinity gradient



Cooper River Transect Analysis

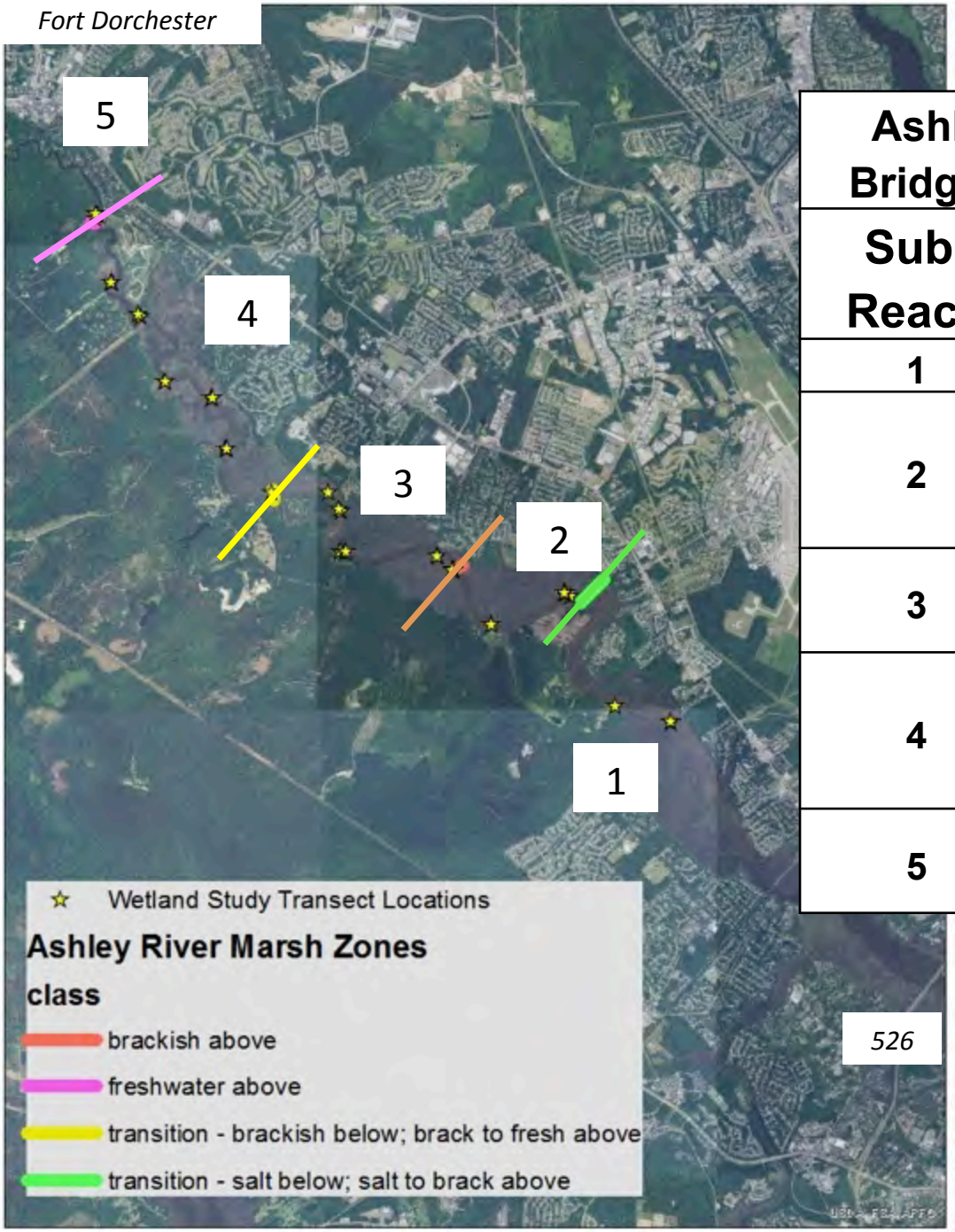
Step 1



- To depict the critical transition zones between freshwater, brackish and saltwater marshes:
  - 500-foot and 2,000-foot transect blocks were delineated for an area of interest along the mainstem of the Cooper River
- Transect analysis illustrates wetland community distribution and abundance, and critical points of corresponding salinity changes
  - Facilitates assessment of wetland function

Source: US Corp of Engineers, Charleston Harbor Project

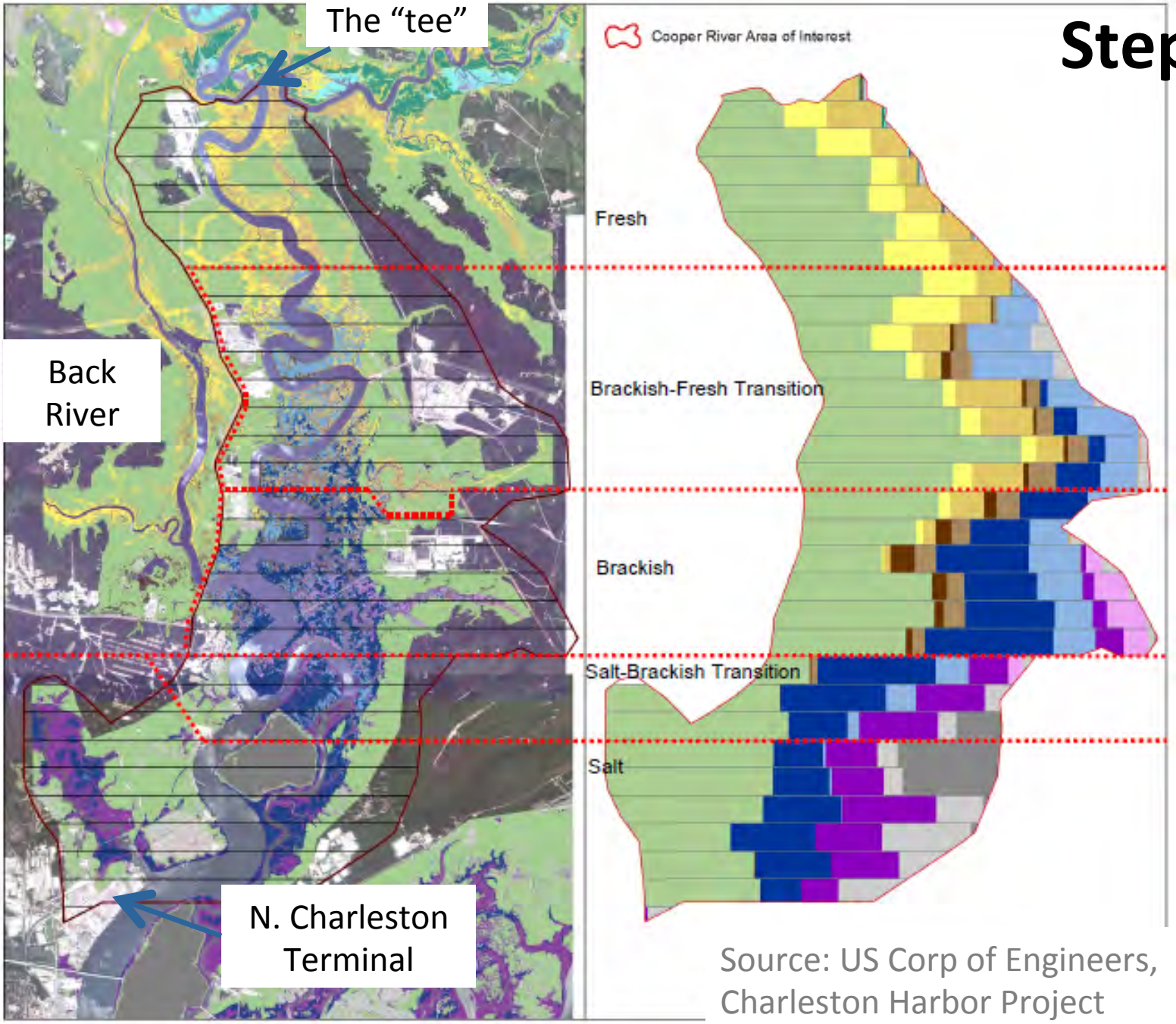
Step 1



Ashley River Tidal Marsh Zones - 526 Bridge (0.0 rm) to Kings Grant (14.8 rm)		
Sub-Reach	**Length (river miles)**	**Marsh Zone**
1	0.0 – 5.5	Salt-marsh
2	5.5 – 7.2	Salt to Brackish Transition
3	7.2 – 9.6	Brackish Marsh
4	9.6 – 13.6	Brackish to Fresh Transition
5	13.6 – 14.8	Freshwater Marsh

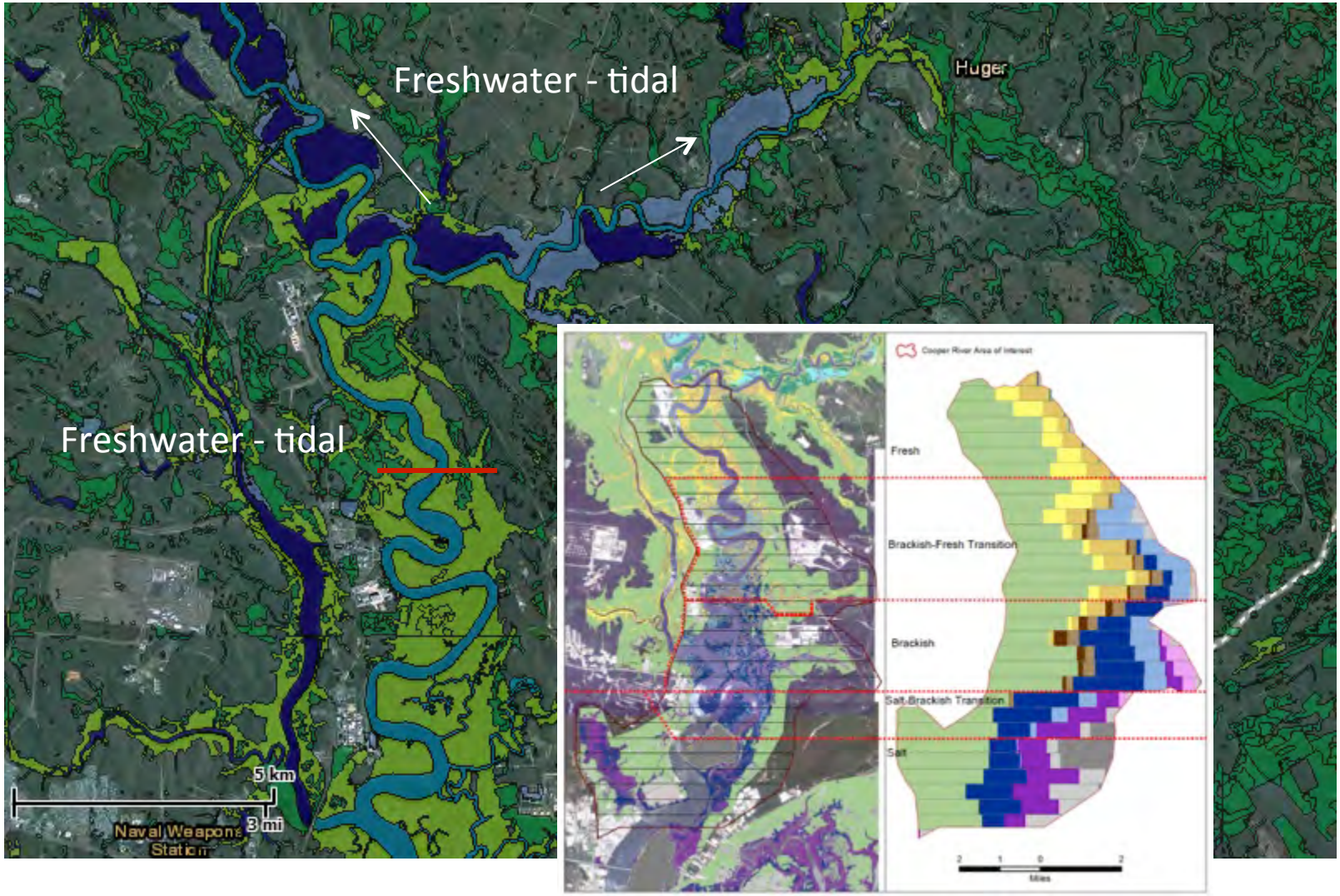
Source: US Corp of Engineers, Charleston Harbor Project

Step 1

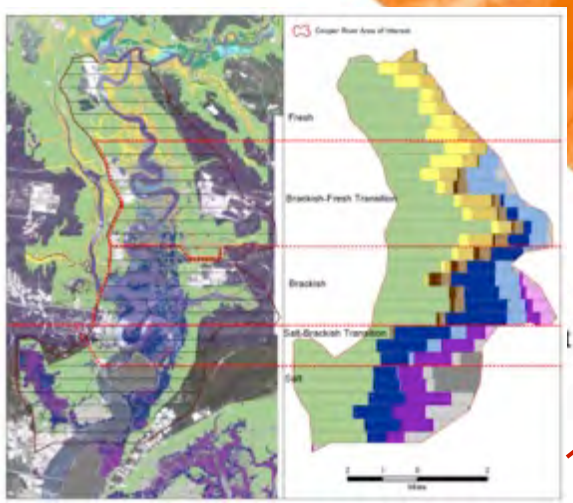


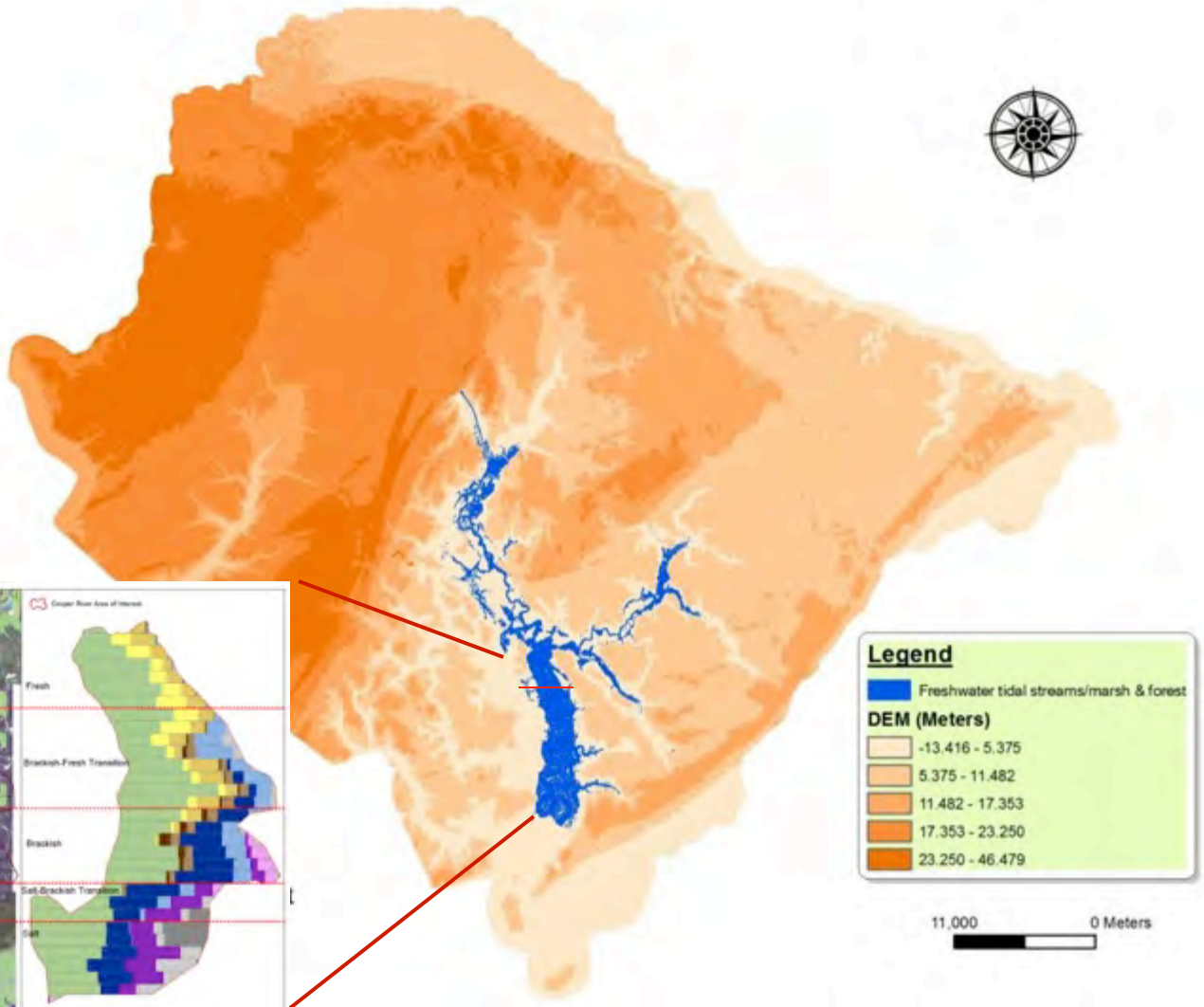
Source: US Corp of Engineers, Charleston Harbor Project

Cooper River Tidal Reach



Freshwater Tidal Reach – Cooper River, South Carolina





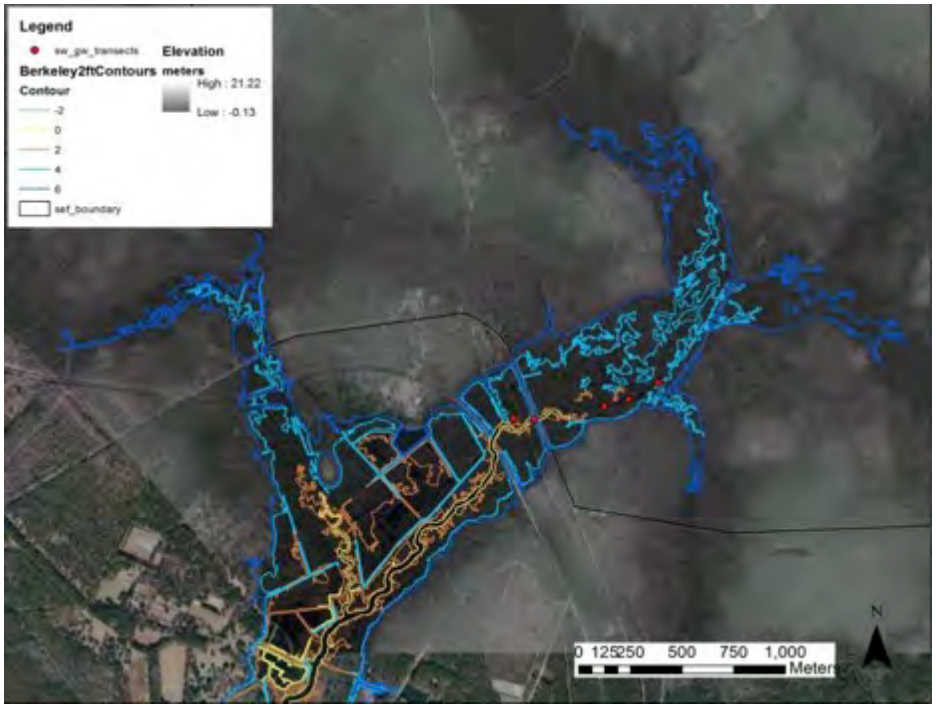
Issues in Recognizing Tidal Freshwater Streams

- Assumption that tidal systems are “salty”
- Assumption that tidal streams only interact with marshes
- Erroneous classification
- Incomplete data

From B. Czwartacki

Classification of Tidal Streams

- Lack of a common classification is a major issue
- Classification system should reflect factors that affect the function of the system
- Tidal systems have two dominant factors:
  - Salinity
  - Channel morphology



From B. Czwartacki

Perillo's Classification of Tidal Courses

Suggested to provide common basis to characterize tidal systems.

Basis: channel development and morphology

Name	Water in low tide	Depth (cm)	Width (cm)	Cross-section area (cm^2)
Tidal rills	No	<1	<2	<2
Tidal grooves	No	1–5	2–10	<50
Tidal gullies	No	5–100	10–100	50–1,000
Tidal creeks	Yes	10–200	10–200	100–4,000
Tidal channels	Yes	>100	>200	>2,000

Depth is the mean vertical distance from the thalweg to the bankfull border of the indentation. Width is the mean horizontal distance measured across the indentation between the bankfull borders.

The addition of a salinity vs. freshwater designation could be used to link water quality that directly affects wetland type and function?

From: Perillo, 2009

Proposed Tidal Creek Classification System

An integration of physical and chemical based systems

Phsyical Factors:

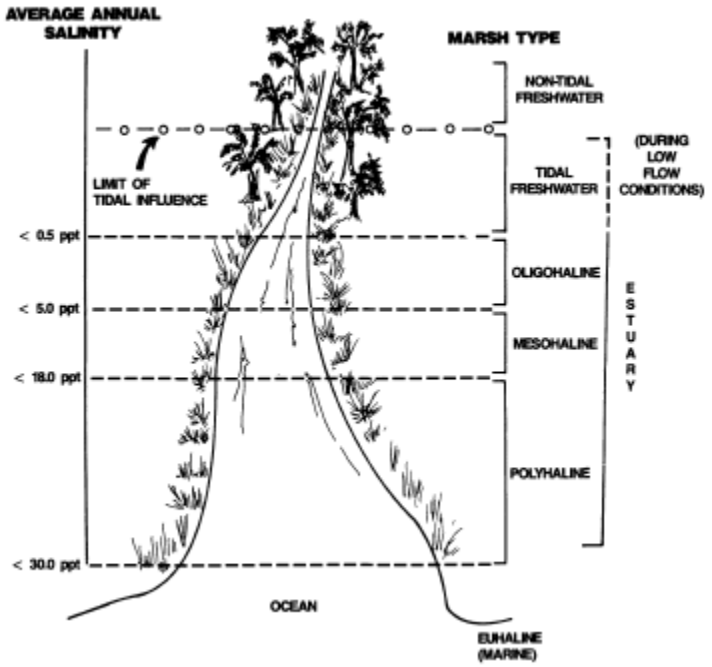
- Channel dimensions
- Hydroperiod

Tidal Course	Water at low tide	Depth (cm)	Width (cm)	Cross Section (cm^2)
Rills	No	< 1	<2	<2
Grooves	No	1-5	2 – 10	2 - 50
Gullies	No	5 – 100	10 – 100	50 – 1,000
Creeks	Yes	10 – 200	10 - 300	100 – 4,000
Channel	Yes	> 100	> 300	> 3,000
River	Yes	> 100	> 5,000	> $5x10^5$

After Perillo, 2009

Chemical Factor:

- Salinity



From Odum, 1988

Proposed Tidal Creek Classification System Based on Odum & Perillo

Salinity Class	X	Hydro-Physical Setting
Euhaline		Rill
Polyhaline		Groove
Mesohaline		Gulley
Oligohaline		Creek
Fresh		Channel
		River

Example: Oligohaline Creek

Merit: Provides characterization information needed to interpret channel and wetland processes.

Wetlands

- Defined according to the Cowardin System
  - Employing the tidal water regime modifier is essential for all palustrine wetlands adjacent to tidal courses.

Summary

- Tidal freshwater wetlands (TFWW) are an important component of coastal wetlands;
- Data is needed to quantify the extent of TFWW;
  - Common classification
- Biogeochemical functions of TFWW have not been adequately characterized ; it may have significant effects on the estuary;
- Hydrologic functions are sensitive to sea level rise & development

Acknowledgements:

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