Remnants of Tidewater Rice Farming as Important and Unique Fish and Shellfish Habitat in the Lower Cape Fear

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Part 1

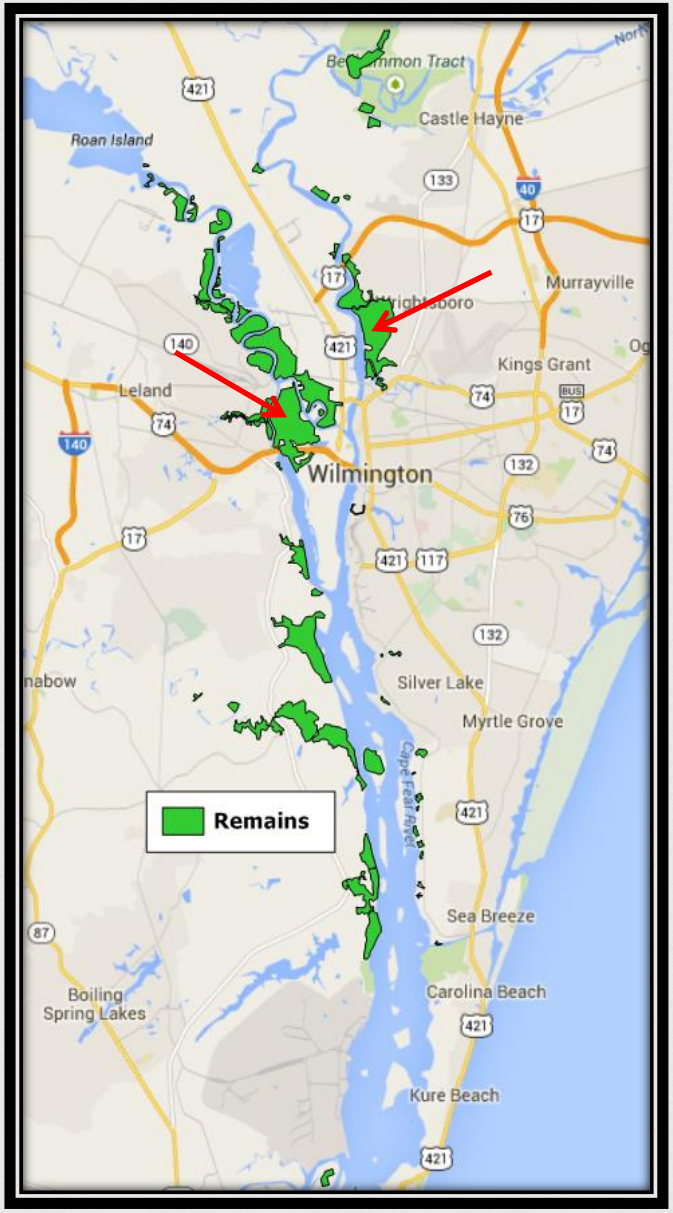
What did tidewater rice farming look like, what do the remains look like, and where, and how much remains?

The Components of Tidewater Rice Farming

Orton Plantation 1890 - State Archives of NC via Public Radio East

What do the remains of canals, ditches and rice fields look like from the air?

NW Eagles Island -- Photo by Alan Cradick



Google Street Maps = Base Map

Where are the remains of tidewater rice farming in the Lower Cape Fear?

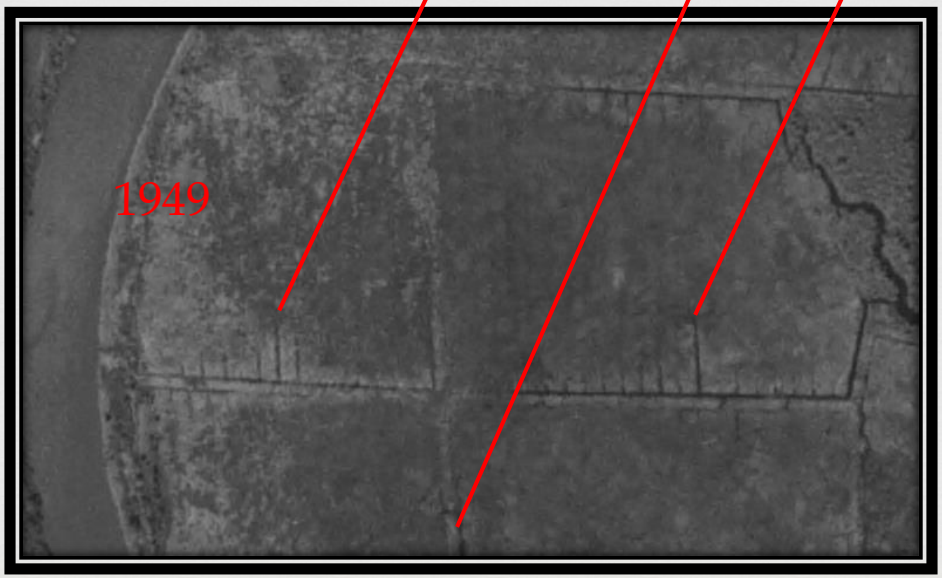
- Locations defined by where freshwaters and sufficient tidal range coincided
- 64 Locations identified so far
- Area = 10,069 acres (4,075 ha)
- Mainly W side of LCFR
- "Heartland" focus of research
  - NW Eagles Island , CFR (595 acres)
  - Smith Creek, NE CFR (1297 acres)

Part 2

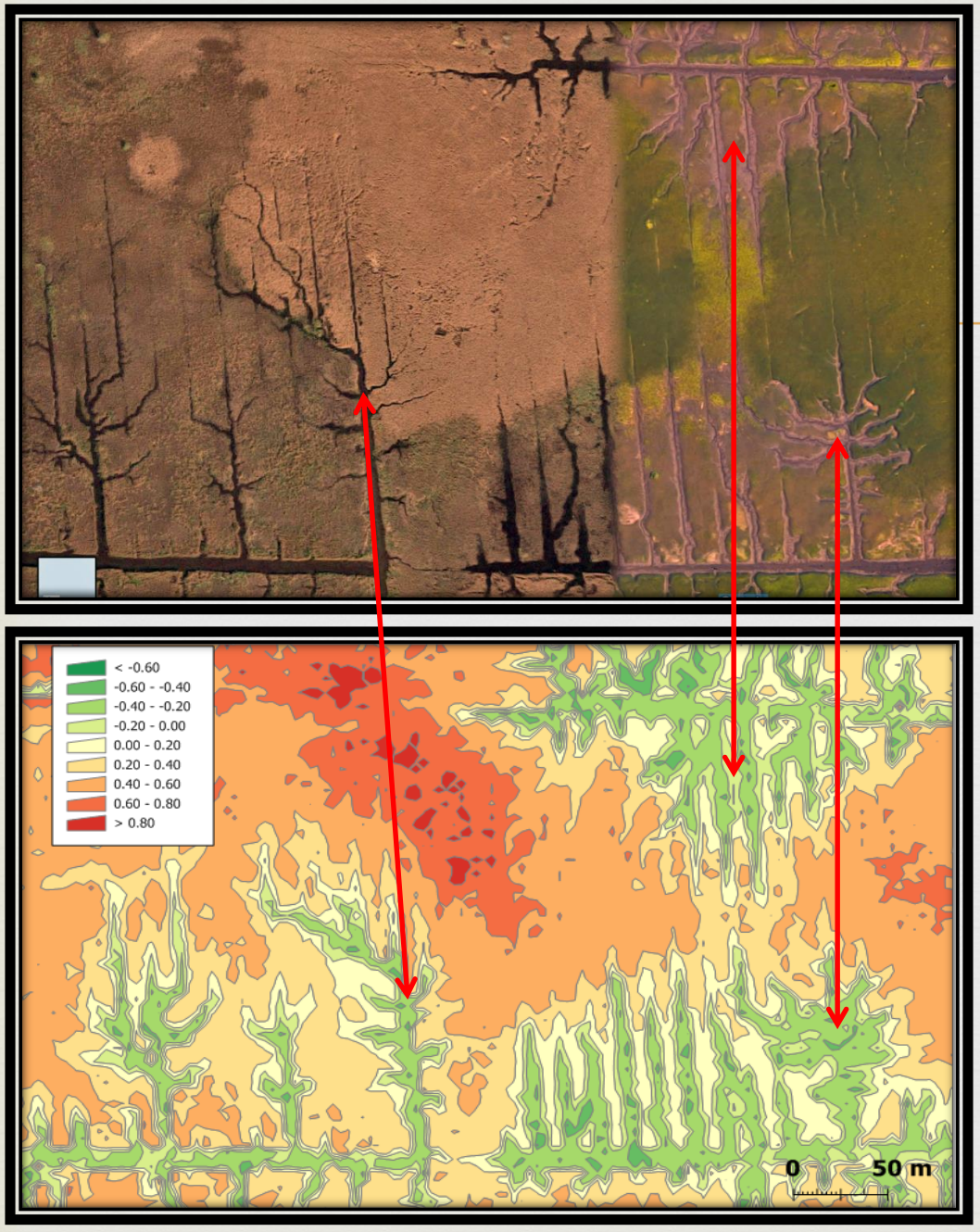
What changes are occurring in the canals, ditches and former rice fields as revealed by analysis of LiDAR data?

Erosion already evident in 1949 and change over 67 years

Google Earth 10/29/2016



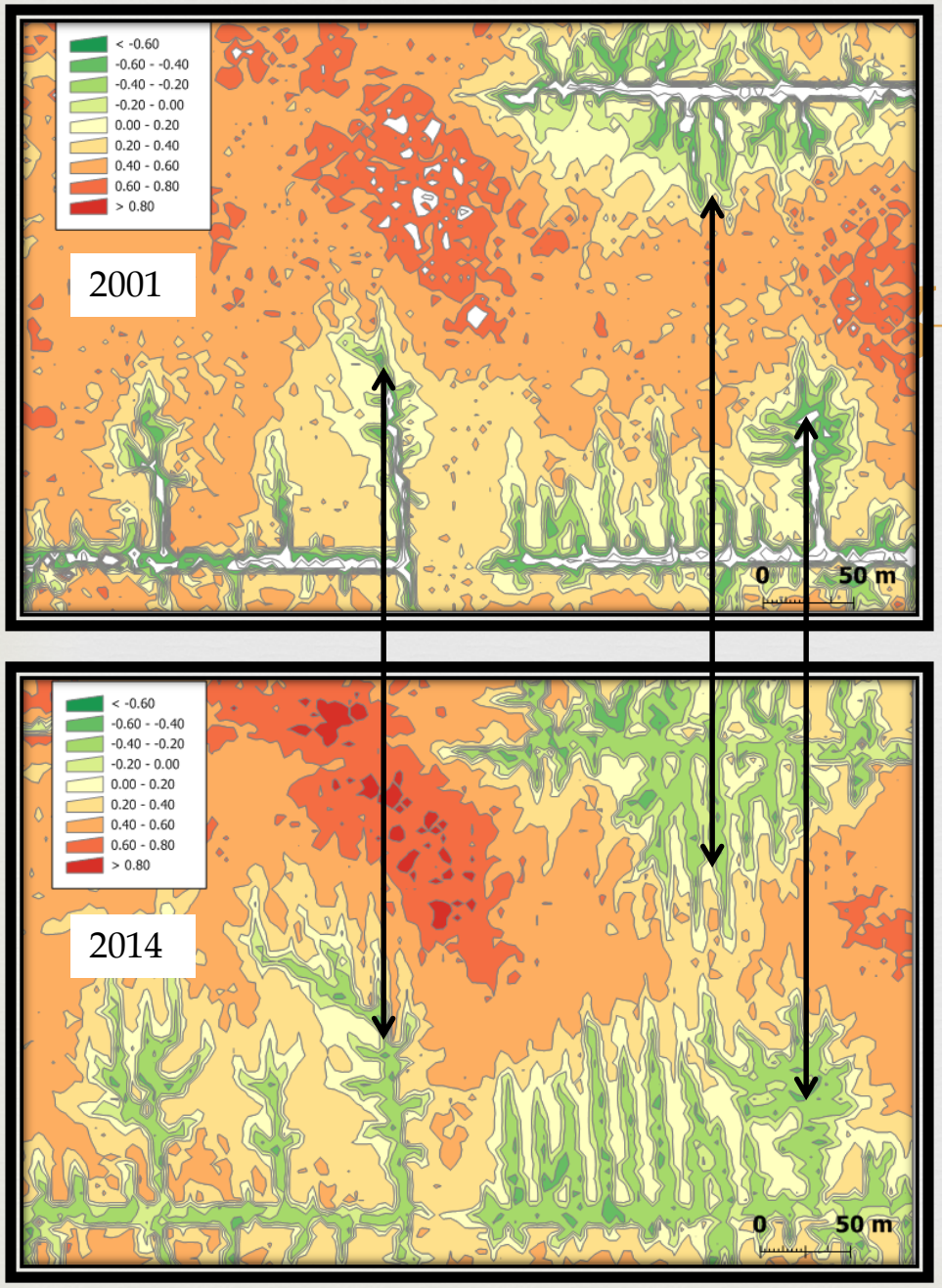
Aerial photography 1949 via NHC GIS



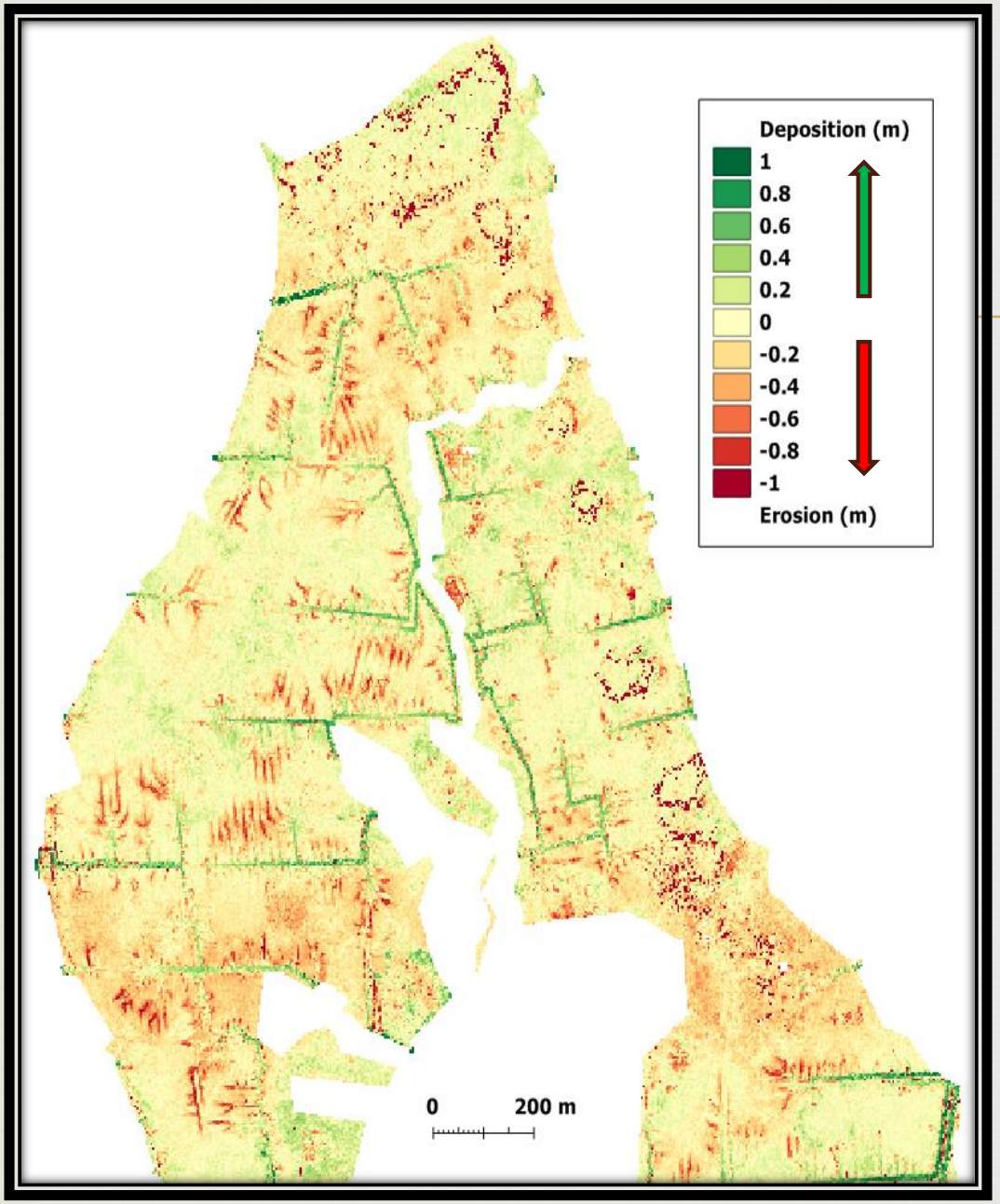
Recent Google Maps (images merged - low tide on right)

Comparison of erosion on Google Maps and LiDAR

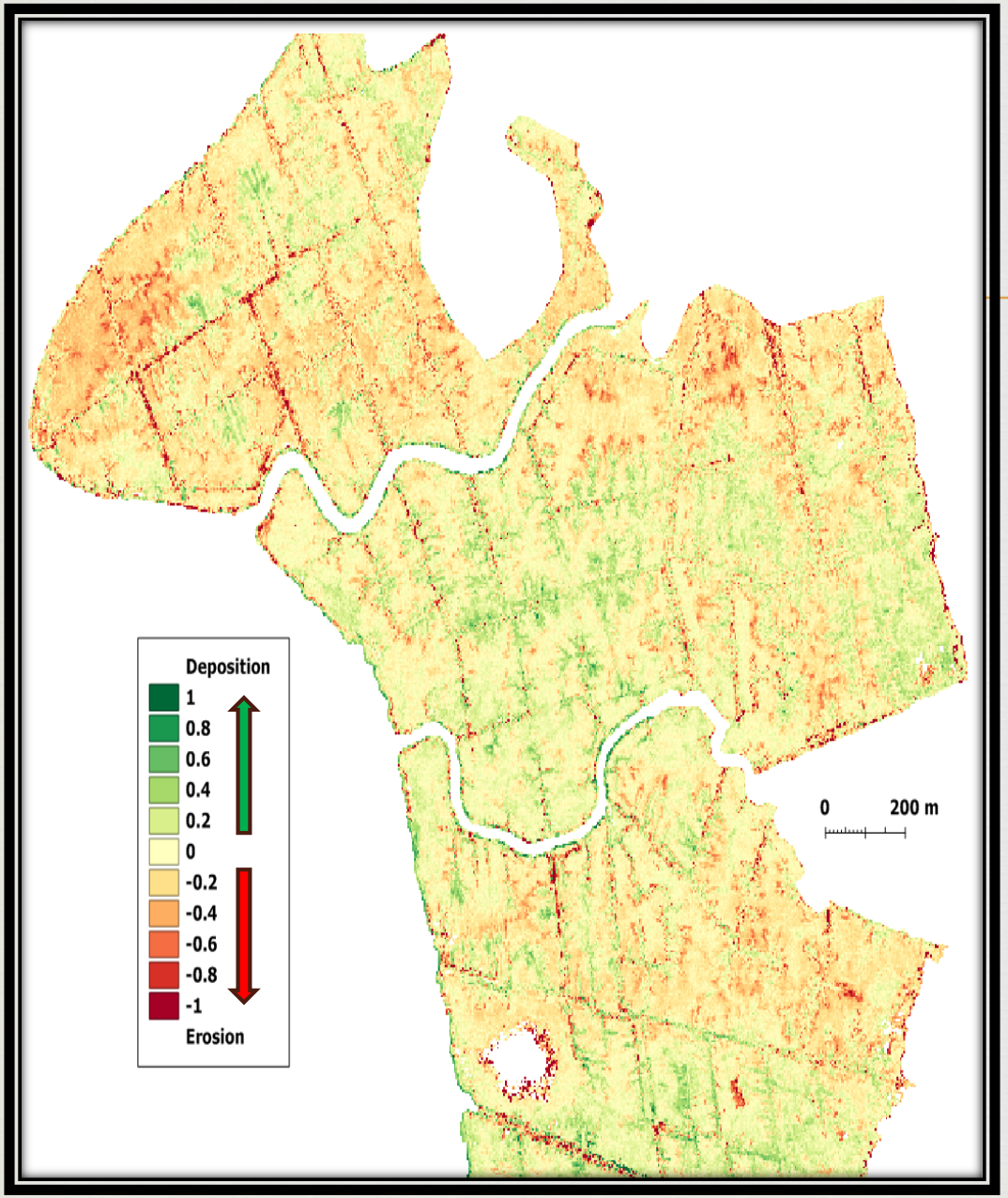
2014 LiDAR as a contour map



Visual change on Eagles Island from 2001 to 2014 using LiDAR contouring



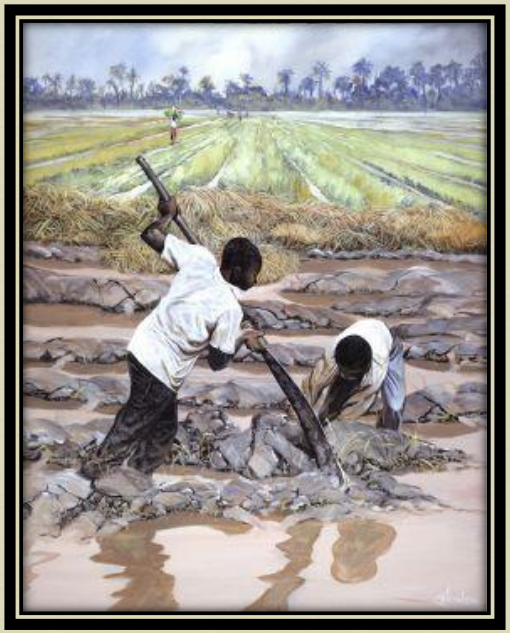
Where were the changes in canals, ditches and former rice fields on Eagles Island from 2001 to 2014 using LiDAR subtraction?



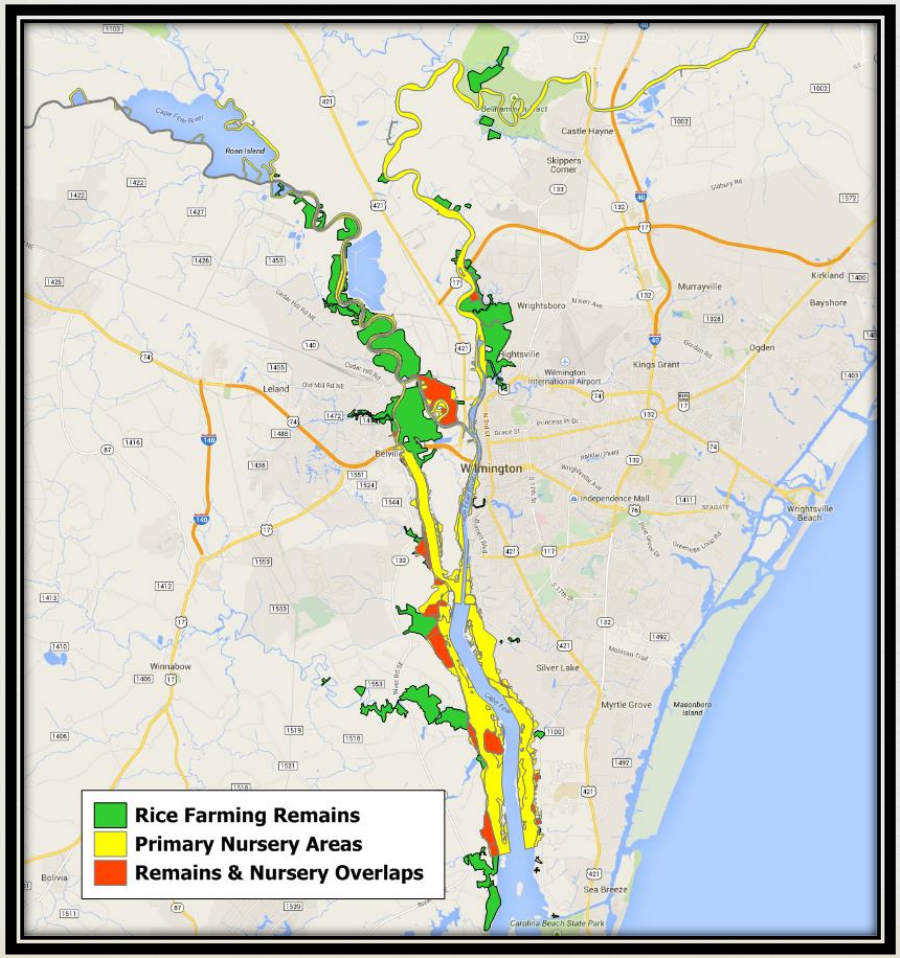
Where were the changes in canals, ditches and former rice fields at Smith Creek from 2001 to 2014 using LiDAR subtraction?

Part 3
Are the remnants unique and important fish and shellfish habitat?

- Spatial relationship with Primary Nursery Areas
- Commercial and recreational species richness



How do the remains of tidewater rice farming relate to critical habitat for young and juvenile fishery species?



- Primary Nursery Areas
  - 1,297 acres of overlap between rice farming remains and PNAs
  - 19% of the total area with rice farming remains is <u>within</u> PNAs
  - Much of the area with rice remains is <u>adjacent</u> to PNAs

Commercial and recreational species richness at 10 sampling locations in and around former rice farming areas in the Lower Cape Fear

Fishes

- Summer flounder (3; 6) *
- Atlantic croaker (2; 7)
- Atlantic menhaden (1; 5)
  Striped mullet (1; 7)
- Southern flounder (1; 10)
- American shad (1; 2)
- Spot (0.4; 10)
- Striped bass (0.1; 2)
- Red drum (0.08; 2)

Shellfishes

- Blue crab (31; 9)
- Brown shrimp (6; 6)
- White shrimp (3; 8)

*Numbers within parentheses:

First number = millions of pounds caught in NC in 2015

Second number = number of sampling stations at which species occurred among ten stations in and around former rice areas

Underline = highly appreciated recreational fisheries species

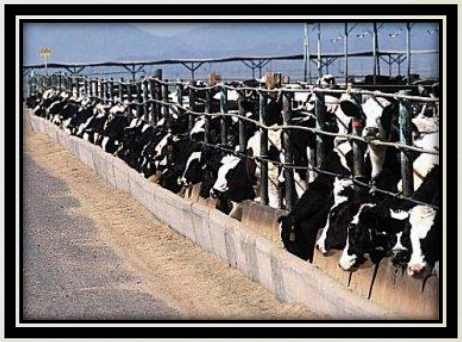
Data from the NC DMF juvenile trawl program from 2001 to 2014, Weinstein et al., 1980, Rozas and Hackney (1984), and Posey (2010)

Part 4
How is erosion influencing fish and shellfish habitat in former rice areas?

- Edge as a measure of habitat interface

What is edge, and why is it an important measure of the quantity of fish habitat provided by the rice remnants?

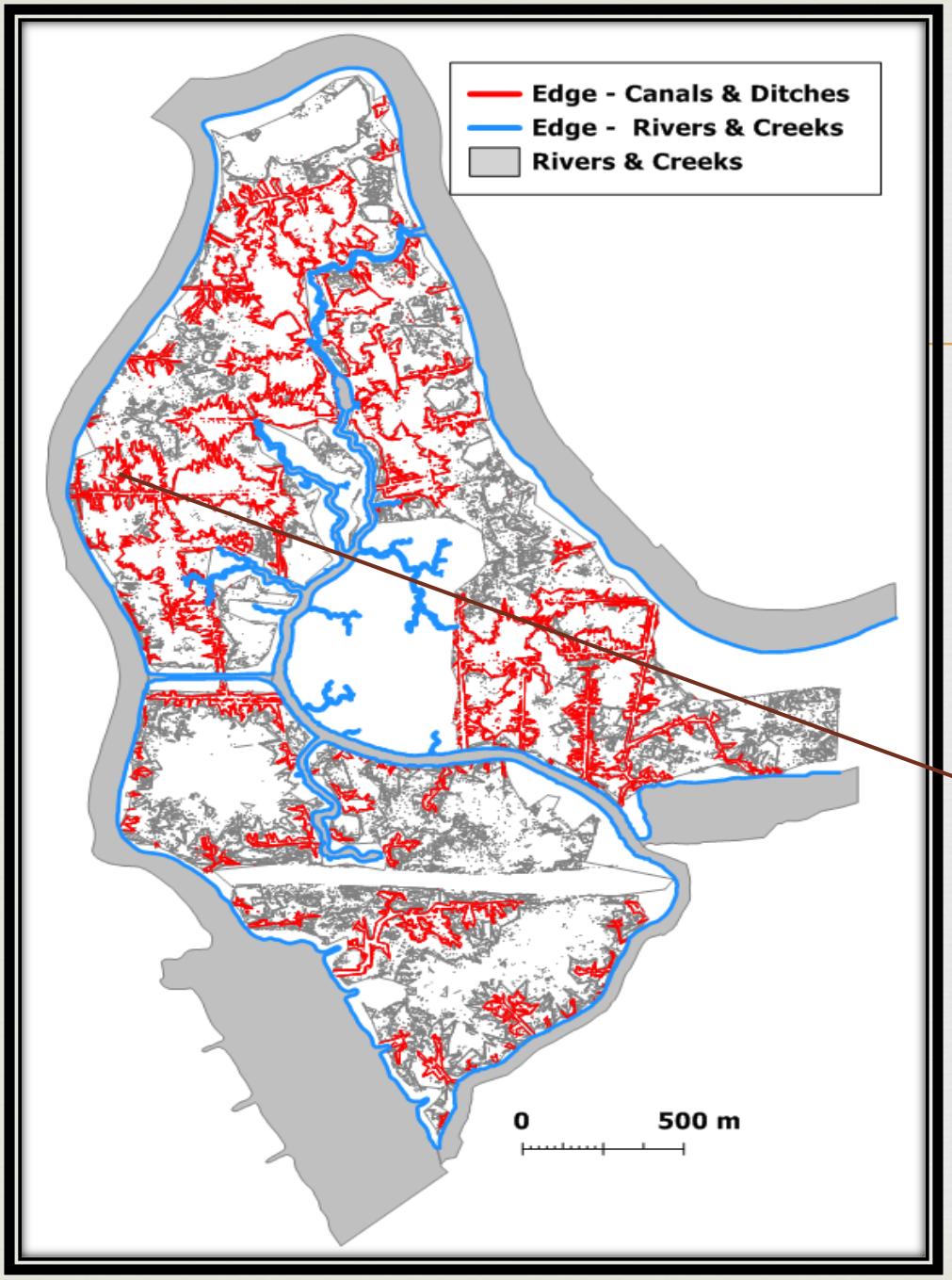
- Edge is the measure of the interface between the open waters of canals, ditches and the marsh vegetation of the former rice fields, and also includes the river and creek interface
- Services of marsh edge habitats: increased feeding area, elevated prey densities, and protection for fishes and shellfishes
- Marine transients* often remain near the edges of salt marshes
- High densities of fishes and shrimps are found along the edges of flooded marsh creeks (read also canals and ditches)
- Concentrated Animal Feeding Operation -Trough
- The longer the edge, the greater the opportunities

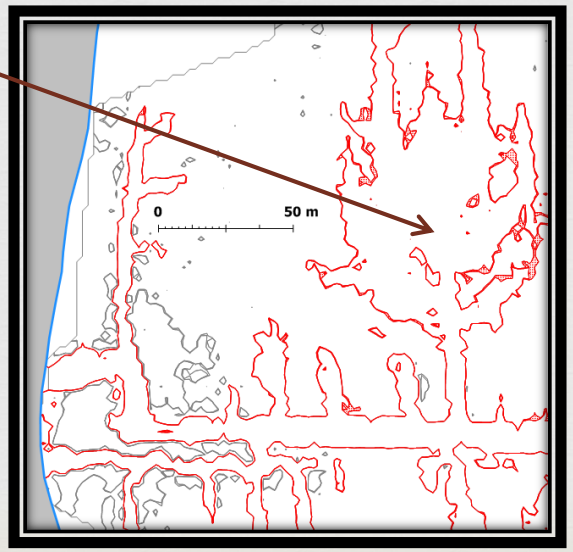


* Mainly the commercially and recreationally most valuable species

Why areas of rice remains “have the edge”

- Increasing edge interface in former rice areas is mainly due to increasing erosion of former rice fields





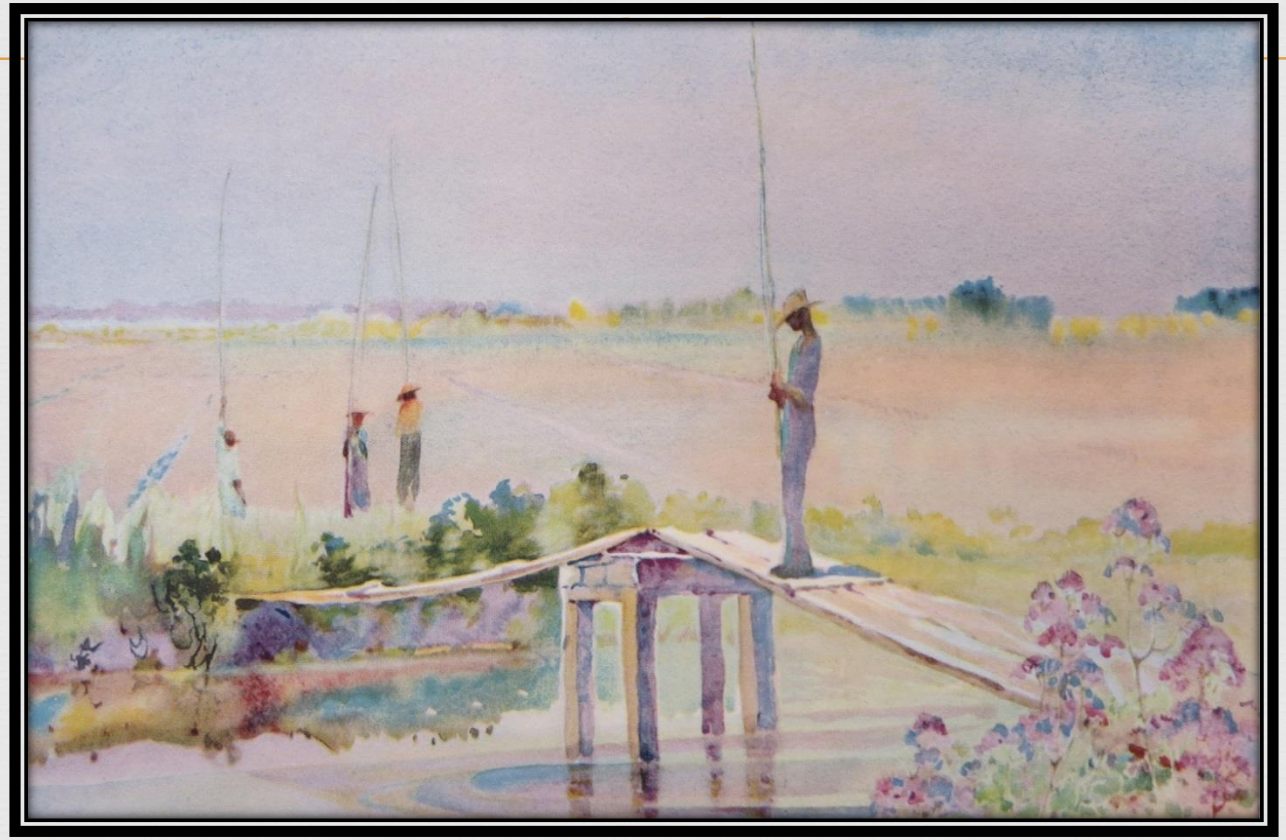
Edge comparisons for Eagles Island and Smith Creek

- Length of edge habitat: rice remains vs. natural waters
  - 4x at Eagles Island
  - 23x at Smith Creek! !
- Edge density at bank full (length of edge/area of remains)
  - 5x more dense at Smith Creek than at Eagles Island

What have we learned, and what is the future of fisheries productivity in former rice areas?

- The canals, ditches and former rice fields are an important and unique habitat for fishes and shellfishes in the LCF as indicated by:
  - Being extensive and man-made
  - The presence of commercially and recreationally important species
  - Close spatial association with Primary Nursery Areas
- Measures of edge habitat length and edge density provide an indication of the effect of erosion on opportunities for increased feeding area, elevated prey densities, and protection for fishes and shellfishes among rice farming remains
- Erosion of former rice fields contributes to increased fish and shellfish habitat due to increases in length of edge habitat and open water area
- But decreases in habitat beneficial for fishes and shellfishes can be expected as erosion causes biologically productive former rice fields to give way to open water

Thank you!



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The way ahead

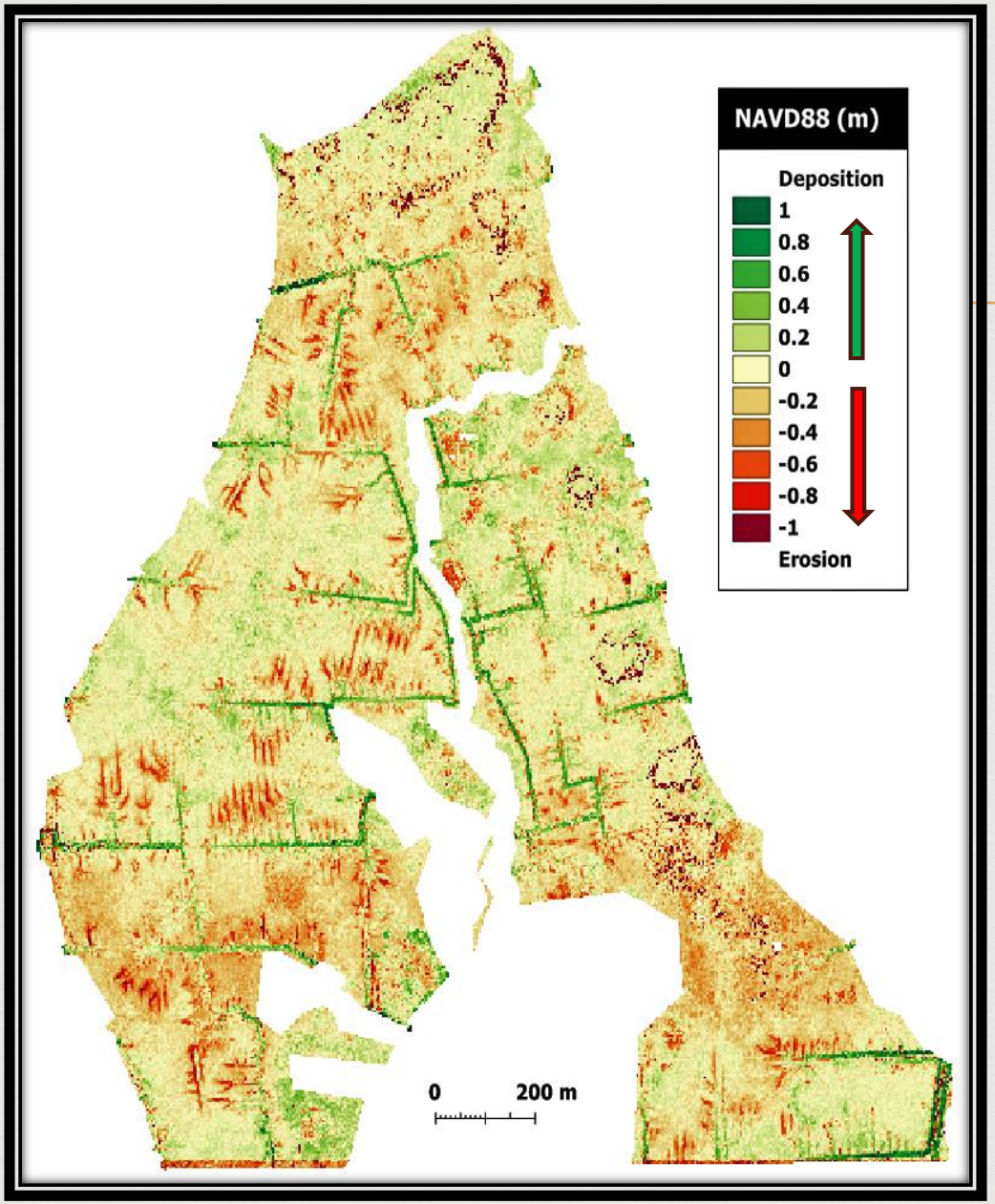
- Directions for further research?
- Ideas for mitigation?
- Worthwhile to continue?

What should be next?

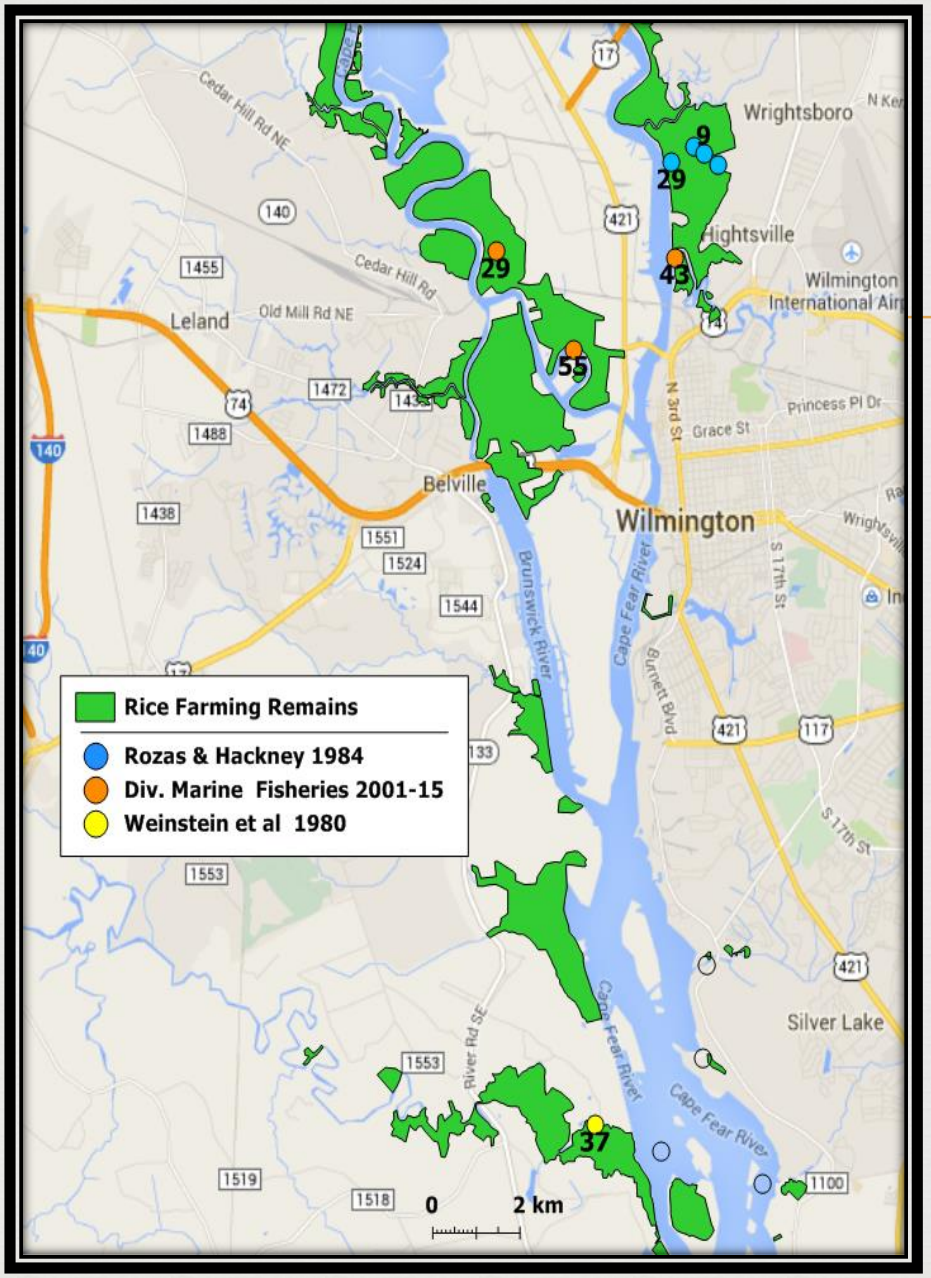
- Is anything to be done management-wise?
- Do these findings have any implications for management?
- Follow up research on
  - the changing condition of the remnants as fish and shellfish habitat?

- Effect on fisheries productivity of erosion, deposition and the changing environment in the LCF

Not used



Where were the changes in canals and former rice fields on Eagles Island from 2001 to 2014 using LiDAR



What was the species richness at sampling stations within or close to areas of rice farming remains?

Richness is a measure of the number of different kinds of organisms present in a particular area

Questions Addressed about the Remnants of Tidewater Rice Farming

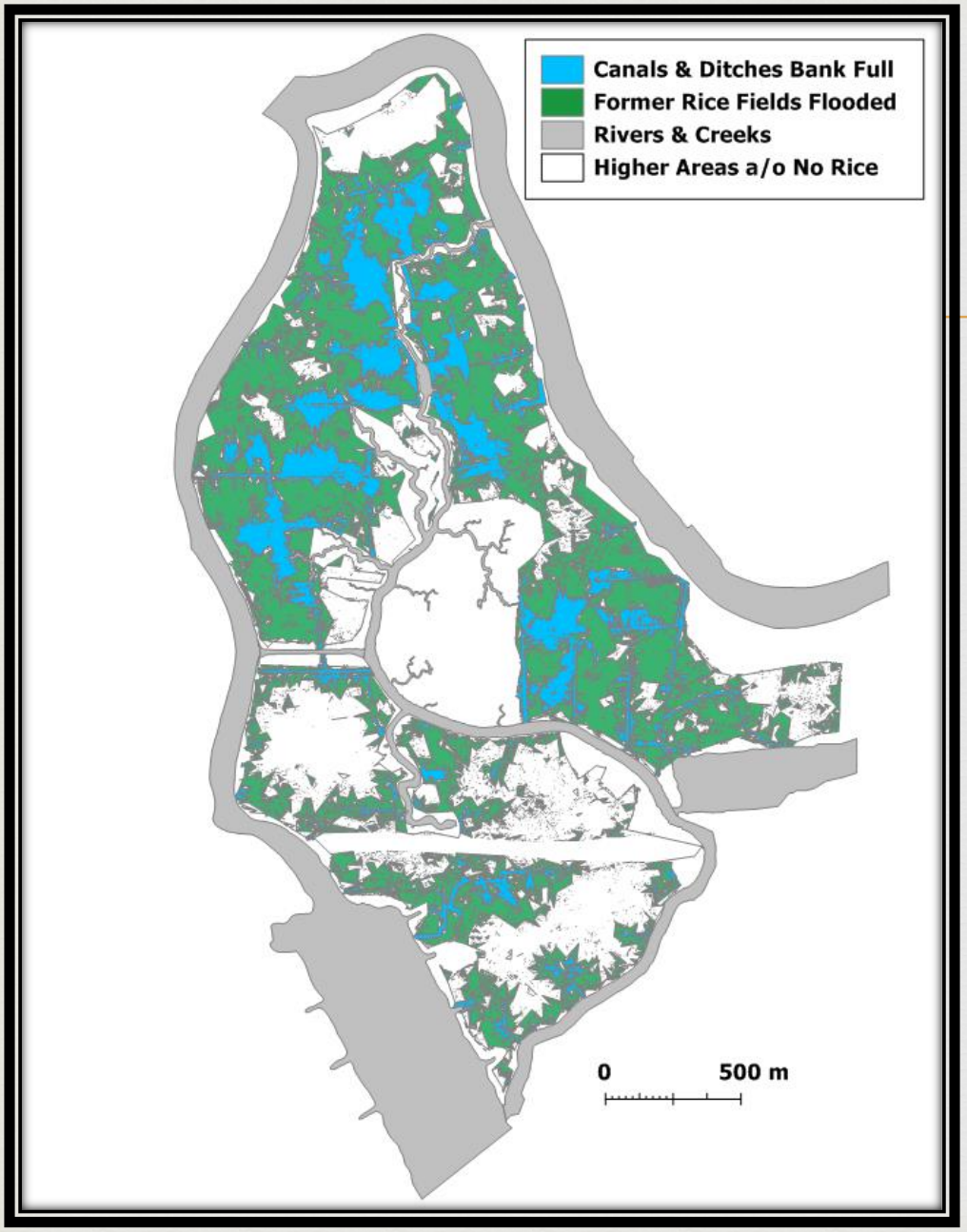
- What did tidewater rice farming look like and where are the remains?
- Are the remnants unique and important fish and shellfish habitat?
- Are the remnants likely to be highly productive habitat for fishes and shellfishes, and why?
- What is the condition of the remnants and how is that likely to affect their future fisheries productivity?

To do

- Comparative stat from ne cfr
- Paintings for dressing on the section
- Wetland context – histogram comparing wetland LCF and Wetland in remains

What are some other indicators of change in condition?

- Erosion first detected on aerial photo of Eagles Island in 1949
- Erosion and deposition by area and vertical measure:
  - Most widespread by area within vertical distance of < 0.1 m
  - Nearly all by area occurred within a 0.3 m range
- Impression:
  - Material moving from one place to another with small net loss from each of the two study areas



By what amount has erosion increased habitat area among the canals, ditches and former rice fields?

- When canals, ditches and eroded areas of former rice fields are bank full they provide additional habitat about equal to that of rivers and creeks*

* Assumes one-half of river & Redmond Cr. area & all of Alligator Cr. are associated with Eagles Island rice remains habitat