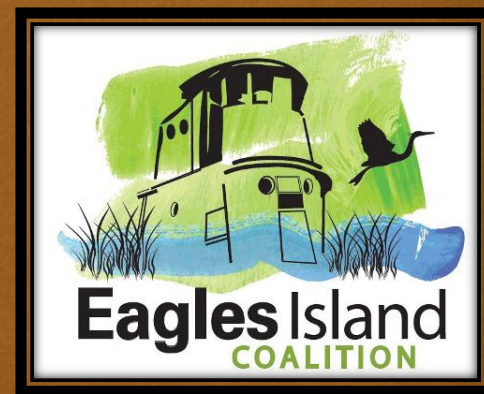


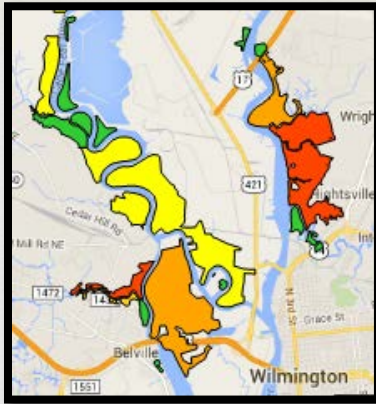
Erosion of Aquatic Habitat in the Cape Fear Estuary: What's Known, What's New and What's Next?



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Associate Member, Eagles Island Coalition

Cape Fear River Partnership
1st Quarter Meeting
Fayetteville, NC
February 24, 2020





2. Extent: 26% of the area at 20 locations is eroded

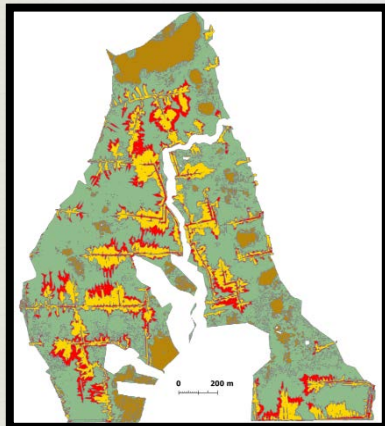


1. Pervasive: 65 locations

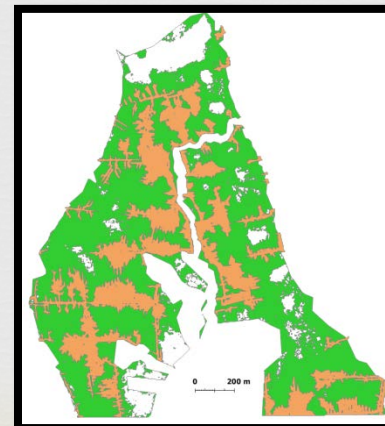


3. Erosion traced back to 1949; 1949 to 2001 and 2001 to 2014 rates estimated

What's known about erosion in the Cape Fear Estuary?



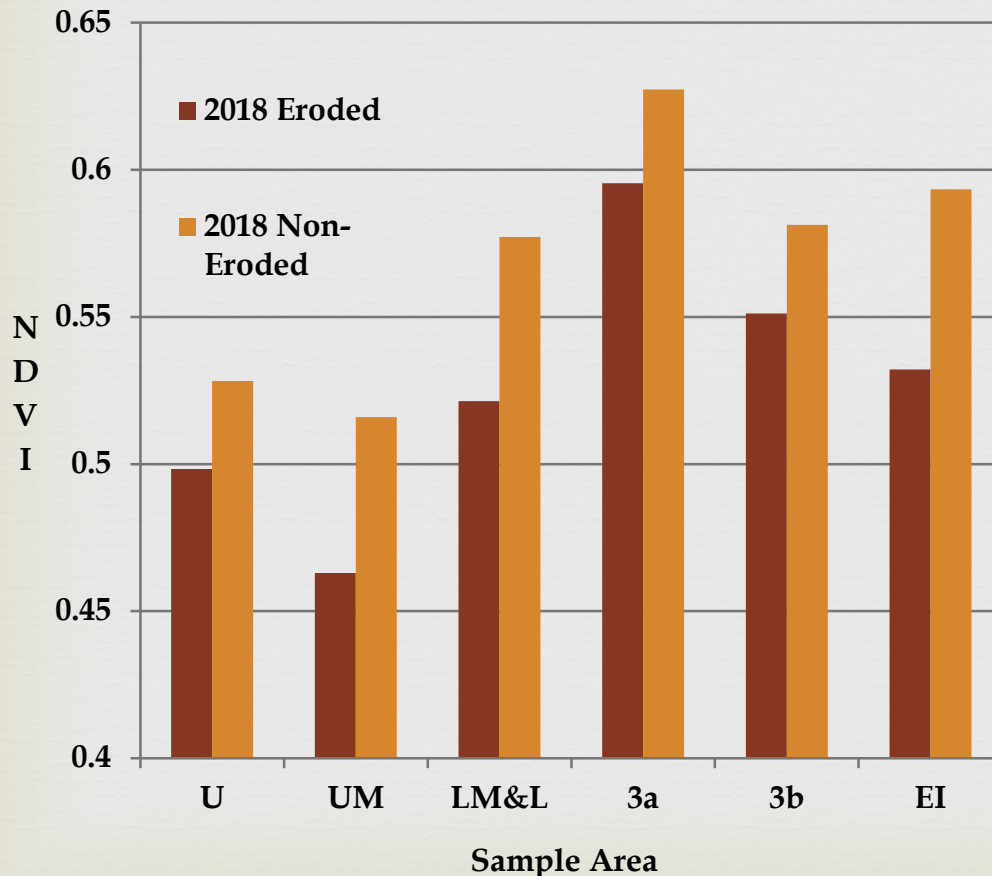
4. Rates of erosion exceed accretion at 4 of 5 sample locations (2001 – 2014)



5. Results so far: Erosion creates new widespread aquatic habitat space in CFE wetlands

Is erosion negatively impacting the health of marsh vegetation? Normalized Difference Vegetation Index as an indicator

Mean NDVI in Eroded and Non-Eroded Marsh Areas at Six Locations on 8/24/2018

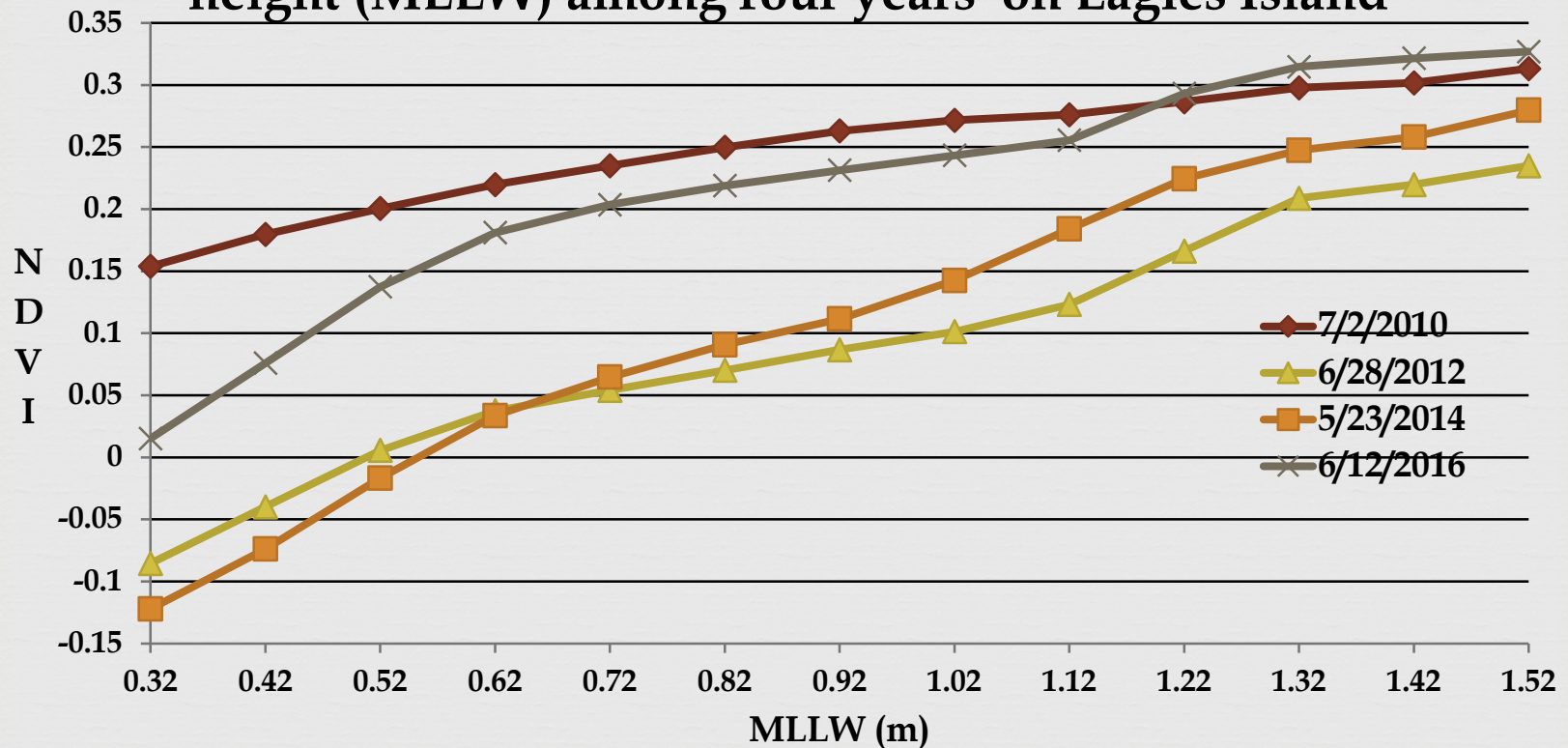


- NDVI indicative of marsh vegetation health
- Based on Planetscope multiband 3 m and NAIP 1 m multi-band imagery
- Comparisons of vegetation health in eroded and non-eroded marsh
- 6 locations (806 ha in total) x dates in 6 years = 36 comparisons in all

Are depth and duration of inundation affecting marsh vegetation health?



Marsh vegetation health (NDVI) by 10 cm contour height (MLLW) among four years on Eagles Island



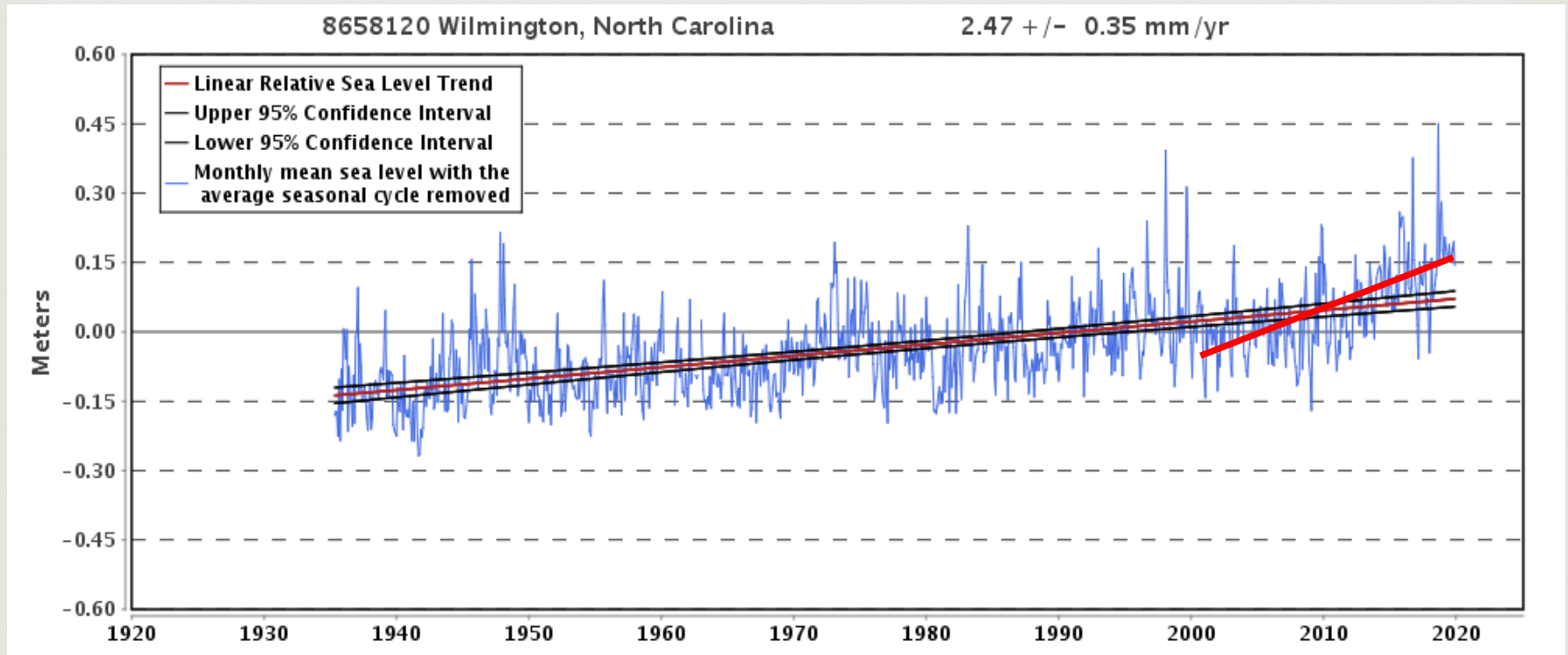
What's next to do?



- ❧ Hi-res drone imagery program of eroded and non-eroded areas:
 - ❧ Vegetation species ID
 - ❧ Vegetation development
 - ❧ (Many thanks to CFRW for providing the pilot, drone, and primary processing of the data!)
- ❧ Supervised classification of aerial and satellite images:
 - ❧ Influence of wet/dry areas on NDVI

What's the future?

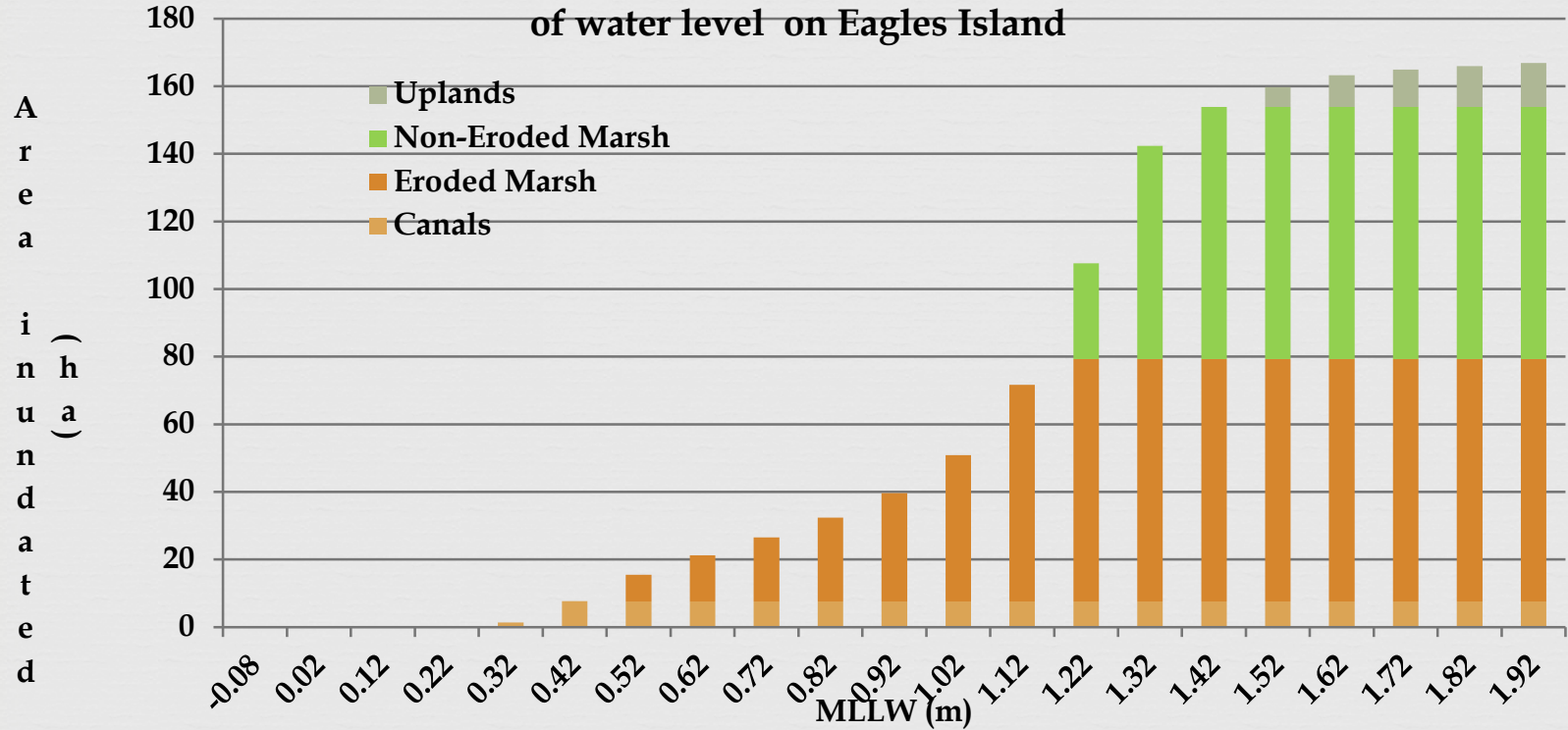
Erosion and Sea Level Rise (SLR) both result in increased depth and duration of inundation. SLR will exacerbate the effects of erosion on the estuary.



Thank you!



Cumulative area inundated in eroded areas by habitat type as a function of water level on Eagles Island

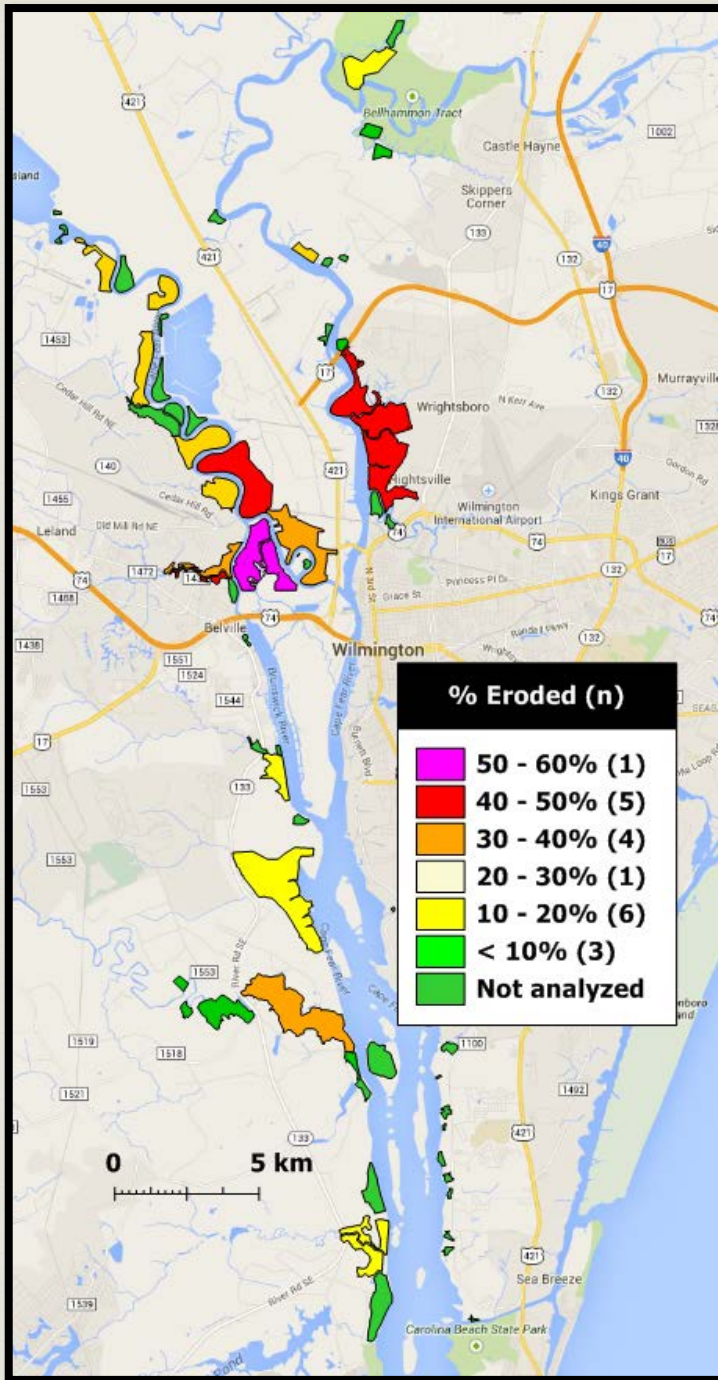


Overview



- ❧ What do we know?
 - ❧ When did erosion begin?
 - ❧ Where is erosion taking place?
 - ❧ Which habitats are affected?
 - ❧ How deep is erosion?
 - ❧ At what rate is erosion proceeding?
 - ❧ Vs accretion
 - ❧ Is erosion associated with any particular wetland feature?

Where is the erosion & how extensive is it?



- ❧ Eroded former rice fields & canals = 2,759 ha at 65 locations
- ❧ 2,099 ha in 20 locations analyzed (76%)
- ❧ Eroded area
 - ❧ Overall, 26% of the total area of the former rice fields among the 20 sample locations is eroded
 - ❧ Eroded area classes are clustered:
 - ❧ by frequency in the lower and upper ranges
 - ❧ spatially just north of Wilmington in the CFR & NECFR
- ❧ Overall, erosion is widespread, but variable in extent from place to place

What are the maximum depths of erosion?

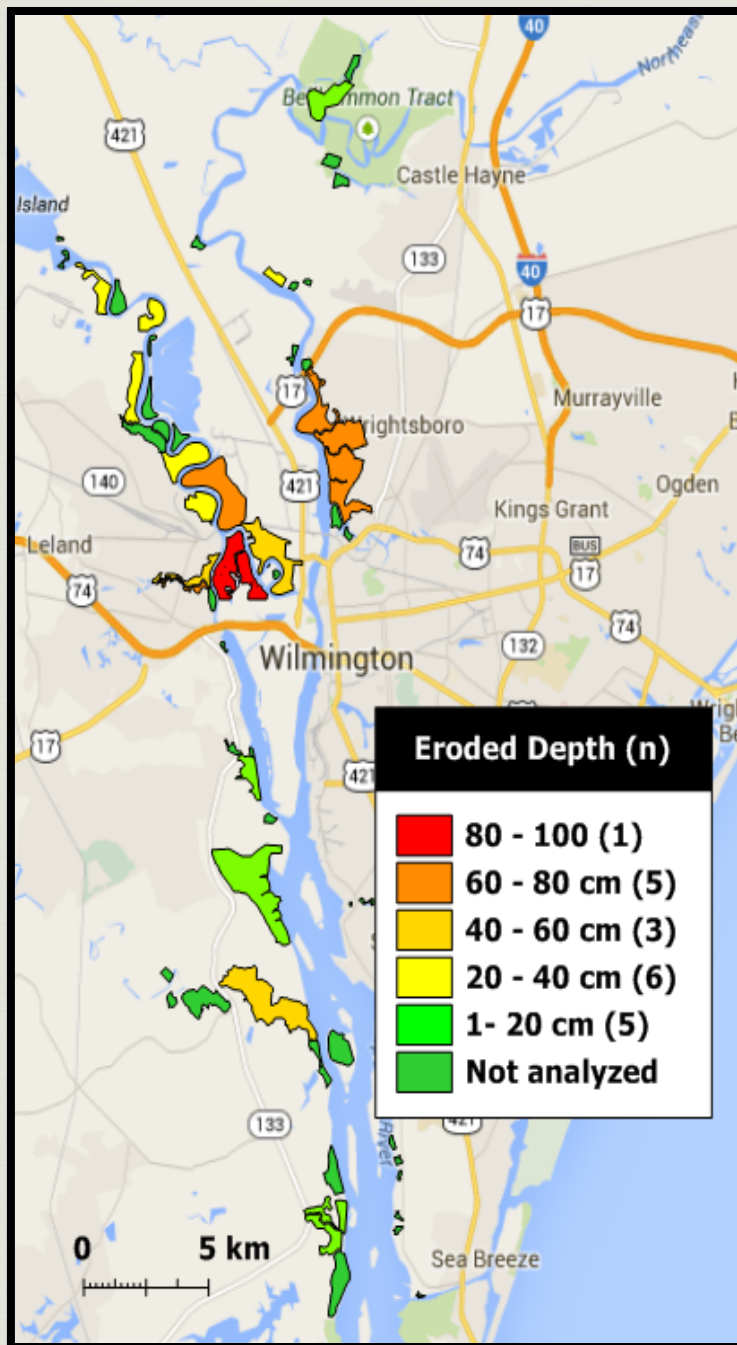
❧ Depth of erosion

❧ Ranges up to 80 - 100 cm

❧ Fairly evenly distributed by depth class

❧ Indicative progression of erosion considering area and depth together:

❧ Variable, but more advanced just north of Wilmington in the CFR and NECFR





Ponding during cold season as a surrogate for LiDAR

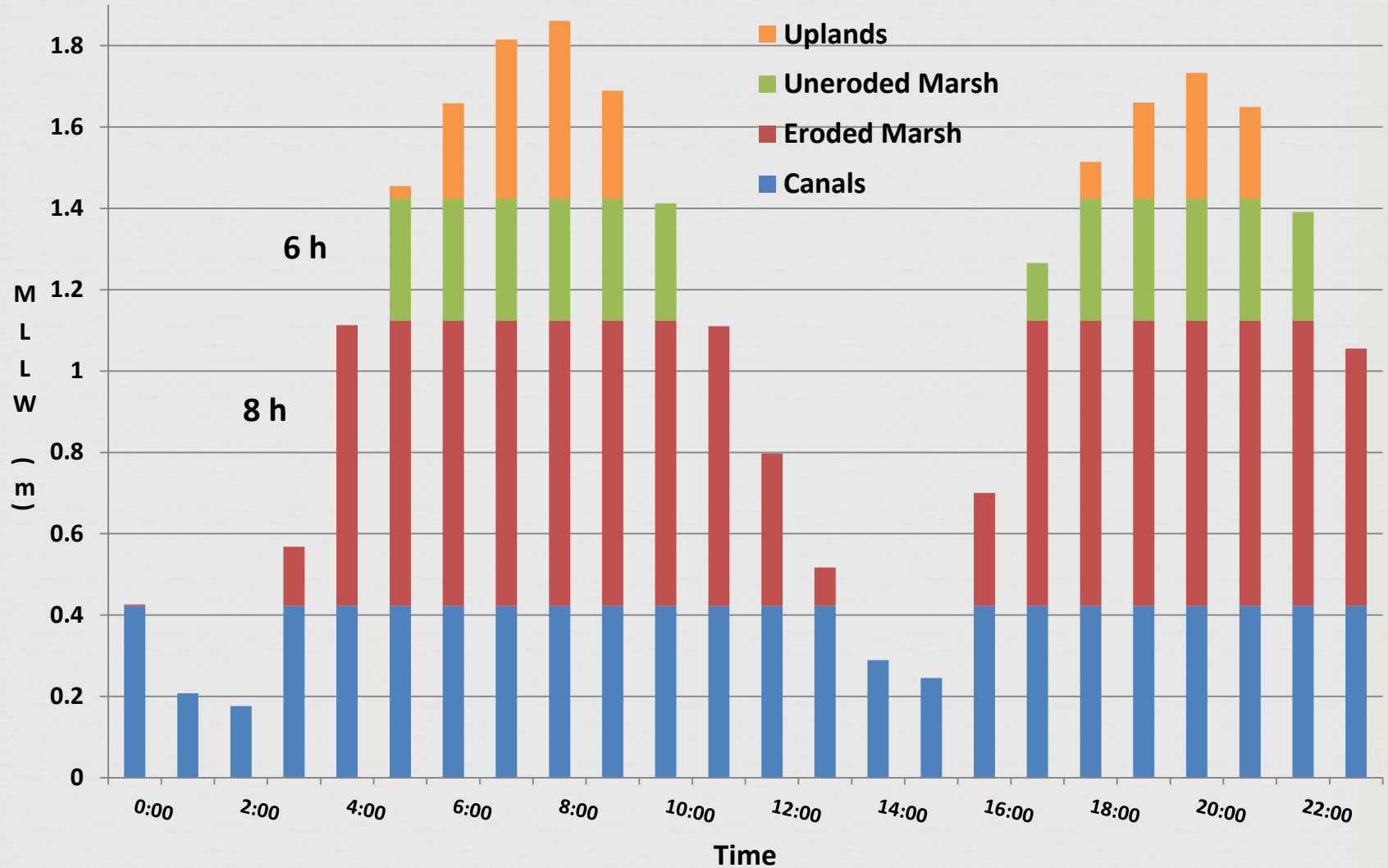
20 cm 2014 LiDAR contour over Google Earth

Indicative Erosion Rates (ha/y)

Location	Historical 1949 to 2001 (Ponding)	Recent 2001 to 2014 (LiDAR)
EI	0.7	1.3
U	1.0	-0.8
UM	1.0	0.7
LM&L	1.2	0.3
CFR 3a	0.3	4.3
CFR 3b	0.7	0.6

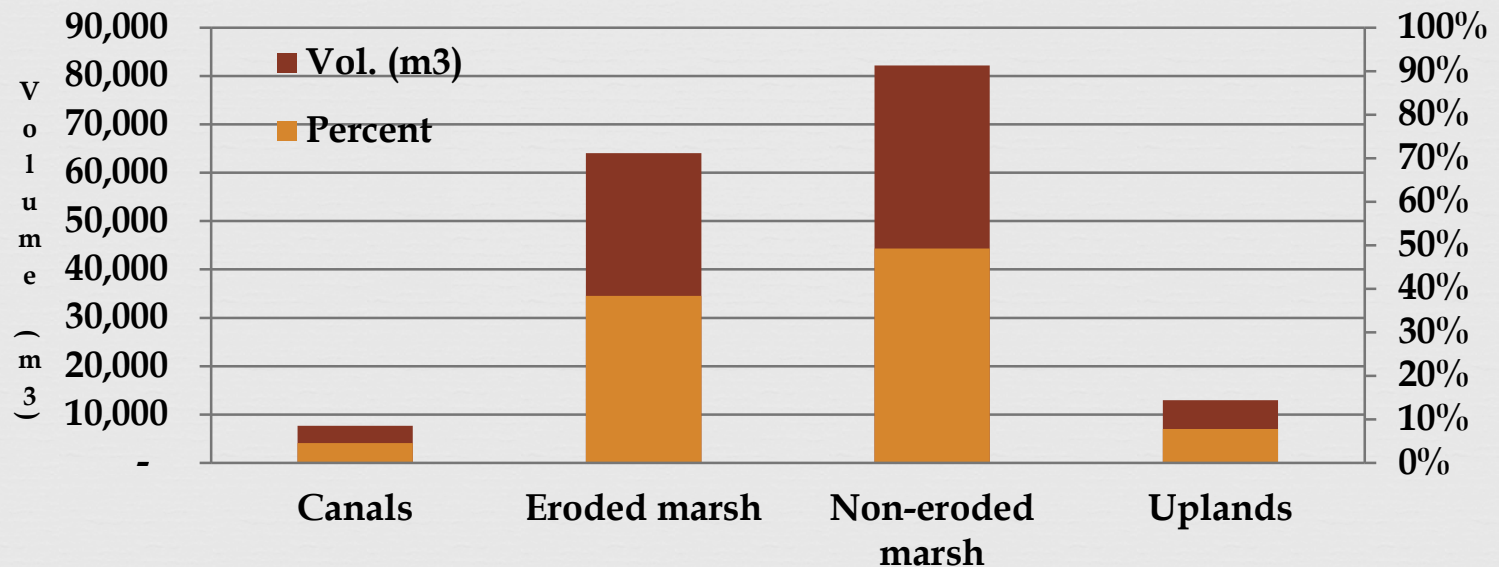
For how long has habitat erosion been taking place and at what rates has it been progressing?

Height (m) and duration (h) of inundation based on hourly water levels in four habitat types on Eagles Island on February 27, 2014

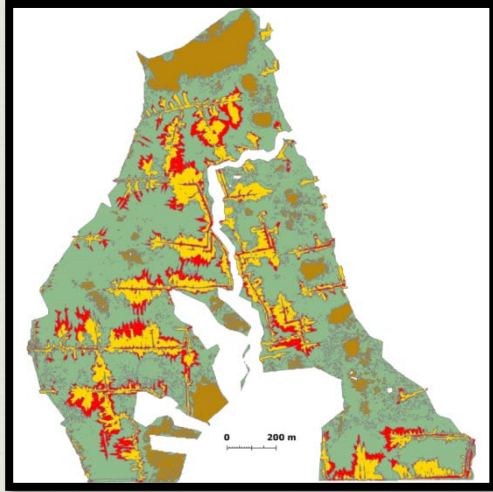




Volume by habitat when fully inundated in areas where erosion occurs on Eagles Island

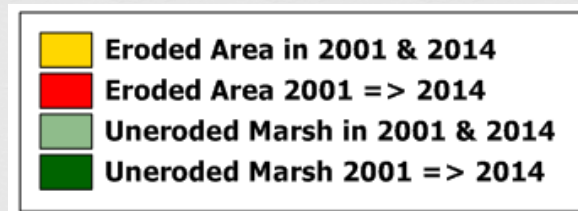
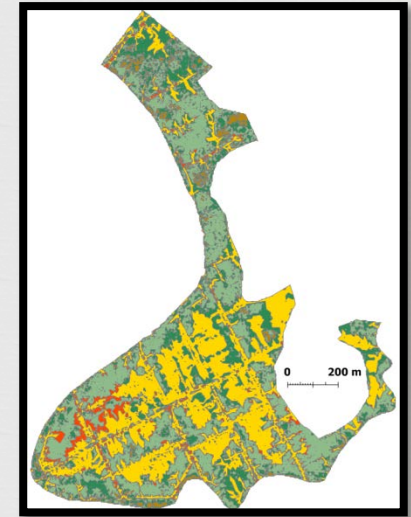


EI
172 ha **E 1.3** **A -0.1**



How do erosion & accretion rates compare 2001 to 2014 (ha/y)?

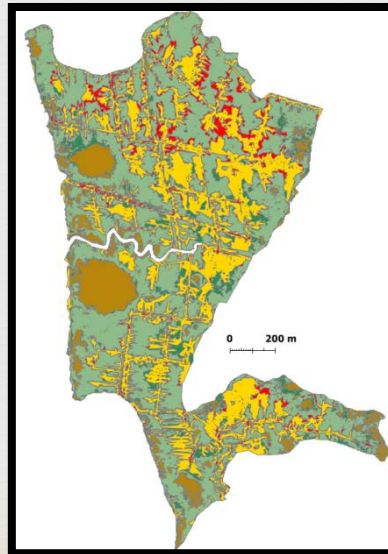
U
94 ha **E 0.8** **A 1.2**



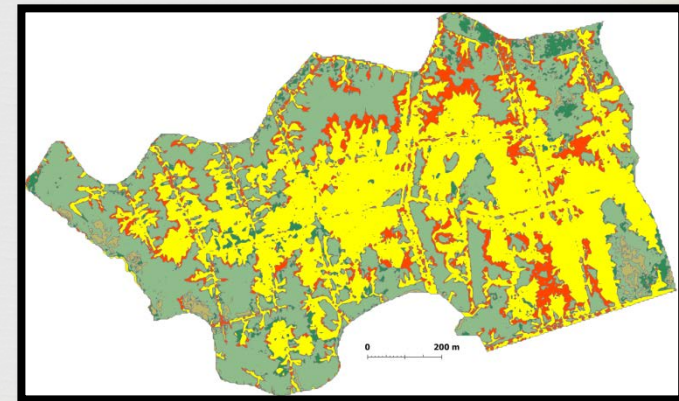
CFR 3a 197 ha **E 4.3** **A -2.3**



LM&L 170 ha **E 0.3** **A -0.2**



UM
102 ha **E 0.7** **A -0.6**



Effect of Erosion on Habitat Metrics



- ❧ Area and volume

- ❧ SLR

 - ❧ Slr viewer

 - ❧ https://coast.noaa.gov/digitalcoast/tools/slr.html?utm_source=newsletter&utm_medium=MailChimp&utm_campaign=DC_C_Feb20

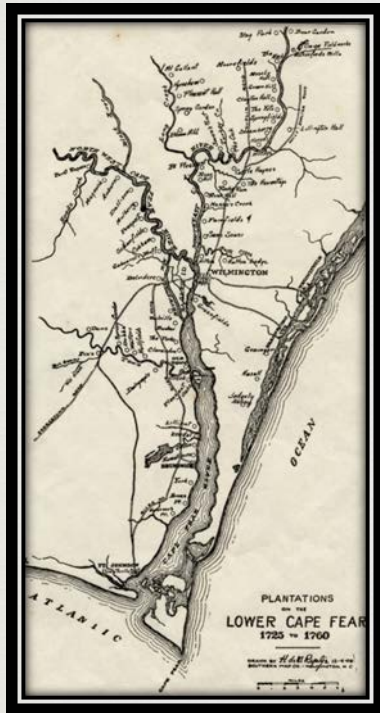
- ❧ To do

 - ❧ Species differences: Supervised classification of multi-band imagery verified by drone (ID of plant varieties by flower)

 - ❧ Seasonal vegetation health (NDVI) in eroded and non-eroded areas

 - ❧ Hot spot analysis to identify most affected (hot spots) and least affected (cold spots) areas of marshes

What does historic tidewater rice farming have to do with aquatic habitat erosion?



Plantations on the LCF
1725- 1760



Digitized remains of rice field ditches over Google Maps Satellite image

To do

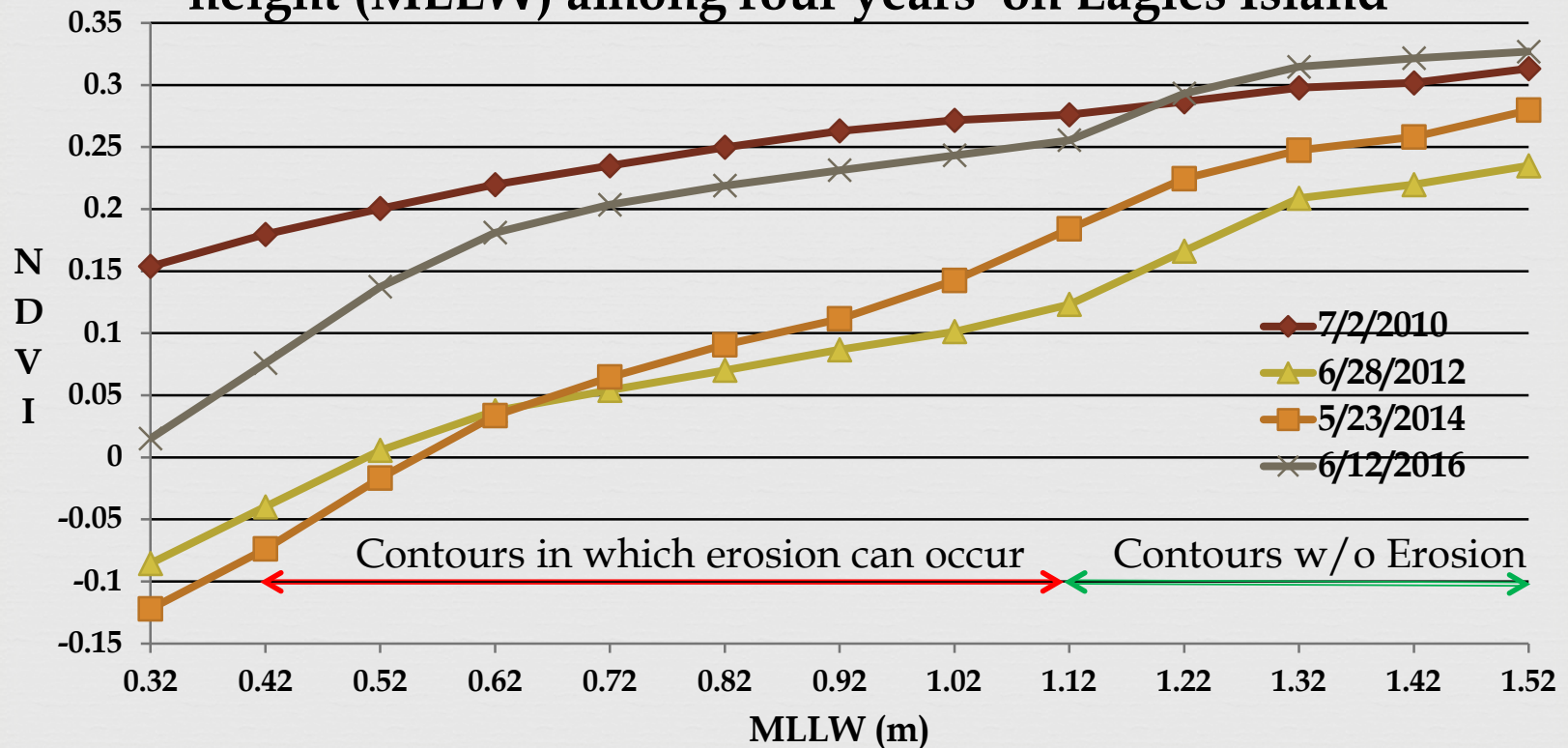


- ❧ Ho
- ❧ Single slide “What do we know?”
 - ❧ 6th erosion
- ❧ Modify space slide to show non E
 - ❧ Cpy and modify table?
- ❧ Get vol. data
- ❧ Details
 - ❧ Total area for E vs NE comparison from tables
 - ❧ Area w/i contours on EI
- ❧ SLR comparison
- ❧ Read mtg and print bsvkground
- ❧ Read paper
- ❧ Need ## on areas affected for mtg – take pp and paper

Are depth and duration of inundation affecting marsh vegetation health?

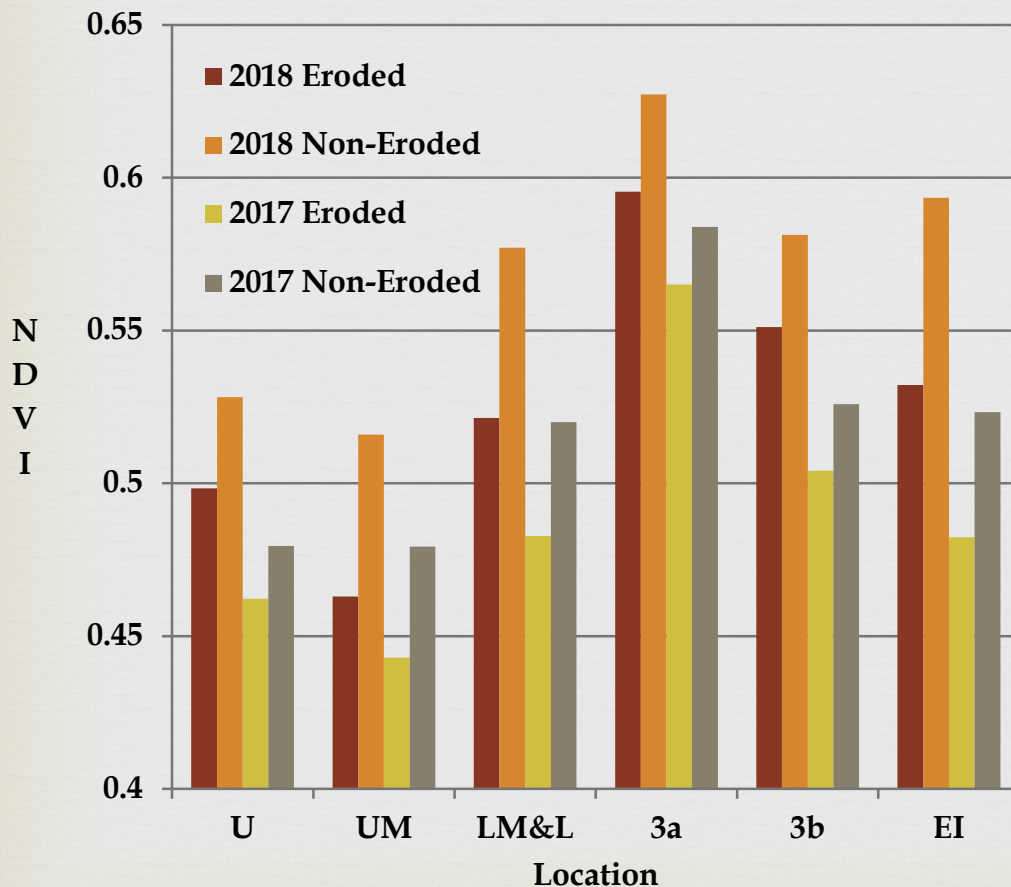


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