Spatiotemporal Patterns of Tidal Creek Expansion and Riparian Mangroves in the Southern Everglades

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Landward Creek Expansion and Coastal Encroachment: Pattern- Process Relationships

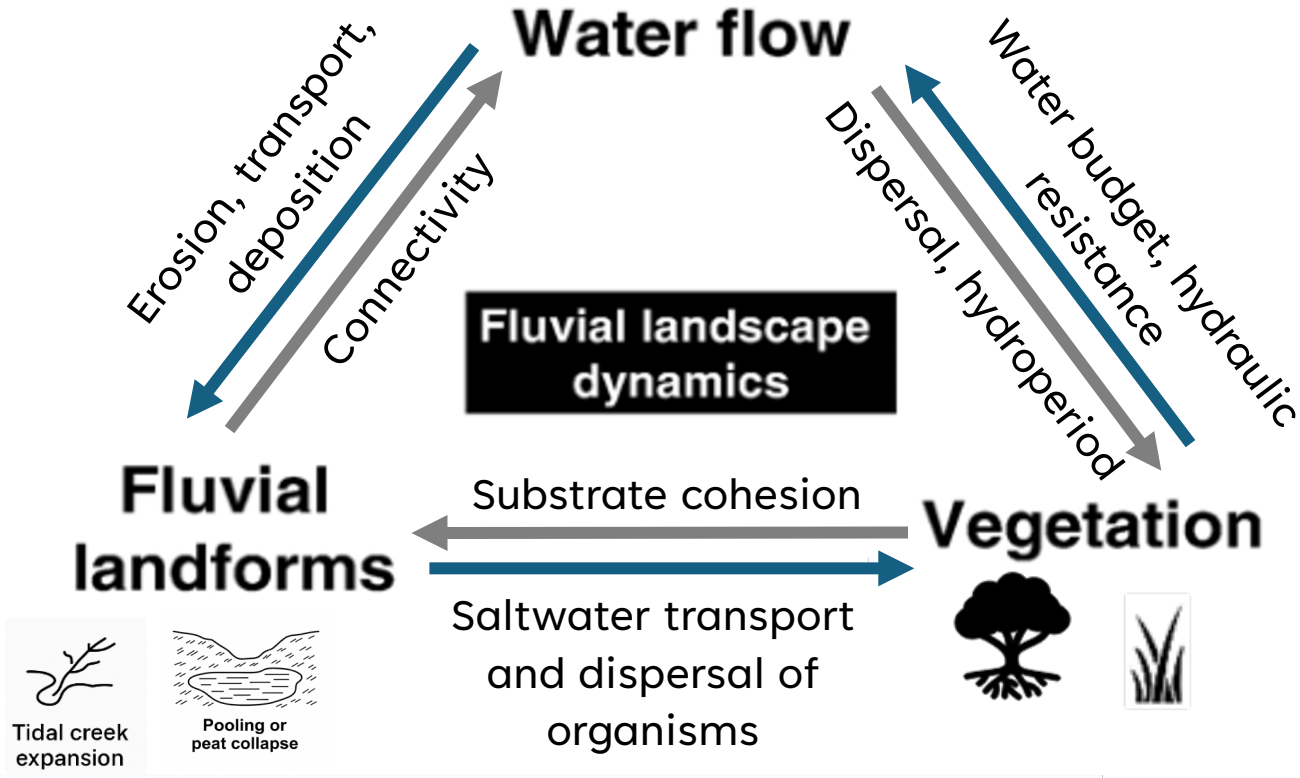
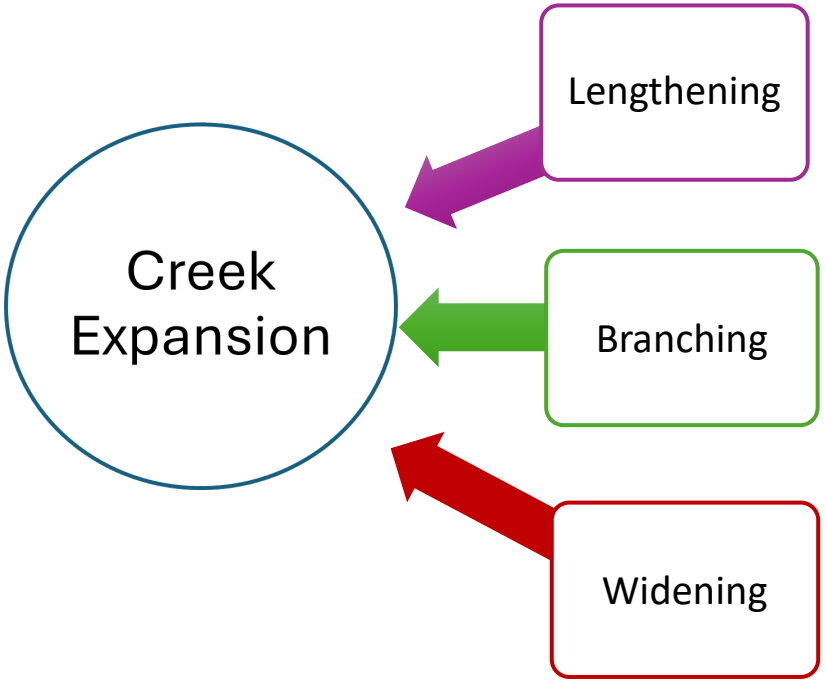
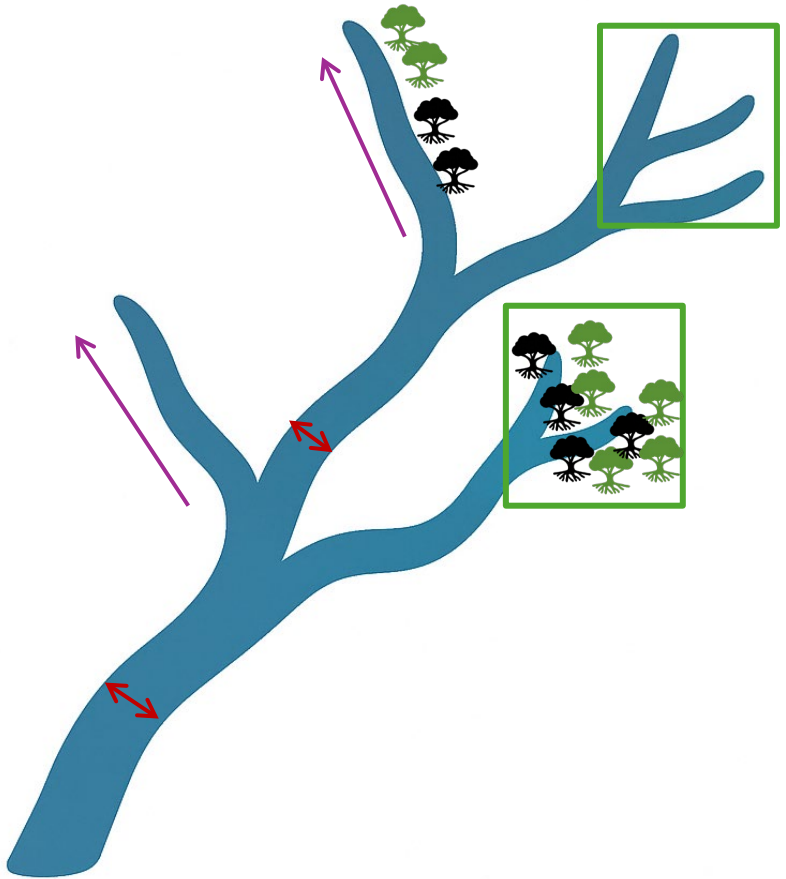


Figure adapted from Corenblit et al. 2007

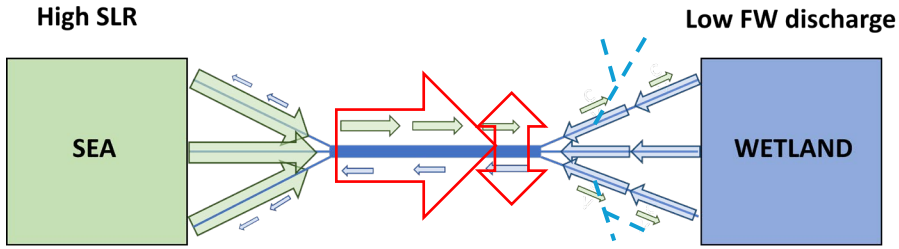
Components of Creek Expansion



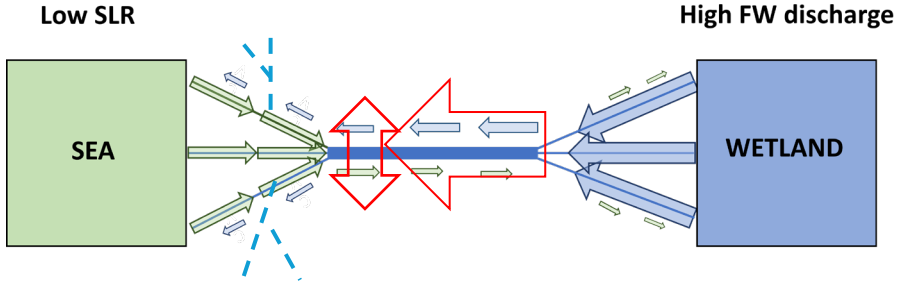


Theoretical seasonal hydrological "forces"

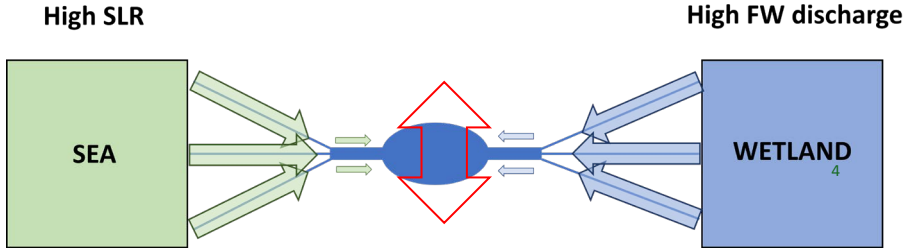
Increasing SL + Unchanged seasonal freshwater discharges



Decreasing SL + Increasing freshwater discharges

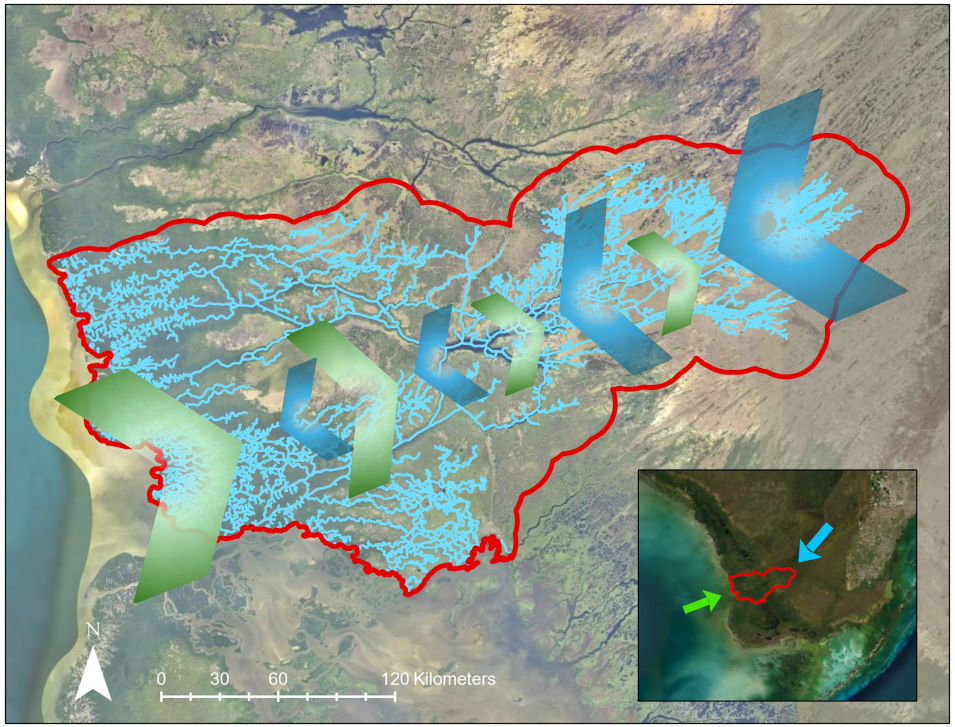


Equal SL & freshwater discharges

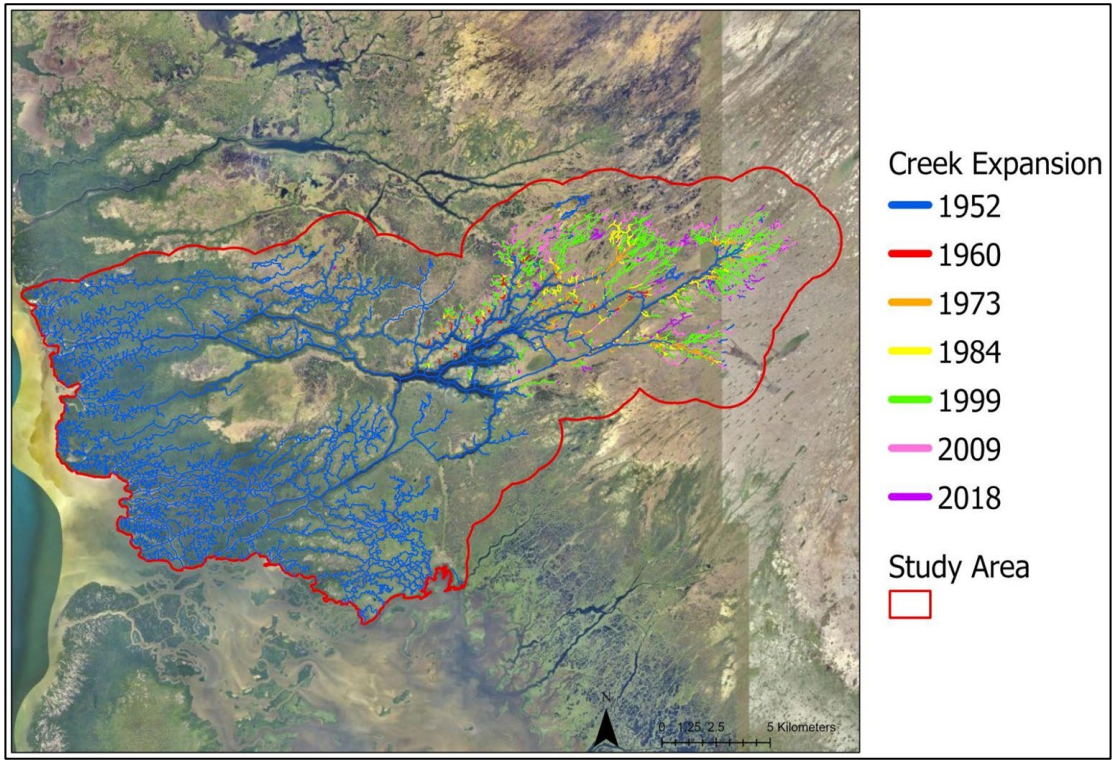


Study Area: Shark-Harney River

- 434 km^2 buffer around the creek network
- Bi-directional waterflow



Landward Creek Expansion in the Shark-Harney River



- 118 km of lengthening over 66 yrs since 1952

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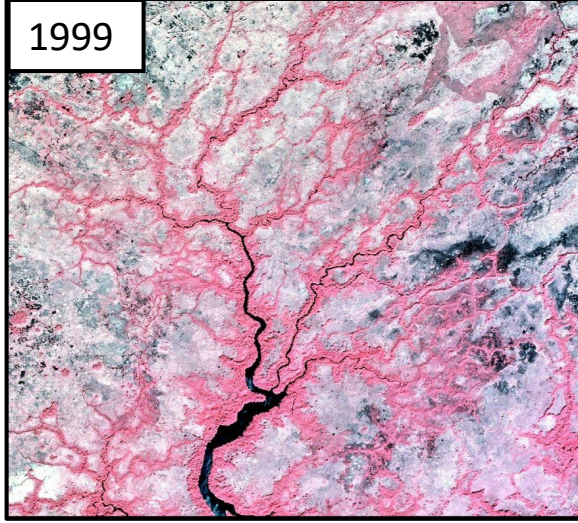
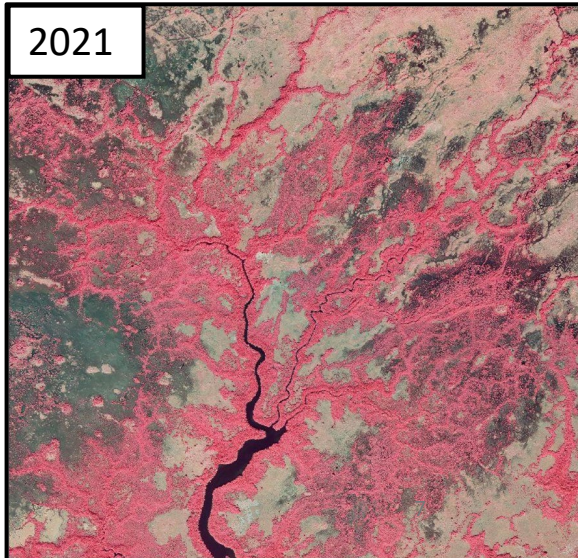
Questions and hypotheses

How do creek width and riparian mangrove cover vary across the coastal-inland gradient from 1999 to 2021 ?

H1: *Creek width will be greater near the coast and decrease inland, reflecting the magnitude of tidal influence*.

H2: *Mangrove buffer width will be greater near the coast and decrease inland, reflecting tidal-driven zonation patterns and historical establishment.*



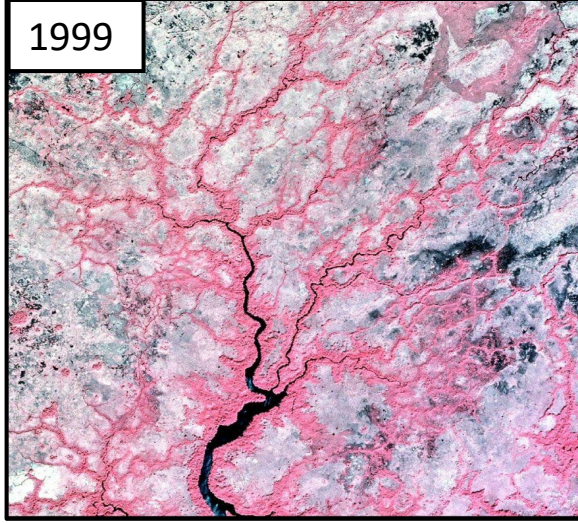


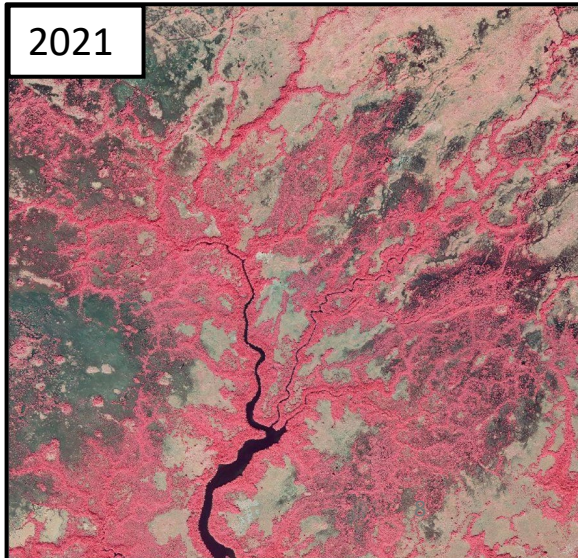
Questions and hypotheses

What are the spatial patterns of creek and mangrove change from 1999 to 2021 across this gradient?

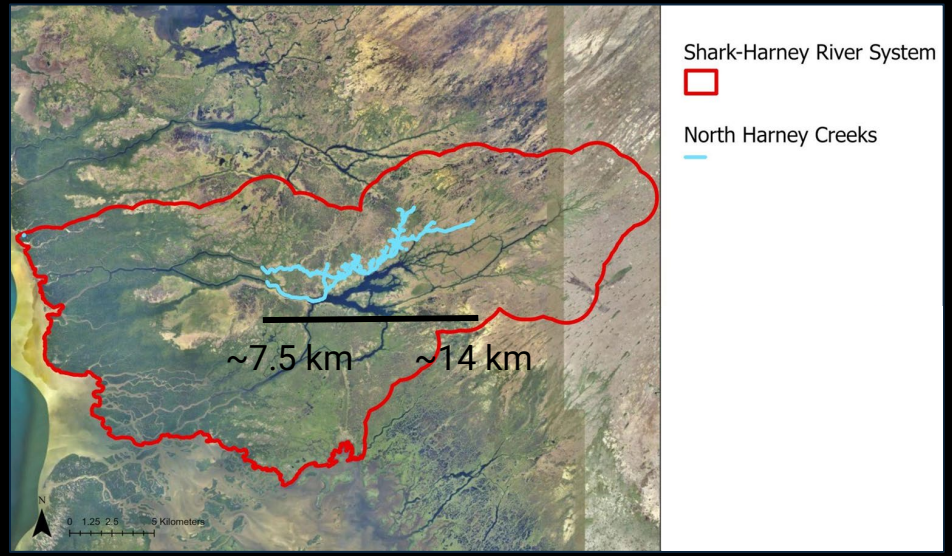
H3: *Creek widening will be more pronounced closer to the coast and diminish inland, due to reduced tidal reach*

H4*: Mangrove cover will increase across the region, with slight inland gains suggesting local dispersal or expansion into previously marsh dominated banks.*



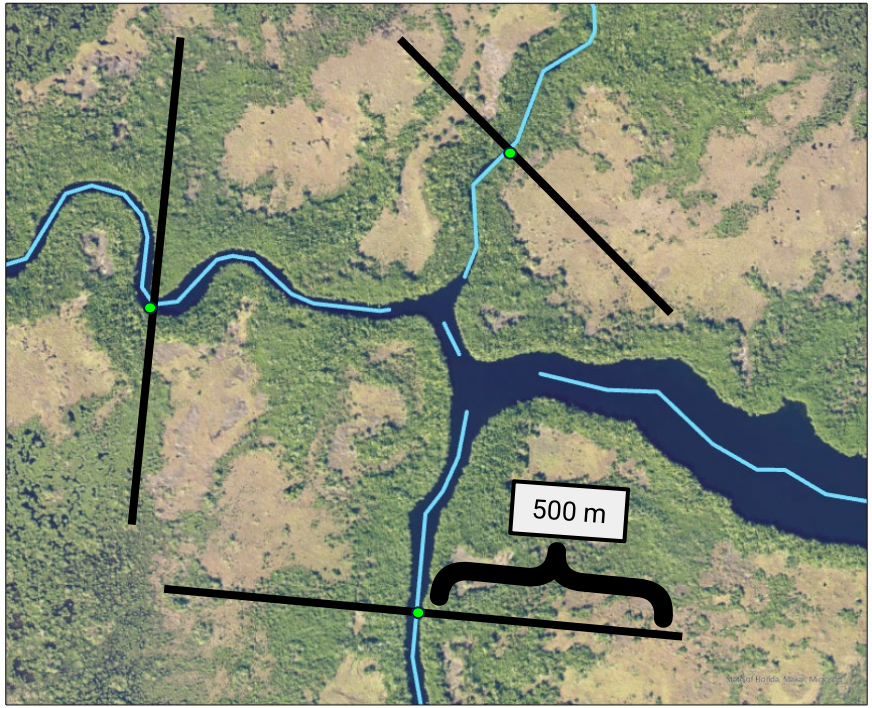


Quantifying Change in Creek Width and Riparian Mangrove Cover



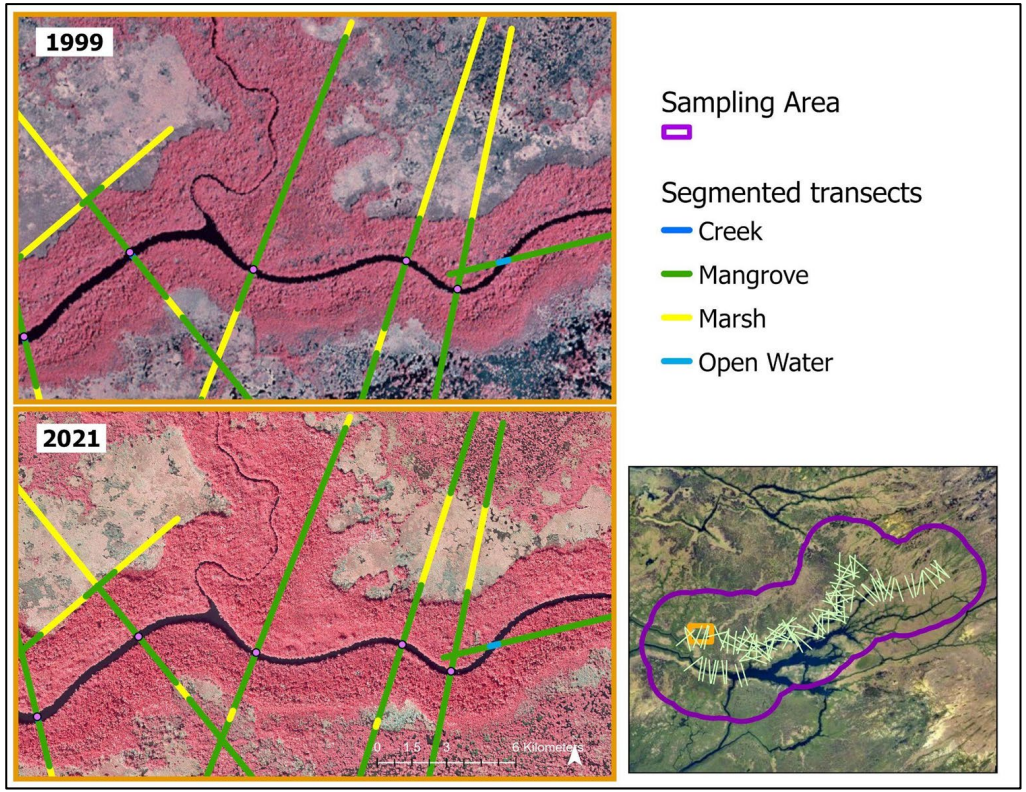
Ecotone: from mangrove to freshwater marsh communities

Methods: Perpendicular Transects



- Select **visible creeks** only
- **Clip** creeks at intersections
- **Transect Generation** in R Studio
  - Length = 1 km (500 m bi-directional)
  - Density = 4 per creek km

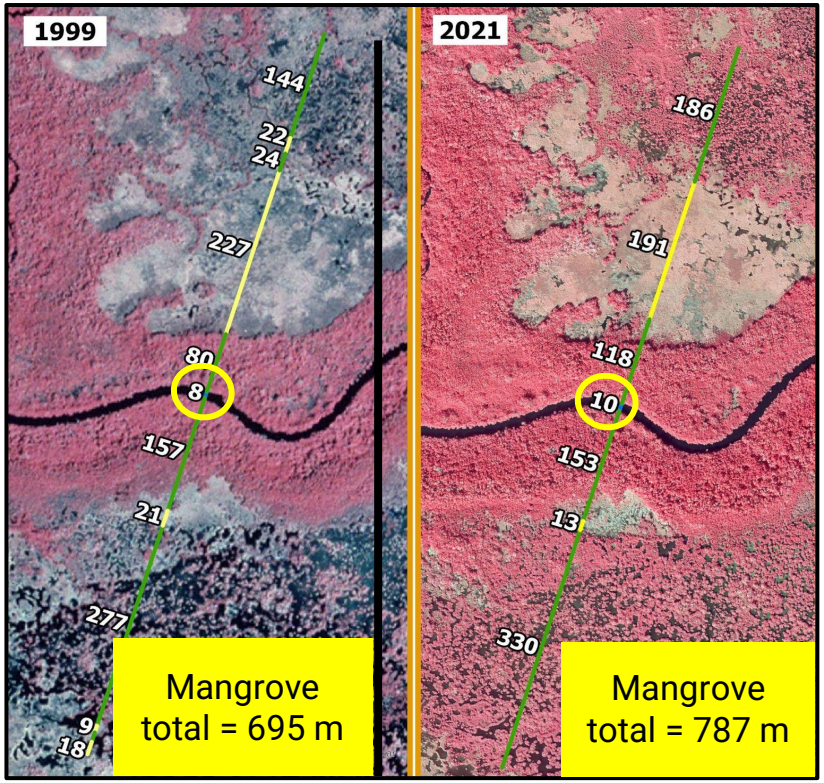
Methods: Transect Segmentation



- Create raster mosaic dataset for available ortho **aerial photography** from fdot.gov
- Clip and classify transects by **vegetation type**
- Overlay **transects** in ArcGIS Pro

ArcGIS Pro

Analysis of Change

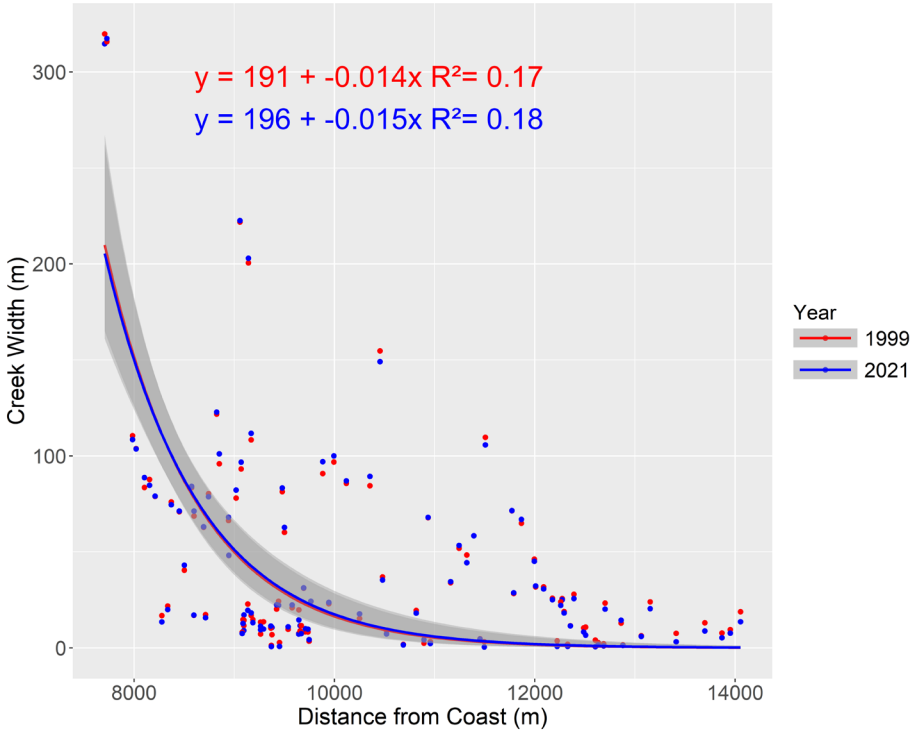


Creek Change = +2 m

Mangrove Change = +92 m

Change < 2 m not considered in analysis

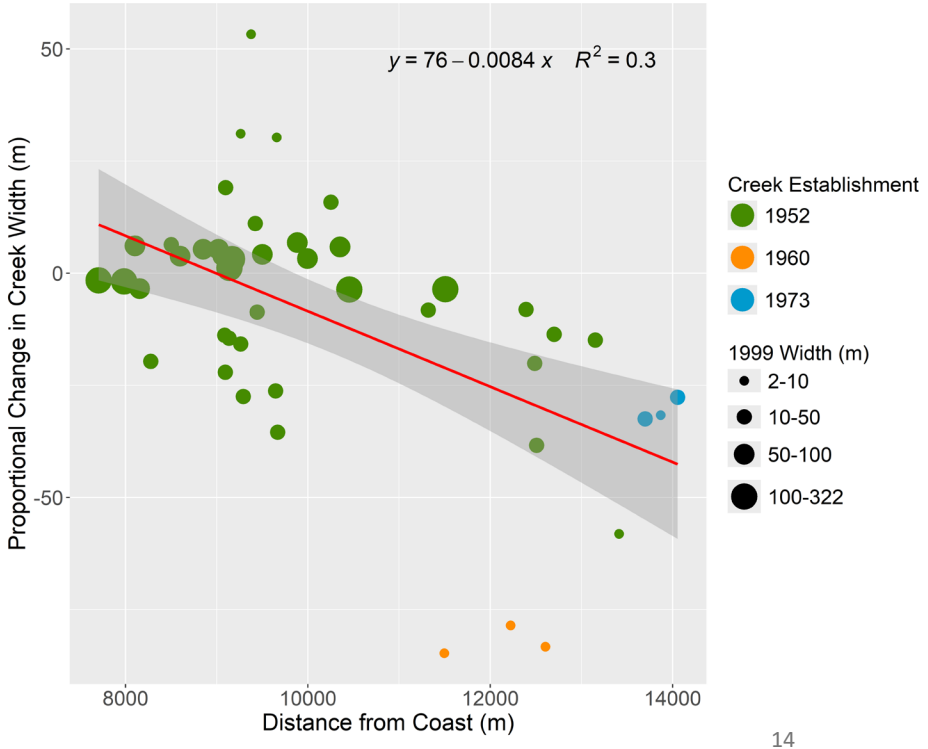
Creek Width Distribution



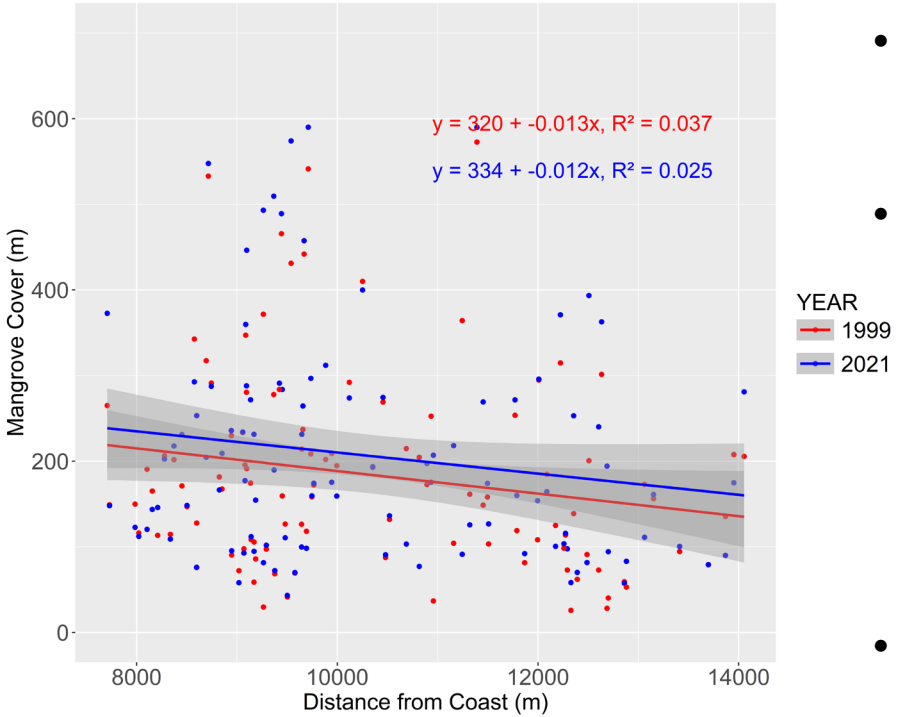
- Creek width is **greater** towards the coast and **decreases ~15%** with each kilometer moving away from the coast.
- **No significant difference** between 1999 and 2021 distribution.

Proportional Creek Width Change

- Creek width change is **positive towards** the coast and **negative away** from the coast
- Change in creek width **decreases 8.4%** per kilometer moving away from the coast



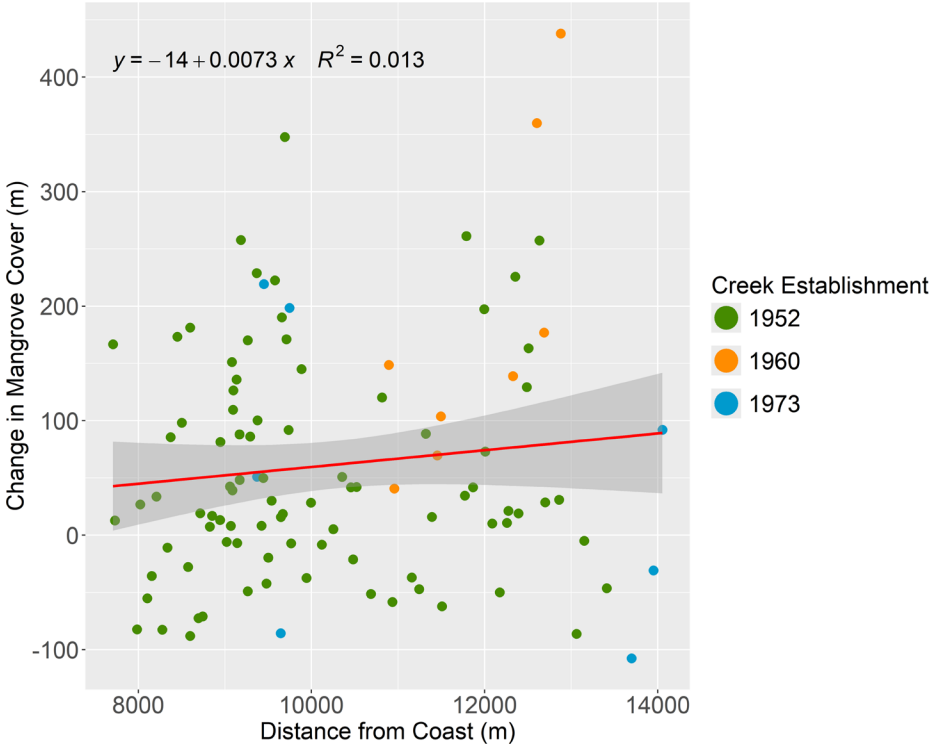
Mangrove Distribution



- All sampled creeks buffered by mangroves
- Mangrove cover is **greater** towards the coast and **decreases ~13 ± 5 m** in 1999 and **~12±4 m** in 2021 with each kilometer moving away from the coast
- Mangrove cover is **greater in 2021**.

Mangrove Change

- Change in mangrove cover is **positive** throughout the study area
- Change in mangrove cover **increases** **7.3 m** per kilometer moving away from the coast

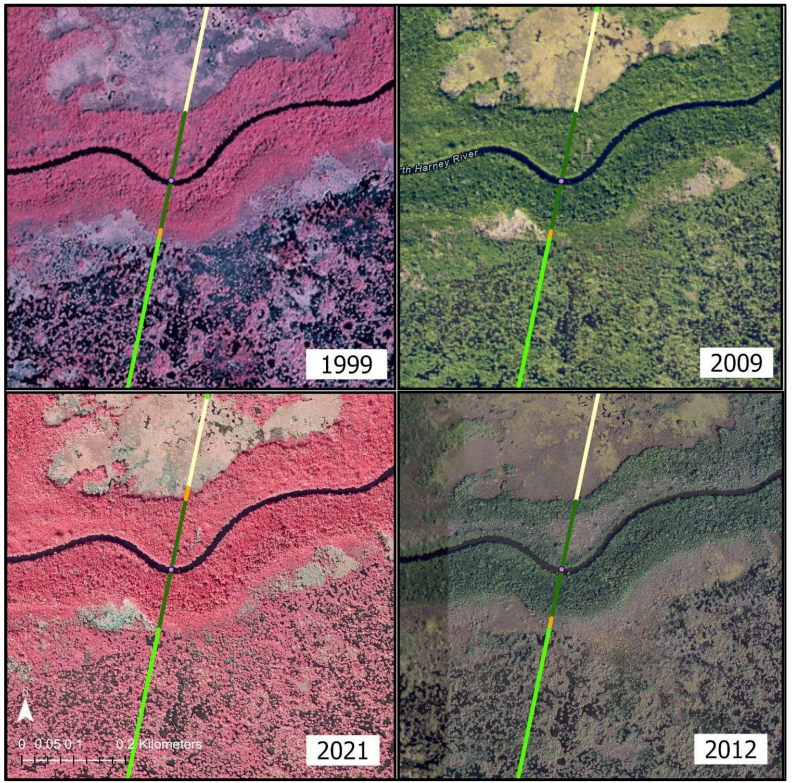


Conclusions

- Creek width and mangrove cover distributions are greater towards the coast (~7.5 km-14 km)
- Change in creek width is negative and displays a decreasing trend moving inland
- Change in mangrove cover is positive displays a slight increasing trend moving inland

Next Steps

- Increase temporal resolution and include the entire study area
- Change between classes
- Model the relationship of riparian mangrove change with all metrics of creek expansion as a function of distance from the coast.



Acknowledgements

NSF

SFCCESU

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FCE LTER

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