

Shifting Sands: The Geomorphic change at the Amelia and Cumberland Island inlet

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INTRODUCTION

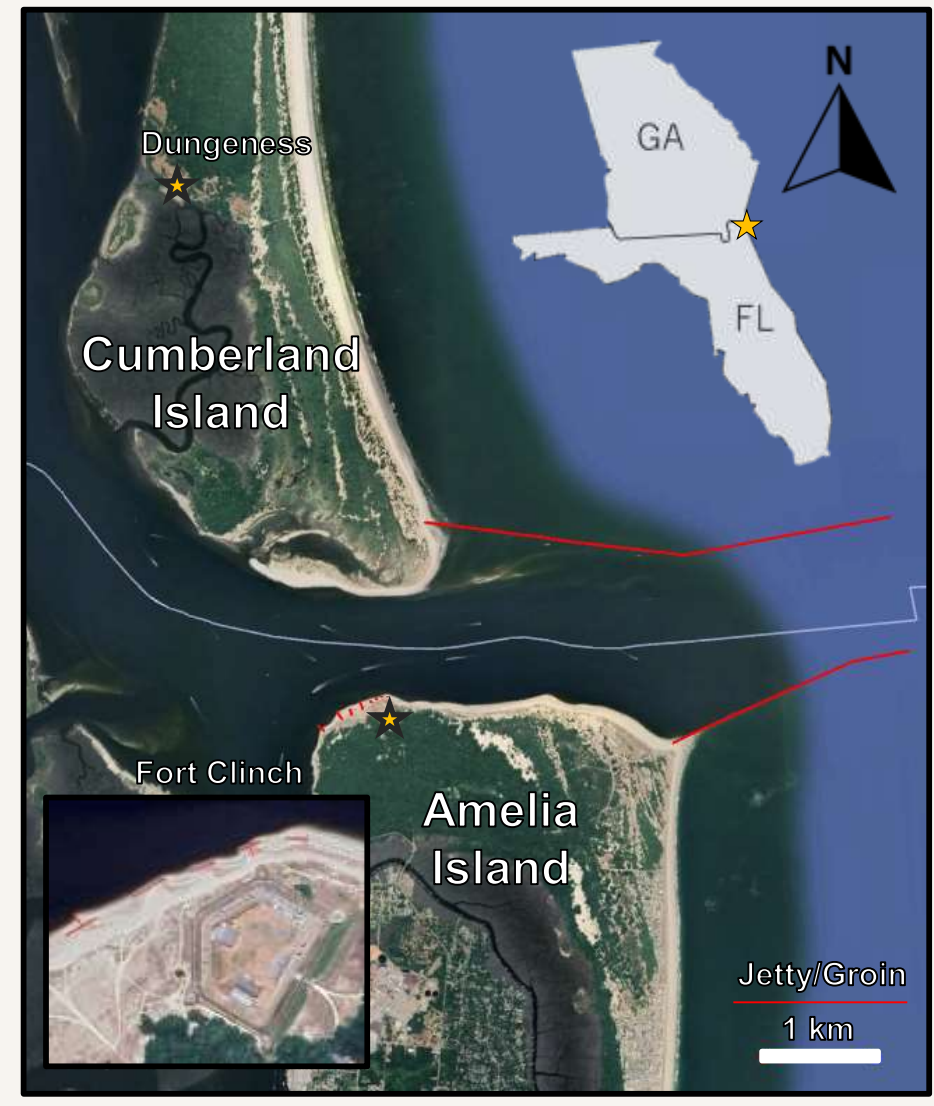


Figure 1. Satellite view Cumberland and Amelia Island (2024)

Coastal waterways and barrier islands are a critical resource to our national coastlines that are under constant change due to erosion, weather events, and sea-level rise.

Cumberland Island and Amelia Island both share the St. Marys River inlet (Figure 1), establishing the Georgia/Florida border, which is an area that serves as an important access point to the local economy and national security. This inlet is used both by cargo ships as well as naval ships and submarines, creating lots of jobs and opportunities for the local economy and its people.

This area also attracts a lot of tourism, that comes to observe the beauty of this local coastline. It is important to study the activity of this waterway and its beaches to better understand the history of the area and how to preserve it in the future.

OBJECTIVES

The objective of this study are to:

- Analyze the erosion rate on both sides of the inlet to model and predict future geomorphic changes along the adjacent island shorelines.

METHODS

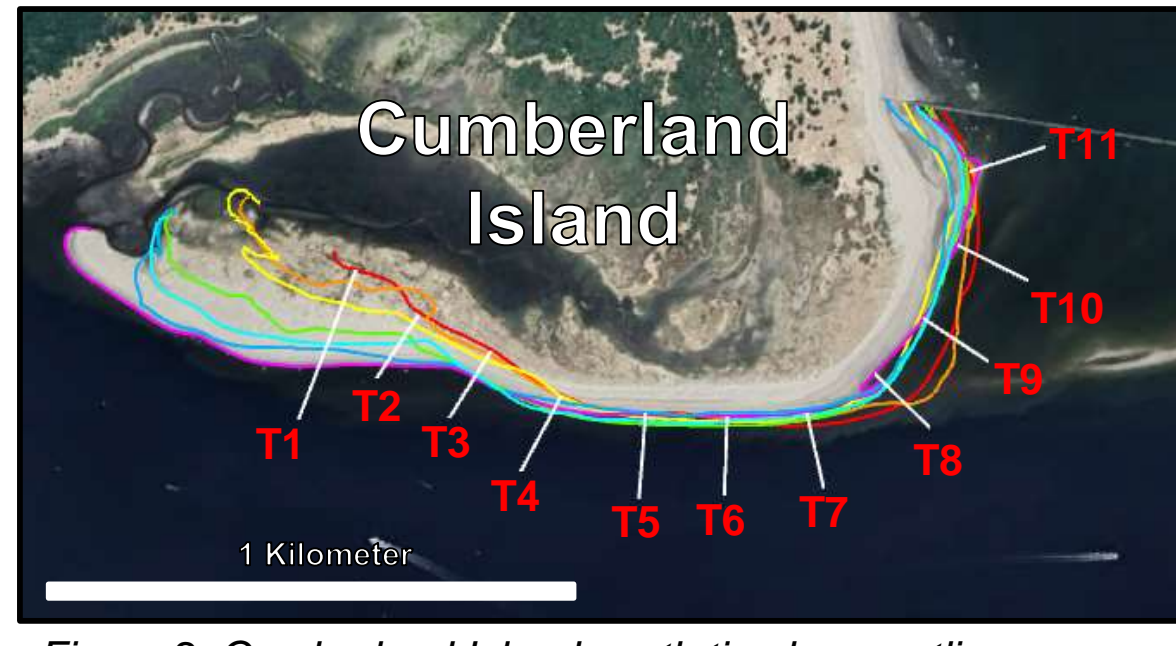


Figure 2. Cumberland Island south tip shore outlines

- 1994 Shoreline
- 1999 Shoreline
- 2004 Shoreline
- 2009 Shoreline
- 2014 Shoreline
- 2019 Shoreline
- 2024 Shoreline

- Outlined the shore once every five years from 1994 to 2024 in Google Earth Pro (Figure 2 and Figure 3).
- Measure erosion/accretion rate along each transect from 1994 to 2024 (Figure 2 and Figure 3)
- Observed local NOAA buoy (kb0201), located within the inlet, to determine ebb or flood dominance
- Calculated the coastal vulnerability index (CVI) at both ends of each island.

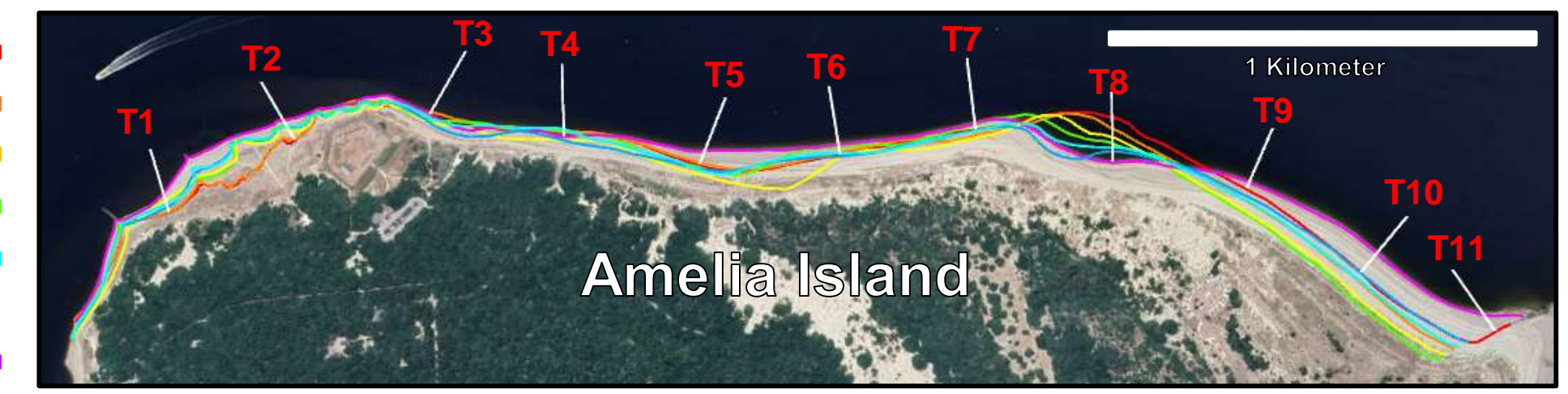


Figure 3. Amelia Island north tip shore outlines

RESULTS



Figure 4. Cumberland Island south tip future shoreline prediction

- 2024 Shoreline
- 2054 Shoreline

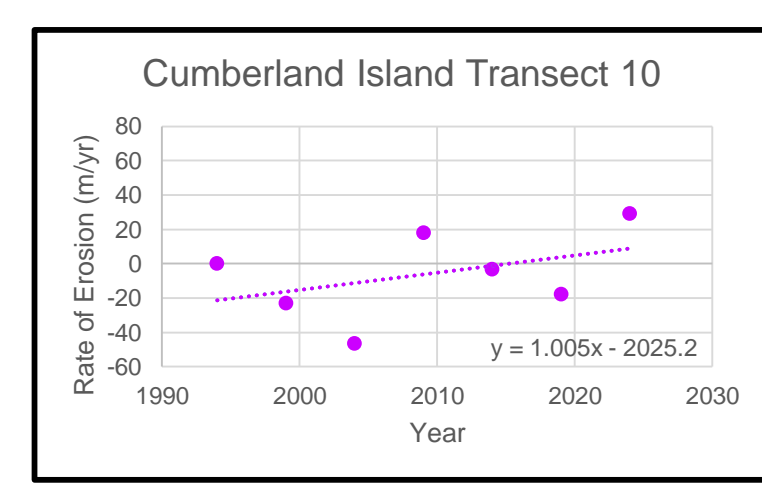


Figure 6. Cumberland Island T10 average erosion/accretion rate

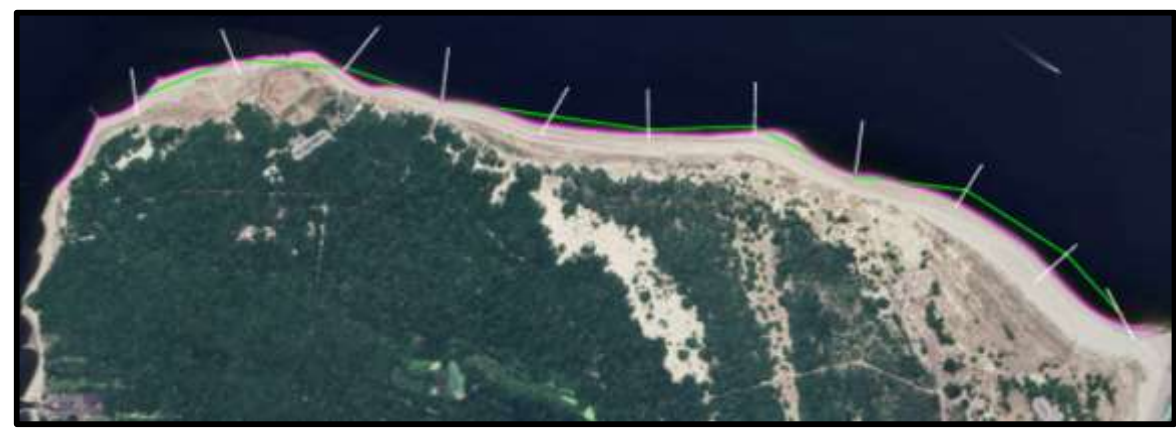


Figure 5. Amelia Island north tip future shoreline prediction

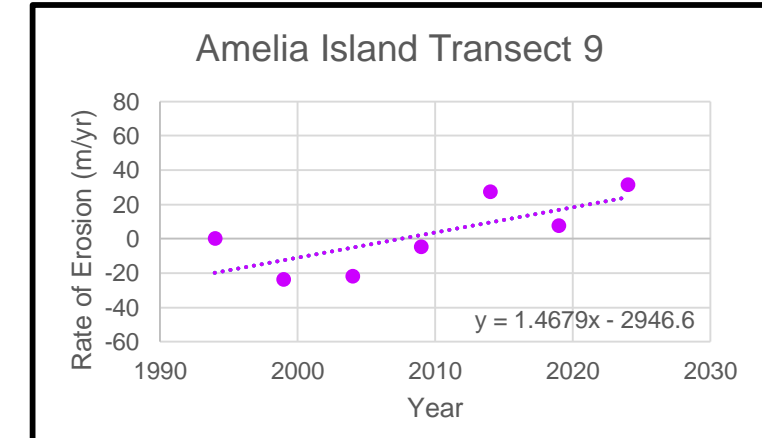


Figure 7. Amelia Island T9 average erosion/accretion rate

- Figure 4 shows accretion appearing to occur the most from transects 1-3 and 9-11. Transects 4-7 appear to stay relatively unchanged.
- Figure 5 shows overall accretion for all transects with an exception for transects 9-11, with a much higher rate of accretion.
- Table 1 and Table 2 shows that both these coastlines have characteristics that make them appear to be stable environments.
- Both Figure 6 and Figure 7 shows that the erosion rate changes frequently, going back and forth between eroding and accreting.
- From January 2025 to March 2025, the average tidal force was 0.06 knots per hour in the ebb tide direction.

| Variable | Value | Rank | Notes |
|-------------------------|------------|------|--|
| Beachwidth | 16m | 2 | 5,000m from shore |
| Coastal Slope | 0.35% | 2 | 5,000m from shore |
| Relative Sea Level Rise | 2.61 mm/yr | 3 | Station #8720030 (Fernandina Beach) & #8720218 (Mayport) |
| Erosion/accretion | +2.35 m/yr | 1 | |
| Mean Tidal Range | 1.61m | 4 | Station #8720030 (Fernandina Beach) & #8720218 (Mayport) |
| Mean Wave Height | 0.8m | 2 | Station #41112 (Fernandina Offshore) |

Table 1. South Cumberland Island CVI: 6.32 – Stable

| Variable | Value | Rank | Notes |
|-------------------------|------------|------|--|
| Beachwidth | 16m | 2 | 5,000m from shore |
| Coastal Slope | 0.219% | 1 | 5,000m from shore |
| Relative Sea Level Rise | 2.61 mm/yr | 3 | Station #8720030 (Fernandina Beach) & #8720218 (Mayport) |
| Erosion/accretion | +2.72 m/yr | 1 | |
| Mean Tidal Range | 1.61m | 4 | Station #8720030 (Fernandina Beach) & #8720218 (Mayport) |
| Mean Wave Height | 0.8m | 2 | Station #41112 (Fernandina Offshore) |

Table 2. North Amelia Island CVI: 4.47 - Stable

CONCLUSIONS

- The 30-year projection for both shorelines shows that there shouldn't be much change to the shape or size of the beaches or the inlet which is further backed by multiple CVI estimates (Table 1 and Table 2)
- Both shorelines towards the east and west sides appear to be overall accreting the most compared to the coastlines parallel to the inlet, with some exceptions (Figure 4 and Figure 5)
- Considering the inlet's significance to both the economy and national security, navigation though this body of water should not be at any risk in the near future. This is most likely due to the jetties, local tidal patterns, and routine dredging.
- This project could continue to observe the rate of erosion on these coastlines and could be expanded to integrate weather events. We hypothesize that hurricanes may have the greatest influence on the rate of erosion on a yearly basis.

ACKNOWLEDGEMENTS

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