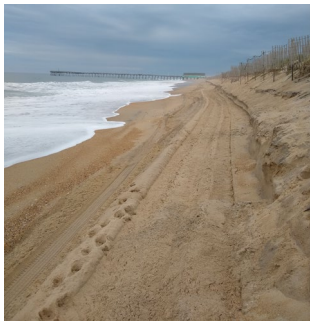
US Army Corps of Engineers®
Engineer Research and Development Center

Flood and Coastal Systems

Resilient Coastal and Estuarine Systems:
Resilience of Coastal Dunes

Need



Predictive capabilities of coastal nearshore, beach, and dune evolution are lacking on time scales of human relevance (days to decades). While episodic storm-induced erosion is reasonably well understood, the comparatively slow process of post-storm beach and dune recovery is poorly constrained. Recovery represents the aggregation of numerous small-scale sediment transport processes by both waves and winds and which occur over time scales of seconds to decades. These range of scales make measurement and prediction of recovery processes difficult, contributing to a poor understanding of expected future coastal evolution. However, understanding the natural processes contributing to foredune growth, and how coastal management activities like beach nourishments affect these natural processes, is particularly important for coastal stakeholders as dunes often serve as the first line of defense for storm-induced flooding and are therefore an important form of nature-based infrastructure. This project focuses specifically on the recovery and growth of dunes.

Approach

A combined field and numerical modeling approach is utilized to investigate how alongshore variable beach properties relate to spatio-temporal patterns in dune erosion and growth along a section of coast which was recently nourished. Dune evolution differed behind the nourishment and the adjacent, unnourished coastline.

- High-resolution mobile (CLARIS) and fixed continuously terrestrial lidar are utilized to resolve patterns in dune growth in response in the town of Duck, NC and at the FRF over a one-year period
- Numerical modeling using the coupled ***Windsurf*** framework provides insights into the physical processes contributing to alongshore variable rates of dune growth following the nourishment
- ***Windsurf*** is extended to included additional processes relevant to the field site, including moisture controls on aeolian transport

Outcomes

This work utilizes a unique site and set of conditions to understand how beach nourishment modifies dune growth. The combination of field observations and numerical modeling provides an understanding of how and why the nourishment alters dune dynamics. This provides direct answers for how beach management practices alter natural dune dynamics and contributes to Engineering with Nature initiatives. Continued development and application of the ***Windsurf*** modeling suite provides an incremental step towards a predictive model for medium-term morphologic prediction of beach and dune evolution.

Point of Contact

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