Drivers of Alongshore Varying Dune Evolution

Implications for Susceptibility to Climate Change Hazards

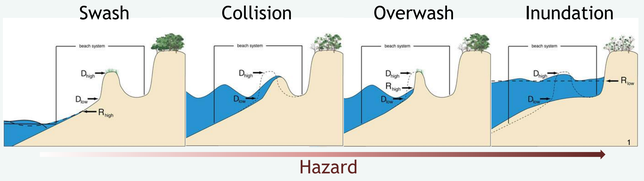
PAIGE A HOVENGA[1], KATYA JAY[2], PETER RUGGIERO[3], SALLY HACKER[2]

[1]School of Civil and Construction Engineering, [2]Department of Integrative Biology, [3]College of Earth, Ocean, and Atmospheric Sciences

BACKGROUND

The ability to predict coastal hazard vulnerability will be important for future coastal managers as changes in climate increase sea level and alter storminess. Coastal dunes help protect against destructive surge and waves during storm events. Dune height, width, and stability are affected by waves, wind, storms, and beach grass species.

The objective of this interdisciplinary research is to understand how dunes respond to storm events and recover afterward in order to assess the resiliency of natural and managed beaches. Outcomes from this research will improve the ability to forecast coastal vulnerability to extreme events.



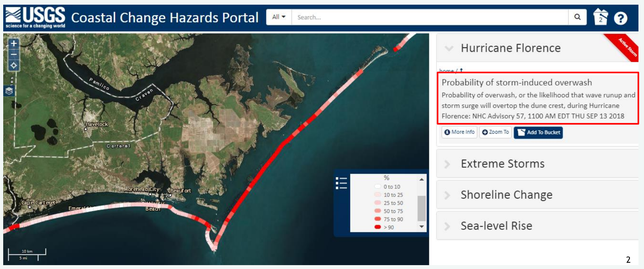


Figure 1. US Geological Survey prediction of dune overwash resulting from Hurricane Florence

STUDY AREA

Four low-lying barrier islands off the coast of North Carolina (Figure 2).

- Managed - Bogue Banks
- Unmanaged (Cape Lookout National Seashore) - Shackleford Banks, South Core Banks, North Core Banks

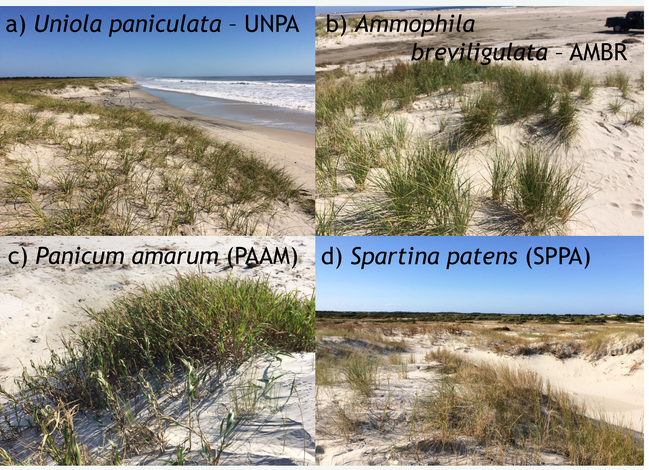


Figure 3. Native dune grasses species

[1]US Department of the Interior | USGS http://coastal.er.usgs.gov/hurricanes/impact-scale/inundation.php
[2]US Department of the Interior | USGS https://marine.usgs.gov/coastalchangehazardsportal/

Figure 2. Study domain (left to right) Bogue Banks, Shackleford Banks, South Core Banks, and North Core Banks

FIELD DATA COLLECTION

October 2016, 2017, and 2018 field campaigns

Collected the following at 77 sites along the study area…

Real Time Kinematic (RTK) GPS surveying:

- Cross-shore topographic profiles
- Along-crest topographic profiles
- Ecological quadrat

Ecological quadrat sampling:

- Percent ground cover
- Percent plant cover
- Density of beach grasses

Sand samples

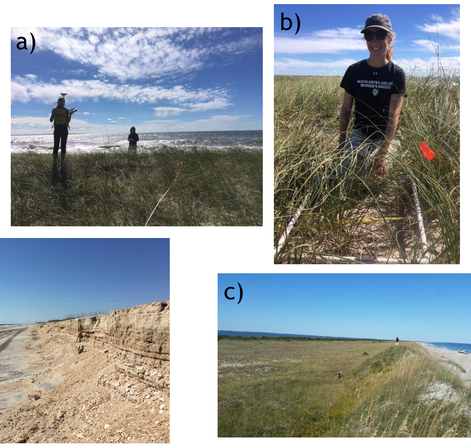


Figure 3. (a) RTK GPS surveying, (b) ecological quadrat sampling, (c) measurements being collected at dune crest and dune heel, (d) scarping caused by Hurricane Matthew 2016

RESULTS

Interested in differences along the coast and change from year to year.

- Dune: toe, crest, heel, and volume
- Shoreline position
- Density and species of beach grasses

Variability in the dune properties across the four barrier islands from 2016 to 2017.

Figure 4. (a) cross-shore elevation and ecological quadrat locations, (b) along-shore dune crest elevations, (c) dune crest histogram, (d) dune toe, crest, and heel identification, (e) coarse sand sample, (f) hummocky dune, (g) continuous dune, (h) fine sand sample

RESULTS CONT.

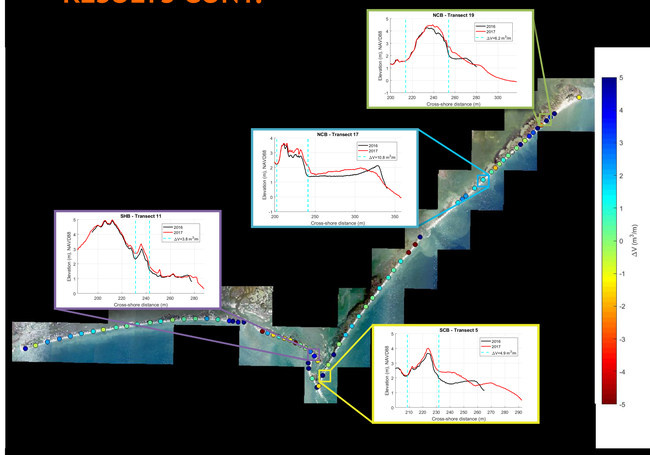


Figure 5. Dune volume change from 2016 to 2017

POST HURRICANE FLORENCE

- October 09-19, 2018

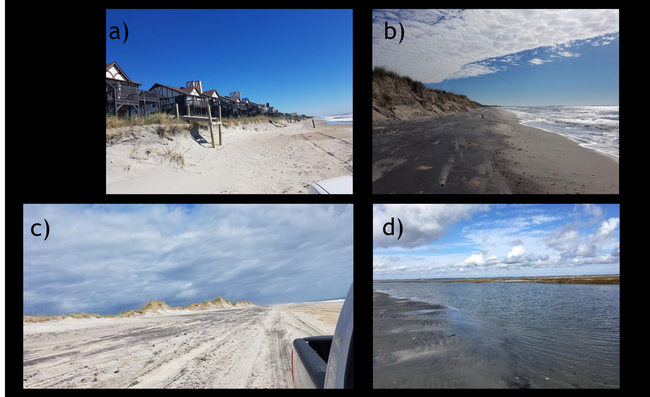
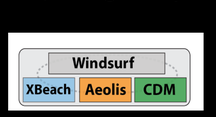
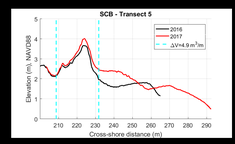


Figure 5. Dune scarping on (a) Bogue Banks (b) Shackleford Banks and (c) South Core Banks. (d) new inlet on South Core Banks

FUTURE WORK

Windsurf (numerical model) includes waves, wind, sand size, and grass species





- Simulate beach and dune evolution over a range of time scales
- Estimate alongshore variable probabilities of dune erosion, overwash, and inundation under present and possible future scenarios

Oregon State University

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