DUNE EVOLUTION AND LOCAL CLIMATE CHANGE IN ISLA SALAMANCA NATIONAL PARK, COLOMBIA

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Pye (1983) and others proposed that sediment supplied from eroding coasts may spark transgressive dune activity.

On the other hand, an abundant vegetation coverage on dunes may result in the slowing down of the advance rates of dunes, and diminishing sediment movement.
Objectives

- To understand the processes associated with dune evolution and coastal retreat in a tropical location.

- To define recent trends of rain and wind over time.

- To analyze the effect that precipitation and wind may have on dune evolution.
Study site
Rain Seasonality

Average Monthly Rainfall in Santa Marta and Barranquilla

Rainfall (mm)

Santa Marta
Baranquilla

January
February
March
April
May
June
July
August
September
October
November
December
Dune morphology
Dunes as pictured in 1953 and 2010
Dunes as pictured in 1970 and 2009

Taken by von Erffa
Port development in the Magdalena River

Photo taken by von Erffa, 2009
Coastal Changes
Dune stabilization along the study site during the last 60 years has been accelerated by changes on climatic variables such as rainfall and wind.
Monthly (rainfall) and hourly data (wind) from two weather stations located in the outskirts of the study site were analyzed through linear regression models and lowess (a non-parametric curve fitter).

The outcomes from both stations were compared and related to the ENSO phenomenon.
Rainfall findings for Santa Marta

\[ y = -11737.13 + 6.16x \]  
Eq. 1
Rainfall findings for Barranquilla

\[ y = -10533.15 + 5.74x \]  

- \[ \text{Total Annual Precipitation (mm)} \]

- Y-axis: 0 to 200, 400, 600, 800, 1000, 1200, 1400, 1600

- X-axis: 1942 to 2012

- Year
Wind trend in Santa Marta based on hourly data
ENSO and wind

Graph showing the relationship between ENSO events and wind velocity over time.
Concluding Remarks

- Higher precipitation and fewer wind events over 6 m/s have contributed to increased vegetation over the dunes.

- Inland sediment movement and dune activity were more active in the past.

- Old parabolic dunes are being truncated at the coast by erosion.

- Assessing the weight that sediment availability vs. changes in weather have had in the system needs further research.
Acknowledgments