

Beach Stabilization and Dune Restoration in Progreso, Yucatan, Mexico

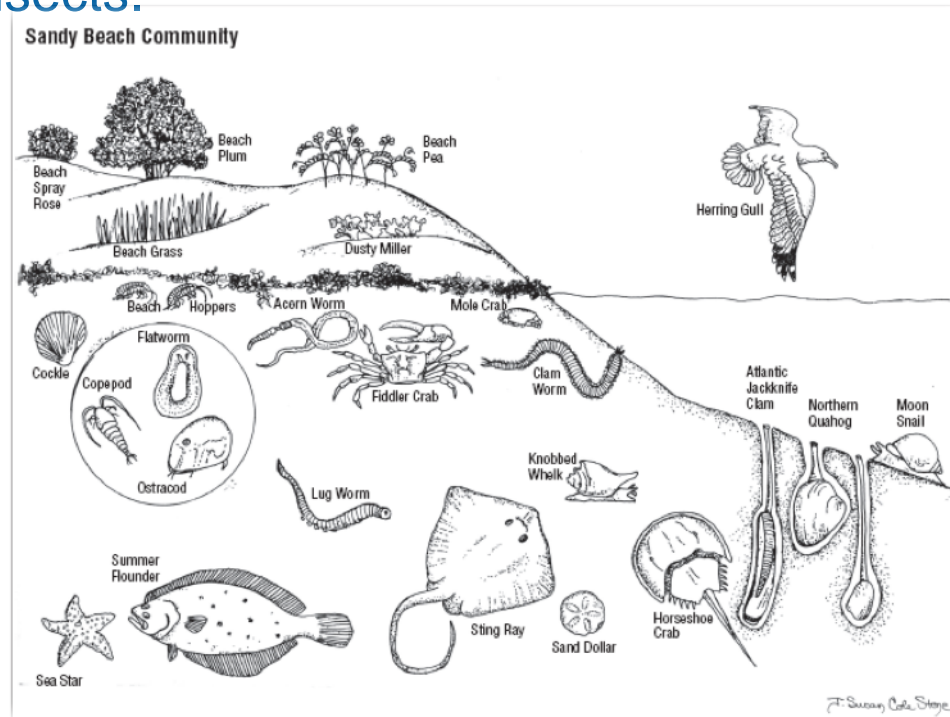


Project Team Members

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What is a Healthy Beach?

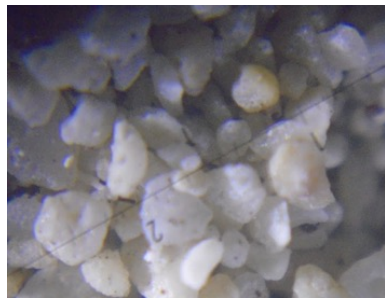
- Hundreds of species of plants and animals inhabit a healthy coastal environment.
- The coastline extends from the low tide beach to the grasslands and sand dunes.
- The primary tool in assessing the health of a beach is its ability to have a balanced erosion and accretion cycles and to support a variety of plants, invertebrates, birds and insects.



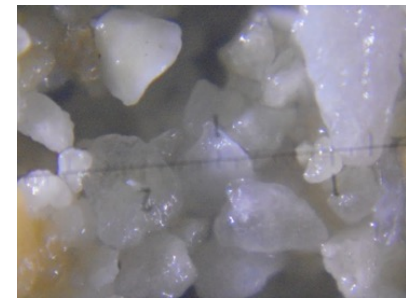
SAMARCEL BEACH STABILIZATION TREATMENT PROCESS

- Natural biodegradable proprietary polysaccharide protein biopolymers, PPBs.
- PPB formulation, SandFirst (SF) designed through laboratory testing with sand from the site.
- When the PPB SF product is applied, the natural color and texture of the sand are not altered.

without SandFirst



with SandFirst





Project Site in Progreso, Yucatan, Mexico



Figure 1. Location of the study area. T100-T400 represent the profiles measured in the Treatment zone and profiles O100-O200 and E100-E200 correspond to the West and East Control zones, respectively.



APPLICATION AND EVALUATION

- 85-m long treated beach. 1 kg of SF per meter was applied at low dosage (4 g/L) over a 6-month period.
- Evaluated changes in Treatment zone and two Control zones (evolution of the coastline and sediment volumes) using 136 profiles and a linear regression analysis of the data.
- Evaluated the changes in sediment volumes for a section of the profile corresponding to 30 meters (approximately 10 m of dry beach and 20 m of submerged beach) bounded between the levels +1.0m to -1.5m was selected.
- Determined if there were differences in the sediment balance between Treatment and Controls. An analysis of variance was also performed.

Treatment Application





Dune Restoration



Reclaimed windblown sand



Native plant species placement, sand fence installation and application of the PPB SandFirst for dune stabilization

Profile Evolution



August 5, 2016



August 20, 2016



September 6, 2016



Bathymetry- Sept. 10, 2016

Profile Evolution



Sea turtle, Sept. 10, 2016



Application - Sept. 12, 2016



October 18, 2016



After a storm, Oct. 31, 2016

Profile Evolution



November 16, 2016

Control West - Nov. 16, 2016



February 4, 2017

Control West- February 4, 2017



Evolution of the Coastline

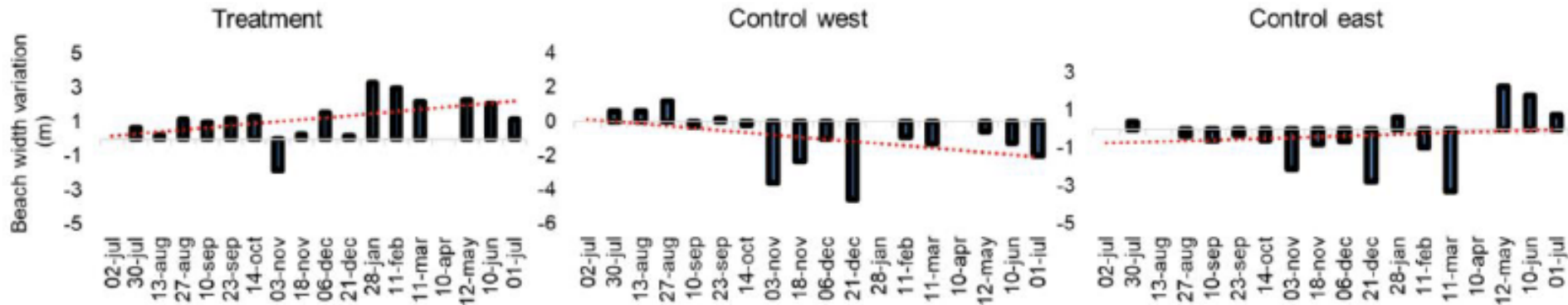
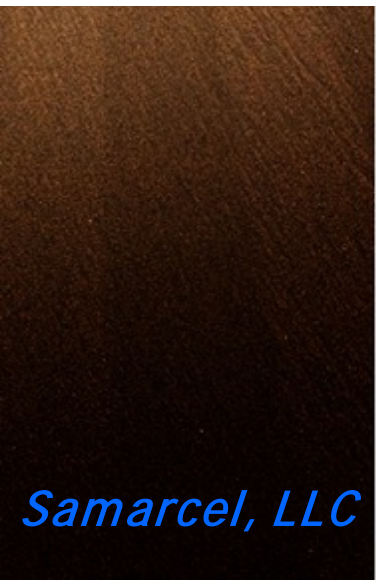


Figure 5. Time series of the coastline in the Treatment zone and the Control zones





Sand Volume Variations

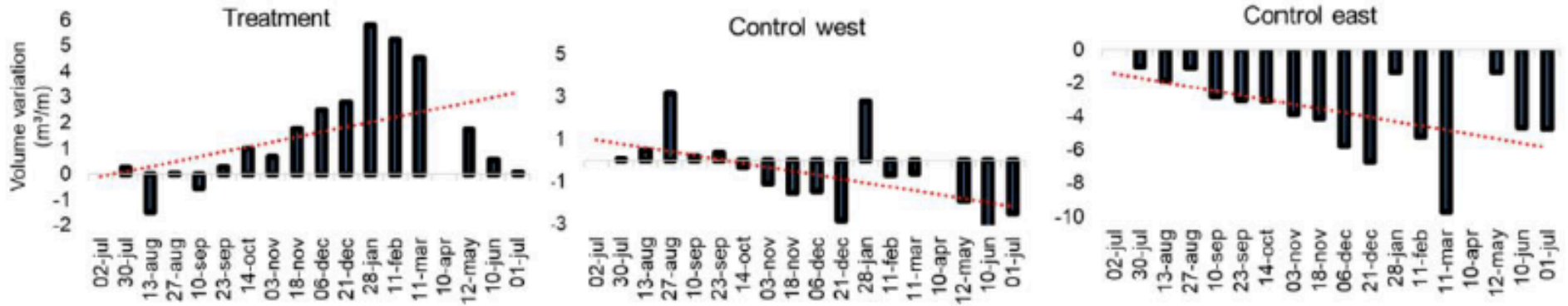
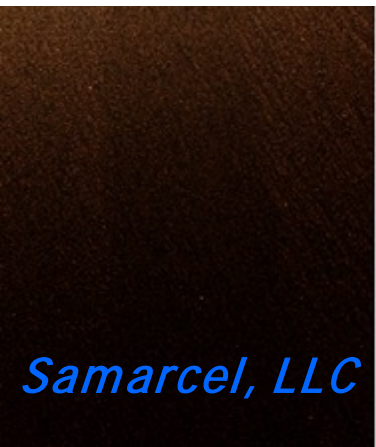


Figure 7. Average variation of the sand volume, and tendency (red line) in the Treatment zone and in the Control zones



Profile Evolution



March 11, 2017



Control West- March 11, 2017

Control East- March 11, 2017

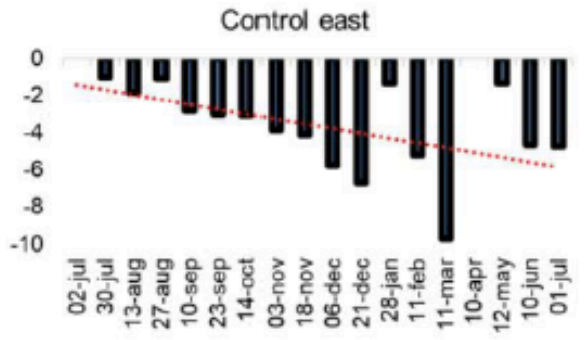
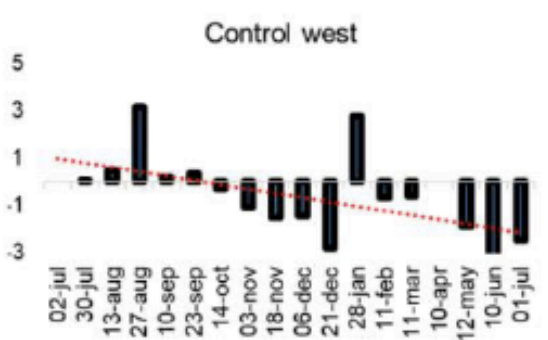
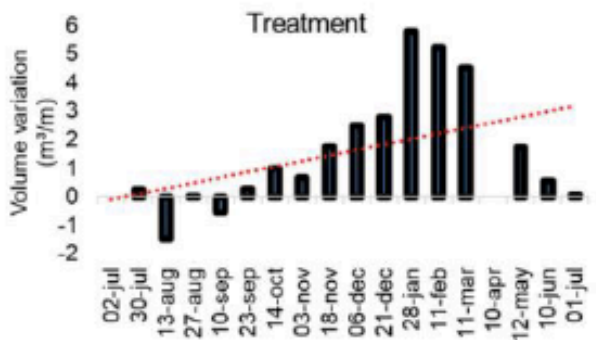


Figure 7. Average variation of the sand volume, and tendency (red line) in the Treatment zone and in the Control zones

Profile Evolution



Major Storm: May 4, 2017



Major Storm: June 10, 2017

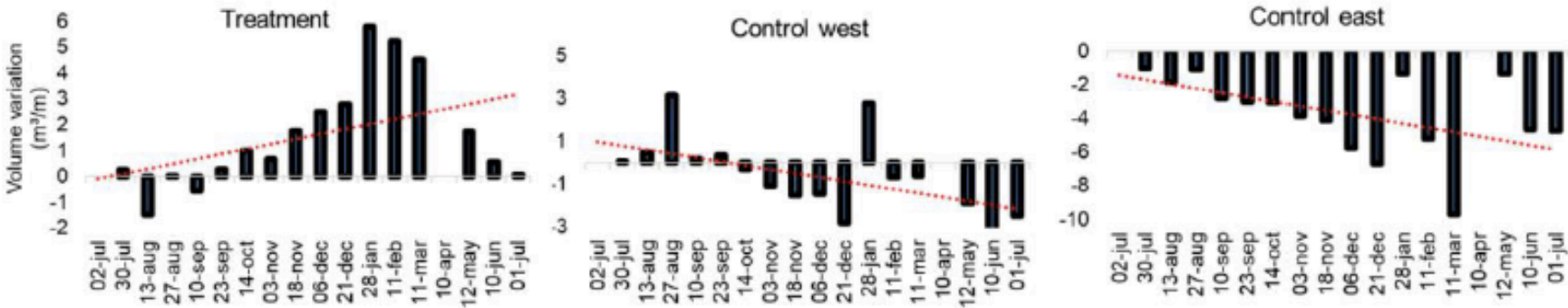


Figure 7. Average variation of the sand volume, and tendency (red line) in the Treatment zone and in the Control zones

Dune Condition Following Storm



A severe storm affected the Yucatan coast on May 4th, 2017. The dune demonstrated its importance by preventing an inundation of the premises.

Profile Evolution



February 26, 2018



April 23, 2018

Project Results

- In the Treatment zone, the sediment balance (erosion/accretion rate) was stable between the supralittoral and sublittoral areas ($0.06 \text{ m}^3/\text{m}$), while in the Control zones it had an average negative balance of $-4.04 \text{ m}^3/\text{m}$.
- The coastline in the Treatment zone shows a tendency to expand seaward. The Controls regressed.
- Our findings suggests that the treatment is a suitable method for increasing beach resilience and may be used to complement beach renourishment projects.
- The sand dune restoration was successful. Dune vegetation was enhanced by the PPB treatment.





Commitment to WODA Statement

- The project increases energy efficiency by making renourishment projects more effective through enhanced sand retention and dune restoration.
- The project created a carbon sink through the restoration of the beach dune by reclaiming windblown sand and planting native species.
- The project enhanced beach resilience by increasing beach width and yielding a positive net sediment balance.



Commitment to WODA Statement

- Restoration of the dune created new habitat (275 m²) that provided protection to some invertebrate species.
- The PPB treatment and sand dune and fence design/location did not impede the nesting of sea turtles as three successful nestings and hatchings were observed on the beach during the project.
- Well informed approach that makes appropriate use of surveying, monitoring and adaptive management.



Thank You!

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