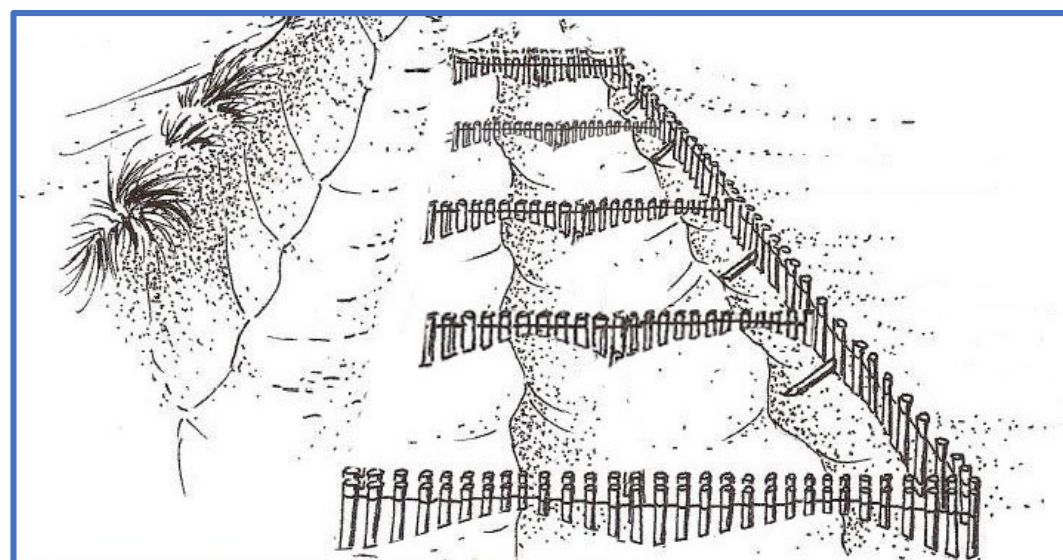


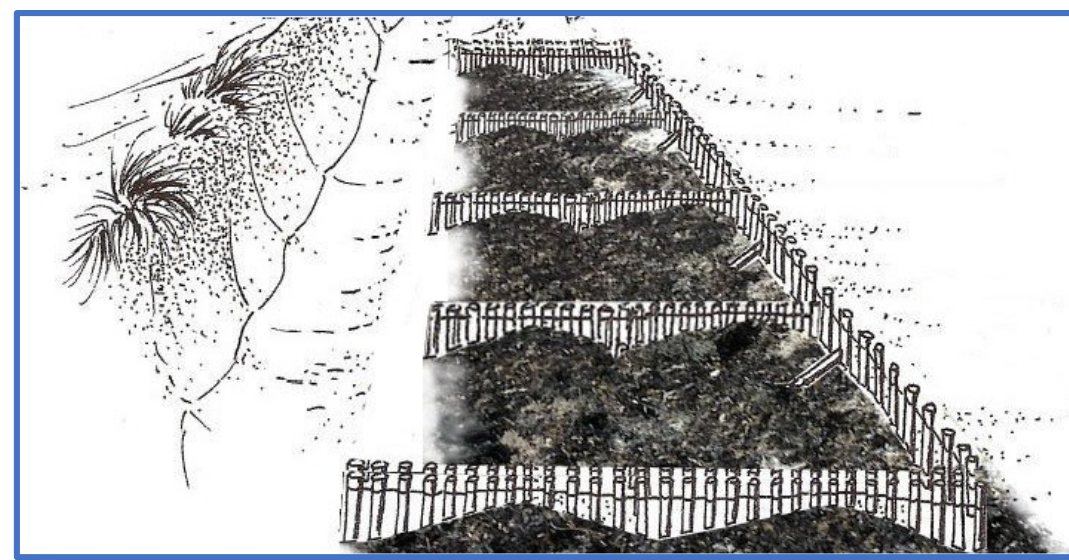
Shorelines are the locus of significant and diverse economic activity as well as ecosystem services and conservation interest. At a time of global climate change and sea level rise, the type of management being implemented has direct influence on the future of the shoreline and its resources. Several approaches can be taken, but in practical terms, the overwhelming response has been, and continues to be, to armour or nourish the shoreline and prevent it moving. This removes the shoreline's natural resilience, damages the coastal ecosystem and the resources it provides, and has a direct economic cost (in design, construction and maintenance) and indirect costs (through its impact on recreation, scenic quality, tourism potential and several other economic activities).

AlgoBox Concept

In order to gain maximum profit from the aeolian transport potential and from the nutrient release generated by wrack decomposition (which may facilitate plant growth and sediment fixing), we proposed an experimental tool, the “AlgoBox”, which consists in sand-trapping fence cases filled by algae wrack after partial aeolian sand deposition. The fixing of sand in the “AlgoBox” by vegetation colonization is facilitated by the nutrients released by wrack decomposition during spring and summer seasons (Sedrati and Cochet, 2015).



Sand-trapping fences cases



Sand-trapping fences filled by algae AlgoBox®

Experimental site



The coast of south Brittany in France is subject to severe erosion. This coast is characterized mainly by seacliffs and headland embayed and pocket beaches with a “low- tide-terrace” active morphology. Wrack deposits (macroalgae: mainly *Soleiria Chordalis*) also form significant seasonal accumulations on the beaches, thus impacting their morphology and ecosystem. Because of the absence of sediment stocks that could be used for beach nourishment, shoreline management has had recourse, thus far, to “hard” engineering techniques to hold the coastline. The use of “soft” engineering techniques to protect dunes and beaches in south Brittany has been limited to the implementation of sand fences on the dunes to limit human access to these fragile systems. The aeolian sediment transport potential, with a relative abundance of onshore winds on this coast, has unfortunately been under-exploited. Experimentation of the AlgoBox tool took place on Penvins beach SW of Suscinio Bay. This beach is subject to regular red algae wrack (between 2000 to 4000 m³ per year).

AlgoBox implementation

59 non closed boxes (Open Algobox) and 2 closed boxes (reinforced Algobox) were installed along 400 m of eroded shoreline at Penvins beach in July 2014.

This ecological engineering system (61 AlgoBox) installed on Penvins beach – Suscinio Bay of cost **13.000 euros**.

The relatively windy summer period at Suscinio Bay has favored aeolian sediment accumulation in the AlgoBox®. The aeolian sediment infill in the Algobox was from one AlgoBox to another depending on its size and exposure to the wind. The AlgoBox® were filled once in October 2014 (after the first red algae wrack) by a height of about 40 cm of algae (mostly *Solieria chordalis*). Between 12 m³ for the reinforced Algobox and 4.5 m³ for the open algae Algobox were deposited in each Algobox. Three AlgoBoxe were not filled with algae to act as a control space (Witness Algobox).

High frequency monitoring protocol of a series of parameters has been set up. This protocol includes monitoring of beach topographic profiles, algae degradation and vegetation/floral colonization. Data from field measurements were analyzed within weather-marine context (wave, tide, rain falls and wind parameters).



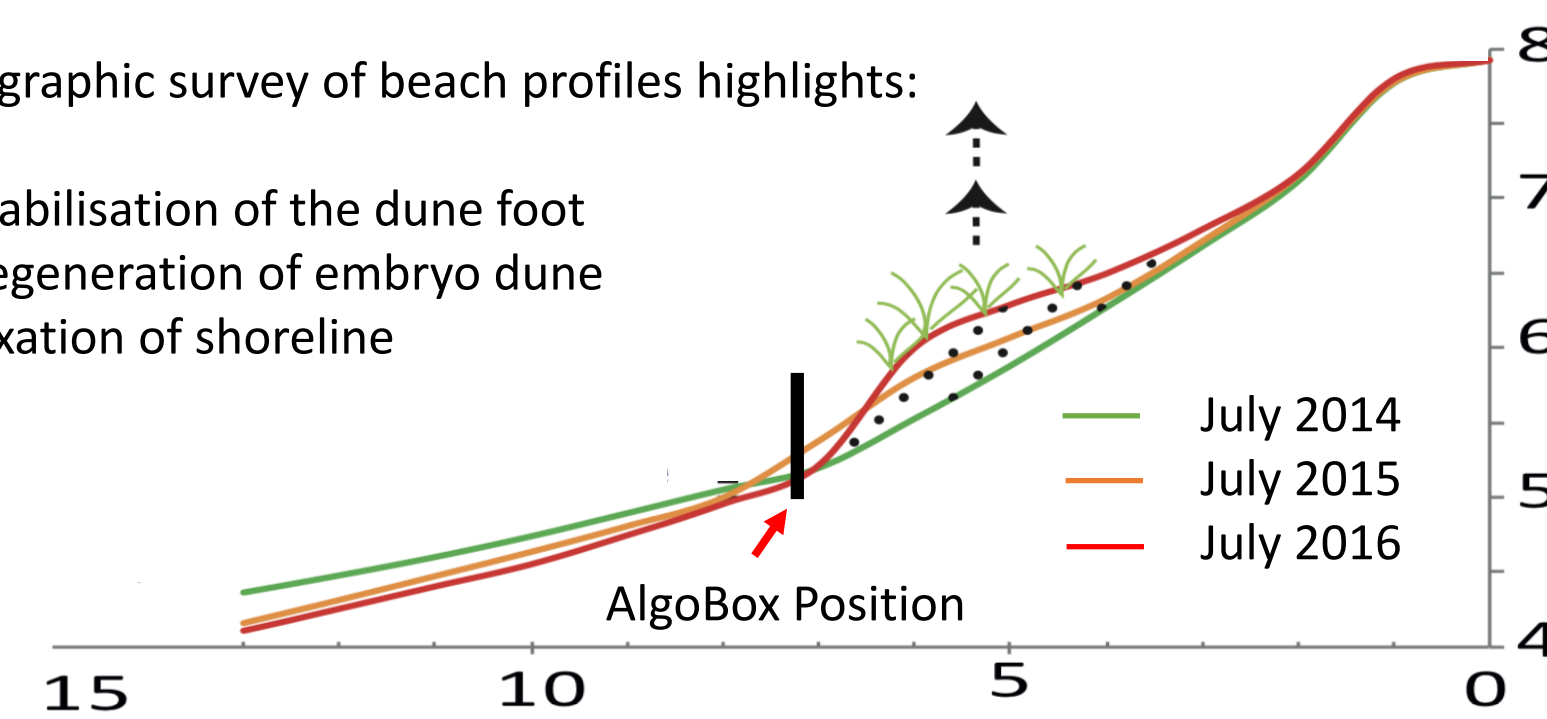
Series of photos showing: (A) initial state of the beach, (B) AlgoBox, (C) AlgoBox implementation, (D & E) AlgoBox filling by red algae.

AlgoBox Survey



Topographic survey of beach profiles highlights:

- Stabilisation of the dune foot
- Regeneration of embryo dune
- Fixation of shoreline



Vegetation and floral species richness was multiplied by 4 => for a total of 33 species

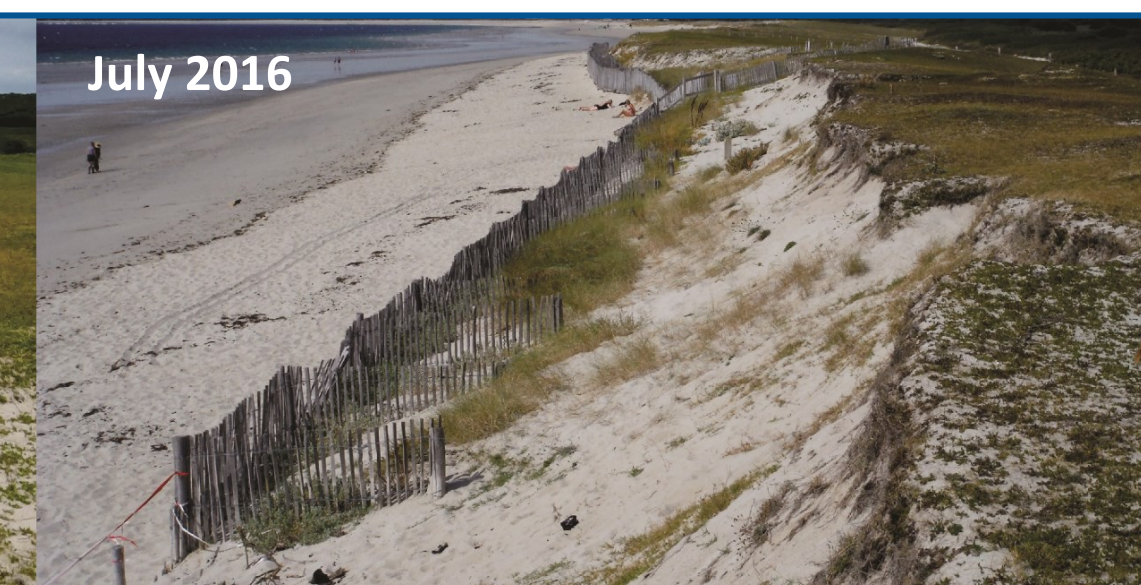
Increase of the vegetated area (70% in AlgoBox filled with algae against 20% in witnesses AlgoBox – not filled with algae)



Significant resistance of the system to high energy conditions (storm during spring tide from January 12 to 13, 2015)

AlgoBox Efficiency

AlgoBoxs® allowed partial fattening and stabilization of the dune foot of the experimental area. They also favored the colonization of this sector with the multiplication of its floral specific richness. With the positive results of this experiment, two new beaches in Southern Brittany were equipped with AlgoBox. A new beach in the island of Martinique (Caraibes) subject to massive strandings of red algae will also be equipped very soon by adapted AlgoBox.



Three photos showing the evolution of the experimental site.

Penvins Beach
Suscinio Bay