Initial development of an artificial dune

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1. INTRODUCTION

During strong wind conditions, the local Spinoladijk is blocked due to wind-blown sand. However, this Spinoladijk is an important access road to a leisure beach club and cleaning this dike is a labour-intensive, expensive, and unsustainable work. A dune-in-front-of-a-dike solution was implemented to mitigate this sand nuisance. By creating an artificial dune seawards of the seawall, the traditional sea dike is strengthened with the aid of a nature-based solution. Benefits are a higher level of coastal safety and at the same time a more natural vision and higher ecological and socio-economical values. There are still some knowledge gaps in arranging such solutions (Rizvi and Riel 2020). In this study, we want to identify how these plants must be arranged and especially to define the optimal plant density to protect the dike from sand nuisance.

2. METHODS

A new engineered dune was built at Ostend Oosteroever, Belgium to find out how dunes can be deployed as a coastal protection measurement by using a dune-in-front-of-dike concept. A dune of 2400m² was divided in six zones (1-6) of 20x20m² each with a different planting strategy (regular, clustered and staggered) and density (6, 9 and 15 plants/m²) (Figure 1A). By monthly monitoring the topographical changes with drone surveys combined with weekly measurements on 12 cross-shore profiles (two per zone), conducting aeolian transport measurements and simultaneously measuring wind conditions, the effect of density and planting strategy during the initial months (January-April 2021) of dune development is studied.

3. RESULTS

Results show a clear difference in cross-shore profile development for the different zones (figure 1b), in which the influence of the density is much more prominent than the pattern. Deposition occurs higher and over a shorter distance with increasing density. Sand accumulates on the seawards side of the dune and goes landwards once the vegetation is saturated. At the end of April, zone 4 (9 plants/m² staggered) had the most growing potential (no deposition across the last 2.50m in landward direction). The overall volume of sand accumulated in the dune area is increasing in time and is independent of density and planting strategy, hence completely governed by the aeolian sand supply from the beach. The largest volume change corresponds to the strongest wind conditions (6-8m³/m dune growth at the end of April).

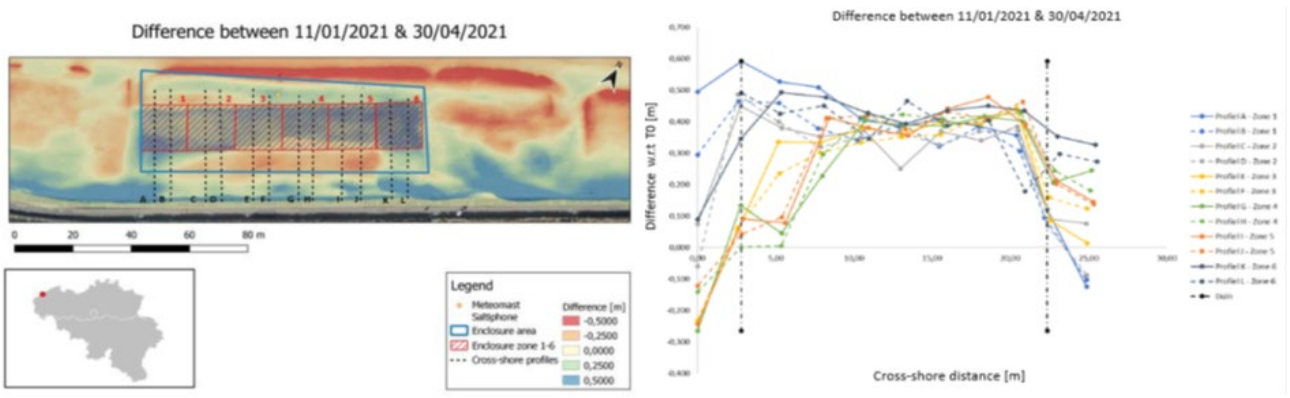

Figure 1: (A) Dune-in-front-of-a-dike pilot site at Ostend Oosteroever, Belgium divided in 6 zones and 12 cross-shore monitoring profiles, (B) cross-shore profile development on 30/04/2021

4. REFERENCE

Rizvi, Ali Raza, and Kirstin Van Riel. 2020. “Nature Based Solutions for Climate Change Adaptation – Knowledge Gaps.”