

Nebkha @Raversijde due to *Leymus arenarius*

Verwaest Toon¹, Montreuil Anne-Lise², Taelman Charlotte³, Provoost Sam⁴, Dahirel Maxime³, Rauwoens Pieter⁵ and Bonte Dries³

¹ Waterbouwkundig Laboratorium, Departement Mobiliteit en Openbare Werken

E-mail: toon.verwaest@mow.vlaanderen.be

² Antea Group Belgium, Roderveldlaan 1, 2600 Antwerpen

³ Vakgroep Biologie, Universiteit Gent, K.L. Ledeganckstraat 35, 9000 Gent

⁴ Instituut voor Natuur- en Bosonderzoek, Havenlaan 88, 1000 Brussel

⁵ Faculteit Industriële Wetenschappen, Campus Brugge, Katholieke Universiteit Leuven, Spoorwegstraat 12, 8200 Brugge

Nebkha dunes are discrete mounds of sand formed by sand deposition within an isolated plant or a group of plants [Hesp, 2024]. Although often associated with desert environments, nebkhas are described for our coastal region as well [Ruz *et al.*, 2017].

Seaward of the dune-in-front-of-dike pilot area at Raversijde-Mariakerke, a considerable nebkha has started to form in the presence of *Leymus arenarius* ("Zandhaver") in recent years. Initially, in this (750 m x 20 m) dune-for-dike area, dune formation was steered by marram grass (*Ammophila arenaria*, "Helmgras") plantations and brushwood hedges in the start of spring 2021. Today, 3 years later, the average aeolian accumulation in this area is ca. 1,5 m. Although the dune growth rate in this area is expected to decrease over time, at present the growth rate is still very high ca. 13 m³/m/year [Montreuil *et al.*, 2025, *in prep*]. The plantation of marram grass in this area has illustrated nicely how this plant species is an efficient dune-building bio-engineer in coastal environments [Bonte *et al.*, 2020].

Unexpectedly, at one specific location seaward of the dune-in-front-of-dike pilot area, a field nebkha dunes with *Leymus arenarius* has started to develop, without any plantation efforts. This grass species is also known to be a dune-building bio-engineer. It has been applied to strengthen dunes in northern Europe [Greipsson & Anthony, 1994]. At Raversijde this nebkha field first appeared on the beach in autumn 2021 in front of the planted dune, and then gradually expanded laterally and vertically. As seen from the latest drone survey carried out on 22/10/2024, the surface area of the vegetation patch is measured to be ca. 20 m x 20 m and is located at an elevation ca. 2 m above the beach level. The time series of DEMs show that the patch is increasing both in height and in width. Additionally, vegetation classification results show that the species recently has spread and infiltrated the dune pilot site, and in one specific location, even has locally overgrown *A. arenaria*. In this part, dune growth appears to be slightly stronger than in the surrounding parts where *A. arenaria* is dominant.

Beach flora along the Belgian coast is monitored systematically since 2007. Most of the plant species growing on beaches have dune-building bio-engineering capacities, especially the perennial grasses, and are therefore important initiators of dune formation. The monitoring shows that *Elymus arenarius* is a rare, highly ephemeral beach plant in Belgium.

Monitoring and research of embryo dunes at Raversijde and other places on the Belgian beaches will continue in the coming years e.g. via European projects Manabas Coast [weblink 1] and DuneFront [weblink 2]. One of the research questions is whether *Leymus arenarius* can be an efficient dune-building bio-engineer for the Belgian coast.

Authors express their gratitude for Flemish and European funding for monitoring and researching new dunes on the Belgian beaches as nature based solutions for coastal protection and ecological restoration.

Bonte, Dries; Batsleer, Femke; Provoost, Sam; Reijers, Valérie; Vandegehuchte, Martijn L.; Van De Walle, Ruben; Dan, Sebastian; Matheve, Hans; Rauwoens, Pieter; Strypsteen, Glenn; Suzuki, Tomohiro; Verwaest, Toon; Hillaert, Jasmijn (2021). Biomorphogenic Feedbacks and the Spatial Organization of a Dominant Grass Steer Dune Development. *Frontiers in Ecology and Evolution*, 9, 2021, DOI: 10.3389/fevo.2021.761336

Greipsson, Sigurdur & Davy, Anthony (1994). *Leymus arenarius*: Uses and characteristics of a dune-building grass. *Icelandic Agricultural Sciences*. 8. 41-50.

Hesp, Patrick (2024). Coastal Dunes: Types, Initiation, Morphology, Evolution, and Relationships to Surfzone-Beach Systems and Climate. DOI: 10.1016/B978-0-323-90798-9.00074-3

Montreuil, A-L.; Dan, S.; Houthuys, R.; Verwaest, T. (2025). Monitoring of the dune for dike pilots: Evolution after 3 years. Version 3.0. FH Reports, 21_014_3. Flanders Hydraulics: Antwerp

Ruz, Marie-Hélène; Héquette, Arnaud; Marin, Denis (2017). Development of large nebkhas along an accreting macrotidal coastline, Northern France, Aeolian Research, Volume 24, 2017, Pages 1-14, ISSN 1875-9637, <https://doi.org/10.1016/j.aeolia.2016.11.002>

Keywords

Coastal Protection; Dunes; Vegetation