The sequence of the old dunes (foreground), a covered mudflat landscape (mid) and the young dunes (horizon) is unique in Europe.
Dune grasslands of the Belgian coast

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Introduction
The Belgian coastal dunes are located in north-western Belgium in the province of West-Flanders, along the North Sea. The coast is 65 kilometres long with the highest dunes reaching ca. 30 m. However, most of them are no more than 5 to 10 m above sea level. The climate of the Belgian coast is oceanic - mean annual temperature of ca 10°C, mean number of days of frost of 45 days, mean maximum temperature of 22°C in the month of July, mean annual precipitation of 750-800 mm.

Morphogenesis and abiotic conditions of the Belgian coastal dunes
The coastline is naturally bounded by a continuous row of dunes, only interrupted at the estuaries of the rivers IJzer and Zwin by still active coastal mudflats the Belgian coastline is part of an island barrier running from the North French Cap Blanc Nez to Esbjerg in Denmark. The former mudflats found behind the dunes, has been transformed into polders by land reclamation and the closing of tidal inlets.

Two abiotic factors have a very important influence on the diversity of the grassland of the Belgian dunes: the ground water level and the lime content of the soil. The natural variation in soil humidity, from wet dune valleys to very dry dune tops is heavily disrupted by drinking-water abstraction. Nevertheless grassland examples from wet types (Calthion palustris, Lolio-Potentillion) to dry types (Koelerio-Corynephoretea), and all intermediate conditions still occur. There is a gradient in lime content of the dune soils from west (± 8%) to east (± 4%) and from the seaward side to the landward side. The west-east gradient is linked to the abundance of shells carried along from the lime cliffs of northern France and southern England (De Puydt, 1972). The seaside-landside gradient is a question of time and decalcification. The older dunes are situated more inland. They are older and in consequence they are more decalcified. Leaching out causes a third gradient, from the upper soil to the under soil.

From the middle of the medieval period onwards the dunes were important as hunting areas (‘harena’) and also as grazing land for cattle. The count’s bills indicate that the dunes of the west coast, in the 12th century, yielded 40 pieces of cattle annually (Termote, 1992). Most of the coastal villages date from the 11th-13th century. They were originally mainly settlements of cattle breeders that evolved into villages. Grazing land, for sheep at first, but later also for cattle, is provided mainly by former salt phases subsequently converted into polders. In the dunes themselves a quite elevated landscape appears after two stages of wandering dunes. It is suitable as grazing land (Koelerio-Corynephoretea vegetation) or meadowland (Calthion vegetation), and also, to a lesser degree, as arable land for rye cultivation (De Ceunynck, 1987; Termote, 1992).

The geomorphological history of the western Belgian coastal plain started about 10,000 years ago. Due to the melting of the north European ice caps, the sea level started to rise. The sea gradually flooded the lower landscape, and sand and clay were deposited. The foundation of the Holocene deposits in the coastal plain is characterized by the occurrence of the so-called ‘base peat’ which locally reaches an age of 9,000 years. The groundwater table also started to rise resulting in the formation of a peat bog. Due to a further sea level rise, however, the peat bog became flooded and became covered with sand and clay, deposited in mudflats circumstances. The mudflats rose again by accretion and new peat bogs and also dunes appeared. From time to time these were flooded by the sea. The peat layers that were formed in a later stadium than the ‘base peat’ are the so-called ‘surface peats’. Peat layer datings in combination with archaeological discoveries allow us to more or less date the main dune formations (Mostaert, 1985; De Ceunynck, 1987, 1992; De Moor and Mostaert, 1993).

The oldest dune formations were formed probably from about 5,000 years ago. The ‘Old dunes of Ghyvelde-Adinkerke’, on the French-Belgian border, are a relic of these. They are mainly decalcified and therefore quite unique for the Belgian coast. The Violo-Corynephoretea in Belgium is limited to these old dunes.

About 3,000 years ago a new dune chain was formed, a few kilometres towards the seaside. The coast was growing seaward. Those ‘Old dunes of De Panne’ also disappeared mainly because of new inundations. From the 9th century onwards, new dunes arose on the sea front and square fronts along tidal channels. These ‘Subrecent dunes’ or older