



# Dunes of the Gardno-Łebsko Spit



The Gardno-Łebsko Spit is a part of a dune lined coastal section between Łupawa river mouth in the west and Piaśnica mouth in the east. This sandy strip of land separates the Baltic Sea from the extensive Gardno-Łebsko plain, featuring organogenic accumulation plains and numerous coastal lakes, such as Łebsko and Gardno, as well as Sarbsko lake, the former outside of the Słowiński National Park boundaries. The age of the spit itself has not been accurately determined. The start of the current phase of aeolian processes is dated to the turn of the 15th century. Fossil soils and archaeological finds confirm that timeline.

## Physical and geographic conditions

A specific set of physical and geographic conditions was responsible for the creation and development of dunes on the Gardno-Łebsko Spit. An appropriate stock of loose sands conducive to transport by wind as well as a certain wind regime were the main contributors here. The impact of wind on the soil depends on vegetation as well as rainfall volume and frequency. To this day the dunes are continually transformed, stabilised by vegetation and then set into motion once again by factors such as:

- extreme wind speeds resulting in windblow, which consequently causes wind erosion troughs and ditches which in turn activate the dunes once again,
- natural forest fires,
- fires caused by the destructive actions of people, such as deforestation in the Middle Ages associated with the demand for timber as a construction material.

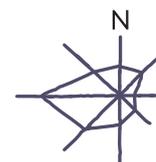


Gardno-Łebsko Spit

### Seaside barkhan dunes



(grow without vegetation, lighter material in the arms is blown out first, the arms of a barkhan dune are aligned in accordance with the prevailing wind direction)



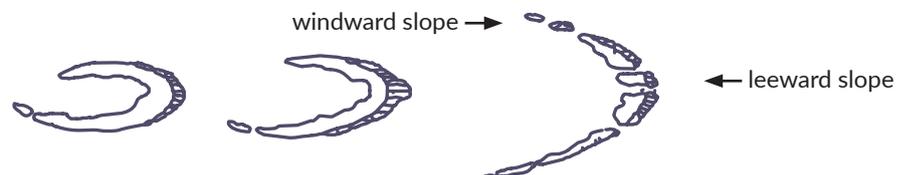
wind direction →

### Crescent shaped barkhan dunes



### Parabolic dunes

(onset of vegetation on the lower arms of the dune slows down their migration, the head of the dune, more difficult for the vegetation, moves ahead of the arms)





Czołpińska Dune



Łącka Dune

## Where does the sand on the Gardno-Łebsko Spit come from?

Sand is thrown up onto the beach by the sea and then carried inland by the wind, initially feeding primary dunes. These mounds usually form outside of the wave breaking zone, at the back of the beach and are parallel to the coastline. These transverse dunes grow to a certain height and once they reach approximately 10 - 12 m a.s.l. their tops are destroyed by the wind. The sand is then transported further inland, creating more dunes which become more permanent as they are stabilised by vegetation over time. Such dune banks then become a source of alimentation for future dunes or are destroyed by abrasion. Until recently, according to general opinion migrating dunes were to be continually fed by sand blown off the beach. However, recent research has shown this thesis to be flawed. Well, it turns out that almost four times as much sand is carried by the wind from the backbeach during a year, because it is coarser due to the presence of vegetation. This causes the creation of a new primary dune embankment or the addition of a sea-facing slope to an existing older primary dune. Backbeach Sand has no physiographic means of reaching the shifting migrating of the interior of the Spit. These dunes were formed at the very beginning of the stabilisation of the Spit, the surface of which, devoid of vegetation at that time, was susceptible to the rapid formation of a migrating dunes complex, unique on a European scale.

Czołpińska Dune and Łącka Dune are the most popular migrating dunes in Słowiński National Park.

## Dune migrations

The movement of sand grains starts with the wind blowing at 5 m/s. Sand is rolled up the gentler windward (proximal) slope of the dune and when it reaches the top it rolls down the steeper leeward (distal) slope. Sand extraction (deflation), transport and deposition (accumulation) are processes which occur continually. The speed at which dunes on the Gardno-Łebsko Spit migrate varies. Parabolic dunes which require a strong presence of vegetation to grow make up the western and eastern parts of the Spit. These dunes are fairly slow, migrating up to 3 m per year (most have been forested). The middle section of the Spit, approximately 5 km long and 1 km wide, is made up of migrating dunes. Barkhan dunes as well as crescent shaped barkhan dunes, which migrate between 3 and 10 m per year can be found here. Direction of aeolian processes, including the direction of dune migration on the Gardno-Łebsko Spit, is determined by the strong impact of the prevailing westerly and north-westerly winds and assumes an easterly and south-easterly direction.