

Our Beaches

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Due to the ever-changing global climate, the frequency and intensity of extreme atmospheric phenomena are increasing. Strong winds, similar to hurricanes and tornados observed on the Atlantic, are starting to appear in the region of the Baltic Sea. How are they affecting Poland's coast?

Along the Polish sea shore, similarly to most of other sandy coasts in the world, the erosion process prevails over the accumulative process. In the long term, about 60-70% percent of the Baltic coastal zone in Poland is subject to erosion, accompanied by the permanent recession of the shoreline, as well as the toe of dunes and cliffs. According to numerous analyses and assessments, the recent average shoreline retreat in Poland amounts to 0.5-0.9 m/year, which results in the loss of large areas of land, up to 340,000 m²/year. There are a wide range of shore protection measures for remedying coastal erosion, and a few of these methods, both

conventional and innovative, have been applied in Poland. Nowadays, 'soft' technical solutions, friendly to the environment, are becoming popular, squeezing out classical heavy engineering structures, which significantly affect natural hydro- and morphodynamic coastal processes.

Erosive threats

The retreat of the sea shore in Jastrzębia Góra, attaining the rate of 1.6 m per year, is one of the most spectacular examples of cliff erosion, stemming from natural causes yet amplified by human impact. The cliff, built of clayey and silty sand, is convex seawards and thus vulnerable to erosion due to storm waves. On a second front, the cliff structure is continually affected by the flow of groundwater, which is to a large extent nourished by a leaky sewage system, comprising the storm-water drains of the village. Buildings located at the cliff edge in Jastrzębia Góra, one of which has recently collapsed, illustrate both sea-borne erosion and land-borne erosion (predominantly induced by human activities). The beach at the cliff toe is very narrow, constituting a weak obstacle for wave attack. The small beach width is also unattractive for tourists, who visit this summer resort in great number.

Erosion of the dune coast in Poland is very common. Hel Peninsula is a specific narrow strip of lowland, where this



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Disappearance of the beach near Rewal due to intensive erosion. Heavy shore protection measures (rubble-mound seawall and groins) proved to be ineffective



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Władysławowo harbor at the root of Hel Peninsula. The natural littoral system has been affected by harbor breakwaters

erosive process is particularly dangerous because there is no way for people to pull back from the destructive action of sea waves. The construction of a massive seawall at the cliff of Rozewie in the early 20th century is said to have launched accelerated erosion at Hel Peninsula, caused by sediment source cut-off at Rozewie. Soon after that, Władysławowo harbor was settled in 1936/1937, and its breakwaters perturbed the longshore sediment transport, which had previously supplied sand to the beaches of Hel Peninsula. For years after WWII, the sediment from the navigable channel and the harbor entrance was dredged and carried offshore, thus being lost totally from the coastal system. Therefore, presumably, the severe storms in the early 1980s caused catastrophic abrasion of the beaches and dunes. In this case, again, the deficit of sandy material in the nearshore zone was apparently caused by human impact.

Protection measures

Since the 1980s, a number of optimized engineering activities have been proposed by coastal experts, among them the research team at the Institute of Hydroengineering of the Polish Academy of Sciences (IBW PAN), with the aim of restoring the shore equilibrium at many Polish sites. Such optimization studies have ensured the implementation of modern sustainable shore protection measures. These mostly comprised 'soft' methods of coastal defense, preserving the value of the natural undisturbed environment. For the shore at Hel Peninsula, we should mention artificial beach nourishment, correlated with the maintenance of Władysławowo harbor (sand bypassing around the harbor), as well as the biological strengthening of dune slopes using vegetation (special kinds of grass and bushes) and fascine fences constructed at the dune toe to facilitate eolian accumulation of sand. The activities carried out along the coast

of Hel Peninsula have brought back wide beaches and the system of wood-overgrown high dunes.

Cliff protection also requires compound action. At Jastrzębia Góra, for instance, a light revetment made of gabions was placed at the cliff toe. This venture has stopped the sea-borne erosion. At the same time, however, the cliff should have been drained. This has not been achieved on time and a new landslide has recently taken place at the cliff. To complete the protective system, artificial beach nourishment is recommended at the foreshore.

Prospects and future

Shore evolution depends on the joint action of waves and sea level changes (storm surges). As observations reveal that the wave climate along the southern Baltic coast has become more severe of late, design criteria in coastal engineering should account for the anticipated sea level rise: according to various predictions, from 20 to 90 cm in 100 years.

Various scenarios for predicting the accelerated sea level rise and its influence on the Polish coastal regions have been investigated at IBW PAN since the 1990s. Such studies have been carried out under a few international research programmes, most recently under the EU project named SURVAS (Synthesis and Upscaling of sea-level Rise Vulnerability Assessment Studies). ■

Further reading:

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- Zawadzka E. (1999). *Developmental tendencies of the Polish shores of the South Baltic Sea* [in Polish] Gdańsk: Gdańskie Towarzystwo Naukowe.