

FORMATION, DEVELOPMENT AND CONTEMPORARY DYNAMICS OF COASTAL ZONE IN VENTSPILS, LATVIA

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Abstract

Coastal processes in Ventspils are of the same environmental importance as in the whole Latvia. Accumulation of sand to the north from the port territory and erosion to the south is the result of natural processes and anthropogenic activities. By accumulation of sands the territory of the town is expanding more and more, but due to erosion of the coast Ventspils is losing lands. Formation and development of one of the most interesting parts of Ventspils called Ostgals ("End of the port") is very close entailed with sand moving and formation of travelling dunes. People during centuries looked for the best way how to stop sand movement. Nowadays coastal processes and forecasts must be taken into account in the planning processes.

Introduction

The Baltic Sea coast management problems are significant to all Latvia, as its marine border is about 500 km long. It is important also for Ventspils, as in its administrative territory the sea coast takes 12 km in its administrative territory. In the sea coast management a wide range of issues must be taken into account and one of the most important are the coastal processes – both the natural and those arisen due to anthropogenic activities (Fig. 1).

Ocean and sea coast belts in all the world are in the constant development process, in the course of time the coastal abrasion and impending of the sea upon the land are followed by the accumulation of deposits and increase of land area at the expense of the sea.

During the last 20 – 30 years in the coast of Latvia (and in the whole world) the abrasion of the shore during storms intensifies, the areas of increased risk widen. At the same time the construction in the coastal belt increases – infrastructure improvements, building of new production units and extension of ports.

At the coast of Latvia, in the area directly and indirectly subjected to the sea activities, two main types of coastal groups can be observed: bluffs and accumulative

coasts. Coastal abrasion includes 120 – 150 km long coastal belt or 26 –30 % of the total length of coastal line and accumulation processes about the same part (Eberhards, 2006).

Usually, the frequency and length of storms, and the height of waves and their gradient towards the coast are considered as the main factors of the coastal changes. Another substantial factor influencing stability of the sea coasts is the increasing anthropogenic impact.



Fig. 1. Coastal processes in Ventspils

Sand dynamics and OSTGALS development

A striking example of the dynamics of the coastal processes and the impact of human activities upon them can be found in the formation of the Ostgals – a district of Ventspils.

Still until 1921 the Ostgals was located outside the town's territory. From sandy plain into fishermen village, from a fishermen village into a part of a town – that was the fate of the Ventspils Ostgals. It is not known who was the first to name it Ostgals, however the name itself gives us a hint – this area is placed exactly at the end of the town's port.

The territory by the sea, where the Ostgals is located nowadays, has been a sandy plain bordering seaside forest. In Ventspils map of 1829 and in town map of 1834 approved by the Russian tsar Nikolay I it can be seen that the current territory of the Ostgals is almost not habited.

Stories and legends about the travelling sandy dunes that cover up houses with sand, destroy forests and fields are known in the Kurzeme region from a long time ago. For example, they tell about the house which was covered up by sand during a storm in a night, and people who were in had to get out through a chimney.

At the turn of 18th and 19th centuries the problem of blowing sand became even more acute. Along almost all the Kurzeme coast, including the Ostgals, sandy plains started to spread out and the sandy masses, free from the vegetation cover, become threatening.

The consequences of sand blowing were and are the formation of dunes. The loose sand is transported to the coast by the sea. Washed ashore and dried by the sun, sand is blown by the wind further landwards. If there is a barrier in the way of the wind that scales down its force, the sand forms a deposit and a dune is being formed. Not always the sea and wind allow a dune to consolidate. Activities of wind and humans can damage the vegetation cover and reset free sand that used to be covered by vegetation cover. Wind blows the sand, that was won back from the vegetation, further into land and the naked dune starts to move. This is how *a wandering dune* appears. If such a dune is not stopped, it can bury everything on its way – roads, forest and even houses. Depending on the amount of sand and the intensity of wind dunes in the coast of Latvia have travelled at different pace – from several decimetres to 3.7 metres per year (Bušs, 1960).

Although the problem of sand blowing in Kurzeme became aggravated at the turn of 18th and 19th centuries, it is known that already in 1625 inhabitants of Ventspils complained to the duke: „Our houses and gardens are so far covered up with sand that we will be forced to tear down the houses and move somewhere else”, but in 1693 Ventspils town council issued a decree about infringing dunes. Wandering dunes went forward leaving behind dead wood stumps (Štrumfa, 1999).

In 1817 the chief road director of Russia engineer Devolant wrote to the Minister of Finance that the forest in the estuary of the Venta despite of being 745.5 m away from the port serves as a barrier for the sand blown by wind, but it is being cut out, and wherewith he asked to forbid the further deforestation.

Formation of sandy plains and wandering dunes largely depends upon human activities. Not only in the territory of Latvia, but also in Denmark, France, Germany already in medieval times dunes were covered up with forests, as these areas were not suitable for agriculture due to sand soil and uneven relief. Coastal forests suffered heavily when shipbuilding and other areas of industry developed and especially during wars – forests were cut out or burnt. Evanesce of forests was influenced also by simple everyday activities – like pasturing stock and picking up forest bedding. For the territory of Ventspils, especially near the port, certain role was played by construction of the port breakwaters. The first Ventspils port breakwaters were built in the Duke Jacob's time, later in the turn of 19th and 20th centuries they were rebuilt and extended. Construction of breakwaters had certain effect on the process of sand deposition to the south from the estuary of Venta River, increasing the land territory here and decreasing the territory on the other bank of Venta. This process still continues today, from early 20th century up to this moment the sea on the left side of the estuary of Venta has receded by 600 metres (Eberhards, 2006).

The reason of formation of the Ostgals was to prevent sand blowing with the help of farmers – afforestators of dunes, who were housed there. Already in the early 19th century the government of Russia (Kurzeme in that times was the part of Russia) approached sand consolidation issue, but in the 30ies of the 19th century special commissions were formed with the task to establish which places on the Baltic Sea coast are threatened by sand and where the forest as the only sand protector should be

conserved. Commissions, which involved also state forest district foresters, established that in many places, where forest is being hacked out, sand deposits have become threatening and sand is moving further and further landwards. With the reference to the materials of the commission a special order was issued by which along the all Baltic Sea coast a 150 fathom (319.5 m) wide forest protection belt was established, but in particularly dangerous places, Kurzeme coast among those, – 250 fathom (532.5 m) wide. In the protected forest belts, particularly in dunes, it was allowed to cut only windfallen trees and dead wood, but it was forbidden to pasture, collect moss, bedding, cones, needles, roots, to mow grass and heather and make fires.

The first sand consolidation works in Kurzeme were commenced in 1834, when local farmers covered sand with brushwood and branches and made fences. After fences were made and the sand calmed down, they planted dune reeds, birch, black alder, poplar and other plants in a part of the area, but in the other – disseminated pine, birch, larch and alder seeds. To protect dunes from trampling they were fastened and afforested. Together from 1835 till 1880 the area of uncovered sands decreased twofold (from 7700 ha till 3900 ha).

Another method how to stop sands should be certainly mentioned – settling of people on them, which was a beginning of construction of the Ostgals in Ventspils. In early 1830ies the tsar of Russia Nikolay I approved the rules of the Ministers commission on fastening the state sandy coastal lands, allowing farmers to settle there, and receive notable incentives from the state: „...release from corvee works for 6 years, possibility to receive woods for construction of the building and court, tree plants for planting in the coast for free, for 12 years each house receive firewood for free and each one, who undertakes to build a house for himself in 6 years time, for every room with belonging buildings 150 roubles in paper money...” (Štrumfa, 1999). If in 1858 in Ventspils town map in the Ostgals only one building plot of Jānis Princis was marked, then in 1899 in the map of the state land on the left bank of the Venta river of Kurzeme government all this land is marked as inhabited lands, consequently in this time the Ostgals has developed into a village, where the main activity of inhabitants was fishery, and it becomes an inseparable part of Ventspils (see Appendix).

Scientific aspects of coastal processes

In 1900-1905-ies Ventspils port breakwaters were rebuilt and extended thus completely blocking longshore drift and deposit flow was completely closed. Already in 1908 accumulation of sand in the shallow water belt in the front of the southern breakwater began, waterline moved by 120 m deeper into the sea but in the further 40 years by 650 m more. Deposits that flow in through the port gates arrived to the outer harbour and silted the shipping canal. Substantial amount of sand was transported to the outer harbour with waves, which went over the southern breakwater during the strong storms. As a result of rapid coast growth to the south from the port breakwater around 1930 a several hundred metre wide bare sand belt appeared, and blowing of large masses of sand landwards began and foredunes were formed (Eberhards, 2006).

In order to investigate the processes on the sea coast in the framework of state monitoring local Ventspils monitoring was implemented since 1992. Upon the request of Ventspils City Council, under supervision of G.Eberhards (professor of the Faculty of Geography and Earth Sciences of the University of Latvia) systematic investigations were performed in the 24 km long coast on the both sides of Ventspils port.

The overall increase of the coast since 1898 until 1993, when the systematic observations were started according to the order of Ventspils City Council, is from 900 m wide (against the end of the southern breakwater) up to 250 – 300 m wide (against the southern border of the city. The amount of increased land in the mentioned period is 118 –120 ha. In the 2.2 km long build-up coast belt to the south from the port the amount of accumulated deposits can be evaluated as 6.97 million m³.

At the moment the coastal line has become stable and from year to year varies within 15-20 m, but in the beach and foredune belt the intensive accumulation of sand continues (see Appendix). To the north from the northern breakwater in the 3 km long coastal belt in the first 35 years after construction of the port breakwaters the summary changes of the coast were minimal. Substantial changes of the coast in the several kilometres long belt began only after the Second World War, with the dredging of the shipping canal and dumping of the dredged ground in the sea, further from the coast.

In the period from 1955 till 1961 the shipping canal was dredged by 8-9 m. From 1955 the sea dumpsite close to the coast was closed and a new place far from the coast is

formed. Shipping canal is more dredged and extended and in 1981 it was 14.4 m deep. The ground dredged from the outer harbour and shipping canal is dumped in the far sea dumpsite, from which it cannot return to the shallow waters.

Consequently from 1956 in the shallow water belt to the north of the port a crucial deposit deficit was created, but, starting from 70ies – total break of the deposit flow, as a result of which intensive abrasion of the coast began and continues up to this day. The length of the continuous main coast abrasion belt reaches 12 – 14 km.

In order to decrease the main coast erosion, the ground dredged from the shipping canal starting from 1993 is being dumped in the initial sea dumpsite closer to the coast (which was being used until 1953). However since the transport that is used for shipping the dredged ground and dumping in the sea dumpsite, cannot get to the coast closer than 4 m isobaths, large part of the deposit material still remains outside the zone of active natural longshore transport of deposits.

From 1992 in the coastal zone to the north from Ventspils port the summary retreat pace of the bluff in the different coastal segments have been different. In the periods of frequent strong storms (1980-1993) or during strong storms (1993, 2002) in the separate segments the bluff can be eroded by 5-10 or even 10-20 m, which is a catastrophic erosion. For example: in the storm of January 8-9, 2005 in Ventspils town coast area the bluff was washed off and retreated by on average 3-6 m, at maximum 15 m, the washed off dune protective zone ~5 ha, the amount of the material from 13 km long segment washed into the sea ~0.5 milj.m³, to transport such amount ~11000 freight cars would be needed (see Appendix).

In relation to the abrasion processes that are characteristic to the coast to the north from the port, it is important to take into account the forecasts about retreat pace of the coast, especially when planning new construction territories in the Staldzene (northern part of Ventspils on the coast). Assuming that in the nearest 40-50 years the previous hydrometeorological conditions and the previous long-term local bluff retreat pace will remain, the minimum width of the main coast zone subject to abrasion (real risk zone) in the Ventspils coast will reach 50 -150 m (Eberhards, 2006).

Using information about natural values

and forecasts of coastal erosion in the planning

In the management of the Baltic Sea coast and planning of its territories' development it is important to take into account both natural and port's hydrotechnic construction caused coast changing processes – sand accumulation to the south from the port and coast wash off to the north from it. Accordingly, special attention to these processes was drawn in Ventspils city territory plan and development plans (Ventspils development programm, 2004; Ventspils territory plan, 2006).

This plan envisages paying particular attention to preserving dunes, especially grey dunes, when developing construction in the south west territory. Since research (Samite, 2004) revealed the grey dunes – protected biotope of European importance – as the most significant natural object in the south west territory of the city, the protective belt of the Baltic Sea in Ventspils southern part is defined along grey dune border. Landscaping grey dune territory according to aforementioned research recommendations (e.g. advices on ways to organise the flow of pedestrians, to place pathways and signs, etc.) will ensure protection of this nature value. All the recommended activities will receive approval in the detail planning of the town's south west territory.

According to the data of continued sea coast monitoring and the geological forecast in this region in the next 60 years the retreat of sea coast will be for 50-60 m, in separate sections 110-120 m and even up to 140-150 m. Therefore, no constructions are planned according to the short-term forecast (25 years) and the long-term forecast (60 years) in that belt. It should be noticed that if Ventspils port should develop further to the north, then the zone of intensive abrasion will move northwards (Eberhards, 2006).

Coastal abrasion and sand accumulation processes are influenced by natural and anthropogenic factors in a very complex way. The example of Ventspils shows that it is very important to understand reasons of coastal processes and take them into account in planning processes.

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Appendix

PHOTOS OF THE COAST AND DUNES



Dunes near Ostgals



Ventspils beach at the beginning of the 20-th century



Planting in dunes in 1995



The dunes on summer 2007



*Abrasion coast in the beginnings
of the 20-th century*



Abrasion coast after the storm in 2005