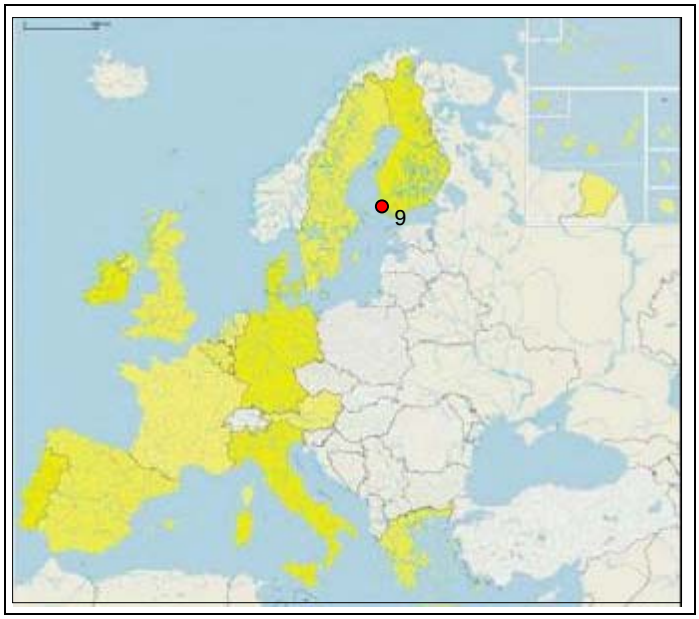
WESTERN COAST OF FINLAND (FINLAND)



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1. GENERAL DESCRIPTION OF THE AREA

1.1 Physical process level

1.1.1 Classification

The coast of Finland is bounded by the northern gulfs of the Baltic Sea: the Gulf of Finland and the Gulf of Bothnia in north-south direction. The total length of the Finnish coast is 46,062 km, which includes all islands and archipelagos. The rugged coastline is deeply indented with bays and inlets. The offshore region is studded with islands. The Finnish shore areas have considerable value and the coast differs significantly from other coasts of the Baltic Sea e.g. the Gulf of Finland contains an archipelago comprised of thousands of islands and small, rocky islets. The principal archipelagos are the Åland Islands and the archipelago of Turku and are unique within the Baltic.

Fig.1: Location of case area.

Rocky shores make up almost 42% of the total. The islands of the outer archipelago of the Gulf of Finland and southwestern Finland have almost entirely rocky shores while farther to the north rocky shores occur only sporadically. Till shores are as extensive as rocky shores and are mostly found on the coast of the Gulf of Bothnia. The largest continuous area of till shore is at the archipelago of the Quark. Gravel and sand shores occur on the southern and southwestern coasts. Silt, clay and marsh shores, which account for more than 10% of all shores on the Finnish coast, are most typical of the inner parts of the coastal zone.

In short, the coasts of Finland are characterized by a rapidly advancing shoreline, brackish water, a micro-tidal environment, a humid climate with moderate winds and long, severe winters.

Fig. 2: Rocky coast Aland archipelago.

1.1.2 Geology

Finland occupies the central part of the predominantly Late Archean and Early Proterozoic Fennoscandian Shield. The bedrock can be subdivided into three broad domains that have shared a common history since about 1.8 Ga. These three crustal units essentially comprise a Late Archean cratonic nucleus flanked on both sides by early Proterozoic mobile belts. The Kola-Lapland domain, to the NE of the Karelian craton, records the amalgamation at around 1.9 Ga of several distinct crustal units of both Proterozoic and Archean age, and is more characteristic of collisional tectonic processes. In contrast, the Svecofennian domain, to the SW

of the Karelian craton, is entirely early Proterozoic in age, and indicates relatively rapid formation and accretion of new crust between about 1.97- 1.86 Ga.

1.1.3 Morphology

Coastal zone

The shores of Finland are controlled by ancient structural and glacial formations, although the littoral landforms are generally poorly developed because of coastline transgression.
The *rocky shores* are largely composed of roches moutonnees exposed from beneath a thin soil layer, and there are few signs of abrasion.

The *stony shores* have been formed of till from which the finer material has been washed out, whereupon the ice has smoothed the stones into shore pavements and pushed up the boulders to form a rim at the foot of the abrasion slope. The material washed out from such shores usually accumulates in pocket beaches.

Sandy shores are found extensively in connection with the skirts of sand running along the sides of eskers. The sandy ridges forming on accumulation shores are frequently covered by blown sand bound together by lyme grass. Reed and meadow mouths are found in bays and river mouths where the bottom is composed of mud or silt.

Baltic Sea

Fig. 3: Gravel beach at Hanko Peninsula.

In many respects the Baltic Sea occupies a very special position among the seas on the earth. One might even say, that the only thing, which justifies us to call it a sea is that it is certainly not a lake - at least not any more. However, when the ancient basin of the present Baltic was released under the cover of the continental ice shield some 11 000 years ago, it first became a lake, then a sea, a lake and a sea again; all these drastic changes occurred in less than 3000 years! This alteration was, in principal, brought about by variations in proportional strengths of the two "competing" phenomena both of which were direct consequences of the melting of the glaciers: land upheaval and rise of the sea level. The last lake phase (Yoldia) ended, when the rising sea pushed salt water upstream to the Danish channels and beyond them. After passing the sill the seawater had free access and gradually the whole basin became brackish. This Littorina Sea was, in fact, even saltier than the Baltic Sea is at present, and also much larger. However, land upheaval has been the indisputable winner since the late Yoldia and it is still conquering land from the sea in many places around the Baltic.

Fig. 4: Rocky coast at northern coast Baltic Sea.

Land uplift

The whole coastline of Finland is affected by land uplift, which amounts to 9 mm a year at its most rapid, on the coast of the Bothnian Bay. Land uplift is least pronounced in the eastern Gulf of Finland. This glacio-isostatic land uplift causes a seaward movement of the shoreline amounting to hundreds of meters a century on the gently sloping shores of the Bothnian Bay, cutting short the development of littoral landforms.

1.1.4 Physical processes

Storm events

Storms associated with cyclones moving on the polar front are experienced mainly in autumn; the shores of the Gulf of Finland and the southwestern islands are scoured by waves whipped up by the southerly winds. The winds shifts to the west in the latter part of the cyclone, when the waves wash the shore of the Gulf of Bothnia.

Tide

Tidal fluctuations in water level are in the order of only a few centimetres.

Water level variation

Wind and changes in air pressure can give rise to major variations in water level at the heads of the Gulf of Finland and Gulf of Bothnia, especially in early winter. Long-term variations in water level show a periodicity of 11-12 and more obviously 22-23 years.

Current

There are weak coastal currents running northward in the Gulf of Bothnia and westward in the Gulf of Finland.

Ice

In winter, coastal waters and sea areas are covered by stationary ice for as long as 5.5 months on average at the head of the Bothnian Bay and over 3 months on the southwest coast. Low-pressure systems and winds in early winter frequently cause water levels to rise and detach this ice from the shores, leading to rafting, piling up of the ice on the shores, or even ice-push effects extending tens of meters up the shore and involving the transportation and deposition of stones and boulders. Thermal ice movement also shapes the shores of bays and narrow straits.

1.1.5 Erosion

The active coastal dune fields of Finland are located between the swash zone ecotone and the forest edge ecotone. The effect of waves during storms reaches far beyond the actual beach and can cause great changes (erosion) to sandy beaches at an exceptional speed. On the other hand, there can be periods, perhaps decades, of quiet evolution between the more severe storms. During the 90's strong winds occurred and locally erosion of the coastal dunes at the Finnish coast has taken place.

Fig. 5: Packed ice at sandy beach, Hanko, most southern point of Finland.

1.2 Socio-economic aspects

1.2.1 Population rate

The Finnish coastal area is sparsely populated. About one third of the shore zone has been developed. The areas of the coastal dunes, where some erosion locally occurs, are usually desolated and undeveloped areas.

1.2.2 Major functions of the coastal zone

- **Tourism and recreation:** The extent of the Finnish coastal zone and the abundance of islands means that Finland has an exceptionally long shoreline. The feature that has brought about most changes in the coastal landscape of Finland is the rapid increase in the number of holiday houses. As a result of the attraction of the sea these houses tended to be built as close as possible to the shoreline. However, they have sprung up along the coast without any real land use planning. The shores that are most ideal in terms of their landscape and natural environment have now been occupied.

- **Nature conservation:** Finland's shores show substantial geological variation and are rich in biological diversity and productivity. A lot of nature reserves are therefore present along the Finnish coast.

1.2.3 Land use

Finland's coastal area is in general desolated. Forestry and coastal plains are the usual land use functions. In general nature can take its course at the Finnish coasts. In the last years however, a rapid increase in holiday houses is taking place in the coastal zone of Finland. No land use planning was applied in the placement of these houses.

2. PROBLEM DESCRIPTION AND STRATEGY

Concluding, because of the absence of any significant tide, a relative sea level decline (due to land uplift) and moderate wave climate, coastal defence is not an issue in Finland.

Locally, some erosion has been taking place at the coastal dunes of the Finnish coast due to sea level rise and strong winds in the '90s. However, the occurring erosion of the coastal dunes does not threaten the safety of the hinterland, buildings or recreational possibilities. The eroded areas are mostly desolated and enough safety is preserved because the coastal dunes are very wide. Therefore, some erosion of these coastal dunes is not considered to be a problem and no measures are taken to stop the erosion. The policy option applied in Finland is do nothing.

The main problems observed at the coastal zone of Finland concern threats of nature. Examples of these threats are construction (threatening the natural state of the coast), trampling, forest invasion and eutrophication caused by water and air pollution.

3. REFERENCES

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Figures:

Figure 1: http://www.icm.noaa.gov/country/finland.html
Figure 2: http://www.virtualtourist.com/m/tt/1292d/
Figure 3: http://www.virtualtourist.com/m/tt/1292d/
Figure 4: http://www.virtualtourist.com/m/tt/1292d/
Figure 5: http://www.virtualtourist.com/m/tt/1292d/