

Changing traditional coastal defence policy to stop erosion - DK

1. Policy Objective & Theme

- ADAPTATION TO RISK: Managing impacts of climate change and safeguarding resilience of coasts/coastal systems
- ADAPTATION TO RISK: Preventing and managing natural hazards and technological (human-made) hazards
- SUSTAINABLE USE OF RESOURCES: Preserving coastal environment (its functioning and integrity) to share space
- SUSTAINABLE ECONOMIC GROWTH: Balancing economic, social, cultural development whilst enhancing environment

2. Key Approaches

- Integration
- Participation
- Knowledge-based
- Ecosystems based approach
- Technical

3. Experiences that can be exchanged

This case highlights that, even following nearly a century of traditional, hard coastal measures to prevent coastal erosion and which only reduced the erosion rate, a mix of new hard and soft techniques were able to reverse the trend and prevent erosion with limited effects elsewhere.

4. Overview of the case

The coastline of West Jutland is extremely vulnerable to erosion from the North Sea. In the past, in order to help the socio-economic development of the area, hard structures were used as coastal flood defence mechanisms. A change of policy and transfer to predominantly soft techniques has led to a situation where erosion is no longer a problem. It has aided the tourist industry by re-creating beaches and safeguarded the socio-economic development of the local communities.

5. Context and Objectives

a) Context

The Western coast of Jutland faces the North Sea and is typically sandy beaches in front of dune ridges. The coastal dunes form a belt up to 10 km wide and are particularly vulnerable to erosion. However, in the 70 km stretch enclosing the fjords of Ringkøbing and Nisum to Nisum Bay many of the dunes are very narrow, being hundred metres or less. Ringkøbing Fjord is Denmark's largest enclosed fjord with an outlet to the North Sea at the lock in Hvide Sande. The fjord is 40 km long and 10 km wide. North of Ringkøbing fjord, the Nisum fjord is located with a surface of 70 km². It is a shallow fjord area with shoals and sandbanks and with intertidal zones and salt marshes with brackish lagoons, meadows and reedbeds. The fjord is connected with the North Sea by sluices at the small town of Torsminde. Nisum Bay is the largest of the three bays and is connected to the North Sea by the Thyboron Channel. Average erosion of the west coast is 2 to 4 m. per year, with a maximum of 8 m a year. In the early 19th century, the dunes were stabilized by marram grass planting, and groynes were built which has resulted in reduced erosion. In 1981, in a severe storm, many dunes disappeared or were weakened along a 50 km length of the coast. The coastal area is important for agriculture viz. intensive cash crop and roughage production; tourism and recreation; fishing and aquaculture. Ringkøbing Fjord is a RAMSAR site.

The natural erosion from the North Sea has been greatly exacerbated by human intervention e.g. in 1910 the natural outlet for Nisum Bay closed and a new one was excavated. However, the new one was too shallow for fishing vessels so, in 1931 the old channel was re-opened but had consequently to be controlled by sluices (including a ship lock). Two jetties were built to protect the entrance from filling up with sediment and then a third was added when the first two were found to be inadequate. Although erosion increased, the barrier had to be preserved to protect the town of Ringkøbing. The high erosion rates have had the effect of significantly reducing the protection against flooding provided by the dunes and caused loss of valuable recreational areas.

b) Objectives

In 1982, it was decided to implement a coastal protection scheme based on an agreement between municipalities, counties and the state. The policy was to re-establish a safety level against flooding to a 100-year minimum return period, to stop the erosion where towns are situated close to the beach and to reduce erosion on those parts of the coast where future erosion would reduce the safety against flooding to less than 100 years.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

The Danish Coastal Authority (Kystdirektoratet) is a division of the Ministry of Transport and the state advisory body on coastal protection. It is responsible for constructions and maintains state coastal protection on the west coast of Jutland. Other assignments are harbour operation, dredging and storm surge alerts for this coastline and the tidal flats.

b) ICZM tools

Since 1875, groynes have been the major method of coastal defence and ca. 100, built of granite and concrete, have been placed along this coastline. It was not until 1974 that sand nourishment began to be used. A large scale, coastal protection scheme was undertaken 1987-99 to ensure the safety of the coastline. As a result, all that is needed today is maintenance. The following technical measures have been employed:

Detached breakwaters: to reduce the nourishment volume needed. 140 breakwaters were constructed.

Nourishments: applied to stop the coastline from receding any further whilst recognising that this does not prevent erosion. A specially built vessel is used to draw in sand from the sea bottom ca. 5-10 km from the coast and transport it to the coast where it is coupled to a large rubber hose, after which the sand is pumped offshore onto a sand bar or onto the beach itself. Sand applied to the beach directly acts as standard beach nourishment; that applied underwater to the sand bar acts as a wave-breaker. Little of this sand migrates to the beach. In 2005, the west coast was nourished with ca. 2.4 m. m³ of sand. Revetments: to reach the safety level required but where nourishment was not possible because there was not enough land between the beach and the properties or infrastructure to build a sufficient dune volume. About 25 km. were built in total along the foot of the dunes.

With respect to nourishment, it was found that in the first year, beach nourishment gave a better stabilization of the beach. However, in the longer term, shoreface nourishment is the better option due to a better cost effectiveness, although direct beach nourishment is still required as the additional sand acts as a buffer and prevents erosion of the dunes during storms.

7. Cost and resources

When the project began the costs were about 20m. DKK/year rising to between 80-90m. DKK by 1997. The expenses are shared between the Danish state, and the affected coastal municipalities.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

From 1998, the very high erosion rates are no longer a fact; on average, it is now only 0.1 m/year. Without coastal protection, an average of 2-4 m. of coast would disappear every year. The safety level of the dunes has been re-established to

a level of at least 100 years, the goal set in 1982. The use of breakwaters has reduced the need for nourishment landward of the breakwaters by 50%. The more effective nourishment of the sand bar was also cheaper than nourishment of the beach. The nourishments have been shown to be highly effective since the coastal erosion has been stopped where it was the aim. It also appears, that after a decade, there have been no effects of the measures taken felt outside of the project area. Locally, some leeside erosion still occurs downstream of the detached breakwaters and revetments. There is still uncertainty about the grain size of sand that should be used for maximum effect.

Socio-economically, an additional positive effect is that the beaches have been recovered and can be used for recreational purposes again.

9. Success and Fail factors

There has been a political will and appropriate funding with the necessary administrative institutions in place. There was flexibility in trying to do something new and untried to remedy a century old problem. This entailed 'learning by doing' and basing new decisions on the outcome of previous decisions taken (adaptive management). Also knowledge gained in participating in EU-project have been vital.

10. Unforeseen outcomes

In those areas from where the sand is taken, the bottom-fauna. re-established within one year and in the nourished areas within 2-3 years. However, the re-established individuals after one year are smaller in size.

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13. Sources

- Western Coast Of Jutland (Denmark) (Undated) P. Sistermans & O. Nieuwenhuis. Dvh Group, Netherlands
- www.kyst.dk



West coast of Jutland (244.69 KB) 