Coastal defence issues and lessons from the Schleswig-Holstein coast of northern Germany

Coastal Defence Issues and Lessons from the Schleswig-Holstein Coast of Northern Germany

No. 115

Report on a visit by Robin Hamilton,
Senior Officer, Colchester
and Richard Leafe, Coastal Geomorphologist,
Peterborough

5-11 June 1993

1. AIMS AND OBJECTIVES

The aim of this study is to gather information on the current geomorphological status of the north-west German coast and assess the role and nature of coastal defences in this context.

German soft engineering techniques are often promoted as suitable solutions to the erosion problems of south-east England. A clear understanding of the realities in which these techniques have and are evolving is therefore important to English Nature.

Specific objectives are:

- to evaluate the historic and present use of brushwood groynes;
- to evaluate the plant and animal communities that exist in areas subject to temporary seasonal inundation by the sea, including the impact of grazing. German experience in this area is of interest to the developing concept of tiered defence in England;
- to assess attitudes and viabilities of managed retreat in a German context.

2. GEOMORPHIC ENVIRONMENT

2.1 The Schleswig-Holstein west coast comprises a series of sandy off-shore barrier islands behind which extensive saltmarshes have developed, providing considerable protection to the mainland currently located some 20 km behind the barrier islands and bars.

2.2 The barrier islands are derived of fluvio-glacial sands pushed on-shore at the end of the last ice age by relatively rising sea levels. Saltmarshes developed behind reaching a post glacial maximum some 200 years ago.

2.3 Since this accretion maximum the whole region is now retreating landward, driven by the current rise in relative sea level. The sandy barrier islands are moving eastwards at a rate of up to 20 m a year! Saltmarshes formally protected by these islands have experienced a massive decrease in area over the last 200 years. Steepening of the intertidal area, erosion of protective sand bars and associated saltmarsh are now inducing 'coastal squeeze' as the outer shoreline progresses toward the highly defended German mainland.

3. CURRENT COASTAL DEFENCE POLICY

3.1 The German Regional Government have taken the decision to maintain the current position of the coast. Therefore the outer islands, saltmarsh islands or 'Halligen' and the mainland are maintained using a variety of sea defence techniques.

3.2 The key to this strategy is the maintenance of the largest of the outer barrier islands, Sylt, in roughly its present position by artificially recharging the beach. The recharge operation is an annual event, estimated to cost up to DM945 million (£378m) over the next 30 years. Part of the reason for the high cost of this operation is that the sand is not controlled by artificial structures but allowed to drift freely, eroding from the Sylt foreshore and providing much needed additional sediment for islands to the south and east of this outer line.

3.3 All of the Halligen are now ringed with a low rock revetment, armouring the former

saltmarsh cliff. The armour is no higher than the saltmarsh although a low wall a few metres inland protects the islands from normal spring tides. Only winter surge tides will flood the Halligen. Property on the Halligen has traditionally been protected from winter floods by being built on top of individual embankments or 'Warfts'. The Warfts are now being heightened in order to provide protection against the current trend in sea level rise and increased storminess.

3.4 The mainland is now almost continuously protected by a high sea wall or dyke. Historically the dyke has been fronted by artificially created saltmarshes using brushwood enclosures and mud gripping techniques. Large areas of artificial saltmarshes are still present, constructed when these areas were still broadly accretional. Today however increased tidal volumes behind the barrier islands have lead to the erosion of these saltmarshes in several locations.

3.5 Several of the Halligen have been connected to the mainland by a dyke, acting as a dam across the tidal channel. This significantly reduces tidal velocities adjacent to the new dyke creating conditions favourable for saltmarsh construction. This in turn reduces the tidal volume and lessons the erosive power of the flood and ebb tidal currents, reducing the erosive pressures on adjacent intertidal areas.

3.6 Future policy of the ALW (German equivalent of the NRA) is based upon the abov principle and more, larger, dams are planned. Combined with the recharge of Sylt the policy amounts to a huge 'hold the line' operation. Although the proposed new dams will be locally successful in reducing or even reversing erosion, the overall trend of coastal squeeze looks set to continue. The ALW are aware of the short term approach reflected in present policies, realising these solutions may not be sustainable in the future, both physically and financially.

4. SHORELINE MANAGEMENT TECHNIQUES

4.1 "Hold the line" combined with shoreline advance

This technique, involving construction of brushwood groynes ("lahnunen") in front of hard defences, is adopted:

- In areas where there is a natural tendency to accretion that can be accelerated, to create new saltmarsh.

  - in front of dykes in sheltered situations;
  - beside dams constructed between islands (eg Nordstrand) and the mainland.

  The saltmarsh thus created is healthy, but extremely uniform in structure and species composition.

- To reduce erosional effects on existing saltmarshes (eg Westerhaver).

It is not ALW policy to attempt shoreline advance:

- For agricultural land claim.

- In areas where the natural tendency is for the foreshore to erode (where lahnungen are known to be ineffective).

4.2 Managed retreat and tiered defences

4.2.1 Full managed retreat

Deliberate retreat to a new alignment, with little or no maintenance of former defences, is accepted as an option, and occasionally practised, by the ALW. The conservation agencies, however, are only just now beginning to recognise its value for habitat creation, an interesting contrast with the respective positions of the equivalent bodies in England. Nevertheless, the examples that we saw had developed excellent saltmarsh with the full range of characteristic species.

Managed retreat is not seen as a feasible option for most sites, despite the increasing difficulty and expense of holding the line. This is chiefly because of the distribution of houses and farmsteads: scattered evenly throughout the low-lying land rather than built on rising ground or clustered in villages as in East Anglia.

4.2.2 Tiered Defences

Tiered defences are best developed on the Halligen, low-lying but inhabited islands of saltmarsh characterised by:

- Outer defences of rock armour protecting the edge of the saltmarsh.
- A low "summer dyke", usually only a few metres back from the saltmarsh edge, and likely to be overtopped up to 20 times each autumn/winter.
- Secondary defences for farmsteads, which are placed on man-made hillocks (Warfts), typically less than 1 ha in extent, with little more than the farm buildings and a freshwater pond for livestock.
- The land within the summer dyke (all of which floods in winter storms, leaving only the Warfts uncovered) managed for grazing and/or hay.
- A diverse plant community.
- A rich breeding bird community.
- Enormous numbers of wintering wildfowl.

Whereas grazing is generally regarded as increasing plant species diversity, experiment reduction/cessation of grazing has produced a dramatic increase in breeding bird density.

Predicted erosion in ungrazed areas has not occurred, even in small plots, experimentally stripped of vegetation, which rapidly recolonised.

Winter floodings is seen as a positive benefit by the farming community, as a source of nutrients and also of sediment to keep pace with rising sea level.

ALW believe that a large proportion of the available sediment is trapped because inundation, though infrequent, occurs during stormy conditions when sediment is most mobile.

Whilst tiered defence to these specifications (particularly the rock armour) could not be constructed cost-effectively in England, we believe that a simpler form of forward defences could be achieved, and should be the subject of an experimental scheme.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 The overall geomorphic context, despite morphological differences, is similar to south-east England, ie. a broadly erosional environment experiencing rapid change as a result of relative sea level rise: "coastal squeeze" in action.

5.2 ALW recognises that its current sea defence policy (eg. construction of more hard dams to reduce tidal circulation around nearshore islands) may be sustainable only in the short - medium term (50 - 100 years). However, the abundance of infrastructural development in the defended land means that there is no obvious alternative to holding the line.

5.3 Brushwood groynes (lahnungen)

- are effective in accelerating accretion;
- will not reverse erosion and are not used for this purpose;
- may have a limited application in fairly sheltered locations to reduce scour and "train" channels;
- should not be constructed in East Anglia in an attempt to reduce or reverse erosion in open coast situations;
- have no application in East Anglia to promote accretion, as no suitable sites exist.

5.4 Tiered defences: on land subject to winter flooding only:

- there is significant residual agricultural potential and high conservation value;
- grazing increases plant diversity;
- breeding bird density is inversely proportional to grazing intensity;
- optimum conservation value may be achieved by varying the management between different site;
- contrary to traditional assumptions in Germany, ungrazed saltmarsh is not more susceptible to erosion;
- it is important to establish saltmarsh vegetation before reducing the height of outer defences;
- good drainage is essential. It is facilitated in German sites by the sandy substrate.

5.5 We recommend that:

- tiered defences should be trialled in eastern England as an alternative to full

managed retreat;

- ESA mechanisms could facilitate the establishment of suitable sites subject to winter flooding as could the proposed habitat improvement scheme;
- in potential retreat areas where land levels are too low for the establishment of saltmarsh, consideration should be given the use of artificial recharge, using fee-draining, sandy sediment as an alternative to silt.

References

A full bibliography, slides, maps and video is available from the authors.