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The Danish Board of Technology
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Before the Ocean Rises

It is time for us to prepare ourselves for the rise of the sea level - on local and national basis.

The rise in the sea level will affect nature, farming, housing and coastal facilities >

Already now coastal local authorities must take the rise into account >

The national effort - monitoring >

The sea around us will begin to rise as a result of the climate changes - most experts agree on this. When it happens, it will affect nature as well as agriculture, housing, and other facilities near our coasts. Within the local and the regional authorities the planning and the initiatives that make allowance for the rise of the sea level hardly exist despite the extent of its consequences.

Today already, local authorities with a coastline in their area ought to include a rise of the sea level in their planning, and they would benefit from involving the local interests of the existing associations of house owners, farmers, fishermen, and nature organisations.

Besides national monitoring further information and demands on an increased planning are needed too.

This Newsletter reports on the project of the Danish Board of Technology about the challenges the rise of the sea level will cause in coastal areas.

Now is the time to prepare for the rise of the seas as a result of the climate changes. The sea level around Denmark will rise probably about 50 centimetres during the next hundred years. It implies that the geography of the country will change. We will experience how the sea claims land from low areas and how the areas along the streams will be flooded more frequently.

Though the rise in the sea level is not expected to appear clearly during the first years, it is essential to map out the most exposed areas and to assess areas with tangible assets like infrastructure, housing and industrial facilities. Large trade and industrial enterprises must be able to plan on long-term perspectives for investment in buildings and production equipment to be profitable. Public planning within state, regional and local authorities are expected to be based on an even longer time perspective, because the expenditures are nearly

insurmountable if you have to move railroads, harbours, roads, sewerage, hospitals, schools, or homes for those who require full-time care. Therefore it is important to include the sea level in the future planning in areas near coasts or fjords.

More Speed on Planning

170 municipalities in Denmark have a coastline, and a great many of the low areas with natural resorts, agricultural areas, housing and summer cottage areas will be flooded in the future.

Only few have initiated plans to make allowance for the future, increased sea level - among these are the Danish Coastal Authority, port authorities, some insurance companies and some local authorities. But many local authorities and officers, mortgage-credit institutions, farmers' unions, house owners' associations, summer cottage owners, busi-

ness companies and tourist industries have not yet initiated a change in their planning for the reduced and altered territories.

The Jutland Wadden Sea has 107 kilometres of dikes that must be enforced and enlarged in due time. Streams with outfalls through the dikes will be more difficult to drain because of the outside pressure from the sea and the inside pressure from the rising subsoil water, and because of another result from global warming: a larger amount of rainfall during winter. At the Jutland Wadden Sea a bigger pump capacity must be established together with areas for monitored flooding to prevent breach of the dikes.

Hence it is essential to map exposed areas along the Danish coasts and assess their socio-economic value to make a qualified basis on which we can decide if it will be worth it to maintain them in the long run. In Denmark a lot of houses in the coastal city - and summer cottage areas are situated in low areas and only few of them have bases originally constructed to be under water frequently. In many places the sewerage systems will cause problems too, when the sea level rises and the subsoil water rises with it in the coastal areas. Animals and plants depend on beach- and coastal areas with tidal water. The Jutland Wadden Sea is for instance a valuable food- and resting-place for migratory birds, when they travel from African wintering grounds to breeding grounds in the northern parts of Europe. Its present coastline consists of dikes, which stop the water, so at a higher sea level the tidal flats outside the dikes will be covered by water all the time in the future. There are no alternatives for the birds in the area, and there are no plans or decisions made to lay out new areas for them. It is an open question in other areas too, whether to let present meadows or low water areas spread further into the country concurrently with the rising sea level, at the expense of for instance farmland.

Consequences for Coastal Areas

- Enhanced coastal erosion because of the rise of the sea level
- Loss of natural wetlands
- Added pressure on areas exposed to flooding because of the combination of sea level rise and enhanced storminess

Costs

- Enhanced costs for coast protection
- Costs for laying out existing farmland to new wetlands concurrently with the sea level rise
- The need for enlarged and enforced dikes
- The possible need for new dikes to secure new, flood exposed areas
- Higher costs to drain farmland in such areas

Different Interests

Thus, in the nearest future a lot of assessments and considerations of pros and cons must be made concerning the different social groups and the different types of land. More water means less land, and we ought to begin the discussion about the allocation of the land, which will be left. The debate about the greenhouse gases takes place mostly between experts, but the question about how to react to the sea level rise are presumably better and more viably resolved by the citizens in the areas, that will be affected. Are low situated summer cottages, building sites, industrial plants and farm land to be maintained, or do we want nature and the sea to reign - and if so, how is this return to nature going to take place? How do we ensure that new facilities and the improvements on the old ones will make allowance for the climate changes, and how do we ensure that the costs connected to the sea level rise will be fairly allocated? If we begin the planning now, potential conflicts between for instance the interests of nature preservation and agriculture might be prevented, and it will be easier to distribute the costs in connection with for instance summer cottage areas between the owners, the local authorities and the state.

The project "New Climate - New Life" of the Danish Board of Technology

In February 2004 the Danish Board of Technology carried out two scenario workshops on the rise of the sea level in Skallingen and Ho Bugt/Varde Ådal near Esbjerg and Karrebæk Fjord and Dybsø Fjord near Næstved.

About twenty local politicians and technicians, farmers, people from house owners' associations, and nature organisations took part in each of the scenarios. During the day they worked out their vision of the local area in the future and its consequences for how to decide priority and how to plan with a sea level, that will rise faster and faster.

The general conclusion was, that the citizens wish to protect built-up areas and other substantial facilities against the rise of the sea level, for instance by dikes, but apart from that they wish to let the sea spread freely over existing farmland and nature resorts.

You can read more about the project on

www.tekno.dk

Recommendation of Citizen Involvement

The participants in the scenario workshops, which the Danish Board of Technology has arranged in Næstved and Esbjerg, wanted to let

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nature rule the changes of the landscape. The sea should be allowed to spread over the low, marginal farming areas, and compensation should be given to the people affected by this. Sand - and dune coasts with special value for tourism should be secured against erosion. Local dikes should secure important city - and summer cottage areas. This applies to existing transport facilities too - but not to the ports. Some suggested they should be shut down or removed. New facilities and built-up areas should from now on be placed on higher ground compared with now. The participants in the workshops expressed no interest in 'large-scale dike' solutions or the possible control of the water level in large water areas and at stream outfalls by dikes, floodgates, and sluices. The recommendation was to abandon or remove that which cannot be protected by minor local actions.

The scenario workshops were characterised by a great commitment and a significant agreement about the long-term goals for the local areas. The expected conflicts between for instance the interests of agriculture and nature did not materialise and the discussions were marked by a pragmatic and realistic attitude to the extent of the problems and the necessity of solving them in due time.

The most important message from the participants in the scenario workshops in Næstved and Esbjerg seems to be their recommendation that the citizens must be involved in

England and the European Environment Agency Call for Action

In April 2004 the English Government published an extensive investigation of the consequences of the climate changes for Great Britain. The estimation is that at least 4 million people and their properties to a value of more than £ 200 billion risk flooding in 2080 if we don't prepare ourselves in due time. The Britons take the climate changes seriously. The Danes ought to do so too.

Read more on:

<http://www.foresight.gov.uk/fcd.html>

The European Environment Agency, The EEA, has recently published a report that gives an account of the human, environmental, and economic consequences we will experience as result of climate changes. "The report stresses the need for strategies to adapt to the climate changes on European, national, and regional level", says Professor Jacqueline McGlade, President of the EEA, in a press statement.

You can have the report on:

[Http://reports.eea.eu.int/climate_2_2004/en](http://reports.eea.eu.int/climate_2_2004/en)

the planning of the future of their own area, and that the results of the sea level rise must be incorporated in the plans for the local, the municipal, and the regional plans - *now!* Workshops like these are definitely one way to get a local debate started, but moreover there is a need for the relevant, national institutions to compile information for the local authorities on the sea level rise and how to cope with it.

A National Challenge

The consequences of the rise of the sea level have been the focus of the work in the Danish Board of Technology, although it is only one part of the climate change. Other vast climate changes have not been treated separately in this project - for instance more violent and frequent storms, increased precipitation and a changed nature.

All together the climate issue will be a steadily increasing challenge at all levels in our society, and being a country with a lot of coasts the rise of the sea level has special importance for Denmark.

In a lot of places there is only a modest public awareness about the fact that it is time for planning the changes that will arise with the slowly rising sea.

The Danish Board of Technology has offered its assistance to exposed local authorities in order to bring up the issue for discussion - as a first step towards initiatives and planning that take the consequences of the rise in the sea level into account.

In the report from the Danish Board of Technology, 'Når havet stiger' ("When the Sea Rises"), the task group recommends that the national institutions work out information for the affected local authorities. This includes the Danish Environmental Protection Agency, the National Environmental Research Institute, the National Agency for Enterprise and Construction, the Danish Forest and Nature Agency and the National Coastal Authority. The task group recommends that the information should list a survey of issues for nature, environment, preservation-worthy buildings, trade and industries, building- and infrastructure, and suggestions for technical solutions.

The Task Group of the Danish Board of Technology

- Walter Brusch, the Geological Survey of Denmark and Greenland
- Karen Edelvang, the DHI - Water and Environment
- Jes Fenger, the National Environmental Research Institute, Denmark

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Fra rådet til tinget

Newsletter from The Danish Board of Technology to the Danish Parliament

- Carsten Rahbek, the University of Copenhagen, Zoological Museum
- Michael Stoltze, the Danish Society for Nature Conservation
- Peter Vestergaard, the University of Copenhagen, Institute of Biology
- Søren Gram, project manager the Danish Board of Technology
- Bjørn Bedsted, project officer The Danish Board of Technology

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Jørgen Madsen, communication officer, writes this issue.

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