

# Making deltas cope with the effects of climate change - Europe

## 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

## 2. Key Approaches

- Knowledge-based
- Socio-economic
- Technical

## 3. Experiences that can be exchanged

Technical measures are often referred to as “hard solutions” and system-based measures as “soft solutions”. The core of the system-based approach is the fact that natural processes are given as much free reign as possible within a delta area. Only then can a delta adjust to changing circumstances such as those brought about by climate change. In principle, there are four possible strategies by which natural processes can be given the scope they need.

## 4. Overview of the case

A system-based approach aims to harness and use dynamic forces and create a dynamic equilibrium between land and water. Four strategies of system-based measures can be distinguished with the extent to which measures could contribute to the continued existence of deltas partly dependent on the space and scope available within a given delta. Which measure can best be taken depends on local ecological, economic and social circumstances.

## 5. Context and Objectives

### a) Context

Where a river enters an ocean or sea, sediments transported by the river are deposited. As layer upon layer is deposited a platform of sediment, the delta, is built up and rises above sea level. At the seaside of the delta erosive forces like currents, tides and waves play a role. As long as the net rate of sediment supply exceeds the rate of removal a delta will build seawards. Their fertile soil, presence of fresh water and the proximity of transport routes over river and sea make them an ideal place to live and for economic activities. However there is a downside: lying in the low coastal zone makes deltas vulnerable to all kinds of disasters like hurricanes and tsunamis. In the future this vulnerability will only further increase, because of sea level rise as a result of climate change. The global temperature is set to increase by a few degrees, resulting in the weather becoming much more extreme in many places, with more storms and changed river discharges. The sea level will also rise faster than in the preceding centuries. These changes will have a severe impact on the natural processes in deltas and in the lives of those living in these areas. Deltas will be affected by climate change, probably in the near future and the future of people and their economies is at stake as well.

As long as the natural processes in a delta are allowed to run their course and sufficient sediment is transported, a delta can grow at the same rate as a rising sea level. But inhabitants of deltas have been adapting their environment for centuries to suit their own needs. The main effects of human interventions is a shortage of sediment and the disruption of the natural processes. Consequently, the relative influence of the sea increases, resulting in erosion at the delta front and subsidence of

the delta. As a result affected deltas are no longer able to respond to modified circumstances such as climate change. For inhabitants of the delta area, this means an increased risk of flooding. Until recently, society relied on technical engineering measures. A re-appraisal of natural, geo-morphological processes, however, is currently gaining in importance. A fuller consideration of natural, dynamic forces in a delta, in an integrated, system-based approach seems to be a more flexible and promising way to cope with climate changes.

## **b) Objectives**

Until recently, society relied on technical engineering measures. A re-appraisal of natural, geo-morphological processes, however, is currently gaining in importance. A fuller consideration of natural, dynamic forces in a delta, in an integrated, system-based approach seems to be a more flexible and promising way to cope with climate changes.

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

### **a) Project Management**

The work was carried out in the framework of the Dutch National Research Programmes Climate changes Spatial Planning and Living with Water and commissioned by the International Association of Dredging Companies (IADC) and World Wide Fund for Nature Netherlands (WWF).

### **b) ICZM tools**

Four strategies of system-based measures can be distinguished: physical measures aimed at:- the management of sediment; the management of water, adaptation of human behaviour and no action. The extent to which measures could contribute to the continued existence of deltas is greatly depending on the space and scope available within a given delta. Which measure can best be taken depends on local geo-morphological, ecological, economic and social circumstances. It will not be possible to save an entire delta with a single type of "soft" intervention. System-based measures will not be sufficiently effective to completely exclude the need for technical measures. However, on a smaller scale and locally, system-based measures can be adequately effective. Strategies 1 and 2 consist of permanent, physical measures that influence the water and/or sediment management of the delta. These measures can include full or partial system recovery or the steering of natural processes in the delta system. In strategy 3, no measures are carried out with regard to the actual delta processes but human use of the delta is modified. The distribution of people and activities in a delta can be regulated with spatial planning. In addition, solutions that limit the damage as much as possible, compensation by means of an emergency fund or insurance and the temporary evacuation of residents during floods are part of this strategy.

From the available data three simple, generic indicators were extracted that provide a first, quantitative glance of vulnerability, stocks at risk and the potential for system-based measures. These are: 1/100 yr surge height, people potentially flooded in 2000 and area of the coastal plain between 0 and 2 m above mean sea level. In addition to these generic indicators, a range of specific indicators is provided that can offer detailed informed on specific aspects of vulnerability, risk and the potential of system-based measures.

## **7. Cost and resources**

No costs are available.

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

The system-based approach has two advantages over most technical measures: it is often cheaper and it is more sustainable in the long run. A disadvantage is that societies which have grown accustomed to the fixed equilibrium existing in many deltas today, will need to adapt their way of life in such a way that they can cope with the dynamic equilibrium associated with a system-based approach. This will in many cases not be easy. However, there is a lot at stake and both costs and sustainability are crucial when dealing with the question of how societies in deltas can best cope with the effects of climate

change. It should be borne in mind however, that a system-based approach can require “hard” interventions (e.g. constructing a dam to direct a sediment loaded longshore drift to the coast). Likewise, a “soft” intervention is not necessarily system-based. Ideally a system-based approach only requires a one-off intervention, after which natural processes take over as “custodians” of the area.

## 9. Success and Fail factors

In densely populated deltas, it will be difficult to take system-based measures that require a lot of space. In the case of deltas in poor countries, where the costs are much greater than the benefits, it may be an option not to take physical measures at all. Spatial planning is then a way of adaptation in which different zones in a delta are identified by which the spatial distribution of people and human activities is regulated. As a last resort, political measures (gradually removing the population from the delta ) and/or economic measures (insurance, compensation for losses) can be applied. Even if deltas cannot be fully protected by system-based measures, this can still be a suitable localized solution.

## 10. Unforeseen outcomes

None so far.

## 11. Prepared by

A. H. Pickaver, Coastal & Marine Union (EUCC)

## 12. Verified by

Jan Vermaat, Institute for Environmental Studies, Vrije Universiteit

## 13. Sources

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