

Specific Targeted Research Project

**Thematic priority:** Forecasting and developing innovative policies for sustainability in the medium and long term

# Framework for coastal erosion management

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# Framework for coastal erosion management

**A sustainable solution to coastal erosion problems should be based on an understanding of the sediment dynamics, framed in a policy context with explicit objectives and an institutional environment in which each stakeholder has a clear role. The CONSCIENCE project introduces the Frame of Reference as an aid to formulate this policy. Through this Frame a transparent erosion management policy becomes possible. Also the different EuroSION concepts can be given a suitable place in management.**

## Description of the Frame of Reference template

The Frame of Reference has been developed by Van Koningsveld (2003) as a means to better match specialist knowledge with end user needs. The template consists of three levels: the strategic, tactical and operational level (figure 1).

Characteristics of the Frame of Reference are the definition of clear objectives at strategic and tactical levels and an operational decision recipe involving four steps. At the highest (policy) level a strategic objective is formulated, determined by the long term vision about desired development of the coast. This vision could be based on generic ideas about sustainable development and should ideally reflect the interdependency of the natural coastal and socioeconomic systems.

Strategic objectives tend to vary slowly. Nonetheless they do have a profound impact on the kind of policy and management that is required and acceptable (Van Koningsveld, 2003)

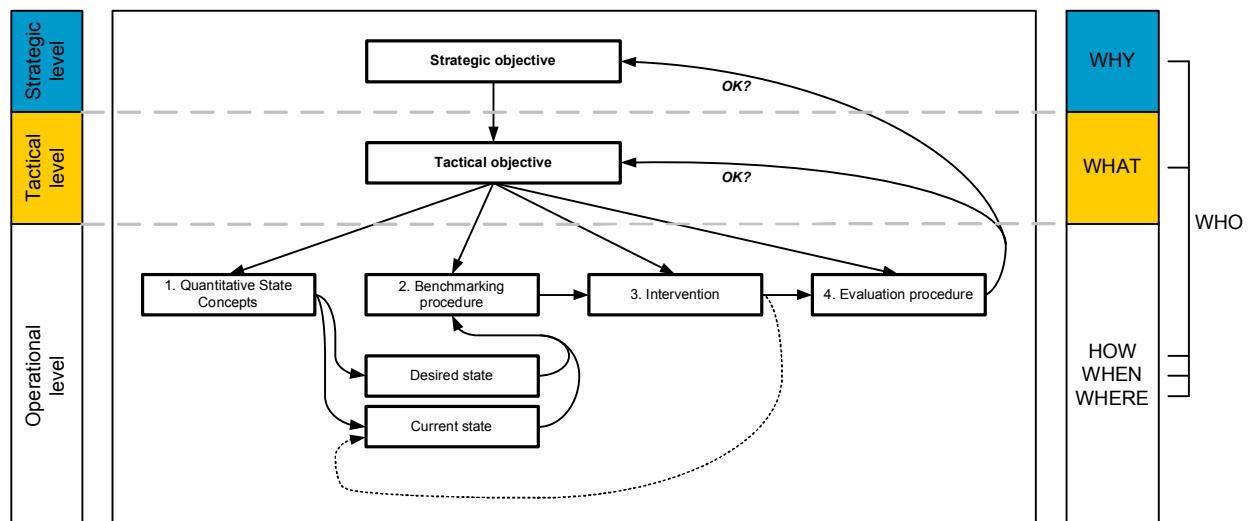


Figure 1: Generic Frame of Reference for coastal management.

At the next level one or more objectives are formulated describing in more detail what has to be carried out in order to achieve the strategic objective. As this implies a choice between different tactics, we call these the tactical objective(s). If, for instance, at a strategic level the objective formulated is 'sustainable development of coastal values and functions', then at the tactical level we have to choose between different options, such as maintaining the coastline at its current

position (i.e. not allowing erosion), or allowing a certain variability in coastline position.

The tactical objective expresses our vision on how to handle the interactions between the natural and the socio-economic system. It is a concrete implementation of the strategic objective. Tactical objectives are assumed to be related to the status and of values and interests in the coastal zone. As such the tactical objectives should include an explicit indication regarding the temporal and spatial scales involved. It may take many tactical objectives to cover all scales intended in the strategic objective.

Once this tactical objective has been defined, the actual management process regarding interventions can be formulated through four steps, namely:

1. *Quantitative state concept*: a means of quantifying the problem in hand. Coastal state indicators (CSIs) (i.e. specific parameters that play a role in decision making) are relevant at this stage of the process.
2. *Benchmarking process*: a means of assessing whether or not action is required. CSIs are compared to a threshold value at this stage.
3. *Intervention procedure*: A detailed definition of what action is required if the benchmark values are exceeded.
4. *Evaluation procedure*: Impact assessment of the action taken. If the action was not successful it may be necessary to revise the strategic/operational objectives (hence the feedback loops in Figure 1).

Having formulated the strategic and tactical objectives, the operational management is largely a matter for coastal practitioners and experts. In the benchmarking procedure the current state of the coast is compared with the desired state, after which the need for intervention is determined. The procedure describes the kind of information that is needed and how it is collected. Ideally a monitoring programme is in place which enables a pro-active response. Simulation models can be used to predict future coastal behaviour based on historic data.

In order to follow these operational steps, it is evident that we first need tactical and strategic objectives. These cannot be derived by scientists and practitioners alone, since this requires political decisions about the desired development of the coast and how much effort (time and money) society is willing to spend on reaching or maintaining this desired development.

### **Setting objectives**

At the strategic level we have to answer questions regarding the values and functions of our coast. For instance, many coasts contain valuable ecosystems, sometimes explicitly protected through national or European legislation (e.g. Natura 2000). At the same time these coasts are used for recreation, housing, groundwater extraction, agriculture etc. Where the hinterland is low lying, the coast also has a protection function against flooding from sea. Coastal erosion can threaten one or more of these values and functions. Before deciding to act to control erosion, it is advisable first to analyse the relationship between coastal dynamics and the functions of the coast. For instance, a dynamic and sometimes eroding coastline is less of a problem in the absence of built-up areas. Seasonal beach erosion may not be a problem for recreation, if it only happens during the winter storms. In other instances, it may be essential not to tolerate any coastal erosion in case this would lead to significant coastal flooding of built-up areas.

In practice, it appears very difficult to set realistic and unambiguous objectives for coastal erosion management. This already became apparent from the analysis of 60 case studies done by the EUROSION project, which concluded that very few

case studies had clearly defined their objectives for coastal erosion management. Developing strategic and tactical objectives should be part of a broader ICZM policy. Using the principles of ICZM is the best way to guarantee a sustainable development policy for coastal erosion, which has the support of all relevant stakeholders.

At the strategic level, objectives are often linked to key policy principles, such as safety and sustainable development. But from a strategic objective it does not directly become clear how to deal with coastal erosion. Therefore, a tactical objective is needed to determine if coastal erosion needs to be controlled or not. For instance, in the UK, the Department for the Environment, Food and Rural Affairs (Defra) has defined the following possible tactical objectives for coastal erosion management:

- Hold the line: maintain or upgrade the level of protection provided by defences;
- Advance the line: build new defences seaward of the existing defence line;
- Managed realignment: allowing retreat of the shoreline, with management to control or limit movement;
- No active intervention: a decision not to invest in providing or maintaining defences.

### **How do the EuroSION concepts fit in the FoR?**

The concepts of coastal sediment cell, strategic sediment reservoir and favourable sediment status can be used for implementation of erosion management at the operational level:

- The coastal sediment cell is the most logical unit to express the sediment situation. Therefore, the coastal cells concept can be used in definitions of the quantitative state of the coast (step 1).
- Favourable sediment status is an expression of the desired state of our coast and can be used for the benchmarking procedure (step 2).
- The strategic sediment reservoir is an essential component of the quantitative state of the coast (step 1), and can also be used as a sediment supply for nourishments as an intervention measure (step 3).

Coastal resilience, in a normative way, can be used as a guiding principle when formulating an objective for coastal policy. It fits in the goal of sustainable development, under the assumption that enhancing coastal resilience implies working with natural processes and thus is more efficient in the long run than using a strategy based on resisting the natural dynamics.

Examples of resilient objectives are 'managed realignment' and 'do nothing'. But even an objective such as 'hold the line' could allow for some resilience, for instance by using nourishment to replace losses and maintain a healthy beach. It is often not necessary to demand that at any point in time and place the coastline should be at a pre-defined position. Allowing some flexibility in this criterion would enable the coastline to fluctuate around an average position, which is much more efficient. For example, the Dutch definition of the 'coastline' is related to a *volume* of sand around the mean low water line. This definition allows redistribution of sediment close to the coastline without changing the formal coastline position.

### **Data and Monitoring and the FoR**

By using the Frame of Reference it becomes possible to identify when data is key to informing coastal erosion management decisions. First of all data on the contemporary coastal condition is required for benchmarking: i.e. comparing the current state of the coast with a preferred situation. Secondly, data is needed for the evaluation of measures: do the measures bring the state of the coast closer to the desired state? For these comparisons it is necessary to define Coastal State

Indicators (CSIs). CSIs can be described as *a reduced set of parameters that can simply, adequately and quantitatively describe the dynamic-state and evolutionary trends of a coastal system*. In other words, CSIs relay a complex message in a simple and useful manner. These indicators should adequately describe the quantitative state, allowing a comparison with threshold conditions in the benchmarking step.