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# Review of Existing Knowledge and Management Approaches of Coastal Erosion

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# **Review of Existing Knowledge and Management Approaches of Coastal Erosion**

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**March 2010**

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The report builds on the WP2 report "Review of existing Knowledge: Focus on Scientific and Technical Progress" – March 2008 (Deliverable 6).

In fact it is a re-structured and improved version of D6, extended with governance topics of WP3 (specifically in Chapter 6).

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# 1. Introduction

The CONSCIENCE project has as a central objective the development and testing of concepts, guidelines and tools for the sustainable management of coastal erosion in the European region. This work will be based on best available scientific knowledge and on existing practical experience. The project has a number of aims:

1. To define a decision-making framework based on the concepts formulated by the EUROSION project;
2. To develop these concepts into measurable standards, which can be evaluated in practice for any field situation.
3. To link these standards to ongoing European initiatives; and,
4. To produce guidelines and tools to enable effective implementation of European coastal erosion management.

Implementation of an overall policy framework for sustainable coastal erosion management requires an operational set of concepts and techniques which can be used by coastal managers. The EUROSION project identified four such concepts which form the basis of a sustainable management policy. These are shown in Box 1. The key aim of the CONSCIENCE project is, therefore, to provide the manager with the necessary guidelines and tools to implement these four concepts in order to achieve a sustainable management approach. Such an approach requires knowledge and recognition of both science and policy.

## **Box 1 – Definitions of the four key concepts** (formulated by the EUROSION project)

**Coastal resilience:** the inherent ability of the coast to accommodate changes induced by sea level rise, extreme events and occasional human impacts, whilst maintaining the functions fulfilled by the coastal system in the longer term.

**Strategic sediment reservoirs:** supplies of sediment of 'appropriate' characteristics that are available for replenishment of the coastal zone, either temporarily (to compensate for losses due to extreme storms) or in the long term (at least 100 years). They can be identified offshore, in the coastal zone (both above and below low water) and in the hinterland.

**Favourable sediment status:** the situation where the availability of coastal sediments support the objective of promoting coastal resilience in general and of preserving dynamic coastlines in particular.

**Coastal sediment cell:** a coastal compartment that contains a complete cycle of sedimentation including sources, transport paths, and sinks. The cell boundaries delineate the geographical area within which the budget of sediment is determined, providing the framework for the quantitative analysis of coastal erosion and accretion. In this respect, coastal sediment cells constitute the most appropriate units for achieving the objective of favourable sediment status and hence coastal resilience.

## 1.1 *EUROSION and its key findings*

The EUROSION project was commissioned in 2001 by the Directorate-General Environment of the European Commission upon an initiative of the European Parliament. Its aim was to evaluate the social, economic and ecological impact of coastal erosion on European coasts and assess

the needs for action. The project started in 2002, ended in 2004 and cost €5 million. The study covered all coastal Member States of the European Union, including the new Member States. A customised Geographical Information System was set up for the entire European coastline, as well as a database with information on shoreline management from 60 case-study sites across Europe.

According to EUROSION findings, approximately 20,000 kilometres of coast, corresponding to 20%, faced serious impacts in 2004. Within the period 1999-2002, between 250 and 300 houses had to be abandoned in Europe as a result of imminent coastal erosion risk and another 3,000 houses saw their market value decrease by at least 10%. The EUROSION project highlighted five key findings. These are:

1. Shortage of coastal sediments and space results in “coastal squeeze”;
2. [Current] Environmental Impact Assessment (EIA) practices do not address coastal erosion properly;
3. The risk of coastal erosion is supported financially by the public at large;
4. Traditional approaches to counteract coastal erosion may be counterproductive;
5. The knowledge base for decision-making on coastline management is generally weak.

It is anticipated that this situation will be aggravated by rising sea levels and a more unpredictable and extreme storm climate associated with climate change. This will result in a long term threat to the sustainability of many coastal activities, coastal biodiversity, the safety of economic assets and people, as well as the ability of the coast to provide a ‘natural’ coastal defence.

In light of these findings, the report "Living with Coastal Erosion in Europe: Sand and Space for Sustainability" makes four recommendations, based on the concepts outlined above, to cope with coastal erosion in Europe (European Commission, 2004):

1. Strengthen coastal resilience by restoring the sediment balance. This will require identifying areas where essential sediment processes occur, and identifying "strategic sediment reservoirs" from where sediment can be taken without endangering the natural balance;
2. Take the cost of coastal erosion into account in planning and investment decisions;
3. Make responses to coastal erosion pro-active and planned. Instead of the current reactive approach to "fix" coastal erosion when it happens, a long-term and more planned approach is needed. It should be based on regional coastal sediment management plans aimed at restoring coastal resilience. The plans should comprehensively assess what is at stake and what the costs and consequences of different policy options are (i.e. protect - do nothing - abandon the area);
4. Strengthen the knowledge base of coastal erosion management and planning to ensure informed decisions and the application of best practice.

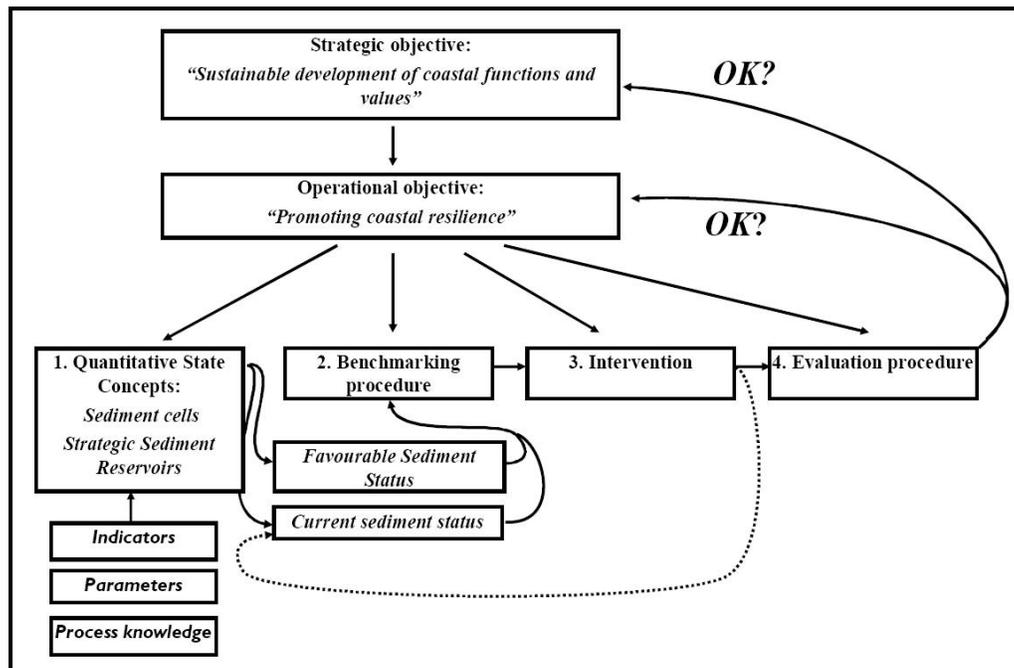
## **1.2 CONSCIENCE approach**

While the EUROSION project has advanced society's understanding of the physical coastal processes that drive coastal change, little progress has been achieved in the development of a decision making framework for the operationalisation of the EUROSION concepts. The CONSCIENCE project aims to address this gap by taking the concepts identified in EUROSION as a starting point and making them operational for real day-to-day management and strategic policy making.

From the EUROSION recommendations it is evident that sediment cells and sediment reservoirs are so-called “quantitative state concepts”, that require indicators and parameters for their operationalisation, based on process knowledge. On the other hand, favourable sediment status is a normative concept, that is, something to be desired in order to reach the operational objective

of promoting coastal resilience (which is also a normative concept). All these concepts should be supportive to the strategic objective of a sustainable development of coastal functions and values.

In order to operationalise the key concepts derived from the EUROSION project, it is necessary to frame them in a policy context so that each concept is related to a particular phase of the policy cycle. In order to do this a Frame of Reference has been designed that formalises this cycle. This frame of reference is shown in Figure 1.



**Figure 1.1: A simplified CONSCIENCE project Frame of Reference for implementing coastal erosion management policy**

The Frame of Reference recognises the four basic steps in policy making, namely:

1. *Quantitative state concept*: a means of quantifying the problem in hand. Coastal State Indicators (CSIs) are relevant at this stage of the process. A CSI may be defined as a specific parameter that plays a role in the decision making 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 choice of action has to be made, based on criteria such as costs and benefits, environmental effects and societal preferences. Actions include engineering solutions (hard and soft), planning and zoning (e.g. a set-back line) and non-structural instruments such as financial compensations, insurance and subsidies.
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 3.1).

Essentially the frame of reference in Figure 3.1 describes the steps in the coastal erosion management process by building on the key EUROSION concepts. The Frame of Reference is the starting point for the CONSCIENCE project. In order to operationalise the concepts, the criteria or factors that determine the usefulness of the concepts must be understood. In this regard the three relevant domains are science, policy and management. For each of these domains different criteria play a role in a concept:

- **Science:** scientific *validity*. Does the concept relate to a theory? Is there empirical evidence linked to the concept? Is there a body of knowledge?
- **Policy:** political *relevance*. Can the concept be linked to judgements, legislation, ethics, economy, culture?
- **Management:** practical *usefulness*. Can the concept be measured? Is it explainable to people? Can it be controlled? Where is it located in the management process?

It is anticipated that using the Frame of Reference, particularly with regard to the policy and management domains, will be helpful in answering these questions.

### **1.3 Report lay out**

Considering the different domains where the EUROSION concepts play a role, this report starts with a description of different aspects, opinions and connotations related to the EUROSION concepts (section 2). Then after an update on key issues since EUROSION (section 3), a review is given of progress in science (section 4), of advances in policy development mainly focussing on the EU level (section 5) and of current coastal policies and management practices in different countries (section 6). Finally in section 7, some preliminary conclusions are drawn.

This report is a co-production of Workpackages 2 and 3. The report builds on the internal WP2 report "Review of existing Knowledge: Focus on Scientific and Technical Progress" – March 2008, by extending the scope to include existing management approaches. The purpose of the report is to create and reinforce the central focus of the project CONSCIENCE.

## 2. EUROSION concepts

The Frame of Reference for coastal management will enable CONSCIENCE to define relevant parameters to qualify and quantify coastal resilience and favourable sediment status. Firstly, to aid understanding of the concepts, all the different aspects, opinions and connotations are mapped out. This is called “concept mapping”. This is a technique used to visualise relationships between different concepts in recognition of the fact that the concepts will have different connotations for different users. Each of the EUROSION concepts is mapped separately by splitting them into sub-concepts or aspects. These are shown in Figures 2.1 to 2.4 respectively. The relationships between the entities are hierarchical (i.e. A — B means B is a part of A). The rationale here is that it will make it easier to identify where more detailed information on the concept is needed. The concept maps divide each of the concepts into three (for coastal cells two) aspects: namely physical definition, quantification and implications for policy and management. A further division of each aspect has been made, to include, for example, time and space dimensions. For each of these sub-aspects a number of attributes, parameters, typologies or other descriptors are presented. These refer to the knowledge base of the respective scientific or policy domain. These lists should be regarded as illustrative and will be developed during the course of project. Wherever another key concept is mentioned in the concept map, this is highlighted to illustrate the linkages between the concepts at the right ontological location.

### 2.1 Coastal sediment cell<sup>1</sup>

A concept map for coastal sediment cells is shown in Figure 2.1. A coastal sediment cell may be defined as a coastal compartment that contains a complete cycle of sedimentation including sources, transport paths and sinks. The cell boundaries delineate the geographical area within which the budget of sediment is determined, providing the framework for the quantitative analysis of coastal erosion and accretion. In this respect, coastal sediment cells constitute the most appropriate units for achieving the objective of favourable sediment status and hence coastal resilience. The application of coastal sediment cells requires the establishment of a sand budget for a coastal area. This gives an insight to the relative importance of the various sediment sources and losses, resulting in deposition and erosion. Despite much effort in coastal science, the determination of the correct fluxes for specific coastal environments is still surrounded with large uncertainties making the job of the coastal manager more difficult.

### 2.2 Coastal resilience

EUROSION recognised the sustainable development of coastal zones and the conservation of dynamic habitats, especially on the remaining undeveloped coast, as important long term goals for European coastal areas. This requires a respect for, and in many cases restoration of the natural functioning of the coastal system and hence its natural resilience to erosion. EUROSION defines coastal resilience as the inherent ability of the coast to accommodate changes induced by sea level rise, extreme events and occasional human impacts, whilst maintaining the functions fulfilled by the coastal system in the longer term. A concept map of coastal resilience is given in Figure 2.2 .

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<sup>1</sup> The description of this and following concepts is based on the EUROSION report ‘Living with coastal erosion in Europe: Sediment and Space for Sustainability. Part I – Major findings and policy Recommendations of the EUROSION project’. 10 May 2004. RIKZ et al.

### **2.3 Favourable Sediment status:**

EUROSION proposed the introduction of the concept of favourable sediment status as the cornerstone of coastal resilience and sustainable shoreline management to European legislation. In the vision of EUROSION the objective of favourable sediment status for the coastal zone shall be achieved for each coastal sediment cell principally via the designation of strategic sediment reservoirs in combination with traditional measures such as spatial planning, building regulations, environmental assessment procedures and coastal erosion mitigation measures. A concept map for this is illustrated in Figure 2.3.

### **2.4 Strategic Sediment Reservoir:**

EUROSION defines strategic sediment reservoirs as amounts of sediment with 'appropriate' characteristics that are kept available for future replenishment of the coastal zone, either temporarily (to compensate for losses due to extreme storms or adverse human intervention) or in the long term (at least 100 years). It is recognised that many coastal erosion problems are caused by a human induced imbalance in the sediment budget. Natural sediment sources are depleted by sand mining activities, trapped in river reservoirs upstream or fixed by coastal engineering structures. Restoring this balance will require identifying areas where essential sediment processes occur, and identifying strategic sediment reservoirs from where sediment can be taken without endangering the natural balance. The CONSCIENCE project will explore the applicability of defining and designating strategic sediment reservoirs both in the coastal zone and river catchments. A concept map for strategic sediment reservoirs is shown in Figure 2.4.

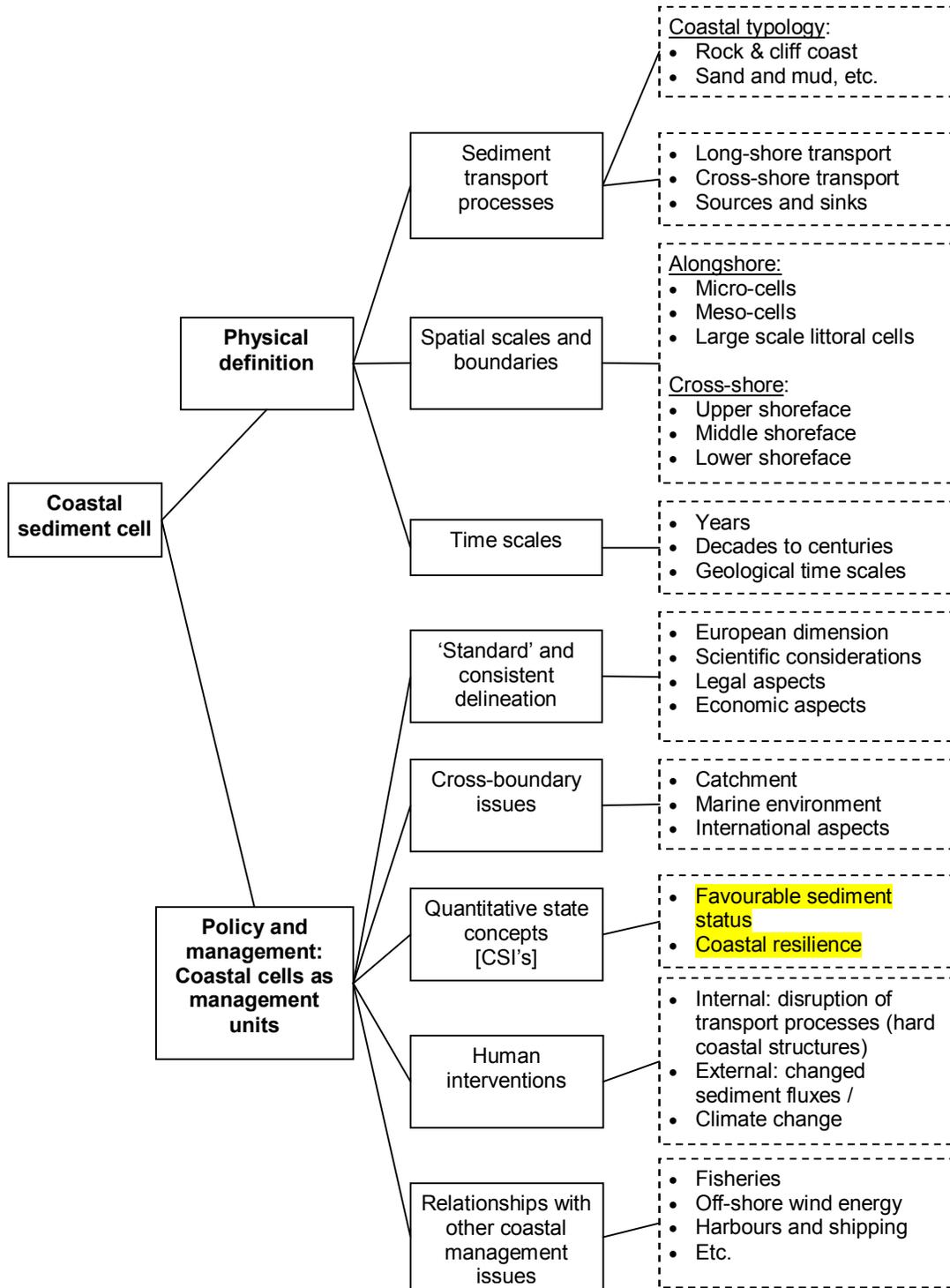


Figure 2.1 Concept map of the coastal sediment cell

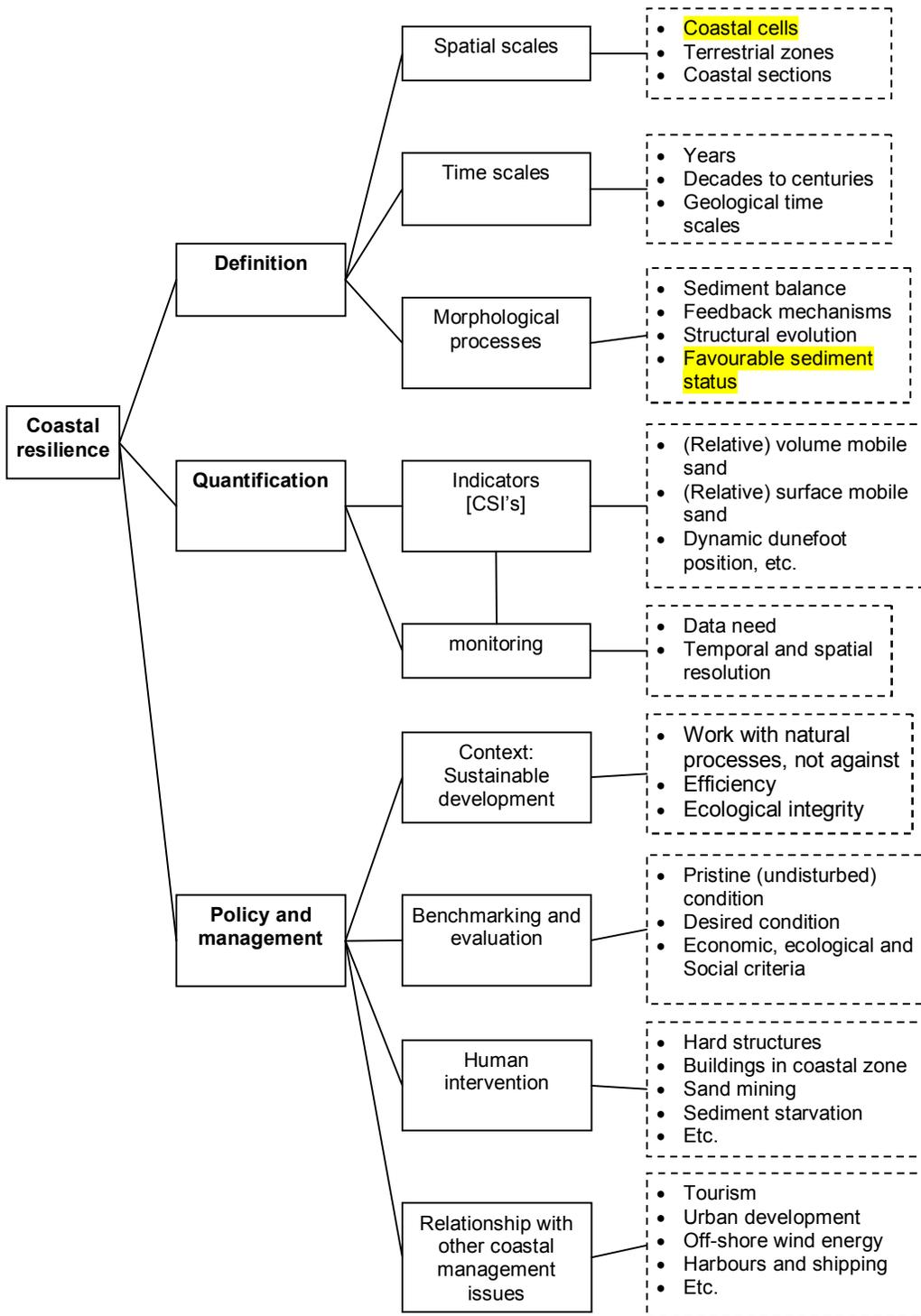


Figure 2.2 Concept map of coastal resilience

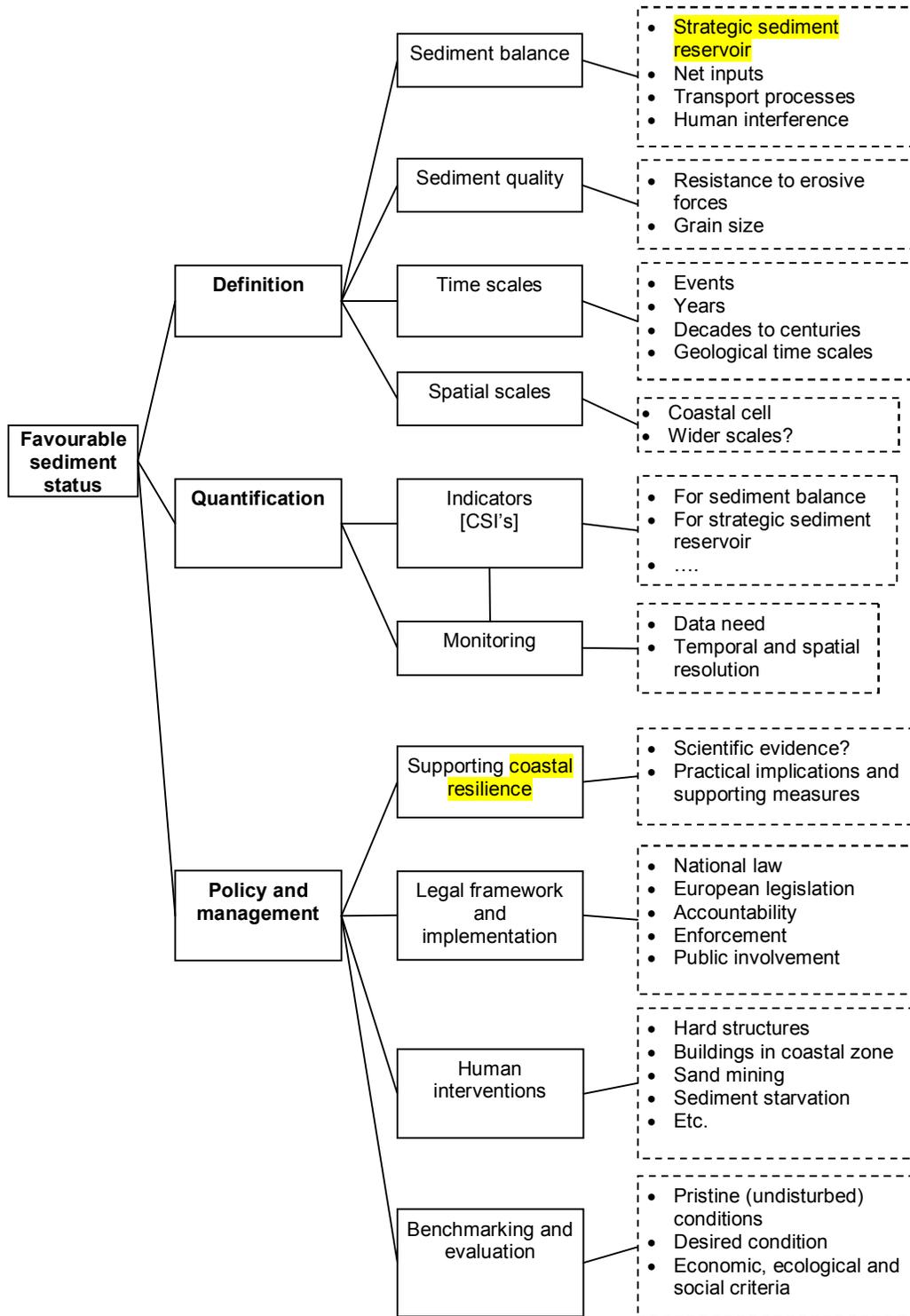


Figure 2.3 A concept map of Favourable Sediment Status

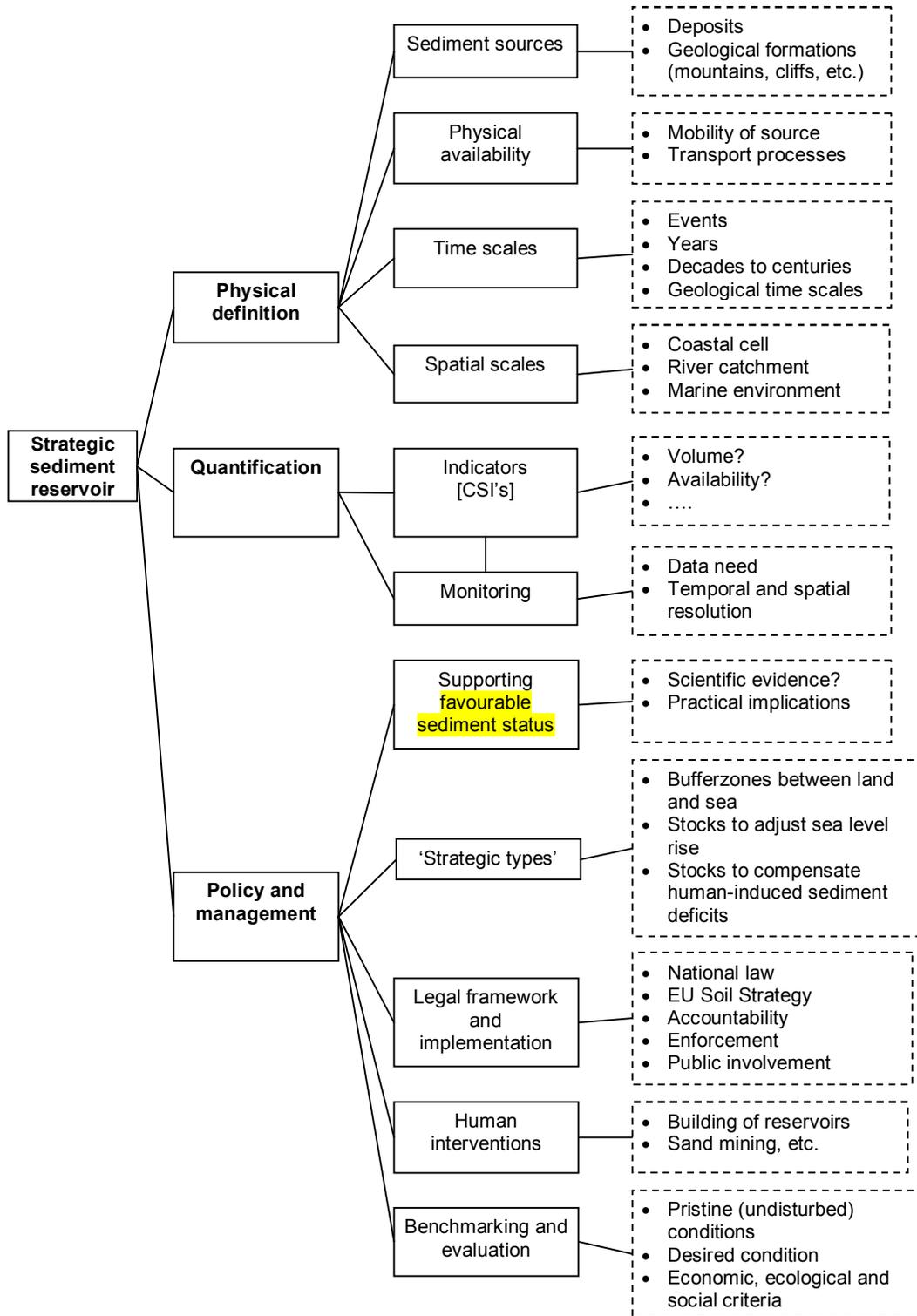
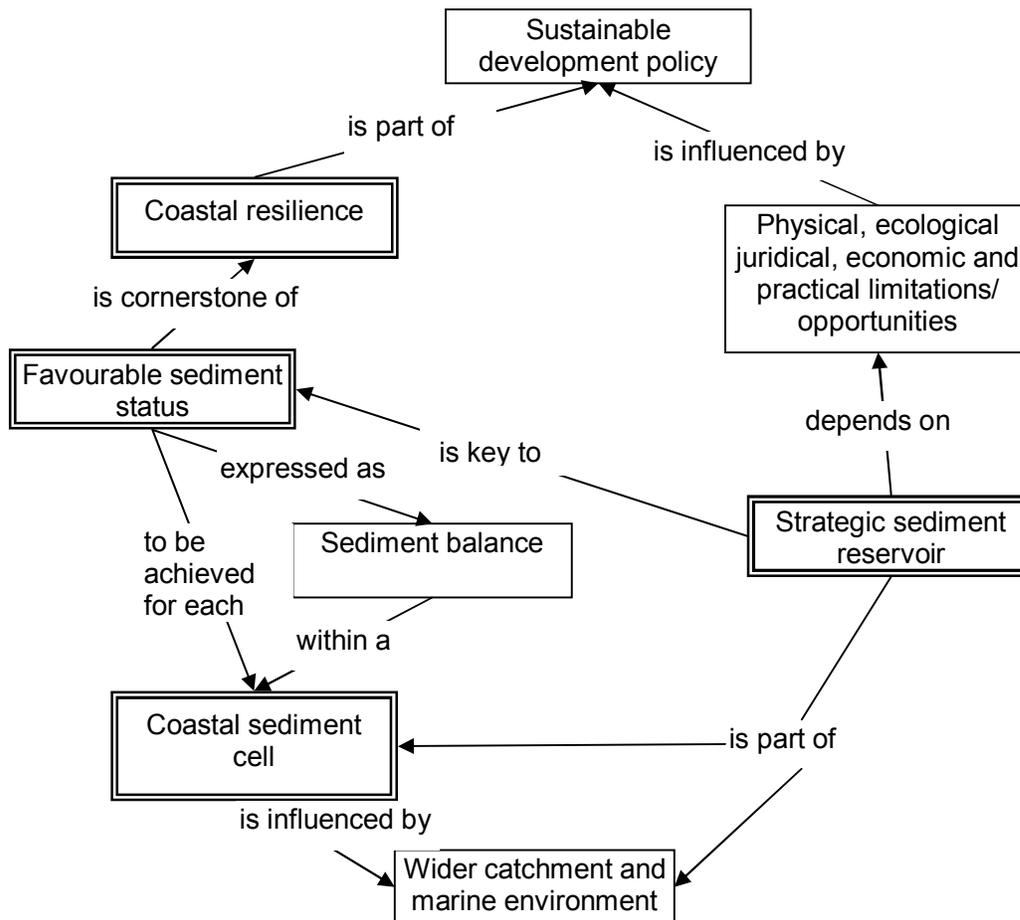


Figure 2.4 A concept map of strategic sediment reservoirs  
 An over-arching concept map is shown in Figure 2.5, which links all four concepts to each other.  
 Important issues to consider are:

- A close (causal) linkage is supposed between coastal resilience and favourable sediment status: the latter is considered a key condition ('cornerstone') to reach the former.

- Coastal resilience is explicitly mentioned as a policy objective that will help achieve sustainable development of the coast.
- Strategic sediment reservoirs are considered a key operational condition to fulfil favourable sediment status.
- Coastal cells are considered the appropriate unit not only for analysis of the sediment balance, but also as a management unit. More specifically, the EUROSION project recommends that for EACH coastal cell a favourable sediment status should be reached.



**Figure 2.5 Concept map of the four coastal erosion concepts**

A second aspect to the work of the CONSCIENCE project is to identify Coastal State Indicators for each of the above concepts, which are scientifically sound, relatively easy to monitor and understandable to policy makers. In a similar way to EUROSION, the practical application of CONSCIENCE tools and results, and the engagement of end-users, will be tested at six different test sites in Europe. The establishment of an end-user group will also ensure that there is optimal communication between the scientists working on the project designing the tools and guidelines and the end-users who will put these into practice. Overall this will reflect the principles of successful ICZM as outlined in the Recommendation on the implementation of ICZM by ensuring that coastal erosion is managed in a way that works with natural processes and respects the carrying capacity of ecosystems as well as involving all the relevant bodies in any management regime. It has been recognised in the EUROSION project that sound coastal management is

especially critical in response to future sea level rise, other implications of climate change and an expected increase in economic activities within coastal areas.

### 3. Update on key issues since EuroSION

Key issues to have emerged since the completion of the EUROSION project, which drive the need for an operational framework for erosion management are described below as:

- Increased scientific evidence for climate change.
- Increased risk of flooding and flood events.
- Lack of strategic response to coastal erosion management.
- Increased public and political awareness of the issues.

#### 3.1 *Increased scientific evidence for climate change*

The EUROSION project ended in May 2004. Since this there have been a number of key events at a European level which have emphasised the need for a change in approach to how erosion is managed. Arguably the most publicised of these has been the potential impact of climate change and consequent sea level rise. The most recent IPCC report has recognised that the implications of climate change for coastal environments and low-lying areas has increased substantially and six findings are relevant to future policy-making (Nicholls et al., 2007):

1. Coasts are experiencing the adverse consequences of hazards related to climate and sea level;
2. Coasts will be exposed to increasing risks, including coastal erosion, over coming decades due to climate change and sea-level rise;
3. The impact of climate change on coasts is exacerbated by increasing human-induced pressures;
4. Adaptation for the coasts of developing countries will be more challenging than for coasts of developed countries, due to constraints on adaptive capacity;
5. Adaptation costs for vulnerable coasts are much less than the costs of inaction;
6. The unavoidability of sea-level rise, even in the longer-term, frequently conflicts with present-day human development patterns and trends.

The 20th century has seen a rise of global sea level that has contributed to increased coastal inundation, erosion and ecosystem losses but it is important to note that there is considerable local and regional variation due to other factors. Current predicted changes in sea level estimate a rise of up to 0.6 m or more by 2100; a further rise in sea surface temperatures by up to 3°C; larger extreme waves and storm surges; as well as altered precipitation and run-off patterns. Again these phenomena will vary at regional and local scales, but the IPCC report states that impacts will be “overwhelmingly negative” (Nicholls et al., 2007, p.317). An acceleration in the rate of sea-level rise may mean that morphology cannot keep up, particularly where the supply of sediment is limited. This could happen, for example, when coastal floodplains are inundated after natural levees break or artificial embankments are overtopped. Browne and McLachlan (2003) opine that an acceleration in sea-level rise will widely exacerbate beach erosion around the globe, however, this will depend on local conditions, namely the total sediment budget. Sea-level rise is likely to cause an inland migration of beaches and the loss of up to 20% of coastal wetlands, reducing habitat availability for several species that breed or forage in low-lying coastal areas (Alcamo et al., 2007, p.543). According to Nicholls et al. (2007) several recent studies indicate that beach protection strategies and changes in the behaviour or frequency of storms can be more important than the projected acceleration of sea-level rise in determining future beach erosion rates (Ahrendt, 2001; Leont'yev, 2003). Therefore it could be concluded that sediment budget approaches are most useful to assess beach response to climate change (Cowell et al., 2006).

### **3.2 Increased risk of flooding and flood events**

A secondary but equally as relevant consequence of climate change and sea-level rise will be the increase of flood risk. Hence, many coastal cities require upgraded design criteria for flood embankments and barrages (e.g., the Thames barrier in London, the Delta works in the Netherlands, and planned protection for Venice) (Fletcher and Spencer, 2005). Media coverage of flood events illustrate that this already occurring. The prediction of precise locations for increased flood risk resulting from climate change remains an inexact science, as flood risk dynamics have multiple social, technical and environmental drivers (Few et al., 2004). Winter floods are expected to increase in maritime areas and flash floods are likely to increase throughout Europe. Coastal flooding related to increasing storminess and sea-level rise is likely to threaten up to 1.6 million additional people annually according to Alcamo et al. (2007, p.543). It is interesting to note that some countries have already developed flood risk policies in light of recent events as well as at the European level where a Directive on Floods has just been adopted. Since the IPCC's Third Assessment Report in 2001, governments have increased the number of actions for coping with extreme climate events. Alcamo et al. (2007) state that current thinking about adaptation to extreme climate events has moved away from reactive disaster relief towards more proactive risk management. Nicholls et al. (2007) recognise that the impacts of flood events will vary according to different sea-level rise scenarios, socio-economic situation and adaptation assumptions. They emphasise that upgraded defences will reduce the impacts of floods substantially: the greater the upgrade the lower the impacts. This reaffirms the need for a strategic and adaptive management policy. Many countries in north-west Europe have adopted the approach of developing detailed shoreline management plans that link adaptation measures with shoreline defence, accommodation and retreat strategies such as Shoreline Management Plans in the United Kingdom (Cooper et al., 2002; Defra, 2004; Hansom et al., 2004). Tol et al. (2007) state that parts of the Mediterranean and eastern European regions have been slower to follow this pattern and management approaches are more fragmented.

Given the recent and anticipated increases in damages from extreme events, the insurance industry and others are making greater use of catastrophe models. Using such models the Association of British Insurers have calculated that the number of properties at risk of flooding in eastern England will rise by 48% from 270,000 to 404,000 if there was a rise in sea level by 0.4m [This assumes no new building between now and the middle of this century] (ABI, 2006, p.6). These catastrophe models also cover event generation (e.g., storm magnitude and frequency), hazard simulation (wind stresses and surge heights), damage modelling (extent of structural damage), and financial modelling (costs) (Muir-Wood et al., 2005). The insurance industry has several practical approaches for adapting to the growing climate-related risk to property. These include raising the cost of insurance premiums, restricting or removing coverage, reinsurance and improved loss remediation (Dlugolecki, 2001). Work completed by the Comité Européen Des Assurances<sup>2</sup> (CEA) (2005) identifies the key elements of the prevention cycle where insurance could have the most substantial influence – including aspects of loss reduction (where to build and what to build), emergency planning, and improving risk knowledge following a flood event (lessons learned).

The unpredictability and uncertainty of future climate change is an obvious problem in making these adjustments. Insurers are also involved in discussions of measures for climate change mitigation and adaptation, including measures such as more stringent control of floodplain development and remedial measures for damages derived from weather action and extreme events (ABI, 2000). It is important to note that insurance coverage for natural events, and consequently how the costs of climate change are supported by different parts of society, varies between European Member States. The CEA examined this topic and found (2005 press release):

- Where private insurance covers weather risks (e.g. Sweden, United Kingdom), the costs of climate change are shared among the insured portions of society;

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<sup>2</sup> European Insurance and Resinsurance Agency.

- Where government carries the risk as “insurer of last resort” (e.g. France, Spain), the costs of the extreme impacts of climate change are borne by the taxpayer;
- Where there is neither insurance nor state-backed compensation for weather risks (e.g. Greece), the costs of climate change fall on the individual.

At a European level, the European Union Solidarity Fund (EUSF)<sup>3</sup> was created after the floods in central Europe in the summer of 2002 with the aim of providing fast, effective and flexible financial aid after a major natural disaster has occurred. The need for a financial instrument distinct from the structural ones was deemed to be all the more necessary after the 2003 heat wave, which largely damaged the Mediterranean countries. It is essential to note that this instrument was not designed to cover all costs linked to natural catastrophes. Payments are limited to emergency operations undertaken by public authorities and exclusively for non-insurable damages (CEA, 2007). In addition, the fund does not finance any long-term actions, such as prevention measures and it does not compensate for private losses.

The IPCC report (Nicholls et al., 2007) suggests that the most appropriate response to sea-level rise for coastal areas is a combination of adaptation to deal with the inevitable rise, and mitigation to limit the long-term rise to a manageable level. Adaptive capacity may be defined as the ability of a system to evolve in order to accommodate climate changes or to expand the range of variability with which it can cope. Mitigation would decrease the rate of future rise and the ultimate rise, limiting and slowing the need for adaptation. Obviously those countries with a limited capacity to adapt will be much more vulnerable to climate change. This would suggest that adaptive policies should be developed sooner rather than later. Crooks (2004) states that adopting a static policy approach towards sea-level rise conflicts with sustaining a dynamic coastal system that responds to perturbations via sediment movement and long-term evolution. An adaptive management approach is one of the principles of successful ICZM stipulated in the EC Recommendation. De Groot and Orford (2000) state that a key element of adaptation strategies for coastlines is the development of new laws and institutions for managing coastal land. They highlight the fact that there is no EC Directive on coastal management, despite the fact that Member States were encouraged to develop and publish coastal strategies by 2006 under the Recommendation on ICZM. The lack of a Directive reflects the complexity of socio-economic issues involved in coastal land use and the difficulty of defining acceptable management strategies for the different residents, users and interest groups involved with the coastal region (Vermaat et al., 2005).

A key conclusion of the 2007 report is that reactive and standalone efforts to reduce climate-related risks to coastal systems are “less effective” than responses which are part of integrated coastal zone management, including long-term national and community planning (Nicholls et al., 2007, p.340). They hypothesise that the extent to which climate change and sea-level rise are considered in coastal management plans is “a useful measure of the commitment to integration and sustainability” (p.340). The European Environment Agency (2003) however state that while the integration of sustainability goals into other sectoral policy areas is progressing, for instance, through national, regional and local sustainable development strategies and plans, these have not yet had a decisive effect on policies (EEA, 2003). More recently the EEA (2006) has stated that policies for the EU's coasts have “a long history but have not been implemented in an integrated manner so far”. They opine that this presents opportunities to promote the integration of river basins, coastal zones and marine regions and enhance cooperation with existing legal mechanisms, discussed in section 6.

### **3.3 Lack of strategic response**

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<sup>3</sup> See [http://ec.europa.eu/regional\\_policy/funds/solidar/solid\\_en.htm](http://ec.europa.eu/regional_policy/funds/solidar/solid_en.htm)

The Netherlands is one of the only countries in Europe to have a strategic framework for coastal erosion management (see 6.1.1). As there is no over-arching strategic erosion management framework at the European level, it is proposed to look at this within the context of ICZM. There remains widespread variation in ICZM progress at a European level. This is evident from the various approaches taken when implementing the Recommendation on ICZM. A table of progress is presented below (Table 3.1). An evaluation of the ICZM Recommendation was carried out by Rupprecht Consult and the International Ocean Institute between January and August 2006 with a final report submitted to the Commission in December 2006 (Rupprecht Consult, 2006). The evaluation concluded that the ICZM Recommendation has been beneficial for the coastal management of Europe. In concluding this, the Evaluation team found that the eight principles of good coastal management contained in the Recommendation created a new awareness in some Member States. In other Member States it generated an increased level of awareness at the regional level regarding long-term coastal challenges. Generally it was established that ICZM is implemented as a national strategy and does not, therefore, take trans-boundary concerns fully into account.

**Table 3.1 North West Europe Member State progress on implementation of the European ICZM Recommendation**

Country	Stocktake	Strategy	Reporting	
Belgium	Yes	No	Yes	
France	Yes	Yes	Yes	
Germany	Yes	Yes	Yes	
Ireland	In progress	No	No	
The Netherlands	Yes	No	Yes	
United Kingdom	Yes <sup>4</sup>	Under development	Yes	
• England	n/a		n/a	
• Scotland	n/a		Yes	n/a
• Wales	n/a		Yes	n/a
• Northern Ireland	n/a		Yes	n/a

A review of the main body of scientific literature since 2004 has revealed little or no publication on strategic management of erosion. The majority of peer-reviewed papers on coastal erosion are limited to operational responses primarily at localised sites. This is explored in more detail in section 4. What is clear is that there is a predominance of sea-level rise / implications of climate change-type papers. These all emphasise the need for an integrated management approach to climate change.

At the international scale, a study was carried out in the USA in 2005 which examined the vulnerability of the coastal counties of the USA to erosion by combining a socio-economic vulnerability index with the US Geological Survey's physically based coastal vulnerability index. The result of this was the production of a county-based index of overall coastal place vulnerability. The authors (Boruff et al., 2005) found that the majority of coastal hazards research focused on the definition and analysis of the physical characteristics of coastal vulnerability, with little reference to social indicators. They also found that there is little integrative work on coastal vulnerability. Any that do exist focus on local case study sites rather than regional or national comparative assessments. The results indicate that place vulnerability along the coast is highly differentiated and influenced by a range of social, economic, and physical indicators. This could be an important tool for the management of coastal erosion in Europe as currently it would appear that erosion is managed on a case-by-case basis with a lack of an overall strategy.

There has also been a number of papers on the success of integrated coastal management to date. These range from an analysis of individual projects to broader successes at a national

<sup>4</sup> Some parts of the UK have carried out stocktakes at regional levels.

and/or regional scale. One important development in this area has been the establishment and work of the EC Working Group on Indicators and Data. This group established two sets of indicators, one aimed at measuring progress in ICZM, and the other one measuring sustainable development of the coast (Pickaver *et al.*, 2004).

### **3.4. *Increased public and political awareness of the issues***

While it is impossible to present an exhaustive list of all erosion events since 2004, examples from each CONSCIENCE partner country is given in Appendix A. These were reported in the media at both national and sub-national scales.

## 4. Scientific progress

This section of the report presents an overview on scientific progress in coastal erosion management since the end of the EUROSION project. This was carried out by way of a literature review of international, European and national peer-reviewed papers. While it is impossible to adequately cover all of these in depth, this section focuses on selected references published between 2003-2007 that mention key EUROSION concepts. The literature searches have been performed using <http://www.sciencedirect.com>; <http://scholar.google.com/> and some other online sources of peer reviewed publications. These databases have been searched for the occurrence of the relevant EUROSION concepts or parts of concepts in the given wording (e.g. searches were performed for “coastal sediment cell” and “sediment cell”) within abstract, title, keywords, and full text of the publications. The searches have been performed in “All sources” and “All sciences” only for such materials.

### 4.1 Coastal resilience

EUROSION recognises the sustainable development of coastal zones and the conservation of dynamic habitats, especially on the remaining undeveloped coast, as important long term goals of European coastal zones. This requires a respect for, and in many cases restoration of the natural functioning of the coastal system and hence its natural resilience to erosion. EUROSION defines coastal resilience as the inherent ability of the coast to accommodate changes induced by sea level rise, extreme events and occasional human impacts, whilst maintaining the functions fulfilled by the coastal system in the longer term.

**Richard J. T. Klein, Robert J. Nicholls and Frank Thomalla (2003) Resilience to natural hazards: How useful is this concept? *Global Environmental Change Part B: Environmental Hazards, Volume 5, Issues 1-2, Pages 35-45.***

This paper recommends that “resilience only be used in a restricted sense to describe specific system attributes concerning (i) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction and (ii) the degree to which the system is capable of self-organisation.” The authors investigate the concept of resilience to natural hazards on the example of the weather-related hazards in coastal megacities.

**A.J. Long, M.P. Waller and A.J. Plater (2006) Coastal resilience and late Holocene tidal inlet history: The evolution of Dungeness Foreland and the Romney Marsh depositional complex (U.K.), *Geomorphology, Volume 82, Issues 3-4, Pages 309-330.***

The authors use the definition of Coastal resilience after Klein et al., 1998 (Klein, R.J.T., Smit, M.J., Goosen, H., Hulsbergen, C.H. (1998) Resilience and vulnerability: coastal dynamics or Dutch dikes? *Geogr. J.* 164, 259-268): “Coastal resilience” describes the self-organising ability of a coast to respond in a sustainable manner to morphological, biological and/or socio-economic pressures.

They state that this concept is useful from a morphological perspective as it helps to understand the ability of a coastal landform to respond to external drivers that include relative sea-level (RSL) rise, an increase in storm magnitude/frequency, or a fall in sediment supply. “A morphologically resilient coast is one that can maintain its long-term form despite experiencing short-term variations in the forcing processes, including sediment supply, on which it depends.”

**Daniel M. Alongi (In Press) Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science, Corrected Proof, Available online 3 October 2007***

“This review assesses the degree of resilience of mangrove forests to large, infrequent disturbance (tsunamis) and their role in coastal protection, and to chronic disturbance events (climate change) and the future of mangroves in the face of global change.”

**Michael Elliott, Daryl Burdon, Krystal L. Hemingway and Sabine E. Apitz (2007) Estuarine, coastal and marine ecosystem restoration: Confusing management and science – A revision of concepts. Estuarine, Coastal and Shelf Science, Volume 74, Issue 3, Pages 349-366.**

This paper reviews recent concepts, understanding and experience related to the restoration, recovery and human-related modification of estuarine, coastal and marine ecosystems. It divides them into four categories: “natural recovery from a natural or anthropogenic change (whether adverse or otherwise); anthropogenic interventions in response to a degraded or anthropogenically changed environment; anthropogenic responses to a single stressor; and habitat enhancement or creation”. This work presents a conceptual framework for restoration and recovery of marine marginal and semi-enclosed areas based on exploration of the plethora of terms used in restoration science and management. While doing this it presents a series of examples of management actions such as realignment and the restoration of docks, biogenic reefs, saltmarsh, seagrass, beaches and upper estuarine water quality.

## **4.2 Operational processes**

Quantitative state concepts will be defined and delineated for different types of coasts (sandy, gravel, soft and cliff coasts) in association with the end-user groups and the associated questionnaire. This approach will be generic across the study areas. It will also demonstrate what can be done with a minimum amount of data.

### **4.2.1 Coastal sediment cell<sup>5</sup>**

A coastal sediment cell may be defined as a coastal compartment that contains a complete cycle of sedimentation including sources, transport paths and sinks. The cell boundaries delineate the geographical area within which the budget of sediment is determined, providing the framework for the quantitative analysis of coastal erosion and accretion. In this respect, the coastal sediment cells constitute the most appropriate units for achieving the objective of favourable sediment status and hence coastal resilience.

**N.J. Cooper and N.I. Pontee (2006) Appraisal and evolution of the littoral ‘sediment cell’ concept in applied coastal management: Experiences from England and Wales. Ocean & Coastal Management, Volume 49, Issues 7-8, Pages 498-510.**

**Summary:** Cooper and Pontee (2006) provide a review of the historic approach to coastal zone management and describe the reasons for the introduction of the littoral ‘sediment cell’ concept to shoreline management planning in England and Wales. The paper discusses strengths and limitations of the approach and makes recommendations towards its further improvement.

**This paper gives the following definition for “sediment cell”:** Sediment cells were identified according to littoral sediment transport processes and are defined as units of coastline within which the natural processes are relatively self-confined and there are distinct inputs (sources), throughputs (sediment transport) and outputs (sinks or stores) of non-cohesive sediment. This is often defined as a classic “source-transport pathway-sink” model, which changes along the shoreline of this cell being independent of changes within either updrift or downdrift cells.

**Gesche Krause and Cidiane Soares (2004) Analysis of beach morphodynamics on the Bragantian mangrove peninsula (Pará, North Brazil) as prerequisite for coastal zone management recommendations. Geomorphology, Volume 60, Issues 1-2, Pages 225-239.**

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<sup>5</sup> The description of this and following concepts is based on the EUROSION report ‘Living with coastal erosion in Europe: Sediment and Space for Sustainability. Part I – Major findings and policy Recommendations of the EUROSION project’. 10 May 2004. RIKZ et al.

This paper uses the concept of the “coastal cells” applied to the implementation of recommendations for an integrated coastal zone management scheme of the mangrove peninsula of Braganca, State of Para (North Brazil). The authors identify “coastal cell” as a coastal management unit. The cells identified by this study were relatively small on the scale of 1-3km.

#### **4.2.2 Strategic Sediment Reservoir**

EUROSION defines strategic sediment reservoirs as amounts of sediment with ‘appropriate’ characteristics that are kept available for future replenishment of the coastal zone, either temporarily (to compensate for losses due to extreme storms or adverse human intervention) or in the long term (at least 100 years).

No references precisely matching this concept have been found.

[G. Fontolan, S. Pillon, F. Delli Quadri and A. Bezzi \(2007\) Sediment storage at tidal inlets in northern Adriatic lagoons: Ebb-tidal delta morphodynamics, conservation and sand use strategies. \*Estuarine, Coastal and Shelf Science\*, Volume 75, Issues 1-2, Pages 261-277.](#)

This paper deals with the relevant to the concept of “Strategic Sediment Reservoir” subject, however, does not name it in a same way.

It concludes that “when coupled with sedimentological data, the sand stored in ebb delta may be classified using GIS and catalogued following the volume, mean grain size and sorting, thus providing a useful tool for a preliminary assessment of sediment compatibility for possible re-nourishment of neighbouring beaches subject to erosion.”

#### **4.2.3 Favourable Sediment status**

EUROSION proposed the introduction of the concept of favourable sediment status within the European legislation as the cornerstone of coastal resilience and sustainable shoreline management. In the vision of EUROSION the objective of favourable sediment status for the coastal zone shall be achieved for each coastal sediment cell principally via the designation of strategic sediment reservoirs in combination with traditional measures such as spatial planning, building regulations, environmental assessment procedures and coastal erosion mitigation measures.

No references precisely matching this concept have been found.

### **4.3 Technological response**

There have been numerous developments in technologies for monitoring coastal zones in the recent past. Many of these tools have been developed by scientists to address questions about detailed coastal processes. A detailed separate report on coastal monitoring methods and an overview of predictive models for coastal evolution has been produced by CONSCIENCE and reference should be made to this document for further information.

### **4.4 Review of relevant EU projects**

CONSCIENCE will build upon an already existing knowledge base, developed in a large number of past and on-going research projects. A number of these projects also build on the experience gained from the EUROSION project but vary in their focus. The involvement of CONSCIENCE partners in many EU projects guarantees an effective and efficient uptake of this important knowledge experience while also providing an opportunity to develop best practice. Research findings, recommendations and databases from these projects will be utilised by CONSCIENCE.

The projects which are of particular relevance to CONSCIENCE are listed and briefly outlined in Table 4.1.

**Table 4.1 Other projects with outcomes relevant to CONSCIENCE**

<b>Project name</b>	<b>Brief description and aims</b>	<b>EUROSION element</b>	<b>Thematic focus</b>	<b>Environmental focus</b>	<b>Application area</b>	<b>Transferable outcomes</b>
<p><b>Beach-Med</b></p> <p><i>Environmental Recovery and Maintenance of Eroding Littorals with the Use of Marine Sandy Deposits</i></p> <p>Interreg IIB</p>	<p>The purpose of this project is to define technical, environmental and economic issues associated with the extraction of marine borrow sand, essential for the reconstruction and the conservation of eroding coasts.</p>	<p><i>No mention</i></p> <p>Note: most available documents are in Italian or Spanish</p>	<p>Optimal technologies for dredging and nourishment.</p>	<p>Offshore basins and beaches</p>	<p>Western Mediterranean area specifically France, Spain and Italy.</p>	<p>The main aim of the project is to define a potential market for sand nourishment works aimed at beach reconstruction and management in the western Mediterranean Sea. Also aims to make public and private operators in the sector, sensitive to the opportunity of investing in this field, on the grounds of a defined framework for technical, economic and environmental macro-elements.</p>
<b>Project</b>	<b>Brief description</b>	<b>EUROSION</b>	<b>Thematic</b>	<b>Environmental</b>	<b>Application</b>	<b>Transferable</b>

name	and aims	element	focus	focus	area	outcomes
<b>Beachmed-e</b>  <i>Strategic management of beach protection measures for the sustainable development of Mediterranean coastal areas</i>  Interreg IIC  Regional Framework Organisation	<p>The aim of the project is to address coastal vulnerabilities and to make the instruments developed for this available to local authorities. Specifically the project aims to 1) design and construct technical instruments to characterise erosion at a European scale and to aid the sustainable use of resources; 2) to set up management instruments to relate urban development with morphologically fragile areas, prone to ordinary and exceptional sea storms; and 3) to establish normative and organisational instruments to define, regulate and manage coastal defence by all parties involved (private and public).</p>	<p><i>No mention</i></p> <p>GESA links to strategic sediment reserve concept.</p> <p>Builds on BEACHMED project (above)</p> <p>Note: most available documents are in Italian or Spanish</p>	<p>There are 9 sub-projects which focus on various topics namely: monitoring techniques [OPTIMAL], characterisation of hydro-meteorological conditions [NAUSICAA], alternative beach nourishment sources [ReSaMMé]; protocol for dredging and beach nourishment [EuDREP]; integrated CZM plans for Mediterranean coastlines [MEDPLAN], ICZM pilot studies [ICZM-MED]; management of sand deposits [GESA], sand dune rehabilitation [PosiDune]; European observatory for the defence of the Mediterranean coast [ObseMedi].</p>	<p>Various – beaches, coastal areas, offshore basins</p>	<p>Western Mediterranean area</p>	<p>Hydrodynamic atlas of the coastline (erosion and sea-storms) [NAUSICAA]; Development of a protocol for dredging and beach nourishment [EuDREP];</p> <p>MEDPLAN builds risk scenarios into coastal management plans;</p> <p>Multi-disciplinary study of the way sand deposits and sand collected by coastal infrastructure is managed as well as the recovery of sediment from river beds;</p> <p>ObseMedi aims to draft rules and regulations for the exploitation of underwater deposits and nourishment.</p>
<b>Project name</b>	<b>Brief description and aims</b>	<b>EUROSION element</b>	<b>Thematic focus</b>	<b>Environmental focus</b>	<b>Application area</b>	<b>Transferable outcomes</b>

<p><b>CoastView</b></p> <p><i>Developing coastal video monitoring systems in support of coastal zone management</i></p> <p>Framework V Research &amp; Technical Development (RTD Action).</p>	<p>This project aims to simplify the task of the coastal manager who needs to know when a valuable component of the coast is at risk, which processes are responsible, and consequently what appropriate form of intervention (if any) is required in order to sustain or improve the resource.</p>	<p><i>No mention</i></p> <p>Builds on the European Coast3D project that was concerned primarily with the task of integrating existing measurement, modelling and process understanding.</p>	<p>Technological</p>	<p>Sedimentary coastlines</p> <p>Defended and undefended coastlines</p> <p>Coastal inlets</p>	<p>Case studies represent continuous-undefended and defended coastlines and coastal inlets with a single bar and coastal inlets with multiple complex bars in 4 European case studies in the Netherlands (Egmond), Italy (Lido de Dante), Spain (El Puntal) and Teignmouth</p>	<p>Develop improved video systems for delivering Coastal State Indicators (CSIs) promptly to the coastal manager at the appropriate temporal and spatial scales.</p> <p>CSIs developed focus on coastal protection, navigation, recreation and ecosystem protection.</p> <p>The video-CSI system will allow effective detection of erosion 'hot-spots', long-term trends in coastal evolution and provide an early warning system for coastal flooding. The system will also facilitate a 'real-time' evaluation of coastal hazards (e.g. the location of sandbars in navigable channels).</p>
Project name	Brief description and aims	EUROSION element	Thematic focus	Environmental focus	Application area	Transferable outcomes
<p><b>CoPraNet</b></p>	<p>The projects helps establish a coastal</p>	<p><i>No mention</i></p>	<p>Capacity building</p>	<p>Beaches</p>	<p>European wide</p>	<p>Best practice experience and</p>

<p><i>Coastal Practice Network: Contribution to the establishment of a European Coastal Practitioners Network</i></p> <p>Interreg IIC</p>	<p>practitioners network and bridge the gap between planners, managers and the research community across Europe. It was established to develop and exchange information on best practice in the coastal zone on the issues of sustainable tourism, coastal erosion and beach management.</p>		<p>Best practice techniques</p>	<p>Coastal zone management</p>	<p>The partnership consists of 21 partners from 11 countries encompassing 11 regional and local authorities, 2 government institutes, 4 universities and 4 NGOs.</p>	<p>planning guidelines in dealing with beach management, erosion and flood risks in the planning process, establishing a multilingual information system on best practice experience, disseminating best practice to all participating authorities of good practice experience on the basis of real cases presented by participating local, regional and national authorities.</p>
<p><b>MESSINA</b></p> <p><i>Managing European shorelines and sharing</i></p>	<p>Intends to partly bridge “knowledge gaps” of some local authorities and institutions, by raising their managerial and</p>	<p>Will build on the GIS for coastline management Recommendations of EUROSION</p>	<p>Capacity building Technological advances Best practice</p>	<p>Nearshore areas</p>	<p>Local case study sites for each of the 4 practical guides: Engineering</p>	<p>Development of a “coastal manager toolkit” consisting of 4 practical guides: Monitoring and modelling the</p>

<p><i>information on nearshore areas</i></p> <p>Interreg IIC</p>	<p>technical capabilities through a mutualisation of the experience and by upgrading existing shoreline management guidelines through an integration of the latest techniques and methods available in Europe.</p>				<p>case studies from Italy (3), Latvia and Poland.</p> <p>Spatial policy case studies from France (2) and Poland.</p> <p>Monitoring and modelling the shoreline case studies from Dubai, Sicily, Wales, France, Wales, England (2) and the CoastView project.</p> <p>Valuing the Shoreline case studies from Sweden, France, Netherlands (2) and Italy (2)</p>	<p>shoreline, Valuing the shoreline, Engineering the shoreline, and, Integrating the shoreline into spatial planning processes</p>
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## **5. Advances in Policy Framework for Decision Making**

### **5.1 Introduction**

In order to produce guidelines to enable the effective implementation of a decision making process based on the concepts formulated by the EUROSION project, it is necessary to take stock of approaches to decision making in the coastal zone. This section reviews developments in legislative and policy frameworks and describes key management concepts to have emerged or gained widespread recognition since 2003. (The effectiveness of these governance arrangements in practice will be contemplated in further detail at a later stage through WP3). Olsen and Nickerson (2003) state that governance addresses the values, policies, laws and institutions by which issues are addressed, by probing the fundamental goals and institutional arrangements that form the basis for decision making. Management is achieved within a governance framework via the implementation of administrative or technical goals. The same meaning is adopted in this report.

Noronha (2004) has stated that the absence of an integrated holistic approach to policy-making, and a failure to link the process of policy-making with the substance of policy, results in outcomes that some would consider inferior when viewed within a sustainability framework. It is clear from the various peer-reviewed papers, international reports and project experience that there needs to be a move away from reactive policy to one of proactive policy. In light of this it is necessary to examine key legal developments since the end of the EUROSION project which may instigate national strategic responses to coastal erosion. While there is no one legal mechanism dealing specifically with this issue, it can be addressed through a number of existing instruments but more importantly it will become an important issue in the relatively new legal instruments such as the Marine Framework Directive and the Floods Directive which are briefly outlined below..

### **5.2 EU Legislative - and Policy Frameworks**

#### **5.2.1 Environmental Impact Assessment (EIA) Directive**

The EUROSION project specifically recognised the limitations of the EIA Directives when considering coastal erosion. One of the main criticisms of the EIA was that an EIA is mandatory only for projects listed in Annex I. Those listed in Annex II are subject to an EIA only “where Member States consider that their characteristics so require”. Annex I projects include crude-oil refineries, trading ports, pipelines for the transport of oil, gas or chemicals. Projects in Annex II include certain infrastructure projects including harbours, ports and fishing harbours (not covered by Annex I), intensive fish farming; reclamation of land from the sea; coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, jetties and other sea defence works, excluding the maintenance and reconstruction of such works; and marinas. This has not changed.

Another criticism of the EIA Directive was the lack of public involvement in the process. Following the signature of the Aarhus Convention by the EC in 1998, the Community adopted a new Directive 2003/35/EC amending amongst others the EIA Directive. This Directive intends to align the provisions on public participation in accordance with the Aarhus Convention on public participation in decision-making and access to justice in environmental matters. It is anticipated that this will make the EIA process more transparent and provide more opportunities for public involvement, however, the way in which this is to be achieved is at the discretion of the individual Member States.

One of the most significant failings of EIA is that it reacts to development proposals rather than anticipating and steering them. This results in a process that can identify and assess development impacts but is unable to guide development (Glasson, 1999). It is hypothesised that the SEA Directive will address these failings.

### 5.2.3 Strategic Environmental Assessment (SEA) Directive

Strategic Environmental Assessment (SEA) is still a relatively new concept. The Directive was adopted in June 2001 and took effect for Member States in July 2004. By its nature, however, it covers a wider range of activities, and usually a wider area often over a longer time span than the EIA process. SEA can be applied to an entire sector (such as a national policy on energy for example) or to a geographical area, (for example, in the context of a regional development scheme). The Directive sets out a series of steps that must be undertaken as part of any assessment. These include scoping, the consideration of alternatives, the preparation of an 'environmental report', public consultation and the proposal of adaptation, mitigation and monitoring measures. The findings of the environmental report must be taken into account during preparation of the plan or programme. Article 5 of the Directive states that "Member States shall in all cases take into account relevant criteria set out in Annex II, in order to ensure that plans and programmes with likely significant effects on the environment are covered by this Directive". Annex II lists characteristics of the effects and of the area likely to be affected, in particular it lists the transboundary nature of the effects, the risks to the environment and the effects on areas or landscapes that have recognised international, Community or national protection status. This should help address sediment management and coastal erosion, however, the extent to which this has been achieved would require an examination of SEAs carried out to date which is beyond the scope of the CONSCIENCE project.

### 5.2.4 Floods Directive

On 18 September 2007 the European Council formally adopted a Directive on the assessment and management of floods (COM(2006)15 final). Its aim is to reduce and manage the risks that floods pose to human health, the environment, infrastructure and property. Under the Directive Member States will firstly need to carry out a preliminary assessment to identify the river basins and associated coastal areas at risk of flooding. For these areas, responsible authorities will then be required to draw up flood risk maps and subsequently flood risk management plans focused on prevention, protection and preparedness. According to Article 6 (6) Member States may decide that, "for coastal areas where an adequate level of protection is in place, the preparation of flood hazard maps shall be limited to" "floods with a low probability, or extreme events scenarios". Since 1998 floods in Europe have caused some 700 deaths, the displacement of about half a million people and at least €25 billion in insured economic losses ([http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm), accessed 21 August 2007). The compromise package agreed earlier this year strengthened the requirements on international cooperation in shared river basins and streamlined it with respect to preliminary flood risk assessment and mapping. In addition, there is a great emphasis on the role of flood plains and sustainable land use practices. The effects of sea-level rise, and climate change adaptation generally, will be considered in the first implementation cycle, starting in 2011 with the preliminary flood risk assessment.

Preliminary flood risk assessment will only be taken in areas where potential significant flood risks exist or are reasonably foreseeable in the future. Flood risk management plans will be developed and implemented at river basin/sub-basin level to reduce and manage the flood risk. These plans will include the analysis and assessment of flood risk, the definition of the level of protection, and identification and implementation of sustainable measures taking into account the possible effects in upstream and downstream areas. The Commission has highlighted the synergies between this Directive and the existing Water Framework Directive. In this regard, the Commission foresees that implementation of the Floods Directive would be carried out by the same administrative bodies as the WFD. Member States will have the option of including the flood risk management plans in the river basin managements plans required under the WFD. In the case of international river basins, Member States must coordinate with each other so that problems are not passed on from one area to another. All stakeholders must be given the opportunity to participate actively in the development and updating of the flood risk management plans. Risk assessments, maps and plans must

furthermore be made available to the public. These three steps are to be repeated in a six-year cycle to ensure that long-term developments are taken into account. The timescale for implementation is as follows: Member States will firstly carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they then need to develop flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.

### **5.2.5 Soils Directive**

In September 2006, the Commission adopted a comprehensive EU strategy specifically dedicated to soil protection. The Communication from the Commission to the Council, Parliament, the European Economic and Social Committee and the Committee of the Regions on this strategy specifically stated that the Commission will “assess possible synergies between measures aiming at protection and sustainable use of soil and measures aiming at the protection of coastal waters, including those incorporated in the Thematic Strategy on the Protection and Conservation of the Marine Environment” (COM (2006)231 final, p.12). In the strategy on soil protection it was recognised that erosion of land on the coast inevitably leads to physical loss of soils – e.g. from land on top of eroding cliffs, or on lowland subject to tidal inundation and sea level rise (Van Camp et al., 2004). The strategy also stated that coastal erosion may also lead to losses of certain soil functions and their substitution by other functions. In response to this strategy a Directive establishing a framework for the protection of soil (COM (2006) 232 final). Article 6 of the proposed Directive will require Member States to identify, within 5 years from the transposition date, areas within their national territory where there is “decisive evidence or legitimate grounds for suspicion” that erosion by water or wind has occurred or is likely to occur in the near future. Member States are then required to devise a programme of measures including at least risk reduction targets, the appropriate measures for reaching those targets, a timetable for the implementation of those measures and an estimate of the allocation of private or public means for the funding of those measures (Article 8(1)). As this is merely a proposal at this time one could envisage that sediment management plans may fall within this Article as a means of addressing erosion.

### **5.2.6 Climate Change strategy**

The second European Climate Change Policy (ECCP II) was launched in October 2005. This focuses specifically on impacts and adaptation. The ECCP II working group has carried out specific work on climate change impacts on the water cycle, water resource management and prediction of extreme events as well as a report specifically on marine resources, coastal zones and tourism (Ecofys BV, 2006). This latter report reiterates the connections between ICZM and climate change adaptation, namely the aspects of long-term and cross-sectoral planning and the fact that natural dynamics are taken into account. It goes on to point out that “there is not a single leading organisation in coastal zone management, often making it unclear who is responsible for regulations” (p.5). In addition it recommends that Member States “should be encouraged to develop long-term strategies for coastal protection with a view towards 2100” (p.5). The report concludes by suggesting that there should be a “climate proofing of existing legal instruments” the rationale being that this would be more adequate than creating a new “Adaptation Directive” (p.6). Regarding flood risk and coastal erosion management, the report suggests that work on climate change in the coastal zone could be integrated with an understanding of the overall coastal policies in operation. It adds that there “may be a place for funding structures in relation to flooding and coastal erosion or related plans” (p.7).

### **5.2.7 Maritime Strategy Directive**

In 2005, the Commission has proposed a Marine Strategy Directive to address environmental protection and conservation of the marine environment in marine waters not covered by the Water Framework Directive. This was later adopted in June 2008. The aim of the Marine Strategy Directive is “to aim to achieve good environmental status” of the EU’s marine waters by 2021. This Directive establishes European Marine Regions on the basis of geographical

and environmental criteria, in a similar way to the River Basin Districts established by the Water Framework Directive. Each Member State within a marine region is required to develop a strategy for its marine waters. Such a strategy will contain a detailed evaluation of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programmes to be carried out in that marine region. These strategies should culminate in the delivery of a programme of measures designed to achieve or maintain good environmental status. The Directive, however, specifically states that Member States should not be required to take specific steps where there is no significant risk to the marine environment, or where the costs would be disproportionate taking account of the risks to the marine environment, provided that any decision not to take action is properly justified (MSD, para. 11). It is anticipated that through the design of such strategies, climate change should be fully taken into account.

The Directive recognises that the programmes of measures developed under the marine strategies will be effective only if they are devised on the basis of a sound knowledge. With respect to this, the Directive states that provision should be made for the preparation at national level of an appropriate framework, including marine research and monitoring operations, for informed policymaking (MSD, para. 23). The measures developed should be devised on the basis of the precautionary principle and the principles that preventive action should be taken, that environmental damage should, as a priority, be rectified at source and that the polluter should pay (MSD, para. 27).

Paragraph 34 of the Directive recognises that due to the dynamic nature of marine ecosystems and their natural variability, as well as the fact that pressures and impacts on these environments may vary with changing patterns of human activity and the impact of climate change, that it is essential to recognise that "good environmental status" may have to be adapted over time. For this reason, the Directive recommends that the programmes of measures developed must be flexible and adaptive and take account of scientific and technological developments.

Marine waters is defined in the Directive as meaning the "waters, the seabed and subsoil on the seaward side of the baseline from which the extent of territorial waters is measured extending to the outmost reach of the area where a Member State has and/or exercises jurisdictional rights, in accordance with the United Nations Convention on the Law of the Sea". Member States are required to have completed an initial assessment of the current environmental status of the waters concerned and the environmental impact of human activities on such waters by July 2012. A programme of measures designed to achieve good environmental status must be developed by 2015 at the latest.

### **5.2.8 Integrated Maritime Policy**

The Marine Strategy Directive will deliver the environmental pillar of a broader, EU Integrated Maritime Policy. The Commission adopted a Maritime Policy Green Paper in June 2006 (COM(2006) 275 final) as a first step towards the development of this new policy. The mandate for the Green paper was to examine all economic activities which are linked to or impact on the oceans and seas, as well as all the policies dealing with them, with a view to finding the best way to extract more benefit from the oceans in a sustainable manner. The paper covered topics such as the sustainable development of maritime regions, maximising the quality of life in coastal regions, providing tools to manage human relations with the oceans and maritime governance. The background paper on climate change stresses the need for ICZM policies to be tailored to climate change priorities (European Commission, 2006). It suggests that such policies should aim to improve the resilience of coastal areas to adapt to change, and to provide space for coastal processes to operate and achieve a more equitable sharing of risks *inter alia* by using financial instruments. It also suggests that the implications of climate change are borne in mind when planning future coastal development.

Subsequent to widespread consultation on the Green Paper on this, the Commission produced the Blue Book – an Integrated Maritime Policy for the European Union (COM (2007) 575 final). [The Integrated Maritime Policy aims to provide a coherent framework, which exploits synergies between different policy areas of the sea and resolves potential conflicts.](#) It lays the foundation for the governance framework and cross-sectoral tools necessary for an

EU Integrated Maritime Policy and sets out the main actions that the Commission will pursue during the course of this mandate. The Commission will:

- invite Member States to draw up national integrated maritime policies, working closely with stakeholders, in particular the coastal regions;
- propose in 2008 a set of guidelines for these national integrated maritime policies and report annually on EU and Member States' actions in this regard from 2009;
- organise a stakeholder consultation structure, feeding into further development of the maritime policy and allowing exchange of best practices.

In order to embrace a more integrated governance approach, the Commission will issue in 2008 a set of guide lines on common principles and stakeholder involvement for maritime policies and will report on the Member States actions by 2009. The Communication recognises that an integrated governance framework for maritime affairs requires horizontal planning tools that cut across marine-related sectoral policies and support joined up policy making. Marine Spatial Planning and ICZM are recognised as key approaches for sustainable decision-making.

The Green Paper and since then, the Blue Book, recognises the role of Marine Spatial Planning as part of an overall integrated management approach. The main elements of MSP are likely to include an interlinked system of plans, policies and regulations; the components of environmental management systems (e.g. setting objectives, initial assessment, implementation, monitoring, audit and review); and some of the many tools that are already used for land use planning. The Communication on a roadmap for MSP: achieving common principles in the EU (COM(2008) 791 final) was adopted by the Commission on 25 November 2008. The Communication provides information on current MSP activities in the Member States, outlines the instruments which impact upon it and sets out key principles underpinning it. The Communication seeks to encourage a broad debate on how a common approach to maritime spatial planning can be achieved in the EU. Importantly, the Roadmap states that "climate change, in particular the rise of sea levels, acidification, increasing water temperatures, and frequency of extreme weather events is likely to cause a shift in economic activities in maritime areas and to alter marine ecosystems". In this regard the Roadmap highlights the contribution MSP can play in mitigation, by promoting the efficient use of maritime space and renewable energy, and in cost-efficient adaptation to the impact of climate change in maritime areas and coastal waters.

The Roadmap states that "MSP should be legally binding if it is to be effective. This might also raise the issue of the appropriate administrative framework for MSP" ((2008) 791 final; p.10). The Roadmap also recognises that coastal zones are the "hinge" between maritime and terrestrial development and for this reason it is necessary to coordinate terrestrial spatial planning with MSP ((2008) 791 final; p.11). In 2009, the Commission will also set up of a system for the exchange of best practice among authorities in maritime spatial planning and integrated coastal zone management.

In the Action Plan (SEC (2007) 1278) accompanying the Blue Book there is a specific action devoted to mitigation and adaptation to climate change. On 29 June 2007, the European Commission adopted its first policy document on adapting to the impacts of climate change. This Green Paper "adaptation to climate change in Europe - options for EU action", builds upon the work and findings of the European Climate Change Programme. On the basis of responses received from a broad public consultation on the paper, the Commission will propose more concrete EU policy orientations for adaptation to climate change in a White Paper scheduled for publication by the end of 2008.

### **5.2.9 Lisbon and Gothenburg Agendas**

During a meeting of the European Council in Lisbon in March 2000, the constituent Heads of State and Governments launched a "Lisbon Strategy" aimed at making the European Union the most competitive economy in the world and achieving full employment by 2010. This strategy has three pillars composed of economic, social and environmental goals. The environmental pillar emphasises the fact that economic growth must be decoupled from the use of natural resources and has since been furthered through the Gothenburg agenda. The

Gothenburg Agenda seeks to refine the goals of the Lisbon Strategy by ensuring that any future development should be both environmentally and socially sustainable.

After an interim review of the Lisbon Agenda, the Community found that the outcomes were disappointing, particularly with respect to employment. It was recognised that future Cohesion Policy would need to incorporate the Lisbon and Gothenburg objectives. In order to give the strategies some added momentum the Commission proposed a simplified coordination procedure and more national focus to be achieved via National Action Plans (NAPs). This has strengthened the synergies with the Lisbon Strategy and highlighted a number of key measures that are to be brought forward at a national level. As a fundamental basis the Gothenburg Agenda provides a long-term approach for making all European policies more sustainable. The Gothenburg Agenda and the Sustainable Development Strategy as a whole was reviewed and updated in 2005 and covers the timeframe from 2005-2010. The strategy now contains objectives for addressing climate change as well as targets aimed at better management of natural resources both of which should help address erosion management in Europe. At the same time the European Council adopted guiding principles on Sustainable Development.

### **5.2.10 The Åarhus Convention and associated Directives**

Following the signature of the Åarhus Convention by the Community on 25 June 1998, the Community adopted in May 2003 a number of Directives aimed at delivering the Convention's provisions. Briefly, the Convention aims to ensure access to environmental information, public participation in the decision-making process as well as access to justice in environmental matters. Firstly, Directive 2003/4/EC was enacted on public access to environmental information on 28 January 2003. Secondly, Directive 2003/35/EC providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending these aspects in the EIA Directive and the IPPC Directive was enacted. Thirdly on 24 October 2003, the Commission presented a proposal for a Directive on access to justice in environmental matters as the final step in delivering the objectives of the Åarhus Convention. A Regulation (EC No. 1367/2006) on all three aspects of the convention was adopted in September 2006 and applies these provisions to all Community institutions. In addition, the regulation requires those institutions and bodies to provide for public participation in the preparation, modification or review of "plans and programmes relating to the environment".

### **5.2.11 Protocol on ICZM in the Mediterranean**

In January 2008 in Madrid the Contracting Parties to the Barcelona Convention (EC is the contracting party to the Convention, as well as 7 EC members and 2 Accession Countries) signed, after more than six years of negotiation, a Protocol on Integrated Coastal Zone Management in the Mediterranean. This protocol is open for signature by the Contracting Parties that have not yet done so until 20 January 2009. It is expected that The Protocol will be ratified and enter into force in 2009.

With regard to coastal erosion the Protocol mentions under Article 23:

1. In conformity with the objectives and principles (of ICZM – ed.) set out in Articles 5 and 6 of this Protocol, the Parties, with a view to preventing and mitigating the negative impact of coastal erosion more effectively, undertake to adopt the necessary measures to maintain or restore the natural capacity of the coast to adapt to changes, including those caused by the rise in sea levels.
2. The Parties, when considering new activities and works located in the coastal zone including marine structures and coastal defence works, shall take particular account of their negative effects on coastal erosion and the direct and indirect costs that may result. In respect of existing activities and structures, the Parties should adopt measures to minimize their effects on coastal erosion.
3. The Parties shall endeavour to anticipate the impacts of coastal erosion through the integrated management of activities, including adoption of special measures for coastal sediments and coastal works.

4. The Parties undertake to share scientific data that may improve knowledge on the state, development and impacts of coastal erosion.

As a concrete measure under Article 6, the Parties shall establish in coastal zones, as from the highest winter waterline, a zone where construction is not allowed. Taking into account, *inter alia*, the areas directly and negatively affected by climate change and natural risks, this zone may not be less than 100 meters in width. If, and when, implemented this measure might have direct positive impact in reducing the long term negative effects of coastal erosion.

### 5.3 Key developments

A number of key developments will have important roles to play in the future management of coastal erosion in Europe.

#### 5.3.1 Advances in ICZM

ICZM promotes the sustainable management of coastal zones through co-operation and integrated planning, involving all the relevant players at the appropriate geographic level. The Recommendation of the European Parliament and Council concerning the implementation of ICZM in Europe (2002/413/EC) forms the current policy basis for ICZM in Europe. Chapter 1 of the Recommendation specifically refers to the need to address the issue of coastal erosion. The Recommendation encouraged Member States to undertake a stocktake to analyse relevant law and policy frameworks and based on the results of this, Member States were encouraged to develop national strategies. The objective of these is to increase the coherence between the many national, regional and local regulations and initiatives affecting coastal zones. In formulating national strategies, Member States were asked to follow the principles of good ICZM, contained in the Recommendation, to ensure good coastal management and governance. These are shown in Box 6.2.

- (a) a **broad overall perspective** (thematic and geographic);
- (b) a **long-term perspective** which will take into account the precautionary principle;
- (c) **adaptive management** during a gradual process;
- (d) **local specificity** and the great diversity of European coastal zones;
- (e) working with **natural processes** and respecting the carrying capacity of ecosystems;
- (f) involving **all the parties** concerned in the management process;
- (g) support and involvement of **relevant administrative bodies**;
- (h) use of a **combination of instruments** designed to facilitate coherence;

#### Box 6.2 The principles of good ICZM as contained in the ICZM Recommendation

The European Commission was also obliged to provide the European Council and Parliament with an evaluation report and a proposal for EC legislation, if appropriate, by January 2007. To inform this, an external evaluation of the implementation of the ICZM Recommendation was carried out by Rupprecht Consult and the International Ocean Institute (Rupprecht Consult, 2006). The evaluation highlighted the success and potential of the European ICZM Recommendation (Rupprecht Consult, 2006) in facilitating improved coastal management and revealed that the ICZM principles have created a new awareness in some Member States. The evaluation also recognised that ICZM is a key instrument in linking the legislation and policies of terrestrial and marine environments. This will be intrinsic to any future actions taken by the European Union in relation to an over-arching Maritime Policy.

Many of the principles of good ICZM contained in the Recommendation are relevant to the implementation of a sustainable approach to erosion management, for example, a long term perspective, local specificity, involving all the relevant parties and working with natural processes. The long-term perspective emphasises the need for a precautionary approach to

management. It is anticipated that this will grow in importance in future given the likely implications of climate change, such as sea-level rise and increased flooding. The need for involvement of all relevant actors in the decision-making process has been given added impetus with the implementation of the Aarhus convention and its associated Directives.

Subsequent to the adoption of the EC Recommendation on ICZM in 2002, an EU ICZM Expert Group was established which agreed on a Working Group on Indicators and Data (WG-ID) to develop a set of indicators to aid assessment of the status of ICZM implementation. A document describing an indicator to measure the progress of ICZM implementation in the coastal zone was presented by the WG-ID to the second meeting of the Expert Group in June 2003 (Pickaver, 2004). This Progress Indicator allows Member States and the Accession Countries to determine the extent of implementation of ICZM at national level and to assess whether progress is leading to improved sustainability of coastal resources. The EU ICZM Expert Group agreed to adopt the Progress Indicator, to begin testing it, and to modify it according to the feedback. A revised Progress Indicator of 31 Actions divided into 4 phases was adopted by the 5<sup>th</sup> Meeting of the EU ICZM Group of Experts in September 2005.

It has been recognised that scientific knowledge is communicated primarily to other scientists. Publications are available to other members of the scientific community but rarely accessible to non-expert coastal and marine professionals. Advances in techniques and knowledge therefore may not be readily available to practitioners. While the CONSCIENCE project attempts to address this in relation to erosion management, other projects may provide knowledge transfer opportunities. The ENCORA project, for example, operates on a “network of networks” basis which organises a number of services to enable coastal practitioners to take better advantage of existing knowledge resources in Europe, in order to address future coastal management issues. These services are being implemented by a number of national coordination offices, that exist in 18 European countries and rely on three different types of networks, namely, national networks, thematic networks and affiliated networks. Two of the thematic networks are of particular relevance to CONSCIENCE. These are the thematic network on long-term coastal geomorphological change (theme 5) and sustainable coastal engineering techniques (theme 8).

### **5.3.2 European Maritime Policy and Marine Spatial Planning**

As discussed in section 5.2.8, the Blue Book on an Integrated Maritime Policy for Europe was published in October 2007. This clearly focuses on the possible implications of climate change and stresses the need for ICZM policies to be tailored to climate change priorities. The previous Green Paper recognised the concept of coastal resilience and the need to provide space for coastal processes to operate. The Green Paper also recognised a future role for Marine Spatial Planning which has been expanded upon more recently in the Roadmap for MSP accompanying the Blue Book (see section 5.2.8). This MSP concept also has widespread international support (for example, through the OSPAR secretariat) and international experience suggests that it can facilitate sustainable development and strategic planning as well as multiple use allocation and associated conflict mitigation and reduction for offshore areas (UNESCO, 2006, Ehler *et al*, 2007). It is anticipated that Marine Spatial Planning will be a key element in implementing Europe’s Integrated Maritime Policy. It also provides an opportunity to frame sustainable erosion management practices within a wider marine planning system thereby ensuring a consistent approach to issues such as monitoring. The Integrated Maritime Policy for Europe is based on the ecosystems approach to management. This fits well with the CONSCIENCE frame of reference which is iterative and links science with policy and management.

## **5.4 Applicability and usefulness of EUROSION concepts**

Although rarely mentioning erosion management explicitly, the various EU Frameworks provide ample support for further implementation of sustainable erosion management based on EUROSION concepts.

In summary this conclusion is based on the following observations:

- The Floods- and Water Frame Work Directives ask for an assesement of river basins and associated coastal areas under risk of flooding (by 2011) and for the development of risk maps and establishment of flood risk management plans. The introduction of sediment management plans and (e.g.) of coastal cells as spatial units, may contribute to successfully fulfilling these requirements
- The Soils Directive requires the identification of areas prone to erosion and the devise of a programme of action. The outline of a sediment management plan including actions to define coastal cells, strategic sediment reservoirs etc., are important to achieve the policy goals.
- The Climate Change Policy (ECCP II) emphasizes the connection between Climate Change and Integrated Coastal Zone Management, stressing the importance of a long term / large scale approach , respecting natural dynamics. Sediment management and the resilience concept perfectly comply with these recommendations.
- The Maritime Strategy Directive and Maritime Policy require an evaluation of environmental state, the definition of “good environmental status”, setting clear environmental targets and implementation of monitoring programs. The need for ICZM policies is obvious, recognizing coastal resilience and the need to provide space for natural processes. Once again, it is clear that concepts like coastal cells and favourable sediment status, as parts of sediment management, may play an important role.

## 6. Current Policy- and Management Approach

### 6.1 Review of different EU countries

The ultimate objective of CONSCIENCE is to deliver guidelines and tools to enable effective implementation of European coastal erosion management, based on the concepts and recommendations as formulated by the EUROSION project.

As such, it is important to have an overview of current legal and administrative responsibilities, of existing decision making approaches (including insight into public participation and communication aspects), of cost and financing mechanisms of coastal erosion and of differences across EU countries, with regard to knowledge, capacities and existing practices. However, as the EUROSION concepts and recommendations advocate a sediment management approach to coastal erosion, the first questions to be answered are:

- What is the existing policy and management strategy with regard to coastal erosion of the EU country ?
- Is it formalized ? Is a policy document available ?
- Is a sediment management approach (are the EUROSION concepts) implied in this policy ?

The answers to these questions determine whether it is appropriate to elaborate consecutive questions regarding legal and institutional implementation.

In the following sections the results are given of the review for a selected number of EU countries.

#### 6.1.1 The Netherlands

The Netherlands is one of the only countries in Europe to have a strategic framework for coastal erosion management. Traditional coastal policy in the Netherlands is primarily aimed at protection against flooding. This gradually changed over the years to take account of other factors such as ecological considerations and sustainability. As a result it was decided that a new coastal policy was needed in order to ensure the sustainability of all coastal functions. In 1990, this culminated in the adoption of the national policy of "Dynamic Preservation". The strategic objective of this policy was "to guarantee a sustainable safety level and sustainable preservation of values and functions in the dune area". More recently the National Spatial Strategy (NSS 2006) reconfirmed the strategic objective of the large-scale coastal policy in the Netherlands, rephrasing it as: "to guarantee safety against flooding and to preserve spatial quality of the coastal zone".

##### Policy aims and objectives <sup>6</sup>

Coastal policy in the Netherlands during the last decades shows a gradual development from a small to a large-scale approach, guided by objectives and criteria at strategic-, tactical- and operational levels.

Safety against flooding of the (predominantly sandy) coast, is the primary concern of coastal policy in the Netherlands. The Flood Defence Act (1996) defines the implicit *strategic* objective: dunes must be able to withstand a storm event with a probability of exceedance of 1 in 10,000 years in the provinces of North and South Holland. For coastal provinces with less economic value the probabilities are 1 in 4,000, respectively 1 in 2,000 years. A test procedure using a dune erosion model during design conditions indicates the strength of the dunes as a flood defence. At the *tactical* level the objective of the safety policy is to preserve the rest strength of the dunes, defined as the minimal dune volume to withstand the design storm.

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<sup>6</sup> see: Mulder et al. (2007), Proc. 30<sup>th</sup> Int. Conf. Coast. Eng, San Diego USA, Vol. 2 (1705 – 1717)

In order to stop any further structural recession of the coastline, in 1990 the Dutch Government adopted the national policy of “Dynamic Preservation” (MIN V&W, 1990), defining as a *strategic* objective: a sustainable safety level and sustainable preservation of values and functions in the dune area. Implementation was guided by the *tactical* objective<sup>7</sup>: to maintain the coastline at its 1990 position. As a standard of reference a so-called Basal Coast Line (BCL) has been defined for each coastal section of 250m wide. This definition relates the coastline position to the ten-year trends in sand volume in the upper part of the profile (between dune foot and approx. –5m) (see e.g. Van Koningsveld and Mulder, 2004).

Considering that morphological developments at larger scales (e.g. sand losses at larger depths and long term developments like sea level rise) are neglected by the BCL approach, in 1995 the Dutch Government decided on an extended large-scale approach: additional compensation of sand losses at deeper water (Min V&W, 1996, 2000). The recent National Spatial Strategy (NSS, 2004) reconfirmed the strategic objective of the large-scale coastal policy in the Netherlands, rephrasing it as: to guarantee safety against flooding and to preserve spatial quality of the coastal zone. As an additional large-scale *tactical* objective<sup>7</sup>, NSS (2006) defined the preservation and improvement of the Coastal Foundation: the area between dunes and the modified –20 m depth contour. The Coastal Foundation is a new large-scale indicator. Acknowledging sand as ‘the carrier of all functions’, NSS (2006) underlined the importance of sand nourishments as principle components of the *operational* framework.

### Coastal management at different scales

Strategic coastal policy objectives have been translated into *tactical* management objectives at three different scales (see Figure 6.1). The basic idea behind the distinction into different management scales is that the large scale sets boundary conditions for the smaller scales, for example, preservation of the dune rest strength creates boundary conditions for safety against flooding at any place and any moment, preservation of the Basal Coast Line (BCL) creates boundary conditions for preservation of the dune rest strength over a period of (10) years and alongshore distances of kilometres, whereas preservation of the Coastal Foundation in turn creates boundary conditions for preservation of the BCL over decades to centuries and over alongshore distances of 10’s to 100’s of kilometres.

Considering that sustainable coastal management by definition must take account of the threats and potential benefits of large-scale developments, the basic question is: how to implement the large scale objective resulting into optimal profit at smaller scales? Translated for the nourishment policy of the Netherlands, the question is: which is the optimal distribution of nourishment amounts in space and in time, in order to create conditions for growing with sea level rise of the total Coastal Foundation, for preservation of the BCL and of the dune rest strength?

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<sup>7</sup> In earlier publications (e.g. Van Koningsveld and Mulder, 2004) this has been indicated as an *operational* objective. However, it is concluded that this is confusing. Coastal policy and management in the Netherlands are guided by objectives and criteria at three distinct levels: *strategic* (sustainable preservation of safety and functions), *tactical* (preservation of dune rest strength, of Basal Coastline and of Coastal Foundation) and *operational* (sand nourishments).

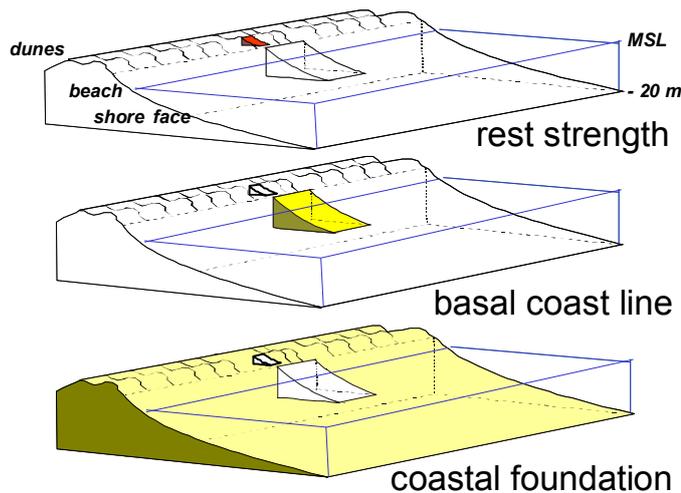


Figure 6.1 – Definition sketch of three different scales in coastal management :

- Dune rest strength: days – meters
- Basal Coast Line: years – kilometres
- Coastal Foundation: decades/ centuries – 10's / 100's kilometres

from: Mulder *et al.*, 2007.

### EUROSION concepts

The Netherlands coastal policy is based on a sediment management approach. This is in line with the approach advocated by EUROSION. To varying extents, the EUROSION concepts (although phrased differently) play a role.

#### Coastal resilience

The concept of *resilience* itself is hardly mentioned explicitly in the policy objectives.

Besides the strategic objective “to guarantee safety against flooding and to preserve spatial quality of the coastal zone”, the National Spatial Strategy (2006) depicts a development perspective for the coastal zone where: “Safeguarding of the dynamic sandy coastal system as carrier of all functions in the coastal zone, comes first. Priority in this respect has the preservation and development of *resilience* and natural dynamics”.

In general, emphasis is on sustainability (translated as the potential to guarantee all coastal functions on the long term), and on an optimal use of natural processes. The latter is reflected in the name of the policy “Dynamic Preservation”, and in the three-step strategy for coastal erosion management (NSS, 2006):

1. Preservation of sand and free transport of sand alongshore and cross shore of the coast;
2. Sandy measures as much as possible, whenever interference is necessary;
3. Immobilization of sands by hard structures, only in an extreme case.

#### Strategic sediment reservoirs

The policy of the Dutch government is aimed at stimulating a shift of sand mining from land to sea (Min V&W, 2000). As such, *implicitly* the North Sea is being indicated as the strategic sediment reservoir for the Netherlands.

Sand mining at sea is only permitted seaward of the minus 20m depth contour (or seaward of the coastal foundation as defined by NSS (2006)). The extraction policy for the North Sea is laid down in the Regional Extraction Plan North Sea (Regionaal Ontgrondingenplan Noordzee RON-MER).

#### Favourable sediment status

The favourable sediment status of the Dutch coast is defined in terms of preserving a certain reference sediment volume. This reference volume is defined at different spatial scales related to different management objectives (see above; Figure 6.1).

### Coastal sediment cell

At the largest scale the Netherlands coastal policy defines the coast as the coastal foundation (Figure 6.2): a littoral cell delimited at the seaward side by the -20 m depth contour and at the landward side by the landward boundary of the dune massive. Alongshore limits are represented by the boundaries with Belgium in the South and with Germany in the North.

Preserving the sand volume of the coastal foundation by nourishments, for practical purposes coastal management distinguishes between 3 sub-cells: Wadden, Holland and Delta (Figure 6.3).

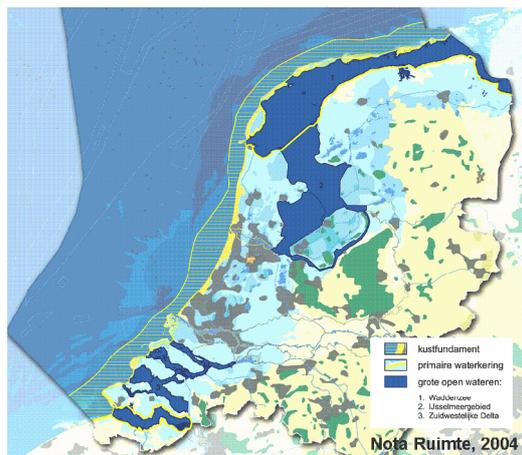


Fig. 6.2 Coastal Foundation (*kustfundament*) (NSS, 2006)



Fig. 6.3 Sub-cells of coastal foundation

At the medium scale, the position of the coastline is derived from the sediment volume around the Mean Low Water line (MLW) (see Fig. 6.4). This position is determined yearly, at intervals of 250m alongshore (Figure 6.5). As such, the position of the coastline is related to the sediment volume of a medium scale coastal cell of 250m wide and approximately 1000m long and 8m high (also see Figure 6.1).

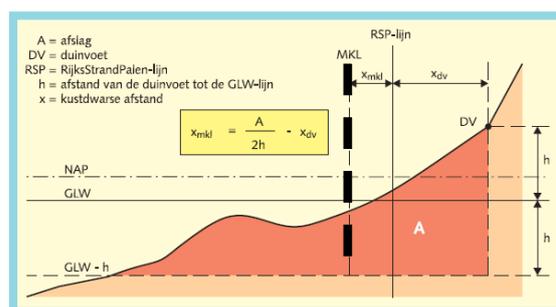


Fig. 6.4 Definition of coast line (MKL) (DV = dune foot; GLW = MLW)

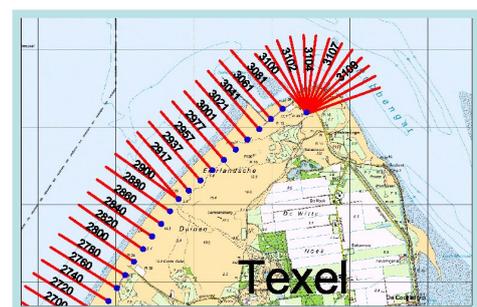


Fig. 6.5 Alongshore position of coast line observations (250 m intervals)

### Relevant future developments

Recently an authoritative government commission presented a report with recommendations on necessary future adaptive measures to climate change for the Netherlands (Deltacommissie, 2008). The report underlines the importance of a sediment management approach for the coast, recommending an increase in the total sand input to the coastal system to a level that should result in a seaward extension of the coast line of about 1 kilometre over the next century. The reservation of the necessary sand mining areas at the North Sea is an important implication of this recommendation.

Implementation of this recommendation will take place in the forthcoming update of the existing water- and coastal policy documents; the Waterplan 2009.

### 6.1.2 UK - England

Coastal policy development in England is taking place at different administrative levels and with different focus:

- At national level DEFRA prepared recently a draft national ICZM strategy with UK-wide policy objectives based on a common set of guiding principles, which can be applied in a flexible manner at local level;
- At regional level, 49 Shoreline Management Plans (SMPs) have been developed combining multiple local authorities and focusing on identifying appropriate policy options;
- At local level Coastal Defence Strategy Plans are developed in order to implement tailored solutions/measures for local coastal issues.

These authorities execute the legislative framework for the coastal management. At all levels the issue of coastal erosion is being addressed in the policy documents.

#### Policy aims and objectives

The aim of the government's 'Making Space for Water' strategy (see <http://www.defra.gov.uk/environ/fcd/policy/strategy/vision.htm>) is

"To manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as:

- to reduce the threat to people and their property; and
- to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

According to the Spending Review SR04 (April 2005 to March 2008 - see <http://www.defra.gov.uk/environ/fcd/policy/aim.htm>) the Target is: "we will manage flood and coastal erosion risk so as to contribute to sustainable development, including minimising the loss of life and improving the standard of protection for at least 100,000 households".

SR04 had the following critical success factors:

- "Flood and coastal erosion risk managed so as to contribute to sustainable development, including the delivery of real social and environmental benefits as well as the protection of economic assets;
- Minimised loss of life;
- Improved standard of protection for 100,000 households;"

As of 1 April 2008, Defra's High Level Targets have been replaced by "Outcome Measures" (see <http://www.defra.gov.uk/environ/fcd/policy/strategy/sd4/default.htm>). There are 9 of these (7 of which apply to coastal erosion risk) listed on the web page – but no threshold or target values have been given.

The policy options considered in a Shoreline Management Plan are set by Defra in 'Shoreline Management Plan Guidance Volume 1: Aims and requirements, 2006) as:

1. Hold the line;
2. Advance the line;

3. managed realignment
4. no active intervention

### **EUROSION concepts**

#### Coastal resilience

The concept of 'coastal resilience' is only indirectly addressed:

- The government's policy aim is developing 'sustainable defence measures'
- Throughout all provided documents, the importance of working with natural processes is recognised. The most prominent example, where this principle has been followed and implemented, is the case of shoreline management. The emphasis given to working with natural processes in the development and review of Shoreline Management Plans shows that this approach has become accepted practice in the UK, at least in the area of coastal protection and flood defence (EU-EVA).

#### Strategic sediment reservoirs

The concept of 'strategic sediment reservoirs' is not recognised in the documents.

#### Favourable sediment status

The concept of 'favourable sediment status' is not recognised in the documents.

#### Coastal sediment cell

At the broadest scale the UK coastline has been split up into 11 sediment cells and a series of sub-cells (Figure 6.6). Within each sediment cell longshore processes are largely considered self-contained. More recently the coastline has been re-divided into geomorphological processes units (so-called Shoreline Behavioural Units) as part of the Future Coast project sponsored by Defra. The development of the sediment cells signalled a move away from administrative boundaries to 'process' boundaries; a move towards regional management and shared responsibilities, and a recognition of the wider demands on the coastal zone (CR-SP). The SMPs involve a coastal strip between 50 and 150 kilometres long and combine multiple local authorities and interested stakeholders through a series of Coastal Groups.

The mapping of littoral cells in England and Wales was originally undertaken by Motyka and Brampton (Mapping of Littoral Cells, HR Wallingford Report SR328, January 1993). This was reviewed for the second round of SMPs (Defra, Shoreline Management Plan Guidance Volume 2: Appendix E: Open coast SMP management boundaries, 2006). This suggested small alterations. The Coastal Groups were also re-organised this year (Fig. 6.6 and 6.7).

### **Relevant future developments**

Reorganisation of legislation pertaining to the coast is underway. The Marine Bill is likely to introduce a system of marine spatial planning, streamline the existing marine consenting processes, and strengthen ICZM tools and processes (EU-EVA). However, most of the proposed new legislation concerning the Marine Bill deals with areas that are mainly concerned with marine related issues. Specific coastal issues, such as how to integrate land-sea interactions, are not well addressed (EU-EVA).

In April 2008 DEFRA (<http://www.defra.gov.uk/enviro/fcd/policy/strategy/ha1a.htm>) announced :

A new era for flood and coastal erosion risk management starts today with the Environment Agency taking on the strategic overview of the coast.

The Strategic Overview is a new way of working between Government, the Environment Agency, Local Authorities and coastal flooding groups to improve the sustainability, prioritisation and management of all work on the coast. Whilst the Environment Agency has the overview, close collaborative working with Local Authorities on the coast is essential to ensure vital skills and expertise is used effectively for communities in need.

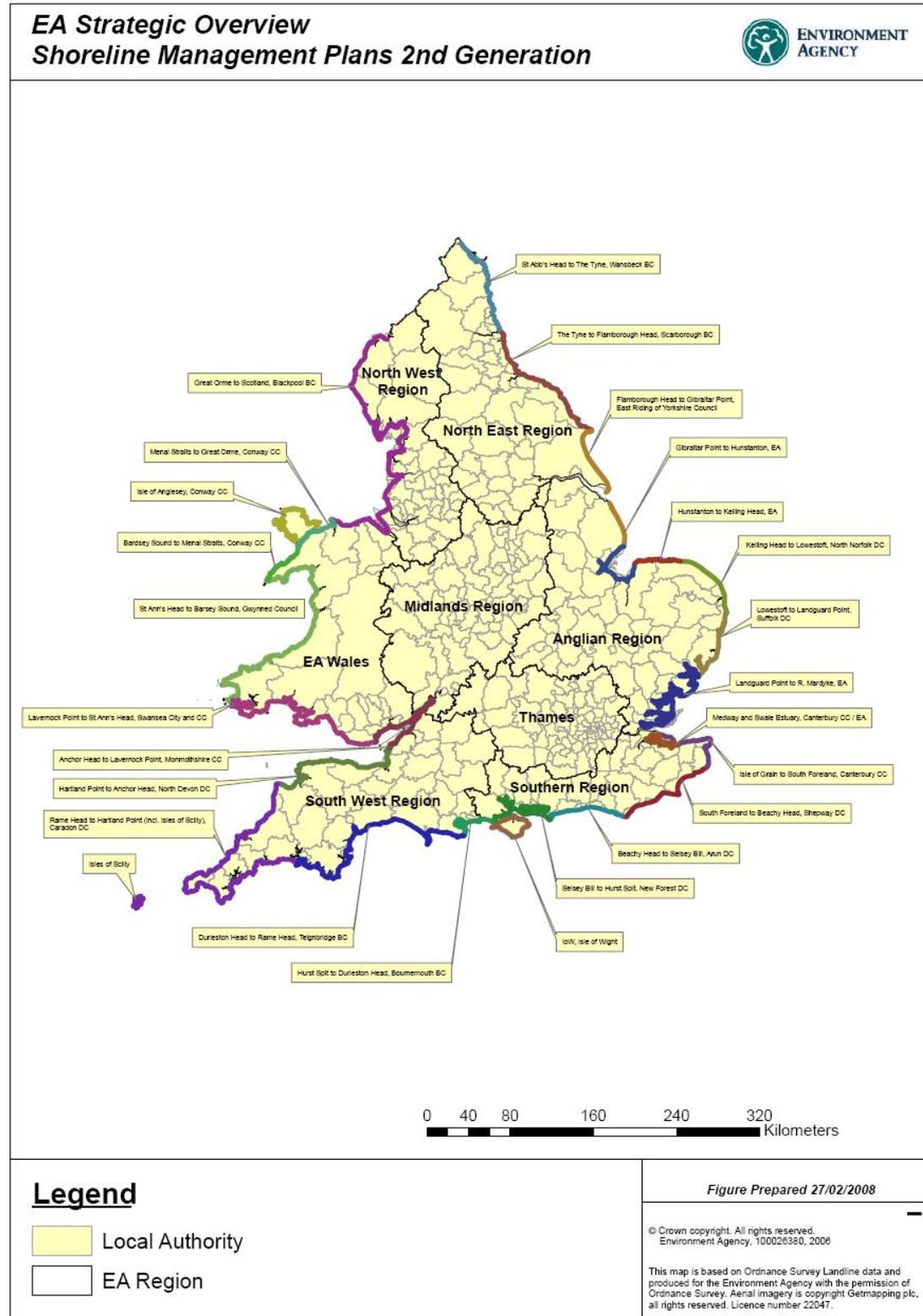
The following outlines the arrangements:

- The Environment Agency will be the lead for all sea flooding risk management
- Local Authorities will remain the lead for coastal erosion risk management

- The Environment Agency will approve schemes and allocate funding<sup>1</sup> for all capital flood and coastal erosion risk management work to themselves, Local Authorities and Internal Drainage Boards<sup>2</sup>
- The Environment Agency will have a strategic oversight for all Shoreline Management Plan production and quality control on behalf of Defra
- The Environment Agency will work with Local Authorities to ensure that all flood and coastal erosion works are properly planned, prioritised, procured, completed and maintained
- Future legislative changes will extend the Environment Agency's supervisory duty to cover coastal erosion.



**Fig. 6.6** Littoral cells in the UK



**Fig. 6.7 Coastal Groups UK**

### 6.1.3 Ireland

The national approach to coastal zone management has primarily been a top down planning and regulatory approach, with responsibilities shared over a range of government departments and local authorities. A number of policy documents are important for strategic approaches to management of coastal zones. These include the National Spatial Strategy (NSS) for Ireland 2002-2020 (EU-EVA) which contains a strong commitment to sustainable development, being a twenty-year planning framework designed to deliver more balanced social, economic and physical development between regions (EU-EVA). Supporting documentation for its development did explicitly consider climate change, sea level rise and storm frequency (EU-EVA). Coastal erosion is not mentioned in the NSS, but in the National Development Plan (NDP), which is aligned with the NSS objectives, coastal protection is addressed in a sub-programme (NDP). The National Development Plan (2007-2013) was launched in January 2007 and is entitled "Transforming Ireland - A Better Quality of Life for All".

Chapter 8 of the NDP concentrates on Enterprise, Science and Innovation Priority and under this there is a specific Sub-Programmes on Marine and Coastal Communities. This programme is comprised of three sub-programmes on seafood development, fisheries and coastal infrastructure and coastal protection. Approximately €23 million is targeted for protecting the coastline from the impact of flooding and erosion. The finance ear-marked for coastal protection will fund a "mixture of risk evaluation, development of procedures and guidance for scheme selection, planning and development assistance and capital projects of both a hard and soft engineering nature" (NDP, p.186). The National Coastal Protection Strategy Study will also be completed as part of this sub-programme.

Previously in 1997 a draft national ICZM policy document was produced but to date this has not been implemented. Instead, an emphasis has been placed on responding to obligatory legislative requirements such as the implementation of the EC Water Framework Directive, which is seen in part as a delivery mechanism for some elements of ICZM. Despite this a number of policy documents at national level recommend the development of a national ICZM strategy. This is re-iterated in the NSS which states that such a strategy will be taken forward by the Government Departments concerned, drawing on EU recommendations on the implementation of ICZM and national and international ICZM research and experience (NSS).

There is a complex legal and administrative framework which complicates the integrated management processes. The main legislative and policy instruments for the terrestrial part of the coastal zone are the spatial planning laws (source: EU-EVA). Seaward of the Mean High Water Mark is governed by the Foreshore Acts, 1933 -2005 which regulate licensing and leasing as well as other activities in the coastal zone. It has been widely recognised that this legislation is in need of review (Brady Shipman Martin, 1997)

#### **Policy aims and objectives**

The strategic objective as mentioned in the NSS is

- sustainable development based on balanced social, economic and environmental development.

At the local level (e.g. the CONSCIENCE pilot site at Inch Beach, Co. Kerry) this involves the strategic objective of sustainable development of the beach and sustainable tourism (expressed as the objective to maintain the recreational carrying capacity of the beach and to enhance the safety of existing structures). Local authorities are obliged to make County Development Plans for their functional areas. These are legally binding documents and generally govern how an area is planned and managed. All of the coastal local authorities pay a significant amount of attention to coastal management in their current development plans. Local authority based coastal strategies deal with a range of issues, including coastal protection, development in the coastal zone, protection of coastal biodiversity, access to the coast and sustainability of coastal industries such as fishing. In Kerry County Development

Plan 2003-2009, the Council state that they intend to designate a Coastal Development Zone based on the importance of or preserving marine habitats and coastal landscapes. In addition the Council expresses its commitment to assist in the development of an ICZM strategy for the county in association with other relevant agencies and bodies.

At present, decisions on coastal protection are made locally but in close association with the responsible central government department, i.e. The Department of Agriculture, Fisheries and Food as they generally fund such projects. The County Development Plan specifically states the following in relation to coastal protection:

It is an objective of the Council to:

- Prohibit development: In those parts of the Coastal Development Zone where such development could not be adequately safeguarded over the lifetime of the development without the construction of coastal defences, or 2. Where existing coastal defences, properly maintained, would not provide an acceptable standard of safety over the lifetime of the development.
- Prohibit development in areas of the Coastal Development Zone where the natural erosion process is likely to threaten the viability of such development.
- Prohibit any coastal protection works which have not been the subject of a recognised design process and have not been assessed in terms of their likely impact on the marine environment.
- Implement site specific management policies to ensure that erosion is not initiated or aggravated by the impact of human activity.
- Prohibit the removal of beach material, aggregates, sand and gravel, including the removal of material from sand dune ecosystems

### **EUROSION concepts**

None of the Euroasion concepts are recognised in the policy documents. The concept of 'coastal resilience' is only indirectly addressed through the strategic objective of 'sustainable development'. There is no evidence that working with natural processes has happened or is expected to happen (source: EU-EVA). The Kerry County Development Plan (2003-2009) expressly states that it is an objective of the Council "to prohibit any development that would damage or lead to the erosion of the dunes in areas where sand dunes have a high amenity value and provide coastal protection".

### **Relevant future developments**

The National Coastal Protection Strategy Study will identify areas at risk from erosion and flooding and will quantify damages arising. The situation, with or without global warming induced sea level rise, will be examined.

## **6.1.4 Poland**

Poland is at the beginning of the process of formulating a national ICZM strategy. A draft version has been circulated among stakeholders but a national stocktake has not been conducted (Coastal Wiki). The main reasons for this is a lack of financial resources and some political changes which have been taking place in Poland lately (source: EU-ICZM website). Not all sectors and hardly any sectoral policies have been considered at this stage (EU-EVA).

A long-term programme of coastal protection to minimise threat to coastal zone posed by climate change and related rise in sea level has been adopted and is being implemented. It takes into account safety, risk management and environmental protection. The programme has been adopted in the form of a legal act, and financing for its implementation has been allocated. The programme is based on the coastal protection strategy prepared with a 100-year perspective (EU-EVA).

The Polish legal system contains several institutions, regulations and competence solutions, which are concerned specifically with spatial planning of the coastal zone, concordant with the concept of ICZM (MinTC, 2005).

### **Policy aims and objectives**

The exact time horizon of the national ICZM strategy has not been considered yet, but sustainable development, satisfying the need of future generations, has been adopted as a basis for the strategy. The welfare of the coastal population, as a superior goal, is to be achieved mainly by economic development of the region by development of ports and related trade and shipping (EU-EVA).

It is assumed that there will be one national ICZM strategy (which however does not exclude the development of regional ICZM strategies). As a first approach, it is assumed that the main strategic aims of development in the coastal zone will be (MinTC, 2005):

- improvement of welfare of the coastal population,
- maintaining, and where necessary improving, the safety of the hinterland (taking into account sea level rise),
- maintaining, and where necessary improving, the state of environment.

Coastal protection at the local level has been fully covered and a full set of measures to protect the coast against foreseen sea level rise have been included in the national programme for coastal protection (EU-EVA).

### **EUROSION concepts**

None of the EUROSION concepts are specifically mentioned in the policy documents. The concept of 'coastal resilience' is only indirectly addressed through the strategic objective of 'sustainable development'.

Regarding the concept of the 'coastal cell' the following issues are recognised:

- By law, there is an up to *circa* 3 km wide coastal belt consisting of a technical belt (10m to 1 km wide) and a protective belt (100m to 2.5km), in which aspects of safety and risk management must be considered;
- However there is an intention to limit the geographic perspective of the strategy towards the coastal communes and major coastal agglomerations. This approach seems inappropriate because very often important factors influencing the coastal zone are located outside the coastal communes (EU-EVA).

### **Relevant future developments**

The Polish legal system, distribution of competences, and at least some methods and practices of management already form a good basis for realising and further development of ICZM (Min TC, 2005). Poland has stepped up its efforts to move from its multi-sectoral legal framework towards the formulation of a National ICZM Strategy (EU-EVA). Nevertheless, there is still a very long road to go. Besides legal revisions and attaining a properly functioning comprehensive monitoring system of the coastal zone, the most important work is to achieve real public participation in management. This is not a specifically Polish problem, but a question arising for all the other 19 coastal Member States of the EU (MinTC, 2005).

## **6.1.5 Romania**

A national ICZM Law was developed in the year 2002 (Emergency Ordinance 202/2002, approved by the Romanian Parliament as Law No. 280/2003). The law was followed by the definition of a long-term ICZM Outline Strategy (EU-EVA), in the period 2005 – 2006. In order to apply the Draft National Strategy and improve the functionality of the ICZM Law, proposals were made for changes in several of the ICZM Law's paragraphs. Both Romanian ICZM strategy and Law are currently waiting for debate and approval in the Romanian Parliament, after being once returned to experts. The reasons for this first failed debate are nevertheless

related more to the instability of the frail majority in the Romanian Parliament than to the issues included in the Law and Strategy.

Regarded as a multi-sector, long-term policy, the Outline Strategy should function as a “policy agenda”, a “reference framework”, providing directions for the desired developments in the most important economic sectors of the Romanian coastal zone. It takes into account the environment, water resources management, spatial and land-use planning and coastal defence through protection against coastal erosion. Climate change is indicated as an increased hazard for the Romanian coast and recommendations exist mentioning that special attention must be given to these changes (EU-EVA).

The activities along the coastal zone are mainly controlled through laws and regulations (EU-EVA).

### **Policy aims and objectives**

The Outline Strategy is considered as the basis for action planning and implementation to achieve sustainable development of the coastal zone (netcoast.nl).

Visions and strategies exist in the Outline Strategy as basis for further sectoral development plans, but these still have to be elaborated in detail (EU-ICZM website). Once the Strategy is approved, the National Committee (consisting of main stakeholders) shall deal with its implementation (EU-EVA).

During the past two years the National Committee has become functional and a series of measures have been taken, aiming mainly at

- the environmental protection and rehabilitation of the coast; and
- regulation of the activities on tourist beaches.

Several more technical parts of required legislation have also been approved and are on course for implementation. It is nevertheless too early to make any provisions on the future evolution, especially in the absence of the new and improved version of the ICZM Law and Strategy (EU-ICZM website).

### **EUROSION concepts**

#### Coastal resilience

The concept of ‘coastal resilience’ is only indirectly addressed:

- The Outline Strategy aims to deliver sustainable development of the coastal zone
- Studies regarding the carrying capacity of the coastal zone either exist or are underway, addressing the importance of natural processes (EU-EVA).

#### Strategic sediment reservoirs

The concept of ‘strategic sediment reservoirs’ is not recognised in the documents.

#### Favourable sediment status

The concept of ‘favourable sediment status’ is not recognised in the documents.

#### Coastal sediment cell

Some aspects of the coastal cell concept can be recognised: the development of the Outline Strategy took into account the geographic perspective, various geographic units being dealt with according to the peculiarities for each zone. Development plans for each of the zones will be regulated according to the distance from the shoreline in various ways (EU-EVA).

### **Relevant future developments**

The definition of the Romanian Outline Strategy stipulates a series of changes in order to make it fully operational. The current mechanisms ensuring the implementation of ICZM

needs to be improved. A series of management structures related to the environmental rehabilitation of the Romanian Coast are now underway (such as the projects for building new waste water treatment plants, and the Plan for the Rehabilitation against Erosion of the Southern Sector of the Romanian coast), that takes into account existing and proposed measures (EU-EVA).

Adaptive planning is foreseen, and significant changes in the state of the coast will be dealt with by the National Committee in order to provide adaptive measures to improve the situation and/or change the existing strategies (EU-EVA).

Protection of the Romanian Coast against erosion is currently the subject of several feasibility studies, and plans for the entire protection exist till the year 2020 (EU-EVA).

As it is still an outline draft, it can be foreseen that many technical problems / conflicts shall appear during its future implementation. A general problem encountered so far in Romania, is effective law enforcement which is critical to success. Nevertheless, the National Committee, as leading unit of the Romanian ICZM, has already begun to abide by the defined strategy (EU-ICZM website).

### **6.1.6 Spain**

Coastal erosion in Spain has been managed in the last 20 years, in the framework established by the 1988 Shores Act (Ley de Costas). Before the enactment of this legal text, many engineering works had already been developed in response to erosion problems. In the mid seventies, a study was developed to value situation and resources of the Spanish littoral fringe. In this study (Plan Indicativo de Usos del Dominio Público Litoral), erosive areas were identified. This fact allowed for the possibility of the development of specific corrective programs for those areas where they were necessary.

From the enactment of the 1988 Shores Act on, an important part of the budget of the General Directorate for Coasts has been used in coastal defence works (Barragán Muñoz 2003)<sup>8</sup>. This legal text, has triggered important advances for the management of coastal areas, but it have not established a proactive sediment management policy, where areas with a negative sediment balances are completely identified (and the analysis periodically updated), action defined and funding assigned. According to it, the administration responsible for preventing and repairing coastal erosion is the central state. It has the duty to establish the limits and to manage the coastal fringe where beaches are located, the Marine and Terrestrial Public Domain (DPMT). Based on the Shores Act, coastal erosion has been fight mainly by applying nourishment and engineering works in those areas severely suffering erosion processes.

The framework also had other lacks that have influenced very strongly the erosion policy in the last 20 years. The coordination processes among central and local administration, necessary for fixing damage produced by wave energy, have been scarce and the informative and participative processes about works developed have not been complete and many times inexistent.

In order to overcome the deficiencies of this framework, and following the EU Recommendation on ICZM (413/2002/EC), the National ICZM Strategy has been developed with clear strategic and specific objectives that conform with the principles of good ICZM management (EU ICZM website). This strategy, that has not been implemented yet, refers to the 1988 Shores Act (Ley de Costas) establishing mechanisms to include lacking practices in traditional coastal management.

One important advance of the National ICZM Strategy is that apart from the central state level particularly decentralized structures such as the autonomous communities and municipalities have a big say in ICZM matters. Competencies and responsibilities are complex and

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<sup>8</sup> Barragán Muñoz, Juan M., 2003, The End of the Century for Coastal Management in Spain, Journal of Coastal Research, 19-2, 314-325

considered in the National ICZM Strategy (EU-EVA). In the ICZM Strategy convincing initiatives, measures and activities are proposed that take account of the highly decentralised governmental structure of Spain and the need for new multi-level governance instruments concerned with coastal management, e.g.:

- A “Director’s Plan for the Sustainability of the Coast“ is developed;
- Concluding cooperation agreements and following arrangements with the autonomous communities (to create new vertical coordinating mechanisms);
- Establishing a **National Coastal Council** (creating new important horizontal and vertical coordinating mechanisms) (EU-EVA).

A basic element of the new strategy is the involvement in the management of coastal areas of the different groups with interest in the coast. In order to do so, transparency and participation must be assured. In the case of erosion, many different groups are affected and traditionally they have not been included in the decision making processes, or they have been included without much capacity of defending their interests. Another very important element of beach erosion policy is the fulfilment of the requirements established in the Directive 2001/42/EU for the Strategic Environmental Assessment. It is a tool that can be very effective for the regulation of the different human activities in the coast that have potential erosive impact on the Spanish shore.

### **Policy aims and objectives**

In Spain, erosion triggers two important problems in the coast: avoids protection of human infrastructures (located in the back beach) from wave energy and reduces the available surface of beaches for tourism. Those problems influence importantly coastal policy. When infrastructures in danger are basic for social and economic activities of the coast, especial measures to diminish erosion are usually taken. On the other hand, in many areas (e.g. The Mediterranean), economic dependence on massive tourism triggers overuse of beaches and lack of more available sand. Small losses of sand surface undertake important problems for local managers (A fact that worsens the situation is that, although they suffer directly the problem, they not have the authority for applying corrective measures). The main consequence of it, is that social demand for sand directs decisively erosion policy. In this sense, it becomes very important the development of the National ICZM Strategy, because on it, erosion/accretion processes of the coast are analysed in detail. As it has been said previously, sediment processes of many areas of the Spanish coast were not known precisely.

In this point, it is important to consider the problems of coordination that have existed during the last decades among the different administrators. Due to the lack of applicable coordination mechanisms among them, when chronic erosion situation or storm episodes occur, response measures are taken not immediately. Many locally known erosion processes remain unresolved for years due to the lack of effective communication existing with the central administration.

Another important novelty of The National ICZM Strategy is that takes into account long-term scale. The time horizon for the Spanish strategy is not explicitly specified on it. However, it can be deduced that along term time horizon for the Spanish strategy is not explicitly specified. However, it can be deduced that a long-term horizon is assumed. All strategies mention sustainability, referring to three dimensions of sustainability, i.e. ecological, economic and social, and to the needs of current and future generations. Coastal protection is addressed as well as long-term changes such as climate change, sea level rise and increasing frequency and violence of storms.

A very important goal of the 1988 Shores Act, is to assure public property of the shoreline fringe and the seaward shore and restrict construction and other uses in the private property part towards the land for a certain distance from the shoreline. Such measures have been reported to be quite successful for the public property part and are executed through national level government organisations. Additionally there are usually environmental laws that also impact on the coast by making special provisions to the planning and protection of particularly valuable areas or overseeing development projects. So far it has been reported that the various policy and legal instruments lack coherence (EU-EVA). The goal of National ICZM

Strategy is to a framework where those policies and legal instruments can be managed with an improved coherence.

At the local level there are several policy options to manage erosion processes:

- Do nothing,
- Hold the line, and,
- Managed realignment (EUR-ED).

Moreover there are also some substantial activities such as buying built-up land on the coast for protection and restoration of the coast (EU-ICZM website).

### **EUROSION concepts**

None of the EUROSION concepts are clearly recognised in the policy documents. However, in two cases, they may be related to some concepts that can be found in the Shores Act and The National ICZM Strategy.

The concept of 'coastal resilience' is only indirectly addressed through the strategic objective of 'sustainable development'. This concept can also be related to the carrying capacity of the coastal zone, which has been explicitly included in the ICZM Strategy.

Regarding the concept of 'coastal cell' the following issues are recognised:

- Different segments of the national coastal zone are identified, and,
- Management of coastal areas shall be based on river basins (EU-EVA).

The other two EuroSION concepts, Favourable sediment status and Strategic sediment reservoirs are not considered and related to other concepts of the documents describing the erosion policy.

### **Relevant future developments**

The implementation of The Director's Plan for the Sustainability of the Coast shall become an important policy and regulatory instrument supporting the already existing and to quite some extent successful 1988 Shores Act (Ley de Costas). The new strategy will allow creating a unified body of management of the coastal area. This is very important for understanding the effects of erosion on the whole coastal system and applying the best measures of correction. The introduction of public participation activities and information and communication measures is very convenient for managing erosive processes. In order to achieve a global satisfactory response, all involved agents should participate in the decision making processes. It is important to quantify costs and benefits for all agents, know their vision and degree of satisfaction with the current situation, and study their suggestions. For that, it is necessary that they are well and completely informed. The autonomic and local administration must also be included in the processes of decision making from the beginning and keep there along the whole process. Only if this happens, mistakes made in the past may be corrected.

As it is considered in the Directive 2001/42/EU, environmental assessment should be made of policies, plans and programs, not only of specific projects. Managers and other social groups should have access to those assessments when they are included in participative processes. In this way, a more informed debate will take place during participative processes related to erosion.

The National ICZM Strategy will also allow arranging the different sectorial and regional legal requirements affecting the management of the coastal area, lacking coherence for many years. The application of proactive measures directed to reduce erosion and its effects in the natural, social and economic subsystems will be also very important for improving situation of the Spanish shore.

### **6.1.7 Denmark**

A national strategy for ICZM in Denmark has not yet been elaborated. They will pick up ICZM activities following the structural reform of the Danish municipal and regional system in 2007 (EU-EVA).

The Danish government perceives the Danish planning system (Planning Act) in general to be adequate to manage the challenges to secure a proper balance between conservation and development of the coastal zone, supported by existing laws (especially the Coastal Protection Act), regulations and practices as well as implementing EC Directives and policies. The Danish coastal zones are regulated by no less than 26 Acts and a number of different systems of regulation (CES).

Danish legislation is permissive. National government only has the duty to judge proposals on their impact on the environment and, for instance, on sediment processes. The power to undertake initiatives is given to the counties through legislation (CR-PS).

### **Policy aims and objectives**

The Planning Act ensures that the overall planning synthesises the interests of society with respect to land use and contributes to protecting the country's nature and environment, in order to ensure

- sustainable development of society with respect for people's living conditions and for the conservation of wildlife and vegetation.

The policy background to the process of strategic planning is enshrined within the Coastal Protection Act that allows coastal protection where necessary, but promotes natural processes where possible. In particular:

- coastal/flood protection can be allowed only where significant assets are at stake;
- nature preservation is of high priority especially the maintenance of natural coastal dynamics;
- if old coastal/flood protection works are refurbished, the work must be minimal and redundant protection removed; and
- coastal/flood protection works must be technically optimised and fitted into the existing environment in a discreet way (CR-SP).

Ensuring the adequate performance of flood defences is embedded in a contractual framework between the Ministry of Transport (MT) and the Danish Coastal Authority (DCA). This involved the following objectives/actions:

- dike inspections (twice per year, embedded in law);
- inspection and monitoring of forelands (by the Danish Veterinary and Food Administration);
- coastal retreat and changes in dune width are monitored once per year;
- surveying of dike profiles (every 5 years in order to monitor consolidation);
- monitoring and evaluation of water levels and wave conditions (every 5 years - part of the 'contract of result');
- five yearly evaluations of the hydraulic climate are made; and
- research and development programmes (focus on risk assessment, requirements for economic efficiency, damage potential part of the 'contract of result').

This process delivers a prioritised programme of actions based on risk. Two time horizons are used, 10 and 25 years into the future (CR-SP).

### **EUROSION concepts**

None of the EUROSION concepts are recognised explicitly in the policy documents. However, the overall planning for 'sustainable development' and the high priority for maintenance of natural coastal dynamics indicate some implementation of the concept of 'coastal resilience'.

### **Relevant future developments**

The Ministry of Environment has postponed a debate on a possible national strategy on ICZM until after 2007 when the reform is implemented (EU-ICZM website).

## **6.1.8 Conclusions**

Considering the current national policies in the different, study site countries, the general picture is that sediment management as a basic approach to coastal erosion management is starting to gain recognition. However, implementation in the majority of countries has not

reached the stage yet of explicitly introducing EUROSION concepts ( see summary in Table 6.1).

**Table 6.1 Summary with qualitative indication of the degree to which EUROSION concepts are explicitly implemented in National coastal policies of the pilot countries**

EUROSION Concepts	NL	UK	IRL	PL	R	E
sediment management :	+	--	--	--	--	+/- <sup>1)</sup>
Coastal resilience :	( <i>sustainability</i> )					
Strategic sediment reservoir :	+	--	--	--	--	--
Favourable sediment status:	+	--	--	--	--	--
Coastal sediment cell :	+	+	--	+/- <sup>2)</sup>	--	+/- <sup>3)</sup>

Notes: 1) reference to sediment balances  
2) reference to coastal belt  
3) reference to coastal segments

## 6.2 Policy level experience with EUROSION concepts

As part of the CONSCIENCE project, a questionnaire was designed specifically for the purpose of gaining insight into the current approach to erosion management by key personnel in DG Environment as well as high-level decisions makers at both Member State and sub-national level. The aim of this questionnaire was to assess the current levels of awareness of the concepts developed in the EUROSION project and how these concepts have been taken forward in policy documents as well as at the practical level. Respondents were identified from a trans-national database of contacts, developed by the EUCC. Semi-structured interviews, based on the questionnaire, were then carried out and this document contains the responses. A sample questionnaire is included in Appendix B.

### 6.2.1 Results of interviews

#### 1. Are you aware of EUROSION and/or its outcomes?

EU Level	National Level*	
Yes = 5	Yes = 5	No = 2

\* The following countries from were invited to participate: Croatia, Ireland, Romania, The Netherlands, Spain, and the United Kingdom. Responses were received from respondents in Croatia (1), Ireland (1), the Netherlands (1), Poland (1), Spain (1) and the United Kingdom (1). Through the EUCC's database of contacts responses were also obtained from Portugal (1) and France (4). The responses and information received should be regarded cautiously given the low response rate.

It should be noted that respondents from Poland, Spain and the United Kingdom stated that whilst they were aware of the EUROSION project they were not aware of specific EUROSION outcomes or practical results.

#### 2. If yes, have you used any or all of the following concepts in your policy documents? Please specify.

- Coastal sediment cell
- Coastal resilience
- Favourable sediment status

- **Strategic sediment reservoir**

All European level respondents stated that some concepts were used more than others. Respondent A from DG Environment stated that the EUROSION concepts have been used in policy documents but stressed that some concepts have been used more than others, for example, coastal resilience.

A respondent from the European Environment Agency (EEA) stated that their organisation was only interested in the data that the EUROSION project produced – not the actual concepts. It was made clear that the EEA do not produce policy documents but provide a general picture of the European environment. They provide information for decision makers and in this regard they have mentioned the EUROSION concepts but have not actively advocated them as such.

At the sub-national level, the respondent from Croatia explained that the Croatian part of the Adriatic Sea did not experience significant erosion and for this reason the EUROSION concepts did not appear in any policy documents. The respondent stated that only a few localised areas could potentially suffer from erosion but added that they were not aware of the existence of any systematic research or project dealing specifically with erosion or its management in Croatia. The Croatian respondent added that the National Environmental Strategy and National Environmental Action Plan (Official Gazette 46/2002) deal with soil erosion caused by clear-cutting of the trees.

The respondent from Ireland said that all the EUROSION concepts, with the exception of 'Favourable Sediment Status' were used in policy considerations. It should be noted here that Ireland is in the process of developing a National Coastline Protection Strategy.

The respondent from the Netherlands opined that concepts were like themes in that they emerge and fade, and may reappear in future with different names and in different guises when there is a window of opportunity. The respondent stressed that to anticipate that concepts will emerge into management practice is over-simplistic. The respondent felt that the EUROSION project came up with and repeated "a couple of sound concepts that have been around for a decade or two". The respondent suggested that to go from an idea to implementation requires lots of communication, a common understanding and constant repetition and explanation. It was felt that this was not a one-way process but in the respondent's experience, the process was far more subtle, and relied on the drive of individuals and the level of simplicity of the concept.

Specifically, in relation to the coastal sediment cell concept the respondent stated that this concept needs constant repetition amongst decision makers. In the Netherlands the concept first emerged in policy documents in 2000 ([3<sup>rd</sup> Coastal policy document, 2000](#)), but was officially introduced as the 'coastal foundation' in the [National Spatial Planning Strategy of 2005](#). The coastal foundation is defined from the -20m depth contour to the landward edge of the dunes. In the Netherlands, 'coastal resilience' is a concept that has been embedded into the 3<sup>rd</sup> Coastal Policy document (2000). In terms of coastal policy this means soft measures (sand nourishment) where possible, and hard measures (dikes, dams, barriers) where necessary. For the future, concepts like transforming from a defence line into a multifunctional defence zone are slowly emerging.

The concept of favourable sediment status can be interpreted many ways in the Netherlands, for example, as meaning enough sediment available by maintaining sediment reservoirs, mostly offshore areas for future dredging or alternatively a favourable sediment status for the coastline itself. For the latter, in the Netherlands, a so-called basal coastline has been defined. This virtual coastline (defined as the coastline in 1990) is compared with the actual monitored coastline (coastal cross sections lying 250m apart are measured annually for the complete Dutch coast). The difference implies erosion or accretion. In the case of (ongoing) erosion, the respective location is adopted in the annual nourishment scheme. So for the second interpretation there is a formal use of the concept. With respect to the first interpretation, the respondent feels that the North Sea is perceived as being 'full of sand' for policy makers and hence there is no sense of urgency to manage this resource.

In relation to the concept of strategic sediment reservoir, the respondent states that there are dredging locations in the North Sea that can be seen as sediment reservoirs. These are located beyond (deeper than) the -20m depth contour and are listed in a regional dredging plan ([RON](#)). On the basis of the Sediment Extraction Act (*Ontgrondingenwet*) and in accordance with the general and specific conditions of RON, the permit sets out the requirements that the sediment extraction activity (extraction of filling sand, building and concreting sand, gravel, shells) must meet in terms of depth, scale and location; it also states whether or not an environmental impact report or an environmental study must be carried out in advance.

The concepts of 'Favourable Sediment Status' and 'Strategic Sediment Reservoirs' are used in Poland while 'Coastal Sediment Cell' and 'Coastal Resilience' are not. The Spanish respondent stated that the concepts of 'Coastal Sediment Cell', 'Favourable Sediment Status' and 'Strategic Sediment Reservoirs' had been used in policy documents but not 'Coastal Resilience'. In the United Kingdom, 'Coastal Sediment Cell' is the spatial unit which underpins the development of shoreline management plans. Coastal resilience is used with a wider meaning than that put forward by EUROSION. In the UK it is defined as a much broader concept meaning the ability of a coastal community to recover after an event. 'Strategic Sediment Reservoirs' are used specifically in UK Environmental Impact Assessment Regulations in support of a proposal for aggregate extraction. The concept of 'Favourable Sediment Status' is not used in UK policy documents as yet.

Outside the CONSCIENCE project partner countries, the utilisation of EUROSION concepts continues to be mixed. In France, for example, two of the four respondents had used all four concepts in their policy documents while the remaining two respondents had used only the concept of 'Coastal Sediment Cell' in their policy documents; both of which were in the form of regional coastal atlases. One of the French respondents stated that while they do not use the term 'Strategic Sediment Reservoirs' they do use the term 'deposits of importance' which has the same meaning.

All the EUROSION concepts have been used in Portuguese policy documents.

### **3. At what scale do such policies apply? (E.g. national/regional/local)**

All the European level respondents stressed that they were not responsible for the formation of policy documents. One respondent from DG Environment explained that the concepts derived from the EUROSION project are contained in policy documents that apply to all of the European Union but that it is the responsibility of the individual Member State to take the concepts forward. A second respondent from DG Environment stated that some of the EUROSION concepts could not be applied by the EU as they do not, for example, work at cell level. This would be more suited to the Member State itself.

At the sub-national level, the respondent from Croatia also said that of the policies relevant to coastal zones, these applied at the national level. The Irish respondent stated that the concepts also applied to all policy scales yet there are no dedicated erosion policies at any scale (national, regional or local). The respondent from the Netherlands said the policies all applied at a national scale. In Poland the policies that contain the EUROSION concepts apply within the limits of the coastal authority responsible. In Spain and the United Kingdom the policies apply nationally. In France, all the policies that contain the above-mentioned concepts apply at the regional level. Two of the respondents stated that specifically the policy applies to a sedimentary unit comprising several large sedimentary cells which correspond roughly to regional administrative boundaries. In Portugal the policies apply at both regional and local levels.

### **4. If yes, have you used any or all of the following concepts in practical erosion management policy? Please specify.**

- Coastal sediment cell
- Coastal resilience
- Favourable sediment status
- Strategic sediment reservoir

All European level respondents stressed this was up to the individual Member State and not the Commission or any of the European institutions.

The use of the concepts in the Netherlands and Croatia are outlined above under Question 2. In Ireland all the concepts have been used in practical erosion management policy at the local scale. Only the concept of favourable sediment status has been used in practical erosion management policy in Poland. In Spain they have used the concept of 'Coastal Sediment Cell' to decide what can be done and what is most suitable for a specific coastal cell or a given segment of the coast. The concept of 'Favourable Sediment Status' has been used to inform the decision-making process on what action if any is best suited to the local circumstances. Likewise the concept of 'Strategic Sediment Reservoirs' has been used in order to establish where future sediment for nourishment purposes can be obtained. The concept of 'Coastal Resilience' has not been used in Spain at the practical level. In the United Kingdom, the concept of 'Coastal Sediment Cell' is fundamental to shoreline management plans with a consequent use at the practical level.

In France, one respondent stated that the concept of 'Coastal Sediment Cell' was used in a practical way in strategic coastal management of Languedoc-Roussillon (June 2003) and in the Spatial Lido of Sète in Marseille. The same respondent utilised the concept of 'coastal resilience' for rehabilitation of the Bouches du Rhone region; favourable sediment status for restoration of the beach Fleury d'Aude; and the concept of strategic sediment reservoirs for nourishment of the beaches of the Gulf of Aigues Mortes. A second French respondent stated that the concept of 'Coastal Sediment Cell' had been utilised in an erosion risk atlas for the coast of Camargue. A third French respondent used the 'Coastal Sediment Cell' concept when carrying out beach re-nourishment at the Gulf of Aigues Mortes (1 million m<sup>3</sup>). A fourth French respondent stated that in the area of Charente-Maritime, the management authority has a strategy entitled 'Dynamic Management of Sediments'. This involves studies to identify areas where accretion is causing problems for navigation and/or shellfish farming, built-up areas at risks from erosion and development of a management plan for sediments. This work has been on-going since 1999. It is noted that any such management plans are subject, inter alia, to sand dredging operations.

The respondent from Portugal stated that all the EUROSION concepts had been utilised at a practical level but no examples were given.

#### **5. At what scale were such erosion projects? (E.g. national/regional/local)**

None of the respondents from the European Commission or at European level felt in a position to answer this question. The Croatian respondent stated that it was not applicable to that country. In Ireland and Spain the projects referred to were at the local level. In relation to the Netherlands, the respondent stated that there is a generic national policy of hold the coastline. For this, the sand nourishment scheme is designed nationally by Rijkswaterstaat. To achieve this every year it is decided whether nourishment is needed, where it is needed and the method of nourishment is also decided. In France and Portugal, the concepts were used at both the local and regional scales.

#### **6. Have the concepts proved useful when considering the management of erosion?**

Both respondents from DG Environment felt the EUROSION concepts have proved useful. One respondent added that similar concepts are now arising in other policy areas, for example, adaptation to climate change. The respondent also stressed that the EUROSION concepts are not just useful for sediment management but may be used for other resource management policy. The respondents from the EEA also felt the concepts proved useful for generating additional data on Europe's coasts.

The Irish respondent felt that the EUROSION concepts were very useful when considering the management of erosion as they focus attention on the importance of the sediment system in the coastal zone and the potential for negatively impacting on same. The respondent from Croatia did not feel this question could be answered for that country. The respondent from the Netherlands agreed that the EUROSION concepts had proved useful especially to help underpin and explain Dutch coastal management internationally. The respondent felt that the

concepts had emerged from decades of research in coastal morphodynamics, and commonly apply to all sandy coasts. Challenges for other types of coasts may be somewhat different. Even so, it was felt that as concepts they are useful. The respondent from Spain felt that the concepts have proved not only useful but 'absolutely essential to take meaningful decisions on the coastal zone'.

In France, one respondent stated that the EUROSION concepts must be complied with in order to be eligible for the maximum financial grant. Another French respondent said that most erosion management studies carried out in that region between 2001 and 2005 referred generally to the EUROSION concepts. A third French respondent said that in his specific region the sediment cell concept was used to determine the study area, coastal resilience was reflected in the choice of aid operations to achieve the favourable status of sediments and the strategic reserves of sediment identified in preparation of preliminary transfer of sand. In Portugal the respondent replied that the concepts were indeed useful and that they had used them to frame specific coastal management plans for Alcobaça-Mafra and Sintra-Sado.

### **7. Do you think the concepts will be useful in future erosion management policies?**

All respondents from the European level felt that the concepts would be useful in future erosion management policies. One respondent from the EEA stated that the concepts were also useful for Integrated Coastal Zone Management (ICZM) but there is a great need for such concepts and principles to be able to be implemented in practice.

All respondents at the sub-national level felt that the concepts will be useful for future erosion management policies. The respondent from the Netherlands stated that the concepts were timeless because they are based on working with natural processes. Due to the fact that they are sustainable they will be retained but the respondent also emphasised the need to repeat and explain the ideas behind the concepts constantly. One French respondent stated that while the concepts are beginning to be used more frequently in policy documents, this progress is perhaps too slow and there may be a need to make the concepts 'more general'.

The Croatian respondent stated that considering existing erosion problems and inevitable consequences of climate change (sea level rise, frequent storms etc.) that are already occurring, and expected to increase in the Mediterranean coastal area including Adriatic that in future, a long-term and more planned approach to coastal management is needed. The respondent envisages that a Croatian national strategy on the marine environment should take into consideration all the pressures that result in the erosion of coastal land. In that sense and taking into consideration the features of Croatian coastal area, the respondent feels that the concepts and results of the EUROSION project as well as future results from the CONSCIENCE project can be used in the creation of national environmental policy as well as local environmental management programmes.

### **8. Do you think the concepts can be improved?**

The respondents from the European level all stated that the concepts can be improved in the sense that they can be made more operational. One respondent from the European Commission recognised that the EUROSION outcomes had not been fully implemented or taken on board and consequently that this needed to be addressed. A second respondent from DG Environment felt that the EUROSION concepts needed to be presented and explained to decision-makers to enable them to put the concepts into practice.

The respondents from the EEA stated that everything can be improved upon. In this regard one respondent identified the problem as being more to do with take up of the concept. The respondent used the example of the EUROSION sediment cell concept and said it is a very good and useful idea but there is little sign of it being implemented. The respondent felt that improvement needs to be about penetration and that it must be remembered that the quickest way is not always the shortest. The respondent felt that researchers needed to look at the tools being used and the ways the concepts are being communicated to others as this is where improvement is necessary.

One respondent from the EEA mentioned the new Maritime Policy and how it advocates Marine Spatial Planning (MSP) which is complementary to ICZM. The respondent described

how MSP can take risks from erosion into account which will in turn mean that managers will need to organise themselves better at the coast. In this regard the EUROSION concepts may also be useful. In addition they may also be useful in policy development, for example, in relation to climate change adaptation, MSP can deliver this as adaptation also has a spatial dimension. MSP and the adaptation strategies could therefore be seen as new enforcement mechanisms which should deliver ICZM and encourage coastal managers to take a more sustainable management approach which may incorporate concepts such as those derived from the EUROSION project.

The respondent from Croatia felt it was the implementation of the concepts into practice which was important. Specifically the respondent stated that local knowledge relating to erosion experiences should not be neglected and such experience may also bring new ideas and solutions in managing erosion. The Irish respondent reiterated this point but added that feedback and case studies on actual use of the concepts in implementation will be necessary to give a definitive answer on whether or not the concepts can be improved. The respondent from the Netherlands stated that the concepts may need to be fine-tuned rather than fundamentally changed. The respondent felt the concepts now seem to imply static boundaries of cells and reservoirs and stressed that in reality they are not static, but move just like Natura 2000 areas. In this regard the respondent stated that improvement of the concepts should therefore never go hand in hand with an urge to statically or even legally define boundaries for cells and reservoirs.

All four French respondents stated that the concepts, per se, are well-defined but what is missing is information on how they have been implemented and what benefits their implementation have made to the erosion management process. There is a need for greater dissemination on this aspect perhaps through feedback or benchmarking which in turn will allow for calibration and consequent improvement.

## 6.2.2 Conclusions

It is clear, even from this limited number of respondents, that fundamentally the EUROSION concepts are regarded as useful. All respondents recognised the need for better communication of the concepts to those involved in managing erosion on a daily basis. One respondent from DG Environment stated that coastal resilience is probably the concept that is most easily understood. It could, for example, mean sustainable management which is something that everyone can easily sign up to. The respondent added that the CONSCIENCE project needs to refine the concepts from EUROSION to make them relevant to local areas and managers. The concepts need to be made meaningful. In this way ICZM could also be promoted in general through adaptation to coastal risk and climate change both of which are central to the recent Integrated Maritime Policy and Marine Strategy Framework Directive.

Respondents from DG Environment felt that the EUROSION project was a very good stepping stone towards the integrated approach to coastal management. It took an incremental approach with the different concepts it developed. It effectively captured the tension between what was happening on the ground and the need to take action. It meant decision makers had to look at their whole coast not just one section. It took a more gradual approach to management and therefore the concepts were, and remain, very useful. Another respondent from DG Environment recognised that there are many potential policy areas where the EUROSION concepts can be taken forward and made more operational, for example, in the Mediterranean this could be progressed through the Mediterranean Action Protocol and its associated work group. It may also provide a path for dissemination of the concepts.

At the sub-national levels, opinions and experience varies according to Member State. This is symptomatic of the fact that different Member States have different approaches to managing coastal erosion. The Netherlands and Spain, for example, are much more proactive in their management approach than, for example, Ireland where management takes place without any strategic national, regional or local policy. The result is that while the EUROSION concepts may be known and regarded as useful, there is little practical experience of how the concepts have been used at the site level to improve overall management.

### 6.3 End user experience with EUROSION concepts

In parallel with the above work, a short questionnaire survey was designed and distributed to all CONSCIENCE partner end-users to assess the current perception of erosion in their area, along with their attitudes and a number of related issues such as training and guidance, monitoring, coastal protection and science in policy making.

The questionnaire has been specifically adapted for use at site level. An example is included in Appendix C.

#### 6.3.1 Results of end-user questionnaires

The end users came from a number of European countries (Ireland, the Netherlands, Poland, Romania, Spain and the United Kingdom). In general the end-users were the local level decision maker at the site (i.e. local authority level). In certain countries, another end user was the regional or national decision maker. Usually the national institution has regional representatives. In Ireland, for example, the relevant Government department has a number of regional engineers based in different parts of the country. They liaise with the engineers based at the local level. In Romania, all the beaches in the country are managed by the "Romanian Water – Dobrogea Littoral Water Directorate". This is a national administration coordinated by the Ministry for the Environment. The study area for the CONSCIENCE project is a beach in the Danube Delta which is designated as a Biosphere Reserve. For this reason it is managed by an Administration that is also coordinated by the Ministry for the Environment. The institutional level of the various respondents is summarised in the table below.

Country	Institutional	Governance Level
Ireland (3)	Local authority (1) Government Department (2)	Local National/Regional
Netherlands (9)	Knowledge Institute (1) Local authority (4) Regional authority (2) Government Department (2)	National Local Regional National
Poland (1)	Local authority (1)	Local
Romania (2)	Biosphere Authority (1) National authority (1)	National/Regional National
Spain (2)	Government Department (2)	National
UK (3)	Semi-State body (1) Private consultancy (1) NGO (1)	National/Regional National/Regional Local

While it is recognised that the CONSCIENCE end user sample size is quite small, the responses are still useful in informing the project about how erosion is viewed and managed in a discrete number of sites across Europe.

#### 1. Is coastal erosion an issue in your region?

Country	Response
Ireland (3)	Yes = 100%
Netherlands (9)	Yes = 100%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 100%

All end-users who responded to the questionnaire agreed that coastal erosion was an issue in their region.

**2. Is there an explicit policy with respect to shoreline position that applies in your area?**

<b>Country</b>	<b>Response</b>
Ireland (3)	No = 100%
Netherlands (9)	Yes = 55.6%, No = 33.3%, Unanswered = 11.1%
Poland (1)	Yes = 100%
Romania (2)	Yes = 50%, No = 50%
Spain (2)	No = 100%
UK (3)	Yes = 100%

The responses to this question are varied. In some countries there appears to be a clear belief that there is an explicit policy (or not) which governs the end-users management actions. In other countries, such as the Netherlands and Romania there appears to be uncertainty on this point.

### 3. Have you ever received training or guidelines on management of coastal erosion?

Country	Response
Ireland (3)	Yes = 100%
Netherlands (9)	Yes = 66.7%, No = 33.3%
Poland (1)	Yes = 100%
Romania (2)	Yes = 50%, No = 50%
Spain (2)	Yes = 100%
UK (3)	Yes = 66.7%, No = 33.3%

The majority of respondents have received training or guidelines on the management of coastal erosion. It is not known whether there is a policy decision at a strategic level to provide such material in countries where the response rate is 100%.

### 4. Do you feel that additional training or guidelines would assist you in your current role?

Country	Response
Ireland (3)	Yes = 100%
Netherlands (9)	Yes = 77.8%, No = 22.2%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 50%, No = 50% <sup>9</sup>

The majority of respondents feel that additional training or guidelines would assist them in their current management role.

### 5. Are you aware at what specific location (sites and positions within those sites) erosion occurs?

Country	Response
Ireland (3)	Yes = 100%
Netherlands (9)	Yes = 88.9%, No = 11.1%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 100%

All respondents were aware of the specific locations where erosion was occurring in their region.

### 6. Do you have a routine monitoring strategy at locations where erosion has been identified?

Country	Response
Ireland (3)	No = 100%
Netherlands (9)	Yes = 55.6%, No = 44.4%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	No = 100%
UK (3)	Yes = 100%

The responses to this question reflect the fact that approaches to monitoring of sites where erosion occurs is very mixed. In some areas there is routine monitoring, namely, Poland,

<sup>9</sup> One respondent answered no to more training but yes to guidelines.

Romania and the UK. In countries such as Ireland and Spain there is no routine monitoring. In the Netherlands, there seems to be monitoring at some locations and none in other locations.

#### 7. Do you know the main reasons for the erosion at the sites in question?

Country	Response
Ireland (3)	Yes = 66.7% Unanswered = 33.3%
Netherlands (9)	Yes = 55.6%, No = 33.3%, Unanswered = 11.1%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 100%

In Ireland, the reasons for erosion are action by the sea combined with a naturally soft coastline. In the Netherlands, most of the respondents did not provide a reason for erosion in their areas but some suggested natural causes such as currents were the reason. In Poland the respondent stated that there is storm-induced erosion of beaches as well as a longshore transport problem.

In Romania one respondent stated that the reduction of sediments transported by the Danube River due to the dams built up-stream on the Danube River and its tributaries were the primary cause of erosion. A second respondent from Romania provided detailed information on the main reasons for erosion in her region. These are:

1. Hydro-technical works along the Danube and its tributaries, which led to a 50% decrease of alluvia (sands) transported by the Danube, with negative consequences on the sedimentary balance of beaches.
2. Changes in sediment transport balance due to the construction of shore protection facilities;
3. Offshore extension of the jetties from the Sulina mouth of the Danube Delta. This led to the deviation of the sediments transported by the Chilia Distributary (northern branch of the Danube Delta) and to the seaward change in position of the discharge position of sediments transported by Sulina Distributary;
4. Extension and modernisation works of Midia, Constanta and Mangalia harbours, by construction of long jetties and piers. These coastal structures caused the offshore deviation of coastal currents which ensure the longshore sand transport for the beaches from the Southern part of the Romanian Black Sea coast;
5. Offshore sediment transport by wave action;
6. Natural process of cliff retreat over the years at a rate of some 0.6 m/year
7. Increase tendency of the sea level with an average of 1.5 - 2 mm/year, which leads to the withdrawal of the shore line;
8. 50% decrease of marine shellfish stock, which leads to decrease of biogenic sand quantity.

In Spain one respondent felt that sediment loss and redistribution were the main causes of erosion in one site. In another region erosion was a result of shoreline tilting in combination with a problem of shoreline fluctuation and storm impacts. In East Sussex in the UK, erosion was caused by the drift of shingle and storm tides. Another respondent stated that in his region erosion was a result of coastline position / discontinuities; changing (long/short term) bathymetry; depletion of sediment and disruption of longshore transport; as well as sealing off of sediment sources. A third respondent stated that in his region sediment supply was less than losses due to littoral drift.

**8. a) Do you think there is a need to provide erosion protection or upgrade existing protection schemes?**

Country	Response
Ireland (3)	Yes = 100%
Netherlands (9)	Yes = 66.7%, No = 22.2%, Unanswered = 11.1%
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 66.7% No = 33.3%

In Ireland, one respondent stated there was a need to provide protection at locations which have not yet been protected. In the Netherlands one of the respondents who replied 'yes' stated that nourishment was need for economic reasons. Other 'yes' respondents felt that more protection works or upgrades were needed where the areas were important recreational areas and as such important for the local economy. Of the 'no' respondents from the Netherlands, all felt that the current policy suffices.

In Poland, the respondent stated that the erosion problem still exists. In Romania, one respondent stated that the Danube Delta Biosphere Reserve is a protected area and that accordingly it is important to monitor the natural evolution of the area, including erosion. They felt that the protection of this area of coast should be ensured through some sort of sediment re-nourishment. A secondment respondent from Romania stated that the problem of coastal erosion is very important at national level. Beach erosion leads to loss of territory, and sometimes irreversibly compromises the marine ecosystem and the socio-economic value of the coastal area: tourism, balneology, safety of constructions and especially marine constructions, coastal community health, fishing, etc. This in turn leads to significant damage to the national economy and jeopardises the lasting development of the coastal zone.

In Spain the respondents felt that specific combinations of shoreline configuration and storm impact may cause problems to the surrounding population and for this reason works should be provided or upgraded where necessary. In the UK all respondents felt that additional protection works or upgrade of existing works was on-going under various contracts and projects.

**b) If yes, when is this level of protection required (i.e. immediately or in months / years)?**

The responses to this question cannot be categorised as the answer is completely dependent on the location in question. Example responses are tabulated below. Note: none of the UK respondents replied to this question.

Country	Response
<b>Ireland</b>	Yes – immediately but depends on urgency
	Years
	Some locations immediately, other locations: months, years into the future
<b>Netherlands</b>	Immediately
	Immediately, if an economic function is in danger
	Quickly, especially at a specific location (Brouwersdam 2), because in this region extreme sports have already disappeared and a beach restaurant has to be moved in 2009.
	Within a few years
<b>Poland</b>	In years
<b>Romania</b>	According to the Masterplan from the JICA (Japan International Cooperation Agency) – led project: "Study regarding the protection and

	rehabilitation of the Southern part of the Romanian Black Sea Coast", a measure plan was worked out, regarding the protection and rehabilitation of the beaches from the southern part of the Romanian Black Sea coast. It includes short, medium and long term works. During this project the Southern part of the Romanian coast was divided into sectors and sub-sectors according to the characteristics of coastal sediments transport. Each sector was analyzed according to a clear criteria system, in order to point out the priority areas to be protected and execution stages. First stage, which will take place between 2008-2020, includes 3 implementation phases of the project: - phase 1 (year 1 – year 4) Mamaia Sud, partial North and Centre, Eforie Nord (1) sectors - phase 2 (year 5 – year 9) Mamaia Centre (1); Tomis Nord, Eforie Centre sectors and rehabilitation of Olimp-Mangalia area; - phase 3 (year 10 – year 14) Mamaia Centre (2), Tomis Centre, Eforie Nord (2), Eforie South (1) sectors and rehabilitation of Olimp-Mangalia area; Stage 2, will be put into practice after 2021, for the following sectors Tomis South, Eforie South (2), Olimp Mangalia and 2 Mai – Vama-Veche.
<b>Spain</b>	Immediately because now problems occur every winter
	Not urgent

**9. If required, would you prefer coastal protection to take the form of ① conventional coastal engineering structures (hard or soft) or ② some sort of sediment re-nourishment?**

Country	Response
Ireland (3)	① = 100%
Netherlands (9)	② = 66.7%, Both = 11.1%, Unanswered = 22.2%
Poland (1)	Both = 100%
Romania (2)	② = 50%, Both = 50%
Spain (2)	Both = 100%
UK (3)	② = 66.7% Both = 33.3%

**10. In your experience have seawalls, groynes or similar conventional coastal engineering structures been effective in controlling erosion?**

Country	Response
Ireland (3)	Yes = 66.7%, No = 33.3%
Netherlands (9)	Yes = 22.2%, No = 44.4%, Both = 11.1%, Unanswered = 22.2%
Poland (1)	Both = 100%
Romania (2)	Yes = 50%, Both = 50%
Spain (2)	Yes = 50%, Both = 50%
UK (3)	Both = 66.7% No = 33.3%

In Poland the respondent stated that it depends on location and conditions of the coast as well as local objectives. In Romania one of the respondents stated that the structures solve only locally the erosion problem and added that they could have destructive effects on adjacent areas particularly if there is no integrated project/plan for the entire coastal area. In the UK, the respondents felt that it really depended on the site in question.

**11. a) Is there an obvious source of sediment supply for your beaches?**

Country	Response
Ireland (3)	Yes = 66.7%, No = 33.3%
Netherlands (9)	Yes = 77.8%, No = 11.1%, Don't know = 11.1%,
Poland (1)	Yes = 100%
Romania (2)	Yes = 100%
Spain (2)	Yes = 100%
UK (3)	Yes = 66.7% No = 33.3%

**b) If yes, then do you have information available for both this sediment and the existing sediment on your beach (quantity or quality)?**

Country	Response
Ireland (3)	No = 100%
Netherlands (9)	Yes = 22.2%, No = 44.4%, Don't know = 33.3%,
Poland (1)	Yes = 100%
Romania (2)	Yes = 50%, No = 50%
Spain (2)	Yes = 100%
UK (3)	Yes = 66.7% Don't know = 33.3%

From the above responses it is clear that the majority of respondents are aware of an obvious source of sediment supply for their beaches but the information they have on this source is variable. In Ireland, for example, the respondents have no information on the source. This is true for the majority of the Dutch respondents as well. In Poland, Spain and the UK this information is available.

**12. Do you feel that science has a role in helping to manage eroding coastlines?**

Country	Response	Explanation
<b>Ireland</b>	Yes	Monitoring, modelling, predicting, engineering, designing
	Yes	Various studies such as hydrodynamic studies and various wave studies and sediment transport models
	Yes	An understanding of the processes involved in the erosion provides for a more appropriate solution.
<b>Netherlands</b>	Yes	Blank
	Yes	Blank
	Yes	Blank
	Yes	Research and learning from other locations
	Yes	Advise on morphological, ecological and financial effects of coastal management policy, on the short and long term.
	Yes	Blank
	Yes	Blank
	Yes	Blank
	Yes	Research on causes and prevention
<b>Poland</b>	Yes	Science should provide erosion models based on available data for specific locations of the coastline
<b>Romania</b>	No	Blank
	Yes	Only scientific monitoring can determine the causes and the effects of erosion. After that, the necessary economical and ecological measures can be taken.

<b>Spain</b>	Yes	Better understanding coastal processes and design rules
	Yes	
<b>UK</b>	Yes	Development of 'sands' technology; inshore/offshore waves; offshore sediment movement, monitoring/analysis.
	Yes	Monitor and forecast changes in light of forcing factors
	Yes	Intervention policies should be based on scientific evaluation rather than other methods.

It is clear that all respondents bar one from Romania feel that science has a role to play in helping to manage eroding coastlines. The most significant role that science can play would appear to be in modelling and monitoring of coastal change.

### 13. Are you aware of the EUROSION project or its outcomes?

Country	Response
Ireland (3)	Yes = 33.3%, No = 66.7%
Netherlands (9)	Yes = 11.1%, No = 77.8%, Unanswered = 11.1%,
Poland (1)	Yes = 100%
Romania (2)	Yes = 50%, No = 50%
Spain (2)	Yes = 100%
UK (3)	No = 100%

It is clear from the responses to this question that the majority of respondents in the CONSCIENCE project are unaware of the EUROSION project and its outcomes.

### 14. Have you encountered / do you use the following terms:

Country	Coastal sediment cell		Coastal resilience		Favourable Sediment Status		Strategic Reservoir Sediment	
Ireland [EU1]	Yes	An area within which erosion /deposition takes place and sediment supply etc. is <b>identifiable</b>	Yes	Ability of coasts to recover from events (storms, etc.)	Yes	Stable coastline or coastline where natural processes result in favourable coastline conditions over a period of time	Yes	Reservoir of sediment to assist beach recovery following erosion (e.g. river/offshore deposits)
Ireland [EU2]	Yes	Source of sediment	Yes	Ability to withstand erosion	Yes	Level of equilibrium where sediment can be maintained	Yes	Suitable source of sediment that will not have other detrimental effects
Ireland [EU3]	Yes	A discrete area of coastline where there is a common sediment transport regime	Yes	The ability of a coastline to withstand and recover from erosion	Yes	An area/cell where the reservoir/transport regime is unlikely to result in erosion difficulties	Yes	An area that could be utilised to provide a source of suitable sediment for replenishment/nourishment purposes

Country	Coastal sediment cell		Coastal resilience		Favourable Sediment Status		Strategic Reservoir Sediment	
Netherlands [O]	<b>Unanswered</b>		<b>Unanswered</b>		<b>Unanswered</b>		<b>Unanswered</b>	
Netherlands [MTB]	No		No		No		No	
Netherlands [PB]	No		No		No		No	
Netherlands [PVDK]	No		Yes	Flexibility of the coast	Yes	Without danger	Yes	Enough supply without immediate

								danger (or on short term)
Netherlands [MB]	No		Yes	Extent to which the coastal system naturally recovers from 'momental' (?) (storm)erosion	Yes	Extent to which the characteristics (granular composition, environmental protection quality, colour) are useful for the intended application	Yes	Long term availability of appropriate (physical, environmental protection and also financial and technical) sediment for coastal management.
Netherlands [TD]	Yes	Blank	Yes	Blank	Yes	Blank	Yes	Blank
Netherlands [RDW]	No		No		No		No	
Netherlands [HSN]	No		Yes	The ability of the coast to naturally maintain itself	No		No	
Netherlands [FW]	No		No		No		No	
Poland [AS]	Yes	An autonomous or partly autonomous in terms of sediment exchange stretch of the coast	Yes	The ability of the coast to accommodate changes induced by waves, sea level rise, etc.	No		Yes	Marine resources of sediment available for coastal zone protection.
Romania [BG]	No		No		No		No	
Romania [CD]	Yes	Cells of coastal sediments: coastal areas with a precise delimitation, where the sediment sources are precisely determined and the transfer modalities are well known	Yes	Possibility of natural recovery of the coastal area after the cease of the specific coastal phenomena (storm waves, etc)	Yes	Sedimentary balance for a period of time when the coastal area was affected by specific phenomena	Yes	Identification of some natural areas in emerged (onshore) or offshore areas, which are rich in sand that can be used for artificial beach nourishment

Country	Coastal sediment cell		Coastal resilience		Favourable Sediment Status		Strategic Sediment Reservoir	
Spain [SA]	Yes		No		No		Yes	
Spain [L]	Unanswered		Unanswered		Unanswered		Unanswered	
UK [PA]*	No		No		No		No	
UK [UD]	Yes	Self-contained stretch of coast with no sediment entering or leaving the cell	Yes	? of coast to respond to changing external factors, i.e. ? coast has high resilience, sinking sandy ?flow?	Yes	There is more sediment in the system than currently needed, i.e. sufficient sediment input or/and sufficient sediment store	No	Probably similar to favourable sediment status
UK [IT]	Yes	Coastal area in which sediment can freely move	Yes	Ability of particular coast to withstand erosion	Yes	Sufficient sediment with coastal sediment cell to sustain the coast	Yes	Sediment available within coastal sediment cell that can be used to replenish coastal areas

\* Has heard of the terms but has an insufficient level of understanding for definition.

It is clear from the responses above that there is a mixed understanding of the EUROSION concepts with some concepts clearly being better understood than others. It would appear that each respondent has, however, a uniquely personal interpretation of what the concept means.

### 6.3.2 Conclusions on end-user experience

It is clear from the responses to the questionnaire that coastal erosion is regarded as an issue in all the CONSCIENCE end-user sites. In some locations there is an explicit policy covering the issue while in other areas there is no policy. It would also seem that there is uncertainty around whether there is a clear policy basis or not. It may be said that within each Member State one would assume that all end-users doing the same job should be working from the same policy basis.

When asked if guidelines or training were received, the end-user respondents stated that they had received such guidelines / training. This however also varied within Member States. In the Netherlands, Romania and the United Kingdom the responses varied. This could be explained by the differences at which the respondents work, i.e. whether at the local, regional or national level. Most respondents think that additional training or guidelines would help them in their jobs. A slight preference was expressed towards additional guidelines rather than training. This is an important finding for the CONSCIENCE project.

All the end-user respondents were aware of specific sites within their area where erosion currently occurs. In relation to monitoring of these sites, however, responses varied. In Ireland and Spain for example it was found that there was no routine monitoring strategy in place. In Poland, Romania and the United Kingdom such a routine monitoring strategy does exist. In the Netherlands there seemed to be uncertainty as to whether such a monitoring strategy existed. Again this could be explained by the fact that different respondents were working at different levels of governance. It could be the case that those at the most local decision-making level are more aware of the monitoring activities in place whereas those at the national level may be more concerned with strategic management of the erosion issue rather than local level work practice.

In a similar vein, the majority of respondents were aware of the reasons for the erosion occurring. Interestingly, when asked about upgrading current protection works the majority of respondents felt that these works were in need of upgrading. In this regard it is interesting to

contrast this response with that relating to monitoring. It may be suggested that if pertinent monitoring strategies were in place in all sites this could inform the decision-making process relating to the upgrade of coastal protection works. In relation to when the respondents felt that such work was required, the responses indicate that this very much depends on site location. When asked about the type of protection needed, there was a range of preferences. In Ireland there was a preference for conventional engineering structures. In most of the other CONSCIENCE sites, the respondents expressed a preference for a mix of conventional engineering structures and re-nourishment. In terms of the effectiveness of such works to date the respondents stated that this depended on the site location. It is acknowledged that a range of other factors come in to play regarding the effectiveness of coastal protection works.

Most of the respondents were aware of a source of sediment supply for their beaches. Similarly, almost all of the respondents had information on this source except for Ireland which interestingly has no monitoring strategy in place. It could be argued that such a position supports the need for a comprehensive monitoring strategy to be implemented at sites prone to erosion.

All the respondents, bar one, felt that science has a role to play in helping to manage eroding coastlines. The most significant role that science can play would appear to be in modelling and monitoring of coastal change. This is an important finding for the CONSCIENCE project which seeks to develop an operational support structure for sustainable coastal erosion management. In terms of the EUROSION project, the end user respondents were mostly unaware of it. It is important to point out, however, that the concepts advocated by the EUROSION project, were recognised and understood to varying degrees by the respondents. It is clear from the responses that some of these concepts were better understood than other and that generally there exists a very high level of personal interpretation in relation to these concepts.

It may be concluded that from this survey it would appear that currently there is a diverse range of approaches to all aspects of erosion management within the CONSCIENCE case study sites.

## 7. Summary and Overall Conclusions

Various existing EU Frameworks implicitly provide ample support for further implementation of sustainable erosion management based on EUROSION concepts. However, sediment management principles need to be made explicit.

Considering the current national policies in the different, study site countries, the general picture is that sediment management as a basic approach to coastal erosion management is starting to gain recognition. However, implementation in the majority of countries has not reached the stage yet of explicitly introducing EUROSION concepts.

From a (limited) number of respondents on EU-, and national level policy makers, it is clear that fundamentally the EUROSION concepts are regarded as useful. All respondents recognised the need for better communication of the concepts to those involved in managing erosion on a daily basis.

A quick scan among a number of end-users (local- and regional level coastal managers) in six European countries, underlines the importance of coastal erosion as an important issue. When asked if additional guidelines or training might be welcome, a slight preference was expressed towards additional guidelines rather than training.

The summary of conclusions illustrates the value of a number of scheduled, future products of CONSCIENCE:

- In order to make sediment management principles more explicit in EU policy documents, an attempt will be made to indicate how sediment principles (like EUROSION concepts) are linked to principles of ICZM. ( product D11).
- In order to improve and stimulate the implementation of sediment management
  - a set of guidelines will be developed (product D20),
  - tested in the various pilot sites, documenting experiences with the implementation including feed-back from the extended network of European coastal managers (product D18).

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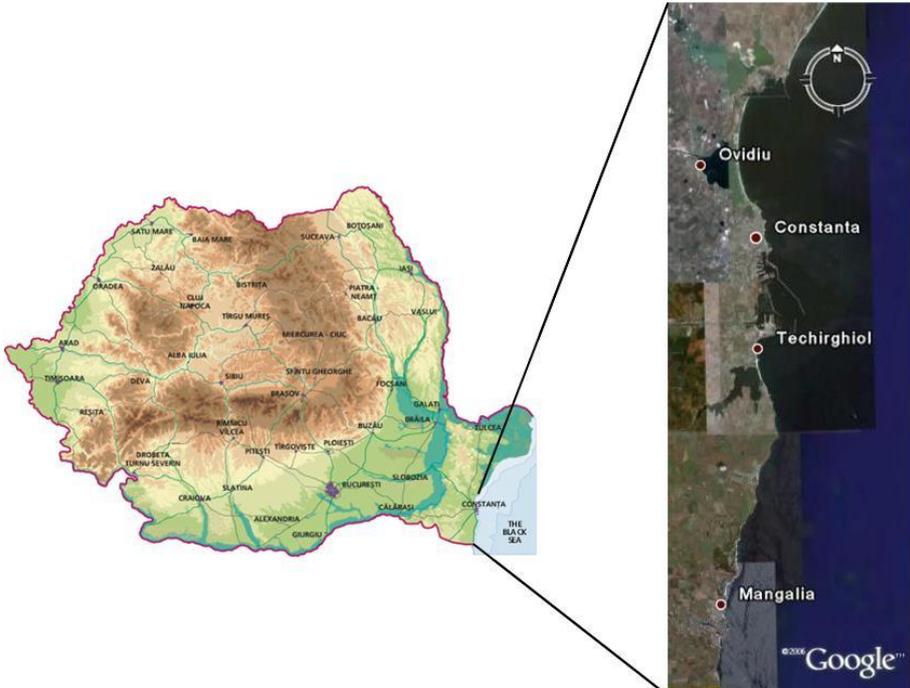
## Appendix A CONSCIENCE Case Studies

This section includes two short case studies from each CONSCIENCE partner, one from their country and one from their local study area, on coastal erosion events. The aim of this section is to provide a snapshot of erosion events that have received media attention since 2003. Where possible, coverage of erosion events at national government level have also been included.

### IRELAND

CASE STUDY 1	
Country, place:  Slea Head, Co. Kerry, Ireland	
Date of event	08/04/2007
Description of event	Erosion of cliffs at the scenic Slea head Road caused massive landslide of earth and rock below the road at Cuas na gColúr between Coumeenole Bay and Dún Chaoin.
Event impact	Major cracks lined a 10m stretch of roadway, which has been closed and diversions put in place. Negative impact on local tourism industry till the road, which is a major tourist attraction, is opened again.
Event response e.g. crisis management, funding, public awareness	<p>The collapse occurred at Easter and the Kerry County Council moved very quickly to provide a temporary roadway, ensuring the Slea Head route, so important for tourism in the Dingle Peninsula, remained open.</p> <p>Building of a new road at Slea Head in the Dingle Peninsula to replace a section that collapsed several months ago started in August. The one-kilometre stretch will cost €900,000 to build with work expected to be completed by October. Agreement had to be reached with three landowners to acquire the necessary land while funding has been approved by the Department of the Environment.</p> <p>A temporary relief road has been in place since April to enable traffic to continue moving around the coastal route. The 350-metre replacement road had been constructed following a cliff collapse. The land for the temporary road had been provided by local couple Máirín and Sean O Dálaigh.</p>
Media coverage of the event	<a href="http://www.ireland.com/newspaper/ireland/2007/0410/1176125085272.html">http://www.ireland.com/newspaper/ireland/2007/0410/1176125085272.html</a> <a href="http://archives.tcm.ie/irishexaminer/2007/08/17/story40165.asp">http://archives.tcm.ie/irishexaminer/2007/08/17/story40165.asp</a>

## ROMANIA

CASE STUDY 1	
<p>Country, place</p> <p>Romania, Southern part of the coast</p>	
<p>Description of event</p>	<p>Coast - ~ 60 kms in length – main activity: tourism, very developed. The coast has been subject to strong and continuous erosion during the past decades.</p>
<p>Event impact</p>	<p>Loss of hundreds of hectares of touristic beaches, having a negative impact mainly on coastal tourism.</p>
<p>Event response e.g. crisis management, funding, public awareness</p>	<p>In 2004 the Romanian Govt. (Ministry for Water Management and Sustainable Development) required institutional help from the Govt. of Japan via the Japan International Cooperation Agency (JICA). Under the financial support of JICA, an exhaustive report on the coastal erosion along the entire Southern part of the coast has been developed by a Japanese – Romanian research consortium led by ECOH Corporation (Japan). The study provided a plan for protection against erosion along all the beaches from the Southern part of the coast, to be put in practice till 2020. Romanian Govt. now applies for funding from EU funds for the development of the project in 2 pilot sites. The JICA-funded study and plan have been widely covered by the Romanian media during the past years (especially 18 months). Links to be found below. Other proposals have also been made for coastal protection and presented in the media, but with a much lower coverage. Links are also presented below.</p>
<p>Type of media coverage of the event and web links where available</p>	<p>Coverage for JICA Study  <a href="http://www.presaonline.com/stire/in-cativa-ani-romania-ar-putea-ramane-fara-plaje,36904.html">http://www.presaonline.com/stire/in-cativa-ani-romania-ar-putea-ramane-fara-plaje,36904.html</a>  <a href="http://www.presaonline.com/stire/japonezii-ne-vor-reabilita-litoralul,36842.html">http://www.presaonline.com/stire/japonezii-ne-vor-reabilita-litoralul,36842.html</a>  <a href="http://www.green-report.ro/dynamic/revista/numere-revista/nr-3-aprilie-2007/protectia-mediului/sos-plajele-in-pericol---132.htm">http://www.green-report.ro/dynamic/revista/numere-revista/nr-3-aprilie-2007/protectia-mediului/sos-plajele-in-pericol---132.htm</a>  <a href="http://www.hotnews.ro/articol_66610-Marea-inghite-annual-3-metri-din-plaja-romaneasca.htm">http://www.hotnews.ro/articol_66610-Marea-inghite-annual-3-metri-din-plaja-romaneasca.htm</a> (from “Banii Nostru” newspaper, may 03, 2007)  <a href="http://www.9am.ro/stiri-revista-presei/Social/13528/Plajele-romanesti-pe-cale-de-disparitie.html">http://www.9am.ro/stiri-revista-presei/Social/13528/Plajele-romanesti-pe-cale-de-disparitie.html</a>  <a href="http://www.9am.ro/stiri-revista-presei/Social/37702/-Litoralul-in-pericol-.html">http://www.9am.ro/stiri-revista-presei/Social/37702/-Litoralul-in-pericol-.html</a>  <a href="http://www.banknews.ro/stire/9328_litoralul_romanesc_pierde_anual_in_medie_trei_metri_de_plaja_din_cauza_eroziunii.html">http://www.banknews.ro/stire/9328_litoralul_romanesc_pierde_anual_in_medie_trei_metri_de_plaja_din_cauza_eroziunii.html</a></p>

<p><a href="http://www.monitorulbt.ro/index.php?module=show_stire.php&amp;tip=Economic&amp;id=51913&amp;a=&amp;email=">http://www.monitorulbt.ro/index.php?module=show_stire.php&amp;tip=Economic&amp;id=51913&amp;a=&amp;email=</a></p> <p><a href="http://www.gandul.info/social/miliarde-euro-mediu-aprobate-europeni.html?3932;855000">http://www.gandul.info/social/miliarde-euro-mediu-aprobate-europeni.html?3932;855000</a></p> <p><a href="http://www.dailybusiness.ro/proiectul-de-reabilitare-a-litoralului-va-costa-in-total-316-mil-euro_cat-8_article-1599.html">http://www.dailybusiness.ro/proiectul-de-reabilitare-a-litoralului-va-costa-in-total-316-mil-euro_cat-8_article-1599.html</a></p> <p><a href="http://www.business-adviser.ro/investitii_reabilitare_litoral.html">http://www.business-adviser.ro/investitii_reabilitare_litoral.html</a></p> <p><a href="http://www.bloombiz.ro/article—x-Destinatii_de_Vacanta-Refacerea_litoralului_va_costa_Romania_pesto_300_de_milioane_de_euro—305138.html">http://www.bloombiz.ro/article—x-Destinatii_de_Vacanta-Refacerea_litoralului_va_costa_Romania_pesto_300_de_milioane_de_euro—305138.html</a></p> <p><a href="http://www.cotidianul.ro/index.php?id=4381&amp;art=10353&amp;cHash=be92b5f7d9">http://www.cotidianul.ro/index.php?id=4381&amp;art=10353&amp;cHash=be92b5f7d9</a></p> <p><a href="http://www.cotidianul.ro/index.php?id=9690&amp;art=25735&amp;cHash=7722df2ded">http://www.cotidianul.ro/index.php?id=9690&amp;art=25735&amp;cHash=7722df2ded</a></p> <p><a href="http://www.jurnalul.ro/articole/86107/diguri-subacvatice-la-mare-316-milioane-de-euro-pentru-refacerea-plajelor-romanesti">http://www.jurnalul.ro/articole/86107/diguri-subacvatice-la-mare-316-milioane-de-euro-pentru-refacerea-plajelor-romanesti</a></p> <p><a href="http://www.telegrafonline.ro/pdf/930125ff5144df6c4ec040a277f2f397.pdf">http://www.telegrafonline.ro/pdf/930125ff5144df6c4ec040a277f2f397.pdf</a></p> <p><a href="http://www.evz.ro/article.php?artid=295552">http://www.evz.ro/article.php?artid=295552</a></p> <p><a href="http://stiri.kappa.ro/actualitate/japonezii-ne-repara-plajele/stire_79559.html">http://stiri.kappa.ro/actualitate/japonezii-ne-repara-plajele/stire_79559.html</a></p> <p>Other plans</p> <p><a href="http://www.stirilocale.ro/constant/Plaja_Venus_un_prim_pas_in_stoparea_eroziunii_costiere_IDN9082.html">http://www.stirilocale.ro/constant/Plaja_Venus_un_prim_pas_in_stoparea_eroziunii_costiere_IDN9082.html</a></p> <p><a href="http://www.ziua.ro/display.php?data=2007-09-15&amp;id=226667">http://www.ziua.ro/display.php?data=2007-09-15&amp;id=226667</a></p> <p><a href="http://revistaepoca.wordpress.com/voci/sa-lamurim-o-rubrica-de-titus-filipas/dezvoltarea-durabila-a-litoralului/">http://revistaepoca.wordpress.com/voci/sa-lamurim-o-rubrica-de-titus-filipas/dezvoltarea-durabila-a-litoralului/</a></p> <p><a href="http://www.evz.ro/article.php?artid=317790">http://www.evz.ro/article.php?artid=317790</a></p> <p><a href="http://www.evz.ro/article.php?artid=297059">http://www.evz.ro/article.php?artid=297059</a></p>
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**SPAIN**

**CASE STUDY 1**

Country, place

*Catalan coast  
Spain*



Date of event	November 2001 (the largest recorded storm by existing wave buoy network and the largest in the hindcasted wave time series from 50s)
Description of event	Impact of an Eastern storm along the northern part of the Spanish Mediterranean coast (Valencia and Catalonia). The storm was characterised by very high waves (Hs up to 7 m in some areas) and storm surge (> 50 cm) in such a way that a large number of beaches were eroded and/or inundated. Sketch above shows locations where significant damages were detected. The photo shows the Lloret de Mar beach during the storm.
Event impact	The impact of the storm produced beach erosion and coastal infrastructure damages (some harbours were affected and many promenades/waterfronts were also damaged). Because during the storm, wave periods were long, induced wave run-up was very high and, as a result of this, many areas were temporary inundated by water and sand (removed from beaches).  After this storm, other ones of shorter return periods have also affected to almost the entire Catalan coast (2003), although inducing smaller damages.

Event response e.g. crisis management, funding, public awareness	Central Government (Ministry of Environment) dedicated a relatively high budget to recover the affected areas (estimated amount of 4.8 millions of €). In addition to this, particulars with homes and businesses close to affected waterfront also had to cover some of the damages through insurances (most of damages were related to inundation).
Type of media coverage of the event and web links where available	Large coverage in newspaper and national TV channels. <a href="http://www.elpais.com/articulo/Comunidad/Valenciana/22/millones/recuperar/zonas/costa/danadas/temporales/elpepuespval/20031227elpval_18/Tes">http://www.elpais.com/articulo/Comunidad/Valenciana/22/millones/recuperar/zonas/costa/danadas/temporales/elpepuespval/20031227elpval_18/Tes</a>

## UNITED KINGDOM

<b>CASE STUDY 1: Happisburgh, UK</b>	
Location:  Happisburgh, Norfolk, United Kingdom	 <p>2006                      2003                      1992</p>
Date of event	Continual erosion of soft cliffs
Description of event	Since 1990, 25 houses in Happisburgh have been lost due to cliff erosion. The wooden sea defences built in the late 1950s at have been failing over the last few years, and large chunks of the sandy cliffs are regularly falling into the sea.
Event impact	As a result of the decision to carry out 'managed retreat' along this frontage, rapid cliff erosion means that many homes and businesses are at imminent risk of falling into the sea. The majority of owners who bought properties at a time when the coastal defence policy was to 'hold the line' are finding that their buildings insurance does not cover loss of assets due to coastal erosion. In 2004, the launch ramp for the lifeboat station had to be abandoned and collapsed shortly thereafter.
Event response e.g. crisis management, funding, public awareness	Thousands of tonnes of rock have been brought to Happisburgh and placed on the beach thanks to a scheme funded by £200,000 from North Norfolk District Council and, quite probably uniquely, to the tune of around £50,000 from the pockets of the villagers and their international supporters. Although the rocks have not yet been engineered into a finished defence, their presence has prevented further subsidence of the cliffs during recent storms and has temporarily halted the loss of cliff top assets. It is anticipated that these temporary defences will protect the cliffs for up to 10 years.  A funding campaign is currently under way at <a href="http://www.buyarockforhappisburgh.co.uk">www.buyarockforhappisburgh.co.uk</a> and Coastal Concern Ltd. The monies raised through these charities will be used in conjunction with funds from North Norfolk District Council.
Type of media coverage of the event and web links where available	<a href="http://www.happisburgh.org.uk/press/nce070607.html">http://www.happisburgh.org.uk/press/nce070607.html</a> <a href="http://news.bbc.co.uk/1/hi/england/norfolk/6444581.stm">http://news.bbc.co.uk/1/hi/england/norfolk/6444581.stm</a> <a href="http://www.guardian.co.uk/2020/story/0,,1304301,00.html">http://www.guardian.co.uk/2020/story/0,,1304301,00.html</a>

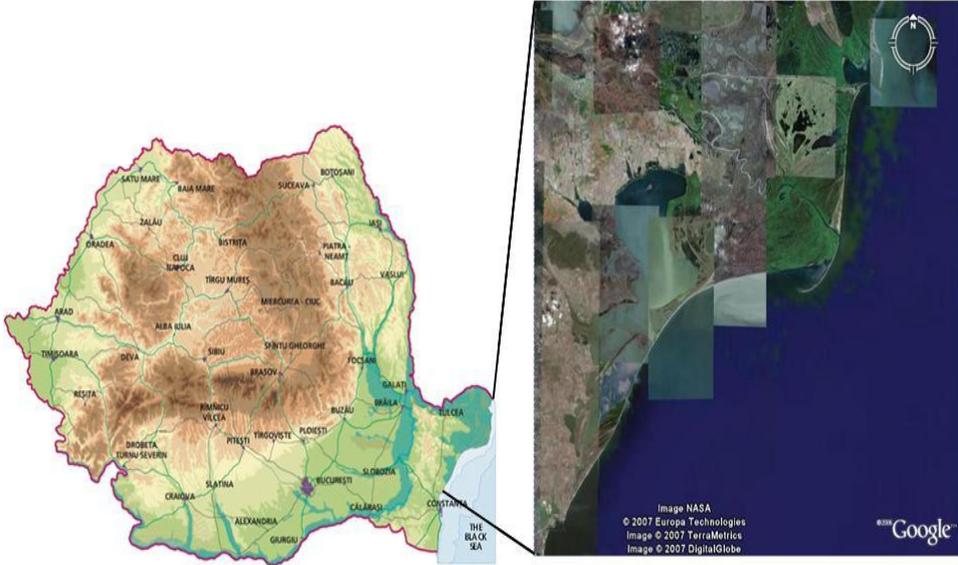
## Local case study sites

### IRELAND

CASE STUDY 1	
Country, place  Inch Beach, Co. Kerry, Ireland.	<i>Insert map if available</i>
Date of event	09/01/2007
Description of event	Kerry County Council's senior engineer has warned that a road along the coast near Inch beach, a major tourist route, is in danger of collapse. The spell of high winds and waves over the winter 06/07 has accelerated erosion problems eating away the earthen cliff beneath the road, according to county engineer Tom Curran.
Event impact	A 400 metre section near the world-famous viewing point across Dingle Bay was now seriously undermined. Negative impact on local as well as whole Kerry tourism industry. Work has to start without the necessary funding by the departments. If necessary the council would have to borrow the money, which could jeopardise other programmes.
Event response e.g. crisis management, funding, public awareness	Appealing for funds from the Government need €4 million for immediate works to prevent its collapse. Applied every year to the Department of the Marine for funding and looking for support from the Department of the Environment as realigning the existing roadway which is a part of the repair works.
Media coverage of the event	<a href="http://www.ireland.com/newspaper/ireland/2007/0109/1168033124612.html">http://www.ireland.com/newspaper/ireland/2007/0109/1168033124612.html</a>

## ROMANIA

### CASE STUDY 1

<p>Country, place</p> <p>Romania, Northern part of the coast (Danube Delta)</p>	
<p>Date of event</p>	<p>xx/xx/200x</p>
<p>Description of event</p>	<p>Coast - ~ 180 kms in length. It is all part of the Danube Delta Biosphere Reserve and almost entirely wild. There are only 2 villages at ~ 2 km distance from the beach along the entire section. Tourism – developed along not more than 5 kms. Several fishermen collection points scattered along the coast. Almost the entire DD coast has been subject to coastal erosion.</p>
<p>Event impact</p>	<p>Till now, no exhaustive study regarding the impact of coastal erosion in this area has been performed, even because of the big complexity of evaluating the impact on environmental goods from a biosphere reserve.</p>
<p>Event response e.g. crisis management, funding, public awareness</p>	<p>Recently (mid September) an agreement was signed between the Romanian Ministry for Water Management and Environmental Protection and the USAID for the development of a feasibility study regarding coastal erosion in front of the Danube Delta. Immediately afterwards, media gave attention to the argument of coastal erosion along the Danube Delta coast and the potential remediation plan. Before, media extremely seldom paid any attention to the problem – and in articles covering the entire Romanian littoral.</p>
<p>Type of media coverage of the event and web links where available</p>	<p>Coastal erosion in front of the Danube Delta  <a href="http://www.romanialibera.ro/a43831/annual-litoralul-romanesc-pierde-aproximativ-2-metri-de-plaja.html">http://www.romanialibera.ro/a43831/annual-litoralul-romanesc-pierde-aproximativ-2-metri-de-plaja.html</a>  <a href="http://www.jurnalul.ro/articole/86107/diguri-subacvatice-la-mare-316-milioane-de-euro-pentru-refacerea-plajelor-romanesti">http://www.jurnalul.ro/articole/86107/diguri-subacvatice-la-mare-316-milioane-de-euro-pentru-refacerea-plajelor-romanesti</a>            Recent USAID Programme  <a href="http://www.smartfinancial.ro/smarttourist/turism+in+romania/acord+romano-american+de+prevenire+a+eroziunii+litoralului">http://www.smartfinancial.ro/smarttourist/turism+in+romania/acord+romano-american+de+prevenire+a+eroziunii+litoralului</a>  <a href="http://www.ziare.com/385_000_dolari_de_la_USTDA_pentru_nordul_Litoralului-140198.html">http://www.ziare.com/385_000_dolari_de_la_USTDA_pentru_nordul_Litoralului-140198.html</a>  <a href="http://www.themoneychannel.ro/articol_20857/mprumut_nerambursabil_de_385_000_dolari_pentru_zona_nordica_a_litoralului.html">http://www.themoneychannel.ro/articol_20857/mprumut_nerambursabil_de_385_000_dolari_pentru_zona_nordica_a_litoralului.html</a></p>

## SPAIN

<b>CASE STUDY 2</b>	
Country, place  S'Abanell beach, Blanes (Spain)	 
Date of event	Nearly every year storm impacts (e.g. 10/2006; 05/2007)
Description of event	The impact of different storms (of relatively short-return periods) on an erosive beach, s'Abanell beach (Blanes, Spain) produces episodes of nearly full disappearance of the sub-aerial beach.
Event impact	This causes existing infrastructures in the backbeach to be directly exposed to wave action. This has resulted in numerous events of damages in the existing promenade (see photo). In addition of this, there is a desalinization plant in the area that have some elements in the beach (e.g. pipes connecting wells). These elements have also been affected by the storms in such a way that the plant operation (and the fresh water production) has been interrupted several times.
Event response e.g. crisis management, funding, public awareness	Administrations (Municipality, Regional Government and Central Government) have rebuilt (several times) the promenade. The municipality has claimed to the Ministry of Environment a definitive solution for the beach and, although different proposals have been done, no definitive solution has yet been adopted.
Type of media coverage of the event and web links where available	Frequent appearance in local newspapers and TV-channels. <a href="http://www.vilaweb.cat/www/elpunt/noticia?p_idcmp=2210005">http://www.vilaweb.cat/www/elpunt/noticia?p_idcmp=2210005</a> <a href="http://www.elpais.com/articulo/cataluna/avance/mar/dana/inutiliza/desaladora/Blanes/elpepuespcat/20061022elpcat_19/Tes">http://www.elpais.com/articulo/cataluna/avance/mar/dana/inutiliza/desaladora/Blanes/elpepuespcat/20061022elpcat_19/Tes</a>

**UNITED KINGDOM****CASE STUDY 1**

<p>Country, place <b>Fairlight Cove, East Sussex UK</b></p>	
<p>Date of event</p>	<p>October 2006 – March 2007</p>
<p>Description of event</p>	<p>Subsidence due to the erosion of a previous landslide resulted in the loss of cliff top land and properties including the building shown above. This event follows a series of cliff falls and continued erosion, which have resulted in the loss of several homes and up to 90m of land since 1998.</p>
<p>Event impact</p>	<p>In addition to the loss of homes and land, the main access road through the village has been declared unsafe, and with a potential erosion rate of up to 25m per year, more than 100 additional houses could be lost during the next 10 years. This could ultimately lead to the abandonment of the village.</p>
<p>Event response e.g. crisis management, funding, public awareness</p>	<p>The Fairlight Cove Preservation Trust was established to assist in obtaining funding and permission for a coastal defence and stabilisation scheme for the affected area. An initial planning application was approved by the local council in early 2006 but was ultimately blocked by Natural England. Following an agreement early in 2007, the £3.7million scheme has been awarded 100% funding through the Defra 'Capital Programme' and work began at the site in June 2007.</p> <p>The cliff will be drained and wells installed to lower the water table, preventing further slumping of the cliffs, whilst the construction of a rock bund will protect the cliff from wave energy and erosion of material from the toe of the landslide.</p>
<p>Type of media coverage of the event and web links where available</p>	<p><a href="http://www.news.bbc.co.uk/1/hi/england/southern_counties/5277558.stm">www.news.bbc.co.uk/1/hi/england/southern_counties/5277558.stm</a> <a href="http://www.fairlight.org.uk">www.fairlight.org.uk</a> New Civil Engineer: 20/09/07 pp24-25.</p>

<b>CASE STUDY 2</b>	
Country, place <b>Pevensey Bay East Sussex UK</b>	   
Date of event	Continuous coastal erosion
Description of event	The predominant wave direction is from the southwest mean that shingle beach material is transported along Southeast England's coast from west to east. Longshore transport through Pevensey Bay means that roughly 25,000cu.m per year passes annually onto the Bexhill frontage. At the same time, some 5,000cu.m of shingle arrives on the western side of Sovereign Harbour. This is transported around the harbour during the winter and added to the beach on the eastern side. Thus natural longshore transport results in a loss of 20,000cu.m of material from the Pevensey frontage, which, if not correctly managed leads to severe coastal erosion and flooding.
Event impact	No recent erosion events with direct loss of assets (other than beach material). During extreme conditions, sea defences in Pevensey Bay may be breached resulting in severe flooding and lowering of beach levels. Residents of beach front properties are evacuated as homes and other assets are damaged.
Event response e.g. crisis management, funding, public awareness	A 25-year, £30 million scheme to provide protection to more than 6000 homes and 17,000 people along a 9km stretch of the Sussex coastline is under way. The work is managed by Pevensey Coastal Defence Ltd and is funded through the public/private partnership Pathfinder Initiative (HM Treasury). The scheme comprises the repair and replacement of coastal defence infrastructure such as groynes and a beach recharge and recycling scheme. Beach reprofiling is also carried out following storm events to prevent permanent lowering of the crest.
Type of media coverage of the event and web links where available	Pevensey Coastal Defence Ltd: <a href="http://www.pevensey-bay.co.uk">www.pevensey-bay.co.uk</a> Rother District Council: <a href="http://www.rother.gov.uk">www.rother.gov.uk</a> Wealden District Council: <a href="http://www.wealden.gov.uk">www.wealden.gov.uk</a>

# Appendix B Questionnaire Strategic Decision Makers

Questionnaire for Strategic Decision Makers at Member State and National levels

Name:	
Organisation:	
Country:	
Job Description / Title:	
Contact Details (optional):	Phone: e-mail:

Q1. Are you aware of EUROSION and/or its outcomes?

Q2. If yes, have you used any or all of the following concepts in your policy documents?

- Coastal sediment cell
- Coastal resilience
- Favourable sediment status
- Strategic sediment reservoir

Q3. At what scale do such policies apply? (E.g. national/regional/local)

Q4. If yes, have you used any or all of the following concepts in practical erosion management policy?

- Coastal sediment cell
- Coastal resilience
- Favourable sediment status
- Strategic sediment reservoir

Q5. At what scale were such erosion projects? (E.g. national/regional/local)

Q6. Have the concepts proved useful when considering the management of erosion? Explain.

Q7. Do you think the concepts will be useful in future erosion management policies?

Q8. Do you think the concepts can be improved?

Thank you for your time - please feel free to add any further comments with regard to coastal erosion and management, this questionnaire or the CONSCIENCE Project:

## Appendix C Questionnaire for End-Users

Name:	
Organisation:	
Country:	
Job Description / Title:	
Contact Details (optional):	Phone: e-mail:

Q1	Is coastal erosion an issue in your area?	YES / NO
Q2	Is there an explicit policy with respect to shoreline position that applies in your area?	YES / NO
Q3	Have you ever received training or guidelines on management of coastal erosion?	YES / NO
Q4	Do you feel that additional training or guidelines would assist you in your current role?	YES / NO
Q5	Are you aware at what specific location (sites and positions within those sites) erosion occurs?	YES / NO
Q6	Do you have a routine monitoring strategy at locations where erosion has been identified?	YES / NO
Q7	Do you know the main reasons for the erosion at the sites in question? YES / NO If yes please elaborate:	
Q8	a) Do you think there is a need to provide erosion protection or upgrade existing protection schemes? YES / NO (please explain): b) If yes, when is this level of protection required (i.e. immediately or in months / years)?	
Q9	If required, would you prefer coastal protection to take the form of ① conventional coastal engineering structures (hard or soft) or ② some sort of sediment re-nourishment?	① or ②
Q10	In your experience have seawalls, groynes or similar conventional coastal engineering structures been effective in controlling erosion?	YES / NO
Q11	a) Is there an obvious source of sediment supply for your beaches? b) If yes, then do you have information available for both this sediment and the existing sediment on your beach (quantity or quality)?	YES / NO YES / NO
Q12	Do you feel that science has a role in helping to manage eroding coastlines? If yes please elaborate on what you feel this role should be:	YES / NO
Q13	Are you aware of the EuroSION project or its outcomes?	YES / NO

Q14	<p>Have you encountered / do you use the following terms:</p> <ul style="list-style-type: none"><li>• <i>Coastal sediment cell</i>: YES / NO (If yes, please explain what you understand by this term)</li><li>• <i>Coastal resilience</i>: YES / NO (If yes, please explain what you understand by this term)</li><li>• <i>Favourable Sediment Status</i>: YES / NO (If yes, please explain what you understand by this term)</li><li>• <i>Strategic Sediment Reservoir</i>: YES / NO (If yes, please explain what you understand by this term)</li></ul>
Q15	<p>Do you think that the above concepts are applicable / useful when considering the management of erosion?</p> <p>YES / NO (please explain):</p>

Thank you for your time - please feel free to add any further comments with regard to coastal erosion and management, this questionnaire or the CONSCIENCE Project: