

**For information**

# **State of the Coasts in Europe**

**Towards a EEA assessment report**

**Background paper**

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# **State of the Coasts in Europe**

Background paper

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# 1. SETTING THE GROUND FOR THIS ASSESSMENT

## 1.1 Background paper

### *Purpose of this paper*

This background paper is to inform the European Commission (DGENV) and its expert group on Integrated Coastal Zone Management (EU ICZM) about the progress and first results with the EEA's work undertaken for assessing the sustainable spatial development of coastal regions of Europe. The specific objective of this work is to contribute to the review by the European Commission, in 2006, of the EU ICZM Recommendations, which requires information on the effects of the policies and financial instruments directed to coastal management. The EEA intends, to the extent of information capacities, to contribute to the review by promoting spatial analysis and enhancing the integration of relevant environmental data with related socio-economical data. The EEA is making use of recent outcomes of several European projects (such as EuroSION) and is benefiting from the testing of coastal indicators by the EU working group under ICZM Expert group as well as from the application of land accounts by the EEA. The work also includes a dialogue with coastal stakeholders, taking into account the diversity of European situations and contexts.

### *Scope of the paper*

The paper takes stock of the status of the work in November 2004, draws some lessons and identifies the next steps for developing further the policy background, the conceptual framework, the stakeholder involvement and the corresponding consultation process and the spatial and temporal assessment and data needs. As far as the assessment of the environmental status of European coasts is concerned, two underpinning activities are being worked out: spatial analysis of the state of coasts as a result of changes in the use of land, linked to the development of different policies (e.g. tourism, physical planning, agriculture, etc.); and, the gathering and analysis of stakeholders' views and opinions regarding the analytical approach and the results.

## 1.2 Short review of policy relevance

The state of coasts is often described through the management of coastal issues at local and regional scale; however, coastal issues are also recognized to be of high relevance for Europe, which cannot be solved by the Member States separately (e.g. common natural and cultural heritage, transfers of pollutants and sediments, tourist flows, maritime safety). Problems related to the state of the coast and coast as an entity in Europe have been specifically addressed by recent policy documents: Communication from the Commission (ICZM Strategy, 2000), EU ICZM Recommendation (2002). Coastal zone is mentioned in the Environmental Impact Assessment Directive (2001), coastal waters and their quality are addressed in the Water Framework Directive (2000), and as for respective designated areas by Quality of bathing water Directive (1976, proposed for amendment in 2002) and Directive on quality required of shellfish waters (1979). Coastal zones are also mentioned in European Spatial Development Perspective (1999), EC Treaty (1999) Art. 130a (promotion of economic and social cohesion) mentions islands as areas requiring special attention.

Nevertheless, in practice, it has been a slow process to identify and implement dedicated EU coastal policies. A first communication on integrated management of the coast in 1973 (Committee of Ministers Resolution (73) 29 on the protection of coastal areas) has needed more than 20 years to be tested in 10 pilot sites through the Demonstration programme in ICZM (1996-1999), and almost 30 years until the Recommendation on ICZM (2002). A brief review shows that ICZM Recommendation is an important piece in the juridical deployment, but being a set of recommendations it means that an effective implementation depends largely on voluntary measures by individual Member States. It also shows that this approach bears limited results in terms of integrating the existing directives, programmes and frameworks that impact on the policy management of coast.

At national level, the situation is very similar, as shown by the French example. From the Rapport Picart, which was commanded in 1971 and presented in 1973, 30 years have passed until the last alert message from the CNADT littoral Commission (Conseil National de l'Aménagement et du Développement du Territoire), coinciding with the Parliament decision to implement the French ICZM Strategy.

The ICZM Recommendation gives most recent and comprehensive representation of EU policy for coastal environment. This act is clearly addressing the coasts from the standpoint of sustainable development, encompassing economic, environmental and social aspects (Figure 1-1). This background paper is mostly concentrating on environmental issues having in mind economic and social linkages as well as the issue of diversity of EU coasts and the perspectives of local, regional, national and EU governance levels.

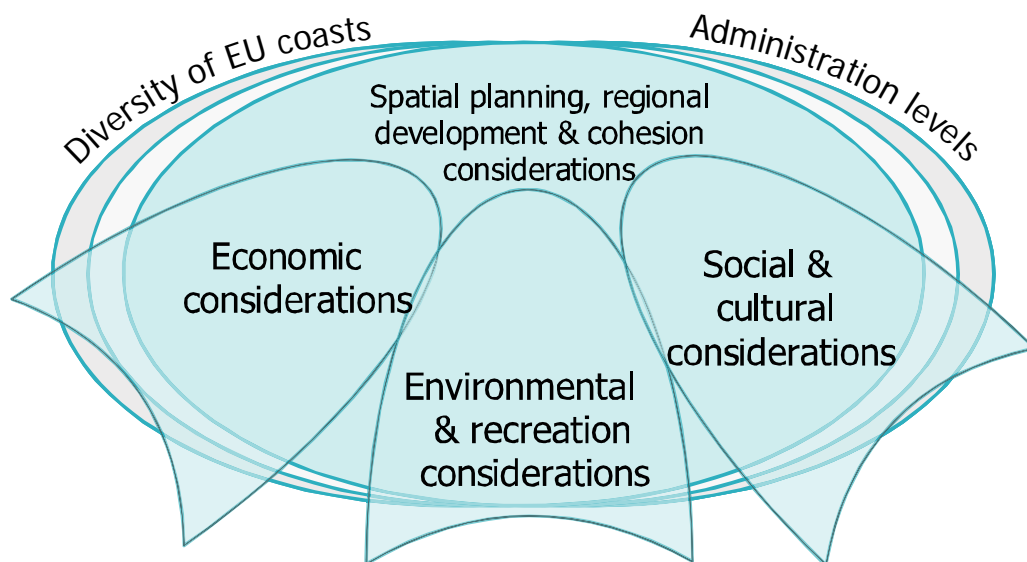


Figure 1-1. ICZM targets sustainable development on the coasts while this paper concentrates of environmental aspects.

To perform a policy-relevant integrated assessment of the state of coasts in Europe, the driving forces behind the change have to be aggregated into a more focused policy

analysis model (figure 1-2), where the main economic sectors are identified from both the environmental pressures and the policy response sides.

**Sectoral policies selected for analysing the pressures on the state of coasts:**

- Agriculture – Common Agriculture Policy reform, Rural development regulation (plans)
- Tourism - sustainable use of land and water resources, coast amenity, seafood security and bathing water, reducing disturbance of ecosystems, secondary homes
- Fisheries and aquaculture – Common Fisheries Policy implementation, integrated resource management plans
- Industry, energy and harbours - spatial planning (clustering), IPPC Directive, maritime transport and related economic activity
- Transport and urban development – supply of infrastructures, sprawl, landscape and habitats fragmentation

In recent years, the EU has been continuously developing the frameworks and legislative base to facilitate the integrated and cross-cutting approach in policy. Such integration objectives are yet to make their mark for coastal zone management, as part of the progress towards improving territorial spatial cohesion and sound regional policies.

**Integrated and horizontal policies selected for analysing the policy responses on sustainable development of coasts.**

- Policy frameworks: European Spatial Development Perspective, Sustainable Development Strategy, 6<sup>th</sup> EAP (+ Thematic Strategies Marine, Soil, Urban)
- Water Framework Directive (+ Urban Waste Water Treatment, Nitrate, Bathing water quality Directives)
- Birds and Habitat Directives (NATURA 2000)
- Environmental Impact Assessment Directive (1997)
- Strategic Environmental Assessment Directive (2001)
- Structural funds and the Cohesion Fund

One of the difficulties for coastal management so far has been the fact that yet too few policy elements are tackling directly the space across the sea and land boundary, i.e. the coastal zone - defined by the unique combination of coastal land strip and adjacent marine aquatic area. In this context, EU ICZM Recommendation provides a unique policy opportunity to enhance the sea/land interface, which might be reinforced by the discussions about the scope of the proposed EU marine strategy. Together with frameworks such as ESDP, SDS, 6<sup>th</sup> EAP and funds for regional development and cohesion it also provides the integration platform for other directives relevant to the coast. With the focus to their respective target area WFD (coastal and transitional waters), Habitats Directive (eight of the forty priority habitats are coastal) and EIA directive (Annex III demanding EIA for development projects on the coastal zone) also address the sea/land interface.

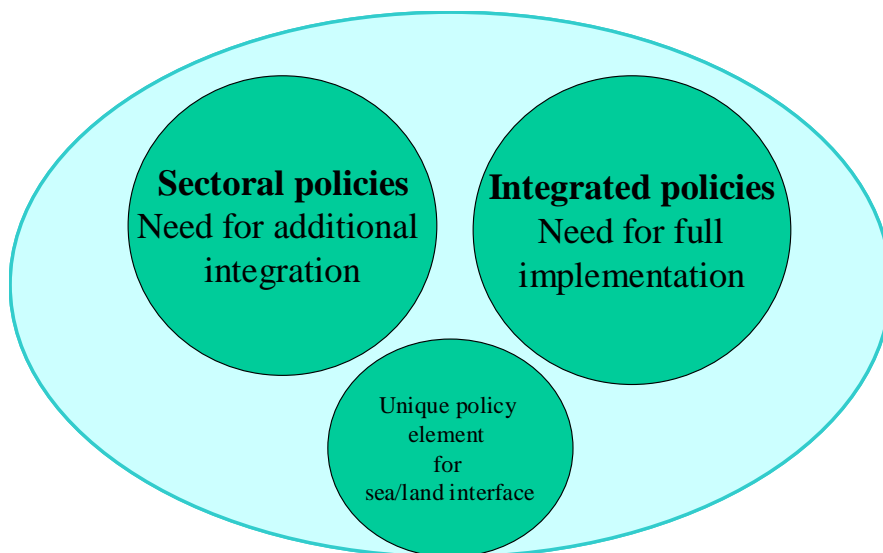


Figure 1-2. Approach for coastal environment policy analysis.

The efforts of regional seas Conventions (North Sea, Baltic and the Mediterranean) in the development of ICZM tools are also playing important role. Regional seas have initiated very promptly action plans and pilot site experience on integrated management at the coast. Nature Protection and Biodiversity Group of the Helsinki Convention (HELCOM HABITAT) has been addressing ecosystem approach and ICZM in the Baltic Sea. Recent developments in the Barcelona Convention might really represent a good opportunity for the implementation of ICZM in the Mediterranean. The role of the Marine Thematic Strategy (European Marine Strategy), through the promotion of the ecosystem approach, might be important; the synergetic effect with regional seas conventions will be a crucial element of the discussions, as the thematic strategy does not foresee any concrete measures, leaving the goals to be made operational and implemented at regional level.

## **2. HOW THE ASSESSMENT IS BEING DEVELOPED**

### **2.1 Information sources**

**The Working Group on Indicators and Data**, established to support the EU ICZM expert group is led by ETCTE/EEA and has brought much valuable experience and knowledge in the design of the assessment. The WG-ID has drawn up two indicator sets:

- A set of 26 indicators measuring progress in implementing ICZM (the ‘progress indicator’)
- A set of 27 indicators of sustainable development of the coastal zone (the ‘SD indicators’)

Used together, the two sets should reveal the degree to which implementation of ICZM can be correlated with a more sustainable management of coastal resources. That is, decisions using an integrated approach should see a positive improvement in the state of the coast with simultaneous progress towards sustainable development. The indicators measuring progress in achieving sustainable development of the coast will in turn feed back to give policy makers an indication of the need for further action in ICZM.

So far, these 2 sets are being tested and validated at national, regional and European scale and an explicit list of indicators (table 2-1 and 2-2) with harmonised consistent methodology have been produced at different scales. Work will continue during 2005. This process will allow setting a first baseline on ICZM implementation in 2006 and gradually construct a footpath between the two sets to link and correlate their results. This also makes possible to deepen into the analysis of their meaning, in particular through a number of consultations at different levels with coastal stakeholders and experts. Therefore, the indicators developed by the WG-ID have permitted the emergence of harmonized environmental indicator set, which is applicable across European coast and builds a common coastal knowledge through EU Member States and their regions. These indicators together will have an essential place in the vision of the 2006 State of Coasts assessment.

**Table 2-1: An Indicator for Measuring Progress in the Implementation of ICZM**

Phase	Action	Description	National		Regional		Local		Notes
			1995	2000	1995	2000	1995	2000	
<b>I. Laying the basis for ICZM</b>	1	Aspects of coastal management are taking place.	Yes	Yes	Yes	Yes	Yes	Yes	
	2	Decisions about planning and management on the coast are governed by general legal instruments.	No	Yes	No	Yes	No	Yes	
	3	Aspects of the coastal zone, including marine areas, are regularly and routinely monitored.	No	Yes	Yes	Yes	Yes	Yes	
	4	Planning on the coast includes the provision, where appropriate, for the protection of natural areas.	No	Yes	Yes	Yes	Yes	Yes	
	5	Funding is generally available for the implementation of coastal management plans.	No	No	No	No	No	No	
<b>II: A framework for ICZM exists</b>	6	An ICZM strategy (including the marine environment) has been produced which takes into account both the inter-dependence and disparity of natural processes and human activities.	No	No	No	No	No	No	
	7	Existing instruments are being adapted and combined to deal with planning and management issues on the coast.	No	Yes	No	Yes	No	Yes	
	8	Ad hoc demonstration projects are being carried out that contain recognisable elements of ICZM.	No	Yes	Yes	Yes	Yes	Yes	
	9	A formal 'state of the coast' report has been written with the intention of repeating the exercise every 5 or 10 years.	No	No	No	No	No	No	
	10	A coastal management plan, embracing a long term perspective, has been developed, with relevant issues identified and an implementation strategy drawn up and adopted.	No	No	No	No	No	No	
	11	A sustainable development strategy is in place which includes the precautionary principle and an ecosystems approach, and which treats coastal areas as distinct and separate entities.	No	Yes	Yes	Yes	Yes	Yes	
<b>III: Vertical and horizontal</b>	12	All relevant parties concerned in the ICZM decision-making process have been identified and involved.	No	Yes	No	Yes	Yes	Yes	



Phase	Action	Description	National		Regional		Local		Notes
integration exists between coastal planning and management agencies. Most of the time, decision-making includes relevant stakeholders and coastal communities.	13	√ Sufficient human resources, with a specific responsibility for ICZM, are placed at each administrative level from national government to coastal municipality.	No	Yes	No	No	No	No	
	14	An adequate flow of relevant ICZM information from the national to the local authority, and back again, is reaching the most appropriate people at each administrative level.	No	No	No	Yes	No	Yes	
	15	There is sufficient support and involvement of the relevant administrative bodies, nationally, regionally and locally, to allow and improve co-ordination.	No	No	No	Yes	No	Yes	
	16	Examples of best ICZM practice are available and being used for specific solutions, and flexible measures, to ensure the diversity of Europe's coasts.	No	Yes	No	No	No	No	
	17	Scientific and technical information is being made available in a form understandable to lay people without losing its coherence and validity.	No	No	No	Yes	No	Yes	
	18	Adequate mechanisms are in place to allow the general public to take a participative and inclusive (as opposed to consultative) role in ICZM decisions.	No	No	No	No	No	Yes	
	19	Routine (rather than occasional) co-operation across local, regional or national boundaries is occurring.	No	No	No	Yes	No	Yes	
	20	An efficient means to resolve conflicts between stakeholders is in place.	No	No	No	No	No	No	
IV: Efficient, adaptive, participatory, integrative	21	A comprehensive set of indicators is being used to assess whether or not the coast is moving towards a more sustainable situation..	No	No	No	No	No	No	
	22	A long-term financial commitment is in place for the implementation of ICZM.	No	No	No	No	No	Yes	
	23	An assessment of progress towards meeting sustainability goals is being made continuously.	No	No	No	No	No	No	

Phase	Action	Description	National		Regional		Local		Notes
planning and management is in place V: Full implementation of ICZM	24	Monitoring of the coastal zone sees a positive trend towards greater sustainability of coastal resources, an improvement in the state of the coast and in coastal habitats and biodiversity.	No	No	No	No	No	No	
	25	All of the above actions have been implemented with problem areas given special attention.	No	No	No	No	No	No	
	26	Re-evaluation of progress in implementing ICZM begins again automatically.	No	No	No	No	No	No	

In completing the form, all boxes should be filled in with a 'yes' or 'no' answer with data that is available from the period of the previous assessment. In other words, all answers for the year 2000 will cover the period 1996-2000. It is proposed that the table is completed again at intervals of three-five years.

**Table 2-2. Indicators of sustainable development of the coastal zone – calculations completed or in preparation**

Calculation completed at level indicated

Calculation in preparation at level indicated

No	INDICATORS	MEASUREMENTS	EU	NATIONAL	REGIONAL
1	Demand for property on the coast	<ul style="list-style-type: none"> <li>Size and structure of the population living on the coast</li> </ul>	Coastwatch	France	Southern North Sea
2	Area of built-up land	<ul style="list-style-type: none"> <li>Percent of built-up land by distance from the coastline</li> </ul>	Coastwatch	Malta, France	Catalunya, Southern North Sea
3	Rate of development of previously undeveloped land	<ul style="list-style-type: none"> <li>Area converted from non-developed to developed land uses</li> </ul>	Coastwatch		Catalunya,
4	Demand for road travel on the coast	<ul style="list-style-type: none"> <li>Volume of traffic on coastal motorways and major roads</li> </ul>			Nord-Pas de Calais
5	Pressure for coastal and marine recreation	<ul style="list-style-type: none"> <li>Number of berths and moorings for recreational boating</li> </ul>			Southern North Sea
6	Land take by intensive agriculture	<ul style="list-style-type: none"> <li>Proportion of agricultural land farmed intensively</li> </ul>	Coastwatch		
7	Amount of semi-natural habitat	<ul style="list-style-type: none"> <li>Area of semi-natural habitat</li> </ul>			Southern North Sea
8	Area of land and sea protected by statutory designations	<ul style="list-style-type: none"> <li>Area protected for nature conservation, landscape and heritage</li> </ul>		Malta	Southern North Sea
9	Effective management of designated sites	<ul style="list-style-type: none"> <li>Rate of loss of, or damage to, protected areas</li> </ul>			
10	Change to significant coastal and marine habitats and species	<ul style="list-style-type: none"> <li>Status and trend of specified habitats and species</li> <li>Number of species per habitat type</li> <li>Number of Red List coastal area species</li> </ul>			
11	Loss of cultural distinctiveness	<ul style="list-style-type: none"> <li>Number and value of sales of local products with regional quality labels or European PDO/PGI/TSG</li> </ul>			Southern North Sea
12	Patterns of sectoral employment				

		<ul style="list-style-type: none"> <li>• Full time, part time and seasonal employment per sector</li> <li>• Value added per sector</li> </ul>			
13	Volume of port traffic	<ul style="list-style-type: none"> <li>• Number of incoming and outgoing passengers per port</li> <li>• Total volume of goods handled per port</li> <li>• Proportion of goods carried by short sea routes</li> </ul>			
14	Intensity of tourism	<ul style="list-style-type: none"> <li>• Number of overnight stays in tourist accommodation</li> <li>• Occupancy rate of bed places</li> </ul>			
15	Sustainable tourism	<ul style="list-style-type: none"> <li>• Number of tourist accommodations holding EU Eco-label</li> <li>• Ratio of overnight stays to number of residents</li> </ul>			
16	Quality of bathing water	<ul style="list-style-type: none"> <li>• Percent of bathing waters compliant with the guide value of the European Bathing Water Directive</li> </ul>	EEA		
17	Amount of coastal, estuarine and marine litter	<ul style="list-style-type: none"> <li>• Volume of litter collected per given length of shoreline</li> </ul>			
18	Concentration of nutrients in coastal waters	<ul style="list-style-type: none"> <li>• Concentration of nitrates and phosphates in coastal waters</li> </ul>			OSPAR, HELCOM, BONNCON
19	Amount of oil pollution	<ul style="list-style-type: none"> <li>• Volume of accidental oil spills</li> <li>• Number of observed oil slicks from aerial surveillance</li> </ul>		Belgium	Southern North Sea
20	Degree of social cohesion	<ul style="list-style-type: none"> <li>• Indices of social exclusion by area</li> </ul>			Southern North Sea
21	Relative household prosperity	<ul style="list-style-type: none"> <li>• Average household income</li> <li>• Percent of population with a higher education qualification</li> <li>• Value of residential property</li> </ul>			Southern North Sea
22	Second and holiday homes	<ul style="list-style-type: none"> <li>• Ratio of first to second and holiday homes</li> </ul>		France, Malta	Southern North Sea
23	Fish stocks and fish landings	<ul style="list-style-type: none"> <li>• State of the main fish stocks by species and sea area</li> <li>• Recruitment and spawning stock biomass by species</li> <li>• Landings and fish mortality by species</li> <li>• Value of landings by port and species</li> </ul>	EEA		Southern North Sea
24	Water consumption	<ul style="list-style-type: none"> <li>• Number of days of reduced supply</li> </ul>			

25	Sea level rise and extreme weather conditions	<ul style="list-style-type: none"> <li>• Number of 'stormy days'</li> <li>• Rise in sea level relative to land</li> </ul>		Poland	
26	Coastal erosion and accretion	<ul style="list-style-type: none"> <li>• Length of protected and defended coastline</li> <li>• Length of dynamic coastline</li> <li>• Area and volume of sand nourishment</li> </ul>	EUROSION	Netherlands	Southern North Sea
27	Natural, human and economic assets at risk	<ul style="list-style-type: none"> <li>• Number of people living within an 'at risk' zone</li> <li>• Area of protected sites within an 'at risk' zone</li> <li>• Value of economic assets within an 'at risk' zone.</li> </ul>	EUROSION	France	



The INTERREG IIC project DEDUCE (2004-2007) launched recently, will be useful to apply in an experimental way the indicators developed by the WG-ID, in different test areas along the European coast.

The populating of the indicators will also oblige to look at existing data at regional and national level and to build a common pool of harmonised (or comparable) data for the coast.

The core information used for **spatial assessment** of the coasts at the European level is the result of the analysis of several existing and accessible databases (details in table 2-3):

- LaCoast Database
- Corine Land Cover 90
- Corine Land Cover 2000
- Corine Coastal Erosion
- Natura 2000 Database
- EuroSION Database

The results of the corresponding data processing have served as an input for developing some of the indicators described above.

In addition, several **relevant projects and networks** have also brought data and valuable experiences to this report. **EIONET** network of national focal points will be called to review and comment the draft assessment report developed on the basis on this background paper in June 2005. In parallel, close cooperation between ETC Terrestrial Environment and other **ETC's of the EEA** (in particular ETC Biodiversity and ETC Water) is facilitating the elaboration of several sections of the assessment, especially in terms of indicators.

**Regional organisations**, such as PAP-RAC and the Blue Plan, HELCOM and VASAB 2010, have also participated in the discussion of the pre-assessment and have brought data and information concerning their respective regions. Moreover, the CPMR (Conference of Peripheral Maritime Regions of Europe), an association of some 150 maritime regions in Europe has offered support in data and information for the pre-assessment, as well as very concrete practitioner-based knowledge and sensibility.

**Several projects** have significantly contributed to the current work and complemented the results. GMES Coastwatch project (2003-2004, new bidding phase in 2005) contributed greatly through its ICZM indicator service and its service on marine water quality based on WFD and MTS. EUrosion project (2002-2004) has built a very relevant framework to assess coastal erosion and the vulnerability of the coast, with the development of specific data such as the update of Corine Coastal erosion map, a layer with the areas located under 5 meters, the update of LaCoast for some new Member States (Poland, Latvia, Estonia and Lithuania), etc. Overlay analysis of these results with CLC2000 and N2000 databases will allow building new indicators and maps for the next phase of work. FP6 EUROCAT project (2001-2004) has worked on Integrated European catchments management and sustainable use of

water resources at catchments scale. It has brought several well-documented case studies across Europe with indicators and data concerning coastal water pollution.

## 2.2 Data status

The following table provides an overview of availability, access conditions, temporal and geographical coverage and some other parameters of the databases used for main spatial data processing and analysis.

Table 2-3. Overview of main databases used for spatial assessment of the coasts.

Data source	LaCoast database	Corine database 1990	Corine database 2000	Corine Coastal Erosion	Natura 2000 database	EUrosion
Data custodian	JRC	EEA	EEA	CEC/EEA	DGENV	DGENV
Status	Finished	Historical	Under development	Historical	Finish in 2004	Finish in 2004
Responsible authority	JRC (Joint Research Centre) and DG Environment	European Commission – DG-Environment Nuclear Safety and Civil Protection	EEA	European Environment Agency	DG ENV is the owner of the database. Management under ETC NPB	DG-Environment
Start date	1975-76, depending on the country	1986	1999	1985	Starting network in 1992 when Council of Ministers adopt the Habitat Directive.	January 2002
End date	1986-95, depending on the country	1995	On going	1990	At the end of 2004 the Commission will review Natura 2000 contributions from Member States.	May 2004
Probability of availability	100%	100 % (Archive)	Once finished 100%	100 % (Archive)	Once finished, ETC TE will have 100% access	Depending on the layer
Data availability	100% available	Total	Partial	Total	Partial today in ETC-TE	Depending on the layer
Geographic coverage	10 Member States of the European Union (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal,	EU 15 (with the exception of Sweden) and some accession countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia)	15 Member States of the European Union and Liechtenstein, as well as in the 10 PHARE accession countries	EU - 12 member states except the Greek Islands, former GDR, Madeira and Azores	EU countries (EU 15 plus several accession countries)	EU 15 + Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Poland, Romania, Slovenia + European ultra-peripheral regions (Guadeloupe, French



	Spain)					Guyana, Azores, Sao Miguel Is., Canary Islands - Tenerife)
<b>Spatial resolution</b>	Minimum mapping unit 25 ha	100 m X 100 m	100 m. X 100 m.	100 m X 100 m	Depending on Member States	Depending on the layer
<b>Temporal coverage</b>	2 periods: 1975-76 and 1986-95	1990 +/- 5	2000 +/- 1 year	1990 +/- 5	Depending on Member States	Depending on the layer
<b>Quality</b>	Accuracy $\geq$ 85 %	Accuracy $\geq$ 85 %	Accuracy $\geq$ 85 %	Accuracy $\geq$ 85 %	Depending on Member States	Depending on the layer
<b>Access conditions</b>	Agreed dissemination policy from the start	unclear data dissemination policy	agreed dissemination policy from the start	unclear data dissemination policy	Agreed dissemination policy from the start	Depending on the layer

As seen from the table, different databases have sometimes several data gaps in terms of temporal and spatial coverage, which makes difficult to compare the data herein. As a result, the spatial discordance of the data layers often does not allow establishing coastal trends, which asks for an effort for improvement of resolution (both temporal and spatial) and harmonization (seamless data). In terms of data availability several problems have been found. For example, utilisation of EuroSION database remained limited at this stage of the work due to late of the final version (June 2004) and in some cases due to copyright restrictions. Results of CLC2000 became only gradually available during the year, which did not allow to process data for more than individual countries. It is expected to have all the complete databases during 2005 (Figure 2-1).

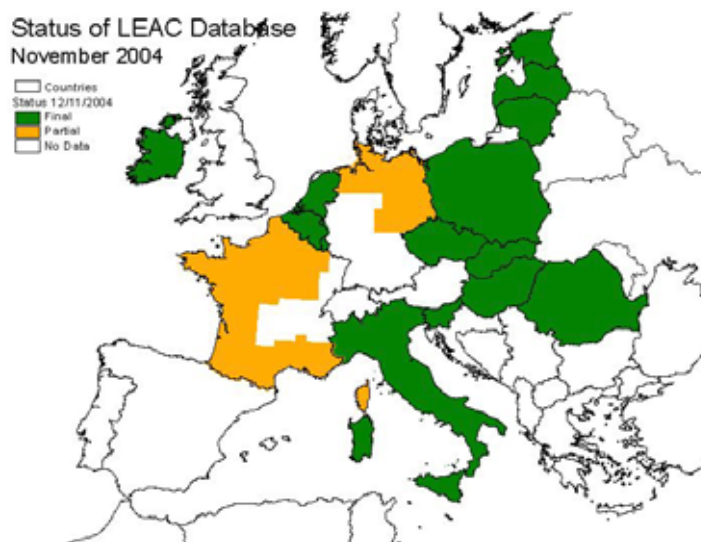


Figure 2-1 Availability of CORINE Land Cover 2000 data (LEAC database status)

### 2.3 Main steps in spatial data processing: methodology

As a preparatory step, all data bases referred above were integrated in the spatial information system, using GIS tools. During that work necessary geodata manipulation and necessary corrections were made to have consistent layers and comparable data. When available, all integrated data sets were included in TERRIS database at the ETC-TE/EEA. The information system was also used for integration of spatially distributed statistical data (population, land use, tourism, transport, etc) to have them compared with the land use changes.

Land and Ecosystem Accounting (LEAC) methodology, developed in EEA and ETC-TE serves as the main analysis tool for identification of spatial and temporal changes in the coastal environment.

The Land accounting is a methodology allowing the analysis of conflicts in space and time, from local to global scales, and can be used for monitoring the changes in coastal systems. Land cover is an (ex-post) image of land use and ecosystems condition. Accounts can be compiled in monetary or physical units. Changes in structure, patterns, quantity and quality are included into accounts. Indicators can be easily derived from accounts. Land use relates to the many economic and social functions of land: housing, food production, industrial activities, services, transport, recreation, nature protection.

Main stages of LEAC application for the coastal assessment can be presented as follows:

- Stratification of the territory into accounting units:
  - Definition of dominant landscape types as approximation of actual land cover (box 1)
- Calculation of land cover changes:
  - Accounting of land cover stocks
  - Determining land cover changes (for ex. from CLC1990 to CLC2000)
  - Identification of land cover flows (grouping individual changes into processes) (box 2)
  - Pre-processing and classification of data
- Applications
  - Defining the coastal extent (Figure 2-2)
  - First results of implementation for Europe with CLC2000
  - Presentation of land cover change intensity in 3x3 km cells

Box 1. Classification of Dominant Landscape Types (Level 1)
A1 Urban dense areas
A2 Dispersed urban areas
B1 Broad pattern intensive agriculture
B2 Composite rural landscape

C1 Forested landscape  
 C2 Open semi-natural or natural landscape  
 C3 Landscape with no dominant land cover character

Box 2. Nomenclature of Land Cover Flows (Level 1)

LCF1 Urban land management  
 LCF2 Urban sprawl  
 LCF3 Extension of economic sites and infrastructures  
 LCF4 Agricultural rotation and intensification  
 LCF5 Conversion of land to agriculture  
 LCF6 Forests creation and management  
 LCF7 Water body creation and management  
 LCF8 Changes of land cover due to natural and multiple causes

Based on Corine Land Cover, the land accounting methodology (Figure 2-3) allows to measure:

- Land cover stocks at time 1 and time 2,
- Land cover changes (time 2 – time 1)
- Land cover flows

Land account makes the best use of CLC different databases. With the new update of CLC2000, a long series of land cover stocks, changes and flows can be done since 1975, thus on a 30 years time span for most of the European countries.

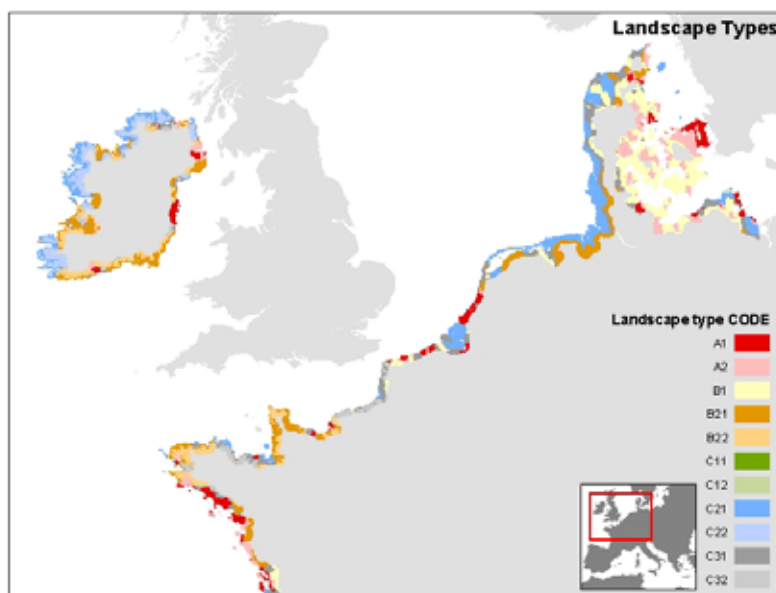


Figure 2-2. Dominant landscape types and definition of the coastal extent in LEAC.

Land stocks are calculated on the bases of the 44 classes of CLC for the different years and changes are grouped in to land cover flows to explain these changes. For example, loss of wetland (loss of stock and identified change) can be due either to the flow “intensification of agriculture”, “afforestation”, or “urban sprawl”. This information, coming from CLC (based on EO products), can be enriched by the other data bases presented in Table 1. For example, by combining the CLC with N2000 data LEAC can be used to determine the surface of wetlands protected by N2000, but also the loss of wetlands observed outside of N2000 sites. This loss of wetlands can be related with an afforestation trends which in some places is driven by a targeted policy implemented during the period of analysis.

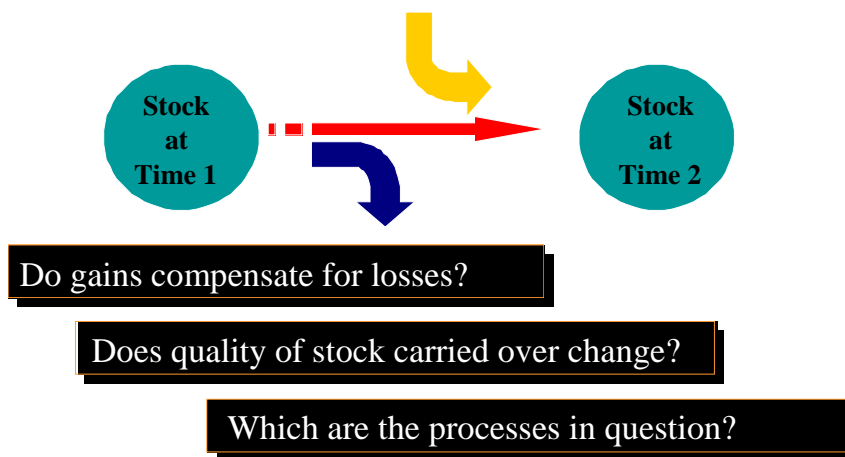


Figure 2-3. The concept of land cover stock and flow accounts.

Statistical data can be included and spatially redistributed on the basis of function of the land cover types. This allows better show their spatial distribution and makes more understandable and measurable the change of the statistical parameter in a determined coastal unit during a certain period of time.

## 2.4 Consultation phases

During the course of the year, preparations for this paper involved several consultations regarding content, prioritisation of issues, the policy relevance and the interest of stakeholders. An overview of the main consultation events is given in table 2.4.

Table 2-4. Overview of consultation done so far and planned for remaining 2004.

<b>Workshops</b>	
Workshop on European coastal indicators and data, 8-9 June 2004, Malta	Blue Plan, PAP-RAC, Black Sea Commission, VASAB2010, WG-ID, GSE Coastwatch
Littoral 2004, 20-21 September, Aberdeen, UK	Coastal experts, researchers and stakeholders
WG-ID meeting, 24-26 October 2004, Gdynia, Poland	Members of the group, DEDUCE and SAIL partners
EU ICZM Expert Group, 24 November 2004 Rotterdam, The Netherlands	Progress report from WG-ID and presentation of the background paper
European conference on coastal defence management: European coasts at risk, how to manage? 25 November 2004, Rotterdam, The Netherlands	Dutch government event at the occasion of the Dutch EU presidency, presentation of main findings from the background paper
European Conference on Coastal Zone Research: an ELOISE approach, 14-18 November 2004, Portoroz, Slovenia	Presentation of relevant EEA activities and needs
<b>Ad hoc consultations</b>	
CRPM 1 <sup>st</sup> October 2004, Barcelona	Consultation of priority issues
DG-ENV 15 November 2004	Consultation of the final draft paper

The consultation with DG ENV, EIONET and ETC-s, CPRM and other coastal stakeholders will increasingly continue during the 2005. As for the regional validation of land accounts methodology, the results of the activity will be presented for discussion with regional organisations:

- Mediterranean: Blue Plan + PAP-RAC (Split, June 2005)
- North Sea: North Sea Commission's International Conference on ICZM, Ringkoebing, Denmark, 1-3 March 2005
- Atlantic: Algarve Coastal Conference, April 2005

To establish direct contacts with national experts in CAP, forestry, N2000 and for validation of the results a mission is planned as a field trip to some Baltic Sea and NW Atlantic coastal areas in May and July 2005.

### 3. ASSESSMENT OF TRENDS RELATED TO ENVIRONMENT: PRELIMINARY SELECTED RESULTS

#### 3.1 Status of spatial assessment work

The preliminary results presented in this chapter should be regarded as an indication of how the assessment will gradually develop throughout the work in 2005, with the view to complete the analysis of the main changes that can be observed on the European coast. These preliminary results have to be understood as tests, first indications still to be elaborated towards conclusions. They have been built on the basis of the first available data from CLC2000 and other available data, reviewed in section 2.2. The work of new GIS data integration is ongoing, and only first relevant results have been used in this chapter.

Table 3-1. Challenges and problems in the different EU maritime regions (EEA, 1999)

Atlantic	North Sea	Baltic	Western Mediterranean
<p>Dichotomy of under-exploitation of abandoned areas and overexploitation and rising population of areas under development.</p> <p>Risks linked to natural conditions (insufficient amount of drinking water, erosion, fires, flooding).</p> <p>Maintain coastal ecosystems threatened by coastal erosion, regression of beaches and scarcity of water resources in humid southern zones.</p> <p>Seasonal pressure of tourism, especially in southern Brittany.</p> <p>Qualitative degradation of river and sea water (industrial dumping and abandoned mining sites).</p> <p>Apparition of extreme situations in agriculture: over-exploitation of certain zones, abandonment of other zones.</p> <p>Growing urban pressure, especially around 'capitals' and coastal cities, and diffuse and uncontrolled urbanization in interior zones.</p>	<p>Strong consensus for integrated management of coastal areas.</p> <p>Improve quality and availability of operational information for spatial planning.</p> <p>Encourage renewable forms of energy.</p> <p>Coastal erosion.</p> <p>Reduce level of marine pollution.</p> <p>Concern to protect natural areas still untouched by economic development.</p>	<p>Increase in eutrophication leading to the proliferation of algae.</p> <p>Origin of major problems: nitrogen due to combustion of fossil fuels, agriculture and landfills; added phosphorus (agriculture and landfills).</p> <p>Numerous of hot-spots (direct industrial discharges).</p> <p>Global vulnerability of the Baltic Sea due to less saline water and its nature as a closed sea (narrow exchange corridors with the North Sea).</p>	<p>Conscious of rich natural heritage which is threatened and is at risk (natural risks, agriculture, tourism, transport, urbanization in coastal areas).</p> <p>Prospects for fragile or low-density areas in all aspects.</p> <p>Control of tourism development.</p> <p>Manage and protect inland and marine waters; specific problems in semi-arid zones; regulating debit and quality of water, provision of water and risks linked to natural conditions (erosion, desertification, saline intrusions in groundwater).</p>

One of the approaches not yet explicit in the present paper is the assessment of coastal issues by European regional seas, which is a relevant way to put in perspective the environmental problems faced by maritime areas in the EU and the related responses

therein. A comparison over time, taking as a starting point the overview run in the context of INTERREG.II.C some 5 years time ago (table 3-1), will be provided with the help of stakeholder consultation (chapter 2.4). This approach, already discussed in chapter 1.2 will be elaborated in the next phase of work in the form of “regional sea profiles” to address the diversity of European coasts. It will also serve as a basis for the inclusion of the fisheries topic in to assessment.

### 3.2. Land cover changes in the coastal zone

#### Coastal urban development patterns and their causes

Top five changes in the ten kilometres from coastline show that urban development is still an important pattern and very prominent in particular in the Netherlands and Italy. In the other countries it is the agriculture land, especially pastures and forest that shows more changes in terms of affected surfaces. Nevertheless, the patterns of urban development on the coast have been identified by some national ICZM Strategies as one of the main drivers of change.

For the period 1990-2000, most of the countries show differences between the coast and inland in terms of urban development. Land take by urban development in the coastal zones (10 km buffer) is proportionally much higher than the rest of the country (Figure 3-1). These differences are especially significant in countries like Estonia, where more than 68% of the total uptake of the country happens at the coast. They are also high in Italy, Romania, Netherlands, Belgium and Lithuania. Probably also in France but data are not complete so far.

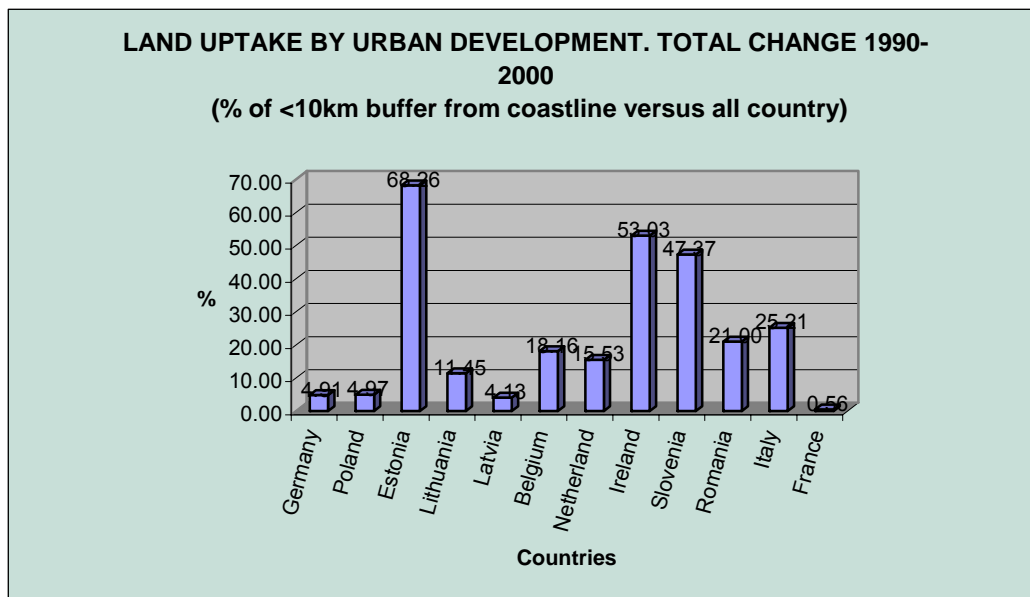


Figure 3-1.

Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

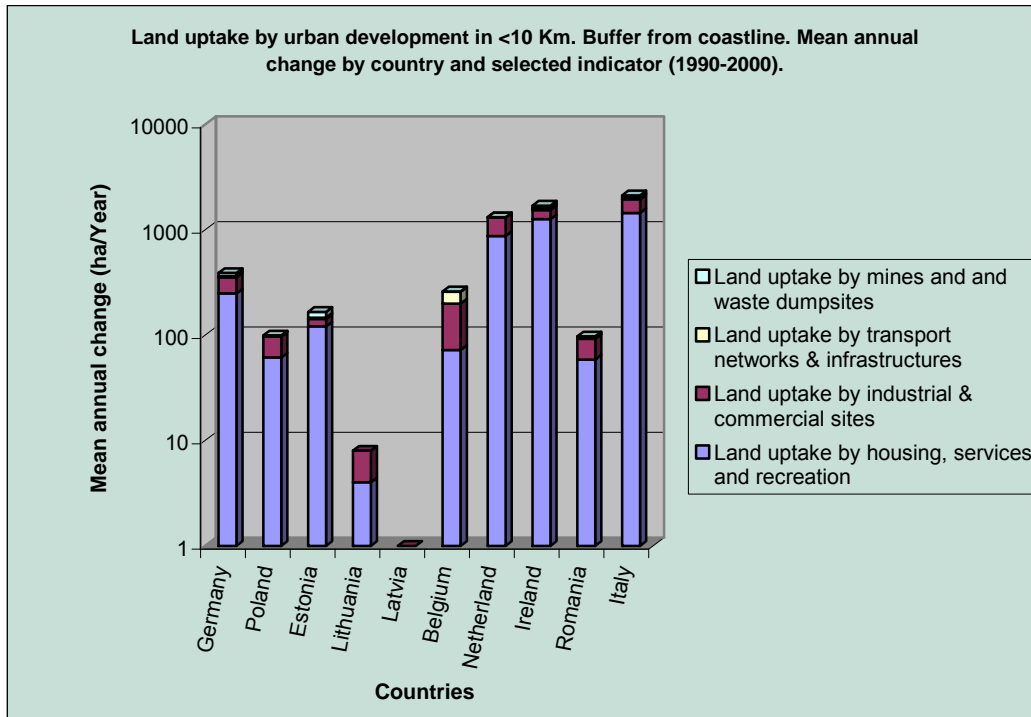


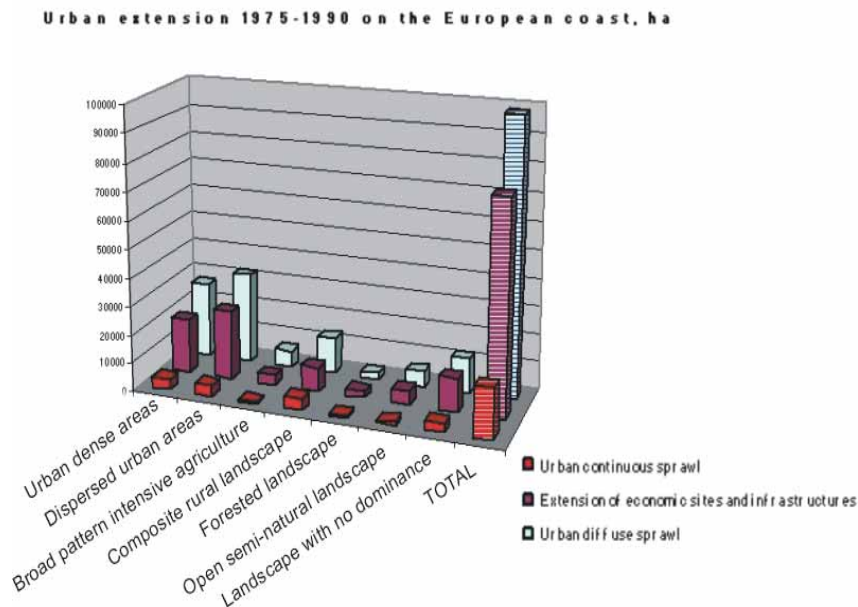
Figure 3-2.

Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

Disaggregating land uptake by categories, one can see that in all the countries, except Latvia and Slovenia, the land take by housing, services and recreation is the main driver of urban development (figure 3-2). It represents around 65-70% of the total yearly uptake. Urban development is based on a residential model of land occupation. The second main driver is the land take by industrial and commercial sites, which shows important rates in both Latvia and Slovenia.

Dominant Landscape Types (DLT) represents a relevant way to approach coastal landscape typologies for all European coasts (chapter 2.3).





### Figure 3-3.

Source: Integration of geographical and statistical data in the environmental accounting framework; methodological development based on two case studies. Integration of environmental accounts in coastal zones; case study of tourism (ETC-TE/EEA)

During the **period 1975-90**, the extension of urban areas along the European coast (Figure 3-3) bears two different characteristics:

#### **Diffuse Urban Sprawl**

There is a high share within surface occupied at the coast (<10 km) by the urban diffuse sprawl compared with the urban continuous sprawl. Diffuse sprawl has likely strong correlations with the sprawl of economic sites and infrastructures.

A question on the impact of structural policies arose here, that would need to be analyzed. Structural funds have been mainly focused towards the development of infrastructures and it seems that infrastructures have a strong correlation with diffuse sprawl, which in turn strongly impacts on quality of life (increased need for accessibility, more traffic accidents, more air pollution) but also on ecosystem health (direct loss of soil, soil sealing, barrier to the coastal flows that allow resiliency of the system, fragmentation, etc). This trend will require further analysis, in particular in connection with the EU Structural funds and the related trade-offs in terms of social and economic opportunities (number of firms that have been attracted, number of job created, etc) against their cultural and ecological impacts.

Urban continuous sprawl is quite maintained within the urban dense areas, but once sprawl occurs, the dispersed areas become new basis for more expansion with a high proportion to expand hinterland. Therefore, coastal cities and region need to be much more efficient in terms of land planning taking into account not only the coastline, but also the new and likely future linkages with hinterland planning (river basins and offshore areas). Policies are strongly needed to back and support these actions and the forthcoming urban environment thematic strategy might represent an opportunity to address this issue.

#### **Composite rural landscape**

The other dominant landscape affected by urban growth is the composite rural landscape and the landscape without European-wide dominance. Both landscapes are very balanced landscape, with a surface more or less equivalent of different land covers. The composite rural landscape is a very relevant landscape in Europe as it is the place where more traditional rural landscapes can be found. Both landscapes are then extremely relevant in term of landscape value and protection; both are the most affected by urban growth.

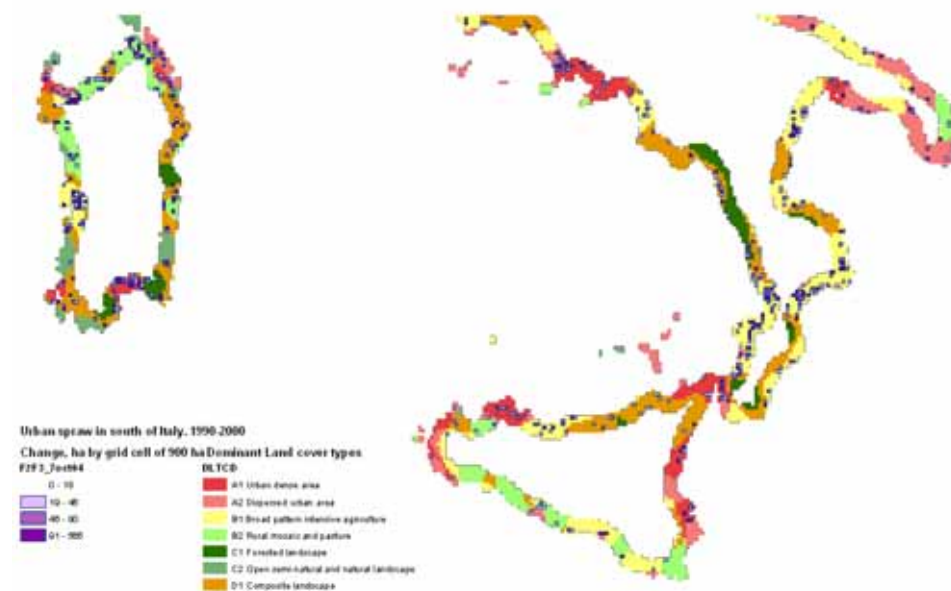
During the **period 1990-2000**, urban sprawl took different forms along the different coastal regions.

In Italy urban growth is happening around the largest cities, but also all along the coastal strip, with a high intensity. These intensive developments went on at the expenses of rural landscape types, affecting mainly composite and broad pattern

intensive agriculture. But it has also affected, to a lesser extent, some areas of rural mosaic patterns and forest landscape, which is a major point of concern. Such urban sprawl over agrarian land has been correlated with farm withdrawal, as described in detail in Section 3.3 on natural resources.

Coastal sprawl appears very important in the southern regions (Calabria, Basilicata, Sicily and Sardinia). This may reflect the fact that the tourist model for the coast is actually developing intensively in these regions. Would this trend be confirmed, it would raise further significant issues for the future related to land planning (including ownership matters) and carrying capacities of sensitive environments to sustain more urban residential developments.

Besides residential sprawl, leisure infrastructures such as golf courses and marinas are as important in intensity of changes, the former being a driver for the latter.



Done by : EEA

Source: LEAC (UNDER DEVELOPMENT)

Draft message: The coast is the territory most affected by the residential model of spatial occupation, which is very land consuming. This is taking place in particular in the Mediterranean, the Black Sea, the Atlantic coast and the southern part of the North Sea. Moreover this land occupation is in general irreversible, or very costly to be reversed.

### The coasts of Europe: towards an urban development model?

Though varying according to the countries, regions and dominant landscapes, the phenomena of land take by urban development in coastal areas is continuing, even in areas already highly urbanized. On the following pages are presented 4 different cases of coastal urbanisation from different European regions; countries, herewith referred to as examples, are obviously different in terms of their socio-economic development

situation, thus requiring some differentiated analysis that will be performed in 2005. However, these first observations are useful to understand better the regional strategies of development, the comparative advantages and disadvantages of the regions and the different use of EU funds. These aspects will be taken into account in the following stage of the assessment work.

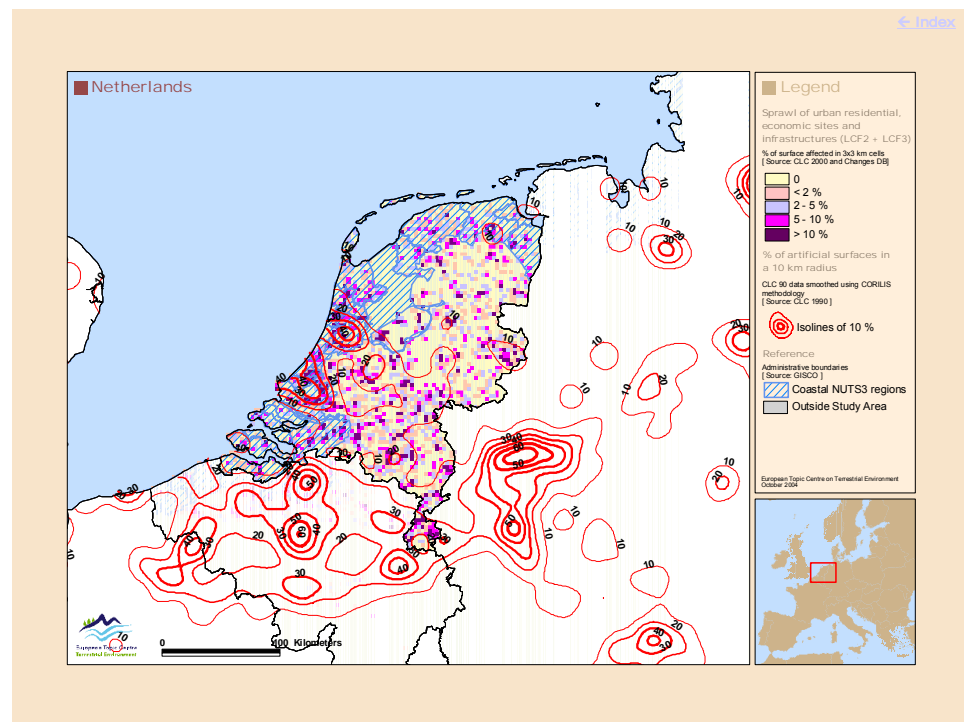
### *North Sea case (the Netherlands)*

#### **Trends 80-90:**

- Rapid economic growth during the 80s and before (since 2d world war)
- Driven by harbors, commerce and oil production
- High GDP

#### **Trends 90-2000:**

- Continue to grow at a lower rate at the coast and more in the hinterland
- High pressures on natural resources and high protection
- GDP still high but lowering down



Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

The Netherlands has a long history of coastal artificialisation. Coastal regions are under very high urban density, in great part due to its maritime culture and the location of main European harbours area such as Rotterdam, the Hague and Amsterdam. Urban development has remained important at the coast, but has expanded towards the hinterland during these last 10 years, creating a huge and dense 'coastal' hinterland. Pressure upon natural areas (specially on wetlands) and designated areas will be analysed later in this report.

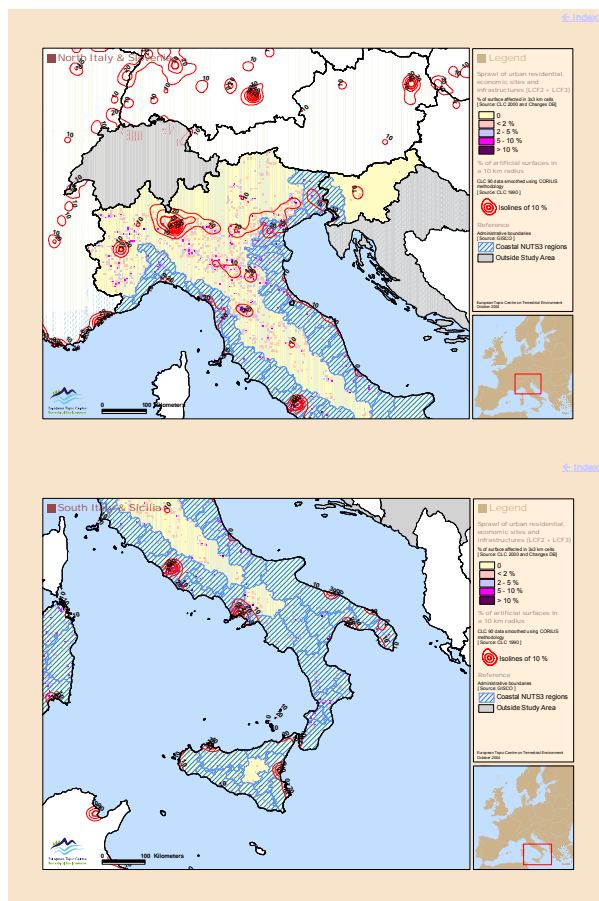
## ***Mediterranean case (Italy)***

### **Trends 80-90:**

- Strong differences between north and south.
- High GDP, signs of decrease
- High tourism in the whole country, mitigated with commerce and manufacture in the North.

### **Trends 90-2000:**

- Urban land cover continue to sprawl in a diffuse manner in plains in the north and in the central axe of the country
- High growth of urban sprawl along the coasts in the South. Monoculture of tourism continued.
- Mediterranean coast receive also retired people from all EU
- Increased pressures on natural resources
- GDP decreasing.



Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

North of Italy presents a very high density of urban sprawl especially around the area of Milan and the plain of the Po. It is especially related to the region of Lombardy and Emilia-Romagna, which are part of the European “high developed corridor”, from London, Rotterdam, Paris, and Lyon to Milan.

Dispersed sprawl is not so apparent along the coast, even if it seems important near Livorno, Ravenna and Ancora in the Adriatic, and especially Roma. The high number of small and medium cities in the interior (Toscana, Umbria, Abruzzo) gives dynamism to a very discontinuous urban fabric in all the central axis of North and central Italia.

The South of Italy presents a model of urban sprawl much more related to both the existence of big cities (Roma, Naples-Salerno), and the coastal area. The last is especially true in Basilicata and Calabria, but also in Sicily, where the urban sprawl at the coast is practically the only huge change observed.

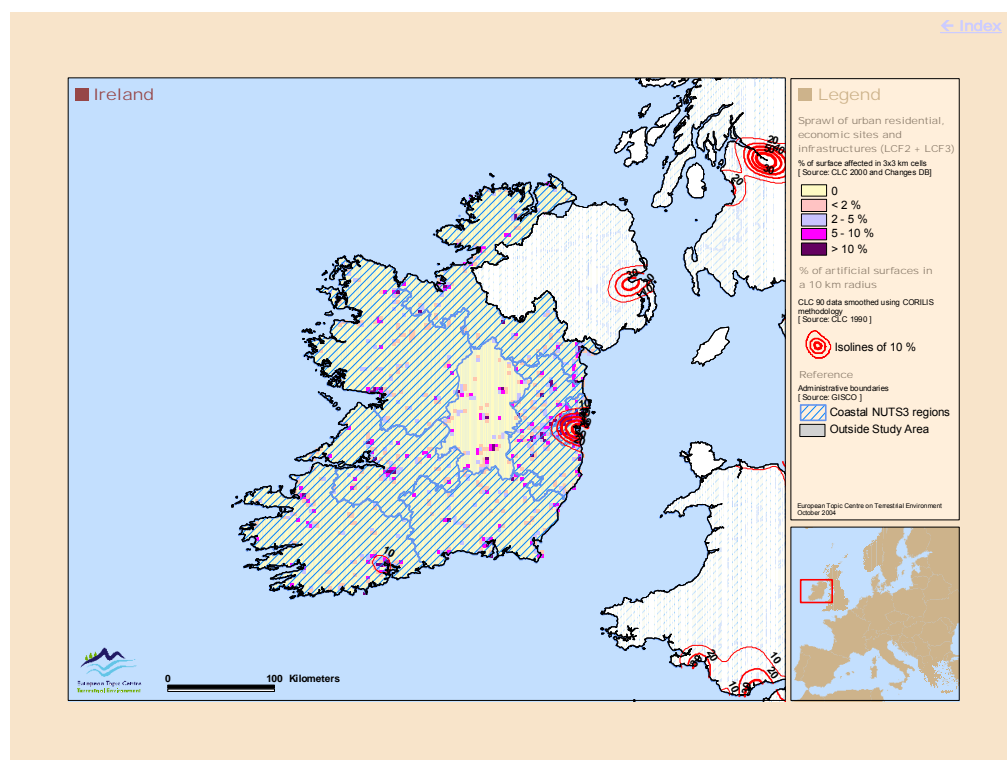
### *Atlantic case (Ireland)*

#### **Trends 80-90:**

- High GDP and growing, in phase with the Economic boom.

#### **Trends 90-2000:**

- Higher GDP rate in EU and growing.
- Boom of secondary residences and diffuse sprawl. Trend likely to be continued.
- Conservation important but pressures growing on natural resources
- Towards the phasing out of massive EU structural funds



Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

Although urban sprawl is not one of the five top changes, its distribution is important because it affects the whole country, even if some concentrations are observed around Dublin (specially) and Cork. This diffusion needs to be analysed at the light of natural resources and agricultural land, to understand the strong pressures it creates on landscapes and ecosystems. The high economic growth that shows Ireland makes it quite specific and unique.

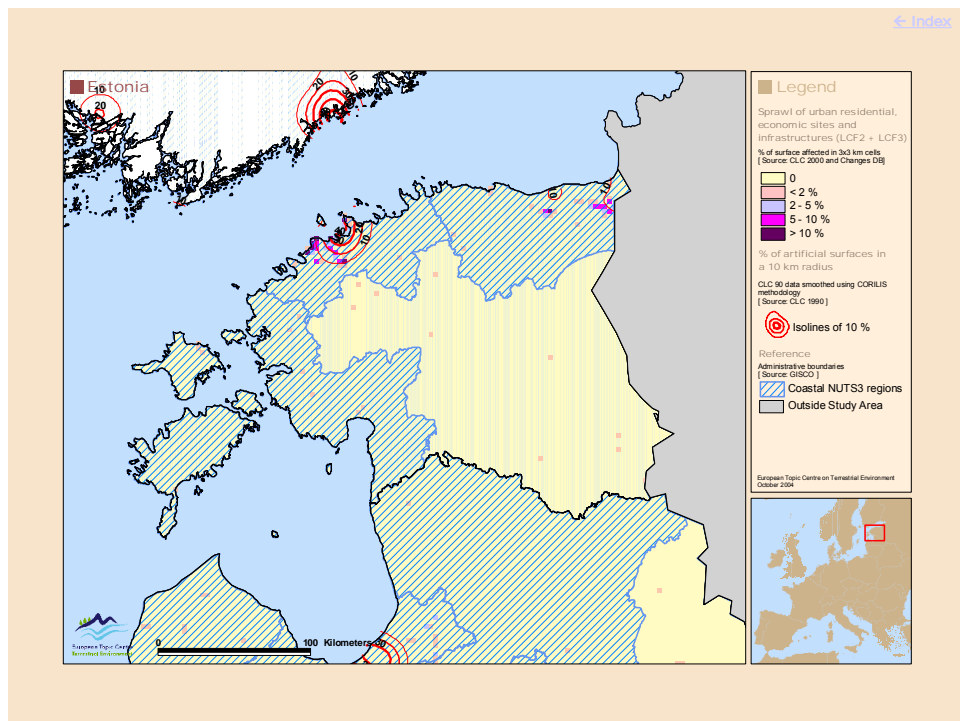
### ***Baltic case (Estonia)***

#### **Trends 80-90:**

- Low GDP
- Incipient growth

#### **Trends 90-2000:**

- New bourgeoisie cannot still afford for secondary residence, but absence of residential sprawl on the coast may be the result of strict coastal protection laws, overall low population density or young urban history where most of the people in cities have strong ties to rural areas and often already possess a farm house. Emergent trend.
- Likely to have an economic boom and urban development in the 10 next years.
- Supported by the new architecture of the structural funds for 2007-13



Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

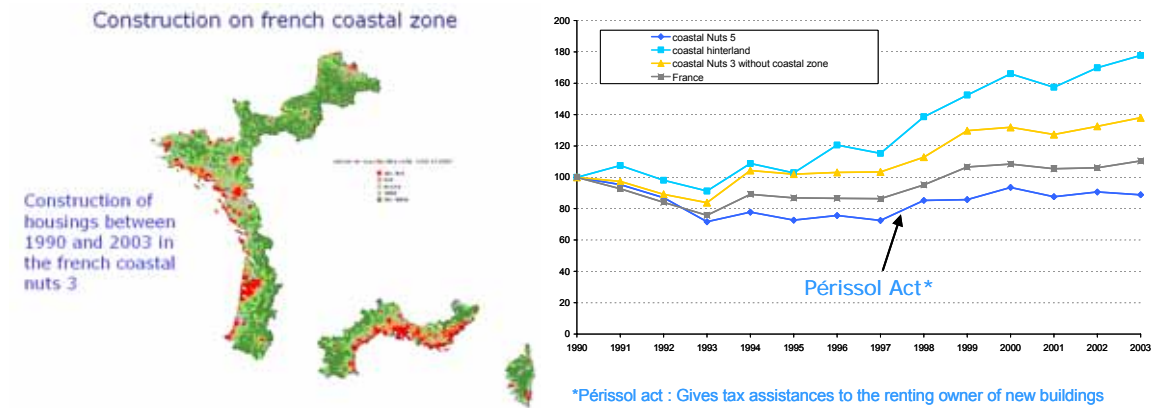
In the Baltic States, changes in the urban model are very moderate, showing incipient concentration around existing urban nucleus, especially at the coast. Out of these there is a tendency to diffuse sprawl, in forming moth holes, with a tendency to discontinuous urban fabric. However the proportion of the coast affected by this urban growth (specially industrial) is important even if the general trend is low, during the period 1990-2000.

### Case study in France

(results from WG-ID indicator testing)

In the map below done on the basis of construction permits by French departments between 1990 and 2003, pressure continue very high in the Mediterranean coast even if the degree of occupation has become very high (mature situation). But high pressure by construction is happening also in the Atlantic coast and even in regions such as Brittany.

However, trends show that the new constructions are sprawling farer from the coastline, provoking a shift of more occupation of the second and third line of coast. This urban trend is also correlated with a social shift: the near coastline is reserved for the seasonal tourist whether hinterland becomes the home place of the yearly residents.



Source: IFEN, Observatoire du littoral, S. Colas

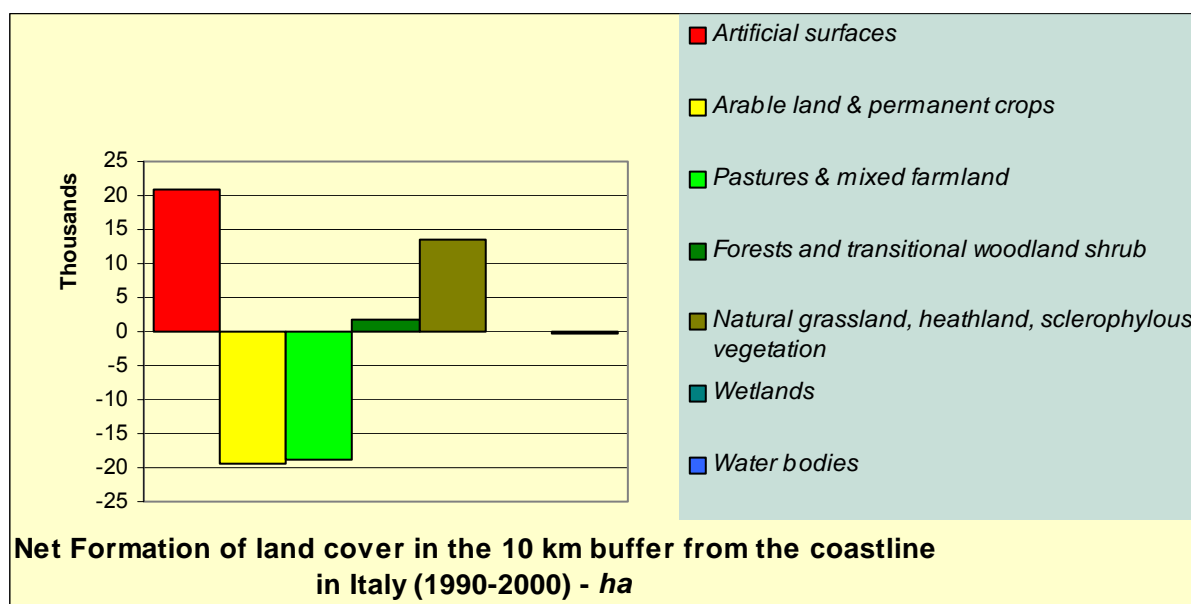
The coast with its cities and harbours, with its tourist and secondary residences, supports the regional development inland.

With the launch of “Périssol act”, in 1997, which allows facilities to rent houses, an unexpected trend happened: growth of construction affecting the coast and their hinterland.

### 3.3 State of natural resources in European coasts

#### Loss of agricultural land

Most of the land uptake by urban and infrastructure development during the selected periods affects agricultural land. The situation is general in all the selected countries creating wider areas of soil sealing. At the same time, good soils are destroyed in an irreversible manner.



Source: LEAC/EEA-ETC/TE

#### Status of pastures

Conversion of pasture into arable land is one of the most important spatial changes found. Does this mean that there is a loss of pasture? As it seems, conversion from pasture to arable land has taken place in a very extensive way in Ireland. Agriculture statistics reveal that this change is correlated with an increase of forage production for cattle husbandry, basically for milk production. Yields of 100 tonnes of green matter by Ha are needed. Different impacts comes out of that: first for the landscapes, with the loss of pastures which are a denominated habitat 2000 priority habitat, the augmentation of nutrients to grow the maize, the loss of organic matter in the soil and the lower retention of nutrients associated to it, which provokes leakage of nutrients into groundwater. Soils began poorer in micro-organisms, with a simplification of the bio-diversity due to monoculture.

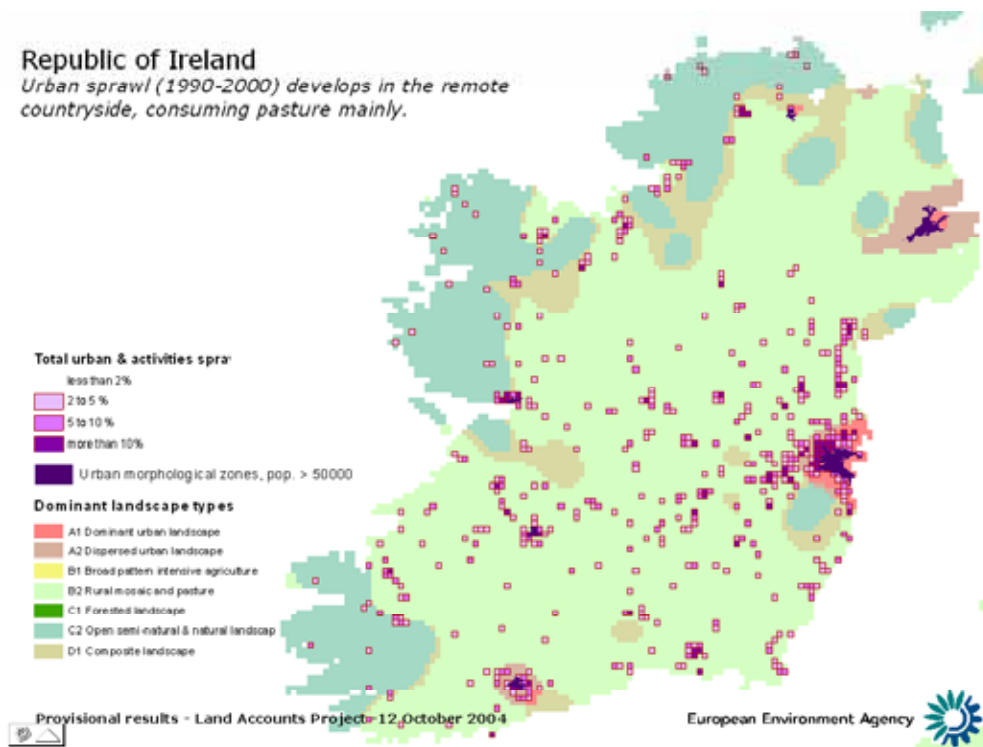
The ideal situation is the maintenance of culture rotation with maize, sugar beets, corn, barley and maize. In this rotation, there are temporary pastures included. Rotation is still happening in Baltic Countries and Poland. On the reverse, Italy and Ireland seems to have well specialised in forage for their milk production which tend to replace pastures.

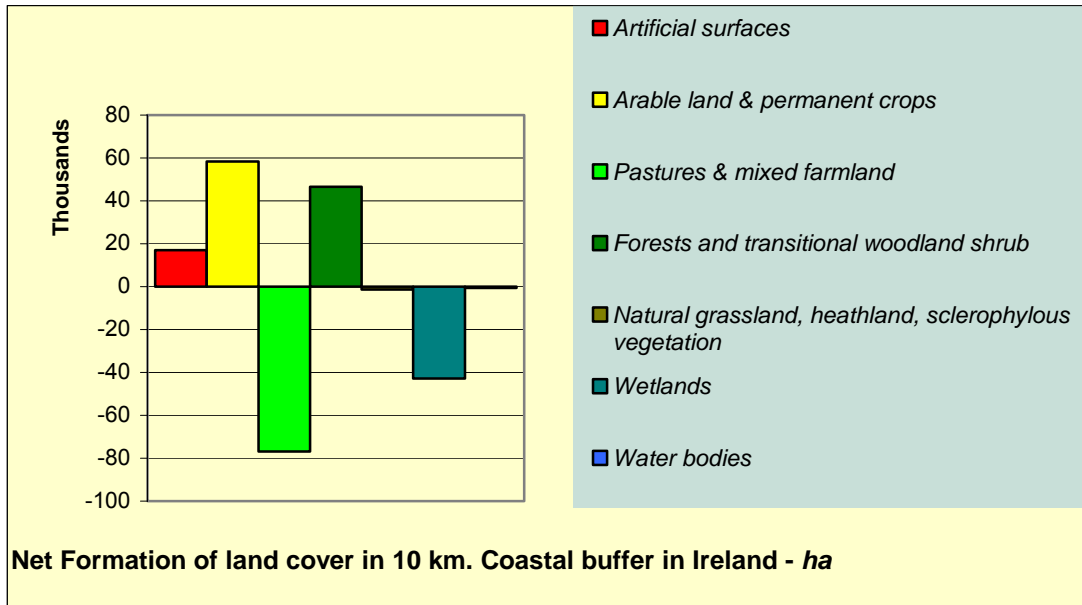


There is a real challenge to conserve pastures, as they are not competitive for milk production. On the contrary, they have high landscape value as they serve as a buffer to absorb nutrients before going to the rivers and they support a number of small animals (insects, birds and mammals), having an important share in support to the biodiversity.

### Example of Ireland

Urban sprawl in the Republic of Ireland doesn't develop around Dublin and cities mainly but, instead, is very widespread over the countryside. Residence and Sport & leisure facilities are the main drivers. Pastures are extensively consumed by the urban land uptake.

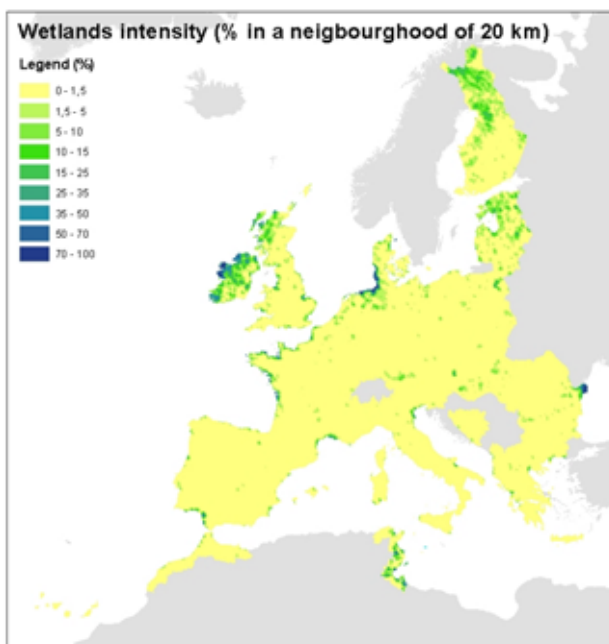




Source: LEAC/EEA-ETC/TE

### Wetland status

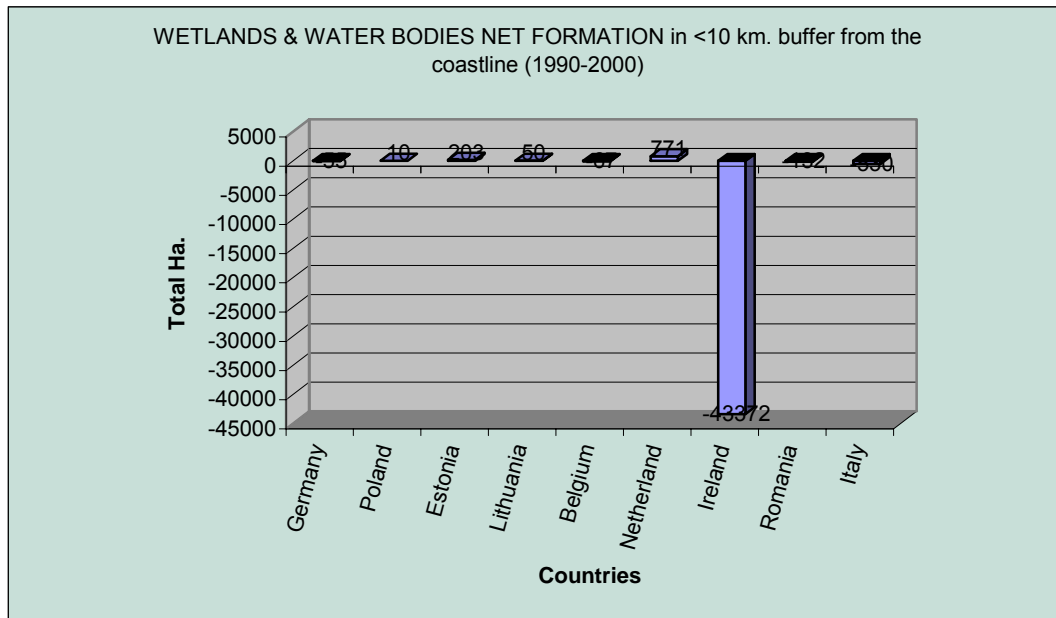
The coastal wetlands are areas above the low tide level, which are subject directly or indirectly to tidal influence. These areas may include certain types of freshwater bogs and marshes where the height of the water table varies with the height of the water in the adjacent estuarine system, all brackish water marshes and lowlands, mangrove stands, sand and mudflats. People in a broad spectrum of activities are using the main part of the coastal European wetlands. Through these activities, wetlands are subject to a range of factors that can lead to loss of wetland area and degradation of wetland quality.



Done by : EEA

Source: LEAC (UNDER DEVELOPMENT)

As shown the previous map, Ireland is one of the countries with a highest percentage of wetland intensity in neighborhood of 20 kilometers (chapter 2.3). But at the same time is as well the country that has loss more hectares of wetlands between 1990-2000, as you can see in the following figure.

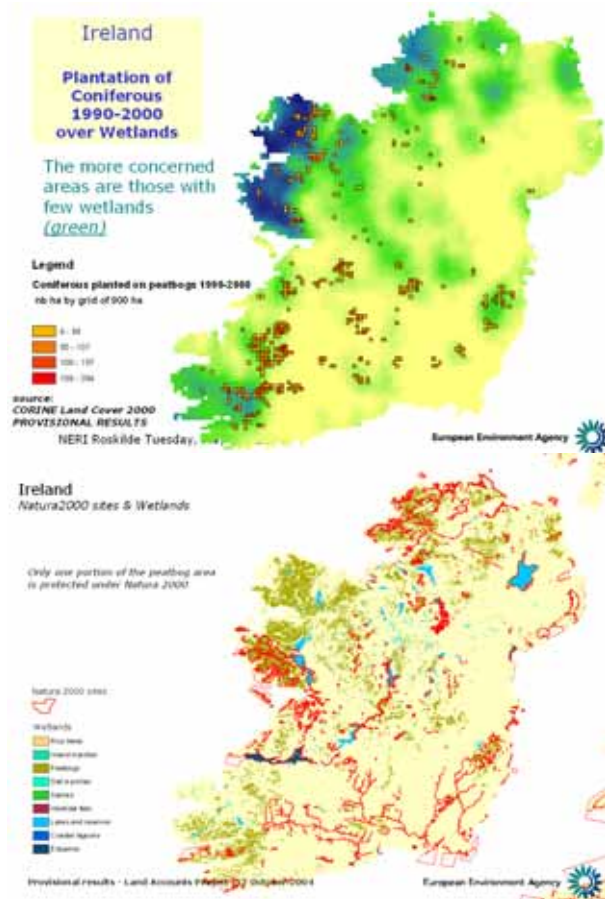


Done by : ETC-TE

Source: LEAC (UNDER DEVELOPMENT)

Ireland presents a tremendous share of wetland loss (43 372 ha) during the period. This surface of wetlands is constituted basically by peat bogs, whose 41.602 ha have been planted with coniferous. Then consumption of the wetlands is due firstly to agro forestry and secondly to agriculture and formation of dry forest.

Peat bogs are not very common in the whole Europe and are concentrated in few countries such as Ireland, UK, Sweden and Finland. Therefore the loss of peat bog in Ireland is an important signal of attention.



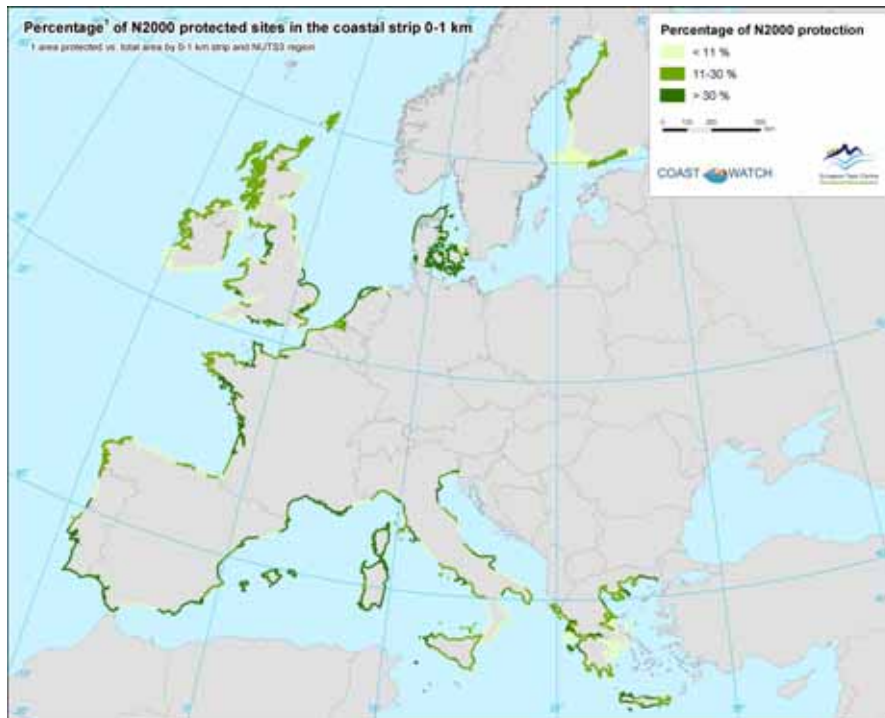
The map shows that the protection of the natural sites alone cannot counter balance diffuse loss of biodiversity. Adequate sector policies are necessary as well. Tests are needed to see how policy is responsible of this negative trend.

New build up areas and plantation of forest happen to be stronger where no protection exists. Preliminary results show that peat bogs given their uniqueness in Europe need to be more highly protected in Ireland, with an extension of dedicated NATURA2000 areas. Moreover, if results are confirmed, the PAC subventions and structural funds need to be revised in order to avoid these trends.

It is to be seen how pressures will play upon wetlands in the Baltic coast, as well as in Romania an the countries of the Black Sea, where tourism and construction are likely to develop in the next 10 years and hence the importance of NATURA2000 implementation.

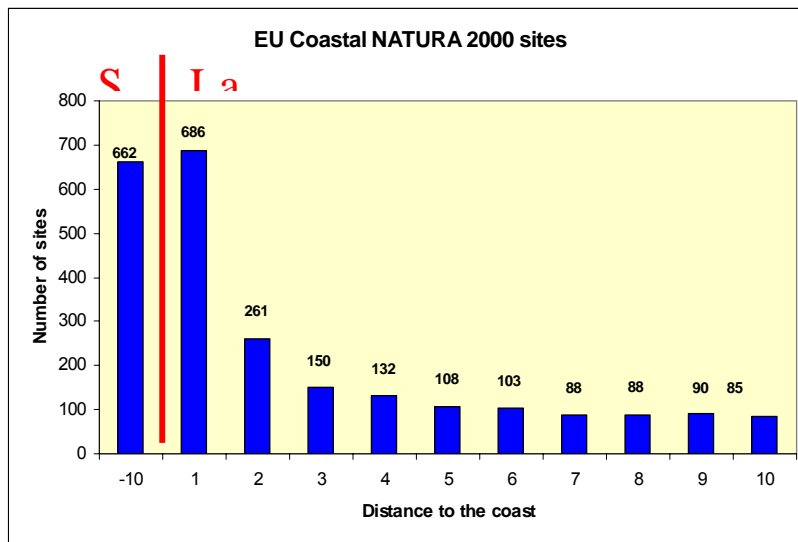
### **Nature protection: NATURA2000 at the coasts**

The average of Natura 2000 protection along the European coast is especially strong in the first kilometers of coastline both landwards and seawards.



Done by : ETC-TE/Coastwatch

### Number of N2000 along the EU coast in the distance to coastline (<10km land wards and seawards)



Done by : ETC-TE/Coastwatch

### 3.4 Coastal water pollution

In relation to the data collection on coastal water pollution, the main data suppliers used until now has been Coastwatch water quality maps and ETC Water indicators, although other data providers has been consulted, such as regional seas or concrete projects.

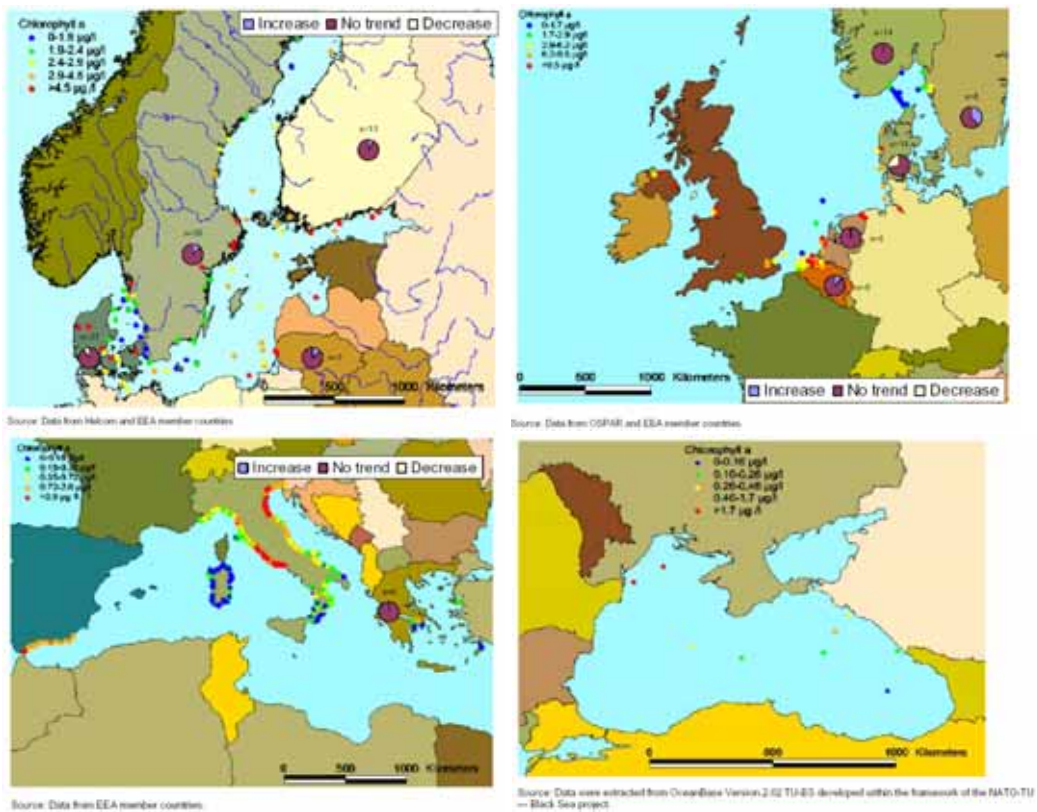
In general the data existing is quite good in terms of temporal, geographical coverage.

There are several indicators from ETC-Water which can be interesting to illustrate the coastal water pollution:

Pollution from nutrients and hazardous substances

- (WEU13) Chlorophyll-a in transitional, coastal and marine waters (7 May 2004)

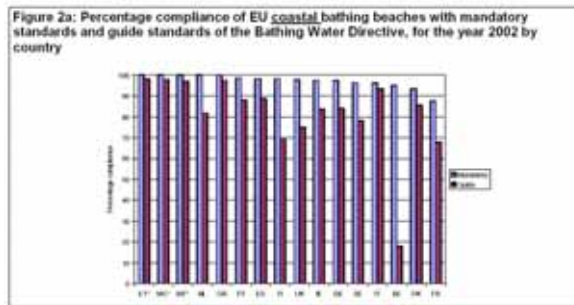
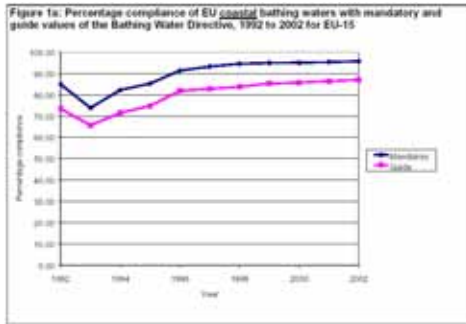
*Summer surface chlorophyll-a concentrations — Spatial distribution of concentrations and trends per country*



- (WEU14) Phytoplankton algae in transitional and coastal waters (7 May 2004)

Pollution from point sources and river basins

- (WEU7) Source apportionment and loads (riverine and direct) of nutrients to coastal waters (7 May 2004)
- (WEU11) Bathing Water Quality (7 May 2004)



Done by : EEA /ETC Water

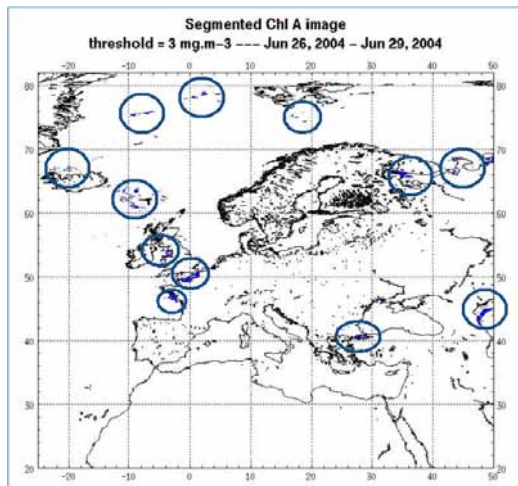
Based on Earth Observation data and state-of-the-art models, the Coastwatch Marine Water Quality Service delivers key parameters for reporting and assessment (it is possible to do specific request of data if needed).

The Service mentioned above can supply information related to bio-geo-physical parameters, such as:

- Chlorophyll-a concentration
- Suspended particulate matter
- Water transparency
- Sea surface temperature
- Photo-synthetically available radiation

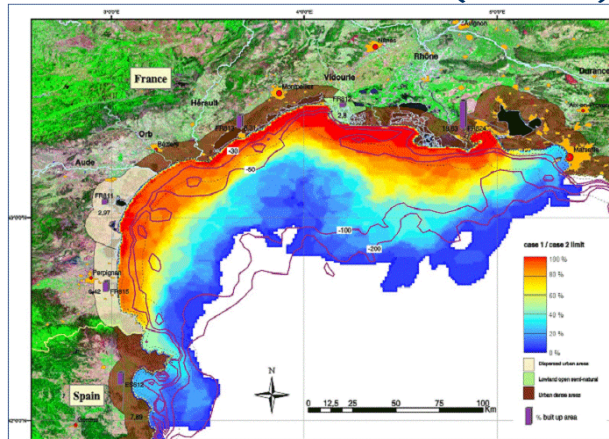
The products are available in Near Real Time; archives can be reprocessed on-demand to supply hind cast information. These products are also available as daily, weekly, monthly or yearly synthesis. The water quality monitoring service is offered for all the European seas, including countries bordering regional seas (e.g. Mediterranean or Black sea countries).

## Examples of Coastwatch products concerning coastal water pollution

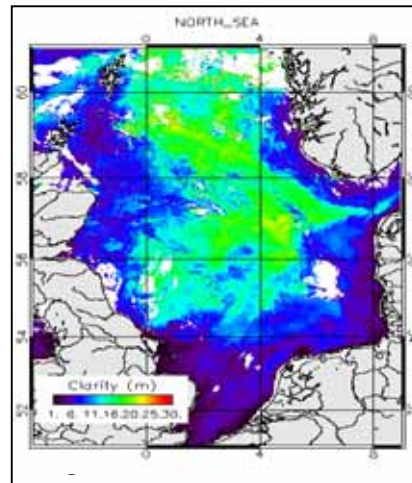


European blooms monitoring - View at a glance 29 June 2004 (Processed by ACRI)

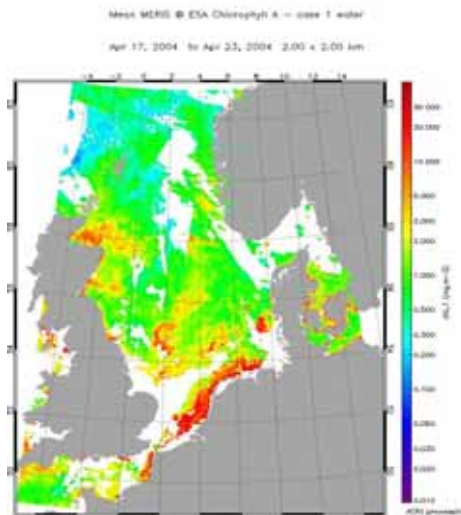
Indicator of persistence of turbid waters in transitional waters (Lion Gulf)



Sea Water transparency (m): MERIS



Through these parameters algae blooms can be monitored in real time which is very useful when occurred in tourism, aquaculture. In the Mediterranean some episodes of algae bloom affecting directly human health through dispersion of contaminated marine aerosols.



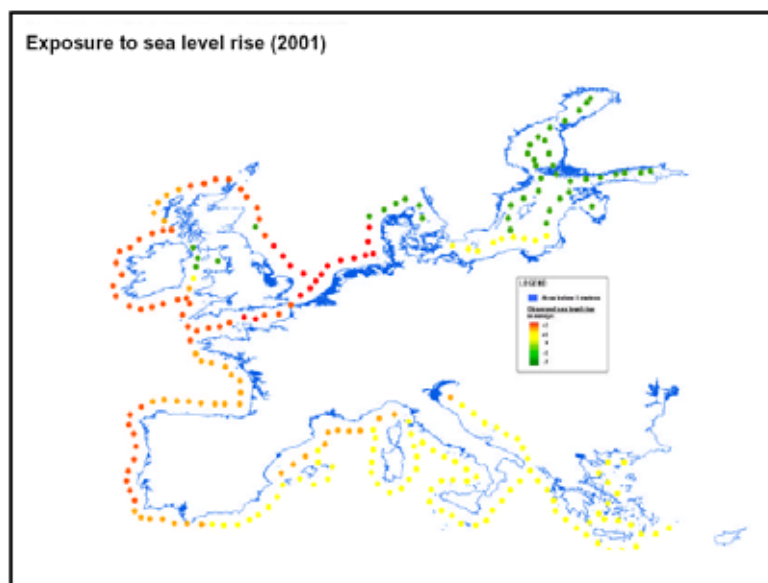
- In 2002 about 20M€ loss of mussel cultures in the River Scheldt area.
- Predicting of risk based on EO-data chlorophyll and wave data.
- Decision support for closing dams to keep Harmful algae blooms outside the estuary.



### 3.5 Other relevant trends

#### Impact of climate change on the European coast

It is widely debated that possible sea level rise and increase in strength and frequency of storms may increase coastal erosion and cause coastal floods (or inundation). Many countries have assessed the potential threats from the climate change to their coastal areas. On the European scale the **EUrosion** project has been dealing in depth with coastal erosion, which contemplates in some extent how climatic change will affect European coast.



Done by : EUrosion

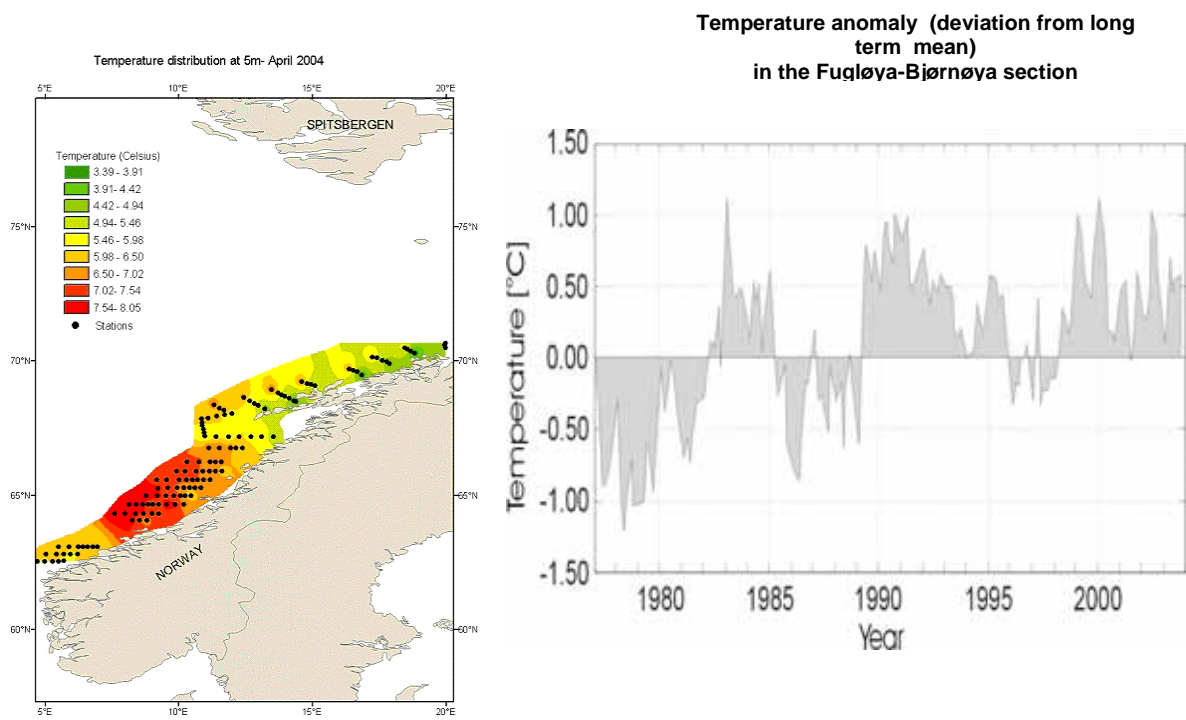
This layer provides information on the relative sea level rise at 237 locations along the European coastline. These locations are situated 50 to 100 km away from the shoreline. Distance from one location to another location is approximately 100 km. The accessibility to this relevant data depends on each data provider. In this case, as a EUROSION assignment, this layer is publicly available inside and outside the European Commission, but in other layers problems of copyright can be found.

Coastal Hydrodynamics and water quality Service of **Coastwatch** project consists of almost 20 years of global quality assured wind and wave observations, global hind casts and is providing on a global basis wind and wave forecast 5 days ahead in time fully automated every six hours 7 days per week. Local wave propagation and overtopping models are integrated in the service. The main parameters delivered by the service are wind & waves, currents and sea level while the supply features are:

- Spatial Coverage: world wide
- Spatial resolution: 104m to 1m
- Temporal coverage: -20years to +5days
- Temporal resolution: Typically 3 hours

- ▶Parameters: Wave height, wave period, wave direction
- ▶Processing: Spectra, Integrated Parameters, Extremes.
- ▶Delivery form: 2D-tables, graphs, time series
- ▶Delivery format: ASCII, HTML, XML, SVG.
- ▶Delivery media: Internet

The Water Quality Service offers data on sea surface temperature on real time that allows the monitoring of the changing climate of the ocean.



Source: Coastwatch/IMR

## 4. LESSONS LEARNED FROM THE WORK SO FAR

### 4.1 Need of a coastal analytical framework

#### Coastal units

For coherent assessment needs, it is necessary to identify the different spatial units related to the European coasts. There are different spatial units being used such as grids, administrative units, river basins, sea catchments, bio-geographical regions and others. For the purpose of the EEA assessment report, spatial units were designed to fit land accounting that can seamlessly be referred to for other analytical purposes. These reporting units the Dominant Landscape Types (Chapter 2.3), clipped with the 10 km coastal buffer zone. However, ideally the coastal assessment would rather need its own concept of spatial units. There are several candidates to be used for this purpose.

Coastal units might be defined as a coastal area that follows the logic of littoral cells - coastal compartments with autonomous sediment balance. Coastal land cover can in these limits be assessed on any resolution level, including dominant landscape types.

However, the level of littoral cells may be too detailed for European level assessments and their aggregation in some other meaningful units may be useful. Here we propose the concept of “coastal region” (figure 4-1), a coastal area that follows the logic of regional sea divisions and contains several littoral cells and coastal land cover units with resolution needed for assessment needs (figure 4-2). These coastal regions would remain distinctive from other coastal regions, because of common nature of the coastal environment but also internal co-operation across administrative boundaries and (potential) partnership with other coastal regions. Designed as such, the coastal regions would address the ecosystem approach by following the bio-geographic and oceanographic features but will also take in to account existing political, social, and economic and management divisions. Typically, coastal regions would often feature a coastal or shoreline management plan and active coordination forum.

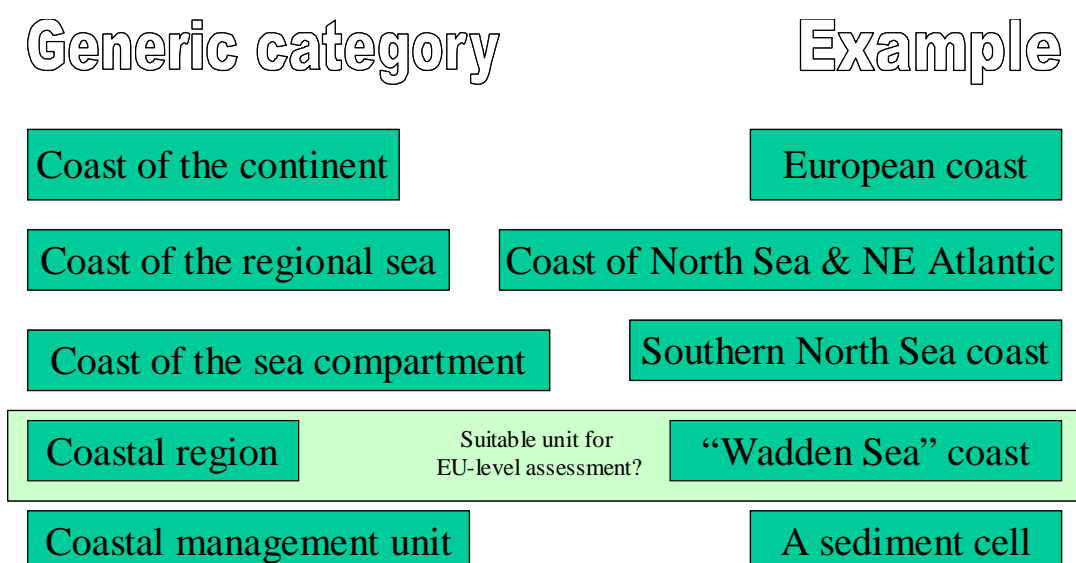


Figure 4-1. Coastal region in the hierarchy of coastal spatial assessment

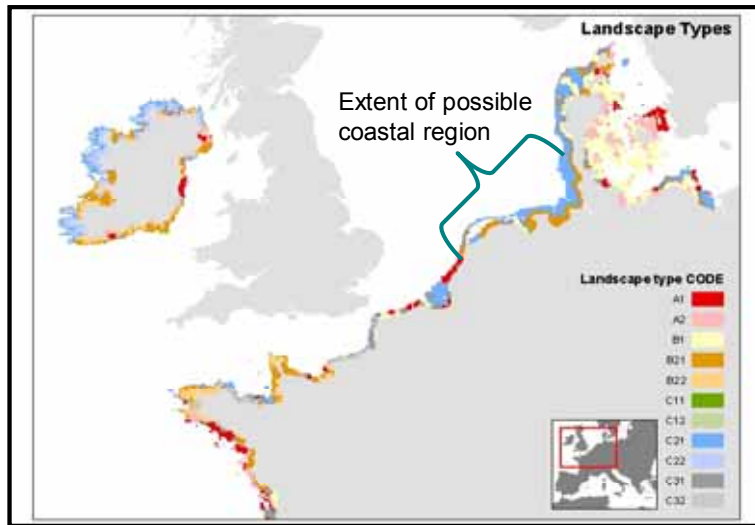


Figure 4-2. Coastal region as a spatial unit for the coastal assessment.

The Water Framework Directive provides geographical determination of coastal water. River Basin Districts cover also respective coastal water, because coastal water is surface water, in respect of chemical status it shall also include territorial waters (WFD, Art 2). According to WFD a coastal region could be a stretch of coastal water associated with land of nearest (or most appropriate) river basin district(s) (figure 4-3). The link between river basins and coastal water bodies is stressed in the European Strategy for ICZM (2000) which says that “15) Water: (...) the Commission will need to work with the Member States to articulate links between river basin plans and other spatial planning for the targeted area, including any coastal zone or structural fund plans.”



Figure 4-3. Coastal region defined as stretch of coastal water associated with land of nearest (or most appropriate) river basin district(s).

Source: France's river basin districts boundaries courtesy Ministère de l'Ecologie et du Développement Durable, Direction de l'Eau

The need to improve the spatial coherence and to develop a spatial framework for European Marine Strategy is also addressed by the EU Environment Council (Conclusions, 4 March 2003) which stresses the need to clarify the connection of MTS with Habitat and Birds Directive, as well as marine related parts of WFD and Community policy on ICZM.

### **Towards spatial integration of individual indicators**

Large collection of different data and indicators (chapter 2.1) creates difficulties for focusing on the most critical situations (stakeholder conflicts) on the European coast. On other hand, management effort could be more targeted to the problems areas if coastal zones with sound development are explicitly known. Such a need for spatial optimisation of management responses could be based on spatial integration of individual indicators in to meaningful assessment of areas with accumulating problems, as well as areas where development is already sustainable. Here is an example of possible definition of so-called “hotspots” and “green areas”:

- Hotspots - high urbanization, habitat loss, erosion and no or high protection (>30% of NUTS surface)
- Green areas - high protection (>30% of NUTS surface), high species richness and connections N2000 land & sea.

Figure 4-4 illustrates the implementation of this concept by using available spatial data sets. At the present stage the conflict analysis is possible only for coastal stakeholders representing urban development and nature protection. But further integration of other data set would allow also assessing other contradicting interests.



Figure 4-4. Example of indicator integration focusing on the most critical situations on the European coast.

Land accounting method, enhanced by coastal conflict concept allows analysing the trends in a spatial and time perspective, identify main spatial conflicts and give idea why they occur. It can also provide information about the possible causes (often multiple), which includes unexpected effects of different policies implementation and the main impacts in terms of location and time, often result of complex and indirect mechanisms.

### **Need to balance the EU and local/regional level approach**

The diversity of European coasts is represented by variability of coastal ecosystems and management models at different administration levels. This creates the need for multiple approaches in assessment of the state of coastal environment. Some indicators may maintain their relevancy regardless geographic scale span from local to EU level (for example, hazardous substances), others may be crucial on local but not so relevant on EU level (for example coastal defence systems). Some issues are best assessed on EU level because the situation needs to be generalised and meaningfully aggregated to make it relevant for EU policies (for example urban sprawl and SDS).

This creates the need for separate, but still coordinated assessment levels on EU and local/regional scale. EU level context needs possibilities for validation, case studies and some relevancy to spatial planning. Local and regional assessments need to see themselves in the wider frameworks and need assistance to recognise the local impacts of large EU policies.

Land accounting is also useful to work on a different scales and data resolution levels. It is feasible to feed land cover data with new information and new layers with more resolution at national, regional and local levels where and when needed. Coastal units, at the smaller level, can be aggregated to the highest level, taking into account both the scale integration and the land/sea relations (from river catchment, to coastal region and seawards limits). Results can show how a determined policy has been applied and which impacts it has had in a concrete coastal unit and in a larger coastal territory (by aggregation of similar coastal units).

## **4.2 Data gaps and needs for future work**

Chapter 2.2 already gave an overview of main data sources and problems associated with these data sets. More specific requirements for updating the information base are related to improvements in:

- Temporal coverage (add 2000 data, or later, in particular CLC2000),
- Spatial coverage (add new Member states, for example in NATURA2000)
- Thematic coverage (add coastal water quality and ports data, make full use of EUrosion data)
- Population data (incorporate 2001 census on the level of coastal units)

A further element in data needs is related to improved spatial resolution of the data available for assessment. Improvements are discussed for land accounts methodology (DLT smoothing algorithm with 10 km radius, finer cells for change detection etc.).

Coastal water data should be available by some coastal regions (to be determined) or WFD water bodies. Cooperation with GSE Coastwatch may provide spatially distributed data of coastal water turbidity (exceed of threshold of suspended matter in sea water) and transparency (equivalent of Secchi disc depth) as approximation for the coastal water quality.

However, the increased spatial resolution is not a goal in itself, because for assessment on European level the most detailed data is not appropriate. This concerns also the thematic resolution e.g. which data layers are included in the spatial assessment. What is needed for achieving the sound multi-scalar approach is balanced thematic (and spatial) resolution of the data between European and local/regional level data. For example, as geographical extend would decrease from European to local, the relevancy and amount of individual data layers has to increase in order to address the situation in sufficient detail for local needs and coastal management issues. There is a challenge for research community to create such sound data up/down scaling methodology, especially if adapted to the coastal environment context.

In chapter 4.1 the role of coastal conflict concept in monitoring the hotspots was already discussed. An aspect of this concept is also related to the resolution problems. Applying coastal conflict concept would allowing to select areas of European coast where is justified the investment for creating “zoom in” e.g. detailed data sets for selected areas of most pronounced problems.

Finally, all activities in data processing and analysis should lead to completing of certain assessment products linked to relevant policy events. This will help to provide the baseline to monitor the progress in the state of coasts and implementation of ICZM.