CASE STUDY: 'REGIONAL SCALE MAPPING OF COASTAL EVOLUTION AND RISKS'
CENTRAL SOUTHERN ENGLAND COASTAL STUDY AREA

LOCATION: The central southern coast of England, on the Channel/La Manche.

SIZE OF STUDY AREA: Approximately 375 km of coastline (including the 110km coast of the Isle of Wight).

WHY WAS THIS STUDY AREA CHOSEN?
It is the area represented by SCOPAC (the Standing Conference on Problems Associated With the Coastline), the Regional Coastal Group for central southern England, which brings together 30 Local Authorities and other stakeholders.

'Coastal Groups' have been established around the coast of England and Wales based on 'sediment cells', to bring together the Local Authorities and other stakeholders involved in coastal defence in order to ensure a strategic approach. The Study Area contains a wide variety of landforms: high sea cliffs, soft cliffs, landslide complexes, barrier beaches, saltmarsh, estuaries and natural harbours. SCOPAC "believes that the question of climate change impacts is probably the most important issue to be faced by coastal local authorities and communities they represent, alongside other organisations, in the coastal zone".

KEY NATURAL HAZARDS AND ISSUES IN THIS STUDY AREA:
There are many coastal cities and towns located along the SCOPAC coast. Tourism is a key industry for much of the area due to the quality of the natural environment and a legacy of Victorian seaside development. Other coastal industries are also present, such as commercial and naval docks, cross-channel ferry ports and an oil refinery. Much of the coast is affected by active coastal erosion, flooding and landsliding, which can result from exposure to Atlantic storm waves. Sea level rise and an increase in the intensity of storms predicted by the IPCC will lead to a greater frequency of damaging events in this area.

WHO IS RESPONSIBLE FOR MANAGING THESE ISSUES?:
Members of SCOPAC Regional Coastal Group: Members are public authorities and other bodies with an interest in coastal defence along the central southern coast of England.

MAPPING AND INVESTIGATION BY:
Isle of Wight Centre for the Coastal Environment, Isle of Wight Council, UK. Project Manager- Dr. Robin McInnes OBE, Senior Coastal Scientist- Helen Fairbank, Senior Coastal Geomorphologist- Jenny Jakeways; Consultants: Halcrow Group and Mark Lee.

SCOPAC Regional Coastal Group, England. SCOPAC works to promote sustainable shoreline management, and to facilitate the duties and responsibilities of local authorities and other organisations managing the coastal zone of central southern England.

Plates 27 & 28 (above): Chale Terrace, Blackgang, Isle of Wight, in the 1890s and in 2006. All the land and properties in the foreground have been lost due to coastal erosion and landsliding.
EXAMPLES FROM THE STUDY AREA:
A set of 9 maps have been produced for the central-southern coast of England, predicting future changes in hazard and risk and creating additional planning guidance. Climate change is likely to result in changes to three factors strongly affecting the coast of this Study Area: (1) rising sea levels, (2) increased coastal erosion, and (3) increased winter rainfall and potentially more extreme events:

- Cliff recession rates of soft rock cliffs could increase by up to 100% due to increased erosion resulting from sea level rise and higher winter groundwater levels. This increase in risk to coastal settlements would also create additional sediment supplies from the eroding cliffs;
- A major hazard is increased potential for reactivation of relic landslides around and beneath the towns of: Lyme Regis in Dorset; the Ventnor Undercliff and Cowes-Gurnard frontage on the Isle of Wight; and elsewhere. The intensity and frequency of wet winters and increased coastal erosion are the key factors promoting current and future ground instability at these locations;
- Beaches fronting coastal lowlands are especially vulnerable to the impacts of storms and are reliant on fresh sediment supply. Increases in both flood risk and development pressure on the lowlands behind these beaches raises major questions over their sustainability in the long-term;
- Rates of erosion of saltmarshes in estuaries will rise, due to 'coastal squeeze' of the marshes backed by defended or rising land and changes in sediment supply. As well as an important loss of environmental habitat, removal of this natural defence will expose developed areas behind to increased risks.

Decisions to 'hold the line' of current coastal defences will become increasingly expensive and technically difficult to achieve in the future, due to overtopping by rising sea levels, combined tidal and fluvial flooding, loss of protecting beaches and marshes, increased wave force and change in wave direction, changes in sediment supply and loss of sediment, decreased stability of protected cliffs, and a greater frequency of damaging storm events.

WHY IS THE MAPPING USEFUL?
The RESPONSE mapping provides a clear, logical, visual picture of future coastal risks that can be communicated to non-specialists, including planners and decision-makers. It also encourages a strategic and precautionary approach with co-ordination between adjacent Local Authorities and risk managers. It is expected that climate change will not create new hazards in this Study Area but it will change the patterns and intensities of existing coastal hazards. The magnitude and consequences of these changes could be severe.

KEY MESSAGES:
- It is essential to understand the impacts of climate change now, so appropriate decision-making can be implemented through the planning and political processes. Social, economic and political changes over the next 80 years could be as significant as climate change in determining future coastal risk and how coastal risk is managed;
- The threat of climate change should focus attention upon the needs for forward planning and preparedness. Waiting for overwhelming evidence of physical impacts will miss the opportunity to reduce and avoid future risks in the most cost-effective and achievable way.


FOR FULL INFORMATION: INCLUDING A FULL SET OF COASTAL EVOLUTION AND RISK MAPS AND THE STUDY AREA REPORT, PLEASE SEE CHAPTER 3a ON THE ACCOMPANYING CD-ROM.
CASE STUDY: 'REGIONAL SCALE MAPPING OF COASTAL EVOLUTION AND RISKS'  
REGIONE MARCHE COASTAL STUDY AREA, ITALY

LOCATION: The Marche Region is on the east coast of Central Italy, on the Adriatic.

SIZE OF STUDY AREA: The 172km coastal zone includes 4 Provinces and 23 Communes. The most important cities of the Region are located along the coast (Ancona 100,000 inhabitants, Pesaro 90,000 inhabitants) and with other main towns (Fano, Senigallia, Civitanova Marche and San Benedetto del Tronto, all with over 40,000 inhabitants) form an almost continuous conurbation along the main transportation routes north-south (highway A14, motorway SS16 and the Bologna-Bari railway).

WHY WAS THIS STUDY AREA CHOSEN?  
The Marche Region Coastal zone is representative of the physical setting and development patterns of the Italian coast. It includes a continuous flat beach shoreline (81% of the total length) which is an important tourism destination between May and September, and two high cliffs of environmental, historic and artistic value which are designated as Natural Parks (San Bartolo Hill and Mt. Conero).

KEY NATURAL HAZARDS AND ISSUES IN THIS STUDY AREA:  
Coastal erosion from storm waves is a significant issue for economic stability, due to its impact on tourism and major infrastructure. Over the course of the last century a sediment transport deficit from rivers has led to a crisis in the coastal system, starved of naturally supplied material derived from the drainage basins - a typical feature of the regional "comb" system.

WHO IS RESPONSIBLE FOR MANAGING THESE ISSUES?:  
Regione Marche is responsible for the Territory, Mobility & Infrastructure Government Service

OTHER KEY DOCUMENTS FOR THIS STUDY AREA:  
▷ The Plan for Integrated Management of Coastal Areas (Marche Region, 2005);
▷ The Plan for Hydrogeological Assets (Marche Region, 2004)

MAPPING AND INVESTIGATION BY:
I.R.P.I. - C.N.R. Perugia, Italy : Maceo-Giovanni Angeli (Research Manager), Franco Marabini (Researcher), Riccardo Menotti (Researcher), Fabrizio Pontoni (Geoequipe - Consultant), Paolo Gasparetto (IQT - Consultant).  
Marche Region - Regional Basin Authority : Mario Smargiasso (Director), Luigi Diotallevi (Manager)

Plate 30 (above left): The beach between Fano and Pesaro showing intensive use of the beach for tourism. Plate 31 (above right): "Pocket" beach at Sirolo.
AN EXAMPLE FROM THE STUDY AREA:
A set of 7 maps have been produced for the Regione Marche coast, predicting future changes in hazard and risk.

Within Regione Marche a 15.18 km length of coast lies within the Municipalities of Senigallia, Montemarciano and Falconara Marittima. Currently, coastal defence works cover 3.7 km of this length in the Montemarciano and Falconara Municipalities. The main existing works are: emerging breakwaters, submerged breakwaters, 1 pier, 1 groyne and 10 submerged groynes. The sedimentary characteristics of the beach above water level indicate the presence of 25% sand and 75% gravel and the major catchment basins that transport solid material are the Misa (sand) and Esino (sand and gravel) Rivers. The direction of the longshore drift is towards the north. The northern beaches are formed of sand (with longitudinal bars) and the southern beaches are gravel.

The current hazard is the progressive erosion of the beach, particularly during intense sea storms. In the northern part of the Study Area (Senigallia) the impact of sea level rise on the very low angle beach will result in increased risk to the important tourism beaches, used very intensively during the summer season. The southern part of the Study Area is exposed to erosion resulting from the refraction of sea waves due to the presence of hard coastal defences around an important oil refinery (API). Here the risk is to strategic infrastructure (the Adriatic State road and railway). The problems began after industrial development of the area in 1960. The cause is the lack of solid material carried in suspension down the Esino River and the screening action of part of the API embankment against storm waves from the north. The area is suffering from a serious sedimentary imbalance. The sands of the submerged beach have been progressively reduced; it used to provide a form of breakwater against the swell, with sedimentary structures such as longshore bars or shoals.

The current management policy is beach re-nourishment with sand and gravel along the whole shoreline. The sand required (about 1,000,000 mc) will be sourced off Marchean coast, and this project requires economic resources. In the southern area the plan is to dismantle some of the low-crested breakwaters situated opposite the railway station of Marina di Montemarciano and those above sea-level situated north of the mouth of the River Esino. By using material obtained from these works with the addition of further material, some emergent breakwaters will be built that will cover the whole stretch of shoreline.

WHY IS THE MAPPING USEFUL?
The mapping was very useful because it allows a homogeneous approach to the problem in the whole coastal zone and encourages the involvement of all relevant public and private stakeholders according to the current principles of the European Directives.

KEY MESSAGES:
- The investigation has highlighted that a high level of territorial imbalance or territorial disequilibrium exists all along the coastline of Marche Region that will worsen as climate change progresses;
- The Marche Region is putting economic planning into practice and great importance has been given to techniques of beach nourishment, to reconstruct the natural form of the beach "structures" that reduce wave energy;
- When considering the impacts of climate change and sea level rise, strategies developed for the coast and catchment basins (regarding transportation of solid material) are a fundamental and historic step forward from a period of large-scale exploitation of the available resources to ensuring compromise between economic needs and physical balance.

FOR FULL INFORMATION: INCLUDING A FULL SET OF COASTAL EVOLUTION AND RISK MAPS AND THE STUDY AREA REPORT, PLEASE SEE CHAPTER 3b ON THE ACCOMPANYING CD-ROM.
CASE STUDY: 'REGIONAL SCALE MAPPING OF COASTAL EVOLUTION AND RISKS'
LANGUEDOC ROUSSILLON COASTAL STUDY AREA, FRANCE

LOCATION:
The Languedoc Roussillon coastal study area is on the Mediterranean shoreline, stretching from the Rhone river delta westward to the Spanish border.

SIZE OF STUDY AREA: 215 km of coastline

WHY WAS THIS STUDY AREA CHOSEN?
The departments of Gard, Hérault and Aude present a fragile sandy and low-lying shoreline, where numerous erosion and marine flooding events have occurred, putting at risk significant assets linked to intensive development.

By contrast, in the south of the Study Area, the coast of Pyrénées Orientales is formed by hard rocky cliffs which are much more resistant to erosion.

KEY NATURAL HAZARDS AND ISSUES IN THIS STUDY AREA:
Present-day erosion and marine flooding along the sandy coast puts urban, tourism, industrial and agricultural assets at risk. Levels of risk are likely to increase with climate change, also implying longer stretches of coast will be affected. Coastal risk is lower along the rocky-cliffed coast of Pyrénées Orientales, but climate change may result in the loss of pocket beaches due to a lack of sediment supply.

WHO IS RESPONSIBLE FOR MANAGING THESE ISSUES?:
Local authorities: townships and township communities

BRGM, Orleans, France: C.VINCHON (BRGM/ARN) (following L.CLOSSET: Head of the French participation in the Project, Coordination, synthesis and reporting
D. IDIER, M.GARCIN(BRGM/ARN): Data collecting and GIS elaboration, Map realisation
Y.BALOUIN (BRGM/LRO), Regional expertise and validation

Plate 33: The eastern part of the Lido de Sète, where vineyards are put at risk by beach erosion
Plate 34: An oblique view of Carnon beach, coastal defence management
EXAMPLES FROM THE STUDY AREA:
A set of 7 maps have been produced for the Languedoc-Roussillon coast, predicting future changes in hazard and risk, with special attention to the area around the town and Lido of Sète.

Plate 35: Right- Map 6 showing changes in coastal hazards along the coast near Sète; Plate 36: Below- Present-day erosion and marine flooding, likely to experience increased coastal hazards Languedoc-Roussillon, France.

The northern and central coast of Languedoc Roussillon is typically low-lying and characterised by a set of Lidos separated from the sea by barrier beaches, which are vulnerable to storm waves. Erosion and marine flooding hazard is expected to increase in the future on the sandy coast and involve wider stretches of coast. This hazard increase will result in increased levels of risk for urban, tourism, agricultural and industrial assets. The region is an important tourism destination, and consequently levels of risk can increase in the summer due to higher populations in the area. Expected population increase in the coming decade will also enhance the risk.

WHY IS THE MAPPING USEFUL?
The mapping provides a regional overview of coastal risk. It also builds a strong relationship with former and future development planning. The mapping methodology can be applied in any area, allowing comparisons with other regions. This technique enables identification of ‘hotspots’ as priorities for considering the impacts of climate change in planning. The maps need further study (of detailed processes and assets at risks) and updating if they are required for use at a local, rather than regional, scale.

KEY MESSAGE:
Coastal risk in Languedoc Roussillon has to be managed through plans which integrate knowledge of climate change impacts with considerations of the cost/efficiency of asset protection, and be placed in the context of an understanding of the behaviour and transfers of sediments within sedimentary cells.

OTHER KEY DOCUMENTS FOR THIS STUDY AREA:
- Mission interministérielle d’aménagement du littoral de Languedoc Roussillon, 2003,
- Orientation stratégiques pour la gestion de l’érosion en Languedoc Roussillon, 2003,

FOR FULL INFORMATION:
INCLUDING A FULL SET OF COASTAL EVOLUTION AND RISK MAPS AND THE STUDY AREA REPORT, PLEASE SEE CHAPTER 3C ON THE ACCOMPANYING CD-ROM.
CASE STUDY: 'REGIONAL SCALE MAPPING OF COASTAL EVOLUTION AND RISKS'
AQUITAINE COASTAL STUDY AREA, FRANCE

LOCATION:
The Aquitaine shoreline stretches from the Gironde estuary to the
Spanish border on the Atlantic coast of south-west France.

SIZE OF STUDY AREA: 240 km of coastline

WHY WAS THIS STUDY AREA CHOSEN?
In the north of the Study Area, the Gironde and Landes coastline is
sandy (with ridge and runnel beaches and large dune systems) and
development is focused on river outlets, leading to defence against
the sea.

In the south of the Study Area, the Pyrénées-Atlantiques coastline is
made of soft cretaceous sediment cliffs showing high levels of
instability and intensive land use.

KEY NATURAL HAZARDS AND ISSUES IN THIS STUDY AREA:
Erosion of the sandy coast is important around the urbanised river
outlets, where the efficiency of existing defences needs to be
examined. The river outlets and backshore floodplains are subject to
marine flooding hazard.

In the south, the cliffs of the Pays-Basque area are affected by instability and erosion,
mainly due to rock weathering and ground water fluctuations, providing little sediment
supply to the fringing beaches. Erosion and marine flooding affects the developed areas
and is likely to increase in the coming decades.

MAPPING AND INVESTIGATION BY:
BRGM, Orleans, France: C.VINCHON (BRGM/ARN) (following L.CLOSSET
BRGM/ARN): Head of the French participation in the Project,
Coordination, synthesis and reporting.
D. IDIER, M.GARCIN (BRGM/ARN): Data collecting and GIS elaboration.
Map realisation
C.MALLET, S.AUBIE (BRGM/AQUI). Regional expertise and validation
EXAMPLES FROM THE STUDY AREA:
A set of 7 maps have been produced for the Aquitaine Coast, predicting future changes in hazard and risk. On the sandy Aquitaine coast erosion is expected to increase as a result of climate change impacts, but existing storage of sediment (sandbars and dunes) forms relative adaptation capacity for erosion. Marine flooding hazard at river outlets in the southern part of the area is expected to increase. In Pays-Basque, in the south of the region, cliff instability and beach erosion are expected to increase with climate change, which would put numerous assets at risk.

WHY IS THE MAPPING USEFUL?:
The mapping provides a regional overview of coastal risk. It also builds a strong relationship with former and future development planning. The mapping methodology can be applied in any area, allowing comparisons with other regions. This technique enables identification of ‘hotspots’ as priorities for considering the impacts of climate change in planning. The maps need further study (of detailed processes and assets at risks) and updating if they are required for use at a local, rather than regional, scale.

KEY MESSAGES:
▷ An increase in levels of risk on the coast is expected based on climate change hypotheses;
▷ There is relative adaptation capacity on the sandy coast, except at low points (river outlets);
▷ Coastal development planning must integrate the hypothesis of climate change.

OTHER KEY DOCUMENTS FOR THIS STUDY AREA:  (http://littoral.aquitaine.fr/)

FOR FULL INFORMATION:
INCLUDING A FULL SET OF COASTAL EVOLUTION AND RISK MAPS AND THE STUDY AREA REPORT, PLEASE SEE CHAPTER 3d ON THE ACCOMPANYING CD-ROM.
CASE STUDY: 'REGIONAL SCALE MAPPING OF COASTAL EVOLUTION AND RISKS'
NORTH YORKSHIRE COASTAL STUDY AREA, ENGLAND

LOCATION: North Yorkshire is located on the north-east coast of England, facing the North Sea.

SIZE OF STUDY AREA: 91 km of coastline.

WHY WAS THIS STUDY AREA CHOSEN?
The North Yorkshire coast is characterised by high cliffs composed of sandstones and clays. Landslides and coastal erosion are impacting on the coastal towns and villages.

The study area covers 91km of coastline, of which approximately 15km are currently protected, 32km lies within the North Yorkshire Moors National Park and 41 km is designated as Heritage Coast. There are also several Sites of Special Scientific Interest (SSSIs) extending 34km along the coast together with 15km of Sensitive Marine Areas. The coastline is generally unspoilt with major population centres at Whitby, Scarborough and Filey. 75% of the 108,000 residents live within the coastal settlements of Staithes, Runswick Bay, Sandsend, Whitby, Robin Hoods Bay, Scarborough and Filey. The towns are protected from the North Sea by a variety of coastal defence structures. The estimated value of these structures is believed to exceed £150 million [€223m] and the value of the assets they protect is much greater.

KEY NATURAL HAZARDS AND ISSUES IN THIS STUDY AREA:
The North Yorkshire coast currently erodes at an average of 9cm year where the geology is predominantly shale and 28cm year where the geology is glacial drift. The coast is particularly susceptible to landslips. At present in the North Yorkshire region sea levels and mean annual temperatures are rising. Mean sea levels along the coast have risen at rates of between 1.5mm and 3.6mm per year over the last 80 years. Long-term temperature records show that the 1990s were the warmest decade since the 19th Century. Evidence also suggests that winters in the 1990s were wetter than ever before, for example there was a threefold increase in the number of "wet" winter days at Whitby during the 1990s. The coastal zone is vulnerable to rising sea levels and changing patterns of tidal flooding and coastal erosion.

WHO IS RESPONSIBLE FOR MANAGING THESE ISSUES?
Scarborough Borough Council and other members of the North East Coastal Authorities Group.

Plate 40: The town of Filey in North Yorkshire is the southerly terminus of the nationally important Cleveland Way long distance coastal path, which runs along the entire length of the Study Area. The path is used by an estimated 300,000 visitors per year and adds £1 million to the local economy. The coastal path is under constant threat from erosion and landslides.

MAPPING AND INVESTIGATION BY:
Scarborough Borough Council, England : John Riby (Coastal Manager), Stewart Rowe (Senior Engineer), Cllr. Godfrey Allanson.
EXAMPLES FROM THE STUDY AREA:
A set of 7 maps have been produced for the North Yorkshire coast, predicting future changes in hazard and risk. Climatic scenarios produced by the UK Climate Impacts Programme suggest that North Yorkshire will be 1.5 and 4°C warmer by the 2080s. Wetter winters and drier summers will accompany this warming. Winters are expected to bring 60% more rain. Climatic change will lead to more depressions giving stronger winds and increased wind speeds. The scenarios for sea level rise in North Yorkshire for 2080 give a rise above the 1900 level of 15-75cms. Government planning guidance for sea level rise recommends allowances of 4mm/year north of Flamborough Head. Impacts of rising sea levels will include:

- Increased risk of tidal flooding including the overtopping, bypassing and breaching of coastal defences due to both sea level rise and increased storminess, and growing concern this may lead to "insurance blight" for businesses and households;
- Storm surges are expected to increase in height and frequency;
- Changing sea temperatures will affect the type and quality of fish stocks; intertidal habitat trapped between rising seawaters and hard coastal defences will suffer coastal squeeze.

WHY IS THE MAPPING USEFUL?

- The process of developing the maps has provided a new perspective and improved understanding of the changes in patterns of coastal risks expected along the North Yorkshire coastline. Existing information is now presented in a user-friendly format, which is readily understood by a non-technical audience;
- The maps allow the potential impacts of climate change and the future of the coastline to be communicated clearly to decision-makers and planners.Whilst the news of climate change is not new, RESPONSE presents the information in a non-sensationalised format, based on an understanding that the coastline has always evolved and will continue to do so. The magnitude and rate of change may be increasing and certain areas are more vulnerable to climate change than others;
- The process has raised awareness of the climate change predictions in our area. Lobbying is underway to employ an officer to advise on climate change. In particular the issues of long-term climate change (100 years) have been more readily embraced by planners.

KEY MESSAGES:

- Mapping and regional-scale assessment of the current and predicted risks associated with coastal processes and climate change is the most effective methodology for transmitting information. A picture really does tell a thousand words;
- As the development of the maps progressed, the highlighting of "hotspots" became clear. Although these areas of concern were already known the predicted affects of climate change had not been accounted for.


FOR FULL INFORMATION: INCLUDING A FULL SET OF COASTAL EVOLUTION AND RISK MAPS AND THE STUDY AREA REPORT, PLEASE SEE CHAPTER 3e ON THE ACCOMPANYING CD-ROM.
PRACTICAL APPLICATION OF THE RESPONSE METHODOLOGY

POLICY TO PRACTICE - MAKING IT WORK WITHIN EXISTING POLICY FRAMEWORKS

Fundamental to the practical application of any natural hazard management plan is the availability of reliable and accurate data. The RESPONSE Project mapping methodology outlined in this Training Pack essentially demonstrates a process of data collection and interrogation, allowing an assessment to be made of future natural hazards and risks. Provision of such information ensures that political decisions and policy development can be based on sound technical information and expert knowledge. The RESPONSE mapping must fit within the policy framework operating in the county concerned.

As part of the RESPONSE Project a review was made of legislation and policy for managing natural hazards (instability, coastal flooding and erosion) in the coastal zone. The purpose of this report was to consider successes and problems with policy, practice and management of coastal natural hazards at an international, European and national level in selected EU Member States, identifying good practice to assist long term planning and risk management. The report is accompanied by a comparative matrix of Member States' policy approaches for the management of coastal natural hazards. The full report and accompanying matrix can be viewed on the RESPONSE CD-Rom. A short summary of the report is provided opposite.
A REVIEW OF LEGISLATION, POLICY AND GOOD PRACTICE FOR MANAGING NATURAL HAZARDS WITHIN COASTAL ZONES: REPORT SUMMARY

International legislation and policy provides an over-arching framework, which is then translated into national and local legislation and guidelines. The main international legal instruments specifically relating to the marine and coastal areas are the United Nations Convention on Law of the Sea (UNCLOS), Agenda 21, International Maritime Organisation (IMO) Conventions and the Ramsar Convention on Wetlands.

Many International treaties and conventions are legally binding. However, they can only bind those states that agree to join them and, therefore, their effectiveness depends on the principle of consent.

Climate change and global warming are an increasingly political concern but, at an international level, policies on climate change have been difficult to agree and achieve global agreement. The UN Framework Convention on Climate Change (UNFCCC) sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. The current focus of the Convention is the consideration of what can be done to reduce global warming and to cope with the temperature increases that are inevitable.

European legislation and policy provides a strategic framework for all aspects of land use and development within the EU, including natural hazards. Legislation from the European Parliament is implemented in Member States and covers major issues such as protection of the environment.

Coastal issues are of great importance for Europe, and the issues involved cannot be solved by Member States separately. Problems related to the state of the coast in Europe are specifically addressed by the 2001 EU Recommendation on Integrated Coastal Zone Management (ICZM). The Recommendation provides the policy integration platform on which to base other European directives relevant to the coast, in particular the Water Framework Directive, the Birds and Habitats Directives and Environmental Impact Assessment Directive.

The formation and practical implementation of national legislation and policy will be influenced by national priorities and in terms of coastal management, the incidence and severity of natural hazard events. A review of national policy in a number of EU Member States has revealed many examples of good practice, including; UK planning guidance which ensures that natural hazards such as instability are considered; and the compensatory system provided by the French Law Barnier for people living in high risk areas. The report also reveals wide variation in regional policy and implementation of hazard management frameworks. For example, in Italy the regional governments have significant responsibility for issues such as natural hazard management. In Regione Marche, the extent of hazard events such as instability means that such issues are a priority for the region. In view of this, Regione Marche has prepared a comprehensive coastal zone management plan and developed advanced hazard mapping techniques.

The review of administrative frameworks for natural hazard management has demonstrated that at international, European, national and regional levels, an integrated and multidisciplinary approach to management is imperative, including planners, engineers and decision-makers. It is also crucial that decisions and strategies should be based on a sound knowledge and understanding of the geological and geomorphological information. The RESPONSE Project Training Pack details a transferable approach to assign and prioritise coastal hazard and risk at a regional scale. The methodology demonstrates the process of data collection and interrogation and illustrates how this information can be transferred into planning guidance.

FOR THE FULL REPORT 'A REVIEW OF LEGISLATION, POLICY AND GOOD PRACTICE FOR MANAGING NATURAL HAZARDS WITHIN COASTAL ZONES' AND THE ACCOMPANYING MATRIX, SEE SECTION 5 OF THE CD-ROM.
RESOURCES ON THE ACCOMPANYING CD-ROM

This publication draws upon the experience of the RESPONSE Project team, gained over many years and specifically over the lifetime of this study. In addition to the work presented in this Training Pack and the accompanying Good Practice Guide, the Project has undertaken a great deal of investigation into coastal risk management and the likely impacts of climate change on natural hazards at the coast.

The CD-Rom presents a vast resource of information and background reports produced as part of the RESPONSE Project, including documents prepared by the Study Areas. The RESPONSE project methodology was developed and tested in five regional case Study Areas and each of these areas has prepared a comprehensive report which includes the full sequence of coastal evolution and risk maps for each Study Area.

Full contents list of the CD-Rom

1) Summary Leaflet - downloadable pdf file
2) Report - Full Methodology for the Development of Coastal Evolution and Risks Maps
3) Case Studies - The experiences of the five European Coastal Study Areas and their full sets of coastal evolution and risk maps
   a. Southern Central England, UK
   b. Regione Marche, Italy
   c. Languedoc-Roussillon, France
   d. Aquitaine, France
   e. North Yorkshire, UK
4) Report - A Call For Action: The Economic Impacts of Natural Hazards and Risks in Coastal Zones, Taking Account of the Consequences of Climate Change
5) Report - Practical Application of the RESPONSE Methodology: A Review of Legislation, Policy and Good Practice for Managing Natural Hazards (coastal erosion, instability and flooding) within Coastal Zones
6) Report - Evolving Coastlines: Coastal Processes and Climate Change Predictions in the Coastal Study Areas
7) Report - Evolving Coastlines: The Vulnerability and Adaptive Capacity of Coastal Settlements

Please note: all reports on the CD-Rom are available in English only.
THE FILM ON THE ACCOMPANYING DVD

The RESPONSE DVD is a fifteen minute film exploring the issues facing Europe’s coastal communities and introducing the aims and results of the European RESPONSE Project including the innovative methodology that may be used to map coastal evolution and risk.

It provides an introduction to the likely impacts of climate change at the coast, and explains the potential for coastal hazards such as erosion, flooding and landsliding to increase. As such hazard events become more frequent and severe; responsible authorities must find a way to manage the increasing levels of risk being faced by coastal communities and the associated economic and social costs.

The DVD is tri-lingual, with commentary provided in English, Italian and French. It was filmed at locations in the UK, Italy and France. Locations featured in the film include:

Plate 44: Landsliding at Blackgang, Isle of Wight, UK
Plate 45: The impacts of rising sea levels in Venice, Italy

RESPONSE DVD: Target Audience
The RESPONSE DVD is appropriate for both technical and non-technical audiences. The film provides a concise introduction to the issues of coastal risk management and climate change and the RESPONSE Project. It may be a useful resource for the following audiences:

- Local and regional authority officers;
- Politicians and decision-makers;
- Engineers;
- Planners;
- Other interested stakeholders.

This 'Training Pack' and the accompanying 'Good Practice Guide' provide further advice for managing the coastal risks arising from climate change in coastal zones.
IDENTIFYING AND REDUCING FUTURE COASTAL RISK

IDENTIFYING FUTURE COASTAL RISK
This Training Pack and the accompanying CD-Rom and DVD have presented an innovative methodology for identifying and mapping coastal evolution and risks in regional study areas. The maps provide a generic overview of the coastline in terms of current and future hazard and risk allowing ‘hotspots’ of future hazard activity to be identified. The regional approach can be used by planners, engineers, coastal managers and decision-makers to plan for the future and prioritise resources accordingly.

An evaluation of the likely costs associated with increasing coastal hazards in a changing climate promotes a precautionary approach to coastal risk management. By preparing for the impacts of climate change at the coast and implementing strategies of adaptation, future risk to coastal communities may be reduced. However, in order to effectively implement sustainable strategies for the future, it is necessary to have political support and appropriate legal frameworks in place.

This Training Pack demonstrates an approach to allow users to identify areas of high risk at the coast, in view of the impacts of climate change.

REDUCING FUTURE COASTAL RISK
For advice on how to manage and reduce coastal risks, see the accompanying publication ‘Responding to the Risks from Climate Change in Coastal Zones: A Good Practice Guide’.

The Good Practice Guide provides advice and guidance on sustainable coastal risk management for local and regional authorities responsible for managing natural hazards at the coast. The publication describes the physical processes of coastal change and considers the influence of human settlements and coastal defence structures. It includes an account of the nature and scale of coastal risks and current frameworks for monitoring, assessing and managing of coastal risks. The guide highlights state-of-the-art examples of good practice in risk reduction from around Europe.

The Good Practice Guide considers the impacts of climate change and provides advice on integrating coastal risk mapping into the planning system, through the use of planning policy guidance. A further topic that is addressed is the issue of engaging the local community in risk management and promoting a co-ordinated response to coastal risks.
CONCLUSIONS AND RECOMMENDATIONS

- Coastal risks are increasing significantly in some regions as a result of the impacts of climate change. The results of this study should assist decision-makers in addressing the subject of coastal risks due to the impacts of climate change, at a regional-scale;
- Increasing pressure for expansion of development into areas at risk or marginal risk will exacerbate coastal management problems, particularly in the context of climate change;
- A certain amount of future climate change is now inevitable in response to the effects of anthropogenic influences in recent decades. Sustainable coastal risk management measures should involve understanding and working with natural coastal processes wherever possible and promoting adaptation to coastal and climate change;
- Coastal erosion, landslide and flood risks must be taken fully into account to aid sustainable land-use planning and management. Governments are urged to prepare and maintain up-to-date planning policy guidance documents for coastal hazards and risks;
- The greatest possible use should be made of field data, historical records, palaeoenvironmental and archaeological data to improve our understanding of coastal change without placing undue reliance on theoretical modelling techniques;
- Successful implementation of risk management strategies must involve the local community and stakeholders. As the impacts of climate change affect vulnerable communities around Europe’s coast, difficult decisions must be made, for example the decision to stop defending certain coastal settlements. Communicating difficult decisions to the public is an issue already being faced by many local and regional authorities. Further research and advice for such authorities would be extremely valuable for an increasing number of cases around Europe;
- The most successful risk management strategies have been those implemented with strong support from local politicians. This support is aided by the preparation and publication of well-illustrated informative guidance aimed at the educated layman;
- The RESPONSE Project illustrates a regional-scale qualitative approach to coastal risk management in the context of climate change, together with a number of examples of good practice. Further research would be beneficial in terms of assessing the components of risk in a quantitative way.
Mapping Coastal Risks in a Changing Climate

A Training Pack

www.coastalwight.gov.uk/response