THESEUS: Innovative technologies for safer European coasts in a changing climate

SCIENCE POLICY BRIEF 1

EC Flood Directive 2007/60/EC
Preliminary Flood Risk Assessment (Article 4; Article 14)

Project THESEUS

Promotion of "healthy" coasts for both development and the natural environment taking into consideration governance structures, natural responses to coastal processes and perceptions of flood risk. Development of an integrated methodology for risk assessment of coastal flooding and erosion taking into account the changing climate and integrating the best technical and adaptive capacity in coastal management in a strategic framework; including response strategies and application.

Policy focus

Contribution to consolidated methodologies for risk assessment with analysis of drivers and impacts of changing flood risk and uncertainties in coastal processes.

Purpose of this policy brief

The EC Flood Directive aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. This policy brief is a contribution towards Chapter 2, Article 4 of the Directive which requires Member States to carry out an initial preliminary assessment of the flood system based on existing knowledge to assess potential risks. This requires:

- The choice of a conceptual model and development of a methodology which allows assessment of risk to be undertaken
- Consideration of topography, defences, existing and potential future water sources, hydrological and geomorphological characteristics
- Consideration of the social and ecological aspects of the coastal flood system in addition to the physical characteristics above
- Collating and use of available or readily derivable information
- Consideration of the historical occurrence of floods

This brief describes how the THESEUS project has addressed these issues to achieve a more comprehensive understanding of the coastal flood system.

Key policy milestones requiring technical / scientific support:

Based on available or readily derivable information, such as records and studies on long term developments, in particular the impacts of climate change on the occurrence of floods, a preliminary flood risk assessment shall be undertaken to provide an assessment of potential risks.
Preliminary flood assessment is due by 22 December 2011 (FD Article 4.2), updated by 22 December 2018 and every 6 years thereafter (FD Article 14.1).

Relevant THESEUS outputs and key findings

THESEUS key findings are based on the activities carried out in 8 representative case study sites around Europe: Varna spit (Bulgaria), Vistula delta plain (Poland), Elbe estuary (Germany), Scheldt estuary (Belgium/Netherlands), South Devon (UK), Gironde estuary (France), Santander spit (Spain) and Po Delta coastal plain (Italy).

Climate change is expected to result in sea-level rise and more severe storms. Based on THESEUS experience in the case study sites, the policy approach to the consequences due to these issues is not uniform across Europe. In some cases the option for responding reactively (wait for the flood) is selected, whereas in others policies are formulated in a more proactive way, including incorporating sea-level rise in the design of the flood defences. This difference in attitude is often related to:

- uncertainty or ignorance concerning current rates of sea-level change;
- limited funds, especially prior to disasters;
- differences in planning time horizons. The longer the time horizon considered, the more relevant are change factors such as sea-level rise to design.

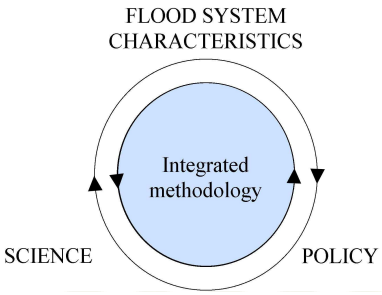

Figure 1.

Despite these differences, the development of flood risk assessments all require the consideration of the same factors. This includes consideration of the physical, social and ecological aspects of the flood system as these are strongly interlinked (see Figure 1) and can all affect the consequences of a flood event. The THESEUS project has adopted the Source-Pathway-Receptor-Consequence (SPRC) conceptual model which is capable of incorporating these influences along with the potential consequences of both climate change and engineering management techniques on the flood system.

Key findings which appeared across the sites were:

- A holistic approach taking account of physical, ecological and human factors provides a more comprehensive understanding of flood risk including the options for mitigation. The SPRC conceptual model provides a useful basis for structuring existing knowledge and understanding into a framework which can be utilised within preliminary flood risk assessment and then management planning.
- Any assessment should start with establishing a comprehensive understanding of the current flood system in regard to flood risk management. This is particularly true when multiple agencies are involved in both decision-making and funding. The undertaking of this process helps in the development of linkages between the various institutions and clarifies the current governance structure especially where decision-making responsibilities lie.
- The existing flood policies reflect the importance of flood risk relative to other risksand flood history.
- Climate change is a relatively new factor driving concern. The way it is included in the flood policy differs essentially, ranging from neglect (“first see, then belief”) to full incorporation (including the design and construction).
- The perception of risk may be different between the flood managers and those who might be affected. This may affect future management decisions.
- Determining social vulnerability to flood risk is not a straightforward activity, as:

- It is highly context-specific;
- There is no single variable, which explains the vulnerability of specific social groups coherently and for all of the disaster phases;
- Preparedness, risk awareness, capacity to receive help during the event and flood impact can all influence degrees of vulnerability.

- Mapping the existing flood system based on the coastal geomorphology, current land-use and natural habitats allows the inter-connectivity of the flood system to be determined. The effects of internal or external change on the flood system can then be assessed.
- It is widely recognised that flood risk management can be achieved by a combination of:
  - Reducing the probability of a flooding event (via soft or hard defences)
  - Reducing the impacts of flooding (via building construction for flood resilience)
  - Avoiding flooding (via focusing development outside the floodplain in planning policy)
  - Evacuation and 'preparedness' planning

In situations where the flood risk is considered dominant in the risk domain (like the Scheldt and Elbe estuaries), there is a strong tendency to focus on the reduction of the probability of flooding using coastal defences and nourishment schemes. Here, consideration of alternative approaches is not widespread. In situations where the flood risk is considered as one of the many risks, like Varna coast, Gironde and Exe to Sound estuaries, a more balancing approach between these flood reduction options can be observed.

Recommendations to policy makers – Next steps

Although the variety of coastal sites along the European coast is enormous, the experience from this project indicates that the following should be recognised in order to achieve a robust preliminary assessment:

1. The societal/ecological aspects of the flood system are as important as the hydrological aspects; these should be given equal prominence in any assessment.
2. A conceptual model which incorporates the flood system and its influences as a whole should be utilised; this will allow for a wide range of management options to be considered (e.g. spatial planning, novel engineering techniques, natural habitats and processes) and allows the identification of areas where further, or more detailed, investigations are required.
3. An initial conceptual mapping of the flood system with its internal and external linkages can help promote communication and understanding of flood risk, especially when considering climate change influences.
4. Establishing flood hazard and risk maps of the current situation is essential, as these provide a benchmark against which future risk levels can be assessed.
5. To assist in short-term decision-making, long-term flood risk assessments should be prepared to identify potential impacts.
6. A network/group of all those with responsibilities in the flood prone area should be established and regular contact maintained; it has to be clearly identified where responsibilities lie within the group; differences in flood risk understanding and perception should be determined and taken into consideration when making management decisions.

Outlook - Accessibility of results

Project document repository: **www.theseusproject.eu**

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Further information on the THESEUS project

Starting/Ending date of project:
December 2009 – November 2013

Coordinator:
Dr Barbara Zanuttigh, University of Bologna

EC Contribution: 6'530'000 €

Type of R&D:
Large Collaborative Integrated Project

PROGRAMME: FP7 Environment (including Climate Change), ENV2009-1

Web-Link: www.theseusproject.eu

Additional technical / scientific information:
OD1.7 Report on consolidated methodologies for the assessment of coastal vulnerability and resilience to erosion and floods

Related projects / activities:
- MICORE (2011): www.micore.eu
- FLOODSITE (2009): www.floodsite.net

Participating countries/institutes:

IT	UniBo	Alma Mater Studiorum - Università di Bologna
ES	UC	Universidad de Cantabria
UK	UOP	University of Plymouth
DK	AAU	Aalborg Universitet
NL	INFRAM	INFRAM International BV
DE	GKSS	GKSS - Forschungszentrum Geesthacht GMBH
UK	SOTON	University of Southampton
FR	UVSQ	Université de Versailles St-Quentin-en-Yvelines
FR	CETMEF	Centre d'Etudes Techniques Maritimes Et Fluviale
UK	MU	Middlesex University Higher Education Corporation
PL	IMGW	Instytut Meteorologii I Gospodarki Wodnej
BG	IO-BAS	Institute of Oceanology - Bulgarian Academy Of Sciences
GR	AUEB-RC	Athens University of Economics and Business - Research Center
NL	KNAW	Koninklijke Nederlandse Akademie Van Wetenschappen
IT	CORILA	Consorzio per la gestione del centro di coordinamento delle attivita di ricerca inerenti il sistema lagunare di Venezia
PL	IBW PAN	Instytut Budownicta Wodnego Polskiej Akademii Nauk
UK	BANGOR	Bangor University
FR	BRGM	Bureau de Recherches Géologiques et Minières
DE	HPA	Hamburg Port Authority
FR	EID	EID- Mediterranée
LV	UL	Latvijas Universitate
IT	ISPRA	Istituto Superiore per la Ricerca e la Protezione Ambientale
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USA	UD	University of Delaware
ME	UNAM	Universidad Nacional Autonoma De Mexico
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TA	NCKU	National Cheng Kung University