

THESEUS: A new wave in coastal protection

Coastal zones are subjected to multiple change factors. Preventing and responding to coastal disasters and enhancing resilience to coastal erosion and flooding needs a holistic, participatory and inter-disciplinary approach where science is embedded in the social, cultural and economic context in which coastal communities live. THESEUS developed such a systematic approach to delivering both a low-risk coast for human use and healthy habitats.

THESEUS final event (<http://www.theseusproject.eu/finalconference>) was held in Brussels on October 18th, 2013. The conference was attended by over a 100 participants, of which a fourth were end users, including coastal managers, decision makers and policy makers.

After presentations, synthesising the most relevant issues addressed by THESEUS, the attendees discussed and interactively ranked in Working Groups the weakest points and the suggested actions for improving three key issues addressed by the THESEUS project:

- Risk assessment
- Risk mitigation
- Science and policy integration

Risk assessment: take a close look at the future

The three most relevant **weak points** identified are

1. **The data for the evaluation of risks are hard to get**

The source data about the basic conditions are often dispersed, and the different owners do not always talk to each other. There is a lack of a common glossary when dealing with risk. At the same time, open access to data which often needs careful interpretation can be a risk in itself. Also stakeholders sometimes have different interests which prevent them from sharing information.

2. **Expert judgment is needed in all stages of Risk Assessment**

Risk assessment requires a multi-disciplinary team to properly assess risks, and such teams are not always available. The judgment of specialists is needed in all stages of the Risk Assessment process, from data collection and model creation all the way to interpretation and use of results.

3. **Estimates of potential damages are subjective and incomplete**

In most cases, detailed information on the economic and social damages occurred during past events are not available, nor information about the corresponding governmental compensation or the way ecosystem services are considered and quantified. Moreover, intangible damages are difficult to be evaluated, and it is also particularly difficult to put weights to the different elements brought into the calculation of risk.

Uncertainty in risk assessment is considered as an inherent characteristic and therefore not as a weak point but a challenge that can be overcome only by means of scenario analysis.

The **suggested actions identified as most relevant** include

1. **Develop a participatory multi-stakeholder approach to risk assessment:**

It will lead to a more objective and more optimal prioritization of the potential damage.

2. **Apply an appropriate multi-scale approach towards risk assessment:**

It takes the economic, ecologic and social phenomena into account, that take place in different scales of space and time.

3. **Publish data sets for risks assessment:**

Define data needs and develop databases to verify existing data and collect missing data. Data should be as uniform as possible; existing environmental agencies at national and EU level may be held responsible for collecting data and maintaining data bases.

It is also suggested:

- to get better at learning from experience in case studies;
- to make wider use of probabilistic approaches;
- to develop indicators and criteria for all risk categories.

Risk mitigation: the costs are higher than the benefits!

The **weak points** that were ranked as most important are

1. **The public is not fully aware of the risk at stake:**

The public does not fully understand the nature and the kind of risks that are at stake. Moreover, risk awareness is a function of the frequency of the floods, so often people are unprepared to face a critical event.

2. **Mixed solutions to maximize cost effectiveness and flexible strategies to adapt to inherent uncertainties are often overlooked:**

The integration of different mitigation options to maximize cost-effectiveness is often not considered and the use of adaptive strategies facing uncertainties in risk assessment is insufficient.

3. **Funding for risk mitigation is not sustainable:**

Much of the funding that exists today for risk mitigation is only temporary, and not integrated into a sound long term policy and governance.

The most significant **suggested actions** to achieve a better risk mitigation strategy are

1. **Combine mitigation options and apply flexible multiple purpose solutions**

Cost effective solutions can be found by combining , for instance, ecological protection measures with tourism or other economic activities.

2. **Include environmental risk in public education programs**

To include environmental hazards and risk in public education programs, so that community resilience can be increased by increasing risk awareness and to understand risk attitudes, so that risk mitigation strategies can be people-centred. Investing in education is often a cost effective measure to increase risk awareness and community resilience. However, the effectiveness of education campaigns should also be monitored.

3. **Build with nature, use 'Green Infrastructures'**

Science-Policy Interface: it can be done!

The **weakest points** are that

1. **Funding is usually focused on short term priorities:**

The funding for coastal protection and coastal research is usually focused on the short term (5-10 years) while the phenomena and needed actions act on a considerably bigger time scale.

2. **Scientists disseminate their message only within the scientific community:**

- Scientists concentrate on publishing for their peers ('publish or perish) and hardly develop specific outputs addressed to coastal managers and decision makers. Much of the research

is organized along scientific disciplines, which makes that results are not yet coherent solutions that can be used by policy.

- The mismatching terms used by scientists and policy makers.
- The time that is sometimes required to policy makers to pick up technological innovations.
- 3. **The unclear ownership of the environmental policy:** “Who is responsible, who pays for what?”

Suggested actions to strength science and policy interface are:

1. **Follow-up on a long term vision on coastal system services at national and EU scale:**
The follow up should not only concern the method, but should focus on the coastal governance as well and to create a common entry (platform, portal) for policy makers regarding the outputs of research projects
2. **Combine research and demonstration activities in coastal management**
Combining research and demonstration in projects on coastal management is vital for developing coherent solutions and demonstrating impact. However, care should be taken to avoid commercial pushing. Projects should include a ‘Pathway towards impact statement’, and demonstration projects may also be funded as separate entities.
3. **Apply a multi-stakeholder approach to risk governance**
The governance of risk is not a technical exercise anymore. It must be done with the support and expertise of the stakeholders in the area to update risk assessment on a regular basis. In this way, a more clear definition of responsibility and communication flow is supported.

Sustainable coasts: Innovations and recommendations from THESEUS:

- *Technical innovation and best practices in coastal engineering*
THESEUS studied the resistance of grass covered sea dikes, as well as methods for upgrading conventional rubble mound coastal structures, the use of artificial reefs as a wave dampening structure, and best practice for beach nourishment. THESEUS also systematically analysed the use of floating wave energy converters for coastal protection purpose.
- *Preserving and enhancing coastal ecosystems*
THESEUS demonstrated how adopting a systems perspective allows the process understanding of habitats to be integrated with coastal engineering and social aspects of flooding to augment and increase the options available to flood risk managers, and be compliant with the Habitats directive.
- *The governance dimension*
THESEUS analysed risk perception in terms of paradigmatic tensions associated with conflicting pertinence, normative and evidence claims. As such, THESEUS allowed for the clear identification of norms as the main source of varying perceptions regarding coastal risks. THESEUS also developed a simplified model of insurance taking explicitly into account spill-over effects, which has allowed for a rethinking of the issues of scales and linkages, beyond the private/public dichotomy.
- *Decision making for a sustainable coast*
THESEUS developed a powerful tool to help decision makers in defining optimal strategies to minimize risk in the short, medium and long-term scenarios. The resulting software reproduces in a simplified way the most relevant physical processes (coastal erosion and flooding) induced by waves and sea-levels taking into account physical and non-physical drivers, such as climate change, subsidence, population growth and economic development.

Conclusions

This summary highlights the most relevant burning issues in view of i) the EU Floods Directive, ii) the EU Habitats Directive, iii) the recently adopted EU Climate Change Adaptation Strategy, iv) the 5th IPCC assessment report and v) the upcoming Horizon2020 Framework programme, with specific focus on Security, Disaster Resilience & Climate Change topics.

The project findings have been synthesized in many products, among which the following specifically address some of the weak points identified by the working groups (follow up the delivery and update of these products through the project webpage: www.theseusproject.eu).

Policy briefs	Strengthen science and policy interface
Informative booklets on coastal risks	Increase risk awareness
THESEUS Decision Support System	Support sustainable defence planning strategies
Coasts@Risk, Coastal Engineering Special Issue, to be published by Elsevier in 2014	Scientific dissemination to boost long term interdisciplinary approaches to risk management
Coastal risk assessment and mitigation in a changing climate, Elsevier, to be published in 2014	Provide coastal managers with scientific innovation and propose cost-effective portfolios of mitigation measures