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HRPP 306

Flood Risk Analysis and Management – Achieving Benefits from Research

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Reproduced from a paper presented at the
European Conference on Floods
Vienna
17-18 May 2006



FLOOD RISK ANALYSIS AND MANAGEMENT – ACHIEVING BENEFITS FROM RESEARCH

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Summary

This short paper considers two examples of potentially deriving greater benefit from expenditure on research on flood risk management. Both examples come from current EU funded projects in the Sixth Framework Programme. The FLOODsite Integrated Project is undertaking research into integrated flood risk analysis and management methodologies. The EC project stops short of implementation and uptake into practice of the research outputs, which are critical to deriving lasting public benefit from the advances in knowledge and understanding created in the project. The FLOODsite team has recognised this and has produced a Communication and Dissemination Plan to guide better the transfer of the research to end-users. In addition, the Coordinator has established close links with stakeholders as part of a planned integration of the research into national practice in the UK. The second example project is the Coordination Action **CRUE** which forms part of the ERA-NET programme. **CRUE** approaches the delivery of greater benefit from research expenditure from a different perspective, the closer collaboration and cooperation between the national funding programmes for research. This has already led to a common call for research funded from several Member States' national programmes. The expected outcome of the activities on the process of research commissioning and management and dissemination of the research outputs should bring long-lasting benefits to all the Partners in the ERA-NET. The ultimate goal of **CRUE** is to establish an enduring programme of research collaboration and integration beyond the network funding.

1. Introduction to the FLOODsite project

The Integrated Project FLOODsite is the largest ever EC research action on flood risk management, with an EC “grant to the budget” of nearly €10 Million. The project, which started in 2004, is scheduled to take 5 years to complete, and involves approximately 150 researchers from 13 countries. HR Wallingford leads the project consortium of 36 partners which includes many of Europe's leading institutes and universities and the project involves managers, researchers and practitioners from a range of government, commercial and research organisations, specialising in aspects of flood risk management.

FLOODsite is interdisciplinary, integrating expertise from across the physical, environmental and social sciences, as well as

spatial planning and management. There are 35 project tasks including the pilot applications in Belgium, the Czech Republic, France, Germany, Hungary, Italy, the Netherlands, Spain and the UK. FLOODsite covers the physical, environmental, ecological and socio-economic aspects of floods from rivers, estuaries and the sea. The project will deliver:

- An integrated, European, methodology for flood risk analysis and management
- Consistency of approach to the causes, impacts and control of flooding from rivers, estuaries and the sea
- Techniques and knowledge to support integrated flood risk management in practice
- Dissemination of this knowledge including the development of training media

- Networking and integration with other EC national and international research.

The FLOODsite Management Team has set out a vision for the project as:

- The results of our research will make a difference to the way flood risks are managed within member states of the EU and more broadly
- The partners will work together to support implementation of the research results in practice
- Implementation of the research results will ultimately benefit the citizens of Europe, through a reduction in flood risk and an improvement in resilience in the face of flooding
- The team will produce peer-reviewed scientific publications from their research.

The progress of the project is monitored by three “Boards”,

- The Scientific and Technical Advisory Board considers the scientific quality of the project and publication of the results,
- The Application and Implementation Board advises on the implementation of the project science in practice and
- The Project Board overviews the whole project.

These boards provide advice to the FLOODsite Management Team, but have no responsibility for the financial or contractual approval, which rest with the client, DG Research.

2. FLOODsite objectives and the proposal for an EU Directive

Recently a proposal for a Directive on the assessment and management of floods¹ has been published by the *Commission*, which makes specific reference to FLOODsite as

¹ Commission for the European Communities: “Proposal for a Directive of the European Parliament and of the Council on the assessment and management of floods” COM(2006) 15 final: Brussels, 18 January 2006

relevant research for the Directive. The proposed Directive aims at the reduction of flood-related risks to human health, the environment and economic activity. It applies to the whole Community territory, and therefore to flood risk management in both rivers and coastal areas. The explanatory notes to the proposed directive refer to existing European actions including the Integrated Project FLOODsite and the Coordination Action CRUE, both of which are funded from DG Research.

The objectives the main Themes of research, as given below, show that FLOODsite is directly relevant to the implementation of the proposed Directive.

Theme 1 - Risk analysis: Scientific knowledge and understanding (Tasks 1 to 11)

- To improve understanding of the primary drivers of flood risk (waves, surges, river flow etc.) through research on the issues and processes that contribute most to current uncertainty in flood risk management decisions.
- To improve understanding, models and techniques for the analysis of the performance of the whole flood defence system and its diverse components, including natural and man-made defences (e.g. seawalls, embankments, dunes) and the extent of inundation.
- To understand the vulnerability and sensitivity of the receptors of risk and to improve and harmonise the methods to evaluate societal consequences and to estimate flood event damages

Theme 2 – Innovative mitigation and sustainable flood risk management (Tasks 12 to 17)

- To evaluate flood risk management measures and instruments after the event (ex-post) and to develop sustainable flood risk management strategies and evaluate these prior to implementation (ex-ante) under consideration of a wide range of different physical and societal conditions.
- To improve flood risk mitigation measures that are applied during the

flood event, through improved technology for flood warning in small flash-flood catchments and through measures for emergency evacuation.

Theme 3 – Frameworks for technological integration (Tasks 18 to 20)

- To integrate the scientific, technological and procedural advances to support long term flood risk management decisions.
- To integrate the scientific, technological and procedural advances to support flood event management decisions.
- To develop a framework for the identification and quantification of the influence of uncertainty in the process of flood risk management.

Theme 4 – Pilot application sites (Tasks 21 to 27)

- To provide real sites with real and specific problems upon which tools, techniques and decision support systems may be developed and tested.
- To provide feedback into the research and development process from flood risk managers and river, estuary and coastal stakeholders.
- To ensure the FLOODsite deliverables are of real value, practicable and usable.

Theme 5 – Training activities (Tasks 28 to 31)

- To provide a series of Best Practice Guidance based upon the research outcomes
- To disseminate, and support transfer of knowledge to the stakeholder communities
- To provide public educational tools (web-based)

It is planned that the new Directive should be aligned appropriately with the Water Framework Directive. It sets out the need for assessments, maps and plans that cover the river basin district including the borders of the river basins, sub-basins and associated coastal zones through preliminary flood risk assessment; flood risk maps, and, flood risk management plans. The knowledge from FLOODsite will support the preparation of these assessments, maps and plans through

the results of several of the Tasks². Whilst recognising that the proposal for the Directive has yet to be approved and the wording may change, the relationship between FLOODsite and the issues raised in the implementation of the Directive (as proposed) are outlined below.

Preliminary flood risk assessment (Articles 4 to 6)

- Likelihood of future floods (Tasks 1 and 2)
 - Tasks 4, 6 and 7 look at the security of flood defences
- Consequences of floods (Tasks 9 to 11)

Flood risk maps (Articles 7 and 8)

- Guidelines on flood hazard mapping (Task 3)
- Flood probability (Tasks 1 & 2) and the related issues:
 - Tasks 4, 6 and 7 look at the security of flood defences
 - Task 20 considers uncertainty
- Projected depths and velocity (Task 8)
- Bank erosion (Task 5)
- Potential damages (Tasks 9 to 11)

Flood risk management plans (Articles 9 to 12).

- The flood risk management cycle (Tasks 12, 13 & 14)
- Preparedness (Tasks 11, 16, 17 & 19)
- Spatial planning and land use (Tasks 12, 13, 14 & 18)
- International rivers (Tasks 21, 22, 23 & 25)

3. Outcomes and benefits of research

FLOODsite will produce a range of outputs, principally listed as the deliverables in the EC contact and scientific publications in Journals and at conferences. At the end of the second project year the research team had produced over 130 publications together with 10 formal deliverables as tabulated below. The intention is that publications and public deliverables will be available from the

² Fuller descriptions of the FLOODsite Tasks are available from the project website www.floodsite.net

project website, either as direct downloads or as links to the project partners' or a publisher's web according to any copyright restrictions.

Table 1 FLOODsite Deliverables achieved in first two years

Deliverable	Description
D1.1	Hill-slope hydrological model for flash flood areas
D9.1	Guidelines for flood damage evaluation
D15.1	Report on Structured Algorithm System
D18.1	Report on the development of a DSS for long-term management planning
D23.1	Report on observational methods in flash flood monitoring
D25.1	Baseline risk analysis for Scheldt Estuary
D28.1	Project communication and dissemination plan
D32.1	Project website operational
D32.2	Language of risk
D32.3	Protocols for data sharing

However, the outcomes of the research are broader than just the contract deliverables, the consequential outcomes, either directly through the project or through the actions of others, include:

- Reputation for academic groups involved through peer-reviewed publication
- Training of young researchers
- Increase in research capability within the member states involved
- Informing the development of policy at national and international level
- Improved flood risk management practice in terms of effectiveness and efficiency
- Increased capability of organisations involved in flood management services and consultancy

Optimising these outcomes will require additional activities outside the work programme set out in the description of work of the research project to transform the project knowledge into changed working practices and procedures.

4. Integrating research into national contexts to deliver benefits in practice

In the preparation of the project, the partners consulted with and obtained support from

several operational and policy-making agencies in their own countries. It was recognised that FLOODsite provides a unique opportunity to share methods and techniques with other European countries, learning from others and thereby providing “added value” to the national finance applied to the project. The commitment of the project team to go beyond the traditional dissemination of research outputs is demonstrated through the work of the FLOODsite Application and Implementation Board (AIB), which has membership drawn from stakeholder organisations in France, Germany, Hungary, Italy, the Netherlands, Spain and the UK. This board considers in particular actions which are needed to ease the transition of knowledge from the research domain into national practice.

Unless others use the project results in their broadest form, there will be little public benefit from the expenditure on the research; however, the implementation and uptake of the research outcomes lie outside the scope of the EC project. Thus it will be essential to take action on uptake and implementation beyond the conclusion of the research phase of the project. By implementation and uptake we mean:

- Uptake is the result of successful dissemination or communication activities, whereby the audience undertakes an evident change in behaviour by incorporating the knowledge they have gained in methods of working, design processes or similar,
- Implementation is an extension of uptake, which transforms a willingness on the part of the audience to undertake a change in behaviour into a formal part of working practices.

In the UK, the Coordinator is working closely with national stakeholders, Defra and the Environment Agency, to facilitate the implementation and uptake of the research results. FLOODsite was conceived whilst the UK Foresight Flooding project was in progress using knowledge of its potential recommendations. FLOODsite adopted the source-pathway-receptor-consequence model of the analysis of flood risk which underlies the national flood risk management practice and FLOODsite also addresses some important areas of research identified by Foresight.

The programme of R&D on Flood and Coastal Erosion Risk Management in England and Wales run by Defra and the Environment Agency now supports FLOODsite through a parallel contract with HR Wallingford. The national support complements the EC grant funding and the stretches beyond the completion of the EC funding to ensure take-up of the research into practice. The involvement of the Agency in the research opens up a clear path and responsibility for uptake of the results into practice. The case for national support included a “benefits plan” which identifies the benefits which will accrue to the Environment Agency and the public from the research and identifies “owners” responsible those benefits. The benefits may arise as improved productivity, cost avoidance, risk reduction and service improvement through better targetting of expenditure on maintenance of flood defence assets and the development of policy options for sustainable flood risk management over a generational timeframe. Measuring the benefits will

require the collection of the appropriate data. The delivery of the benefits will be monitored and managed initially through the national research programme themes, with a separate benefits plan for each of the four themes involved; the benefit plans will be kept under active review during the research.

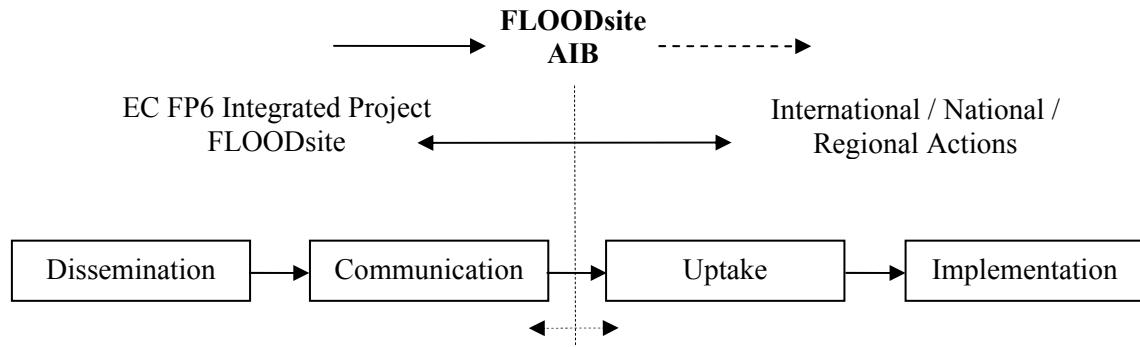
5. Communication and dissemination of the research results

A clear plan for communication and dissemination is essential to maximise uptake and eventual implementation of the FLOODsite project work and so it is important to note the broader context in which communication and dissemination are placed. The project has set out a plan for communication and dissemination of the research results, which was developed in partnership with representatives of UK and Dutch stakeholders and in consultation more broadly with the AIB members. The plan builds on the principles of Leggett and Elliott (2002)³ developed for improving the implementation and adoption of R&D results in the UK. The purpose of the Communication and Dissemination Plan is:

- To set out the vision, principles and philosophy for communication and dissemination from the FLOODsite project.
- To identify actions that will form part of the co-ordinated communication and dissemination activities for the project, recognising that these actions will be scoped and co-ordinated more fully as the project progresses.
- To provide guidance to Task Leaders regarding how actions should be planned and undertaken.

Four stages can be used to illustrate the process of dissemination through to implementation, as illustrated below.

³ Leggett D & Elliott C (2002), Improving the Implementation and Adoption of Flood and Coastal Defence R&D Results, Technical Report W5G-003/TR, Environment Agency R&D Dissemination Centre, c/o WRc, Frankland Road, Swindon, SN5 8YF, UK



The Communication and Dissemination Plan has identified seven main stakeholder groups with whom the project partners must interact:

- The Research Team (FLOODsite)
- The broader Flood Risk Management (FRM) Research Community
- FRM Professionals (including regulators and operators, emergency planners and services)
- The Academic Community, which differs from the FRM Research Community in its (additional) focus on teaching and training
- Policy makers, who set regulatory, legislative and other decision taking frameworks (and are separate from the FRM professionals who work within these frameworks); Policy makers are likely to be national, regional and local government authorities
- Local Groups (including Non-governmental Organisations (NGOs), community groups, etc.)
- General Public, with special attention for the next generation of potential scientists.

There are also seven main types of communication and dissemination activity: technical reports and guidance, journals and papers, conferences, websites and email, pilot studies, teaching material and courses, and, public media (including TV, radio, newspapers, exhibitions, road shows, etc.). The overall plan contains identified actions covering these activities, so that the resources for communication and dissemination within the project can be directed in the most effective manner.

6. Coordination of research on flood risk in the ERA-NET CRUE

Public funding of research to support flood risk management is undertaken in many EU Member States, with the level of funding depending upon the importance of flood security for the national or regional economy and the toleration of flood risk by the public. Within a particular member state there are often several parties involved in flood research and the exact resource expended on this research at a European scale is unknown but probably exceeds €30 Million per annum. There are no known, formal, international coordination actions for flood research within the nationally funded programmes. This leads to potential duplication of research effort and difficulty in deriving the full benefits of investment in research and development within Europe.

The ERA-NET scheme within the EC Sixth Framework Programme (FP6) seeks bring more structure to the European Research Area through a series of coordination actions that bring together the funders of research programmes at national and regional level. One of these Coordination Actions is CRUE –“Coordination de la Recherche sur la gestion des inondations financée dans l’Union Européenne” (Coordination of research financed in the European Union on flood risk management), which is coordinated from the UK Department for Environment, Food and Rural Affairs (Defra). The vision for CRUE is to develop strategic integration of research at the national funding and policy development levels within Europe to provide knowledge and understanding for the sustainable

management of flooding risks at the river basin and coastal process cell scale.

In the context of the EC funded research, there appears to have been no formal link between all the flood risk issues funded within different parts of the EC work programme, apart from clustering activities on specific topics in FP4 and FP5 such as RIBAMOD, RIPARIUS, MITCH and ACTIF. Apart from this, there is an informal intergovernmental group of North Sea Coastal Managers (NSCMG) who meet to discuss issues of common interest including coastal flooding research. Transnational cooperation for the major international rivers in Europe is undertaken by standing commissions such as the International

Commission for the Protection of the Rhine (IKSR), which may include exchange of research information. The lack of information on the scale of the research sector and the fragmentation of the European Research Area on this topic and was a justification for undertaking the FP6 Coordination Action, **CRUE**.

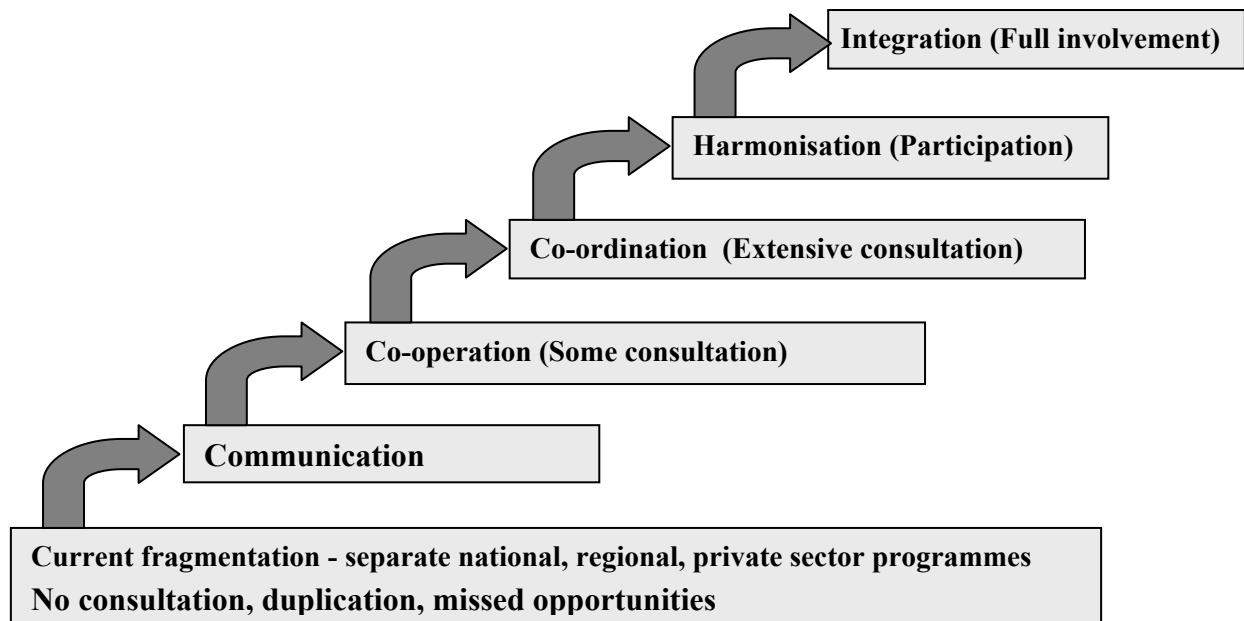
CRUE involves research funders from across Europe: Austria, England & Wales, Finland, France, Germany, Italy, the Netherlands, Poland, Scotland and Spain. The project commenced in November 2004 with a duration of 4 years. The project has eight work packages as tabulated below.

Table 2 The CRUE Work packages

Number	Title
WP1	Network management and coordination
WP2	Inter-comparison of national research programmes
WP3	Identification of good practice on programme identification and management
WP4	Dissemination methods for current national research results
WP 5	Identification of opportunities and gaps in research
WP6	Pilot common calls for research
WP7	Development and promotion of a European research agenda for flood risk mitigation
WP8	Network development

The **CRUE** ERA-NET will introduce structure within this area of European research through an inter-comparison of the process of research programme formulation, implementation and management. This will lead to the consolidation and promotion of best practice and the identification of gaps and opportunities for international collaboration on future programme content. **CRUE** will also address the pressing need to improve the dissemination of existing research results to derive public benefit from past investment in the generation of

knowledge and understanding. To advance the process of better European cooperation between research activities carried out at national or regional level; the ERA-NET scheme has a progressive approach. **CRUE** contains an evolving set of activities, starting with increasing mutual knowledge through information exchange among policy makers and managers of similar scientific areas, and expected to lead step-wise to stronger forms of cooperation and coordination as illustrated below.



An early action in **CRUE** has been to develop a searchable database of research programmes and projects on flood risk management to support the later phases of the project. The Partners have already launched the first of two joint calls for research as a practical demonstration of collaboration. The ultimate goal of **CRUE** is to establish an enduring programme of research collaboration and integration beyond the network funding. Thus as an output it is intended to develop an integrated programme of transnational research activities with a common strategy, a joint work programme, common calls for proposals, a common multinational evaluation and a common plan for dissemination of results or experiences.

7. Discussion and Conclusions

Flood management in Europe is in a process of change. In May 2005, a major international conference was held on flood management at Nijmegen⁴: the Third international Symposium on Flood Defence, (see also www.isfd3.nl). This drew an audience of over 300 researchers, experts and professionals engaged in flood management worldwide. The move from flood protection

and defence to integrated flood risk management and “making room for rivers” was evident in many national contexts and in the policy of the EU as presented by DG Environment. This change has been brought about by the coincidence of development of the science of flood risk management and the urgency to take action following significant flooding in many countries which are acting as catalysts for change.

This change in philosophy is at the heart of the FLOODsite objectives and research plan. The project partners have been exploring the proper system representation and societal understanding of flood risk management as the context within which the scientific and technological research advances will be implemented. Thus the FLOODsite project research is leading the international state-of-the-art. FLOODsite is an ambitious project which will maintain the world-leading leading position of Europe in knowledge and practice for flood risk management. The pilot studies draw together the development and testing of the project knowledge and will provide feedback from flood risk managers and river, estuary and coastal stakeholders. The use of the pilot sites and collaboration with executive agencies in several countries will ensure that FLOODsite deliverables are of real value, practicable and usable. It is recognised that to derive full benefit from the

⁴ Van Alphen J, van Beek E & Taal M Eds. (2006), *Floods, from Defence to Management*, Symposium Proceedings, Taylor & Francis, ISBN 0415391199

advances in knowledge and understanding, specific action will be necessary to integrate the relevant project results into policy and practice within the flood risk management community in each Member State. In the UK, the national support funding to FLOODsite is designed to ensure effective implementation and uptake of the research results and ultimately this will need the involvement of all professionals in the flood risk management community.

Greater benefit from research expenditure can also come from improved integration and cooperation between the research programmes and projects funded at a national level. Indeed the research resource available nationally far exceeds that centrally from DG Research. **CRUE** is exploring how to overcome the real difficulties in building a programme based upon common interest topics across groups of countries. Cooperation between national funders in promoting a common agenda and programme of research will provide further opportunities for research teams and partnerships established under the EC Framework Programme instruments to be engaged together on research beyond the EC funding. It is expected that the successful completion of **CRUE** will have long-lasting influence on

the national research programmes of flooding of most or all of the Partners involved.

The advances made within both FLOODsite and **CRUE** will underpin and support the implementation of the assessments and plans envisaged under the proposed Directive on flood risk management.

8. Acknowledgements

The work described in this publication was supported by the European Community's Sixth Framework Programme through the grant to the budget of the Integrated Project FLOODsite, Contract GOCE-CT-2004-505420 and also the Environment Agency Contract SC0500052 with HR Wallingford. This paper reflects the authors' views and not those of the European Community, Defra or the Environment Agency. The Coordination Action **CRUE**, Contract ERAC-CT-2004-515742, is funded from the Sixth Framework Programme Priority ERA-NET: support for the co-ordination of national, regional and European activities in the field of research and innovation.

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