Sediment research needs

The aim of this paper is to indicate sediment management knowledge gaps related to the Water Framework Directive implementation challenges and, based on that, to propose a way forward to bridge these gaps through EC FP7 research activities. This paper is prepared by the European Sediment Network (SedNet).

SedNet

SedNet started in 2002 as a Thematic Network with funding from the European Commission DG-Research under the 5th RTD Framework Programme. It was aimed at setting up a European network in the field of 'assessment of fate and impact of contaminants in sediment and dredged material and at sustainable solutions for their management and treatment'.

Since 2005 SedNet has run independently from the EC. It brings together experts from science, administration and industry. It interacts with the various networks in Europe that operate at the national or international level and that focus on specific fields such as science, policy making, sediment management, industry and education.

SedNet is now the European network aimed at incorporating sediment issues and knowledge into European strategies to support the achievement of a good environmental status and to develop new tools for sediment management. The focus is on all sediment quality and quantity issues on a river basin scale, ranging from freshwater to estuarine and marine sediments. More information can be found on www.SedNet.org.

Sediment

Sediment is an essential, integral and dynamic part of our river basins. Where human activities interfere with sediment quantity or quality, sediment management becomes necessary. One of SedNet's main recommendations is to integrate sustainable sediment management into the European Water Framework Directive (WFD) related policy, legislation, and implementation process. This is to achieve good ecological status, or potential, and at the same time to support the well being of the European economy.

WFD challenges

Worldwide, river basins are under pressure from human activities that affect their chemical and ecological status and deplete available soil-sediment-water resources. The wide range of economic activities and the hydrological complexity of many river basins, both in terms of the functioning of the sediment-soil-water system and of the links between water quality, quantity and economic activities, make the integrated management of river basins difficult and challenging.

In Europe pollution from agriculture, together with morphological pressures (the physical alteration of the channel for water supplies, hydroelectricity and flood control) are seen as the two main issues endangering the achievement of good ecological status of European river basins[1]. Impairment of water quality through remobilisation of (historic)

[1] Menedez M., De Rooy M., Broseliske G., Mol S. 2006. Key Issues and Research Needs under the Water Framework Directive – Final Document, comprising Phase 1 and Phase 2, December 2005. Issue date: 26/01/2006.

contaminants and the degradation of habitats through changes in sediment transport are further challenges for the objectives of the WFD, which are closely connected to morphological pressures and river dynamics.

Uncertainties

When facing the above – also sediment related - challenges, river basin managers are uncertain about:

- The combined impact of the above issues;
- Changes in socio-economic driving forces and resulting pressures;
- Effects of climate change; and the
- Effectiveness of measures aimed at improving the ecological status.

The 7th EC RTD Framework Programme (FP7) may provide an excellent opportunity to call for project proposals aimed to help to reduce some of these uncertainties.

System understanding

In general uncertainty can be reduced by improving of our understanding of the functioning of the biophysical 'sediment-water-soil' system (Drivers > Pressures > State > Impact pathway understanding) as well as of the 'societal system' (evaluating the DPSI understanding as a base for 'society' to define Response measures). Effective management combines the understanding of both the biophysical and the societal system.

However, this DPSIR framework can prove to be too difficult to communicate to river basin managers and other stakeholders[2]. Hence a more understandable and thus communicable framework is desirable. The EC FP6 project RISKBASE (www.riskbase.info) made a first attempt to develop such a framework (figure 1).

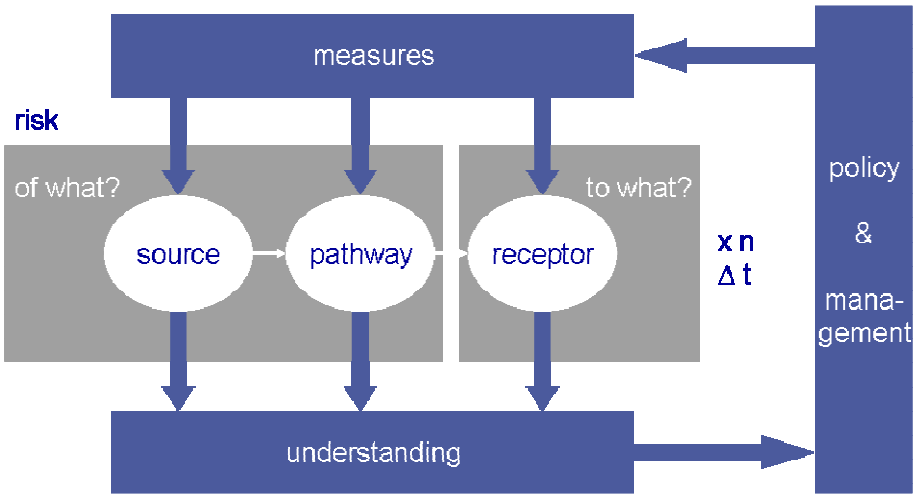

Figure 1. A **DRAFT** conceptual framework for system understanding and its application in river basin policy development and management. Please note that the framework is explicitly **cyclic** and hence **iterative**, thus driving improvements (RISKBASE, 2007). Abbreviations: **xn** = **spatial scale** (multiple sources, pathways and receptors), **Δt** = **temporal scale** (e.g., climate change and changes in socio-economic driving forces).

[2] Experience from river basin (Danube, Ebro, Meuse) stakeholder workshops executed by SedNet and/or EC FP6 Integrated Project AquaTerra (www.eu-aquaterra.de)

State-of-the-art

Several EC FP5 projects (e.g. SedNet) were, and some FP6 projects (e.g. IPs AquaTerra and Modelkey) are focused at improving and/or synthesising of our system understanding – at least to some extend also for sediments – for the 'source-pathway-receptor' chain (see Figure 2). Recently also two important Coordination Actions (CA) projects were started under FP6 aiming to synthesise the available 'understanding' from these EC FP projects and from other major initiatives. Based on that synthesis a generic framework for risk based management of river basins is being developed (RiskBase: www.riskbase.info) and an integrative risk governance model is also being developed (RiskBridge: www.riskbridge.eu). There is close cooperation between these CAs.

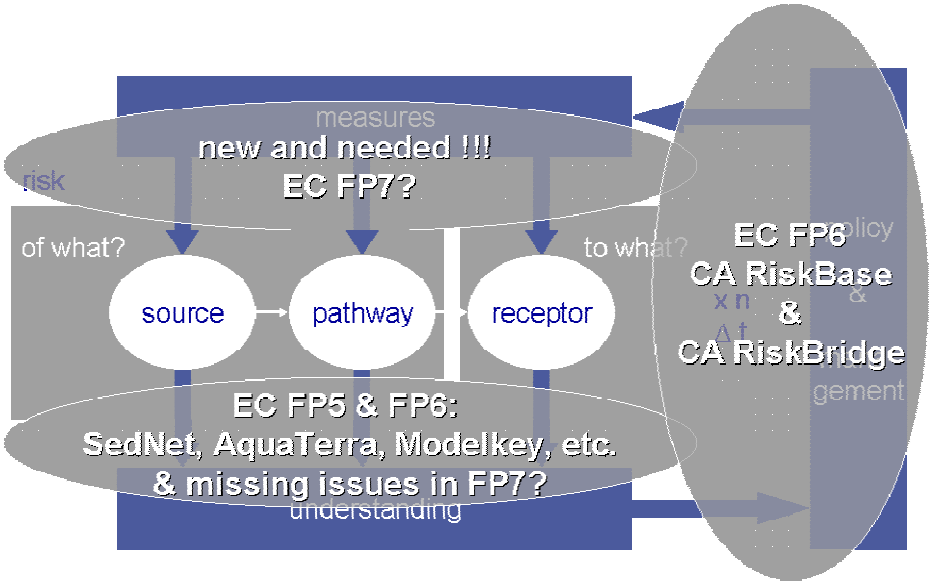

Figure 2. Positioning of some major EC FP projects that contribute to the improving of our system understanding (CA = Coordination Action).

A field that was/is – to our knowledge – not yet addressed by FP research is research dedicated to study the effectiveness, efficacy and efficiency of (response) measures aimed to improve the ecological status[3]. This uncertainty about measures is a major draw back for river basin managers to propose Programme of Measures (POMs) as should be done at water body scale in the WFD River Basin Management Plans (RBMPs).

Recommendations for FP7 research

"Understanding":

Research activities aimed at (further) improving the understanding of the role of sediment in the functioning of the natural sediment-soil-water system in river basins with a specific focus on:

- the relation between sediment contamination and its actual impact on the functioning of ecosystems (ecological status)

  Several EC FP6 project at least partly focus on this issue. Some major EC FP6 projects that can be mentioned in this perspective are, for instance, the

[3] To date, as a result of research (national & EC FP, Interreg and Life) there is especially in the field of contamination - of course – already a lot of understanding on the effectiveness, efficacy and efficiency of measures aimed to remediate (point) sources and/or to block or remediate contamination pathways. However, there is no/not much integrated understanding of the effectiveness, efficacy and efficiency of POMs aimed to improve the ecological status.

Integrated Projects AquaTerra and Modelkey, but also projects such as Rebecca and ENVASSO may contribute. SedNet could play a role by organising an international workshop or conference (early 2008?), where the top-level sediment scientist from these projects are invited and where their sediment related findings can be reviewed and synthesised. The synthesis could then be aimed at finding out what essential new understanding has been achieved, for which awareness should be raised at the policy and management level (see figures 1 & 2). Furthermore, based on that review and synthesis a research agenda could be proposed for addressing the essential gaps in knowledge that are still left. The success rate of such a workshop or conference could significantly be enhanced if it is supported (financially or at least in kind) by EC DG Research and possibly also EC DG Environment.

- improving our understanding of the combined impact of sediment quantity and quality on the ecological status

  To our knowledge, such research[4] would be completely new and could be an issue to be addressed by a (medium or large scale) collaborative research project that could be started in the short term (call in the 2nd or 3rd round for FP7 project proposals?).

"Measures":

- 'Large-scale' ($\geq$ water body) field experiments in which the effectiveness of measures are meticulously monitored over a long period ($\geq$ 5 years) and then evaluated (a.o. cost-benefit)
- Selection of study areas & measures, and evaluation of monitoring results in close consultation with stakeholders

  This type of research would, in our opinion, be really 'cutting-edge' and very challenging and could be a major step forward to advance the 'state-of-the-art' in this field. Clearly this does not only address sediment issues, but would need to include ***sediment as a key variable****. We estimate that such research would also result in commitment of the many 'river basin managers', all over Europe, that are now struggling to define their POMs to improve the ecological status of the water bodies for which they are responsible to elaborate a RBMP.*

  *However, we realise that it will be highly complex to design and then conduct such (medium to long term) challenging research with quite some uncertainty about its outcome due to the highly dynamic nature of river basins (key question: "****How to differentiate the effect of measures from natural variability, specifically over a long time frame?****"). Hence, it may be a good suggestion to further work out this research recommendation, e.g. through a feasibility study.*

  Could such a feasibility study be financial supported under FP7? (PS: under FP6 there seemed to be an appropriate tool for such issues: Specific Support Actions. Is something comparable available under FP7 that could be appropriate?).

[4] This research activity is also and specifically endorsed by Danube sediment scientists (IHP community) deriving from the 13 major Danube countries as well as by Danube stakeholders (e.g. ICPDR, WWF) and basin users (Hydropower & Drinking water associations). Source: Report on the SedNet Round Table Discussion "Sediment Management – an essential element of River Basin Management Plans", Venice, 22-23 November 2006 (soon to be made publicly available through the SedNet website at www.SedNet.org