European Sediment Research Network

Acronym: SedNet

EC contract No. EVK1-CT-2001-20002

Key action 1.4.1 *Abatement of water pollution from contaminated land, landfills and sediments*

WORK PACKAGE 2: SEDIMENT MANAGEMENT AT THE RIVER BASIN SCALE

Workshop 3

Modelling and other decision-support tools for sediment management

10th to 11th November 2003, University of Lleida, Lleida, Spain

SedNet

SedNet is the acronym for the demand-driven European Sediment Research Network. The SedNet objective is to form inter-disciplinary links between scientists, engineers, sediment managers and those responsible for developing and implementing sediment related policy, at the European scale. The initial focus of SedNet is on understanding how contaminated sediment influences river system functioning and, from there, how contaminated sediment and dredged material can be managed.

The SedNet activities are financially supported for three years by the EC under the FP5 EESD programme and within area 1.4.1 on "Abatement of water pollution from contaminated land, landfills and sediments" (Thematic Network project, EC contract No. EVK1-CT-2001-20002, starting date: 1 January 2002).

All SedNet activities aim to improve networking. In addition, SedNet aims to develop a document that contains recommendations in the form of guidance for integrated and sustainable sediment management, from the local level to the river basin scale.

Introduction

The third workshop of SedNet Work Package 2 was held at the University of Lleida, Spain, November 10th and 11th 2003. Sixteen participants from six countries attended, representing sediment interests in policy, practice and research. The workshop took the form of a discussion forum with keynote presentations at intervals throughout the meeting to focus thought and stimulate debate in order to satisfy specific objectives. Prior to the workshop, discussion papers outlining the key topic areas were distributed to all attendees to inform and allow preparation for the discussions. These discussion papers (see section Associated material) and the full minutes of this workshop can be found on the SedNet website: www.sednet.org.

The objective of this workshop was to assemble some of Europe's leading scientists and stakeholders dealing with sediment in order to:

- identify the main tools that are available to provide information on sediment, and associated contaminants, including their sources, transfers, transport and deposition in river basins;
- identify the uses of these tools, with particular focus on modelling techniques;
- identify their relative strengths and weaknesses; and
- identify how they can be used within sediment management programmes, frameworks and legislation.

Workshop participants

Name	Affiliation	Country	Representation	Role at workshop
J. Carles Balasch	University of Lleida	Spain	Scientist	Participant
Kazimierz Banasik	Warsaw Agricultural University	Poland	Scientist	Discussion paper Oral presentation
Ramon Batalla	University of Lleida	Spain	Scientist	Coorganiser WP2 core group
Jos Brils	TNO	The Netherlands	Scientist	SedNet Coordinator
Marc Eisma	Rotterdam Municipal Port Management	The Netherlands	Stakeholder	Discussion paper WP2 core group
Joaquim Farguell	University of Barcelona	Spain	Scientist	Participant
Celso Garcia	University of the Balearic Islands	Spain	Scientist	Discussion paper Oral presentation
Carlos Gomez	University of Alcala de Henares	Spain	Scientist	Participant
Joachim Karnahl	University of Stuttgart	Germany	Scientist	WP2 core group representative
Harald Köthe	Federal Institute of Hydrology	Germany	Scientist/ Stakeholder	Discussion paper Oral presentation WP2 core group
Feliciana Licciardello	Universita degli Studi di Catania	Italy	Scientist	Participant
Phil Owens	NSRI, Cranfield University at Silsoe	UK	Scientist	Coorganiser Discussion paper Oral presentation WP2 core group
Rosa M Poch	University of Lleida	Spain	Scientist	Participant
Albert Rovira	University of Lleida	Spain	Scientist	Participant Fieldtrip coorganiser
Joan M. Verdu	Department of Agriculture, Catalan Government	Spain	Stakeholder	Participant
Damia Vericat	University of Lleida	Spain	Scientist	Participant Fieldtrip coorganiser

Summary of workshop issues and perspectives

There are a variety of tools available for scientists and managers to use for sediment management. These tools can be divided into three main groups:

- measurement and monitoring tools for assembling information on sediment-contaminant processes and dynamics;
- physical and mathematical models; and
- decision support systems (DSS).

The information obtained from each of these types of tools is different and complementary, and each type can be considered part of a sequential process of decision-making.

The first group (measurement and monitoring tools) primarily provide information and data on how the sediment-contaminant system behaves. Such information is needed because:

- It tells us the source of the sediment and contaminants;
- It tells us how much is being transferred (fluxes);
- It provides us with an understanding of how the sediment-contaminant system behaves and functions at a variety of scales from particle interactions up to the river-basin scale;
- It provides baseline values and temporal trends in system behaviour and response; and
- It informs decision-making for sediment managers and assists with policy-making.

An additional need is that such information and data are required by models and DSS.

There are a large number of measurement and monitoring techniques and tools. Some of these are listed in Table 1. Each of these have strengths and limitations. It was felt that there is probably a sufficient "toolbox" to be able to provide most of the information and data needed to make informed management and policy decisions. It is likely, however, that these tools and techniques are not being used in the most appropriate and cost-effective way. In addition, there is a lack of integration between scientists and sediment managers, which means that appropriate state-of-the-art tools are not being used by managers, and also that scientists may not be collecting the right type of information for sediment managers.

In terms of research needs, it was identified that:

- We need better in-situ sediment quality measurement and monitoring tools;
- We need better ways of extrapolating in-situ point measurements to catchment scales; and
- We need better information and data of sediment and contaminant dynamics on floodplains and in reservoirs and harbours.

Table 1 – Measurement and monitoring techniques and tools used to identify and quantify sediment and contaminant sources and transfers in river basins (adapted from Table 2 in Report of SedNet WP2 Workshop 2, Hamburg, Germany, May 2003)

Direct	In-direct
River gauging	Remote sensing including digital photogrammetry
Sediment/turbidity monitors	Historical data and surveys
Chemical monitoring	Biological assessment
Sediment sampling • automatic river water samplers • sedimentation tube sampler • Helley-Smith sampler • net and basket samplers • buckets and pit traps • vortex bedload sampler • conveyor belt bedload sampler And sediment analysis	Tracers and fingerprinting techniques including: • colour; • magnetic tracers; • radionuclide tracers; • geochemical tracers; • organic tracers; and • N and C isotopes.
Bank erosion pins/stakes/PEEPs;	Sediment in depositional environments (reservoirs, lakes, floodplains, river dead zones)
Temporal assessment of landscape changes	

Models represent one of the most useful types of tool available to scientists and managers. Models can provide representations of sediment fluxes and transfers in rivers systems. As such, they enable managers to evaluate different scenarios, including changes in the role of point and diffuse inputs to rivers, and the response of river basins to changes in land use, land management and climate.

There are a variety of models currently available, or under development, which include: physically based models, conceptual models, statistical models and regression models, and Table 2 lists some examples.

Table 2 – Examples of models used to estimate water, sediment and contaminant fluxes and transfers in river basins

Material	Models
Water	SWAT, TOPMODEL, SHE
Soil erosion/sediment delivery	USLE, EUROSEM, SWAT, WEPP, ANSWERS, Morgan-Morgan-Finney, Sedimentgraph
Sediment (and associated contaminants) transport and deposition	Sedimentgraph, SOBEK, COSMOS, HEC.RAS, HEC6, MIKE 21C DEFT, TELEMAC
Metals	MONERIS
Phosphorus	PIT, PSYCHIC, INCA-P, MONERIS
Pesticides	EXAMS, GLEAMS, AGNPS, MIKE-SHE, POPPIE, SWATCATCH, GWAT

One of the main requirements of these models is data, both for running the models and for model validation. Examples of the type of detailed data that many of the models listed in Table 2 require, but are currently lacking, include:

- Soil erosion and sediment delivery from land to waters;
- Sediment (suspended sediment and bedload) and contaminant fluxes;
- Sediment-contaminant interactions;
- Geochemical and biological processes and interactions;
- Sedimentation dynamics in rivers (including floodplains), reservoirs and harbours; and
- The amount of gravel abstracted from channel beds and banks.

For most of these, detailed spatial and temporal data are needed

It was generally agreed, that there is a minimum level of data required for models and DSS. As such, there is clearly a need for a harmonised sediment measurement and monitoring network throughout Europe.

Some additional research needs that were identified included:

- A better understanding of the complexity of river basin systems;
- Increased computational power/capacity; and
- Appropriate resources to develop models for today's management issues.

A final group of tools that were considered at this workshop were Decision Support Systems (DSS). These are computer-based information systems developed to assist decision-makers to address semi-structured tasks in a decision domain. Typically there are three main components within a DSS (Engleman *et al.*, 2003 – see Workshop minutes):

- A user interface enabling easy interaction between the user and the system;
- A database containing the raw and processed data of the domain and the study area; and
- A toolbase (or toolbox) with the methods, techniques and software instruments required to work in an effective manner with the domain models and the data.

Clearly, such systems provide a useful framework with which to assist and inform sediment management at the river basin scale. However, at present, sediment quantity and quality aspects

are not yet fully integrated into most DSS for integrated river basin management. Therefore, it is necessary to identify how sediment data and sediment models can be integrated into existing DSS.

Key messages and recommendations

- At present we probably have the measurement and monitoring tools to provide us with the necessary information to address most river sediment issues, but we may not be using the tools to their best use for sediment management.
- We have some of the modelling tools required for sediment management but there is a need for better and more comprehensive input data and the need for data to test these models. Data on sediment fluxes and transfers is also need for risk assessment and cost-benefit analysis.
- There is a clear need for an inventory of sediment data for European river basins. There is a need to asses what is already available and what is needed, and who would manage this European sediment database.
- There is a need to integrate better the available measurement and monitoring tools and models into basin-scale decision support systems.
- There is a need to ensure that sediment (quantity and quality) is routinely measured and monitored (at least at a minimum, basic level) as part of a Europe-wide sediment monitoring network. One way forward would be to include such a network in national programmes to implement the WFD (and possibly the Soil Thematic Strategy). This needs to be done in a harmonised way throughout Europe.

Main outputs from the workshop

- A list of the main tools available for sediment management.
- An evaluation of their strengths and weaknesses.
- An assessment of the data needed for both an understanding of the system and for use in models and DSS.
- An improved understanding of the role of tools within sediment management programmes and sediment policies and legislation

Associated material

Several WP2 Discussion Papers were produced:

- Predicting of sedimentgraphs for small agricultural catchments, by Kazimierz Banasik
- Sources and transfer of contaminants in river basins, by Marc Eisma
- Developing a successful Decision Support System: a process involving collaboration, by Guy Engelen and submitted by Harald Köthe
- Methods and techniques to measure, sample, and quantify sediment transfer in fluvial systems, by Celso Garcia
- Tracing techniques for sediment management, by Phil Owens

Poster papers were also produced:

- WEPP modelling of a small Mediterranean watershed, by Feliciana Licciardello, Mark A. Nearing and S. M. Zimbone
- Runoff and erosion modelling by AGNPS in an experimental Mediterranean watershed, by Feliciana Licciardello and S.M. Zimbone
- Downstream effects of dams in the fluvial dynamics of the Lower Ebro River, by Damià Vericat and Ramon J. Batalla

Discussion papers and abstracts of the poster papers can be found in the minutes of this workshop on the SedNet website: http://www.sednet.org.

This Work Package 2 report

The contents of this workshop report have been evaluated and approved by the workshop participants (identified above) and the WP2 Core Group (see below). Cover photo: 79 kg Helley-Smith bedload sediment sampler, operated from a bridge, Lower Ebro River, Spain (by Phil Owens)

Information on SedNet

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