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BOOK REVIEW

Bernd Westrich, Ulrich Förstner (Eds.): Sediment dynamics and pollutant mobility in rivers—an interdisciplinary approach

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With sediment management moving up the environmental and political agendas (Förstner 2002) there is an increasing need for research that aims to understand sediment dynamics and the interactions between sediment and pollutants in river systems. Thus, this book represents a very important and timely contribution to the research literature.

The book mainly describes work undertaken within the Fine Sediment Dynamics and Pollutant Mobility in Rivers (Sedymo) research program which was funded by the German Federal Ministry of Education and Research (BMBF) between May 2002 and July 2006. Further information on Sedymo can be found in Westrich and Förstner (2005). Given the timing of the Sedymo program, and the fact that many of the participants were also active in SedNet, there was considerable interaction between the two European sediment initiatives. Thus it made sense that a conference was held in March 2006 at Hamburg University of Technology to present the main findings of the Sedymo program and some key recommendations from SedNet activities. This conference is described in more detail in Owens and Petticrew (2006). Thus, while this book presents many of the research findings of the Sedymo program it also contains many chapters that describe SedNet activities and also additional research projects from Europe (e.g. Scotland, Switzerland) and worldwide (e.g. Canada). The book is, therefore, able to present very detailed research projects while also providing a broader perspective on fine sediment dynamics and pollutant mobility in rivers, and this blend provides a very valuable approach. Furthermore, because many of the sub-chapters describe research focused on some of the main river systems in Europe, such as the Elbe, Rhine and Scheldt, the book is able to go into greater detail and able to demonstrate the linkages between different aspects of sediment-pollutant interactions, compared to books in which each chapter is separate from the other chapters in that book.

The book is over 400 pages in length, with over 100 authors from 12 countries. There are 10 main chapter sections and 36 sub-chapters. The main chapter sections are:

- Introduction;
- Managing river sediments;
- Hydrodynamics;
- Transport modeling;
- Catchment modeling;
- Sediment–water interactions;
- Transport indicators;
- Fine sediment particles;
- Microbial effects; and
- Sediment toxicity data.

With a book of this size and detail it is difficult to describe all of the sub-chapters and all of the main findings in the limited space of this report. Instead we describe some key themes and issues.

Sections 1 and 2 set the scene for the subsequent sections of the book. Sub-chapters describe the dual issues of sediment quantity and sediment quality in river basins, describe key sediment–pollutant processes, and consider

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conceptual and data requirements for sediment research. These sections take a broader perspective which allow the more detailed case study-type chapters to be placed into context.

Section 3 of the book considers hydrodynamic interactions in rivers and, in particular, factors that control sediment stability in riverine and lacustrine environments. Several of the chapters describe developments in field- and laboratory-based experiments which have investigated hydrodynamics at the sediment–water interface, which is a key zone that regulates the stability and mobilization of channel-bed sediments and associated pollutants.

Section 4 of the book focuses on the development of numerical models of sediment–pollutant transport and their application to rivers such as the Elbe, Rhine and Scheldt. Several of the sub-chapters describe attempts to model fine sediment, both as individual particles and as flocs, and recognize the importance of modeling sediment according to particle size characteristics. The differentiation between dissolved and particle-associated pollutant transport are also addressed.

Larger scale sediment–pollutant modeling is the theme of section 5. Sub-chapters describe a variety of different models that operate at different spatial and temporal scales, and consider different driving forces. Chapters consider modeling soil erosion and sediment delivery due to land use changes, modeling of sediment–pollutant transport in river channels and floodplain deposition, and modeling of pollutant (e.g. phosphorus) inputs, from both point and diffuse sources, and downstream fluxes.

Section 6 comprises five sub-chapters dealing with biological, chemical and physical controls on sediment–water interactions. The influence of particulate and dissolved organic matter on fine-sediment flocculation is addressed in natural riverine systems and laboratory experiments. Meso-scale field and laboratory experiments on sediment–water interactions in a variety of chemical and hydrodynamic conditions improve our knowledge to better inform issues of contaminant remobilization from sediments.

Sections 7 and 8 present empirical work on fine sediment dynamics in river, floodplain, estuarine and marine environments. Novel approaches such as comparisons of natural versus human-made storm events allow the differentiation of terrestrial and channel-bed sources of sediments and contaminants. Case studies for the use of trace metals, rare earth elements and natural isotopes as tracers of fine sediments are presented.

Three papers in section 9 emphasize the need to consider the biological effects of microbes on fine sediment transport, trapping and storage in aquatic systems. The variable role of biofilms as a stabilizer and destabilizer of sediments, and as both a sink and source of contaminants, are highlighted in a review paper by Flemming et al. (2007).

The final section in the book deals with sediment toxicity, with an initial paper proposing approaches to quality assurance of ecotoxicological sediment analysis and two case studies using toxicity data from the Elbe and the Nectar Rivers. Uncertainties and errors associated with sediment data quality are necessities for successful sediment management in the world's intensively used rivers and their estuaries.

Some of the key issues coming from the chapters in the book are:

– the important role that microbial activity plays in controlling and regulating sediment–pollutant mobility and transport dynamics, including impacts on sediment stability and sediment flocculation; and
– the need for continued development of field and laboratory techniques, field sensors and numerical models.

The editors have done an excellent job in collating the research described in this book and providing a sound structure to the book. There are very few errors and the layout and illustrations are of good quality. This book is a very useful addition to the literature on sediment science and sediment management in river systems, mainly from a European perspective. It is an excellent compliment to other recent books such as the SedNet series (Barceló and Petrovic 2007, Bortone and Palumbo 2007, Heise 2007, Owens 2008) and other edited books on similar themes (e.g. Kronvang et al. 2006, Owens and Collins 2006, Perry and Taylor 2007). One of the things that is evident with all of the books listed above, which is most encouraging, is the way in which scientists, managers and stakeholders are increasingly working together in order to provide optimum solutions for sediment–water management in river systems. The book will mainly be of interest to research scientists and graduate students, although those concerned with sediment management and policy development will also find it very useful.

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