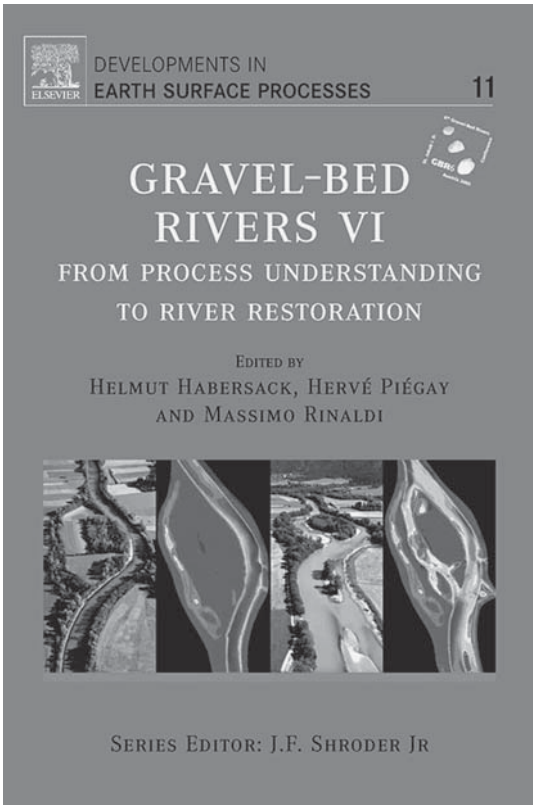
Gravel-bed rivers 6 — from process understanding to river restoration, edited by Helmut Habersack, Hervé Piegay & Massimo Rinaldi, 2008. Developments in Earth Surface Processes 11. Elsevier, P.O. Box 211, 1000 AE Amsterdam, The Netherlands (order through: http://www.elsevierdirect.com/viewcart.jsp). Hardcover, 836 pages. Price USD 185.00; GBP 115.00; EUR 155.00. ISBN 978-0-44-52861-2.



The 6th International Gravel Bed Rivers workshop has resulted in this comprehensive book, which contains 30 chapters from 88 contributing authors. It is organised into 6 sections that follow the key themes of the workshop. The first section gives a general overview of spatial and temporal scales for the analysis of river processes. Then follow two sections with contributions on flow and sediment dynamics at small scales within river channels, and with chapters on sediment delivery and storage at larger scales. The fourth section addresses channel change and instability, and the fifth deals with ecohydrology and ecohydraulics. The final section comprises contributions that deal with the application of fluvial geomorphology to river management, and restoration issues. Most chapters include discussion and reply comments from conference participants.

The first theme addressed in the book is "Scales of analysis for gravel bed rivers", giving an overview of the importance of scale in terms of understanding river processes. The first chapter considers the spatial and temporal scales that characterise flow dynamics, roughness, sediment transport, channel morphology and pattern, and ecology. The second chapter emphasises the importance of considering variability within reaches and therefore the limitations of the concept of stability inherent in regime theory. The third chapter considers scale in terms of hydrodynamics, and suggests that velocity spectra are composed of four scales. In addition, this chapter demonstrates the importance of averaging across scales to represent complex flows.

The second theme, "Analysis of processes at point and local scales", includes physical models, field studies and numerical analyses of flow structure and sediment transport and their impacts on hydrodynamics and channel morphology. Interesting measurements and numerical simulations are presented in Chapters 4 and 5 of flow both within and above a gravel bed, providing a unique insight into the relationships between interstitial flow (measured using pressure sensors and inferred from thermal properties) and the turbulent boundary layer above. The next two chapters examine the dynamics of bifurcations. Chapter 6 highlights the intrinsic tendency for bifurcations to be unbalanced and sensitive to initial channel configuration. Numerical modelling of sediment transport is dealt with in Chapter 7, which shows that – when heterogeneous sediment mixtures are considered – only less frequent flood discharges produce substantial changes in bed topography. Chapter 8 reviews the effects of large floods and identifies that the aggregate effect of large floods is greatest in headwater channels, whereas individual large floods are most significant in the middle

portion of drainage basins. The review of bank erosion processes in Chapter 9 highlights that fluvial-erosion and mass-failure models have not yet been integrated and that future models can be successful only if feedback between these processes is accounted for. The response of bed-surface grain-size distributions to cycled hydrographs is detailed in Chapter 10. It is concluded that bed samples easily obtained during low flow are representative of bed surfaces at higher flows when the sediment surface is not easily sampled, although this outcome depends on a constant sediment supply. Chapter 11 reviews the role of armour layers, sediment supply and bedload transport, highlighting improvements in understanding that enable well defined trends to be identified. The complex character of this problem has prevented so far the development of a "general equation".

The key themes of the third section are sediment delivery and storage. Results from the CAESER cellular model dealt with in Chapter 12 demonstrate the importance of antecedent conditions which result in non-linear relationships between water discharge and sediment yield. This work demonstrates the uncertainties involved in sediment-transport predictions. In contrast to this numerical model, Chapter 13 uses data from different spatial and temporal scales to quantify changes in sediment supply and transfer and their relationship to changes in land use. Chapter 14 predicts changes in gravel-river beds under different climate-change scenarios, and highlights the need to improve the parameterization of boundary conditions to produce "convincing" model predictions. Chapters 15 to 18 detail that the current bedload-transport theory does not adequately describe the complexity of gravel-bed rivers. These complexities include: differences in sediment supply not accounting for variability of sediment load (Chapter 15); the importance of geomorphic units, relative elevation and frequency of potential mobilization (Chapter 16); the role of sediment waves (Chapter 17); and the presence or absence of stabilizing bedforms associated with periods of low and high sediment supply respectively (Chapter 18).

Section four addresses channel change and instability. The focus of Chapters 19 and 20 is on anthropogenic modification of river systems that lead to changes in bed texture, and the resulting degradation of habitats (Chapter 19), and on significant channel incision resulting in increased flood risk and sediment-storage potential (Chapter 20). The most interesting chapter in this section (Chapter 21) highlights the role of riparian vegetation and demonstrates that the interaction between floods and vegetation growth may govern the development of single-thread or braided-river channel planforms supporting the theoretical concept on vegetation growth damping lateral erosion. The final chapter documents the impacts of large-magnitude floods in Switzerland immediately prior to the workshop.

The fifth section pays attention to ecohydrology and ecohydraulics. Chapter 23 broadens previous studies to investigate possible approaches to restoring physical processes that support ecosystem functions throughout the floodplain. Perhaps the most interesting experimental study in this book is an investigation of macro-invertebrate behaviour in gravel beds (Chapter 24) under conditions of increasing velocities and turbulence. The outcome indicates that relative rather than absolute hydraulic forces dictate animal movements, and the study shows the potential for experimental approaches to ecological investigations. In contrast, Chapter 25 investigates ecology at a much broader scale using hydraulic geometry as a tool for predicting the ecological impact of stream restoration. Chapter 26 considers the importance for the development of vegetation communities of bar morphology and the granulometry of the substrate.

The final section considers river management and restoration, starting with a broad overview of river restoration in the Alps (Chapter 27). The most significant conclusion from this chapter is that many rivers are close to a state where "natural" river restoration will be impossible. The following chapter addresses the need to include uncertainty in river-restoration projects. Chapter 29 considers historical channel changes and assesses the potential for natural flood processes to restore the structure

and function of the floodplain. The final chapter quantifies the ecological benefits of restoration and identifies both successes and limitations in a large-scale restoration project.

Both the editing and the production of the book meet high standards. I would strongly recommend the book to those interested in gravel-bed rivers. The book would undoubtedly be most valuable for individuals, but its price may be prohibitive. The book belongs, however, in earth-science libraries.

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