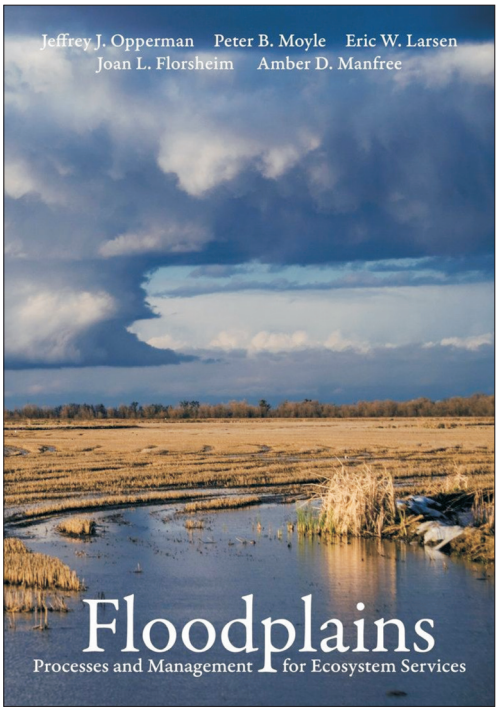
BOOK REVIEW SECTION

Opperman, J.J., Moyle, P.B., Larsen, E.W., Florsheim, J.L. and Manfree, A.D.: Floodplains: Processes and Management for Ecosystem Services. Oakland, University of California Press, 2017. 258 p.

Floodplains are usually treated subordinate to channels in geomorphological and environmental research. This book brings a wealth of arguments for the joint presentation of river channels and their floodplains. (In Hungary, where morphological floodplains make up almost two-thirds of the territory, this approach should be just natural.) From a geomorphological aspect, the importance of floodplain connectivity is underlined throughout. In the biogeochemical section we read, for instance, that the densities of zooplankton and aquatic macroinvertebrates are much (15 and 30 times, respectively) higher in backwaters or floodplain lakes than in the main Danube channel.

It can be anticipated from the background of authors that the comparison of floodplain definitions will be followed by the presentation of the geomorphic processes which shape floodplains. The distinction between braided and anastomosing channel types (often rather vague in literature) is clearly drawn here: braided channels are divided by unstable mid-channel bars, while anastomosing channels by fairly stable, vegetated islands. Throughout the book the modern concept is adhered to that vegetation growth is a principal agent of the geomorphic evolution of floodplains. Floodplain erosion during floods is another important issue in fluvial geomorphology. The authors point out that it is equally possibly associated with scour at the site where floodwater breaches the natural levee and further away on splay deposits.



Much more space is devoted, however, to the other side of the coin, i.e. how geomorphology influences floodplain ecology. Although numerous arguments are cited for the importance of this control, the reviewer feels that the ecological classification of wetlands (into eupotamon, parapotamon etc.) could have been better integrated with that of floodplain landforms. On the other hand, some of the main topics of the book (floodplain connectivity, the duration and frequency of floods, predictability of peak flows) appear in this chapter and related to biogeochemical processes such as nutrient retention. The main idea is that floods (not only the major floods but a series of moderate inundations, too) create a landscape mosaic, a dynamically changing pattern of wetlands with constant properties, which ensure high levels of biodiversity (Shifting Habitat Mosaic concept). The hydrarch succession is directed towards landscape homogeneity, but floods reset the stage of this succession and maintain a heterogeneous floodplain pattern.

The basic conceptual frameworks of river/floodplain ecology (the River Continuum Concept, the Flood Pulse Concept, the Riverine Productivity Model) are described, assessed and the need for their integration is pointed out. A crucial issue concerns the turnover of nutrients between the river and the floodplain water bodies. Some observations indicate that local autochtonous sources supply abundant and easily available nutrients. Floodplain forests with trees of rapid growth rate, well adapted to inundation (like cottonwood), contribute to carbon cycling. Recent findings, however, point to the role of algae in sustaining the floodplain food web. Floating algal mats in standing water (well-known from the Danube Delta) as well as floodplain soils and sediments are important carbon reservoirs. Fish species are classified according to their use of the floodplain

and for most of the classes (for floodplain spawners, floodplain foragers and pond fishes) both permanent wetlands and seasonal floodplains are vital habitats.

The importance of floodplains is measured by the provision of ecosystem services by them. The main services described in the book are sediment and nutrient (mostly nitrogen and phosphorus) storage, carbon sequestration in soil and vegetation, groundwater recharge (drought mitigation), fish productivity due to variable habitats, recreation (hunting, fishing, bird watching), the maintenance of biodiversity and allowing some agricultural activities (on condition that they are compatible with inundation). Unfortunately, little mention is made of the scientific assessment of water-based ecosystem services (see e.g. Martin-Ortega, J. *et al.* 2015).

The first part focused on natural processes, while the second acknowledges that the overwhelming majority of the world's rivers and floodplains are heavily transformed by human society. The book uses the term 'novel ecosystem' for these modified conditions. Ample evidence is cited for the homogenisation of flow regimes which leads to homogenised aquatic flora and fauna (generalist species becoming more and more abundant) as well as microbial life. In addition, the loss of floodplain connectivity can slow down, but in some cases speeds up the spreading of alien species. Novel ecosystem requires a new approach to restoration, which is called by the authors 'reconciliation', because management should reconcile competing demands for land and water. The emphasis here is improving the provision of ecosystem services and resilience through active management. This compromising approach means that human impact is not excluded from the floodplain and even alien (but non-invasive) species are tolerated to some extent. (Think of the debate about the benefits and risks of black locust in the Hungarian floodplains.)

The next chapters of the book focus on flood management (the term preferred to 'flood control'), where traditional structural techniques of flood hazard reduction are presented and criticised. Instead, 'green infrastructure' solutions are proposed which can be integrated with 'soft engineering' techniques. It is emphasised that the flood hazard should be viewed in the river-basin perspective: floodwater retention upstream of sites with high flood hazard has to have priority. In addition, in certain case structural solutions (levee setback, floodways only inundated during high floods, flood by-passes) are to be considered.

In spite of the similarity in their main hydrological properties, they are very different from each other. This means that general conclusions for their restoration/rehabilitation are rather risky to draw. Consequently, authors had decided to present floodplain management strategies on case studies. The case studies include the Room for the River project in the Netherlands, the Danube restoration in Bavaria, the Ebro River in Spain, the Mississippi floodways (the New Madrid and Atchafalaya floodway system), the Napa River in California and the Murray-Darling river system in Australia. Naturally, the book would have profited from the analysis of some other rehabilitation projects outside the United States, for instance, from Australia (referring to the works of Gary Brierley and Kirstie Fryirs) and France (based on papers by Hervé Piégay). This would have reduced the bias to US rivers. Instead, a detailed study of the flood risk in the Central Valley of California follows and allows authors to assess the benefits of the floodplain reconciliation model proposed by them.

The conclusions summarise the basic principles of floodplain management which are assumed to be valid worldwide. For the maintenance of novel floodplain ecosystems, too, inundations allowed by floodplain connectivity, are inevitably necessary. Floods predictable in timing are needed for geomorphic and biological diversity. Flood-risk management should be designed with the entire drainage basin in site and a flexible comprise of the combination of both structural and non-structural measures. The message engineers can learn from the geomorphologist and ecologist authors of the book is that with careful floodplain management it is possible to reconcile human interests and environmental values.

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REFERENCE

Martin-Ortega, J., Ferrier, R.C., Gordon, I.J., Khan, S. eds. 2015. *Water Ecosystem Services: A Global Perspective.* Cambridge, Cambridge University Press.

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