

# Nature-Based Flood Risk Management on Private Land

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Editors

# Nature-Based Flood Risk Management on Private Land

Disciplinary Perspectives  
on a Multidisciplinary Challenge



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# Foreword: Nature-Based Flood Risk Management

Extensive resources have been spent to foster the understanding of risks from flooding and to design and, where possible, implement risk reduction interventions, particularly in the last two decades. The benefits are visible in both science and society, given the widespread knowledge on FRM and the effects of implemented biophysical measures and policy instruments. However, flood disasters and risks remain one of the most demanding challenges from natural hazards worldwide. This calls for additional efforts, notwithstanding the inherent characteristic of risk that it may not be fully prevented.

Advancements in science and practice can build on the historical development of dealing with and preparing for flooding so far. After flood protection, the risk management paradigm has been promoted since the 1990s. The latter has led to, for example, an inclusion of exposure and vulnerability in the assessment of flood challenges, increased diversity of flood risk reduction interventions, a relative evaluation of risk instead of targets of absolute flood protection and greater attention to the societal processes of managing flood risks within the governance context. Knowledge and practices have profited from interdisciplinary and cross-sectoral collaboration, respectively, partly even from transdisciplinary co-design, co-deployment and co-evaluation. Hence, the question: what are the next steps? How to advance the relevance of future efforts in science and society to further reduce flood risks?

One possible way forward seems to tackle real-world flood issues more comprehensively. “Comprehensiveness” in this case means the degree of considering (all) aspects involved in FRM with their contextual, spatial and temporal features and interrelations. It does not assume that everything could and should be understood and managed. Instead, it raises the question where, among the wide range of aspects with their interrelations, may we lack understanding and management although they are relevant. This question addresses real-world phenomena and hence is ontological. Another possible way forward is to strengthen the conceptual and methodological ties between the description and explanation of individual aspects of FRM to better represent interdependencies. This way is driven by knowledge gaps and methodological limitations, which is thus epistemological.

Natural and social science systems' approaches trying to further conceptualise and operationalise complexity, dynamics and social construction could be of added value there. Neither way is exclusive of the other; they just represent two options for future efforts.

Land as a natural integral of atmosphere, geosphere, hydrosphere and biosphere is one key realm for flood risk generation and hence risk reduction. Land at the same time is the biophysical integral of natural and anthropogenic processes with the latter ranging from near-natural to technical interventions. And land represents immaterial societal meanings regarding the three pillars of sustainability with facilitating and regulating institutions such as property rights, planning designations and land markets. According to its central role, land has always played a part in FRM research and practice. Nevertheless, the focus changed under the above paradigms. While land was the main target for being kept free from inundation under the flood protection paradigm, land with its assets became the receptor for risk reduction under the current FRM paradigm. Furthermore, land is supposed to integrate an even wider range of natural and societal processes as the multiple aforementioned dimensions show.

In line with that, there are some indications that the consideration of land has not yet reached a degree of comprehensiveness that covers all relevant processes with their interdependencies. For example, there are recent efforts around the world, particularly in the USA and European Union, to study and apply NBS for flood retention. Respective measures are intended to stimulate or mimic natural processes while being integrated (e.g. agriculture) or separated from other land uses. Most of them interfere with the land, and some require significantly more land than hard engineering constructions, which they are often envisaged to complement rather than replace. The effects of altering natural processes on the land involve the full scope of the multidimensionality of land stated above. Hence, NBS raise the issue of comprehensiveness for the assessment of their (multiple) effects and implementation under the societal context. Hereby, both the assessment and implementation are likely to be framed by the diversity of natural and societal conditions and thus by the locality.

Taking such a comprehensive view on land makes FRM research and practice much more complicated than previous methods of flood protection and the current risk assessment and reduction. Research especially needs to consistently address (the same) land from a multidisciplinary view, drawing from an array of natural sciences, engineering sciences and humanities before it comes to an interdisciplinary and even transdisciplinary entanglement of concepts and methods towards an emergent knowledge. Among others, this can lead to a combined spatial and temporal assignment of various natural and societal land functions with their mobility. In addition to that, a FRM practice particularly faces the tasks of creating multi-actors' fora with the mandate of developing and implementing site-specific and even dynamically implemented measures and instruments to alter societal land functions together with landowners and users. While the prerequisites from individual disciplines and sectors are already well advanced, theoretical and

methodological basics and practical experiences for tackling this comprehensiveness lag behind.

The challenges of properly addressing comprehensiveness are not limited to FRM; rather they are common for many thematic areas of environmental (risk) management. Current studies and discourses on, for example, nexus approaches and sustainable economies are indications for that. Insofar, FRM challenges are just one part of an overall task of tackling the complicity of human–environment interrelations. At the same time, individual aspects involved in flood risk generation and risk reduction are mostly well understood; therefore, advancements for a more comprehensive FRM research and practice could become a thematic front runner also for other fields of environmental development and risk management.

This book, *Nature-Based Flood Risk Management on Private Land*, can be seen as a contribution towards a more comprehensive approach to land and land-dependent NBS. It addresses potentials and experiences with the practical application of NBS on private and partly public land from a wider view of various disciplines. Hereby, it exceeds a technical or impact assessment interest, which is undoubtedly the basis for any standardised design of respective measures and their transparent evaluation. Moreover, the aim of the book is to exploit existing projects as an initial step of medium-term studies.

After a conceptual setup, cases of fluvial flooding on different geographical scales are used for the analysis. All case sites are situated in headwaters or plains of river basins within central parts of the European Union. The approach is descriptive, involving, or at least reflecting, various disciplines. First, a disciplinary or interdisciplinary core team presents the NBS with their implementation. Second, comments from authors with other disciplinary backgrounds and not involved in the case widen the view and provide additional reflection. With this arrangement of the book, the cases serve as valuable illustrations. As a kind of report, they do not claim to present detailed evidence and explanation. In contrast, the cases become a point of departure for future studies to add depth of knowledge and practical experience.

Further analysis of these and other cases based on an inductive single and comparative case study design can then allow for the formulation of conceptual and methodological hypotheses, which may be empirically tested to gain evidence-based explanations. Hereby, and in addition to the societal relevance of the topic, there will likely be some room for the originality of results. The latter might range from development or adaptation of concepts and methods to frameworks for an integrated investigation of land in FRM. The outreach of this kind of research could then trigger innovation for FRM.

Following this, sequential approach could overcome a widespread understanding that the effectiveness of FRM mainly depends on the research and design of biophysical measures, while successful implementation is just a matter of negotiation, persuasion and maybe payment. On the contrary, it conceptualises the challenges of gaining more effectiveness through further entanglement of biophysical and societal aspects. This acknowledges that different biophysical processes of the land for flood generation and the societal meanings of this land according to the institutional context are seen as extensively interwoven.

The book remains humble in this respect. And this is one of its strengths since the scientific prerequisites for further ambition are not yet sufficient. Another merit is the rich empirical basis and the multidisciplinary reflection, which are highly informative and set the scene for a broader discussion of NBS, the implementation mechanisms and the societal context referring to the accessibility of the required land. Presentation of the cases remains predominantly neutral to avoid bias regarding simple and general pros and cons for certain types of measures. This openness inspires further discussions without promoting NBS as the sole future strategy.

Compared to some previous researches, the cases sharpen the perception of already known and uncover new barriers and enablers for the implementation of land-based flood risk reduction measures. For instance, the engagement of individual owners of huge farms has not been taken into account in earlier works on government-led vertical and community-based horizontal FRM strategies. At the same time, innovative planning and funding instruments are critically discussed, even admitting the higher degree of effectiveness of traditional vertical instruments. Of course, most of the cases are based on well-known natural-based solutions such as decentralised water retention and space for the river. Nevertheless, the involvement of property rights focusses on intersectoral coordination processes and others enhance the comprehensiveness of framing the FRM problems.

Overall, approaching land with NBS in the manner of the book *Nature-Based Flood Risk Management on Private Land* facilitates a move towards a more comprehensive and integrated manner of tackling flood issues. This poses valuable new questions for research and practice. How far the answers to these questions will support a higher effectiveness of flood risk reduction cannot be anticipated at this stage. Maybe, also limited land accessibility defines the tolerability of risk from a benefit–cost point of view since willingness to act and pay also determines the maximum benefits. To explore this in future studies and real-world cases with the comprehensiveness laid out in the book appears to be a timely and well-justified ambition.

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## Foreword: The Network LAND4FLOOD

In 2013, the Akademie für Raumforschung und Landesplanung (ARL) supported a summer school in Utrecht (Netherlands) organized by Thomas Hartmann and Tejo Spit on Sustainable Governance of Land and Water. The participants of the summer school were Ph.D. students and professors—and during that week in Utrecht, the participants had a chance to explore challenges of water and land governance. This was the real beginning of a future network that resulted in an exceptionally stable and productive cooperation. In 2014, the Czech team (Jiřina Jilková and Lenka Slavíková) responded to a project call from the Czech Ministry of Education within the LE-EUPRO II programme for networking projects and were successful. The aim of the project called CrossFlood (cross-border flood risk management) was the establishment of an interdisciplinary network of institutions and experts who share a focus on cross-border management of flood risks called floodland. The expertise of Elbe, Rhine and Danube river basin management authorities in governance and technical solutions in water and land management has been critically evaluated, and innovative solutions for complex planning approached have been discussed in accordance with the shift from flood protection to wider flood risk governance. The idea for a future COST Action—a special programme to fund academic networks in European Union—was formulated: in order to deal with flooding, the use of (private) land for flood water retention needs to be addressed.

In this way, the small Czech network project became a success story. Within its lifetime, the group of colleagues from different disciplines—including hydrology, spatial planning, economics, law and others—and different countries prepared the proposal for a wider network on the relation between land and flood risk management (FRM). Previously, this topic had barely been addressed in the academic debate, and the network had the ambition to put this topic on the academic and political agenda. In 2017, the proposal was approved and network Land4Flood (Natural Flood Retention on Private Land) started. The smooth transfer from the CrossFlood project to LAND4FLOOD COST Action is well captured in the joint special issue of the *Journal of Flood Risk Management* on “Land for Flood Risk



Management: A catchment-wide and multi-level perspective”. The group continues to grow—now including academics and stakeholders from more than 30 countries—and it represents the important baseline for the future evolution of collaborative projects, publications and events.

This book on *Nature-Based Flood Risk Management on Private Land* demonstrates the specific character of the network—an interdisciplinary group, grounded in the field, presenting original perspectives from different contexts and at different scales. The book is organized into four parts. Part I sets up the overall framework related to the debate about nature-based solutions (NBS). The following parts are organized according to the scale of measures examined—small, medium-sized and large-scale measures. This format gives the reader a clear orientation and opportunity to compare perspectives.

The paper by Hartmann, Slavíková and McCarthy critically assesses how water management is currently changing its approach to floods in favour of more NBS. The authors mention the pitfalls and problems related to NBS and the specific differences in comparison with grey infrastructure measures: they require more land than traditional measures, and this land is often owned by private landowners. Hartmann et al. call the land a critical factor for determining the implementation of NBS. Land use—both urban and agricultural—has changed immensely over the last decades. These processes include a more intense use of urban areas, the increasing use of heavy machines and a change in the production structure, including the elimination of buffer zones on agricultural land. Compacted soil has decreased ability to hold water, which, in turn, speeds up the flow of water on the soil’s surface. This increases the volume and speed of water flowing into waterways and heightens the risk of flooding. The current agricultural policy does not aim to stop this development. Also in the urban realm, land management is not yet considered an essential element of FRM. This book contributes to elaborating on how land matters for FRM in general and nature-based FRM in particular.

Even interventions on small scales may have big impacts on the larger scale, but knowledge of these connections is limited (O’Connell 2007). The authors mention that research has not yet produced conclusive evidence on whether local NBS can have an effect on large-scale flooding. Why are NBS favoured in the current policy on FRM? This book sets out to explore this question and searches for examples. This proves to be an interdisciplinary endeavour. Therefore, a special format for the book has been chosen: it is based on case studies and subsequent commentary solicited from different disciplinary perspectives.

*Raska, Slavíková and Sheehan* discuss the issue of scale in NBS for FRM. They derive the importance of the scale from the dichotomy between hydro-ecological and institutional approaches. They explain the scale in interdisciplinary perspective using various examples from history, geosciences and social sciences, often in historical perspective. They introduce both an epistemological and ontological view of scale. Their approach introduces a theoretical and a philosophical dimension to the book. However, their concept has very practical implications related to upscaling or downscaling decisions with the primary motivation to augment resilience. They analyse fragmentation of land and the mismatch in socio-ecologic

systems as the real problems of land management. They conclude by emphasizing the need to realign the scales of flood risk measures.

Part II deals with small-scale property solutions. Case studies from three countries are presented here—Poland, Czech Republic and Flanders (Belgium). *Matczak, Takacz* and *Goździk* present the small retention programmes in the Polish forests. *Slavíková* and *Raska* present in their paper a different case: measures taken on privately owned agricultural land. The study presents an exceptional case for the post-socialist planning context where the engagement of private actors is almost forgotten after 40 years of collective management of the land. The authors call this approach an environmentally concerned philanthropy and leave the question of upscaling open.

Part III of the book is devoted to medium-sized infrastructure. The accent shifts to measures like urban wetland restoration in floodplains. The paper by *Macháč* and *Louda*, and the related commentaries by *Gutman* and *Pohl*, presents the case of the Czech city Pilsen. The other case (presented and commented in three papers) is the Blauzone Rheintal—example of a measure encompassing a whole catchment.

Large-scale catchment solutions are presented in Part IV of the book. The cases include the relocation of dikes (river landscape Elbe–Brandenburg in Germany and Oekense Beek in the Netherlands). *Warner* and *Damm* look at different measures from different perspectives—hydrology, finance, governance, property rights. In comparison with small-scale measures, large projects bring greater complexity in relation to financing, ownership and project initiator interactions. Also, *Kaufmann* and *Wiering* prove that from the flood retention plan to making this plan a reality a lot of land needs to be covered. These examples from the book illustrate the variety of approaches to nature-based FRM from different disciplinary angles.

The pressing question in this context is: how do initiatives go from isolated positive cases to a legitimate, outspread practice, or, in other words, how to scale-up successful practices? There is no simple answer. The authors and commentators have clearly shown that, if we want to achieve flood retention relevant from a hydrological point of view, a couple of aspects need to be considered:

- The catchment dimension is relevant, and at the same time, it needs to be broken down into a set of locally specific measures.
- An intersectoral and thus interdisciplinary coordination between flood management and spatial planning is essential for nature-based flood risk management.
- Public funding remains utterly important to realise flood risk management. Market and commons-led initiatives are not yet a viable and only exceptional alternative for a central government-coordinated approach.
- Nature-based flood risk management asks for more inter- and transdisciplinary communication and research.

The idea of NBS is discussed in all contributions, whereas the tone of the book is not about NBS as a superior strategy; it is rather about the challenges that are precipitated by the inevitable interaction with the owners often privately owned

land within a river basin. The diverse from multiple disciplines in this volume contributions show that in order to find alternative, more efficient, and effective ways to deal with floods is indeed a multidisciplinary challenge.

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