RiverCare: towards self-sustaining multifunctional rivers

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Introduction

Rivers are inherently dynamic water systems involving complex interactions among hydrodynamics, morphology and ecology. In many deltas around the world lowland rivers are intensively managed to meet objectives like safety, navigation, hydropower and water supply. With the increasing pressure of growing population and climate change it will become even more challenging to reach or maintain these objectives. In the meantime there is a growing awareness that rivers are natural systems and that, rather than further regulation works, the dynamic natural processes should be better utilized (or restored) to reach the multifunctional objectives. Currently many integrated river management projects are initiated all over the world, in large rivers as well as streams. Examples of large scale projects in the Netherlands are 'Room for the River' (Rhine), the 'Maaswerken' (Meuse), the Deltaprogramme and projects originating from the European Water Framework Directive (WFD). These projects include innovative measures executed never before on this scale. Although estimates have been made on the effects of these measures for many of the individual projects, the overall effects on the various management objectives remain uncertain. For all stakeholders with vested interests in the river system it is important to know how the system evolves at intermediate and longer time scales (10 to 50 years) and what the consequences will be for the various river functions. If the total, integrated response of the system can be predicted, the system may be managed in a more effective way, making optimum use of natural processes. In this way, maintenance costs may be reduced, the system remains more natural and more self-sustaining and ecosystem services can be safeguarded or even enhanced. The unprecedented extent of the current interventions, together with comprehensive in-situ monitoring now offers an excellent opportunity to gain extensive knowledge about their intermediate and long-term impacts.

Scientific challenges

To obtain the objectives mentioned above, interdisciplinary research is necessary related to the following key-aspects:

River morphodynamics: Many human interventions currently taken in rivers and streams, such as longitudinal training dams, construction of side cannels, removal of bank protection, remeandering of streams, dredging and nourishment and floodplain rehabilitation, initiate morphological changes that may ultimately hamper various river functions. Since most of these measures have not, or not at the current scale, been implemented before, it is unknown from experience what the morphologic evolution will be and how this will impact river functions. Therefore, knowledge of the morphologic effects of these interventions is crucial for a cost-effective management.

River ecology: Ecological processes will also be affected by these interventions. To understand and predict the ecological response, knowledge of biotic and abiotic processes needs to be integrated. The current scientific understanding of the dynamic interactions and feedback mechanisms between these processes is still limited, especially at the quantitative level and when it comes to establishing predictive models. There is also a need for a generic classification system of ecosystem units that is interpretable by and useful for stakeholders with various interests.

Ecosystem services: An integrated way to evaluate the societal impact of human interventions in river systems is by quantifying ecosystem services. River systems provide valuable ecosystem services such as safety, navigability, biodiversity, climate buffering and spatial quality. Suitable approaches, indicators and standards need to be developed in order to quantify these ecosystem services and evaluate the societal impact of human interventions.

Uncertainty: Management decisions rely on predictions of future developments in the river system. These predictions usually involve large uncertainties which tend to be overestimated, thus forcing managers to conservative choices. Quantifying and where possible reducing the uncertainties in the prediction of future developments will help managers to take more robust and cost-efficient measures.

River governance: Implementing measures in river systems involves many stakeholders with varying perspectives and perceptions. A better understanding of these frames and the way stakeholders interact may open ways to a new and innovative governance model for river management.

Communication and valorisation: For valorisation the challenge is how to translate specialist knowledge to practical relevant and useable information. Models, tools and guidelines should be developed that can be used effectively by end users in national or international contexts. This requires close cooperation between scientists, stakeholders and end users in developing these products.

RiverCare

The NCR partners have taken the initiative for a multidisciplinary research programme called RiverCare that has been granted in the 'Perspectief-programma' of the Technology Foundation (STW) of The Netherlands Organisation of Scientific Research, NWO. In RiverCare the NCR partners (5 universities, Rijkswaterstaat, Deltares and Alterra) and other public and private parties (STOWA, RIVM, Province of Gelderland, Arcadis, Bureau Waardenburg, Royal HaskoningDHV, Witteveen+Bos, HKV, Tygron, T-Xchange, LievenseCSO) collaborate to address the scientific challenges and get a better understanding of the fundamental processes that drive ecomorphological changes, predict the intermediate and long-term developments, make uncertainties explicit and develop best practices to reduce the maintenance costs and increase the benefits of interventions. The projects currently carried out in the Netherlands provide a unique opportunity to achieve these objectives. The findings should lead to a 'Virtual River', an interactive design tool that integrates all the collected knowledge and can be applied worldwide for lowland rivers.

RiverCare will run from 2014 until 2019. The programme consists of 8 projects each consisting of 2 or 3 research positions, adding to a total of 20 (15 PhD and 5 postdocs). Figure 1 shows the coherence between the projects.

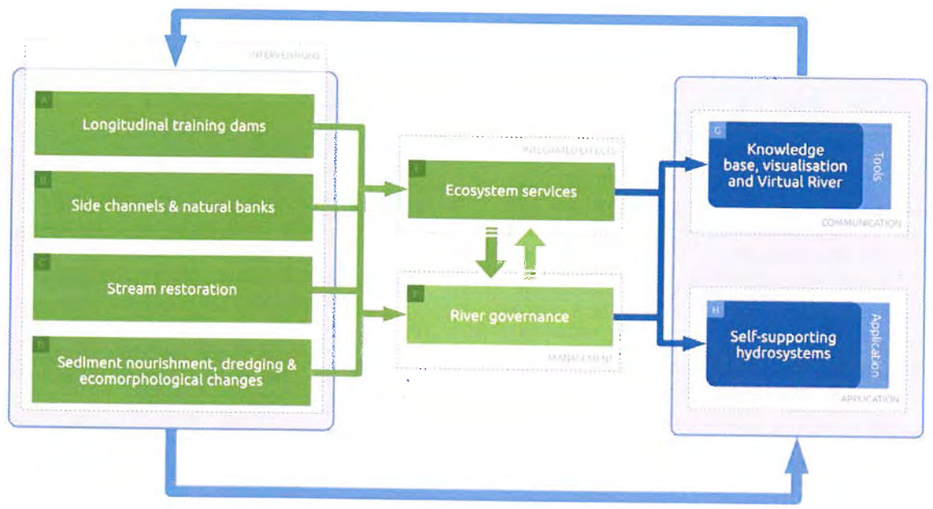

Figure 1. Structure of RiverCare consisting of eight projects.

The Netherlands Centre for River Studies (NCR) is a collaboration of the major developers and users of river related expertise in the Netherlands and consists of the universities of Delft, Nijmegen, Twente, Utrecht and Wageningen, UNESCO-IHE, Alterra, Deltares and Rijkswaterstaat-WVL.

NCR's goal is to build a joint knowledge base on rivers in the Netherlands and to promote (and bring into practice) cooperation between scientific institutes in the field of river studies in the Netherlands. This cooperation strengthens the national and international position of Dutch scientific research and education and contributes to the leading role of the Netherlands in river engineering and river management.

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