Guest Editorial, part of a Special Feature on New Methods for Adaptive Water Management

Resources Management in Transition

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In recent years, the prospects of severe climate change have increasingly focused attention on the long-term sustainability of current practices of resource management, which no longer appear robust to uncertainty from extreme weather events or trends. Increased awareness of uncertainties and the complexity of the systems to be managed highlight the need for some profound changes in resource management (Gleick 2000, Pahl-Wostl 2007). Uncertainties and complexity have always characterized water management. Water management traditionally emphasizes the reduction of uncertainties, often by designing systems that can be predicted and controlled. This has resulted in a strong emphasis on technical solutions to rather narrowly defined problems. However, human–technology–environment systems are more appropriately described as complex adaptive systems where unpredictable co-evolution makes uncertainty irreducible. Managing under inevitable uncertainty requires improved learning and adaptation, in addition to control. The goal of management should be to increase the adaptive capacity to learn from and better cope with uncertain developments, rather than to try to find optimum solutions. Water-management science must confront the main barriers to learning and adaptation: path dependence emerging from sunk costs in prior paradigms, infrastructure, and existing practices. Developing new paradigms and practices has gained increasing importance with the attempt to implement integrated management approaches.

The challenges of improving the scientific foundations of adaptive and integrated water management and of understanding the transition toward adaptive and integrated management regimes have been tackled in the European project NeWater (*New* methods for adaptive *Water*

management under uncertainty). This special feature showcases some of the key work efforts conducted under the umbrella of the NeWater project. One major goal of NeWater has been the development of a conceptual and methodological framework for the transition of prevailing water-management regimes to adaptive ones. Based on this framework, specific approaches and tools have been further developed for practical applications in a number of case studies in Europe (Elbe, Guadiana, Rhine, and Tisza), in Central Asia (Amudarya), and in Africa (Nile and Orange). The emphasis of the work reported in this special feature is on the development of conceptual foundations and methodological innovations.

Pahl-Wostl et al. (2007) describe how the principles of adaptive water management might improve the conceptual and methodological base for sustainable and integrated water management in an uncertain and complex world. Their critical debate is structured around four questions: (1) What types of uncertainty need to be taken into account in water management? (2) How does adaptive management account for uncertainty? (3) What are the characteristics of adaptive-management regimes? (4) What is the role of social learning in managing change? They conclude that major transformation processes are needed because, in many cases, the structural requirements (e.g., adaptive institutions and a flexible technical infrastructure) for adaptive management are not available.

Huitema et al. (2009) assess the idea of adaptive water management from the perspective of the governance literature. They highlight that attention should be called to the complexities associated with participation and collaboration, the difficulty of experimenting in a real-world setting, and the

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politicized nature of discussion on governance at the bioregional scale.

van der Brugge and van Raak (2007) investigate three central concepts from the transition-management literature for their potential contribution to adaptive management. They conclude that, in particular, the notions of arenas and shadow networks merit further study through joint research.

Sendzimir et al. (2007) examine what barriers and bridges operate at which scales to either enhance or block the potential for transition (transformability) of the regime that currently manages the Tisza river basin in Hungary. Special attention is paid to comparing the transformability of the Tisza with other regional resource-management regimes in Sweden and Florida based on the relative contributions of shadow networks, local champions, and innovative ideas.

Krysanova et al. (2008) provide an overview of existing practices for coping with floods and droughts, compare strategies in different river basins, and outline the areas that need improvement. An analysis of the coping strategies shows that structural measures exist in all seven river basins, but that non-structural measures are generally not very extensive or advanced.

Aerts et al. (2008) advocate a diversification of measures as one robust strategy to address the challenges of climate change. They introduce a new method based on Modern Portfolio Theory (MPT) that contributes to developing flood-management strategies. This theory aims at finding sets of investments that diversify risks, thereby reducing the overall risk of the total portfolio of investments.

Raadegever et al. (2008) reflect on strategies for transboundary management. Their paper presents a comprehensive overview of regime features that support adaptive management, focused on transboundary river-basin management. It then collates these features into a framework describing actor networks, policy processes, information management, and legal and financial aspects. Subsequently, this framework is applied to the Orange and Rhine basins.

Nilsson and Renöfält (2008) describe the key issues associated with environmental flows in river management needed to address the challenge of how to satisfy the needs of both humans and nature without sacrificing one or the other. They review knowledge in this field, provide examples on how the flow regime and the water quality can impact ecosystem processes, and conclude that most problems are associated with low-flow conditions. Given that reduced flows represent an escalating problem in an increasing number of rivers worldwide, managers are facing enormous challenges.

Schlüter and Pahl-Wostl (2007) propose an agent-based modeling approach to explore system characteristics and mechanisms of resilience in a complex resource-management system, based on a case study of water use in the Amudarya River. The aim is to investigate the influence of (1) the organizational structure of water management, (2) information on water availability, and (3) the diversity of water uses on the resilience of the system to short- and long-term water scarcity. Diversification of resource use, e.g., irrigation and fishing, increases the performance of the decentralized regime and the resilience of both.

Dewulf et al. (2007) outline a framing approach to cross-disciplinary research that focuses on the different perspectives that researchers from different backgrounds use to make sense of the issues they want to research jointly. They analyze the challenges posed by frame diversity and the methods used to support social-learning processes to develop the capacity of researchers to cross the boundaries for their domain of expertise and engage in productive interdisciplinary research.

Medema et al. (2008) critically review the claims made for integrated water-resource management and adaptive management against evidence from their implementation, and explore whether or not criticisms are rooted in problems encountered during the translation from research to practice. They discuss these findings in the context of the broader societal challenge of effective translation of research into practice, science into policy, and ambition into achievement.

In guiding this special issue to fruition, we have been struck by the way in which reframing sustainable water management within an adaptive-management paradigm has encouraged a generosity of intellectual spirit among the involved researchers. Disciplinary and professional distractions have receded in the face of problem statements that transcend specializations. The nature and benefits

of such inclusive yet highly productive collaboration are largely hidden in the products of our activities. We would, however, like to acknowledge here the often courageous commitment to transdisciplinary working exhibited by the NeWater project team. Professional and intellectual risk taking have characterized much of the research; leading, as demonstrated by the contributions in this special issue, to richer, more nuanced appreciations of the challenges facing those communities exposed to urgent water-resource management issues.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/vol14/iss1/art46/
responses/

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