



Climate Change – a Global Challenge for Water Governance

Claudia Pahl-Wostl

Abstract

The 21st century poses extreme challenges for the governance of environmental problems. Climate change and the concomitant increase of extreme events have exposed vulnerabilities of current resource governance regimes. This has provided further arguments for the need to develop flexible and adaptive governance approaches and innovative approaches to deal with risk and uncertainty to implement and guarantee the long-term sustainability of water management. It has also provided strong arguments for the need to adopt a global and multi-level perspective on water governance issues. Dealing with challenges of climate change requires increasing the adaptive capacity of water governance regimes. Required are robust strategies that perform satisfactorily under a range of initially uncertain but possible future developments. Such strategies can only perform effectively in water management regimes that allow for learning and adapting to new insights. The global dimension of the governance challenge is manifold. Global processes are needed to share and evaluate in a systematic fashion lessons learned to develop a “diagnostic approach” that allows linking specific characteristics of a climate change adaptation problem with appropriate governance approaches towards its solution. Further innovative processes for global governance need to be developed to deal with challenges requiring a global, coordinated response.

Palabras clave (Key words): Water Governance, Adaptive Water Management

1. Introduction

In the past decade, a major change in the rhetoric surrounding water resources management became evident. The debate is now dominated by an increased awareness of integrated management approaches, taking into account environmental, economic and social considerations, and by the search for strategies that go beyond technical end-of-pipe solutions. In other words, the importance of improving water governance is now widely recognised.

Water crises have often been caused by problems of governance and inefficient and ineffective management not by resource or technology problems. Correspondingly more and more voices have advocated the need for a radical change, for a paradigm shift in

water management. The arguments put forward differ in detail and emphasis but not in the essential elements of the nature of the needed paradigm shift which are (Pahl-Wostl, 2006):

- move towards participatory management and collaborative decision making,
- increased integration of issues and sectors,
- management of problem sources not effects,
- decentralized and more flexible management approaches,
- more attention to management of human behaviour by “soft” measures,
- include environment explicitly in management goals,
- open and shared information sources (including linking science and decision making),
- incorporating iterative learning cycles.

The paradigm shift in water management may be interpreted as a sign of an increased awareness of complexity and a fundamental change in understanding what management implies which is not only limited to the field of natural resources and water (Pahl-Wostl, 2007):

In recent months the debate on improvements to water management has been increasingly dominated by the need for adaptation to climate change. This debate has shifted the importance of addressing increasing uncertainties to the centre stage. Experience from the past is no reliable guide for the future, and water management is confronted from all fronts with unprecedented situations.

Overall, the perceived need to change water management concepts and practice, to involve a wide range of stakeholders and to foster social learning can be explained by several insights that are not entirely new but have only recently been seriously taken into account:

- Increasing interdependence between government bodies and other stakeholders (e.g. collective decisions, distinctive competences and complementary contributions) reduces the efficacy of a traditional command-and-control management style and requires a shift towards a more interactive and participatory style.
- The increasing complexity of natural resources management (e.g. a shift towards integrated approaches in management objectives, heightened awareness of the complex nature of socio-ecological systems) requires an enhanced capacity for learning and innovation that functionally engages a wider group of stakeholders.
- Increasing uncertainties (e.g. climate change, dynamic socio-economic conditions) require a more adaptive and flexible management approach to realise a faster coping cycle that allows the rapid assessment and implementation of the consequences of new insights. This requires new skills and capabilities, informal management structures and the inclusion of expert knowledge as well as local lay knowledge.

The rising demand to account better for the full complexity of those systems being managed is driven in part by better appreciation of increasing uncertainties due to climate change and globalisation. In developing and threshold countries, in particular, socio-economic change is occurring at an unparalleled fast pace. Established planning approaches in water management, developed in industrialised countries that rely strongly on the ability to predict the effect of management measures, and design systems that can be controlled are less appropriate in highly uncertain and complex situations.

However, barriers to innovation are often more conceptual than technical. Progress in developing, and in particular in implementing, innovative management approaches has not kept pace with the expressed need for change in management paradigms and practices. Integrated and adaptive management approaches are required that perform well under complex and unpredictable conditions and that can be tailored to the institutional, cultural, environmental and technological settings of river basins..



Figure 1: *The past may not be a reliable guide for the future: Boat in the Guadiana basin reminding visitors that there used to be water and a fishery prior to overexploitation by agricultural irrigation (by courtesy of Andrew Ross)*

2. Uncertainties and complexity

Uncertainties and complexity characterise water management. Water management traditionally emphasises 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. Water management science must confront the main barriers to learning and adaptation: path dependence emerging from sunk costs in prior paradigms, infrastructure and

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

existing practices. Developing new paradigms and practices has gained increasing importance with the attempt to implement integrated management approaches. The prospects of climate change strongly suggest that the goal of management should be to increase the adaptive capacity to cope with uncertain developments rather than to try to find optimum solutions. What is required are robust and flexible approaches that perform well under a range of possible but initially uncertain future developments.

Different kinds of uncertainties have to be taken into account when trying to manage complex adaptive systems in an uncertain environment:

- Ambiguity (= more than one legitimate and plausible interpretation) exists in defining operational targets for different management goals to be achieved; conflicts of interest require participatory goal setting (not by experts alone) and a clear recognition of the uncertainties in this process.
- The outcomes of management measures are uncertain, due to the complexity of the system to be managed and to uncertainties in environmental and socio-economic developments that influence the performance of implemented management strategies.
- New knowledge about system behaviour and insights gained during the implementation of policies may suggest options for change in management strategies.
- Changes in environmental and/or socio-economic conditions may demand change in management strategies.

Water management has a strong and successful tradition in dealing with environmental uncertainties that can be captured by formal and quantitative methods. However, even for factors such as the variability of precipitation, where these methods worked in the past, climate change introduces major uncertainties (Milly *et al*, 2008). The importance of different perspectives and framings of the problem, for example, in scenario planning, are beyond the scope of current management practice. Changes in water management paradigms and innovative methods are required to do justice to the real complexity that water management has to face.

3. Adaptive management

Adaptive management is here defined as a structured process for improving management policies and practices by systemic learning from the outcomes of implemented management strategies and from taking into account new knowledge that becomes available during the implementation process.

The idea of adaptive management has been discussed in ecosystem management for quite some time. It is based on the perception that the ability to predict future key drivers that influence an ecosystem, system behaviour and responses, is inherently limited. The most effective form of adaptive management employs management programmes that are designed to experimentally compare selected policies or practices by evaluating alternative hypotheses about the system being managed. This implies that hypotheses can be generated and that the outcomes of experiments allow a differentiation between the comparative advantages of different hypotheses.

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

As defined above, adaptive management is rather encompassing and broader than the established use of the concept in environmental management. A systematic approach to learning under conditions of high uncertainty need not necessarily include the implementation of small-scale experiments on the ground (which are not always possible) but should be perceived as the guiding paradigm for the design of adaptive policy processes.

However, the implementation of adaptive management is only possible if certain structural conditions are fulfilled. Hence the implementation of adaptive management needs an integrated system design. Which features of a management regime render it more adaptive to maintain environmental, economic and social sustainability in a fast-changing, uncertain world? Some structural requirements for a system to be adaptive have been summarized in table 1 (Pahl-Wostl, 2007; Pahl-Wostl, 2007).

Table 1. Regime elements characterising an integrated, adaptive water management regime.

Dimension	Integrated, Adaptive Regime
Governance Style	Polycentric, horizontal, broad stakeholder participation
Sectoral Integration	Cross-sectoral analysis identifies emergent problems and integrates policy implementation
Scale of Analysis and Operation	Transboundary issues addressed by multiple scales of analysis and management
Information Management	Comprehensive understanding achieved by open, shared information sources that fill gaps and facilitate integration
Infrastructure	Appropriate scale, decentralised, diverse sources of design, power delivery
Finances and Risk	Financial resources diversified using a broad set of private and public financial instruments

The characteristics of integrated adaptive regimes are best seen as working hypotheses since the change towards more adaptive regimes is still slow, and empirical data and practical experience are thus limited. One possible reason for this lack of innovation is the strong interdependence of the factors that stabilise current management regimes. One cannot, for instance, move easily from top-down to participatory management practices without changing the whole approach to information and risk management. Further, despite these general patterns one cannot expect that simplistic panaceas will provide guidance. Science and policy will always be faced with the challenge of designing processes of change without completely understanding the system and problems to be managed. This is also the key challenge for dealing with climate change.

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

The global dimension of this unprecedented governance challenge is manifold. Global processes are needed to share and evaluate in a systematic fashion lessons learned to develop a “diagnostic approach” that allows linking specific characteristics of a climate change adaptation problem with appropriate governance approaches towards its solution. Required is an approach of intermediate complexity taking into account complexity in a systematic fashion (Pahl-Wostl, 1995; Ostrom, 2007; Young, 2007). On the one hand, too generic and simplistic approaches will hardly be able to address the complexity of real governance regimes. Panaceas have proven to be weak in their explanatory power and not very useful or even detrimental for policy advice (Ostrom *et al.*, 2007). On the other hand, too detailed analyses will hardly lead to insights that can be generalized across individual cases.

Further innovative processes for global governance need to be developed to deal with challenges requiring a global, coordinated response such as biofuel production or food crises. However, processes of global water governance are only slowly emerging (Pahl-Wostl *et al.*, in press).

4. The emerging global water governance landscape

Water problems have traditionally been considered to be local or regional problems. However, there are strong arguments to take the global dimension into account (Pahl-Wostl, , in press; Alcamo, 2008). First, the hydrological system is a global system and exchange processes occur at global level over relevant time periods (e.g. climate change impacts; other teleconnections for instance between deforestation and precipitation). Second, global environmental change (GEC) and socio-economic phenomena at the global level increasingly create situations in which the driving forces behind water related problems and conflicts lie outside the reach of local, national or basin oriented governance regimes (e.g. global trade impacts on water quantity and quality). Third, many local phenomena occur globally such as erosion, eutrophication, urbanisation, biodiversity loss, or the introduction of invasive species. The same is valid for many human health issues like the poor quality of drinking water supply and of sanitation in poor countries. Such local phenomena may imply alarming global trends, e.g. the construction of dams led to a fragmentation and flow alteration of the world’s river basins with major and sometimes irreversible impacts on associated freshwater ecosystems (Nilsson *et al.*, 2005). Furthermore, lessons learnt in one part of the world, could be useful and relevant for other parts of the world and comparative learning justifies a global approach. This could be of particular relevance regarding responses to climate change.

Such arguments have led to governance initiatives at global level dominated by networks with different players with a dominance of non-state actors:

- Established in 1996, the **World Water Council**, a multi-stakeholder platform, addresses global water issues through the **World Water Forum** and associated ministerial conference. The conference adopts a political declaration of action points.
- The 2000 **Millennium Development Goals** (MDGs) aim, inter alia, to cut in half the proportion of people without access to safe drinking water and sanitation, and sound water management is seen as key to achieving all the Goals. However, such goals cannot be achieved without global leadership.(4)

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

- The 2002 **EU Water Initiative** (EUWI), states that the EU is committed to contribute to the MDGs on water, through voluntary agreements and mobilizing financial resources.
- **Emerging Global Industrial Players** such as multinational water corporations are participating in domestic water supply and wastewater treatment in several cities.
- The **global diffusion of institutions** (formal and informal rules) can be perceived as self-organized governance structures in an increasingly globalized world, or as a process managed by influential actors to promote some values at the cost of others.

The heterogeneous actor landscape and complex, diffuse networks of interactions reflect that international water governance is fragmented and complex. Postulating that future developments are characterized by the trends towards globalization versus regionalization and centralization versus decentralization one can envisage four scenarios (Pahl-Wostl, in press).

Global multi-level initiative(s): In recent years, low global funding for and the lack of state interest to deal with water and the growing interest in promoting private sector participation in water governance has led to several initiatives. Such initiatives could compete (with synergetic, duplicative or contradictory results) or collaborate (with synergetic results), but collaboration without leadership is unlikely.

Regional, multi-level initiatives: In a multi-speed world, where some regions are more developed than others, successful initiatives may be regionally anchored. These include the EU's Water Framework Directive, and initiatives such as the Mekong River Commission and the Southern African Development Community.

Global treaty based regimes: For the past fifty years, there have been efforts to codify common principles of water law that apply in different regions leading to the influential 1966 Helsinki rules of the International Law Association and its more recent update in 2004. Such initiatives develop common management norms but face competition from the globalisation process.

State centred, unilateral, centralized initiatives: With the rise of terrorism and the return to unilateralism by the United States, one sees a growing trend towards state centred management of water, focusing on national interests and protecting the politically sensitive resource of water.

Each of the outlined scenarios has its own advantages. A centralised state centred approach appears to be outdated, but since water is a politically sensitive resource, many governments will avoid giving up control to fluvial or global regimes. A multilateral regime assures state sovereignty while promoting common norms for dealing with water. Where multilateral agreement is not possible, solutions may be sought effectively at regional level. A pluralist, multi-actor approach may work well for developed countries where institutional processes exist to ensure accountability of the key actors, but there are major doubts about whether such processes will function well for the developing countries.

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

5. Some final considerations

Climate change has exposed vulnerability of current water management regimes and requires a transition in water management paradigms towards adaptive and integrated approaches. Different countries face different degrees of urgency to deal with the problem. Hence we can expect to witness a whole range of policy experiment in the years to come. What is needed is a globally coordinated learning process to be able to share lessons learned and to jointly build a global knowledge base. This would support the development of the “diagnostic” approach which develops tools to analyse problems embedded in context and supports the development of context specific integrated solution instead of advocating simplistic panaceas.

It is unclear how global multi-level water governance will develop. A major challenge is to understand how all these different processes and actors in concert determine certain policy outcomes and how change in governance regimes occurs and what is required to meet the normative principles of good water governance. According to UNDP “good water governance” is characterized by being:

- Participatory
- Consensus oriented
- Accountable
- Transparent
- Responsive
- Effective and efficient
- Equitable and inclusive
- Follows the rule of law

The normative principles of “good water governance” should be guiding evaluation and design of governance regimes. The scientific and policy communities need to focus on some key questions:

- a) What are the most likely developments in water governance and will they meet the emerging challenges arising from global and climate change for the sustainable management of water resources at global scale?
- b) Under what conditions will polycentric governance frameworks provide a base for adaptive, multi-level governance that can flexibly respond to emerging challenges and changes in structural context at different scales?
- c) How can legitimacy, legality, accountability, equity, transparency, effectiveness and efficiency be ensured in such complex and polycentric governance frameworks?
- d) Under what circumstances will global governance networks work in favour of the poor and underprivileged and lead to an empowerment of those whose voice is not yet heard to guarantee the key issues of access to water and sanitation?

Acknowledgements

The ideas presented in this paper have been developed in the context of the European project NeWater (New Approaches to Adaptive Water Management under Uncertainty):

CLIMATE CHANGE – A GLOBAL CHALLENGE FOR WATER GOVERNANCE

www.newwater.info and the Global Water System Project, a joint project of the Earth System Science Partnership: www.gwsp.org. Prepared under contract from the European Commission Contract No. 511179 (GOCE) Integrated Project in PRIORITY 6.3 Global Change and Ecosystems in the 6th EU framework programme.

References

- Alcamo, J.,** C. Vörösmarty, R.J. Naiman, D.P. Lettenmaier, and C. Pahl-Wostl, 2008. A grand challenge for freshwater research: understanding the global water system., *Environ. Res., Lett.* 3, 010202.
- Milly, P. C. D.,** J. Betancourt, M. Falkenmark, R.M. Hirsch, Z.W. Kundzewicz, D.P. Lettenmaier and R.J. Stouffer, 2008. Stationarity is Dead: Whither Water Management?, *Science* **319**, 573-574
- Nilsson, C.,** C.A. Reidy, M. Dynesius, C. Revenga, C., 2005, Fragmentation and flow regulation of the world's large river systems, *Science*, **308**, pp 405-408.
- Ostrom, E.,** Janssen, M.A., and Anderies, J.M., 2007. Goying beyond panaceas. *Proc Natl Acad Sci USA*, **104** (39), 15176-15178.
- Pahl-Wostl C.,** 2007. The implications of complexity for integrated resources management. *Environmental Modelling and Software* **22**, 561-569
- Pahl-Wostl, C.,** 2007. Transition towards adaptive management of water facing climate and global change. *Water Resources Management*. **21**(1), 49-62.
- Pahl-Wostl, C.,** J. Gupta, and Petry, D. Governance and the Global Water System: Towards a Theoretical Exploration, *Global Governance* (in press).
- Pahl-Wostl, C.,** J. Sendzimir, P. Jeffrey, J. Aerts, G. Berkamp, and K. Cross, 2007. Managing change toward adaptive water management through social learning. *Ecology and Society* **12**(2): 30. [online] URL: <http://www.ecologyandsociety.org/vol12/iss2/art30/>
- Pahl-Wostl, C.,** M. Craps, A. Dewulf, E. Mostert, D. Tabara, and T. Taillieu, 2007. Social learning and water resources management. *Ecology and Society* **12**(2): 5. [online] URL: <http://www.ecologyandsociety.org/vol12/iss2/art5/>
- Pahl-Wostl, C.,** N. Isendahl, S. Möllenkamp, M. Brugnach, P. Jeffrey, W. Medema and T. Tessa de Vries, 2006. Paradigms in Water Management. Deliverable D.1.1.2 of the NeWater project. URL: www.newwater.info.
- Young, O.,** 2007. Designing Environmental Governance Systems: The Diagnostic Method. Keynote at IDGEC Synthesis Conference, Bali 2006. Summary published in IHDP Newsletter, 1.2007, 9-11.