



# Water Governance – an historical perspective on current debates

**DOI:**

[10.1016/j.worlddev.2016.11.014](https://doi.org/10.1016/j.worlddev.2016.11.014)

**Document Version**

Accepted author manuscript

[Link to publication record in Manchester Research Explorer](#)

**Citation for published version (APA):**

Woodhouse, P., & Muller, M. (2017). Water Governance – an historical perspective on current debates. *World Development*, 92(1), 225-241. <https://doi.org/10.1016/j.worlddev.2016.11.014>

**Published in:**

World Development

**Citing this paper**

Please note that where the full-text provided on Manchester Research Explorer is the Author Accepted Manuscript or Proof version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version.

**General rights**

Copyright and moral rights for the publications made accessible in the Research Explorer are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

**Takedown policy**

If you believe that this document breaches copyright please refer to the University of Manchester's Takedown Procedures [<http://man.ac.uk/04Y6Bo>] or contact [uml.scholarlycommunications@manchester.ac.uk](mailto:uml.scholarlycommunications@manchester.ac.uk) providing relevant details, so we can investigate your claim.



# Water Governance – an historical perspective on current debates

P. Woodhouse and M. Muller

Author-accepted manuscript: published 2017 in *World Development* 92:225-241

DOI information: 10.1016/j.worlddev.2016.11.014

## Abstract

Since the UN water conference at Mar del Plata in 1977, there have been international debates about how water governance could and should respond to the challenges of sustainable development. New global institutions were established to promote universal norms of governance based on the 1992 'Dublin Principles' and its version of 'Integrated Water Resource Management' (IWRM). Many of these prescriptions were contested, not least because of their advocacy of market-based approaches to address what were posed as challenges of scarcity and environmental sustainability.

The paper examines the drivers that have informed different conceptualisations of water governance. It shows how 'scarcity' has become central to narratives that sought to focus governance at the river basin scale, to restrict water use in favour of the protection and restoration of water resource ecosystems and to prioritize economic efficiency through market mechanisms. It then reviews the experience of a diverse set of countries, some of which have implemented systemic governance reforms and others whose trajectories have been more evolutionary, driven by domestic contexts.

These practical experiences, supported by a growing understanding of polycentric approaches and how networks cross and link a range of geographic and administrative scales, have given rise to alternatives to the normative IWRM, river basin-focused approaches to water governance. Despite continuing concerns about 'planetary environmental boundaries' and transboundary security, these are proving to be weak motivations for adoption of formal global systems of water governance. Instead, new narratives emphasise locally-diverse approaches that see water governed within "problem-sheds" rather than "water-sheds".

Water governance remains a scene of contestation between local and 'global' criteria and developmental and environmental goals. But, in the face of challenges of complexity and diversity and the emerging understanding of network governance, emerging practitioner-oriented guidance is focusing on general principles and explicitly avoiding normative approaches.

## 1. Introduction

Water and its governance has attracted increased attention as a policy concern in recent years. The United Nations has determined that water is a human right (United Nations 2010). The global business community, through the World Economic Forum's Annual Global Risks Report has repeatedly identified water crises<sup>1</sup> as one of its top global risks (WEF, 2016)

A broad goal for governments and business is to achieve "water security" usefully defined as "the reliable availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies" (Grey & Sadoff, 2007, p547-8). This definition includes the risks of flood and drought posed by water as well as the maintenance of important ecosystems and recognises that communities may have different "acceptable" levels of risk and protection.

Concern about water as a source of societal risk has increased as climate change may reduce water resource availability in already dry regions and "intensify competition for water among agriculture, ecosystems, settlements, industry, and energy production, affecting regional water, energy, and food security" (IPCC, 2014, p232). It is also expected to concentrate rainfall in less frequent, but more intense, events, leading to increased flood risks. This presents new challenges of distribution and efficiency.

Some authors have forecast the emergence of dangerous 'global syndromes' (Vorosmarty *et al.*, 2010; Vorosmarty, Hoekstra, Bunn, Conway & Gupta, 2015) while others warn of 'water wars' unless governance is improved (Serageldin, 2009). The UN's inter-agency consortium, UN-Water, reports that, although there is enough water in aggregate to meet growing global demand for food and fibre, major changes in policy and management will be needed. A continuing theme of the UN World Water Assessment Programme's World Water Development Reports has been that the 'global water crisis' is one of governance (WWAP, 2016). The World Economic Forum concluded that improved water governance is necessary "to adapt to climate change and accommodate a growing population and economic development" (WEF, 2016 p7). The OECD has undertaken a major review of water governance (OECD 2015a).

---

<sup>1</sup> Defined as "A significant decline in the available quality and quantity of fresh water resulting in harmful effects on human health and/or economic activity."

In response to growing perceptions of a water crisis, the literature about water governance has grown rapidly over the past two decades. In the 1990s, Google Scholar records just 47 references to the phrase 'water governance' (compared to 1270 for 'environmental governance'). By 2014, there were 2460 references to 'water governance' compared to 6170 for 'environmental governance' (Google Scholar references, excluding citations). This literature derives from a range of perspectives. Some is simply descriptive, documenting more or less formal institutions of water governance, their changing characteristics and the roles that they play (Caponera, 1992; Muller, 2012b). A more analytical, practitioner-oriented literature seeks to understand and improve upon current policy and practice (OECD, 2015c). This includes a sub-set that reflects on the position of water professionals (Molle, Mollinga & Wester, 2009). There is also an extensive theoretical literature, interrogating water governance from a wide range of disciplinary perspectives (Huitema *et al.*, 2009). Finally there is much frankly polemic literature, advocating normative objectives coloured by political perspectives and reflecting the authors' location on an 'environmental Kuznets curve' (see, for example, US-focused Conca, 2006)).

This diversity of perspectives poses a methodological challenge for this broad review of water governance. Despite the consensus about its importance, it is often not clear what water governance entails nor even what its goals should be. This has made comparative approaches difficult, even when they deal with just one use of water (domestic) and one outcome (health) (Gondhalekar, Mollinga & Saravanan, 2013). So it is understandable that, when considering the diverse contexts, activities and outcomes that characterize water resource governance, comparison is loose and implicit rather than rigorous (Mollinga & Gondhalekar, 2014). Reflecting this, the present review samples the diversity of the literature to illustrate particular issues rather than focusing on any one strand.

Water is a fugitive, unequally distributed, highly variable yet renewable natural resource which is inherently part of the natural environment but whose use is essential to all social and economic activity. The diversity of circumstances in which water is found and used makes it difficult to define any single coherent policy for its governance (OECD, 2015b). The United Nations has struggled to define governance indicators for the water resource-related targets (6.4 and 6.5) of Sustainable Development Goal 6: "*Ensure availability and sustainable management of water and sanitation for all*". Initial proposals were for indicators based on subjective scores of the quality of policies, institutions, management tools, and financing or, in shared river basins, the mere existence of an international management agency (IAEG-SDGs, 2016). The resort to using as indicators the mere

presence of governance instruments, rather than their effectiveness, is diagnostic of the scarcity of evidence about the outcomes of such organisational models.

The OECD has defined water governance as “the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management” (OECD 2015a, p5). This helpfully distinguishes water governance from ‘water resource management’- which is often taken to include water governance but can usefully be considered to focus on the operational activities of monitoring and regulating water resources and their use - and planning, building and operating water infrastructure. Water governance is then the overarching framework which sets objectives, guides the strategies for their achievement and monitors outcomes.

This review begins by identifying some key theoretical elements in the literature on ‘governance’ in general and considering some of the conceptual underpinnings of specific relevance to water governance. Focusing on the governance of the resource rather than its management or the services derived from it, we outline the emergence of normative narratives about a ‘global water crisis’ and the central importance of a narrative of scarcity in particular, showing how this allies with both an economic narrative which suggests that the challenges are best addressed through market related mechanisms, and also an ecological narrative that emphasises water conservation.

The resulting conceptual tensions are explored to assess how they have played out, in section 3, in policy debates and, in section 4, in the practice of water governance in different contexts. In section 5 we return to the conceptual underpinnings of water governance and reconsider them in the light of context-specific experience. In the concluding section we suggest that, while efforts continue to identify a framework for the transfer of experience from one context to others, recent international experience shows that local complexity and diversity challenge universalising norms of ‘best practice’ and that practice can, at best, only be guided by general principles. We argue this is an important step towards a concept of water governance that can more effectively address changing demands on the use of water to achieve social, economic and ecological goals.

## 2. Conceptualising water governance

In this section we identify some key elements encountered in debates about water governance. These include aspects arising from the 'materiality' of water, its multi-faceted nature as a natural resource, and from its competing and complementary uses, both of which have implications for social organization. A closely-linked question is that of what goals water governance seeks to achieve, and how these may vary with changing material conditions of societies. This review takes as a starting point an assumption that the context in which people and their societies interact with water frames the way that the relationship is described. This in turn determines the rules and procedures that constitute water governance and explains why water governance discourses are so often discordant. We consider three of the most often-debated questions about how water is governed: who should participate in decision-making; at what geographical and political scales should governance institutions operate; and what is the appropriate role of market or non-market criteria in allocation of water. We do not seek to synthesise these elements into a single framework, as we share with others (e.g. Srinivasan, Lambin, Gorelick, Thompson & Rozelle, 2012, para 5) the view that a single conceptual framework for the study of human-water systems has yet to be identified (and we later suggest that such a framework may not prove helpful in practice), but it seems clear these factors shape the way water governance is conceived, discussed and reflected in practice.

Water runs through all human activities and our interactions with it as a natural resource are part of broader narratives about the relationship between humans and nature. In particular, a narrative of 'scarcity' has long legitimated modernist responses of infrastructure building (Swyngedouw, 1999). More recently, it has also underpinned universalising principles which validate markets and pricing and a goal of sustaining 'natural hydrology' as means of arbitrating between competing uses of water. We therefore consider the consequences and limitations of the 'scarcity' narrative in water governance. Finally, we consider how generic concepts of 'governance' necessarily impinge on discourses in what is often considered to be a distinct 'water sector'.

### **Histories: collective action, state formation, modernisation**

Efforts to control, manage and govern the use of water are as old as agriculture and human settlement. In early societies, the challenge posed by water management was to enable social cooperation, even if it was in the form of enforced collective action, to take the steps necessary to gain some control over the resource. Wittfogel (1957) was among the earliest writers to try to move beyond the descriptive approach and to theorise the relationship between social organisation and the management of water. Drawing on observations from China, India and Sri Lanka to Central

America, Mesopotamia, Egypt and East Africa, he argued that hierarchical state formation was essential to enable development of water irrigation infrastructures in regions across the world.

While Wittfogel's 1950s interpretation of the "despotic" nature of "oriental" governance in such 'hydraulic societies' reflected the cold-war tensions of the time, other authors such as Caponera (1992, p11) provided a more positive perspective: "as soon as human groups settled around a water point or a river valley, the need arose for minimum water control in order to satisfy the water demands and to ensure an equitable water distribution between different uses and users". While his focus was on the formal frameworks of law, Caponera also acknowledged that the specific arrangements depended on many factors, ranging from the physical conditions and climate to socio-economic circumstances, power relations and religious and philosophical belief frameworks.

Early studies focussed on agrarian societies but water management has also been integral to industrialisation. Water has driven machinery and generated electric power while watercourses have enabled bulk transport. More recent narratives of the relationship of social and political change and water governance have emphasised the role of water infrastructure development as a more or less conscious strategy of building modern nation states in the early 20th century, as documented by Swyngedouw (1999) for post-imperial Spain, and by Reisner (1986) for the western United States.

Modernisation goals were shared by the Soviet Union: Gorky reportedly said that an untamed nature constituted "a despot"; that Soviet engineers were making "mad rivers sane"; and that dams were weapons in the war between socialists and their capitalist enemies (Rook 2004). The literature on post-colonial Asia and Africa documents similar paths (Molle *et al.*, 2009), although each case has its governance particularities. Nation-building ventures were actively encouraged by the example of the USA's Tennessee Valley Authority (TVA), a symbol of modernisation that placed water at the centre of multi-sector development planning, a controversial venture in its own right (Ekbladh, 2002; Rook, 2004).

The political economy dimension is often evident in such 'modernisation' drives. Aside from promoting its approach on the Mekong and the Yangtze, the TVA's David Lilienthal promised it would bring "a second Bolivarian revolution" to Colombia (Neuse 1996, p261). In Africa, Arthur Lewis, as economic advisor to Premier Nkrumah, described the political economy that drove the construction of Ghana's Akosombo Dam and its contribution to Nkrumah's overthrow (Tignor, 2006). The cold war political economy of Egypt's High Aswan Dam is extensively documented but with limited reference to the tensions that saw a technically inferior option adopted to control the Nile because the colonial alternative, based on infrastructure in Sudan, Ethiopia and Uganda, would

undermine Egypt's sovereignty (Collins, 1994). Shah (2009) locates the current dramatic challenges of water management in South Asia against a history of irrigation development in which the colonial period was but one chapter of a much longer and broader story of political, social, economic and environmental change (Stone, 1984; Venot, 2009). Parallel to these societal narratives are the many practitioner histories that explain in considerable detail the institutional arrangements that allowed the objective 'development' requirements of their diverse societies to be met through application of human ingenuity and financial resources (Mead, 1903, Olivier 1976).

### **Environmental goals of mature democracies vs development challenges in growing economies**

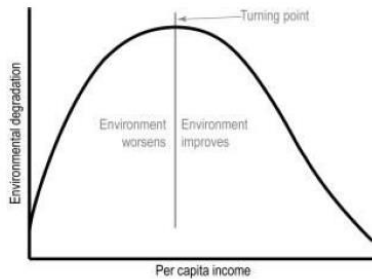
The 'post-modern' world of developed countries with mature economies has generally turned away from engineering increased water supply toward less grandiose goals of 'demand management' and environmental protection (Postel, 1984). These goals are part of broader narratives of ecological modernization (Dryzek, 2013) that envisage 'decoupling' economic growth from natural resource use to reduce the environmental impacts of social and economic activities (UNEP, 2015).

However, rapidly growing, urbanizing and industrializing developing countries still face huge challenges of developing and managing their water resources to keep pace with increasing demands. Water abstractions are expected, in one widely-cited scenario, to increase by 55% by 2050 (OECD, 2012). In many locations, demands on water resources have already grown beyond the point at which the primary objective is simply to make water available, to further encompass measures to protect the resource from pollution and communities from its extremes. When this happens, trade-offs must be made about who may use water for what purpose and under what conditions. So what are the formal and informal institutional arrangements that enable strategies to emerge and decisions to be taken? What actions must be taken by which actors and agencies to give effect to those decisions? How and to whom they will account for their performance, if at all? This is the stuff of water governance.

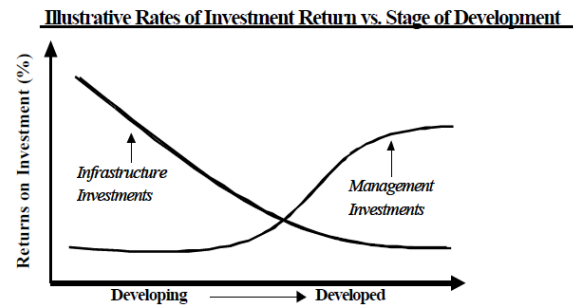
Some evidence suggests that the focus and locus of water governance moves as contexts change and new sets of problems and preferences emerge. Grey and Sadoff (2006) suggest a generic progression whereby an emphasis on developing increased supply through infrastructure development gives way to institutional and regulatory approaches to manage water consumption. They argue that this is, in part, because the latter strategies yield better returns on investment once there is adequate infrastructure in place to enable them. The changing focus may also reflect the evolution of societal priorities, described theoretically by the 'environmental Kuznets curve' which suggests that environmental protection improves once incomes reach a critical threshold (Stern, Common & Barbier, 1996). This may also explain the enthusiastic promotion of water management



norms for conservation and demand management by developed world actors in poorer countries (Muller, 2011).



*Environmental Kuznets curve*



*source: Grey and Sadoff (2006)*

### **Participation and deliberative democracy**

But through what mechanism are changing social preferences reflected in water management practice? A consistent theme in the water governance debate has been the concept of what, at the 1977 UN water conference in Mar del Plata, was simply described as ‘participation’. It was suggested that this could help to ensure that the perspectives and knowledge of water users were recognized and tapped, in turn improving the quality of water management decisions. It built on the (then) conventional wisdom of development planning which emphasized that the success of a plan would depend on public acceptance which could “be facilitated by some kind of public participation in the discussion and formulation” (Waterson, 1965, p466) not least because, in mixed economies, private sector organisations would play a large part in implementation. This technical and functional approach was superseded by the more expansive goal of “participatory environmental governance”, enshrined in the final Declaration of the 1992 UN Conference on Environment and Development which stated as a principle that “environmental processes are best handled with participation of all concerned citizens, at the relevant level”. Not only would information concerning the environment be available to all but each individual would have “the opportunity to participate in decision-making processes” (UN, 1992, p3).

Saravanan, McDonald and Mollinga (2009) attribute the ‘Integrated Water Resource Management’ (IWRM – see below) approach to governance to Jurgen Habermas, for whom participation was a critical element of democracy, not simply a mechanism to gain information and improve decision-making. His propositions were eagerly adopted by a generation of environmental advocates,

informing much of the generic environmental governance debate and reflected in a range of policy initiatives. In Europe, participation was explicitly promoted by the Water Framework Directive (2000) as detailed by Newig and Fritsch (2009), and this approach supported, and indeed required, the decentralization of functions and arrangements that could provide forums for such engagements.

**Scales matter – but should watersheds take precedence over problem-sheds?**

However, it is not only participation processes that need to be undertaken at an appropriate scale. Dynamic and unpredictable water resources require flexible and adaptive approaches to their management. Yet the scales at which water flows and is used often cut across political and administrative boundaries, economic agglomerations and social and cultural groupings, complicating decision-making and posing significant governance challenges.

One obvious scale for water governance is national since it is at this level that political actors and interest groups compete, make tradeoffs and lobby governments to make policy and pass legislation that guides subordinate institutions. In federal states like Australia, Brazil, the USA and India, water resources are the mandate of sub-national entities. Federal arrangements within, and confederal arrangements between, sovereign states add further complexity to the political processes inherent in water governance (Garrick, Anderson, Connell & Pittock, 2014). Southern Africa's Protocol on Shared Rivers (SADC, 2000), establishes consultation procedures and encourages (not requires) countries to coordinate and harmonise their approaches on shared rivers. Similarly, Europe's national water administrations are guided and regulated by the European Commission under an umbrella water framework directive (WFD, 2000). However, even as they pooled sovereignty, national governments were constrained by the powers of their sub-national governments. Thus, German *Länder* were unwilling to relinquish their powers over water resources and blocked the establishment of cross-border basin organisations (Moss, 2004), preferring instead to achieve coordinated action by creating joint commissions, such as the International Commission for the Protection of the Rhine.

Politically determined scales make less sense from the perspective of environmental governance in which physical geography takes priority (Bierman *et al.*, 2010) and the river basin is an obvious 'anchor scale' for governance and management of water resources. However, while many practical water management functions are best undertaken at a basin scale, the centrality of the basin envisaged in IWRM since the 1990s is increasingly questioned. Other scales matter, particularly from the perspectives of water users.

While the 'watershed' or river basin may appear to sectoral water specialists as a more logical management unit than 'arbitrary' political or administrative boundaries, water decisions are rarely separable from social and economic decisions in practice. One conceptual response to the limitations of the 'watershed' has been to focus instead on the relevant 'problem-shed' (Mollinga , Meinzen-Dick & Merrey, 2007) which may be bigger or smaller than the 'watershed'. As an example, water supply to South Africa's Gauteng province and surrounding region, with a third of the country's population and much of its economic activity, comes from a system that taps four separate river basins (Muller, 2012a).

The question of scale also arises when participative approaches are promoted. Newig and Fritsch (2009) note that the effectiveness of participatory environmental governance is often greater at scales that are small enough to allow face-to-face interactions between actors. However, in many cases, resolution of issues requiring the internalisation of environmental externalities (often a key objective of environmental governance) can only be achieved at a larger scale. This 'nesting' of decision-making at different scales is an important element of Ostrom's (2009a) framework for understanding the institutional basis for management of natural resources

At the other extreme, Pahl-Wostl, Conca, Kramer, Maestu & Schmidt (2013) suggest that there are 'missing links' in global policy formulation that can only be filled through global initiative and there have been proposals for global scale water governance or at least norm-setting (Conca, 2006; Pahl-Wostl, Kabat & Möltgen, 2008). Perhaps the most important practical global governance initiative was the establishment in 2003 of UN-Water, which coordinates 27 international agencies with interests in water management. In addition, a high level advisory board was convened by the UN Secretary General (UN Water, 2016). However, this potentially powerful network reflects many of the tensions and conflicts of the UN system as well as between different interest groups, prompting a search for alternative approaches (Castro, 2007; Pahl-Wostl, Gupta & Petry, 2008).

### **Public resource or private property? Markets or administrations?**

As soon as demands for water require financial investments in infrastructure and institutions to meet them, it becomes logical to treat water as an economic good, in at least some of its uses. This serves to determine, for instance, the sources of the funds required for such development. So, in the USA, water schemes to enable agricultural and urban development in the Western states at the turn of the 20<sup>th</sup> century were explicitly funded by sales of the associated land (USA, 1902).

Moreover, since most of the world's water abstractions serve economic users such as agriculture, power production and industry, there would appear to be a strong argument for using market

instruments to guide water allocation. The market paradigm has been widely promoted over the past three decades (see below) and has clear governance implications. But its general application requires clear property rights in water. In practice, the legal status of water resources varies widely, reflecting the values of the society concerned and the distribution of power and interests within it, as well as the multiple uses to which water resources are put. While property rights in land are often described as a “bundle of sticks”, a collection of rights of access, exclusion, use and disposal that together constitute ownership, water ‘rights’ are considerably more complex. Indeed, Zellmer and Harder (2007, p684) suggest that property in water should rather be considered as a ‘web of interests’.

China’s Yangtze River provides a practical example of this web. Water is withdrawn for agriculture and to supply human settlements and industries as well as supplementing supplies to regions beyond the river basin. But the river is also used for navigation and hydropower production which require a continual flow, as do many cultural, recreational and tourism activities. In addition, significant volumes of domestic and industrial waste are discharged into the river, which removes, dilutes and partially purifies them but also reduces water quality for other uses and users downstream. Finally, floods and droughts regularly afflict the river basin and cause significant social and economic damage if not effectively managed. Water resource governance has to balance all these interests (Yang & Muller 2009). This raises particular challenges for legal definitions of property in water:

“The fact that water is a moving resource necessarily limits the appropriateness of traditional concepts of ownership. Although water laws differ widely, notions of substantial public rights in the resource is a major theme across allocation regimes and throughout history. One result is that lawmakers have superimposed administrative systems in an attempt to regulate private interests in the use of water and to advance the broader public interest.” (Getches, Zellmer & Amos, 2015, p1)

Given such complexities, the case for using markets and prices as the *primary* instruments of governance to achieve goals of efficiency, equity and sustainability is weak. This has not prevented policy-makers from seeking to do so. The World Bank’s 1992 Water Resources Management Policy explicitly promoted market approaches:

“At its core is the adoption of a comprehensive policy framework and the treatment of water as an economic good, combined with decentralized management and delivery structures, greater reliance on pricing, and fuller participation by stakeholders.” (World Bank 1993, p10)

Similarly, the European Commission's "Blueprint to Safeguard Europe's Water Resources" identifies pricing as an incentive to use water efficiently and as a powerful awareness-raising tool for consumers, combining environmental with economic benefits, as required by the Water Framework Directive of 2000. 'Putting the right price tag on water' is seen as one of the measures to achieve the overall resource-efficiency objective of Europe 2020. However, rather than seeking to allow markets to make allocation decisions, the objective is characterised as an environmental intervention: "Not putting a price on a scarce resource like water can be regarded as an environmentally-harmful subsidy" (EC 2012, p10). We return later to consider the role of the market in water governance.

### **The discourse of scarcity and its implications for water governance**

Whether viewed from the perspective of economic returns on investment or as democratic response to changing social preferences, the objectives of water governance will change over time to meet changing circumstances. However, for much of the past three decades this argument has been somewhat obscured by a perception that water is generally a 'scarce resource' (Postel 2000).

Given the continuing impact of this 'scarcity' narrative on water governance, it is important to understand the nature of this influence. Most fundamentally, the scarcity narrative has focused governance efforts on the management (restriction) of demand, rather than the increase in supply. This is evident in the European Union where, while the challenge is posited as one of scarcity (questionable in much of temperate Europe), the underlying objective is to reduce environmental impacts by reducing water withdrawals. For developing economies, the scarcity narrative became the foundation for a particular approach to water governance and management characterised by the 1992 International Conference on Water and the Environment (ICWE) in Dublin as 'Integrated Water Resources Management' (IWRM), discussed in more detail below.

The relevant prescriptions of IWRM were: first, that water should be managed within the boundaries of natural hydrological units constituted by river basins or watersheds within which water was identified as a renewable, but finite (and hence potentially scarce) resource. Second, since water was thus defined as scarce, it had to be treated as an economic good. Then, third, to resolve inevitable competition over access to the scarce resource, participative approaches had to be adopted within the boundaries of the river basin. Consistent with this 'demand management' approach, the 'Dublin Principles' include no reference to infrastructure development to increase water availability (Young, Dooge & Rodda, 1994). This implicitly constrains strategies that might increase supply, for example through storage infrastructure or through transfers between river basins.

This approach, which effectively restricts choices, locates ‘scarcity’ as a ‘totalising discourse in both north and south’ (Mehta, 2010, p2) that may obscure context-specific political questions of water allocation in favour of universal technical and normative criteria. The scarcity narrative supports two important ideological positions. First, it demands efficiency (maximising economic returns) in water allocation and thus recourse to economic valuation of implicitly competing uses of water in order to allocate water between them to greatest economic advantage. Second, it promotes an interpretation of environmental conservation that treats minimizing departure from ‘natural hydrology’ as the criterion for ‘sustainable’ water resource management. In part, this is justified by contemporary efforts to rectify past ‘mistakes’ in water management: channelling of river beds; encroachment of settlement onto floodplains leading to flood risks; and obstructing fish migrations to spawning sites. But, while redress of ‘excessive’ development is framed as returning rivers to more natural conditions, there is a risk that privileging natural hydrological patterns and their associated ecologies as benchmarks for sustainability will make water scarce for all other social goals.

Luks (2010, p99) has argued for a distinction between ‘limits’ as objective, empirically verifiable characteristics, and ‘scarcity’ as individual or social subjective perceptions of what those limits signify. Water limits may be measured in terms of flow volumes in streams or recharge rates of aquifers but what this signifies in terms of water use for particular purposes is subject to cultural and political values and priorities (WEF, 2014). Empirically, the over-riding importance of political context in water allocation is demonstrated in large urban water supply systems, many of which divert, store and deliver water from sources far afield. Such tensions between context-specific political priorities and efforts to implement universal ‘technical’ principles based on economic or environmental criteria supported by narratives of water scarcity underpin many of the debates about water governance over the past three decades.

### **So what do we mean by water governance?**

While the drivers of water governance narratives are complex and nuanced, so too are current concepts of governance more generally. In both cases, it is necessary to go beyond just the “rules, practices and processes” approach taken by the OECD. Rhodes (1996) identified six distinct applications of the term, referring to the minimal state, corporate governance, new public management, the Washington Consensus’ ‘good governance’, socio-cybernetic systems and self-organizing networks. He suggested that the best approach was to “rescue” the concept “by stipulating one meaning” (Rhodes, 1996, p660). But which is relevant to the governance of water?

Fukuyama's (2013, p3) definition of "... governance as a government's ability to make and enforce rules, and to deliver services, regardless of whether that government is democratic or not" is not of much use in complex local water management situations where governments' role is necessarily limited. But his later reflection (Fukuyama, 2016, p100) is more helpful, pointing out that "The two apparently opposed meanings of governance—on the one hand, governing without government, and on the other, traditional state-based public administration—are in fact linked." He now approximates Rhodes who, for his purposes (the study of British government and public administration), said that "governance refers to governing with and through networks" (Rhodes 2007, p1246), envisaging a "core executive" and "decentralised, steered networks". This conceptual structure resonates with that of Elinor Ostrom who, in order to explain how the use of 'common pool' natural resources such as water could effectively be governed, conceptualised a series of 'nested' or 'polycentric' institutions (Ostrom 2009a). We return to consider the relevance of these perspectives once the context has been further established. We now turn to consider how policy and practice have played out in recent decades.

### 3. 'Global' evolution of a 'universal' paradigm

The surge of interest in water governance over the past two decades and the emergence of a (briefly) dominant paradigm was the outcome of a series of global initiatives, starting with the 1972 Conference on the Human Environment, which placed environmental issues on the global political agenda. The 1977 UN Conference on Water in Mar del Plata, Argentina, convened as a follow-up, provides a useful baseline from which to review the evolution of the discourse and remains the only formal global governmental meeting to focus solely on water matters.

The Mar del Plata problem statement was that the "accelerated development and orderly administration of water resources constitute a key factor in efforts to improve the economic and social conditions of mankind" and "it will not be possible to ensure a better quality of life and promote human dignity and happiness unless specific and concerted action is taken to find solutions and to apply them at the national, regional and international levels" (UN, 1977, p1)

Many of the issues raised in subsequent debates – coordination of different users and authorities, participation and accountability for decisions, and legal frameworks to ensure effective water allocation – were about water governance. Because water matters were often dealt with by "numerous agencies without adequate coordination and without adequate links to other aspects of national planning", institutional arrangements should ensure "real coordination". This was not just a

matter of more efficient public administration; the recommendations also called for clarity on the roles and powers of government agencies and the way in which they conferred rights to use water on individuals.

The importance “of obtaining effective participation in the planning and decision-making process involving users and public authorities” was emphasised since “such participation can constructively influence the choice between alternative plans and policies” (UN, 1977, p35). A specific recommendation was that countries should “promote interest in water management among users of water; users should be given adequate representation and participation in management.” Also needed was a coordinated approach to water planning that defined the rules of public ownership of water and was “flexible enough to accommodate future changes in priorities and perspectives” (UN, 1977, p32).

Two other themes anticipated subsequent debates on environmental issues and integrated water resource management. Reflecting its genesis in the UN’s 1972 environment conference (UN, 1972), the Mar del Plata explicitly recognised the importance of mitigating environmental impacts of water resource developments through the use of “systematic and comprehensive” environmental impact assessments. Integration was emphasised throughout: for policies and legislation, planning and management, quantity and quality, surface and underground water. More generally, multi-purpose approaches were encouraged, characterised as “integrated water resource development and management” (UN 1977, p78).

The Mar del Plata conference report was endorsed by the 116 governments present. While focusing on resource management, it also declared that “all peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantity and of a quality equal to their basic needs” and proposed the International Drinking Water Supply and Sanitation Decade (1981-90). But while the drinking water decade was implemented, the 1980s were considered to be a ‘lost decade’ for water resources (Scheumann & Klaphake, 2001).

That changed in the 1990s. While water was hardly mentioned by the 1987 World Commission on Environment and Development (Brundtland, 1987), it was firmly on the agenda of the 1992 UNCED conference (the Rio ‘Earth Summit’) which sought to reconcile the apparently divergent priorities of environmental protection in the north and socio-economic development in the south (UN 1992). A preparatory ‘International Conference on Water and the Environment (ICWE)’ brought together “experts and professionals well versed in the different fields of water” (Young *et al.*, 1994) in Dublin in 1992. Convened by a group of UN agencies, the Conference’s primary outcome, the “Dublin



Principles” (ICWE, 1992), was decided by voting rather than the UN process of consensus and reflected the dominance of environmentally-oriented delegates from Europe and North America. But, while ICWE’s status as an ‘expert’, not inter-governmental, meeting limited its impact (Biswas, 2004), it shaped policy over the next decade.

Chapter 18 of Agenda 21, UNCED’s action programme, attempted to reconcile different concerns. While the ICWE Principles stated simply that “Water has an economic value in all its competing uses and should be recognized as an economic good”, Agenda 21 was more nuanced: Water resources management should consider “water as an integral part of the ecosystem, a natural resource and a social and economic good....In developing and using water resources priority has to be given to the satisfaction of human needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged appropriately” (UN 1992, s18.8). Agenda 21 also recognised that water resources would still be “developed” which Dublin did not. However, it was not Agenda 21, but ICWE’s ‘Dublin Principles’ which had the greater impact over the following decade, driven by the establishment of the World Water Council (WWC) and the Global Water Partnership (GWP), both explicitly committed to the promotion of the Dublin Principles. (ICWE’s proposal for “a world water forum or council” involving private institutions, regional and non-governmental organizations along with “all interested governments” was not approved at UNCED.)

The WWC’s first triennial World Water Forum (WWF) was held in 1997. The second, in the Hague, saw sharp divisions. The ‘World Water Vision’ produced for the event stated that “there is a water crisis, but it is a crisis of management”. Overall, it promoted Dublin principles such as ‘holistic’ management of the water resource at catchment level, and declared that ‘participation is key’ but focused on “full cost pricing” as “the single most immediate and important measure” (WWV, 2000, p33). The central narrative of the ‘instrument principle’ characterised water as a scarce commodity, which would be transferred from inefficient to ‘higher-valued’ uses by getting the price right. Moreover, it argued, investments required to address population growth and rising demand would be beyond the fund-raising capacity of the public-sector, and the private sector would only invest if prices reflected the ‘full cost’ of supply.

Many participants felt that the WWV was promoting “a corporate vision of privatisation, large-scale investments and ... insufficient emphasis and recognition of the rights, knowledge and experience of local people and communities and the need to manage water in ways that protect natural ecosystems.” (Morley, 2002, p7). There was, at the time, growing tension over the promotion of privatisation of public services and the Vision reflected efforts by French, British and US multinationals to gain market share (Bakker, 2007). Following highly-publicised protests and

cancellation of contracts, such as that at Cochabamba, in Bolivia (Nickson & Vargas 2002), they have subsequently retreated from many markets in poorer countries (Kishimoto, Lobina & Petitjean, 2015).

The divisions in The Hague were repeated in Kyoto in 2003. The 2006 WWF in Mexico City was met by street demonstrations and organisers of 'Alternative Water Forums' arguing that the WWC was dominated by commercial interests. The controversy about the organisation of water service provision ultimately distracted and detracted from the wider governance challenges of the water resource agenda and, since the conclusions of WWF meetings are not binding, there has been dwindling political engagement. The 6<sup>th</sup> WWF was held in the WWC's home of Marseilles in 2012 after no country offered acceptable hosting arrangements. The political declaration from the 7<sup>th</sup> WWF held in Korea (WWF, 2015) confirmed this lack of ambition or impact, focusing mainly on getting a dedicated Sustainable Development Goal for water on the global agenda to provide an implementation roadmap for the sector. Similarly, for almost two decades, the Global Water Partnership doggedly promoted its interpretation of IWRM, despite growing criticism that its approach was simplistic and politically naive. Only recently has it departed from this position, with no reference to IWRM in a recent publication focusing on water security (Sadoff, *et al.*, 2015). The change in perspective was confirmed by a frank review of the limitations of the IWRM approach (Shah, 2016).

This shift was one consequence of a programme of work initiated by the OECD in 2010 to address the challenge of improving water governance in and beyond its member countries. The OECD programme started from the potentially controversial premise that: "... the current water "crisis" is not a crisis of scarcity but a crisis of mismanagement, with strong public governance features." It recognised the inherently complex nature of the water cycle, its vital contribution to health, poverty alleviation, agriculture and energy and the multiplicity of actors, motivations and stakes in water policy (OECD 2011, p17).

Based on this initial work, the 2013 Water Governance Initiative (WGI) sought to develop a set of general principles. Reflecting the OECD's structure and approach to its mission of "promoting policies that will improve the economic and social well-being of people around the world", it was practitioner-oriented with representatives from national governments, water sector institutions as well as some NGOs and academics. The WGI report, tabled at the 7<sup>th</sup> WWF in Korea, emphasised the continued importance of improving water governance but recognised that there could be no normative blueprint (OECD 2015b). This was a significant turning point in water resource governance discourse.

## 4. Context-specific experience of water governance in practice

To consider how theoretical debates about water governance have been influenced by practice and vice versa we review briefly a number of national jurisdictions (the scale at which most water governance arrangements continue to be framed), chosen to illustrate a diversity of hydrologies, economies and political systems as well as water governance approaches. In some cases, notably the European Union, Mexico, Brazil, Chile, South Africa and Australia, this was a period of major water governance reforms. In others such as China, India, USA and Turkey, there was an evolution of business as before. We outline water resource contexts and challenges, legal frameworks and institutional arrangements as well as key outcomes in the domains of water security for large urban areas; impact on agriculture; environmental status; and the management of local and transboundary conflicts.

**The European Union** has a special position since it recently reformed its systems of water governance and its members also led the promotion of new approaches internationally, through aid and related relationships. An extensive literature addresses both theoretical approaches and operational outcomes. The Water Framework Directive (2000), product of a decade of negotiation, embodies much of the ‘Dublin agenda’:- it mandates participative governance processes, uses the river basin as a management unit, promotes the use of economic instruments and sets environmental quality as its key objective.

But the WFD operates across radically different physical contexts, from relatively arid Mediterranean areas to the well-watered temperate climates of central and northern Europe and the largely reclaimed landscapes of the Netherlands and Belgium. Member countries’ long and different traditions and institutions of water management range from the centuries old Dutch *waterschappen* (Toonen, Dijkstra & van der Meer, 2006) and Spanish *comunidades de regantes* (Garrido, 2011) to the more recent innovations of France’s ‘basin parliaments’ (Roussary, 2014) while Britain had delegated significant resource management functions to private water service providers, overseen by the national Environment Agency (Watson et al 2009).

To achieve harmonisation within this diversity, the WFD specifies procedural approaches, described as “mandated participatory planning” (MPP) rather than traditional technical standards. Koontz and Newig (2014, p248) explain that MPP, “... mandates the explicit formulation of certain plans or programmes on a national, subnational or even cross-national level.” Member states must assess

their situation and then develop programmes to attain the Directive's political objectives. "MPP combines three important policy making phenomena: multi-level governance, participatory governance, and nested policy cycles" (Koontz and Newig, 2014, p595)

This generic approach was acceptable in Germany since it did not usurp the constitutional powers of their sub-national *Länder* by requiring separate river authorities. It allowed Britain to use its centralised national Environment Agency to manage water resources. The WFD is also extremely flexible with regard to environmental standards. The low countries can classify much of their resource as "artificial" while a 'heavily modified' status is also allowed, which protects arid Mediterranean countries where requiring a 'good ecological status' would compromise agriculture.

The overall conceptual approach of the WFD has been criticised as not particularly rigorous. Bouleau and Pont (2015) describe it as an "ambiguous piece of law" and not particularly coherent with modern concepts of ecology that acknowledge continuous environmental evolution and human/nature interactions. Nevertheless, many practitioners still consider it a useful instrument to achieve the desired harmonised approaches to the different problems confronted in diverse jurisdictions.

While implementation has been slow (BMU 2012, DEFRA 2011), it is too early to draw firm conclusions about the WFD's effectiveness as a governance model for Europe's water resources given its long term goal of achieving a good ecological status in all surface waters by 2027. The WFD's implementation also reflected national political economies. In Spain (Swyngedouw, 2013), it became a lobbying tool in policy debates about trade-offs between river transfers and desalination. In Britain, it was used to promote huge investments in London's wastewater (Thames Water, 2005) while in France, the WFD ended an experiment in river basin parliaments because they did not fit the institutional requirements of the framework. In many other countries, the WFD's impact was limited to inserting new terminologies into existing policy documents. Behagel and Arts (2014) found that the WFD's performance was not (yet) convincing in any of its innovative governance dimensions – the use of multi-level institutions, the involvement of non-state actors and new modes of accountability. And, in straitened economic times, the WFD's environmental focus is in tension with the different values inherent in the goal of economic efficiency (Feuillette *et al.* , 2016).

Meanwhile, solid cooperation in the governance of Europe's transboundary rivers predates the WFD. Substantive governance arrangements on the two major shared rivers, the Rhine and the Danube, were catalysed by pollution and flood disasters (van Dijk, Martein & Schulte-Wulver-Leidig, 1995; Geilan *et al.*, 2004; Hooijer, Klijn, Pedroli & van Os, 2004). A feature of current transboundary

governance is that formal cooperative structures (Commissions) serve primarily to coordinate work undertaken by joint teams drawn from national administrations.

**The USA's** governance of water resources reflects its federal system and history of territorial settlement, the diversity of hydrologic regimes producing a different legal regime for water in each state. In some, land owners gain 'riparian rights' to use rivers. In the arid west, a first-come, first-served "prior appropriation" system applies while ten states have hybrid systems (Getches *et al.*, 2015). Where rivers and groundwater cross state boundaries, water is allocated by negotiation, adjudication or, *in extremis*, federal determinations. Federal government authority derives from the Constitution's commerce, property, 'general welfare' and international treaty clauses. These allow it oversight of navigable waters and interstate fisheries and a stake in arid western states where it controls much of the land. 'General welfare' provisions permit interventions in pollution and water quality issues while the treaties clause allows federal action in rivers shared with neighbours, Canada and Mexico.

Where limited water is available, state courts settle water matters (McDonnell, 2015). But governance is moving from courts to formalised administrative systems in response to the difficulty of adjudicating *ad hoc* claims in complex and changing circumstances. The immense scale of such exercises is illustrated by the adjudication in the Snake River, a tributary of the Columbia, which took 37 years to settle over 150 000 claims (Thorson, 2015).

The combination of a legal system that adjudicates property rights within a regulatory framework constrained to focus on environmental issues has produced an avalanche of popular and academic literature decrying the ineffectiveness of water governance, particularly in states with prior appropriation systems (see for example, Reisner, 1986, as well as the more systematic analyses of Getches *et al.*, 2015). Yet the recent extreme drought in California has had limited economic impact on agriculture and food prices, suggesting that the framework has enabled water users to adapt in order to optimise their water use under changing circumstances (Cooley, Donnelly, Phurisamban & Subramanian, 2015). Nonetheless, the equity of the distribution of costs and benefits between agriculture, urban users and the environment is vigorously debated (EWG, 2004).

The US has provided many prototypes for 'rational' water resource management whose adoption has been advocated elsewhere. These need to be understood in terms of their specific political economic contexts, however. For example, Roosevelt's TVA, often presented as a flagship of public planning and regional water development (Ekbladh, 2002), was designed to circumvent private electricity cartels and state resistance to his federal New Deal initiatives (Wengert, 1957; Meyer &

Foster, 2000). A legacy is that contemporary challenges in the US system include a proliferation of overlapping national, state and local agencies. Limited coordination and poor performance of some agencies contributed to the disastrous New Orleans flood that followed Hurricane Katrina in 2005 (Cigler, 2007).

**Water governance in India** is a challenge at almost all scales, from that of individual farmers to the management of the great transboundary rivers of the sub-continent. India shares the challenges of federalism, and the tensions between different levels of governance. At one extreme, much of India's water is drawn from shared rivers, the Indus, Ganges and Brahmaputra. Trans-boundary governance is a (federal) foreign affairs concern and there are disputes with neighbours over both the development and the operation of infrastructure. But the extensive powers of the States limits the federal government's ability to promote inter-state resource management and development or to negotiate water sharing agreements with neighbouring countries (Chokkakula, 2012).

A "national mission" was declared to address pollution and overuse of the Ganges but has had little impact, due to limited financial resources and a failure to support decentralised approaches (Schiff, 2014). Similar dysfunction is evident in unsustainable groundwater use by agriculture where water governance has been characterised as "anarchy" (Shah, 2010). Absent effective governance, has led to a crisis in which farmer suicides are used as indicators of failing groundwater supplies (Narain, 2006). Innovative approaches to control groundwater use have included the restructuring of electricity supply and subsidies to constrain pumping (Shah 2010). More generally, India's water governance problems have been linked to entrenched hierarchies within government – the 'hydrocracy' dominated by water engineers (Molle *et al.*, 2009) – and within Indian society more broadly. The latter is illustrated by Gandy's (2008) analysis of the failures to improve water supply in Mumbai, and by analyses (Mehta, 2001; Mollinga, 2010) of polarised controversies over dams and irrigation infrastructure.

**Australia** also shared the dilemmas of federalism. A particular problem was the management of the intensively used Murray-Darling, the country's principal river system which covers four states and the Capital Territory. A 2004 agreement on a National Water Initiative sought to promote greater cooperation between the states and federal government (COAG 2004). It established a new authority to oversee the Murray Darling system, gave federal government powers in respect of environmental issues and responsibility for water pricing and markets to the Australian Competition and Consumer Commission (smaller rivers remained under state control, operating under nationally determined principles). After decades of dispute, more water was diverted to the aquatic environment at the cost of substantial compensation to persuade farmers to relinquish some of

their water rights. Stakeholder-based participatory planning processes were attempted but were repeatedly undermined as key user groups sought to maximise compensation and minimise concessions (Marshall, Connell & Taylor, 2013). However, market instruments such as water trading, which were enabled by the reforms, proved to be successful and are credited with enabling Australia's agricultural sector to manage a long period of extreme drought (Connor & Kaczan, 2013).

**South Africa** shares Australia and the Western USA's arid climate and growing water demands. Democratic government in 1994 enabled a reform of water resources management and new policy and legislation were introduced (Muller 2012b), reflecting international trends. While powers were not allocated to provinces, decentralised catchment management agencies with stakeholder representation are slowly being established with most resource management still undertaken nationally. However, South Africa has sustained a degree of water security, from the resource perspective, in part due to informal stakeholder engagement in resource management operations (Muller 2012c). This builds on previous reforms promoted by a 1970 Commission of Enquiry (South Africa 1970) which recommended that, while central control over water resources initiated in 1956 should be strengthened, greater attention should be given to coordination with other sectors and classes of water users. Although heavily used rivers are shared with neighbouring countries, conflicts have been avoided through governmental commitments to regional cooperation and a formal protocol (SADC, 2000).

**China's** rapid economic growth and its water-related development challenges offer a vivid example of the complexity and dynamic nature of water governance. There is a proliferation of agencies involved in water governance, from the Politburo at national level to city authorities and more local structures below. There is also limited integration between water resource management, environmental protection and resource users such as agriculture and urban service provision.

While mega-projects such as the south-north water transfer continue under central direction to address macro-scale challenges, Mol and Carter (2008) report that there is no 'national' picture of water reform. Rather there is a diverse dynamic transition underway from administrative command/control to regulatory mechanisms. This includes local experimentation with a range of different approaches, including economic incentives, in different rivers and provinces (Nickum and Lee, 2006). The dry north requires increased water use efficiency and reduced demand, while the humid south has to manage pollution from cities and industries that affect downstream communities.

Concern over the condition of the aquatic environment had been raised at central leadership level as long ago as 1992 (Wang 2002). However, widely reported deterioration of water quality shows that the local and provincial agencies responsible have not yet achieved effective control (Walker, Hilton, Chen, Huang & Chen, 2014). On transboundary rivers, China takes a pragmatic approach. It has refused to join the Mekong River Commission but agreed to release water from its dams in the basin to alleviate drought in the Lower Mekong and it is also establishing an alternative cooperation mechanism (Tiezzi, 2016).

**In Turkey,** water management is highly centralised and politicised. This is illustrated by controversy over the Great Anatolian Project (GAP), formally conceived to support the development of regional agriculture and hydropower in the relatively poor south east of the country. This region is contested by Turkey's Kurdish minority, however, and critics claim that the GAP's main goal is to weaken Kurdish nationalism and strengthen the Turkish state (Hommes, Boelens & Maat, 2016; Varsamidis 2010; Tsakalidou 2013). It has also aggravated conflict at other scales, notably with Syria and Iraq which share the Tigris and Euphrates Rivers, because it has caused population relocation and political tension over unequal distribution of benefits. Conflicts in Syria and Iraq make it difficult to ascertain the impact of the GAP on its neighbours with whom there is long-standing contestation:- "Turkey has consistently claimed the Euphrates and Tigris are 'national rivers' and its decisions are 'basin scale'. Opponents have argued that Turkey makes all the decisions and can control all the water. Others argue "this ignores ... the downstream decisions made by Syria and Iraq, which have their own infrastructure. This has made it convenient to blame any failed downstream harvest or other adverse effects on Turkey." (Warner , Wester & Hoogsteger, 2014, p476). More important from a governance perspective, "The river basin meets with counter-frames from NGOs, rebels, and water users. The cases illustrate that the real negotiation processes and power struggles do not take place at river basin scale, but in different arenas at different scales, aptly described by the concept of polycentricity" (Warner *et al.*, 2014, p478).

In **Chile,** the 1981 Water Code of the Pinochet dictatorship introduced radical market-based governance with privatised, tradeable water rights (Hearne & Donoso, 2005), policies that were central to a broader neoliberal programme (Budds, 2013). National government focused on administering private water rights rather than promoting public interest issues. Conflicts arose between hydropower companies and mines and downstream farmers in relatively small, isolated catchments and there was speculation and 'hoarding' of water rights. Disputes were adjudicated in civil courts which had limited technical competence and did not easily allow public interest issues to be introduced (Bauer 2015). Revision of the Water Code in 2005 became a test of the democratic



political settlement. So Chile has still to find governance arrangements that can balance the dominance of major economic actors (hydropower generators in the well-watered south, mining companies in the arid north), the social and economic interests of other rural communities and the environment.

**Mexico and Brazil**, both federal states with very diverse resource endowments and water demand profiles, have engaged in extensive programmes of reform over the past two decades. Both have three tiers of water resource institutions with national agencies responsible for federal rivers but not for those which flow within only one state. In Brazil, while there is a basic architecture of river basin organisations and water agencies that implement and operate schemes, the law allows for a flexible allocation of functions to suit particular circumstances (Pena & Solanes, 2003).

Such arrangements do not always provide for conflict resolution. Brazil recently suffered an acute consequence of jurisdictional proliferation. Metropolitan Sao Paulo suffered severe water restrictions during a drought because a “water war” between Sao Paulo and Rio de Janeiro states delayed critical infrastructure development (OECD, 2015c), a dispute eventually resolved by the country’s Constitutional Court. Meanwhile, in Mexico, some observers speculated that the delegation of functions to river basin authorities that crossed state jurisdictions was “a federal gambit to neutralize the states’ growing interest and power around water resources” (Scott & Bannister, 2008). An assessment of both countries’ efforts to promote greater participation in water management decisions is revealing: “stakeholder engagement and widespread social mobilisation should not preclude sound technical knowledge and the exercise of public authority” and “that bottom-up approaches need to be complemented by a top-down process to guarantee the accomplishment of national goals and long-term objectives.” (OECD 2015c, p22).

### **Conclusions from country-specific experience**

While there is great diversity in the small selection of cases and issues reviewed here, some tentative conclusions can be drawn about the nature of water governance issues in the key dimensions considered.

**Water security for large urban areas** is a major governance challenge across many regions. The experience of Sao Paulo, Brazil, highlights the difficulties of coordinating action across states and local government jurisdictions as well as between resource managers in multiple basins and the service providers dependent on them. Water quality challenges in China reflect the difficulty of incentivising local actors to regulate their (ab)use of the resource. Similarly, in Indian cities the high

cost of the infrastructure required to support large urban populations is aggravated by the absence of a unified vision of what constitutes a 'public interest'. In contrast, financial capability and strong systems of utility accountability may explain why cities in Europe and the USA are generally water secure, despite the environmental conservation priorities of the former and the complexities of water resource governance in the latter. Meanwhile, South Africa's centralised governance of inland water resource systems has maintained urban water security, despite climatic variability, helped by structured, if informal, involvement of local stakeholders in planning and operations as well as the clear distinction between resource management and service provision.

**The environmental outcomes** are more difficult to assess. While Europe is unlikely to meet its aspirational goals by the WFD's target date of 2027, the general state of the aquatic environment is reasonably good and improving in many jurisdictions. The situation in the USA is similar while Australia has invested heavily in environmental protection. This may reflect different priorities and greater financial capacity than in rapidly growing countries like China and India, where there is widespread environmental degradation but where, as in South Africa, public authorities prioritise service provision over resource conservation.

**Tradeoffs between agriculture and other users (including the environment)** are evident in all the countries reviewed, in different ways. South Africa's 1970 Commission of Enquiry advised farmers that efficiency improvement was essential, since little new water would be available for them. In the USA, the apparently cumbersome rights system allowed flexibility in allocation between agricultural users during droughts. Europe's WFD pressured farmers towards greater efficiency but relaxed some environmental requirements in recognition of varying local climatic conditions. Australia paid farmers for water for the environment but allowed them to retain and trade water during drought periods. Chile retreated from its extreme market-based deregulation in the face of agriculture/hydropower conflicts. In Mexico and India, an uneasy balance of power is maintained between agricultural and other users not least by tolerating over-use by both. Meanwhile, China is experimenting with a range of economic incentives to improve agricultural efficiency.

**The governance of transboundary rivers** and associated data generation and infrastructure investments have been argued to be a force for international cooperation (Wolf, 2006). However, this is highly contingent on political and economic contexts, giving rise to diverse transboundary relationships. India's ability to participate in cooperative management of the Ganges with neighbouring Bangladesh, Bhutan and Nepal (Crow & Singh, 2000) is hobbled by constitutional allocation of powers to its States. In the absence of formal agreements and consistent with 'hydro-hegemony' theories of power relations in transboundary rivers (Zeitoun, Eid-Sabbagh, Talhami &

Dajani, 2013), Turkey aggressively exploits downstream weakness in Syria and Iraq. Conversely South Africa's position as a potential upstream hegemon is mediated by the SADC Protocol. China offers a further variant. It has refused to join the Mekong River Commission but cooperates operationally with downstream countries to mitigate drought.

**Few systemic conclusions** can be drawn from this review. Indeed, perhaps the most striking feature is complexity and diversity. In almost all jurisdictions, governance powers and functions are dispersed amongst multiple institutions at different scales and hierarchical levels. Overarching national (or regional) frameworks give stronger or weaker powers to the centre. Different families of institutions perform different functions within these architectures, reflecting specific challenges as well as historical institutional and social contexts. In this diverse universe, performance depends as much on exogenous economic and political factors as on water governance arrangements themselves.

Many of the governance arrangements are dynamic, evolving to reflect changing socio-economic and political contexts that include social preferences with respect to the environment. Understanding the difference between *ad hoc* responses to immediate pressures and strategic adaptation is a substantial research agenda in its own right (Huitema *et al.*, 2009). While the temptation to address this diversity and complexity with attempts at simplification is strong, as Ostrom (2009a) warned in her Nobel Prize lecture:

“When the world we are trying to explain and improve ... is not well described by a simple model, we must continue to improve our frameworks and theories so as to be able to understand complexity and not simply reject it.”

## 5. Different perspectives, different approaches to governance

Over the period reviewed, discourses of scarcity and participation have dominated much of the academic literature on water governance, reflecting the flood of interest in governance requirements for environmental sustainability, particularly in industrialised economies of the 'global north'. But there is also a significant stream of literature focused on the social and economic drivers of water management and use. A clear distinction emerges between the normative literature and

that which is more empirical and practitioner oriented, and between that which prioritises protection of the aquatic environment and that which addresses the role of water in supporting growing societies. Are these streams fated to run in parallel or is there potential for convergence? In many respects, it appears that there are fundamental differences.

### **Scarcity**

Scarcity was not a major concern at the UN's 1977 Conference at Mar del Plata which was dominated by government-based practitioners. The word appeared just eight times in 117 pages, in relation to finance and land, as a constraint on rainfed agriculture and as 'relative scarcity', to be addressed through technological innovation (UN, 1977). In contrast, it was the first word in the report of the 1992 Dublin Conference: "**Scarcity** and misuse of fresh water pose a serious and growing threat to sustainable development and protection of the environment." (ICWE, 1992)

There is limited evidence for water scarcity at a global level. Water resources are generally renewable and human activity uses less than 10 percent of 'available' renewable surface and groundwater flows. At an aggregate 'global' level, freshwater 'planetary boundaries' have not been crossed (Steffen *et al.* , 2015). Nor is resource scarcity the primary concern of, for instance, African Ministers of Water whose policy intent is to raise the proportion of the continent's water resources used from 5% to 40% (AMCOW, 2013).

At local scales, however, demand for water often exceeds available supplies, particularly in arid regions where water is used for irrigation (Agnew and Woodhouse, 2011, pp1-4), but also in areas of intense economic activity such as southern California or the Gulf states. In the latter cases, water availability is determined by the financial capacity to generate additional supplies, whether by desalination or pipelines from afar. In poor countries where finance is limited, the challenge is 'economic water scarcity' rather than 'physical water scarcity' (IWMI, 2007). Widely used scarcity indicators (e.g. Falkenmark , Lundqvist & Widstrand, 1989) are based on water required for local food production, which can also be addressed through trade in 'virtual water' (Allan, 1998; Wichelns, 2015; Muller & Bellman 2016). In comparison, direct human need for water (drinking, cooking, hygiene) is 'minute' by comparison (Rijbersman, 2006).

### **Participation**

Efforts to promote participation are often associated with issues of scale. Many contributions to the literature on environmental governance explicitly seek to open up the political arena for environmental interests (Newig & Fritsch 2009). This, it is believed, will 'lead to outputs ... with higher environmental standards' although, as Newig (2012, p51) notes, the evidence for a link

between participation and effectiveness is 'sporadic and ambiguous'. Where there is a range of potential sites for participation, 'forum shopping' for the most supportive location is an obvious strategy for interest groups (Mehta, Leach & Scoones, 2001; Meinzen-Dick & Pradhan 2002).

Yet, independent of the location, participation in the complexities of water and its governance has provided many challenges for its proponents. In the USA, Ansell and Gash (2008) reviewed 137 attempts to put 'collaborative governance' into practice and found limited success, concluding that successful outcomes depended on time, trust and interdependence. In Europe, Neef (2009) confirmed the findings of Kaika and Page (2003) and Kampa, Kranz and Hansen (2003) that the participation mandated by the WFD was often unequal and weak. In poorer countries, the challenge was compounded by the burden of establishing new institutions and high transaction costs (Huitema *et al.*, 2009; Shah & van Koppen, 2006).

More substantially, Neef (2009) also noted that participative approaches often ignored power structures both within local communities and wider governance regimes and overstated the potential benefits of devolving decision-making. This is found even – or perhaps particularly – where state policy explicitly sets out to overturn existing water allocation patterns. In South Africa's efforts to redress past injustice, participation has been challenged by profound asymmetries of knowledge and power that favour the status quo (Brown, 2011; 2013). The significance of scale and organization is recognized by radical theorists such as Harvey (2011, p102), who pointed out that Ostrom's studies were always of small groups of resource users and that, at larger scales, "the whole nature of the common-property problem and the prospects of finding a solution change dramatically". In jurisdictions where collaborative participation seems to help achieve effective water security outcomes, the stakeholders involved are often the larger and more powerful interests, with citizens represented primarily through their local government authorities (Muller 2012c). This is consistent with the recent OECD water governance review which concluded that stakeholder participation was an important component but that evidence of effectiveness to help guide process design is still limited (Akhmouch & Clavreul 2016).

### **Scale**

The logic of choosing the river basin as the primary scale for water governance is now widely challenged. Examples of successful water management interventions and governance institutions that illustrate that 'you can ignore the basin' are provided by Giordano and Shah (2014, p374) who conclude that "we need to put the problems first and then work to find pragmatic solution". The 'basin' is often not the operational scale. Thus South Africa's inland economic hub, around Johannesburg, straddles the Continental divide between the Limpopo and Orange Rivers which drain

to the Indian and Atlantic Oceans respectively. Its regional water utility draws on transfers from two other river systems, so that the four river basins are thus merely elements of a larger operational system (Muller, 2012c).

Venot, Bharati, Giordano & Molle (2011, p160) had previously pointed out that the basin is seldom the locus for decision-making where non-water issues are also at play. Using an Indian case, they conclude that “the river basin has yet to acquire a social reality. It is not yet a ‘space of engagement’ in and for which multiple actors take actions.” As noted earlier, the USA’s TVA, the prototypical river basin initiative, was guided by political economy considerations, rather than hydraulic logic (Ekbladh, 2002).

At the scale of transboundary shared rivers, river basin organisations do not determine, and may not even facilitate agreement between countries, for example on the division of costs and benefits of resource development. Indeed, regional negotiations are often easier in a more general context, with a package of items for discussion, enabling cross-sector trade-offs to be made. Despite decades of effort, only 36 parties have ratified the UN Watercourses Convention (UN, 1997), few of whom are involved in the more intractable trans-boundary disputes. The diversity of state interests and geographical contexts is just too great to be captured by a generic agreement (Salman 2007).

Other ‘global governance’ proposals have achieved little traction, perhaps because the narrative of ‘global’ water governance has little purchase on the actual practice of water management. Gupta and Pahl Wostl (2013, p3), for example, simply list problems such as “Lack of common problem definition; incoherent policy initiatives; global drivers of change (e.g., climate change): local policies to deal with local issues that add to serious global trends (e.g. dams)”. Conca’s (2006) proposals for “instruments of governance without government” to stop people from “pushing rivers around” are polemical without engaging with actual processes of management. The World Commission on Dams process tended towards advocacy. Its recommendations, curtailing governments’ scope for sovereign decision-making, was adjudged unhelpful by many developing countries as well as by agencies such as the World Bank (UNEP 2003). Similarly, the examples of ‘missing links’ in global policy formulation which need to be filled through global initiative, cited by Pahl-Wostl *et al.*, (2013) have yet to be widely accepted.

Global water modellers now suggest that global water governance is needed to address ‘global syndromes of increasing environmental stress’ (Vorosmarty, Pahl-Wostl, Bunn, Conway & Gupta, 2013, p539). But a lack of confidence in these arguments is reflected in parallel suggestions that “a centralized overarching governance system for water is unlikely and possibly undesirable; however,

there is a need for a high-level think tank and leadership to develop a cosmopolitan perspective to promote sustainable water development” (Gupta & Pahl Wostl, 2013, p1). Other authors seek to identify an overall conceptualisation derived from empirical case studies. However, it is acknowledged that, despite a growing number of case studies, each providing valuable insights into context-specific dynamics of water resource management, attempts to obtain a synthesis “towards a common language, ideas or metrics on freshwater sustainability” have been unsuccessful (Srinivasan *et al.*, 2012 p2). Instead, they have argued that a limited number of outcomes, or ‘syndromes’ may be identified as representative of the diverse sets of empirical contexts likely to be encountered. A similar quest is pursued by Gondhalekar, Mollinga & Saravanan (2013, p274) who seek to identify “whether certain configurations of causality can be held to be common across certain types of situations”. Acknowledging that a ‘plurality’ of frameworks is the most likely result, they suggest “that plurality would avoid both the ‘every situation is unique’ and ‘the same mechanisms work everywhere’ positions”. As it stands, this quest to identify common frameworks for different contexts is somewhat undermined by OECD’s (2015a) observation that the large diversity of situations requires context-related responses adapted to local specificities.

### **Markets**

The Dublin approach, particularly as pursued by the World Water Council, reflected many of the pillars of the Washington Consensus (Williamson, 2004) and, as we observed earlier, was opposed on those grounds (Dellapenna 2011). Yet the main arguments against greater use of market mechanisms are practical rather than ideological. It is common cause that well-defined property rights are a precondition for effective markets. Smith (2008) has argued that this requirement is not trivial given the heterogeneity of water uses, the costliness of monitoring them and the difficulties in predicting water availability. Multiple uses of water, natural monopolies around its distribution and extensive government regulation also limit the extent to which market forces can allocate water (Debaere 2012). Chile’s drastic deregulation and privatisation of its water resources resulted in conflicts and perverse outcomes that highlighted the limits of market mechanisms (Bauer, 2015).

Beyond the complexities inherent in attaching property rights to quantities of water, efforts to imagine a regime of water resource quality markets foundered when it was recognised that the institutional requirement to determine and then manage quality parameters in an operational context would just be another form of regulation (Spulber & Sabbaghi, 1995). Winpenny (1994), acknowledged this, suggesting that pollution charges might encourage industries to use less water but that their waste discharge would still require ‘command and control’ regulation. This raises questions about how property ‘rights’ in water could best address quality and illustrates the water

governance challenges posed when individualised water use rights confront broader social or ‘public interest’ priorities. Zellmer (2008) describes how US courts struggle to characterise the nature of property inherent to water, as the country is forced to adapt its water use in the face of climate challenges and changing public priorities towards, for instance, environmental protection. Saxer (2010) explains how, in the USA, the ‘public trust doctrine’ (Sax 1970) is constraining ‘private rights’ for public purposes, without requiring compensation.

Given the complexities of using market mechanisms to adjudicate on water governance decisions, many authors, regardless of their ideological perspective, lapsed quickly into the easier terrain of water supply and sanitation services (Winpenny 1994, Spulber & Sabbaghi, 1995, Bakker 2005). But the governance of utility services and the policy, public finance and business issues they raise are very different to the challenges of determining how variable, unpredictable and often non-excludable natural resources can be allocated and protected. The emerging conclusion is thus that formal markets will only be applicable to water resources with related uses, in bounded local situations (Dellapenna 2012). This is consistent with recent experience in California and Australia, where the economic impact on agriculture of record droughts has been relatively limited, largely due to intra-sectoral trading systems that allowed farming communities to optimise use of the limited water available (Aghakouchak *et al.*, 2014).

### **Water governance: Networks and nested hierarchies**

This review has suggested that water governance is highly contextual, influenced by physical factors, levels of economic and social development as well as political and cultural norms that have often evolved over long periods. No common architecture can be demonstrated and efforts to promote normative approaches such as Dublin IWRM or global water conventions have had little impact. So is there a useful conceptual framework of water governance that can be applied to this diversity, given the multiplicity of specialized functions required to achieve water security?

Some generic features in systems of governance do emerge. Conceptually, the approach of Rhodes begins to approximate to that of Elinor Ostrom. Rhodes suggested that “governance refers to governing with and through networks” (Rhodes 2007, p1246), envisaging a “core executive” and “decentralised, steered networks”. This is consistent with what Ostrom (2009b) conceptualized as a series of ‘nested’ or ‘polycentric’ institutions to govern the use of ‘common pool’ natural resources such as water, noting the need for an overarching framework of support for local action.

This approach finds resonance in some of the more recent writing on the subject. Meadowcroft (2007, p303) notes, “... this steering logic also implies an important role for public authorities at all



levels – including local and regional governments, national states, supranational unions, and international bodies. In other words, ‘government’ is central to ‘governance’ for sustainable development”.

One test of the robustness and relevance of this approach is whether the practical challenges of water management offer a useful medium through which to consider governance in a more generic and conceptual sense. There is evidence for this. Examples of water governance are often used to illuminate issues of scale, polycentricity and participation that are fundamental to much wider debates. Van Meerkerk (2015) uses the experience of water governance in the Netherlands to consider the role of ‘connective managers’ in ensuring the effectiveness of governance networks. Ansell and Torfing (2015) use the example of responses to California’s water challenges to consider whether generic collaborative governance approaches can be scaled up. Newig, Schultz and Jager (2016) use water to illustrate generic scale issues in environmental governance. Political geographer David Harvey (2011, p102) acknowledging Ostrom’s contributions, notes, in relation to the role of states and hierarchies, “what looks like a good way to resolve problems at one scale does not hold at another scale.” His conclusion is that this is why “collective organization of small-scale solidarity economies along common-property lines cannot translate into global solutions without resort to nested hierarchical forms of decision making.”

## 6. Conclusion – broad principles not normative approaches

This review has shown that water and its governance continue to be a focus for theoretical debate and polemic contestation, across a wide range of disciplines. There is some congruence with a sometimes parallel “practitioner literature”, which is often seized by similar concerns but informed by broader as well as more immediate perspectives. The conclusions are sometimes similar – so the UN’s position on participation at Mar del Plata in 1977 is similar to that of Habermasian theorists two decades later: participation by interested parties can produce decisions that are better accepted and implemented than technocratic diktats. Where there is discord, it is often about which actors set the agenda for what issues.

In many jurisdictions there is an institution with overarching decision-making authority, be that the US or Brazilian supreme courts or national governments in China or South Africa. However, general power relationships must be distinguished from those specific to the water realm. Generic mechanisms may be used to displace communities for many purposes – commercialisation of agriculture, expansion of industry and cities, development of roads and airports - as well as the

construction of dams. But specific water governance arrangements may be required to adjust water use authorisations to adapt to changing climates and social preferences.

Adaptive approaches (Pahl-Wostl, Gupta & Petry, 2008) are evident in some systems of water governance we have reviewed. An early action of South Africa's new democratic government was to replace permanent water allocations with temporary use licences that take account of the changing environment (Muller 2012b). The USA's hydropower licensing laws require operators to show that continued operations are in the public interest (Rudberg, Escobar, Gantenbein & Niro, 2014). However, in jurisdictions such as the USA, India and Mexico, adaptation is forced rather than governed when 'water rights' and aquifers are found to be dry.

But while participatory and adaptive approaches to water governance are often responses to specific political, economic and hydrological contexts, we have argued that conceptual approaches over the past two decades have been dominated by a characterisation of water as a 'sector' to be governed by technical criteria, legitimated by a narrative of water 'scarcity'. This gave rise to governance norms based on environmental and economic (efficiency) criteria independent of political priorities of social development. The packaging of these technical criteria under the banner of 'integrated water resource management' is now challenged by suggestions that water governance should focus political decision-making on a 'nexus' or 'problemshed' of interrelated development priorities. Much contemporary research interest now focuses on 'evidence-based policy', asking to what extent a typology of 'problemsheds' may be established such that experience in one context may be transferrable to another (cf Srinivasan *et al.*, 2012; Gondhalekar *et al.*, 2013).

The turn to more context-specific criteria for water governance has opened space to challenge arguments that competing uses of water, as a scarce resource and 'economic good', should be subject to arbitration by markets or cost-benefit calculations. The alternative position, supported both by actors who seek to manage commercial risk as well as by anti-commodification polemicists, recognises non-economic allocation processes rooted in alternative value systems for water while accepting that market mechanisms can help to optimise water use among similar users (WEF, 2014). These perspectives see water governance conceptualised in a more flexible and enabling manner, as exemplified by the OECD Secretary General's submission to his Council in 2015:-

"... governance is good if it can help to solve key water challenges, using a combination of bottom-up and top-down processes while fostering constructive state-society relations. It is bad if it generates undue transaction costs and does not respond to place-based needs."

Beyond these general criteria he suggested that water governance systems should be designed according to the specific challenges they are required to address:

“ ... “forms” of water governance should follow “functions” of water governance. Structuring, institutionalising, and/or formalising institutions should not detract from the ultimate objective of delivering sufficient water of good quality, while maintaining or improving the ecological integrity of water bodies.” (OECD 2015a, p5)

While this pragmatic approach is supported by much of the evidence reviewed in this paper, it is unlikely to end the debates. Disagreements will continue about appropriate goals for environmental protection and the scales and processes through which these should be determined and enforced. The balance between the public nature of the resource and private rights to it will continue to be the subject of political contestation as will entitlements to waters in shared rivers and the obligations of riparian states to each other. But the OECD’s principles do at least provide a framework within which practitioners can work and their guidance may provide some protection from efforts by enthusiastic advocates of approaches that subordinate local political priorities to ‘universal’ technical norms.

## References

- Aghakouchak, A., Feldman, D., Stewardson, M.J., Saphores, J.D., Grant, S. and Sanders, B. (2014). Australia's drought: lessons for California. *Science*, 343(6178), 1430-1431.
- Agnew, C. and Woodhouse, P. (2010). *Water resources and development*. Abingdon: Routledge.
- Akhmouch, A. and Clavreul, D. (2016). Stakeholder Engagement for Inclusive Water Governance: “Practicing What We Preach” with the OECD Water Governance Initiative. *Water*, 8 (5).
- Allan, T. (1998). Watersheds and problemsheds: Explaining the absence of armed conflict over water in the Middle East. *Middle East*, 2(1), 50
- AMCOW (2013). Decisions of the 11th Executive Committee of the African Ministers Council on Water, Cairo.
- Ansell, C. and Gash, A. (2008). Collaborative governance in theory and practice. *Journal of public administration research and theory*, 18(4), 543-571.
- Ansell, C. and Torfing, J. (2015). How does collaborative governance scale? *Policy & Politics*, 43(3), 315-329.
- Bakker, K. (2007). The “commons” versus the “commodity”: Alter-globalization, anti-privatization and the human right to water in the global south. *Antipode*, 39(3), 430-455.
- Bauer, C.J. (2015). Water conflicts and entrenched governance problems in Chile’s market model. *Water Alternatives* 8(2), 147-172

- Behagel, J.H. and Arts, B.A.S. (2014). Democratic governance and political rationalities in the implementation of the water framework directive in the Netherlands. *Public Administration*, 92(2), 291-306.
- Biermann, F., Betsill, M.M., Vieira, S.C., Gupta, J., Kanie, N., Lebel, L., Liverman, D., Schroeder, H., Siebenhüner, B., Yanda, P.Z. and Zondervan, R. (2010). Navigating the anthropocene: the Earth System Governance Project strategy paper. *Current Opinion in Environmental Sustainability*, 2(3), 202-208.
- Biswas, A.K. (2004). From Mar del Plata to Kyoto: an analysis of global water policy dialogue. *Global Environmental Change*, 14, 81-88.
- Biswas, A.K. and Tortajada, C. (2009). (Eds) *Impacts of megaconferences on the water sector*. Heidelberg : Springer Berlin.
- BMU (2012). *Water Framework Directive Implementation of WFD programmes of measures – interim results*. Berlin: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).
- Brown, J. (2011). Assuming too much? Participatory water resource governance in South Africa. *The Geographical Journal*, 177(2), 171-185
- Brown, J. (2013). Can participation change the geography of water? Lessons from South Africa. *Annals of the Association of American Geographers*, 103(2), 271-279
- Brundtland, G. H. (1987). *Report of the World Commission on environment and development: our common future*. New York: Oxford University Press
- Budds, J. (2013). Water, power, and the production of neoliberalism in Chile, 1973–2005. *Environment and Planning D: Society and Space*, 31(2), 301-318.
- Caponera, D.A. (1992). *Principles of water law and administration*. Rotterdam: Balkema.
- Castro, J. (2007). Water governance in the twenty-first century. *Ambiente & sociedade* 10 (2), 97-118.
- Chokkakula, S. (2012). *Disputes, (de) politicization and democracy: Inter-state water disputes in India*. Working Paper No 108. Hyderabad, India: Centre for Economic and Social Studies.
- Cigler, B.A. (2007). The “big questions” of Katrina and the 2005 great flood of New Orleans. *Public Administration Review*, 67(s1), 64-76.
- COAG (2004). *Intergovernmental Agreement on a National Water Initiative*. Council of Australian Governments. Commonwealth of Australia and the Governments of New South Wales, Victoria,

Queensland, South Australia, the Australian Capital Territory and the Northern Territory.

[http://www.bom.gov.au/water/about/consultation/document/NWI\\_2004.pdf](http://www.bom.gov.au/water/about/consultation/document/NWI_2004.pdf)

Collins, R. (1994). History, hydropolitics and the Nile: myth or reality. In: Howell, P. and Allan, J. A. (Eds) *The Nile: Sharing a Scarce Resource*. Cambridge: Cambridge University Press (pp109-36)

Conca, K. (2006). *Governing Water*. Cambridge Ma : MIT Press.

Connor, J.D. and Kaczan, D. (2013). Principles for economically efficient and environmentally sustainable water markets: The Australian experience. In: Schwabe, K., Albiac-Murillo, J., Connor, J.D., Hassan, R., Meza González, L. (Eds.) *Drought in Arid and Semi-Arid Regions*. Springer Netherlands. (pp. 357-374).

Cooley, H., Donnelly, K., Phurisamban, R. and Subramanian, M. (2015). *Impacts of California's Ongoing Drought: Agriculture*. Oakland Ca: Pacific Institute.

Crow, B. and Singh, N. (2000). Impediments and Innovations in International Rivers: The Waters of South Asia. *World Development* 28(11), 1907-1925.

Debaere, P. (2014). The Global Economics of Water: Is Water a Source of Comparative Advantage? *American Economic Journal: Applied Economics*, 6(2), 32-48.

<https://www.aeaweb.org/articles?id=10.1257/app.6.2.32>

DEFRA (2011). *Water for Life – White paper*. Department for Environment Food and Rural Affairs. London: HMSO.

Dellapenna, J.W. (2008). Climate disruption, the Washington consensus, and water law reform. *Temp. L. Rev.*, 81, 383.

Dellapenna, J. W. (2012). The myth of markets for water. In: J.Maestu (Ed.) *Water trading and global water scarcity: international experiences*. Abingdon: Routledge.

Dryzek, J. (2013). *The Politics of the Earth* (3<sup>rd</sup> ed). Oxford: Oxford University Press.

EC (2012). *A Blueprint to Safeguard Europe's Water Resources*, Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions, COM(2012) 673 final. Brussels: European Commission

Ekbladh, D. (2002). "Mr. TVA": grass-roots development, David Lilienthal, and the rise and fall of the Tennessee Valley Authority as a symbol for US Overseas Development, 1933–1973. *Diplomatic History*, 26(3), 335-374.

- EWG (2004). *California water subsidies: Findings*. Washington DC: Environmental Working Group,
- Falkenmark, M., Lundqvist, J. and Widstrand, C. (1989). Macro-scale water scarcity requires micro-scale approaches. *Natural resources forum*, 13 (4), 258-267
- Feuillette, S., Levrel, H., Boeuf, B., Blanquart, S., Gorin, O., Monaco, G., Penisson, B. and Robichon, S. (2016). The use of cost–benefit analysis in environmental policies: Some issues raised by the Water Framework Directive implementation in France. *Environmental Science & Policy*, 57, 79-85.
- Fukuyama, F. (2013). *What Is Governance?* CGD Working Paper 314. Washington, DC: Center for Global Development.
- Fukuyama, F. (2016). Governance: What Do We Know, and How Do We Know It? *Annual Rev. Polit. Sci.*
- Gandy, M. (2008). Landscapes of Disaster: water, modernity, and urban fragmentation in Mumbai. *Environment and Planning A*, 40, 108-130
- Garrick, D.E., Anderson, G.R., Connell, D. and Pittock, J. (Eds.) (2014). *Federal Rivers: Managing Water in Multi-layered Political Systems*. Cheltenham: Edward Elgar Publishing.
- Garrido, S. (2011). Las instituciones de riego en la Espana del este. Una reflexion a la luz de la obra de Elinor Ostrom. *Historia Agraria*, 53, 13–42.
- Geilen, N., Jochens, H., Krebs, L., Muller, S., Pedroli, B., van der Sluis, T., van Looy, K. and van Rooij, S. (2004). Integration of ecological aspects in flood protection strategies. Defining an ecological minimum. *River Research and Applications*, 20, 269-283.
- Getches, D., Zellmer, S. and Amos, A. (2015). *Water Law in a Nutshell, 5<sup>th</sup> edition*. West Academic.
- Giordano M. and Shah, T. (2014). From IWRM back to integrated water resources management, *International Journal of Water Resources Development*, 30 (3), 364-376
- Gondhalekar, D., Mollinga, P. and Saravanan, V. (2013). Towards systematic comparative water and health research. *Water International*, 38 (7), 967-976
- Grey, D., Sadoff, C. (2006). Water for Growth and Development. In: *Thematic Documents of the IV World Water Forum*. Mexico City: Comision Nacional del Agua.
- Grey, D. and Sadoff, C. (2007). Sink or swim? Water security for growth and development. *Water Policy*, 9 (6), 545–571

- Gupta, J. and Pahl-Wostl, C. (2013). Global water governance in the context of global and multilevel governance: its need, form, and challenges. *Ecology and Society* , 18(4), 53
- Harvey, D. (2011). The future of the commons. *Radical History Review*, 109, 101-107
- Hearne, R.R. and Donoso, G. (2005). Water institutional reforms in Chile. *Water Policy*, 7(1), 53-69.
- Hommel, L., Boelens, R. and Maat, H. (2016). Contested hydrosocial territories and disputed water governance: Struggles and competing claims over the Ilisu Dam development in southeastern Turkey. *Geoforum* 71, 9–20.
- Hooijer, A., Klijn, F., Pedroli, G. and van Os, A. (2004). Towards Sustainable Flood Risk Management in the Rhine and Meuse river basins: synopsis of the findings of IRMA-SPONGE. *River Research and Applications* 20, 343-357
- Huitema, D., Mostert, E., Egas, W., Moellenkamp, S., Pahl-Wostl, C. and Yalcin, R. (2009). Adaptive water governance: Assessing the institutional prescriptions of adaptive (co-)management from a governance perspective and defining a research agenda. *Ecology and Society* 14(1), 26.
- IAEG-SDGs (2016). Compilation of Metadata for the Proposed Global Indicators for the Review of the 2030 Agenda for Sustainable Development Metadata for Goal 6 (updated 16 March 2016). Inter-agency Expert Group on SDG Indicators. <http://unstats.un.org/sdgs/files/metadata-compilation/Metadata-Goal-6.pdf>
- IWMI (2007). *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture*. London: Earthscan and International Water Management Institute.
- ICWE (1992). *The Dublin statement on water and sustainable development*. International Conference on Water and the Environment (ICWE), Dublin.
- IPCC (2014). *Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group II Chapter 3*. New York: Cambridge University Press.
- Kaika, M. and Page, B. (2003). The EU Water Framework Directive: Part 1. European policy-making and the changing topography of lobbying. *European Environment* 13(6), 314-327.
- Kampa, E., Kranz, N. and Hansen, W. (2003). *Public participation in river basin management in Germany*. Berlin: Ecologic Institute.
- Kishimoto, S., Lobina, E. and Petitjean, O. (2015). *Our public water future: The global experience with remunicipalisation*. Transnational Institute (TNI)/Public Services International Research Unit

(PSIRU)/Multinationals Observatory/Municipal Services Project (MSP)/European Federation of Public Service Unions (EPSU).

Koontz, T.M. and Newig, J. (2014). Cross-level information and influence in mandated participatory planning: Alternative pathways to sustainable water management in Germany's implementation of the EU Water Framework Directive. *Land Use Policy*, 38, 594-604.

Kramer, A. and Pahl-Wostl, C. (2014). The global policy network behind integrated water resources management: Is it an effective norm diffusor. *Ecology and Society*, 19(4), 11.

Luks, F. (2010). Deconstructing Economic Interpretations of Sustainable Development: Limits, Scarcity and Abundance. In: L. Mehta (Ed.) *The Limits to Scarcity. Contesting the Politics of Allocation*. London: Earthscan.

Marshall, G.R., Connell, D. and Taylor, B.M. (2013). Australia's Murray–Darling Basin: a century of polycentric experiments in cross-border integration of water resources management. *International Journal of Water Governance*, 1(03-04), 197-217.

Mead, E. (1903). *Irrigation Institutions*. New York and London: MacMillan.

<https://archive.org/details/irrigationinsti01meadgoog>

Meadowcroft, J. (2007). Who is in Charge here? Governance for Sustainable Development in a Complex World. *Journal of Environmental Policy & Planning*, 9 (3-4), 299-314,

Mehta, L. (2001). The Manufacture of Popular Perceptions of Scarcity: Dams and Water-related Narratives in Gujarat, India. *World Development* 29 (12), 2025-2041

Mehta, L., Leach, M. and Scoones, I. (2001). Editorial: Environmental Governance in an Uncertain World. *IDS Bulletin* 32(4) Brighton: Institute of Development Studies.

Mehta, L. (2010). Introduction. In: L. Mehta (Ed.) *The Limits to Scarcity. Contesting the Politics of Allocation*. London: Earthscan.

Meinzen-Dick, R. and Pradhan, R. (2002). *Legal Pluralism and Dynamic Property Rights*, CAPRI WORKING PAPER NO. 22, CGIAR Systemwide Program on Collective Action and Property Rights Secretariat . Washington DC: International Food Policy Research Institute

Meyer, W B. and Foster, C. (2000). New Deal Regionalism. Discussion Paper E-2000-02, Kennedy School of Government. Boston: Harvard University



- Mol, A.P., and Carter, N.T. (2006). China's environmental governance in transition. *Environmental politics*, 15(02), 149-170.
- Molle, F., Mollinga, P.P. and Wester, P. (2009). Hydraulic bureaucracies: Flows of water, flows of power. *Water Alternatives*, 2(3), 328.
- Mollinga, P. (2010). The Material Conditions of a Polarised Discourse. Clamours and Silences in Critical Analysis of Agricultural Water Use in India. *Journal of Agrarian Change*, 10 (3), 414-436
- Mollinga, P. and Gondhalekar, D. (2014). Finding structure in diversity: A stepwise small-N/medium-N qualitative comparative analysis approach for water resources management research. *Water Alternatives*, 7(1), 178-198
- Mollinga, P.P., Meinzen-Dick, R.S. and Merrey, D.J. (2007). Politics, plurality and problemsheds: A strategic approach for reform of agricultural water resources management. *Development Policy Review*, 25(6), 699-719.
- Morley, D. (2002). *Perspectives on Freshwater. Issues and recommendations of NGOs*. London: United Nations Environment and Development Forum.
- Moss, T. (2004). The governance of land use in river basins: prospects for overcoming problems of institutional interplay with the EU Water Framework Directive. *Land Use Policy*, 21(1), 85-94.
- Muller, M. (2008). The challenges of implementing an African water resource management agenda. In: K. Kondlo and C. Ejiogu (Eds) *Africa In Focus. Governance in the 21st century*. HSRC Press, <http://www.hsrcpress.ac.za/product.php?productid=2283&cat=0&page=1&featured&freedownload=1>
- Muller, M. (2012a). Water management institutions for more resilient societies. *Proceedings of the Institution of Civil Engineers-Civil Engineering*, 165 (6), 33-39
- Muller, M. (2012b). Lessons from South Africa on the management and development of water resources for inclusive and sustainable growth. (background paper for) European Development Report, ODI/DIE, Available at SSRN 2333044.
- Muller, M. (2012c). Polycentric governance: water management in South Africa. *Proceedings of the Institution of Civil Engineers Management, Procurement and Law*, 165, 1-8
- Muller, M. and Bellman, C. (2016). *Trade and Water: How Might Trade Policy Contribute to Sustainable Water Management?* Geneva: International Centre for Trade and Sustainable Development (ICTSD)

- Narain, S. (2006). Why do farmers have to die? <http://www.downtoearth.org.in/blog/why-do-farmers-have-to-die-7936>
- Neef, A. (2009). Transforming rural water governance: Towards deliberative and polycentric models? *Water Alternatives* 2(1), 53-60
- Neuse, S.M. (1996). *David E. Lilienthal: The journey of an American liberal*. Univ. of Tennessee Press
- Newig, J. (2012). More effective natural resource management through participatory governance? Taking stock of the conceptual and empirical literature – and moving forward . In: Hogl, K., Kvarda, E., Nordbeck, R. and Pregernig, M. (Eds.) *Environmental governance. The challenge of legitimacy and effectiveness*. Cheltenham: Edward Elgar
- Newig, J., Schulz, D. and Jager, N.W. (2016). Disentangling Puzzles of Spatial Scales and Participation in Environmental Governance—The Case of Governance Re-scaling Through the European Water Framework Directive. *Environmental Management*, 1-17.
- Newig, J. and Fritsch, O. (2009). Environmental governance: participatory, multi-level – and effective? *Environmental Policy and Governance* , 19, 197–214
- Nickson, A. and Vargas, C. (2002). The Limitations of Water Regulation: the Failure of the Cochabamba Concession in Bolivia. *Bulletin of Latin American Research* 21 (4), 99-120
- Nickum, J. and Lee, Y-S. (2006). Same Longitude, Different Latitudes: Institutional Change in Urban Water in China, North and South. *Environmental Politics*, 15 (2), 231–247.
- OECD (2011). *Water Governance in OECD Countries: A Multi-level Approach*, OECD Studies on Water. Paris: OECD Publishing.
- OECD (2012). *OECD Environmental Outlook to 2050*. Paris: OECD Publishing.
- OECD (2015a). *OECD Water Governance Initiative*. (accessed at) <https://www.oecd.org/gov/regional-policy/OECD-Principles-on-Water-Governance-brochure.pdf>
- OECD (2015b). *OECD Principles on Water Governance, Note by the Secretary-General*, Doc C(2015)71 Ref: JT03376062). Paris: OECD Publishing
- OECD (2015c). *Water Resources Governance in Brazil*, OECD Studies on Water. Paris: OECD Publishing. <http://dx.doi.org/10.1787/9789264238121-en>
- Olivier, H. (1976). *Great dams in Southern Africa*. Cape Town: Purnell.

- Ostrom, E. (2009a). Beyond Markets and States: Polycentric Governance of Complex Economic Systems (accessed at) [https://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/2009/ostrom\\_lecture.pdf](https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2009/ostrom_lecture.pdf)
- Ostrom, E. (2009b). A General Framework for Analyzing Sustainability of Socio--Ecological Systems. *Science* 325, 419--422.
- Pahl-Wostl, C., Kabat, P. and Möltgen, J. (Eds.) (2008). *Adaptive and Integrated Water Management*. Berlin: Springer
- Pahl-Wostl C, Gupta J, and Petry D. (2008). Governance and the Global Water System: A Theoretical Exploration. *Global Governance: A Review of Multilateralism and International Organizations*, 14 (4), 419-435.
- Pahl-Wostl, C., Conca, K., Kramer, A., Maestu, J. and Schmidt, F. (2013). Missing links in global water governance: a processes-oriented analysis. *Ecology and Society* 18(2), 33.
- Peña, H. and Solanes, M. (2003). *Effective water governance in the Americas: a key issue*. GWP Samtac (South American Technical Advisory Committee) presentation at 3<sup>rd</sup> World Water Forum, Kyoto.
- Postel S. (1984). *Water: Rethinking Management in an Age of Scarcity*. Worldwatch Paper 62. Washington, D.C.: Worldwatch Institute.
- Postel, S. (2000). Entering an era of water scarcity: the challenges ahead. *Ecological applications*, 10(4), 941-948.
- Reisner, M. (1986). *Cadillac Desert: The American West and Its Disappearing Water*. New York: Viking
- Rhodes, R. (1996). The new governance: governing without government. *Political studies*, 44(4), 652-667.
- Rhodes, R. (2007). Understanding governance: Ten years on. *Organization studies*, 28(8), 1243-1264.
- Rijsberman, F. (2006). Water scarcity: fact or fiction? *Agricultural water management*, 80(1), 5-22.
- Rook, R. (2004). Race, Water, and Foreign Policy: The Tennessee Valley Authority's Global Agenda Meets "Jim Crow". *Diplomatic History*, 28(1), 55-81.
- Roussary, A. (2014). The reorganisation of drinking water quality governance in France. Responsibility-based governance and objective-driven policy setting in question. *Revue d'Etudes en Agriculture et Environnement-Review of agricultural and environmental studies*, 95(2), 203.

- Rudberg, P.M., Escobar, M., Gantenbein, J. and Niiro, N. (2014). Mitigating the Adverse Effects of Hydropower Projects: A Comparative Review of River Restoration and Hydropower Regulation in Sweden and the United States. *Geo. Int'l Envtl. L. Rev.*, 27, 251.
- SADC (2000). Revised Protocol on Shared Watercourses in the Southern African Development Community (signed in) Windhoek, Namibia: 7<sup>th</sup> August 2000.
- Sadoff, C.W., Hall, J.W., Grey, D., Aerts, J.C.J.H., Ait-Kadi, M., Brown, C., Cox, A., Dadson, S., Garrick, D., Kelman, J., McCornick, P., Ringler, C., Rosegrant, M., Whittington, D. and Wiberg, D. (2015). *Securing Water, Sustaining Growth: Report of the GWP/OECD Task Force on Water Security and Sustainable Growth*. Oxford: University of Oxford, UK.
- Salman S. (2007). The United Nations Watercourses Convention Ten Years Later: Why Has its Entry into Force Proven Difficult? International Water Resources Association, *Water International*, 32 (1), 1-15.
- Saravanan, V., McDonald G. and Mollinga, P. (2009). Critical review of Integrated Water Resources Management: Moving beyond polarised discourse. *Natural Resources Forum* 33 , 76–86
- Sax, J. L. (1990). The Constitution, Property Rights and the Future of Water Law. *University of Colorado Law Review*, 61, 257.
- Saxer, S.R. (2010). The fluid nature of property rights in water. *Duke Environmental Law & Policy Forum* , 21.
- Scheumann, W. and Klaphake, A. (2001). *Freshwater resources and transboundary rivers on the international agenda: From UNCED to RIO+10*. Bonn: Bundesministeriums für Wirtschaftliche Zusammenarbeit und Entwicklung.
- Scott, C. and Banister, J. (2008). The Dilemma of Water Management 'Regionalization' in Mexico under Centralized Resource Allocation. *Water Resources Development*, 24 (1), 61–74
- Serageldin, I. (2009). Water wars? *World Policy Journal*, 26(4), 25-31.
- Shah, T. (2010). *Taming the anarchy: Groundwater governance in South Asia*. Abingdon: Routledge.
- Shah T. (2016). *Increasing water security: the key to implementing the Sustainable Development Goals*. Stockholm: Global Water Partnership.
- Shah, T. and van Koppen, B. (2006). Is India ripe for integrated water resources management? Fitting water policy to national development context. *Economic and Political Weekly* XLI (31), 3413-3421

- Schiff, J.S. (2014). Silencing the Opposition: The State v. Civil Society in India's Ganges River Basin. *International Studies Perspectives*, [15\(2\)](#)
- Smith H.E. (2008). Governing Water: The Semicommons of Fluid Property Rights. *Arizona Law Review* 50, 445-478
- South Africa (1970). *Report of Commission of Enquiry into Water Matters*. Pretoria: Government Printer.
- Spulber, N., Sabbaghi, A. (1995). Economics of water resources: From regulation to privatization. *Journal of Economic Literature* 33(1), 284-285.
- Srinivasan, V., Lambin, E.F., Gorelick, S.M., Thompson, B.H. and Rozelle, S. (2012). The nature and causes of the global water crisis: Syndromes from a meta-analysis of coupled human-water studies. *Water Resources Research*, 48(10).
- Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A. and Folke, C. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 1259855.
- Stern, D.I., Common, M.S. and Barbier, E.B. (1996). Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development. *World development*, 24(7), 1151-1160.
- Stone, I. (1984). *Canal Irrigation in British India*. Cambridge: CUP
- Swyngedouw, E. (1999). Modernity and Hybridity: Nature, *Regenerationismo*, and Production of the Spanish Waterscape, 1890 1930. *Annals of Assoc. of American Geographers*, 89(3), 443 – 465.
- Swyngedouw, E. (2013). Into the sea: desalination as hydro-social fix in Spain. *Annals of the Association of American Geographers*, 103(2), 261-270.
- Thames Water (2005). *Thames Tideway Strategic Study Steering Group Report Final Report*. London: Thames Water.
- Thorson, J. (2015). Reflections on Western General Stream Adjudications Upon the Signing of Wyoming's Big Horn River Adjudication Final Decree. *Wyoming Law Review*, 15.
- Tiezzi, S. (2016). *Facing Mekong Drought, China to Release Water from Yunnan Dam* (accessed at) <http://thediplomat.com/2016/03/facing-mekong-drought-china-to-release-water-from-yunnan-dam/>

- Tignor, R. (2006). *W. Arthur Lewis and the Birth of Development Economics*. New Jersey: Princeton University Press.
- Toonen, T.A., Dijkstra, G.S. and Van der Meer, F. (2006). Modernization and reform of Dutch water boards: resilience or change? *Journal of Institutional Economics*, 2(02), 181-201
- Tsakalidou, I. (2013). The Great Anatolian Project Is Water Management a Panacea or Crisis Multiplier for Turkey's Kurds? New Security Beat, Environmental Change and Security Program, Woodrow Wilson International Center for Scholars (accessed at <http://www.newsecuritybeat.org/2013/08/great-anatolian-project-water-management-panacea-crisis-multiplier-turkeys-kurds/>)
- UN (1972). *Report of the United Nations Conference on the Human Environment, Stockholm 1972* A/CONF.48/14. New York: United Nations
- UN (1977). *Report of the United Nations Conference on the Human Environment*. United Nation's publication, Sales No.: E.T3.II.A.1U. New York: United Nations.
- UN (1992). *Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 3-14 June 1992)*, United Nations General Assembly Document A/CONF.151/26. New York: United Nations
- UN (1997). *Convention on the Law of the Non-Navigational Uses of International Watercourses, Status as at 08-11-2016*, United Nations Treaty Collection (accessed at [https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-12&chapter=27&clang=en#1](https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&clang=en#1)).
- UN (2010). *The human right to water and sanitation. Resolution adopted by the General Assembly on 28 July 2010*, United Nations General Assembly Document A/RES/64/292. New York: United Nations
- UNEP (2003). *Analysis of Reactions on the World Commission on Dams Report*. Nairobi: United Nations Environment Programme Dams and Development Project Secretariat.
- UNEP (2015). *Options for decoupling economic growth from water use and water pollution. Report of the International Resource Panel Working Group on Sustainable Water Management*. Nairobi : United Nations Environment Programme.
- UN Water (2016). *A guide to UN Water*. (accessed at [http://www.unwater.org/downloads/UNW\\_brochure\\_EN\\_webversion.pdf](http://www.unwater.org/downloads/UNW_brochure_EN_webversion.pdf))
- USA (1902). The Reclamation Act (Act of June 17 1902, ch. 1093,32 Stat, 388), Washington DC.
- Van Dijk, G., Martein E. and Schulte-Wulver-Leidig, A. (1995). Ecological rehabilitation of the river Rhine: Plans, Progress and perspectives. *Regulated Rivers: Research and Management*, 11, 377-88.

- Van Meerkerk, I., Edelenbos, J. and Klijn, E.H. (2015). Connective management and governance network performance: the mediating role of throughput legitimacy. Findings from survey research on complex water projects in the Netherlands. *Environment and Planning C: Government and Policy*, 33(4), 746-764.
- Varsamidis A. (2010). *An assessment of the Water Development Project (Gap) of Turkey: meeting its objectives and EU criteria for Turkey's accession*. MA Thesis, Naval Postgrad School, 2010. Available at: [http://edocs.nps.edu/npspubs/scholarly/theses/2010/Dec/10Dec\\_Varsamidis.pdf](http://edocs.nps.edu/npspubs/scholarly/theses/2010/Dec/10Dec_Varsamidis.pdf) (Accessed September 2014)
- Venot, J-P (2009). Rural Dynamics and New Challenges in the Indian Water Sector: The Trajectory of the Krishna Basin, South India. In: F Molle and P Wester (Eds.) *River Basin Trajectories. Societies, Environments and Development*. Wallingford: CAB International
- Venot, J-P., Bharati, L., Giordano, M. and Molle, F. (2011). Beyond water, beyond boundaries: spaces of water management in the Krishna river basin, South India. *Geographical Journal*, 177 (2),160-170
- Vorosmarty, C.J., McIntyre, P.B., Gessner, M.O., Dudgeon, D., Prusevich, A., Green, P., Glidden, S., Bunn, S.E., Sullivan, C.A., Liermann, C.R. and Davies, P.M. (2010). Global threats to human water security and river biodiversity. *Nature*, 467(7315), 555-561.
- Vorosmarty, C., Pahl-Wostl, C., Bunn, S. and Lawford, R. (2013). Global water, the anthropocene and the transformation of a science, *Current Opinion in Environmental Sustainability*, (5), 539–550
- Vorosmarty, C., Hoekstra, A., Bunn, S., Conway, D. and Gupta, J. (2015). What scale for water governance, *Science*, 349, 6247.
- Walker, B., Hilton, I., Chen, H., Huang, Y. and Chen, Y. (2014). *China's water security crisis*. Europe China Research and Advice Network (accessed at) [http://eeas.europa.eu/china/docs/division\\_ecran/isl22\\_chinas\\_water\\_security\\_crisis\\_beth\\_walker\\_et\\_al\\_en.docx](http://eeas.europa.eu/china/docs/division_ecran/isl22_chinas_water_security_crisis_beth_walker_et_al_en.docx)
- Wang, S. (2002). *Resource Oriented Water Management: Towards Harmonious coexistence between man and nature*. Beijing: China Water Power Press.
- Warner, J., Wester, P. and Hoogesteger, J. (2014). Struggling with scales: revisiting the boundaries of river basin management, *WIREs Water* 2014, 1, 469–481. doi: 10.1002/wat2.1035
- Waterston, A. (1965). *Development planning: lessons of experience*. Baltimore: Johns Hopkins Press

- Watson, N., Deeming, H. and Treffny, R. (2009). Beyond bureaucracy? Assessing institutional change in the governance of water in England. *Water Alternatives* 2(3), 448-460
- WEF (2014). *Water Security Towards a Values-based Approach*, Global Agenda Council on Water Security, Coligny: World Economic Forum.
- WEF (2016). *The Global Risks Report 2016*, 11th Edition, Coligny: World Economic Forum.
- Wengert, N. (1957). The politics of river basin development. *Law and Contemporary Problems*, 22(2), 258-275.
- Wichelns, D. (2015). Virtual water and water footprints add little insight to the analysis of sustainability, efficiency, or equity. *Water Alternatives*, 8(3), 396-414
- Williamson, J. (2004). A Short History of the Washington Consensus, Paper commissioned by Fundación CIDOB for a conference "From the Washington Consensus towards a new Global Governance," Barcelona.
- Winpenny, J. (1994). *Managing water as an economic resource*. London: ODI/Routledge.
- Wittfogel, K. (1957). *Oriental Despotism: A comparative Study of Total Power*. New York: Random House.
- Wolf, A. (2006). Conflict and Cooperation Over Transboundary Waters. Human Development Report Office Occasional Paper. New York: United Nations Development Programme
- World Bank (1993). *Water Resources Management*. Washington: World Bank.
- WWF (2016). *Ministerial Declaration at the 7th World Water Forum*, Gyeong-Ju: Korea (accessed at) [http://eng.worldwaterforum7.org/outcome/fo/view.asp?notice\\_seq=9&key=&keyWord=&sh\\_forum\\_gb=140103&page=1](http://eng.worldwaterforum7.org/outcome/fo/view.asp?notice_seq=9&key=&keyWord=&sh_forum_gb=140103&page=1)
- WWAP (2016). *The United Nations World Water Development Report 2016: Water and Jobs*. United Nations World Water Assessment Programme. Paris: UNESCO.
- Yang, X. and Muller, M. (2009). Taming the Yangtze River by enforcing infrastructure development under IWRM. In: R. Lenton and M. Muller (Eds.) *Integrated Water Resources Management in Practice: Better Water Management for Development*. London: Earthscan.
- Young, G., Dooge, J. and Rodda, J. (1994). *Global Water Resource Issues*. Cambridge: Cambridge University Press.



Zeitoun, M., Eid-Sabbagh, K., Talhami, M. and Dajani, M. (2013). Hydro-hegemony in the upper Jordan waterscape: Control and use of the flows *Water Alternatives* (6), 86-106

Zellmer, S, and Harder, J. (2007). Unbundling property in water. *Alabama Law Review*, 59, 679.