

## Environments

**Abstract** This chapter examines how environmental concerns have been addressed in global water governance. It begins with a synopsis of some of the persistent and emergent factors affecting the health of freshwater ecosystems. It then situates the emergence of global water governance in the context of environmental values that gained political salience during the 1960s onward and which structured initial links of science to policy. This chapter shows how environmental concerns led to a commitment to developing more routine world water assessments. These have evolved over time and in response to the growing knowledge of the planet provided by the Earth sciences. Higher resolution accounts of both surface and groundwater availability are critical for global water governance, but can also belie the concrete environmental complexities at regional or local scales. To examine this complexity, the chapter concludes with a case study of the Mekong River Basin to show how western agendas of global water governance and IWRM have clashed with local and regional dynamics.

**Keywords** Ecosystems · Groundwater · Earth science · Earth system Values · Environmentalism · Mekong River Basin

Global water governance emerged parallel to, and was influenced by, broader environmental movements in the latter half of the twentieth century. As a consequence, the concerns of global water governance have

been influenced by the western ideas and values that have dominated environmentalism. This has led to contests over how to pursue global water governance because western ideas and values toward the environment have significant blind spots regarding class, race, and gender that affect how others, particularly the poor, are perceived with respect to environmental goods (see Guha 2000). These contests have conditioned sustainable development since the 1980s (Lélé 1991). In fact, drawing diverse views of the environment into a single framework for governance was the ostensible goal of sustainable development and the stated view in *Our Common Future* that: “The Earth is one but the world is not” (World Commission on Environment and Development 1987). So, even though there has always been consensus that water’s vital role in providing the environmental conditions for all life must be given utmost priority, it has nevertheless remained challenging to develop a structure for governance that can accommodate multiple social perspectives toward a shared planet.

This chapter begins by providing a snapshot of the importance of freshwater ecosystems. This importance cannot be overstated and, precisely because so much is at stake with respect to water, is the site of numerous governance dilemmas and challenges. This chapter then situates the emergence of global water governance in the context of broader environmental concerns that gained political salience from the 1960s onward. This historical element is critical because, as Chap. 1 noted, water professionals pushed ideas of IWRM with greater energy when they perceived that sustainable development did not give water the attention they thought it warranted. It is also important because broader cultural perspectives toward environmental concerns influenced the values and judgments used to link science to policy. In global water governance, this link was forged initially by the American Gilbert White (1978), who provided the first global assessment of water resources and needs in preparation for the UN Conference on Water in Mar del Plata. From this beginning, and as the chapter considers, world water assessments have evolved over time and in response to the growing knowledge of the planet provided by the Earth sciences. These provide higher resolution accounts of both surface and groundwater availability and the effects of humans on planetary systems. Today, these assessments are critical for global water governance, but they can also belie environmental complexities at regional or local scales. The result is that global water governance must navigate a constant tension between multiple kinds of environments—from arctic to arid—that water supports and the complex

ways these different environments affect the global water system. To show how the connection between local contexts and global systems is shot through with governance challenges, the chapter concludes by examining the Mekong River Basin as a case study in how a western-led agenda of global water governance and IWRM has clashed with local and regional dynamics.

## WATER'S ENVIRONMENTAL IMPORTANCE

Water's links to the environment and to ecosystem services have fluctuated historically and in relation to different cultural demands. For hydrologists, it is critical to think about these dynamics not as distinct spheres of humans and nature but rather as a set of mutual, coevolving relationships (Falkenmark and Rockström 2004). These relationships are complex and multifaceted. They are also characterized by change, which makes understanding the environment a moving target (Folke 2003). Today, as thousands of dams, millions of cubic meters in reservoir storage, rapidly expanding megacities, and kilometers of pipes and canals wring the planet to quench human demands, the global water system is moving in novel ways as the cumulative impacts of humanity push the Earth system beyond the bounds of natural variability (Lehner et al. 2011; McDonald et al. 2014; Rockström et al. 2014). A significant driver of these changes is anthropogenic climate change, which is altering the Earth system as a whole with significant effects for the global water cycle and for assumptions about natural variability that have historically provided water management with a set of parameters for planning (Milly et al. 2008). Given the massive impacts of human water uses, it is now fair to say that water systems are not only moving—they are also morphing into new configurations as human activity alters the Earth system (Schmidt 2017b).

Earth's freshwater ecosystems are home to approximately 126,000 species, yet they are some of the most heavily altered and degraded ecosystems on the planet; these ecological problems, in part, issue from poor governance and lack of coordinated approaches to ecosystem management (Carpenter et al. 2011; UNESCO 2006). Globally, wetlands have declined an estimated 64–71% in the twentieth century alone with degradation continuing mainly due to urban and industrial sprawl and expanding agricultural lands (Gardner et al. 2015). Freshwater species have decreased by 50% since 1970, and rivers are often deprived of the flows

necessary for ecosystem functioning or have water quality that is heavily degraded from poorly managed infrastructure or unregulated pollution (Gleick and Palaniappan 2010). These declines are significant not only because changing species configurations affect how ecosystems function but also because these challenges are compounded by patchy governance regimes trying to both conserve freshwater ecosystems and secure the livelihoods of millions of people (Vörösmarty et al. 2010; Russi et al. 2013).

Unfortunately, the vital role of water in biodiversity is not the only environmental challenge for global water governance. Unsustainable groundwater withdrawals for irrigated agriculture are closely tied to the structure of global food supply chains and trade (Dalin et al. 2017). The water demands of rapidly developing economies now push groundwater systems beyond sustainable limits: China's heavy reliance on irrigated agriculture has caused groundwater abstraction to increase from 10 km<sup>3</sup> per year in the 1950s to more than 100 km<sup>3</sup> per year by the 2000s, while overextraction of groundwater in the Central Ganga Plain in India is having significant social and environmental consequences (Wang et al. 2010; Ahmed et al. 2014). The governance dimensions of groundwater are made all the more complicated because many institutions for managing groundwater were initially designed for surface water systems that are ill-suited for the unique challenges presented by the massive expansion of groundwater extraction currently underway around the globe (Birkenholtz 2015). Given that nearly half of the world's seven billion human inhabitants rely on groundwater for drinking water, and that groundwater is critical to the environmental and surface water flows, it is critical that it be governed with much greater care (Alley and Alley 2017).

Climate change presents a major challenge to aquatic environments as precipitation regimes shift, glaciers retreat, and extreme events of flood and drought increase in likelihood and intensity. These effects are compounded by governance challenges, such as efforts to address climate change by touting hydroelectricity as a clean energy alternative despite the fact that reservoirs collectively produce the equivalent of one gigaton of CO<sub>2</sub> emissions annually (Deemer et al. 2016). This amounts to just over 1% of global greenhouse gas emissions, which is small but also not zero. It also does not include the effects of dams on the global carbon cycle (Maavara et al. 2017). Nor does it include emissions or impacts of pouring thousands of tonnes of concrete into infrastructure projects or the large social and environmental impacts of dams. In Brazil, for

instance, many of the social and environmental impacts of dams, such as displaced peoples and biodiversity loss, are systematically underestimated (Fearnside 2016). Yet, the push for hydropower in response to climate change is often calculated as relative to higher polluting fossil fuels that have a large water impact in addition to their greenhouse gas emissions. Conventional and unconventional fossil fuel production requires water inputs that are often orders of magnitude greater than the millions of barrels of oil produced each day. In many cases, the challenges of biodiversity, climate change, and dams are layered upon each other. For example, the Colorado River, a key river in the western USA, suffers from invasive species, point source pollution (e.g., from cities), nonpoint agricultural pollutants, and overextraction (Kennedy et al. 2013; Jones-Lepp et al. 2012). This remains still a partial list: The fate of pharmaceuticals and endocrine disrupting chemicals in freshwater systems can also alter aquatic species and ecosystems while raising serious health considerations for human populations (Snyder et al. 2004).

Recognizing the interdependency of humans and ecosystems and developing better governance mechanisms is essential to achieving sustainable management of the planet's freshwater (Matthews 2016; Sedlak 2014). It is also an empirical and ethical imperative for the millions of people who remain without access to reliable and safe drinking water and those who also lack sufficient sanitation (Feldman 2012). Problems arise, however, when it comes to the task of recognizing this interdependency in a way that draws together the multiple social systems currently in place to govern water into a global schema. Indeed, this was and remains a central challenge of global water governance—and the broader agenda of sustainable development to which it often appeals for normative force. One aspect of these complex challenges that is often overlooked is the role of predominantly western values and judgments that have suffused how interdependence should be understood and acted upon to link science to policy.

## THE WESTERN ROOTS OF GLOBAL WATER GOVERNANCE

Refusing analytical distinctions between humans and nature is often touted as key to understanding relationships among water, humans, and non-humans as well as to thinking critically about the cultural assumptions that link empirical assessments to normative claims about how governance should proceed (Postel and Richter 2003; Falkenmark and Folke

2010). Despite this, western-led discourses that installed the nature/society distinction initially are often quickly dissociated from the similarly western-led discourses on water governance seeking to connect science to policy. As many studies have shown, cultural judgments linking empirical assessments of water to social and political institutions cannot be avoided (e.g., Feldman 1995; Espeland 1998). In part, this is because complex systems must always be simplified for the purposes of governance and management, and the judgments made to convert complex systems into manageable units are influenced by historical obligations, cultural values, and interpretations of environmental change. Rather than ignoring or skirting around these cultural influences, a more promising route is to make the implicit cultural roots of global water governance an explicit matter of discussion and debate.

There is no obvious starting point for discussions of values that have deep cultural roots. At the global level, however, key values related to water were articulated by the first director of UNESCO, Julian Huxley (1935, 1943), who swooned over the model of water management that the USA had developed in the Tennessee Valley Authority. Huxley believed the combination of social and environmental engineering undertaken by the TVA could serve as a model for UNESCO programs that would similarly pursue forms of multipurpose, comprehensive resource development and management. Huxley not only liked the combination of natural resource management and social development, he also liked that both were put in service to a liberal approach to social planning. For his part, Huxley (1946) advocated a “scientific humanism” that would vouchsafe social evolution from the clutches of metaphysical and nationalist philosophies. Of course, liberalism was not neutral either. As many scholars have shown, it was common in the postwar era and throughout the Cold War to use water resource development as a tool against communism (e.g., Ekbladh 2010; Sneddon 2015). Critically, however, Huxley was also an avowed eugenicist who believed that social progress could be objectively determined across races and ethnicities. This kind of racism—couching cultural values in the language of science—was not unique to Huxley and also inflected approaches to international development in which water often figured centrally in claims about progress and in legitimizing interventions in the Global South (Escobar 2008, 2012).

The environmental movement that emerged in the 1960s sought to challenge western biases regarding the natural world. Lynn White Jr.

(1967) famously argued that the “roots” of the ecological crisis were to be found in the religious axioms of the West and the unique status assigned to humans. These failed, in White’s view, to provide an empirical basis for the world’s “emerging, entirely novel, democratic culture.” For White, what was novel was not democracy per se but rather the new, global scale it sought to operate at. Indeed, many environmentalists pointed out that scale was a key issue for ecological concerns. Extensive human intervention into ecological systems was eloquently, if devastatingly captured in books like Aldo Leopold’s *Sand County Almanac* and Rachel Carson’s *Silent Spring*, both of which galvanized environmentalists through their attunement to both science and values. More apocalyptic bells were sounded in Paul Ehrlich’s *The Population Bomb* and the Club of Rome’s *Limits to Growth*, which warned that the novel rates of industrial consumption and population growth could not be supported by a finite planet. In response, and using techniques that were developed in part to manage water development projects, economists and planners began to focus on growth *rates* instead of on absolute measures of resource limits (Mitchell 2014). In hindsight, even this proved unmanageable; the post-1945 era of global industrialism has been described as the “Great Acceleration,” owing to Earth’s material resources and energy being channeled into human service at an ever-increasing rate (McNeill and Engelke 2016).

In 1964, and in response to US concerns about the lack of understanding of global hydrology, UNESCO inaugurated the International Hydrological Decade (for an overview, see Schmidt 2017a). The goal of the decade was to produce an account of “water and man”—that is, a universal and objective account of humanity’s relationship with water that was based on a scientific worldview (Nace 1969). The decade was the first international scientific collaboration of hydrologists and got underway just as the environmental movement gained global momentum. In 1972, the UN held a conference in Stockholm on the Human Environment, the first global conference of its kind. It was a landmark event and supported by many international agreements, such as the Great Lakes Water Quality Agreement signed between Canada and the USA, as well as numerous new environmental agencies and laws (see Lazarus 2004). Increased awareness and political will on environmental issues was not limited to government agencies. New fields of environmental ethics and economics were developed to cultivate new values—new axioms for the emerging democratic culture that would need to

confront growing demands for water and other natural resources. At the first Earth Day in 1970, Gaylord Nelson proclaimed that: “The economy is a wholly owned subsidiary of the environment, not the other way around.”

By the time IHD ended in 1974, environmentalism was in full swing. And, when the outcome of the IHD was to convene a global, UN-backed water conference in Mar del Plata, these entanglements were deepened as different governmental and non-governmental actors sought to have their voices heard and views toward water represented (Macekura 2015). They were not always successful, particularly because the aim of global water governance was, at that time, primarily interested in producing a global picture of both humans and water—a scale not particularly conducive to giving serious or sustained attention to cultural differences. As a result, it must be kept in mind that while it was widely agreed to that water is of utmost importance, just *how* that importance was to be understood, interpreted, and governed has always been a matter of contest over which judgments best explain the complex interrelationships among water, humans, and all other life. The focus on new values for linking humans and nature, however, often ignored issues of race, gender, and class in attempts to mobilize environment concerns (Zimring 2016; Gaard 2001). When arguments over new values fell on deaf ears, environmental justice movements took political action against environmental inequalities (Schlosberg 2004, 2010). For feminist scholars, the focus on western values remained a central problem because the putatively “rational” axioms of western thought reified distinctions that were not empirically tenable—notably the unique status of humans as qualitatively distinct from, and superior to, nature (Merchant 1980; Plumwood 2002).

Growing recognition of ecological interdependence intersected with the emergence of global environmental institution building in both the IHD and Mar del Plata. Since that time, contests have continued over how western ideas separating nature from society should be understood, revised, or abandoned. Frequently, scholars have argued that the distinction should be rejected in favor of new concepts, such as the “hydrosocial cycle,” that seek to eliminate divisions of hydrology (i.e., nature) from humanity (i.e., society). Some, such as Linton (2010, p. 1), argue that because hydrological science is a social practice—the practice of doing science—that understandings of water are socially constructed to such an extent that “water is what we make of it.” On



Linton's account, even the global water crisis is simply a crisis of one way of thinking about and knowing water. It is hard, however, to see how the global crisis of chronically water-deprived children dying from thirst, malaria, or diarrhea is a social construction. So, even if we agree that science is a social practice, it does not lead to the conclusion that anything goes when it comes to water (Schmidt 2014). A more promising route is to consider how numerous social practices produce reliable empirical knowledge (Harding 2015). This also helps to avoid the unethical stance where the knowledge production practices of other cultures are dismissed in a view of "science for West, myth for the rest" (Scott 1996).

Water problems are real—all too frequently they are matters of survival for the world's poorest populations and for many aquatic species. The connections among western values and scientific assessments have positioned global water governance within the broader liberal compromise of sustainable development. As Chap. 4 examines in more detail, the assumptions about "society" that underlie global governance warrant as much or more scrutiny than those regarding "nature." What we are concerned with here, however, is how scientific assessments were used to connect environmental concerns to global water governance and how these connections shifted over time as empirical assessments improved understandings of the Earth system. Forging the links between science and policy involves numerous normative judgments, and forging global agreements is no easy task. Given this, an obvious question arises: How have the subtle, yet shared values that provide legitimacy for the complex judgments involved in governance evolved over time to incorporate the improving empirical picture of Earth's freshwater systems?

### LINKING "ENVIRONMENT" TO GLOBAL WATER GOVERNANCE

The IHD provided the first global atlas of the world's water balance (Korzoun et al. 1978). It also proved a decisive and important step marking the "coming of age" of global hydrology (Nace 1980). The knowledge produced by global hydrologists was critical in the project of international water management and the attempt in Mar del Plata to ensure that the holistic and integrated nature of water became a permanent fixture in the public conscious. It was a project that was both scientific and normative, as this statement by the Secretary General to the Mar del Plata conference, Yahia Abdel Mageed, reveals:

It is hoped the water conference would mark a new era in the history of water development in the world and it would engender a new spirit of dedication to the betterment of all peoples; a new sense of awareness of the urgency and importance of water problems; a new climate for better appreciation of these problems; higher levels of flows of funds through the channels of international assistance to the course of development; and in general a firmer commitment on the parts of all concerned to establish a real breakthrough so our planet will be a better place to live in. (quoted in Biswas and Tortajada 2009, p. 5)

At the Mar del Plata conference, delegates sought a rational basis for holistic planning that would use global hydrology as the basis for determining national-level laws and policies (Biswas 1978). It was a challenge shaped by the consequences of accelerating industrial demands of human societies, advances in technology, and of a global population that reached approximately 4.2 billion people in 1977. The main output from the conference was the Mar del Plata Action plan, which in retrospect provided the first international basis for IWRM (Biswas 2004).

As it was conceived at Mar del Plata, integrated water management was a holistic approach that recognized the importance of effective governance. It also recognized deep social challenges, with the 1980s being declared a decade for International Drinking Water and Sanitation by the United Nations. Despite the momentum achieved at Mar del Plata, neither IWRM nor water issues in general garnered the same kind of attention throughout the 1980s that was achieved by sustainable development. Although scientists and academics such as Holling (1986) and Vogel (1997) continued to emphasize the importance linkages between ecosystem health and water governance, it was not significantly addressed at global conferences. Rather, what increasingly occupied water managers was water's relationship with multiple different sectors that presented risks to water. A key conference in this regard was held in 1987 on the topic of human transformation of the Earth. There, Mark L'vovich and Gilbert White (1990) made the first historical estimates of the accelerating use of water by industrial societies over the past three centuries (see also Schmidt 2017a). Water was explicitly linked to global circulation models of the climate by the late 1980s and to emerging concerns over global warming (Gleick 1989). In this sense, risks to water were increasingly being connected to the picture of the planet emerging from the Earth system sciences.

In 1993, Gleick (1993) provided an assessment of the state of the world's water resources that anticipated a biennial assessment process that by 2014 was in its eighth volume. These more routinized assessments were key to developing a global consensus among governance practitioners on the key stressors and risks to the global water system. At the mid-point of the 1990s, water policy expert Sandra Postel, together with key figures in the environmental movement Paul Ehrlich and Gretchen Daily, estimated that humans were appropriating roughly half of the Earth's available supply of renewable freshwater (Postel et al. 1996). Building on these findings, and on growing calls for a world water assessment, the Sixth Session of the Commission on Sustainable Development stated in 1998 that there was a need for regular, global assessments on the status of freshwater resources. As a result, the United Nations World Water Assessment Programme (WWAP) was founded in 2000 with a primary aim to monitor, assess, and report on the world's freshwater resources and ecosystems, water use and management, and to identify critical issues and problems. The main output of WWAP is the World Water Development Report (WWDR). The WWDR reports have developed along with technological and scientific advances in Earth system science to offer increasingly higher resolution accounts of both surface and groundwater availability and the impacts of humans on the planetary system.

Improved assessments of the world's water were paced by the growing prominence of water governance on the global stage. In 1996, with backing from the World Bank and the UN, the Global Water Partnership (GWP) was established as an umbrella organization for promoting and coordinating IWRM and its linkages to water issues on a global scale. The upshot was a period of contest as the management focus of IWRM increasingly rubbed up against emerging concerns of global governance. For some, a key concern was that governance might be relegated as a tool to achieve the objectives of IWRM rather than as an approach with the capacity to deal with the interlinked dynamics of an increasingly globalized world economy (Rogers and Hall 2003; Lautze et al. 2011). It was an important consideration as IWRM ascended to near hegemony in the water sector in the 1990s (see Conca 2006). A related concern was that attention to the environment—and of thinking about the environment in global terms—could be hedged in by IWRM, which focused on the watershed scale and not on global concerns. Indeed, by the end of the millennium key figures in global hydrology, such as Malin

Falkenmark (2001), increasingly pressed the global community to link water, food, and the environment in broader discussions regarding the governance of scarce resources.

The focus on watershed concerns in IWRM was part of a long-standing process of identifying the river basin, or watershed, as the natural unit of management (Cohen and Davidson 2011). The idea was intuitive: Since water is a key environmental, industrial, and social constraint and since watersheds are the spatial units capturing and directing water flows, the watershed presents a seemingly natural scale for decision making. The assumption, though widely touted, has serious flaws in terms of governance (see Warner et al. 2008): One is that determining the scale of the “watershed” is a political decision given that many large watersheds, such as the Nile or the Ganges, have many sub-basins that are both large and complicated. A second is that many institutional and jurisdictional boundaries do not follow those of watersheds, so judgments will inevitably be made regarding how this “natural” unit is defined. Particularly in international contexts, where water routinely crosses national borders, the claimed “naturalness” of watersheds can only be maintained by highly orchestrated governance arrangements (Blatter and Ingram 2001). Nevertheless, the watershed remains an important spatial unit for governance as it has been for management because, even despite its fuzzy political edges, it is often the scale at which science, policy, and politics intersect on environmental issues (Cohen 2012).

The Second World Water Forum in The Hague in 2000 proved a turning point for water governance, which was identified as the first of three priority action areas at the International Conference on Freshwater in Bonn in 2001 (Rogers and Hall 2003). That year also marked the start of the Millennium Ecosystem Assessment, a global collaboration of scientists that published its results in 2005 and which proved an important influence in the shift toward resilience-based approaches to environmental management and governance. As Chap. 1 covered, by the early 2000s there were several tensions within the global water community over how to achieve IWRM, yet there was also considerable momentum as a growing number of countries adopted IWRM as part of various development projects. Amid this tension, resilience-based approaches to environmental management and governance offered a unique solution that left the policy frameworks of IWRM in place while providing a new perspective on the complex and changing ecological conditions faced by water managers. Resilience refers to the capacity of a socio-ecological

system to adapt to disturbances that result from either human or non-human forces while still maintaining its functions and feedbacks (see Folke 2006). In the new millennium, it presented a way to maintain policy stability in places where IWRM was adopted while also opening the path for understandings of “integration” to migrate from one premised on the “balance of nature” to one in which constant change and coevolution were the norm.

The cultivation of resilience-based, adaptive management techniques alongside IWRM policies presented a significant moment for aligning water management with the approach to global environmental governance that appreciated the nonlinear and multiscale dynamics of complex systems. It also provided a certain amount of flexibility as the experimental approaches of adaptive management could be used to legitimate the testing and trial of new governance structures for sustainable development (Feldman 2007). Conceptualizing and reinvigorating IWRM through adaptive management techniques involved expanding the traditional focus on water management from the “blue” water of lakes and rivers to incorporate the links of water management to “green” water flows, such as evaporation, that were closely tied to land-cover change and ecosystem processes (Falkenmark and Rockström 2004). When the Millennium Ecosystem Assessment (2005) released its findings in 2005, the shift toward learning about water governance through techniques of adaptive management strengthened the connections between shared approaches to understanding both water governance and global environmental change (Pahl-Wostl 2007). The findings of the Millennium Ecosystem Assessment further bolstered the momentum that the first WWDR had achieved in 2003 by once more emphasizing the deep links between humans and the Earth system. The 2003 WWDR report, *Water for People, Water for Life*, argued that the global water crisis had deep social and environmental interconnections and precipitated the UN Declaration of the *Water for Life* decade in 2005.

A critical component to the resilience of socio-ecological systems was the need to preserve adequate environmental flows for ecosystem functioning. Calculating the water flows needed for different aquatic ecosystems to remain healthy over time, space, and scale has been attempted through a variety of methodological approaches (see Acreman 2016). All of these are part of the growing appreciation of human impacts on aquatic ecosystems that led scientists and policy makers, including

environmental NGOs and the World Bank, to begin to take concerns over environmental flows more seriously (Dyson et al. 2003; King and Brown 2006; Hirgi and Davis 2009). In Europe, the EU Water Framework Directive became a key piece of policy for regulating environmental flows within and among member states (see Acreman et al. 2008). The growing recognition of the need for enhanced environmental flows, however, faced steep challenges not only from years of entrenched water use practices—many codified in legal rights—but also from the more severe and intense extremes of water resulting from climate change. In Europe, heavily developed rivers faced the prospect of increased intensity of rainfall and flooding (Christensen and Christensen 2003). In Africa, climate-induced flood events exposed deep social inequalities in the development of infrastructure, especially among the urban poor (Douglas et al. 2008). What was becoming clear was that environmental flows did not equate to natural flows and that, going forward, the human imprint on the global water system would need to be dealt with at multiple scales and in the context of existing, often unequal social structures.

The 2006 WWDR, *Water a Shared Responsibility*, further advanced the theme of social inequality and the need for integrated approaches to water to move away from business as usual. The report engaged with a wide spectrum of pathways to solve water challenges, including addressing water and sanitation services, agriculture, energy, and a specific focus on environmental sustainability (UNESCO 2006). The report captured in governance terms the increasing complexity besetting global water challenges as human demands on hydrological systems continued to grow. Throughout the first decade of the new millennium, a spate of studies revealed human impacts on freshwater ecosystems while new technologies, such as the paired GRACE satellites, provided new technologies for assessing groundwater (Meybeck 2003; Vörösmarty et al. 2004, 2010; Famiglietti et al. 2011). Increasingly, scholars and practitioners sought ways to connect local and global water challenges in the Anthropocene—the new epoch coined to capture the many ways in which humans now rival the great forces of nature (see Gupta et al. 2013). Recognition of these challenges was met by shifts in the hydrological sciences to more fully assess human impacts on the global water system at multiple scales and in a context where water was one component of a set of interlocking Earth system dynamics (Vörösmarty et al. 2013; Savenije et al. 2014).

With the growing recognition of complexity and change in human-water relationships, it became increasingly clear that no single framework for governance could manage water in a holistic sense. Or did it? The rejection of IWRM and its particular approach to holism also spurred a new approach to holism—where, rather than try to assemble all the dynamics affecting water into a single framework, the aim is to govern the overall dynamic of an interconnected system in which water is connected to food, energy, and the climate. One way to contrast the two approaches is to note that IWRM sought to *collect* all of the variables affecting water as the basis for integrated, holistic decision making. By contrast, what is now known as the water–energy–food–climate nexus seeks to govern the *connections* among water and multiple other sectors. This type of holism is still concerned with the global water system but it is not fixated on making water the common denominator for integration. Governing these multiple connections became a central element of environmental concern in 2011 at a conference in Bonn in preparation for the Rio+20 conference set for 2012 (Hoff 2011). There are many elements to the emerging discourse on governance and the nexus (see Chap. 3), but one of the key features of this new approach is the attempt to reconcile the fact that environmental impacts on water can come from multiple—often unanticipated—directions in an era of global environmental change (Pittock et al. 2015).

The turn to the nexus is part of a broad shift currently underway in global water governance toward thinking about water as part of a set of interconnected social-ecological systems. It is a shift with important implications for IWRM (see Benson et al. 2015) and also one being affected by new governance institutions, such as the Global Water System Project (2014). Here, once more, it is critical to highlight the ways in which numerous values come to bear on how science is linked to policy, especially when recognition of interlinked Earth and economic systems is brought into discussions and policies of sustainability (Hussey and Pittock 2012; Lawford et al. 2013; Ringler et al. 2013). There is a concern, both material and moral, that the exchange of one set of scientific ideas about the global hydrological cycle for those of Earth system sciences may still connect governance concerns to the environment in ways that exclude or marginalize non-western perspectives (Schmidt et al. 2016; Schmidt 2017a). To see how the evolution of approaches to water management and water governance can operate in this way, it is helpful to consider a case study of the Mekong River Basin, where

numerous interventions over several decades reveal the difficulties related to environmental aspects of global water governance. There, and despite the laudable principles of good governance regarding participation and transparency, little or no space for participation is actually provided, while the environment is considered secondary, or not all, in comparison with economic growth and development. Across the Mekong Basin, as in much of the developing world, the space for an environmental voice in water governance is often significantly curtailed by geopolitical and economic development agendas.

### THE MEKONG RIVER

The 800,000 km<sup>2</sup> Mekong Basin is home to the Mekong River, the seventh longest river in the world. The transboundary Mekong River is shared by six countries: China, Burma, Thailand, Laos, Cambodia, and Vietnam. Known as “the breadbasket of Southeast Asia,” the Mekong Basin is home to a population of 70 million with 90 distinct ethnic groups (Galipeau et al. 2013). With its extensive wetlands and floodplains, the Basin supports the largest inland fisheries in the world with an annual catch of 2.6 million tonnes and over 500,000 tonnes of other aquatic animals (e.g., aquatic insects, amphibians, and mollusks) valued annually at between \$3.9 and \$7 billion (Hortle 2007). Over two-thirds of the Basin’s population are involved in fishing for their livelihoods or to support food security (Mekong River Commission 2003). In the Lower Mekong Basin, aquatic resources make up between 47 and 80% of animal protein in rural diets (Baran and Ratner 2007; Friend and Blake 2009). Biodiversity in the Mekong Basin is second only to the Amazon, with over 1200 species of fish and a number of endemic and endangered species such as the giant Mekong catfish, which can grow to three meters and can weigh over 300 kg, the giant Mekong stingray, and the Mekong river dolphin (Dugan et al. 2010). Although a healthy and functioning environment in the Mekong has been shown to underpin the livelihoods and food security of much of the basin’s population, the agenda and unfolding of water governance and the space for environmental considerations have been largely a western import that has faced obstruction by regional and local agendas seeking rapid economic growth through hydropower development, transport, and irrigation.

An early contribution to the emergence of environmental water governance in the Mekong was a Ford Foundation-sponsored report by



Gilbert White (White et al. 1962) entitled, *Economics and Social Aspects of Lower Mekong Development*. The White Report went beyond the engineering and technical considerations of previous studies into water resource management across the basin to look at the potential environmental and social impacts of development. For White et al. (1962), the report drew from concerns emerging in the growing environmental movement in the USA that was shifting the development purview beyond a quest for growth at any cost to encompass considerations of environmental impacts and the integrated nature of water, humans, and the environment. The report was also a way for White to illustrate Asia's first, large-scale efforts to study the economic, institutional, and social aspects of development prior to development actually occurring.

After a period of political unrest and conflict across the Basin, the coordinated, western-led effort behind water governance linked with the environment was picked up again in 1995 with the formation of the Mekong River Commission (MRC). The MRC is primarily a western-funded River Basin Organization (RBO) representing all the states in the Basin, but with China and Myanmar only acting as dialogue partners. The MRC funding donors introduced a set of governance objectives that moved away from the heavy focus on water resources development to one that contained principles based on “sustainable development, utilisation, management and conservation of the water and related resources of the Mekong River Basin” (MRC 1995).

The source of the MRC's funding in western institutions has shaped the emergence and dissemination of good water governance principles such as participation and transparency, and the consideration of environmental impacts of development. These environmental water governance principles imported by the MRC have been further espoused by western-funded INGOs. Under the MRC, this new development agenda emphasized cooperation around scientific studies, capacity building, and environmental protection (Jacobs 2002). For its donors, the MRC also provides a strategic opportunity to open dialogue spaces with the region's emerging markets. Finally, it allows them to meet aid objectives by encouraging good governance principles in the Basin's future water management (McCawley 2001).

For some governments in the region, these new principles were not well suited to their existing development pathways or political systems. The government of Laos, for example, may have perceived the concept of good water governance as a threat to its power base through the

promotion of devolution from the government to a form of governance that included the state, the market, civil movements (NGOs), and civil society (Matthews and Schmidt 2014). As noted by Ribot (2004), the devolution of power is often met by strong resistance from those in power. Although the Lao government was reluctant to accept these new principles, the MRC and its donors were also seen as an important source of much needed funding and economic stimulus for underdeveloped states. With increased confidence and stability in the region, from 1990 to 1995, net Overseas Development Assistance flows to Thailand and Indochina rose by approximately 400% from \$422 million to \$1.66 billion USD (OECD 1997).

The MRC was not the only funder espousing the principles of environmental water governance. From the 1990s, The Asian Development Bank (ADB) and the World Bank also promoted a brand of good water governance, but one that was more closely aligned with neoliberal policies that encouraged the market-led development of natural resources recognizing that environmental impacts were part of the trade-offs needed to develop. A centerpiece of this agenda was the implementation of the Greater Mekong Subregion (GMS) Programme, a scheme strongly focused on the connectivity of markets and economies and private sector investment in hydropower development to advance economic growth and reduce poverty within the framework of good governance (Middleton et al. 2009). The GMS mandate has promoted interconnectivity and hydropower development, including private sector investment in mainstream and tributary dams, but still included calls for participation and transparency in decision making although with less emphasis on preserving ecosystem health (Cornford and Matthews 2007). The program's focus on development appears to have been more rapidly accepted by the region with all basin states signing on as members.

Despite good governance principles being strongly promoted by the MRC, the ADB, and the World Bank, a scalar disconnect has arisen between these agendas and those of many of the basin states. This disconnect may have emerged when the member states assumed the MRC would follow a development path that pursued rapid economic growth similar to the path taken in the USA and Europe through the construction of mainstream and tributary hydropower dams and large irrigation projects (Lang 2005). The disconnect between the environmental and water governance agendas of western donors and NGOs in the region and that of basin states has emerged as a key point of contention within

the MRC. Ultimately, the deadlock around this debate has nullified the meaningful implementation of many environmental water governance principles across the basin. As a result, the concerns of international donors for holistic, participatory water management, programs of environmental and ecosystem protection, and monitoring and evaluation have been tolerated by member states to demonstrate their commitment to these processes, but at the same time government policies have continued to focus on top-down, non-transparent decision making and rapid water resource development despite its impacts on ecosystems (Suhardiman et al. 2012). In fact, to date the MRC has largely only managed to gain cooperation from all of its member states on apolitical issues. This disconnect allows governments to implement policies of sovereign interest “because the MRC lacks power to direct transboundary water governance issues in the region” (ibid).

The disconnect between competing agendas and differing interpretations of governance and environment valuation and protection has delegitimized other efforts at IWRM and basin-wide water management plans, further increasing the lack of transparency. National governments may view any efforts introduced by outside actors concerned with the environment or social issues as something they must pay lip service to, but which are counter to national efforts to quickly modernize or develop water resources (Geheb et al. 2014).

Meanwhile, the World Bank and ADB’s assistance with domestic policies and the GMS Programme have scaled good governance principles alongside a neoliberal vision of rapid economic growth including hydropower and irrigation development. This has shifted the concept of participation and transparency away from individual countries and local scales to a larger scale that creates an area of perceived harmonious community called the “Greater Mekong Subregion.” This scaling of participation and transparency at a basin level has meant that the application of good water governance principles including environmental considerations can be achieved through INGO participation in planning although this participation may be tokenistic (Matthews and Schmidt 2014). In reality, many basin states have only engaged with non-local actors and avoided any real devolution of power, thereby creating an illusion that they are following the norms of IWRM and good water governance promoted by donors.

INGOs across the Mekong Basin have also used water governance as a vehicle to articulate power and legitimacy through their western

representation and the discourses and practice they promote (Peet and Watts 2004; Matthews 2012). This perceived legitimacy and western-influenced knowledge may be both unrepresentative of local needs and clashing with regional development discourses. For example, many INGOs in the region promote a brand of IWRM and water governance that heavily critiques hydropower as being devastating to the environment of the region while downplaying its economic benefits. Sundberg (1998, p. 14) argues that they assume “the moral authority to speak for nature.” This use of western knowledge by INGOs enables them to articulate a form of power and claim legitimacy within environmental and social impact debates, but is out of step with the development agenda of regional states. This INGO perspective has also not always been accurately representative of local level needs (Sunderberg 1998). This clash of agendas and forms of knowledge has created tensions between states, the private sector, and INGOS. As a result, in many cases states have delimited their influence and controlled their activities.

The above examples illustrate how different agendas shape the application of water governance to environmental concerns. Increasing pressure on water due to climate change and population growth can also have detrimental impacts on the establishment of water governance. In 2016, for example, an El Niño-inspired drought across the Mekong Basin resulted in unilateral decisions around water management with Thailand installing dozens of pump stations along the Mekong mainstream, seeking to withdraw 47 million cubic meters of water over 3 months to irrigate thirsty fields in the country’s northeast—one of the country’s poorest regions. Downstream countries asked that Thailand’s activities be submitted to scrutiny by the MRC as part of a process of water governance. Thailand, however, rejected the request due to the pressure to appease domestic politics.

Across the basin, the MRC’s dominance of the water governance agenda has been under pressure. The MRC’s legitimacy has been under question due to the many deep divisions between the Mekong countries’ growth agendas and that of western donors’ water governance. The institution has been further wracked by reforms and significant changes to its *modus operandi*, which only serves to deepen the ambiguities associated with regional water governance and management. The MRC has found that with increasing demands for energy and water for irrigation and the deep inter-linkages of water to political economies across the region, it is progressively difficult for a RBO to build

cooperation and a shared vision for the development of the Mekong Basin. Hale and Held (2012, p. 169) articulate this challenge in their analysis of global governance when they state that "...the emergence of new powers, the growing challenges of collective action problems and the complexity of institutions that seek to address them—have made it increasingly difficult to govern transnational problems through multilateral cooperation." Although the MRC may find these new dynamics increasingly constraining, the new governance reality offers space for non-traditional actors such as the private sector, to influence, either positively or negatively, the ability of the states to promote good water governance practices.

As a result of this weakening of the MRC, in March 2016, China announced the creation of the Lancang-Mekong Cooperation Mechanism (LMCM). The LMCM is designed to "strengthen cooperation in such fields as infrastructure, engineering machinery, electricity, construction materials and communications." The mechanism includes a RMB 10 billion yuan concessional loan and a US\$10 billion credit line, including a US\$5 billion preferential export buyers' credit and a US\$5 billion special loan on production capacity cooperation. Its members include all the regional riparian states (unlike the MRC, in which China and Myanmar are only dialogue partners). The fund aims to finance up to 20 dams in the region. Chinese firms are already the most active dam builders in the Mekong with 57 dams commissioned, 12 under construction, and 16 planned or proposed in the region (Matthews and Motta 2015). The latter includes the soon-to-be-announced Pak Beng on the Mekong mainstream in Laos, to be developed by Datang International.

The LMCM is more than just finance, however. The mechanism's focus on cooperation over water resources increases China's hegemony in the region and could potentially undermine the efforts of the western-funded MRC. The mechanism also increases China's bargaining power and influence on the lower basin states. Through the LMCM, China can exert influence on ASEAN members on issues such as the South China Sea. The LMCM allows China to lead the direction and set the tone of water governance across the region.

Both China and the USA have been working to influence the emergence of water governance in Myanmar and along the Irrawaddy and Salween rivers: The 6000 megawatt Myitsone Dam, which was to be developed by the China Power Investment Corporation, was suspended in 2011. Its suspension by the Myanmar president had a significant

impact on China's relationship with its southern neighbor. In September 2016, fighting in Karen was said (by activist and NGO groups) to be an effort by the Burmese Border Guard Force to clear people from the Hatgyi Dam's inundation zone. This dam is slated for development by Sinohydro, and the forced displacement has fueled speculation that the Myanmar military is working closely with Chinese hydropower development companies. The World Bank has given a US\$100 million loan to strengthen and improve Myanmar's water management capabilities, thereby ensuring that US-led interests in water governance across the region are also prominent.

As in many parts of the world, the basin states of the Mekong have been consumers of international development knowledge. The principles of participation, equity, environmental sustainability, and transparency in water governance and decision making have been imported and driven into the region from outside agendas. The introduction of the good governance principles drew from an international trend encouraging a new "softer development agenda" focusing on good governance issues that emerged in the 1980s and one that was heavily promoted by INGOs from the mid-1990s (McCawley 2001). As the Mekong Basin case demonstrates, however, how the western-led and imported agendas of water governance and environmental concerns are interpreted and applied by countries remains contested. The Mekong case study is representative of the close linkages between water governance, economics, and the power of environmental concerns. As we move deeper into the increasingly unpredictable Anthropocene, the pressures of population growth, consumption, climate change, and the associated increased water demand will make water governance and the management of environmental trade-offs an increasingly contested space.

## CONCLUSION

The Mekong River case provides a snapshot of the intersections of western environmental values, global governance, and the dynamics at play in linking science to policy. It is also emblematic of the politics and economics that shape the discourse around water governance in much of the developing world. Increasingly, calls to shift toward a "green economy" for the purposes of sustainable development are met skeptically by developing nations who fear that, under the pretense of environmental policy, they will be subject to new and unfavorable economic arrangements

(Conca 2015). It is a legitimate concern given that international development has, despite constant claims to the contrary, facilitated a massive shift in wealth from the Global South to the Global North (Kar and Schjelderup 2016). These practices have not infrequently exacerbated environmental harms in ways that reflect and reinforce the prevailing inequalities of social and political structures (Sachs 1999; Downey 2015).

Nevertheless, global water governance is critically dependent on a shared understanding of the environment as a way to link the many facets and demands of humans, non-humans, and ecological processes on water. Over the decades since Mar del Plata, there has been an increasingly sophisticated accounting of human impacts on the global water system and the regional and local causes of pressures at lower scales. How these scientific assessments fit with the institutions and programs of global water governance, however, has been heavily influenced by western values and concerns. Notably, US- and UN-led networks and organizations have supported agendas of IWRM that captured international water management that later came to dominate global water governance. The upshot of having western ideas and norms facilitate the links between scientific assessments of the global water system and programs of global water governance is that these values have similarly pervaded approaches to other facets of sustainability regarding economies and societies.

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2017, XI, 123 p. 1 illus., Hardcover

ISBN: 978-3-319-61502-8