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Léna Salamé, Daene C. McKinney, Jerome Delli Priscoli, Toshio Koike, Jack Moss, Mara Tignino, Owen McIntyre, Hussam Hussein, Mahsa Motlagh, Aaron T. Wolf, Lynette de Silva, Natasha Carmi, Danilo Türk, and François Münger

Abstract

The water epistemic community discusses water matters and directly or indirectly advises policy and decision makers in ways that reflect its beliefs on one hand, and its agreements and disagreements, on the other hand. It discusses water in ways that reflect the variety of scientific and indigenous backgrounds of its members, the richness of their different expertise, their cultural and social beliefs, practices and aspirations, as well as their ethical, spiritual and religious values. These discourses cover issues as complex as the value of water and the nuances between water security, sustainability and integrated water resources management. They deliberate over statements as sensitive as claims insisting that wars will be fought over water. They examine the impacts of phenomena such as climate change over water and how humans should adapt to it; and the list is as long and vast, as the number of complex issues intertwined with the governance of water. Is water an instrument of peace, or rather the source of (inevitable) conflict? Are water infrastructures good or bad? What are the limits of international law in the management of transboundary water resources? How should one refer to and assist, a person who has been displaced because of water related hazards? This chapter shares with the reader a

L. Salamé (✉)
Paris, France
e-mail: lenasalame@gmail.com

D. C. McKinney
Department of Civil, Architectural and Environmental Engineering, University of Texas, Austin, TX 78712, USA

J. Delli Priscoli
GWP TEC, IWR USACE (ret.), Arlington, VA 22201, USA
e-mail: jdpriscoli@gmail.com

T. Koike
International Centre for Water Hazard and Risk Management (ICHARM), Public Works Research Institute (PWRI), 1-6, Minamihara, Tsukuba, 305-8516, Japan
e-mail: koike@icharm.org

J. Moss
Former Director, AquaFed – the International Federation of Private Water Operators, 75004 Paris, France
e-mail: info@aquafed.org

M. Tignino
Faculty of Law and Institute for Environmental Sciences/Geneva Water Hub, University of Geneva, Geneva, Switzerland
e-mail: Mara.Tignino@unige.ch

O. McIntyre
University College Cork, College Road, Cork, T12 K8AF, UK
e-mail: o.mcintyre@ucc.ie

H. Hussein
Department of Politics and International Relations (DPIR), University of Oxford, Manor Road, Oxford, OX1 3UQ, UK
e-mail: hh.hussam.hussein@gmail.com

M. Motlagh
Bonn Alliance for Sustainability Research/Innovation Campus, Bonn, Germany
e-mail: mahsa.motlagh@gmail.com

A. T. Wolf
College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331, USA
e-mail: wolfa@geo.oregonstate.edu

L. de Silva
Program in Water Conflict Management and Transformation, Oregon State University, Corvallis, OR 97331, USA
e-mail: desilval@geo.oregonstate.edu

N. Carmi · F. Münger
Geneva Water Hub, Organisation Météorologique Mondiale (OMM), Geneva, Switzerland
e-mail: ncarmi@genevawaterhub.org

F. Münger
e-mail: fmuenger@genevawaterhub.org

D. Türk
Former President of the Republic of Slovenia, Ljubljana, Slovenia
e-mail: danilo.turk@up-rs.si

Geneva Water Hub, Organisation Météorologique Mondiale (OMM), Geneva, Switzerland

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non-exhaustive selection of such discourses. It sheds the light on a number of expressions, buzz words and polemics that have been overused—sometimes—with a relative indifference of their subtleties.

Keywords

Water discourses • Political will • Capacity building • Knowledge development • Water governance • Risks • Dialogues • Policies • Uncertainties • Water resources sustainability • Sustainable water resources management • Integrated water resources management • Water security • Hydro-economic modeling • Sustainability indices • Climate change • Water security • Adaptation strategies • Water pricing • Market discourse • Costs • Revenue • Value of water • Complexity • Trade-off • Political dilemma • Usages of water • Policy objectives • Policy instruments • Price • Taxes • Market principles • Affordability • Stakeholders • Valuing water • Environmental refugees • Migrants • Push factors • Pull factors • International water law • Transboundary aquifers • Fragmentation • Sovereignty • Distributive equity • Malthusian rationale • Neo malthusian • Water wars • Water conflicts • Water cooperation • Hydropolitics • Conflict transformation • Faith-based traditions • Spiritual practices • Transformative practices • Water conflict management • Water cooperation • Water diplomacy • Water-related disaster • Flood • Sediment disaster • Vulnerability • Self-help • Mutual-support • Public-support

Abbreviations

ASCE	American Society of Civil Engineers
BATNA	Best Alternative to a Negotiated Agreement
CEO	Chief Executive Officer
COP21	Conference of the Parties 21st session
Covid-19	Coronavirus Infectious Disease 2019
DRR	Disaster Risk Reduction
EIA	Environmental Impact Assessment
ETHZ	Swiss Federal Institute of Technology Zurich
GCM	Globe Circulation Models
GDP	Growth Development Product
GHLP-WP	Global High Level Panel on Water and Peace
GOWP	Global Observatory on Water and Peace
GWH	Geneva Water Hub
HydroSOS	Global Hydrological Status and Outlook System
IDPs	Internally displaced persons
ICJ	International Court of Justice
IHL	International Humanitarian Law
ILC	International Law Commission
INDCs	Intended Nationally Determined Contributions
IOM	International Organisation for Migration
IWRM	Integrated Water Resources Management
MENA	Middle East and North Africa region
MLIT	Ministry of Land, Infrastructure, Transport and Tourism of Japan
MOOC	Massive Open Online Course
NATO	North Atlantic Treaty Organization
NCA	National Climate Assessment
NGO	Non-Governmental Organisation
ODA	Overseas development assistance
OECD	Organization for Economic Cooperation and Development
SDC	Swiss Agency for Development and Cooperation
SDGs	Sustainable Development Goals
UN	United Nations
UNECE Water Convention	Convention on the Protection and Use of Transboundary Watercourses and International Lakes
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNIGE	University of Geneva
UN IPCC	United Nations International Panel for Climate Change
UNSC	United Nations Security Council
UN-Water	United Nations Water
UNWC/UN Water Convention	United Nations Convention on the Non-Navigational Uses of Transboundary Watercourses
UPWCD	Universities Partnership for Water Cooperation and Diplomacy
USAID	United States Agency for International Development
USCCSP	US Climate Change Sciences Program
U.S. ICA	U.S. Intelligence Community Assessment (ICA)
WASH	Water sanitation and hygiene
WMO	World Water Data Initiative
WWC	World Water Council

7.1 Introduction—Political Will = (Trust + X^2) * Perseverance

The most common excuse we hear for not achieving good water governance, efficient transboundary cooperation, sustainable development or any other cherished objective in this field, is the lack of political will. Decision makers, analysts, scientist, activists, are all fond of saying that we have all the technology we need to address the water crisis—all we lack is political will. Everything is in place except that one "little" element. What is political will? How do you build it? And how can we influence it in the right direction?

A decade ago Hammergren characterized political will as "the slipperiest concept in the policy lexicon," calling it "the sine qua non of policy success which is never defined except by its absence." (Hammergren 1998).

In the literature 4 main elements of political will have surfaced.

1. A sufficient set of decision makers
2. With a common understanding of a particular problem on the formal agenda
3. Is committed to supporting
4. A commonly perceived, potentially effective policy solution (Post et al. 2010).

To kick off this process, one obviously needs to establish trust among concerned players (i.e. decision makers at any level, whoever they are and whatever the issue at stake is). Trust is necessary to mobilize the right set of players who would then be willing to work together. Without it, decision makers would not even come around the same table, let alone make decisions together.

One also clearly needs to ensure perseverance and long term commitment. Water governance processes are long and difficult. They are complex, they impact a humongous set of stakeholders, they have to survive, and be revived, throughout governmental changes and upheavals.

This covers the first and third conditions stipulated above and it already sounds like the hardest things to achieve; and yet, this is not even close to be enough for the accomplishment of the political will, which is in turn necessary to achieve good water governance.

The second and fourth conditions are still missing along with an essential ingredient: the binder of all 4 elements. This binder is "knowledge and capacity". It is the X in the subtitle formula and *it has to be squared* to indicate its primordial importance. Without it the process ultimately and inevitably falls apart. It is indeed not enough to have a sufficient set of decision makers who trust each other. They have to get "interested" in the issues at hand. They have to "understand it" (condition No. 2). And only if, and when, they do, can they develop effective and mutually accepted solutions (condition No. 4), which they then have to explain clearly and convincingly to their constituency and obtain its approval.

Only knowledge and well developed capacities can foster these two conditions. The epistemic "water community" is the one who makes such knowledge and capacity available to policy and decision makers. With all its efforts the community facilitates their understanding of issues at stake, gets them interested in those, and finally informs the development of their solutions. With this support from the epistemic community all 4 elements constituting political will become available and can be firmly bound together in the hope to achieve effective water governance.

The equation used as a subtitle of this section is of course a suggestive, rather than a rigorous mathematical one. It could initiate alone a full-fledged contradictory discourse as to whether it represents or not the structure of political will in an accurate manner. However, this debatable nature reflects the actual slippery characteristics of political will who is supported and informed by the prevailing water discourses.

The term "water discourses" stands for different intellectual frames within which water, its manifold attributes, utility as well as associated stresses and threats are viewed, narrated, discussed and evaluated. Their ultimate goal is to formulate principles and recommend solutions to policy and decision-makers.

Water discourses reflect values, concerns, and compassion. They are logical constructs, but not always necessarily technically or scientifically robust. At the same time, they reflect the plurality and multiplicity of opinions on a given topic. Their proliferation indicates their inherent and sometimes limited focus while it mirrors and feeds the character seldom objective or rationale of human decisions. Thus instead of one "Water Discourse" we have quite a number of them, partially conflicting but frequently also supplementary to each other.

The water epistemic community indeed discusses water matters and directly or indirectly advises policy and decision makers in ways that reflect its beliefs on one hand, and its agreements and disagreements, on the other hand. It discusses water in ways that reflect the variety of scientific and indigenous backgrounds of its members, the richness of their different expertise, their cultural and social beliefs, practices and aspirations, as well as their ethical, spiritual and religious values.

These discourses tackle countless numbers of questions that interest policy and decision makers. It informs them and hence impact the governance of water resources and related institutions. These discourses weigh the pros and cons of affirmations which can spark political and media

antagonisms at national and international scales. They discuss added values and shortcomings of their own respective perception and observations. They debate and question practice on the ground.

Their exchanges and the product of their continuous debates enrich the scientific basis upon which political will may be mobilized. Sometimes, their discourses are literally taken over and continued in political arenas where they morph into yet another dimension of argumentation and polemics. They end-up, being reflected in the reality on the ground. Once a discourse's outcomes advance to constitute the underlying paradigms and foundations of legally enshrined or customary governance practices, they impact our lives and daily routines of interactions with water.

These discourses are thus key elements in the constitution of a "common understanding of a particular problem" (second condition above) and the "rapprochement" towards a "commonly perceived, potentially effective policy solution" (fourth condition). They also contribute in building the knowledge and capacities of decision and policy makers and directing them in their actions.

They cover issues as complex as the value of water and the nuances between water security, sustainability and integrated water resources management. They deliberate over statements as sensitive as claims insisting that wars will be fought over water. They examine the impacts of phenomena such as climate change over water and how humans should adapt to it; and the list is as long and vast, as the number of complex issues intertwined with the governance of water.

Is water an instrument of peace, or rather the source of (inevitable) conflict? Are water infrastructures good or bad? What are the limits of international law in the management of transboundary water resources? How should one refer to and assist, a person who has been displaced because of water related hazards?

This chapter shares with the reader a non-exhaustive selection of such discourses. It sheds the light on a number of expressions, buzz words and polemics that have been overused—sometimes—with a relative indifference of their subtleties.

Section 7.2 starts with a discussion of the long evolution of a well-known discourse, from sustainable water resources management, to integrated water resources management and, more recently, water security. Section 7.3 addresses the question of adapting to climate change impacts and how the water community and the climate change community might communicate to the benefit of informing and harnessing political will. Section 7.4 follows with an illustration through the case of Japan. It shows how increasingly vulnerable but well informed societies can use intensified hazards as a chance to adapt and achieve drastic social change. Section 7.5 explains how achieving a sustainable balance between costs, revenues and value appreciation can be challenging for policy and decision makers. Section 7.6 tackles a legal discourse that has occupied the minds of people, politicians and decision makers a lot in the past decade: the question of environmental migration, their rights, the legal protection they can aspire to. It is followed by another Sect. 7.7 on a legal discourse spelling-out issues related to the fragmentation of international water law, discrepancies between various legal texts and how they might serve or harm political will and decision making in transboundary contexts. The chapter goes on with another famous (or infamous) debate—in Sect. 7.8—around the idea of water wars and how they might influence the minds of key actors and then in turn the reality on the ground. Section 7.9 discusses approaches of conflict management in situations of risks and uncertainties. Section 7.10 brings spiritual and faith-based traditions to the table as solutions applicable to water diplomacy at various levels and scales. These tools bring ethical and moral water-considerations into the otherwise tough political processes. The chapter finishes on a high with Sect. 7.11, arguing how water can be used as an instrument for peace, informing, debating and ultimately mobilising political will behind a set of arguments and solutions.

7.2 The Sustainability Discourse

7.2.1 Introduction: Sustainable Water Resources Management, IWRM and Water Security

7.2.1.1 Sustainable Water Resources Management

Sustainable development was introduced broadly by the Bruntland Commission (WCED 1987) as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*." This declaration recognized the priority of the essential needs of the poor and the limitations imposed by technology and social organization on the environment's ability to meet present and future needs. However, the description is very optimistic, but vague with details left for later and lacking specificity for implementation (Bartlett 2006: 22; Benton 1994: 129). This was a somewhat narrow path from which to begin the discourse on sustainable water management. From there, the discourse has proceeded to various definitions of sustainable development of water resources, integrated water resources management, and more recently water security. All of these have more or less been based on what has become known as the "triple bottom line" of balancing economic, social and environmental development to achieve sustainable pathways.

Recognizing that there is no clear, commonly accepted definition of sustainability, we can consider the debate over

how it might best be done. The sustainable development of water resources was defined by a joint UNESCO/ASCE committee as "*Sustainable water resource systems are those designed and managed to contribute fully to the objectives of society, now and in the future, while maintaining their ecological, environmental and hydrological integrity*" (Loucks and Gladwell 1999). This was a recognition of the failure of previous "meet the requirements" approach to water resources management and allocation, where water use strategies accommodated projected population growth and economic development with minimal consideration of ecological carrying capacity or water resource availability (Loucks and Gladwell 1999). The sustainability approach also recognized the notions of no long-term decrease of future generation welfare as a result of water resource systems and consideration of risk, resiliency and vulnerability (Loucks 1997). Although the original concept of sustainable water resources management is still valid, water management policies that promote sustainable water resources systems are difficult to identify because of growing environmental, water scarcity and climate change considerations.

7.2.1.2 Integrated Water Resource Management

Integrated Water Resource Management (IWRM) became an over-riding paradigm for discussing, legitimizing, and implementing policies of water resources management, subsuming the notion of sustainability (Orlove and Caton 2010). IWRM has been defined as "*a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*" (Global Water Partnership 2000). IWRM is an empirical concept built upon on-the-ground experience of practitioners (UNESCO 2009). IWRM sets out to reconcile competing uses for water, with legitimacy attained through public participation, and with coordination and technical competence assured through specialized basin entities or agencies where they exist (IWRM 2015). New issues of water management continue to emerge, particularly climate change mitigation and adaptation, ecosystem degradation and the water-energy-food security nexus (Hissen et al. 2017). The Agenda 2030 Sustainable Development Goals (17 SDGs with 169 associated targets) have embraced water resources through SDG-6 (Ensure availability and sustainable management of water and sanitation for all), and Target 6.5, in particular, indicates that IWRM must be implemented at all levels by 2030 (United Nations General Assembly 2015). IWRM is generally envisioned to have 4 main components: (1) an enabling environment of policies, laws, plans and strategies; (2) political, social, economic and administrative institutions; (3) management instruments, or tools and activities that enable decision makers and users to make rational and informed choices; and (4) financing for water resources development and management (United Nations Statistics Division 2018).

7.2.1.3 Water Security

Over the past decade or so, the global discourse on sustainable water resources management has been used to shape the IWRM concept (Kramer and Pahl-Wostl 2014). However, water security has recently supplanted the concepts of sustainable water management and IWRM in the policy discourse (Staddon and James 2014; Gupta et al. 2016). Much of this has been prompted by predictions of a global water crisis and its effect on different facets of livelihoods and economies (Fischhendler and Katz 2013). Water security has been defined as "*the 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 and Sadoff (2007). Sadoff and Grey's definition of Water Security and others (Grey et al. 2013; Hall and Borgomeo 2013) highlight the importance of risk management in the consideration of water security. More recently, the United Nations has expanded Grey and Sadoff's definition to explicitly capture interactions with wider social, economic, political, and environmental systems as "*the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability*" (UN-Water 2013b). The World Bank has viewed water security as "*a state in which water is effectively and sustainably managed, both to leverage its productive potential and to mitigate its destructive potential*" (World Bank 2017). Water security seeks to balance human and environmental water needs while safe-guarding essential ecosystem services and biodiversity (Bakker 2012). It incorporates and extends key aspects of IWRM and includes a return to the conceptual focus on risk, resilience and vulnerability, bringing the importance of risk management into the discourse.

7.2.2 Sustainability–How Do We Implement It?

Many guidelines for implementing sustainable water resources management have been published (United Nations Conference on Environment and Development 1992; Serageldin 1995; Loucks and Gladwell 1999; Loucks 2000). No

doubt these guidelines have provided some assistance and guidance to those who are involved in planning and decision making in specific regions. However, they are very broad and must be translated into operational concepts that can be applied to the planning and management of water resources systems in specific basins. The connection between the technical water planning problems (hydrology and environmental aspects) and the socioeconomic conditions of society must be considered. To achieve sustainability, a region's environmental management and socioeconomic development goals must be considered in terms of sustainability criteria or goals. Who will define these goals? Who will be responsible for ensuring that reasonable strategies are developed to achieve these goals? Who will be responsible for monitoring the long-term success or failure of these attempts?

One method that has been used to assist in the analysis and design of sustainable water resource systems is *hydro-economic modeling*. Short-term and long-term objectives based on sustainability criteria, e.g., in terms of risk minimization in water supply, environmental conservation, equity in water allocation, and economic efficiency in water infrastructure development, can be incorporated into hydro-economic modeling frameworks so that system performance can be evaluated and controlled in light of system sustainability (Cai 1999; Harou et al. 2009).

7.2.2.1 Hydro-Economic Modeling

Management of water resources requires an interdisciplinary approach, integrating natural and social sciences (McKinney et al. 1999). Important economic concepts that need to be considered in the sustainable management of water resources include transaction costs, agricultural productivity effects of allocation mechanisms, inter-sectoral water allocations, environmental impacts of allocations, and property rights in water for different allocation mechanisms. Hydro-economic models are best equipped to assess water management and policy issues in a river basin setting (Cai et al. 2002). It is at the basin level that hydrologic and economic relationships can be integrated into a comprehensive modeling framework and, as a result, policy instruments, which are designed to make more sustainable use of water resources, are likely to be developed and applied at this level.

7.2.3 Sustainability–How Do We Measure Achievement?

A water resources sustainability index that makes it possible to evaluate and compare alternative management policies for water resources systems. The sustainability index (SI) summarizes the performance of alternative policies from the perspective of water users and the environment; it is also a measure of a system's adaptive capacity to reduce its vulnerability. SI is an integration of performance criteria that capture the essential and desired sustainable characteristics of the basin. The index facilitates comparison of policies when there are trade-offs among performance criteria. The extent to which water management policies are sustainable can be determined using the SI. Sustainability can be measured by individual, group of individuals, geographic region, or sector (Sandoval-Solis et al. 2011).

7.3 Water Resources Investments and Adaptation to Climate Change

Since the dawn of human civilizations, societies made water investments to deal with the exigencies of nature. Today, most reasons world leaders and the climate change community, cite as to why we should be concerned with climate changes, deal with impacts of water events such as sea level rise, floods, drought, tsunamis and more.

What messages on adapting to climate change impacts might the water community bring to the climate change community? This section offers eight reflections to try and respond to this question.

7.3.1 Relationship Between Climate Change and Water Resources Management

There is a close relationship between climate and water resources management because the changes in temperature, precipitation and snowmelt observed now and projected for the future can cause changes in seasonal and spatial distribution of water, causing floods and droughts (USACE 2011).

Nevertheless, the data on climate changes and water, precipitation and stream flow are still vague. For example, the charts in Figs. 7.1, 7.2 and 7.3 show that:

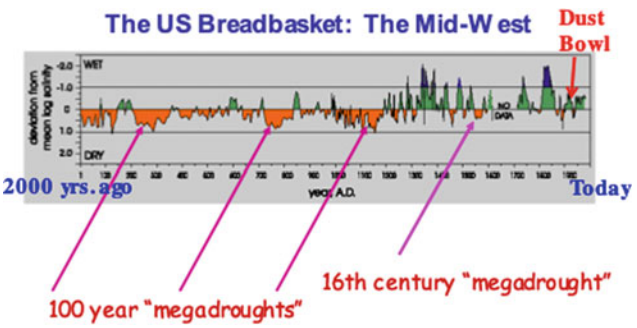

Fig. 7.1 2000-year climate history of central US. *Source* HRS Centre for Hydrometeorology and remote sensing, Overpeck, University of California, Irvine, 2004

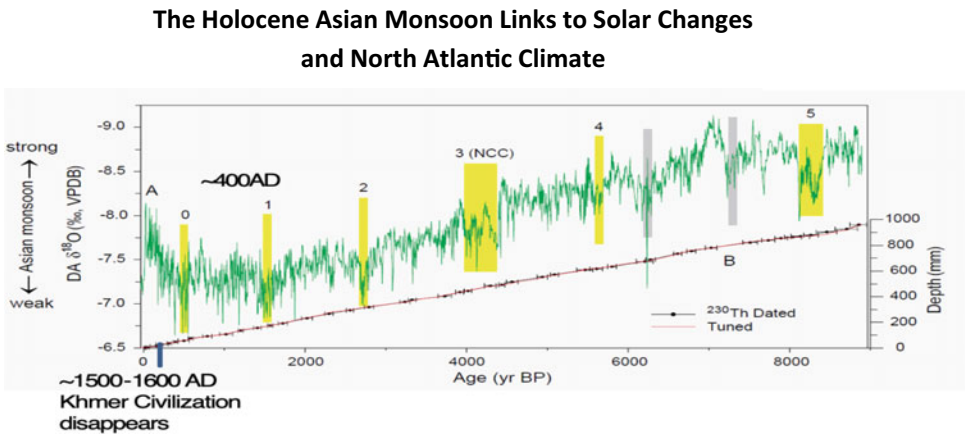

Fig. 7.2 The Holocene Asian Monsoon links to solar changes and North Atlantic climate. *Source* Wang et al. (2006) also presented by E. Stakhiv, USACE IWR, Johns Hopkins SAIS, Lecture, in "International Water Issues", December 14, 2016

- In North America droughts have pronounced multi-year to multi-decadal variability, but there is no convincing evidence for long-term trends toward more or fewer events.
- The Holocene Asian Monsoon is linked historically to solar changes and the North Atlantic climate over thousands of years.
- The decadal variability in Mekong rainfall pattern exists over thousands of years.

Climate variability and the key water related events stemming from such changes have always been with us. However, regional trends in extreme events are not always captured by current Globe Circulation Models (GCM) and it is difficult to assess the significance of these discrepancies and distinguish between model deficiencies and natural variability.

This leads some hydrologists to conclude that factoring in resiliency in water resources systems design and planning is still the safest approach.[1]

Historical exploration of climate variability clearly shows how closely linked the professional water community needs to be to the climate change community.

7.3.2 Water Security is Crucial to Achieving Adaptation to Climate Change

Water security is crucial to achieving significant human adaption to impacts of climate changes and offers important new "soft power' to decision makers.

Water security is increasingly prevalent in the world debates. The World Water Council (WWC) has used Water Security to frame its agenda which is contained in, "A Pact for Water Security" published in 2013 (WWC 2013). The U. S. Intelligence Community Assessment (ICA 2012) noted:

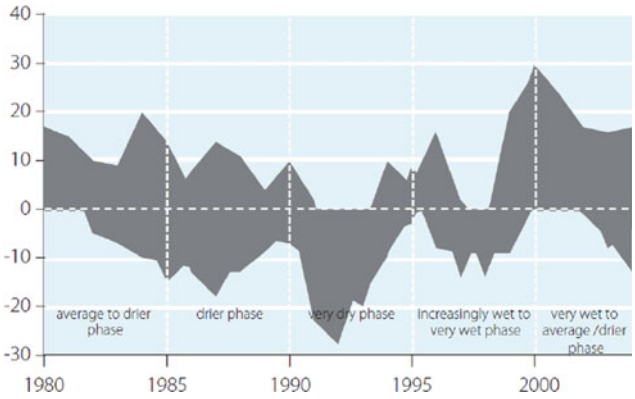

Fig. 7.3 Decadal variability in Mekong rainfall (percentage of the range in annual rainfall values compared to the long-term term historical mean). *Source* Mekong River Commission 2010, also presented by E. Stakhiv, USACE IWR, Johns Hopkins SAIS, Lecture, in "International Water Issues", December 14, 2016

> During the next 10 years, many countries […] will experience water problems—shortages, poor water quality, or floods—that will risk instability and state failure, increase regional tensions […] Between now and 2040, fresh water availability will not keep up with demand absent more effective management of water resources. Water problems will hinder the ability of key countries to produce food and generate energy, posing a risk to global food markets and hobbling economic growth.

Our English dictionaries defines security as, "freedom from danger, from fear or anxiety, from want or deprivation." (Webster's 1985). This definition closely parallels the history of humanity's management of water, of becoming engineers to assure we have good water, in the right quantity at the proper time and place, to predict floods, impound water for droughts, use water to help us generate wealth and avoid deprivation. Indeed, thousands of years ago Yu the Great became the first unifier of China in large degree due to his flood control measures (Fig. 7.4).

To the degree that humans enhanced their personal sense of security and reduced internal fears from the fatalisms of

[1]Lecture by Sorooshian (2010).

Fig. 7.4 Yu the Great. *Source* https://www.travelchinaguide.com/intro/history/prehistoric/great_yu.htm

droughts and floods, they became more sedentary and less migratory, they began to create, they invented languages, they freed up time to invest, and they started to mold their homes. Security defined as freedom from fear, anxiety, want and deprivation was enhanced.

All rich civilizations have invested social capital in actions to help achieve the sense of managing such uncertainties as a precursor to growth and prosperity. When such efforts deteriorated so too did societies. The same is true today.

This puts projections of variabilities and ways to deal with them in the historical purview of water resources management. Thus water actions, behavioral management and hard infrastructure, are really prime societal means to adapt to, and manage, the uncertainties of change, and are the keys to social resiliency; and thus keys to achieving what we might call the small "s" of security and show in Fig. 7.5. To the degree they achieve stability they contribute to the larger sense of security through reduced sense of vulnerability and contribute to the large "S" of social system stability and security.

Unless societies do something to attenuate the impact of flood and drought they have little chance to develop. Indeed, we see people in such societies become fatalistic. They accept and actually come to expect the fate of being wiped out and starting again every several years. Fear and security, the small "s," is pervasive and carried in memory generationally.

In Southern Africa, 61% of the area, 77% of the people and 93%[2] of the water are in shared basins; meaning that international river basins form an important element of the Southern African Regional Security Complex.

In Fig. 7.6 Turton and Warner map how countries in Southern Africa are both adaptively and water secure. We see many countries that are water secure but adaptively not secure thus pointing again to the role of water infrastructure investment in reaching social stability.[3]

Further Fig. 7.7 shows a relationship between water infrastructure investment and democracies in Africa. Both reveal a political economy of water investments as platforms for growth and achieving the small "s" security.

Water security is achieved through balancing the productive use with managing vulnerabilities to its destructive power; to balancing access to it with living with acceptable levels of risks from unpredicted event (Grey and Sadoff 2007).

The Asian Development Bank notes the close correlation between achieving national water security and governance (Fig. 7.8).

USAID studies have begun to show (Fig. 7.9) that most states that are highly fragile or at high risk for instability are also vulnerable to climate related threats. However, the converse is not true. Once again this shows the importance of the linkages of adaptation investments to stability.

War and large scale violence are what we might call the big "S". They are the traditional concerns of the security community. Investments in the small "s" of water security become critical to enhancing the big "S" or avoiding large scale social violence and instability and governance.

The security communities worldwide could well look at strategically important areas of the world and ask how they might use the soft power of water investment and ask: "How might investments in water actions achieve the small "s" and thus help achieve big "S"—security."

7.3.3 Fears of Climate Change Impacts Prevents Anticipation and Adaptation

We are raising fears and anxieties over impacts of projected changes in climate while inadvertently denying means to cope with these impacts.

The major reasons repeatedly used in talking points of international officials, for why we should deal with climate change are potential water related events and their projected social impacts. They primarily are social impacts of: frequency and intensity of droughts and floods; sea level rise; water access and scarcity; water quality and health problems; increased frequency of torrential rain; intensification of typhoons/hurricanes, and; others. Fortunately, the world is placing increased focus to adaptation. Too dominant a focus on mitigation with little on adaptation can mean we could

[2]Turton A. R., personal communication, September 2010.

[3]Personal communication with Antony Turton, September 2010.

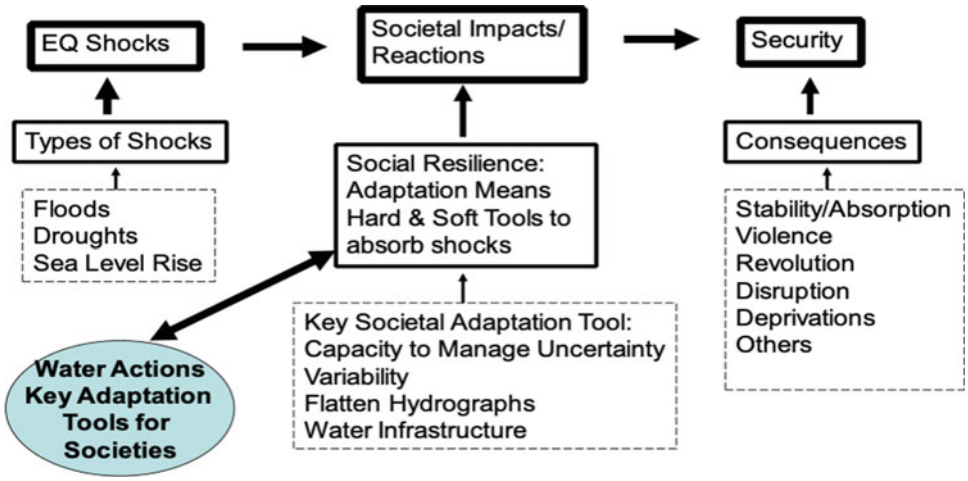

Fig. 7.5 Environment/water actions are adaptation tools and keys to societal security/stability. *Source* Delli Priscoli (2009)

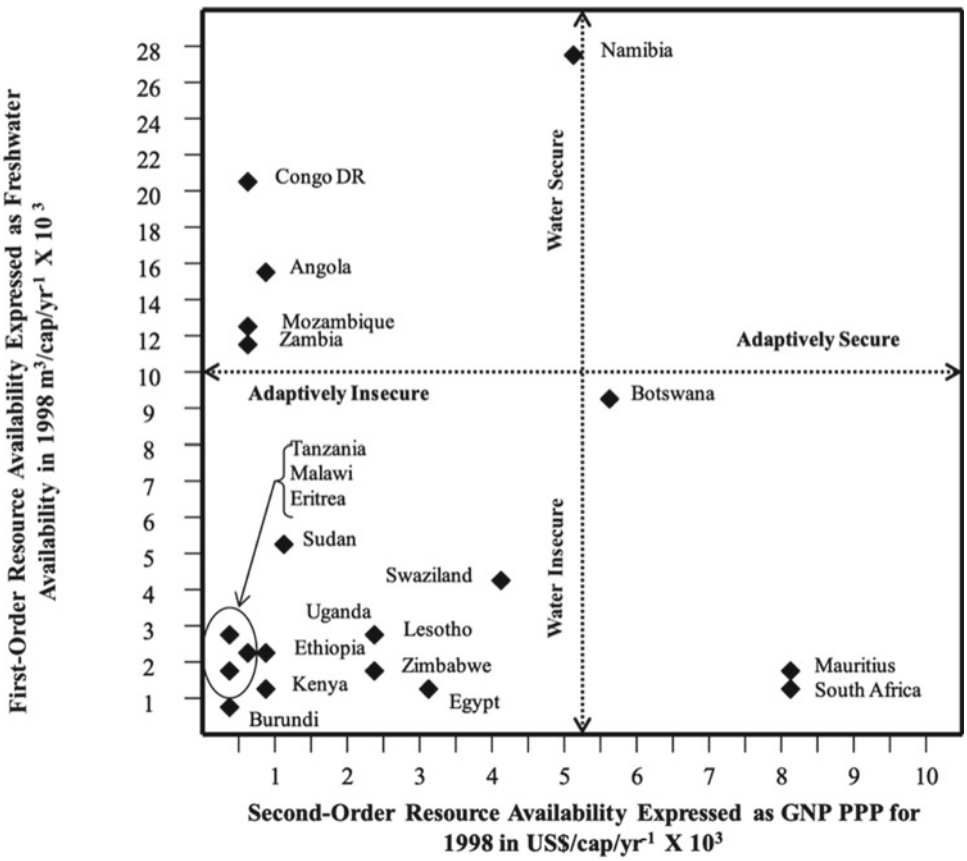

Fig. 7.6 Adaptive security matrix. *Source* Turton and Warner (2002)

inadvertently deny people adaptive means to cope with these projected high impact events. This raises important ethical and public policy issues.

Information from GCMs do not offer adequate reliability in precipitation and run off. And such is necessary to gauge potential social impacts. Regional trends in extreme events are not always captured by current models and it is difficult to distinguish between climate model deficiencies and natural variability (USCCSP 2008). Never the less, the climate models leave water managers to contend with 23 GCMs generating numerous scenarios (Delli Priscoli and Stakhiv 2015). This is juxtaposed to over 100 years of peer reviewed analytical approaches to risk and uncertainty of extreme events in the hydrological community.

If the academic and political communities are going to offer reasonable social impact assessments of projected climate changes, we must encourage more cooperation between climate modelers and hydrologic modelers. We need better

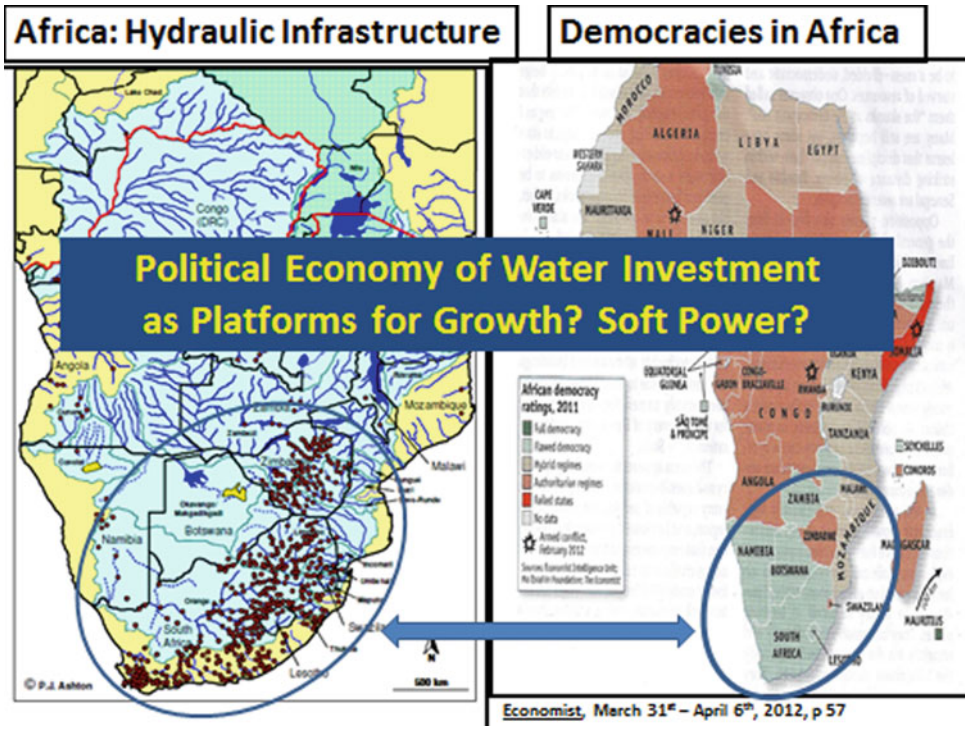

Fig. 7.7 Hydraulic infrastructures and democracies in Africa. *Source* The Economist, March 31–April 6, 2012, page 57

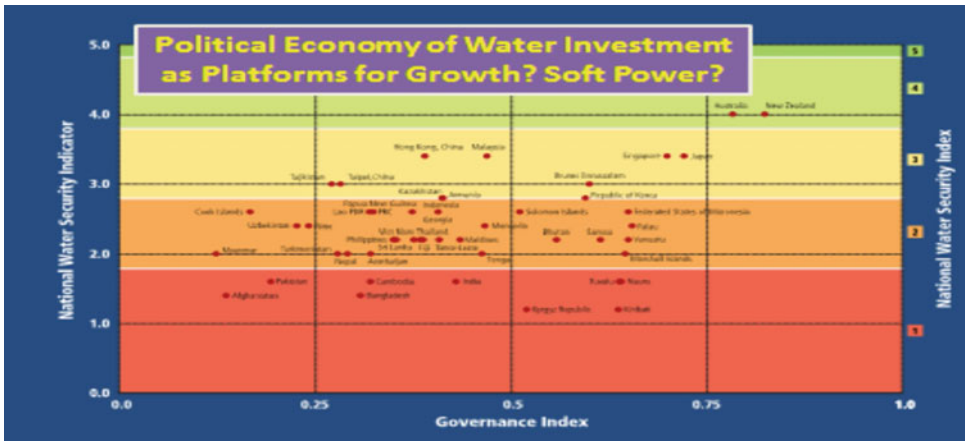

Fig. 7.8 National water security and governance. *Source* Asian Development Bank (2013)

understanding of adapting to what? To do this we also need to close the gap between how engineers versus scientist use technical information especially on characterizing risks.

Closing this gap is necessary if we are to relate to the general public. It is the first step in learning about potential social impacts of changing climate. It is necessary if we are to formulate macro-economic benefits/costs of water infrastructure investment so as to provide baseline for public debates on national trade–offs. It is essential to our financing institutions capacity to do socio-economic vulnerability assessments for water infrastructure investments? It is essential to insurance industries capacities to produce realistic actuarial rates.

7.3.4 Managing Variability and Risk Reduces Poverty and Creates Wealth

Managing variability and risk, in water resources especially, is necessary to reduce poverty; break the fatalistic determinisms pervading intergenerational memories, and; to create wealth by building platforms for growth.

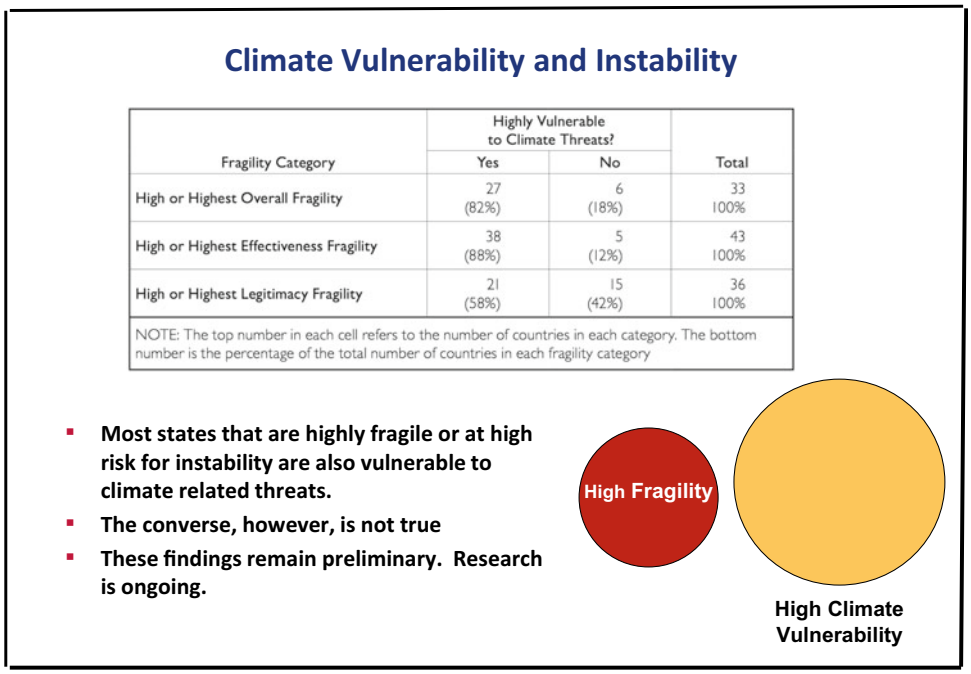

Fig. 7.9 Climate vulnerability and instability. *Source* Moran et al. (2018) used in J. Delli Priscoli's lecture "Defining Water Security and Transforming Water Conflicts," Harvard Kennedy School of Government

To understand social impacts, we must understand that the change in climate is not from some stable sense of nature or climate we experience today to dire unknown future perturbations. Nature is always changing; climate is always changing; social systems are always changing. To assess social impacts of climate change we need to relate that projected climate events and changes to our human activities: in other words, how are two ever changing dynamic systems likely to relate.

When looking at thousands of years of human and climate interactions on the Nile, paleontologist and archeologists note that the only constant is change, thus questioning the validity of making climate change the prime dependent variable! But for social impacts it is the shorter decadal changes that are crucial. Failures to help humans react to such decadal changes can result in terrible social events; some have even noted cannibalism. Historically, the major macro social means to help humans to adapt in the shorter term have been water investments (Delli Priscoli and Hassan 1998).

In 2007 Grey and Sadoff referred to World Bank data describing Zimbabwe, Ethiopia, Kenya and Mozambique and the variance of their GDPs depending on rainfall. In fact, the variations in GDP due to the inability of dealing with variations in rainfall (the peaks and lows of the hydrograph, floods and droughts) might account for almost 25–30% of variations in GDP. The International Water Management Institute (IWMI), in 2009, notes that Ethiopia's limited ability to cope with droughts and floods are estimated to cost the economy one-third of its growth potential (Grey and Sadoff 2007). If such assessments are close to reality that could negate effectiveness of much development aid in its hitherto administered form.

It seems that water infrastructure investment brings damages as a percentage of GDP to roughly 5% levels in the rich world as opposed to around the 25–30% often estimated in the poorer world. Means to flatten the hydrograph must be taken to avoid accelerating the discrepancies between the poor and rich. Much of the prescriptions of the rich to the poor, behavioral and individual regulation are not what those same rich used to gain wealth.

Figure 7.10 shows a relationship between the Human Development Index and Damages as % of GDP. It also shows a movement of the transition countries toward the upper left.

Figures 7.11 and 7.12 paint similar pictures for post war Japan and modern China. They capture some of the interactions between the two dynamic systems; nature and humans. As the index—damages as percentage of GDP—lowers it also is an indicator of increased resiliency; resiliency to allow the social systems to continue functioning even under the stress of large scale hazard events.

We might then ponder: do rich countries have high resiliency because they are rich or did they become rich because they invested in resiliency measures?

7.3.5 Communication Around Risks Impacts Policies and Governance

How risk is communicated and managed will impact the health of our political cultures; and governance structures.

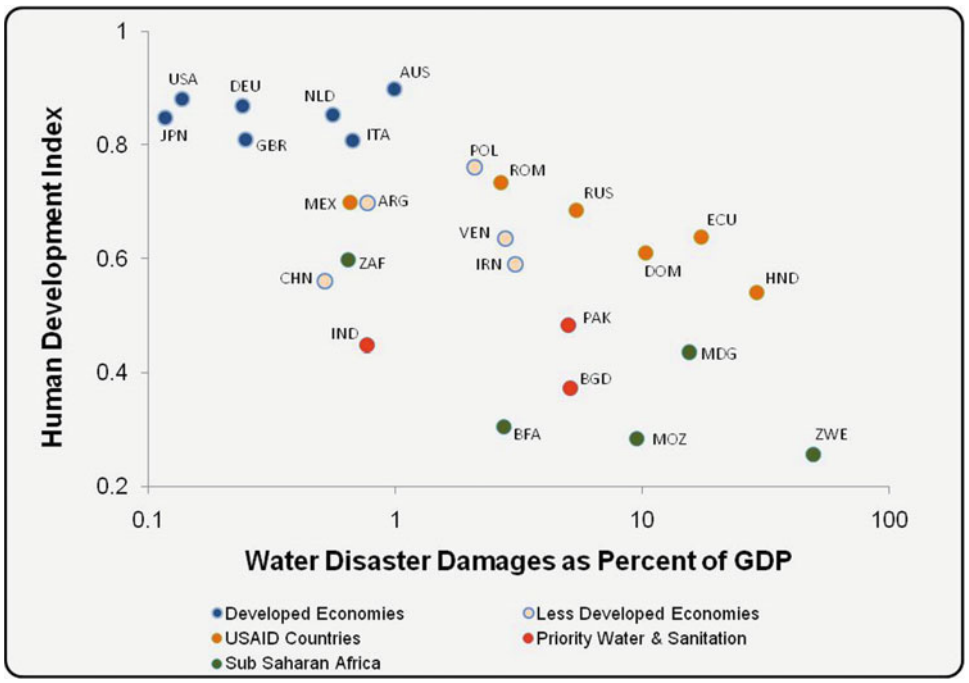

Fig. 7.10 Human development and water disaster damages as percent of GDP. *Source* Mendoza (2010)

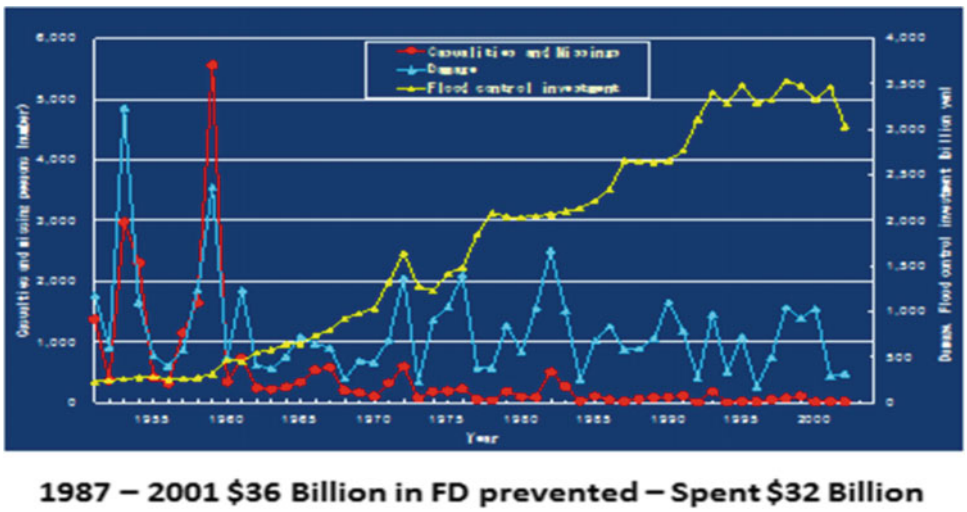

Fig. 7.11 Flood damage and flood control investment in Japan. *Source* MLIT (Ministry of Land, Infrastructure, Transport and Tourism, Japan) (1987)

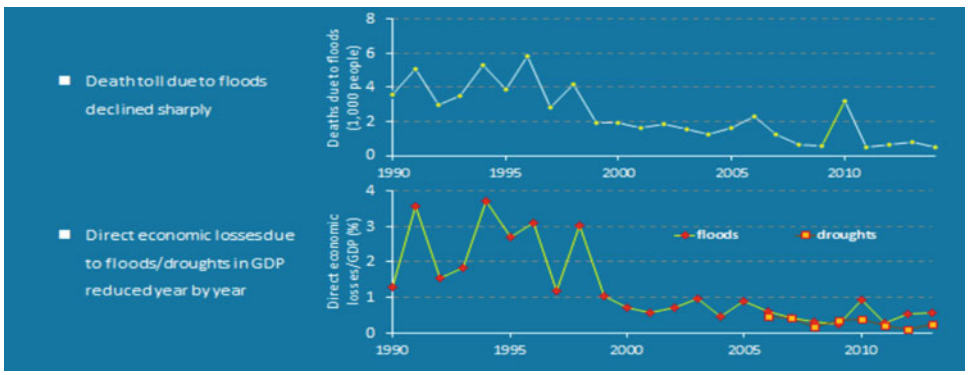

Fig. 7.12 Strengthening of flood control and disaster mitigation strategy. *Source* Water in China, Ministry of Water Resources China, Strengthening of Flood Control and Disaster Mitigation Capacity, in 2015 also presented to World Water Council BOG Nanjing, 2015

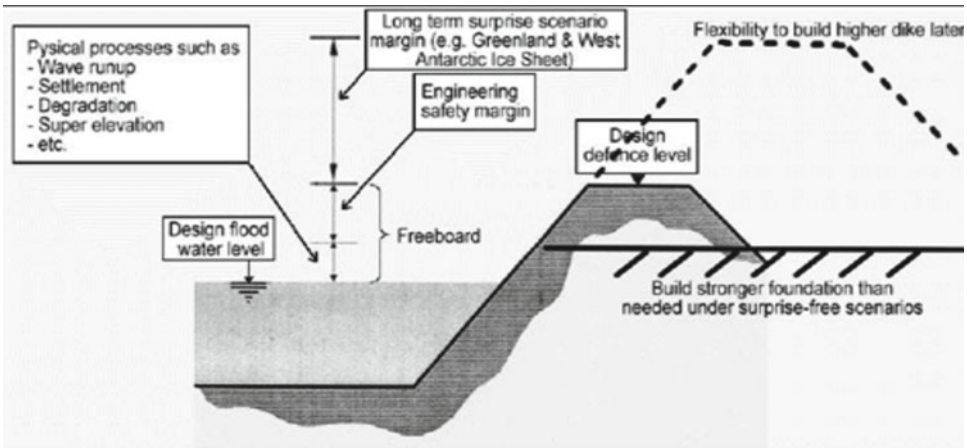

Fig. 7.13 Climate uncertainty leads to engineering uncertainty. *Source* Dessai and van der Sluijs (2007)

The water climate dialog makes us aware that somehow we need to collectively better describe risks and uncertainties with those publics we seek to serve—we may be adding confusion to confusion with different uses of data, definitions of uncertainty and risk; stemming from our separate communities. If we do not improve, we all risk having our publics react by rejecting what they perceive as dueling experts and dueling visions of science and engineering and ultimately depreciating the credibility of science; something none of us want.

The emerging paradigms of Disaster Risk Reduction (DRR) place the onus of understanding the complexities of risk reduction options on the public and local officials. In order for the new paradigm to succeed, we need to dramatically improve risk communication policies and procedures for DRR. Some argue that the 100-year flood should be termed the 1% or high risk flood, and the 500-year event becomes the 0.2% or extreme risk flood. Some believe, however, that the movement to a risk-based water resources planning and decision making framework and away from designing to pre-determined engineering design standards may result in more structures being built in flood hazard zones, increasing exposure and susceptibility to flooding. The water resources management options and the context of water and risk are dealt in more detail in Chaps. 18 and 22 respectively.

What happens if the populace decides to accept a 'tolerable degree' of risk that is greater than engineering design standards, based on their calculation of a risk-cost optimum?

In a democratic society, the key is to link risk with responsible behavior; to encourage the active choice and acknowledgement of flood risks, versus a passive reliance on institutional actions or solely on a professional paternalism —be that an ecological or engineering paternalism. However, the public must somehow be fully aware of both the risks and consequences.

Defining 'tolerable risk' and 'residual risk' no longer remains a scientific or technical exercise, as it quickly moves into the realm of political choices, with aspects of equity, social justice, joined with a myriad of other aspects of ethics and morality. More details of the ethical aspects of water resources management are available in Chap. 5. With climate change and adaptation, that becomes exceedingly more difficult because of increased uncertainties that complicate rational decision making and engineering adaptive measures (Fig. 7.13).

There is no 100% safety; there will be residual risk. Systems can perform as designed while events still overwhelm them—this is hard to communicate. Therefore, people must actively choose/accept levels of risk versus passive be told what to accept. Communities need to be involved in risk management of where they live.

7.3.6 Behavioral Regulations Are Insufficient as Adaptive Strategies

Behavioral regulations and individual life style changes are insufficient adaptive strategies for most of the world. Adaptive water resources strategies will require various forms of infrastructure and storage.

Recently, the CEO of a prominent environmental NGO publicly stated,

> If we do not do anything about climate change the people of Bangladesh will continue to be flooded … and … we can no longer engineer our way out of the crisis of climate change…[4]

Is such a statement accurate? What does it say to policy makers? What does this say about how we dialog between the water community and climate change community which is introducing more uncertainty? What is the best strategy for

[4]"The Great Mississippi River: Restoring Balance Symposium," Symposium VIII of the Religion, Science and the Environment Symposia, under the auspices of His All Holiness Ecumenical Patriarch Bartholomew, 18th–25th October 2009, New Orleans.

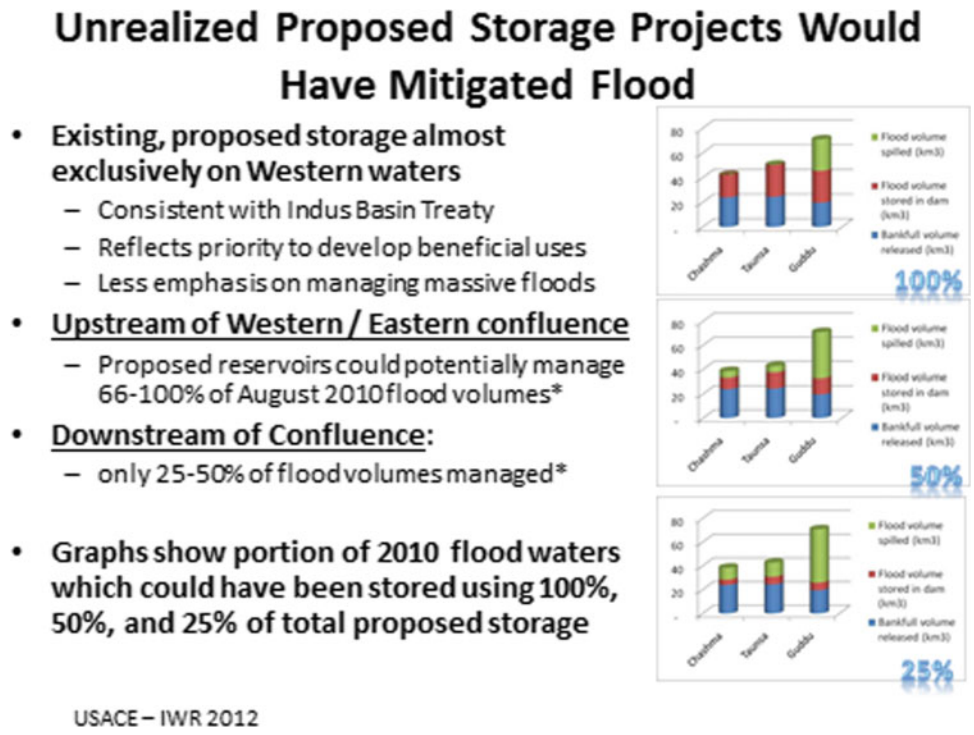

Fig. 7.14 Unrealized proposed storage projects. *Source* U.S. Army Corps of Engineers, Institute for Water Resources, Joint Post Pakistan Flood Study, Ft. Belvoir, va. 2012

dealing climate uncertainty and water resources: hard structures or soft behavioral changes?

The answers are not obvious. Some answer by saying the "soft path," or behavioral management is the best approach and even the most democratic. Early UN IPCC reports and many others spoke of water demand and institutional adaptation as primary components for increasing system flexibility to meet uncertainties of climate change. However, several mainstream professional water associations in the world were not so sure and emphasized changing operating rules and looking at hard infrastructure.

Primary reliance on demand management can be dangerous; especially where there is little water availability. Water demand management is dealt with in Sect. 18.6. What are the social/political impacts when our primary means to adapt is to order people to behave; this is unlikely to produce more democracy. In fact, one can argue that the investment in water infrastructure provides more social resiliency as it buys time and space for people to continue living and coping with and recouping from, water related disasters. And it is increasing social resiliency that is critical to prepare for social impacts of uncertain future events.

For example, in the late summer of 2011 the Mississippi River reached some of the highest recorded levels in US history. This was managed through the Mississippi River and Tributaries (MR&T) project which was constructed over the last 70 years (USACE, MVD 2012; Post 2011 Report).

The 2011 event was close to the size of the historic 1927 event. By contrast in the 2011 event over 4.0 million people were protected. The MR&T realized $478.3 billion in flood damages prevented which means that it had a large positive return on public investment. A similar story can be seen in the performance of the three Gorges Dam in the Yangtze floods of 2011.

Tragically the non-attention to water infrastructure investment resulted in significant losses in the Indus floods of that period. One fifth of the country was covered. Ten million people were left homeless and more than 21 million people were affected. The White House noted that every dimension of our Relationship—politics, economics and Security—shifted as a result of this historic disaster.[5] The Washington Post reported that "instead of forging unity, the Disaster seems to have deepened age-old fissures. The four provinces are engaged in cut throat battles for shares of flood aid money and people fleeing from the flood stream to the city Karachi (The Washington Post 2010).

Pakistani/U.S. post flood studies showed that proposed reservoirs could potentially have managed 66–100% of August 2010 flood volumes. Figure 7.14 shows portions of 2010 flood waters which could have been stored using 100, 50 and 25% of total proposed storage.

While some have seen the Indus flood as an indicator of climate change most hydrologists see it as a less then extreme 50-year event. What happened? Over the years socio-economic activities increased with little attention given to adaptive investments to help manage large events. If

[5]U.S. White House, coordinator for Afghanistan and Pakistan, August 23, 2010.

this situation is repeated worldwide; one may ask, what will happen if larger scale extreme events occur?

In October 2012, people up and down the Eastern Coast of the United States suffered enormously from Super storm Sandy induced storm surges that flooded major urban areas and severely damaged hundreds of kilometers of shoreline. One hundred seventeen people in the U.S. were killed and 650,000 homes were damaged or destroyed. Damage estimates for New Jersey—New York area alone exceeded $60 billion. Political arguments of who will pay and how much should be rebuilt continue.

Sandy alerted the U.S. to the growing challenges of climate variability and urban design. Figure 7.20 was developed by National Geographic and depicts how Manhattan would look with an additional 1.5 m or so of sea level rise, plus the 4-m-high storm surge from Sandy.

The third National Climate Assessment (NCA) for the U. S., May 2014, noted:The nation's economy, security, and culture all depend on the resiliency of urban infrastructure systems. How will New York City and other coastal cities prepare for this type of inundation (US Global Change Research Programme 2014)?

Post Sandy assessments revealed that along the Atlantic coast, there was significantly less damage and social disruption from hurricane Sandy, around those areas with existing hurricane shore protection projects. While this shows the importance of infrastructure investment it also brings to light the difficult questions of how to choose what to protect and how to fund protections and how to integrate structural and non-structural measures (Delli Priscolli and Stakhiv 2015). Figure 7.15 illustrates the new paradigm for flood risk management.

Storage, multi-purpose reservoirs and non-structural methods, must be at the center of societies' climate change adaptations to deal with the projected impacts of climate change. This is one of the most tangible and pressing points of water—climate change dialog; one that is at the heart of dealing with social impacts of changing climate.

So what is the best strategy for water when dealing with uncertainty of the types projected in climate change? The answer has huge implications for type and health of political cultures.

7.3.7 The Focus on Adaptation Can Improve Dialogs Between the Rich and Poor

The World Water Council (WWC) initiated dialogs on water climate change and adaptation revealed virtual opposite views of what the rich countries prioritize versus what the poor countries prioritize for water adaption measures (Fig. 7.16). The developed countries are more likely to think of environment and security in terms of global environmental changes and developing countries are more concerned with the human security implications of local and regional problems.

Using prescriptions for structuring water, based on the experiences of one socio-economic stage for another stage, is dangerous and likely to provoke resentments or even violence. Thus the rich—poor dialog over water is an important part of achieving security. The climate—water dialog offers enormous opportunity to restructure this rich—poor dialog in such directions.

Investment in water infrastructure (hard and soft) is a primary means both to achieving social ends of reducing poverty and to managing climate uncertainties for acceptable social stability, resiliency and security. This should be a powerful message to pursue in the water-climate change dialog as it moves to means for adaptation.

7.3.8 We Know Climate Change Impacts and How to Approach Them

Despite the uncertainties we have basic ideas of where most important social impacts will occur and on how to approach them.

Coastal areas will be most vulnerable on all scenarios due to sea level rises, ground subsidence and storm surges. At the same time, mega cities, mostly near the sea, continue to grow (US Global Change Research Programme 2014). This raises many questions: What should be done? What levels of protection should we seek? How will we pay? Can we realistically talk of relocating cities?

We are learning much of eco-system service of estuaries and wetlands such as dissipating storm surge impacts and

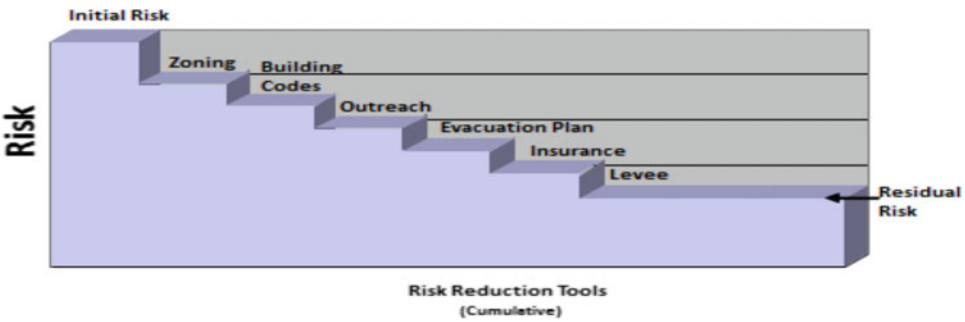

Fig. 7.15 Flood risk management: the new paradigm. *Source* U.S. Army Corps of Engineers, Head Quarters Civil Works, Briefing, Washington, D. C. 2012

Political Dialogue: Ministers DC's-LDC's-TC'S

	Best Practises	No regret	Climate proofing
Developed countries	+	+	+
Countries in Transition	+	+/-	-
ODA	+	-/+	-

Fig. 7.16 Political dialogue ministers DC's-LDC's-TC's. *Source* Joint IWA—World Water Council workshop, Delft IHE, August 2008

more. There is broad consensus, regardless of climate change projections, that we must increase efforts to re-nourish and restore their functions. To build flexibility we need also to think of beneficial uses of flood zones to reduce vulnerability and to increase resiliency of ecosystems; these increase resiliencies.

Regardless of the extent of changes, we need early better warning systems; the social component of this is critical. We need to increase the people centered flood warning as dissemination and communication critical.

Existing social inequities are likely to be accentuated under most change scenarios. Since absolute safety is not possible, we must find ways to minimize effects when and if project design values are exceeded. Communicating risk is difficult already but even more difficult regarding residual risk. More Community participation in disaster preparation needs to be undertaken in what we know are vulnerable areas and population.

7.3.9 Conclusion

UN-Water notes, "Adaptation to climate change is mainly about better water management."[6] Water investments must be key parts of any adaptation strategies or mechanisms negotiated around climate variability. A survey by French Water Partnership (Cran and Durand 2015) reports that 92% of Intended Nationally Determined Contributions (INDCs), part of the Paris COP21 agreements, submitted to the UN by 129 countries include water. The survey notes that water is the first priority noted for adaptation.

[6]https://sustainabledevelopment.un.org/content/documents/UNWclimatechange_EN.pdf.

The rhetoric "more floods and more droughts" is not sufficient: more then what? Where? It is misleading. Humans have a rich history of their interactions with climate: we need to better mine this collective experience and rely on our history in our policy proclamations.

Events in nature have always impacted and forced behavioral changes from humans. However, as humans' capacity to reflect and understand has grown so too has the capacity for humans to think ahead and act to mitigate or adapt to anticipate changes; to actively interact with their destinies. Humans discovered they did not just migrate as climates changed; they become sedentary and developed means to adapt to changes. Theses interactions have grown ever more complex; so much so that it is hard to separate the human from nature—they really are one.

The heart of this paradigm is that more than preserving or restoring we are actually jointly designing our ecology—our home—with nature.

7.4 Flood Management Policy Evolution Against Intensified Hazards and Vulnerability of Society—A Case in Japan

7.4.1 Heavy Rainfall Events and Risk Reduction Measures in Japan

In recent years, extreme water-related disasters have occurred one after the other in Japan: Izu-Oshima heavy rain disaster in 2013, Hiroshima sediment disaster in 2014, Kanto and Tohoku heavy rain disaster in 2015, Hokkaido and Tohoku heavy rain disaster in 2016, Northern Kyushu heavy rain disaster in 2017, and Western Japan heavy rain disaster in 2018. These disasters open up a long list of complex issues such as the number of victims, the diversity of damage types, and problems related to evacuation and flood control structures.

After the sediment disasters in Izu-Oshima and Hiroshima, the Sediment Disaster Prevention Act was amended in November 2014. It then mandated the prompt public announcement of the basic investigations' results on, sediment disaster risk as well as, the enhancement of warning and evacuation systems for better sediment disaster management. In January 2015, the national government proposed a new disaster-related policy, "The way of disaster prevention and mitigation corresponding to a new stage". It places the highest priority on the protection of human lives and the prevention of devastating social and economic damage. In May 2015, the Flood Risk Management Act was revised. The revision requires that underground malls implement measures for safe evacuation and inundation prevention. It also requires that measures for the protection

of lives be implemented, assuming floodwaters, landside waters, and storm surges of largest scales based on scientifically applicable methods. In July 2018, the government also published a calculation method as per the new requirements of the Flood Risk Management Act, to define the "largest expected hazards".

Despite these national efforts, problems still arose when the Kanto and Tohoku heavy rain disaster occurred two months later, in September 2015. Many people were very late to evacuate from floods caused by overflows and levee breaches. They were stranded in houses and other places surrounded by floodwaters. As a result, about 1,300 people were rescued by helicopter and nearly 3,000 by ground forces. Post-disaster investigations found that the evacuation order was not issued—in some areas—before the levee breaches. In response to lessons learned from this disaster, the Social Infrastructure Development Council submitted another report to the national government in December 2015 (Council for Social Infrastructure Development 2015). The report aims at rebuilding a risk-conscious well-prepared society against water-related disasters. It proposes the basic planning concept for the reduction of damage during large-scale flooding, including measures to, save people from being stranded, ensure wide-area evacuation, and prepare structures and facilities for better risk management.

The national government later decided to apply the report's proposals to rivers managed by prefectures in addition to those managed by the State. In August 2016 however, the Hokkaido-Tohoku heavy rain disaster occurred and caused severe damage to areas along prefecture-managed rivers. Residents of an elderly home were killed, and the local economy was devastated as a consequence of the disaster. In response, another report was submitted, addressing the basic concept for rebuilding a risk-conscious and well-prepared society against water-related disasters in small- and middle-sized rivers (Council for Social Infrastructure Development 2017). The report encourages more cooperation between the State and prefectures in order to totally avoid flood victims and aim at fewer socio-economic losses as a consequence of flooding of small- and middle-sized rivers.

Based on these two reports, the Flood Risk Management Act was amended in May 2016. The revision legalizes the creation of a council for damage reduction during large-scale flooding by State and prefectural rivers. It recommends that a council should be organized based on geographical considerations and administrative boundaries. The revised act also requires that managers of facilities whose users need help to evacuate in case of emergency, prepare an evacuation plan and conduct evacuation drills. In addition, the State government is now allowed to practice the authority originally belonging to prefectures, if necessary, in the case of post-disaster reconstruction projects and dam redevelopment projects. To accelerate the effect of the revisions, the MLIT also announced in June 2016, an urgent action plan for rebuilding a risk-conscious and well-prepared society against water-related disasters.

The Northern Kyushu heavy rain disaster occurred merely two weeks after this announcement by the MLIT. At that time, a band-shaped precipitation system formed over the Seburi Mountains on the border between Fukuoka and Saga Prefectures. As much as 169 mm hourly rainfall poured on Asakura City, Fukuoka Prefecture, slightly short of 187 mm—the highest hourly rainfall recorded during the Nagasaki heavy rain in 1982. The rainfall reached 778 mm after nine hours, which made it among the most extreme rainfall events since meteorological observation started in Japan. Asakura City, who experienced the 2012 Northern Kyushu heavy rain disaster, had prepared for heavy rainfall and associated hazards. It created disaster prevention maps to assist citizens in taking independent action in cases of emergencies designated evacuation sites in each community, and conducted evacuation drills. On the day of the disaster as well, the city issued evacuation preparation information, evacuation advisories, and evacuation orders at appropriate timings. Despite all these measures, the City found itself faced with the sad reality of 35 citizens either killed or missing.

Record heavy rainfall hit Hiroshima, Okayama and Ehime Prefectures of Western Japan in July 2018, leaving around 250 people either dead or missing. A single heavy rain event fatally made over 200 victims for the first time since 1982. Severe damage was also caused to economic and other activities. The Cabinet Office of Japan estimated that the infrastructural damage added up to between 0.9 to 1.7 trillion Yen (approximately 10 to 20 billion US Dollars), which is an order of magnitude larger than the amount caused by other recent flood disasters.

The disaster resulted from continued heavy rainfall during 24 to 72 h, over almost all parts of western Japan. The record intense convergence of water vapor indeed lasted for several days over the region due to the characteristic meandering pattern of the jet stream. Experts pointed out another factor that contributed to the extreme phenomenon: continuous supplies of water vapor into the atmosphere due to higher sea surface temperatures around Japan at that time.

Increased floodwaters induced by the heavy rainfall devastated many parts of western Japan in different forms of hazards such as inundation due to levee breaches and overflows, debris flows, mudflows, and urban inundation. Hiroshima, Okayama and Ehime Prefectures, where many observation stations recorded 24 to 72-h rainfall of over the 100-year return period, experienced particularly severe damage. In some places, the backwater phenomenon occurred at the confluence of the main and tributary streams; in other places, multiple factors were found to have contributed to unprecedented disasters, in which sediment

transported from hills and mountains deposited in rivers, reducing their cross-sectional area and eventually causing floodwaters to overflow. Moreover, with eight dams in the three Prefectures filled up to the flood control capacity, the dam operators were forced to start the operation prepared to cope with extreme floodwaters and prevent dam failure. This was another aspect of this heavy rain disaster deserving attention. This disaster was as if all types of recent disasters had occurred simultaneously all across western Japan.

After carefully analyzing the characteristics and issues related to the disaster and devising a basic policy for effective disaster management, the Social Infrastructure Development Council submitted a report to the MLIT on December 13 (River Council for Social Infrastructure Development 2018), suggesting a series of actions that should be implemented immediately. The report proposes organizing a system to promote self-help and mutual support in case of disaster towards building communities where each member can take appropriate evacuation action independently. To this end, it suggests calling for more cooperation from the private sector such as the mass media and communication companies, increasing the quality and quantity of information on disasters, risks and evacuation, as well as improving tools and methods for informing the public better. The report also provides advice on social infrastructure planning to prepare for multi-hazard and hazards exceeding the design capacity of structures and offers proposals to accelerate post-disaster recovery and reconstruction, and raise public awareness of disaster risks. Overall, it stresses the importance of a "multi-layered" effort, in which actions planned from different perspectives are taken for well-defined purposes.

7.4.2 Increasingly Intensified Water-Related Disasters

Water-related disasters continue to be more destructive. As the climate continues to change, the frequency and pattern of heavy rainfall changes, and in turn, it affects the pattern of river-related disasters, which are used to create disaster types never seen before. Furthermore, as Japan's population is decreasing and aging rapidly, the society as a whole is losing awareness towards risks.

7.4.2.1 Changing Natural Hazards

The Automated Meteorological Data Acquisition System (AMeDAS), a regional meteorological observation system operated by the Japan Meteorological Agency, started its operation in 1974, collecting hourly rainfall data from about 1,300 stations across the country. According to the data collected by AMeDAS, unprecedented heavy rainfall occurs more frequently throughout the country. The finding is from an analysis in which the total observation years of 44 were divided into three periods, then the yearly number of stations that recorded the highest 24-h rainfall in history was counted, and an average number of such stations was calculated for each period. As shown in Fig. 7.17, the average was around 20 stations per year in the first two periods while it was more than 50 in the last period. In July 2018 with a heavy rain event, a new record was registered at only 14 stations for hourly rainfall, but 125 stations were registered for 48-h rainfall, and 123 stations for 72-h rainfall, which shows that about 10% of the stations in Japan observed the highest long-term rainfall in the history of the country.

As the pattern (e.g., intensity and frequency) of heavy rain has changed, the patterns of sediment- and water-related disasters have started changing. In Northern Kyushu during the heavy rain disaster of 2017, slope failures and debris flows occurred in many parts of the Sefuri Mountains, which are mainly covered with granodiorite and schist rocks. Decomposed granite soil, produced from granodiorite rocks and weathered deep inside of the mountain, played a critical role in this disaster. This type of soil, locally called "*Oni-masa* (evil decomposed granite)," was transported from the mountains to the rivers through slope failures and then in debris flows. After temporarily depositing in and around the river courses, the soil was again transported downstream in floodwaters and filled the narrow,

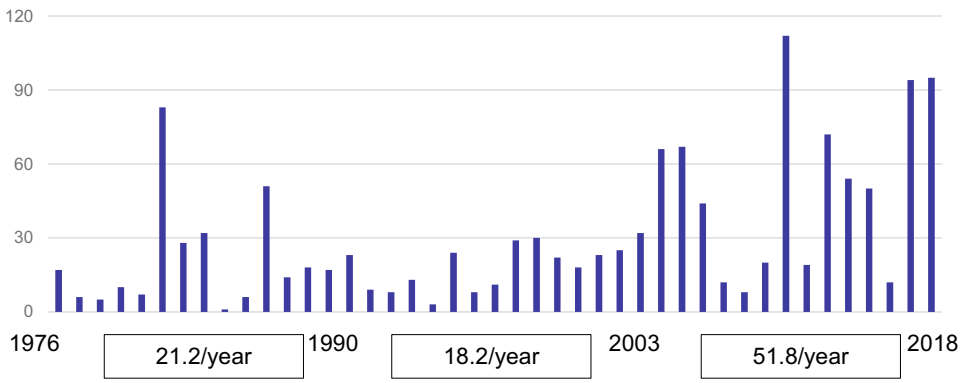

Fig. 7.17 Yearly number of AMeDAS stations that recorded the highest 24-h rainfall in history

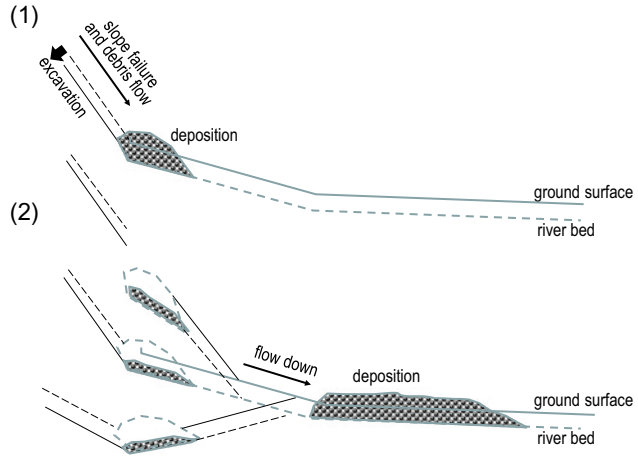

Fig. 7.18 Two step processes of the flooding caused by a combination of sediment and floodwaters. (1) Forming deposition by slope failures and debris flows. (2) Transportation of the deposited sediment downstream in floodwaters, filling the narrow, gently-sloped river courses running, and spreading floods, sediment and driftwoods over the valley plains

gently-sloped river courses running through the small plains in the valley bottoms (Harada and Egashira 2018). As a result, the flood flow was blocked from running in the river courses and spread over the valley plains, and completely changed the idyllic landscape of the area. Figure 7.18 illustrates the processes schematically. In fact, a similar disaster occurred in the Pekerebetsu River of Hokkaido when the Hokkaido and Tohoku regions were hit hard by heavy rain in 2016. This type of disaster became widely recognized by the public as "flooding caused by a combination of sediment and floodwaters" when it also occurred in July 2018 in many parts of Hiroshima Prefecture.

Given the same total rainfall, the flood peak is larger when the rainfall duration is shorter and the intensity is greater. Conventionally, short, strong rainfall patterns derived from historical events have been used to define the design flood peak discharge for planning river channels and dam reservoirs. In some recent cases, however, the rainfall has become longer, and total rainfall has become larger as reported in the July 2018 heavy rain event. A larger rainfall leads to a larger discharge for a longer period even if the flood peak discharge does not reach the design level. Consequently, dams use up the flood control capacity. In addition, if one considers the case of rivers merging at a confluence, typically, the flood runoff starts first in tributaries and then moves to the main stream. However, when the discharge in tributaries is still large because of longer heavy rainfall while the flooding is reaching its peak in the main stream, the backwater phenomenon occurs at the confluence. It has been commonly known that a levee breach on one side saves the other, but this conventional wisdom may not necessarily be the case in all cases. Once the backwater phenomenon starts, the water level remains high for a long period even if a levee breaches on one side of the river. Then, the levees weaken as more water permeates into the levee bodies, and eventually the levees breach on both sides of the river. During the July 2018 heavy rain, the area around the Oda River, a tributary of the Takahashi River in Okayama Prefecture, suffered severe damage when this phenomenon occurred concurrently with other factors. Figure 7.19 shows the complicated processes of the series of bank breaches schematically (River Council for Social Infrastructure Development 2018).

7.4.2.2 Increasingly Vulnerable Society

During the Hokkaido and Tohoku heavy rain disaster in 2016, nine residents lost their lives at an elderly home in Iwaizumi Town of Iwate Prefecture. The Northern Kyushu heavy rain disaster in 2017 claimed 40 deaths, 80% of which were 60-year old or beyond. In the July 2018 heavy rain disaster, about 56% of the victims were 65 or older. However, in Mabi Town of Kurashiki City, Okayama Prefecture, where the inundation depth reached around five meters, the number for the same age group shot up to nearly 90% (Ohara and Nagumo 2018). In Japan, demographically speaking, the ratio of the working-age people, aged between 15 to 64 per one aged 65 and over, was 3.9 in 2000, and 2.3 in 2015, and it is estimated to be 1.4 in 2065. A downward trend in this ratio indicates that a smaller percentage of people will be able to help themselves and help others evacuate and take other necessary actions in case of disaster and that a larger percentage of people will need help from others.

The Kanto and Tohoku heavy rain disaster in 2015 highlighted different problems in disaster management: evacuation information was issued too late, and few residents evacuated in time. Another lesson was learned from the July 2018 heavy rain disaster, which fatally affected the areas around the Takahashi and Oda Rivers. The municipal offices in charge of the areas had published a sediment and flood hazard map for 100- and 150-year heavy rain events. The inundation depth during the disaster virtually matched the depth illustrated in the hazard map. Moreover, a questionnaire survey later found that many residents in the areas had known about the map before the disaster. However, the survey also revealed that only a quarter of the residents had understood how to utilize the map (Council for Social Infrastructure Development 2018). These results indicate that providing the population with risk information is not enough as the population does not necessarily understand its real purpose.

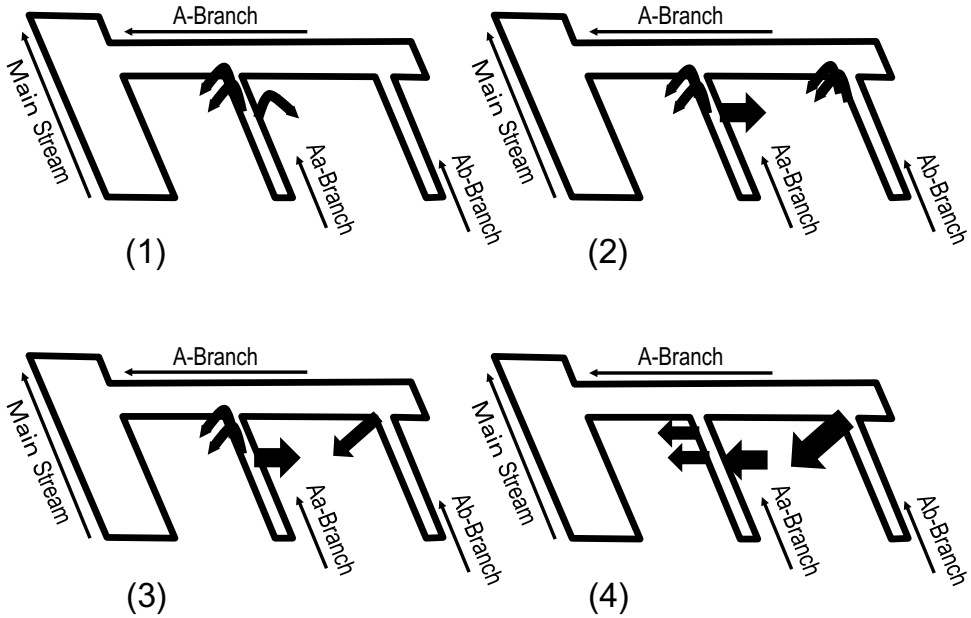

Fig. 7.19 Processes of the series of bank breaches. (1) overflow at both banks of Aa-Branch, (2) bank breach at the right bank of the Aa-Branch and overflow at the confluence of A-Branch and Ab-Branch, (3) bank breach at the confluence of A-Branch and Ab-Branch, increase of the inundation depth and change of the flood direction at the right bank of the Aa-Branch, (4) bank breaches at the left bank of the Aa-Branch

7.4.3 Towards River Planning and Management that Can Adapt to Social and Environmental Changes

What needs to be done to cope with increasingly intensified water-related disasters? The key is to build a new flood control system by visualizing changes in risk, which arise as natural hazards change in pattern and intensity and society becomes more vulnerable. A new system should also be built by utilizing the evidence-based combination of various structural measures with non-structural risk-reduction approaches.

7.4.3.1 Coping with Changing Natural Hazards

The Flood Risk Management Act was partially revised in 2015, and the expected largest natural hazards (river and urban floods) were determined in July 2015 as the criterion for implementing measures that can minimize disasters' damage to lives, property, society and economy even in case of flooding or other events due to hazards whose intensity exceeds the capacity of structures. At that time, it was generally considered as too early to use climate change simulation results to define the hazards. They were thus defined based on rainfall data from past observations. With Japan divided into 15 zones, the highest average rainfall intensity was calculated for each zone in relation to its area and rainfall duration, based on past observational data. After defining the relationship between the area of a zone and the rainfall intensity at each hour of the rainfall duration by using the highest average rainfall intensity, the relationship is applied to a river basin in the same zone. This approach is designed on the assumption that the heavy rain that occurred in a given zone will recur anywhere in the same zone.

In recent years, a present-climate reproduction experiment (1951–2011) and a future climate prediction experiment (2051–2110) were conducted using high-resolution global atmospheric models and high-resolution regional atmospheric models. The former experiment calculated 100 members using different initial values by adding small perturbations to sea ice and sea surface temperature, while the latter experiment calculated 90 members by adding perturbations to the pattern of sea surface temperature predicted in the future. A present-climate non-global warming experiment (1951–2011) was also conducted by fixing the greenhouse gas concentration at the pre-Industrial Revolution level and using the sea surface temperature without the trend components and corresponding sea ice as the boundary conditions. By dynamically downscaling data obtained from these simulations, more advanced products were developed, for they can help reflect the effects of topography and cumulus convection in simulation (Hoshino and Yamada 2018). These types of products make it possible to compare the occurrence of heavy rainfall, which is considered as very basic of probability density function, under the present and future climate conditions while considering the uncertainty. Such products also make it possible to assess the greenhouse effect in the present climate and, understand the impact of climate change quantitatively.

7.4.3.2 Coping with Increasingly Vulnerable Society

In order to protect oneself from unprecedented hazards, one needs to strengthen imagination about what may happen next and be able to react to signs of coming hazards and take appropriate actions automatically. For individuals to achieve and exercise this capacity, science and technology should not only provide them with accurate forecasting information but also, with the necessary support to increase their understanding of the given information. It should also offer them opportunities to plan sequences of necessary actions to practice in normal times, and take on their own when necessary.

Science and technology should also be interactive by always keeping a dialogue open with the general public, answer questions and explain scientific findings in an easy-to-understand manner. To strengthen self-help, mutual-support and public-support in the whole disaster risk reduction processes, including preparedness, evacuation, response and recovery, such interactions are also key to increase public trust in science and technology as illustrated in Fig. 7.20. All this requires an actor to facilitate dialogues among the public, local and national governments, and the science and technology community. This landscape indicates that universities, citizen's groups, and private think tanks are expected to play such vital role as facilitators.

The power of individuals becomes the power of a community when people gather and unite as one group. Similarly, the power of a community contributes to strengthening the power of a region and then the power of a nation. The disaster management office of the government enhances its action by cooperating with other offices in charge of urban development, traffic control, and environmental protection to promote the transformation or creation of a society to build a new society that is resilient, dynamic and sustainable. To that end, government offices should share data and information, coordinate disaster-related policies with other policies from different fields. Fields such as those expected to lead the next generation, towards smart cities, innovative mobility services, and green infrastructure. Efficient coordination would ideally go through the data platform initiative aiming at integrating real and virtual spaces, and implant quality social infrastructure. A crisis created by increasingly intensified hazards and increasingly vulnerable societies should be taken as a chance to make a drastic social change. Now is the time that science and technology and society collaborate in an interdisciplinary and transdisciplinary way, and, through this collaboration, sensible decisions be made and then executed with persistence.

7.5 The Water Pricing and Market Discourse

7.5.1 Introduction

We use water because it is valuable - but we lose it because it is free.

(Adapted from Pavan Sukhdev).

In the global political discourse, water is an orphan: mostly neglected and undernourished. This may seem strange because, water is one of the fundamental elements or resources that underpins, or undermines, all three dimensions of sustainability—social, environmental and economic. The sad truth though is that water has a very low profile in international political priority setting, while in many

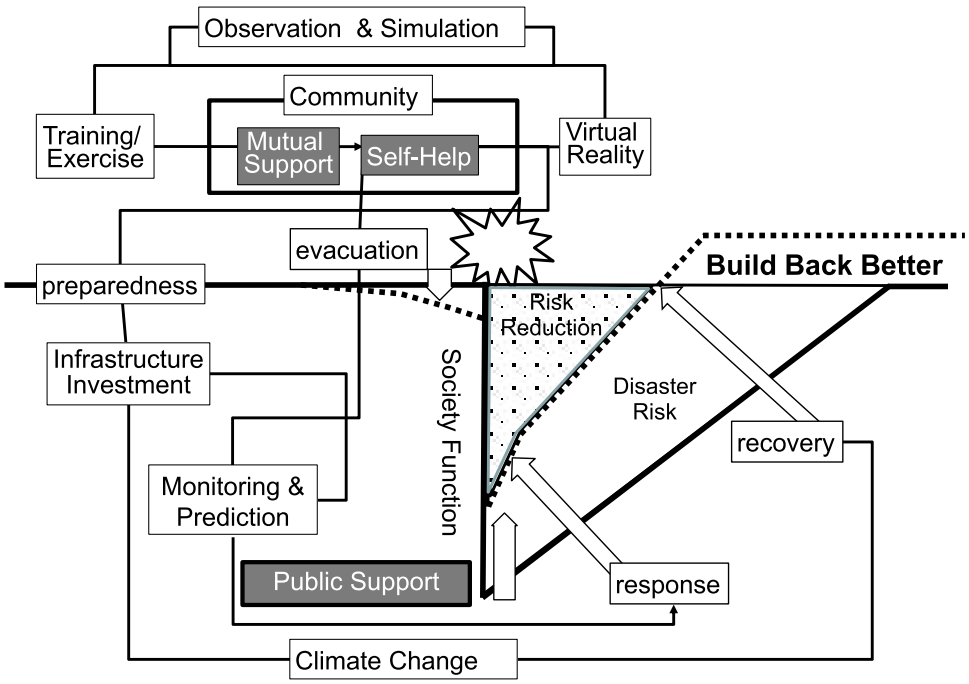

Fig. 7.20 Contributions by science and technology to public-support, mutual-support and self-help for reducing water-related disaster risk in the overall disaster management processes including preparedness, evacuation, response and recovery

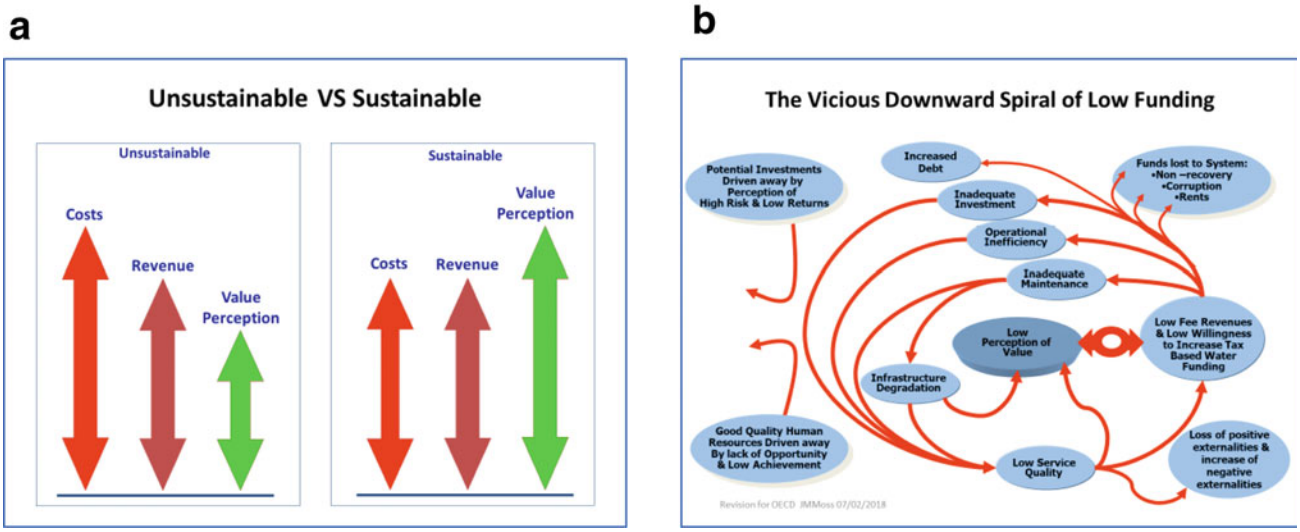

Fig. 7.21 **a**, **b** Unsustainable water economics need reversing to escape the vicious downward spiral of low funding and failing services

countries the economics of water are based on premises that are unsustainable. The relationships between costs, revenues and value of water are the wrong way round (Fig. 7.21a). The result is that almost all levels of water management are under-resourced, trapped in a 'vicious downward spiral' (Fig. 7.21b) and as a result the sector is virtually, if not actually, bankrupt. This is reflected in the poor state, or even complete lack, of water management systems, infrastructure and services in many locations.

It is possible that the UN 2030 Agenda for Sustainable Development[7] might change this situation. However, not much will happen unless a realistic approach to water economics and finance is adopted across all dimensions of water management.

This politico-economic challenge is now widely recognized, but meeting it effectively over the long term proves to be elusive. Some people advocate pricing and others markets. On their own neither of these work because of the unique roles that water plays and the governance that water decision making requires. Both these approaches have real weaknesses and ignore the real complexity behind the problem, so debating them in isolation does no more than maintain an arena for ideological conflicts. At best, these resolve nothing, and at worst they prevent progress on making tangible improvements where they are needed.

The billions of people who suffer from underperforming services or lack access altogether, the water resources that are degrading, and the ecosystems that are decimated by pollution or over-extraction, all deserve better attention. The urgency to deliver solutions is growing faster than the commitment to finding and implementing the courses of action needed.[8] This means that it is becoming increasingly difficult to overcome the growing burdens of financial, social and environmental debt.

There are no miracle solutions and there never will be. The best option outcomes will come from actions based on a deeper understanding of the multi-faceted complexity of water in a sustainable context. This requires both realistic approaches to water economics, and political decisions that take account of them.

This section will attempt to highlight the linked political and economic challenges and suggest some ways to progress beyond simplistic concepts and ideologies.

7.5.2 Need for Precision and Clarity to Unravel Complexity

It is essential to escape from broad generalisations and unravel the complexity by being very clear on a multitude of different aspects of the water challenges. All too often, water is treated as a homogeneous entity, as if it is the same thing everywhere, fulfilling the same functions for all users and uses. This leads to it being nothing, being managed nowhere and those who should take responsibility for it not doing so. To escape from this trap some precise, context specific, questions need to be answered.

[7]United Nations General Assembly Resolution A/RES/70/1. Transforming our world: the 2030 Agenda for Sustainable Development—21 October 2015.

[8]UN-Water SDG 6 Synthesis Report—2018 Forthcoming.

7.5.2.1 What Water?

Water is powerful. It can be constructive either as a substance or through the services it provides and equally it can be destructive through droughts, floods and as a vector of disease. As it flows through the water cycle and value chain, water takes on different natures and fulfils different roles. Water is required to satisfy many different needs of different users and uses in different times and places. It has critical interactions with other natural, human and economic resources.

This means that before any meaningful decisions are taken, trade-offs decided and economic policy instruments mobilised, it is essential to define the water or waters that are being considered. It is important to be clear on what water, of what quantity and quality, where, and when, is under consideration for the decisions needed in each given situation. It is also necessary to identify how many different demands on the available water there are and how these interact or interfere with each other.

Important in making such a case by case analysis is the need to identify when water is playing a role or function as a 'substance', a 'good', a 'commodity' or a 'service'.

A great deal of the ideological discourse that impairs progress in water management is based on a deliberate over-simplification of these distinctions. This viewpoint treats all water as a 'global common' and thus excludes all other roles and, in consequence, the necessity of managing the diversity of situations that arise in reality. While it is broadly true that at global level, the water, be it in the sea, the atmosphere, or occurring naturally on or under land, can be considered a 'common', this does not hold up when faced with practical reality. Even 'naturally occurring' water requires management and protection to be sustainable and to avoid 'tragedy of the commons'[9] situations. This incurs real effort and real costs, which have to be met by someone, somewhere, sometime.

Economists identify many different types of commodities, goods and services. These include, common goods, public goods, private goods, common pool resources, club goods, normal goods, rival goods, and excludable goods. At some point in the water cycle and viewed from the point of view of an individual use or user of water, almost all of these can be applied in a specific case.

Moreover, water, especially in the wastewater part of the water cycle can also be a nuisance or 'bad' that conveys social, environmental and economic harm. It seems that 'bads' can take as many forms as 'goods', thus affecting both individuals and the community.

To add another layer to the complexity, these 'goods' or 'bads' and the systems needed to deliver or overcome them for users and uses, generally take the form of natural monopolies. This means that free markets are not able to help determine prices or the value of either water or the services it provides or of the damage it can do.[10]

7.5.3 Individual Versus Collective Positions

A single user can have multiple relationships with water, thus viewing it as complying to different definitions with different values within a short space of time. The collective view of the community as a whole might be quite different from the individual's point of view.

This might mean that in certain limited circumstances setting a price or resorting to a market to determine what should be paid could work, while in most cases, such principles are not applicable.

In very limited circumstances an individual user can potentially arrive at a sustainable decision on how to compensate whom for the water or water use that person is enjoying or the harm that use is causing to others. However, that not only means the person needs to be able to determine the costs and benefits, but also needs to know clearly to whom, and how, to pay the balance in a way that provides sustainable compensation for them.

In the more usual situations, the information needed and the competing interests are too complex for this to succeed. This means that to be able to reach decisions on how to recover the costs of benefits (or dis-benefits) of water other processes need to be employed.

7.5.4 The Role of Politics and the Political Dilemma

The need to find acceptable shared understanding, decide priorities equitably and arbitrate between competing interests can only be met through appropriate political process by means of a stable system of water governance.[11] This means that strong political leadership is essential and this imposes a real responsibility on those political decision makers. Even though in today's climate, when people are increasingly disenchanted with politics and less willing to accept the decisions or dictates of politicians, it remains difficult to see how these issues can be resolved other than through a political process.

In this context '**p**olitical' (small 'p') is the process of making decisions that apply to members of a group or community in order to organise and control the distribution of resources, opportunities, risks and benefits within that

[9]Elinor Ostrom—Governing the Commons—The evolution of institutions for collective action—Cambridge University Press—1990.

[10]Ostrom – op cit.

[11]OECD Water Governance Initiative.

community and between its members. At the same time, it also organises the interrelationships between that group and other communities and states. This is not the same as '**P**olitical' (big 'P') in the sense of power politics, but of course the two politics are closely related.

The challenge is to find the best long-term fit between the positions taken by different individuals or sub-groups that may reflect divergent or competing interests or be based on different scales of space or time. Making trade-offs of this kind is essentially a political (small 'p') task.

It has been said that inherent to the idea of "economy" are trade-offs—more of this for less of that, recognising that the number of absolute win–win policies, anywhere, ever, is near nil.[12]

The challenge for the decision makers in formulating policy, determining cost recovery levels and determining trade-offs in the field of water governance are considerable. The decisions required are full of uncertainties, involve many (all) stakeholders, are unlikely to please everybody and rarely show quick results. In short everything that plays badly in the short horizons of power Politics (big 'P').

To make matters worse, not only are the policy challenges numerous and complex, but the policy instruments to solve them are very limited in number. Laws and regulations are difficult and costly to devise and enforce. Pricing instruments are limited to tariffs, taxes and subsidies.[13]

In politics at all levels, there are pressures and temptations to take short-term expedients with soft palliative effects when long-term decisions that face hard realities are needed. This is often particularly strong in the politics of water-related decision making. It is compounded by the emotional connotations that water carries. The difficulties of understanding the complexities of water issues and their interaction with social and economic activities and environmental forces, when added to these, are probably the root cause of the common "unsustainable downward spiral" in the economics and performance of many water institutions. They are the prime reason why water pricing, as a financial or policy instrument, is rarely effective in ensuring that adequate funds are available for water resource management and other water services.

So, what can policy makers do to improve the situation? How can their advisors and water experts help them? What roles can water users and other stakeholders play?

7.5.5 Some Suggestions for a Way Forward

The simple answer is "a great deal" and yes, everybody can play a part. Indeed, they must do urgently before it is too late.

While it is beyond the scope of this section and the competence of its author to provide all the answers, the following are some suggestions. These build on the analysis outlined above.

7.5.5.1 Publicise and Prioritise the Importance of Water Issues

At all levels, from the global to the very local, there is a need to do more to help everybody to understand the urgency and impact of a multitude of water issues and the way these affect different stakeholders, users and uses. All those who know about these issues have a responsibility to spread the word in accurate and precise ways.

7.5.5.2 Identify and Segregate the Different Conditions, Roles and Usages of Water

In order to arrive at good policies and processes, the complexities outlined above need to be analysed and unravelled. One of the ways to avoid confusion and conflicting interests is to have the many different issues identified and described as clearly as possible. This can be done by identifying the different 'value drivers' and 'value perspectives'.[14]

7.5.5.3 Break These Down into Their Component Parts

In this way different problems that need to be solved in different ways are not mixed together in an impenetrable tangle. Once identified it is easier to determine the kind of policies and policy instruments that can be used to allocate the costs and benefits, design cost recovery systems and set up the regulations and incentives that will enable them to function.

7.5.5.4 Develop a Collective Valuing of Water Approach

The steps 2 and 3 above will be made more effective if a collective valuing water approach is taken.[15, 16] Considerable work has been done in recent years to develop approaches to determining the full value of water and the

[12]Janan Ganesh—Financial Times November 21 2017.

[13]Managing Water for All: An OECD Perspective on Pricing and Financing, OECD 2009.

[14]J. Moss, G. Wolff, G. Gladden and E. Guttierez: Valuing water for better governance, CEO Panel 2003.

[15]High Level Panel on Water: The Bellagio Principles on Valuing Water, 2017.

[16]Australian Water Partnership: Valuing Water: A Framing Paper for the High-Level Panel on Water, 2016.

benefits it provides in ways that enable the perspectives of all users and uses and all externalities to be taken into account.[17,18]

This approach also gives a better chance for agreement to be reached on the roles that water is playing for different interest groups, in a practical and pragmatic way, that can help to avoid or overcome ideological positions that often impede progress. It enables the different value perspectives and value drivers to be identified.

Having involved stakeholders in separating out all the component uses of water in a way that achieves consensus, it is then necessary to determine the economic characteristics of water in each of these roles. The aim should be to be as clear as possible on whether, in that identified role, the water is a 'good' or 'bad', 'public' or 'private', 'excludable' and so forth.

7.5.5.5 Use the Above to Define Clear Policy Objectives

With the clarity and agreement provided by these steps, it should be much easier for the appropriate decision makers to determine clear policy objectives. A policy objective in this sense is the precursor step to setting a policy. It is a definition of what outcome the policy is aiming to achieve. It requires clear statement of the problem to be solved and way it is planned to be overcome. Setting clear, well defined policy objectives is important to enable appropriate policies to be developed that work for each specific challenge. It is also a way to improve the chances that the ensuing policy is aligned with other interests and reducing the risk of unintended consequences.

7.5.5.6 Match These Policy Objectives with Corresponding Policies Supported by Appropriate Policy Instruments

Once the policy objectives are clear, an actual policy can be formulated and with it the policy instruments needed to make it work. In the context of devising cost recovery, this is where things become even more challenging, because there are only three kinds of economic policy instruments available, **T**ariffs or prices, **T**axes and subsidies, or fiscal **T**ransfers (the 3Ts).[19]

If one accepts the Tinbergen rule that any one policy can only be supported by a single policy instrument, this does not give a great deal of scope for resolving multi-faceted problems. This is one of the reasons for breaking the challenges down into the smallest discrete and well-defined component parts that are practical. In this way, in theory at least, the three basic policy instrument tools can be available and adapted in detail to several objectives in parallel, thus multiplying the number of precise instruments available for the best effect.

As indicated above, one of the difficulties in this field is the very limited range of economic policy instruments that can be used in comparison with the number of policy objectives that need to be satisfied. This is illustrated in the diagram below Fig. 7.22, which indicates in the column on the left an extensive list of potential policy objectives. These can only be funded in the long-term by the three kinds of policy instruments (the 3Ts), of which only tariffs and taxes are truly sustainable.

The revenue streams that can provide this funding are shown on the right of the diagram. These are slightly more numerous and can be broken down further to increase the range of options available.

The water allocations for abstraction rights that can be issued to enable water market to function are included within the category T1 as 'other user charges'.

7.5.5.7 Measure and Monitor All Decisions and Outcomes with Appropriate Metrics

Good data enables good management and good management generates good data. The converse is equally true and is a factor that contributes to the vicious downward spiral. This means the process of setting and implementing water policy is not complete without designing appropriate and well-focussed performance indicators that can be measured and monitored effectively. This implementation process should enable all parties to see and review how well the policy is working and to adjust it in a timely way if needed. The design of key performance indicators and the measuring, monitoring and review process is important because if not done well these can lead to misleading or erroneous conclusions. Nevertheless, the search for perfection can lead to paralysis so to progress imperfectly is better than not to progress at all.

7.5.5.8 Use Prices Where Possible

Price is arguably the most effective and transparent policy instrument and theoretically can be used to send effective signals to users. However, there needs to be a simple and obvious link between the price charged and the benefit enjoyed that is comprehensible for users so that it impacts their behaviour. Ideally the purchase of the product or

[17]World Business Council for Sustainable Development (WBCSD): Business Guide to Water Valuation: 2013.
[18]Dustin E. Garrick, Jim W. Hall, Andrew Dobson, Richard Damania, R. Quentin Grafton, Robert Hope, Cameron Hepburn, Rosalind Bark, Frederick Boltz, Lucia De Stefano, Erin O'Donnell, Nathanial Matthews, Alex Money: Valuing water for sustainable development; 2017.
[19]Managing Water for All: An OECD Perspective on Pricing and Financing, OECD 2009.

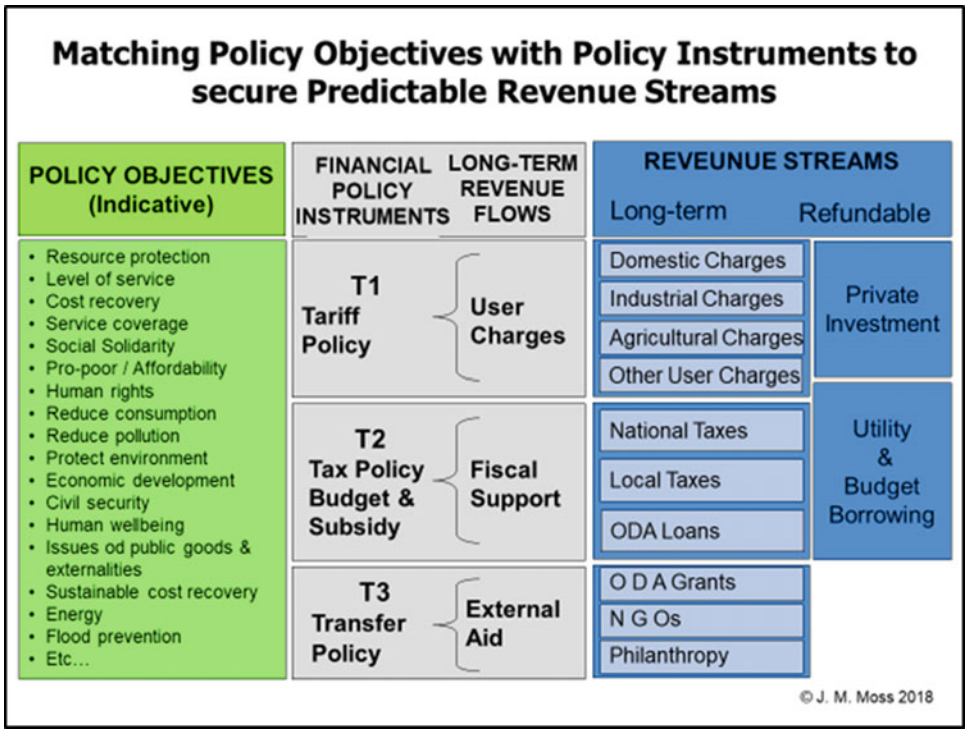

Fig. 7.22 Matching policy objectives with policy instruments to secure predictable revenue streams

service should be measurable and its use variable at the user's discretion.

A volume-based water use tariff can be effective to send messages to users about water conservation for economic or environmental protection. It is less effective for sending signals about wastewater and pollution issues. Volume-based charges or tariffs can be used for domestic, commercial, industrial and irrigation consumption and can also be applied to water abstraction and wastewater discharge.

A fixed or standing charge is very logical to cover the invariable costs of availability of the basic infrastructure that are incurred whether or not the service is used. For example, the costs of a dam for irrigation do not disappear in a rainy year when irrigation is not needed. Similarly, the size and part of the operating costs of public water supply systems is often determined by the constraints of fire or flood protection. This represents another fixed cost and the benefits are only appreciated if a fire or flood occurs. The invisible effect on insurance premiums is missed. Factors of this kind mean that such charges tend to be unpopular and be seen as a tax. Deciding whether to use a volume related or a fix charge can involve some difficult trade-offs.

Isolating and explaining each price element is possible in many cases, but requires considerable and regular explanation and runs the danger of creating a complex presentation of items in the billing process.

These constraints underline the necessity of breaking policy objectives down into discrete and recognizable components and then deciding if each of these prices are workable. It has to be recognized that using prices, whilst preferable, is not always possible.

7.5.5.9 Use Taxes When Needed

Having exhausted the possibilities of pricing, the other basic option is to resort to a system of taxes. Taxes can be raised at different geographical scales, by different organizations, for different purposes and with different effects. As a general rule, the closer in both geography and organization they are to the use or user of water the easier it is to make them understandable, transparent and to use them to send messages to users.

Many of the costs mentioned above can be covered as a local tax if the appropriate authority has the mandate to do so. In this case, it is advisable to have accounting safeguards that ensure that the taxes are adequate (in combination with tariffs if these are used) to ensure that the revenue stream is dedicated to the water system in question and is predictable, reliable and sufficient over the long term.

Significant costs arise in water management at a scale and by organizations that extend beyond the immediate local context. Usually, there is little choice but to cover these costs from regional or nationally raised taxes. Examples include basin and aquifer resource management, environmental protection or restoration, flood control, navigation, hydroelectricity, etc.

When a tax is raised at anything above the local service level, it becomes increasingly difficult to show that it has a

clear link with the policy objective it is aimed to finance. This means that taxes or charges raised at these levels are much less likely to be able to send messages to users and other stakeholders. It also means that unless strict budgetary control and administrative procedures are in place, and these are protected from political interference, the revenues that were identified to fulfil a specific policy objective may not arrive in a predictable way, where and when intended.

The transfer of tax revenues from the collecting to the spending authority will normally take the form of subsidies or fiscal support. In most cases, this makes them more appropriate to paying for large irregular capital expenses than for routine operation and maintenance.

Tariffs (prices) and taxes of the kind outlined above both raise money for the systems or services from the people who ultimately benefit from those services. This means that, so long as they are set at adequate levels, they are sustainable over the long term.

The third 'T' of the trio, is transfers in the form of overseas development assistance (ODA). This is a way of using tax revenue from taxpayers who do not benefit, or at least only very indirectly, from the services. They cannot be relied on permanently and therefore, while being very useful to initiate and accelerate development, are unlikely to lead to sustainable long-term outcomes.

7.5.5.10 Consider Market Principles Carefully

Market principles can work in limited circumstances, but they only really work in carefully prepared and regulated conditions.

There are few examples of 'free markets' being used to set prices and recover costs of water delivery. The most common is where tanker services are used for water supply. Competition between tanker operators and consumer demand for water has some influence on the prices charged. However, these 'markets' are rarely transparent and unbiased and raise a large number of negative issues for the community as a whole. There are even fewer examples where policies and regulations to overcome these issues have been put in place.

There are some examples where specific policies and their attendant regulations have been used to mobilize 'controlled' markets. The most common are those that are used in water deficient regions to optimize the use of scarce resources for agriculture. These are not really markets for water, but markets for abstraction rights or allocations of water. However, they do permit 'water trading' that in principle ensures that the available water is used for the most beneficial outcomes.[20]

The few examples that do exist show that markets can work when they are deliberately facilitated, regulations are clear and data is accurate, timely and available. This requires clear and consistent policy making and subsequent administration of regulations.

7.5.5.11 Devise and Enforce Regulations that Support Allocation Decisions, Prices, Taxes, Markets and Subsidies Systems in Line with the Policy Objectives

Responsible political decision making to arrive at sustainable water management requires well-designed and well-implemented rules and regulations. These are needed to ensure that the trade-offs that are essential to preserve an equitable balance between different interests are made and carried out fairly. They are needed to keep all the parties (including the decision makers) "honest" and to enable the powerful, the weak and the voiceless (nature) to coexist.

It is easy to think of regulations being constraining, and whilst this is often the outcome when seen from an individual stakeholder's position, viewed collectively, regulations should be conceived as enabling—permitting the maximum benefit for the greatest number of interests. Rules and regulations form another family of policy instruments that can be an adjunct to the 3Ts and greatly enhance their effectiveness.

Clear rules and regulations are required at every stage, from policy formation to implementation, and at all scales from the supranational hydrological unit through to the local level. This presents a significant challenge of coordination and consistency.

In practice, regulations also need to be reviewed regularly to ensure that they are being applied as intended and are the achieving the outcomes required. If they are not, this can be because the original policy objective was misconceived, that the situation they were designed for has evolved, or that the regulations have not been applied properly.

The success of regulations, and indeed the whole governance system they underpin, depends on some key factors. These include regulatory independence from all parties, the skills and means available within the regulatory body, the respect and level of compliance by the regulated, the transparency of the process and the quality of the data and information used. Particular threats to good regulation come from political interference, under resourcing and "regulatory capture".

7.5.5.12 Manage Exceptions with Care

In almost any policy outcome, some kind of exception is likely to occur. When they do, great care is needed to ensure that the solution adopted does not undermine the whole

[20]Murray Darling Basin Authority: https://www.mdba.gov.au/managing-water/water-markets-and-trade (Accessed 6/2/2018).

policy. Short-term expedients or ill-conceived palliatives can undermine the long-term policy objective.

A common pitfall in water governance and economics is the exception of 'affordability'. There certainly are farmers who would find it difficult to pay the costs of irrigation or water pollution prevention measures. There are also people who do not have enough income to pay domestic water and wastewater charges. National interest, social solidarity, equity, human rights compliance—there are many reasons why some people should be given support. There are also a number of ways that can be used to provide help so long as these are dealing with exceptions and not the general rule. If they do become the general rule, this probably means that there is a failure in the policy objective, policy formulation, policy instrument and policy implementation chain that requires review and adjustment.

The common pitfall is the one that, seeing that some people are unable to pay charges above a certain level, a charge is set that is lower than the real costs. Unless the shortfall this creates is compensated for by some other policy instruments, this leads to the downward spiral of service degradation. This can sometimes become the problem of 'lack of willingness to charge' on the part of the policymaker rather than a 'lack of ability to pay' on the part of the users.

There is an extensive body of literature[21] and practical experience on appropriate and effective methods of providing assistance to those who find themselves in genuine difficulties with payment. Describing these is beyond the scope of this section. To be effective the beneficiaries need to be targeted and the instruments used require careful application. They usually depend on special charges, specific payment regimes, or some form of subsidy. While the use of such approaches is clearly necessary in specific cases, they almost always come with both economic and social costs. They can be costly to administer, give rise to stigmatization of the people they target and sometimes deliver unintended benefits to users who do not need them. For these reasons, it is important to pay attention to the perversity of subsidies and social support systems, but recognize that these may be necessary to overcome genuine problems of affordability and the need to prioritize the human rights to water and sanitation.

7.5.6 Identifying All the Costs

The viability of any water system depends on the association of all the costs incurred with all the revenues collected. The cost recovery system has to be set in advance and in accordance with the service and performance levels that are targeted. Actual costs result from the investments made, the efficiency of operation and the flow of revenue to the service to cover them. Cost and price are therefore interdependent. Each has an impact on the other.

Establishing all the costs (including 'direct' and 'indirect'), both in advance at the estimation stage and controlling them as outcomes can prove to be very difficult.

Direct costs are categorized in various groups, capital investment (infrastructure), operating expenses (e.g. labour, energy) maintenance and renewal, and financing. The time cycles of each these can vary substantially. For example, capital investment costs are often very large, but occur infrequently, while labour costs have to be paid on a recurring basis and immediately. The effects of time and uncertainty lead to the difficulties with identifying, assessing, allocating and pricing risk.

Indirect costs are even more challenging. These include items such as resource cost, externalities (both positive and negative) and opportunity costs.

Designing a cost discovery system has to take account of these differences. An aggregate has to be made to include and cover all of the costs completely. However, the estimates of costs, benefits and risks are often made by a range of different parties, who have different inherent assumptions and objectives. Similarly, the control and allocation of costs can be interpreted differently by different interests in the value chain.

Here again, good governance in the form of administrative procedures, reporting, audits, monitoring and regulation, all of which should have a strong emphasis on transparency, is essential.

7.5.7 Involving Stakeholders in Making Trade-Offs

Identifying the range of interests of different uses and users, understanding their relative importance and deciding how to accommodate them is a central problem. It is a problem that has to be faced even when setting prices or stimulating market forces as means of creating revenue streams to cover costs. It becomes even more critical when allocation and trade-off decisions have to be made politically, which is often the case.

The water allocations or trade-offs that have to be made are often looked upon as simple binary arrangements. This is usually too simplistic. The issues are multi-faceted and involve several interested parties who have different objec-

[21]The social dimensions of tariffs for water supply and sanitation services—OECD 2018.

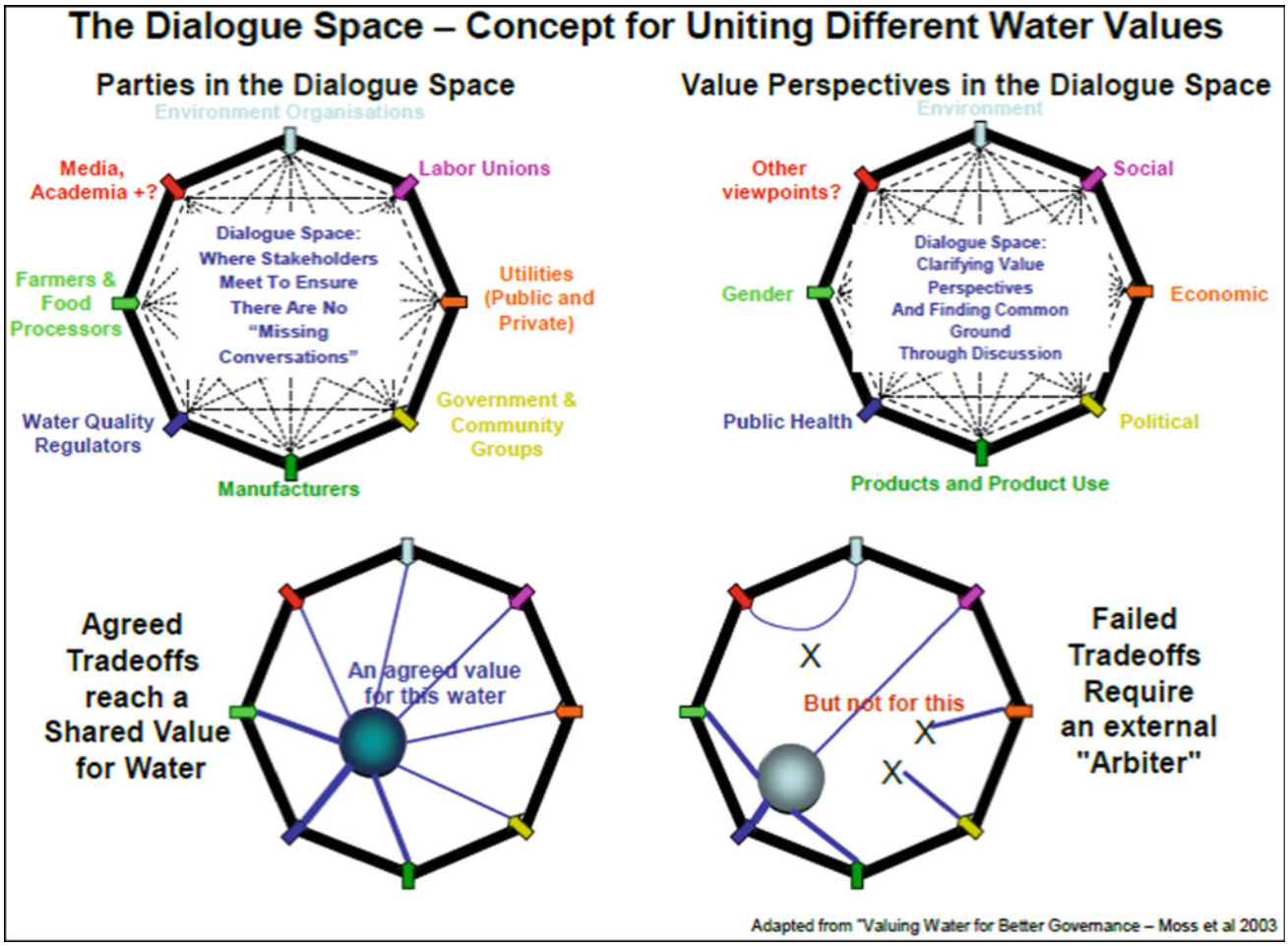

Fig. 7.23 Using the 'Dialogue Space' to agree multi-variant trade-offs

tives. These positions can be identified using a 'dialogue space'[22] approach based on 'value perspectives'[23] and 'value drivers'[24] that enables multiple stakeholders to converge on shared understanding and multi-variant trade-offs (Fig. 7.23).

It is becoming more and more common to hear this kind of stakeholder engagement approach being advocated. It is an approach that has considerable merit but is also quite complicated to achieve and to maintain. It can be hard to assemble all the stakeholders who should be represented, especially the weak and voiceless ones. This can be difficult even at a modest local scale and generally becomes progressively more difficult as the scale increases. It is important that the representatives of different stakeholder groups truly speak for that group. It is important to establish the legitimacy of the convening party and the neutrality of the conduct of the consultations. The process needs to be conducted in a way that gives all participants confidence and ensures that some 'voices' do not dominate and thus distort the outcome. There is always a danger that certain groups that actually want to distort the outcomes can achieve their ends by 'consultation capture' or boycotting the process.

The final outcome, whether a complete consensus or not, needs to be a set of decisions that inform policy objectives. These outcomes need to be endorsed by the politically responsible decision making, who must be involved in the process. Even if a complete consensus is not reached, the decision maker, who is probably forced to make decisions and direct the policy chain anyway, will be better informed. This should assist in setting prices, stimulating markets, and defining regulations and subsidies.

7.5.8 Conclusion

Setting the revenue levels needed to cover the costs of any water service that preserves or enhances the value of the substance water, or that the water service, delivers to

[22] J. Moss et al. (op cit).
[23] Ibid.
[24] Ibid.

stakeholders presents a significant series of challenges. The instruments available to meet these challenges are very limited which means that the problem needs to be broken into as many component parts as practicable. It will never be easy to achieve satisfactory outcomes as conditions and pressures inevitably involve in the time interval between decision and outcome can be very long.

This section has argued for a series of pragmatic and practical steps, built around the concepts of 'valuing water' and discrete steps in the policy making process, which can help communities and their leaders to arrive at solutions, at the different scales involved, that can ensure that viable and sustainable water supplies and services can be provided.

To be effective, prices or taxes should not be set in an arbitrary manner. The use of markets or market forces have only very limited potential but can be considered as a way to enhance water use or operational efficiency.

7.6 Environmental Migration, Rights of Refugees and Impact on Water Conflicts

Environmental degradation, and in particular water scarcity, may play a role in influencing a person's decision to migrate. In 2017, according to UN statistics, the number of international migrants reached 244 million and 763 million internal migrants.[25] The Global Water Institute estimated that around 700 million people in 43 countries suffer from water scarcity.[26] Moreover, two-thirds of the global population live in areas that experience water scarcity for at least one month a year.[27]

Making assessments and predictions about environmental migration is a complex undertaking. Because migration involves numerous variables, it is often impossible to isolate environmental factors as the sole drivers of the decision/necessity to move. As it was noted "the decision to migrate is often made because of a variety of "push" and "pull" factors. Rarely is the decision to migrate made due to a single reason".[28] This recognition does not mean to deny that the degradation of the environment may be one of the drivers of displacement.

Migration can occur due to a combination of various environmental factors, which are more numerous and more intense today. Droughts, desertification and water scarcity are likely to increase because of climate change. Soil degradation graduality diminishes the productivity of land, affects livelihood, and thus compels people to move to other areas once their land becomes uninhabitable. Moreover, changing precipitation patterns creates pressures on the availability of water supplies. Sea level rise will extend areas of salinisation of groundwater and estuaries, resulting in a decrease in fresh water availability for humans and ecosystems in coastal areas. Already, environmental migration in Asia has been directly linked to glaciers melts.[29] Most of the largest rivers in this region, including the Ganges and Bhramaputra, which provide water to around 500 million people, survive on meltwater from glaciers in Himalaya. Lower-lying populations could be affected by reduced water flows as glacial meltwater is indispensable for these populations to maintain supplies during dry seasons.

As these examples illustrate, water insecurity may be among the causes of migration.

Literature has mostly focused on climate change induced migration and displacement due to disasters.[30] Water issues have mostly been considered in relation to land degradation, desertification and extreme weather events such as floods, hurricanes and typhoons.[31] First, this section examines the lack of an agreed terminology for the category of persons having, or not, crossed international borders due to environment degradation. The use of the term 'environmental

[25]E. Mach: Water and Migration: How Far Would You Go for Water? In: A. de la Rochefoucauld, C. M. Marenghi, Water and Human Rights. a Catholic Perspective on the Human to Water (Caritas in Veritate Foundation Working Papers, 2017), p. 80.

[26]Global Water Institute. Future Water (In)Security: Facts, Figures, and Predictions (2013).

[27]M. Mekonnen, A. Hoekstra: Four Billion People Facing Severe Water Scarcity. Science Advances. 2(2) (2016). Available at: https://advances.sciencemag.org/content/2/2/e1500323/tab-pdf (accessed 20 April 2018).

[28]F. Renaud, J. J. Bogardi, O. Dun, K. Warner, Control, Adapt or Flee. How to Face Environmental Migration? InterSections, No. 5, United Nations University, Institute for Environment and Human Security, pp. 9–10 (2007).

[29]Office of the United Nations High Commissioner for Human Rights, Climate Change and the Human Rights to Water and Sanitation, Position Paper (2009). Available at: https://www.ohchr.org/Documents/Issues/Water/Climate_Change_Right_Water_Sanitation.pdf (accessed 20 April 2018).

[30]See: M. Morel, N. de Moor: Migrations climatiques: quel rôle pour le droit international? Cultures et Conflits (88) (2012) pp. 61–84. Aavilable at: https://journals.openedition.org/conflits/18580#quotation (accessed 20 April 2018). Projet de Convention relative au statut international des déplacés environnementaux, Revue européenne de droit de l'environnement, Centre international de droit comparé de l'environmment (4) (2008), pp. 452–505. A. Epiney: « Refugiés écologiques» et droit international in C. Tomuschat, E. Lagrange, S. Oeter (eds.), The Right to Life, Leiden/Boston (2010) pp. 371–401. H. Zeghbib: Les réfugiés environnementaux. Une catégorie juridique en devenir. Hommes et migrations (1300) (2012), pp.132–142. C. Cournil: Les 'réfugiés environnementaux': enjeux et questionnements autour d'une catégorie émergence. Migrations Société (128) (2010/2), pp. 69–79. R. Zetter: Protecting People Displaced by Climate Change: Some Conceptual Challenges', in J. McAdam (ed.), Climate Change and Displacement, Multidisciplinary Perspectives, (Oxford/Portland 2010), pp. 131–150. R. Cohen and M. Bradley: Disasters and Displacement: Gaps in Protection. International Humanitarian Legal Studies (Vol. I 2010), pp. 63–78.

[31]See for example: R. Cohen and M. Bradley (2010).

refugees' has been criticized by scholars[32] because of the risks of confusion with the legal definition of refugee under the 1951 Geneva Convention relating to the Status of Refugees. According to this Convention, refugees are defined as any person having a 'well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion'.[33] Moving beyond this lack of agreed terminology, the second part of this section will underline that international law protects the rights of persons displaced as a result of environmental degradation. Emblematic examples are the 2009 African Union's Convention for the Protection and Assistance of Internally Displaced Persons in Africa (Kampala Convention) and the 2010 Agenda for the Protection of Cross-Displaced Persons in the Context of Disasters and Climate Change (Nansen Initiative).[34] In light of these and other instruments, the section argues that human rights law, international refugee law and international humanitarian law provide solid legal frameworks to protect the rights of environmental migrants. A final part puts environmental displacement in the context of water conflicts. It is argued that water can be both a trigger and a victim of conflicts. More specifically, through the case study of water scarcity, it is explained how environmental disasters can trigger or enhance armed conflicts, which themselves may intensify environmental problems and, thus, aggravate the causes of displacement.

7.6.1 The Disagreement Over the Term 'Environmental Refugees'

In the absence of a clear terminology for those having crossed borders for environmental reasons, misleading terms have been used early on. In 1985, El—Hinnawi, proposed to call 'environmental refugees' 'people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life'.[35]

In 1993, Myers defined 'environmental refugees' as:

> people who can no longer gain a secure livelihood in their erstwhile homelands because of drought, soil erosion, desertification, and other environmental problems. In their desperation, they feel they have no alternative but to seek sanctuary elsewhere, however hazardous the attempt. Not all of them have fled their countries; many are internally displaced. But all have abandoned their homelands on a semi-permanent if not permanent basis, having little hope of a foreseeable return.[36]

Despite these definitional attempts, the United Nations High Commissioner for Refugees insisted that the term 'environmental refugees' may be confused with the status of refugee established by the 1951 Geneva Convention. Such confusion should be avoided,[37] as using the term 'refugee' would risk to undermine the regime of protection granted by the 1951 Convention. In this regard, the Chaiperson's Summary of the 2011 Nansen Conference of 2011 noted that: "the terms 'climate refugees' and 'environmental refugee' should be avoided, as they are legally inaccurate and misleading". The Conference however also recognized that there is "a need to clarify the terminology for displacement related to climate change and other natural hazards".[38]

Considering the risk of confusion, international instruments have increasingly used the category of 'migrants' to define the phenomenon of flows of persons in a country or across the borders resulting from environmental factors. According to the International Organisation for Migration (IOM):

> Migration refers to the movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification.[39]

The use of the term migration can be explained as revealing the increasing recognition of the need to better understand migrations flows, especially related to the impacts of climate change. For example, the 2010 Cancun Agreements adopted under the umbrella of the UN

[32]See especially: R. Zetter (2010). R. Cohen and M. Bradley (2010).
[33]Article 1A (2).
[34]Convention for the Protection and Assistance of Internally Displaced Persons in Africa, 23 October 2009. Available at: https://au.int/sites/default/files/treaties/7796-treaty-0039_-_kampala_convention_african_union_convention_for_the_protection_and_assistance_of_internally_displaced_persons_in_africa_e.pdf (accessed 20 April 2018). Nansen Initiative: Agenda for the Protection of Cross-Border Displaced Persons in the Context of Disasters and Climate Change (Nansen Initiative, Geneva, 2015). Available at: https://nanseninitiative.org/wp-content/uploads/2015/02/PROTECTION-AGENDA-VOLUME-1.pdf (accessed 20 April 2018).
[35]E. El-Hinnawi: Environmental Refugees (United Nations Environment Programme, Nairobi, 1985), p. 4.
[36]N. Myers: Environmental Refugees in a Globally Warmed World. BioScience, 43(11), 752, pp. 752–761, (1993).
[37]UNHCR, 'Climate change, natural disasters and human displacement: A UNHCR perspective', 23 October 2009, 3. S. Castles: Environmental Change and Forced Migration: Making Senses of the Debate, Working Paper No. 70, New Issues in Refugee Research (Refugees Studies Centre, University of Oxford, 2002), p. 5.
[38]Chaiperson's Summary, Nansen Conference on Climate Change and Displacement in the 21st Century, Oslo, 6–7 June 2011, para. 21. Available at: https://pnc.iucnp.org/wp/wp-content/uploads/2011/06/Chairpersons-Summary-Nansen-Conference-on-Climate-Change-and-Displacement.pdf (accessed 20 April 2018).
[39]Glossary on Migration by the International Organization for Migration, 2011.

Framework Convention on Climate Change (UNFCCC), affirmed that States should take "[m]easures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at the national, regional and international levels".[40] Moreover, following the Doha Conference in 2012, an Advisory Group on Climate Change and Human Mobility was established to make recommendations to UNFCCC Parties on the need to include migration and displacement in the COP 21 in Paris. The Doha decision encouraged "further work to advance the understanding of and expertise on loss and damage, which includes […] enhancing the understanding of […] how impacts of climate change are affecting patterns of migration, displacement and human mobility".[41] More recently, migrants' rights have been formally recognized in the 2015 Paris Agreement.[42]

The term of 'environmental refugee' is not included in international instruments and should be avoided as it does not correspond to the definition given by the 1951 Geneva Convention. It is also misleading because of the confusion between a refugee who is a person outside their country of nationality or residence and internally displacement persons (IDPs) who remain in their own country. The term 'environmental migrants' would suitably cover both IDPs and cross-border displacement.[43]

The terminological disagreement does not preclude the analysis of how existing legal frameworks capture the phenomenon. It should be noted, however, that linguistic choices will ultimately have an impact on what legal frameworks apply, and how, to the people who have to cross borders for environmental reasons. Leaving this question aside for now, the following developments move beyond the conceptual disagreement to focus on the protection of the rights of persons displaced as a result of environmental degradation, by existing international legal frameworks.

7.6.2 International Legal Frameworks

Climate change, water scarcity, land degradation or flooding have already caused cross-border displacement and migratory movements. As the limitation of water uses and disaster-related movements are likely to become more diverse and new patterns will emerge, the question arises as to whether and how current international law addresses this pattern. There are several provisions relevant to the issue but they are scattered throughout three main areas of international law: international humanitarian law, human rights law and international refugee law.

First, international human rights law is a body of law applicable both in times of peace and armed conflicts. Some instruments of human rights law such as the International Covenant on Civil and Political Rights point out that State parties may take measures derogating from their obligations under the Covenant to the extent and so long as they are necessary 'in time of public emergency which threatens the life of the nation',[44] a condition that may exist for instance in situations of sudden-onset disasters or violent conflict over diminishing water resources. Everyone is protected by human rights law by virtue of being a human being and, as such, persons on the territory of a foreign State and stateless persons are also protected under human rights law. The principle of *non-refoulement* prohibits that a country receiving asylum seekers return them to a country in which they would likely be in danger of persecution based on 'race, religion, nationality membership of a particular social group or political opinion'.[45] At the 2011 Nansen Conference, the importance of human rights principles, and in particular the principle of *non-refoulement*, was highlighted as a possible protection framework for those displaced across borders but not falling under the refugee protection regime.[46]

Human rights protection, while important, has however a limited protection system. In particular, it does not regulate admission into a foreign State and provides no clear answer on what status should be conferred to those persons during their stay abroad. Article 14 of the Universal Declaration of Human Rights establishes the right to seek and enjoy asylum, but not to receive it, as this remains a sovereign decision of the State. In contrast, Article 18 of the EU Charter of Fundamental Rights guarantees the right to asylum but limits it to cases of persecution as defined by the 1951 Refugee Convention.

In addition to general human rights provisions, there are a number of specific treaties relevant for persons moving or

[40]The Cancun Agreements: Outcome of the Work of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention, Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010, FCCC/CP/2010/7/Add.1, Decision 1/CP.16, para. 14(f).

[41]Decision 3/CP.18, para. 7(a) (vi).

[42]Paris Agreement, 12 December 2015, preamble. Available at: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf (accessed 20 April 2018).

[43]F. Renaud, J. J. Bogardi, O. Dun, K. Warner (2007). F. G. Renaud, O. Dun, K. Warner, J. J. Bogardi: A Decision Framework for Environmentally Induced Migration, International Migration, 49 (S1), e5–e29 (2011).

[44]Article 4.1. International Covenant on Civil and Political Rights, 1966.

[45]Article 33 of the 1951 Convention relating to the Status of Refugees, 1951.

[46]Chaiperson's Summary, Nansen Conference on Climate Change and Displacement in the 21st Century, Oslo, 6–7 June 2011, para 22.

displaced to another country. Particularly important is the International Convention on the Protection of the Rights of All Migrant Workers and Their Families, as it is a basis for the protection of individuals who have crossed borders in the context of climate change. However, it only applies if the individual concerned is a 'migrant worker', i.e. a 'person who is to be engaged, is engaged or has been engaged in a remunerated activity in a state of which he or she is not a national' and his or her family members.[47] In addition to this restriction, it should be underlined that the number of States that have become party to this Convention is limited.[48]

Second, moving to the next corpus of norms, international refugee law applies to persons who have been compelled to flee across borders. As such, it provides a specific status and ensuing status rights exclusively for non-national of a state and stateless persons. 'Refugee' is defined in the 1951 Convention on the Status of Refugees and its 1967 Protocols as a person who 'owing to well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that countries'.[49] The list of criteria given by the Convention is strictly political. Environmental, social or economic considerations are excluded. Environmental reasons have not been included among the reasons of persecutions. As detailed as this provision may be, it fails from addressing the case of individuals who owe to well-founded fear of being subject to natural disasters, or unwillingly had to take refuge abroad because a natural disaster actually occurred.

At the regional level, the Arab Convention on Regulating Status of Refugees in Arab Countries of 1994 contains a broader definition of the word "refugee". This broader notion is particularly interesting as it encompasses people who unwillingly took refuge abroad 'because of the occurrence of natural disasters or grave events resulting in major disruption of public order in the whole country or any part thereof'.[50] Overall, however, the degree to which refugee law helps address normative gaps in relation to displaced people by environmental degradation remains very limited because of its very object, which is itself constrained to people who had to leave the territory of their state of origin, or who are stateless.

The Convention on the Status of Stateless Persons of 28 September 1954 may become important in the case of loss of territory and the end of statehood. International law traditionally sets the three criteria of (i) population, (ii) effective state authority and iii) state territory as the three constitutive elements of statehood. This Convention could be of relevance in the context of the disappearance of islands States due to the rising seas and erosion. According to the Convention, the state of domicile or residence should offer a set of status rights to stateless persons and facilitate their naturalization as much as possible.[51]

The inherent limitations of refugee law and of the norms on the status of stateless persons make them ill-suited for dealing with the case of environmental migrants. Indeed, the majority of those displaced by environmental degradation, is not crossing borders but is likely to become internally displaced. Persons displaced within the territory of states due to climate-related events are IDPs. According to the 1998 United Nations Guiding Principles on Internal Displacement (hereinafter Guiding Principles), IDPs are 'persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result or in order to avoid the effects of […] natural or human-made disaster, and who did not cross an internationally recognised State border'.[52] Even though the Guiding Principes do not explicitly include climate change or water scarcity as a cause of internal displacement, they list the cases of internal displacement in a non-exhaustive manner. The majority of those displaced by impacts of climate change or water scarcity do not cross border but they are likely to become internally displaced. The 2011 document of the Nansen Initiative, explicitly recognises natural and man-made disasters as possible causes of displacement, irrespective of whether or not they relate to changing climate patterns.[53]

Beyond international human rights law and international refugee law, norms and principles of international humanitarian law (IHL) can also be used to prevent the environmental situation from deteriorating before individuals are forced to move. For example, in the context of the protection of objects indispensable to the life of civilian populations such as water installations, Article 54 of the First Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts makes reference to the fact that attacks against these objects may move away the population from an area of conflict. In this regard, the Protocol is clear that forced displacement of population because of the destruction of objects indispensable to their survival is prohibited under IHL. By establishing such prohibition, one of the goals of the 1977 Additional Protocol is to prevent the emergence of such

[47]Article 2.1. International Convention on the Protection of the Rights of All Migrant Workers and Members of their Families, 1990.
[48]51 State parties as of 25 April 2018.
[49]Article 1(A) (2) of the Convention on the Status of Refugees.
[50]Article 1 of the Arab Convention on Regulating Status of Refugees in Arab Countries.
[51]Article 32.
[52]Report of the Representative of the Secretary general, Mr. Francis M. Deng, submitted pursuant to Commission Resolution 1997/3, Addendum Guiding Principles on Internal Displacement, 1998, para. 2.
[53]The Nansen Conference: Climate Change and Displacement in the 21st Century, Oslo, 5–7 June 2011, Chaperson's Summary, para. 19.

undesirable behaviours and, thus, prevent the destruction of objects that would lead to the displacement of populations.

The applicability of these legal frameworks to the case of displaced individuals facing environmental disasters, if imperfect, must be acknowledged and activated. The following developments aim to emphasize this necessity by showing how water scarcity, displacement and armed conflicts are intertwined.

7.6.3 Displacement, Water Scarcity and Armed Conflicts

Without establishing a unique causal phenomenon, it is considered that environmental deterioration may cause displacement; that water scarcity is likely to trigger or, at least, enhance conflicts; that displacement can also intensify conflicts, which themselves may exacerbate environmental deterioration.[54] The origins of a significant number of migrants' movements are found in the linkages between climate change, water scarcity, poor governance and conflict. While environmental deterioration may cause displacement, it should be recalled that environmental degradation acts together with other factors such as economic, demographic or political ones.[55]

Like other environmental factors of migration, water scarcity can lead to temporary and permanent movements depending on the duration and severity of water stress as well as the coping capacity of populations. Most people moving because of water insecurity try to reach water resources closest to home, traveling the shortest distance possible. Migration related to water tends to be internal or regional, considering that those who do not have the means to access water locally will seldom have the means to move beyond their region. Often, the decision to migrate in the context of water scarcity is the result of environmental factors (e.g. rainfall variability, drought, desertification, salinization), combined with human factors (e.g. unsustainable land and water management).[56]

Inequality in the distribution of water resources and risks of shortage are contributing causes of tension and conflict between States. Let us take the situation of Syria prior to the beginning of the civil war in 2011.[57] When droughts are prolonged as a result of climate change, farmers may be forced to migrate to urban centres. This is especially true in situations where proper water governance and efficient irrigation systems are absent or weak. Likewise, the Darfur conflict, characterized by rivalry between local communities and tribes for access to arable land and water resources, is a prime example of such a relationship between water scarcity, migration and conflict.[58]

Not only can water be a cause of displacement, this resource may also be targeted during armed conflicts. There are significant examples—from the 2006 Lebanon war and the 2011 intervention by the North Atlantic Treaty Organization ('NATO') in Libya to the conflict in Syria—where the destruction of water supplies, sanitation systems and electrical facilities caused serious disruption and deprived the population of water supplies.[59] These cases illustrate that water may be used as a military strategy and it may be a 'victim' of wars.[60]

Given the possible impacts of armed conflicts on water, the provision of access to water, sanitation and hygiene (WASH) to refugees and displaced people is one of the highest priorities of UNHCR. Because of the cross-cutting and pervasive nature of access to water and sanitation services, the UNHCR put this issue at the heart of 1992 Water Manual for Refugee Situations and the 2008 Guidance for UNHCR Field Operations on Water and Sanitation Services. The field operations carried out by UNHCR and other humanitarian organisations such as the International Committee of the Red Cross contribute to the protection of the human right to water. This right must be respected both in times of peace and war. The principles and rules dealing with the protection of refugees and IDPs could reduce the risk of tensions due to the pressure over water and sanitation on the local environment. Similarly, international refugee law provides the protection of the rights of displaced population and local communities in their access to sources of water.

7.6.4 Conclusion

The existing international legal frameworks protect the rights of migrants but the norms are scattered throughout three main areas of international law: international humanitarian law, human rights law and international refugee law.

[54]T. Hagmann: Confronting the Concept of Environmentally Induced Conflict. Peace, Conflict and Development 6 6, 1–22 (2005).
[55]G. Hugo: Environmental Concerns and International Migration. International Migration Review, 30 1, pp. 105–131 (1996). F. Renaud, J. J. Bogardi, O. Dun, K. Warner (2007).
[56]J. J. Bogardi, F. Renaud, F.: Migration Dynamics Generated by Environmental problems, Proceedings 2nd International Symposium "Desertification and Migrations", Almeria, Spain, 25–27 October 2006.
[57]P. H. Gleick: Water, drought, climate change, and conflict in Syria. Weather, Climate and Society, 6, pp. 331–338 (2014).
[58]United Nations Environment Programme (UNEP): Sudan: Post-Conflict Environmental Assessment. Synthesis Report (UNEP, Nairobi, 2007).
[59]M. Tignino: Water During and After Armed Conflicts. What Protection in International Law? Brill Research Perspectives in International Water Law (1.4) (2016).
[60]Salamé, L., Swatuk, L., and van der Zaag, P., (2009) 'Developing Capacity for Conflict Resolution Applied to Water Issues', Chapter 6 in Blokland, M. W., Alaerts, G. J., Kaspersma, J. M., & Hare, M. (Eds.) Capacity Development for Improved Water Management, Taylor and Francis, London.

More can be done to strengthen the relationship between water and migration policies. First, migration should be integrated in legal frameworks on water. For example, by recognizing the need of pastoralists to move in times of droughts and environmental stress or, as has been done by some African states, by developing transhumance agreements that permit movements along traditional routes across international borders. Pastoralists in Africa often rely on traditional informal arrangements that facilitate cross-border movements to have access to water resources. Second, the water needs of migrants may be included implicitly in the interpretation and application of international instruments such as the UN Convention on the Law of the Non-Navigational Uses of International Watercourses. For example, a watercourse or an aquifer State should take into account 'the social and economic needs of the watercourse States concerned" and "the population dependent on the watercourse in each watercourse State' in determining the equitable and reasonable uses of a shared water resource. In light of this principle, a watercourse or an aquifer State should take into consideration migrants' needs when they determine the equitable use of transboundary water resources.

If more can be done, it is because migration in water policies is not explicitly arranged under current laws and treaties. In that context, a better understanding of the links between water and migration can be obtained from looking at more traditional types of migration in response to water stress. Pastoral livelihoods are a prime example of a livelihood that uses migration as a key element in a rural livelihood strategy. As an internal and cross-border issue, migration poses challenges to the traditional governance systems, as it needs to be addressed at all levels, local, national and international.

International law may strengthen the inclusion of migrants' rights in water management. The governance of fresh water is attracting increasing attention at the international level. The centrality of water resources governance to the international community's agenda is attested by the Sustainable Development Goals (SDGs). Moreover, in June 2015, the Organization for Economic Cooperation and Development (OECD) adopted the Principles on Water Governance. These instruments point out the centrality of principles on equitable sharing of water resources and the need to ensure their protection for future generations.

Because of the increasing number of conflicts and associated (forced) migration and due to the fact that migration is seen as one of the drivers of sustainable development (benefits of migration have been recognized by the Sustainable Development Goals (SDGs), especially under target 10.7), there is a window of opportunity in the current international arena for discussing and moving forward with migration policies, and integrating migration in water governance and vice versa.

7.7 Sovereignty, Fragmentation and the Limitations of International Water Law: The International Law Commission Draft Articles on Transboundary Aquifers

7.7.1 Introduction

Through the adoption in 2008 of Draft Articles on the Law of Transboundary Aquifers,[61] the International Law Commission (ILC) belatedly recognised the vital importance of groundwater resources in satisfying urgent human needs, as well as the distinct geophysical characteristics and unique vulnerability of such resources. After decades of neglect of international groundwaters by the international community, preparation of the Draft Articles offered the Commission an opportunity to contribute to the elaboration of a comprehensive and coherent body of international rules covering the utilisation, protection and management of all shared transboundary water resources. However, rather than promoting further convergence in this field around principles and approaches now firmly established in international water law, the Draft Articles as adopted create additional uncertainty and confusion. They would appear to take a regressive approach to the management of shared groundwater resources, which is less concerned with cooperative management than with facilitating the unilateral use of such resources by the aquifer States. The Draft Articles emphasise the territorial sovereignty of aquifer States in a manner that undermines the commitment to engage in equitable and reasonable utilisation of shared water resources on the basis of a distributive conception of equity.

This departure from the legal approach long established in respect of international watercourses would appear to be due in large part to a failure on the part of the Commission to fully consider the scope of existing generally relevant instruments, or to fully understand the distributive nature of the conception of equity residing at the very heart of international water resources law and informing every aspect thereof. The values underlying the traditional approach are based upon a recognition of the unique and total dependence of humans upon water, not alone in terms of immediate human survival, but also in terms of their economic, social, environmental and cultural human development.

[61] UN Doc. A/RES/63/124 (2009). See *Report of the International Law Commission on the Work of Its Sixtieth Session*, UN GAOR, 62nd Sess., Suppl. No. 10, UN Doc. A/63/10 (2008).

7.7.2 Fragmentation in International Law

The phenomenon of fragmentation in international law has long been recognised by expert commentators,[62] and has even been the subject of an in-depth study by the ILC in 2006, which concluded that 'fragmentation does create the danger of conflicting and incompatible rules, principles, rule-systems and institutional practices.'[63] It is understood to be a particular problem in the field of international environmental and natural resources law, which has seen significant treaty proliferation, as illustrated by the hundreds of multilateral environmental agreements (MEAs) adopted since the early 1970s. This has led to the creation of an extensive complex of cooperative inter-State institutions, some of which are rule-making in nature, as well as a broad range of rules on pollution abatement and remediation, on biodiversity conservation, and on related inter-State information-sharing and permitting procedures.[64] Koskenniemi traces fragmentation in international law to the practice, which is particularly prevalent in international environmental law, of delegating international legal standard-setting to take place 'within the framework of multilateral treaty law-making processes'.[65] Such "treaty congestion"[66] was always likely to create regime overlaps, regulatory lacunae and legal inconsistencies, especially when one considers the complex interactions between the rules of international environmental law and other fields of international law, such as international human rights law, international natural resources law or international economic (trade and investment) law.[67] One leading commentator has noted, for example, that.

> [t]he fragmentation of international environmental law arising from the creation of multiple regimes and institutions with similar or conflated regulatory mandates is extant, and has undoubtedly given rise to the risk of duplication, divergence, and even conflict between environmental standards and obligations.[68]

7.7.3 Fragmentation in International Water Resources Law

Unfortunately, it appears that the risk of legal fragmentation giving rise to such confusion, and even to conflicting normative requirements, also arises in the field of international water resources law.[69] While the international rules applying to international "watercourses", which are normally understood to include rivers and lakes which cross or form the territorial boundaries of States, as well as groundwater bodies hydrologically connected thereto,[70] is quite extensively developed and thoroughly codified, the law applying to transboundary aquifers is more nascent due to a dearth of international practice. There are barely a handful of instruments dedicated to the cooperative management of shared international groundwaters,[71] compared with over 400 agreements relating to transboundary surface waters.[72] To make matters worse, for a variety of historical reasons river basin agreements tend to completely ignore or only nominally address the issue of groundwater resources.[73]

[62]See, for example, M. Koskenniemi and P. Leino, 'Fragmentation of International Law? Postmodern Anxieties', (2002) 15 *Leiden Journal of International Law* 553–579.

[63]United Nations General Assembly, *Fragmentation of International Law: Difficulties Arising from the Diversification and Expansion of International Law (Report of the Study Group of the International Law Commission)*, UN Doc A/CN.4/L.682 (13 April 2006), at para. 14.

[64]See, for example, T. Stephens, 'Multiple International Courts and the "Fragmentation" of International Environmental Law', (2007) 25 *Australian Yearbook of International Law* 227; J. Ellis, 'Sustainable Development and Fragmentation in International Society', in D. French (ed.), *Global Justice and Sustainable Development: Legal Aspects of Sustainable Development* (Martinus Nijhoff, Dordrecht, 2010) 57–73.

[65]See F. M. Platjouw, *Environmental Law and the Ecosystem Approach: Maintaining ecological integrity through consistency in law* (Routledge, 2016), 99–120, at 106, citing M. Koskenniemi, 'International Legislation Today: Limits & Possibilities' (2005) 23 *Wisconsin International Law Journal* 61.

[66]'"Treaty congestion" is a term of art used to describe the problems of actual substantive treaty conflict, treaty obligation and objective conflicts, and procedural conflicts which arise as a result of the proliferation of international treaties in the past three decades.' See B. L. Hicks, 'Treaty Congestion in International Environmental Law: The Need for Greater International Coordination', (1999) 32/5 University of Richmond Law Review 1643–1674, at 1646. See further, D. Anton, '"Treaty Congestion" in Contemporary International Environmental Law', in S. Alam, et al.(eds.), *Routledge Handbook of International Environmental Law* (2012).

[67]See, for example, O. McIntyre, 'Substantive Rules of International Water Law', in A. Rieu-Clarke, A. Allen and S. Hendry (eds.), *Routledge Handbook of Water Law and Policy* (Routledge, London, 2017), 234–246, at 235.

[68]K. Scott, 'International Environmental Governance: Managing Fragmentation through Institutional Connection', (2011) 12 *Melbourne Journal of International Law* 1, at 4. See further, Platjouw, *supra*, n. 5, at 105.

[69]See further, O. McIntyre, 'International Water Resources Law and the International Law Commission Draft Articles on Transboundary Aquifers: A Missed Opportunity for Cross-fertilisation?', (2011) 13 *International Community Law Review* 1–18.

[70]Article 2(a) of the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses (New York, 21 May 1997), (1997) 36 *ILM* 22, in force 17 August 2014, defines a "watercourse" as.'a system of surface waters *and groundwaters* constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus' (emphasis added).

[71]See further, McIntyre, *supra*, n. 9, at 4–5.

[72]See, K. Mechlem, 'Moving ahead in protecting Freshwater Resources: The International Law Commission's Draft Articles on Transboundary Aquifers', (2009) 22 *Leiden Journal of International Law* 801–821, at 803.

[73]Mechlem, *ibid.*, at 804.

Nevertheless, when charged with codifying the international law applying to transboundary aquifers, the International Law Commission (ILC) appears, almost inexplicably, to have studiously ignored key elements of the established legal framework,[74] including even its own earlier work on international watercourses.[75] Despite the undoubted customary status of many of the requirements set out in the 1997 UN Watercourses Convention (UNWC),[76] the ILC's 2008 Draft Articles on the Law of Transboundary Aquifers make no reference to this or any other seminal instrument or codification[77] in the area international water resources law. Though there had been previous attempts to codify the field of international groundwater law[78] and to provide guidance on national measures,[79] these were not widely endorsed or followed by States. While the 2008 Draft Articles follow a similar format to the UNWC, they are in a number of significant respects radically different and arguably less progressive.

7.7.4 The Challenge of Scope and Definition

Problems immediately arise regarding the respective scope of application of the 2008 Draft Articles and the UNWC, as the latter purports to apply to groundwaters physically linked to shared transboundary surface waters.[80] This position has been clear since the adoption of the 1994 ILC Draft Articles on the Non-Navigational Uses of International Watercourses,[81] which formed the basis of the 1997 Convention. In conjunction with the adoption of the 1994 Draft Articles, the ILC also adopted a Resolution on Confined Groundwaters,[82] which made a clear distinction between groundwater 'related to an international watercourse', to which the 1994 Draft Articles and thus the UNWC apply, and 'confined transboundary groundwater', to which the Resolution would apply. In any case, the Resolution would commend States to be guided where appropriate by the principles set out in the 1994 Draft Articles, which were in effect the result of an exercise in codifying the rules of international water law over a period of more than 20 years. It is quite clear, however, that the ILC was not at this time focused upon groundwater and these arrangements did leave clear lacunae in coverage. For example, it appears that neither the UNWC nor the 1994 Resolution would apply to aquifers that are recharged solely from precipitation or that discharge either into the sea or into another aquifer. Such 'orphaned' resources included important groundwaters, such as the Rus Aquifer shared by Saudi Arabia and Qatar and the Mountain Aquifer underlying Israel and the West Bank.[83]

Therefore, in the 1990s the Commission had been concerned to ensure consistency and coherence in the rules of international law applying to both surface waters and groundwaters, whilst recognising that unique regulatory challenges might occasionally arise in the case of shared groundwater resources due to their particular hydro-geological characteristics. Also, by addressing the problem of 'regulating transboundary groundwater',[84] which appears sufficiently broad to include both 'related' and 'confined' groundwater, the ILC Resolution also appears to have tacitly acknowledged that it may not always prove easy to divide groundwater resources into these two mutually exclusive categories. The International Law Association had likewise sought to promote such coherence in adopting the 2004 Berlin Rules, Article 42 of which provides that the rules generally applicable to 'internationally shared waters' should apply to an aquifer that is either connected to international surface waters or that is unconnected to such surface waters but is intersected by the boundaries of two or more States.[85]

The 2008 ILC Draft Articles, on the other hand, define an "aquifer" as 'a permeable water-bearing geological formation underlain by a less permeable layer and the water

[74]Exemplified by the 1997 UN Watercourses Convention, *supra*, n. 10, then the only globally applicable international treaty instrument in the field of international water resources law. However, since opening up to global accession, the 1992 UNECE Water Convention constitutes another globally applicable framework convention relating to shared international freshwater resources, Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 17 March 1992, 1936 UNTS 269.

[75]ILC 1994 Draft Articles on the Law of the Non-Navigational Uses of International Watercourses, ILC, *Report of the International Law Commission on the Work of its Forty-Sixth Session*, II(2) *Yearbook of the International Law Commission* (1994).

[76]See, for example, the Commission's own endorsement of the customary status of the principle of equitable and reasonable utilisation as formulated in Articles 5 and 6 of the UNWC, *ibid.*

[77]A notable example of such an instrument would be the International Law Association's seminally important 1966 Helsinki Rules on the Uses of the Waters of International Rivers, International Law Association, *Report of the Fifty-Second Conference of the International Law Association* (ILA, Helsinki, 1966).

[78]International Law Association 1986 Seoul Rules on International Groundwaters, ILA, *Report of the Sixty-Second Conference of the International Law Association* (Seoul, 1986). See also, Chapter VIII on 'Groundwater' of the ILA 2004 Berlin Rules on Water Resources, ILA, *Report of the Seventy-First Conference of the International Law Association* (Berlin, 2004).

[79]UNECE 1989 Charter on Groundwater Management, UN Doc. E/ECE/1197ECE/ENVWA/12.

[80]See the definition of "watercourse" set out in UNWC Article 2(a), *supra*, n. 10.

[81]*Supra*, n. 15.

[82]*Yearbook of the International Law Commission,* 1994, vol. II (Part Two), at 135.

[83]See Mechlem, *supra*, n. 12, at 805–806.

[84]Resolution on Confined Groundwaters, *supra*, n. 22, para. 1.

[85]*Supra*, n. 18.

contained in the saturated zone of the formation',[86] which would appear to include both confined groundwaters and those connected to surface waters. The inclusion of "recharging aquifers",[87] "recharge zones"[88] and "discharge zones"[89] within the regime proposed under the Draft Articles very strongly suggests that aquifers connected to surface waters are included. While the ILC's Commentary to the 2008 Draft Articles acknowledges the danger of overlap with the general rules of international water law and highlights the need for clear priority in the case of conflict, the Commission failed to clarify the matter by declining to include in the final text the originally proposed Draft Article 20 on the relationship between the Draft Articles and other conventions and international agreements.[90]

Therefore, the 2008 Draft Articles give rise to systemic uncertainty regarding which set of rules ought to apply to transboundary groundwaters physically connected to a system of surface waters, quite apart from any scientific or legal uncertainty that might persist as to the nature, extent or adequacy of any hydrological connection between groundwaters and surface waters. Such uncertainty regarding the scope of application of the respective water resources regimes produces a number of unhelpful anomalies. For example, as they only apply to a "transboundary aquifer" or "transboundary aquifer system",[91] it would appear that the 2008 Draft Articles do not apply to an aquifer that is situated entirely within the territory of one State but contributes to the flow of an international watercourse. One would expect that such water resources would be included within the concept of an "international watercourse",[92] to which the UNWC or the general rules of international water law would apply. Commentators have noted the irony, in the light of the emphasis on the sovereignty of aquifer States under Draft Article 3, of exempting such "sovereign resources" from the *lex specialis* rules of the Draft Articles[93] and thereby ensuring that they remain subject to the more general international rules.[94]

It is beyond question that, during several decades of codification and elaboration of international water law, first of the ILC's 1994 Draft Articles and later of the UNWC, the drafters involved did not focus sufficiently, if at all, on the unique regulatory challenges posed by shared international groundwater resources. It is all the more regrettable, therefore, that the ILC's 2008 Draft Articles exacerbate the resulting legal uncertainty and confusion that have inevitably impeded inter-State cooperation regarding these vitally important resources.[95] Moreover, the 2008 Draft Articles mark a retreat from the integrative approach adopted under the ILA's 2004 Berlin Rules, which include an Article 6 on 'Integrated Management' and, more specifically, an Article 5 on 'Conjunctive Management' which provides that 'States shall use their best efforts to manage surface waters, groundwater and other pertinent waters in a unified and comprehensive manner'.[96] The Commentary to Article 5 explains that this provision expresses 'a duty on the part of States to participate in a system of conjunctive management' and notes broad international support for such a duty.[97]

7.7.5 The Spectre of Sovereignty

The key difference introduced by the 2008 ILC Draft Articles, and the one which can be linked to several of the other departures from the established paradigms of international water law, is the inclusion of an express reference to the sovereignty of aquifer States over the aquifer in a manner implying that this is the key guiding principle of the instrument. Draft Article 3 includes a strident articulation of territorial sovereignty, which is unusual in international water law. It is also worth noting that it precedes the provisions setting out the key legal principles traditionally governing this area,[98] thereby implying that such principles are subject to strict consideration of the requirements of sovereignty, whatever these may be. Draft Article 3 provides that

> Each aquifer State has sovereignty over the portion of a transboundary aquifer or aquifer system located within its territory. It shall exercise its sovereignty in accordance with international law, and the present draft articles.

Whilst it is self-evident that each aquifer State enjoys sovereignty over its respective portion of the geological formation within which shared groundwater is held, just as a watercourse State enjoys sovereign control over the portion

[86] Draft Article 2(a).
[87] Draft Articles 2(f) and 12.
[88] Draft Articles 2(g) and 11.
[89] Draft Articles 2(h), 6, 10 and 11.
[90] *Report of the International Law Commission on the Work of Its Sixtieth Session, supra*, n. 1, at 15–17. The proposed Draft Article 20 would have accorded clear priority to the provisions of the 2008 Draft Articles (or any resulting convention) over the provisions of the 1997 UNWC in the case of any conflict.
[91] Draft Articles 1 and 2.
[92] UNWC Article 2.
[93] Mechlem, *supra*, n. 12, at 809.
[94] C.G. Lathrop, 'Finding the Right Fit: One Design Element in the International Groundwater Resource Regime', (2009) 19 *Duke Journal of Comparative and International Law* 413–431, at 422–423.
[95] See further, S.C. McCaffrey, 'The International Law Commission Adopts Draft Articles on Transboundary Aquifers', (2009) 103 *American Journal of International Law* 272–293, at 274.
[96] *Supra*, 18.
[97] *Ibid.*, at 13.
[98] Draft Articles 4 and 5 set out the principle of equitable and reasonable utilization, usually regarded as the overarching and cardinal rule of international water law, while Draft Article 6 sets out the closely related obligation not to cause significant transboundary harm.

of the riverbed of an international watercourse falling within its territory, aquifer States would not normally be understood as enjoying exclusive sovereign rights over the transient water resources contained therein. However, read in conjunction with the Draft Articles' inclusion within the definitional scope of an "aquifer" of both the 'permeable water-bearing geological formation' and the 'water contained in the saturated zone of the formation',[99] Draft Article 3 clearly amounts to an attempt to exert national sovereign control over the shared water resources per se. While a geological element might certainly be subject to a form of territorial sovereign control analogous to property,[100] it would be more usual to regard the migratory natural resource as subject to a sovereign right to utilise, which would be limited by an obligation to consider the corresponding sovereign rights of other aquifer States.[101] These would be identified through the process of equitable balancing of related needs and benefits inherent to the principle of equitable and reasonable utilisation.

Of course, the Commission could have avoided this difficulty by providing separate definitions for an "aquifer", focusing on the geological formation, and for "groundwater" contained therein, along with parallel legal regimes for the sovereign control and protection of the functioning of the former, and for the utilisation and shared management of the latter. It is not at all clear why the ILC departed from this established practice,[102] whilst even expressly referring in its Commentary to the definition of an "aquifer" provided under the EU Water Framework Directive, which only includes the 'geological strata' and not the water contained therein.[103]

In contrast, the drafters of the 1997 UNWC, which at various stages included the ILC itself and the Sixth Committee of the UN General Assembly, had not found it necessary to reiterate the sovereignty of watercourse States over those portions of their national territory associated with an international watercourse. As regards any question of watercourse States enjoying sovereignty over the shared international watercourse, or the water resources contained therein, the UNWC takes a markedly different approach, providing instead that

> Watercourse States shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse.[104]

This provision epitomises the key difference in tone between the UNWC and the 2008 Draft Articles and demonstrates how the latter instrument lacks the nuance and subtlety inherent to international water law, requiring as it does a delicate consideration and balancing of the diverse interests of States located in different positions on a watercourse and/or characterised by different levels of dependence upon its waters. The 2008 Draft Articles' clear emphasis upon aquifer States' sovereignty over shared groundwater resources, with its implicit stress upon the narrow and short-term self-interest of aquifer States, appears to represent something of a retreat from the needs-based, distributive equity that is central to the principle of equitable and reasonable utilisation, and is thus so characteristic of the UNWC.[105] In fact, it appears inconsistent with the entire historical and conceptual development of this cardinal principle of international water law which, at its most basic level can be understood as a means of limiting, on the basis of the sovereign equality of States, the flawed application of absolute theories of territorial sovereignty in the particular and unique context of shared freshwater resources.[106] It

[99]2008 ILC Draft Articles, Article 2(a).

[100]The Commentary to the 2008 Draft Articles, *supra*, n. 1, at 39, notes the quite radical view expressed by certain States, and seemingly supported by the ILC, that.'water resources *belong* to the States in which they are located and are subject to the exclusive sovereignty of those States' (emphasis added).

[101]See, for example, the 1978 judgment of the Swiss Federal Court in *Argau v. Zurich*, quoted by S. C. McCaffrey, *The Law of International Watercourses* (2nd ed.) (OUP, Oxford, 2007), at 390, which suggests that, as regards the use of shared water resources, it is necessary, on the basis of the sovereign equality of States, for the normal exercise of sovereignty to be severely curtailed. See further, McIntyre, *supra*, n. 9, at 12.

[102]See, for example, Article 3 of the ILA's 2004 Berlin Rules, *supra*, n. 18, which defines "aquifer" and "groundwater" separately. See also, the Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters, Article 1, (1985) 25 *Natural Resources Journal* 715; the Bellagio Draft Agreement Concerning the Use of Transboundary Groundwaters, Article 1, (1989) 29 *Natural Resources Journal* 663.

[103]Directive 2000/60/EC, (OJ L 327, 22 December 2000), Article 2 (11).

[104]UNWC, Article 8(1).

[105]On the 'distributive' nature of equitable apportionment of quantum and uses of shared international water resources under international law, see O. McIntyre, 'Utilization of shared international freshwater resources—the meaning and role of "equity" in international water law', (2013) 38/2 *Water International* 112–129. See further, L. F. E. Goldie, 'Equity and the international management of transboundary resources', in A. E. Utton and L. Teclaff (eds.), *Transboundary Resources Law* (Westview Press, London 1987); J. Lautze and M. Giordano, 'Equity in transboundary water law: Valuable paradigm or merely semantics?, (2006) 17 *Colorado Journal of International Environmental Law and Policy* 89–122; V. Lowe, 'The role of equity in international law', (1992) 12 *Australian Yearbook of International Law* 54.

[106]See further, O. McIntyre, *Environmental Protection of International Watercourses under International Law* (Ashgate, Farnham, 2007), who explains at 76–78 that the principle of equitable and reasonable utilisation is based on the doctrine of "limited territorial sovereignty".

certainly runs counter to the spirit and intent of the related "community of interest" approach in international water resources law,[107] which has been endorsed consistently by the International Court of Justice (ICJ) in both the Gabčíkovo-Nagymaros[108] and Pulp Mills[109] cases, and can only be understood as a diminution of individual State sovereignty over shared water resources as 'it expresses more accurately the normative consequences of the physical fact that a watercourse system is, after all, a unity'.[110]

Concerns regarding the downgrading of the principle of equitable and reasonable utilisation, and the distributive equity values inherent thereto, are compounded by the particular formulation of the '[o]bligation not to cause significant harm' set out in Draft Article 6, which declines to include any reference to the payment of compensation in the event that the most equitable and reasonable accommodation of riparian States' interests nevertheless involves harmful use of the shared waters. Therefore, in contrast to the position under the UNWC,[111] it is not implicit under the 2008 Draft Articles that the principle of equitable and reasonable utilisation enjoys priority over the duty to prevent significant transboundary harm in the case of transboundary aquifers. This again conveys the impression that the Draft Articles are less concerned with distributive equity than with robust unilateral use rights based on territorial sovereignty, which, as with the analogous property rights to which the ILC's 2008 Commentary alludes,[112] would only be restricted to the extent strictly necessary under the *sic utere tuo* principle.[113]

The potentially regressive influence of the emphasis on sovereignty employed in the 2008 Draft Articles upon established patterns of equitable inter-State cooperation over shared water resources has been aptly illustrated by the 2010 Guarani Aquifer Agreement,[114] which cites the Draft Articles in its Preamble. The Agreement defines the "Guarani Aquifer System" as a 'transboundary water resource', thereby focusing on the water resources element rather than the geological formation, but reiterates that '[e]ach Party exercises sovereign territorial control over their respective portions'[115] after identifying the four aquifer States as 'the sole owners of this resource'.[116] This unhelpful language is strongly reminiscent of that employed in the 2008 Draft Articles and the associated ILC Commentary, and would appear to confirm the fears of one leading commentator in respect of Article 3 of the Draft Article, who observes that 'the first sentence of Article 3 lets the genie of sovereignty out of the bottle, and the second sentence cannot put it back in'.[117]

This apparent retreat from distributive equity as the overarching paradigm, in favour of a more assertive territorial sovereignty, is borne out elsewhere in the text of the 2008 Draft Articles. For example, the Draft Articles appear to place considerable emphasis upon natural, geophysical characteristics as a factor in determining an equitable and reasonable allocation of shared groundwater resources. Draft Article 5(1)(d) stresses 'contribution to the formation and recharge of the aquifer', which the Commentary explains 'means the comparative size of the aquifer in each aquifer State and the comparative importance of the recharge process in each State where the recharge zone is located'.[118] Whilst geophysical factors are listed first amongst those identified as relevant to equitable and reasonable utilisation

[107] See further, J. Gjørtz Howden, *The Community of Interest Approach in International Water Law: A Legal Framework for Common Management of International Watercourses* (University of Bergen, 2019).

[108] *Case Concerning the Gabčíkovo-Nagymaros Project (Hungary/Slovakia)*, (1997) ICJ Reports 7, para. 85, where the Court quoted from a seminal statement on the community of interest principle by the Permanent Court of International Justice in the *Territorial Jurisdiction of the International Commission of the River Oder* case, Judgment No. 16 (10 September 1929), PCIJ Series A, No. 23, at 5–46.

[109] *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, (ICJ Judgment, 20 April 2010), para. 281.

[110] McCaffrey, *supra*, n. 41, at 165, who further explains that.'[w]hereas the doctrine of limited territorial sovereignty merely connotes unilateral restraint, the concept of a community of interest evokes shared governance, joint action' (original emphasis).See further, McIntyre, *supra*, n. 46, at 28–40.

[111] In clarifying the relationship between the principle of equitable and reasonable utilisation and the duty to prevent significant transboundary harm, the ILC's 1994 Commentary to the Draft Articles on the Non-Navigational Uses of International Watercourses, supra, n. 15, states, at 236, that.'the State whose use causes the harm shall … consult with the State suffering such harm over … the extent to which such use is equitable and reasonable taking into account the factors listed in Article 6'.

[112] See *supra*, n. 40.

[113] It is instructive that Lathrop notes, *supra*, n. 34, at 423, in relation to internal groundwater resources, i.e. those located wholly within the territory of a single State, that.'Such sovereign resources, being fully excludable, are private goods. Their "ownership" structure most closely resembles private property: a single rights-holder … that is subject only to the omni-present rule of property ownership *sic utere tuo ut alienum non laedas*'.

[114] Guarani Aquifer Agreement (Argentina, Brazil, Paraguay, Uruguay), (San Juan, 2 August 2010).

[115] Article 2 (emphasis added). Though Article 3 does seek to qualify such unilateral sovereign control by providing that.'The Parties exercise in their respective territories the sovereign right to promote the management, monitoring, and sustainable utilization of the Guarani Aquifer System water resources, and shall use such resources on the basis of reasonable and sustainable use criteria, respecting the obligation of not causing significant harm to the other Parties or the environment.'.

[116] Article 1 (emphasis added).

[117] McCaffrey, *supra*, n. 35, at 291.

[118] *Supra*, n. 1, at 45.

under the UNWC,[119] any impression of the de jure or de facto priority of such factors has been emphatically dispelled by the very minor significance normally attributed in the practice of general international water resources law to such factors as the extent of a shared watercourse or drainage basin within the territory of a riparian State or its contribution to the river's flow.[120] In practice, priority has tended to be given to factors concerned with human and economic need and dependence, thereby stressing the distinctly distributive character of the equity involved. The 2008 Draft Articles actively stress those geophysical factors peculiar to transboundary aquifers, which suggests a less distributive approach more in keeping with the precepts of State sovereignty over, and property in, the groundwater resources concerned.

Similarly, the 2008 Draft Articles suggest something of a retreat from the intense procedural and institutional cooperation required to achieve the community of interest approach necessary to give meaning to the rather vague and flexible principle of equitable and reasonable utilisation and the distributive equity inherent thereto. Though Draft Article 15 on '[p]lanned activities' links any EIA to the procedures of inter-State notification, consultation, negotiation and independent fact-finding, as subsequently recognised by the ICJ in the Pulp Mills case,[121] and though Draft Article 7(2) clearly provides that 'aquifer States should establish joint mechanisms of cooperation', the Draft Articles provide considerably less detail about, and place less emphasis upon, procedural obligations than is the case with Articles 11–19 of the UNWC. This omission seems rather at odds with the Court's findings on the centrally important role of procedural rules for the general duty of cooperation and the key substantive obligations of international water law[122]—including equitable and reasonable utilisation, prevention of significant transboundary harm, and environmental protection—set out once again in the Draft Articles.[123] It suggests a recognition on the part of the Commission of the potential role of detailed legal requirements for inter-State procedural engagement in placing practical limits upon aquifer States' sovereign freedom of action.[124]

7.7.6 Conclusion

Even though the ILC's 2008 Draft Articles on Transboundary Aquifers are now highly unlikely to give rise to a generally applicable multilateral convention in this field, it is nevertheless unfortunate that the international community has been deprived of a long-overdue opportunity to clarify and rationalise the international rules applying to international groundwater resources in a manner that is coherent with the established rules applying to international watercourses. As a dedicated instrument specifically designed to address the particular challenges associated with the legal management of such resources, the Draft Articles undoubtedly provide helpful guidance concerning their cooperative utilisation and protection. However, with their emphasis upon the sovereign rights of aquifer States, the Draft Articles also represent a retreat from the established paradigm of distributive equity—a paradigm based on values likely to prove essential to ensuring effective inter-State cooperation regarding this essential resource as we enter an era in which the global freshwater crisis has come to be recognised as 'the new environmental crisis of the twenty-first century'.[125] In this context it is disappointing that the Commission failed to seize the opportunity to craft a legal framework for ensuring the conjunctive, and therefore optimal, management of shared international surface and groundwater resources.

7.8 The Discourse on Water Wars

7.8.1 Neo-Malthusian Rationale

The discourse on water wars is embedded in a Malthusian rationale, which focuses on the deterministic relation between physical water scarcity and conflicts, seeing a deterministic link between scarcity and increased population in explaining how water wars will be inevitable. Malthus mistakenly argued over two centuries ago that food production would not be enough to meet the needs of the growing population, and this would result in famine and deaths. Neo-Malthusians inform the discourse on water

[119]Article 6 of the UNWC on '[f]actors relevant to equitable and reasonable utilization' lists first, in Article 6(a),'Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character'.

[120]See A. Tanzi and M. Arcari, *The United Nations Convention on the Law of International Watercourses: A Framework for Sharing* (Kluwer Law International, The Hague, 2001), at 124; X. Fuentes, 'The Criteria for the Equitable Utilization of International Rivers', (1996) 67 *British Yearbook of International Law* 337–412, at 398–407; McIntyre, *supra*, n. 46, at 179–183.

[121]*Supra*, n. 49.

[122]*Pulp Mills, ibid.* See further, Owen McIntyre, 'The Proceduralisation and Growing Maturity of International Water Law', (2010) 22 *Journal of Environmental Law* 475–497, at 488–491.

[123]Draft Articles 4–6 and 10–12.

[124]See further, O. McIntyre, 'Sovereignty and the Procedural Rules of International Water Law' in T. Tvedt, O. McIntyre and T. Kassa Woldetsadik (eds.), *Sovereignty and the Development of International Water Law* (I. B. Tauris, London, 2015) 321–340.

[125]See E. Brown Weiss, *International Water Law for a Water-Scarce World* (Martinus Nijhoff, The Hague, 2013), at 1.

wars, and include new threats such as climate change. The assumptions behind scarcity are that natural resources are finite, limited, and scarce, emphasising environmental limits and absolute scarcity (Gleick et al. 2009). This neo-Malthusian approach emphasises the linear relationship between hydrological systems, climate patterns, population growth, and pollution on the available water resources, which are finite and limited (Linton 2010). The book *Limits to Growth* published in 1972 underlines the absolute scarcity and the environmental limits to growth, as the earth has physical limited resources to support the needs of human society (Meadows et al. 1972). If the thresholds are breached, this would result in the collapse of the world system (Meadows et al. 1972). The book highlights the necessity to limit needs and consumption patterns, and this is particularly important in today's society, which is driven by abundance that leads to never-ending needs and desires. Recent developments within this stream of literature are the concepts of anthropocene and of planetary boundaries, which are based on the belief that the growing population and the human activities are putting a further pressure on the Earth System, and this could cause irreversible changes to the climate and to the environment, ultimately resulting in catastrophic events (Rockström et al. 2009).

7.8.2 The Construction of the Discourse on Water Wars

Some scholars identified water scarcity as the main driver of water wars in semi-arid regions like the Middle East, suggesting the possibility for water wars in the Middle East (Lowi 1995; Gleick 1993). For these scholars, what is special about water, is that water is not only scarce, but also vital, a matter of national security, and demand is outstripping supply, making competition for the shared water resources leading, towards armed conflicts. Remans (1995) emphasised that the Middle East, South America, and South Asia are "well-known examples" of water wars, while Homer-Dixon (1994: 19)—studying the case of Jordan—concludes that "the renewable resources most likely to stimulate interstate resource war is river water", and Butts (1997: 72) notes that "history is replete with examples of violent conflicts over water", especially in the Middle East. Boutrous Boutros-Gali, former UN Secretary General, said that "the next war in the Middle East will be over water, not politics" (in Butts 1997: 65). Late King Hussein of Jordan identified water as the only issue that might lead Jordan to war with Israel. Water was symbolically described as the "blue gold", for which countries will be fighting for in the twenty-first century. The image of "blue gold" was first used by Barlow and Clarke (2002), but in the context of water privatisation and commodification. In the 1990s, mass media have extensively emphasised this idea of water wars, with titles such as "the water bomb", "water wars and peace", "Africa's potential water wars" (Sid Ahmed 1999; Adam 2000; Smith 1999).

7.8.3 Academics Supporting the Discourse

In 1984, Naff and Matson (1984: 181) started the academic discourse on water wars arguing: "water runs both on and under the surface of politics in the Middle East". Homer-Dixon had a central role in developing this discourse in academia, analysing several shared river basins looking for links between scarcity of water resources and armed conflicts. He concluded that "the renewable resource most likely to stimulate interstate resource war is river water" (Homer-Dixon 1994: 19). For him, "environmental scarcities are already contributing to violent conflicts in many parts of the world. These conflicts are probably the early signs of an upsurge of violence in the coming decades that will be induced or aggravated by scarcity" (Homer-Dixon 1994: 6). For Homer-Dixon, developing countries will not be able to adapt to the social effects of environmental degradation, consequently becoming more vulnerable to conflicts and wars over scarce water resources. In fact, scarcities of resources will lead to social unrest that can result in violent civil and inter-state conflicts. The development of this literature in academia led Amery (2001: 51) to refer to it as "the well-established and thoroughly documented positive link between resource scarcity and violent conflict". At the end of the past century, many others have also contributed to the academic research reinforcing the discourse on water wars, and linking scarcity of water resources with wars and armed conflicts. For Westing (1986: 9), "competition for limited [water resources…] leads to severe political tensions and even to war". For Trolldalen (1992: 61), "competition for both quality and quantity of shared water at a local level often leads to international water conflicts". Water scarcity as leading to water wars was picked up and developed also by the scholars and practitioners working on strategic studies (Sherk 1999), as Samson and Charrier (1997: 6), who suggested that "growing conflict for increasingly scarce water resources looms ahead". In the 1990s, this discourse on water wars was captured also by several administrations and governments, who believed that water scarcity represented a potential threat for their national security. As reported by Floyd (2010: 75–76), Homer-Dixon has briefed in several occasions the US State Department on the threat of potential water wars. Measures taken by the US administration included the creation in 1993 of the new governmental position of Deputy Under Secretary for Environmental Security in the Defence Department. For Ohlsson and Turton (1999) the relevant question became quantitative: what is the

threshold of water scarcity? This question pushed engineers and hydro-geologists, pioneered by Falkenmark, to research the idea of water stress threshold and indicators of water scarcity (Falkenmark et al. 1989).

7.8.4 Limits of the Water Wars Discourse

The discourse on water wars was viewed as an unfounded hyperbole by several academics, as the empirical evidence linking water scarcity and armed inter-state conflicts was not straightforward (Allan 2002; Alam 2002). Homer-Dixon has recognised that he overstated the deterministic approach adopted for his analysis of hydropolitics (Homer-Dixon 1999: 139). He (1999: 139) admitted that the story is more complicated than it appears:

> In reality, wars over river water between upstream and downstream neighbours are likely only in a narrow set of circumstances: the downstream country must be highly dependent on the water for its national well-being; the upstream country must be threatening to restrict substantially the river's flow; there must be a history of antagonism between the two countries; and, most importantly, the downstream country must believe it is militarily stronger than the upstream country. Downstream countries often fear that their upstream neighbours will use water as a means of leverage. This situation is particularly dangerous if the downstream country also believes it has the military power to rectify the situation.

Nevertheless, it has to be noted that even when he changes his mind and tries to correct his statement, his explanation is still narrow-minded. In fact, he apparently had a case like the Nile's in mind and it is very well known that the geographic, political, socio-economic and hydrological setting of the Nile (or similar basins) are not the same around the world. Delli Priscoli (1998) underlined that the discourse on water wars has been conducting towards misleading conclusions with extensive speculation rather than sharp analysis. In particular, Allan (2002) developed the concept of virtual water, meaning the water necessary to produce any good or service, such as food. For Allan, importing one kilo of cereal meant importing the corresponding amount of water used to produce it. For him, food security does not necessarily mean food self-sufficiency. In this way, Allan (2002) explained through the concept of virtual water trade why there have not been water wars in the Middle East—as in this region over 60% of water is used for irrigation.

Water conflicts scholars from the International Peace Research Institute have also showed that the discourse on water wars has not solid empirical evidence (Toset et al. 2000). The discourse on water wars has also been criticised for overlooking whether other variables could be the real causes of conflicts where there is water scarcity. For instance, Smith (1994) argues that in the Senegal River conflict, ethnic and class reasons were more important than natural resources as drivers of the conflict. For Levy (1995: 45), general poverty rather than water scarcity is the main driver of conflict in the cases considered by Homer-Dixon, who focused only on developing countries. Moreover, Brown and Mcleman (2009) suggest a correlation between underdevelopment, lack of democracy, and conflict rather than with water or natural resources scarcity. Gleick (1994) has also questioned the fact that conflicts over water are a new phenomenon. Some scholars have argued that water scarcity can be an opportunity for water peace rather than wars (Salehyan 2008; Reuveny 2007; Nordås and Gleditsch 2007).

This claim is further supported by the work of the Oregon State University, led by Wolf, who analysed transboundary water interactions in the past 50 years, finding no instances of water wars, and showing that there have been more cases of cooperation (Wolf 1998). In other words, Wolf (1998) proved that the number of cases of water conflicts over shared water resources is minimal compared to the instances of transboundary cooperation. However, Wolf's idea of a continuum of cooperation or conflict has been criticised by the recent critical hydropolitics literature, developed by the London Water Research Group. This critical hydropolitics literature has focused on cooperation and conflict over shared water resources and Zeitoun and Mirumachi (2008) critically examine the role of treaties, which are often seen as a positive example of cooperation. They argue that cooperation is not always good, as treaties can codify an existing asymmetrical status quo, and treaties can also become the subject of the conflict. Zeitoun and Mirumachi (2008) developed the Transboundary Water Interaction Nexus (TWINS) matrix to analyse the nature of conflict and cooperation between riparian states over shared water (Zeitoun and Mirumachi 2008). In this way, they go beyond the idea of a continuum of conflict or cooperation, emphasising the co-existence of conflict and cooperation. They also show the nuances of conflict and cooperation, as there are different degrees of cooperation and of conflict, and not only armed conflicts.

7.8.5 Critics to the Assumption of Water Scarcity

The discourse on water wars has been criticised also for its assumption of water scarcity. In fact, the literature that looks at the politics of scarcity challenges the neo-Malthusian understanding of scarcity and its assumptions, seeing the problem in the way that scarcity is conceptualised. This literature focuses on issues of access to natural resources,

emphasising power asymmetries, and access to water. For this literature, the mainstream discourse of water scarcity is used to justify certain projects and interventions, like dams and mega-projects, silencing discussions about alternative solutions. These solutions are often engineering or market-oriented solutions, which overlook the socio-economic problems within water scarcity, often proving tragic results for the urban poor communities. This is shown by Shiva in the case of India (Shiva 2002) and Perreault in the case of Bolivia (Perreault 2006). Scholars within this critical body of literature have shown how the discourse of water scarcity is deployed to support the political agendas of the states. Swyngedouw (1999) and Bakker (2002) analysed the case of Spain, showing how the state deployed this discourse to justify huge infrastructural projects; Alatout (2008) showed how it was used to justify the huge infrastructural projects and legitimise the building of Israel; Edwards (2013) shows the deployment of the discourse of water scarcity by powerful actors to support market-oriented reforms, Hussein (2016, 2017a) shows how the discourse of water scarcity is constructed in Jordan to drive towards supply side solutions, legitimising in particular the construction of the Disi water conveyance (completed in 2013) and the on-going Red Sea Dead Sea Canal project (Hussein 2017b, 2018).

For this critical approach the issue is in the inequitable institutional and governance arrangements. As emphasised by Mehta (2010: Chap. 1), the key issue is not about the availability of a resource, but rather about who has access in an adequate quantity to it, which is the outcome of political processes and decisions of inclusion and exclusion, which could be linked to the price of water, to the lack of infrastructures, or to social exclusion. The attention should be on who primarily benefits by the sanctioned solutions and improved efficiency. It should also be on who is marginalised from these solutions. It is argued that the increased benefits will be privatised and go to those in the powerful class, while the poor will be further marginalised, if judicious re-distributive mechanisms are not adopted (Allouche et al. 2015: 616). Solutions should therefore be on dismantling the institutional barriers that cause discrimination and inequalities. Clear examples of structural inequality and distribution in the water sector come from: the West Bank, where it has been argued that water scarcity is an issue of structural discrimination against Palestinians and privileged access to water to illegal Israeli settlements; in apartheid South Africa, where inequalities based on discriminatory policies were extensive also in the water sector (Movik 2012); and in India, where access to certain wells is denied to so called lower caste women (Singh 2006). Nevertheless, in the scarcity discourse, efficiency arguments prevail on equity arguments, and neo-Malthusians arguments are enriched by the scarcity concept. For Mehta, it is necessary to consider who is consuming what and for whom are the limits. Scarcity is for Mehta "a crisis of unequal power relations" for the control of water resources (Mehta 2005: 4). Mehta argues: "this naturalization of scarcity […] largely benefits powerful actors. Thus, water 'crises' must also be seen as the crisis of skewed access to and control over a finite resource" (Mehta 2005: ix). Mahayni emphasises that the hegemonic scarcity discourse neutralises factors like inequitable access to natural resources, which need to be addressed to solve the scarcity issue (Mahayni in: Harris et al. 2015). Mehta explores the meanings and experiences of scarcities, as the hegemonic framing tends to present scarcity as a singularised problem, overlooking the diversities within it. This results in the hegemonic framing overlooking regional differences within the same country, or cyclical variations over time. Also Lankford shows the necessity of moving beyond the volumetric in order to solve the issue of water scarcity, underlining the need for water distribution among its users and of water equity (Lankford in Mehta 2010: 195–196). As shown, this critique undermines the main assumption of the discourse on water wars: water scarcity. This literature shows the necessity to investigate issues of access and equity rather than simply of quantity and of balance between supply and demand. It also showed that at the sub-sovereignty level (social) power relations matter most and not the water war scenarios. In fact the water and violence discourse should be carried out along these different scales showing that two farmers who may have to share a well which is the only source of water may kill each other but the same simplistic reaction is gradually vanishing as we move towards larger scales where options and trade-offs and bargaining space "automatically" grows.

7.9 Decision Making Under Risk and Uncertainty: Approaches from Dispute to Cooperation in Transboundary Basins

7.9.1 Introduction

Water systems crossing national boundaries make riparian states of any shared basin connected in a complex network of environmental, political, economic, and security interdependencies. Meanwhile, water insecurity is emerging, in various forms, as a massive challenge for the global community. Transboundary basins where each riparian state has its own agenda filled with ambition, preferences, challenges, and threats, thus need "smarter" governance (Rogers et al. 2010). National boundaries make water issues political, and so the sensitivity and complexities of transboundary water management multiply (Moller 2005).

As water availability decreases due to population growth, together with the trend in water demand, tension and competition over secure access to this limited resource, will increase (UN Water 2013a). Maintaining stress-free relations between states is crucial to ensure water availability for human, economic, and environmental necessities. Although many international water agreements have been signed throughout history, the way countries manage emerging pressures around water in order to avoid further conflicts, is often not clear. The complexity of governance arrangements mirrors the complexity of interactions among population growth, economic and political aspirations, geographic factors, and uncertain climatic conditions for transboundary cooperation over shared waters. Given its size and scale, the challenge calls for a practical, case-specific, and dynamic governing framework. Such a framework would bring together actors from across a range of sectors and allows them to work pro-actively and address these interrelated issues (Josef and Kipping 2006). For doing so, we need to understand how power is exercised in the governance of waters, how decisions are taken and implemented, who the stakeholders are, and what incentives they face in a transboundary context (Harris and Booth 2013).

Water is crucial for security. It has become an essential element not only in the fight against poverty but also in the context of peace and political stability (see Sect. 7.3). While there is a potential for dispute, transboundary basins provide significant opportunities for international cooperation leading to economic growth, sustainable development, and security (Sadoff and Grey 2002). Contemporary transboundary water management is a process of sharing water among different allocation arrangements, distributing benefits assigned to such allocations, and consistently resolving conflicts among involved stakeholders. While cross-border cooperation is linked to many other political factors and international relations considerations, experience evidenced that a resource as treasured as water can be a catalyst for cooperation rather than conflict when it is shared (Dinar 2007; Wolf 2007). Transboundary water-related challenges force governments and other stakeholders towards closer collaboration to safeguard the availability of adequate water, and ensure that appropriate measures are taken in the interest of water security (Islam and Susskind 2013). Water security discourse is dealt with in detail in Chap. 8.

Across the world, hundreds of agreements have been signed in the course of history, and even hundreds of institutions have been set up to manage water equitably and sustainably. Globally, 153 countries share rivers, lakes, and aquifers, and 592 transboundary aquifers have been identified by UNESCO's International Hydrological Programme to date, which is home to more than 40% of the world's population. However, only fewer than half of the world's transboundary basins are subject to any kind of formal agreement outlining how the resources are to be shared and managed cooperatively (Granit 2010). Although the number of transboundary water disputes in the last 70 years was not significant, much work is necessary in order to reach peaceful and functioning agreements. Since 1948, 37 conflictive incidents of acute intensity over water occurred, 295 international water agreements were signed, including the UNECE Water Convention and 116 river basin organizations that were established reflecting different levels of transboundary cooperation through institutionalized cooperative practices (Schmeier and Gerlak 2014).

In bringing together diverging interests of riparian states, one creates a space of mutual economic interdependence, which can enhance interest in collaborative management through legitimate agreements. Transboundary river agreements also act as capacity building measures to boost social and economic cohesion in a region and, by extension, peace, and security in the long-term (IWA 2015). Nevertheless, such agreements must be flexible in nature. They should capture future uncertainties with foresight while resolving contemporary water-related issues. For example, even though the Indus water treaty is a successful cooperative transboundary water management agreement between India and Pakistan, it does not provide for environmental changes. As such, current climate change events may put the past successful institutions at risk (Zawahri 2008). Such agreements must be revisable and flexible in order to evolve and to adapt to external spurs, whether these are variations in the ecosystem, climate, or socio-economics or population growth. Reaching an agreement on how to share transboundary water resources requires concerned stakeholders to identify mutual benefits and costs, as well as potential areas where their interests converge and then, develop mechanisms to secure them over time (Motlagh et al. 2017).

7.9.2 Moving from Conflict Towards Cooperation

A move from single-purpose to the multi-purpose planning of a river basin is necessary to capture the full range of potential benefits such as hydropower, irrigation, industries, navigation, fisheries, etc. Phillips et al. (2006) indicated that joint development of shared water resources could provide additional benefits to all riparian countries by enhancing economies of scale, increasing planning horizons, bringing efficiency, reducing costs, and attracting the investments required for water resource management.

In any water system, cooperation is formed as stakeholders aim to develop and sustain a good relation towards reaching a satisfactory output (Mostert 2003). Stakeholders cooperate when the perceived net benefits of cooperation are more significant than that of individual actions, and when the

distribution of the expected benefits seem reasonable (Phillips et al. 2006). The higher the perceived and potential gains are, the better is the chance of success for mechanisms to promote cooperation in water management. A secure water future is likely to stem from some level of cooperation in transboundary management. Results may materialize in the shape of information sharing alone, or along with coordinated arrangements in the form of partial collaboration. Furthermore, in better cases, it can even result in joint actions (such as joint infrastructure development). In all cases, an apt joint institutional mechanism should be in place (Sadoff et al. 2015).

UNDP (2006) stated that the prevention of water conflicts could not be achieved without adequate cooperation in managing those waters through robust and equitable structures and institutions for collaboration at national and international levels. This cooperation should not be seen as a goal per se, but rather as an essential instrument to meet the objectives of each riparian country, improve water governance and, attain noticeable progress towards regional security and sustainable development (Leb 2015). Through collaboration, riparian states can collectively develop a better understanding of water governance challenges associated with climate change. They can then work together towards sustained wellbeing in the long-term and how it may be enriched in practice (Madani and Hipel 2011).

A fundamental shift in the way we manage our transboundary waters is urgently needed to avoid any form of conflict. One of the primary objectives of transboundary water management is the identification of potential cooperation areas. This can happen through the establishment of common platforms allowing for the development of frameworks, which in turn help decision makers understand and mitigate the risk of conflicts. Conflict prevention and resolution are highly political processes in which politicians make decisions on resource use. On the other hand, political structures in riparian countries, as well as hegemony and power asymmetries among them, affect related arrangements significantly (Chikozho 2015). According to Earle et al. (2010), political borders divide transboundary basins; politicians make decisions on transboundary water resources, and political structures in each riparian country shape the status of transboundary water management in a unique way. In other words, the management of transboundary waters is heavily influenced by 'hydro-politics,' and this must be considered when aiming at achieving cooperation with the ratification of agreements at basin level by all riparian states (Kim and Glaumann 2012).

Literature analysis suggests that transboundary river basins are characterized by profound economic and political asymmetries among their riparian countries; these asymmetries shape the nature of cooperative arrangements as well as some of the constraints that may emerge. Zeitoun and Mirumachi (2008), propose an analytical method helping transboundary water initiatives respond to power asymmetry. They note that the most dominant riparian is often able to direct the outcome of any interaction with neighboring states towards its own benefit and gains. There are two possibilities to counter such situations: either find ways to strengthen the weaker actors or level the playing field for cooperation through facilitation and considerable incentives.

The co-existence of conflict and cooperation is key in addressing challenges raised by differing interests of a multitude of stakeholders who happen to be users of a common pool resource such as shared waters. Adding political factors to cooperation processes makes the terrain for basin-wide negotiations more complex as it adds different perceptions and expectations of decision makers to negotiation processes (van Laerhoven and Andersson 2013). A set of power relations among riparian actors shapes transboundary water management, which in turn may impact coexisting conflict and cooperation over the same waters. Often cooperation is measured against the existence of river basin organizations, the willingness of states to take part in joint actions, or against the presence of multilateral agreements that reflect political power and embed national interests (Ravnborg et al. 2012). When power asymmetry becomes challenging for cooperative actions, one way to influence would be to conceptualize and derive positive-sum outcomes, promoting "win–win" options to the satisfaction of all parties. Assuming that conflict is the lack of cooperation, quantitative studies helpfully led us away from the threat of 'water wars' suggested by environmentally determinist approaches (Fröhlich 2012).

Even though transboundary water issues are complex, it has been proven that water disputes can be mediated through diplomatic mechanisms, equitable benefit-sharing strategies, as well as the development of human and institutional capacities. These can indeed support regional cooperative strategies and allow for the prevention of adverse effects of unilateral measures (Sechi and Zucca 2015). This section focuses on water diplomacy as a capacity building mechanism for transboundary cooperation. In Sect. 10.5 the role of economic instruments to enhance transboundary water cooperation is discussed.

The effectiveness and sustainability of cooperative arrangements are more important than the number of agreements concluded between states in a basin or the presence or absence of a basin management organization. In general, when agreements which address the systematic complexity of the hydrological conditions, and provide a platform for a dynamic negotiation process are in place, the cooperation is likely to be successful in the long-term (De Stefano et al. 2012). Through the cooperative development of water resources, current tensions between riparian

countries can be reconciled through political will and bring economic, environmental, and social benefits to all states. With the proper perspective, transboundary water resources can, therefore, become a source of regional cooperation, peace, and security.

7.9.3 Establishment of Transboundary Cooperation

Cooperation comes in various forms, ranging from the initial level of communication to joint action and investment (Sadoff and Grey 2002). Similarly, there are different types and levels of incremental benefits, such as economic, environmental, social, or political ones. Practical cooperation can range from relatively easy data sharing and hazard warning protocols to fully integrated approaches to developing and co-managing basin-wide transboundary waters. The continuum of cooperation can be conceived from unilateral and independent action towards coordination and collaboration to joint investment and management of development projects (De Man 2016).

Cooperative actions are often discouraged by inaccurate information and lack of transparency, but this could be changed with more credible information sharing and trust-building techniques (Wouters 2013). A reliable database of water availability, allocation, and consumption, which includes meteorological, hydrological, and socio-economic data, is a fundamental tool for informed decision making. According to Zeitoun and Mirumachi (2008), cooperation and regional agreements over water must satisfy several initial conditions. For instance, due to the impending influence of sovereignty on treaty formation and cooperation in general, cooperative arrangements need to be "rational" for concerned individuals as decision makers. The idea of individual rationality presumes that countries decide independently whether to participate in a transboundary cooperation and negotiation process; their ultimate aim being to maximize their individual benefits in any possible manner. The direct and indirect spectrum of benefits of cooperative actions indeed often affects the level and quality of cooperation.

Comprehending the hydrological processes and synergies of a river in its upstream–downstream linkages is the basis for problem-solving in the basin. It serves as an appropriate input for effective and efficient planning of cooperative management strategies at the international level (Eynon 2016). Therefore, investigating and understanding upstream–downstream linkages of hydrological, social, and environmental processes, facilitate river modeling and data sharing among riparian states. Satisfactory incentive-compatible options can then be jointly found (Harrison 2006). Technically and economically focused analysis of linkage identification can, however, not fully match real-world complexities due to the overarching political issues and frameworks. Different tradeoffs between benefits, on the one hand, and subjective values such as ethics and fairness, on the other hand, are difficult to associate (Yang and Wi 2018). Nexus research in a transboundary context helps reveal the resource and economic wins or losses for a riparian state, resulting from unilateral acts of another riparian state. In the case of dams, for example, assessing the impact of different operation modes based on the interest of the operating country gives insights into which choice is most beneficial for the neighbors' national interest in terms of resources security, and hence economic benefits.

7.9.4 Water Diplomacy Framework

Diplomacy is a tool frequently used within the consensus-building framework globally. It can be understood as a process of individuals coming together to build mutual understanding and trust across their differences, and generate constructive outcomes through dialogue (De Man 2016). Those outcomes include building or strengthening mutual trust, quality communication, and understanding across differences, expanding participation around relevant issues, jointly analyzing a problem or context, and developing a cooperative agenda for action (Motlagh et al. 2017). Addressing transboundary water conflicts is a core purpose in water diplomacy, rooted in international relations. Water diplomacy methods are therefore expected to play an increasingly important role in preventing, mitigating, and resolving the growing number of water-related conflicts and, create room for more extensive cooperation.

Water diplomacy applies the principle of diplomacy, where agreements are negotiated to advance common agendas among actors. However, it is marked by several significant shifts, both in the substantive content of what is negotiated and who is involved as well as in practice or means of conduct (Zandvoort et al. 2018). Water diplomacy is not understood as the adoption of an agreement only. It incorporates all phases of the negotiation, along with the implementation of related policies, decisions, and programs. Beyond 'water-centric' thinking, key sectors, actors, and institutions across the water, energy, food, and environment domains can be identified, their synergies exploited, and tradeoffs evaluated to achieve overall environmental sustainability goals (Kibaroglu and Guersoy 2015).

Islam and Susskind (2013) defined water diplomacy, which also refers to as hydro-diplomacy, as all methods of interaction between non-state and state actors and the involvement of at least one international governmental organization to practice communication aimed at avoiding

hostility. The Water Diplomacy Framework developed by Islam and Susskind in 2013 is an interesting one among many other similar frameworks. It suggests the implementation of a negotiated approach to managing complex water-related problems. It builds on the concept of using mutual gains and negotiated approaches in transboundary disputes. It also recommends, overcoming the historical zero-sum orientation in favor of the pursuit of innovative resolution of water issues at the basin scale. Water diplomacy approaches may use technical methodologies and assessments as entry points. It is, however, equally important to engage politically with the highest levels of government representatives from the beginning of the process. To secure political "buy-in", they have to be fully aware of the process from the start (Alaerts 2015).

According to the traditional understanding of diplomacy, international relations are focused on the states as their main actors. Transboundary cooperation is then primarily applied to government-to-government collaboration. This mode of arrangements among officials and state actors is considered as formal diplomacy. It takes place over a formal process of negotiation (Barua 2018); and cooperation is determined by the political attitudes of riparian basin states. On the other hand, informal diplomacy is referred to, as commencing dialogue among non-state, non-official actors, to build relations, resolve conflict, and build trust, based on agreed agenda and responsibilities.

However, the concept of formal and informal diplomacy has been transforming during recent decades. The multi-track water diplomacy framework has emerged. It stages various stakeholders within the water governance framework to ensure basin-wide water security at multiple scales. This framework is an effective mechanism to support the identification, communication, and resolution of water-related problems across sectors and administrative boundaries, at different levels of governance and decision making processes (Huntjens et al. 2017). When the multi-track diplomacy framework is applied to the water diplomacy notion, many actions, and initiatives—beyond river basin politics and transboundary water agreements—become relevant.

Effective water diplomacy methods need to be flexible enough to respond to different political landscapes and climate changes at global, basin-wide, and national scales. Water-related diplomatic procedures take place in an informal context with non-state actors or sometimes with official actors in informal positions. Water diplomacy tracks and tools such as various dialogue mechanisms and communication techniques, joint fact-finding missions, joint scientific, value-creating method, and mutual gain tactics need to be more accessible to experts, practitioners, and foreign policy actors and stakeholders to work together more effectively (Susskind 2017). Islam and Susskind's water diplomacy framework recommends that a neutral facilitator is hired to conduct a stakeholder assessment. Agreeing to share a resource requires the mediator to be involved in the identification of bilateral as well as mutual costs and benefits, while devising the instruments of securing the benefits and minimizing the costs. In this study, we focus on three main analytical tools of water diplomacy.

7.9.4.1 Multi-stakeholder Participation

Transboundary water management in many countries is characterized by overlapping and competing responsibilities among government bodies at the national and international levels. Disputes often arise when management decisions are formulated without sufficient participation by local communities and water users at all scales, failing to take into account social rights and practices (Susskind 2017). Political willingness for cooperation is essential, and institutions and stakeholders on each side of the border should exchange data and information and develop joint plans for water resource management. After initiating communication and interaction platforms for identified and relevant stakeholders, the objective of the diplomatic approach is to promote the necessity to increase engagement into the negotiation process towards win–win outcomes. Stakeholders of a shared waterbody can belong to one of these groups: governments (national, provincial, municipal), businesses, academia, NGOs (national and international), communities (farmers, urban residents, and locals) (van Rees and Reed 2015).

Stakeholder-centred vision and learning focus on adaptive management of water resources are significant factors to improved management and allocation of water resources (Song et al. 2016). Through tactics introduced by the Water Diplomacy Framework, stakeholders are encouraged to move beyond their initial positions regarding interests, values, and practice and to come up with innovative ways of compensations and value creations. They are encouraged to find common interests and accommodate the needs of all involved parties (Islam and Susskind 2013). Stakeholders' involvement is an on-going, long-term effort that adapts to the conditions, needs, and dynamics of the cooperation process. The notion that stakeholders should be given the voice in the management of their water resources is one of the motives for cooperation, and the key is to ensure that all stakeholders see the benefit of their involvement and know their voices are heard.

The context includes the geo- and biophysical, hydrological and socio-economic factors which shape the interests, discourses and institutions (drivers) determining stakeholders' behavior, and the relationship between them in terms of power asymmetries and politics. The inclusiveness of their participation is also influenced by the tools available to them, such as access and participation in decision making on transboundary water and nature governance, technical capacities, and skills. Interactions between actors, then, lead

to specific decisions related to transboundary water governance, which in turn have an impact on water allocation, water pollution, and environmental sustainability.

A number of factors can enable better nexus governance. These are for example the acknowledgment of shared understandings between different stakeholder groups based on their level of interaction and relation, the setting of flexible policy boundaries, the enhancement of knowledge-based dialogues, and the introduction of capacity building plans such as joint training, human skill-building strategies, and institutional capacity development practices.

7.9.4.2 Value Creation in Negotiations

In the negotiation over transboundary waters, value creation to increase mutual gains from cooperation may happen in numerous ways based on the characteristics of each transboundary basin. In general, involved stakeholders look for opportunities to achieve an agreement that is mutually advantageous for all. It requires negotiators to think of tradeoffs in which each gets their most fundamental interest met, in exchange for helping the other sides to achieve their topmost priority (Susskind 2017). At the beginning of a mutual gains negotiation, stakeholders must be reminded that it is in their common interest to engage in the creation of additional values to be added to already existing ones, before determining who gets what and how much. The more value is generated, the higher the chances are that all stakeholders will exceed their BATNA[126] and thus find a mutually beneficial and satisfactory outcome.

Cooperation among stakeholders emerges as a voluntary arrangement to engage in a mutually beneficial exchange instead of competition over a shared resource. The likelihood of cooperation is greater where resources are adequate, and the benefit of cooperation expanded beyond unilateral actions. Zero-sum thinking emerges when people think of water as a fixed and limited resource (Vetter 2016). The value creation technique focuses on positive-sum, or mutual gain approaches during interest-based transboundary negotiations, by challenging old-fashioned thinking about exclusively resource-focused water management. There are three assumptions: (1) water is a flexible, not a fixed resource, (2) science, policy, and politics combine to create water networks, (3) water networks are complex. They need to be treated as open-ended and unpredictable rather than closed and predictable systems. These three fundamental assumptions embedded in the Water Diplomacy Framework have significant consequences on the way water disputes solutions are addressed (Islam and Susskind 2013).

One of the underlying principles of the Water Diplomacy Framework is that water is a flexible resource in availability, and riparian states need to use this insight to expand the probability of conflict resolution. It helps riparian countries shift their focus away from allocating fixed quantities of water, towards the "water flexibility" concept. It gears their thinking way from the competitive perception of shared waters, towards the advantages of allocating the benefits of cooperative water resources management (Islam and Susskind 2013). Through a mutual gains approach, countries can brainstorm options to expand the supply and accessibility of water through conservation, wastewater recycling, technological advances such as desalination, and by imagining new agricultural or industrial processes to use water more efficiently. They thereby free up more water for other purposes. Based on such assumptions, diplomats often focus on what share of the existing water will be given to whom, while the way how benefits will be shared derives from cooperative development actions (Huntjens et al. 2015).

7.9.4.3 Joint Fact-Finding

According to the Water Diplomacy Framework, the root of many complex water-related challenges lies at the intersection of multiple causal forces in observational signatures with often conflicting perceptions and values related to decision making. The issue is about determining who decides, who gets water, how and how much? In such conditions and with such concerns, neither numbers nor narratives will resolve the dilemma to reach a satisfactory solution. One way to address complex water problems is to reframe them as a joint decision making activity starting from the problem's identification, through innovation, and implementation. Shared gains opportunities can then generate politically legitimate strategies and projects, based on science with stakeholders' active participation. In other words, rather than merely sending information back and forth, the Water Diplomacy Framework would encourage riparian states to collaboratively, through information collection and research, assess benefits, values, and shared interests, conduct feasibility studies and, develop a basis to address their outcomes and expected results (Islam and Susskind 2013).

Joint fact-finding is a collaborative process allowing for strategy-setting given resolving disputes and addressing cooperation obstacles by jointly gathering and analyzing scientific or technical data. Such fact-finding strategy can be delegated to a group of experts, policymakers, and stakeholders form each riparian state, often managed by a professional facilitator, to depoliticize the situation and discourage states from censoring information on national security-related issues (Warner 2007). Such transparency in

[126]BATNA in negotiation theory refers to the Best Alternative to a Negotiated Agreement or the most advantageous alternative course of action a party can take if negotiations fail and an agreement cannot be reached.

data collection and distribution can contribute to trust-building and create an environment for cooperative negotiation. It requires the states to work together, generate opportunities, and to develop alternative responses to each current and future problems (Motlagh et al. 2017).

By promoting joint fact-finding in the negotiation process, it is possible to generate a deeper understanding of relevant issues by all decision makers. The end goal of joint fact-finding is not to establish 'the truth,' but arrive at an agreed-upon understanding that is both scientifically sound and publicly credible, which allows stakeholders to engage further in collaborative problem-solving.

This process gives decision makers a basis to identify cooperation opportunities by reducing uncertainties around them, allowing them to understand promising incentives and making cooperation politically more attractive than unilateral action (Islam and Susskind 2013).

Practical approaches such as water diplomacy techniques, IWRM framework, issue linkages, side-payments, and benefit sharing dialogue tools—both at sectoral and transboundary levels—are all needed to tackle complex transboundary water management issues. However, in order to have better leverages in solving problems cooperatively, international water law brings together the legal and quasi-legal instruments of transboundary water agreements. In other words, water diplomacy tools, techniques, and dialogues have to combine with water law to protect riparians' rights and deal with water cooperation complexities. Transboundary water cooperation policy processes indeed happen with different levels of reliability and will. They thus offer different opportunities for the inclusion of negotiations results and decision making in a diplomatic environment alone.

Even though the law is not essential for cooperation, a legal framework can create a more predictable and stable environment, which in turn can reduce any potential for conflict (UNEP 2002). When no formal transboundary water cooperation policy process is in place, informal dialogues may be regarded as early-stage transboundary water cooperation. At the other end of the scale, a transboundary water cooperation policy process may be characterized by a well-established formal framework that includes legal agreements, institutional structures, and joint action programs. It is important to understand international water law in its functionality to facilitate a culture of communication amongst riparian states, provide them with a common language, constitute a starting point for their negotiations, adoption, and further expansion of innovative problem resolution for transboundary water resources management.

Learning from success stories and comparing applied approaches may help to link all instruments and initiatives coherently and then, articulating common methods and principles, which can be later modified and applied to the uniqueness of each basin. The analysis of successful river basin cooperation experience shows that in all regimes, shared infrastructures such as dams, are a primary driver of cooperation among countries. Equitable and reasonable distribution of costs and benefits amongst riparian states plays a significant role in the development of cooperation (Arjoon et al. 2016). Joint actions provide both economic and non-economic benefits that can be extracted in different time frames from short to long term. The involvement of local stakeholders and different types of relevant organizations, at an early stage of the development of transboundary negotiations, may also contribute to preventing water conflicts (Huntjens et al. 2015). Conclusively, it is apparent that different socio-economic contexts need to find their unique set of indicators, interests, and befitting processes to achieve cooperative transboundary water management through diplomatic mechanisms. The integration of science, policy, and practice in multi-track water diplomacy processes can contribute to enhanced transboundary water cooperation precisely in conflict-prone basins.

7.9.5 Concluding Remarks

Sustainable water resources management is one of the foremost global challenges; however, despite the complexity of the challenge, water can become a subject for cooperation and can be transformed from a source of potential conflict into an instrument of peace. Once a cooperative interest exists, the only problem, which remains to be solved, is the allocation of associated joint costs and benefits of cooperation within the framework of international law. Socio-economic approaches that accompany institutional set-ups, under diplomacy shelters, are some of the most effective approaches, which can be used in negotiation processes for achieving basin-wide, sustainable, and functional agreements (Hefny 2011). All mentioned tools and approaches are individually useful, and investing in them often extends to better policies and decision making. As helpful as they could independently be, their effectiveness would undoubtedly increase if they were well combined, in accordance with the law, and while taking into account parties' interests, internationally coordinated engagement is also required to build robust and political involvement by foreign policy communities and governments (Tawfik 2015).

Achieving an agreement around the use of challenging and strategic resources such as water requires a long, intensive, and engaging negotiation process. It has to address the identification of mutual benefits and interests of decision makers. It has to conceive instruments to secure enough benefits and share them equitably in a transparent manner. The main challenge remains, however, to establish how transboundary water management can be sustainable and inclusive while guaranteeing that benefits derived from it, are equitably

shared among all stakeholders. Negotiated water solutions—as a result of transformational change in water management—should constitute enabling elements for sustainable and climate-resilient development of concerned states.

Hence, there is a need for innovative, context-specific new tools and approaches to help negotiators and decision makers understand and overcome uncertainties in a transparent manner. For instance, the language barrier among stakeholders can lead to frustration and a lack of motivation for collaborative actions. Coming up with a mutual language to describe and communicate around water issues, can increase trust and transparency among actors, help their interactions and dialogue, and enhance their capacities. Such a mutual language can also support the science-policy dialogue between academics and practitioners. It can make the application of science and evidence in policy development more accessible, and decision making processes better informed.

Before the ratification of new agreements, basin states should make sure that it accommodates significant flexibility measures, and can adapt to future anthropological and natural changes. Furthermore, keeping states engaged and guaranteeing the long-term sustainability of a cooperative agreement requires the investigation of additional gain options. The agreement has to create economic, social, and environmental benefits for all. Any process of water law development will be preceded by a phase during which international partners can express their interests and establish a platform to identify challenges, opportunities, bottlenecks and, formulate the necessary policies, strategies, and approaches to address them (Murthy 2015).

Without adequate cooperative approaches to foster collaboration in transboundary water management, we face unilateral appropriation of water resources, which often leads to tensions among riparian countries and can accumulate over time (Dinar 2008). However, even with the finest of intents, it may prove increasingly challenging to develop the most appropriate policies, laws, and management arrangements for transboundary settlements, during prolonged water-related uncertainties or, when there are tensions between national priorities and transboundary considerations (De Man 2016).

Successful transboundary cooperation cases demonstrate that since cooperation is mostly conditional, as long as a set of *sine qua nones* are available and, particular ranges of incentives are ensured, it does progress. Practice also shows that basin-wide efficiency requires regional cooperation. Moreover, real-life cases teach that cooperative decision making can be made possible in a transparent environment if it is sustained with a variety of compensation options, institutional frameworks, and incentive-compatible considerations.

7.10 Transformative Practices for Water Diplomacy

7.10.1 Introduction

Water conflicts arise, and are expected to increase, because water is often managed for multiple uses and competing demands. In addition, water crosses political borders. Globally, approximately 600 aquifers are shared across an international border (IGRAC 2017); as are about 310 river basins, encompassing 40% of the world's population and close to 50% of the land surface of the earth (McCracken and Wolf, forthcoming). Here, we define a conflict as the perception that one or more parties is being prevented from taking a particular action (such as building a large dam) and that an activity (e.g., economic sanctions, threats of military violence) can be utilized to overcome the difficulty (Frey 1993; Delli Priscoli and Wolf 2009). Such perceptions heighten regional tensions and threaten economic, social and geopolitical stability.

Legal mechanisms and frameworks for mitigating water conflicts among states have their place in the management process. This approach to water diplomacy relies on statutes, regulations, precedence and guidelines; it is a traditional system, often involving courts. However, the legal approach to water and environmental law provides the added challenge of needing to incorporate the complexities of governance and societal, economic, ecosystem and scientific issues and concerns (Steinway and Botts 2011).

Another approach is alternative dispute resolution (ADR) which generally requires fewer resources of finances and time. ADR utilizes arbitration, negotiation and/or mediation to mitigate conflict through settlement. Through an informal court process, an arbitrator provides binding arbitration to arrive at a solution, while parties retain the right to trial through nonbinding arbitration. With negotiation, parties or third party actors work towards reaching an agreement. Mediation provides additional flexibility. A neutral party, a mediator or facilitator, helps guide the process to optimize effective and open exchange, while allowing the parties to play an active role in the process (de Silva et al. 2018). However, ADR generally tends to be content-based (Lederach 2003).

Conflict transformation, which might be regarded as a subset of ADR, focuses on relationships, seeking healthier interactions among individuals, among parties, and between humans and the environment. This approach promotes longer-term constructive change, extending beyond remedy of a single dispute (Lederach 2003). Conflict transformation taps into physiological, emotional, intellectual and spiritual

Table 7.1 The universality of the four worlds. From course material of an annual Oregon State University course entitled "Water Conflict Management and Transformation," offered by the authors

Rothman, Jay. ARIA (1989, 1997)	Adversarial (antagonistic)	Reflective (resonance)	Integrative (invention)	Action
Water Resources (Wolf 1999)	Rights	Needs	Interests	Equity
Water Visual (Wolf et al. 2010)	Basin w/borders	Basin w/out borders	Enhanced benefits	Equitable distribution of benefits
Maslow's (1954) Hierarchy of needs	Physiologic	Safety	Belongingness and love	Self-actualization
Levels of holiness (Sinai, Temple, prayer service)	Physical	Emotional	Mental	Spiritual
Jewish/Catholic Textual Analysis	*P'shat*: literal	*D'rash*: allegorical	*Remez*: tropological	*Sod*: analogic
Kabbalistic worlds (Kemenetz pp.16–17)	*Assiyah* (actualization) It is perfect (h)	*Yetzirah* (formation) You are loved (v)	*Beriyah* (creation) All is clear (h)	*Atzilut* (emanation) I am holy (Y)
Elements and Archangels	West, Rafael, earth	South, Michael, water	East, Gavriel, wind	North, Uriel, fire
Buddhism: Four Sights/Noble Truths/Four Jhannas	Sick/*Dukkha* (suffering)/physical joy	Aged/ *Tanha* (desire)/ rapture	Dead/*Nirvana* (a-suffering/equanimity	Holy/eightfold path/lucidity
Sufi Muslim Moral Stuctures	*Sharia:* Quranic law	*Tarikah:* inner emotional practice	*Hakika:* direct understanding of truth	*Marifah:* deep attunement to the Divine
Hindu AUM and Vishnu's totems	A—from abdomen/mace—physical strength	U—from chest/lotus flower—glory of existence	M—from throat and above/discus—mind chakra	*Turiya*—silence/conch—primeval sound of creation

necessities, often associated with Maslow's hierarchy of needs (Maslow 1954). Faith-based traditions also perceive the world as built on a scaffolding of physiological, emotional, mental and spiritual experience, a framework often referred to as the four worlds (Wolf 2017). Outlined in Table 7.1 is the universal construct of the four worlds from a selection of faith based traditions and social frameworks.

7.10.2 Spiritual and Faith-Based Traditions

The notion of the four worlds extends back thousands of years, to faith based traditions such as Jewish, Buddhist, Muslim and indigenous people of the Americas (Wolf 2017). These practices provide universal constructs and tools to navigate contentious situations and mitigate disputes. Here we provide a glimpse of how traditions associate with the four worlds.

To give the Jewish perspective, Wolf (2017; Table 7.1) recounts Moses' experiences on Mount Sinai, presenting the "four worlds through four levels of holiness" (p. 38). After spiritual endeavor, the Children of Israel are described as gathering at the base of Mount Sinai, where Moses builds an altar and gives offerings on behalf of the nation. Wolf (2017) states that "this experience of physical construction and sacrifice with the entire nation represents the first level—that of physical holiness" (p. 38). Moses climbs the mountain

with the elders, Aaron and his sons, where they experience the presence of God as they eat and drink, in gratitude and bliss. This emotional exhilaration is considered as the second "world." Summoned by God to the summit of the mountain, Moses receives the Ten Commandments and is ordered to teach these edicts. This occurrence is regarded as the third level of knowing: awareness or intellect. The fourth level is experienced at the apex of the mountain, which Wolf (2017) describes as, "the thickness of the cloud itself (*'av ha'anan*), the Divine presence" (p. 39).

From the Buddhist tradition, we learn that Siddhartha, leaves the confines of the palace for the first time, and as he travels through the city of Kapilavast, he witnesses four sights:

> …he saw: an aged man, who represented physical decay, or *annika*, impermanence; a sick person, who experienced *dukha*, suffering; a corpse, suggesting the powerful idea of *annata*, that the link between being and non-being is a tenuous one; and finally an ascetic, a holy man who devoted himself to a spiritual understanding of the roots of suffering (Mills 1999; Rahula 2007; both in Wolf 2017, p. 39).

Wolf (2017) clarifies how the four worlds are experienced through Islam:In Islam, the bounded, physical expression of the path to holiness is most commonly manifested through *Sharia*, the law as derived from the Quran. To the physical path of *Sharia*, the Sufis, mystics of the Muslim world, add three, each building on those before: *Tarikah*, the inner practice, expressed with deep emotion through love for each other and for God; *Hakika*, or truth – the direct understanding of the divine presence; and *Marifah*, the deep attunement with God, as intuited through "the eye of the heart" (Smith 1991, in Wolf 2017 p. 43).

In the tradition of many indigenous people of the Americas, the medicine wheel holds spiritual significance. It is in alignment and harmony with the four levels. Furthermore, the Laika Earthkeepers, ancestors of the Inca, had animal symbols that correspond to energy points of the body (chakras): The physical, emotional, intellectual, and spiritual experiences correspond to the serpent, jaguar, hummingbird, and eagle, respectively (Wolf 2017).

The four worlds correlate with the four stages of water conflict management, allowing for a subtle melding of spiritual practices with hydro-diplomacy. In doing so, Maslow's hierarchy of needs (Maslow 1954) are aligned with Rothman's model of the four stages of negotiation (Table 7.1). Rothman initially described his stages as ARI—Adversarial, Reflexive, and Integrative (Rothman 1989). When ARI became ARIA, adding Action, Rothman's terminology (1997) also evolved to Antagonism, Resonance, Invention, and Action. We retain the former terms, feeling they are more descriptive for our purposes. These common water claims (listed in Table 7.2) stem from an assessment of 145 treaty deliberations described in Wolf (1999). Rothman (1995) also uses the terms rights, interests, and needs, in that order, arguing that "needs" are motivation for "interests," rather than the other way around as we use it here. For our purposes, our order feels more intuitive, especially for natural resources. These sets of collaborative skills (listed in Table 7.2) draw from Kaufman (2002), who ties each set of dynamics specifically to Rothman's ARIA model in great detail, based on his extensive work conducting "Innovative Problem Solving Workshops" for "partners in conflict" around the world (Wolf 2010). Simply put, the universality of the four worlds is associated with the four stages of water conflict transformation. Notice for example, that the first row of Table 7.1, corresponds to the first column in Table 7.2. In this way, the lessons that spiritual practices can provide can be linked to water diplomacy application. We begin, by exploring a hydro-conceptual framework, and follow with water diplomacy demonstrations through a spiritual lens.

7.10.3 The Four Stages of Water Conflict Management

The collaborative skills used in the stages of water conflict management (see Table 7.2) provide tools to manage and transform national and international water conflicts. This framework of the four stages is one of several instruments to manage conflict, but is by no means a template; this framework builds on extensive international case studies and the experience of water practitioners, coupled with spiritual practices. The stages follow the Rothman's ARIA model, described earlier.

Stage 1 of the four stages of water conflict management is adversarial, in which the communication style among stakeholders (nations) tends to be argumentative and

Table 7.2 Four stages of water conflict transformation. These negotiation stages build primarily on the work of Jay Rothman (Rothman 1989, 1995, 1997), Kaufman (2002) and Wolf (1999). This table is modified from Fig. 6.1, in Jerome Delli Priscoli and Aaron T. Wolf. Managing and Transforming Water Conflicts. Cambridge University Press, New York, New York, 2009, 354 pp. [© Jerome Delli Priscoli and Aaron T. Wolf 2009; Reprinted with permission]

Negotiation stage	Common water claims	Collaborative skills	Geographic scope
Adversarial	Rights	Trust building	Nations
Reflexive	Needs	Skills building	Watersheds
Integrative	Benefits	Consensus building	"Benefit-sheds"
Action	Equity	Capacity building	Region

combative in nature, with actors believing they know the "wants" of the opposing party. Emphasis is on past interactions. There is little to no trust, nor interest in listening to others regarding the matters of concern. Great efforts are placed on one's own claim to a right to water, through priority, sovereignty or other contextual and geographic framing. Regarding possible remedies, parties may only be aware of win/lose outcomes, and applying legal mechanisms. At this stage, trust-building is essential. It is critical in this stage to place emphasis on practices that promote being fully present, listening without judgement and making actors more cognizant of their own communication style as an avenue to deeper understanding (Cosens et al. 2012).

Stage 2 of water conflict management is reflective. During this phase, the parties display more willingness to listen and an increased ability to learn about the underlying reasons and perspective of the other actors. Focus during this engagement is content-based, with the goal of the resolution process being mitigation of the conflict and movement toward an agreement that addresses the immediate concern of the parties. This phase emphasizes bringing about more awareness of needs and interests rather than rights. Improving listening skills can be essential to building trust and negotiating an advantageous outcome that benefits both sides. This win–win approach comes through parties having the courage to listen to the needs, motivations, and fears of each other. Through this process parties learn to communicate more effectively, and paraphrase and validate what a party member has heard. They learn to voice each other's concerns, opening the way to brainstorming possible workable options. Rich and creative thinking can spark constructive possibilities, increasing the likelihood of everyone benefiting. Metaphorically it is as though a veil has been lifted; emphasis is placed less on rights, sovereignty and political demarcations, and more on what's needed for the river system and the watershed (Delli Priscoli and Wolf 2009).

Stage 3 of water conflict management is integrative, in which parties come to an increased sense of awareness of being an integral part of a system in which stakeholders' concerns are melded with the interests, needs and values of other community actors. This phase allows for a shared and collaborative perspective that gives rise to more comprehensive economic and social benefits. These benefits may extend beyond sharing water to, for example, environmental conservation, agricultural production and even trade (Sadoff and Grey 2002). These benefits may extend to the region, conceptually envisioned without political boundaries, and beyond the confines of the river system. The result should enhance the socioeconomic well-being of a people, which might eventually manifest as increased life expectancy, personal income, and literacy rates (Delli Priscoli and Wolf 2009).

The final stage focuses on implementing actions and ensuring that benefits are equitably distributed among actors, across a country and a basin. In this stage, the needs of each actor or region are incorporated into the solution through agreements. To accomplish this, institutional constraints or political boundaries that might have been removed conceptually, to spawn creative thinking are reinstated. They are replaced to ensure fair distribution of economic, social, and environmental gains among nations and actors. Assessing benefits within political demarcations may require creative solutions or a shift in resources to bring about more equitable basin-country distributed benefits. Innovative water arrangements should be broad, going well beyond water issues, a basin or country boundary (Sadoff and Grey 2002). The allocation of benefits and costs, termed benefit-sharing, can foster robust relationships among actors, providing effective and resilient mechanisms and institutions when implemented appropriately. This allocation can also result in joint actions that include collective participation, cooperative ownership, integrated assessment and design and shared investment (Sadoff and Grey 2002).

Movement through these four stages is not necessarily linear. Consider how the four worlds can exist simultaneously, and how they may not necessarily occur sequentially. Rain provides one example. In the physical realm, in a drought prone region, harvested rain can help maintain vital human body functions. It may also be emotionally gratifying to quench one's thirst. One can certainly intellectualize examination of rain patterns and the quantity of water collected; and spiritually, drinking water can consecrate our entire being. Likewise, a watercourse can serve as a regional-scale example: In the physical realm, the watercourse might represent a community's primary drinking water source; at the emotional level, the watercourse may provide aesthetic value and beauty to a people; intellectually, organizations can calculate the instream ecological flow; and spiritually, the watercourse might be utilized for river baptism or, like the Ganges River, be considered sacred.

Fusing spiritual practices at the appropriate negotiation stage requires creativity and resourcefulness to craft activities for water ministers, professionals and stakeholders for water diplomacy.

7.10.4 Examples Melding Spiritual Practices with Water Engagement

Spiritual practices from faith-based traditions have intangible gifts to offer. They provide guidance and teachings in kindness, compassion and mercy, and pathways to clemency and healing that can be applied to hydro-diplomacy. Provided below are faith-based approaches such as meditation, the application of talking sticks, the use of narrative tools (stories), and love as a spiritual practice.

Meditation is part of many hallowed traditions. It is associated with psychological, emotional, physical, intellectual and spiritual gains. It facilitates feelings of connectivity, including to the universe, Earth systems, life force, and animate and inanimate objects. In this open mode, the meditator's stress is reduced, which can produce a ripple effect, bringing a calmness to others in the same space and encouraging others to be more receptive to listening and hearing differing perspectives. Quieting the mind in this way can bring a sense of clarity to complex challenges, spurring creativity in decision making. So, incorporating meditation and moments of silence, when appropriate (at the start of a meeting and after a meeting break), can bring water delegates to a state of awareness, to be fully present (Tolle 2002). Similar benefits can be gained through the use of a labyrinth for spiritual practices and walking meditations, while providing participants and water practitioners with a direct connection to nature and "contemplative movement" (Barbezat and Bush 2014). Forms of meditation can be introduced at any stage in water conflict transformation, though meditation in motion may be invaluable during the integrative and action stages, when innovation and insights are needed.

The talking stick is an integral part of spiritual and cultural ceremonies performed by indigenous people of North America. It is an object passed around indicating who "has the floor". The talking stick is a sacred symbol of authority and power. When utilized within talking circles during council meetings, there are specific rules for communicating. One rule invites whoever holds the stick to speak without interruption, while others listen without scrutiny, honoring the sanctity of the spoken word (Avant 2017). In this respectful way, each member is permitted to speak and also listen, in turn. Similar approaches can be utilized or modified for facilitating water conflicts, but may be particularly useful in the adversarial and reflective negotiation stages of water conflict management (Table 7.2).

Written and oral storytelling traditions are essential to our communication. Sacred texts, such as the Bible or Vedas, convey stories of the creation of the world and teach us how to act. Stories have the unique ability to activate the language components of the brain, and stimulate the listener to experience the same sensation the speaker is expressing, making it a shared experience (Chen et al. 2017). In this way, we are drawn to listen more acutely, accessing empathy and humanity (LeBaron 2002). This form of social encounter, when appropriate, can provide stakeholders and actors with the opportunity to tell their own water story (one-on-one or in a group setting), providing context that might uncover other aspects of a person's life experience in a non-threatening way. This approach can be especially instrumental in building trust, during the adversarial stage of a negotiation (Table 7.2).

Love as a sacred practice is central in all faith-based traditions. Love for oneself, community and all manifestations within the universe are all regarded as forms of God. Chittick (1983) and Tolle (2002) say that thinking otherwise is to increase the pain (physical and emotional) for ourselves. This concept of "otherness" separates us from our most noble calling. It is only through conscious vigilance (staying fully present) that "oneness" prevails (Chittick 1983; Tolle 2002). For water diplomats to walk this spiritual path of love, consideration during negotiations must be given to the whole, and the fundamental goodness of all.

These examples illustrate how combining the four stages of water conflict transformation and spiritual practices can be used to balance national water interests and water for the regional good, or balancing human needs and ecological conservation while keeping actors and diplomats grounded in ethical and moral hydro-considerations. Integrating the four stages of water conflict transformation and faith-based traditions can expand our perception of water claims and broaden proprietary rights from independent holdings to joint ownership to an amalgamation, in which separateness no longer exists. These stages might be regarded as different ways of being and engaging with other actors. These differences reflect different levels of awareness. Just as a change in the state of matter requires a transfer of energy into or out of a system, likewise, a change in engagement with actors requires new input of information and/or increased energy. This new input facilitates transformation, transcendence or a shift.

7.10.5 Conclusion

Competing demands on water are expected to increase. In addition, about 310 river basins are shared by two or more nations impacting more than one-third of the world's population.

While the legal system and alternative dispute resolution provide mechanisms to mitigate conflicts, they often do not address all the nuances that water presents, and primarily do not extend beyond remedy of a single dispute. Conflict transformation offers longer-term constructive change, more flexibility, and is relationship-centric. The four stages of conflict management (adversarial, reflective, integrative and action) are linked to the physiological, emotional, intellectual and spiritual necessities; a four worlds framework.

This concept is fundamental to faith-based traditions, providing guidance and teachings in kindness, compassion and mercy and offering practices such as mediation. As such, the four stages of water conflict management framework combined with spiritual practices might be a practical tool for water practitioners (Wolf 2017; p. 46). After all, changes in worldview or negotiation stage are a natural part of the

human evolutionary process. Individual and collective growth; increased awareness; and physical, emotional, intellectual and spiritual shifts in energy are within the range of the human experience and potential.

Despite these assertions, establishing international water arrangements such as water treaties among contentious states or states and international organizations can take decades: 10 years for the Indus, 30 years for the Ganges, 40 years in the case of the Jordan (Delli Priscoli and Wolf 2009). During those time spans, both ecosystem and human health suffered from poor water and environmental management.

However, if any of us can move toward structures that result in more constructive outcomes, then it is within the capacity of the rest of us (Angelou 2010). Practicing water conflict transformation infused with spirituality can set in motion a more ethical and reverential approach to water. This approach can guide our visionary future of embracing sustainable development goals: water security for all; socioeconomic prosperity and government stability; and equity beyond gender, race, class, sex and age. We can then expect to inhabit a planet with healthier ecosystems; sustainable agriculture, fisheries, and clean energy industries; and efficient and effective water management.

7.11 The Discourse on Water and Peace "A Matter of Survival"

7.11.1 Background

Water is life. It is a fundamental condition of human survival and dignity, and is the basis for the resilience of societies and the natural environment. Unlike other natural resources, water has no substitute: the only substitute for water is water.

Water is scarce: about two billion people still lack access to safe drinking water. Most of them live in fragile, often violent regions of the world where water is a matter of life and death. The growing imbalance in global water supply and demand leads to tensions and conflicts, and could potentially evolve into a widespread threat to international peace and security. Water deprivation is increasingly seen as a fundamentally political and security problem, and no longer simply as a problem of human development and environmental sustainability.

Many transboundary water basins are located in areas marked by interstate tensions and, in some places, armed conflicts, both among, and within states. Although water, historically, has rarely been the direct cause of armed conflicts, the future may not resemble the past since the world's population continues to grow. Water shortages and tensions over water quality can spiral into armed conflict and war. In recent years, water has been increasingly used as a weapon of war by non-state actors, such as in Darfur, Somalia, Iraq and Syria.

Water issues are a global development problem and need to be approached in a comprehensive manner. Over the past century, different and complimentary discourses have been developed in relation to water; some of which have been discussed and elaborated on in previous sections of this chapter. This final section elaborates on the water-peace discourse. It relates to global initiatives offering windows of opportunity for a promising future, using water as a vehicle of peace, particularly within the transboundary water context.

7.11.2 Preventive Diplomacy and Water Cooperation

In modern diplomacy, the role of preventive diplomacy in mitigating and/or limiting the escalation of disputes between the parties, has been recognized by global and state-actors (UN 2011 p. 2). The tendency is to take preventive measures and use different vehicles of peace including that of natural resources to foster cooperation and eliminate potential contributors to conflict (Carmi et al. 2019).

Preventive diplomacy has many forms and should be understood broadly. It includes but is not limited to diplomatic efforts of states to prevent an imminent armed conflict. It involves political engagements of governments, technical expertise, international financial institutions, business ventures as well as a variety of civil society based initiatives. It includes long term efforts to strengthen water cooperation as well as emergency humanitarian assistance in cases of natural disasters.

In 2017, the Security Council held a briefing on Preventive Diplomacy and Transboundary Waters, emphasizing the role of water diplomacy and cooperation in conflict prevention (Whatsinblue 2017). Mr. Guterres identified water scarcity as a "growing concern" among the complex contemporary challenges to international peace and security, and called for strengthening of preventive activity (UNSC 2017). Since then, the UN Security Council held other meetings specifically devoted to the issues of water—related to both, protection of water in armed conflicts and to preventive diplomacy relating to water (Whatsinblue 2018).

This illustrates the growing awareness of the need to strengthen preventive diplomacy in all of its dimensions and water is an integral part of this effort. Some of the relevant forms are well known and historically tested. Transboundary water cooperation has been established in many post conflict situations and has helped preventing recurrence of armed conflicts. Other forms are new or still at the evolutionary stage. The increased awareness of water-related consequences of climate change and consideration of measures to be developed have focused attention on situations such that of the Lake Chad and in the Sahel where curbing the

ongoing armed conflict represents an urgent priority. An array of activities focusing on the Aral Sea and water issues in Central Asia belong to the examples of preventive diplomacy which requires long term engagement and careful building of cooperative mechanisms for the future. In the Middle East water cooperation is an increasingly important issue for future peace.

The historic experience of water cooperation has to be understood against the background of the broad needs of preventive diplomacy of our era. In Europe every major peace agreement since the Peace of Westphalia of 1648 included—or was followed by water cooperation arrangements. They were initially related to navigation on international rivers. Subsequently they included a number of aspects of water management and environmental protection. A recent example is the Sava River Treaty, signed in 2002. That treaty bound together several countries of the former Yugoslavia, some of whom were involved in bitter armed conflicts of the 1990s. The constructive potential of transboundary water cooperation is historically proven.

7.11.3 The Development of the Water-Peace Discourse Between Cooperation and Conflict

Competition for limited freshwater resources is alarmingly increasing due to various factors, including a drastic increase in water demand for food, security, and energy consumption, coupled with pollution, and inefficient uses of resources. Climate change increases the erratic frequency of water availability. This increases the tensions and competitions among the various users of freshwater resources.

In the past years, there have been increasing warnings about the possibility that water conflicts and water shortage coupled with poverty and societal instability, could weaken intra-state cohesion and fuel inter-state conflicts. At local level, we see the emergence of increasing intersectorial conflicts. The majority of disputes are complex, multifactorial, but are often expressed as water issues. On the other hand, water is also a tool for cooperation, and is the subject of agreements, and joint commissions, often at the basin or regional levels, as documented in the literature.

The water-peace discourse exists between the two poles of conflict and cooperation, and is built around two key objectives:

- preventing water-related conflicts and
- leveraging water as an instrument of peace.

The discourse is meant to strengthen the linkage between the existing Sustainable Development Goals SDG6 and SDG16. The water-peace discourse has been developed through the interactive dynamics and leadership of the following three main initiatives:

7.11.3.1 The Blue Peace Initiative

The Blue Peace initiative was launched by Switzerland in 2010, based on the premise that water cooperation among borders, sectors and generations can foster peace, stability and sustainable development, by turning competition over limited freshwater resources into collaboration (Blue Peace website).

This initiative has developed within the past decade into a growing global movement which "aims to develop a culture of peace and preserve precious freshwater resources, while achieving equitable and sustainable use of water across boundaries, sectors and generations."

The "Blue Peace Movement" is expanding globally and taking roots. Through a number of events, the "Movement" is addressing water problems of our era, jointly with the broadest representations of civil society, youth, artists, business and academic communities. Such collaborative efforts constitute a stepping stone towards the realization of SDG6 and SDG16.

In 2019, and in a collaborative effort between the Economist Intelligence Unit (EIU) and the Swiss Agency for Development, the Blue Peace Index was developed as "an objective, quantifiable tool to assess countries" and basins degree of transboundary sustainable and equitable cooperation (https://bluepeaceindex.eiu.com/#/).

On February 18, 2020, a conference was held to celebrate the Blue Peace Decade. The conference emphasized the need for intensified action in the field of international water cooperation, notwithstanding the obstacles that impede progress at this stage. The key among these obstacles is the waning commitment to multilateral cooperation generally, and multilateral water cooperation specifically. Therefore, the forthcoming World Water Forum, originally planned for 2021 in Dakar-Senegal before Covid-0.19 pandemic, will carry a particular significance to water cooperation and peace. Some of the aspects that were hitherto underdeveloped, such as the transboundary aquifer cooperation have to be put more centrally now.

7.11.3.2 The Geneva Water Hub

Water can become a theme for collaboration and an instrument of peace. It is with this positive vision that the Geneva Water Hub was established, with the support of the Swiss Agency for Development and Cooperation (SDC), and the University of Geneva (UNIGE) in 2014.

The Geneva Water Hub aims at developing the hydropolitics agenda to help prevent water-related conflicts at intersectoral and transboundary levels at an early stage,

and to promote water as an instrument of peace and cooperation, through its three main functions of advocacy, Think Tank, and research and education (Geneva Water Hub website).

In 2015, Switzerland, GWH and the Strategic Foresight Group (SFG) were instrumental in the mobilization of countries to support the creation of the Global High-Level Panel on Water and Peace, described below, for which GWH is the Secretariat—The GWH is now recognized as a global center of the University of Geneva, specialized in hydropolitics.

The GWH defines water diplomacy as "a strategic tool for reconciling conflicting interests including and beyond water, based on the increasing global recognition of the water-peace nexus/pardigm. We view water diplomacy as one form of preventive diplomacy that adopts a multidisciplinary approach and innovative tools, that uses water as a vehicle for peace and a bridge that connects the development and peace agendas. Peace, according to us, is not the absence of armed conflict but rather the prevalence of sustainable development based on the premises that sustainable peace, sustainable development and humanitarian response, are the three edges of a triangle, with water at its center. The convergence of these three agendas is at the heart of the dynamics of the International Geneva.

The GWH continues to look at effectively bringing together partners committed to promoting the water and peace agendas, and it is gaining traction.

7.11.3.3 The Global High Level Panel on Water and Peace (GHLP-WP)

Upon the request of the SDC, a consultation was conducted with governments and experts from across world, which revealed that although water was recognized internationally as a development and human rights issue, yet its implications for peace and security were inadequately addressed. There was a clear need for a global platform that would look into the issue of water in the context of maintenance of peace and security, from a technical to a political level. This led to the launching of the GHLP-WP, on 15 November 2015 at an inter-ministerial gathering presided over by Switzerland, and including the 15 co-convening countries who expressed interest in its mandate.

The GHLP-WP, chaired by Dr. Danilo Türk, one of the co-authors of this section, was mandated to develop a set of recommendations aimed at strengthening the global architecture to prevent and resolve water-related conflicts, that were outlined, 2 years later, in the report "A Matter of Survival" (GHLP-WP 2017). In all of the different chapters of the report, cooperation is a central pillar.

Although the mandate of the GHLP-WP ended in 2017 in terms of the provision of recommendations, yet the Panel continues to enrich the reflection globally on the water-peace discourse, and some of the panelists are actively involved in pushing the agenda forward, each within his area of expertise. In Fall 2019, the Panel met informally during the Budapest Water Summit in October, as it continues to play a main role in the development of the water-peace discourse, and the bridging of the development, humanitarian and peace agendas.

For the first time it is history, the United Nations Security Council, convened a first thematic Open debate, under the presidency of Senegal, on 22nd November 2016, on linkages between water, peace and security. Senegal is one of the co-convening countries of the GHLP-WP and its nominated panelist acted as its vice-chair. This special session was attended by 70 member states in a positive and forward looking atmosphere, and a strong recognition of the role of water in preventive diplomacy, as well as an important enabler to peace and security (United Nations 2016a, b).

In the years that followed, several other thematic sessions on water were held at the UNSC, under the leadership of other countries, also keen on the water-peace discourse. Accordingly, recent armed conflicts and other situations on the agenda of the Security Council have been characterized by water—related issues and the UNSC addressed them in its resolutions and presidential statements.

In its work, the GHLP-WP recognized that new mechanisms of water diplomacy will have to address, inter alia, the issue of the "fragmented landscape" of water related international institutions. In the UN system alone there are 32 entities dealing with water and cooperating within the loosely organized coordination mechanism, the "UN Water".

The role of UN-Water is essential and both the GHLP-WP, and GWH value the contribution it made as an observer to the Panel, and a partner in the discussions on water and peace.

7.11.4 Elements of the Water-Peace Discourse

Since 2017, the Geneva Water Hub, has been following up on the key recommendations of the Panel, and overseeing the implementation of some of them. The report "A Matter of Survival" has received global attention, and to date has been translated into 4 languages. The progress in the implementation of the Panel's recommendations is detailed in the report "Determined Steps" in March 2019, and in the report "Intensified Action" published in June 2020 (Geneva Water Hub 2019a, b, 2020c).

These recommendations call for the development of tools, and the use of the following elements to achieve the main two objectives of the water-peace discourse, and include institutional, legal, financial and political instruments.

7.11.4.1 The Global Observatory on Water and Peace

Many existing organizations and mechanisms are contributing significantly to water cooperation to the extent possible at the current level of international cooperation. However, an important feature of discussions relating to international water cooperation is the limited capacity of international actors to act collectively and effectively at the political and diplomatic levels and the search for a global home of hydro-diplomacy. Accordingly, the Panel report called for the establishment of the Global Observatory on Water and Peace (GOWP), as a global network, to facilitate assistance to interested stakeholders in using water as an instrument of cooperation, in avoiding tension and conflicts, and to promote peace. The GOWP adopts the knowledge management approach, and discreet facilitation rather than the traditional dispute settlement, peacemaking or peace building approaches.

The GOWP is a network of nodes of different natures which possess analysis and strategic foresight capability on water and peace in their "specific context"; this reflection is carried out in a creative dynamic exchange and contributes to creating a discreet "global space" (Safe Space) to progress on the key themes for their regional context, of a generic scope, or of global scope. The GOWP is both in line with the work of the GHLP-WP and is one of its recommendations. There are two main types of nodes: (i) regional nodes (ii) societal nodes.

The current mode of operation of GOWP is flexible and open for further partnerships, given that the GOWP is an inclusive network that ensures linking partners working on water cooperation to fill in the critical gaps of the global water architecture. It was officially launched during the 5th Arab Water Week at Dead Sea in March 2019, under the Patronage of His Royal Highness Prince El Hassan Bin Talal, member of the GHLP-WP. It is expected that the network will further expand to include various kinds of actors committed to the water and peace agenda. The December 2019 edition of the Water Diplomat, included a Water Talk about the Global Observatory on Water and Peace, to further communicate and explain its mandate, and its mode of operation. The Water Diplomat is a free monthly global news and intelligence resource platform accessible online and through a newsletter, launched jointly by the GWH and OOSKA news, with the goal of promoting access to political stakes of water management that are making news around the world (Water Diplomat Talks, December 2019). In addition, there is a series of short videos on the website of the Geneva Water Hub that explain and update the progress in the work of the Global Observatory on Water and Peace (Geneva Water Hub 2020a, b).

The first regional partner of the GOWP in the West African region, the Pôle Eau Dakar (PED) was established by the Senegalese Ministry of Hydraulics and Sanitation. It was officially launched during the Kick–off meeting of the Forum of Dakar on June 19, 2019 in Dakar. Its mission is to "to promote concerted development of skills and practices at local and regional levels to promote integrated management of water resources based on strengthening hydro-diplomacy and peace" (Brochure PED- Initiative Pole Eau de Dakar: Processus de Creation).

In March 2019, the Permanent Council of the Organization of American States (OAS) expressed its interest to contribute to the GOWP node for the Latin American States. The development of regional partnerships in the Middle East and North Africa (MENA) as well as Central Asia are underway. The development of GOWP nodes is closely related to specific interests and challenges that differ from one region to another.

The societal nodes of the GOWP include among others the youth, the media, women water diplomats, and the Group of Friends on Water and Peace in the International Geneva. These partners contribute to the reflection and advancement of the water-peace discourse from their own perspectives.

The GOWP has developed the additional capacity to convene "what is called a Safe Space": a discreet process bringing together identified stakeholders to address a given sensitive "water and peace discourse" issue. Safe space meetings allow discussions, inter alia, on innovative finance, transboundary cooperation and water security in a confidential manner Water diplomacy is here understood as encompassing all these aspects and the concept of "Safe Space" discussions is a vital part of it. A "Safe Space" Fund is being set up to support the launching of promising "Safe Space" processes, or to accelerate an existing process.

7.11.4.2 The Geneva List of Principles on the Protection of Water Infrastructures During and After Armed Conflicts

Water is rarely—if ever—the sole reason for armed conflict. Other factors—economic injustice, political competition and ethnic hostility lead to outbreaks of violence. Increasingly, however, these factors are linked to the disputes over possession of vital resources, including water. It is therefore important that policies aiming at prevention of armed conflict include water issues and water diplomacy into a comprehensive prevention strategy.

In many ongoing armed conflicts, water has been used as a weapon of war. Water infrastructures have often become targets of armed attack. All this has had an extremely negative effect on civilian populations and produced grave violations of international humanitarian law. In addition, water stress and water-related disasters are among the main consequences of global warming and have severe

humanitarian consequences. They often cause population movements and tensions resulting in violent conflict and threats to international peace and security.

Following the recommendations of the Global High Level Panel on Water and Peace, the Geneva Water Hub's Platform for International Water Law at the University of Geneva, in collaboration with other academic partners, international and non-governmental organizations, prepared the "Geneva List of Principles on the Protection of Water Infrastructure" (in short the Geneva List) during and after armed conflicts. This document provides the first ever systematic compendium of all existing principles and rules regarding water in armed conflicts, such as international humanitarian law, the human rights to water and sanitation, international water law and international environmental law. The compendium covers water, and water related infrastructures, during armed conflicts and post conflicts and contributes to the agenda for the protection of civilian populations. In addition, it contributed to identify gaps in the legal protection of water related infrastructures such as the electrical infrastructures.

This legal document is destined to States and non-state actors (Tignino and Irmakkesen, forthcoming). In the process of peace building, after an armed conflict ends, care for water infrastructure, water management and international water cooperation becomes a condition for the normalization. Water represents a vital lynchpin between post conflict reconstruction and the long term development strategy. The UN Security Council is expected to develop a policy framework for protecting water resources and installations in armed conflicts and in other situations on the agenda of the Council.

In March 2019, the Geneva List of Principles on the Protection of Water Infrastructure was launched in Washington DC, at a working meeting at the World Bank and, subsequently, at the International Peace Institute (IPI) in New York (Geneva Water Hub 2019a, b). These discussions helped to fine-tune the document and develop close cooperation with UNICEF, which in turn is also leading on the publishing of a series titled "Water under Fire" (UNICEF 2019a, b). These publications aim to improve the protection of civilians, in particular children, who are most affected by the violations of international norms protecting water infrastructure and water resources in armed conflicts.

In addition, the Geneva List of Principles should be used as a training material for military personnel, both within national systems and, in the international operations. Discussions are ongoing with the Sanremo Institute of International Humanitarian Law and, collaboration is underway with the Geneva Academy of International Humanitarian Law and Human Rights as well as the Geneva Centre for Security Policy (GCSP). In addition, the Geneva Water Hub who is a founding member of the Environmental Peacebuilding Association hosted by the Environmental Law Institute in Washington DC, is actively engaged in its Interest Group on Water. Through this endeavour, it will work on reinforcing the role of water in post-conflict situations and peacebuilding activities.

The next steps in terms of the Geneva List will be the monitoring and compliance, and this entails a close cooperation of the Geneva Water Hub and humanitarian organizations and UN bodies.

7.11.4.3 The Blue Peace Financing Initiative

In line with the Panel's recommendation, the SDC, the United Nations Capital Development Fund (UNCDF) and the GWH, together with transboundary basin organizations, countries, municipalities and other partners from the public and private sectors, have developed the Blue Peace Financing Initiative.

The aim of the Blue Peace Financing Initiative is to encourage transboundary and multisectoral water cooperation by facilitating access to financial capital for multisectoral and joint investment plans. It suggests that water is the perfect entry point to develop new opportunities for impact investments contributing to all SDGs. From the investors' perspective, multisectoral investment plans offer very interesting risk reduction properties. Indeed, the likelihood of political, social or economic conflicts driven by diverging interests can be reduced if all interested parties are involved in the negotiation of an agreement based on the reality of water availability. As of today, the Blue Peace Financing Initiative is working at two different levels:

1. at the regional level, with transboundary water organizations; and
2. at the sub-national level, with municipalities or local authorities in both developed and developing countries.

A long-term objective of the Blue Peace Financing Initiative is to also develop a Blue Peace Standard, which will serve as a guideline for any actor on how to approach water as an entry point for cross-sectoral, transboundary and inter-generational cooperation, leading to the sustainable use and management of water in the quality and quantity needed and therefore to circular economies as well as inclusive and peaceful societies. The Standard will also serve as an internationally recognized certification tool, requiring any project, plan, product, investment and/or process to be in compliance with the Blue Peace Standard in order to use it. This will allow e.g. investors to have a clear understanding on what they invest in, and it will give e.g. consumers a clear understanding on provided services and products (livelihoods assets and public goods).

7.11.4.4 The Adoption of Standards and Norms to Mitigate Inter-Sectoral Water Management Conflicts

Giving a voice to people affected by water scarcity is essential for sound water management and peaceful development.

The Geneva Water Hub analysed the potential effect of existing and in-development instruments, that are aimed at regulating responsible practices, including water, in socially and environmentally-sensitive businesses, in particular in the mining and metal industries; sectors that are challenging to influence. As such, and in line with the recommendations of GHLP-WP, the GWH developed, and started implementing a strategy to incentivize the use of responsible water practices in large-scale mining operations.

Multiple-issue standards applicable to large-scale mining, and including independent third-party certification mechanisms as a guarantee for compliance, may reduce the risk of conflicts between water used by mining industries and local uses. All standards do not integrate a significant water component, and some are limited in their geographical scope.

The GWH decided to support a process relating to standard setting through discussions with investors and international mining companies. This process aims at facilitating the adoption of high standards, showcasing the added financial value from the related adoption. In order to achieve this, the Geneva Water Hub will use new requirements from investors and the insurance sector as a leverage. These industries are concerned with, potential impacts of water-related risk on financial performance on one hand, and high costs resulting from water pollution or conflicts (operation delays, cancellation of licenses, reputation damages) on the other hand. Their concerns constitute real incentives for change in water practices and a certification is a viable quality assurance mechanism.

7.11.4.5 The Global Data System

Recommendations relating to the quality and quantity water data were a key aspect in both the High Level Panel on Water and the Global High Level Panel on Water and Peace. In 2018 and 2019, the World Meteorological Organization (WMO), and partners collaborated with the Geneva Water Hub and the Group of Friends on Water and Peace, to create a coalition of countries, and institutions to advocate the importance of investing in water data, for the sustainable water management and aversion of risk (https://public.wmo.int/en/media/news/wmo-advances-water-data-and-peace-agenda#:~:text=The%20World%20Water%20Data%20Initiative,water%20data%20by%20decision%2Dmakers). The question of data must be understood beyond the circle of specialists and should be a major theme in the preparation of the UN mid-term review of the Water Action Decade in 2023. This requires visible steps and the creation of a single UN Data Portal for Water.

Initiatives such as the Global Hydrometry Support Facility (WMO HydroHub), the WMO Global Hydrological Status and Outlook System (HydroSOS) and the World Water Data Initiative (WWDI) are important building blocks to help include the water data in the peace agenda. This initiative has the aim to build a common understanding of the issues as a common basis for discussion among countries. It will also help to strengthen the links between operational hydrology and policy.

Mobilizing a coalition for data on water and peace is crucial for meeting the challenges of our century (Muenger et al. 2020).

7.11.4.6 The Global Water Conventions

The Panel encouraged the use and adoption of International Water Law in transboundary water cooperation, by states. The two United Nations Conventions; the 1997 UN Watercourses Convention and 1992 UNECE Water Convention, provide the necessary legal basis for improved international cooperation. Transboundary water cooperation agreements should be concluded among countries sharing rivers, lakes and aquifers. Regional conventions and agreements for collaborative management of water resources should be encouraged, especially among countries that have decided not to accede to the global conventions (Tanzi et al. 2015; GWH 2016). Additional "soft law instruments" need to be developed where necessary, including in the area of inter-sectoral water management.

In addition, the developments in financial mechanisms have to be linked with the international water law framework, i.e. the transboundary cooperation financial mechanism among party members to these conventions.

7.11.4.7 Research and Education

Research is carried out by two research teams, the UNESCO Chair on hydropolitics and the Platform for International Water Law of the GWH. These two research teams focus on a better understanding of challenges related to water governance and on legal frameworks structuring water management. They conduct strategic analysis for evidence-based decision making.

Within this framework, and in order to understand the triggers for water cooperation, the Geneva Water Hub is currently implementing with UNIGE, ETHZ, Zoï and Oregon State University, a methodology combining different approaches, theoretical frameworks and techniques. It aims at monitoring international hydro political tensions, and identify key variables that could play a role in the production of tensions or cooperation. Anchored in a scientific perspective, this

proposal combines large-N datasets, in-depth processes analysis and science-based visualization tools for the comprehensive and systematic examination of hydro politics. This diversity should increase the understanding of hydro political tensions and inform a wide range of audiences including, in particular, policy and decision makers, water management practitioners, scholars and the general public.

In terms of education, and with the purpose of investing in knowledge and capacity, the Geneva Water Hub through its five-year research and education function, has launched three online and in-class Massive Open Online Courses (MOOC), (i.e. MOOC in management and water policy, MOOC in international water law, MOOC in ecosystem services), training more than 28,000 students.

More than thirty institutions working on knowledge and capacity development in the field of water cooperation and diplomacy have joined the Universities Partnership for Water Cooperation and Diplomacy (UPWCD), launched and coordinated by the Geneva Water Hub. It aims at becoming a one-stop-shop on water cooperation and diplomacy. It integrates all relevant information and resources related to the theme. This includes: events, publications, databases, education material events, and joint research activities (Barua et al. 2019). And its objective is to facilitate cooperation and exchanges among like-minded institutions in order to make a real impact on the global water and peace agenda.

7.11.4.8 Culture

Water is strongly represented in every culture, and religion in the world. In addition to the rationale, political and scientific discourse, the GWH includes the cultural and artistic language to influence the water-peace agenda, through its various activities.

The Symphony on Water and Peace is now a central piece and cultural signature of the Geneva Water Hub and its key partners engaged in the water and peace discourse, and is a translation and clone of the GHLP-WP process, and development. It was developed in parallel, by composers and musicians from the 4 regions in which the GHLP-WP had their regional exchanges with the stakeholders. Accordingly, the Symphony on Water and Peace includes four movements, with a fifth Jazz one, developed in Brasilia calling for action to implement the recommendations (Youtube—Geneva Water Hub—Symphony on Water and Peace). This symphony is a real success and its "making" an excellent illustration of the work of the GHLP-WP. It aims to be the "jingle" of water and peace issues.

In February 2020, the Symphony was performed at the "Festival à Sahel Ouvert" celebrated, on the banks of the Senegal River, that was at the centre of the 1989 Senegalese-Mauritanian conflict. Water, peace, and security was the thematic of this Festival, and was expressed through various creations of art including videos, cinema music, photos. In addition, a philosophic reflection with the local population on the role of water in the sustainability of their societies, led by the eminent Senegalese philosopher Prof. Souleymane Bachir Diagne, and the GWH (Geneva Water Hub 2020d).

Beyond the specific musical piece, the Symphony encompasses the mobilization of arts, culture and philosophy of the GWH water and peace discourse.

7.11.4.9 Way Forward

At the time of fine-tuning this section, the world is still dealing with the outbreak of the COVID-19 pandemic in the beginning of 2021, which has both direct and indirect impacts on the water and peace local, regional and global agenda, at both the short- and long term. Beyond the sanitary aspect, COVID-19 has exposed the fragility and vulnerability of countries and societies (United Nations 2020; OECD 2020; Tignino and Kebebew 2020).

Basic hygiene is a prerequisite to limit the spreading of the virus and water is an essential component of any hygiene measure to be considered. Moreover, the indirect effects are likely to be severe as well and long lasting. Water availability and water infrastructure are vital for survival and development of societies, their agriculture, energy generation, and urban development. Where water availability and infrastructure are negatively affected by disruptions created by the pandemic and its economic consequences, the cumulative effect could be disastrous. It would be irresponsible to ignore these dangers. Every effort will have to be made to retain and strengthen the activities for good management of water resources, for adequate maintenance and development of water infrastructure and for the strengthening of the transboundary water cooperation.

Promoting water cooperation in its various forms has become an urgent task. Water should be used as an instrument of peace; violent conflicts related to water should be prevented. This is a moral imperative and a recognized political need of our era.

There is clearly a need to reinforce the dialogue between the water and the peace sectors. Although steps have been taken with the reflection induced by the GHLP-WP towards the water-peace nexus, yet the road ahead is a long one, but we are definitely on the right track. It is not surprising that in the current discussions on the UN Agenda 2030, the importance of SDG6 and ensuring water and sanitation for all, are already recognized as a priority. Every effort should be made to ensure that the centrality of SDG6 is strengthened and international cooperation in that regard is further developed.

In this context, it is important to recognize the link between water and peace. Water cooperation has historically been an important instrument of international cooperation

and strengthening of peace. This function should be further developed. The role of water basin agencies is undoubtedly central in the sustainable and peaceful development of the region, with the view that conflict takes root in fragile contexts (Muenger and Ndour 2020). In the short-midterm, the operationalization of the Global Observatory on Water and Peace, with the analytic capacity and the safe space convening capacity of the various partners, the monitoring and compliance of the Geneva List, the use of innovative Blue financing mechanisms, will assist in engaging the UN Security Council, and UN General Assembly with concrete tools and mechanisms to use water as a vehicle of Peace.

The world has to face the drama of water in its many manifestations through a set of carefully devised and sophisticated strategies. These should involve individual states and governments, regional organizations, including transboundary water management systems and global organizations, including the United Nations system and global financial institutions. These should also involve more dialogue between the water and peace actors.

It is time to act, and the time is Now. After all, water is A Matter of Survival, and one of the biggest challenges of the twenty-first century.

References

Adam P (2000) Water wars and peace. BBC News Online, 9 January

Alaerts G (2015) Institutions for river basin management the role of external support agencies (international donors) in developing cooperative arrangements. The World Bank, Washington, DC

Alam UZ (2002) Questioning the water wars rationale: a case study of the Indus waters treaty. Geogr J 168:341–353

Alatout S (2008) 'States' of scarcity: water, space, and identity politics in Israel, 1948–59. Environ Plann D Soc Space 26:959–982

Allan T (2002) The middle east water question: hydropolitics and the global economy. Ib Tauris

Allouche J, Middleton C, Gyawali D (2015) Technical veil, hidden politics: interrogating the power linkages behind the nexus. Water Altern 8

Amery H (2001) Water, war and peace in the middle east: comments on Peter Beaumont. Arab World Geogr 4(1):51

Angelou M (2010) Master class: the lessons—the connections that sustain us. (Video presentation) 2010. https://www.oprah.com/own-master-class/maya-angelous-master-class-quotes/all#ixzz4tH97vBxA. Accessed 20 September 2017

Asian Development Bank (2013) Asian development bank outlook 2013: measuring water security in Asia and the Pacific

Arjoon D, Tilmant A, Herrmann M (2016) Sharing water and benefits in transboundary River Basins. Hydrol Earth Syst Sci 20

Avant JT (2017) Talking stick and feather: indigenous tools hold sacred power of free speech. In Indian Country Today. August 15, 2017. https://indiancountrymedianetwork.com/history/events/talking-stick-and-feather-indigenous-tools-hold-sacred-power-of-free-speech/. Accessed on 12 December 2017

Bakker K (2002) From state to market?: water mercantilización in Spain. Environ Plann A 34:767–790

Bakker K (2012) Water security: research challenges and opportunities. Science 337:914–915. https://doi.org/10.1126/science.1226337

Barlow M, Clarke T (2002) Blue gold: the fight to stop the corporate theft of the world's water. The New Press

Bartlett AA (2006) Reflections on sustainability, population growth, and the environment—2006. In: Keiner M (eds) The future of sustainability. Springer, Dordrecht, pp 17–37

Barua A (2018) Water diplomacy as an approach to regional cooperation in South Asia: a case from the Brahmaputra Basin. J Hydrol 567:60–70

Barua A, ter Horst R, Sehring J, Bréthaut C, Salamé L, Wolf A, Nicol A (2019) Universities' partnership: the role of academic institutions in water cooperation and diplomacy. Int J Water Resour Dev 1–7

Benton T (1994) The greening of Machiavelli: the evolution of international environmental politics. Royal Institute of International Affairs, London

Blue Peace. https://www.thebluepeace.org/about-blue-peace-who-we-are. Accessed on 8 May 2020

Brown O, Mcleman R (2009) A recurring anarchy? The emergence of climate change as a threat to international peace and security: analysis. Confl Secur Dev 9(3):289–305

Bush M, Barbezat D (2014) Contemplative practices in higher education: powerful methods to transform teaching and learning. Jossey-Bass, California

Butts KH (1997) The strategic importance of water. Parameters 27 (1):65

Cai X (1999) A modeling framework for sustainable water resources management. PhD dissertation, University of Texas at Austin

Cai X, McKinney DC, Lasdon LS (2002) A framework for sustainability analysis in water resources management and application to the Syr Darya basin". Water Resour Res 38(6):1085–1098

Carmi N, Alsayegh M, Zoubi M (2019) Empowering women in water diplomacy: a basic mapping of the challenges in Palestine, Lebanon and Jordan. J Hydrol 569:330–346

Chen J, Leong YC, Honey CJ, Yong CH, Norman KA, Hasson U (2017) Shared memories reveal shared structure in neural activity across individuals. Nat Neurosci 1:115–125

Chittick WC (1983) The Sufi path of love: the spiritual teachings of Rumi. State University of New York Press, Albany, New York

Chikozho C (2015) Pathways for building capacity and ensuring effective transboundary water resources management in Africa: revisiting the key issues, opportunities, and challenges. Physics and Chemistry of the Earth Parts

Cosens B, de Silva L, Sowards AM (2012) Introduction to Parts I, II, and III. In: Cosens B (eds) Transboundary river governance in the face of uncertainty: the Columbia River treaty—a project of the universities consortium on Columbia River Governance. Oregon State University Press, Corvallis, Oregon

Council for Social Infrastructure Development (2015) Report on flood disaster risk reduction against large-scale inundations. Rebuilding flood-conscious societies through awareness-raising, Japan. https://www.mlit.go.jp/river/mizubousaivision/toushin_e/1512_toushin_e.pdf. Accessed on 23 April 2020

Council for Social Infrastructure Development (2017) Report on rebuilding flood-conscious societies in small and medium river basins, January 2017, Japan. https://www.mlit.go.jp/river/mizubousaivision/toushin_e/1701_toushin_e.pdf. Accessed on 23 April 2020

Council for Social Infrastructure Development (2018) Flood risk management for wide-area and long-lasting rainfall—multi-layered countermeasures for complex disasters, Japan. https://www.mlit.go.jp/river/mizubousaivision/toushin_e/1812_flood_risk_management_e.pdf. Accessed on 23 April 2020

Cran M, Durand V (2015) Review of the integration of water within the intended nationally determined contributions (INDCs) for COP21. French Water Partnership (FWP) and Coalition Eau. https://iwa-network.org/wp-content/uploads/2016/03/1448965142-2015-11-29_Review-of-Water-integration-in-INDC_VF.pdf

De Man R (2016) Transboundary wastewater governance—options based on an uncertainty perspective. The Hague Institute for Global Justice, Working paper, pp 15, 30

De Silva L, Veilleux JC, Neal MJ (2018) The role of women in transboundary water dispute resolution. In: Fröhlich C, Gioli G, Cremades R, Myrttinen H (eds) Water security across the gender divide. Water security in a new world. Springer, Cham

De Stefano L, James D, Kerstin S, Strzepek KM, Shlomi D, Wolf AT (2012) Climate change and the institutional resilience of international river basins. J Peace Res 49:193

Delli Priscoli J (1998) International conflicts related to transboundray water. Leadersh Environ Dev Online J

Delli Priscoli J, Hassan F (1998) Water and Civilization. UNESCO

Delli Priscoli J (2009) Water and security: cause war or help community building? White paper. US, Army Corps of Engineers, Institute for Water Resources (USACE, IWR)

Delli Priscoli J, Wolf AT (2009) Managing and transforming water conflicts. Cambridge University Press, New York

Delli Priscoli J, Stakhiv E (2015) Water related disaster risk reduction (DRR) management in the United States: floods and storm surges. Water Policy

Dessai S, Sluijs JP (2007) Uncertainty and climate change adaptation—a scoping study. Rep. NWS-E 2007-198

Dinar A (2007) Literature on conflict negotiation and cooperation over shared waters. Retrieved from water and conflict bibliography. https://biblio.pacinst.org/conflict/

Dinar S (2008) International water treaties negotiation and cooperation along transboundary rivers. Routledge, New York. ISBN: 0-203-93445-8, Master e-book

Edwards G (2013) Shifting constructions of scarcity and the neoliberalization of Australian water governance. Environ Plann 45:1873–1890

Eynon K (2016) Powerful water: a literature review of transboundary water interaction in the Nile Basin. University of Cape Town, Cape Town, South Africa

Falkenmark M, Lundqvist J, Widstrand C (1989) Macro-scale water scarcity requires micro-scale approaches. Natl Resour Forum (Blackwell Publishing Ltd.) 13(4):258–267

FAO (2010) International watercourses/river basins including law, negotiation, conflict resolution and simulation training exercises. Information products for Nile Basin water resources management. FAO

Fischhendler and Katz (2013) The use of 'security' jargon in sustainable development discourse: evidence from UN commission on sustainable development. Int Environ Agreem 13:321–342

Floyd R (2010) Security and the environment: securitisation theory and US environmental security policy. Cambridge University Press

Frey FW (1993) The political context of conflict and cooperation over international river basin. Water Int 18(1):54–68

Fröhlich C (2012) Water: reason for conflict or catalyst for peace? The case of the Middle East. L'Europe En Formation 365(3):139–161. https://doi.org/10.3917/eufor.365.0139

Future Water (2011) Assessment of the irrigation potential in Burundi, Eastern DRC, Kenya, Rwanda, Southern Sudan, Tanzania, and Uganda. NELSAP CU/RATP2/2011/01. Wageningen, the Netherlands

Geneva Water Hub (2016) Promoting the effectiveness of international water law in support of security and peace: think tank roundtable summary report. https://www.genevawaterhub.org/sites/default/files/atoms/files/gwh_ghlp_roundtable_iwaeffectiveness_rev_march2017nomail_0.pdf. Accessed on October 2016

Geneva Water Hub (2019a) The Geneva list of principles on the protection of water infrastructure. Geneva 2019

Geneva Water Hub (2019b) Determined steps: follow up activities and implementation of the recommendations of the report of the global high-level panel on water and peace "A Matter of Survival", Geneva, March 2019

Geneva Water Hub (2020a) 2020 world water day in times of crisis/ a global home for water and peace, 22 March 2020. https://www.genevawaterhub.org/news/2020-world-water-day-times-crisis

Geneva Water Hub (2020b) Stay tuned, the global observatory on water and peace, 11 May 2020. https://www.genevawaterhub.org/news/stay-tuned-global-observatory-water-and-peace. Accessed on 11 May 2020

Geneva Water Hub (2020c) Intensified action: second progress report on the follow up activities and implementation of the recommendations of the report of the global high-level panel on water and peace "A Matter of Survival", June 2020

Geneva Water Hub (2020d) Art for water and peace. https://www.genevawaterhub.org/resource/art-water-and-peace#SahelOuvert. Accessed on 2 June 2020

Gleick P, Cooley H, Cohen M, Marikawa M, Morrison J, Palanappn M (2009) Dams removed or decommissioned in the United States, 1912 to present. The World's Water 2008–2009. Pacific Institute for Studies in Development, Environment, and Security, Island Press, Washington, DC

Gleick PH (1993) Water and conflict: fresh water resources and international security. Int Secur 79–112

Gleick PH (1994) Water, war and peace in the Middle East. Environ Sci Policy Sustain Dev 36(3):6–42

Global High-Level Panel on Water and Peace (2017) A matter of survival (report). Geneva Water Hub, Geneva

Global Water Partnership (2000) Integrated water resources management, global water partnership, SE-105 25 Stockholm, Sweden

Grey D, Sadoff CW (2007) Sink or swim? Water security for growth and development. Water Policy, Iwaponline.com 9(6):545–571

Grey D, Garrick D, Blackmore D, Kelman J, Muller M, Sadoff C (2013) Water security in one blue planet: twenty-first century policy challenges for science. Phil Trans R Soc A 371:20120406. https://doi.org/10.1098/rsta.2012.0406

Granit J (2010) Identifying business models for transboundary river basin institutions. In: Earle A, Jagerskog A, Ojendal J (eds) Transboundary water management: principles and practice. Earthscan, Washington DC, pp 143–156

Gupta J, Dellapenna JW, van den Heuvel M (2016) Water sovereignty and security, high politics and hard power: the dangers of borrowing discourses! In: Pahl-Wostl C, Bhaduri A, Gupta J (eds) Handbook on water security. Edward Elgar Pub, Cheltenham, pp 120–138

Hall J, Borgomeo E (2013) Risk-based principles for defining and managing water security. Phil Trans R Soc A 371:20120407. https://doi.org/10.1098/rsta.2012.0407

Hammergren L (1998) Political will, constituency building and public support in the rule of law programs. Center for Democracy and Governance, Bureau for Global Programs, Field Support, and Research U.S. Agency for International Development, PN-ACD-023

Harada D, Egashira S (2018) Behavior of Driftwood in terms of convection-diffusion equation. In: Proceedings of the 21st IAHR-APD Congress 2018, Yogyakarta, Indonesia

Harou J, Pulido-Velazquez M, Rosenberg D, Medellin-Azuara J, Lund J, Howit R (2009) Hydro-economic models: concepts, design, applications, and future prospects. J Hydrol 375(3–4):627–643

Harris D, David B (2013) Applied political economy analysis: five practical issues. ODI Politics and Governance. January 2013

Harris LM, Goldin JA, Sneddon C (2015) Contemporary water governance in the global South: scarcity, marketization and participation. Routledge

Harrison GW (2006) Making choice studies incentive compatible. In: Kanninen BJ (eds) Valuing environmental amenities using stated choice studies. The economics of non-market goods and resources, vol 8. Springer, Dordrecht
Hefny MA (2011) Water diplomacy: a tool for enhancing water peace and sustainability in the Arab region. Second Arab Water Forum, Cairo
Hissen N, Conway D, Goulden M (2017) Evolving discourses on water resource management and climate change in the Equatorial Nile Basin. J Environ Dev 26(2):186–213
Homer-Dixon TF (1994) Environmental scarcities and violent conflict: evidence from cases. Int Secur 5–40
Homer-Dixon TF (1999) Environment, scarcity, and violence. Princeton University Press
Hoshino T, Yamada TJ (2018) Analysis of annual maximum precipitation over first-class river basins in Japan using a large-ensemble dataset (d4PDF). J Jpn Soc Civil Eng 74(4): I_187–I_192
Huntjens P, Lebel L, Furze B (2017) The effectiveness of multi-stakeholder dialogues on water: reflections on experiences in the Rhine, Mekong, and Ganga-Brahmaputra-Meghna river basins. Polit Sci. https://doi.org/10.7564/15-IJWG98
Huntjens P, Valk S, Zhang T, Warner J (2015) Adaptive delta governance learning from dynamic deltas. The Hague Institute for Global Justice, The Hague, The Netherlands
Hussein H (2016) An analysis of the discourse of water scarcity and hydropolitical dynamics in the case of Jordan. Doctoral dissertation, University of East Anglia
Hussein H (2017a) A critique of water scarcity discourses in educational policy and textbooks in Jordan. J Environ Edu 49 (3):260–271
Hussein H (2017b) Politics of the Dead Sea Canal: a historical review of the evolving discourses, interests, and plans. Water Int 42 (5):527–542
Hussein H (2018) Yarmouk, Jordan, and Disi basins: examining the impact of the discourse of water scarcity in Jordan on transboundary water governance. Mediterr Polit 1–21
IGRAC (2017) Transboundary aquifers of the world. International Groundwater Resources Assessment Centre
Intelligence Community (2012) First U.S. national intelligence report on water. U.S. Intelligence Community Assessment, ICA 2012
Islam S, Susskind L (2013) Water diplomacy: a negotiated approach to managing complex water networks. Routledge, New York
IWA (2015) A world of opportunities—working in the international water sector. IWA Publishing, London. ISBN: 9781780406954
Josef F, Kipping M (2006) Transboundary water cooperation. Federal Ministry for Economic Cooperation and Development, Development Education and Information Division, Bonn
Kamenetz R (1994) The Jew in the Lotus. HarperCollins, New York
Kaufman E (2002) Innovative problem-solving workshops. In Davies J, Kaufman E (eds) Second track/citizens' diplomacy: concepts and techniques for conflict transformation. Rowman & Littlefield, Lanham, Maryland
Kibaroglu A, Gursoy SI (2015) Water–energy–food nexus in a transboundary context: the euphrates–Tigris river basin as a case study. Water Int 40:824–838. https://doi.org/10.1080/02508060.2015.1078577
Kim K, Glaumann K (2012) Transboundary water management: who does what, where? Swedish Water House, Stockholm
Kramer A, Pahl-Wostl C (2014) The global policy network behind integrated water resources management: is it an effective norm diffusor? Ecol Soc 19(4):11–35
Leb C (2015) One step at a time: international law and the duty to cooperate in the management of shared water resources. Water Int 40(1):21–32
LeBaron M (2002) Bridging troubled waters: conflict resolution from the heart. Jossey-Bass, San Francisco, California
Lederach JP (2003) The little book of conflict transformation. Good Books
Levy MA (1995) Time for a third wave of environment and security scholarship? Environ Change Secur Proj Rep 1:44–46
Linton J (2010) What is water?: The history of a modern abstraction. UBC Press
Loucks DP (1997) Quantifying trends in system sustainability. Hydrol Sci J 42(4):513–530
Loucks DP, Gladwell JS (1999) Sustainability critieria for water resource systems. University Press, Cambridge
Loucks DP (2000) Sustainable water resources management. Water Int 25(1):3–11
Lowi MR (1995) Water and power: the politics of a scarce resource in the Jordan River basin. Cambridge University Press
Madani K, Hipel KW (2011) Non-Cooperative Stability Definitions for Strategic Analysis of Generic Water Resources Conflicts. Water Resour Manag 25(8):1949–1977
Maslow A (1954) A theory of human motivation. Pieces of the personality puzzle. In: Theory and research, 5th edn. W.W. Norton & Company, New York, 2010
McCracken M, Wolf AT (Forthcoming) Revisiting international river basins of the world
McKinney DC, Cai X, Rosegrant M, Ringler C, Scott C (1999) Integrated basin-scale water resources management modeling: review and future direction. In: System-wide initiative on water management (SWIM), Research paper no. 6, International Water Management Institute, Colombo, Sri Lanka
Meadows DH, Meadows DL, Randers J, Behrens WW (1972) The limits to growth. New York 102
Mehta L (2005) The politics and poetics of water: the naturalisation of scarcity in Western India. Orient Blackswan
Mehta L (2010) The limits to scarcity: contesting the politics of allocation. Routledge
Mendoza G (2010) Human development and water disaster damages as percent of GDP. US, Army Corps of Engineers, Institute for Water Resources (USACE, IWR)
Mills L-K (1999) Buddhism explained. Silkworm Books, Chiang Mai, Thailand
Ministry of Water Resources China (2015) Strengthening of flood control and disaster mitigation capacity. China
MLIT (1987) Ministry of Land, Infrastructure, Transport and Tourism, Japan
Moller LC (2005) Sharing transboundary rivers. Retrieved from the University of Nottingham. https://eprints.nottingham.ac.uk/13124/1/430535.pdf
Moran A et al (2018) Intersection of global fragility and climate risks. USAID
Mostert E (2003) Conflict and co-operation in international freshwater management: a global review. Int J River Basin Manag 1(3):267–278. https://doi.org/10.1080/15715124.2003.9635212
Motlagh M, Bhaduri A, Bogardi JJ, Ribbe L (2017) The role of trust-building in fostering cooperation in the Eastern Nile Basin: a case of experimental game application. J Natl Resour Dev (JNRD) 7:73–83. https://doi.org/10.5027/jnrd.v7i0.09
Movik S (2012) Fluid rights: water allocation reform in South Africa. HSRC Press
Muenger F, Carmi N, Pellaton C, Willemin J (2020) The key role of water management and data for peacebuilding. WMO Bull 69(1):8–13
Muenger F, Ndour N (2020) La consience de l'eau pour inventer la Diplomatie de demain, Baromètre 2020 de l'eau, de l'hygiène et de l'assainissement N° 06, Etat des lieux d'une ressource vitale, défis et solutions 50, mars 2020

Murthy S (2015) Can international water law be a tool for water diplomacy? J Int Law Peace Armed Confl
Naff T, Matson RC (1984) Water in the Middle East: conflict or cooperation?
Nordås R, Gleditsch NP (2007) Climate change and conflict. Polit Geogr 26(6):627–638
OECD (2020) Covid-19, crisis and fragility. https://read.oecd-ilibrary.org/view/?ref=131_131938-b9ys3suiav&title=COVID-19-Crises-and-Fragility. Accessed on 15 May 2020
Ohara M, Nagumo N (2018) Mortality by age group and municipality in the July 2018 torrential rainfall. J Disaster Res 14(6) (in press)
Ohlsson L, Turton AR (1999) The turning of a screw: social resource scarcity as a bottle-neck in adaptation to water scarcity. Occasional Paper Series, School of Oriental and African Studies Water Study Group, University of London
Orlove B, Caton SC (2010) Water sustainability: anthropological approaches and prospects. Ann Rev Anthropol 39:401–415
Perreault T (2006) From the Guerra Del Agua to the Guerra Del Gas: resource governance, neoliberalism and popular protest in Bolivia. Antipode 38:150–172
Phillips DJH, Daoudy M, Öjendal J, McCaffrey S, Turton AR (2006) Transboundary water cooperation as a tool for conflict prevention and broader benefit-sharing. Stockholm: Swedish Ministry for Foreign Affairs. www.egdi.gov.se
Post LA, Raile ANW, Raile ED (2010) Defining political will. Polit Policy 38(4):653–676. https://doi.org/10.1111/j.1747-1346.2010.00253.x
Rahula W (2007) What the Buddha taught. Grove Press, New York
Ravnborg HM, Bustamante R, Cissé A, Cold-Ravnkilde SM, Cossio V, Djiré M, Yen NTB et al (2012) Challenges of local water governance: the extent, nature, and intensity of local water-related conflict and co-operation. Water Policy 14:336–357. https://doi.org/10.2166/wp.2011.097
Reuveny R (2007) Climate change-induced migration and violent conflict. Polit Geogr 26(6):656–673
Rockström J, Steffen W, Noone K, Persson Å, Chapin FS, Lambin EF, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ (2009) A safe operating space for humanity. Nature 461:472–475
Rogers P, Leal M, Markey J (2010) Running out of water: the looming crisis and solutions to conserve our most precious resource. St. Martin's Press, New York
Rothman J (1995) Pre-negotiation in water disputes: where culture is core. Cult Surviv Q 19(3)
Rothman J (1989) Supplementing tradition: a theoretical and practical typology for international conflict management. Negot J 5(3)
Rothman J (1997) Resolving identity-based conflicts in nations, organizations, and communities. Jossey-Bass, San Francisco, California
Sadoff CW, Hall JW, Grey D, Aerts J, Ati-kadi M, Brown C, Dadson S (2015) Securing water, sustaining growth: report of the GWP/OECD task force on water security and sustainable growth. University of Oxford, UK
Sadoff CW, Grey D (2002) Beyond the river: the benefits of cooperation on international rivers. Water Policy 4:389–403
Salehyan I (2008) From climate change to conflict? No consensus yet. J Peace Res 45(3):315–326
Samson PR, Charrier B (1997) International freshwater conflict: issues and prevention strategies. Green Cross International, Geneva
Sandoval-Solis S, McKinney DC, Loucks DP (2011) Sustainability index for water resources planning and management. J Water Resour Plann Manag 137(5):381–390
Schmeier S, Gerlak A (2014) Climate change and transboundary waters: a study of discourse in the Mekong River commission. J Environ Dev 23(3):358–386
Sechi G, Zucca R (2015) Water resource allocation in critical scarcity conditions: a Bankruptcy game approach. Water Resour Manag 29:41–555
Seregeldin I (1995) Toward sustainable management of water resources (English), Directions in development. The World Bank, Washington, D.C.
Shachter-Shlomi Z. Quoted In: Kamenetz (1994)
Shachter-Shlomi Z (2005) Public lecture. Jerusalem, Israel June
Sherk GW (1999) The fifth horseman: the coming resource and water wars. Def Foreign Aff Strateg Policy 27(4):8–10
Shiva V (2002) Water wars: privatization, pollution and profit. India Research Press
Sid Ahmed M (1999) The water bomb. Al-Ahram Weekly 425:15–21
Singh N (2006) Women's participation in local water governance understanding institutional contradictions. Gend Technol Dev 10 (1):61–76
Smith D (1994) Dynamics of contemporary conflict: consequences for development strategies. Environ Poverty Confl (International Peace Research Institute (PRIO) Report, Oslo) 2(1994):47–89
Smith R (1999) Africa's potential water wars. BBC News Online, 15 November 1999
Song X, Chang KT, Yang LE, and Scheffran J (2016) Change in Environmental Benefits of Urban Land Use and Its Drivers in Chinese Cities, 2000–2010. Int J Environ Res Public Health 13 (6):535. https://doi.org/10.3390/ijerph13060535
Staddon C, James N (2014), Water security: a genealogy of emerging discourses. In: Schneier-Madanes G (eds) Globalized water. Springer, Dordrecht, pp 261–276
Steinway DM, Botts B (2011) Fundamentals of Environmental Law. In: Case DR, Bell CL, Steinway DM (ed) Environmental Law Handbook, 21 Edn. (Government Institutes)
Susskind LE (2017) The political and cultural dimensions of water diplomacy in the Middle East. In: Cahan JA (ed) Water security in the Middle East. Anthem Press
Swyngedouw E (1999) Modernity and hybridity: nature, regeneracionismo, and the production of the Spanish waterscape, 1890–1930. Ann Assoc Am Geogr 89:443–465
Tanzi A, McIntyre O, Kolliopoulos A, Rieu-Clarke A, Kinna R (eds) (2015) The UNECE convention on the protection and use of transboundary watercourses and international lakes. Its contribution to international water cooperation. Leiden, the Netherlands, Brill Nijhoff
Tawfik R (2015) The declaration of principles on Ethiopia's Renaissance dam: a breakthrough or another unfair deal? German Development Institute, Bonn
Tignino M, Irmakken Ö (forthcoming) The Geneva list of principles on the protection of water infrastructure: an assessment and the way forward, Brill Research Perspectives in International Water Law
Tignino M, Kebebew T (2020) Water for the most vulnerable could help stop spread of COVID-19. https://www.newsecuritybeat.org/2020/05/water-vulnerable-stop-spread-covid-19/. Accessed on 6 May 2020
Tolle E (2002) Practicing the power of now: essential teachings, meditations, and exercises from the power of now. New World Library, Novato, California
Toset HPW, Gleditsch NP, Hegre H (2000) Shared rivers and interstate conflict. Polit Geogr 19(8):971–996
Trolldalen JM (1992) International environmental conflict resolution: the role of the United Nations (No. 363.7 T846i). World Foundation for Environment and Development, Oslo, NO
Turton AR, Warner J (2002). Exploring the population/water resources nexus in the developing world. In: Dabelko JD (ed) Finding the source: the linkage between population and water. Environmental Change and Security Project (ESCP), Woodrow Wilson Centre

UNDP (2006) Beyond scarcity: power, poverty, and the global water crisis. Human Development Report, United Nations Development Program, New York
UNESCO (2015) Science report: towards 2030. UNESCO, Paris
UN-Water (2013a) Transboundary waters. https://unwater.org/topics/transboundary-waters/en/
UN-Water (2013b) Water security and the global water agenda: a UN-water analytical brief, 2013, United Nations University, Institute for Water, Environment & Health (UNU-INWEH), Hamilton, Ontario
United Nations Conference on Environment and Development (1992) Agenda 21, Rio de Janerio, Brazil, 3–14 June 1992, 351 pp
United Nations-World Water Assessment Programme (2009) Integrated water resources management in action. Jointly prepared by DHI Water Policy and UNEP-DHI Centre for Water and Environment, UNESCO, Paris
United Nations General Assembly (2015) Transforming our world: the 2030 Agenda for sustainable development. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E. Accessed 28 March 2018
United Nations Statistics Division (2018) Indicator 6.5.1: degree of integrated water resources management implementation, United Nations, Department of Economic and Social Affairs, Statistics Division. https://unstats.un.org/sdgs/metadata/. Accessed 29 March 2018
United Nations Children's Fund (2019a) Water under fire: for every child water and sanitation in complex emergencies. UNICEF, New York, March, p 2019
United Nations Children's Fund (2019b) Water under fire volume 1: emergencies, development and peace in fragile and conflict-affected contexts, UNICEF, New York, August 2019
United Nations (2011) Preventive diplomacy: delivering results. Report of the Secretary General, New York, S/2011/552, 26 August 2011
United Nations (2016a) https://webtv.un.org/meetings-events/security-council/thematic-debate/watch/part-1-open-debate-on-water-peace-and-security-security-council-7818th-meeting/5221217671001/?term=&lan=russian
United Nations (2016b) Meetings coverage: secretary-General. In: Security Council, stresses promotion of water-resource management as tool to foster cooperation. Prevent Conflict. https://www.un.org/press/en/2016/sc12598.doc.htm. Accessed on 23 April 2020
United Nations (2020) Secretary General—statements and messages—G20, other main economies must lead by example, secretary-general stresses, proposing climate-positive actions for building back from COVID-19, 28 April 2020. https://www.un.org/press/en/2020/sgsm20064.doc.htm. Accessed on 1 May 2020
United Nations Security Council (2017) S/PV. 7818 https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/spv_7818.pdf. Accessed on January 2020
U.S. Army Corps of Engineers, Institute for Water Resources (USACE, IWR) (2011) Flood Risk Management Approaches, As Being practiced in Japan, Netherlands, United Kingdom and United States. Report no: 2011-R-08. Alexandria, Va
U.S. Army Corps of Engineers, Institute for Water Resources (USACE, IWR) (2012) Joint post Pakistan flood study
US Climate Change Sciences Program (USCCSP) (2008) Climate models and assessment strengths and limitations, synthesis and assessment product 3.1
U.S. National Climate Assessment, U.S. Global Change Research Program (2014) Climate change impact on the United States. https://s3.amazonaws.com/nca2014/high/NCA3_Climate_Change_Impacts_in_the_United%20States_HighRes.pdf. Accessed on 20 April 2020
van Laerhoven F, Andersson KP (2013) The virtue of conflict: an institutional approach to the study of conflict in community forest governance. Int For Rev 15(1):122–136. https://doi.org/10.1505/146554813805927219
Vetter T (2016) Water connects: a short guide to preventive water diplomacy. Climate diplomacy initiative. Berlin. https://www.climate-diplomacy.org/file/2616/download?token=R_gYczM4
Warner J (2007) Multi-stakeholder platforms for integrated water management. Ashgate, Aldershot
WCED (1987) World commission on environment and development, our common future ("The Brundtland Report"). Oxford University Press, Oxford
Westing AH (1986) Global resources and international conflict: environmental factors in strategic policy and action. Oxford University Press on Demand
Wolf AT (1998) Conflict and cooperation along international waterways. Water Policy 1(2):251–265
Wolf A (1999) Criteria for equitable allocations: the heart of international water conflict. Natl Resour Forum 23(1):3–30
Wolf AT (2007) Shared waters: conflict and cooperation. Ann Rev Environ Resour 32. https://doi.org/10.1146/annurev.energy.32.041006.101434
Wolf A (ed) (2010) Sharing water, sharing benefits: working towards effective transboundary water resources management. A Graduate/Professional Skills-Building Workbook. UNESCO, The World Bank, and Oregon State University. Access at https://transboundarywaters.science.oregonstate.edu/sites/transboundarywaters.science.oregonstate.edu/files/Facilitations/International%20Waters%20-%202010-%20Sharing%20Water%20Sharing%20Benefits%20Workbook.pdf
Wolf AT (2017) The spirit of dialogue: lessons from faith traditions in transforming conflict. Island Press
Wolf AT, Yoffe SB, Giordano M (2003) International waters: identifying basins at risk. Water Policy 5(1):29–60
World Bank (2017) Beyond scarcity: water security in the Middle East and North Africa. The World Bank Group, Washington DC. https://doi.org/10.1596/978-1-4648-1144-9
World Water Council (2015) Integrated water resource management: a new way forward. In: A discussion paper of the world water council task force on IWRM, Marseille
World Water Council (WWC) (2013) Triennial report, delivering a pact for water security. https://www.worldwatercouncil.org/en/publications/delivering-pact-water-security. Accessed on 20 April 2020
Wouters P (2013) International law—facilitating transboundary water cooperation. GWP, 17 pp
Wang Y, Cheng H, Lawrence Edwards R, He Y, Kong X, An Z, Wu J, Kelley MJ, Dyoski CA, Li X (2006) The Holocene Asia monsoon links to solar changes and North American climate. Science 308 (Water Issues)
Yang YCE, Wi S (2018) Informing regional water-energy-food nexus with system analysis and interactive visualization—a case study in the Great Ruaha River of Tanzania. Agric Water Manag 196:75–86. https://doi.org/10.1016/j.agwat.2017.10.022
Zandvoort M, van der Vlist MJ, van den Brink A (2018) Handling uncertainty through adaptiveness in planning approaches: comparing adaptive delta management and the water diplomacy framework
Zawahri NA (2008) International rivers and national security: the Euphrates, Ganges-Brahmaputra, Indus, Tigris, and Yarmouk Rivers. Natl Resour Forum 32(4):280–289
Zeitoun M, Mirumachi N (2008) Transboundary water interaction I: reconsidering conflict and co-operation. Int Environ Agreements 8 (4):297–316. https://doi.org/10.1007/s10784-008-9083-5

Dictionaries

Webster (1985) In Merriam-Webster's. New collegiate dictionary, 9th ed. Springfield, Mass. Merriam Webster, p 1062

Meeting Reports

Joint IWA—World water council workshop, Delft IHE, August 2008
UNEP (2002) Atlas of International Freshwater Agreements. http://hdl.handle.net/20.500.11822/8182
U.S. Army Corps of Engineers (2012) Headquarters Civil Works, Briefing, Washington, D.C.

Newspapers

The Economist, March 31–April 6, 2012, page 57
Washington Post, September 11, 2010, p A8

Personal Communications

Turton AR, September 2010 Coordinator for Afghanistan and Pakistan, Washington DC, August 23, 2010
Sorooshian S (2010) During 2010 KEI International Water Symposium, July 20th, 2010, Seoul, Korea

Websites

Water Diplomat Talks (2019) https://vimeo.com/380247653, December. Accessed on 30 April 2020
Whatsinblue (2017) https://www.whatsinblue.org/2017/06/briefing-on-preventive-diplomacy-and-transboundary-waters.php. Accessed on January 2020
Whatsinblue (2018) https://www.whatsinblue.org/2018/10/the-role-of-natural-resources-as-a-root-cause-of-conflict-briefing.php. Accessed on January 2020
https://www.travelchinaguide.com/intro/history/prehistoric/great_yu.htm. Accessed on 21 April 2020
https://www.unwater.org/water-facts/climate-change/. Accessed on 21 April 2020
https://www.iwa-network.org/downloads/1448965142-2015%2011%2029_Review%20of%20Water%20integration%20in%20INDC_VF.pdf. Accessed on 21 April 2020

Léna Salamé graduated from the Sorbonne University in Paris as a lawyer in international public law. She specialized in conflict management and mediation, at a Harvard-MIT-Tufts joint programme and MWI, Boston, respectively. She served in the United Nations' system for 17 years as the strategic and operational coordinator of its programme on water conflict and cooperation.

Léna conceived around a 100 training courses and capacity building activities on international law, conflict management, confidence building and cooperation processes. She trained over 1500 persons on related topics. She also lectured in over 200 international events around the world. Her audiences encompass young, mid and high-level professionals, executive officers, as well as media professionals, decision makers and the civil society from all continents (i.e. South East Asia, Arab States, Africa, Europe, Latin America, Central Asia). She published a number of scientific articles and scientifically edited over 5000 pages of research related to topics of her competence. Because of this, she is credited for having played a central role in the development and promotion of the modern concept of hydro-diplomacy.

Daene C. McKinney is Professor of Civil Engineering at The University of Texas at Austin. Dr. McKinney's interests include sustainable management of water resources, especially the integration of engineering, economic, environmental and political considerations in transboundary basins. His current research focuses on climate change adaptation in major river basins, impacts of climate change in glacier-dominated river basins, sharing of transboundary aquifers, the development of water management decision support systems, and the application of cooperative game theory to transboundary river basin negotiations. He is Governor (Alternate) of the World Water Council.

Jerome Delli Priscoli was senior advisor at the U.S. Corps of Engineers' Institute for Water Resources. Over 40 years, he directed the Corps research, training and field assistance programs on; Social Assessment techniques, Public Participation, and Alternative Dispute Resolution (ADR). These programs set standards across the USG. The ADR program received the first U.S. Hammer award for efficiency in government from the US Vice President. He directed numerous high-level studies, designed, facilitated and served on many special committees in USACE and the U.S.G. Dr. Delli Priscoli became Chair of the Global Water Partnership (GWP) Technical Committee. He is on board of Governors of the World Water Council. Dr. Delli Priscoli has been advisor to the World Bank on water policy and to all UN water related agencies and IFI's and worked closely with Water Ministers worldwide. He was an original member of the U.S. delegation to the Middle East multilateral peace talks on water. He co-chaired the DG of UNESCO's world commission on Water and Freshwater Ethics. Dr. Priscoli is the Editor in Chief of the peer reviewed journal Water Policy. The American Water Resources Association awarded him the Icko Iben award for achievement in cross disciplinary communications in water.

Toshio Koike received the Bachelor, Master, and Doctor of Engineering, in 1980, 1982, and 1985, respectively, from the University of Tokyo, Japan. He was at the University of Tokyo, as a research associate in 1985 and a lecturer from 1986 to 1987, and at the Nagaoka University of Technology, Japan as an associate professor from 1988 to 1999 and a professor in 1999. In 1999, he joined the Department of Civil Engineering, the University of Tokyo, where he held the position of Professor until 2017. He is also working as Advisor to the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT). Since October 2014, he has been appointed as Director, International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM), Public Works Research Institute (PWRI) in Tsukuba, Ibaraki, Japan.

His research interest includes the water cycle and climate sciences and their applications to water resources management, which can be classified into the following three components, establishment of satellite remote sensing, development of the data integration and information fusion system, and development of the hydrological down-scaling methods including satellite-based data assimilation. Aside from his scientific contributions to water cycle and climate sciences and water resources management, he has been leading the international water cycle science projects and the inter-governmental science and technology cooperation.

Some of the prominent awards he has won recently include the following: "Award for Contribution to the IPCC NOBEL Peace Prize" from "WMO and UNEP" in 2008, "Einstein Lecturer Award" in 2009 from Chinese Academy of Sciences, China, "Japan Water Award -International Contribution" in 2010, "Science Award" from by the Japan Society of Hydrology and Water Resources in 2015.

Jack Moss is retired, having been the Executive Director of AquaFed—The International Federation of Private Water Operators.

Mr. Moss has 30 years' experience in the private sector water services industry. This has taken him to work in water services development in many different situations and countries around the world.

He is particularly interested in the commercial, institutional, human rights, regulatory and governance aspects of water supply and sanitation. He has written papers and made presentations in conferences on these subjects, including for the OECD, World Bank, United Nations etc.

He was chair of the water group of the BIAC (Business and Industry Advisory Committee to OECD) and has been an active contributor to the OECD's work on water and related matters.

He was AquaFed's liaison person with UN Water. He served as a member of UN Water's Task Teams on the water in the post-2015 Development Agenda and contributed to the Open Working Groups deliberations on the SDGs.

He served in the WBCSD water working group and was spokesperson representing the "Major Group—Business and Industry" in the 5th, 6th and 7th World Water Forum political processes, building on previous action of a similar kind in the World Summit on Sustainable Development 2002 in Johannesburg, the CSD 12, 13, & 16 and Rio +20.

In 2002/3 he project managed a multistakeholder project on valuing water for the CEO Panel on Water and co-authored a publication "Valuing Water for Better Governance" that was launched at the 3rd World Water Forum in Kyoto.

Mara Tignino is Reader at the Faculty of Law and the Institute for Environmental Sciences at the University of Geneva. She is also the Coordinator of the Platform for International Water Law at the Geneva Water Hub. Dr. Tignino has been Visiting Professor in various universities including Renmin University of China and the University of Barcelona. She acts as an expert and legal adviser for States and international organisations and has given training workshops in Africa, Asia, the Middle East and South America. In 2017, she won the prize "Women Peacebuilders for Water" from "Fondazione Milano per Expo" for her research on international water law and her dedication to training and mentoring new generations of international lawyers.

Owen McIntyre Professor and the Director of the LL.M. (Environmental and Natural Resources Law) Programme at the School of Law, University College Cork (UCC) and a Co-Director of the UCC Centre for Law and the Environment. He has served as the inaugural Chair of the IUCN World Commission on Environmental Law's Specialist Group on Water and Wetlands, and as a member of the EBRD Project Complaints Mechanism, the Scientific Committee of the European Environment Agency, and the (Irish) Aquaculture Licences Appeals Board. He holds visiting positions at Wuhan University, Xiamen University, Charles University Prague and the University of Dundee, School of Law.

Hussam Hussein is a Postdoctoral Researcher at the Department of International Agricultural Policy and Environmental Governance of the University of Kassel (Germany) and he is focusing on water-food security in the Mediterranean region, with an interest in transboundary water governance. His past research focused on critical hydropolitics in the cases of Jordan and of Lebanon, exploring the role of discourses in shaping water policies. Dr. Hussein obtained his Ph.D. degree in 2017 from the School of International Development, University of East Anglia (Norwich, UK) and is member of the Water Security Research Centre and of the Tyndall Centre for Climate Change Research at the University of East Anglia since 2012.

Mahsa Motlagh is a research associate in the "Digitainable" Project at Bonn Alliance for Sustainability Research, Bonn, Germany. The focus of her research is on the cross-disciplinary interface of social and environmental aspects of digital transformation, sustainable development diplomacy, and capacity building for behavioural change. Holding a Ph.D. in transboundary water governance, Mahsa has specialized in diplomacy in conflict resolution and multi-stakeholder process, human security, and social inclusion.

Aaron T. Wolf is a professor of geography in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. His research and teaching focus is on the interaction between water science and water policy, particularly as related to conflict prevention and resolution. He has acted as consultant to the US Department of State, the US Agency for International Development, the World Bank, and several governments on various aspects of transboundary water resources and dispute resolution. All told, he is (co-) author or (co-)editor of seven books, including Core and Periphery: A Comprehensive Approach to Middle Eastern Water, (Oxford University Press 1997), Transboundary Freshwater Dispute Resolution, (United Nations University Press 2000), Managing and Transforming Water Conflicts (Cambridge University Press 2009), and close to fifty journal articles, book chapters, and professional reports on various aspects of transboundary waters, from the local scale to the international. A trained mediator/facilitator, he directs the Program in Water Conflict Management and Transformation, through which he has offered workshops, facilitation, and mediation in basins throughout the world.

Lynette de Silva directs the Program in Water Conflict Management and Transformation at Oregon State University. She teaches courses in water conflict management; and water resources management; and has acted as a consultant to UNESCO, offering training to senior water professionals. Over the past 20 years, she has worked in areas emphasizing water resources and land management practices. She is a mediator and life coach. de Silva is the co-author of Resolving Environmental Conflicts: Principles and Concepts, Third Edition, published through CRC Taylor and Francis Group, LLC, released in 2019.

Natasha Carmi is an experienced water specialist in hydropolitics with a demonstrated history of working in highly sensitive and timely political environments. She joined the Geneva Water Hub in 2018, as the lead water specialist and contributes primarily to the establishment of the Global Water Observatory on Water and Peace, and the empowerment of women in water diplomacy. She works both on the global and regional aspects of the advancement of the water-peace discourse. Prior to that, she worked as water policy advisor to the Palestinian Negotiations Support Project, working closely with decision makers, and has experience in bilateral and regional water negotiations. Ms. Carmi has worked with water resources and environmental challenges in the Middle East for the past 20 years. She serves frequently as a faculty member for conferences and workshops dealing with transboundary water resources in general, and hydropolitics in particular, at which water is a core political issue and international water law is a necessary framework for resolving conflicts and identifying opportunities and solutions.

Danilo Türk is an Emeritus Professor of International Law, diplomat and politician. Prior to his term as the third President of the Republic of Slovenia (2007–2012) he was teaching international law at the faculty of Law, University in Ljubljana (1982–1992 and 2005–2007). He also worked as human rights expert, both in Slovenia and within the UN. Upon independence of Slovenia he was appointed Ambassador of Slovenia to the UN (1992–2000). He served on the UN Security Council in 1998–1999. Upon successful conclusion of his term, the then Secretary-General Kofi Annan invited him to serve as UN Assistant Secretary-General for Political Affairs (2000–2005). He returned to Slovenia in 2005 where he was elected third President (2007–2012).

In 2015–2017 he served as Chairman of the Global High Level Panel on Water and Peace. Since 2018 he is the Lead Political Advisor to the Geneva Water Hub.

François Münger is the director of the Geneva Water Hub, that is a global unit for water security and peace. The Geneva Water Hub is the Secretariat of the High Level Panel on Water and Peace. He left in December 2014 the direction of the Global Program Water Division of the Swiss Agency for Development and Cooperation—SDC-, that he created and profiled during eight years; the Global Program water being now in the center of the water strategy of the Swiss Federal Department of Foreign Affairs.

Eng. François Münger holds a diploma/M.Sc. in geophysics and mineralogy (University of Lausanne), a diploma/M.Sc. in hydrogeology (University of Neuchatel) and a European M.Sc. in environmental engineering with specialization in biotechnology (Swiss Federal Institute of Technology—EPFL-), as well as a post graduated certificate equivalent to an M.S. in geological and climate hazards (University of Geneva).

He is a senior expert in water, sanitation, and environmental issues. He has worked previously as a scientific researcher for the EPFL in charge of an international project of energy storage in aquifers, as director of a dams and deep boreholes project in Africa, as head of SDC Water Program in Central America and as a senior water specialist of the World Bank in HQ and in Africa. He has also launched various partnerships with public and private sector, NGOs and local authorities, as for example a large partnership on the reduction of the water footprint of twenty + multinational enterprises. Since six years he is supporting the development of capacities and of a portfolio in hydrodiplomacy within the SDC's global Program Water.

He has led various publications and high level meetings on the Human Right to water and supported strong global advocacy campaigns to highlight the importance of sanitation. He has work experience in different private or public institutions in Switzerland, Africa, Latin America, Central Asia and East Europe. In March 2015, with the title of Swiss Special Envoy for water, he took over the creation and launch of the Geneva Water Hub that is now a global center in Geneva and of which he is now the director general.