Transboundary water governance and climate change adaptation

International law, policy guidelines and best practice application

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With contributions from Jing Lee and Anton Earle

Technical Paper

United Nations World Water Assessment Programme

IUCN

Centre for Water Law, Policy and Science

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

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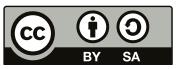
Published in 2015 by the United Nations Educational, Scientific and Cultural Organization,
7, place de Fontenoy, 75352 Paris 07 SP, France

ISBN 978-92-3-100135-2

Suggested citation: Rieu-Clarke, A., Moynihan, A. and Magsig, B.-O. 2015. *Transboundary water governance and climate change adaptation: International law, policy guidelines and best practice application.* WWAP. Paris, UNESCO.



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Copyediting by Simon Lobach
Layout design and typesetting by UNESCO, Paris
Printed by UNESCO, Paris

This publication is printed with vegetable inks on FSC Mixed Sources paper, supporting responsible use of forest reserves, 100% recycled, acid-free and chlorine-free.

Printed in France

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List of acronyms

CBD	Convention on Biological Diversity
COP	Conference of the Parties
EC	European Community
ECJ	European Court of Justice
ECOSOC	United Nations Economic and Social Council
EEA	European Environmental Agency
EIA	Environmental Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GEWAMED	Mainstreaming Gender Dimension into Water Resources Development and Management in the Mediterranean Region
GIS	Geographic Information System
GWA	Gender and Water Alliance
GWP	Global Water Partnership
ICJ	International Court of Justice
ICPDR	International Commission for the Protection of the Danube River
ICWE	International Conference on Water and the Environment
IEEP	Institute for European Environmental Policy
IFAD	International Fund for Agricultural Development
ILA	International Law Association
INBO	International Network of Basin Organizations
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resources Management
MEA	Multilateral environmental agreement
MRC	Mekong River Commission
NGO	Non-governmental organization
OKACOM	Okavango River Basin Water Commission
OSCE	Organization for Security and Co-operation in Europe
PIC	Permanent Indus Commission
RBMP	River basin management plan
RBO	River basin organization
SADC	Southern African Development Community
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNISDR	United Nations International Strategy for Disaster Reduction
USA	United States of America
WFD	Water Framework Directive
WHO	World Health Organization
WMO	World Meteorological Organization
WWF	World Wide Fund for Nature

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Acknowledgements

This publication is a product of a much more extensive body of activities pursuant to the IUCN project *Climate Change Governance Capacity: Building regionally- and nationally-tailored ecosystem-based adaptation in Meso-America* – thanks to the support of the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), on the basis of a decision adopted by the German Bundestag.

The project was also made possible by the contribution of many people. First and foremost, credit must go to Juan Carlos Sánchez, Senior Legal Officer, Environmental Law Centre, IUCN and PhD Candidate at the IHP-HELP Centre for Water Law, Policy and Science (under the auspices of UNESCO), University of Dundee. Without his leadership, there is no doubt that this publication would not have materialised. Juan Carlos not only initiated the project but also generously dedicated his time to overseeing the process of its production and offering his expert insights. Several experts, too many to mention here, have contributed indirectly to the development of the guidelines. The authors are particularly grateful to the expert reviewers of the publication, which included Josh Roberts (ClientEarth), Sonja Koeppel (UNECE Water Convention Secretariat), Emma Mitrotta (IUCN), Warren Waetford (IUCN), Lorena Martínez (IUCN) and Marta Pérez de Madrid (IUCN).

The paper benefitted from the contributions of Jing Lee, who offered invaluable insights into aspects related to ecosystem protection, and Anton Earle, who tackled the critical issue of gender. The authors are also particularly grateful to their supporting institutions, including the Helmholtz Centre for Environmental Research, University of Dundee, Stockholm International Water Institute and the Scottish Government's Hydro Nation Scholars Programme. Lastly, a special thanks goes to the members of the UNESCO Publication Board for their kind consideration of the proposal and the United Nations World Water Assessment Programme of UNESCO for their great effort in making this publication a reality, in particular Diwata Hunziker, Engin Koncagul, Michela Miletto, Valentina Abete and Francesca Greco.

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This publication is a joint collaboration of the following institutions:

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The IUCN Environmental Law Centre (ELC), based in Bonn, Germany, was established in 1970 as a unit of the International Union for the Conservation of Nature in charge of the conceptual development of Law, providing technical legal assistance in drafting and implementing legislation and treaties as well as training, and building capacities to decision-makers at all levels of governance in the fields of biodiversity conservation and sustainable use of natural resources. In collaboration with the IUCN Programmes and Regional Offices, the experts of the ELC work in multiple areas covering issues related to endangered species, forest conservation, protected areas, land use planning, water, transboundary resources, as well as climate change adaptation and mitigation. ELC hosts one the world´s largest and most comprehensive collections of Environmental Law materials, comprised of treaties, national legislation, as well as policy and law literature covering the entire spectrum of issues related to environmental and natural resources conservation. The Centre also manages ECOLEX, a web-based information and capacity-building service on environmental law operated jointly by FAO, IUCN and UNEP.

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United Nations World Water Assessment Programme of UNESCO

As part of its work, the World Water Assessment Programme (WWAP) coordinates the production of the flagship report of the United Nations on freshwater, the United Nations World Water Development Report (WWDR). The WWDR is a joint effort of 31 United Nations agencies and entities that make up UN-Water, and brings together some of the world's leading experts to analyse the state of the world's freshwater resources, provide up-to-date information on changes and management of water supplies, and tracks progress towards achieving international development targets. The WWDR also provides decision-makers with the tools to implement sustainable use of our water – offering best practices to help stimulate ideas and actions for better stewardship of this most essential resource. In addition to coordinating this significant UN report, WWAP contributes to the monitoring of freshwater issues by providing recommendations, developing case studies, enhancing assessment capacity at a national level and informing the decision-making process.

Foreword

Water is at the core of numerous climate change effects and plays a key role in climate change adaptation. It is unequivocal that climate change would have negative consequences on the numerous existing challenges that require good water governance both at the domestic, regional and global levels. In this regard, states have a big role to play in ensuring that they are able to make a comprehensive analysis of anticipated climate change effects on water resources. Considering that most of the planet's water resources transcend boundaries, institutional structures at the basin level should strive to provide for an effective means through which international laws and policies can be coordinated throughout the entire basin. Increasing resilience and the capacity to adapt to climate change as pertains to water resources will also demand a holistic view to be embraced by states. A holistic view to tackling climate change impacts will *inter alia* involve the application of the ecosystem-based approach; it has a significant role to play in enhancing climate change resilience since it involves the integrated management of land, water and living resources while promoting conservation and sustainable use in an equitable way.

In 2001, the 7th Conference of the Parties (COP7) to the United Nations Framework Convention on Climate Change (UNFCCC), known as the Marrakech Accords, agreed on facilitating implementation of the ecosystem approach and welcomed additional guidelines to this effect. The UNFCCC Nairobi Work Programme (NWP) on Impacts, Vulnerability and Adaptation to Climate Change also strives to assist all parties, particularly in developing nations, to ameliorate their comprehension and appraisal of impacts, vulnerability and adaptation to climate change, as well as to make enlightened decisions pertaining to practical adaptation measures and actions to respond to climate change on a robust technical, scientific and socio-economic basis, taking into account present and future climate change and variabilities. Likewise, the NWP also acknowledges the fact that healthy ecosystems have a vital role to play in enhancing resilience and helping people to adapt to climate change, and that the ecosystem-based approach has contributed to *inter alia* sustainable water management, livelihood sustenance and food security, biodiversity conservation and disaster risk reduction.

Water is imperative for the robust performance of social and ecological systems in society. Every day, we gain new insights daily about the correlation between water and climatic changes. It is therefore prudent that water governance be flexible enough to ensure an adaptive and systematic transformation of organizations and institutions both at the global and national levels. A holistic approach to managing water catchments through collaborative governance ought to be supported; a coordinated long-term national and international strategy for sustainable water management in the face of climate change ought also to be developed and valued greatly. This will also entail states recognizing water as a human right, as echoed in General Comment No. 15 on the right to water and sanitation. It is essential that serious measures be taken at global, regional and national levels to ensure that water is valued accordingly and that it is also utilized and conserved in a wise manner. Continuous monitoring and evaluation of water resources should also be recognized and up-to-date information should be made readily available to all stakeholders to ensure efficient governance of water resources in a changing climate.

Matters of global concern like climate change are usually addressed through international governance frameworks and the proposed solutions are usually mediated through the work of state governments. However, climate change governance usually poses arduous challenges for modern political administrative systems that have evolved from handling various issues and are now compelled to adapt and manage the emerging issues of climate change mitigation and adaptation. Climate change governance, therefore, requires governments to take a progressive role in keeping up with shifts in interest perceptions, so that an effective mitigation and adaptation policy system can be sustained. Some of the measures that can assist in effecting such changes include *inter alia* creating new institutional actors, adjusting legal rights and responsibilities, instituting new centres of economic power, and changing perceptions and accepted views and norms.

The climate-change induced fluctuations have influenced and will continue to impact the Earth's ecosystems severely and therefore people's livelihoods and well-being. While the impacts of human-induced climate change worldwide have already been observed, the climate system is constantly changing as a result of natural dynamics. The UN World Water Assessment Programme (WWAP) of UNESCO and IUCN recognizes that the hydrological cycle will be the main medium through which the impacts of climate change, such as water-related disasters, shifts in rainfall patterns and their spatio-temporal distribution, will be felt. Some of the global climate change impacts that scientists had already predicted in the past are presently would occur are presently being felt at different scales: severe floods and droughts; sea level rise; ice on rivers and lakes breaking up earlier; and longer and intensive heat waves, among many others. There is concern that while the world started taking steps to respond to the impacts of future climate change, too little is being done to act on the water crises.

The Intergovernmental Panel on Climate Change (IPCC) has noted that taken as a whole, the range of published evidence indicates that the net damage costs of climate change are likely to be very significant and increase over time. The IPCC also acknowledges the fact that the extent of climate change impacts on individual regions will vary over time with the ability of different societal and environmental systems to mitigate or adapt to change.

At the second session of the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP), which was held in Bonn, Germany (Bonn Climate Change Conference) in October 2015, the delegates discussed climate change mitigation and adaptation, loss and damage, finance, technology development and transfer, and capacity-building. These issues also have a bearing on the findings of this publication, which provides useful insights in the adoption of ecosystem-based climate change adaptation strategies in numerous parts of the globe and offers useful policies, mechanisms and legal measures that can be used to efficiently adapt to climate change-induced effects, particularly with regard to river basins.

As the 21st Conference of the Parties to the UNFCCC, or CMP 11, gathers in Paris from 30 November to 11 December 2015, the common aspiration will be to achieve a legally binding and universal agreement on climate from all nations. It is expected from this conference that water will be incorporated as a central component of adaptation and climate change addressed by water policy-makers at international, regional, national, basin and local levels in their strategies.

The policy guidelines proposed in this paper take this concerns into account, while addressing fundamental factors related to transboundary water governance and climate change adaptation. The central notion is to reinforce water governance capacities as well as the ecosystem-based approach to climate change adaptation policies and measures in river basins across the globe. Accordingly, the guidelines are of prime value to policy-makers, governments, academia, international and national organizations, institutions and civil society groups, who recognize the essential role of ecosystem-based climate change adaptation.

Sustainable management of water is the central component for adapting to a changed climate and, consequently, must be a clear priority in the COP negotiations as well as in the 2030 Agenda and other international discussions revolving around sustainable and equitable development.

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Executive summary

Context

Water is central to climate change adaptation. An ecosystem-based approach to water management offers an effective strategy for adapting to the likely impacts of climate change on water. While the implementation of such a strategy raises a host of complex economic, social, cultural and environmental challenges, the contribution of governance is critical. Both in general and specific terms, the success or failure of any ecosystem-based adaptation strategy is contingent on the existence of effective governance arrangements.

Guiding principles

Experience from the development of water-related governance arrangements across the world suggests that a number of key principles can support ecosystem-based climate change adaptation, but these principles must be flexible enough to accommodate the particularities of diverse local contexts.

A central overarching principle is that ecosystems must be governed as a natural unit. In a water context, this requires the establishment of appropriate arrangements at the river basin level. Since river basins often cross political borders, such general governance arrangements require effective legal and institutional frameworks to be adopted by states sharing the same resource. However, an ecosystem-based approach must also account for the need to make decisions at the lowest appropriate level.

Therefore, strong synergies are needed between community-based governance arrangements and decision-making at a national or international (basin) level. Institutional structures at the basin level, such as joint river basin organizations, offer an important means by which international laws and policies are coordinated across the entire basin. Effective mechanisms for stakeholder participation at the local, national and international level hold many benefits for public officials in their management of water resources, increasing resilience and the capacity to adapt to climate change. It is recognized that the experiences and needs of men and women can differ in this regard, underscoring the importance of incorporating a gendered approach at all levels of water management and development. While progress has been made at the local and national levels, there is a marked lack of consideration for gender issues at the international transboundary level; a situation which will require concerted effort to remedy.

At the transboundary level, the inherent nature of climate change means that international law must grapple with the tension between the preservation of the status quo, and the needed flexibility to meet new demands and face new uncertainties. Various strategies can be employed to enhance the flexibility of water arrangements. For example, fixed quantity allocation mechanisms can be replaced by periodically reviewed percentage allocations.

Provisions for data collection and information sharing are an essential basis needed to develop effective ecosystem-based climate change adaptation strategies. In a transboundary context, it is important for states to be able to compare and align climate change projections and estimated impacts on water resources. Joint or harmonized impact assessments, as well as joint monitoring and joint information systems such as databases or GIS systems, eliminate conflicting results and policies and strengthen cooperation. River basin organizations, such as the Mekong River Commission, play an important role in this respect by facilitating data and information generation, sharing and harmonization.

Climate change is projected to have a significant impact on water quality, with many effects already apparent. Strategic actions and solutions to the impacts of climate change on water quality may include supplementing natural supplies, using more climate-resilient technologies and processes, upgrading water treatment systems, and creating further storage capacity. Climate impact assessments offer an innovative legal mechanism that states could use to identify and address the specific climate effects on water quality.

Photo: André Künzelmann/©Helmholtz Centre for Environmental Research

Meandering river (Patagonia, Argentina)

Climate change is causing more frequent and more severe floods and droughts. Our current state of preparation in the management of the worsening adverse impacts of floods and droughts is inadequate. Improved risk regulation will therefore be critical to any adaptation measure. When integrating measures of risk regulation into climate change law, putting too much blind trust in (sound) science-based risk regulation is the wrong approach, and could backfire. A key approach to effective risk regulation and prevention is to recognize the diversity of local knowledge, the different perspectives on risk, as well as political concerns. Legal rules providing for prior exchange of data and information on measures of prevention undertaken by authorities at various levels of governance, as well as continuous monitoring and exchange, are important adaptation tools to prepare against the effects of flood and drought events.

It has become increasingly recognized that risk management, which underlies uncertainty management, requires that water demand management be tackled as a key component of any climate change adaption strategy. In particular, there should be greater emphasis on the promotion of efficient irrigation, given that irrigation represents 70 per cent of global water withdrawal and accounts for 90 per cent of global consumptive water uses. A wide range of different instruments to improve resource efficiency and promote sustainable consumption are available, including regulatory, economic, information, education, research and development instruments, as well as voluntary agreements and cross-sectional measures.

A major challenge in strengthening compliance with legal commitments is the need to enhance the determinacy of laws relating to water and adaptation measures and to foster shared understanding amongst stakeholders. Tools such as education, awareness and training programmes, reporting, non-compliance procedures, and technical and financial assistance, among others, can be pivotal in strengthening compliance, if targeted effectively.

As a result of a range of converging factors (including climate change), it is predicted that conflicts over water will increase in both frequency and intensity. The importance of understanding the contribution that law can make to resolving potential conflicts over water, through effective dispute avoidance and resolution mechanisms, is vital to strengthening water governance and climate change adaptation arrangements.

1 ▪ Introduction

1.1 Context

Climate change is an extremely complex issue that involves multiple dimensions, dynamic feedbacks and interactions between different elements. Such complexity is amplified by the fact that some impacts only occur indirectly. Drawing a universally valid picture about the impacts of climate change is problematic. Additionally, different ecosystems and communities may not be equally affected (with possible impacts being positive or negative) by the changing climate, and their respective capacities to adapt may vary. Trade-offs between different actors, interests and scales will be inevitable when dealing with climate change.

Water is central to climate change adaptation and the impact of climate change on water resources is a key issue for all sectors and regions. Global warming leads to increased evaporation over oceans, coupled with an increase in continental precipitation, which in turn leads to an increase of the global continental river runoff. However, the interconnections between climate change and water are more complex. One example is the little-studied effect of climate change on water demand – current research focuses primarily on the impacts of climate change on the availability of water. The demand side is crucial, as water demand in some sectors is highly sensitive to the climate. In general, plants need more water as temperatures rise. Under certain conditions, however, their needs for freshwater can be reduced by increasing atmospheric CO_2 concentrations (Cooley et al., 2009). Since agriculture accounts for approximately 70 per cent of global water use, changes in water demand in that sector will have broad implications.

Besides the actual changes in water availability and demand, the magnitude of uncertainty and the complexity of the science of global climate change pose unique resource allocation and risk management challenges (Tarlock, 1992). Uncertainty refers to 'a situation in which there is not a unique and complete understanding of the system to be managed' and includes epistemic uncertainty (deficient/incomplete knowledge), ontological uncertainty (due to the variability and unpredictability inherent to a system) and ambiguity (which results from 'the simultaneous presence of multiple frames of reference about a certain phenomenon') – all increasing the potential of leading to multiple interpretations of a specific issue (Brugnach et al., 2008).

Governance relates to the 'system of values, policies and institutions by which a society manages its economic, political and social affairs through the interactions within and among the state, civil society and private sector' (UNDP, 2004). The concept emphasizes the fact that civil society and the private sector, and not merely the State, have a role to play in decision-making (Allan and Rieu-Clarke, 2010). 'Water governance' can be regarded as the 'political, social, economic and administrative systems that are in place, and which directly or indirectly affect the use, development and management of water resources and the delivery of water service at different levels of society' (UNDP Water Governance Facility, n.d.). Water governance can be conceptualized as 'a means to an end', the end being efficient, equitable and sustainable water management (IUCN, 2009). Governance related to water management must therefore take into account a wider framework than water-specific laws, policies and institutions.

Growing attention has been given to the need to improve water-related governance arrangements in recent years. The 'world water crisis' has even been described as a 'crisis of governance' (WWAP, 2006). It has been argued that improving the way in which water is governed at the local, national and international levels will yield the greatest

Photo: Evan Schneider/©UN Photo

Aerial view of Colombia floods (Cartagena, Colombia)

potential gain in addressing issues related to water availability and access to water. There has been considerable support at the political level for the strengthening of governance arrangements, including the 2000 *Ministerial Declaration of the Hague on Water Security*, the 2001 '*Bonn Keys' of the International Conference on Freshwater*, the 2002 *Plan of Implementation of the World Summit on Sustainable Development*, the 2003 *Ministerial Declaration of the 3rd World Water Forum*, in Kyoto, and the *2006 Ministerial Declaration of the 4th World Water Forum*, in Mexico. In addition, the 2009 *Ministerial Statement of the 5th World Water Forum*, in Istanbul, emphasized that 'good water governance requires multi-stakeholder platforms and legal and institutional frameworks enabling the participation of all, including indigenous peoples, marginalized and other vulnerable groups, promoting gender equality, democracy and integrity' (World Water Council, 2009). The 2012 United Nations Conference on Sustainable Development (Rio+20) and, more recently, the Sustainable Development Goals reaffirmed the need to improve the implementation of integrated water resources management at all levels.

Despite the recognition at the highest levels of the value of governance arrangements, notable challenges remain. UN-Water, for instance, observes within the context of transboundary waters that 'existing agreements are sometimes not sufficiently effective to promote integrated water resources management, due to problems at the national and local levels such as inadequate water management structures and weak capacity in countries to implement the agreements as well as shortcomings in the agreements themselves (for example, inadequate integration of aspects such as the environment, the lack of enforcement mechanisms, limited – sectoral – scope and non-inclusion of important riparian states)' (UN-Water, 2008).

In addressing such challenges, the concept of 'water governance capacity' has been promoted. Water governance capacity reflects a society's level of competence to effectively implement water arrangements through policies, laws, institutions, regulations and compliance mechanisms (IUCN, 2009). Not only must the appropriate laws and policies be designed and adopted, but also the capacity of a range of stakeholders (government, communities, scientists and so forth) must be sufficient in order to ensure that such instruments are implemented effectively.

1.2 Purpose

The purpose of these guidelines is to support water governance capacity and ecosystem-based climate change adaptation measures in river basins around the world. In so doing, the guidelines provide a useful reference tool for policy-makers, decision-makers, actors within the civil society and anyone else who has an interest in strengthening ecosystem-based climate change adaptation.

The report comprises two sections, the first of which presents experiences in the adoption of ecosystem-based climate change adaptation strategies in various parts of the world and offers some insights into the types of mechanisms, institutions, policies and legal measures that could be taken to effectively adapt to climate change-induced impacts on river basins. The first section offers a number of case studies, namely the legal and policy framework of the European Community (EC), the United Nations Economic Commission for Europe (UNECE), the Mekong River Basin, and the Southern African Development Community (SADC). These four cases present some examples of the typical measures that have been taken by states in order to address climate change adaptation issues at a transboundary river basin level.

The second section offers a more detailed analysis of the key measures that have been adopted in order to adapt to climate change within a transboundary water context, identifying nine key principles central to the development of climate change adaptation measures. The report first describes the content and meaning of each principle, whilst also giving examples of their application in a water context.

The first of these nine principles focuses on the ecosystem-based approach, which provides an important foundation for all the other concepts. The content and meaning of the ecosystem-based approach is set out in the guidelines, followed by some examples of its application within a water context.

The second principle relates to institutions. The report argues that in the absence of effective institutional arrangements at the river basin level, more targeted interventions related to climate change will not be possible. Additionally, the importance of public participation in building effective institutions is recognized, as well as the need to strengthen capacity in order to ensure that such participation is meaningful.

The third principle addresses the ways to ensure that water allocations are flexible enough to respond to the uncertainties and capriciousness inherent to climate change. As such, it is closely linked to the issue of institutions discussed in the previous section. Various options and examples of flexible water allocation mechanisms are presented.

A further key foundation for adaptation strategies is reliable data and information. Without reliable data and information, the ability of states to negotiate flexible allocation measures, or the capacity of the public to effectively participate in decision-making, is severely compromised. This complex issue becomes even thornier at a transboundary level, because data and information are often collected at the national level. Joint institutions therefore play a key role in harmonizing data and information between states at the basin level.

The fifth principle seeks to address water quality issues, which are often overlooked or outright disregarded during negotiations on climate change adaptation. The relationship between water quality and climate change is considered, together with various approaches that have been developed to strengthen policies regarding water quality.

The sixth principle focuses more specifically on the impact of climate change, particular focus being given to its impact on floods and droughts. Examples of risk management strategies undertaken to prevent and mitigate the impact of extreme events are presented, and the importance of local knowledge is emphasized.

The seventh principle then deals with the demand side of water policy, which relates to reducing consumption and improving efficiency. This section demonstrates that a focus on the demand side of water provision can offer an important and cost-effective means by which to adapt to the negative impacts of climate change.

The eighth and the ninth principles are more general in nature, but provide important foundations for implementing the more specific climate change adaptation measures. Both principles demonstrate that the effectiveness of more specific ecosystem-based climate change adaptation measures can be secured by establishing strong compliance strategies and effective dispute settlement arrangements. This approach is an important aspect that pervades all of the concepts presented in this section. While some measures may be more or less specific to climate change adaption, it must be recognized that the strength of measures specific to climate change adaptation is highly contingent on the existence of more general cooperative mechanisms at the transboundary level.

The final section of the guidelines seeks to pull together the analysis made in the first two sections and to provide guidance for stengthening the implementation of ecosystem-based adaptation measures in river basins across the globe.

2 ▪ Selected approaches to water and climate adaptation at the regional level

2.1 European Community water law and policy

The European Community (EC) has created extensive legislation and policy on water management. Recently, it has issued further policy guidance on climate change and ecosystem protection.[1] This short section aims to give an overview of the key legal and policy instruments of the EC on water management which also address climate change adaptation. These instruments are referred to throughout this report.

The *European Water Framework Directive* (European Parliament and Council, 2000; hereafter referred to as WFD) is the main legal instrument which regulates water management and protection at the EC level. Central to the WFD is the concept of multilevel governance, integrating simultaneous decision-making on water management across different levels (intergovernmental, supranational, regional and local) and promoting decision-making at the lowest appropriate level (Louka, 2008). Numerous other EC legal and policy instruments contribute towards the task of climate adaptation in water management. Legal documents of particular relevance include the *EC Floods Directive* (European Parliament and Council, 2007), while policy documents include the *EC Communication on Water Scarcity and Droughts* (EC, 2007), the 2009 EC *Guidance White Paper on Climate Adaptation* (EC, 2009a), and the 2009 *EC Guidance document No. 24 River Basin Management in a Changing Climate* (EC, 2009b).

The goal of the EC in creating the WFD was to consolidate the multitude of water-related instruments into one coherent water policy. The WFD can be regarded as a prime example of a forward-looking, holistic and integrative approach to water governance with a strong underlying ecosystem component, because it bases water management on the integrated nature of the water cycle and the interlinkages with water and land use, whilst providing enhanced ecosystem protection (Morgera, 2012). Although the WFD does not explicitly mention climate change, it is generally viewed as being robust and flexible enough to address climate change adaptation, at least in the short term, with ongoing work at the European level to create further complementary tools for incorporating climate change adaptation into water management in the longer term (EC, 2012).[2]

The key objectives of the WFD include the following: to expand the scope of water protection to both surface waters and groundwater; to provide an overall framework, including an integrated

[1] The relevant legislative, soft law or policy documents relevant to water and climate change adaption include the 2000 Water Framework Directive (European Parliament and Council, 2000) and its two daughter directives (Directive 2006/118/EC on Protection of Groundwater against Pollution and Deterioration (European Parliament and Council, 2006), and Directive 2008/105/EC on Environmental Quality Standards in the Field of Water Policy (European Parliament and Council, 2008)); the 1991 Urban Wastewater Treatment Directive (European Council, 1991a); the 1991 Nitrates from Agricultural Pollutants Directive (European Council, 1991b); the 2007 Floods Directive (European Parliament and Council, 2007); the 2007 Communication on Water Scarcity and Droughts (EC, 2007); the 2009 White Paper on Climate Change Adaptation (EC, 2009a); and 2009 EC Guidance document No. 24 River Basin Management in a Changing Climate (EC, 2009b).

[2] EC (2012), together with the analysis of all plans for 110 river basin districts, performs a review of the Strategy for Water Scarcity and Droughts and of the vulnerability of water and environmental resources to climate change and man-made pressures.

Photo: ©Ted McGrath

Danube River (Passau/Melke, Germany/Austria)

approach to water management based on river basins, combining emission limit values and quality standards; to promote sustainable water use based on a long-term protection of available water resources; and to provide for public involvement in decision-making regarding water management (WFD, Art. 1). All of these objectives feed into the Directive's main environmental objective of achieving good status for all waters by 2015 (WFD, Art. 4).

The WFD seeks to achieve an integrative governance approach in several ways. Firstly, it designates the river basin[3] as the ecological area to be managed under a regulatory unit called a river basin district.[4] Secondly, the WFD requires a river basin management plan to be established for each river basin district.[5] For rivers crossing national boundaries, river basin districts and river basin management plans must be coordinated to the fullest extent possible between states.

The WFD is well placed to help foster adaptive management for a multitude of reasons, which are discussed in more detail throughout this section. One key feature contributing to this adaptive capacity is the requirement that river basin management plans be periodically revised to incorporate new information, including measures necessary to adjust to climate change (WFD, Art. 13). Other factors include the requirements for authorities to intensify analysis, implement continuous monitoring of river basin districts, set up integrative programmes of measures, and lay down environmental quality standards and emission limit values (Morgera, 2012). However, further clarification is needed on the methods to assess climate change impacts at different points in the WFD implementation and reporting processes, and on the ways to respond to these impacts accordingly. A climate impact assessment tool would be one way to address this issue (Reese et al., 2010).

The *EC Floods Directive 2007/60/EC* (European Parliament and Council, 2007) supports a framework for climate change adaption in water management by establishing a legal instrument for the assessment and management of the risks posed by floods to human health, the environment, cultural heritage and economic activity. This Directive requires Member States to produce Flood Risk Management Plans by 2015 (discussed in more detail in Section 3.6.2).

Important policy instruments for addressing climate-proofing water management in Europe include the *EC Communication on Water Scarcity and Droughts* (EC, 2007), which makes a series of recommendations, proposals and examples of best practice for addressing resource scarcity

[3] WFD, Art. 2 (13) establishes that a river basin refers to the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta.

[4] WFD, Art. 2 (15) defines the river basin district as the area of land and sea made up of one or more neighbouring river basins, together with their associated groundwaters and coastal waters. Member States must identify the river basins located in their territory and align them to river basin districts, as established in WFD, Art. 3 (1).

[5] The first such plans were required in 2009. Subsequently, the plans should be updated every six years.

and drought. This Communication was one of the foundations upon which the subsequent *EC White Paper on Adaptation* (EC, 2009a) and the 2009 *EC Guidance Document on River Basin Management in a Changing Climate* (EC, 2009b) were developed. The 2009 EC Guidance Document provides best practice principles for dealing with available scientific knowledge and uncertainties about climate change, as well as strategies that build adaptive capacity for managing climate risk, methods for introducing integrated adaptive management within key steps of producing River Basin Management Plans (RBMPs), and lessons on how to address the specific challenges of managing future flood risk and water scarcity. It is too early to assess whether Member States will ensure that their RBMPs (due by the end of 2015) are climate-proof, although early analysis suggests that more guidance and finance is needed for Member States to fully implement climate proofing processes and strategies into their existing RBMPs (IEEP, 2011).

Another critical policy instrument within the EC context is the 2001 *Common Implementation Strategy for EC Water Policy* (EC, 2001), which establishes a network of different levels of government including Member States and the EC, and also between private and public entities that cooperate over implementation of the WFD through a wide range of activities and outputs, including the production of Guidance Documents (EC, 2001; Morgera, 2012).

As a whole, the EC approach to water governance is viewed as an ambitious and successful example of a best practice towards water management. However, there are also criticisms of the EC approach, generally and specifically in relation to its ability to compel Member States to respond to future climate change impacts with effective adaptation. Despite the extensive competences of the EC, the general responsibility for the protection of the environment, including water, lies with the Member States (Kraemer, 2012). As such, the EC is only able to take more control in the process if the objectives of a proposed EC Action would lead to better results at the EC level (*Treaty on the European Union*, 2010; Art. 5(3)). The differing legal systems across the 28 Member States often lead to variations in practical application of EC law. Difficulties which apply to the WFD directly are discussed within the relevant sections below, alongside further discussion of the specific challenges for climate change adaptation in water management, including the need for further clarification on the ways to assess climate change impacts at different points in the WFD implementation and reporting processes.

2.2 UNECE Water Convention

There are over 150 major transboundary rivers and 50 large lakes in the UNECE region, where 20 European countries depend on transboundary waters for more than 10 per cent of their water resources (UNECE, 1992). The need for strong cooperation over transboundary waters culminated in the adoption of the 1992 *UNECE Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (UNECE, 1992; hereafter UNECE Water Convention), which entered into force on 6 October 1996 and requires states to 'prevent control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management' (Art. 2).

Although the UNECE Water Convention does not explicitly mention climate change, it represents one of the most crucial legal frameworks in the UNECE region for cooperation on transboundary aspects of climate change and on the development of adaptation strategies (UNECE, 2009). The Convention includes a number of substantive and procedural obligations related to climate change adaptation which will be discussed in Chapter 3. Such obligations relate to water quality objectives and measures; the inclusion of precautionary principles; data and information exchange over changes in transboundary water conditions; and measures to control and reduce transboundary impacts. There are also obligations for consultations, joint research, monitoring and assessment, emergency warning and response systems, and technology exchange. Further, the Convention requires Parties to enter into bilateral or multilateral agreements and to establish institutions for cooperation and management of shared water resources (such as joint bodies), acting as a platform for transboundary adaptation, discussed further under Section 3.2.1.

The UNECE Water Convention is a framework agreement and, in addition to basin-specific arrangements, subsequent supplementary instruments seek to flesh out the details in specific areas of water management. These instruments include: the *Protocol on Water and Health* (ECOSOC, 1999), and the *Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters* (UNECE, 2003a). Other UNECE environmental instruments forming part of the 'UNECE water regime' (Moynihan, 2015a; Moynihan and Magsig, 2014) support the implementation of the objectives of the UNECE Water Convention regarding adaptive

water management, including the *Convention on Environmental Impact Assessment in a Transboundary Context* (Espoo Convention; UN, 1991), its *Protocol on Strategic Environmental Assessment* (UNECE, 2003b), and the *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters* (Aarhus Convention; UNECE, 1998).

The Water Convention has also influenced the drafting of a number of bilateral and multilateral agreements on transboundary waters[6] in the UNECE region, and as such provided a framework for supporting implementation of climate change adaptation measures at these sub-regional levels. One pertinent example is the Danube Convention where the UNECE played a significant role in both its initial drafting and subsequent instruments on climate change adaptation (Moynihan, 2015a).

In 2003, an amendment to the UNECE Water Convention was agreed upon to allow states situated outside the UNECE region to become Parties to the Convention, followed by a second amendment (EOCSOC, 2003) to set up blanket approval of future accession requests. The second amendment has not yet come into effect and thus, as of November 2015, no non-UNECE Member States have become members of the Water Convention.

Numerous policy documents have been adopted in support of the implementation of the UNECE Water Convention.[7] The *Guidance on Water and Adaption to Climate Change* (UNECE, 2009) is a very progressive policy document of direct relevance to water management and climate change adaptation. It was adopted at the fifth session of the Meeting of the Parties and published in 2009, and provides step-by-step advice on climate change adaptation in transboundary river basins. Even though it is not legally binding, following its adoption the Parties decided to foster implementation of the Guidance through a programme of pilot projects and a platform for exchanging experience with adaptation to climate change in the transboundary context. This platform for exchanging experience is also open to countries outside the UNECE, providing a significant opportunity for knowledge exchange for river basin authorities across the world (UNECE, 2012a). In order to support the Guidance and reflect on the programme of pilot projects, the UNECE recently produced 'Building upon Water and Climate Change Adaptation in Transboundary Basins: Lessons Learned and Good Practices' (UNECE and INBO, 2015) although the role of international law is regrettably a very minor feature of this document.

[6] Including over transboundary rivers such as the Rhine, Danube, Meuse and Scheldt.

[7] For a list of instruments, see the UNECE website: www.unece.org/env/water.html.

2.3 Mekong River Basin

The 1995 *Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin* (MRC, 1995a; hereafter Mekong Agreement) provides a framework of cooperation for the sustainable development, utilization, conservation and management of the Mekong River basin water and related resources (Mekong Agreement, Art. 1).[8]

The Mekong Agreement confirms the sovereign equality and territorial integrity of states (Art. 4), while stipulating that states are obliged to protect the environment and ecological balance of the Basin (Art. 3), in particular the maintenance of flows on the mainstream (Art. 6) and the prevention and cessation of harmful effects that might occur to the environment (Art. 7), while ensuring that the waters of the Mekong River system are utilized in a reasonable and equitable manner pursuant to all relevant factors and circumstances and the Rules of Water Utilization and Inter-basin Diversion (Art. 5, further specified in Art. 26). The Mekong Agreement confers the freedom of navigation on the basis of equality of right (Art. 9), and addresses situations in the event of substantial damage to one or more riparians caused by harmful effects from the use of and/or discharge to waters of the Mekong River by any riparian State (Art. 8), or in the event of an emergency that requires an immediate response (Art. 10).

An institutional structure is instrumental in the implementation of a management plan, especially where an adaptive and flexible management approach is necessary to address the uncertainties caused by climate change (Eckstein, 2009). The Mekong Agreement establishes an institutional mechanism in the form of an intergovernmental agency known as the Mekong River Commission (MRC) for the implementation of the substantive provisions of the Agreement (Mekong Agreement, Arts. 11-27; MRC, 1995b; MRC, n.d.), which is assisted by a Secretariat for Technical and Administrative Tasks created by the MRC Council and Joint Committee (Arts. 28-33). The Agreement sets out mechanisms to resolve disputes on any matter arising under the Agreement, or those pertaining to the actions taken by the implementing organization, particularly to the interpretations of the Agreement and the legal rights of the Parties (Arts. 18c, 24f, 34 and 35).

The MRC has subsequently adopted several procedures and supporting guidelines to provide a systematic and uniform process for the implementation of the Mekong Agreement by the MRC and Member Countries (MRC, 1995c). In relation to climate change adaptation, the MRC is developing an adaptation planning process through pilot projects as part of a Climate Change Adaptation Initiative (MRC, n.d.) to assess climate change impacts and the incorporation of adaptation planning and implementation within the Mekong River basin. The initiative intends to test tools and methods for the assessment of vulnerability and the planning of adaptation efforts that bring together top–down climate science and indigenous knowledge through broad, cross-sectoral stakeholder engagements (Polack, 2010). It promotes a knowledge-based, basin-wide adaptation to the new challenges posed by climate change, through a systematic process of planning, implementation and learning (MRC, 2011).

[8] The areas of cooperation includes irrigation, hydropower, navigation, flood control, fisheries, timber floating, recreation and tourism, in a manner to optimize the multiple-use and mutual benefits of all riparians and to minimize the harmful effects that might result from natural occurrences and man-made activities.

2.4 Southern African Development Community

The Southern African Development Community (SADC) *Protocol on Shared Watercourses* was signed on 28 August 1995 in Johannesburg, and entered into force in September 1998. The Protocol was subsequently revised on 7 August 2000 (SADC, 2000) – hereafter referred to as SADC Protocol – and currently has 14 Member States.[9]

The SADC Protocol provides a legal and policy framework 'to foster closer cooperation for judicious, sustainable and coordinated management, protection and utilization of shared watercourses and to advance the SADC agenda of regional integration and poverty alleviation'.[10] It recognizes the principle of equitable, reasonable and sustainable utilization, as codified in its Art. 1(7), with a view to attaining optimal and sustainable benefits from the watercourse, taking into account the protection of the watercourse for the benefit of current and future generations (Art. 3(7)a).[11] Pursuant to the SADC Protocol, states must consider all relevant factors together when determining what is equitable and reasonable, and the weight to be given to each factor is to be determined in comparison with other relevant factors (Arts. 3(8)a and 3(8)b).[12]

The duty to cooperate, including obligations to inform, to notify, to consult, and to negotiate (Art. 3(5)), as well as to exchange available information and data regarding all aspects of the condition of a shared watercourse (Art. 3(6)), are further developed in the protocol's procedural provision.[13] An institutional framework was set out for the implementation of the SADC Protocol (Art. 5). Article 6 clarifies the relationship between the SADC Protocol and existing or future shared watercourses agreements, and promotes the harmonization of these agreements with the SADC Protocol. Disputes related to the implementation, interpretation or application of the provisions should be resolved in accordance with Art. 7 of the SADC Protocol.

At present, the SADC Protocol is being implemented through the third phase of the Regional Strategic Action Plan (RSAP) for Integrated Water Resources Management and Development in the SADC Region, which aims to strengthen the enabling environment for the governance, management and development of water resources in the region (SADC, 2011).[14] In addition, Programme 15 of RSAP (SADC, 2011) provides for the integration of climate change adaptation into water resources planning and management, reflecting the overall objective of the SADC Protocol to 'foster close and coordinated cooperation in the management … of the shared watercourses' (Art. 2, SADC 2000).

The framework of cooperation laid out in Art. 5 allows for the integration of climate change mitigation measures into the management of shared resources (Eckstein, 2009).

[9] Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Seychelles, Swaziland, Tanzania, Zambia and Zimbabwe. Source: FAOLEX database.

[10] The Protocol seeks to achieve its objective through the promotion and facilitation of shared watercourse agreements and the establishment of institutions for the management of shared watercourses that enable the sustainable, equitable and reasonable utilization of these watercourses. SADC Revised Protocol (Art. 2b and 2c) provides that the sustainable utilization of watercourses entails a coordinated and integrated environmentally sound development and management of shared watercourses.

[11] Art. 3(4) provides that 'State Parties shall maintain a proper balance between resource development for higher standard of living for their people and conservation and enhancement of the environment to promote sustainable development'.

[12] The relevant factors, as stated in Art. 3(8)(a)(i)–(vii), include the natural character of the watercourse; the socio-economic, environmental, and population needs of the watercourse states; existing and potential uses of the watercourses; conservation, protection, development and economy of use of the watercourses and the cost of measures taken to that effect; and the viability of alternatives of comparable value to a particular planned or existing use.

[13] See SADC Protocol; Art. 3(9), which provides that 'State Parties shall deal with planned measures in conformity with the procedure set out in Art. 4(1)'.

[14] The 3rd Regional Action Plan on Integrated Water Resources Management and Development promotes the implementation of interventions from three strategic areas, namely water governance, infrastructure development and water management through a coherent set of activities that aims to achieve three strategic objectives of capacity development, climate change adaptation and social development.

3 ▪ Law, policy guidelines and best practice application

3.1 An ecosystem-based approach

- The ecosystem approach is a process that integrates ecological, socio-economic and institutional factors into comprehensive analysis and action in order to sustain and enhance the capacity of ecosystems to meet current and future needs.
- Central to the ecosystem approach is the integration of management systems of land, water and living resources, in a way that promotes the conservation and sustainable use of resources in an equitable manner.
- The integration of management systems of land, water and living resources is a matter of societal choice, which in turn requires stakeholder participation in relevant decision-making procedures.
- The adoption of an ecosystem approach is central to climate change adaptation, as it aims to increase resilience within the natural system.
- The maintenance of ecosystems' integrity will engender many benefits (both direct and indirect), allowing the ecosystem to withstand stress and disturbance, such as floods, drought, and disease.

The International Union for the Conservation of Nature (IUCN) defines the ecosystem-based approach as 'a process that integrates ecological, socio-economic and institutional factors into comprehensive analysis and action in order to sustain and enhance the quality of ecosystems to meet current and future needs'. It is, therefore, a strategy for the integration of land, water and living resources management that seeks to promote the conservation and sustainability of resources and their physical environment in an equitable manner (IUCN, n.d.).

The fifth Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) adopted 12 complementary and related Principles of the Ecosystem Approach and five points of operational guidance for its implementation (CBD, 2000), which are all listed in **Box 1**.

Fundamental to an ecosystem approach is the recognition that ecosystem management is also a social process. There are many interested actors that must be involved in the development of efficient and effective structures and processes of decision-making and management (CBD, 2004). CBD's Principles clearly state that the objectives of the management of land, water and living resources are a matter of societal choices, where management is to be decentralized to the lowest appropriate level, in order to guarantee greater efficiency, effectiveness and equity. The consideration of all forms of relevant information, including indigenous and local knowledge, innovations and practices. is heavily promoted. Similarly, all relevant groups in the society are encouraged to participate in ecosystem-based management. Given the central importance of the participation of a wide range of actors in society to both ecosystem-based management and climate change adaptation, it will be considered in further detail in the next section.

An ecosystem approach also proposes the use of adaptive management practices.[1] Such practices must embrace the complexity and variability of ecosystem processes and functions through a learning-based management process. Adaptable methodologies and practices must therefore be adopted. This 'learning-by-doing' process should build on existing knowledge whilst making adjustments to cater for unexpected outcomes. In addition, progress should be monitored and evaluated (CBD, 2000).

[1] For an example of an adaptive management framework, see Ramsar Convention on Wetlands (2002).

Photo: André Künzelmann/©Helmholtz Centre for Environmental Research

Measuring tower 'Eddy' for TERENO project at the shore of the Selke River, Neudamm (Börde, Germany)

BOX 1 ■ CBD Principles for an Ecosystem Approach and Points of Operational Guidance

The 12 Principles for an Ecosystem Approach are the following:

Principle 1	The objectives of management of land, water and living resources are a matter of societal choice
Principle 2	Management should be decentralized to the lowest appropriate level;
Principle 3	Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems
Principle 4	Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: (a) Reduce those market distortions that adversely affect biological diversity (b) Align incentives to promote biodiversity conservation and sustainable use (c) Internalize costs and benefits in the given ecosystem to the extent feasible
Principle 5	Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach
Principle 6	Ecosystems must be managed within the limits of their functioning;
Principle 7	The ecosystem approach should be undertaken at the appropriate spatial and temporal scales
Principle 8	Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term
Principle 9	Management must recognize that change is inevitable;
Principle 10	The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity
Principle 11	The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices
Principle 12	The ecosystem approach should involve all relevant sectors of society and scientific disciplines

The five points for operational guidance are:

Point 1	Focus on the functional relationships and processes within the ecosystems
Point 2	Enhance benefit-sharing
Point 3	Use adaptive management practices
Point 4	Carry out management actions at the scale appropriate for the issue being addressed with decentralization to lowest level, as appropriate
Point 5	Ensure intersectoral cooperation

Source: Authors, based on CBD (2000).

Box 2 ■ Ecosystem Approach under the Ramsar Convention on Wetlands

An ecosystem approach, which explicitly recognizes site-based management planning as an element of a multiscalar approach that should be linked to broad-scale landscape and ecosystem planning, is applied in the Ramsar Convention and incorporated in the *Guidelines for the Management Planning of Ramsar Sites and other Wetlands* (Ramsar Convention on Wetlands, 2002; hereafter Ramsar Guidelines). This vision for the *List of Wetlands of International Importance* (Ramsar Convention on Wetlands, 2015) reflects the acknowledgment of the importance of the incorporation of the ecosystem approach in the Ramsar Convention.

The Ramsar Guidelines recognize that river basins are the most appropriate physical entities for water management, where the ecosystem boundary is synonymous with the river basin boundary. They propose an integrated water resources management framework that focuses on the safeguard and maintenance of ecological processes and functioning, which is the hallmark of the ecosystem approach.

The Ramsar Guidelines advocate for the identification and designation of wetlands and their assessment, monitoring and management in accordance with the set management objectives that direct the management planning processes. The adaptive management framework addresses the legitimate interests of stakeholders and the timely adaptation to the ever-changing political climate, accommodation of uncertainty and variability of resources, whilst enabling the designated area to survive the alterations of the natural world, which is increasingly becoming vulnerable to climate change. It stipulates the need for annual or short-term reviews, and major reviews or audits to be conducted as part of the framework of management planning processes. The feedback learning from the cyclical management planning process (from initial designation, objective setting, monitoring and assessment, to the review of implementation) embodies an adaptive management approach.

Sources: Authors, based on Ramsar Convention on Wetlands (2002 and 2015).

Within the context of water, the catchment or basin has been recognized as a natural unit, initially for pollution control, and gradually also for ecosystem management (McIntyre, 2004; Teclaff and Teclaff, 1987; Trouwborst, 2009; ILA, 2004 : Chapter V, Art. 22). This move has been reflected in Art. 20 of the *Convention on the Law of the Non-Navigational Use of International Watercourses* (UNGA, 1997; hereafter Watercourses Convention), which requires states to protect and preserve the ecosystems of international watercourses. While the Watercourses Convention does not explicitly set out what an ecosystem approach to the protection and preservation of international watercourses might entail, Art. 20 at least implies that such an approach should be considered.

There are more explicit references to the ecosystem approach to water resources that can be found in the work related to the implementation of the UNECE Water Convention. Within the UNECE context, guidelines were produced to assist states in developing and implementing national policies, action plans, programmes and practices for the practical application of the ecosystem approach. The growing concern about the degradation of aquatic ecosystems led many UNECE countries to adopt an ecosystem approach, which they integrated with other ecosystem components. The guidelines noted that:

> Aquatic ecosystems are not closed ecological systems. They exchange materials and energy with their surroundings. There is a need therefore to substantially broaden the scope of management to the exploration of the linkages and interactions within the ecosystems. A challenge lies in discovering abiotic and biotic factors, as well as the key linkages that provide for the ecosystem integrity, and to maintain energy, chemical physical and biological balance in the interlocking ecosystems (UNECE, 1993).

For the successful implementation of the UNECE guidelines, the most important aspect of the adoption and application of the ecosystem approach is, therefore, the safeguard of the functional integrity of an aquatic ecosystem where the ecological characteristics and uses of the water are among the parameters to be taken into account (UNECE, 1993).

The adoption of an ecosystem approach is central to climate change adaptation, as it aims to increase the resilience of the natural system. Resilience refers to the ability of the ecosystem to maintain its characteristic patterns and rates of

process in response to the variability inherent to its climate regimes (De Leo and Levin, 1997; Walker, 1992). The many components of biodiversity are in control of the stores and flows of energy, water and nutrients within ecosystems, which provide resistance to major perturbations (CBD, 2000). The maintenance of ecosystem integrity will engender many benefits (both direct and indirect), enabling the ecosystem to withstand stress and disturbance, such as floods, drought, and disease.[2] Such capacity increases the resilience potential of the environment to climate change.[3]

Therefore, the application of mitigating measures should be considered within the overarching ecosystem-based management process. In this context, the ecosystem approach stresses the importance of a proper appreciation or valuation of ecosystem services and the safeguard of ecosystem integrity – both generally and specifically in relation to climate change adaptation measures.[4] The assessment of benefits generated from ecosystem services in relation to climate change adaptation is instrumental for understanding and appreciating the economic and social importance of ecosystem services (Ruhl and Salzman, 2007; Rieu-Clarke and Spray, 2013).

The ecosystem approach puts people and their natural resources use at the centre of the decision-making framework, while also recognizing the need to safeguard the integrity of the natural environment (Masundire, 2003).[5] This approach extends biodiversity management beyond biodiversity conservation, and can be adopted by both public and private entities involved in the regulation or management of human uses of the environment, since it engages the widest range of sectoral interests (Smith and Maltby, 2003). The complexities and intricacies of ecosystems require an integrated approach that involves all sectors. Inter-sectoral and cross-sectoral cooperation will be greatly enhanced and strengthened by an integrated architecture in the design and

Coal Fishing (Jaintiapur, Sylhet, Bangladesh)

implementation of laws and policies. Seen from this perspective, the ecosystem approach does not preclude other existing management and conservation approaches adopted by countries. Approaches to management, such as biosphere reserves, protected areas, and single-species conservation programmes, could be integrated in a way that addresses the complex nature of ecosystems (CBD, 2000).

Due to the increasingly robust discourse on water security (Magsig, 2015) and the close nexus between energy and food security, the emergence of the ecosystem approach is timely, as it gives explicit recognition to the natural infrastructure that sustains life, and thereby promotes an integrated approach that focuses on the adaptive management of ecosystems. This has prompted decision-makers to ensure that resolutions taken in response to a resource management problem take the possible impacts into consideration that such responses might have on other sectors or issues. For example, the proposal to introduce a new energy policy will be considered in light of its possible impact on other sectors, such as food production or water resources management.

As presented in this section,the adoption of an ecosystem approach could also strengthen resilience to climate change. At the same time, the resilience of the ecosystems on which social systems depend will invariably affect the resilience of those social systems, as social and ecological systems are linked in ways likened to synergistic and co-evolutionary relationships. In the context

[2] These supporting ecosystem services include 'nutrient cycling, biological productivity, trophic function, cleansing of water and air, control of erosion, provision of atmospheric oxygen and removal of carbon dioxide, control of the vast majority of agricultural pests and organisms that can cause disease, pollination of many crops, and the maintenance of nature's vast genetic library, from which humanity has already drawn the very basis of civilization' (De Leo and Levin, 1997).

[3] For a comparative analysis of the concepts of resilience and vulnerability, see Miller et al. (2010).

[4] 'Proper' in this context emphasizes the contribution and value of a social, ecological and economic component of the valuation of ecosystem services (Spash and Aslaksen, 2014).

[5] Similarly, the IUCN adopted an integrated approach that places human needs at the centre of biodiversity management, where ecosystems are managed based on the multiple functions the ecosystems perform and the multiple services that it provides (Smith and Maltby, 2003).

of communities whose social systems are directly dependent on natural resources and the diversity of the ecosystems, there is a notable influence of ecosystem resilience on social resilience and on the communities' ability to cope with shocks, especially in terms of food security, and hazards (Adger, 2000).

In this regard, the adoption of an ecosystem approach that promotes ecosystem integrity, especially concerning the continuous supply of ecosystem services, will strengthen ecosystem and social resilience at the same time. In view of the economic and social benefits that result from services provided by natural infrastructure, more support should be given to policy options that sustain the structure and functioning of ecosystems, safeguard ecosystems' integrity and ensure the sustainable provision of ecosystem services (UNECE, 2007).

Box 3 ■ The Okavango River and the ecosystem approach

The Okavango River basin covers an area of 721,000 km^2 and the territories of Angola, Botswana, Namibia and Zimbabwe. The transboundary management institution that oversees the management of the basin is the Permanent Okavango River Basin Water Commission (OKACOM). OKACOM acts as the technical advisor to the contracting parties on matters of common interest relating to the conservation, development and utilization of water resources in the Okavango River basin, and promotes the coordinated and sustainable management of water resources, while addressing the legitimate social and economic needs of the basin states. Angola, Botswana and Namibia are members of OKACOM.

The Okavango Delta Management Plan uses the step-wise approach as recommended under the Ramsar Convention, including site designation and evaluation, definition of management objectives and review of the implementation of the management plan. Stakeholder engagement is recognized as a key component of the plan.

The implementation of the Okavango Delta Management Plan is enhanced by other initiatives such as the Kavango Zambezi Transfrontier Conservation Area and the Botswana National Action Plan under the auspices of OKACOM. Attention is placed on capacity building where increased efforts should be undertaken in the monitoring and assessment of causes and impacts of changing flow regimes. This approach to monitoring and assessment is critical for adaptive management interventions that respond appropriately and in a timely manner to changes.

Source: Authors, based on OKACOM (n.d.).

3.2 Institutional arrangements and public participation

- River basins – as physical and ecological units – offer the most appropriate platform for institutional arrangements that coordinate the implementation of adaptation measures.
- River basin organizations can perform a range of functions in support of ecosystem-based adaptation measures.
- While river basins may be the most appropriate unit for coordinating institutional arrangements, multilevel governance recognizes the need to account for the relationship between local, national, regional and global regimes.
- Decision-making should be made at the lowest appropriate level, and there should be an appreciation that adaptation measures should be implemented at the local or community level.
- Effective implementation of ecosystem-based adaptation measures is highly contingent on public participation at various levels of governance.

3.2.1 Institutional arrangements

The previous section observed that, within a water context, the catchment or basin has been recognized as a natural unit for the implementation of an ecosystem-based approach. A key consideration in this section is, therefore, to consider which institutional arrangements might support such an approach. In this regard, river basin organizations (RBOs) are an important mechanism by which to ensure that water is managed as a holistic and integrated unit. Agenda 21 recognized water as an integral part of the ecosystem, and states that water management – including land and water-related aspects – is best carried out at the river basin or sub-basin level (UNCED, 1992). The Johannesburg Plan for Implementation also emphasized the need to achieve 'integrated management of land, water and living resources', and encouraged states to develop and implement national and regional strategies, plans and programmes for integrated river basin, watershed and groundwater management (World Summit on Sustainable Development, 2002). RBOs can potentially play a vital role in the implementation of such strategies, plans and programmes at a national as well as a transboundary level.

Table 1 ■ Overview of the most common forms of institutional arrangements for water governance

TYPES OF RIVER BASIN ORGANIZATIONS	DESCRIPTION
Advisory Committee	A formalized or quasi-formal organization which undertakes action planning and plays an advisory role; the government delegates strategic planning to the Committee; it usually has no or limited legal jurisdiction.
Authority	An organization which makes planning decisions at a regional or central governmental level; may set and enact regulations or have development consent authority. Authorities are funded on democratic principles and a legal framework to which all relevant individuals and institutions are subject in a basin setting.
Association	An organization of like-minded individuals, a group with a common interest. In the river basin context, an association has varying roles: it gives advice to competent authorities, raises awareness, provides education, promotes ownership of particular issues, and plays an information exchange and dissemination function.
Commission	An organization to which the government delegates powers to examine/study matters regarding natural resources management, and/or to take appropriate measures on those matters. Basin commissions have varying powers that may include an educational role, a monitoring role or fulfilling goals of a specific government's charter or an international agreement. Commissions normally are instituted by a formal statement of a command or injunction by government to manage land and water resources; a commission may also have regulatory powers.
Council	A formal group of experts, government ministers, politicians, NGOs and laypeople brought together on a regular basis to debate matters within their sphere of basin management expertise, and with advisory powers to government. A council is contrasted with a commission which, although also a body of experts, is typically given regulatory powers in addition to a role as advisor to the government.
Corporation	A legal entity, created by legislation, which permits a group of people, such as shareholders (for-profit companies) or members (non-profit companies), to form an organization which then focuses on pursuing set objectives, and, possessing the legal personality, is granted certain legal rights and duties. Also known as a 'company', the primary advantage of a for-profit corporation is that it provides its shareholders with a right to participate in the profits (by dividends) without any personal liability, because the company absorbs the entire liability of the organization.
Tribunal	A basin entity which has formalized procedures and quasi-judicial powers. A heavy emphasis is put on bureaucratic decision-making. Stakeholders may formally participate through hearings. Major decisions are taken by independent bodies, such as a water pricing tribunal. A tribunal acts as a special court outside the civil and criminal judicial system that examines special problems, and makes judgments. An example would be a water tribunal, which resolves disputes between water users. Very few such entities exist purely for river basin management purposes but rather for specific areas, e.g. government pricing tribunals. Some tribunals have specific water functions as a component of a broader river basin management process, where an RBO may or may not exist. These entities have essentially no traditional powers of civil government and do not report to other government agencies, except in situations where a local government body oversees the tribunal. Tribunals play an important role in developed countries and many developing countries.
Trust	A trust is a legal device used to set aside money or property of one person for the benefit of one or more people or organizations. A trust undertakes river basin works, and develops and implements a strategic plan. Its mandate is to be the river basin 'advocate', and it coordinates local programmes through Memoranda of Understanding or other agreements. It raises local levies (funds) for its works and programmes. A Trust keeps monies raised in 'trust' for the benefits of its citizens.
Federation	A collaboration of departments within a government or between national governments created to undertake actions for river basin management. Governance actions at various levels (national, state and local) include agreements on water sharing and water quality management, shared statements of intent, shared policy development, information exchange, and joint actions for the management of ecosystems degradation. Collaboration is articulated in framework directives, cost-sharing arrangements, joint statements of intent, partnerships, joint programmes and common policy.

Source: Reproduced from Hooper (2005) with permission from the copyright holders, IWA Publishing.

Women speak about Water Supply and Sanitation program in Nepal (Pokhara, Nepal)

RBOs can be described as specialized organizations set up by political authorities to deal with water resource management issues at the level of river basins, lake basins or across aquifers, ideally in an integrated manner.[6] Many types of RBOs exist, and RBOs have a wide range of functions, from playing an advisory role in support of government decision-making to constituting an overarching, supranational authority that has supreme power to make decisions in relation to river basin planning, management, development and protection. Table 1 provides an overview of the most common forms of institutional arrangements for water governance.

RBOs can perform a range of basic functions. They can have a planning function, developing river basin plans in order to agree on the use of different water bodies and their sectorial uses, in accordance with national and international strategies and policies. Another important function is the coordination of all relevant water-related institutions at the international, national and subnational levels, and between different groups, such as government agencies, user groups, scientific communities and so forth. Such intersectoral coordination is critical to the implementation of an ecosystem-based approach. RBOs can also play a role in facilitating stakeholder engagement in water planning and development – another key element of the ecosystem-based approach. Stakeholder engagement can be secured by raising awareness of water resource issues, such as climate change adaptation, and by ensuring that stakeholders have opportunities to engage in the decision-making process (IUCN, 2009).

Additional functions performed by RBOs can include implementing water distribution and development through regulations and negotiations; operating and maintaining water work infrastructure; administering water rights; managing conflict resolution; conducting research for planning, monitoring and inspection; and enforcing law and regulations (IUCN, 2009).

RBOs, therefore, constitute an important mechanism in the implementation of ecosystem-based climate change adaptation strategies.

3.2.2 Public participation

As noted previously, the participation of stakeholders in ecosystem-based approaches to climate change adaptation is fundamental. Participation helps to raise awareness of the likely impacts of climate change and the acceptability of various adaptation responses. Participation can also provide decision-makers with local and indigenous knowledge, which can be used for the development of adaptation measures. Moreover, the engagement of the public in decision-making procedures can increase the acceptability of the decisions that are ultimately taken, and heighten the perception that such decisions are adopted through a legitimate process, thus enhancing the legitimacy of decision-making. Participation of the public in decision-making can also support an adaptive management approach, by embedding 'social learning' into the decision-making process. If implemented effectively, such a process can provide a forum in which decision-makers, managers, users, interest groups, scientists and others can collectively manage complex natural resource systems in the context of climate change.

However, while participation is seen as an important element in implementing ecosystem-based

[6] Hooper (2005) defines RBOs as 'organizations with an integrated function over a delineated area of land (the basin) for improved land and water governance. This area can cross international, state, and local government boundaries and thus presents significant administrative, political and cultural challenges'.

approaches to climate change adaptation, it raises a number of complex issues.

Participation can relate to a range of activities. At the basic level, participation involves the provision of information to the public. Consultation, whereby relevant decision-making bodies garner knowledge, perceptions, experiences and ideas from the public on a particular issue related to water and climate change, can be seen as a further step. An additional step involves the active involvement of the public in the development and implementation of decisions, while public representatives may take partial responsibility for the outcome of such decisions.

Who participates in which decisions must be carefully considered. Three categories of public can be identified: i) the general public (all individuals who are not directly affected); ii) the observing public (the media, cultural elites and opinion leaders who may or may not comment); and iii) the directly affected public (those who will experience positive or negative impacts from the outcome of a decision) (Renn, 2008). Along similar lines, Art. 2(4) of the 1998 Aarhus Convention simply refers to 'the public concerned' as being 'the public affected or likely to be affected by, or having an interest in, the environmental decision-making' (UNECE, 1998).

Public participation in the context of water and climate change adaptation can be supported through appropriate legal frameworks at the national and international levels. For example, the 1998 Aarhus Convention rests on three pillars of participation, namely access to information, participation in decision-making and access to justice. While regional in scope, the Convention has been described by former UN Secretary-General Kofi Annan as the 'most ambitious venture in the area of 'environmental diplomacy', which has the potential 'to serve as a global framework for strengthening citizens' environmental rights' (UNECE, 2000).

In relation to access to information, the Aarhus Convention (UNECE, 1998) stipulates that, upon a request for environmental information, each Party must ensure that public authorities make information available to the public within a reasonable time (Art. 4). In addition, public authorities are under an obligation to possess, update and disseminate environmental information relevant to their functions (Art. 5).

In terms of decision-making, the Aarhus Convention stipulates that certain arrangements must be made by public authorities to ensure that affected public and environmental non-governmental organizations are able to comment on planned projects, plans, programmes and laws likely to affect the environment (Art. 6-8). These arrangements include the provision of information on planned environmental decision-making procedures, the promotion of participation at the appropriate stages, and the obligation to take due account of the outcomes of any public consultation (Art. 6).

These legal requirements of consultation are closely aligned with the move towards establishing more concrete procedures relating to environmental impact assessments (EIAs), which have recently been recognized by the International Court of Justice (ICJ) as an obligation of customary international law wherever transboundary impacts are likely to occur (ICJ, 2010; UNECE, 1991). Clearly, the public plays an important role in such an assessment, which should include the likely impacts of climate change and an assessment of the most appropriate adaptation measures.

Finally, the Aarhus Convention supports access to justice and accountability. Within the framework of national legislation, legal persons who consider that their right to either information or participation has been violated must be given a legitimate right to redress, through a review procedure before a court of law or another independent and impartial body established by law.

International law relating to transboundary waters is progressively recognizing the importance of public participation (Jansky and Uitto, 2005). However, while both international law and national legislation increasingly provide for public participation, key challenges remain in securing effective implementation. In this regard, effective implementation is highly contingent on the cultural and political context in which participation takes place, and on the appropriate tools and methods with which to encourage participation. This is particularly true for the participation of women. In the end, strategies addressing water governance challenges can only be effective in the long run if they take into consideration the different concerns and contributions of men and women on the basis of full participation (OSCE, 2012).

3.2.3 Gender and basin governance

There is a plethora of international and regional principles and conventions that aim to support a gender approach towards water governance. The Dublin Principles of 1992 (ICWE, 1992), which form the basis of good water management practice under the IWRM (Integrated Water Resources Management) approach, recognize that 'women

play a central part in the provision, management and safeguarding of water' and state that 'acceptance and implementation of this principle require positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them' (Principle 3 of the Dublin Principles, ICWE, 1992).

In essence, there is the expectation that good water management practice would address gender issues at all levels of water institutions, including at the international transboundary level. It may be argued that some progress has been made in promoting the involvement of women in water management institutions at the local and, to a limited degree, the national level. However, it could be argued that women have gained visibility, but not equal power in decision-making forums.

It has become more common for women to be included in water use and water management institutions at a sub-national level, providing at least the possibility of gender issues being considered. However, at the international level, there is a regular lack of incorporation of gender issues in transboundary water management institutions, which could have major implications, as it has an impact on half of the potential users of a water resource. International agreements or conventions on water management can only be implemented through the local, national and regional organizations that have been created to manage them. It is important to consider three elements of institutional incorporation of gender issues: i) representation of women in decision-making; ii) incorporation of gender in the legislation, policies and strategies of organizations; and iii) representation of women among the technical specialists working in these organizations.

In a study by Earle and Bazili (2013) on a range of transboundary institutions and RBOs (including international agreements such as the UNECE Water Convention, regional agreements such as the SADC Protocol, and basin-level agreements), it was found that there was close to no incorporation of a gendered approach under any of the above three elements. A reason for this could be the intersection of the field of water management (dominated by the hydraulic mission), political science and international relations (Zwarteveen, 2008; Gilmartin, 1994). Empirical research shows that these fields are traditionally male-dominated (Tétreault, 2008; Tickner and Wæver, 2009; Cernea, 2005), and when combined become mutually re-enforcing in this aspect, negating progress currently being made to incorporate gender issues in water management at subnational levels. It can be concluded therefore that there is a difference between water management at the subnational level, where more progress has been made in developing gendered approaches, and water management at the inter-state level where gender is found to be absent.

What remains to be done is to investigate potential avenues for the incorporation of gender issues in the current institutional architecture. Once this is done, recommendations can be made on ways to bring about changes to the international architecture for transboundary water management, in order to better incorporate gender. Such recommendations need to include indicators to measure gender inclusion. By doing so, a tangible contribution will be made to the quality of the inter-state cooperation over water management.

3.2.4 Multilateral governance and financing

While river basins have been identified as an important mechanism to coordinate the management of water resources at a basin level, it is crucial to recognize that not all the relevant stakeholders operate at the basin level, and applicable laws and policies may also exist at a higher level, e.g. global and regional conventions covering multiple basins, or at a lower level, such as national and provincial legislation and custom. Ecosystem-based approaches to climate change adaptation must therefore integrate both top-down and bottom-up approaches (UNFCCC, 2011).

In adopting such an integrated approach, the principle of subsidiarity offers an effective means by which to navigate between governance levels. The principle of subsidiarity requires that decisions be taken at the lowest appropriate level. As noted by GWP (2000), 'for some decisions the appropriate decision unit is the household or the farm… At the other end of the spatial scale the management of international river basins will require some form of cross-national coordinating committees and mechanisms for conflict resolution'. Moreover, numerous global institutions and processes may influence decision-making at the basin level. Conca (2007) highlights several areas where water can be viewed within the context of globalization, namely:

- **Legal** – Water has become the subject of increased diplomatic efforts towards international treaty and policy-making, examples of which include the Watercourses Convention, the UN General Assembly Resolution on the Right to Water (UNGA, 2010), and the Law of Transboundary Aquifers, which consists of

a non-binding set of 2008 ILC Draft Articles on the Law of Transboundary Aquifers, first acknowledged for consideration by the UNGA in 2009 and awaiting further consideration by UN Member States as to whether the Articles will become binding at some future point in time (UNGA, 2009).

- **Conceptual** – Expert networks promoting the science and values of integrated water resources management have flourished in the past few decades. Conca (2007) notes that 'this trend has had important ramifications for how water resources are governed, how water infrastructure is financed and constructed, and how freshwater ecosystems are managed'.

- **Economic** – Water has been the focus of international structural adjustments and privatization pressures over recent decades (Brown Weiss, 2005).

- **Political** – Conca (2007) observes that 'alliances among environmentalists, human rights activities, affected local communities, labour unions, and indigenous peoples' organizations have grown wider, deeper, and stronger', which in turn has 'turned state versus society conflicts over large dams or privatization schemes into matters of global discussion.'

Given that there are numerous global processes that influence basin activities, coordination is one of the main challenges. For instance, in recent decades, the number of multilateral environmental agreements (MEAs) has increased considerably. This, in turn, has led to additional burdens on contracting parties in terms of implementation and reporting, and sometimes to duplication of efforts. For over a decade, the international community has been examining how synergies and interlinkages between MEAs can be exploited. In this regard, the Open-ended Intergovernmental Group of Ministers or Their Representatives on International Environmental Governance (UNEP, 2002) held that 'the clustering approach to multilateral environmental agreements holds some promise, and issues relating to the location of secretariats, meetings agendas and also programmatic cooperation between such bodies and with UNEP should be addressed'.

Article 4(1)(e) of the Climate Change Convention (UNFCCC, 1992) commits the contracting parties to 'develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods.' In furtherance of this goal, the Cancun Adaptation Framework (UNFCCC, 2010) sought to enhance adaptation efforts through, inter alia, greater international cooperation and coherence. The framework urges states to strengthen, consolidate and enhance the sharing of relevant information, knowledge, experiences and good practices, at the local, national, regional and international levels. In order to promote the implementation of enhanced action on adaptation in a coherent manner under the UNFCCC, the Adaptation Committee was set up and a three-year work plan was established in 2012 (UNFCCC, 2015). In its most recent report to COP 21 of the UNFCCC, the Adaptation Committee identified 'building and sharing partnerships and prioritizing areas for cooperation to support improved regional institutional arrangements for adaptation, as well as encouraging the engagement of regional networks and institutions with the Adaptation Committee' as one of the key areas in need of further work and commitment (Adaptation Committee, 2015). Ultimately, RBOs will constitute an important means by which to ensure that global instruments are coordinated at the river basin level.

Global mechanisms also provide an important channel for financing the costs of climate change adaptation. The World Bank estimated that climate change adaptation measures within developing countries are likely to cost US$70-100 billion per year between 2010 and 2050 (World Bank, 2010). Financing for adaptation measures is available through a variety of means, including the Special Climate Change Fund and the Least Developed Countries Fund of the UNFCCC, which are administered though the Global Environment Facility (GEF, n.d.), as well as the Pilot Programme for Climate Resilience and the Global Climate Change Alliance. With regards to international adaptation finance, an interesting instrument under the UNFCCC and Kyoto Protocol is the Adaptation Fund which has been established to finance concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol. The Fund is composed of a two per cent share of proceeds of Certified Emission Reductions (CERs) issued under the Kyoto Protocol's Clean Development Mechanism projects, as well as voluntary pledges of governments and private donors. However, while approved international funding for adaptation measures has increased in absolute terms recently, it is still considerably lower than mitigation funding (Schalatek et al., 2012). Hence, major challenges in generating sufficient funding for climate change adaption remain – particularly for vulnerable countries and population groups.

3.3 Flexible water allocation mechanisms

- In addition to the direct effect of global climatic change on the uncertainty over freshwater availability, it also affects the demand side of water management, thus causing a threat to energy security, food security, and human migration patterns.
- The issue of 'strategic uncertainty' (limited knowledge of the preferences and characteristics of fellow watercourse states) may influence the willingness of states to enter into water agreements.
- International water law must grapple with the tension between the preservation of the status quo and the needed flexibility to meet new demands.
- Various strategies can be employed to enhance the flexibility of water arrangements by avoiding allocation mechanisms that adopt fixed quantities.

Sample-taking at the Bílina River (Ústí nad Labem Region, Czech Republic)

3.3.1 Flexible allocation mechanisms and climate change adaptation

The ultimate aim of (transboundary) water management is to allocate a vital resource in a way that brings maximum benefits to all users, whilst maintaining healthy ecosystems. During this process, stakeholders must be able to predict future freshwater supply and demand – ideally on a seasonal basis. In the past, this has been accomplished by using historical records, but those have become more and more unreliable as the uncertainties of climate change emerged (Draper and Kundell, 2007). Projections on our future climate depend on various speculative factors like the trend of greenhouse gas emissions and the precise effects of these emissions on the atmosphere. Climate forecasts and their implied impacts are highly scenario-dependent (Alcamo et al., 2003). Sustainable freshwater yields may or may not be reduced in the long-term average, but they will definitely be less reliable in the future (Draper and Kundell, 2007). This development will result in higher costs for water infrastructure, intensified competition between water users, and in some cases (primarily in developing countries), slower economic development (Alcamo et al., 2003). In addition to the direct effect of global climatic change on the uncertainty over freshwater availability, it also affects the demand side of water management, thus causing a threat to energy security (De Fraiture et al., 2008), food security (FAO, 2008), and human migration patterns (Weiner, 1993).

In negotiating international freshwater agreements, the issue of uncertainty is an important factor to take into account. Here, the additional component of strategic uncertainty comes into play. 'Strategic uncertainty' describes the limited knowledge of the preferences and characteristics of the other negotiating states (Iida, 1993). This can affect the actual distribution of benefits from a water agreement, which by implication has an effect on both the willingness of states to enter into such an agreement and the stability of the framework created it. An aura of uncertainty usually decreases the size of coalitions adopting international environmental agreements, and hampers both the formation of coalitions and credible commitments (Kolstad, 2007; Drieschova and Fischhendler, 2011).

Box 4 ■ Public participation and the Danube Convention

The Danube River basin is the most international river basin in the world, with 10 riparian countries (Austria, Bulgaria, Croatia, Germany, Hungary, Moldova Slovakia, Romania, Serbia, and Ukraine), as well as an additional nine basin countries (Albania, Bosnia-Herzegovina, Czech Republic, Italy, Macedonia, Montenegro, Poland, Slovenia and Switzerland). The Danube River is the second longest in Europe (after the Volga), stretching from its sources in Germany to the Black Sea. The River Basin covers 312,000 m^2 and its main tributaries are the Drave, Inn, Morava, Prut and Save.

In 1994, the Danube states adopted the Convention on the Protection and Sustainable Use of the Danube (hereafter Danube Convention), which entered into force in 1998. The Contracting Parties to the Danube Convention include Austria, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Slovakia, Slovenia, Serbia, Ukraine and the European Union.

In terms of public participation, the 1994 Danube Convention stipulates that 'the Contracting Parties shall ensure that their competent authorities are required to make information concerning the state or the quality of riverine environment in the Danube Basin available to any natural or legal person, with payment of reasonable charges, in response to any reasonable request, without that person having to prove an interest, as soon as possible'.

No formal mechanism for public participation is included in the Danube Convention. However, public participation provides a fundamental mechanism by which states achieve its main goal, namely sustainable and equitable water management. The need and value of public participation has been taken seriously by the International Commission for the Protection of the Danube River (ICPDR), the institutional mechanism set up to implement the Danube Convention. A number of tools have been adopted by the ICPDR to facilitate participation. Such tools include affording observer status to groups with a legitimate interest in the work of the ICPDR, developing a strategy for public participation, and adopting guidelines for business cooperation.

In terms of observer status and pursuant to the ICPDR's rules of procedure, NGOs, private sector actors, and intergovernmental organizations participate in the activities of the ICPDR. The rules stipulate that observer status will be granted to partners within the Danube River basin who can evidence a strong interest or demonstrate active engagement in Danube protection and water management issues. Observers participate in ICPDR decision-making meetings and expert group meetings.

Additionally, the Danube has successfully implemented a strategy for public participation, in collaboration with the UNDP/GEF Danube Regional Project, WWF and GWP. The Danube Basin was one of the first major international river basins to adopt such a strategy. The strategy contains the following objectives: to ensure public participation in the implementation of the Water Framework Directive in the Danube River basin; to facilitate the establishment of effective structures and mechanisms for public participation in the Danube River basin; and to inform key stakeholders about the structures for public participation and public involvement at various levels.

Source: Authors, based on ICPDR (n.d.).

3.3.2 Strategic action priorities/principles and measures for flexible allocation mechanisms

Legal frameworks aim to provide security of expectations, which may seem a static concept. However, legal frameworks will only be effective if they are able to manage constantly changing societal and political needs (Bothe, 2008; Magsig, 2012). Therefore, international water law must grapple with the tension between the preservation of the status quo and the needed flexibility to meet new demands (Magsig, 2015). It becomes clear that without adopting reasonably flexible allocation mechanisms, international water law will be unable to provide an enabling environment for long-term peaceful management of transboundary freshwater resources (Vinogradov et al., 2003).

The principle of equitable and reasonable utilization, the cornerstone of customary international water law, provides the needed flexibility to adapt to climate change. The principle is encapsulated in the Watercourses Convention, which stipulates that 'watercourse states shall in their respective territories utilize an international watercourse in an equitable and reasonable manner'. The Convention further provides that states should use and develop an international watercourse 'with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse states concerned, consistent with adequate protection of the watercourse' (UNGA, 1997; Art. 5). Article 6 of the Convention lists a range of factors that must be taken into account when determining what is equitable and reasonable. Such factors include those of a natural character (including climatic, social and economic needs), the effects of uses, conservation of water resources, and available alternatives (Wouters et al., 2005). The Convention does not prescribe the weight that should be given to the aforementioned factors, but rather stipulates that 'all relevant factors are to be considered together and a conclusion reached on the basis of the whole' (UNGA, 1997; Art. 6).

Box 5 ■ Strategies for incorporating into treaty arrangements

Flexible allocation provisions: A rather simple method of introducing flexibility is by agreeing on a minimum flow which the upstream riparian has to deliver downstream – enough to maintain human health and basic ecological functions. While this is certainly less restrictive than fixed quantities of freshwater, a downstream state might argue that minimum flow regimes offer too little protection, while the upstream country might be concerned about its ability to deliver the initially agreed minimum in all circumstances.

Another way of improving treaty flexibility is to allocate the water according to percentage and time of flow, rather than a fixed or minimum amount. While this spreads the risk of water stress among all basin states (in both wet and dry conditions), it puts downstream users at particular risk if upstream developmental changes occur, since their share in the water will almost certainly diminish. Furthermore, it requires flexible infrastructure and a political environment which allows for regular communication and data sharing between the parties.

Amend and review processes: Provisions which allow the parties to amend and review their freshwater treaty regime, are vital for its sustainability, since (even when the knowledge about the hydrological system is advanced and the bilateral relations are friendly) the hydrological, social and climatic conditions on which the agreement was based might change considerably. Within the Colorado River basin, for instance, such amendments can be made through 'minutes' which then must be approved by the parties. It is even possible to design a treaty in such a way that a separate body, e.g. a joint commission, could make treaty amendments without the involvement of the states.

Framework agreements: Entering into a framework agreement is a useful tool to make water (re)allocation more flexible. A more general treaty would require the parties to enter into additional agreements dealing with more specific issues of water use and management. The advantage of such an approach is obvious. Subject matters that are not controversial and are considered to be of a rather constant character can be agreed upon and implemented during a first step. Everything else might involve another round of negotiation between the parties. In order to have the effect the parties hoped for, framework agreements usually only work in environments of good political relations between the states, as they require a high level of cooperation. Once in place, however, the benefit of being able to discuss issues linked to climate change and water management variables is invaluable. Also, periodic reviews are more feasible if the provisions dealing with the changing conditions are detached from the main treaty.

Source: Authors.

It can, therefore, be maintained that this cornerstone principle of international water law is flexible enough to cope with future hydrological and development changes (McCaffrey, 2003), since it allows for the implementation of an adaptive management approach which is able to deal with constant change (Neuman, 2001). However, such flexibility potentially comes at the cost of the predictability and certainty that states sharing a watercourse require. In the case of a dispute, both sides are likely to justify their opposing claims by referring to the principle of equitable and reasonable utilization (Rainne, 2006). Although flexibility and future readjustment may be implicit in this principle, its potential is minimized by the lack of specific guidance on the ways to actually apply such readjustment (Goldenman, 1990).

states often employ water treaties in order to stabilize international relations and to strengthen the general principles of international water law (McCaffrey, 2003). However, international freshwater agreements have one inherent shortcoming: they are, in principle, rigid instruments, since they can only be modified according to their own terms[7] or by mutual consent of the parties (McCaffrey, 2003). Hence, if a treaty lacks flexible tools, and a situation of water stress occurs, one party to the agreement may have to reduce its water consumption in order to comply with its international obligations. If it fails to do so, disputes over the shared watercourse are likely to occur (Fischhendler, 2004). It seems possible that in a situation where water stress causes asymmetric harm, the harmed state may want to terminate the agreement, while the co-riparian may want to stick to it, since it benefits from the treaty. However, in its judgment in the Gabčíkovo-Nagymaros case (ICJ, 1997), the ICJ concluded that 'the stability of treaty relations requires that the plea of fundamental change of circumstances be applied only in exceptional cases'. The ICJ further stated that new developments or changing conditions should be dealt with through the implementation of the treaty; not by terminating it (ICJ, 1997). Hence, a treaty is always only as static as its specific terms require. Yet, considering the rapidly changing climate, even if the parties agree to renegotiate their water agreement, this highly sensible diplomatic process may be too lengthy to effectively adapt the changing conditions.

[7] The procedures to amend or modify a treaty are usually provided for in the treaty's relevant provisions. The general rules and principles applicable to the modification of treaties are given in the Vienna Convention on the Law of Treaties (UN, 1969; Part IV).

The question arises whether rigid international water agreements can be adapted to the changing circumstances imposed by global climate change. Several studies have attempted to answer this question, all drawing the same conclusion: The majority of freshwater treaties will have to be fundamentally modified or renegotiated in order to include more flexible mechanisms that effectively address climate uncertainty (McCaffrey, 2003; Goldenman, 1990). The treaties either completely lack flexibility or their provisions are weak in substance. The most prominent shortcoming of rules concerning the allocation of freshwater resources is the assumption of a fixed (and often too optimistic) perpetual water supply and flow allocation regime (Tarlock, 2000). Conversely, a number of treaty mechanisms can be adopted in order to promote a more flexible approach to water allocation, as can be seen in **Box 5**.

At the national level, the inclusion of a robust amend-and-review process within water legislation and surrounding water policy is essential, in order to ensure that water utilization continues to be sustainable, equitable and adaptable to changes, while still protecting investor certainty. Furthermore, states should ensure that water use permits will not be locked in for an unsustainable time period, and that they maximize the benefits of public participation.

3.4 Data and information sharing

- Provisions for data collection and information sharing are an essential component of a resilient framework for ecosystem-based climate change adaptation.
- In a transboundary context, it is important for states to be able to compare and align climate change projections and impacts on water resources.
- Joint or harmonized impact assessments and the development of joint monitoring and joint information systems, such as databases or GIS systems, would eliminate conflicting results and policies, and strengthen cooperation.
- River basin organizations, such as the Mekong River Commission, play an important role in facilitating data and information sharing.

3.4.1 Strategies for data collection and sharing

Provisions for data collection and information sharing are an essential feature in the adoption of an ecosystem-based approach to climate change adaptation. Such provisions allow for informed decision-making and policy formulation across governance levels, and between a wide range of stakeholders. Collecting and sharing information is also vital to building trust and a shared vision amongst riparian countries and stakeholders (UN-Water, 2013). Data and information related to climate change-induced impacts on water quality and quantity, infrastructure projects, extreme events (floods and droughts) and operations for hydropower and irrigation are relevant and should be shared.

In a transboundary context, it is important for states to be able to compare and align climate change projections and impacts on water resources. Joint or harmonized impact assessments and the development of joint monitoring and joint information systems, such as databases or GIS systems, would eliminate conflicting results and policies and strengthen cooperation (UNECE, 2009). Harmonization of data should ideally be agreed upon between states at an early stage in collaborative multilateral or bilateral adaptation planning, in order to ensure an efficient, sustainable and resilient cooperative response. Monitoring and data collection should cover all aspects of the hydrological cycle, and especially information on water use. Data collection systems should also take into consideration the emerging health hazards resulting from climate change, through the monitoring of additional relevant pathogens (Eckstein, 2009). If joint information systems are not in place within a particular basin, regular data and information exchange between countries is needed.

In the transboundary context, the type of data needed for impact modelling and subsequent vulnerability assessments at the national, international and river basin levels include hydrological, meteorological and morphological data, as well as data regarding water quality. These data can then be used to contribute to vulnerability assessments, which address the physical, geographical, social, economic, environmental and psychological aspects of vulnerability at the basin level.[8] Local knowledge is particularly important to take into account when conducting vulnerability assessments.

[8] For more information on vulnerability assessments as a policy tool, see UNECE (2009).

3.4.2 International legal principles, practice and approaches

Part III of the Watercourses Convention contains numerous detailed procedural requirements for the collection and sharing of data and information. Many of these requirements can be considered as a manifestation of the broader duty to cooperate, and some are accepted as customary international law (Rieu-Clarke et al., 2012). Relevant provisions include Art. 11 and 12, which require states to exchange information and to consult and negotiate with each other on the effects of planned measures on an international watercourse, and the general rule of prior notification.

Many of the obligations of Part III of the Watercourses Convention have been uplifted and utilized in other legal frameworks for transboundary waters in different basins around the world. India, for example, is party to bilateral data-sharing arrangements of varying degrees of formality with its neighbours, ranging from Memoranda of Understanding at the technical/expert level with regard to flood data from China (Government of India and Government of China, 2013), to obligations under agreements with Pakistan (Government of India and Government of Pakistan, 1960) and Bangladesh (Government of Bangladesh and Government of India, 1977). The latter facilitates the exchange of data on the Indus and Ganges rivers, respectively. As Allan (2012) notes, 'both the latter agreements are regarded as relatively effective conduits for data transfer, using the medium of technical experts rather than diplomatic contacts'.

In some multilateral basins, RBOs play an important role as data repositories. For example, in the Mekong, data sharing is centralized at the level of the Mekong River Commission, where the four downstream states have established specific procedures for the sharing of data and information (MRC, 2001). In addition, the Mekong Commission Information System provides an invaluable platform for planning and decision-making. The Mekong River Commission secretariat manages the data-gathering network in the four countries, with a view to achieving uniform data collection techniques and compatibility between national systems (MRC, 2002). Similar requirements of uniformity are required in the Inco-Maputo Agreement, which demands that hydrological, geohydrological and water quality data, among others, be 'homogeneous, compatible and comparable' (Government of Mozambique, Government of South Africa and Government of Swaziland, 2002; Art. 12).

Finally and very briefly, in Europe, many requirements are in place to increase data and information collection and sharing under European water law and policy, especially in the WFD and other related Directives. Water authorities are to carry out an analysis of the characteristics of each river basin district, review the environmental impacts of human activities and undertake an economic analysis of water use, in accordance with technical specifications set at the EC level, which are then subject to review and update (WFD, Art. 5).

3.5 Improving and monitoring water quality

- Climate change is projected to have a significant impact on water quality, with many effects already apparent.
- Transboundary pollution is the top priority concern in most regions in the world, and is only likely to become a greater issue due to climate change.
- Strategic actions and solutions to the impacts from climate change on water quality may include: supplementing natural supplies; using more climate-resilient technologies and processes to provide water of sufficient quality for drinking and ecosystem protection; upgrading water treatment systems; and creating further storage capacity to be able to cope with greater microbial, turbidity and chemical load.
- At a national and transboundary policy level, water quality can be addressed through water policy objectives in respect of a range of water quality indicators, including physicochemical, ecological, physical and human health.
- An innovative legal mechanism which states could use to identify and address specific climate effects on water quality is a 'climate impact assessment'.

3.5.1 Strategic actions to improve water quality

Climate change is projected to have a significant impact on water quality, with many of its effects already apparent (UNFCCC, 2011). Such impacts will vary between contexts, but probable direct impacts include higher water temperatures, increased number and heightened intensity of extreme

events including flooding and droughts, and higher variability in precipitation. Greater or lesser runoff affects the sediment loading, chemical composition, total organic carbon content and microbial quality of water (WHO, 2011). Increased thermal pollution will possibly damage ecosystems, human health and water system reliability, while augmenting operating costs.[9] The general resilience of water bodies may be significantly reduced, both in polluted and unpolluted waters. Adaptation measures implemented to cope with climate change can also have secondary effects. More flood control or more watercourse maintenance for navigability will affect water quality, as will increased use of hydropower driven by the desire to switch to renewable energy (Reese et al., 2010). There is still considerable uncertainty as to the specific impacts of climate change on water quality, even in the most highly investigated and regulated basins. Despite such uncertainty, strategic actions are needed to account for the relationship between ecosystem-based adaptation measures and water quality.

Strategic actions and solutions to the impacts from climate change on water quality may include: supplementing natural supplies; using more climate-resilient technologies and processes to provide water of sufficient quality for drinking and ecosystem protection; upgrading water treatment systems; and creating further storage capacity to be able to cope with greater microbial, turbidity and chemical loads. Here, the important role women play through their traditional knowledge of local biodiversity, soils and freshwater resources should be supported (IFAD, 2007). Furthermore, new sources of water may need to be developed, such as recycled wastewater or desalination. Additionally, a continued reduction in the most serious forms of water pollution will be needed to increase water adaptability and resilience. This is especially relevant for building resilience against the inflow of nutrients from agriculture, which is the main consumptive user of water across many parts of the world (Reese et al., 2010).

3.5.2 Legal and policy mechanisms to improve and monitor water quality

At national and transboundary levels, water quality can be addressed through water policy objectives in respect of a range of water quality indicators, including physicochemical, ecological, physical and human health. These water quality indicators may be defined numerically or descriptively (a numerical indicator, for example, can be given at a national level for bacteria, but not so easily for sediment).

Specific measures can also be used to create water policies towards the protection of particular types of waters or water uses, such as specific measures to prevent, control and abate groundwater pollution (European Parliament and Council, 2006), or measures and standards for the treatment of wastewater (European Council, 1991a).

Water quality standards (European Parliament and Council, 2008) can be prescribed to improve water quality for priority substances and pollutants that pose a risk to the environment and humans at basin, national and regional levels. These standards are normally legally binding and determine concentration limits of specific substances in a water body. Standards can be prescribed directly for a wide range of sectors including drinking water, groundwater, water for the energy sector, wastewater, fish production, aquatic habitats and water used for food production. However, before this is possible, data regarding the existing emissions, the discharges and the substances present in a water body should be compiled. Only afterwards can such legally binding standards be created. In a national context, the use of sector-based cleanliness and emissions standards has proved successful in maintaining a high level of physiochemical quality in waters.[10] In a transboundary context, it is also more efficient if riparian countries conduct such assessments using the same criteria or indicators, in order to be able to correlate their data for binational or multinational water quality analysis. Climate change-induced heavy precipitation events, such as flooding, can increase the frequency of wastewater overflows and water contamination. New standards for improved wastewater treatment, regulation of wastewater discharge, and the creation of temporary wastewater storage facilities are useful tools to address this issue.

The Global International Waters Assessment (UNEP, 2006) found transboundary pollution to be the top priority concern in most regions of the world. This will probably become even more problematic due to climate change. Diffuse pollution from agricultural activities (both small-scale and large-scale) and human settlements, where the actual sources of pollution (usually a combination of sources, pesticides, urban run-off, etc.) can be located many kilometres away from a water body, is also a significant issue in transboundary river basins. Regulating diffuse pollution is difficult. In some jurisdictions, statutory provisions have been used to regulate such pollution, for example by

[9] For a comprehensive explanation of a variety of possible impacts of climate change on water quality, see UNECE (2009).

[10] This method has been particularly successful in Germany with regard to wastewater, where standards are in place for 57 different business sectors (Köck, 2012).

setting limits on the application of fertilizer per unit of productive land (European Council, 1991b). However, monitoring such regulations has proved a challenge (Köck, 2012).

An innovative legal mechanism which states could use to identify and address specific climate effects on water quality is a 'climate impact assessment', which could be added to existing national regulatory planning frameworks. The assessment lays down the minimum substantive, formal and procedural standards for assessing the specific climate impact on water quality to be applicable at national and basin levels (Reese et al., 2010). Such assessments should also take a long-term view with regard to the effects of investment and infrastructure decisions.[11]

The WHO's *Guidelines for Drinking-water Quality* (WHO, 2011), the UNECE Water Convention and the various EC Directives provide extensive information and guidance on legal and policy principles and approaches to water quality management, including water quality criteria, objectives and standards.

With its *Guidelines for Drinking-water Quality*, the WHO has produced international standards related to water quality and human health, and provided strategies for managing risks related to drinking water. The Guidelines addresses drinking-water safety (including minimum procedures, specific guideline values and recommended use), microbial hazards, strategies to mitigate against climate change impacts on water quality and chemical contaminants in drinking water. The Guidelines set out important roles for many different stakeholders in ensuring drinking water safety (WHO, 2011).

The Guidelines are intended to be a framework on drinking water quality. They include health-based targets, water safety plans and independent monitoring, which can be adapted to each country-specific situation and form the basis for national laws and regulations. The guidance is advisory in nature, but health-based guideline values for hazardous constituents are derived and presented as maximum recommended concentrations. The guidance is advisory in nature, but health-based guideline values for hazardous constituents are derived and presented as maximum recommended concentrations. Supporting information (consisting of microbial, chemical, radiological and acceptability aspects), as well as a surveillance mechanism which provides feedback for the water safety plans ensure the future viability of the framework.[12]

The UNECE has also produced objectives and standards on water quality and monitoring in the UNECE Water Convention, which provide much potential for transferable best practice to other river basin contexts. The UNECE *Guide to Implementation* defines 'water quality criteria' as being the 'minimum concentration levels for oxygen, and maximum concentration levels for substances in water that do not harm a specific single form of water use (e.g. drinking water use, use of water livestock watering, irrigational water use, water use for recreational purposes, use of water by aquatic life)'. Water quality objectives are described as constituting a numerical concentration or narrative statement that has been established to support and to protect designated uses of water (UNECE, 2013).

Annex III of the UNECE Water Convention (UNECE, 1992) contains guidance on the establishment of water quality objectives and criteria, which should:

a) Take into account the aim of maintaining and, where necessary, improving the existing water quality;

b) Aim at the reduction of average pollution loads (in particular hazardous substances) to a certain degree within a certain period of time;

c) Take into account specific water-quality requirements (raw water for drinking-water purposes, irrigation, etc.);

d) Take into account specific requirements regarding sensitive and specially protected waters and their environment, e.g. lakes and groundwater resources;

e) Be based on the application of ecological classification methods and chemical indices for the medium and long-term review of water quality maintenance and improvement;

f) Take into account the degree to which objectives are reached and additional protected measures, based on emission limits, are required in individual cases.

The UNECE Water Convention also provides further guidance on 'techniques and practices to address pollution from point and non-point sources'. Such techniques and practices include

[11] This is a new idea which needs to be further explored, especially with regards to how it would be integrated into different national and transboundary legal frameworks on a country-specific basin (Reese et al., 2010).

[12] See also Rieu-Clarke et al. (2012).

the establishment of wastewater discharge limits based on best available technology,[13] and the requirements that biological treatment or equivalent processes be applied to municipal wastewater, that appropriate measures be taken (such as the application of best available technology in order to reduce nutrient inputs from industrial and municipal sources), and that appropriate measures and best environmental practices[14] be developed and implemented for the reduction of inputs of nutrients and hazardous substances from diffuse sources, especially where the main source is from agriculture.[15]

The EC has built a substantial body of legislation and policy to address water quality issues, viewed as one of the major areas of concern in water management for this region. The WFD is the main instrument for managing water, including water quality, but other instruments also deal with water quality, including the *Drinking Water Quality Directive* (80/778/EEC; European Council, 1980), the *Urban Waste Water Treatment Directive* (91/271/EEC; European Council, 1991a), the *Nitrates Directive* (91/676/EEC; European Council, 1991b), the *Groundwater Directive* (2006/118/EC, European Parliament and Council, 2006) and the *Environmental Quality Standards Directive* (2008/105/EC; European Parliament and Council, 2008). Major pollutant sources (point and diffuse) are targeted by these directives, but practical challenges remain at the Member State level in addressing some diffuse sources and in achieving the overall WFD objectives of good ecological status of water.[16]

The Environmental Quality Standards Directive supports the WFD implementation of water quality objectives by introducing chemical objectives as part of environmental quality standards for surface waters for 33 priority substances and eight other pollutants, including a requirement to phase out over 20 years discharges, emissions and loss of hazardous substances of high priority (European Parliament and Council, 2008). Member states are also required to set up an inventory of emissions, discharges and loss of pollutants for the river basins on their territory, to be published as part of their River Basin Management Plans under the WFD.

Another important EC instrument, the Urban Waste Water Treatment Directive (European Council, 1991a), helps improve water quality by setting minimum standards for the collection, treatment and discharge of urban wastewater. Full implementation of the Directive, and compliance with its requirements, is part of meeting the obligations of the WFD. Finally, the Nitrates Directive (European Council, 1991b) helps protect water quality, particularly from agricultural pressures, by ensuring that its Member states reduce or prevent water pollution caused by inorganic fertilizer and manure on farmland. The Directive proposes a variety of tools to achieve this, some mandatory, others voluntary. Mandatory tools include the requirement to identify 'vulnerable zones' and create Action Programmes to tackle pollution in these zones. The Nitrates Directive also requires its Member States to establish codes for good agricultural practice with voluntary implementation by farmers.

The broad objectives of the WFD, in combination with the complementary directives, are generally viewed as sufficient to improve and monitor water quality and pollution issues. However, challenges remain in linking the objectives of these directives to all major polluting sectors.

[13] Annex I of the UNECE Water Convention (UNECE, 1992) defines 'best available technology' as being 'the latest stage of development of processes, facilities or methods of operation which indicate the practical suitability of a particular measure for limiting discharges emissions and waste.'

[14] Annex I to the Convention provides guidelines for developing best environment practices, stipulating a range of detailed measures that should be considered, focusing on influencing consumer behaviour and understanding the environmental risks and costs resulting from the production of particular activities and goods.

[15] For a more detailed discussion, see Rieu-Clarke et al. (2012).

[16] For a discussion regarding good ecological status and the main challenges from a Member State perspective, see the Fitness Check of EU Freshwater Policy literature, available at ecologic-events.eu/Fitness-Check-Workshop/sites/default/files/Conclusions_FC_2nd_Stakeholder_WS.pdf

3.6 Managing risk, including floods and droughts

- Climate change is causing more frequent and intense floods and droughts in many locations across the globe.
- Our current state of preparation to manage droughts and floods around the world is inadequate.
- In any undertaking to integrate risk regulation into climate change adaptation law, an emphasis on (sound) science-based risk regulation can be problematic. It is crucial to recognize local knowledge, local risk perspectives and political concerns.
- Since benefits are unlikely to be evenly spread across a community, it is important to pinpoint who actually gains from flood and drought risk management strategies.
- Adaptation tools to prepare against the effects of floods and droughts include legal rules that provide for prior data and information exchange on prevention measures, as well as continuous monitoring.

3.6.1 Managing risk and adaptation to floods and droughts – Key considerations

In many locations across the globe, climate change is causing more frequent and more intense floods and droughts (UNFCCC, 2011). More extreme weather events, combined with exposed and vulnerable human and natural systems, can lead to disasters (IPCC, 2012). By 2050, rising populations in flood-prone lands, climate change, deforestation, loss of wetlands, and rising sea levels are expected to increase the number of people vulnerable to flood disaster to 2 billion (WWAP, 2012). In the European region alone, the average number of annual disastrous weather and climate-related events increased by about 65 per cent between 1998 and 2007 (EEA, JRC and WHO, 2008). Surveys of the existing legal and institutional capacity around the world reveal significant shortcomings in terms of provisions to address the physical and social impacts of these extreme weather events (Rieu-Clarke, 2008; WMO, 2006; Bakker, 2009). This section describes how legal rules, approaches and mechanisms for climate adaptation in water management should consider risks from flooding and drought events, including ways to apply legal provisions in order to ensure a response which seeks to minimize loss of life and damage to property and environment, across transboundary and local watercourse scales. Many of the mechanisms, which are particularly important for addressing risks related to droughts and floods, are also relevant to climate adaptation in water management generally (e.g. the importance of joint information systems and exchange). This section examines the use of legal mechanisms specifically in relation to responses to floods and droughts.

Droughts are projected to intensify in the 21st century due to reduced precipitation and increased evapotranspiration, especially in Central America and Mexico, central North America, southern and central Europe, northeast Brazil and southern Africa (IPCC, 2012). Drought is considered a function of water scarcity, as water scarcity might occur over a long period of time, but the mechanisms needed to deal with longer-term water scarcity and drought situations are very similar. In a situation of drought, it is important to consider the impacts and adaptation options across the whole water supply system. The severity of the impact of its is a factor of exposure and vulnerability levels (UNECE and WHO, 2011). Legal frameworks should create an enabling environment in which different actors can act, working across different scales and at different levels. Furthermore, robust legal provisions should define people's rights to protection from scarcity and drought, and their rights to assistance and compensation.

Our current state of preparation to deal with floods around the world is inadequate. A recent analysis (Bakker, 2009) found that an overwhelming 43 international river basins with frequent transboundary floods during the period 1985-2005 lack the appropriate institutional capacity for managing these events. In this analysis, only 24 out of 692 international water-related treaties contain flood-related components. And critically, flood losses are demonstrated to be significantly higher in transboundary basins that lack the institutional capacity and legal frameworks to deal with such extreme weather events.

A risk-based approach to climate change adaptation seeks to identify both the current and future risks associated with climate variability, floods and droughts, and to analyse and prioritize them, in order to treat these risks, or to reduce them to acceptable levels. When analysing risks, priority should be given to the extreme or high

risks that are most likely to occur, and 'win-win' or 'no-regrets' treatment options should be pursued (UNECE and WHO, 2011).[17] Potential no-regrets measures include many of the measures discussed throughout this report.

Risk management law has been developed to address risk and uncertainty across different areas of law, and some aspects listed below have been identified by Reese et al. (2010) as particularly relevant to risk analysis undertaken as part of climate adaptation:

a) An adequate risk analysis should be appropriate to the degree of potential risk and should be based on as many of the available data, methods and expert studies as possible, in order to identify the possible courses of action along with their costs and benefits;

b) A thorough assessment of the risks and options for action should be devised, and integrated action strategies should be developed involving all relevant stakeholders, with a view to reaching a consensual risk decision appropriate to the problem;

c) Since women are often among the first and most severely hit groups affected by floods and droughts (Cap-Net and GWA, 2006), their participation in the design and implementation of early-warning and emergency systems would induce a well-directed contribution to a more gender-sensitive approach to the management of water-related risks (UNISDR, 2008);

d) Preferably, 'no-regret' measures should be selected in a way that will prove beneficial, or at least cause as little harm as possible (in particular with regard to the integrity of the protected assets concerned), even if the risk anticipated does not occur; and

e) Existing risk measures need to be reviewed and, if necessary, adjusted, in order to take account of new information.

In any undertaking to integrate risk regulation into climate change adaptation law, especially international law, important precautions must be considered. The emphasis on (sound) science-based regulation of risk in international law can be problematic in the sense that it might overestimate the extent to which scientific evidence provides universally accepted and valid valid guidance for risk policy. It is, therefore, crucial to recognize the diversity of local knowledge, local risk perspectives and political concerns (Peel, 2013).

3.6.2 International legal approaches and principles for the management of risk and the adaptation to floods and droughts

International law provides a broad framework within which states must abide to both 'hard' law obligations and 'soft' law commitments that apply to disaster risk management, including managing floods and droughts, as well as climate change adaptation in general. This framework includes obligations and commitments under instruments, such as: the UNFCCC (1992), which centres around the formulation and implementation of measures to facilitate climate adaptation; the United Nations Convention to Combat Desertification (UNCCD, 1994), which aims to mitigate the effects of drought; the United Nations Framework Convention on Climate Change; and the Hyogo Framework for Action (UNISDR, 2005), a non-binding agreement adopted in 2005 by 168 countries who agreed to implement recommendations to strengthen the resilience of states and communities to disasters. The main objectives of the Hyogo Framework include: the integration of disaster risk reduction into sustainable development policies and planning; the development and strengthening of institutions, mechanisms and capacities to build resilience to hazards; and the systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response, and recovery programmes.

[17] 'No-regret' measures include early warning systems; risk communication between decision-makers and local citizens; sustainable land management, including land use planning; and ecosystem management and restoration. Other 'no-regret' measures include improvements to health surveillance, water supply, sanitation, and irrigation and drainage systems; climate-proofing of infrastructure; development and enforcement of building codes; and better education and awareness.

Further global legal obligations specifically address principles needed to adapt to climate change, and to prevent or mitigate the effects of floods and droughts within an international watercourse. For instance, Art. 27 of the Watercourses Convention covers a variety of situations that may be harmful to international watercourses, among them droughts and floods:

> [w]atercourse states shall, individually and, where appropriate, jointly, take all appropriate measures to prevent or mitigate conditions related to an international watercourse that may be harmful to other watercourse states, whether resulting from natural causes or human conduct, such as flood or ice conditions, water-borne diseases, siltation, erosion, salt-water intrusion, drought or desertification (UNGA, 1997).

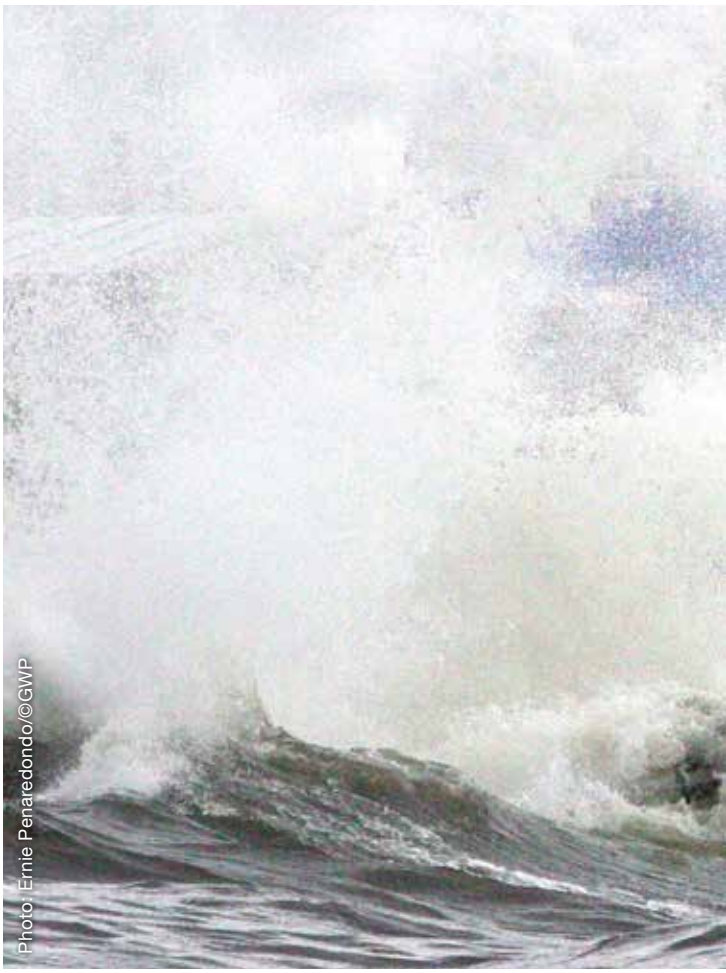
Photo: Ernie Penaredondo/©GWP

In order to specify these 'appropriate measures', states should agree in a bilateral or multilateral setting on special treaty provisions which introduce flexibility during extreme weather events.

In the case of drought, the most popular measures applied to transboundary water-sharing agreements at the bilateral or multilateral level is the 'escape clause', which allows countries suffering from water stress to deliver less water downstream than they would under normal conditions. This further allows them to respond to unpredicted circumstances while not automatically infringing the treaty. For example, the 1944 treaty between the United States of America and Mexico covers such a mechanism in case of drought (Government of the United States of America and Government of Mexico, 1944). Since downstream riparians tend to oppose the use of such a clause (as it implies, they will receive even less water during times of drought), it is often accompanied by a deficit mechanism, which obliges the upstream state to return the amount of water shortfall once the drought has ended.

In another example of transboundary water-sharing agreement, the absence of a drought provision in the 1994 Israel-Jordan Treaty of Peace could have potentially left both countries vulnerable to drought events. However, the treaty did establish another crucial legal tool for managing drought: a Joint Water Committee to resolve conflicts without the need to amend to the original agreement (Government of Israel and Government of Jordan, 1994; Art. VII). During the drought of 1998-1999, Israeli and Jordanian members of the Committee agreed to use another mechanism, including a temporary allocation arrangement which modified the original allocations in order to reflect the changed circumstances (Odom Green and Wolf, 2011).

Response strategies to floods are often overlooked during the negotiations of transboundary freshwater treaties. Given the fact that losses caused by floods are considerably higher in shared basins which lack the institutional capacity, this shortcoming often proves to be rather costly for the basin states affected by such disasters (Bakker, 2009). The coordinated management of floods can reduce the risk of these events considerably. Examples of bilateral and multilateral treaties incorporating such provisions are: the Columbia River Treaty (Government of Canada and Government of the

Typhoon Kiko (Philippines)

United States of America, 1961), which includes a dam operation adjustment mechanism, stipulating that Canada will adjust the operation of hydropower dams to mitigate flooding downstream in the USA; and the Mekong Agreement (MRC, 1995a; Art. 6), which sets maximum river flow rates (WMO, 2006).

Adaptation tools to prepare against the effects of flood and drought effects include legal rules that provide for prior data and information exchange, as well as continuous monitoring. The *Protocol on Water and Health* requires international cooperation in order to establish joint or coordinated systems for surveillance, early-warning systems, contingency plans and response capacities, 'as well as mutual assistance to respond to outbreaks and incidents of water-related disease, especially those caused by extreme weather events' (ECOSOC, 1999).

A further example of model rules related to floods and droughts at the international level can be seen in the work of the International Law Association and its 2004 Berlin Rules (ILA, 2004). Article 34 of the Berlin Rules recommends that 'states cooperate in developing and implementing measures for flood control, having due regard to the interests of other states likely to be affected by the flooding'. Additional recommendations under the Berlin Rules relate to the most expeditious methods of communicating flood events: developing joint contingency plans; data and information collection and exchange; joint surveys, investigations, studies and flood plain maps; flood control measures; and flood forecasting and communication of flood warnings. In relation to drought measures, the Berlin Rules make recommendations in a number of areas where states might cooperate, including developing an integrated strategy for addressing the physical, biological and socio-economic aspects of drought; and defining criteria that activate drought responses.

A more detailed example of good practice of flood management at the transboundary level, which integrates regional level legislation with national level implementation and risk analysis, can be seen within EC water management, as introduced earlier, particularly the Floods Directive (European Parliament and Council, 2007), which provides a comprehensive regional level framework for flood risk analysis. The Floods Directive must

also be coordinated with the WFD river basin management planning process. Together, they provide a strong framework for incorporating adaptation to the climate-related water risks created by more frequent and intense weather events, through tools like risk assessments, monitoring, environmental objective setting, and economic analyses of action programmes to achieve set environmental objectives (EC, 2009b; Quevauviller, 2011).

The Floods Directive calls for national authorities to establish management units (European Parliament and Council, 2007; Arts. 2 and 3 (2)). Authorities must carry out a preliminary flood risk assessment in order to identify areas in which potential significant flood risks exist or might occur, as well as flood hazard and flood risk maps, and flood risk management plans (Arts. 4-7). The Directive also requests the national authorities of each Member State sharing a transboundary river basin to carry out prior information exchange during the conception of a hazard and risk map, with the aim of creating a joint flood risk management plan applying to the basin as a whole (Arts. 6(2) and 8(2) and (3)). In this regard, Member States are asked to coordinate flood control measures as part of their flood risk management plans, so that such measures do not increase the risk of floods in upstream or downstream neighbouring states (Art. 9).

Member States must implement the Floods Directive, both at the national and the local levels. A successful example of such implementation is provided by Germany, where national legislation implements the Directive and lays down detailed requirements to guarantee a thorough risk analysis. German law contains a wide range of obligations including: showing low-, medium- and high-level flood risks and potential damage on hazard maps or identifying hazard zones, and taking account of any climate-related increase in risk, with the risk category reviewed every six years. The law also provides for extensive flood risk management planning, and gives planning authorities the ability to impose restrictions on the use of flood plains (Wasserhaushaltsgesetz, 2009; Reese et al., 2010).

Finally, and also at the European level, the EC has issued a *Communication on Water Scarcity and Droughts*, which includes a technical report providing recommendations on the ways to develop drought plans with mitigation and prevention measures, in order to minimize the environmental, economic and social damage caused by climate-induced water scarcity and droughts, and which contains useful best practices for other regions around the world (EC, 2007).

3.6.4 National adaptation measures for droughts

National level systems are regarded as central to a country's capacity to meet the challenges of climate change-induced drought, but these systems also need to be coordinated across local and international scales. The following section introduces some of the legal mechanisms and strategic action priorities which are recommended as tools for adaptation to drought across national and local levels.

General water management plans should include a drought risk assessment which also coordinates preventive and technical measures to address scarcity and drought. The role of law is to lay down clear requirements surrounding the process, implementation and communication of such an analysis, and the corresponding legal response mechanisms.

Legal rules should provide for measures to prevent water shortage, including provisions to retain and store water. Measures to retain water can include more stringent obligations imposed on water suppliers to upgrade infrastructure, reduce leakage rates and control flow. New building and infrastructure standards can be also used to increase resistance to extreme drought.

Legal provisions to address water retention and savings should go beyond the water management sector. Regulations can be used to stimulate adaptive agricultural practices such as crop improvements that reinforce drought tolerance. Further legal measures on retention methods are discussed in Section 3.6.5.

Water storage measures can include regulations which facilitate the increased use of rooftop rainwater harvesting systems or other traditional rain and groundwater harvesting and storage systems.

Regulations should ensure water treatment works are appropriately prepared for drought risk. Treatment plants and equipment (including chemical treatment and storage, and disinfection

processes) should be prepared for the impact of reduced flow on the treatment process (UNECE and WHO, 2011).

Essentially, legal measures should also restrict access to water by intensive users, and reduce water consumption during times of drought, for example through legal provisions which restrict irrigation or non-essential domestic water use during water shortage. Mechanisms for reducing water consultation and improving efficiency are discussed in the following section.

Communication and education across scales is equally essential. A strategy which seeks to address extreme weather events must be grounded in local knowledge and broadly communicated, so that every citizen is aware of possible personal adaptation measures. Health response systems are useful in this regard, and coordinated early warning systems are essential (UNECE and WHO, 2011).

3.6.5 National adaptation measures for floods

The following paragraphs introduce some of the legal mechanisms and strategic action priorities which are recommended as tools for flood adaptation across national and local levels.

Similarly to drought adaptation measures, an assessment of existing and future flood risks should be part of the general plan that coordinates and integrates preventive and technical flood control measures. Legal instruments should lay down clear requirements surrounding the process, implementation and communication of the flood risk analysis and its results. This could include a duty to show low, medium, and high level flood risks on hazard maps.[18] Legal rules should require these risk categories to be reviewed on a regular basis.

Legal rules should also limit or control the development of buildings through the use of risk level zoning, identifying the risks (including future climate-induced risks) resulting from building in specific zones. For example, in a zone with high flood risks, appropriate legal rules could designate the building of residential properties as a 'non-complying' activity, with exemption only granted in a very limited set of circumstances. In medium-risk flood zones, national building codes and regulations could require certain steps to make buildings flood-proof (such as the requirement to have foundations at a certain distance from the ground).

Legal rules should also provide for water retention and storage. In order to achieve this, appropriate regulation must go beyond the water sector and involve general spatial planning, agriculture and conservation sectors. Water retention in urban areas can be achieved through wastewater management planning, including through statutory provisions that increase the levels of rainwater infiltration and grey water recycling. In rural areas, where the need for water retention improvement is especially high, this could be achieved through improved regulation of agricultural soil management practices and agricultural drainage systems (Reese et al., 2010). Different types of land use will contribute to different levels of water retention, thereby preventing rapid surface runoff and minimizing erosion. Forest stands, arable land, pastures and meadows are all examples of different kinds of natural reservoirs capable of keeping and retaining a certain volume of water. Planning regulations could be used to plan and effectively promote renaturalization of small-scale hydrographic networks in order to enhance water storage (Ristić et al., 2011). Rehabilitation regulations could specify methods to restore 'natural' river channels and reverse much of the unnecessary sealing of the soil surface, allowing water to drain more gradually. This focus on natural retention measures for flood protection is also coherent with the ecosystem-based approach.

It is essential that the above-mentioned legal mechanisms to manage floods and droughts at the national and local levels also feed into the overarching objectives and obligations of transboundary legal frameworks, and regional and international legislation. In addition, since benefits are unlikely to be evenly spread across a community, it is important to pinpoint who actually gains from flood and drought risk management strategies. This can be accomplished by assessing the socio-economic characteristics of beneficiary communities segmented by gender and particular vulnerabilities (e.g. religion, ethnicity or age) (Jha et al., 2012).

[18] As is the case in Germany's Water Resources Act (Wasserhaushaltsgesetz, 2010). For further information, see Reese et al. (2010).

3.7 Reducing consumption and improving efficiency

- Risk management, which underlies uncertainty management, requires the reduction of water consumption and the improvement of water efficiency as part of overall water management.
- Greater emphasis should be put on the promotion of efficient irrigation uses, given that irrigation represents 70 per cent of global water withdrawal and accounts for 90 per centper cent of global consumptive water use. Here, it is important to acknowledge that women are often key actors in irrigation practices, and therefore should have equal access to training and irrigation equipment (FAO, GEWAMED and GWA, 2012). Experience shows that men are usually overrepresented when it comes to planning and decision-making around irrigation management, while the final users of irrigation water are usually mostly women (Zwarteveen, 2008).
- A systematic re-examination of engineering designs, operating rules, contingency plans and water allocation policies for the identification of priority areas in the effort to reduce consumption and to improve efficiency will be crucial to address water consumption and efficiency issues.
- A wide range of different instruments to improve resource efficiency and promote sustainable consumption is available, including regulatory, economic, information, education, research and development instruments, as well as voluntary agreements and cross-sectional measures.

Climate change presents a complex set of conditions for water managers seeking to identify effective interventions in addressing the uncertainty, variability and risk associated with climate change (Aerts and Droogers, 2009). The uncertainty posed by the advent of climate change, besides other factors such as population growth, land use changes, the restructuring of the industrial sector, and environmental demands, worsens the pressure on the hydrological system and water resources (Gleick, 2000), especially through increased occurrence of water scarcity and drought (Benito et al., 2009).

Past efforts in water resources management have responded to changes in demand and supply by minimizing the risk of natural variability and maximizing system reliability (Gleick, 2000). However, in recent years it has become increasingly recognized that risk management, which underlies

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Box 6 ■ Compliance under the 1992 UNECE Water Convention

At the Fifth Meeting of the Parties to the 1992 UNECE Water Convention in Geneva in 2009, the Parties took the decision to establish a mechanism under the Convention, 'through which problems related to implementation and possible differences in the Convention's interpretation could be addressed'. The Convention's Legal Board was then asked to prepare a proposal on the objectives, structure, tasks, functions, measures and procedures for an international and procedural mechanism to support implementation and compliance, which was approved at the sixth Meeting of the Parties in November 2012.

The objective of the mechanism for implementation and compliance is non-confrontational, non-adversarial, transparent, supportive and cooperative in nature. An Implementation Committee, consisting of nine members, was elected by the Meeting of the Parties. The Implementation Committee may consider difficulties in the implementation or application of the Convention that have been sent to them through a number of different procedures.

Firstly, a Party or Parties may – through the so-called Advisory Procedure – request advice from the Committee concerning efforts to implement or apply the Convention.

Secondly, a Party that feels that, despite its best endeavours, it is unable to comply with the Convention, may bring a submission before the Committee. Additionally, a Party or Parties affected or potentially affected by another Party's inability to comply with the Convention may bring a submission before the Implementation Committee. In the latter case, the Party who may be in non-compliance must submit a response within six months.

Thirdly, a scenario may arise whereby the Implementation Committee becomes aware of possible difficulties in implementation or non-compliance by a Party, from information received, for example, from the public. The Committee may then request the Party to provide the necessary information on the matter, which must be supplied within six months.

Upon receiving submissions from one of the three procedures outlined above, the Implementation Committee may decide on a range of actions, including suggesting that domestic regulatory regimes be set up or strengthened and relevant domestic resources be mobilized as appropriate; assisting in establishing or strengthening transboundary water cooperation agreements; facilitating technical and financial assistance, including information and technology transfer and capacity building; and assisting in seeking support from specialized agencies and other competent bodies. The Implementation Committee may also request and assist a Party or group of Parties to develop an action plan to facilitate implementation, and invite the Party or group of Parties to submit progress reports to the Committee.

The compliance committee mechanism under the UNECE Water Convention represents an innovative device to ensure flexibility within treaty arrangements, whilst also providing a supportive method by which to strengthen implementation.

Source: Authors, based on UNECE (2012b).

Ferghana Valley (Kyrgyzstan, Tajikistan, Uzbekistan)

uncertainty management, requires the reduction of water consumption and the improvement of water efficiency (EC, 2007). Water consumption, also called the consumptive use of water, refers to the 'use of water in a manner that prevents its immediate re-use, such as through evaporation, plant transpiration, contamination or incorporation into a finished product' (Gleick, 2000). The reduction in consumption has always been considered the cheapest and most environmentally-friendly adaptation measure for addressing water shortage (Ludwig et al., 2009). Water efficiency is the long-term ethic of conserving water resources, and includes the incorporation of new innovative technologies and the change in usage patterns of water-using products and in behaviours to reduce water consumption (Benito et al., 2009).[19]

Consumption can be reduced and water efficiency promoted through a number of measures, including water-saving devices, grey water re-use, rainwater harvesting and the reduction of non-revenue water loss through leakage reduction in distribution and supply networks. Non-technological approaches aiming to reduce consumption, for instance by inducing changes in behaviours through awareness-raising and metering, can be used to supplement technological measures (EEA, 2012). Studies have shown that water conservation measures that reduce demand on the systems, such as education, industrial and commercial re-use, modern plumbing standards, and pricing policies, are all effective means by which to alleviate the overall stresses on water (Gleick, 2000).

A systematic re-examination of engineering designs, operating rules, contingency plans and water allocation policies for the identification of priority areas in the effort to reduce consumption and to improve efficiency, will be crucial to address water consumption and efficiency issues. Additionally, prices and markets are increasingly recognized as important tools for improving efficiency and balancing water supply and demand. The reduction or elimination of subsidies, sophisticated pricing mechanisms, and smart markets, provide incentives to the public and private sector to reduce their water consumption, increase production despite the limited resources, and reallocate water among different users (Gleick, 2000).

Numerous practical measures can be put in place to reduce consumption and improve efficiency. For example, in France, the imposition of water meters for irrigation beyond abstraction thresholds resulted in a rise in the number of water meters being used from 54 to 71 per cent over the period 2001-2003, representing 85 per cent of the overall irrigated area. In Cyprus, conservation measures at the household level through the re-use of grey water reduced per capita water consumption by up to 40 per cent, whereby 75 per cent of the cost of the system was covered by government subsidies. In Germany, one out of five among the larger cities has been supporting rainwater harvesting to reach the objective of equipping 15 per cent of buildings with rainwater harvesting systems by 2010. A comprehensive programme based on updated water devices and equipment, the introduction of metering and raising public awareness launched in 1997, resulted in the saving of 1.2 billion litres of water per year. The effectiveness of public awareness programmes was demonstrated in a national water-saving campaign launched in France, thanks to which 88 per cent of the public said they would make efforts to save water (EC, 2007).

At the EC level, standard product information on products' consumption of essential resources (including water) are required to be brought to the attention of consumers 'by means of a fiche and a label related to household appliances offered for sale, hire, hire-purchase or displayed to end-users' (European Council, 1992). The design of washing machines and dishwashers falls under the Ecodesign Directive for energy-related products, including water-using products such as shower heads or taps that could contribute to significant energy savings during use (European Parliament and Council, 2009). Such initiatives provide examples of how legislative measures might lead to effective water conservation and increased water use efficiency.

Without institutional support, consumptive water uses cannot be reduced and water efficiency cannot be improved. The revision of the existing institutional architecture may be necessary in order to ensure that it is more conducive to a more adaptive water resources management. Institutional adaptation has been identified as a primary objective of water demand management, as it can increase the flexibility to respond to increasing uncertainties caused by climate change. Institutional reforms, such as changes in organizations, laws, regulations and tax codes, may be the most effective means in aligning water demands with available supplies (Kaczmarek, 1995).

[19] Water efficiency is defined as the accomplishment of a function, task, process or result with the minimal amount of water feasible; and an indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered. Benito et al. (2009) use the term 'water conservation' and 'water efficiency' interchangeably, but noted that the concept of water efficiency focuses on reducing water wastage. They propose that the key to efficiency is reducing water wastage, not restricting water use.

A key sector to be discussed in any study on water consumption and efficiency is agriculture. Agriculture accounts for 70 per cent of global water withdrawal and 90 per cent of global consumptive water use (Kundzewicz and Mata, 2007). The conversion from open channels to pressurized pipe networks improves conveyance efficiency, while the most effective field application is the use of drip systems. Apart from that, the modification of agricultural practices, such as the use of cropping calendars and the shifting to crops that are less water-intensive, are techniques that should be considered for the reduction of irrigation water use. In water-scarce areas, or islands and coastal regions, reusing and recycling wastewater provides an alternative source of water for irrigating crops (EEA, 2012).

3.8 Improving compliance

- **A major challenge in strengthening compliance with legal commitments is the need to enhance the determinacy of laws relating to ecosystem-based adaptation measures and to foster shared understanding amongst stakeholders.**
- **Tools such as education, awareness and training programmes, reporting, non-compliance procedures, technical and financial assistance etc., if targeted effectively, are important in strengthening compliance.**
- **An effective non-compliance strategy at the basin level provides an important means through which to ensure that ecosystem-based adaptation measures are effectively implemented.**

Legitimacy is an important concept in ensuring that states and other actors comply with their legal obligations related to water and climate change adaptation. This is particularly the case at the international level, where strong enforcement mechanisms tend to be lacking. There are two key interrelated elements of legitimacy: *internal* and *external* legitimacy.

Internal legitimacy refers to both the structure and the content of legal norms. Concerning content, legal rules and principles related to climate change adaptation must be articulated in such a way that it is clear to subjects what they must do, may do or must not do. The relationship between rules will also have an important bearing on their effectiveness.

A major challenge in strengthening compliance is the need to enhance the determinacy of laws relating to ecosystem-based adaptation measures. RBOs play a crucial role in coordinating and integrating different legal regimes, in order to ensure that they are harmoniously implemented at the basin level. A further significant challenge relates to the fragmentation of the existing legal architecture for the management of water resources, particularly at the transboundary level. In many parts of the world, legal regimes at the basin level are inadequate to cope with climate change, due to weak treaty arrangements (UN-Water, 2008). The recent entry into force and widespread support for the 1997 UN Watercourses Convention,[20] together with the recent opening up of the UNECE Water Convention to non-UNECE Member States, will play an important role in harmonizing not just water-related agreements, but also other global conventions that (directly and indirectly) have an impact on water (Rieu-Clarke and Rocha Loures, 2009). Parties to both Conventions have committed to promote coordination between the two instruments, and the UNECE Water Convention secretariat has already demonstrated its willingness to act as a platform to support interlinkages and the implementation of the UN Watercourses Convention and other MEAs, despite the current position of the parties to seek no formal joint institution for the water Conventions (Moynihan, forthcoming).

Process features are particularly pertinent in enhancing compliance, especially given that a certain level of flexibility within the legal system is necessary to manage the high levels of uncertainty associated with climate change. An important element in strengthening compliance is the development of shared understandings amongst stakeholders regarding the meaning and applicability of legal rules, and the creation of a legal environment in which the implementation and enforcement of laws related to ecosystem-basin adaptation measures is culturally accepted and commonplace. It is therefore insufficient to simply adopt the appropriate adaptation measures: effective mechanisms must also be in place to ensure that measures are adopted in a fair and equitable manner, engaging all relevant stakeholders. Transparency is a key principle in this regard. Tools, such as education, awareness and training programmes, reporting, non-compliance procedures, technical and financial assistance etc., if targeted effectively, have the potential to strengthen the legitimacy of adaptation measures.

[20] Convention on the Law of the Non-navigational Uses of International Watercourses (UNWC) (adopted 21 May 1997, entry into force 17 August 2014) (1997) 36 ILM 700.

Box 7 ■ Dispute settlement procedures under international law

Dispute settlement in international law covers a broad spectrum of procedures, all consistent with the UN Charter requirement that international disputes between nation-States be resolved peacefully. The following provides an overview of the key procedures:

Negotiation is often the first diplomatic dispute settlement tool to be utilized in the dispute resolution process and it can take different forms, from bilateral talks and diplomatic correspondence to international conferences. Most disputes are by negotiation and, if this is the case, parties should record the terms of settlement.

Joint institutions provide a more formalized framework for dispute resolution (when conflict prevention measures are unsuccessful) and such joint institutions are generally best equipped to conduct fact finding and resolve questions concerning the obligations of the states.

Mediation and good offices are a form of dispute settlement involving third parties. The third party can be a single State or a group of states, an individual, an organ of a universal or regional international organization, or a joint body. The third party offers 'good offices' to the conflicting states by facilitating dialogue and assisting states in the peaceful settlement of the dispute. Mediation involves more active third-party participation in the negotiations. The mediator conducts the negotiations between contending parties on the basis of proposals made by the mediator aimed at reaching a mutually acceptable solution. The mediator's role can involve communication, clarification of issues, drafting of proposals, identification of areas of agreement between parties, and elaboration of provisional arrangements to minimize contentions and propose alternate solutions.

Inquiry and fact finding are procedures specifically designed to produce an impartial finding of disputed facts conducted by a third party, usually a panel of experts or a single expert. states refer questions to a commission for investigation of factual or technical matters after diplomatic negotiations have broken down.

Arbitration is a legal method of dispute settlement which requires the prior consent of each party to the dispute. This is usually done through a special agreement between the parties called a compromise. The use of the Permanent Court of Arbitration is one possible mechanism for conducting arbitral procedures. This type of arbitration (set up by states to decide a case between them) is known as public international arbitration and is distinguishable from another type of arbitration in which individuals or corporations are involved, called private international arbitration, or international commercial arbitration.

Adjudication or judicial settlement involves the reference of a dispute to the International Court of Justice (ICJ) or some other standing tribunal, such as the European Court of Justice (ECJ). The ICJ has the mandate to settle, in accordance with international law, legal disputes submitted to it by states. Proceedings may be instituted either through the notification of a special agreement or by means of application. The ICJ and its predecessor, the Permanent Court of International Justice, have heard numerous cases related to freshwater. In the case of regional adjudication, the procedure for the reference of disputes to a judicial tribunal may be laid down in a regional agreement, and disputes are taken up by a regional court created for this purpose. The Inter-American Court of Human Rights, the European Court of Human Rights and the ECJ are examples of regional tribunals. A regional treaty can also provide for the reference of disputes to the ICJ or to arbitration. Some case law from the ECJ discussing the legal nature of transboundary water management under the EU Water Framework Directive already exists, although it is still early to assess the mechanism.

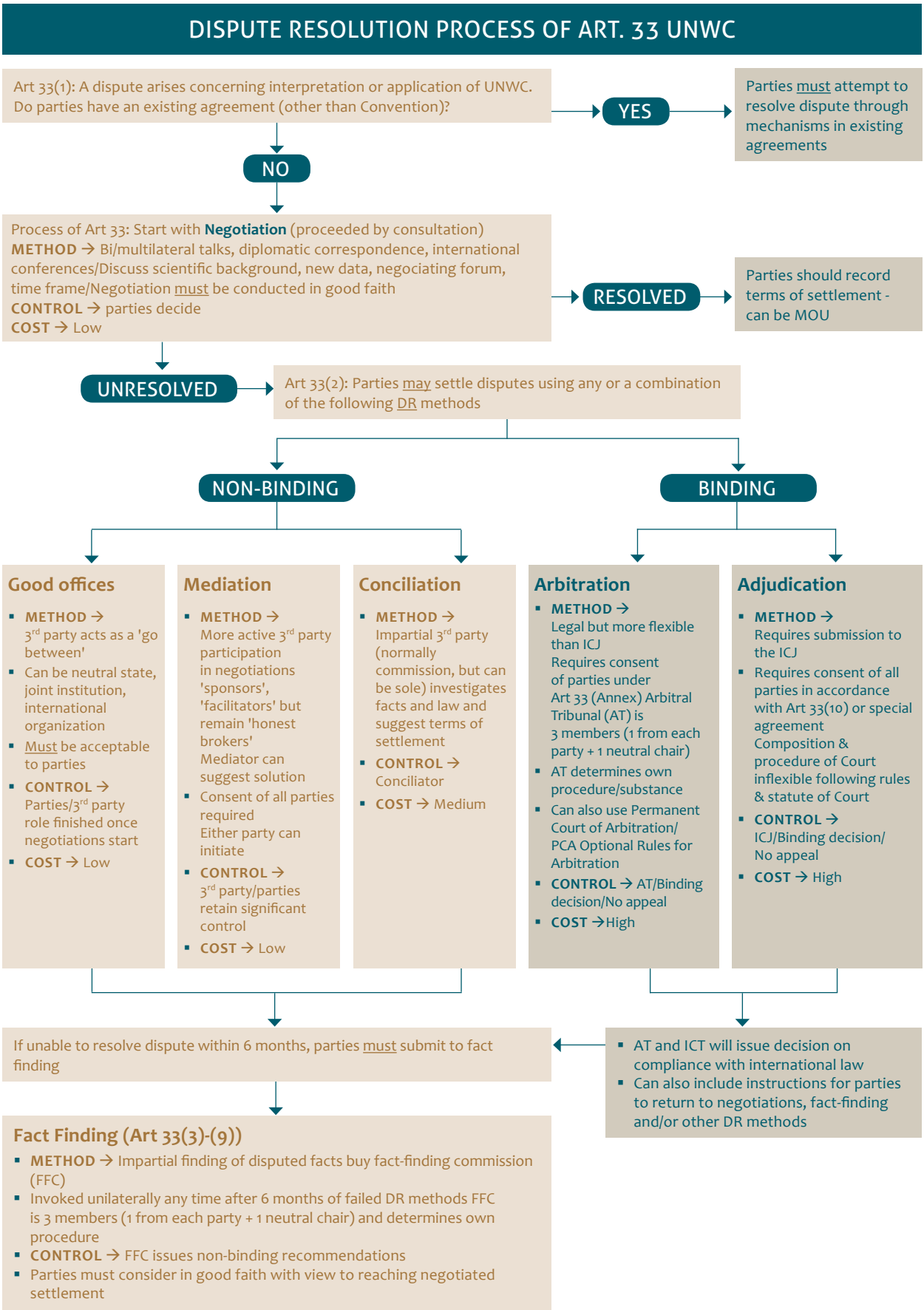
Source: Authors, based on Rieu-Clarke, et al. (2012).

An effective non-compliance strategy can significantly improve the robustness of legal arrangements at the transboundary level. Failure to comply with international commitments is rarely due to a wilful disregard by states of their international commitments. More likely, such failures can be boiled down to a range of factors, including ambiguity and indeterminacy of legal provisions, the limited capacity of parties to carry out their commitments and unreasonable timeframes of the social, economic and political changes envisioned by regulatory treaty regimes (UNECE and UNEP, 2000). In such circumstances, an adversarial approach, under which states are required to comply with their commitments, is likely to serve little purpose, unless sufficient resources are in place to ensure long-term implementation. For that reason, there is an emerging practice of adopting positive measures to ensure compliance.

Within any compliance strategy, certain key elements are essential. First and foremost, compliance must be monitored, and progress in implementation of legal commitments reported. There are several examples of reporting requirements in recent treaty practice. At the regional level, the SADC Protocol requires that watercourse institutions 'provide on a regular basis or as required by the Water Sector Coordinating Unit, all information necessary to assess progress on the implementation of the provisions of … [the]… Protocol, including the development of their respective agreements' (SADC, 2000; Art. 3(c)).[21] At the basin level, the *Convention on the Sustainable Management of Lake Tanganyika* (2000) provides that 'each contracting state shall report periodically … on the measures that it has taken to implement this Convention and on the effectiveness

[21] See also European Parliament and Council (2000) and UNECE (1992).

Figure 1 ■ Dispute resolution under the UN Watercourses Convention



Source: Rieu-Clarke et al. (2012, p. 256).

of these measures in meeting the objective of this Convention' (Art. 22). An example can also be seen in the *Framework Agreement for the Sava River Basin* (2002), which requires the Parties to 'agree to establish a methodology of permanent monitoring of implementation of the Agreement and activities based upon it'. According to Art. 21(2) of the Agreement, such methodology should include provisions for providing 'stakeholders and the general public with access to relevant information'.

As discussed earlier, various other instruments enable public participation in the activities of the basin commissions. Such mechanisms are vital in order to provide the public with the opportunity to express its concerns, and for public authorities to take due account of those concerns in the implementation of any legal commitments.

Furthermore, any compliance mechanism must be 'based on mechanisms designed to enhance, improve and ensure compliance, rather than on compliance control and enforcement tools and traditional judicial mechanisms' (UNECE and UNEP, 2000). Positive measures, such as incentives, are important tools to ensure compliance.

3.9 Dispute settlement and conflict avoidance

- **Due to a range of converging factors, including climate change, conflicts over water are predicted to increase in both frequency and intensity.**
- **For resilient water governance and climate change adaptation, it is important to understand how law can contribute to resolving potential conflicts of use through effective dispute resolution mechanisms.**
- **A well-drafted transboundary watercourse agreement aims to prevent conflict between watercourse states.**

3.9.1 Current conflict-cooperation status

History has known of only one instance in which a war was fought solely over water, which took place 4,000 years ago (Postel and Wolf, 2001).[22] However, there is much discussion over the potential for 'water wars' in the future. The current water crisis is changing global dynamics and the convergence of multiple global crises might create breeding grounds for new conflicts (Magsig, 2011). Due to a range of converging factors, including climate change, future conflicts over water are predicted to increase in both frequency and intensity (Gleick, 2008).

International organizations have responded to this perspective by calling for a new approach to solving conflicts, and for a system that more accurately reflects the conditions and setting of the 21st century, including increasing efforts to foster cross-border or subregional water management arrangements (World Bank, 2011). The participation of women in transboundary dispute resolution is a topic which deserves further research. While some effort has been made to put the gender issue on the international agenda,[23] a strategy as to how this should be achieved is currently missing. Renewed effort on participation of women in transboundary dispute management could improve water management and cooperation, and increase the involvement of civil society in river basin management.

Water can also be considered a catalyst for cooperation. Indeed, collaboration has been the dominant response to differences over the use and management of shared water resources. Between 1948 and 1999, cooperation, including the signing of treaties, far outweighed conflicts over water. Out of the 1,831 instances of interactions over international freshwater resources that were documented to have occurred in the timespan mentioned, 67 per cent were cooperative, while only 28 per cent were conflictual. In those five decades, there were no formal declarations of war over water (Yoffe et al., 2003).

3.9.2 Legal principles and approaches for dispute settlement and conflict avoidance

Law can serve both as a conflict-prevention tool and as a dispute resolution mechanism. A well-drafted transboundary watercourse agreement could have a number of objectives: to prevent conflict between watercourse states by addressing legal weaknesses; to facilitate the work of bilateral and multilateral institutions; to foster and preserving political stability; to establish a fair level-playing field for weaker and stronger riparian states by setting minimum substantive and procedural rules to be followed; to incorporate social and environmental considerations into the management and development of international watercourses;

[22] In 2,500 BC, the two Sumerian states of Lagash and Umma signed an agreement that resolved a violent dispute.

[23] For example, Principle 3 of the Dublin Statement (ICWE, 1992) states: 'Women play a central part in the provision, management and safeguarding of water', and 'implementation of this principle requires positive policies to address women's specific needs, and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them'.

to provide for regular information exchange and mandatory consultations in various situations, such as planned measures and when transboundary harm is being done; and to encourage cooperation among all states within a basin. Institutions within transboundary agreements play a crucial role in facilitating dispute prevention and settlement mechanisms.

Transboundary legal agreements can also include provisions specifically addressing dispute resolution. Most agreements include specific provisions outlining how disputes should be settled and potential conflict should be managed. In the context of an international watercourse, there will often be a range of different legal instruments across different legal sectors and scales that will all apply to a particular river basin, which will not always provide a coherent framework. As discussed previously, the provisions of the Watercourses Convention (UNGA, 1997) can supplement or support transboundary water management even where regional or other watercourse agreements have been adopted. Article 33 of the Convention provides a particularly clear and easily transposable framework for dispute resolution which encompasses a broad range of tools and approaches giving states the necessary flexibility to address a range of dispute scenarios. These tools include negotiation, good offices, mediation, conciliation, joint watercourse institutions and submission of the dispute to arbitration or to the ICJ, all of which require the consent of all parties concerned. Where these methods are unsuccessful, any watercourse State that is a party to the dispute can unilaterally invoke the compulsory fact-finding procedure provided for under Art. 33(3)-(9). The compulsory fact-finding provision contained in the Convention is considered by some to be more akin to compulsory conciliation, since the fact-finding commission's task includes the provision of 'such recommendation as it deems appropriate for an equitable solution to the dispute' (Art. 33 (8)). The recommendations of the commission are not binding on states, but states are required to consider them in good faith. The diagram below summarizes dispute resolution under the Water Convention.

One transboundary river basin, where most of the applicable diplomatic and legal dispute mechanisms have been applied, is that of the River Indus. The *Indus Treaty* between Pakistan and India (Government of India and Government of Pakistan, 1960) provides for a joint institution, the Permanent Indus Commission (PIC), consisting of one member from each country, and corresponding procedures for dispute resolution. The PIC serves as the initial venue where a possible conflict must first be addressed, and is empowered to examine any 'question' which arises between the Parties concerning the interpretation or application of the Treaty, or the existence of any fact which, if established, might constitute a breach of the Treaty, and to resolve the question by agreement (Art. IX (1)). Issues that cannot be resolved by the PIC will be deemed 'differences', which may, depending on their classification, be heard by a 'neutral expert'. The difference will be considered as a 'dispute', if the matter falls outside those listed in Annex F. Disputes are to be resolved through negotiation and, if this is unsuccessful, become subject to arbitration (Rieu-Clarke et al., 2012). These two mechanisms (neutral expert hearing and arbitration) have been recently utilized to resolve two conflicts over the Indus, the Baglihar difference[24] and the Kishenganga dispute.[25]

Finally, as introduced earlier, the ICJ has the mandate to settle, in accordance with international law, legal disputes submitted to it by states (Rieu-Clarke et al., 2012). Proceedings may be instituted either through the notification of a special agreement or by means of application (United Nations Charter, 1945). The ICJ and its predecessor, the Permanent Court of International Justice, have heard several freshwater-related disputes, including: the River Oder case (1929), the River Meuse case (1937), the Gabčíkovo-Nagymaros case (*Hungary* v. *Slovakia*, 1997); the Kasikili/Sedudu Island (boundary river) case, (*Botswana* v. *Namibia*, 1999); the River Niger boundary dispute (*Benin* v. *Niger*, 2005); the Case concerning Navigation and Related Rights (*Costa Rica* v. *Nicaragua*, 2009); Pulp Mills on the River Uruguay (*Argentina* v. *Uruguay*, 2010); and Certain Activities carried out by Nicaragua in the Border Area (*Costa Rica* v. *Nicaragua*, 2013).[26]

The ICJ provides a specialized mechanism for dispute resolution, but its function is 'not to head off disagreements before they become serious, nor to alleviate situations of amorphous tension, but to intervene only when called upon to resolve a

[24] In 2005, Pakistan contacted the World Bank stating that a 'difference' had arisen with India under the Indus Water Treaty relating to the Baglihar hydropower plant, which was being constructed by India on the Chenab River in breach of the provisions of para. 8 of Annex D to the treaty. The bank appointed a neutral expert, who issued a decision in February 2007, which was accepted by the two parties (Salman, 2008).

[25] On September 23, 2011, the Permanent Court of Arbitration conducted an arbitration under the Indus Waters Treaty and issued its Order on the Interim Measures in September 2011, its partial award in February 2013 and the final award in December 2013. The latter had the effect of allowing India to proceed with the diversion of the Kishenganga/Neelum River to produce electricity. Pakistan retained a right to receive a minimum flow of water in the Kishenganga riverbed. All decisions are available on the website of the Permanent Court of Arbitration: http://www.pca-cpa.org/showpageb106.html?pag_id=1392

[26] All of the Court's cases going back to 1947 can be accessed on the website of the International Court of Justice.

particular crisis in the parties' relations'. Normally, Parties will have exhausted several other diplomatic dispute settlement tools before proceeding to the ICJ, but not all disputes are suitable for adjudication. However, an increasingly large number of treaties (in all fields of international public law) allow for referring disputes to the ICJ (Merrills, 2011). While many dispute settlement mechanisms are available and may be increasingly needed as a result of greater pressures on the world's water resources, such 'one-time' solutions may not be the most effective means by which to cope with climate change impacts. The non-adversarial measures described in previous sections (such as joint data and information gathering, joint institutions, public participation and non-compliance strategies) are much more effective means enabling states to set up a long-term resilient governance system capable of coping in a cooperative manner with the uncertainty of the impacts of climate change on transboundary waters.

As climate variability increases, so does the cost of the infrastructure, information and systems needed to cope with it. The biggest impact of climate change in many sectors may well be an increase in the cost of water services. In addition, approaches to water resource management have evolved over the past few decades following the acknowledgment that engineering solutions, while vitally important and an integral part of any future approach, cannot by themselves solve the world's water problems. The most important factors to be considered for climate change adaptation in the water context relate to a range of social, economic and political challenges that have to be addressed, and a variety of 'soft', legal and institutional instruments that can be deployed to complement infrastructural solutions. Experiences from river basins around the world provide numerous examples of ways in which the measures described in this report have been adopted and implemented.

Addressing these complex and often interrelated challenges requires consideration of a whole host of social, cultural, economic, environmental, legal and political factors. However, for the purposes of this report, only the governance-related aspects have been considered. While these governance-related aspects are crucial to the development of climate change adaptation measures, they should not be considered in isolation. The main governance aspects to take into consideration are the following:

a) Adopting ecosystem-based approaches to water management strategies. There is a need to raise awareness, deepen knowledge and enhance understanding regarding the benefits of ecosystem-based approaches. Ecosystem-based approaches should be taken into account when addressing key challenges like deforestation and pollution, and when enhancing sustainable livelihoods and mitigating the effects of extreme events. The value of adopting ecosystem-based approaches towards unsustainable economic activities must be clearly identified and articulated to stakeholders within the basins. As mentioned below, institutions provide an important means by which to deepen knowledge and understanding, and to raise awareness of the benefits of ecosystem-based approaches.

b) Strengthening institutions in order to facilitate ecosystem-based climate change adaptation. One of the greatest challenges in developing such joint institutional arrangements is to ensure that stakeholders are effectively engaged in the decision-making process, particularly at a community level. Capacities need to be developed amongst a range of stakeholders to ensure that decision-making is inclusive and informed by sound ecosystem-based science. It is essential to use a gendered approach to water governance, which is currently largely absent at the international transboundary level. A further key aspect of institutional building is the development of joint systems for monitoring and information sharing. There is a need to strengthen and harmonize national data and information systems at the basin level, and ensure that such data and information is made accessible to decision-makers on an ongoing basis.

c) Coherent legal and regulatory frameworks. Greater effort is needed to address fragmentation and to strengthen coherence between legal instruments addressing climate change adaptation in transboundary river basins, from the local to the international level. There has been a concerted effort to develop legal and regulatory frameworks for climate-proofing water law at the national level in some countries. Elsewhere, national water law must be updated or adopted to align with international commitments and ensured that water law reforms are gender-inclusive. This requires the strengthening of the capacity of community groups and local and national authorities to promote enforcement. At the basin level, a basin-wide approach should be implemented to consider and share the multiple benefits from the different uses of water, and to share the costs of protection in an equitable manner (Moynihan, 2015b). Many basin treaties should be continually amended, to ensure that they are consistent with modern rules and principles of international

environmental law on climate change adaptation and environmental protection of transboundary watercourses. Such an enabling environment is fundamental to the development of ecosystem-based adaptation strategies.

d) Investment in water governance capacity is critical In order for the implementation of ecosystem-based adaptation strategies to be effective, it is essential to ensure that stakeholders have the necessary financial and personal capacities. Building water governance capacity must be seen as an ongoing process, whereby laws, policies and institutions are strengthened to better enable informed decision-making. As noted previously, a key challenge will be the linking of national and local approaches, given that adaptation strategies will only work on the ground if they fit local conditions, cultural traditions and traditional knowledge. Furthermore, providing women with equal access to training and development courses, and promoting their full participation at all levels of water management decision-making will be crucial for the effectiveness of any capacity development strategy. National governments must see the benefits and be willing to cede control. Adaptation efforts must accordingly be based on the opportunities and difficulties defined by local governments. It is crucial to support local ownership of local strategies, since ownership is a precondition for sustainability. Ministries and public authorities should be supported towards greater engagement within decision-making forums at the appropriate levels.

4 Conclusion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As climate variability increases, so does the cost of the infrastructure, information and systems needed to cope with it. The biggest impact of climate change in many sectors may well be an increase in the cost of water services. In addition, approaches to water resource management have evolved over the past few decades following the acknowledgment that engineering solutions, while vitally important and an integral part of any future approach, cannot by themselves solve the world's water problems. The most important factors to be considered for climate change adaptation in the water context relate to a range of social, economic and political challenges that have to be addressed, and a variety of 'soft', legal and institutional instruments that can be deployed to complement infrastructural solutions. Experiences from river basins around the world provide numerous examples of ways in which the measures described in this report have been adopted and implemented.

Addressing these complex and often interrelated challenges requires consideration of a whole host of social, cultural, economic, environmental, legal and political factors. However, for the purposes of this report, only the governance-related aspects have been considered. While these governance-related aspects are crucial to the development of climate change adaptation measures, they should not be considered in isolation. The main governance aspects to take into consideration are the following:

i) **Adopting ecosystem-based approaches to water management strategies.** There is a need to raise awareness, deepen knowledge and enhance understanding regarding the benefits of ecosystem-based approaches. Ecosystem-based approaches should be taken into account when addressing key challenges like deforestation and pollution, and when enhancing sustainable livelihoods and mitigating the effects of extreme events. The value of adopting ecosystem-based approaches towards unsustainable economic activities must be clearly identified and articulated to stakeholders within the basins. As mentioned below, institutions provide an important means by which to deepen knowledge and understanding, and to raise awareness of the benefits of ecosystem-based approaches.

ii) **Strengthening institutions in order to facilitate ecosystem-based climate change adaptation.** One of the greatest challenges in developing such joint institutional arrangements is to ensure that stakeholders are effectively engaged in the decision-making process, particularly at a community level. Capacities need to be developed amongst a range of stakeholders to ensure that decision-making is inclusive and informed by sound ecosystem-based science. It is essential to use a gendered approach to water governance, which is currently largely absent at the international transboundary level. A further key aspect of institutional building is the development of joint systems for monitoring and information sharing. There is a need to strengthen and harmonize national data and information systems at the basin level, and ensure that such data and information is made accessible to decision-makers on an ongoing basis.

iii) **Coherent legal and regulatory frameworks.** Greater effort is needed to address fragmentation and to strengthen coherence between legal instruments addressing climate

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change adaptation in transboundary river basins, from the local to the international level. There has been a concerted effort to develop legal and regulatory frameworks for climate-proofing water law at the national level in some countries. Elsewhere, national water law must be updated or adopted to align with international commitments and ensured that water law reforms are gender-inclusive. This requires the strengthening of the capacity of community groups and local and national authorities to promote enforcement. At the basin level, a basin-wide approach should be implemented to consider and share the multiple benefits from the different uses of water, and to share the costs of protection in an equitable manner (Moynihan, 2015b). Many basin treaties should be continually amended, to ensure that they are consistent with modern rules and principles of international environmental law on climate change adaptation and environmental protection of transboundary watercourses. Such an enabling environment is fundamental to the development of ecosystem-based adaptation strategies.

iv) **Investment in water governance capacity is critical.** In order for the implementation of ecosystem-based adaptation strategies to be effective, it is essential to ensure that stakeholders have the necessary financial and personal capacities. Building water governance capacity must be seen as an ongoing process, whereby laws, policies and institutions are strengthened to better enable informed decision-making. As previously noted, a key challenge will be the linking of national and local approaches, given that adaptation strategies will only work on the ground if they fit local conditions, cultural traditions and traditional knowledge. Furthermore, providing women with equal access to training and development courses, and promoting their full participation at all levels of water management decision-making will be crucial for the effectiveness of any capacity development strategy. National governments must see the benefits and be willing to cede control. Adaptation efforts must accordingly be based on the opportunities and difficulties defined by local governments. It is crucial to support local ownership of local strategies, since ownership is a precondition for sustainability. Ministries and public authorities should be supported towards greater engagement within decision-making forums at the appropriate levels.

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This publication is financed by:


Regione Umbria

Supported by:


Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

based on a decision of the German Bundestag

Water is central to climate change adaptation. An ecosystem-based approach to water management offers an effective strategy for adapting to the likely impacts of climate change on water. While the implementation of such a strategy raises a host of complex economic, social, cultural and environmental challenges, the contribution of governance is critical. This paper explores the role of water governance, in a transboundary context, in a way that identifies best practice examples of effective policy guidelines, and ascertains the contribution that international law can make.

For transboundary rivers, lakes and aquifers, the inherent nature of climate change means that international law must grapple with the tension between the preservation of the status quo, and the needed flexibility to meet new demands and face new uncertainties. Various strategies, which are considered throughout the paper, can be employed to enhance the flexibility of water arrangements. In addressing these issues, it is envisaged that this paper will benefit policy-makers, researchers, civil society and others who are interested in examining how transboundary water governance arrangements can be strengthened to better address climate change adaptation needs.

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