Transboundary Water Governance

Adaptation to Climate Change

Juan Carlos Sanchez and Joshua Roberts (Eds.)





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Foreword

Since the beginning of civilization, water has supported the very essence of life, as well as agriculture, energy, industry, local livelihoods, ecosystems, and cultural and religious traditions. Nevertheless, growing populations, domestic development priorities and competing uses between States have placed increasing pressure on the sustainable management of waters, including transboundary waters. As countries struggle to engage in sustainable development and lift their people out of poverty, climate change presents an additional number of unknowns.

Today we have better understood that water is at the centre of many climate change impacts. Additionally, it is becoming clearer that climate change will likely exacerbate many existing water governance challenges —both locally and internationally—; therefore cooperative solutions should be part of a comprehensive basin-wide adaptation strategy. In this context there is also a pressing need to better understand how institutions and cooperative mechanisms can be more responsive to climate change. Furthermore, there is a need to better understand the role that ecosystems-based approaches can play in enhancing natural infrastructure to strengthen resilience to climate change.

This was part of the pre-conceptual background of the IUCN´s Good Water Governance to Climate Change Project. This project was a joint venture between IUCN´s Environmental Law Centre and the Regional Office for Mesoamerica which provided the much needed experience to better understand the complex relationships between water governance, ecosystem management and climate change adaptation.

Precisely, one of its main goals was to diagnose to better understand the best legal and institutional frameworks for ecosystem-based adaptation. The lessons compiled in this publication respond greatly to insights experienced throughout the project and are only a first step towards understanding what could be described as adaptive water governance capacity. Nonetheless, governance remains only a mean to an end, which in this case is to reduce the high vulnerability levels of different shared river basins, mainly through ecosystem restoration and sustainable development.

After a number of years of gaining experience, there are lessons that are ready to be shared. At the local level ecosystem based adaptation continues to develop as a very cost effective and promising approach to climate change. At the national level, we continue to underpin the need for governance reform highlighting the need to understand environment holistically and not to regulate through piece meal laws and regulations which can have an adverse overall effect. At the basin level, we see the benefits of developing joint collaborative adaptation strategies, considering the basin as the most adequate administrative unit and outplaying the risk of harming due to non-coordinated adaptation efforts. Finally, at the global level, under the UN Framework Convention on Climate Change (UNFCCC), adaptation is gaining in prominence as international efforts become more focused on assisting the most vulnerable countries develop adaptation plans. Furthermore, as the UN has dedicated 2013 as the “International Year of Water Cooperation”, the international community is now recognising the importance of developing cooperative and collaborative responses to climate change.

“Transboundary Water Governance – Adaptation to Climate Change” aims to provide an overview of best practices in transboundary adaptive water governance thus far. It is our hope that this book can

serve as a basis for contributing towards developing a better understanding of the linkages between water and climate change, and what can be done to help institutions and societies to adapt.

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Head, Environmental Law Programme

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Introduction

Joshua Roberts and Juan Carlos Sanchez[1]

Management of transboundary waters is increasingly becoming more challenging, particularly within a context of complex social and environmental changes. Population growth, often concentrated in the developing world, will increase pressure on already scarce resources. With more people there will be more mouths to feed and greater energy needs. Population growth will also lead to reduced water quality from increases in sewage runoff, and industrial and agricultural pollution. These factors will place additional stress on how institutions manage this life-sustaining resource. Climate change is likely to exacerbate these pressures, making it more difficult to manage water across boundaries.

According to the Intergovernmental Panel on Climate Change (IPCC), climate change will result in a number of impacts on water, including, *inter alia*:

- Increase in precipitation for some regions, while decreased precipitation is experienced in others;
- Increase in average river runoff and water availability for some regions, with decreased runoff in others;
- Increased risks of flooding and drought from the corresponding increased precipitation and variability;
- Increase in glacier melt;
- Decreased food security and increased vulnerability for farmers;
- Negative impacts on the function and operation of existing water infrastructure; and
- Significant impacts on *water quality*, particularly related to sediment loading, chemical composition, total organic carbon content, and microbial quality.[2]

Climate variability has always played a factor in societies' relations with freshwater, and environmental systems have always been changing. However, the onset of climate change will increase uncertainty and variability around the availability and quality of freshwater, and in some instances it may irreversibly change some systems. Institutions, which have always been at the heart of how human societies interact with water,[3] will find that what has worked in the past may no longer be the case in the future. In order to maintain sustainable ways of life, these institutions will need to rethink how water is used, managed, and governed at all levels.

Not least because climate change is a global issue, adaptation will require an international response. In 2001, the Conference of the Parties (COP) to the United Nations Convention on Climate Change (UNFCCC) established the Least Developed Countries (LDCs) Work Programme, which had a particular focus on identifying immediate adaptation needs for the most vulnerable countries,

1 Joshua Roberts, Staff Lawyer (U.S. qualified), ClientEarth, London, U.K, Juan Carlos Sanchez, Legal Officer, IUCN Environmental Law Centre, Bonn, Germany.

2 Bates, B.C. *et al.* (eds.) (2008). *Climate Change and Water: Intergovernmental Panel on Climate Change (IPCC) Technical Paper VI*, p. 3. IPCC Secretariat: Geneva, Switzerland.

3 See Cook, J. *et al.* (2011). *Shifting Course: Climate Adaptation for Water Management Institutions.* World Wildlife Fund (WWF): Washington, D.C., U.S.A.

in particular through National Adaptation Programmes of Action (NAPAs).[4] In 2006, the Nairobi Work Programme was established as a knowledge sharing platform, in order to help Parties better understand and assess impacts, vulnerability, and adaptation to climate change, and to make better informed decisions.[5]

The work conducted under these programmes has done a lot to enhance understanding over climate change's impacts on water, and potential adaptation responses. In 2010, in Cancun, Mexico, the Parties to the UNFCCC agreed to establish the Cancun Adaptation Framework, whose objective is to enhance action on adaptation, including through international cooperation and coherent consideration of adaptation under the UNFCCC, particularly for water.[6] Two important components designed to help achieve this objective are longer-term adaptation planning through developing National Adaptation Plans (NAPs), and promotion of sharing knowledge and lessons learned.[7] Furthermore, the Green Climate Fund (GCF) was established to enhance the delivery of climate finance, with a mandate to balance provision of financial resources between adaptation and mitigation.[8] In 2011, in Durban, South Africa, the Parties requested the Secretariat of the UNFCCC to advance and explore links between water, climate change impacts and adaptation strategies.[9]

Despite this progress at the global level, there is still a need to enhance understanding of climate change and water at all levels of governance – from the local to the transboundary level. Increase in climate variability will change the way shared water systems function – hydrologically, ecologically, economically, and socially – requiring cooperative adaptation responses.[10] Because climate change will have local impacts, water management, including laws, policies, and regulations at national and local levels, will play a critical role in supporting adaptive efforts.

In the transboundary context, there are two major implications from a perspective of adaptive governance. First, responses to climate variability will probably increase the need for transboundary water sharing agreements and institutions where there were none. Although there are approximately

4 United Nations Convention on Climate Change (UNFCCC) (2001). Conference of the Parties (COP) Decisions 28/CP.7 and 29/CP.7, FCC/CP/2001/13/Add.4, Report of the Conference of the Parties on its Seventh Session, Held at Marrakesh from 29 October to 10 November 2001.

5 UNFCCC (2006). FCC/SBSTA/2006/11, Report of the Subsidiary Body for Scientific and Technological Advice on its Twenty-Fifth Session, held at Nairobi from 6 to 14 November 2006, pp. 5-13, paras. 11-71.

6 UNFCCC (2010). COP Decision 1/CP.16, paras. 13-14, para. 14(a), FCCC/CP/2010/7/Add.1, Report of the Conference of the Parties on its Sixteenth Session, held in Cancun from 29 November to 10 December 2010.

7 COP Decision 1/CP.16, paras. 15-17.

8 COP Decision 1/CP.16, para. 102.

9 UNFCCC (2011). COP Decision 6/CP.17, para. 4(a), FCCC/CP/2011/9/Add.2, Report of the Conference of the Parties on its Seventeenth Session, Held in Durban from 28 November to 11 December 2011.

10 According to the IPCC, *adaptation describes* "changes in processes, practices and structures to moderate potential damages or to benefit from opportunities with climate change." IPCC (2007). *Climate Change 2007: Synthesis Report*, Annex II – Glossary. IPCC Secretariat: Geneva, Switzerland.

300 transboundary agreements recorded,[11] currently 60 percent of the world's 263 watercourses (158 transboundary river basins) have no cooperative management framework.[12]

Second, where agreements and institutions are already in place there may be a need to adjust the way water is managed in order to adapt to the realities presented by climate change. For instance, while international agreements usually account for seasonal variability, yearly precipitation fluctuations, droughts, flooding from unusually heavy rain fall, and consequences from climate change often remain uncovered.[13]

The aim of *"Transboundary Water Governance – Adaptation to Climate Change"* is to identify issues, both theoretical and practical, that States face in establishing cooperative transboundary mechanisms to effectively adapt water management to climate change. Furthermore, this publication will address complex legal hurdles that existing transboundary water institutions face when attempting to adapt existing mechanisms to function in a changing climate.

Through a number of bilateral and multilateral water sharing agreements that have been concluded over the past century or so, there are many useful examples of States attempting to deal with scarcity and variability. Moreover, as States become increasingly aware of climate issues affecting their basin, there are a growing number of cases that provide lessons and learning tools for initiating and adapting cooperative responses to current and future climate impacts. There are also an increasing number of examples where options for adaptive and cooperative water governance have actively involved – and built the capacity of – numerous and diverse stakeholders on multiple levels for improved implementation.

Evidence regarding the effectiveness of efforts to develop and implement tools for adaptive water governance is still emerging. Nevertheless, there is now enough experience to begin compiling lessons learned and best practices – a goal this publication seeks to achieve. It builds upon IUCN's practical experience on the ground, and particularly from the project *"Climate Change Governance Capacity: Building regionally- and nationally- tailored ecosystem-based adaptation (EbA) in Mesoamerica"*. This

11 Cooley, H. *et al*. (2009). *Understanding and Reducing the Risks of Climate Change for Transboundary Waters* (Pacific Institute: Oakland, CA), p. 8, citing Gleick, P.H. (2000). "How Much Water is There and Whose is it," *The World's Water 2000-2001: The Biennial Report on Freshwater Resources*. Island Press: Washington, D.C., U.S.A.; and United Nations Environment Programme and Oregon State University (UNEP/OSU) (2002). *Atlas of International Freshwater Agreements.* UNEP Press: Nairobi, Kenya.

12 "Of the 105 international basins that employ some type of water management institutions, less than 20 percent of those basins with more than three riparians have multilateral agreements involving all of the riparians." Eckstein, G. (2010). "Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy," *Wisconsin International Law Journal*, Vol. 27(3), pp. 410-461, at p. 442, fn. 143, citing UNEP/OSU (2002), *supra* note 11; and McCaffrey, S. (1990). Sixth Report on the Law of the Non-Navigational Uses of International Watercourses, (U.N. Doc. A/CN.4/427), at p. 43, para. 5, which refers to a 1979 list, compiled by the Secretariat of the U.N., that identified 90 bipartite and multipartite commissions concerned with the non-navigational uses of international watercourses. "… of the 273 known transboundary aquifers worldwide, only one has such a framework – the Genevese Aquifer, (*See Convention relative a la protection, a l'utilisation, a la realimentation et au suivi de la Nappe Souterraine Franco-Suisse du Genevois*, 1 January 2008) – while two others have a basic data sharing agreements." Eckstein, G. and Eckstein, & (2003). "A Hydrologeological Approach to Transboundary Ground Water Resources and International Law," *American University Law Review*, Vol. 19(2), pp. 201-258, at p. 227.

13 McCaffrey, S. (2003). "The Need for Flexibility in Freshwater Treaties," *Natural Resources Forum*, Vol. 27, pp. 156-162, at p. 157.

project has aimed to develop local, national and regional capacities for adaptive water governance through applied research, awareness raising, community participation, and up-scaling effective models of integrated ecosystem approaches to water management.[14] In Mesoamerica, like in many regions of the world, unequal distribution of waters between geographic areas, sectors, and uses has resulted from weak natural resources governance. This has had a direct impact on vulnerable societies that rely heavily on nature and its services to sustain their ways of life. The referred project has built upon the idea that ecosystems are a means to improve livelihoods in a sustainable manner, and it has resulted in the development of valuable lessons for water governance and adaptation.

EbA is being promoted as a methodology that integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to adverse impacts posed by climate change. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both current climate variability, and climate change. It contributes to reducing vulnerability and increasing resilience to both climate and non-climate risks, and provides multiple benefits to society and the environment, recognising that healthy ecosystems have an important role to play in helping people to adapt. EbA is therefore a means of adaptation that is readily available and can be integrated into community-based efforts to addresses concerns and priorities, particularly of vulnerable people.

Unfortunately, there are not many experiences where EbA has been incorporated into relevant laws and policies, either at the national or basin level. This is partly because EbA is still evolving, and also because there are knowledge gaps regarding the inter-linkages between existing governance frameworks, nature, and adaptation challenges and responses.

As awareness of climate change increases, the more evident it becomes that countries and communities lack normative, policy, and institutional capacity to tackle vulnerability to climate change. Thus, there is a need to thoroughly revisit and adjust when necessary national and regional adaptation strategies, considering water governance and EbA as interesting lenses that can support and enrich the process.

In light of the current and evolving context, this publication shares lessons and guidance from project implementation, and analysis of specific countries' governance frameworks. Incrementally, this can support a global community of practitioners in understanding the legal and policy implications of EbA, and adaptive water governance more broadly as an emerging sub-field in environmental law and policy, aiming to bring adaptation considerations into the water sector.

"Transboundary Water Governance – Adaptation to Climate Change" was envisioned as a knowledge resource for decision makers in order to help better understand linkages between water and climate change adaptation from a governance perspective. It is intended to be thought of as a guide for those involved in conceptualizing policies, strategies and drafting laws; and designing institutional dynamics across sectors (e.g., water management, energy, agriculture, health, risk management, biodiversity conservation, etc.) and levels (i.e., global, regional, basin, national, municipal, and local) in relation to water and adaptation. Finally, it should serve as a reference for some of the latest advances in the topic, and as consultative material for non-experts. It compiles and presents new approaches and perspectives of water and climate change with a view towards enhancing adaptive

14 The project has been implemented by the Environmental Law Centre and the Regional Office for Mesoamerica, supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

governance through consideration of ecosystems, environmental services, human dependencies, and full and effective public participation as the best way to cope and to build resiliency.

This publication has been conceived as an input towards various governance processes taking place in different parts of the world. The objective is that it ignites discussion and normative analysis as a means to foster and view gaps and opportunities for strengthening instruments that are being developed (from specific projects to laws), with a view to improving mid- and long-term governance approaches that place ecosystems and its services at their centre. With these objectives in mind, this publication explores and breaks down the concept of governance into the different chapters, with a view to better understand: adaptive water governance, cooperative mechanisms and institutions; enabling environments for participatory adaptive preparedness; and up-scaling successful adaptation approaches into higher basin-level governance reform.

In order to accomplish this task, the first half of the book is divided into five chapters:

Chapter One focuses on the interface between water, climate change, and adaptation. First, it briefly introduces the hydrological cycle, focusing on the specific role that ecological systems play in maintaining water regimes.[15] It then highlights the interconnectedness of ecosystems throughout the water cycle, and effects that climate change will have on this cycle, focusing specifically on changes to various freshwater ecosystems. It also highlights the interactions between river basin ecosystems and human well-being, focusing on the various impacts climate change can have on people. Subsequently, this Chapter provides an overview of the concept of adaptation, highlighting the specific role that EbA can play in adapting water management to a changing climate.

Chapter Two introduces the concept of adaptive water governance, looking at existing relevant substantive international legal principles relating to management of transboundary freshwaters, and how they may require redefinition in light of the need to consider adaptation to climate change. In addition to international principles of freshwater law, Chapter Two points to other relevant international environmental law principles that are relevant to climate change, specifically those contained in Article 3 of the UNFCCC (Sustainability, Precaution, and Intra- and Inter-generational Equity), and the ecosystem approach. Together these principles play an important role in international efforts to integrate climate change concerns into water governance; examples of their incorporation into binding agreements by States are highlighted.

Chapter Three focuses on strategies devised between States to cooperatively respond to climate change and uncertainty. In particular, it identifies various tools that can be built into transboundary agreements, such as flexibility and adaptability, enforceability, resilience, and implementation of the ecosystem approach. Chapter Three also focuses on cooperative mechanisms, including procedural and substantive rules that States use to manage transboundary waters against variability and scarcity. Lastly, it highlights different options and pathways that cooperative relationships can take in response to climate change.

Chapter Four touches upon the role and importance of public and stakeholder participation in the development and implementation of adaptation responses. This chapter addresses the main challenges and constrains for effectively including the public in adaptive governance systems and related decision-making processes. With a particular emphasis on international legal norms around

15 This publication is intended to serve as the third component of a series on IUCN water governance publications. For a thorough discussion and explanation of the hydrological cycle therefore, the reader should refer to *"Governance of Shared Waters: Legal and Institutional Issues"*.

public participation, the chapter then looks at how institutions can foster and coordinate collaborative multi-level climate knowledge and information frameworks that are capable of effectively engaging all relevant stakeholders to develop and implement different adaptive governance strategies.

Finally Chapter Five explores the different cycles of adaptation planning, and how they work on the ground. With a strong focus on participation at the local level, it explores the roles and challenges of transboundary institutions in the adaptation planning process. Using case studies, the chapter draws on specific lessons learned from in-the-field examples in order to extract conclusions from successful strategies for building resilience to climate change (e.g., EbA). Furthermore, it explores how such examples might be up-scaled to the national and transboundary levels in order to drive higher level adaptive governance reforms.

Four case studies are presented with the intent to illustrate the options available to States when devising cooperative adaptation approaches. The case studies bring into focus each major concept addressed in the previous chapters, placing them in the context of a single river basin or region. These cases were chosen considering their geographical variation, their regional complexity, and their varied stages of development, both in terms of international cooperation in water management and in addressing adaptation to climate change. The case studies seek both to exemplify best practices, and highlight challenges related to selected issues identified throughout the publication. They also aim to provide a holistic picture of how the identified basin or region deals with adaptation, highlighting both strengths and weaknesses. The case studies covered are: 1) The Senegal River Basin (shared between Senegal, Guinea, Mali and Mauritania); 2) the United Nations Economic Commission for Europe (UNECE) Region; 3) the Great Lakes Basin (shared between the United States and Canada); and 4) the Sixaola Basin (shared between Costa Rica and Panama).

Chapter One

Sustaining Ecosystems through Better Water Management for Climate Change Adaptation

Stefano Barchiesi, Rebecca Welling, James Dalton, Mark Smith[1]

1.1 Introduction

Impacts of climate change, in combination with other drivers of global change, are compromising our ability to address global economic, security, and social priorities. In terms of impacts of climate change on freshwater, water scarcity currently affects around 700 million people in 43 countries worldwide. It is estimated that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity (<500 m^3 per year per capita), and two-thirds of the world's population could be living under water stressed conditions.[2]

Box 1.1 Climate Change

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). This may be due to natural processes or external forces or to persistent anthropogenic changes in the composition of the atmosphere or in land-use."

Source: IPCC (2001).

Comparatively, climate change impacts on water quality are poorly understood. Information on water-related impacts of climate change is inadequate, especially with respect to water quality, aquatic ecosystems, and groundwater – including their socio-economic dimensions. However, it is likely that higher water temperatures and changes in extremes, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution. These impacts will have negative impacts on ecosystems, human health, water system reliability, and operating costs.[3]

As floods, droughts, and other impacts of climate change on water become more frequent or intense, economies and livelihood security will decline.[4] For example, glacier retreat due to climate change will affect the water supply of an estimated 30 million people in South America alone. It is also predicted that South Asia and Africa will be the most vulnerable regions to climate change-related

1 Stefano Barchiesi, Project Officer, IUCN Global Water Programme; Rebecca Welling, Project Officer, IUCN Global Water Programme; James Dalton, Coordinator, Global Initiatives, IUCN Water Programme; Mark Smith, Director, IUCN Global Water Programme.

2 World Water Assessment Programme (WWAP) (2012). *The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk,* p. 541. UNESCO: Paris, France.

3 IPCC (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Parry, M.L. *et al.* (eds.), p. 175. Cambridge University Press: Cambridge, U.K.

4 Dalton, J., Murti, R., and Chandra A. (2013). "Utilizing Integrated Water Resource Management Approaches to Support Disaster Risk Reduction," in Renaud, F.G., Sudmeier-Rieux, K., and Estrella, M. (eds.), *The Role of Ecosystems in Disaster Risk Reduction,* Part III. U.N. University Press: Bonn, Germany.

food shortages by 2030, due to a high national dependency on crops that are highly vulnerable to changes in temperature and precipitation.[5]

It is important to focus on the role of the environment in providing solutions to climate change, framing nature as part of the solution for adaptation strategies.[6] Livelihoods depend on the sustainability of ecosystems and the variety of services that they provide. Furthermore, household water supply, industry, forestry, agriculture, navigation, energy, and other sectors all rely in different ways on the benefits obtained from ecosystems. In turn, each of these sectors will feel the brunt of climate variability.[7]

Water is arguably the most important of all the resources required for sustaining ecosystems and the services they provide for human health and well-being.[8] Given this importance, water management and the water sector are fundamental to reducing vulnerability,[9] exposure to hazards, sensitivity, and building capacity to mitigate climate change impacts.[10]

Natural infrastructure has been fundamental to water management, and the management of climate variability and extremes throughout history. Natural infrastructure, such as upland forests, aquifers, lakes, and wetlands, provide water storage; wetlands filter water; rivers provide conveyance and transportation; floodplains and wetlands lower flood peaks in downstream cities; and mangroves, coral reefs, and barrier islands protect coasts against storms and inundation. However, focus on reducing water-related vulnerabilities brought by climate change requires that there is new, explicit recognition given to the role of natural infrastructure.

An ecosystem approach to Integrated Water Resources Management (IWRM) therefore offers a foundation for the implementation of adaptation methods, because adaptation is unlikely to work in practice without sustainable water management practices.[11] Better management of water through sustaining ecosystems and the services or infrastructure they provide can be seen as part of a portfolio of solutions to adaptation. Therefore, investing in natural water infrastructure is crucial to building resilient communities and mitigating climate change impacts.[12]

Natural infrastructure does not replace the need for built infrastructure. However, in certain cases it may be a better option, such as when the costs and benefits of ecosystem services exceed those of engineered options.[13] Natural infrastructure can also be integrated within financing and investment

5 WWAP (2012), *supra* note 2, at p. 50.

6 Smith, M. and Barchiesi, S. (2009). "Environment as Infrastructure: Resilience to Climate Change Impacts of Water Through Investments in Nature," *Perspectives on Water and Climate Change Adaptation.* IUCN: Gland, Switzerland.

7 Boelee, E. (ed.) (2011). *Ecosystems for Water and Food Security.* United Nations Environment Programme (UNEP): Nairobi.

8 Bates, B.C. *et al.* (eds.) (2008). *Climate Change and Water: Technical Paper VI,* p.7. IPCC Secretariat: Geneva, Switzerland.

9 Smith and Barchiesi (2009), *supra* note 6, at p. 4.

10 Pahl-Wostl, C. *et al.* (2007). "Social Learning and Water Resources Management," *Ecology and Society*, Vol. 12(2); see also Tompkins, E.L. and Adger, W.N. (2004). "Does Adaptive Management of Natural Resources Enhance Resilience to Climate Change?" *Ecology and Society*, Vol. 9(2).

11 Dalton, Murti and Chandra (2013), *supra* note 4.

12 Krchnak, K. *et al.* (2011). "Putting Nature in Nexus: Investing in Natural Infrastructure to Advance Water-Energy-Food Security," *Background Papers for the Stakeholder Engagement Process, Bonn Conference 2011: The Water, Energy, and Food Security Nexus- Solutions for the Green Economy*, p. 1. IUCN and the Nature Conservancy.

13 *Ibid*.

for built infrastructure. For instance, water can be stored largely through built infrastructure, such as reservoirs or groundwater boreholes, while natural infrastructure can be used to optimise low flow availability. In addition, drinking water provided by built infrastructure systems can be supported by natural infrastructure to minimise source pollution.

The main focus of this chapter is to better understand the interface between water and climate change from an ecosystems and adaptation perspective. First, it will lay the foundations of the hydrological cycle, focusing on the various roles that ecological systems play in maintaining water regimes. It will then highlight the interconnectedness of ecosystems through the water cycle, and effects that climate change will have on this cycle, focusing specifically on changes to various freshwater ecosystems. It will also highlight the interactions between river basin ecosystems and people, focusing on the various impacts climate change can have on human populations. Moving forward, there will be a focus on the role of the ecosystem approach to implementing IWRM to improve how water management can be made more resilient to a changing climate.

1.2 The Hydrological Cycle and Freshwater Ecosystems

The hydrological cycle can be explained as the continuous movement of water on, above, and below the earth's surface (see Figure 1.1). Over time, water is constantly changing states between liquid, vapour, and ice. It also binds the global hydrological cycle together, connecting the earth's atmosphere, land masses, and oceans. Furthermore, water provides important functions, which help to sustain life on earth, including energy exchanges, erosion, the transfer of bio-active chemicals, and climate regulation.[14]

1.2.1 Ecosystems and their interconnectedness through the water cycle

According to the Convention on Biological Diversity (CBD), an "ecosystem" is "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."[15] The 2005 Millennium Ecosystem Assessment (MEA) highlighted ten categories of ecosystems: marine, coastal, inland water, forest, dryland, island, mountain, polar, cultivated, and urban. Inland waters include permanent water bodies inland from the coastal zone, and areas whose ecology and use are dominated by the permanent, seasonal, or intermittent occurrence of flooded conditions. Inland water or freshwater ecosystems (see Box 1.2) are generally comprised of rivers, lakes, floodplains, reservoirs, and wetlands.[16] Likewise, the World Wildlife Fund (WWF) includes rivers, their headwaters, their tributaries and their deltas, lakes, and groundwater resources/aquifers in its description of an "ecoregion", which it defines as a "large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions."[17]

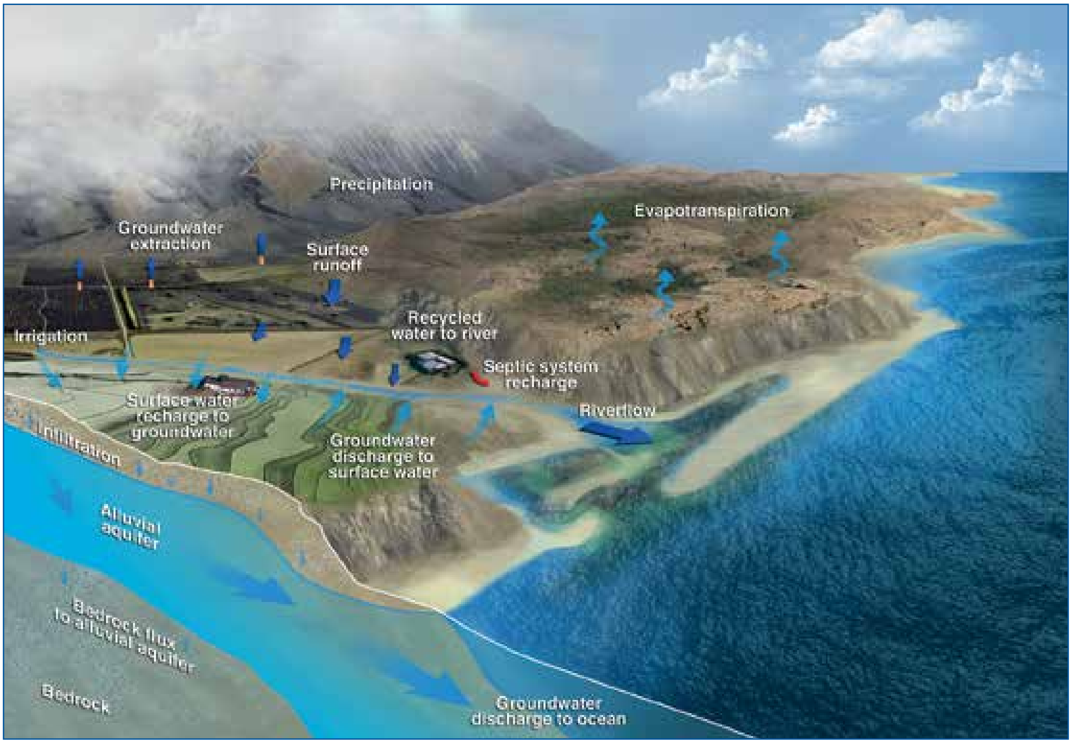
14 *Ibid*.

15 *Convention on Biological Diversity* (CBD), open for signature 5 June 1992 in Rio de Janeiro, Brazil (the Rio "Earth Summit"), entered into force 29 December 1993, (1760 U.N.T.S. 79; 31 ILM 818 (1992)).

16 It is noteworthy that the Ramsar Convention considers "wetlands" to include both inland water and coastal areas between 50 metres below mean sea level and 50 metres above the high tide level or extending landward to a distance 100 kilometres from shore (i.e., coral reefs, intertidal zones, estuaries, coastal aquaculture, and seagrass communities).

17 World Wildlife Fund (WWF) (n.d.). Ecoregions: *Biomes*, (accessed 12 June 2013), *available at* http://worldwildlife.org/biomes.

Figure 1.1 The hydrological cycle[18]



Box 1.2 Freshwater or Inland Ecosystems

Freshwater or inland water ecosystems are aquatic-influenced environments located within land boundaries. This includes those located in coastal areas, even where adjacent to marine environments. Inland water systems can be fresh, saline, or a mix of the two (brackish water).

Headwaters

Many river catchments have their sources in mountainous and upland regions, which are often associated with relatively high rates of precipitation. In some regions, water from melting snow and ice stored in glaciers can help to regulate water flows during the warmer summer months.

Rivers

Most streams gain water as they travel from their headwaters towards lakes and seas, although some streams lose water through either permeable river beds or high evaporation. In regulated rivers, high water stages are likely to occur when the groundwater levels are low and the river will lose water to surrounding aquifers.[19]

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18 Adapted from Schnaar G., Dodge J. and Kear J. (2010). *Draft Groundwater Budget and Approach to a Groundwater Management Plan – Upper and Lower Ventura River.* Prepared for the Ventura County Watershed Protection District by Daniel B. Stephens & Associates, Inc.

19 Kløve, B. *et al.* (2011). "Groundwater Dependent Ecosystems, Part I: Hydroecological Status and Trends," *Environmental Science & Policy,* Vol. 14(7) pp. 770-781, at p. 776.

Groundwater

Groundwater aquifers and river basins are closely related. Through groundwater discharge and river water infiltration, the two systems affect each other's water quantity and quality.[20]

Lakes

In terms of a catchment's physical features, lake basins are often part of river basins, or vice-versa, and the two systems are sometimes difficult to separate from a management perspective. River flow and river water quality are determinants for the ecosystem of the lake into which it flows.[21]

Wetlands

Wetlands are areas of marsh, fen, peatland, or water – whether natural or artificial, permanent or temporary – with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres.[22]

Coastal

Coastal areas concentrate a rich diversity of natural habitat areas such as salt marshes, sea grasses, and mangroves, and a large variety of natural resources. Most of these coastal ecosystems are very dynamic and productive, and are usually used for fisheries and aquaculture exploitation.[23] Important functional relationships exist between river basins and coastal areas, linked through natural processes (water flows and sediment).

Freshwater ecosystems have a significant influence on the hydrological cycle, and hence the supply of water for different human uses, including for irrigation, energy, and transport. The hydrological cycle is therefore not just the movement of water between all parts of the earth in its different forms (vapour, liquid, and ice), but also about links between water and the broader biophysical environment (atmospheric, marine, terrestrial, aquatic, and subterranean).

Two components of the water cycle are generally recognized. "Blue water" is all water that is controlled by physical processes, including evaporation and precipitation.[24] "Green water" is water that is influenced by biological processes such as evapotranspiration by vegetation using water stored in the soil (see Figure 1.2).[25] In essence, the earth's water cycle connects ecosystems, and in turn those ecosystems drive the water cycle.[26]

20 *Ibid.* at p. 775.

21 *Ibid.*

22 *Convention on Wetlands of International Importance* (Ramsar Convention), agreed 2 February 1971 in Ramsar, Iran, entered into force December 1975 (as amended by the Paris Protocol, 3 December 1982, and Regina Amendments, 28 May 1987), (14583 U.N.T.S. 321), Art. 1.

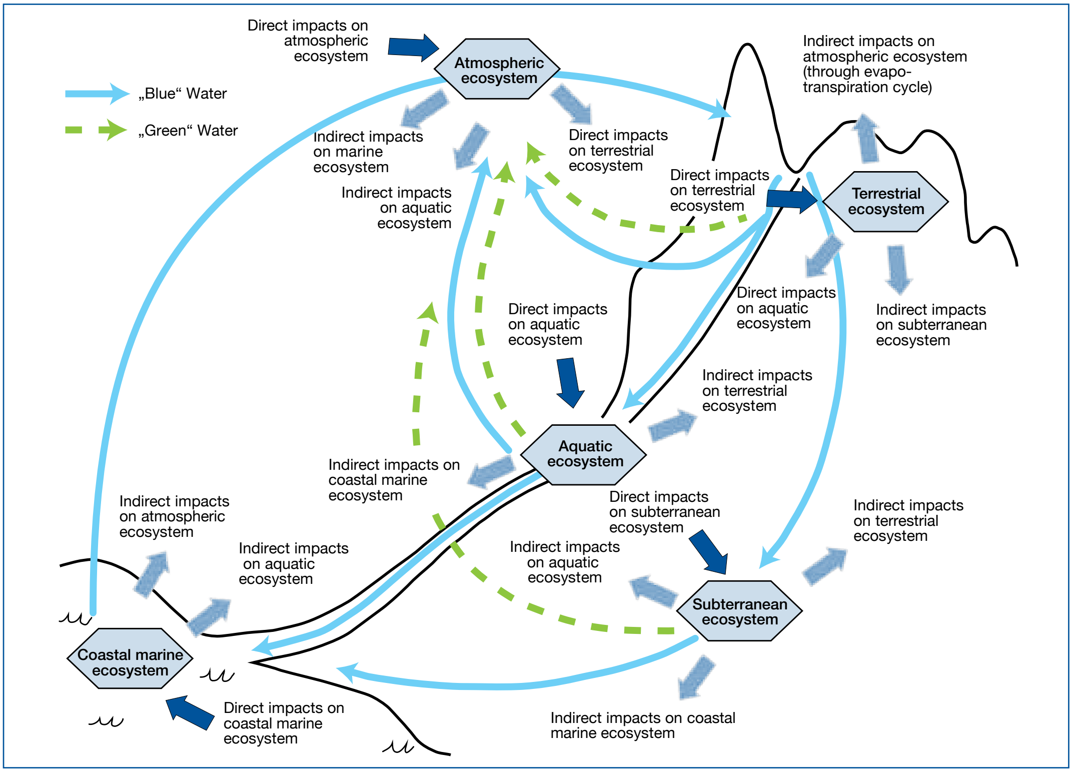
23 Global Environment Facility (GEF) (2011). "From Ridge to Reef: Water, Environment, and Community Security," *GEF Action on Transboundary Water Resources,* p. 31.

24 *See* Falkenmark, M. and Rockstrom, J. (2006). "The New Blue and Green Water Paradigm: Breaking New Ground for Water Resources Planning and Management," *Journal of Water Resources Planning and Management*, Vol. 132(3), pp. 129-132.

25 *Ibid*.

26 Millennium Ecosystem Assessment (MEA) (2005). *Ecosystems and Human Well-being: Synthesis*, p. 46. Island Press: Washington, D.C., U.S.A.

Figure 1.2 The earth's cycle connects ecosystems and ecosystems drive the water cycle[27]



Ecosystems vary greatly in their exposure to precipitation, and hence as source areas for renewable runoff from land surface that emerge as part of the hydrological cycle. This can be illustrated particularly in forest, mountainous, and dryland ecosystems.

Forests are associated with slightly more than half of global precipitation, and yield about half of global runoff.[28] Overall, current forest hydrology research suggests that forest ecosystems are major users of water. Tree canopies reduce groundwater and streamflow through interception of precipitation, and evaporation and transpiration from foliage (see Figure 1.3). As both natural and human-established forests use more water than most replacement land cover (including agriculture and grazing), it is well established that even partial removal of tree cover accelerates water discharge, increasing downstream water flow, and as a consequence potentially increasing the risk of flood during the rainy season.[29] This may also contribute to drought conditions due to the use of water by forests for transpiration, especially daytime temperatures and reduced water storage of soils due to interception by foliage.

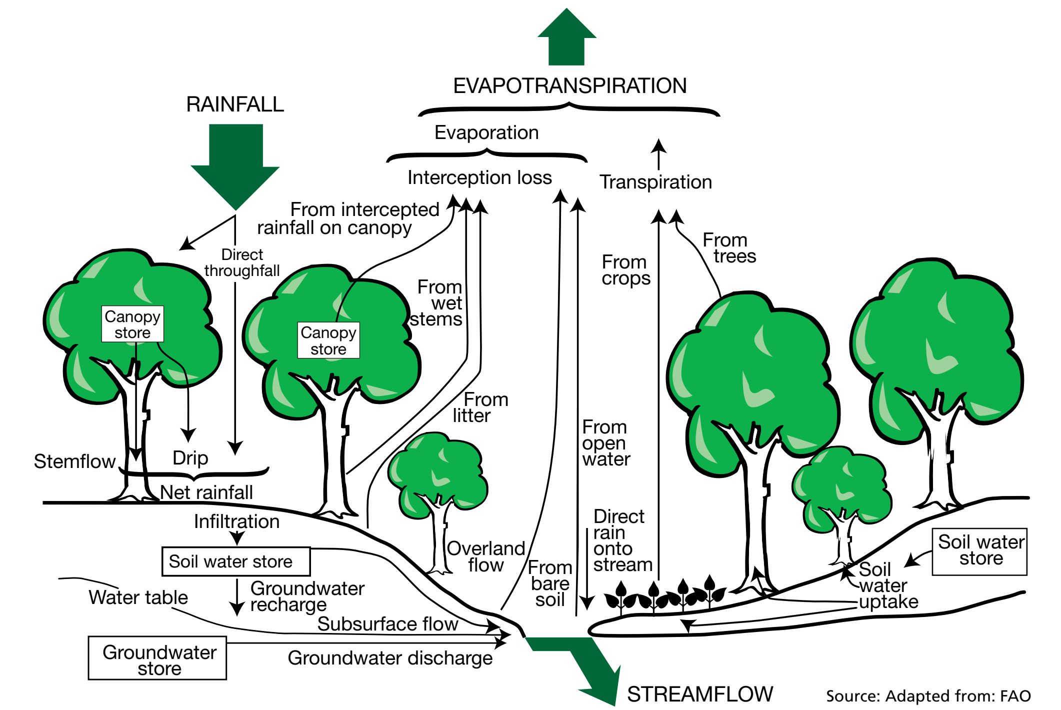
27 Adapted from WRC (2004). *Investment Strategy for the Crosscutting Domain: Water and the Environment.* Water Research Commission Report No. KV148/04. Pretoria, South Africa. 12pp + appendices. South African Water Research Commission. http://www.wrc.org.za

28 MEA (2005), *supra* note 26, at p. 29.

29 Hamilton, L.S. (2008). *Forests and Water: FAO Forestry Paper 155,* pp. 60-61, at p. IX. Food and Agriculture Organisation (FAO): Rome, Italy.

Perhaps the most significant contribution of forests to the hydrological balance of watershed ecosystems is through maintenance of water quality. This is achieved through minimising soil erosion on-site, reducing sediment in water bodies (wetlands, ponds and lakes, streams, and rivers), and trapping/filtering other water pollutants in forest litter and underwood. Also, forestry activities neither involve the use of fertilizers, pesticides or fossil fuels, nor do they result in outfalls from domestic sewage or industrial processes; therefore, they contribute indirectly to water quality.[30]

Figure 1.3 The role of terrestrial vegetation and surface, soil, and groundwater in the water cycle[31]



Source: Adapted from: FAO

Mountainous areas represent one-quarter of both global precipitation and runoff, while cultivated and island systems are the next most important water source areas, each constituting about 15 percent of global surface runoff. All other systems contribute ten percent or less. Paradoxically, dryland ecosystems, due to their large aerial extent, receive a nearly identical fraction of global precipitation as do mountains. However, because of substantial losses from the system due to evapotranspiration, they are a relatively minor contributor to global renewable water supply.[32]

Drylands are conventionally defined in terms of water stress: as terrestrial areas where the mean annual rainfall (including snow, fog, hail, etc.) is lower than the total amount of water evaporated to the

30 *Ibid*.

31 Adapted from the FAO. Hamilton, L.S. (2008), *supra* note 29, at p. 3.

32 MEA (2005), *supra* note 26, at p. 29.

atmosphere. This definition usually excludes polar regions and high mountain areas, which can also be classified as drylands due to their low average rainfall. Drylands can be found on every continent and cover extensive areas of land, stretching more than 41 percent of the earth's land surface. Urban systems, because of their restricted extent (one percent of land area), receive only 0.2 percent of global precipitation and also provide very minor contributions to global runoff.[33]

When looking at how ecosystems are distributed over the landscape, it is also important to recognise that the topography of the land determines the drainage basins and water divides. The catchment is defined as the area from which rainfall will drain into a watercourse through surface flow to a common point. Other related terms include watershed, river basin and drainage basin. A catchment is also the basic unit of the landscape that is often used to explain how the different components of the hydrological cycle interact. Every action that takes place on land has an impact on waters of the catchment – or basin – in which it takes place. Water and land have reciprocal effects: land use depends on water appropriation, and the quality of freshwater systems is directly affected by land use. This is why a true ecosystem approach to water planning and management will take into account all land and water uses at the catchment or basin level, as well as related groundwater and coastal ecosystems.[34]

1.2.2 Ecosystem services and human well-being

The 2005 MEA defines ecosystem services as "the benefits people obtain from ecosystems," and categorises them as supporting, provisioning, regulating, and cultural (see Box 1.3).[35] Food and freshwater supply are examples of provisioning services, while flood attenuation is a regulating service.[36] Other examples include water purification, fish and wildlife habitats, tourism and recreational opportunities, shipping routes, and employment.

Box 1.3 Classification of Ecosystem Services by the 2005 MEA[37]

1. Provisioning Services: Products obtained from ecosystems (e.g., freshwater, food, fibre, fuel, genetic resources, biochemical, natural medicines, and pharmaceuticals).
2. Regulating Services: Benefits obtained from the regulation of ecosystem processes, such as water regulation, erosion regulation, water purification, waste regulation, climate regulation, and natural hazard regulation (e.g., droughts, floods, storms).
3. Cultural Services: Non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences (e.g., cultural diversity, knowledge systems, educational values, social relations, sense of place, cultural heritage, and ecotourism).
4. Supporting Services: Services that are necessary for the production of all other ecosystem services (e.g., primary production, nutrient cycling, and water cycling). They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in other categories have relatively direct and short-term impacts. Some services, like erosion regulation, can be categorised as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people.

33 *Ibid.* at p. 106.

34 IUCN Water (2011). "Water Briefing: Achieving Implementation of Integrated Water Resource Management," Water and Nature Initiative (WANI), *available at* www.waterandnature.org.

35 MEA (2005), *supra* note 26, at p. 7.

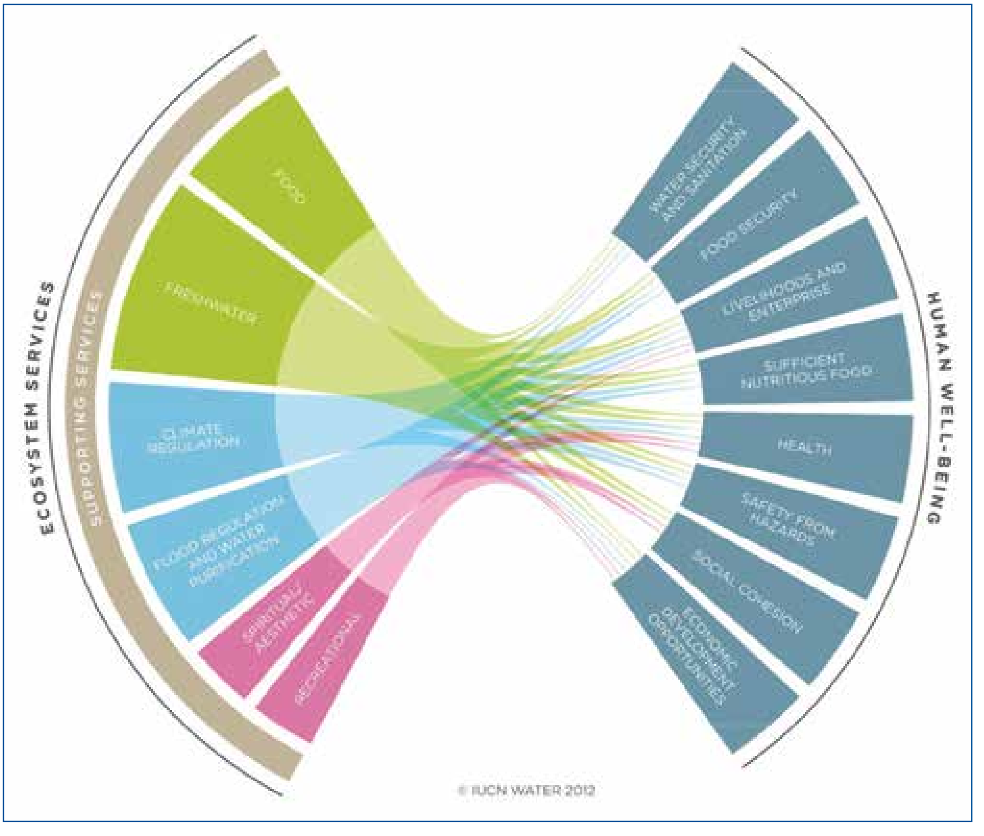
36 Smith and Barchiesi (2009), *supra* note 6.

37 Source: Derived from MEA (2005), *supra* note 26.

Batker *et al.* reported that the two most valuable ecosystem types per unit area were estuaries and floodplains, both of which depend upon natural flow patterns from rivers.[38] Despite representing less than one percent of the earth's land surface, river floodplains were estimated to provide nearly 25 percent of the terrestrial (i.e., non-marine) ecosystem services, with primary benefits including attenuation of flood flows, fisheries productivity, groundwater recharge, and water filtration.[39]

The 2005 MEA defines the link between human well-being and ecosystem services in terms of security, basic material for a good life, health, and good social relations. This relationship is represented in Figure 1.4 to emphasise the complex and dynamic relationship between ecosystem services and the components of human well-being from a freshwater perspective. It aims to intuitively demonstrate the extent to which society and economy are dependent on the sustainability of ecosystems and the variety of services that they provide.

Figure 1.4 Ecosystem services and the linkages with human well-being[40]



38 Batker, D. *et al.* (2010). *Gaining Ground: Wetlands, Hurricanes, and the Economy: The Value of Restoring the Mississippi River Delta.* Environmental Law Institute (ELI): Washington, D.C., *available at* http://www.academia.edu/2960368/Gaining_ground_Wetlands_hurricanes_and_the_economy_The_value_of_restoring_the_Mississippi_River_Delta.

39 Costanza, R. *et al.* (1997). "The Value of the World's Ecosystem Services and Natural Capital," *Nature,* Vol. 387, pp 253-260, at p. 259.

40 IUCN Water (2011), *supra* note 34.

Provisioning services are at the core of satisfying basic human needs. Regulating and supporting services are more related to income-generating activities, such as recession agriculture (cultivation in floodplain areas after flood recession), which depend more on soil moisture and the sediments deposited during flooding.[41] Security from natural hazards also has a strong link with regulation services. In addition, human health can relate to water purification and waste processing, which are a part of regulation services, while also linking to provisioning services for drinking water and food.

Income and food are required to maintain health and to buy medicines, while at the same time health is required to generate income and to collect, grow, or buy food products. For example, aquatic species provide genetic and biochemical resources invaluable for health and pharmaceuticals.[42] Income may also be required to participate in social activities, without which families may become isolated, leading to well-being problems. Cultural services (e.g., sites of scenic beauty valued for recreation, or sites for traditional ceremonies) are also important, although they are less tangible by comparison.[43] The interconnectedness of these well-being components stresses the importance of sustaining all ecosystem services.[44]

It is worth reemphasising that water is arguably the most important of all the resources required for sustaining ecosystems and the services they provide for human health and well-being. In contrast to all other resources, no living organism can survive in the complete absence of water, making it an essential ingredient necessary for all life.[45] With the development and advocacy of Integrated Water Resources Management (IWRM) approaches (discussed more fully below in Section 1.4), other fundamentally important roles of water have become more apparent, particularly the often-ignored need of "water for nature". It is within the concept of IWRM that the interdependence of humans, ecosystems, and water has become most evident.[46]

Box 1.4 Climate Variability

Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. The term is often used to denote deviations of climatic statistics over a given period of time (e.g., a month, season or year) from the long-term statistics relating to the corresponding calendar period. In this sense, climate variability is measured by those deviations, which are usually termed anomalies. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

Source: IPCC (2001).

1.3 The Impacts of Climate Change

Climate change holds many dangers and water is at the centre of its impacts, as it will exacerbate the uncertainty and severity of hydrological variability. For instance, regardless of the hydrological

41 Forslund, A. *et al.* (2009). "Securing Water For Ecosystems and Human Well Being: The Importance of Environmental Flows," *Swedish Water House Report 24,* p. 11. Stockholm International Water Institute: Stockholm, Sweden.

42 Krchnak (2011), *supra* note 12, at p. 3.

43 Forslund (2009), *supra* note 41, at p. 17.

44 *Ibid.* at p. 11.

45 UNEP (2009). "Water Security and Ecosystem Services: The Critical Connection," A Contribution to the United Nations World Water Assessment Programme (WWAP), Nairobi, Kenya, p. 13.

46 *Ibid.*

regime, the impact of variability and climate change on coastal regions (particularly in the East Asia, the Pacific and South Asia Region, and the Caribbean) is expected to be significant in terms of coastal sea level rise, and increased land-based flooding.[47]

Until recently, almost all water management practice has assumed that the best basis for infrastructure design and management was captured through the historical record of that basin's hydrological variability – an assumption of ecosystem "stationarity". However, the basic assumption that recent knowledge served as an effective guide to the future was not widely questioned.[48] More recently, stationarity has been declared "dead" as a result of human-induced climate change.[49]

1.3.1 Climate change impacts on water

Climate change is expected to change rainfall patterns and global temperatures (see Figure 1.5), bringing more frequent droughts and floods, and alongside them more frequent and severe storms. This will affect both quantity and quality of freshwater ecosystems. Lakes will be mainly affected in terms of water levels. Groundwater recharge will also be affected by the change in surface runoff and river flow. Rivers fed by melting glaciers will experience increased flows as long as glaciers still exist, eventually decreasing in flow as glaciers recede. In turn, decreasing river flow, or increasing magnitudes and frequency of floods will affect the health of estuaries and wetlands along the coast.[50] For example, the retreat of mountain glaciers, particularly in the Andes and Himalayas, is expected to increase risk of flooding and mudslide disasters, as well as reduce the long-term availability of freshwater in mountain rivers.[51]

Climate change could also profoundly alter future patterns of both water availability and use, thereby increasing global levels of water stress (see Figure 1.5). Most studies have found that levels of water stress will increase, although there are significant differences in estimates. The IPCC estimates that by 2080, up to 20 percent of the world's population will live in river basins that are likely to be affected by increased flood hazard.[52] Furthermore, the potential changes in water availability and use may aggravate global "water stress". The IPCC also estimates that the number of people living in severely stressed river basins is projected to increase significantly from 1.4–1.6 billion in 1995 to 4.3–6.9 billion in 2050.[53] The population at risk of increasing water stress for the full range of all the climate change scenarios is projected to be 0.4–1.7 billion, 1.0–2.0 billion and 1.1–3.2 billion, in the 2020's, 2050's and 2080's, respectively.

47 Smith and Barchiesi (2009), *supra* note 6, at p. 1.

48 Matthews, J.H. and Wickel, A.J. (2009). "Embracing Uncertainty in Freshwater Climate Change Adaptation: A Natural History Approach," *Climate & Development,* Vol. 1(3), pp. 269-279.

49 Milly, P. *et al.* (2008). "Stationarity is Dead: Whither Water Management?" *Science,* Vol. 319, No. 5836, pp. 573-574.

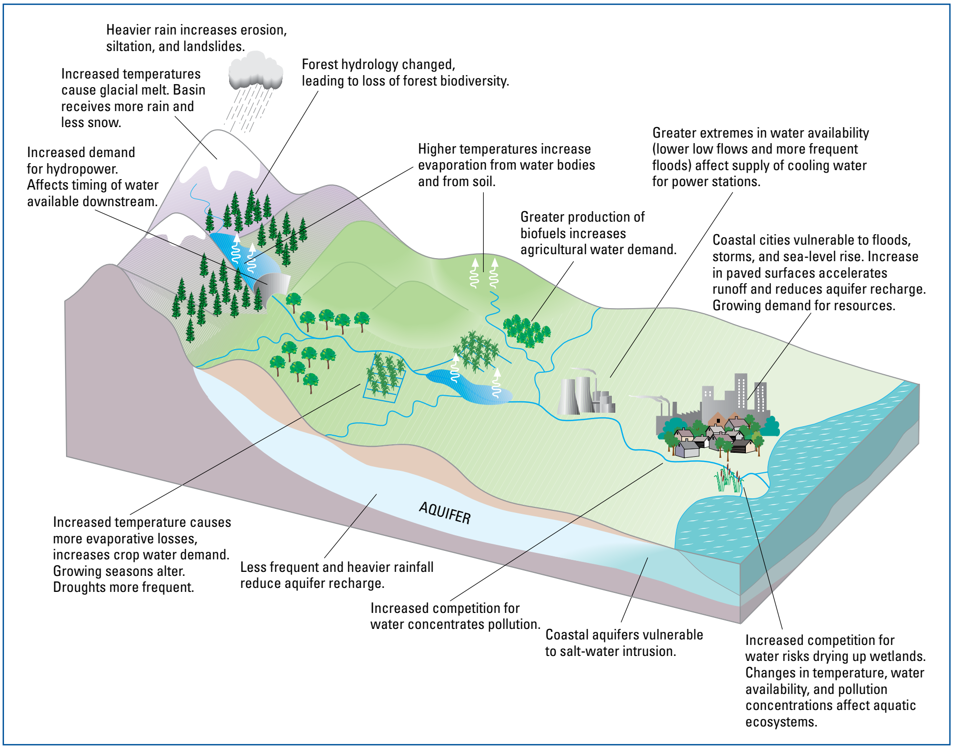
50 Hoerling, M. and Kumar, A. (2003). "The Perfect Ocean for Drought," *Science*, Vol. 299, No. 5607, pp. 691-694, at p. 694; *see* also UNEP-DHI (2011). *Methodology for the GEF Transboundary Waters Assessment Programme, Volume 4. Methodology for the Assessment of Transboundary River Basins* (UNEP, Kenya).

51 IPCC (2007), *supra* note 3, at p. 88.

52 *Ibid.* at p. 35.

53 *Ibid.* at p. 36.

Figure 1.5 Climate change in a typical river basin will be felt across the hydrological cycle[54]



Future water availability and use will also depend on non-climatic factors. Climate change is only one of many factors that will determine future patterns of water availability and use. In the absence of policy changes, non-climatic factors are likely to aggravate or attenuate adverse effects of climate change on water availability and quality, as well as have a significant influence on water demand. Population growth and economic development will play a dominant role in this. Non-climatic impacts could be generated through many realms, from population growth, migration and income, to technologies and infrastructure, land-use patterns, and agricultural activities/irrigation. Disturbingly, such non-climatic drivers could dwarf the impacts attributed to climate change alone.[55] Smart approaches towards water and climate policies, legislation, and management will be required in order to minimise impacts and enhance adaptive capacity.

54 World Bank (2012). *Turn Down the Heat: Why a 4°C Warmer World Must be Avoided,* A Report by the Potsdam Institute for Climate Impact Research and Climate Analytics. International Bank for Reconstruction and Development (IBRD)/World Bank: Washington, D.C., U.S.A.

55 Alavian, V. *et al.* (2009). *Water and Climate Change: Understanding the Risks and Making Climate-Smart Investments Decisions.* IBRD/World Bank: Washington, D.C., U.S.A.

Challenges Associated with modelling climate change impacts

To date, projections of potential impacts of climate change on the hydrological cycle have relied on projections from global and regional climate models. In these models, hydrological processes are currently only crudely represented. In addition, several anthropogenic influences on the hydrological cycle are generally not considered within current climate models. These include water management practices associated with irrigation, large water storage and regulation facilities, such as dams, and agricultural land use changes and management.[56]

Future changes in the hydrological cycle such as precipitation, evaporation, and runoff can be captured for relatively large areas such as bigger river basins. However, detailed changes in regional components of the hydrological cycle, such as groundwater storage changes, snowmelt, permafrost, and wetlands are often poorly represented in climate models.[57] This also indicates that more regional to local level changes in the hydrological cycle are harder to understand and "predict" through modelling. However, these changes are what will affect – both positively and negatively – ecosystem changes, food production, and water availability.

For example, a detailed climate change modelling study for the Pangani River Basin in Tanzania shows that the seasonality of stream flows is likely to change because of hotter and drier periods, especially toward the end of the dry season (May–October). However, the magnitude of this change will vary across sub-catchments, and its impact will depend on water extraction and the characteristics of each sub-catchment.[58]

There is a need for a better understanding of precipitation-evaporation feedback loops, for instance through enhanced modelling techniques, to ensure that we do not lock ourselves into infrastructure solutions that can negatively affect more localised cycles, or that are only valid for a short period of time. Decisions that fail to account for these factors can actually increase a country's vulnerability to climate change impacts. This is known as "maladaptation". Therefore, there is a need to better understand how natural solutions can work with infrastructure to cope with increasing uncertainties that will be faced by river basin authorities and those who live in and rely on the productivity of these areas.

1.3.2 Impacts of climate change on ecosystem services and human well-being

First, climate change is likely to result in catastrophic loss of species in some regions of the world.[59] Changes in flow regimes or water quality due to activities upstream, or due to climate change, will

56 Kabat, P. (2006). "Climate Change Impacts on Global Water Cycle and Implications For Water Management in Europe," in *International Workshop on Climate Change Impacts on the Water Cycle,* Resources, and Quality, (25 & 26th Sept. 2006), Brussels, Belgium.

57 Racherla, P.N., Shindell, D.T. and Faluvegi, G. (2012). "The Added Value to Global Model Projections of Climate Change by Dynamic Downscaling: A Case Study over the Continental U.S. using the GISS-ModelE2 and WRF Models," *Journal of Geophysical Research: Atmospheres,* Vol. 117(20).

58 Tadross, M. and Wolski, P. (2010). *Pangani River Basin Flow Assessment: Climate Change Modeling For the Pangani Basin to Support the IWRM Planning Process,* IUCN WANI and the Pangani Basin Water Board, p. 22. Moshi and IUCN Eastern and Southern Africa Regional Programme.

59 *See* Thomas, C.D. *et al.* (2004). "Extinction Risk from Climate Change," *Nature,* Vol. 427, pp. 145-148; Boelee (2011), *supra* note 7; and Foden, W.B. *et al.* (2013). "Identifying the World's Most Climate Change Vulnerable Species: A Systematic Trait-Based Assessment of all Birds, Amphibians and Corals," *PLoS ONE* 8(6).

disturb coastal ecosystems, having devastating impacts on estuaries, wetlands, and the marine environment. In turn, coral reefs, mangroves, seagrasses, and nearshore terrestrial ecosystems such as lagoons, which are highly interconnected, will also be disturbed.[60]

When vegetation is cleared and upland slopes are eroded, means of buffering surface water runoff by retention of water in soils is weakened, exposing downstream communities to flash-flooding. Drainage and infilling of wetlands also prevents natural water storage, which reduces groundwater recharge and dry-season flows, limiting options for coping with drought. Without these natural infrastructure services that freshwater ecosystems provide, people are more vulnerable or exposed to natural hazards.

Many cities are already exposed to multiple hazards such as landslides, floods and coastal storm surges.[61] These hazards become disasters because of existing vulnerabilities and weakened capacity to prepare for, respond to, and recover from disasters. Uncontrolled urban growth is a good example. Up to 70 percent of the global population is predicted to live in cities by 2030.[62] Some of this urban growth occurs in informal settlements, where housing construction is often of poor quality, and basic infrastructure (drainage, waste disposal, water supply) is lacking. These conditions multiply vulnerability to disasters, especially for the poorest parts of the population, who tend to settle in cheaper, degraded and often more hazard-prone areas.[63] The impacts of drought are also increasingly visible and being documented – both direct and indirect.[64]

Where ecosystem services are not maintained – through, for example, river basin and land management – or choices are made which prioritise food production, which can degrade the ecosystem, benefits to human well-being may be dramatically reduced. Equally, external factors such as climate change can adversely affect the stock of services an ecosystem provides. This breakdown in services means that people may get fewer benefits from nature, and that links between ecosystem services themselves may be reduced or even lost (see Figure 1.6).[65] As discussed earlier, human well-being is dependent upon not one, but multiple and often interrelated ecosystem services. Poorer communities are often less able to cope with these losses, as they often rely most on supporting services provided by ecosystems.[66]

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60 Silvestri, S. and Kershaw, F. (2010). *Framing the Flow: Innovative Approaches to Understand, Protect, and Value Ecosystems Services Across Linked Habitats,* p. 5. UNEP World Conservation Monitoring Center: Cambridge, U.K.

61 International Federation of Red Cross and Red Crescent Societies (IFRC) (2010). *World Disasters Report 2010: Focus on Urban Risk,* p. 20. IFRC: Geneva, Switzerland.

62 World Health Organisation (WHO) (2010). "Urbanisation and Health," *Bulletin of the World Health Organisation,* Vol. 88(4), pp. 241–320.

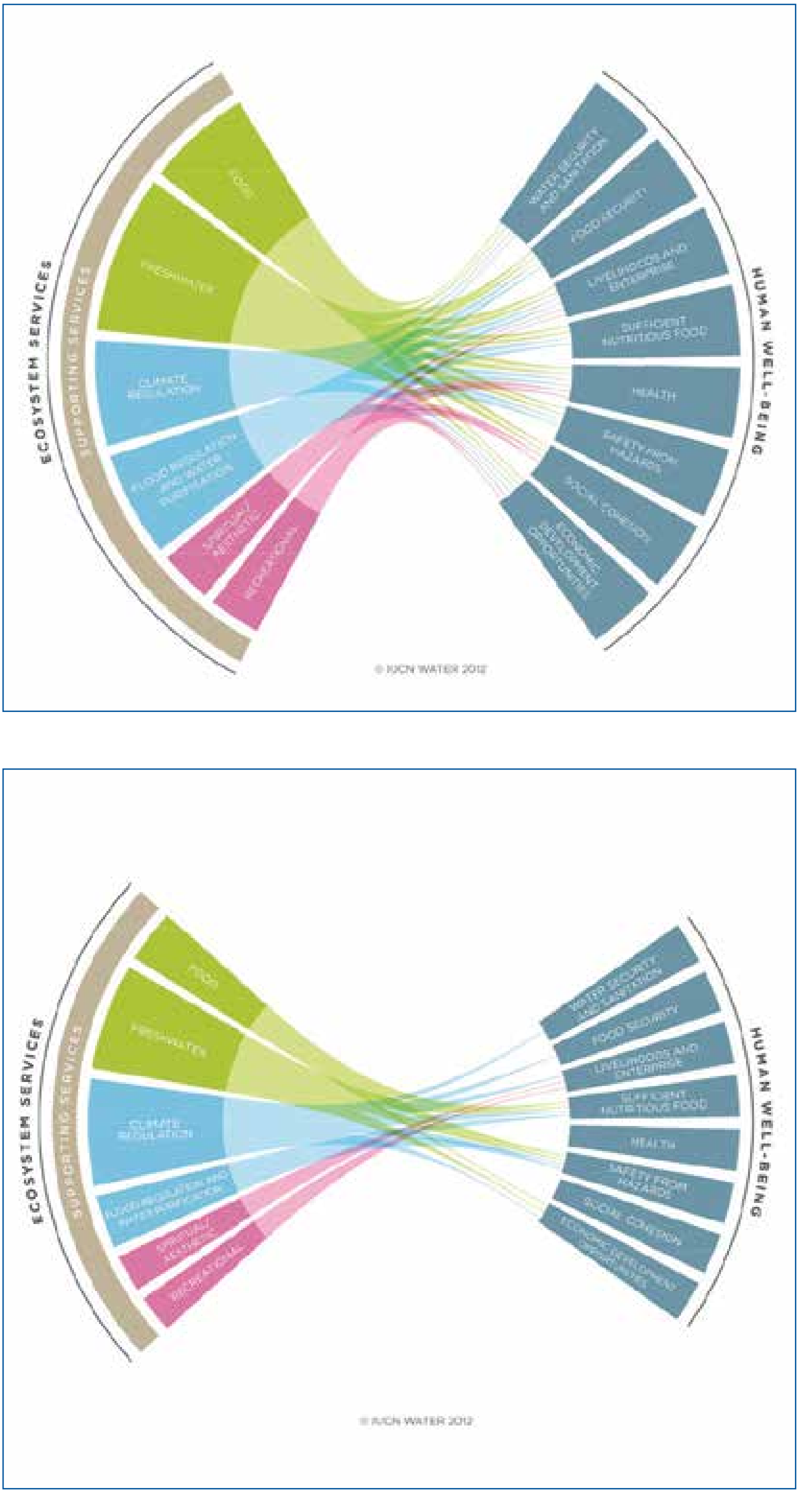
63 Adikari, Y. *et al.* (2010). "Flood-related Disaster Vulnerability: An Impending Crisis of Megacities in Asia," *Journal of Flood Risk Management,* Vol. 3, pp. 185-191, at p. 185.

64 *See* The World Bank (2012), *supra* note 54; and United Nations Convention to Combat Desertification (UNCCCD) (2012). "The Economics of Desertification, Land Degradation and Drought: Methodologies and Analysis for Decision-Making," Background Document, UNCCD 2nd Scientific Conference, Bonn, Germany.

65 Smith and Barchiesi (2009), *supra* note 6, at p. 3.

66 Mayers, J. *et al.* (2009). "Water Ecosystem Services and Poverty Under Climate Change: Key Issues and Research Priorities," *Natural Resource Issues* No. 17, p. 20. International Institute for Environment and Development (IIED): London, U.K.; and Silvius, M.J. *et al.* (2000). "Wetlands: Lifelines for People At The Edge," *Physics and Chemistry of the Earth Part B: Hydrology, Oceans, and Atmosphere,* Vol. 25, pp. 645-652.

Figure 1.6 Degraded ecosystems provide fewer services to human well-being



1.4 Adaptation to Climate Change

1.4.1 Building adaptation through ecosystem services and water management

Nature can only continue to deliver its services where ecosystems are healthy and functioning well. Adapting to climate change therefore demands sustainable ecosystems where water is well managed. This natural infrastructure can then contribute to approaches to buffer communities against the adverse impacts of climate change (see Box 1.5).

In a wider context, natural infrastructure can be seen as one aspect of the "Ecosystem Approach". The Ecosystem Approach is a strategy for integrating management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. It is focused on levels of biological organisation, which encompass the essential processes, functions, and interactions among organisms and their environment. It recognises that humans, with their cultural diversity, are an integral component of ecosystems.[67] Whilst applicable to all types of ecosystems, every natural resource sector has developed its own working definition (e.g., forestry and fisheries).[68]

Box 1.5 Adaptation

Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Capitalising on the ability of healthy ecosystems to assist in human adaptation to climate change has been termed **Ecosystem-based Adaptation (EbA)**. A relatively new concept, EbA integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation, and restoration of ecosystems to provide services that help people adapt to both current climate variability and climate change.

Sources: IPCC (2007); CBD (2004).

67 CBD (2000). Decision V/6, Annex, para. 2, UNEP/CBD/COP/5/23, Report of the Fifth Meeting of the Conference of the Parties to the CBD, held in Nairobi from 15-26 May 2000.

68 Wilkie M.L., Holmgren, P. and F. Castaneda (2003). *Sustainable Forest Management and the Ecosystem Approach: Two Concepts, One Goal. Forest Management Working Paper No.* 25. FAO, Forest Resources Development Service, Forest Resources, Division: Rome, Italy; and De Young, C. *et al.* (2008). *Human dimensions of the ecosystem approach to fisheries: an overview of context, concepts, tools and methods. FAO Fisheries Technical Paper. No. 489.* FAO: Rome, Italy.

Case Study 1.1 Mangrove restoration in Vietnam

In Vietnam, threats from climate change, rapid fluctuations in food prices, the need for energy provision, and forecasts of severe water shortages have created doubt whether the market is capable of delivering all goods and services. Climate change scenarios predict an increase in storm frequency and intensity coupled with sea level rise, and following the devastating impact of the Asian tsunami international organisations have been widely promoting the protection and rehabilitation of coastal areas.[69] In response, a number of Asian countries have initiated large-scale mangrove restoration and rehabilitation programs. In Vietnam and Bangladesh, these actions have been institutionalised within regulatory frameworks governing coastal areas through the national plan for Integrated Coastal Management developed by the Ministry of Natural Resources and Environment.

Since the 1950's, Vietnam has lost over 80 percent of its mangroves. Spraying of defoliating agents during the Vietnam War, and the rapid expansion of the aquaculture industry during the early 1980's, are considered as the two major causes for the decline. In response, mangrove restoration and rehabilitation has been on-going since 1991. In North and Central Vietnam, mangrove restoration and rehabilitation has been promoted for disaster risk mitigation, focusing on its protective function. This is reflected in North Vietnam's most significant mangrove restoration and rehabilitation program, the International Red Cross Disaster Risk Program.[70] In the South, some attempts have been made to promote and design mangrove restoration and rehabilitation as a multi-functional policy to alleviate poverty and diversify livelihoods. Plantations are both species-rich and exist under a number of different land-use arrangements. Under such conditions, mangroves can provide a host of ecological goods and services, as well as livelihood benefits. One such project that reflects this character is the Coastal Wetlands Protection and Development Project, Mekong Delta (1997–2007). In this project, mangrove plantations have been established with the objective of providing protection and increasing ecosystem goods and services, such as aquatic resources.[71] In addition to providing livelihoods, these restoration efforts will contribute towards reducing vulnerability to extreme weather events caused by climate change.

1.4.2 Applying the ecosystem approach to Integrated Water Resource Management

Integrated Water Resource Management (IWRM) is promoted as a mainstream approach to managing water.[72] IWRM is:

> *"a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."*[73]

Practical strategies associated with IWRM are intended to overcome a lack of coordination and disjointed planning among sectors that can otherwise easily result in unnecessary expenditure, and large infrastructure that fails to provide expected results at the expense of natural ecosystems. IWRM is also designed to replace fragmented management of water and encourage sustainable

69 Powell, N. *et al.* (2011). "Mangrove Restoration and Rehabilitation for Climate Change Adaptation in Vietnam: World Resources Report Case Study," *World Resources Report 2010-2011*. WRI: Washington, D.C., *available at* http://www.wri.org/our-work/project/world-resources-report/world-resources-report-2010-2011.

70 *Ibid.*

71 *Ibid.*

72 Jonch-Clausen, T. and Fugl, J. (2001). "Firming up the Conceptual Basis of Integrated Water Resources Management," *International Journal of Water Resources Development,* Vol. 17(4), pp. 501-510, at p. 502; *see* also Global Water Partnership (GWP) (2000). "Integrated Water Resources Management," *Global Water Partnership Technical Advisory Committee, Background Paper No. 4.*

73 GWP (2000), *supra* note 72, at p. 22.

use. Planning for IWRM takes place using inclusive, participatory processes, which Chapter Five will further elaborate upon.[74]

Taking an ecosystem approach to IWRM provides a framework for mobilisation based on the principle that in broad terms, systems to be managed are complex, unpredictable, and characterised by unexpected responses to different interventions.[75] Any approach that aims to maintain and rehabilitate natural regulatory functions of ecosystems within an entire catchment could be considered an ecosystem approach to IWRM.

Application of an ecosystem approach to IWRM has been tested in river basins in different regions and climatic settings around the world. Results have demonstrated the benefits for reducing climate vulnerabilities and strengthening resilience in river basins globally. For example, the IUCN Water and Nature Initiative (WANI) has worked with over 80 organisations across the world to demonstrate water management that supports healthy rivers and communities. The lessons from these demonstrations show that IWRM is practical and achievable, and that tools based on the ecosystem approach can also be used in strategies for climate change adaptation.[76] As a result, the ecosystem approach has emerged as a promising step-wise process to dealing with integration and sustainability of water management. These steps can be related to real-life water management issues using the following seven questions to help frame responses:

1. What is the water-related problem, and what ecosystem services are needed to solve it?
2. What actions are needed?
3. What governance, and what agreements are needed to enable action?
4. What knowledge is needed?
5. What incentives and financing are needed?
6. Who needs to be empowered to act?
7. What capacities are needed?

A portfolio of short case studies from WANI is presented below to illustrate the different steps that make up the ecosystem approach in practice.

Ecosystem services are part of the solution to water scarcity

Different countries are at different stages of recognition and application of environmental flows as a water management tool. Strategies for capacity building in ecosystem management differ by country. A particularly successful strategy has been building capacity for environmental flow assessments in Tanzania. Within a range of activities, multiple scenarios of basin management and development pathways were created for consideration by water authorities and stakeholders of the Pangani River Basin. Presently, adaptable flow management is proving how ecosystem services can help deal with water scarcity.

74 IUCN Water (2011), *supra* note 34.

75 Pahl-Wostl, C. (2007), *supra* note 10.

76 Bergkamp, G. *et al.* (2003). *Change: Adaptation of Water Resources Management to Climate Change,* p. 29. IUCN: Gland, Switzerland.

Improved water governance underpins action

The ecosystem approach to IWRM was incorporated into the strategic vision for inter-institutional coordination of the Tacaná catchment, which straddles the Guatemalan-Mexican border. In the catchment, the community initiated a decentralised community-led policy arrangement based on local initiatives. The arrangement included participation in cooperative settings with governmental bodies and other stakeholders, and an approach that aimed to develop and execute specific water management goals in the region. This approach has had a profound effect on the development of a new water policy for Guatemala that incorporates democratisation of decision-making, and costs and benefits of ecosystem services for the poor.

Lack of transboundary coordination impairs action

A bilateral agreement signed between Burkina Faso and Ghana is testament to the fact that support for dialogue and negotiation between States can result in new mechanisms for transboundary cooperation in basin management. In this case, the multi-stakeholder approach mobilised a partnership among Ministries, decentralised local administration, and civil society to form a transboundary water management forum in the Volta River Basin. This led to formalisation of a joint technical committee on IWRM, and a commitment to establish a basin authority that involves all six riparian States.

Investment decisions support ecosystem approach implementation

In Botswana, an economic valuation of the Okavango Delta resources was carried out, including studies on the wildlife-based tourism industry. New income generating activities for the poor have resulted from combining ecosystem management with enterprise development. Support for innovation in water management by local stakeholders is also creating new opportunities for development of small-scale enterprises that build value in communities from sustainable management of freshwater ecosystems.

Financial incentives support sustainable management of freshwater ecosystems

Major financing commitments by national governments have followed mobilisation of action on restoration and sustainable management of ecosystems. One such example is the Quito Water Protection Fund. In order to ensure that appropriate measures could be taken to protect highland waters for long-term natural regeneration, a pool of local utilities and water-intense companies endorsed the creation of a private trust fund for water conservation. This Fund has demonstrated how payments for watershed services can be included in IWRM planning through an equitable and informed multi-stakeholder platform.

Empowerment enables participation in action

New community-led institutions have been empowered through WANI to make decisions, and represent local views and development priorities in high-level forums such as the Mekong Region Waters Dialogues. There, broad participation of multilateral agencies, governments, the private sector, policy consultants and advisors, members of academia, and activists from NGOs has provided for interaction among stakeholders who have seldom met to discuss common concerns over water use or development in the region. At the local level, villagers also have the opportunity to use indigenous knowledge to conduct participatory research for informing decision-making over fish stocks.

Building consensus legitimates action by actors

When multi-stakeholder platforms are empowered to reform governance of river basin management, charters and codes of conduct for coordinating and integrating management of negotiated water often result in resolution of conflict, sharing of benefits, new investment, and restored ecosystem services. This was the case in the Komadugu Yobe Basin of northwest Nigeria. The broad composition of IWRM committees in the basin, and their involvement in decisions and programmes, allowed for the creation of a water management agency that represents the interests of all stakeholders, including civil society. Through support and re-organisation of the Basin Coordinating Committee, transboundary cooperation has also been established at the federal level.

Framing implementation of an ecosystem approach to IWRM around the aforementioned questions enables collective learning, evaluation and comparison, analysis, and furthers understanding of what can be improved in future projects and programmes. It also allows for a better accounting of the direct benefits of restoring ecosystem services, while reducing vulnerability and strengthening resilience in the basin. Most importantly, however, the lessons learned from many of these case studies show that EbA should be considered an integral part of climate change adaptation strategies, plans, or programmes.[77] These are the types of lessons that are emerging from the different WANI sites, as showcased by Case Study 1.3 below.

Case Study 1.2 Responding to tropical storm Stan in the Tacaná region[78]

Located on the Guatemala-Mexico border, the Tacaná region is a good example of combining EbA and IWRM through ecosystem restoration and overall strengthening of livelihoods and governance capacity. In 2005, tropical storm Stan dropped torrential rains in the Tacaná region. This caused flooding and mudslides, which led to an estimated 2,000 deaths and damages of up to USD$40 million; roads, bridges, water supply systems, crops, and local economies were destroyed.

WANI stepped in to help reverse environmental degradation of the watershed, and to restore and strengthen ecosystem functions in order to reduce the risk of future devastating floods. Around the Tacaná region, management actions have always tended to focus more strongly on ecosystems in the upper watersheds, and on people in the lower watersheds. It was therefore natural that activities should target maintenance of ecosystem services alongside improvement of livelihoods. IUCN-led pilots combined rehabilitation of ecosystem services and more productive and efficient use of water with development of social capital and benefits such as income generation and reducing vulnerability. Activities included aquaculture (fish-farming), honey production and agro-ecology (community gardens), reforestation and mangrove conservation, solid waste recycling, and septic tank initiatives, among others.

These efforts led to local communities organising themselves into "micro-watershed councils" to coordinate watershed management between groups of villages within the basin. Driven by the need to reduce poverty through improving livelihoods and reducing disaster risk, governance through community councils led to diversification of farming systems, including terracing of degraded slopes, and reforestation through the introduction of agro-forestry. Through investment of labour and capital to restore natural infrastructure, communities are becoming better equipped to adapt to climate change, and less vulnerable to severe storms.

77 Bergcamp (2003), *supra* note 76, p. 29.

78 Cartin, M. *et al.* (2012). *Tacaná Watersheds, Guatemala & Mexico: Transboundary Water Governance and Implementation of IWRM through Local Community Action.* IUCN: Gland, Switzerland.

1.5 The Water Governance Connection

Patterns of intensive and conflicting uses of water in transboundary river basins are resulting in significant ecological and economic damage, reduced livelihoods for the poor, and increased political tensions among downstream States.[79] These impacts are becoming exacerbated with growing climate variability. Increasingly, countries are coming to realise that in the long term, climate change adaptation needs to be supported by an integrated, cross-cutting policy approach – in other words, mainstreamed into national development planning through strategies, policies, and law.[80] This highlights the importance and need for good water governance in the face of evolving global climate and social challenges.

However, there is a need to define key governance challenges posed by climate variability and change, and to outline responses that will lead towards more adaptive water governance. Evidence regarding the effectiveness of practices and tools is still emerging, but there appears to be consensus developing with respect to components that make up adaptive resource governance. This evolving approach to governance provides a framework for addressing challenges posed by climate change: high levels of uncertainty; rapid and sometimes irreversible changes in the state of resources and ecosystems; increasing need for inter-sectoral and inter-institutional coordination (including among levels of government); the need to actively involve and build adaptive capacity of numerous and diverse stakeholders on multiple levels; and the role that healthy freshwater ecosystems and sustainability play in fostering adaptive capacity, both in terms of environmental and social resilience.

Catchment boundaries do not normally coincide with socio-cultural and political boundaries, and therefore have not generally been managed as one unit. Many human boundaries, including individual farms, villages, sacred grounds, and provincial boundaries (and beyond), often exist in and across the catchment. Therefore, there is often a "mismatch" between a catchment perspective and economic and political realities. While the principle of subsidiarity – that is, managing at the local scale matched to hydrological boundaries – is one of the principles of IWRM, it adds complexity across national borders when looking at the transboundary level. Transboundary water management nevertheless attempts to bridge these two perspectives.

There will also be a need to focus on institutions and cooperative mechanisms as a way to develop and implement adaptive governance arrangements. Water institutions are at the centre of how society interacts with water, and provide a variety of ecosystem goods and services.[81] They carry out a number of functions that are likely to be affected by climate change, including water allocation, implementation and management of water infrastructure, definition and implementation of flood management policies, and protection, monitoring, and assessment of water quality and quantity.[82] They also maintain environmental integrity, and smooth variability in water supply and delivery to meet human needs (in the past mainly due to seasonality and weather patterns, but now also due to climate change). Water institutions are therefore critical to how we manage climate change, which makes it important to ensure that those institutions are themselves resilient to climate change.

79 GEF (2010). *GEF-5 International Waters Strategy.* GEF: Washington, D.C.

80 UNDP-UNEP (2011). *Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners,* p. 73. Poverty-Environment Facility.

81 Cook, J. *et al.* (2012). *Shifting Course: Climate Adaptation for Water Management Institutions,* p. 4. WWF-US: Washington, D.C., U.S.A.

82 Molle, F. (2009). "Water, Politics, and River Basin Governance: Repoliticizing Approaches to River Basin Management," *Water International,* Vol. 34(1), pp. 62-70.

Institutional strengthening is then key as a means of enabling diverse stakeholders to participate in discovering options, learning, and pursuing joint action.

It must be emphasised that governance options and responses to climate change adaptation are quite new and evolving. Therefore, there is a need to approach adaptation in a flexible learning-by-doing manner. Nevertheless, there are already concrete lessons of approaches that contribute to enhancing adaptive governance. In addition to the examples highlighted above, this publication will, in the following chapters, explore the different approaches and strategies that have been utilised to enhance cooperation through adaptive water governance.

Chapter Two

Adaptive Water Governance and the Principles of International Water Law

Jessica Troell and Greta Swanson[1]

2.1 Introduction

As explained in Chapter One, adaptation can take the form of a broad range of responses. These may range from those geared towards specific, predicted (or existing) climate impacts and managing risk, to responses that are aimed at reducing vulnerability, and building adaptive capacity and resilience to face unknown and often unpredictable threats. The primary focus of adaptation interventions to date has been on the technical options for responding to climate risks. Yet, these technical responses must also address a number of questions that are social and political in nature: What constitutes vulnerability? What are the available and appropriate adaptive responses and at what levels? How can we achieve resilient ecosystems and communities in an equitable manner that accounts for trade-offs between various interests, including countries in a transboundary water basin? These questions will be the focus of Section 2.2 of this chapter.

Adaptation to climate change will require innovations in water governance systems at all levels. Water laws and regulations have a critical role to play in supporting adaptation in the water sector at each level; for example by providing the underlying mandate for improving water quality, generating and sharing data, prioritising and allocating quantities for use, and regulating demand through incentives and pricing mechanisms, while maintaining or improving ecosystem health. Yet, truly adaptive water governance frameworks remain the exception rather than the rule. Few policy, legal and institutional frameworks are specifically geared towards facilitating adaptive water governance, though many incorporate at least some of the relevant components of such frameworks. The lack of effective and equitable water governance frameworks is also often a primary challenge to increasing adaptive capacity and reducing vulnerability to climate variability and change at the local, national, and transboundary levels.

The risks and challenges posed by climate impacts on internationally shared waters will require high levels of transboundary cooperation and joint decision-making. To date, little planning for adaptation has been undertaken at the transboundary level, although this is slowly changing.[2] The impacts of climate variability and change are and will continue to affect the diverse countries sharing transboundary freshwater basins in different ways. Vulnerabilities (including weak governance frameworks) to water-related impacts of climate change vary greatly. This diversity indicates the need for close cooperation among riparians in order to identify all the costs and benefits on a basin scale, and to craft effective adaptation strategies that take the trade-offs that each strategy represents into

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2 *See* Chapter Three of this publication.

account. Countries' differing adaptive capacities also need to be taken into account in structuring adaptation approaches across borders.[3] The legal and institutional frameworks governing the management and development of shared freshwater bodies must, at the very least, not inhibit adaptation approaches at the basin level. Ideally, transboundary freshwater treaties and institutions can provide the context and tools necessary to actively support basin-wide adaptation planning and implementation.[4]

Moving forward, Section 2.3 of this chapter will discuss and identify relevant international legal components of adaptive water governance, particularly through the lens of the existing (and progressively developing) principles of international water law and international environmental law.

While it is not possible to undertake a comprehensive analysis of all international water law principles in the context of this chapter, it explores the relevance, opportunities for application, and potential constraints of two guiding norms: equitable utilisation and the prevention of significant transboundary harm. The realisation of these two principles relies on the implementation of several other principles and norms of international water law that also have significant relevance for adaptation at the transboundary level – particularly the duty to cooperate – and will be addressed as well. The relevance of these norms to climate adaptation overall is discussed in more detail in other chapters of this publication.

This chapter also explores some key principles of international environmental law more broadly to determine how their application in the field of transboundary waters can strengthen the implementation of adaptive water governance in internationally shared basins. Specifically, we look at the principles of precaution, sustainability, as well as the ecosystem approach, which is increasingly being undertaken to achieve these principles.

Before analysing these principles, however, it is useful to clarify precisely what governance challenges are posed by climate variability and change, and to outline the characteristics of what an adaptive water governance framework might look like. The governance of climate adaptation is a new and evolving field. Evidence regarding the effectiveness of practices and tools is still emerging, but there appears to be a consensus developing with respect to the key characteristics of sound adaptive resource governance and the types of policy, legal, institutional, and management practices and tools that foster these characteristics.[5] These practices and tools are aimed at addressing the distinct set

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3 United Nations Economic Commission for Europe (UNECE) (2009). *Guidance on Water and Adaptation to Climate Change*. United Nations: New York and Geneva.

4 See Chapter Three of this publication.

5 *See* e.g., Adger, W.N. (2009). *Adapting to Climate Change: Thresholds, Values and Governance*. Cambridge University Press: Cambridge, U.K.; Adger, W.N. (2003). "Social Capital, Collective Action and Adaptation to Climate Change," *Economic Geography*, Vol. 79(4), pp. 387-404; Boyd, E. and Folke, C. (eds.) (2012). *Adapting Institutions: Governance, Complexity and Social-Ecological Resilience*. Cambridge University Press: Cambridge, U.K.; Corfee-Morlot, J. *et al.* (2009). "Cities, Climate Change and Multilevel Governance," *OECD Environmental Working Papers N° 14*. OECD Publishing: Paris, France; Hill, M. (2012). *Climate Change and Water Governance: Adaptive Capacity in Chile and Switzerland*. Springer Publishing: New York/Heidelberg; Huntjens, P. (2010). *Water Management and Water Governance in a Changing Climate*. Eburon Publishers: Delft, Netherlands; OECD (2011). *Water Governance in OECD Countries: A Multi-level Approach*, OECD Studies on Water. OECD Publishing: Paris, France; Pahl-Wostl, C. (2009). "A Conceptual Framework for Analysing Adaptive Capacity and Multi-level Learning Processes in Resource Governance Regimes," *Global Environmental Change*, Vol. 19, pp. 354-65; Pahl-Wostl, C. (2007). "Transitions Towards Adaptive Management of Water Facing Climate and Global Change," *Water Resource Management*, Vol. 21, pp. 49-62; and Termeer, C. *et al.* (2011). "The Regional Governance of Climate Adaptation:

of governance challenges posed by climate change: high levels of uncertainty; rapid and sometimes irreversible changes in the state of resources and ecosystems; increasing need for inter-sectoral and inter-institutional coordination (including among levels of government); the need to actively involve and build the adaptive capacity of numerous and diverse stakeholders on multiple levels; and the role that freshwater ecosystem health and sustainability plays in fostering adaptive capacity and both environmental and social resilience. These challenges are explored in more detail in the next section.

2.2 Governance Challenges Associated with Climate Change

2.2.1 Governing under uncertainty

Perhaps the most significant water governance challenge presented by climate change is the uncertainty that surrounds the timing, scale, intensity, and character of potential impacts, and how those impacts will interact with other drivers of change. Creating and implementing effective policies, laws, and management frameworks in the face of such uncertainty requires a shift from traditional paradigms that attempt to reduce uncertainties to ones that acknowledge and even embrace change and continuous learning as cornerstones of effective water governance.

While a certain level of uncertainty and complexity is inherent in water planning and management, most countries have traditionally operated under the assumption of stationarity – the idea that natural systems fluctuate, but within an envelope of certainty.[6] In other words, the rules and tools that have been developed are structured to cope with "predictable" uncertainty – such as flood management strategies that are based on an assumption of certain inter-annual or inter-decadal precipitation patterns.[7]

With climate change, however, comes much more unpredictable and indeterminate types of uncertainty. The speed, severity, and complexity of climate change, and its synergistic relationship with evolving, non-climate stressors on water, present challenges that lie far outside the traditional coping capacity of most traditional water governance and management approaches. Yet, water managers cannot wait for certainty to act. People need water for drinking, to sustain agriculture and other livelihoods, and for economic development; delaying decisions on the use and allocation of water until comprehensive studies are conducted would facilitate unsustainable resource development and impacts, further prejudicing the range of options. It is simply not feasible to have a full understanding of the potential impacts of climate change before determining how best to adapt to those impacts.[8] The need to anticipate highly uncertain future developments provides an inherently difficult context for structuring effective water policies and institutional frameworks.[9]

From a transboundary perspective, being able to respond to uncertainty requires flexibility in what have traditionally been relatively fixed agreements and institutional arrangements. The vast majority

A Framework for Developing Legitimate, Effective, and Resilient Governance Arrangements," *Climate Law*, Vol. 2, pp. 159-79.

6 Milly, P.C.D. *et al*. (2008) "Stationarity is Dead: Whither Water Management?" *Science*, Vol. 319, no. 5863, pp. 573-574.

7 Hill (2012), *supra* note 5.

8 National Research Council (2004). *Adaptive Management for Water Resources Project Planning*. The National Academies Press: Washington, D.C., U.S.A.

9 Termeer *et al*. (2011), *supra* note 5.

of formalised cooperation among countries sharing a watercourse takes the form of basin-level or regional treaties and the institutions those agreements create to implement and oversee the procedural and substantive commitments made. These commitments have evolved and shifted over time from an overriding focus on allocation of water supplies and hydropower development to increasingly include provisions for multiple uses, joint development and, increasingly, for environmental protection. [10] While some level of uncertainty is inherent in any water management scheme – due, for example, to seasonal or inter-annual fluctuations in precipitation patterns or increased demand due to development or population growth – international agreements over shared waters have historically lacked robust mechanisms for ensuring the flexibility necessary to respond to such changes.[11] Such flexibility, particularly in allocation mechanisms, is critical in facing the impacts of climate variability and change, as well as the shifting water demands and allocation priorities of riparian countries as they continue to develop, and their populations continue to grow. The role of treaty flexibility mechanisms in facilitating adaptation in transboundary basins is discussed in detail in Chapter Three, and is also addressed in the case study on the U.S.-Mexico International Boundary and Water Commission (IBWC), below.

2.2.2 Multi-level water governance for climate adaptation

Another key governance challenge posed by climate change relates to the cross-sectoral nature of both climate vulnerabilities and adaptive responses. Changes in the timing and frequency of precipitation will impact water directly; the impacts on water services, agriculture, forests, biodiversity, and urban development and planning may be more indirect. These changes will interact with the impacts of other non-climate stressors, such as population growth, urbanization, increasing demands for resources, overexploitation of ecosystems, and changes in world markets.

The multi-sectoral nature of water management and development is broadly acknowledged, along with the need to reduce "siloed" approaches to management and decision-making. Yet, institutional and policy fragmentation remains the norm both within and across sectors. Therefore, adaptive governance will challenge water, agricultural, health, energy, industrial, and other sectors to develop more effective mechanisms for ***horizontal integration***, or inter-institutional and inter-sectoral coordination and cooperation. Such coordination can facilitate the identification of trade-offs and synergies among sectors and their water needs.[12] The challenges to achieving such integration include: lack of finances for coordination, and financial asymmetries across sectors that undermine coordination and effective implementation of water policies across sectors; lack of capacity (staff time and expertise) for effectively managing horizontal coordination across sectors; lack of data and information management capacity; lack of clear lines of accountability among sectors; lack of political commitment to effective coordination; and the absence of strategic planning.[13] These

10 Hamner, J. and Wolf, A. (1998). "Patterns in International Water Resource Treaties: The Transboundary Freshwater Dispute Database," *Colorado Journal of International Environmental Law and Policy*, 1997 Yearbook; McIntyre, O. (2007). *Environmental Protection of International Watercourses under International Law*. Ashgate: Hampshire, U.K.

11 Fischhendler, I. (2004). "Legal and Institutional Adaptation to Climate Uncertainty: A Study of International Rivers," *Water Policy*, Vol. 6, pp. 281-302.

12 UNECE (2009), *supra* note 3.

13 Bauer, A. *et al*. (2011). "The Governance of Climate Change Adaptation in Ten OECD Countries: Challenges and Approaches," *Institute of Forest, Environmental, and Natural Resource Policy Discussion Paper 1-2011*. University of Natural Resources and Applied Life Sciences: Vienna, Austria.

challenges to effective inter-sectoral coordination are further complicated at the transboundary level by disparate approaches to and differing levels of progress in achieving coherence or coordination across sectors.

Climate adaptation governance also requires more ***effective vertical integration***, or coordination among levels of water governance.[14] Vulnerabilities and adaptive capacities vary across communities and localities, yet the causes and solutions occur at multiple levels. At the transboundary level, basin-wide planning and approaches to adaptation are critical, but it is equally important that local realities inform policies and actions at regional and international levels. At the international or global level, critical decisions about allocation of resources and priorities for adaptation are made through treaty negotiations (such as the UNFCCC), and in the creation of "soft law" and donor commitments.

In particular, climate impacts disproportionately affect disadvantaged social groups, which in turn depend greatly on effective local institutions to ensure access to decision-making and assets for improved climate resilience.[15] Local participation and clear accounting for community- and household-level coping capacities and strategies is critical, but much of the experience to date has shown that effective local involvement remains a major challenge.[16] Local knowledge must also feed back into national and basin-wide policies and inform implementation at that level, further stressing the need for effective coordination.

2.2.3 Effective public and stakeholder engagement

A critical aspect of climate adaptive governance that has been a focus of international water institutions, and increasingly integrated into legal agreements, is the need for more active involvement of a diverse array of stakeholders in basin-level decision-making. Many of these stakeholders lack capacity to engage meaningfully in these processes. For example, at the regional level, the 1992 Convention of the Protection and Use of Transboundary Watercourses, and International Lakes (the UNECE Water Convention) and its 1999 Protocol on Water and Health, establish norms for public involvement in the management of international watercourses in the UNECE region. These norms are, in turn, informed by the norms of international law, including the Aarhus Convention on Public Participation in Environmental Decision-making.[17]Several basin-level agreements also reflect a commitment to involving stakeholders throughout the basin in decision-making, although in practice, this has faced serious challenges.[18]

14 *Ibid.*

15 Agrawal, A. and Perrin, N. (2008). "Climate Adaptation, Local Institutions, and Rural Livelihoods," *IFRI Working Paper # W08I-6*. University of Michigan: Ann Arbor, MI, U.S.A.

16 Madzwamuse, M. (2010). *Climate Governance in Africa: Adaptation Strategies and Institutions*. Heinrich Böll Stiftung: Cape Town, South Africa.

17 *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* (The Aarhus Convention), agreed to 25 June 1998, entered into force 30 October 2001, (2161 U.N.T.S 447, 38 I.L.M. 517); Bruch, C. (2002). *The New Public: The Globalization of Public Participation*. ELI: Washington, D.C., U.S.A.

18 For example, the Convention on the Sustainable Management of Lake Tanganyika includes the principle of participation, "…by virtue of which concerned and affected natural and legal persons and Lake Basin communities must be given the opportunity to participate, at the appropriate level, in decision-making and management process that affect the Lake Basin…" in Article 5, which outlines the guiding principles of the Treaty (2338 U.N.T.S. 45). Other treaties focus on access to information as the basis of public involvement, including the Convention on Cooperation for the Protection and Sustainable Use of the

Stakeholder engagement in adaptation planning, implementation, monitoring, and evaluation is critical for several reasons. First, as noted above, adaptation strategies will need to be integrated into local and national development (and sectoral) plans and projects, and will be implemented mainly at those levels. This will require effective and on-going engagement of local individuals, communities, and formal and informal institutions to ensure that these policies, plans, and activities reflect the actual and evolving vulnerabilities, adaptive capacities, coping mechanisms, needs, and priorities of local populations, and that they are in line with national water management and development policies. Second, there is a widespread lack of understanding about climate science and climate change projections, and many misconceptions about the nature, extent and consequences of climate impacts.[19] Effective public involvement can help to raise awareness and understanding of the vulnerabilities, impacts and potential adaptation measures available for responding, and can also clarify where there may be competing values related to the uncertainty surrounding climate risks.

Adaptation often requires behaviour change and this, in turn, requires that stakeholders feel enough responsibility to actively participate in decision-making and implementation of adaptation activities. A high level of stakeholder engagement and "two-way" dialogue on these issues is often necessary to ensure that people understand, agree, and commit to such change. This is further complicated by the fact that climate impacts disproportionately affect those with the fewest resources to cope with them – historically disadvantaged or marginalised groups, including women, youth, elderly, cultural minorities, indigenous peoples, and so on. Giving a "voice" these groups in adaptation decision-making is particularly challenging because they lack formal and legitimate representation by those most capable of participating. Special consideration (and, often, additional resources) must therefore be given to ensure that these groups are effectively engaged and equitably represented. A more thorough exploration of this set of issues is provided in Chapter Four.

2.2.4 Increasing resilience through the ecosystem approach

The impacts of climate change on freshwater systems will not take place in isolation. Non-climate stressors – such as population growth, urbanization, and increasing development – act synergistically with climate impacts to affect the quality and quantity of freshwater. Thus, among the highest priority adaptation measures is finding effective policy, legal, and institutional mechanisms for increasing the resilience of the watercourse ecosystem itself to both climate- and non-climate impacts. This includes protecting and maintaining environmental flows, taking active measures to regulate the introduction and management of invasive species, integrated land-use, and water management practices, among others.[20] Environmental flows – the quality, quantity and timing of freshwater flows – are particularly critical to maintaining ecosystem health and resilience, especially in basins that are already subject to significant levels of abstractive use and pollution.[21]

Danube River (Art. 14) (1994 Convention on Cooperation for the Protection and Sustainable Use of the Danube River, *Multilateral Agreements* 994/49). Moreover, several treaties have developed guidance to facilitate public participation in decision-making. *See* e.g., Southern African Development Community (SADC) (2005). *Regional Water Policy,* section 10; and SADC (2010). *Guidelines on Strengthening River Basin Organizations: Stakeholder Participation.* SADC Secretariat: Gaborone, Botswana.

19 Few, R. *et al*. (2006). "Public Participation and Climate Adaptation," *Tyndall Centre Working Paper No. 95*. Tyndall Centre for Climate Change Research: Norwich, U.K.

20 Cook, J. *et al*. (2011). *Shifting Course: Climate Adaptation for Water Management Institutions*. World Wildlife Fund: Washington, D.C., U.S.A.

21 World Bank (2009). *Environmental Flows in Water Resources Policies, Plans, and Projects: Findings and*

The ecosystem approach to IWRM[22] aims to achieve sustainability and ecosystem conservation using a cooperative, ecology-based management system.[23] It incorporates concepts of sustainability, complexity, interconnection of hydrological, ecological and social systems, precaution, participation, accountability, and adaptive management.[24] Governance tools for ecosystem approaches to IWRM therefore show promise as mechanisms for promoting adaptive water governance, as well as the accounting for environmental flows. The ecosystem approach to IWRM also emphasises the need to base management decisions on sound ecological data, which in turn provides information necessary for effective adaptive governance. The most common entry point to the ecosystem approach to IWRM implementation is through the development of a regional governance programme that develops an overall vision and a plan to achieve that vision.[25] These regional programs often coordinate efforts to conduct ecosystem research that will inform management, provide advice for sector-based management, and engage in restoration activities. This would include the incorporation of land-based activities and inter-sectoral impacts (climate and non-climate) on freshwater systems.

Ecosystem-based adaptation (EbA), promoted under the Convention on Biological Diversity (CBD), builds on the ecosystem approach and:

> *"integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change.[26] It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both current climate variability, and climate change."[27]*

With respect to freshwater systems, changes in patterns and timing of freshwater flows are likely to be among the most significant and widespread impacts of climate change.[28] Shifts in overall volume,

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Recommendations. IBRD/World Bank: Washington, D.C., U.S.A.

22 The ecosystem approach to IWRM comprises management approaches that incorporate (1) long-term sustainability as fundamental value, (2) clear, operational goals, (3) sound ecological models and understanding, (4) understanding complexity and interconnectedness, (5) recognition of the dynamic character of ecosystems, (6) attention to context and scale, (7) acknowledgement of humans as ecosystem components, and (8) commitment to adaptability and accountability. The ecosystem approach to IWRM is more fully explained in Chapter One. Christenson, N. *et al*. (1996). "The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Based Management," *Ecological Applications,* Vol. 6, pp. 665-691.

23 Environmental Law Institute (ELI) (2007). *Ecosystem-based Management: Laws and Institutions.* ELI: Washington, D.C., U.S.A., *available at* http://archive.chesapeakebay.net/pubs/calendar/IC_08-23-07_Handout_3_8296.pdf.

24 ELI (2009). *Ocean and Coastal Ecosystem-Based Management: Implementation Handbook.* ELI: Washington, D.C., U.S.A.; and ELI (2008). *Integrated Ecosystem-Based Management of the U.S. Arctic Marine Environment: Assessing the Feasibility of Program Development and Implementation*. ELI: Washington, D.C., U.S.A.

25 *Ibid.*

26 *Convention on Biological Diversity* (CBD), opened for signature 5 June 1992 in Rio de Janeiro, Brazil, entered into force 29 December 1993, (1760 U.N.T.S. 79). For particular references to the ecosystem approach, *see* e.g., CBD (2008). Conference of the Parties (COP) Decision IX/16 A.1(i), Annex II, paras. 15-18 (UNEP/CBD/COP/DEC/IX/16), 9 October 2008; and CBD (2009). *Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change.* Technical Series No. 41, at pp. 9-13, 39-46. Secretariat to the CBD: Montreal, Canada.

27 Colls, A., Ash, N. and Ikkala, N. (2009). *Ecosystem-based Adaptation: A Natural Response to Climate Change*. IUCN: Gland, Switzerland.

28 Cook *et al.* (2011), *supra* note 20.

seasonality and intensity of precipitation shifts in snowpack melting, changes in evapotranspiration – and other eco-hydrological changes – will seriously impact the timing of freshwater flows.[29] Traditionally, water storage and diversion infrastructure to regulate the timing and volume of flows has been an important mechanism for managing climate variability. However, the development of waters has also often negatively impacted aquatic ecosystems and species.[30] New EbA policy, legal, and institutional mechanisms for defining and integrating considerations of environmental flows into allocation and infrastructure decision-making to ensure ecosystem resilience, and to support sustainable provision of ecosystem services, could provide critical support for adaptive water governance.

The uncertainty surrounding climate impacts on flows further complicates this picture. Sectoral allocation policies, water rights systems, and infrastructure decision-making and operating systems will need to retain flexibility to respond to changing water availability and priorities of use over time. In prior allocation systems – and many transboundary systems grant priority to existing or prior uses in allocation decision-making – climate-induced reduction of flows will likely result in prioritisation of consumptive uses of water, rather than maintaining in-stream flows.[31] Environmental flow allocations must therefore be recognised and prioritised as legitimate and enforceable allocations. For example, the South African water law provides for a "basic human needs and ecological reserve" that must be determined at a catchment level for each water body.[32] Only after the reserve has been allocated may other (consumptive and non-consumptive) uses be considered for allocation.[33] In Australia, each basin authority must create a basin plan that includes "planned environmental water" allocations that reduce the water available for consumptive uses.[34] The case study on Tanzania's Pangani Basin below offers insight into the role that environmental flows assessments can support adaptive decision-making in basin-wide management planning.

Case Study 2.1 Environmental flows and ecosystem-based adaptive governance in the Pangani River Basin[35]

The Pangani River Basin in East Africa is critical to agriculture-based livelihoods, drinking water, pisciculture, and hydropower. Climate studies for the basin have projected decreased rainfall during the dry season; increase in evapotranspiration; overall temperature increases; and resultant impacts on seasonality of streamflows, which will vary across sub-catchments. Stream flow variations, when accompanied by reductions in rainfall are predicted to result in an overall decrease in availability for all major sectors in the basin. Human activities, which have seriously degraded and overexploited the resources in the basin, and increase in demand have already led to conflict among users.

The basin is governed by the Pangani Basin Water Board (PBWB), which operates under the Tanzanian Water Act of 2009. It is a multi-stakeholder Board, representing sub-catchment user associations, private sector users, and public institutions, and it is served by a technical Secretariat. In 2002, a new national water policy prioritised water for basic human needs and ecosystem services, providing a mandate for characterising and prioritising environmental flows at the national level. The Pangani River Basin

29 *Ibid.*

30 World Bank (1998). *Environmental Flows in Water Resources Policies, Plans, and Projects: Findings and Recommendations.* IBRD/World Bank: Washington, D.C., U.S.A.

31 Cook *et al.* (2011), *supra* note 20.

32 Republic of South Africa, Act No. 36 ("National Water Act" of 1998), Part 3.

33 *Ibid.*

34 Commonwealth of Australia, Act No. 137 of 2007 ("Water Act" of 2007), Part 1, Sec. 6.

35 Adapted from J. Cook *et al*. (2011), *supra* note 20, and draws on IUCN (no date). *Climate Change Adaptation in the Pangani River Basin*. Pangani River Basin Management Project.

Management Project was started to assist with undertaking a basin-wide, participatory environmental flows assessment and climate vulnerability assessment. These assessments were then used to create a variety of scenarios (different future development pathways) in order to assess allocation choices and their impacts on flows and on livelihoods.

Supportive legal, policy, and institutional frameworks were critical to achieving the goals of this project. The PBWB and its constituents have worked together on an iterative process towards defining basin-wide allocation priorities based on sound information on climate vulnerabilities, the capacities of the ecosystem, and the needs of the population. A decentralised and "nested" institutional approach has also facilitated this process. Users throughout the basin had access to the decision-making processes at a variety of levels.

The Environmental Flows Assessment (EFA) was a critical aspect of basin-wide planning for adaptation. The EFA was resource-intensive and technically challenging. It was important to build the necessary capacity to undertake the EFA, and understand how to apply it to the planning process. However, the assessment process became an important catalyst for adaptive governance reforms. The chosen allocation scenario will be incorporated into the Basin Management Plan (which becomes legally binding), accompanied by a monitoring and evaluation plan to ensure that the program is achieving the desired state of the resource and increasing resilience in the face of on-going climate change.

2.3 Adaptive Water Governance and the Principles of International Water Law

As outlined in the previous section, adaptive water governance strives to foster both social and ecological sources of resilience, and to create and build adaptive capacities by addressing specific governance challenges posed by climate variability and change. This includes: 1) creating or emphasising policies, laws, management practices, and institutional mechanisms that are flexible and facilitate social and institutional learning and knowledge exchange; 2) building mechanisms for effective multi-level governance; 3) fostering broad-based and institutionalised participation of diverse stakeholders in adaptation decision-making, implementation, and monitoring and evaluation; and 4) supporting ecosystem-based governance approaches to maintain freshwater flows and ecosystem resilience in the face of climate change.

The principles and norms of international water law have evolved to address how uses of shared watercourses should be allocated among two or more riparians, and what procedural responsibilities accrue to those States. International water law also provides an important means to facilitate communications among riparians, promoting cooperation, and acting as a mechanism for conflict avoidance or resolution.[36] More recently, environmental protection of shared watercourses has emerged as a major dimension of international water law.[37]

The question posed in this chapter is whether the existing (and progressively developing) principles of international water law strengthen or reinforce the capacity of transboundary basin institutions and riparian States to achieve adaptive governance. This will focus on two of the traditional substantive principles of international water law: equitable and reasonable utilisation, and prevention of significant harm.

It should be highlighted that the realisation of these two principles encompasses the implementation of other norms and procedural requirements of international water law, most notably that of cooperation in the establishment of transboundary agreements and shared management institutions, which

36 Wolf, A.T. *et al*. (2003). "International Waters: Identifying Basins at Risk," *Water Policy,* Vol. 5(1), pp. 29-60, at pp. 51-52.

37 McIntyre, O. (2007), *supra* note 10.

can also be interpreted as a substantive principle primarily composed of procedural requirements. Additional procedural requirements that support cooperation include: stakeholder and public participation, prior notification (and consultation) on activities impacting the shared watercourse, joint monitoring and data sharing, and dispute resolution.[38] These requirements and norms are significant aspects of sustainable and adaptive water management, and are also key elements of the due diligence required to achieve equitable utilisation and prevention of significant harm. In this chapter, they are thus mainly discussed in the context of these two principles of international law. The relevance of these "procedural" norms to climate adaptation overall is discussed in more detail in other chapters, particularly Chapters Three and Four.

2.3.1 Equitable and reasonable utilisation

The principle of equitable and reasonable utilisation was set forth in the 1966 Helsinki Rules of the International Law Association (ILA), which states in Article 4 that each basin State within a transboundary freshwater basin is entitled to a "reasonable and equitable share in the beneficial uses of the waters of an international drainage basin."[39] Article 5 of the Helsinki Rules provides a list of "relevant factors" to consider in determining what amounts to an equitable and reasonable share, including the geography, hydrology, and climate of the basin, as well as a number of factors related to the economic and social needs of the basin States, availability of resources, feasible alternative measures, and the need to avoid causing "substantial injury" to a co-basin State.[40] While the Helsinki Rules have no formal standing or legally binding effect, they have been broadly accepted by the international community, with many of its elements considered reflective of customary international law. Also, many of the rules have been referred to and adopted by international organisations and countries, for instance in the Protocol on Shared Water Systems in the Southern African Development Community (SADC).[41]

The principle of equitable utilisation also found expression as one of (arguably the primary) the guiding principles of the 1997 U.N. Convention on the Non-navigational Uses of Transboundary Watercourses (1997 U.N. Watercourses Convention). This highly influential treaty was preceded by the Draft Articles of the International Law Commission (ILC), which were based on lengthy and thorough study of practice by States in this area.[42] At the time of publication the convention had not yet entered into force. However with Vietnam´s ratification on May of 2014, the convention's entry into force is now imminent.[43] Furthermore, the treaty still commands customary legal authority as the instrument coming closest to a global freshwater treaty. Indeed, in the Gabĉíkovo-Nagymaros

38 McIntyre, O. (2011). "The World Court's Ongoing Contribution to International Water Law: The Pulp Mills Case Between Argentina and Uruguay," *Water Alternatives*, Vol. 4(2), pp. 124-144.

39 International Law Association (ILA) (1966). *The Helsinki Rules on the Uses of the Waters of International Rivers*, Int'l L. Assoc., Rep. of the 52d Conference, adopted at Helsinki, 20 August 1996, *available at* http://www.internationalwaterlaw.org/documents/intldocs/helsinki_rules.html.

40 *Ibid*.

41 Salman, S. (2007). "The Helsinki Rules, the UN Watercourse Convention and the Berlin Rules: Perspectives on International Water Law," *Water Resources Development*, Vol. 23(4), pp. 625-40; and *Protocol on Shared Watercourse Systems in the Southern African Development Community Region* (Revised), entered into force 1995, revised 1998.

42 McIntyre, O. (2007), *supra* note 10.

43 This is the status as of 22 May 2014. International Water Law Project (IWLP) website. "Status of the Water Convention," visited 28 May 2014, *available at* www.internationalwaterlaw.org.

case, the International Court of Justice (ICJ) made explicit reference to the 1997 U.N. Watercourses Convention to support the claim that the principle of equitable and reasonable use is a general right under international law.[44] Additionally, numerous basin and sub-basin agreements adopted after 1997 have been influenced by the Convention: in the Revised SADC Protocol on Shared Watercourses, many of the key provisions were taken from the 1997 U.N. Watercourses Convention almost verbatim.[45] Moreover, the 1997 U.N. Watercourses Convention has recently seen a resurgence of interest in the international community with a number of new Parties joining as members, which has put the Convention on track for entry into force.[46]

Part II of the 1997 U.N. Watercourses Convention elaborates on the general principles of the Convention, the first of which are equitable and reasonable utilisation, and participation.[47] In particular, the Convention requires States to use and develop international watercourses "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."[48] Watercourse States must participate in the use, development, and protection of the watercourse in an equitable and reasonable manner.[49] This includes "both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof..."[50] Similar to the Helsinki Rules, Article 6 of the 1997 U.N. Watercourses Convention provides guidance on what constitutes equitable and reasonable utilisation in the form of a non-exhaustive (and non-prioritised) list of factors to be considered in making specific allocation determinations. These factors include:

- Geographic, hydrographic, hydrological, ***climatic***, ecological, and other factors of a natural character;
- The social and economic needs of the watercourse States concerned;
- The population dependent on the watercourse in each watercourse State;
- The effect of the use or uses of the watercourse in one watercourse State on the other watercourse States;
- Existing and potential uses of the watercourse;
- Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect; and
- The availability of alternatives, or corresponding value, to a particular planned or existing use.

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44 *Gabĉíkovo-Nagymaros Project (Hungary v. Slovakia), Judgment,* I.C.J. Rep. 1997, p. 7*,* para. 85 (hereinafter referred to as "*Gabĉíkovo-Nagymaros*"); and Rieu-Clarke, A. and Loures, F. (2012)."Should We Care Whether the UN Watercourses Convention Enters into Force?" IWLP Blog, *available at* http://www.internationalwaterlaw.org/blog/2012/07/22/should-we-care-whether-the-un-watercourses-convention-enters-into-force-part-i/.

45 *Ibid.*

46 *Ibid.*

47 *United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses* (hereinafter "1997 U.N. WATERCOURCES CONVENTION"), Adopted by the General Assembly of the United Nations on 21 May 1997. Not yet in force. *See* General Assembly resolution 51/229, annex, *Official Records of the General Assembly, Fifty-first Session, Supplement No. 49* (A/51/49), Art. 5.

48 *Ibid.* at Art. 5, para. 1.

49 *Ibid*. at Art. 5, para. 2.

50 *Ibid.*

In determining what constitutes equitable and reasonable uses, States are to "enter into consultations in a spirit of cooperation," and consider all of the above factors as a whole. Moreover, the principle of equitable utilisation is closely connected to that of equitable participation, or the active participation and cooperation of watercourse States in the use, development, and management of shared waters.[51] Common management arrangements or institutions are thus promoted within the scope of these principles as the primary mechanisms for achieving implementation. A thorough analysis of the role of institutional arrangements in facilitating transboundary adaptation, which is also a critical aspect of adaptive governance, is provided in Chapter Three.

Basin-wide vulnerability assessments, as well as adaptation planning, implementation and monitoring require institutional mechanisms to facilitate and support joint planning, information sharing, and coordination among local, national, and basin-wide adaptation initiatives. Basin-level institutions can also provide an important forum for engaging a broad range of relevant stakeholders to determine trade-offs and priorities among member States related to risk-bearing (or sharing), and to identify the likely benefits and costs of various adaptation options.

The climate, along with hydrology and other relevant physical characteristics of the resource are among the factors listed in the 1997 U.N. Watercourses Convention as relevant to determining equitable and reasonable use. Additionally, a number of factors are listed that could relate to vulnerability of both watercourse States and their populations (i.e., the social and economic needs of watercourse States and the population dependent on the watercourse). Moreover, the "economy of use of the water resource" must be considered, potentially providing the basis for requiring more efficient uses and conservation measures as part of adaptation to decreased flows.[52]

The weight given to any one factor in the list, however, must be determined by comparing it to the other factors, all of which must be considered as a whole.[53] Thus, the guidance provided on how to actually determine what constitute equitable and reasonable uses is vague and there is neither an explicit focus on climate vulnerabilities, nor the role of adaptive management or adaptation measures. The indeterminacy in this articulation thus begs the question of how this principle is being interpreted by States (in the form of basin level treaties and cooperative activities), the international legal community, and international courts.

The ILA's 2004 revision of the Helsinki Rules – the Berlin Rules on Water Resources – set about to "provide a clear, cogent, and coherent statement of the customary international law that applies to waters of international drainage basins…"[54] The authoritative weight of the Berlin Rules is controversial, with many scholars arguing that they went too far in their attempt to "progressively develop"[55] the law of international watercourses, maintaining that the results were thus not representative of the actual status of customary law.[56] However, it is also arguable that the Helsinki Rules, and even the 1997

51 McIntyre, O. (2008). "*The Relative Priority Accorded to Environmental Protection under International Water Resources Law," Environmental Policy and Law*, Vol. 38(3), pp. 131-141.

52 Tarlock, D. (2000). "How Well Can International Water Allocation Schemes Adapt to Global Climate Change?" *Journal of Land Use and International Law*, Vol. 15, pp. 423-429.

53 1997 U.N. WATERCOURCES CONVENTION (1997), *supra* note 47, at Art. 6, para. 3.

54 ILA (2004a). *Berlin Conference (2004) Water Resources Law, Fourth Report (The Berlin Rules on Water Resources)*, Preface, p. 3.

55 *Ibid*.

56 *See* e.g., ILA (2004b). "Water Resources Committee Report Dissenting Opinion," ILA Berlin Conference (2004), *available at* http://www.internationalwaterlaw.org/documents/intldocs/ila_berlin_rules_dissent.html.

U.N. Watercourses Convention, are outdated and not entirely reflective of the enormous growth of customary international environmental and water law practice. As such, the Berlin Rules set about to correct that and further the development of this practice through the enunciation of international best practices and emerging norms.

The Berlin Rules affirm the principle of equitable utilisation to be "universally accepted as basic to the management of…" international waters.[57] The factors to be considered in determining equity in allocations are similar to those in the 1997 U.N. Watercourses Convention and the Helsinki Rules, but expand to include sustainability of proposed and existing uses, and minimisation of environmental harm. These additions are important to the consideration of whether the principle is supportive of climate adaptation at the basin level. Arguably, to achieve ecological integrity and sustainability, watercourse States will need to undertake cooperative vulnerability assessment, and to plan and implement adaptive measures at the basin level as climate impacts are increasingly felt.

The Berlin Rules also articulate the principle of reasonable and equitable utilisation as an obligation to "manage the waters of an international drainage Basin in an equitable and reasonable manner with due regard for the obligation not to cause significant harm to other basin States."[58] Management is defined as including "development, use, protection, allocation, regulation, and control of the waters," which would comprehend a broader scope of obligations than simply an equitable outcome, and focuses not on the right to an equitable share of the beneficial uses of shared waters, but rather on the obligation to jointly manage and develop shared waters.[59] The Berlin Rules stress the need for equitable process, including the need to have due regard for avoiding significant harm to other watercourse States.[60] This would support an integrated reading of the procedural principles that are required to implement equitable and reasonable utilisation – namely, the duties to cooperate;[61] to ensure public participation in decision-making;[62] to refrain from undertaking acts that could cause significant harm to other watercourse States;[63] to undertake impact assessment of programs, projects and activities that may significantly impact the resource;[64] to share information and data;[65] and to broadly ensure that equitable use is sustainable use that protects the ecological integrity of the resource.[66]

This more comprehensive interpretation of the principle of equitable utilisation encompasses many of the aspects of adaptive governance systems. As discussed in the previous section, maintaining the ecological integrity of the resource actually increases the resilience of the resource in the face of climate impacts. The principle of sustainability inherently requires watercourse States to consider

57 ILA (2004a), *supra* note 54 at Art. 12, Commentary.

58 *Ibid*.

59 It should be noted that this interpretation of the principle was highly contentious and was disavowed in the Water Resources Committee Report's Dissenting Opinion that accompanied the publication of the Rules. ILA (2004b), *supra* note 56.

60 ILA (2004a), *supra* note 54, at Art. 12, Commentary.

61 *Ibid*. at Art. 11.

62 *Ibid.* at Art. 18.

63 *Ibid.* at Art. 16.

64 *Ibid.* at Arts. 29-31.

65 *Ibid*. at Art. 56.

66 *Ibid*. at Art. 22. This interpretation would also support the literature of scholars who believe this integrated reading is already required by the 1997 U.N. WATERCOURCES CONVENTION. *See* e.g.*,* McCaffrey, S. (2007). *The Law of International Watercourses*, *2d Ed*. Oxford University Press: Oxford, U.K.; and Rieu-Clarke *et al*. (2012), *UN Watercourses Convention User's Guide*. University of Dundee: Dundee, Scotland.

the future state of the resource. Both climate and non-climate stressors will play a role in determining that state. Procedural requirements, including data and information sharing, conducting iterative impact assessments, and inclusion of stakeholders in decision-making also strengthen the adaptive capacity of transboundary management systems. The uncertainty surrounding climate impacts on water requires on-going generation and sharing of information and data (through joint monitoring, impact assessments, and other means) to continually assess both the changing status of the resource, and the ways in which policies and management decisions are impacting shared waters. Additionally, ensuring equitable management of shared watercourses implies the need to account for the various trade-offs and potential impacts of adaptation activities being undertaken at the national and local levels in each of the watercourse States, as well as the potential for differentiated impacts and benefits of various basin-wide adaptation approaches. Identification of these potential trade-offs and impacts would, in turn, require effective stakeholder engagement at all levels, and a high level of coordination and information sharing among watercourse States.

Significantly, the Berlin Rules also explicitly incorporate the precautionary principle, stating that:

> *"… in implementing obligations … States shall take all appropriate measures to prevent, eliminate, reduce, or control harm to the aquatic environment where there is a serious risk of significant adverse effect on or to the sustainable use of the waters even without conclusive proof of a causal relation between an act or omission and its expected effects."*[67]

This further indicates that climate impacts on the resource must be considered, regardless of the uncertainty surrounding their specific manifestations, when determining whether a use of international waters is reasonable and equitable.

There is evidence of support for the Berlin Rules' interpretation of the principle of equitable utilisation in the language of the recent judgment of the ICJ in the *Pulp Mills* case.[68] In that judgment, the Court reaffirmed the principle of equitable and reasonable use, stating that it requires a "balance between Parties' rights and needs to use the river for economic and commercial activities on the one hand, and the obligation to protect it from any damage to the environment that may be caused by such activities on the other."[69] Thus, environmental protection is integral to decisions regarding the equitable balancing of States' interests in an international watercourse.[70] Indeed, the Court made a clear linkage between equitable and reasonable utilisation and sustainable development of the resource, citing "the need to strike a balance between the use of the waters and the protection of the river consistent with the objectives of sustainable development."[71]

Moreover, the Court acknowledged a "functional link" between the procedural and substantive obligations related to equitable and sustainable management of transboundary watercourses.[72] The procedural duties, including those outlined in the discussion of the Berlin Rules above, were noted by the Court to be "narrower and more specific, so as to facilitate the implementation … through a

67 *Ibid.* at Art. 23.

68 *Pulp Mills on the River Uruguay* (Argentina v. Uruguay), *Judgment*, I.C.J. Rep. 2010, p. 14 (hereinafter referred to as "*Pulp Mills*").

69 *Ibid*. at para. 175.

70 McIntyre (2007), *supra* note 10; Arts. 20-25 of the UNWC also support integration of environmental protection considerations.

71 *Pulp Mills*, *supra* note 68, at para. 175.

72 McIntyre (2007), *supra* note 10.

process of continuous consultation between the parties concerned."[73] The Court also emphasised the importance of institutional arrangements for facilitating coordination and cooperation in a shared basin. As noted above, these are all important aspects of adaptive water governance regimes.

Taking this broadening of the scope of the principle into account, how well does equitable and reasonable use support the proposed characteristics of adaptive water governance? It appears that the progressive development of the principle, as reflected in the *Pulp Mills* case, affirms and supports many of the components that would be required of an adaptive water governance regime. The inclusion of sustainability as an integral component of equitable outcomes is notable in this regard. However, the inherent uncertainties surrounding climate impacts, vulnerabilities, and adaptation leave open the question of how to effectively balance the competing considerations that make up the calculus of what constitutes sustainable development and equitable utilisation across borders. The requirement to adhere to the precautionary principle,[74] and the critical nature of procedural obligations such as prior notification, consultation, and information sharing, support the inclusion of climate change considerations in the balancing of factors in determining what can be equitable and reasonable use of shared waters. However, more specificity will be necessary to guide watercourse States on how to tailor the use of these requirements to achieve adaptive governance.

Innovations in Adaptive Governance: Treaty Flexibility – The International Boundary and Water Commission between the U.S. and Mexico

Given the pervasive lack of baseline data in many transboundary basins, and the high levels of uncertainty surrounding the impacts of climate variability and change on those basins, the focus of adaptive governance must be to develop realistic mechanisms that enable transboundary water institutions to cope with uncertainty in decision-making. The principle of equitable and reasonable utilisation was drafted to be intentionally ambiguous so as to enable the flexibility necessary to cope with changing circumstances.[75] Yet, at the basin level most agreements traditionally lack robust mechanisms to address fluctuations and permanent alterations in flow patterns, water availability, and other relevant climate impacts.[76] An example of innovations in flexibility mechanisms for shared water agreements is provided in the case study on the International Boundary and Water Commission (IBWC).

The IBWC was established in 1899 to implement the boundary water agreements between the United States (U.S.) and Mexico, and to settle any disputes that might arise with respect to those agreements. This includes the distribution and regulation of the waters of the Colorado River shared between the two countries. The Commissioners of the IBWC meet frequently, and each section (Mexican and U.S.) has a full technical and legal staff, and offices close to the borders to oversee project and program implementation.[77] In addition to existing agreements, the Commissioners also

73 *Pulp Mills*, *supra* note 68, at para. 177.

74 The precautionary principle is also referenced in the UNECE *Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (hereinafter referred to as "UNECE Water Convention"), adopted 17 March, 1996, Helsinki, Finland, entered into force 6 October 1996 (1966 U.N.T.S. 269; 31 I.L.M. 1312 (1992)), Art. 2, para. 5(a).

75 McIntyre, O. (1998). "Environmental Protection of International Rivers," *Journal of Environmental Law*, Vol. 10(1), pp. 79-91.

76 Fischhendler (2004), *supra* note 11.

77 *Ibid.*

have the authority to make recommendations to their respective governments to resolve new or anticipated boundary or water issues.[78]

In addition to the on-going coordination between Commissioners, the 1944 Treaty for the Utilization of the Waters of the Colorado and Tijuana Rivers and the Rio Grande (1944 Treaty) established a flexibility mechanism for undertaking rulemaking pursuant to the Treaty. This so-called "minute process" records formal decisions of the Commissioners in the form of minutes in both English and Spanish, and are signed by both Commissioners. The minute is then forwarded on to each government within three days. If neither government expresses approval or disapproval in 30 days, it is considered approved (unless approval is specifically required by the 1944 Treaty). This process has proven useful in securing short-term flexibility in the framework of long-term compliance with the Treaty.[79]

In 2007, seven U.S. basin states concluded a Shortage Sharing Agreement in response to critical water shortages. The Agreement contained an implicit expectation that a portion of the shortage would be borne by Mexico.[80] Following the signing of the Agreement, the U.S. approached Mexico to begin negotiations on its participation. This "Joint Cooperative Process" involved a series of discussions between the U.S. and Mexico, statements, and agreements, all codified in IBWC Minutes. Each stage clarified the substantive issues upon which negotiations were based. Two key ideas were behind the process: 1) a joint cooperative process would address issues between the countries; and 2) the process would involve stakeholder participation.[81]

As part of the process, the IBWC established a binational Core Group to address key issues. The Core Group established four Working Groups to address specific technical issues consisting of representatives of diverse stakeholder groups, including government agencies, NGOs, and academic research organisations.[82] This, along with a previously established Citizen Forum, enabled broad consultation with various stakeholders in the decision-making process. [83] A binational Consultative Council was later established as an umbrella group to the Working Groups to take their information and make recommendations to the Commissioners on appropriate legal and policy measures.

In 2011, the Council recommended the conclusion of a new agreement to provide for new water sources, improve system operations, minimise the impact of shortages, allow Mexico to store water in the U.S., conserve water, and identify water for environmental purposes.[84] On November 20, 2012, Minute 319 was agreed as an amendment to the 1944 Treaty. Minute 319 provides for a series of interim measures, effective through the end of 2017, with a comprehensive Minute to be negotiated in the meantime. The measures provide for the following: setting rules for sharing of both surpluses

78 *Ibid*.

79 Umoff, A. (2008). "An Analysis of the 1944 U.S.-Mexico Water Treaty: Its Past, Present, and Future," *Environs: Environmental Law and Policy Journal, University of California, Davis, School of Law*, Vol. 32(1), pp.69-98.

80 Southern Nevada Water Authority (2010). "Legal Mechanisms and Management Under Continuing Drought: Implications of Lower Lake Levels," Colorado River Commission of Nevada 2010 Symposium.

81 Spener, S. (2012) "Colorado River U.S.-Mexico Joint Cooperative Process," PowerPoint presentation by IBWC, on March 7th, 2012, Colorado River Citizens Forum Meeting.

82 Gimbel, J. (2011) "Colorado River Conservation Board, the United States and Mexico: Bi-National Negotiations on the Colorado River," Presentation at the Colorado Water Congress Summer Conference.

83 Spener (2012), *supra* note 81.

84 *Ibid.*

and shortages of water in the Colorado River and for storage of the Mexican allocation in Lake Mead as a buffer against shortages; establishing an environmental flows requirement; providing for a water exchange and on-going adjustments due to infrastructure damage in Mexico; and recommending a series of cooperative projects between the U.S. and Mexico. The use of interim measures and pilot environmental projects is specifically geared to enable adaptive management, allowing for evaluation of the projects and measures to inform future measures.

The surplus rules in Minute 319 entail an additional allocation of flows to Mexico when the reservoir reaches certain levels. During shortages, when the levels of Lake Mead drop below designated elevations, the agreement allows reduced flows to Mexico, specifying the reductions where the 1944 Treaty failed to do so. Minute 319 also allows Mexico to offset the reductions when it has stored surplus. If the level of Lake Mead drops below another designated level, the parties agree to consult as to the need for further reductions.

The Minute also contains a new provision for environmental flows and habitat restoration, which adds to a 2008 base-flow provision. A five-year pilot program will provide a new allocation for environmental flows, and then evaluate the response of the ecosystem and other outcomes and identify options for future cooperative actions on ecosystem enhancement.

With respect to irrigation, the two countries agreed to cooperate in the building of infrastructure that could provide conservation benefits. The U.S. is to contribute USD$21 million to infrastructure and environmental projects in Mexico, and in consideration for the infrastructure investments Mexico is to provide a one-time transfer of 124,000 acre-feet of water to the U.S. A binational coalition of NGOs will further provide water for base flow, obtained through purchase of agricultural permits in Mexico. Finally, the U.S. and Mexican governments, together with environmental groups, will provide enough water to mimic a flood event with the goal of creating 2,000 acres of new wetland habitat in the Delta.

The Minute agreement formulates several mechanisms for adaptively managing allocation under existing and potential changes in flows, while taking into consideration the impacts of those changes on the shared freshwater ecosystem. The process that was undertaken to reach the interim agreement was highly participatory, involving stakeholders beyond the national and state governments, including water user groups, environmental NGOs, tribes, and others, and formalising arrangements to include these stakeholders on an on-going basis. Moreover, the involvement of states, local governments, and federal agencies required effective multi-level coordination – a process that built on decades of trust building through the established IBWC, yet still took years to negotiate. Multiple purposes of water were also considered, requiring horizontal integration of the environmental, irrigation, energy, and other sectors in the negotiations through the establishment of the Working Groups.

The Agreement also includes provisions for information exchange mechanisms. Water information is to be provided by the U.S. to Mexico, and there are several provisions for evaluating the underlying hydrology of the river, the effects of climate change, and the implementation of the provisions of the agreement. These requirements provide for learning during the five-year period of the agreement, and also promote science-based decision-making. This includes new considerations for increasing allocation to environmental flows as an adaptive management experiment. The Minute also engaged issues outside water allocation to provide equitable benefit-sharing opportunities. For instance, during negotiations Mexico linked its agreement on shortage sharing (a temporary loss of allocation) to the benefits of participating in surplus sharing, and a joint commitment to environmental restoration.[85]

85 Spener (2012), *supra* note 81.

The overarching principle guiding these negotiations and the agreement was the equitable sharing of benefits and burdens of changes in flows in the shared resource. The process relied on a flexible and participatory institutional framework that provided for cooperative problem solving among the parties, adaptive management of the commitments made, and a structure and precedent for future negotiations.[86]

2.3.2 Prevention of significant transboundary harm

The principle of equitable and reasonable utilisation requires the balancing of several non-weighted factors. However, there are additional principles that, when taken together with those factors, appear to require more careful consideration or prioritisation in the determination of what constitutes equitable and reasonable use.[87] Perhaps the most important among these is the principle that calls on riparians to use their shared waters in a way that prevents significant harm and minimises damage to each other. This "no harm" rule is widely recognised under customary international law broadly, and specifically in international water law.

The Helsinki Rules do not include a separate reference to the "no harm" rule, but rather reflect that the harm to a State that may result from the use of the shared watercourse by another State is one of the factors to be considered in determining equitable and reasonable utilisation. In the drafting of the 1997 U.N. Watercourses Convention, there was much debate over the appropriate relationship between the two principles – whether one should be subordinate to the other, or both considered with equal weight.[88] Ultimately, the language reflected an uneasy compromise that left room for interpretation. Article 7 of the 1997 U.N. Watercourses Convention requires that watercourse states shall:

> *"… in utilizing an international watercourse in their territory, take all appropriate measures to prevent the causing of significant harm to other watercourse States; (2) where significant harm nonetheless is caused to another watercourse State, the States whose usage causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard for the provisions of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation."*

Not surprisingly, lower riparians have favoured the interpretation that this construction left the principles on equal footing, while upper riparians have tended to support the reading that the "no harm" principle is subordinate to that of equitable utilisation, given the language requiring "due regard" for the multi-factor test proscribed in Articles 5 and 6.[89]

The Berlin Rules take a different approach, requiring that, "Basin States shall in their respective territories manage the waters of an international drainage basin in an equitable and reasonable

86 The Crop Site (2012). "U.S., Mexico Sign Landmark Water-Sharing Agreement for Colorado River," November 30, 2012, *available at* http://www.thecropsite.com/news/12542/us-mexico-sign-landmark-watersharing-agreement-for-colorado-river.

87 McIntyre (2007), *supra* note 10.

88 *See* Selected Preparatory Documents, Convention on the Law of the Non-navigational Uses of International Watercourses, *available at* http://legal.un.org/avl/ha/clnuiw/clnuiw.html; see e.g., International Law Commission (1994). *Draft Articles and Commentaries Thereto Adopted by the Drafting Committee on Second Reading: Articles 1-33*, reproduced in *Yearbook of the International Law Commission 1994*, Vol. II, Part Two, para. 222 (A/CN.4/L.493 and Add.1 and Add.1/Corr.1 and Add. 2, 12 July 1994).

89 Salman (2007), *supra* note 41.

manner having due regard for the obligation not to cause significant harm to other basin States."[90] In the Commentary, the authors state that, "the interrelation of these obligations is meant to be determined on a case-by-case basis through the balancing process required by the equitable utilization principle." While this interpretation is subject to debate, the Berlin Rules nevertheless arguably present the two principles as having equal weight.[91]

As noted above, in the *Pulp Mills* case the ICJ aligned the concept of equitable and reasonable utilisation with that of sustainable development of the resource. While not explicitly clarifying the relationship between the principles of equitable utilisation and the duty to prevent significant harm, the Court's emphasis on the importance of environmental concerns in the balancing of relevant factors lends itself to a reading that the two are inextricably linked by a duty on the part of shared watercourse States to strive for sustainable use and development of the resource as a prerequisite of achieving an equitable outcome. In turn, this implies the relevance of the rich body of international environmental law that has developed over the last several decades, and the need to apply those principles – including precaution, prevention of environmental harm, and sustainability (including responsibilities to future generations) – to decisions about shared waters.[92]

The Court further elaborated on the principle of prevention by noting that the procedural duties that fall generally under the duty to cooperate – prior notification, information sharing, and consultation – are "intrinsically linked" with the due diligence required of States in implementing the principle.[93] Even more importantly, the Court found that, as a matter of international law, the due diligence required of States to prevent significant transboundary harm has evolved to require watercourse States to undertake impact assessments for any activity that may cause transboundary harm.[94]

Taken together with the broad interpretation of the principle of equitable utilisation, the Court's clarification of the due diligence required to prevent transboundary harm in shared watercourses significantly expands the scope of adaptive governance tools considered to be duties under customary international water law. This is particularly true of the duty to undertake a transboundary environmental impact assessment (TEIA). A TEIA is "[a]n assessment of the likely or potential environmental impacts of [a] proposed activity."[95] While differing political regimes, regional environmental priorities, and cultural values have contributed to variations in EIA processes and standards, the general elements of the EIA process are relatively consistent, at least in principle.[96] This includes prior notification and consultation among parties potentially affected by the project or development, including the public. While the Court in *Pulp Mills* did not elaborate any specific requirements for a TEIA process, there is a great deal of customary practice among States sharing international watercourses, as well as regional treaties guiding TEIA implementation across borders.[97] TEIAs thus provide a specific

90 ILA (2004a), *supra* note 53, at Art. 12, Commentary.

91 Salman (2007), *supra* note 41.

92 McIntyre (2011), *supra* note 38.

93 *Pulp Mills*, *supra* note 68, at paras. 102-115.

94 *Ibid.* at para. 204.

95 Troell, J. *et al*. (2006). "Transboundary Environmental Impact Assessment as a Tool for Promoting Public Participation in International Watercourse Management," in Jansky, L. and Uitto, J.I. (eds.), *Enhancing Participation and Governance in Water Management: Traditional Approaches and Information Technology*. United Nations University Press: Tokyo, Japan.

96 Pulp Mills, *supra* note 68, at paras. 203–205

97 *Ibid.* The 1991 *UNECE Convention on Environmental Impact Assessment in a Transboundary Context* (the Espoo Convention) is arguably the most authoritative and specific international legal codification of TEIA.

framework for operationalizing many of the procedural requirements that are integral to both the principle of equitable and reasonable utilisation, and that of prevention of significant harm.

Impact assessments can also be a critical tool for mainstreaming climate adaptation considerations into project and sectoral planning and development. In particular, Strategic Environmental Assessment (SEA), which broadens the scope of assessment of policies, plans and programs, is a tool that can be used to place a "climate lens" on decisions related to basin-wide planning processes.[98] While impact assessments have traditionally looked at the impacts of projects, programs, and policies on the environment, they can also be a useful tool to assess the vulnerability of policies, plans, programs, and projects to climate risks; identify whether they might lead to increased risks or maladaptations; and help identify adaptation measures to mitigate climate risks and impacts.[99]

Impact assessment legislation often requires the consideration of four categories of impacts that can be used to consider the effects of climate change on many projects affecting waters:

1. Long-term impacts;
2. Cumulative impacts (the ways in which direct impacts of climate change interact with each other or non-climate impacts over time);
3. Long-term impacts; and
4. Irreversible impacts.[100]

Despite the potential utility of impact assessment in mainstreaming climate considerations, the frequent lack of available climate data and the uncertainties surrounding various predicted scenarios complicate the effective incorporation of climate considerations in the assessment process. In order to realise this potential, more specific requirements or guidance on how to assess climate impacts on projects (or, in the case of SEA, policies, plans, and programs) in the context of international waters is necessary. Experience with the implementation of transboundary impact assessment has illustrated the need for specificity in the terms of agreement on procedure to guide State action and avoid the process becoming simply a "rubber stamp" that ultimately undermines adaptive capacity. This could take the form of protocols to existing basin or regional agreements. Lessons from implementation of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context would be particularly salient in this regard.[101]

As a practical matter, the Espoo Convention requires that the country of origin open its EIA and decision-making procedures to the public and authorities in neighboring, potentially affected States, taking their comments into account. *Ibid*.

98 Marsden, S. (2008)*. Strategic Environmental Assessment in International and European Law: A Practitioner's* Guide. Earthscan: London, U.K.

99 *Ibid.*

100 ELI (2011). *Legal and Policy Tools to Adapt Biodiversity Management to Climate Change.* ELI, Washington, D.C., U.S.A.

101 *Convention on Environmental Impact Assessment in a Transboundary Context* (hereinafter referred to as "The Espoo Convention), adopted 25 February 1991 in Espoo, Finland, entered into force 10 September 1997, (1988 U.N.T.S. 310); and Troell (2006), *supra* note 95.

2.4 Principles of International Environmental Law and their Contribution to Adaptive Water Governance

In the *Pulp Mills* case, the ICJ affirmed that emerging norms of international environmental law should inform the interpretation of pre-existing water agreements.[102] This section explores some of these principles in more detail, focusing on how their application to international water law may expand the potential for more adaptive approaches to governing transboundary waters. In particular, this section looks at the principles of sustainability, precaution, and the ecosystem approach, and how these progressively developing norms of international environmental law are expressed in key multilateral environmental agreements.

2.4.1 Sustainability

The principle of sustainable use or sustainable development of natural resources, including water, was first defined in the *"Brundtland Report"* as, "Development that meets the needs of current generations without compromising the ability of future generations to meet their own needs."[103] The principle, in various forms, has since been incorporated in several treaties and other international instruments.[104] According to Sands, there are four recurring elements that appear to define the principle in international agreements:

1. Preservation of natural resources for the benefit of future generations/intergenerational equity;
2. The aim of exploiting natural resources in a manner that is sustainable, rational, or prudent/ sustainable use;
3. Equitable use of resources from an inter-generational but also a transboundary perspective; and
4. Integration of environmental considerations into economic and development plans, programs and projects/integration principle.[105]

102 *Pulp Mills*, *supra* note 68, at para. 204.

103 World Commission on Environment and Development (1987). *Our Common Future*. Oxford University Press: Oxford, U.K.

104 Sands, P. and Peel, J. (2012). *Principles of International Environmental Law, 3d Ed.* Cambridge University Press: Cambridge, U.K. Treaties that incorporate the principle of sustainable use or development include the *Cartagena Protocol on Biosafety to the Convention on Biological Diversity* (hereinafter referred to as the "Cartagena Protocol"), adopted 29 January, 2000, in Cartagena, Venezuela, entered into force 11 September 2003 (2226 U.N.T.S. 208); *United Nations Framework Convention on Climate Change* (hereinafter referred to as "UNFCCC"), adopted June 1992 in Rio de Janeiro, Brazil, entered into force 21 March 1994 (1771 U.N.T.S. 107); *Kyoto Protocol to the UNFCCC* (hereinafter referred to as "Kyoto Protocol"), adopted 11 December 1997, entered into force 16 February 2005 (UN Doc FCCC/CP/1997/7/Add.1); *United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa* (hereinafter referred to as "UNCCD"), adopted 17 June 1994 in Paris, France, entered into force 26 December, 1996 (1954 U.N.T.S. 3); *United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* (hereinafter referred to as "U.N. Fish Stocks Agreement"), opened for signature 4 August 1995, entered into force 11 December 2001, (2167 U.N.T.S. 88); and the *United Nations Convention on the Law of the Sea* (hereinafter referred to as "UNCLOS"), opened for signature 10 December 1982, entered into force 16 November 1994 (1833 U.N.T.S. 3).

105 *Ibid.*

Others have also specifically identified the right to development, EIA, public participation, and access to information as integral to any conception of sustainable development, as well as the role of other principles (namely the polluter pays and precautionary principles) as playing an important role in implementing the principle of sustainable development.[106]

In the *Gabčikovo-Nagymaros* case, the ICJ reinforced the need to "reconcile economic development with protection of the environment" as requiring the two parties to "look afresh" at the environmental consequences of the power plant in question and find a "satisfactory solution for the volume of water to be released" into the Danube.[107] This finding indicates that sustainable development is, in fact, a legal principle that can entail both procedural and substantive requirements, as outlined above.[108]

The principle is incorporated in numerous principles in the Rio Declaration, including Principle 4, which states, "In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it."[109] According to the ILA, it includes seven subsidiary principles, including the sustainable use of natural resources, and the need to take a precautionary approach to decisions impacting human health, natural resources, and ecosystems.[110] The relationship between environment and development is explicit in the Millennium Development Goals (MDGs), which require sustainable development to be incorporated into country policies and programs, and reversal of the loss of environmental resources.[111]

Several multilateral environmental agreements incorporate sustainable development as an objective. Notably, the United Nations Framework Convention on Climate Change (UNFCCC) has several references to – and requirements related towards – sustainable use and development of resources in relation to climate adaptation and mitigation.[112] Article 3.4 of the UNFCCC provides that the "Parties have the right to, and should, promote sustainable development." Thus, under the international climate framework, there is both a right to development and a corresponding duty to undertake development in a sustainable manner.[113] The UNFCCC also addresses sustainable use of resources. Article 2 provides that States are to "allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." Article 3(4) provides that Parties "should promote sustainable development ... to protect the climate system against human-induced change." Finally, under Article 4(1)(d) Parties are to "promote sustainable management and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs … including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems."

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106 McIntyre (2007), *supra* note 10.

107 *Gabčíkovo-Nagymaros*, *supra* note 44, at para. 140.

108 *Gabčíkovo-Nagymaros,* para.140; and *Pulp Mills*, *supra* note 68, at para. 75.

109 *Rio Declaration on Environment and Development 1992*, Report of the United Nations Conference on Environment and Development, 3-14 June, 1992, UN General Assembly, A/CONF.151/26 (Vol. I), (31 I.L.M. 874).

110 ILA (2002). *New Delhi Declaration of Principles of International Law relating to Sustainable Development*, 70th Conference of the ILA, held in New Delhi, India 2-6 April 2002.

111 Sands and Peel (2012), *supra* note 104.

112 UNFCCC, *supra* note 104.

113 ILA (2012). "Legal Principles Relating to Climate Change," 75th ILA Conference, 26-30 August 2012, Sofia, Bulgaria.

One of the three primary objectives of the Convention on Biological Diversity (CBD) is to achieve the sustainable use of the components of biological diversity.[114] Parties are committed to "[d]evelop national strategies, plans, and programs for the conservation and sustainable use of biodiversity."[115] "Sustainable use" is defined in the CBD as:

> *"the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations."*[116]

Moreover, the CBD Secretariat's principles and guidelines for the sustainable use of biodiversity include adaptive management;[117] minimising adverse impacts on ecosystem structure, functioning, and services; [118] advancing international cooperation;[119] and taking an interdisciplinary, participatory approach to governance.[120]

The Ramsar Convention on Wetlands of International Importance includes the principle of "wise use", which encompasses sustainability.[121] The Convention's updated definition of wise use of wetlands, intended to be consistent with the CBD ecosystem approach, is "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development."[122]

As noted above, the ICJ in the *Pulp Mills* case made a clear linkage between equitable and reasonable utilisation of transboundary waters and its sustainable development, citing "the need to strike a balance between the use of the waters and the protection of the river consistent with the objectives of sustainable development."[123] This seems to affirm the assumption of several commentators that, "the principle of equitable and reasonable utilization 'operationalizes' the notion of sustainable development in the specific context of shared freshwater resources."[124] Conversely, it appears that the broad scope of the sustainability principle should apply in interpreting the requirements of the principle of equitable and reasonable use of shared watercourses. This would include support for a precautionary approach that balances human development and environmental sustainability, and takes into account inter-generational equity in decisions regarding shared waters.[125] In turn, this

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114 CBD, *supra* note 26, at Art. 1.

115 *Ibid.* at Art. 6.

116 *Ibid*. at Art. 2.

117 *Ibid.* CBD (2004). Conference of the Parties (COP) Decision VII/12, (UNEP/CBD/COP/DEC/VII/12), 13 April 2004, *Addis Ababa Principles and Guidelines for the Sustainable use of Biodiversity*, Principle 4, p. 12.

118 *Ibid.* at Principle 5.

119 *Ibid.* at Principle 8.

120 *Ibid.* at Principle 9.

121 *Convention on Wetlands of International Importance Especially as Waterfowl Habitat* (hereinafter referred to as "the Ramsar Convention"), adopted 2 February 1971, Ramsar, Iran, entered into force 21 December 1975, (996 U.N.T.S. 245), as amended by the Paris Protocol, Dec. 3 1982, and Regina Amendments, May 28, 1987.

122 Ramsar Convention (2005). COP 9, Resolution IX.1. Annex A, para. 22, "A Conceptual Framework for the Wise Use of Wetlands," to align with CBD "Ecosystem Approach, CBD COP 5, Decision V/8; *see* also Helsinki and OSPAR Commissions; and Ramsar Convention (2002). *New Guidelines for Management Planning for Ramsar Sites and Other Wetlands,* Adopted by Resolution VIII.14 (2002) of the Conference of the Parties to the Ramsar Convention.

123 *Pulp Mills*, *supra* note 68, at para. 177.

124 McIntyre (2011), *supra* note 38.

125 Such an approach has been supported by scholars even before this judgment. *See* e.g., Rieu-Clarke,

strengthens the notion that climate considerations and their impacts on both present and future generations cannot be ignored in transboundary waters planning and decision-making.

The lack of specific guidance on how climate considerations should be mainstreamed into either equitable and reasonable utilisation or the concept of sustainable development of shared waters leaves open a great deal of room for interpretation as to what, specifically, is required of shared watercourse States. One aspect of the concept of sustainable development, as elaborated in key multilateral environmental agreements, is the incorporation of adaptive management and the ecosystem approach as integral to sustainable use of resources.[126] If this can be interpreted as part of the emerging definition of sustainable development, which in turn can be seen as the overarching goal of equitable and reasonable use under the *Pulp Mills* decision, there is further support for the inclusion of climate adaptation measures in decisions regarding shared watercourses.[127]

The emerging doctrine of intergenerational equity, which is integral to the definition of sustainable development, essentially holds that this generation holds natural resources and the services they provide as a trust for future generations.[128] The Experts Group on Environmental Law of the World Commission on Environment and Development identified basic obligations under this doctrine, including the conservation of options, including conservation of diversity of resources.[129] This provides further support for including measures that address or mitigate through adaptive measures the likely or potential irreversible climate impacts on shared waters.

2.4.2 The precautionary principle

Closely related to the principle of sustainability is that of precaution. The precautionary principle holds that where there is risk of serious environmental damage, States must take action to prevent, minimise or mitigate that damage even where there is a lack of scientific certainty with respect to the cause, seriousness or inevitability of the damages.[130]

Precaution is a guiding principle in the UNFCCC, both in relation to mitigation and adaptation. Article 3(3) provides in part:

> *"[t]he Parties should take precautionary measures to anticipate, prevent, or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost."*

A. (2010). *International Law and Sustainable Development: Lessons from the Law of International Watercourses*. IWA Publishing: London, U.K. This reading is also promoted by the inclusion of the sustainability principle in several treaties, including the Danube Convention, *supra* note 18, at Art. 2, paras. 1, 3 and 5; Art. 5, para. 1; Art. 6; the SADC Protocol, *surpa* note 41, at Arts. 2-3; and the UNECE Water Convention, *supra* note 74, at Art. 3, para. 1(i).

126 *See* e.g., UNCCD, *supra* note 104 ; CBD/UNCCD/UNFCCC (2012). *The Rio Conventions, Action on Adaptation*, p. 9; and Ramsar Convention (2002), *supra* note 122.

127 McIntyre (2011), *supra* note 38.

128 McIntyre, (2007), *supra* note 11.

129 *Ibid*.; Experts Group on Environmental Law of the World Commission on Sustainable Development (1987). *Environmental Protection and Sustainable Development: Legal Principles and Recommendations*, Munro, R.D. and Lammers, J.G. (eds.). Springer.

130 McIntyre (2007), *supra* note 10.

Similarly, the CBD applies the precautionary principle, stating that, "where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."[131]

The UNECE Water Convention likewise requires implementation of precaution in taking measures to prevent, control and reduce transboundary impacts in shared watercourses, stating that:

> *"The precautionary principle, by virtue of which action to avoid the potential transboundary impact of the release of hazardous substances shall not be postponed on the ground that scientific research has not fully proved a causal link between those substances, on the one hand, and the potential transboundary impact, on the other hand."*[132]

The Berlin Rules provide that, in relation to all articles relating to protection of the aquatic environment, States should apply a precautionary approach "where there is serious risk of significant adverse effect on or to the sustainable use of waters even without conclusive proof of a causal relation between an act or omission and its expected effects."[133] The ICJ also appeared to support the emergence of precaution as a principle of customary international law in the *Pulp Mills* case, where it held that a precautionary approach "may be relevant in the interpretation and application of the provisions" of the 1975 statute in question.[134]

In the context of international watercourses, implementation of the precautionary principle generally supports consideration of uncertain climate risks to – and impacts on – the resource. Specifically, application of the principle provides further support for the use of impact assessment and the inclusion of climate risks and impacts in determining both what plans, projects and programs might require TEIA, and how TEIA's are executed.[135]

Significantly, the UNECE *"Guidance on Water and Adaptation to Climate Change"* explicitly applies the precautionary principle in the context of adaptation in shared watercourses.[136] The guidance notes that precaution should apply, and preventive adaptive actions should be taken even in the face of scientific uncertainty. Interestingly, it also notes the importance of avoidance "over-adaptation", or maladaptative measures, and instead emphasises prioritising low and no-regrets measures that can provide benefits both under current conditions and a range of future climate conditions.[137] This would include increasing adaptive capacity and reducing vulnerability through sustainable ecosystem management and preservation, such as wetlands conservation.

131 CBD, *supra* note 26, at Preamble, para. 9.

132 UNECE Water Convention, *supra* note 74, at Art. 2, para. 5(a).

133 ILA (2004a), *supra* note 54, at Art. 23(2).

134 McIntyre (2007), *supra* note 10; *Pulp Mills* (2010), *supra* note 68.

135 McIntyre (2007), *supra* note 10.

136 UNECE (2009), *supra* note 3.

137 *Ibid.*; IPCC (2012). "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation," in Field, C.B. *et al.* (eds.), *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Cambridge University Press: New York, NY, U.S.A., cited in African Ministers Council on Water and Global Water Partnership, *Water Security and Climate Resilient Development: Strategic Framework,* p. 6; UNECE (2009), *supra* note 3.

2.4.3 The ecosystem approach

As noted earlier, the ecosystem approach[138] to water management aim to achieve sustainability and ecosystem conservation using a cooperative, ecology-based management system.[139] The ecosystem approach incorporates concepts of: sustainability; complexity; interconnection of hydrological, ecological and social systems; precaution; participation; accountability; and adaptive management.[140] Governance tools for the ecosystem approach therefore show promise as mechanisms for promoting adaptive water governance, and accounting for environmental flows.

Ecosystem-based adaptation (EbA) is specifically promoted under the CBD. EbA builds on the ecosystem approach to management, and:

> *"integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both current climate variability, and climate change."*[141]

The Ramsar Convention also implements the ecosystem approach as another aspect of "wise use", which includes maintaining ecological character and using ecosystem approaches, in the context of sustainable development.[142]

Within international water law, the UNECE Water Convention requires parties to "ensure conservation and, where necessary, restoration of ecosystems."[143] In preventing, controlling and reducing transboundary impact, they are required to develop, adopt and implement measures to ensure, *inter alia*, "Sustainable water resources management, including the application of the ecosystems approach, is promoted."[144] The Berlin Rules further provide that, "States shall take all appropriate measures to protect the ecological integrity necessary to sustain ecosystems dependent on particular waters."[145]

New EbA policy, legal, and institutional mechanisms for defining and integrating considerations of environmental flows into allocation and infrastructure decision-making to ensure ecosystem resilience, and to support sustainable provision of ecosystem services could provide critical support for adaptive water governance. In prior allocation systems – and many transboundary systems grant priority to existing or prior uses in allocation decision-making – climate-induced reduction of flows will likely result in prioritisation of consumptive uses of water, rather than maintaining in-stream

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138 The ecosystem approach incorporates: 1) long-term sustainability as fundamental value; 2) clear, operational goals; 3) sound ecological models and understanding; 4) understanding complexity and interconnectedness; 5) recognition of the dynamic character of ecosystems; 6) attention to context and scale; 7) acknowledgement of humans as ecosystem components; and 8) commitment to adaptability and accountability. Christenson *et al*. (1996), *supra* note 22.

139 ELI (2007), *supra* note 23.

140 ELI (2008) and (2009), *supra* note 24.

141 Colls, Ash and Ikkala (2009), *supra* note 27.

142 Ramsar Convention (2005), *supra* note 122, at Annex A, para. 22.

143 UNECE Water Convention, *supra* note 74, at Art. 2(2)(A).

144 *Ibid*. at Art. 3(1)(i).

145 ILA (2004a), *supra* note 54. For a complete discussion of the incorporation of ecosystem-based approaches in international watercourses law, *see* McIntyre (2007), *supra* note 11.

flows.[146] Environmental flow allocations must therefore be recognised and prioritised as legitimate and enforceable allocations.

Such an approach broadens the scope of activities and impacts that must be accounted for in determining what is considered an equitable and reasonable use of a shared watercourse. Not only uses of a shared watercourse itself, but also local and national land-based activities throughout the basin, biodiversity-related interventions, and even local, national, and transboundary climate mitigation and adaptation activities that could impact the ecosystem would need to be accounted for in planning and decision-making related to shared watercourses. The ecosystem approach would also highlight the applicability of additional international agreements that impact on freshwater ecosystems. In particular, the CBD and the Ramsar Convention can help further strengthen connections between adaptive governance requirements in these treaties and the regulation of shared watercourses.

2.5 Conclusion

The water governance challenges presented by climate change include uncertainty around the timing, scale, intensity, and character of potential impacts, and how those impacts will interact with other drivers of change; and complex, cross-sectoral and multi-level impacts that must be addressed with stakeholder engagement. These challenges imply the need for:

1. Creating or emphasizing policies, laws, management practices, and institutional mechanisms that are flexible and facilitate social and institutional learning and knowledge exchange;
2. Building mechanisms for effective multi-level governance;
3. Fostering broad-based and institutionalised participation of diverse stakeholders in adaptation decision-making, implementation, monitoring and evaluation; and
4. Supporting ecosystem-based governance approaches to maintain freshwater flows and ecosystem resilience in the face of climate change.

The analysis above demonstrates that the current and evolving principles of international water law already provides a framework necessary to achieve such governance systems in shared freshwater basins. However, the implementation of tools under this framework will likely require more specific elaboration of how principles should be applied in light of climate change in order to achieve truly adaptive outcomes, and increase the resilience of shared watercourses and their dependent populations.

The principle of equitable and reasonable utilisation has been interpreted and applied in such a way as to encompass key procedural requirements that are critical for achieving adaptive outcomes: mechanisms for managing uncertainty (information sharing); for maintaining the health of the resource (prior notification); and for ensuring appropriate adaptive responses (stakeholder participation), among others. The "functional link" found by the ICJ in the *Pulp Mills* case between these procedural requirements, and the achievement of equitable outcomes by the ICJ emphasized "a process of continuous consultation between the parties concerned," and stressed the importance of institutional arrangements for facilitating coordination and cooperation in a shared basin. Such joint decision-making and shared management to achieve sustainable use and development of the

146 World Bank and World Wildlife Fund (2010). "Flowing Forward: Freshwater Ecosystem Adaptation to Climate Change in Water Resources Management and Biodiversity Conservation," *World Bank Water Working Note No. 28*. World Bank Group: Washington D.C., U.S.A.

resource implies the need to understand both the climate vulnerabilities of riparian States, and the potential challenges that climate change may pose for the sustainable development of shared basins.

With respect to the duty to prevent significant harm, the increasing emphasis on environmental concerns in basin-level and regional treaties, along with the ICJ's emphatic focus on those concerns in the *Pulp Mills* decision, lends itself to a reading that the two principles are inextricably linked by a duty on the part of shared watercourse States to strive for sustainable use and development of the resource as a prerequisite of achieving an equitable outcome. In turn, this implies the relevance of the rich body of international environmental law that has developed over the last several decades, and the need to apply those principles – including precaution, prevention of environmental harm, and sustainability (including responsibilities to future generations) – to decisions on shared waters.[147] This further expands the scope of adaptive governance tools considered to be duties under customary international water law. Perhaps most significantly, the ICJ's determination that a Transboundary Impact Assessment (TEIA) is now a requirement under international law provides a specific mechanism through which some of these tools may be applied. Again, however, the lack of substantive guidance on what triggers a TEIA, and whether and how climate-related factors should be considered in the assessment process, leaves substantial uncertainty as to whether this requirement will actually be applied to facilitate climate-adaptive decision-making in shared basins.

The lack of a specific mandate to consider climate impacts in international water law (other than as one of several non-weighted factors to be considered in determining what constitutes equitable use) leaves the decision of whether to conduct cooperative, basin-wide vulnerability assessment and adaptation planning to the discretion of the watercourse States. Despite the growing application of the principle of precaution, the uncertainty surrounding climate impacts sets all climate-related decision-making within a realm of ambiguity that could be used as an excuse for inaction. A clear mandate and guidance is thus necessary to ensure that the principles of international water law are implemented to achieve climate adaptive outcomes in shared basins. Some of this work has been undertaken at the basin and regional levels, for example in the guidance produced by the UNECE.

As the 1997 U.N. Watercourses Convention enters into force, there is an opportunity for the global community to integrate the evolving principles and tools of adaptive water governance into existing principles of international water law. This could be in the form of guidance for implementation of the 1997 U.N. Watercourses Convention that assists shared watercourse States in undertaking basin-wide vulnerability assessment and adaptation planning, or in the form of an actual Protocol to the treaty to elaborate the role of climate in determining equitable and reasonable use and in prevention of significant harm. In the years since the 1997 U.N. Watercourses Convention was drafted, much scholarship and practice on adaptive water governance has emerged, and the treaty's entry into force could provide a valuable opportunity to take stock of the specific role that climate change should play in interpreting and applying the principles of international water law.

147 McIntyre (2011), *supra* note 38.

Chapter Three

Cooperative Transboundary Mechanisms

Alena Drieschova and Gabriel Eckstein[1]

3.1 Introduction

Natural freshwater basin boundaries do not usually coincide with man-made borders; more than 500 international freshwater rivers, lakes, and aquifers traverse the frontiers of as many as 148 countries. Consequently, most of the uncertainties in the water sector resulting from climate change can only be successfully addressed through international cooperation. Such cooperation, though, will not be easy. Uncertainties related to climate change pose particular difficulties for international cooperation because of the lack of an internationally shared government and a clear enforceability structure to guarantee implementation of existing rules. This chapter seeks to identify strategies and mechanisms that can help riparian States address the combined uncertainties that result from the effects of climate change and the challenging structure of the international system.

While the uncertainties resulting from climate change could lead policymakers to inaction and delay in establishing water management regimes pending the availability of missing knowledge, the existence of uncertainties should be accepted as a given because it is unlikely that additional research could ever eliminate all uncertainty. Therefore, it is more prudent to develop management strategies that can address uncertainty in an effective manner.[2] This means developing robust and adaptable decision-making procedures that can perform well across a wide range of possible eventualities.[3] Only through the creation of such procedures will it be possible to ensure that effective responses to changing circumstances can be adopted in a timely manner.[4]

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2 Berkes F. (2007). "Understanding Uncertainty and Reducing Vulnerability: Lessons from Resilience Thinking," *Natural Hazards*, Vol. 41(2), pp. 283-295, at p. 284. *See* also Cutter, S.L. *et al*. (2003). "Social Vulnerability to Environmental Hazards," *Social Science Quarterly*, Vol. 84(2), pp. 242-261, at p. 258; Drieschova, A. and Fischhendler, I. (2011). *A Toolkit of Mechanisms to Reduce Uncertainty in International Water Treaties*. The Hebrew University of Jerusalem & CLICO; and Gunderson, L. and Light, S. (2006). "Adaptive Management and Adaptive Governance in the Everglades Ecosystem," *Policy Science*, Vol. 39, pp. 323-334.

3 Keller, K. *et al*. (2008). "Managing the Risks of Climate Thresholds: Uncertainties and Information Needs," *Climate Change*, Vol. 91, pp. 5-10, at p. 6. *See* also Lempert, R.J. (2002). "A New Decision Sciences for Complex Systems," *Proceedings of the National Academy of Sciences USA*, Vol. 99, pp. 7309-7313; and Lempert, R.J. *et al*. (2003). *Shaping the Next One Hundred Years: New Methods for Quantitative, Long-term Policy Analysis*, pp. 33-66. Prepared for the Rand Pardee Center. RAND: Santa Monica, CA, U.S.A.

4 Yearly, S. (1996). "Nature's Advocates: Putting Science to Work in Environmental Organizations," in Irwin, A. and Wynne, B. (eds.), *Misunderstanding Science? The Public Reconstruction of Science and Technology*, pp 172-190. Cambridge University Press: Cambridge. *See* also O'Riordan, T. (1992). "*The Precaution Principle in Environmental Management*," A Working Paper, GEC 92-03. Center for Social and Economic Research on the Global Environment.

Although it often takes decades to negotiate international water agreements, the pace of adjustments necessitated by climate change can increase the demands placed on the flexibility and adaptability of existing agreements.[5] At the same time, flexibility itself can make it easier to negotiate an agreement because the parties have less to fear about the constraints that the agreement might impose on their sovereignty.[6] Once an agreement has been established, flexibility can allow the parties to deviate from the precise wording of the treaty while maintaining its overall spirit.[7]

While many of the uncertainties resulting from climate change cannot be avoided in the foreseeable future, it is possible to establish an internationally more benign environment that is conducive to cooperation and mutual burden sharing. In order to achieve those conditions, it is necessary to encourage trust building among riparians through measures, such as data sharing, coordinated research projects, technical and financial cooperation, and the development of multiple forums for consultations. It is also crucial to increase communication channels between riparians in order to ensure that similar perceptions about existing uncertainties form the basis for cooperative undertakings.

To establish adequate institutional mechanisms for addressing the effects of climate change on freshwater, there is much we can learn from past experience and research. Although the uncertainties resulting from climate change are a new phenomenon of quite unprecedented magnitude, the role of uncertainty in international cooperation, in general, has long been recognised,[8] as has the influence of uncertainty on the design of international institutions.[9] Furthermore, the existence of flow variability has been recognised in the water sector for more than a century. As early as 1863, the Netherlands and Belgium made water allocation from the Meuse River conditional on annual availability.[10] A content analysis of signed international water treaties has, in fact, demonstrated that between 1900 and 2007 approximately half of all of the signed water treaties explicitly referred to flow variability as an issue, and that the ratio of treaties explicitly addressing flow variability has remained constant over that time period.[11] Thus, while the effects of climate change are likely to continue being

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5 McCaffrey, S.C. (2003). "The Need for Flexibility in Freshwater Treaty Regimes," *Natural Resources Forum*, Vol. 27, pp. 156-162, at p. 157.

6 Drieschova, and Fischhendler (2011), *supra* note 2, at p. 5. *See* also Thompson, A. (2010). "The Rational Choice of International Institutions: Uncertainty and Flexibility in the Climate Regime," *European Journal of International Relations*, Vol. 16(2), pp. 269-296, at p. 272.

7 Fischhendler, I. (2004). "Legal and Institutional Adaptation to Climate uncertainty: A Study of International Rivers," *Water Policy*, Vol. 6, pp. 281-302, at p. 21; and Koremenos, B. (2001). "Loosening the Ties that Bind: A Learning Model of Agreement Flexibility,'' *International Organization*, Vol. 55, pp. 289-325, at p. 308.

8 Keohane, R. (1984). *After Hegemony: Cooperation and Discord in the World Political Economy*, *Princeton Classics Edition*, Preface, p. xi. Princeton University Press: Princeton, NJ, U.S.A. *See* also Winham, G. (1977). "Negotiation as a Management Process," *World Politics*, Vol. 30(1), pp. 87-114; and Zartman, W. and Berman, M. (1982). *The Practical Negotiator*. Yale University Press: New Haven, CT, U.S.A.

9 Koremenos (2001), *supra* note 7, at p. 290. *See* also Victor, D., Raustailia, K. and Skolnikoff, E.B. (1998). *The Implementation and Effectiveness of International Environmental Commitments*. MIT Press: Cambridge, MA, U.S.A.

10 Transboundary Freshwater Dispute Database, Oregon State University, College of Science, Program in Water Conflict Management and Transformation, *available at* http://www.transboundarywaters.orst.edu/database/DatabaseIntro.html.

11 Drieschova, A. *et al*. (2008). "Governance Mechanisms to Address Flow Variability in International Water Treaties," *Global Environmental Change*, Vol. 18, pp. 285-295, at p. 291.

unprecedented, there are relevant historical experiences from which we can learn how to address these uncertainties. Those historical experiences, as well as established theoretical arguments, form the basis for the recommendations established in this chapter. Those historical experiences, coupled with established theoretical arguments and more recent work addressing the role of uncertainty for environmental governance,[12] form the basis for the recommendations established in this chapter.

3.2 Strategies for Responding to Climate Change and Uncertainty

Four broad-based strategies have been identified in the literature as possible approaches for assessing environmental uncertainties or, more specifically, climate change-related uncertainties: a) ignoring uncertainty; b) a complete contracts approach; c) an uncertainty minimisation strategy; and d) an open-ended strategy.[13] Prudent planning would suggest that parties adopt multiple concurrent strategies when seeking to address resource related uncertainties. Such a portfolio approach spreads out the dangers of uncertainty by simultaneously including several management strategies.[14]

3.2.1 Ignoring uncertainty

Parties can deliberately or unconsciously deny existing uncertainties. On the one hand, there are "cultures of risk denial" that can cause parties to be unaware of uncertainty.[15] On the other hand, negotiators can purposefully deny the existence of uncertainty, potentially, in order to sell an agreement to domestic constituencies. For example, a treaty allocating waters by attributing fixed quantities to each riparian ignores the likelihood that the water flow will vary from one year to the next and from one season to another. Also, the non-inclusion of conflict resolution mechanisms in water agreements demonstrates a disregard for the possibility that conflicts about the interpretation or implementation of an agreement could arise. Given that existing uncertainties are likely to continue increasing as a result of climate change, a strategy of ignoring uncertainty is best avoided. In fact, a strategy of ignoring uncertainty implies that the parties will be forced to deal with the difficulties at a later time, once they arise. By then, however, the parties will be under considerable time and decision-making pressures, which can further escalate the emerging tensions.

3.2.2 Complete contracts approach

On the other end of the spectrum, agreements may aim for a complete contracts approach focused on providing certainty under all possible circumstances.[16] Under this strategy, agreements specify

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12 *See* Adger, N. and Vincent, K. (2005). "Uncertainty in Adaptive Capacity," *Geoscience*, Vol. 337, pp. 399-410; and Litfin, K. (1994). *Ozone Discourses: Science and Politics in Global Environmental Cooperation*. Columbia University Press: New York, NY, U.S.A.

13 This section draws on Drieschova, A. *et al*. (2011). "The Role of Uncertainties in the Design of International Water Treaties: An Historical Perspective," *Climatic Change*, Vol. 105, pp. 387-408; and Drieschova and Fischhendler (2011), *supra* note 2.

14 Historically, research shows that international water treaties have included, on average, 2.5 out of the four identified strategies for addressing uncertainties. Drieschova *et al*. (2011), *supra* note 13, at p. 398.

15 Adger, N.W. *et al*. (2009). "Are there Social Limits to Adaptation to Climate Change?" *Climatic Change*, Vol. 93, pp. 335-354, at p. 339.

16 *See* Simon, H.A. (1981). *The Sciences of the Artificial* (MIT Press: Cambridge); and Hart, O. and Moore, J. (1988). "Incomplete Contracts and Renegotiation," *Econometrica*, Vol. 56(4), pp. 755-785.

each riparian's obligations under all potential scenarios. Thus, no room is left for any ambiguity in treaty interpretation or implementation.

While it might be attractive for riparians to develop a watertight agreement, the exclusive application of a complete contracts approach can hardly be deemed successful, as uncertainty essentially means that unanticipated scenarios will occur. In such cases, the rigidity of a complete contracts approach can become an extreme hindrance to the search for effective solutions.

Case Study 3.1 The 1944 U.S.-Mexico Rivers Treaty

The 1944 Treaty between the United States of America (U.S.) and Mexico Relating to the Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande (1944 U.S.-Mexico Rivers Treaty), rigidly mandates precise flow volumes in major tributaries to the Rio Grande. However, it only vaguely considers the possibility of extended, large-scale variability in precipitation. When a significant drought hit the region in the late 1990's, Mexico became unable (or was unwilling) to comply with its flow obligations due to water scarcity. As a result, water users on both sides of the border lodged numerous complaints and charges against each other, including an international lawsuit that reached the International Centre for the Settlement of Investment Disputes (ICSID). While the two nations engaged in multiple efforts to achieve a compromise under the treaty, a resolution was only achieved when the rains returned in 2005 and Mexico was able to pay off its water debt.

3.2.3 Reducing the effects of climate change uncertainty

In between these extremes are two additional strategies. In an uncertainty reduction strategy, the parties seek to cooperatively diminish either the effects of uncertainty or its core causes. Such a strategy entails, for example, an increase in shared knowledge in the form of data exchanges, technological cooperation, and/or hydrological modelling.[17] Cooperative engineering projects that seek to establish man-made solutions to environmental hazards are also a part of this strategy, such as the constructions of dams in border areas, or jointly managed multipurpose projects.

While the success of these strategies should not be disregarded – irrigation schemes have, for example, guaranteed food stability for large populations – it should also be recognised that uncertainty can never be eliminated from such schemes. Environmental hazards, which often occur decades after projects are initiated, such as construction of extensive irrigation networks and large dams, demonstrate that environmental complexities often lead to previously unanticipated effects. In this sense, ecosystem approaches might prove to be more sustainable options. The consideration of environmental flows in water sharing agreements allows the reduction of uncertainties connected to ecosystem degradation. The reestablishment of natural flood plains and the destruction of man-made embankments, as well as the re-establishment of the natural meandering of rivers (instead of straightened riverbeds that are beneficial for navigation, but which increase the speed of water flow) are alternative, environmentally friendly, and potentially less risky ways of controlling flood levels.

17 *See* Courtney H. (2003). "Decision-driven Scenarios for Assessing Four Levels for Uncertainty,'' *Strategy Leadership*, Vol. 31(1), pp. 14-22; and Van Asselt, M.B.A. and Rotmans J. (2002). ''Uncertainty in Integrated Assessment Modeling,'' *Climate Change*, Vol. 54, pp. 75-105.

3.2.4 Open-ended approach

Finally, agreements can use an open-ended strategy. Underlying this approach is an understanding that uncertainty is inevitable. The solution is, therefore, to leave room for change by developing inherently flexible management systems that are adaptable to a wide variety of possible outcomes.[18] Provisions under this strategy lead to the establishment of a variety of different communication channels and forums between the parties, the institution of mutual assistance funds, or indirect mechanisms of water allocation. They can also include the option for a gradual construction of regimes over time through feedback loops where each step is a response to preceding experiences and knowledge gained from experiments.[19]

The open-ended strategy represents very clear advantages when seeking to address climate change,[20] and the management of complex systems in general.[21] It provides flexibility, and permits the parties to adapt to new natural circumstances and changing social developments.[22] As it does not infringe on sovereignty as much as other strategies, it also has a tendency to lead to faster agreements between parties.[23] Furthermore, an open-ended approach allows the immediate inclusion of new scientific findings into the process of interstate cooperation without which the parties would have to go through a lengthy process of re-negotiation. For example, while not a water treaty but rather a multilateral environmental agreement, the Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) provides the Parties with leeway in Article 2(9) to adjust the potential impact of substances targeted for reduced use or elimination, as well as limitations on their production, based on new scientific findings and understanding.

The strategies presented here should not be considered mutually exclusive. Quite to the contrary, a degree of enforceability can provide certainty to the parties of an agreement and reduce mistrust between them, factors that are important for obtaining full engagement and cooperation from all participants. In that sense, an ideal agreement would incorporate the flexibility associated with an open-ended approach, the enforceability of a complete contracts approach, and the resiliency of an uncertainty minimisation strategy.

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18 Pahl-Wostl, C. and Jeffrey, P. (2007). "Adaptive Water Management: How to Cope with Uncertainty," *NeWater*, Vol. 4, pp. 1-7.

19 Huitema, D. *et al*. (2009). "Adaptive Water Governance: Assessing the Institutional Prescriptions of Adaptive (Co) Management from a Governance Perspective and Defining a Research Agenda,'' *Ecology and Society*, Vol. 14(1), p. 7.

20 Dowlatabadi, H. (2003). ''Review of: Learning to manage global environmental risks,'' *Climate Policy*, Vol. 3, pp. 315-317; and Raadgever, G.T. and Mostert, E. (2005). "Transboundary River Basin Management – State-of-the-art Review on Transboundary Regimes and Information Management in the Context of Adaptive Management," Deliverable 1.3.1 of the NeWater project, p. 25. RBA Centre, Delft University of Technology.

21 Holling, C.S. (1993). "Investing in Research for Sustainability," *Ecological Applications*, Vol. 3, pp. 552-555, at p. 554. *See* also Johnson, B.L. (1999). "Introduction to the Special Feature: Adaptive Management Scientifically Sound, Socially Challenged," *Ecology and Society*, Vol. 3(1).

22 *See* Athias L. and Saussier S. (2008). "Contractual Flexibility or Rigidity for Public Private Partnerships? Theory and Evidence from Infrastructure Concession Contracts," Working Paper Series Reflexive Governance in the Public Interest, Coordinated by the Centre for Philosophy of Law, Universite Catholique de Louvain, REFGOV-IFM-47; and Henry, C. (1974). "Investment Decisions under Uncertainty: The Irreversibility Effect," *The American Economic Review*, Vol. 64(6), pp. 1006-1012.

23 Fischhendler, I. (2008). "Ambiguity in Transboundary Environmental Dispute Resolution: The Israeli–Jordanian Water Agreement,'' *Journal of Peace Research*, Vol. 45(1), pp. 79-109, at p. 105.

Establishing a complete and well-balanced agreement, however, can take decades; often, more immediate action is required. Moreover, some of the most prominent success stories of transboundary water cooperation have begun with very small projects that have allowed the parties to gradually establish trust.

Case Study 3.2 Evolution of water governance of the Rhine River

Cooperation often evolves from many trial and error attempts, ultimately resulting in the creation of some of the most remarkable transboundary water cooperation schemes. For example, transboundary water cooperation on the Rhine began in 1886 with the establishment of the Salmon Commission, whose purpose was to prevent overfishing of salmon on the Rhine River.[24] That cooperation was interrupted by the economic recession of the 1930's and the Second World War, but resumed again in the 1950's. Over the years, a number of different cooperation schemes were created by the parties, until the main riparians signed the Convention on the Protection of the Rhine against Pollution by Chlorides and the Convention on the Protection of the Rhine against Chemical Pollution, both in 1976. Neither of these conventions was particularly successful in achieving its targets due to technical difficulties, lack of political will, competitiveness concerns, and scientific uncertainty about the risks involved.[25] It required an accident at Sandoz AG in Bern in 1986, where thousands of cubic metres of contaminated water spilled into the Rhine, for the cooperation process to achieve momentum.[26] Soon after, an informal Rhine Action Plan was inaugurated by the parties. This political initiative had precise goals, but no possibilities of legal enforcement. Nevertheless, its success led finally to the signing of the Convention on the Protection of the Rhine in 1999, which institutionalised a complete and fully functioning basin-wide water regime that now serves as a model for other river basins.

3.3 Cooperative mechanisms components

3.3.1 Scope and applicability of cooperative mechanism: the basin approach

The basin approach to the management of transboundary waters has long been recognised as the "fulcrum of water resource development."[27] Supporting an integrated management scheme, the approach is based on the understanding that "surface and groundwaters form a system, and constitute by virtue of their physical relationship a unitary whole," and that "human intervention at one point in the system may have effects elsewhere within it."[28]

The basin approach has been endorsed by the World Bank, the European Union (E.U.), the U.N. International Law Commission (ILC), and numerous non-governmental organisations (NGOs).[29]

24 Drieschova and Fischhendler (2011), *supra* note 2, at p. 25.

25 Nollkaemper, A. (1996). "The River Rhine: From Equal Apportionment to Ecosystem Protection," *Review of European,Comparative, and International Environmental Law*, Vol. 5(2), pp. 152-160, at p. 155; and Verweij, M. (1999). "A Watershed on the Rhine: Changing Approaches to International Environmental Cooperation," *GeoJournal*, Vol. 47, pp. 453-461, at p. 456.

26 See Bernauer, T. and Moser, P. (1996). "Reducing Pollution of the River Rhine: The Influence of International Cooperation,'' *Journal of Environment and Development*, Vol. 5(4), pp. 389-415.

27 Teclaff, L.A. (1996). "Evolution of the River Basin Concept in National and International Water Law," *Natural Resources Journal*, Vol. 36, pp. 359-391, at p. 387.

28 International Law Commission (ILC) (1994). *Report of the International Law Commission on the Work of its Forty-Sixth Session*, [1994] 2 Y.B. Int'l Law Commission, 90, para. 4, (U.N. Doc A/49/10). *See* Chapter One for a more extensive discussion of the basin approach.

29 Eckstein, G. (2010). "Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy," *Wisconsin International Law Journal*, Vol. 27(3), pp. 409-461, at p. 437.

For example, the influential 1966 Helsinki Rules on the Uses of the Waters of International Rivers, formulated by the International Law Association (ILA), encouraged a holistic, basin-wide approach to water management employing "a geographical area extending over two or more States determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus."

Case Study 3.3 Contrasts in Basins

The Aral Sea tragedy is but one of many examples in which independent activity in one region of the basin had disastrous consequences in another part of the basin. In that debacle, under the guidance of the former Soviet Union, riparians on the sister rivers of the Amu Darya and Syr Darya diverted water for agricultural purposes beginning in the middle of the last century. By the 1980's, inflows from the two rivers into the Aral Sea fell by as much as 85 percent. Since Kyrgyzstan, Uzbekistan, Tajikistan, and Kazakhstan became independent States, the coordination difficulties between the riparians have only exasperated. As a result, the Aral Sea – a terminal inland lake, which relies on the two rivers for its entire inflow – nearly dried out entirely. By the early part of the twenty-first century, the Aral Sea had lost one-half of its surface area and 75 percent of its volume.[30] This outcome is the result of practices that ignored the synergistic and causal relationships of hydraulically related freshwaters.

In contrast, the management and protection of the Great Lakes on the border of Canada and the U.S. is now subject to a comprehensive, basin-wide scheme under both the Great Lakes–St. Lawrence River Basin Sustainable Water Resources Agreement of 2005 and the 1978 Great Lakes Water Quality Agreement between the U.S. and Canada, amended in 1983, 1987, and 2012. Under these arrangements, the two Canadian provinces and eight U.S. states collaboratively manage their shared waters through mandatory province and state-level procedures for regulating withdrawals and diversions, obligations for prior notice; and opportunities for comments on all proposed new or increased consumptive uses by all basin provinces and states, and considerable monitoring and reporting requirements. Significantly, the Sustainable Water Resources Agreement provides a framework for jointly managing not only the four transboundary lakes, but also "all streams, rivers, lakes, connecting channels and other bodies of water, including tributary groundwater, within the Basin."[31] As a result, it has been lauded as one of the more progressive mechanisms for the sustainable and collaborative whole-basin management of a transboundary basin.[32] Similarly, the 2012 amendments to the Great Lakes Water Quality Agreement between the U.S. and Canada reference the entire drainage basin and focus on the Great Lakes Basin Ecosystem, which encompasses:

> *"the interacting components of air, land, water and living organisms, including humans, and all of the streams, rivers, lakes, and other bodies of water, including groundwater, that are in the drainage basin of the Great Lakes and the St. Lawrence River at the international boundary or upstream from the point at which this river becomes the international boundary between Canada and the United States."*[33]

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30 Spoor, M. (1998). "The Aral Sea Basin Crisis: Transition and Environment in Former Soviet Central Asia," *Development and Change*, Vol. 29(3), pp. 409-435, at pp. 416-417; and Greenberg, I. (2006). "A Vanished Sea Reclaims its Form in Central Asia: Aral Dam Project Surpasses Expectations,'' *International Herald Tribune*, April 6, 2006, p. 2, *available at* http://www.highbeam.com/doc/1P1-121444994.html (accessed June 6, 2013).

31 *Great Lakes–St. Lawrence River Basin Sustainable Water Resources Agreement* (2005 Water Resources Agreement), signed Dec. 13, 2005, Art. 103.

32 *See* Hall, N. and Stuntz, B.B. (2008). "Climate Change and Great Lakes Water Resources: Avoiding Future Conflicts with Conservation," *Hamline Law Review*, Vol. 31(3), pp. 641-677.

33 *Protocol between the United States of America and Canada Amending the Agreement of November 22, 1978, as Amended* (The Great Lakes Water Quality Protocol of 2012), signed Sept. 7, 2012, Washington D.C., entered into force 12 February 2013, Art. 1(c).

By following a holistic basin approach, countries of each basin are better able to respond to the challenges of climate change and avoid similar ecological disasters. They are able to formulate and coordinate both short-term and long-term strategies, and develop local, national, and basin-level priorities for managing shared waters. They can also develop plans for alternative scenarios that best prepare them for the possible consequences of climate change. Ultimately, basin countries not only gain the ability to pool their resources to maximize the benefits of their shared waters, they also gain the ability to collectively shoulder the projected burdens of climate change.

Accordingly, basin States in regions expecting prolonged and substantial droughts, such as those in the sub-tropics and mid-latitudes, can work together to expand opportunities for capturing what little rainfall does arrive. Such efforts can include rainwater harvesting as well as diverting and managing runoff. Basin States in these regions also can collectively explore means for producing new water, such as through desalination technologies, and enhancing storage potential by constructing new and expanding existing reservoirs. In contrast, countries sharing basins that are likely to see an increase in precipitation, such as those in the tropical regions and higher latitudes, can band together to manage the expected flood waters through diversion schemes and staggered dams designed to minimise the destructive effects of massive deluges.[34]

It is noteworthy that in both scenarios, ecosystem approaches may be appropriate cooperative strategies for responding to climate change challenges. For example, water scarce regions can explore enhancing aquifer storage, recovery opportunities, and reclaiming polluted freshwater, while regions expecting excessive water events can protect and expand existing wetlands capable of absorbing large volumes of water.[35] In this context, "eco-regions" and "problemsheds" (rather than watersheds) have been proposed as alternative or complementary units for water management.[36]

It must be noted that a basin approach might be construed as an affront to sovereignty, especially where, *inter alia:* one or another nation experiences a greater geographic infringement on their territory due to the construction of a dam and reservoir that benefits other riparians; a riparian is prevented from pursuing a desired project because of its effect on the basin or other riparians; a riparian's water allotment is reduced from its historic levels due to variability in precipitation or evolving needs elsewhere in the basin; greater benefits accrue to some but not to all nations in the basin; or one or another nation is expected to bear a larger share of basin management and planning costs. Such infractions, however, may be justified in an assessment of the equitable and reasonable utilisation of the basin's transboundary freshwaters as mandated under international law. Moreover, even where the consequences exceed the bounds of equity and reasonableness, these transgressions often can be rectified through payments made by riparians benefitting from the infringement, or through implementation of benefit-sharing mechanisms.

34 Teclaff (1996), *supra* note 27, at p. 377; and Eckstein (2010), *supra* note 29.

35 U.N. Environmental Programme (UNEP) (2010). *The Greening of Water Law: Managing Freshwater Resources for People and the Environment*, pp. 20-22.

36 Omernik, J. M. and Bailey, R.G. (1997). "Distinguishing Between Watersheds and Ecoregions," *Journal of the American Water Resources Association*, Vol. 33(5), pp. 935-949, at p. 941. *See* also Allan, J. A. (2002). "Hydro-peace in the Middle East: Why No Water Wars? A Case Study of the Jordan River Basin," *SAIS Review*, Vol. 22(2), pp. 255-272; Omernik, J. M. (2003). "The Misuse of Hydrologic Unit Maps for Extrapolation, Reporting and Ecosystem Management," *Journal of the American Water Resources Association*, Vol. 39, pp. 563-573.

Clearly, though, the best of intentions are often thwarted by politics, international relations, or other complications making it difficult to have all basins riparians participate in a comprehensive basin-wide management or cooperative effort. Examples where one or more basin riparians do not fully cooperate abound, including in the basins of the Mekong, Nile, Tigris, Euphrates, and Syr Darya and Amu Darya rivers, as well as over the shared aquifers along the Mexico-U.S. border.

The lack of full basin participation, however, should not prevent a management or cooperative approach that encompasses as much of the basin as is politically and practicably possible. While the entire basin is the preferable scale at which to manage a transboundary freshwater body, failure to realise such a comprehensive approach should not negate pragmatism and achieving what is possible. For instance, the Mekong River Basin encompasses six nations; China and Myanmar have declined joining the coordinated management scheme. Although their absence hinders a comprehensive and fully effective approach, the other four riparians – Cambodia, Lao PDR, Thailand, and Vietnam – have been able to implement relatively successful cooperative mechanisms, including standards for minimum flows, procedures for exchanging information, and creation of a river basin commission. Moreover, they have been able to engage China, and Myanmar to a lesser extent, in dialogue aimed at exchanging information.

3.3.2 Substantive and procedural rules

Within agreements it is possible to distinguish between substantive rules, which establish the "material rights and obligations of the parties," and procedural rules, which "provide the means through which substantive rules are implemented."[37] Typically, riparian States tend to focus considerably more attention on substantive rules, rather than on procedural rules. The substantive rules determine who gets how much. Within the water sector, this is one of the most hotly debated topics. However, an exclusive focus on the allocation of water rights can create zero-sum outcomes and adversarial relationships, which are not conducive for establishing trust between parties. In particular, where parties have not institutionalised any forms of communication and do not share the same data, an exclusive focus on allocating existing waters can lead to mistrust and conflict rather than resolve outstanding issues between the parties.

For this reason, the development of adequate procedural rules is emphasised as a first step for facilitating the creation of a good working environment. In cases where the parties cannot agree on water rights, or can only agree on general principles of water allocation, precise procedural mechanisms can also provide clearer guidelines and commitments for the parties. Once an adequate institutional framework is established, emphasis can be shifted to substantive rules relevant for addressing the effects of climate change in the context of transboundary water cooperation.

In this sense, procedural rules are of particular significance for addressing the effects of climate change, as they can create a framework for responding to unexpected circumstances in an effective and structured way, which contributes to adaptive water governance.

37 Wouters, P. *et al*. (2005). "Sharing Transboundary Waters—An Integrated Assessment of Equitable Entitlement: The Legal Assessment Model,'' *Technical Documents in Hydrology No. 74*, pp. 20 and 22. International Hydrological Programme (IHP) of the United Nations Educational, Scientific and Cultural Organization (UNESCO): Paris, France.

Procedural rules

i. Data sharing

Data and information generation and exchange is critical to the sound management of transboundary waters.[38] Absent such an exchange, basin States and institutions are hampered in their effort to soundly manage shared waters, formulate policies, or take measures in response to climate variability. Hence, the generation and sharing of data is always an excellent start for transboundary water cooperation. The costs are comparatively low, and it tends to equal out the playing field between the parties as all riparians have the same information at their disposal, which helps to reduce misunderstandings and potential suspicions. It is with the help of data sharing that the parties can start to establish what equitable distribution of waters might mean. Data generation and exchanges permit harmonisation of perceptions, and can inaugurate the first communication channels between the parties. It allows the parties to establish a shared language and, in the longer term, potentially create a community of like-minded people who develop the commitment to address shared difficulties in a cooperative and technical manner.[39] On the more technical side, shared information can also increase the amount of resources and data from which future trends of flow variability can be discerned, potentially more quickly and accurately than when each State undertakes the necessary data collection individually.

In the context of climate change and transboundary waters, the type of data and information that should be generated and exchanged includes, *inter alia*, the following: scientific and technical data related to climatic conditions in the basin; the transboundary water body itself, and the surrounding basin environment; geographic, cultural, and socio-economic information on the populations and ecosystems that depend on the watercourse; current and planned water uses; and management activities including regulatory actions and conservation measures.[40]

ii. Monitoring

Monitoring provisions are closely connected to data and information sharing, and can be implemented through official agreements or informal mechanisms that precede formalities. They allow parties to observe and scrutinize changing conditions in the basin, evaluate whether each side is fulfilling its commitments per the agreement, and stay aware of unexpected consequences resulting from the implementation of treaty provisions. In general, monitoring mechanisms permit the parties to evaluate whether the regime operates as it had been anticipated. The results from the monitoring provisions allow the parties to adjust to evolving conditions or unexpected findings in a timely manner. In this regard, it is important to accept unexpected results as a learning opportunity rather than to hide or disregard them as anomalies or failures.[41]

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38 World Bank (1993). *Water Resources Management*, p. 43. World Bank: Washington D.C., U.S.A.

39 *See* Adler, E. (1991). "Cognitive Evolution: A Dynamic Approach for the Study of International Relations and their Progress," in Adler, E. and Crawford, B. (eds.), *Progress in Postwar International Relations*, pp. 43-88. Columbia University Press: New York, NY, U.S.A.; and Haas, P.M. (1992). "Introduction: Epistemic Communities and International Policy Coordination," *International Organization*, Vol. 46(1), pp. 1-35.

40 Eckstein (2010), *supra* note 29, at p. 449.

41 Huitema *et al*. (2009), *supra* note 19, at p. 2.

Case Study 3.4 The International Commission for the Protection of the Elbe River

The 1990 Convention on the International Commission for the Protection of the Elbe (entered into by Czech Republic and Germany) nicely demonstrates how monitoring provisions can be initiated. Article 2 of that Convention provides that:

> "*the Commission shall: […] (d) propose and coordinate the implementation of joint programmes of measurements and investigations to demonstrate the quality of the waters, sediments and effluent and to describe the aquatic and coastal communities, and shall record and evaluate the findings*."

The Commission has been successful in the implementation of joint measurement programs, which were also made public and thus served as an additional enforcement mechanism. The monitoring provisions have been instrumental in the successful reduction of the pollution of the Elbe stemming from point sources and wastewater treatment operations. However, they have achieved limited success in addressing non-point source pollution, such as runoff from agricultural activities.[42]

iii. Technical and financial cooperation

Technical and financial cooperation and assistance can take many different forms. They allow riparian States to pool resources and create, for example, multinational research teams, which permit the parties to harness their respective comparative advantages in research and development and, at the same time, establish a basis for trust. Alternatively, the parties can create a shared financial resource pool, which can operate as insurance or an emergency fund, to partly offset the negative effects of floods and droughts. The Convention on Cooperation for the Protection and Sustainable Use of the Danube employs an insurance mechanism, albeit without establishing a resource pool. Article 17 provides that:

> *"in the interest of enhanced cooperation and to facilitate compliance with obligations of this Convention, in particular where a critical situation of riverine conditions should arise, Contracting Parties shall provide mutual assistance upon the request of other Contracting Parties."*

Technical and financial cooperation can have the additional advantage of enhancing State capacity and, hence, ensuring a higher degree of treaty compliance. These forms of cooperation also establish mutual gains in cooperation and are therefore a good way to start transboundary water cooperation. In and of themselves, they enhance the flexibility of an agreement, and establish a mechanism that is meant to respond adaptively to a changing resource situation.[43] For example, transboundary water cooperation on Lake Victoria began with the establishment of a common five-year research program, which lead to the development of a shared fisheries database and a comprehensive water quality monitoring program. The Lake Victoria Environmental Management Project (LVEMP) was then continued in LVEMP II, which started in 2003.[44]

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42 Dombrowsky, I. (2008). "Institutional Design and Regime Effectiveness in Transboundary River Management? The Elbe Water Quality Regime," Hydrology and Earth System Sciences Discussions, Vol. 12(1), pp. 223-238, at p. 229.

43 Hallegatte, S. (2009). "Strategies to Adapt to an Uncertain Climate Change," *Global Environmental Change*, Vol. 19(2), pp. 240-247, at p. 240.

44 Lubovich, K. (2009). "Cooperation and Competition: Managing Transboundary Water Cooperation in the Lake Victoria Region," *Working Paper No. 5*, p. 2. Foundation for Environmental Security and Sustainability: Falls Church, VA, U.S.A.

iv. Prior notice and consultation

Riparians to a transboundary water body can stipulate in an agreement that they will notify and consult each other in case they plan to establish new water uses on their side of the border. More stringently, they can consent not to undertake any activity that may affect the transboundary water body without the prior consent of the other party. These obligations are, in fact, mandatory under customary international water law, and have been incorporated into the 1997 U.N. Convention on the Non-navigational Uses of International Watercourses (1997 U.N. Watercourses Convention).[45] Such requirements, however, may be insufficient in basins that suffer from high water stress and necessitate more structured or comprehensive mechanisms for dispute avoidance and resolution. Nevertheless, in most basins around the world, these measures are intended to enhance trust; they create stability and certainty so that riparians do not have to be concerned about unpleasant surprises from upstream or downstream water-related development activities. Over time, they can also be considered as an initial step in determining more precise but flexible water allocation mechanisms that respond to changing circumstances and consultations. In contrast to fixed water allocations, such procedures allow for a certain degree of flexibility, because they do not exclude the possibility of changing water use needs and priorities over time; rather, they are conducive to the search for cooperative solutions that meet changing water priorities.

For example, Article 12, paragraph 12, of the 1992 Treaty on the Development and Utilisation of the Water Resources of the Komati River Basin between the Government of the Kingdom of Swaziland and the Government of the Republic of South Africa states that, "No party shall allow within its territory the construction of any water storage work in the Komati River Basin with a capacity in excess of 250,000 cubic metres without the prior approval of the JWC [Joint Water Commission]."

v. Mechanisms for responding to alternative/changing scenarios

Mechanisms responding to alternative or changing scenarios enhance the flexibility of agreements, because they permit the parties to adapt their behaviour to varying circumstances. For example, adaptive management techniques permit the parties to build the experiences and knowledge learned from the outcomes of previous policy choices. Such built-in procedures expand the degree of resiliency of treaty regimes, and can reduce the negative effects of extreme weather events, unexpected industrial contamination, and other unforeseen events.

Managing flow variability also provides many opportunities for States to cooperate internationally, ranging from the establishment of international early warning systems and water flow modelling systems, to flood and drought risk management planning and intervention. In most cases, lower riparians derive more benefits from such measures, because they are more likely to suffer harm from floods and droughts; however, upper riparians also can benefit from compensation for their efforts. Internationally shared early warning systems provide more lead-time for riparians to take preparatory measures in order to minimise the consequences of floods and droughts. Estimates suggest that they have a cost-benefit ratio of 1:2.1 – 14.4 (for Europe and central Asia), 1:40 (for China), and even 1:70 (for Mozambique).[46]

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45 *United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses* (hereinafter "1997 U.N. Watercourses Convention"), adopted by the General Assembly of the United Nations on 21 May 1997. Not yet in force. *See* General Assembly resolution 51/229, annex, *Official Records of the General Assembly, Fifty-first Session, Supplement No. 49* (A/51/49), Art. 5.

46 Rogers, D. and Tsirkunov, V. (2011). "Costs and Benefits of Early Warning Systems,'' *Global Assessment*

In the realm of flood and drought risk management and intervention, international cooperation can lead to more cost-efficient solutions, and generally provides a larger range of strategies for riparians. For example, the terrain of upstream riparians is usually better suited to the construction of dams designed to regulate flow variability, while other downstream locations might be particularly suitable for reforestation or as natural discharge areas. At the same time, riparians can share their expertise for dam construction and environmental impact assessments (EIAs). The comparative advantages of cooperation are nicely illustrated in the cooperation between Hungary, Romania, Slovakia, and Ukraine in the Tisza Basin. There, an online transboundary forecasting system has been established with the financial support coming mainly from Hungary, the most downstream of the riparians, employing a model established by Slovakia, and with data coming mainly from Ukraine.[47] Once such a transboundary forecasting system is established, great care should be placed on preparing national institutions so that the obtained information can be effectively transmitted to the domestic level, and can result in adequate policies and preparations for variability in flows.

Case Study 3.5 The Vuoski River between Russia and Finland

In the case of floods and droughts on the Vuoksi River, Russia and Finland agreed in 1993 to a regulation that permits the upstream riparian, Finland, to release or retain a larger quantity of water from its reservoirs, depending on available weather forecasts, in order to balance the water flow in the river. Under the scheme, Finland is obligated to provide Russia with daily updates on water levels and discharges. Potential damages are compensated upon agreement achieved through a bilateral commission. The regulation has been employed on numerous occasions with highly positive results and no substantial difficulties in its implementation. It has been estimated that Finland has prevented damages from floods and droughts valued at an estimated 10 million Euros, while compensating Russia with one million Euros for losses in hydropower.[48] More recently, Mexico and the U.S. amended the 1944 U.S.-Mexico Rivers Treaty with Minute 319, which enhances both nations' ability to share surpluses and water shortages on the Colorado River through the following: by allowing Mexico, which has a dearth of storage capacity, to store some of its Colorado River allotment in upstream reservoirs in the U.S.; authorising the U.S. to send less water downstream to Mexico in drought years; and creating a mechanism through which Mexico can adjust its water delivery schedule in relation to overall water availability and, thereby, offset mandated reductions.[49]

vi. Means for dispute resolution

International agreements should incorporate means for dispute resolution, which can include diplomatic negotiations between political representatives, establishment of an expert/fact-finding

Report on Disaster Risk Reduction 2011, pp. 13-14. World Bank: Washington, D.C., U.S.A.

47 United Nations Economic Commission for Europe (UNECE) (2009a). "Transboundary Flood Risk Management: Experiences from the UNECE Region," *Workshop on Transboundary Flood Risk Management* (Geneva, 22-23 April 2009), p. 32. *See* also UNECE, (2009b). "Integrated Management of Water and Related Ecosystems – Water and Climate Adaptation in Transboundary Basins, Including Flood and Drought Risk Management," Note by the Secretariat, Economic and Social Council, U.N. Doc. ECE/MP.WAT/2009/4 2 (Sept. 1, 2009).

48 Ollila, M. (2009). "Joint Flood Risk Management: Planning and Implementation – Case Study: River Vuoksi," Workshop on Transboundary Flood Risk Management, Geneva, 22-23 April 2009.

49 International Boundary and Water Commission (2012). "Interim International Cooperative Measures in the Colorado Basin Through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California" (Minute 319). Agreed 20 November, 2012, Coronado, California.

commission or conciliation, third party mediation, an arbitration tribunal, or sending the dispute to the International Court of Justice (ICJ).

In the case of the 1960 Indus Waters Treaty, India and Pakistan agreed in Article IX to a gradational dispute resolution mechanisms beginning with a review by the Permanent Indus Commission, then moving to an assessment by a neutral expert, followed by negotiated settlement. In the event that the dispute is intractable, the parties agreed to take the dispute to a court of arbitration. Recently, when the two riparians could not resolve the controversy over India's Kishenganga hydroelectric project, they took their dispute to formal arbitration before the Permanent Court of Arbitration. A partial award in the case was issued in February 2013.

Ideally, an agreement would incorporate a gradual approach towards dispute resolution, where the parties can start off with simple consultations and move to more compulsory mechanisms if disagreements persist.

Box 3.1 Water Dispute Resolution through the International Court of Justice

In the early years of its operations, the International Court of Justice (ICJ) was only rarely invoked in transboundary waters disputes. That now appears to be changing as, in the past two decades there has been a significant upsurge of water disputes brought to the Court.

One of the most prominent cases considered by the ICJ, the Gabč ikovo-Nagymaros case,[50] was the disagreement between Slovakia and Hungary over the Gabč ikovo-Nagymaros System of Locks on the Danube River. In this case, the original accord did not provide for a referral of conflicts to the ICJ. Rather, the two countries signed a separate agreement to submit their dispute to the Court after diplomatic negotiations had deadlocked.[51]

In contrast, in the *Pulp Mills* case,[52] in which Argentina sued Uruguay over allegations of water pollution resulting from Uruguan pulp mills on the Uruguay River, the parties had explicitly anticipated resolving disputes before the ICJ. Article 60 of the Statute of the Uruguay River specifically provides for ICJ jurisdiction in the event of a disagreement "concerning the interpretation or application of the Treaty and the Statute."

Using a different approach, in the three cases that Costa Rica and Nicaragua have brought to the ICJ,[53] the countries followed the prescribed dispute settlement process detailed in the 1948 American Treaty on Pacific Settlements, known as the "Pact of Bogota," which both had previously ratified. The approach detailed in the Pact is a gradational process that begins with negotiation, followed by mediation by a party to the Pact or individual that is uninvolved in the dispute, a Commission of Investigation and Conciliation under the auspices of the Organization of American States (OAS), and then compulsory jurisdiction of the ICJ. The Pact, however, does not bind the parties to this precise order, and also permits them to seek arbitration, as they deem appropriate.

50 *Gabĉíkovo-Nagymaros Project (Hungary v. Slovakia), Judgment*, I.C.J. Reports 1997, p. 7.

51 Fitzmaurice, M. (1998). "The Gabĉíkovo-Nagymnaros Case: The Law of Treaties," *Leiden Journal of International Law*, Vol. 11(2), pp. 321-344, at p. 325; and Nakamichi, M. (1998). "Note: The International Court of Justice Decision Regarding the Gabĉíkovo-Nagymaros Project," *Fordham Environmental Law Journal*, Vol. 9, pp. 337-372, at pp. 346-347.

52 *Pulp Mills on the River Uruguay* (Argentina v. Uruguay), *Judgment*, I.C.J. Reports 2010, p. 14.

53 These cases include: *Dispute regarding Navigational and Related Rights* (Costa Rica v. Nicaragua), *Judgment*, I.C.J. Reports 2009, p. 213; *Certain Activities carried out by Nicaragua in the Border Area* (Cost Rica v. Nicaragua), Application Instituting Proceedings filed in the Registry of the Court on 18 November 2010; and *Construction of a Road in Costa Rica along the San Juan River* (Nicaragua v. Costa Rica), Application Instituting Proceedings filed in the Registry of the Court on 22 December 2011, joined with Costa Rica v. Nicaragua on 17 April 2013.

vii. Amendment mechanism

A number of different amendment mechanisms can make international agreements inherently more adaptable to changing circumstances. The parties, for example, can decide periodically whether treaty amendments are necessary, or they can stipulate that amendments will be made whenever new scientific knowledge emerges or water flow alters substantially. For example, Article 25 of the 1944 U.S.-Mexico Rivers Treaty authorises the International Boundary and Water Commission (U.S.-Mexico Commission) to supplement the treaty through an amendment-like mechanism referred to as "Minutes".[54] This is a very innovative and highly flexible mechanism that offers considerable potential for addressing climate change related uncertainties. Similarly, while the multilateral Montreal Protocol on Substances that Deplete the Ozone Layer does not focus on transboundary waters, it is instructive in that it establishes regular meetings between the parties where they can exchange new information about research and development, and can decide whether to adjust how substances are controlled under the treaty.

Substantive rules

Water allocations and rights are the most hotly debated topics in international water cooperation. While much attention is focused on the precise water quantities each riparian may be entitled to, establishing the appropriate mechanisms for water allocation may alleviate some of the difficulties that can arise.

i. Fixed allocations

Allocating fixed water quantities can give the parties the illusion of certainty that they will obtain a guaranteed quantity of water. This can potentially make negotiations easier and the public can be more easily convinced of successful negotiations. However, flow variability will inevitably occur, which could make it difficult – and potentially impossible – for an upper riparian to provide the promised quantity of water to a lower riparian. Moreover, there is the possibility that the burdens of droughts or floods will not be shared equitably.[55]

Case Study 3.6 The Syr Darya Basin

In an agreement between Kazakhstan, Kyrgyzstan, and Uzbekistan on the Syr Darya basin, the upper riparian, Kyrgyzstan, was obliged to balance the mismatch between water flows and water needs with the help of the Toktogul Reservoir, and to provide fixed water quantities to the other two basin riparians in exchange for gas and coal payments. Also, because the energy payments of the other riparians were unreliable, the situation put so much strain on Kyrgyzstan in terms of maintenance costs and a loss of hydropower that it decided to pass the Law on the Interstate Use of Water Objects, Water Resources and Water Management Installations in June 2001, stipulating that water is a national resource that can only be sold to other countries at a price and that the other riparian States have to contribute to the maintenance of

54 The Minute process is an innovative process used to respond to changing circumstances and needs of the two countries. Where the Commissioners of the Mexican and U.S. sections both agree on a particular project, approach, or other supplementary process, the Minute containing the decision becomes binding on both nations if neither government submits its disapproval within thirty days following execution of the Minute. For further information *see* Chapter Two of this publication.

55 Wolf, A.T. (2000). "Indigenous Approaches to Water Conflict Resolution and Implications for International Waters," *International Negotiation: A Journal of Theory and Practice*, Vol. 5(2).

the Toktogul reservoir. The new law did not ease the strains with Uzbekistan, which had allegedly already conducted a number of military manoeuvres in proximity to the Toktogul Reservoir in 1997 and 2000.[56] In the meantime, the parties have agreed to share some of the costs associated with the maintenance and operation of Kyrgyz water installations. While the situation remains tense, the parties have managed so far to avoid open conflict through negotiations and the pursuit of unilateral solutions.

ii. Fixed allocations with flexibility provisions

Fixed allocations, on their own, can make it difficult for upper riparians to fulfil their flow requirements, as well as meet their own water needs, where precipitation and natural recharge sources are unreliable. In some cases, fixed allocation schemes can be coupled with mechanisms that allow for greater flexibility in the implementation or interpretation of allocations and obligations. For example, fixed quantity allocations can be combined with percentages of flows to provide more efficient and flexible allocation mechanisms.

Alternatively, parties to an agreement can combine methods of fixed or, preferably, percentage allocations of flows together with particular principles of water allocation, such as equity, rational use, limitations on harm, and sustainability. Such principles can provide guidelines for allocating water while maintaining the spirit of an agreement. In cases of disputes, these principles also provide general guidelines that tribunals can employ in their adjudication.

Case Study 3.7 The Niagara River Water Diversion Treaty between Canada and the U.S.

The 1949 Niagara River Water Diversion Treaty between Canada and the U.S. is an example of a regime that employs fixed quantity allocations in combination with percentages of flows. It established a compromise solution between hydropower obligations and the needs of the tourism industry to maintain the scenic beauty of the Niagara Falls. During the summer months, a minimum of 100,000 cubic feet per second is made available in the river between the hours of 8 AM and 10 PM. During other months, up to 50 percent of the water can be withdrawn for hydropower production, which has to be divided equally between the two nations. These stipulations take into account the possibility of flow variability, and represent a valuable model to follow when, for example, considering environmental flows in water allocation. The treaty also established certain provisions for the variability of demand. It states in Article 8 that:

> *"until such time as there are facilities in the territory of one party to use its full share of the diversions of water for power purposes agreed upon in this Treaty, the other party may use the portion of that share for the use of which facilities are not available."*[57]

Fixed allocations can also integrate inter-annual flow variability by allowing upper riparians to make up for deficient water deliveries in one period in a subsequent period. Such mechanisms, however, may make it difficult for upper riparians to consistently fulfil their flow requirements, as well as meet their own water needs. The situation could be frustrated even further if, as a result of climate change, new long-term flow patterns emerge. Thus, for example, between 1994 and 2005, Mexico

56 Heltzer, G.E. (2003). "Stalemate in the Aral Sea Basin: Will Kyrgyzstan's New Water Law Bring the Downstream Nations Back to the Multilateral Bargaining Table?" *Georgetown International Environmental Law Review*, Vol. 15(2), pp. 291-321, at p. 309; International Crisis Group (2002). "Central Asia: Water and Conflict. ICG Asia Report N°34," Osh/Brussels, 30 May 2002, p. 12; and Muzalevsky, R. (2010). "The Rogun Controversy: Decoding Central Asia's Water Puzzles," *The Central Asia – Caucasus Institute Analyst*, March 3, 2010, *available at* http://old.cacianalyst.org/?q=node/5276 (accessed June 5, 2013).

57 Drieschova and Fischhendler (2011), *supra* note 2, at p. 14.

accumulated a water debt of 1.5 million acre-feet (489 billion gallons) in the Rio Grande Basin, which it was obligated to repay to the U.S. under the 1944 U.S.-Mexico Rivers Treaty via flows in the Rio Conchos, a tributary to the Rio Grande. While the debt, the result of a prolonged regional drought, was eventually repaid after heavy rainfalls replenished Mexico's reservoirs, concerns remain high that expected climate change impacts on precipitation will cause and exacerbate future shortfalls, and reignite bilateral tensions.[58]

iii. Prioritisation of water uses

Another allocation mechanism that would be adaptable to changing circumstances is distribution based upon a prioritisation of uses where, for example, all household needs are met first followed by those of the environment, subsistence farmers, agriculture, hydropower, and industry. This allocation method is not only adaptable to the available water flows, but also to changing water demands. The method can be applied as a first approach to an agreement until a more concrete distribution of water supplies can be established.

Prioritisation of water uses can be found in numerous agreements. For example, the 2002 Water Charter of the Senegal River, entered into by Mali, Mauritania, and Senegal, states in Article 2 that its goal is "to fix the principles and the methods of the distribution of water of the Senegal River among the various sectors of use." The Charter further safeguards water for vital human needs. Similarly, Article 5 of the 1990 Agreement between the Federal Republic of Nigeria and the Republic of Niger concerning the Equitable Sharing in the Development, Conservation and Use of their Common Water Resources provides that, "in determining the equitable share to which each contracting party is entitled pursuant to Article 2, the following factors shall be taken into account," including, *inter alia*, "the dependence of local populations on the waters in question for their own livelihood and welfare."

Prioritisation of water use can also be found in global scale instruments. For example, while the 1997 U.N. Watercourses Convention stipulates in Article 10 that absent local agreements or customs, water use should not be prioritised, the article further provides that "vital human needs" deserve special consideration. Moreover, the U.N.'s Committee on Economic, Social, and Cultural Rights (CESCR) declared in General Comment No. 15, in November 2002, that a human right to water can be inferred from Articles 11 and 12 of the International Convention on Economic, Social and Cultural Rights (ICESCR), thereby prioritising human water needs. Similarly, the 1989 U.N. Convention on the Rights of the Child contains a right to clean drinking water in Article 24. Thus, it appears that water needs for human health and survival are globally considered as the most prioritised form of water usage.

The prioritisation of water uses for human needs can lead to very specific water allocations between parties because of the availability of relatively good estimates of populations living in catchment areas. Similarly, estimates of land in agricultural usage are usually known, and water planners regularly work with estimates of industrial water needs. It would therefore not be too difficult to establish a border or region-specific formula establishing the different water usages multiplied by

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58 Brezosky, L. (2012). "Tempers Boil over Border Water Battle," *MySanAntonio.com*, About the Express-News, April 14, 2012, *available at* http://www.mysanantonio.com/news/article/Tempers-boil-over-border-water-battle-3482548.php (accessed June 4, 2013); and Hawkes, L. (2012). "Water War with Mexico looms in Southwest," *Western Farm Press*, April 13, 2012, *available at* http://westernfarmpress.com/government/water-war-mexico-looms-southwest (accessed June 5, 2013).

their respective water needs. The formula could then provide a basis for calculating the water rights for the respective riparians on an annual basis.

3.4 Developing Governance Structures to Implement Cooperative Mechanisms

As mentioned in Chapter Two, governance is the process by which decisions are made and action taken through the application of responsibility, participation, information availability, transparency, custom, and rule of law. It is the art of coordinating decision-making between and among different jurisdictional levels, and potentially also non-state actors such as multinational corporations, international organisations, and NGOs. Accordingly, governance structures, as differentiated from *government* structures, constitute the processes and systems that facilitate the *governance* process.

In the context of transboundary waters, governance structures can be developed for various purposes including managing and allocating shared waters, coordinating water-related development and conservation activities, protecting aquatic environments for human and environmental health, and for developing collaborative responses to expected and unexpected climatic changes. Such mechanisms can be pursued through a formal organisation developed for specific purposes related to the management of frontier waters, or developed programmatically through offices or departments of two or more riparian governments whose representatives meet periodically or as the need arises. While the latter may suffice where activities are less likely to result in disputes (i.e., data sharing), or where cross-border relations or other complication frustrate full cooperation, institutionalising transboundary water management within a dedicated binational (or multilateral, where the basin encompasses more than two riparians) entity can be an effective means for implementing cooperative mechanisms.

Examples of existing cooperation over transboundary freshwater can take various forms and can be developed under various governance platforms. For example, existing structures that might serve as a basis for such cooperation include the United Nations Framework Convention on Climate Change (UNFCCC), the 1997 U.N. Watercourses Convention, and the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and regional agreements such as the Southern African Development Community (SADC) Revised Protocol on Shared Watercourses, and the Framework Agreement on the Environment of the Mercado Común del Sur (MERCOSUR).

Case Study 3.8 Regional Approaches adopted by the South Asian Association for Regional Cooperation (SAARC) on adaptation

SAARC, an intergovernmental regional economic organisation, has adopted environment as an area of regional cooperation. Under this rubric, in 1987 SAARC conducted a Regional Study on the Causes and Consequences of Natural Disasters and the Protection and Preservation of the Environment. Subsequently, in 1992 SAARC conducted another study on Greenhouse Effects and its Impact on the Region. While both studies lacked focus on adaptation, they resulted in the establishment of a technical committee on environment, which has served as a forum for raising awareness among governmental agencies and NGOs on climate change issues. After the Tsunami of December 2004, and an earthquake that occurred in December 2005, both of which caused devastating physical and human losses, SAARC countries have accelerated their focus on regional cooperation in the areas of environment, climate change, and natural disasters.

Institutionally, all SAARC countries are States Parties to the UNFCCC. Furthermore, SAARC has established regional centres in fields related to environment, coastal zone management, meteorology, disaster management, and forestry. SAARC has also adopted several non-binding instruments on the environment. However, inadequate capacity at local, national and regional levels has prevented effective implementation of these instruments.

In 2008, SAARC adopted an Action Plan on Climate Change. It calls for measures in the areas of *inter alia*, adaptation, mitigation, technology transfer, and management of impacts and risks. Specifically, it calls for capacity building in the exchange of meteorological data, exchange of information on disaster preparedness for extreme events and climate change impacts. Subsequently, in 2010 the SAARC countries adopted the Thimphu Statement on Climate Change,[59] which calls on the SAARC Disaster Management Center to study and analyse the current framework on disaster risk reduction, and make recommendations for further institutional development, collaboration, and resource allocation and planning for disaster prevention, preparedness, and management.

By coordinating and collaborating together via a single binational (or multinational) entity, riparian States can establish trust and a collegial environment in which technical expertise can overrule potential political mistrust. Coordination can also allow the parties to collectively shoulder the financial and resource burdens of research and data generation, implementation of joint hydro projects, pursuit of preventative measures and responses, and other basin-related efforts. Moreover, such an approach can enhance riparians' collective expertise in basin characteristics and management, and aid in developing a cadre of managers and experts who have a unique knowledge of the particular basin. In so doing, nations that coordinate and collaborate via a single entity can also collectively enhance their ability to respond to changing climatic conditions, such as extreme droughts and flood events, in a more dexterous and effective manner.[60]

While there is no ideal model for a formal institutional mechanism, there are a number of factors that are relevant for maximizing the usefulness and operations of such an entity: 1) the extent and scope of authority assigned to the institution; 2) the degree of flexibility afforded the institution in its operation, planning, and project implementation; 3) stakeholder participation; and 4) the financial and other support provided to the institution by the riparian governments.

3.4.1 Institutional structure and authority

Nations are typically reluctant to diminish their sovereignty by delegating decision-making authority to a supranational entity. For example, the U.N. General Assembly Resolution on Permanent Sovereignty over Natural Resources provides that every nation enjoys complete sovereignty over all natural resources found within its jurisdiction.[61] However, there is much to be said about the nature of water that characterises the substance as different from other natural resources, and that diminishes the right of States to take an absolutist position. Instead of the notions of absolute territorial sovereignty and absolute territorial integrity, the doctrines of limited territorial sovereignty and of equitable and reasonable utilisation have now emerged as cornerstones of modern transboundary water relations.

59 South Asian Association for Regional Cooperation (SAARC) (2010). *Thimphu Statement on Climate Change*, Sixteenth SAARC Summit, Thimphu, Bhutan. 28-29 April 2010, (SAARC/SUMMIT.16/15).

60 *See* Jaspers, F. (2003). "Institutional Arrangements for Integrated Water Basin Management," *Water Policy*, Vol. 5(1), pp. 77-90.

61 *See* General Assembly resolution 1803 (XVII) of 14 December 1962, "Permanent Sovereignty over Natural Resources," Seventeenth Session, New York, U.S.A.

Moving along this continuum from no or little authority and strict State sovereign control, to significant institutional authority and diminished State sovereign rights, Lautze et al., have developed a nomenclature to distinguish between three basic types of institutional mechanisms: 1) councils; 2) commissions; and 3) authorities.[62] While these terms are not used universally, this nomenclature provides useful guidance by which to interpret and assess the structure and degree of authority that is imbued in any particular institutional mechanism.

Councils

Councils usually consist of representatives from the two parties (usually between one and nine) who meet at periodical intervals to discuss issues of concern. They have a purely advisory function towards their governments and no decision-making authority.

Commissions

Commissions typically consist of two to three bodies. Often, they include a Secretariat that functions as an administrative support and creates an organisation with a "corporate identity", rather than merely an institutional platform, and a second body composed of commissioners who represent the individual countries. Occasionally, they also include a technical committee that provides background studies and technical expertise. The main functions of a commission consist of monitoring, coordination, harmonisation, policy setting, and the facilitation of planning. Like councils, they usually have a consultative and advisory function and no decision-making authority.

Authorities

Authorities are of two types. Usually they are either applied to concrete water development projects (such as in the Lesotho Highlands water project), in which case they take the character of a public company; or they function as basin authorities (such as the Senegal River Basin Development Authority, known by its French acronym OMVS, which stands for *l'Organisation pour la Mise en Valeure du Fleuve Sénégal*). The OMVS has full legal personality and supranational character that allows it to plan, construct, operate, and maintain jointly owned water projects, even if located fully within one of the Member States. It also has authority to develop strategy for the entire basin, and to periodically reallocate the river's water based on changes in flow and availability, and the changing needs of its Member States.

Authorities tied to concrete projects consist of a chief executive officer, a board of directors, and regular staff. The general basin authorities are usually composed of four organs: a Secretariat and a technical committee, which both operate along the same lines as in commissions; a political council usually consisting of the responsible ministers of the individual States; and lastly the Heads of States. The direct involvement of the Heads of States signifies a higher degree of empowerment for these types of institutional mechanisms, which can even permit them to develop projects that have not directly been agreed upon in treaties.

62 Lautze, J. *et al*. (2013) "International River Basin Organizations: Variations, Options and Insights," *Water International*, Vol. 38(1), pp. 30-42, at p. 31.

The main objectives of authorities "include the ability to make planning decisions, set regulations and undertake development activities."[63] Whereas for commissions, final decisions on implementation are undertaken at meetings of national representatives, authorities can have a decision-making mandate that allows decisions adopted by the members of the joint entity to automatically become binding on the respective governments at the national level. In this case, the States do effectively concede part of their sovereignty to the extent of the jurisdiction of the authority, which can be limited to one issue area such as water quality, to a specific geographic region such as boundary waters, or to other criteria.

Case Study 3.9 The Franco-Swiss Genevese Aquifer

One of the only institutional mechanisms for a transboundary aquifer is the Genevese Aquifer Management Commission established under the Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer. Originally created in 1977, the Convention and its Commission were reauthorised in 2008 for a second thirty-year period. Among other functions, the Commission is responsible for developing a yearly aquifer utilisation program, drafting proposals for measures to protect the aquifer, remedying problems of pollution, appointing advisory technicians, and overseeing the construction of waterworks and equipment. While the Commission functions entirely in a consultative manner, it has developed a long-standing reputation for efficiency and integrity.[64]

Ideally, an institutional mechanism would be a joint riparian effort with jurisdiction over the entire hydrographic basin – all hydraulically-related freshwater in the basin – and the mandate to engage all basin riparians in on-going dialogue, produce and exchange relevant data and information, and coordinate activities designed to prevent and mitigate the impacts of climate change. Moreover, it also should be entrusted with assessing and identifying the most effective preventative and mitigatory measures, crafting appropriate steps that each basin State would take to implement such measures, and the authority to resolve disputes as they arise.[65]

It must be said, however, that it is often difficult to establish such an ideal institution with a single agreement. History has shown that riparians tend to develop such mechanisms gradually as trust increases, financial resources become more available, and the positive results of cooperation encourage the riparians to expand their collaborative efforts into additional areas that deepen existing relationships. Thus, the ideal requirements for an institutional mechanism should not be an obstacle for riparian States to begin cooperating at even the most basic, politically achievable, and socially feasible level. By developing a relationship, however meagre, the riparians can begin to cultivate the trust necessary to eventually achieve a more ideal and effective mechanism. Furthermore, it is possible to have several institutional mechanisms in a single basin. They can either operate at different scales, for example one at the basin level and another one at a particular project site, or they can operate at the same scales but in different segments of the river, or serve different functional purposes (e.g., one related to water quality management and another related to navigation).[66]

63 *Ibid*.

64 *Convention relative a la protection, a l'utilisation, a la realimentation et au suivi de la Nappe Souterraine Franco-Suisse du Genevois* (Convention on the Protection, Utilisation, Recharge and Monitoring of the Franco-Swiss Genovois Aquifer), signed 18 December 2007, entered into force 1 January 2008, *available at* http://www.unece.org.

65 Eckstein (2010), *supra* note 29, at pp. 445-446.

66 Lautze *et al*. (2013), *supra* note 62, at p. 32.

Case Study 3.10 The Okavango River Basin Commission (OKACOM)

The Okavango River Basin Commission (OKACOM) was established in 1994 by Angola, Botswana, and Namibia simply to coordinate the activities of the riparian States. More than ten years later, in 2005, the basin riparians established a permanent Secretariat for the effective functioning of the Commission. Then in 2006, the organisational structure of the permanent OKACOM was defined. It now consists of three entities: 1) the Commission, which is composed of three representatives from each riparian State; 2) the Secretariat, devised as an internal organ to coordinate information sharing and the activities of the Commission; and 3) the Basin Forum, comprised of ten local representatives from each country, which serves to generate a local perspective of the socio-economic and hydro-environmental situation to inform action plans proposed for the basin.[67]

3.4.2 Institutional flexibility and agility

To meet the challenges of climate change and function efficiently, institutional mechanisms require a flexible mandate that allows them to adapt their operations, planning, and implementation activities to changing conditions. As noted by the Intergovernmental Panel on Climate Change (IPCC), while scientists are confident that global climatic changes will affect water worldwide, they are unable to provide precise predictions at the regional and local scales.[68] For example, some climate change models suggest that certain transboundary watercourses, such as the Rhine, Congo, and Indus river basins, should expect an increase in both precipitation and temperature. While the former is likely to result in more flood events, the latter could intensify evapotranspiration resulting in an increase in the frequency of droughts.[69]

The resulting uncertainty in predicting whether the basin should expect floods, droughts, or other climatic impacts in any given season creates considerable planning complications for the basin States and, especially, for established institutional mechanisms. As a result, institutional mechanisms should not be hampered with procedures and obligations that might constrain their ability to quickly and adeptly respond to dynamic climatic changes. Moreover, they must escape the paradigm of stationarity and develop alternative probabilistic approaches that can better respond to the variability of climate change and ensure that any negative impacts are minimised and managed.[70] Such approaches can incorporate flexible management systems that allow the institutions to adapt their mechanisms, activities, and policies in response to changes on the ground, as well as flexible management structures based on short command lines and task-specific working groups, which can operate in parallel to the existing conventional structures.

To achieve this degree of flexibility, basin States must create an environment and a transboundary regulatory structure that fosters the adoption and implementation of an adaptive management approach to the administration of transboundary waters. Explained in Chapter Two, adaptive management is a decision-making framework for governing water that incorporates uncertainty

67 Brachet, C. *et al.* (2012). *The Handbook of Integrated Water Resources Management of Rivers, Lakes, and Aquifers*, pp. 40-41. International Network of Basin Organizations (INBO) and Global Water Partnership (GWP).

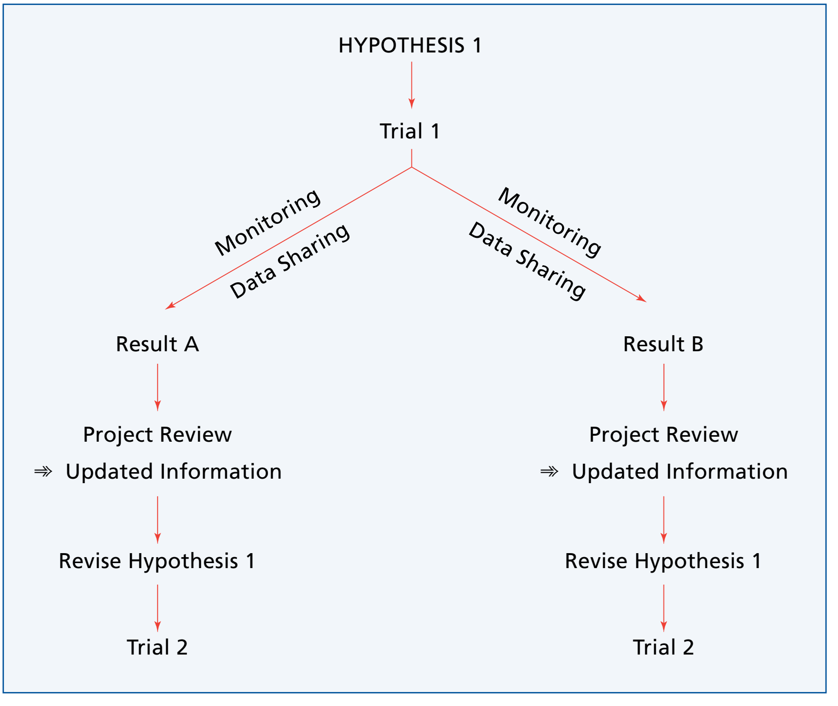
68 Intergovernmental Panel on Climate Change (2008). *Technical Paper on Climate Change and Water*, Doc. IPCC-XXVIII/Doc.13 (8.IV.2008) (Apr. 10, 2008), p. 32.

69 Hirabayashi, Y. *et al*. (2008). "Global Projections of Changing Risks of Floods and Droughts in a Changing Climate," *Hydrological Sciences Journal*, Vol. 53, pp. 754-772, at p. 769.

70 *See* Milly, P.C.D. *et al*. (2008). "Stationarity Is Dead: Whither Water Management?'' *Science*, Vol. 319, pp. 573-574, at p. 573.

into the planning process. It is a process of experimentation that, rather than testing hypotheses in a stilted laboratory setting, implements its trials in the real world.[71] Every subsequent step in the implementation phase is adapted to the effects and results of previous policies. Fundamentally, adaptive management necessitates both feedback and updated information, both of which are dependent on coordinated data sharing, project monitoring, and project review processes, as depicted in Figure 3.1.

Figure 3.1 Adaptive Management Learning Scheme



In the context of institutional mandates, management practices, or legal frameworks, adaptive management entails the acceptance and incorporation of uncertainty into project plans, policies, laws, and regulations through the adoption of a trial and error process. This means that any management or legal framework applicable to a transboundary freshwaters must incorporate language and simple procedures allowing for periodic changes to the objectives, rights, and obligations defined in the instrument. This will permit the agreement to operate dynamically in relation and in response to new information. Likewise, any institutional mechanism authorised to operate on or manage shared waters resources must have the capacity and authority to quickly respond to new data and information, and to alter its policies, activities, responsibilities, and objectives.[72] Thus, for example, an institutional mechanism could be authorised to periodically reduce or increase allocations in response to

71 Bruch, C. (2009). "Adaptive Water Management: Strengthening Laws and Institutions to Cope with Uncertainty,'' in Biswas, A.K., Tortajada, C. and Izquierdo-Avino, R., (eds.), *Water Management in 2020 and Beyond*, pp. 91-92 pp. 91-92. Springer: Verlag, Berlin, Heidelberg. *See* also Bruch, C. and Troell, J. (2011). "Legalizing Adaptation: Water Law in a Changing Climate,'' *Water International*, Vol. 36(7), pp. 828-845.

72 Eckstein (2010), *supra* note 29, at pp. 444-446; and Bruch and Troell (2011), *supra* note 71, at p. 843.

changing levels of precipitation or flow, or as the needs of riparian States change; replace or modify enforcement mechanisms in relation to the efficacy of existing enforcement efforts; or revise basin management strategies and priorities as conditions in the basin change.

Understandably, implementing an adaptive management approach in a transboundary context could prove difficult, not least because it would require governments and policymakers to admit to, and learn from, failures and mistakes in a very public process. It also could face obstacles where the costs associated with implementing an experimental and adaptive approach to planning may be regarded as overly burdensome in political and social contexts, as well as in economic terms.[73] Moreover, adaptive management may be frustrated by a lack of accommodating domestic and transboundary legal regimes that allow flexibility in management decisions.[74]

Nonetheless, in light of the uncertainty of climate change, adaptive management may be one of the few viable methodologies for responding to variability and climate change. Clearly, such an approach requires a flexible political perspective in which governments, policymakers, and the citizenry adopt a long-term time horizon that emphasises a process of learning and improving policies and management, rather than one concerned with ideology and political gain.[75] Additionally, there is a strong case to be made that over the longer term, adaptive management will result in lower societal costs, especially given that inaction could prove disastrous.[76]

3.4.3 Stakeholder participation in institutional mechanisms

The significance and value of stakeholder participation is highlighted in other chapters of this publication as a critical component of adaptive water governance. However, it is worth briefly highlighting in the context of cross-border institutional mechanisms. Institutions established to implement cooperative transboundary water objectives cannot function effectively without participation from those who will be affected by the institution's actions and decisions. Without public involvement, these institutions are likely to lack, *inter alia:* locally-specific information that may be unknown outside the border region; an understanding of the local values and preferences of those most likely to be affected by their decisions; and the ability to fully implement solutions that require local support and execution.[77]

In addition, since climate change adaptation mechanisms are predominantly implemented on a local scale, stakeholder participation in adaptive responses to climate variability cannot be limited to national institutions, even if infused with local representation. Rather, such involvement necessarily includes the development of local institutions, such as cross-border water user associations, watershed management organisations, and other related entities.[78] Polycentric governance has the

73 Arvai, J. *et al*. (2006). "Adaptive Management of the Global Climate Problem: Bridging the Gap Between Climate Research and Climate Policy," *Climatic Change*, Vol. 78, pp. 217-225, at p. 220.

74 Craig, R.K. (2010). "Adapting to Climate Change: The Potential Role of State Common Law Public Trust Doctrines," *Vermont Law Review*, Vol. 34, pp. 781-853, at p. 797.

75 Dernbach, J. (2009). "Navigating the U.S. Transition to Sustainability: Matching National Governance Challenges with Appropriate Legal Tools," *Tulsa Law Journal*, Vol. 44, pp. 93-120, at p. 120.

76 UNECE (2009c). "Water and Adaptation to Climate Change," U.N. Doc. ECE/MP.WAT/2009/4, (Sept. 1, 2009), Main Messages of the Guidance on Water and Adaptation to Climate Change, Annex para. 18.

77 Eckstein, G. (2013). "Rethinking Transboundary Ground Water Resources Management: A Local Approach along the Mexico-U.S. Border," *Georgetown International Environmental Law Review*, Vol. 25(1).

78 Bruch and Troell (2011), *supra* note 71, at p. 831.

advantage of establishing multiple governance mechanisms, at different geographical scales that exist and operate in parallel.[79] Such a governance approach permits the advantages peculiar to each geographic scale to be harnessed. While centralised, government-supported institutions have better coordination capacities and can manage issues at a larger scale,[80] transboundary water issues are often of greater significance to local border communities than to the broader populations of the riparian nations. Moreover, local actors and decision-makers are typically better informed about local and regional cross-border concerns than their national counterparts.[81] By empowering and including local stakeholders in decision-making, identified solutions are likely to be more realistic and effective because of the commitments and level of participation that those stakeholders will bring to the table.[82]

Case Study 3.11 The Abbotsford-Sumas Aquifer between Canada and the U.S.

An example of a local institutional response to a transboundary water issue that incorporates stakeholder participation is the 1996 Memorandum of Agreement (MoA) over the transboundary Abbotsford-Sumas Aquifer entered into by the Department of Ecology of the U.S. State of Washington, and the Ministry of Environment, Lands and Parks of the Canadian Province of British Columbia. While the Agreement does not focus specifically on climate change concerns, it established mechanisms that allow the parties to respond to climatic variability, including procedures and mechanisms for cross-border consultation and exchange of information on water quantity withdrawals and allocations from the aquifer (WA-BC MoA, 1996). Moreover, the MoA allows for the participation of local stakeholders and industry groups in the coordination and management of the aquifer.[83]

3.4.4 Political level of implementation

The degree of interest that a national government may have in a local issue is often in direct proportion to the distance the issue lies physically from the capital. Moreover, management of natural resources that traverse a political boundary may be more effective and efficient at a political level that is more attuned to the geographical scope of the resource. Accordingly, responsibility for the development and implementation of particular institutional mechanisms should not automatically be considered under the purview of the national government. Rather, following the principle of subsidiarity, the management of transboundary freshwaters should be pursued at the lowest level of competent authority.[84]

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79 Imperial, M.T. (2005). “Using Collaboration as a Governance Strategy—Lessons from Six Watershed Management Programs,” *Administration and Society*, Vol. 37(3), pp. 281-320, at p. 287. *See* also Karkkainen, B.C. (2004). “Post-sovereign Environmental Governance,” *Global Environmental Politics*, Vol. 4(1), pp. 72-96.

80 Meinzem-Dick, R. (2007). “Beyond Panaceas in Water Institutions,” *Proceedings of the National Academy of Sciences*, Vol. 104(39), pp. 15200-15205.

81 Eckstein (2013), *supra* note 77.

82 Bruch and Troell (2011), *supra* note 71, at p. 831.

83 Norman, E.S. and Melious, J.O. (2008). “Hidden Waters: The Role of Local Communities in Transboundary Environmental Management Across the Forty-Ninth Parallel,” in Loucky J. *et al*. (eds.), *Transboundary Policy Challenges in the Pacific Border Regions of North America*, pp. 195-219. University of Calgary Press: Calgary, Canada.

84 Eckstein (2013), *supra* note 77.

A local approach is likely to be more responsive and more adaptable to changing circumstances and improved knowledge.[85] For example, the effects of climate change along the Mexico-U.S. border threaten the region in ways that have yet to be fully ascertained. While studies generally forecast more arid conditions and reduced rainfall and stream flow throughout the border area in coming decades, how, where, and to what extent those changes will occur are still subject to debate and speculation. Moreover, the projected changes are likely to vary all along the frontier, affecting different segments of the border in disparate ways. While comprehensive, border-wide responses to climate variability may be suited for certain transboundary water bodies, sub-national bodies – who typically are better informed about community and regional cross-border concerns than federal bureaucrats, and are more likely to comply with a locally tailored accord – could be far more agile in formulating local responses and solutions to their unique circumstances as climatic and related changes become apparent.[86]

This "bottom-up" approach to the management of cross-border freshwaters, however, is not a broad panacea for every transboundary river, lake, or aquifer scenario. Factors and characteristics, such as the geographic scale of a particular water body, may dictate the level of administrative authority necessary to respond to particular issues and challenges posed.

Case Study 3.12 The Mimbres River Watershed between Mexico and the U.S.

For example, where a basin is contained within a limited region, such as the Mimbres River watershed – an endorheic or terminal basin traversing the border between New Mexico in the U.S. and Chihuahua in Mexico – local participation and decision-making is particularly appropriate. In contrast, where the specific water challenge involves a basin that transects or impacts a much larger area – for example, the Rio Grande, with its numerous tributaries and hydraulically linked aquifers, which begins in the Rocky Mountains of the U.S. and eventually forms the border between the U.S. and Mexico – a strictly local arrangement may be less suitable or effective. Rather, decision-making ought to be handled by the lowest level of administrative authority with competence over the resource and its implications.[87]

3.4.5 Formality of the Agreement

Institutional mechanisms can be crafted utilising a variety of formal and informal mechanisms. It is noteworthy that such arrangements, especially at the local level, need not be formal agreements containing all of the requisite bureaucratic minutiae found in treaties. Rather, the degree of formality pursued should, to some extent, be in proportion to the political level at which the mechanism is implemented. Thus, where the institution is intended to have a broad jurisdictional scope and authority that significantly impacts the parties' sovereignty, it may be prudent to follow a more formalistic treaty approach. However, in certain cases, the management of transboundary waters may be more convenient and effective where cooperation at the sub-national level is pursued informally. Memoranda of Understanding (MoUs) and other similar informal frameworks are often justified where the needs for simplicity, lower public profile, speed, and flexibility outweigh the customs and procedures required of formal accords. In other circumstances, some measure of formality may

85 More discussion on approaches to multiple levels within the basin approach can be found in Chapters One and Five of this publication, particularly on the division of the basin into smaller units and how does this influence the most appropriate institutional architecture for adaptation responses.

86 Eckstein (2013), *supra* note 77.

87 *Ibid*.

adequately be achieved at the local level through a contract for goods or services that avoids the full rigors of formal treaties, but retains certain legal procedures and requirements of contract law.[88]

Case Study 3.13 Cities of Ciudad Juárez, Chihuahua, Mexico and El Paso Texas, U.S.

In an effort to simplify their cross-border water relations, the water utilities of the sister cities of Ciudad Juárez in Chihuahua, Mexico and El Paso in Texas, U.S., entered into a MoA in 1999, under which the two entities agreed to do the following: share data, information, and technology; exchange information on funding sources and mechanisms; coordinate efforts to secure water supplies; improve wastewater treatment systems, and examine reuse opportunities; develop a joint outreach program for the efficient use and re-use of water on both sides of the border; and cooperate over other transboundary projects of common interest. In a similar vein, the Department of Ecology of the U.S. State of Washington and the Ministry of Environment, Lands and Parks of the Canadian Province of British Columbia have cooperated over the transboundary Abbotsford-Sumas Aquifer since 1996 under a MoA that facilitates opportunities for cross-border stakeholder involvement and allows for prior consultation over and opportunities for commenting on proposed water quantity allocation decisions with potential transboundary implications.

In contrast, the cities of Derby Line in Vermont, U.S., and Stanstead in Quebec, Canada, employed a contractual arrangement to create a private company owned by the two municipalities that provides potable water to their residents. While the source of the water is a transboundary aquifer, the wells are located in Stanstead, Quebec. In addition, Derby Line and Stanstead have also entered into a separate contractual arrangement, under which wastewater from both communities is treated on the Canadian side.[89]

3.4.6 Financial and other support for institutional mechanisms

An especially noteworthy aspect of an institutional mechanism that requires attention pertains to the financial and related support provided to the institution. Regardless of the authority granted to an institution, the absence of financial and other mechanisms to support and sustain the institution's activities can render the institution ineffective and irrelevant. Hence, to ensure that an institutional mechanism can produce the expected benefits and promises, it must have the appropriate resources to carry out its mandate. This includes both financial and human resources, and the political capital necessary to carry out policies and implement projects that may be unpopular but necessary. Accordingly, governmental support by all of the basin riparians must be secured and assured in order to allow the institution to formulate and implement its responsibilities effectively.[90]

For financing transboundary water bodies, a number of different funding options are available. On the one hand, there are funding options internal to the basin. Those include contributions from the member States, which can stem directly from national budgets or community levies. For such direct forms of funding it is necessary to determine an allocation key, based on equality, in relation to the countries' wealth, or on a criterion of usefulness such as the catchment area in a country's jurisdiction, the population living in that catchment area, or the total water use per country. An alternative internal funding source may come from taxes on water and/or hydropower users and polluters. Institutional mechanisms, like basin organisations, can also charge fees related to the sale of their services, such as the provision of data, the conduct of feasibility studies and hydraulic modelling, and general assistance to developers. Revenue generated from these services, however, is usually only a small

88 *Ibid*.

89 Forest, P. (2010). "A Century of Sharing Water Supplies between Canadian and American Borderland Communities," *Munk School Briefings No. 15*, Program on Water Issues, Munk School of Global Affairs, Trinity College, University of Toronto, October 2010, p. 19.

90 Eckstein (2011), *supra* note 29, at p. 448.

fraction of the costs associated with the daily operation of an institutional mechanism. Among the external funding options, institutional mechanisms might pursue public and private donors, as well as public-private partnerships. Examples of public donors who have funded projects include, but are not limited to, the World Bank, the Global Environmental Facility (GEF), the Adaptation Fund and the Green Climate Fund (GCF) under the UNFCC, the E.U., and national development agencies such as the Canadian International Development Agency (CIDA) or the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) from Germany. When evaluating these different funding options, it should be considered that the sustained functioning of a shared water body is enhanced both: a) having a degree of financial autonomy from the member States; and b) being funded through regular income in the long term.[91]

3.5 Conclusion

Globally, 276 rivers and lakes and at least 273 aquifers traverse international political boundaries; with the exception of most island-nations, every country in the world is hydrologically connected to one or more of its neighbours. The unavoidable interdependencies created by freshwater, as well as the uncertainties resulting from climate change, such as increased frequency of extreme weather events and long-term changes in flow patterns, strongly support the need for enhancing transboundary cooperation as a means for avoiding possible conflict, depletion, negative economic consequences, and environmental damages.

Yet, of the multitude of international watercourses, more than half have no cooperative management framework; of the 105 international basins that employ some type of water management institution, fewer than 20 percent of those with more than three riparians have multilateral agreements involving all of the riparians.[92] Furthermore, of the hundreds of transboundary aquifers identified to date, only the Genevese Aquifer has a formal institutional framework, while two others have a basic data sharing arrangement with only limited institutional structures.[93]

While these figures suggest considerable opportunities for transboundary water cooperation, this chapter should not be interpreted as promoting a treaty or other arrangement for every transboundary river, lake, and aquifer basin globally. In fact, certain transboundary basins, owing to unique climatic, geographic, ecological, or demographic characteristics, may not need any effort to enhance water management. Nevertheless, experience suggests that where riparians do coordinate

91 Brachet (2012), *supra* note 67, at p. 89.

92 UNEP (2002). *Atlas of International Freshwater Agreements*, compiled by Wolf, A., Oregon State University; and McCaffrey, S.C. (1990). *Sixth Report on the Law of the Non-Navigational Uses of International Watercourses*, U.N. Doc. A/CN.4/427, reprinted in [1990] II Y.B. Int'l L. Comm'n at 43, para. 5, U.N. Doc. A/CN.4/SER.A/1990/Add.1 (Part 1).

93 *See Convention relative a la protection, a l'utilisation, a la realimentation et au suivi de la Nappe Souterraine Franco-Suisse du Genevois*, *supra* note 64; *Establishment of a Consultation Mechanism for the Northwestern Sahara Aquifer System (SASS)* [2002], between Algeria, Libya and Tunisia, Rome, Italy December 19-20, 2001 via proces verbal (Minutes), endorsed by Algeria on January 6, 2003, and the *Programme for the Development of a Regional Strategy for the Utilisation of the Nubian Sandstone Aquifer System (NSAS) - Terms of Reference For the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System*, agreed to by Chad, Egypt, Libya and Sudan, Tripoli, October 5, 2000, both *available at* http://www.fao.org/docrep/008/y5739e/y5739e05.htm; and Eckstein, G. and Eckstein, Y. (2003). "A Hydrogeological Approach to Transboundary Ground Water Resources and International Law," *American University International Law Review*, Vol. 19(2), pp. 201-258, at p. 227.

their management activities and overcome the lack of trust and the fear of losing sovereign control, transboundary water cooperation can generate considerable economic, societal, and environmental gains in the realm of disaster prevention, water security, research and development, habitat and species protection, and returns on water infrastructure investments.

Toward this end, the present chapter has identified various tools for managing transboundary waters that can help alleviate both the general challenges of cooperating over transboundary water resources and the specific difficulties resulting from climate change. Among the most fundamental suggestions are:

1) A stepwise approach to cooperation that encourages trust and collaboration, the sharing and harmonisation of data and information, and the de velopment of realistic expectations about cooperation;
2) A focus on establishing sound, albeit flexible procedural bases for cooperation that can respond to supply and demand variability, before developing substantive rules and water allocation criteria;
3) Development of mechanisms that are both flexible and resilient; and
4) Development of a subsidiarity-based approach alongside polycentric forms of governance that allow local and informal initiatives alongside official interstate cooperative efforts.

Chapter Four

Stakeholder and Public Participation in Adaptive Water Governance

Joshua Roberts and Garima Joshi[1]

4.1 Introduction

Developing adaptive responses to environmental change is not a straightforward process. While adaptation aims to help those that may be affected by climate change prepare for the future, uncertainty and incomplete information make action difficult.[2] In the transboundary context, different levels of decision-making – from local to international – pose challenges towards adequate representation of stakeholder concerns at all scales, and incorporation of relevant data into final decisions.

In response, multilevel governance processes have begun to evolve. Non-state actors now play increasingly important roles in decision-making, and policy and implementation processes are no longer performed solely by central governmental actors.[3] While transboundary river basin institutions are still necessary for coordinating adaptation responses, in a multi-level and often polycentric system (i.e., systems with many centres of decision-making that are formally independent of each other), they are but one of many stakeholders responsible for devising and implementing adaptive solutions to water management.[4]

As has been stressed throughout this publication, adaptive water governance enhances capacity to deal with climate change. This requires moving away from seeing institutions as static organisations with rigid hierarchical structures to more dynamic systems that can respond to uncertainty.[5] It also requires nonlinear and flexible social learning that focuses on scenario planning and "learning-by-doing".[6]

These requirements reinforce the need for adaptive information management, where stakeholders collect, share, analyse, and incorporate relevant data and information into adaptation policies and

1 Joshua Roberts, Staff Lawyer (U.S. qualified), ClientEarth, London, U.K., and Legal Consultant, IUCN Environmental Law Centre, Bonn, Germany; Garima Joshi, Legal Consultant, IUCN Environmental Law Centre, Bonn, Germany, and J.D., Villanova University of Law, Pennsylvania, U.S.

2 Gardner, J. *et al*. (2009). "A Framework for Stakeholder Engagement on Climate Change Adaptation," *CSIRO Climate Change Adaptation Flagship Working Paper No. 3* (May 2009), p. 8, *available at* http://www.csiro.au/resources/CAF-working-papers.html.

3 Timmerman, J.G, and Langaas, S. (2005). "Water Information: What is it Good for? The Use of Information in Transboundary Water Management," *Regional Environmental Change*, Vol. 5(4), pp. 177-187, at p. 181.

4 Vincent Ostrom defined the idea of polycentric political systems some time ago, and it has been increasingly referred to in literature on transboundary water governance. *See* Ostrom, V. *et al*. (1961). "The Organisation of Government in Metropolitan Areas: A Theoretical Inquiry," *American Political Science Review*, Vol. 55, pp. 831-842.

5 Pahl-Wostl, C. (2007a). "The Implications of Complexity for Integrated Resources Management," *Environmental Modeling Software*, Vol. 22(1), pp. 561-569.

6 Pahl-Wostl C. (2007b). "Transitions Towards Adaptive Management of Water Facing Climate and Global Change," *Water Resources Management*, Vol. 21, pp. 49-62.

implementation strategies.[7] It also reiterates the need for effective coordination, communication, and collaboration, which can be idealized as the creation of "information networks". As a prerequisite, a certain level of support, trust, and political will must exist between relevant stakeholders to cooperatively collect and share information, and to understand and mitigate conflicts and trade-offs. The process must also be cognizant of power asymmetries that exist between different stakeholder interests, with a view to levelling the playing field. For that, legal and institutional frameworks need to ensure accountability between actors, guaranteeing that adaptation efforts actually help the individuals at which they are aimed.

The first part of this chapter will focus on the role and importance of stakeholder and public participation in responding to and building resilience to climate change, highlighting specific challenges towards realising full and effective engagement in adaptive governance. The chapter will then touch upon different tools that can contribute to building an enabling environment for involving all relevant stakeholders in effective adaptive water governance.

4.2 Stakeholder and Public Participation in Adaptive Water Governance

Stakeholder and public[8] participation,[9] especially within the context of a complex and multifaceted issue such as climate change, is crucial.[10] Different stakeholders play a number of roles, and inclusiveness and representation can provide a number of benefits to the adaptation process. Nevertheless, participation is not a straightforward process, and there are a number of challenges that prevent effective engagement by all relevant stakeholders. It should be noted that these challenges are not necessarily limited to adaptation, and they are common to water governance in general. We highlight these dynamics in the following section.

7 Pahl-Wostl, C. *et al*. (2012). "From Applying Panaceas to Mastering Complexity: Toward Adaptive Water Governance in River Basins," *Environmental Science and Policy*, Vol. 13, pp. 24-34, at p. 28.

8 It is important to distinguish "the public" from "stakeholders". Stakeholders often have a defined or recognised interest, whereas the public is defined more broadly, and many not have a clear interest. For the purposes of this chapter, we will use the terms "involvement", "participation", and "engagement" interchangeably under an overarching concept of targeting the public and stakeholders in decision-making more broadly. *See* Troell, J. (2010). *Public Participation in International Waters Management: A Handbook*, p. 9. ELI: Washington D.C.

9 There are different types of participation: "Information sharing" assumes a simple one-way flow of information. "Consultation" goes further, depicting a two-way flow of information. It may consist of an exchange of views between decision-makers and the public, or even surveys or interviews. "Collaboration", or active involvement, goes further still, where joint activities, such as shaping the process or priorities, are undertaken with the public and/or stakeholders, even if the decision-maker retains ultimate authority to decide a course of action. An additional level of participation, "empowerment", implies providing relevant stakeholders control over decision-making, resources and activities. *See* Rey, D., Roberts, J., Korwin, S., Rivera, L. and Ribet, U. (2013). *Understanding and Implementing the UNFCCC REDD+ Safeguards*, at pp. 49-50. ClientEarth: London, U.K.

10 Kravchenko, S. (2009). "The Myth of Public Participation in a World of Poverty," *Tulane Environmental Law Journal*, Vol. 23(1), pp. 34-55, at p. 37.

4.2.1 The role and importance of stakeholder and public participation in climate change adaptation

A broad array of stakeholders play diverse roles in developing and implementing adaptive responses. First, different stakeholders contribute towards the collection and use of data and information to develop adaptation responses.

Appropriate adaptation responses build upon a broad knowledge base of different types of data and information. For instance, models and scenarios are particularly useful tools for assessing potential futures and impacts throughout the basin.[11] Development of these tools require, *inter alia*: scientific and technical data related to climactic and hydrological conditions in the basin, environmental data and information, geographic, and cultural and socio-economic information.[12]

Stakeholders need to be able to agree on what to do with the information once it has been produced. Objectives for the use of that information need to be defined, which will determine what types of information and data need to be produced, and how.[13] For instance, it can be agreed through wide stakeholder consensus that information will be used to plan and develop vulnerability assessments and/or strategies, or to make or amend particular strategy options.[14]

In the transboundary context, formal institutions at the local, regional, national, and international level have played a key role in defining information needs, as well as collecting and sharing data and information. Nevertheless, for a number of reasons – including lack of political will, trust, and capacity – basin-wide data and information is often incomplete, and information management systems are often inadequate.[15] For instance, States may have failed to come to a consensus on methodologies, techniques, procedures, assumptions, or technologies to generate and process data and information.[16]

Non-state actors are therefore highly relevant for supplementing State-gathered information. At the local or micro-basin level, for instance, community stakeholders often have a better understanding of environmental, agricultural, socio-cultural, and economic conditions than government agencies.[17] Community-based and non-governmental organisations (NGOs) can help gather and communicate such information to decision-makers at local, national, and even transboundary levels. Furthermore, academic institutions, and international observation networks and agencies are often able to supplement other information sources with larger data sets at higher scales (e.g., at transboundary and

11 UNECE (2009). *Guidance on Water and Adaptation to Climate Change*, p. 57. U.N.: Geneva, Switzerland.

12 *See* Chapter Three, Section 2.2 of this Publication.

13 Timmerman and Langaas (2005), *supra* note 3, at p. 182.

14 The use of planning tools such as vulnerability assessments and adaptation strategies as a way to channel information into participatory approaches towards adaptation will be one of the focuses of Chapter Five.

15 USAID (2010). *Asia-Pacific Regional Climate Change Adaptation Assessment, Final Report*, p. 46. USAID: Washington D.C., *available at* http://pdf.usaid.gov/pdf_docs/PNADS197.pdf.

16 *See* Eckstein, G. (2013). "Rethinking Transboundary Ground Water Resources Management: A Local Approach Along the Mexico-U.S. Border," *Georgetown International Environmental Law Review*, Vol. 25(1).

17 Bruch, C. (2001). "Charting New Waters: Public Involvement in the Management of International Watercourses," *Environmental Law Reporter*, Vol. 31(12), at p. 11390.

regional levels).[18] Private sector actors from agriculture, forestry, hydropower, fishing, and manufacturing can also share valuable information (e.g., water quality data, business interests, and needs) at multiple levels – from local to international.

Stakeholder engagement is also necessary for understanding and considering different interests or rights that exist in a basin (e.g., economic, cultural, recreational, and religious). In order to be effective, the development of adaptation measures need to be informed and shaped by social, institutional, ecological, economic, and political dynamics. These are issues that cannot be fully understood unless relevant stakeholders (e.g., local communities and institutions) are effectively engaged, and their views are taken into account. For instance, indigenous groups may possess traditional or customary rights to land or natural resources, including water, which may or may not already be officially recognised by decision-making authorities.[19] Furthermore, support from influential private sector actors, and even well organised civil society organisations, could be a necessary precondition for moving politically sensitive or controversial water management decisions forward. It is important to note that this aspect of participation raises issues around the ability of certain actors to be effectively represented, particularly because private sector interests often possess more bargaining power than others.

The success of many adaptation responses also relies on public ownership and participatory approaches to implementation. Adaptation is not just about responding to impacts – it is also about adopting alternative livelihoods, and more sustainable patterns of development. These changes may not come easily, either because of entrenched interests, long-standing cultural traditions, insufficient information and understanding of climate change impacts, or a lack of capacity. In order to address these challenges, emphasis can be placed on enhancing stakeholder awareness and understanding of climate change impacts, ideas around uncertainty, and potential benefits and trade-offs of certain decisions.

For example, ownership and active involvement is particularly relevant for ecosystem-based adaptation (EbA) approaches such as reforestation and mangrove restoration.[20] Such approaches are currently being demonstrated in the Sixaola River Basin, which is shared between the Republic of Costa Rica and the Republic of Panama. There, local border communities have been actively involved in the development and implementation of ecosystem restoration efforts. The success of these strategies, which also focus on sustainable livelihoods, has relied largely on empowerment and community involvement in their development, planning, and implementation.

In order to up-scale successful adaptation strategies – such as those implemented in Sixaola – to the binational level, communities need to have adequate representation at higher levels of governance.

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18 Examples include the World Hydrological Cycle Observing System (WHYCOS), the Global Climate Observing System (GCOS), the Global Earth Observation System (GCOS), the UN Global Environment Monitoring System (GEMS), the FAO's Information System on Water and Agriculture (FAO AQUASTAT), the WMO's Hydrological Information Referral Service (WMO INFOHYDRO), and the International Groundwater Assessment Centre (IGRAC).

19 Evidence has shown progress in domestic legal systems since the adoption of the U.N. Declaration on the Rights of Indigenous Peoples by the General Assembly of the U.N. in 2007, although challenges still remain. *See* UN Permanent Forum on Indigenous Rights (n.d.). "Advances in the Recognition of Indigenous Rights Since the Adoption of the UN Declaration," *Indigenous People Indigenous Voices Fact Sheet*, *available at* http://www.un.org/en/events/indigenousday/pdf/indigenous_Advances_Eng.pdf.

20 Such participatory adaptation strategy options – and how they are implementation on the ground – will be more fully explored in Chapter Five.

Through cooperation and communication across scales, successful local adaptation responses can be replicated elsewhere in the basin. Representation at higher governance levels can also help communities access additional resources for further work on adaptation. As explained in previous chapters, vertical coordination is a key element of adaptive governance.

Lastly, transparency and effective stakeholder and public participation also have the potential to improve accountability, which combined are key components of adaptive capacity.[21] Effectively implemented, these principles hold the promise that potential complications and conflicts (e.g., disputes between different stakeholder groups, such as environmental NGOs and agricultural interests; or between decision-makers and citizens affected by adaptation decisions, such as government decisions that impact indigenous and local communities) can be resolved throughout planning, implementation, and monitoring processes. On the other hand, where there is a lack of transparency or opportunities to participate in adaptive processes, legitimacy is likely to be compromised. This is not particular to the adaptation context, and it is typically evident in most contexts that relate to water management. For instance, congressional authorisation of the construction of the Belo Monte dam in Brazil in 2005, which was arguably in violation of indigenous peoples' right to Free, Prior and Informed Consent (FPIC), has resulted in numerous demonstrations and lawsuits against the project.[22] These disruptions have caused delays to the project, as well as public international criticism.

4.2.2 Challenges to stakeholder and public participation in adaptive water governance

There are a number of challenges that hinder the prospect of public participation in developing and implementing adaptation measures, particularly in the transboundary context.

At the outset, an underlying practical challenge for ensuring full and effective stakeholder and public participation is a lack of resources or institutional capacity. For instance, national adaptation plans (NAPs) and national adaptation programmes of action (NAPAs) developed under the United Nations Framework Convention on Climate Change (UNFCCC) are supposed to be developed according to the principles of participation and full transparency.[23] However, countries have experienced challenges in implementing these principles, particularly in the areas of free flow of information, awareness-raising, and communications within and between different levels of government due to insufficient financial resources and a lack of stakeholder capacity to effectively participate in adaptation planning processes.[24] At the government level, problems may also relate to inefficiencies in public administration, understaffing, competition between different government agencies, and political changes.[25]

21 Hill, M. (2013). *Climate Change and Water Governance: Adaptive Capacity in Chile and Switzerland*. *Advances in Global Research No 54*, p. 56. Springer: Dordrecht, the Netherlands.

22 *See* International Rivers, "Belo Monte Justice Now! Legal Campaign," (6 November 2012), *available at* http://www.internationalrivers.org/resources/belo-monte-justice-now-legal-campaign-7716.

23 *United Nations Framework Convention on Climate Change* (UNFCCC), adopted June 1992 in Rio de Janeiro, Brazil, entered into force 21 March 1994 (1771 U.N.T.S. 107), at Arts. 4(1)(a) and 6(a)(iii); *see* also COP Decision 5/CP.17, para. 3; Annex, para. 3.

24 USAID (2010), *supra* note 15, at p. 32; *see* also Dixit, A. (2012). *Ready or Not: Assessing Institutional Aspects of National Capacity for Climate Change Adaptation*. World Resources Institute (WRI): Washington D.C.

25 Kallis, G. *et al*. (2009). "Collaborative Governance and Adaptive Management: Lessons from California's CALFED Water Program," *Environmental Science & Policy*, Vol.12, pp. 631-643, at p. 637.

Challenges also relate to scale. Stakeholder engagement at the transboundary level is particularly complex due to multiple governance levels. While having a river basin organisation (RBO) in place may help coordinate the process, it may still be challenging to effectively engage all stakeholders, due to limited capacity and financial resources.[26]

Another major issue relates to power dynamics that exist within society, whereby some actors are better equipped to represent their interests at different levels – sometimes at the expense of others. This imbalance can exist between different stakeholders, for instance between powerful industrial or agricultural lobbies and civil society groups. Nevertheless, power asymmetries may also exist within communities themselves. This is most common with frequently marginalised groups, such as indigenous peoples, women, and minorities. In these instances, community representatives should always act in the best interests of those they purport to serve.[27] Traditional leaders that represent indigenous communities should not further dynamics of elite capture of benefits and natural resources.[28] Where relevant power asymmetries are not addressed in the decision-making process, well-resourced interests are likely to benefit at the expense of marginalised and under-represented groups, or individuals that do not have a strong voice.

Furthermore, conflict between powerful interests may stand in the way of collaboration. Potential for dialogue may arise where these parties are locked into long-term and costly litigation,[29] or where a relatively "safe space" is established for speaking more openly.[30] However, the latter option can create trade-offs, whereby a "closed door" negotiating environment arises, excluding other affected individuals or groups from the conversation.[31] Therefore, there is an inherent tension between creating a flexible decision-making atmosphere, and maintaining transparency, legitimacy, and accountability. For example, this has been the case throughout the stakeholder dialogue processes in the Sacramento-San Joaquin Bay-Delta in California. There, agricultural interests, water districts, public agencies, and large conservation groups have been fighting for years over how to maintain sustainable water supplies for users in a changing climate while restoring the degraded Delta ecosystem. While various processes have been constructive, they have tended to exclude other "in-Delta" interests, resulting in a legitimacy deficit and a lack of public support for many proposed measures.[32]

Legal frameworks can be used to help balance power relationships between stakeholders. As explained further below, procedural participation rights (i.e., the right to access information, the right to participation, and the right to access justice) provide the basis for allowing stakeholders and interested members of the public to be involved in decision-making. Furthermore, legal frameworks can provide a basis for more localised decision-making. However, in countries where control over

26 USAID (2010), *supra* note 15, at p. 33.

27 *See* Troell (2010), *supra* note 8, at p. 12.

28 Hirsch, C. *et al*. (eds.) (2012). *REDD+ and Indigenous Peoples*, pp. 4-6. Centre for Development and the Environment, University of Oslo: Oslo, Norway, December 2012.

29 *See* e.g., Kallis *et al*. (2009), *supra* note 25, at p. 637.

30 *Ibid*. at p. 638.

31 Green, O.O. (2012). "Iterative Processes for Resilient Transboundary Water Management Collaboratively Governing the Okavango for Adaptation," (SSRN), p. 7, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2039023.

32 *See* Shilling, M., London, J.K. and Lievanos, R.S. (2009). "Marginalization by Collaboration: Environmental Justice as a Third Party in and Beyond CALFED," *Environmental Law and Policy*, Vol. 12, pp. 694-709.

natural resources has traditionally rested with centralised government agencies, there may be reluctance towards devolving authority to the local level, or to the public. If such rights are not incorporated into relevant laws and regulations, there can be no legal basis for ensuring that all relevant stakeholders are represented in developing and implementing adaptation measures.

Even when such rights are embodied in legal frameworks, it is common that individuals and groups are unaware that these rights exist, or that they lack capacity to exercise them. For instance, the Binational Commission for the Sixaola River Basin, which oversees basin management in the Sixaola River Basin, guarantees space for local stakeholder representation. However, it is common that not all local representatives are able to attend meetings because they are unable to take time away from activities that secure their livelihoods. Again, this tends to be an issue experienced by more vulnerable and marginalised groups. There is therefore not only a need to ensure that legal frameworks are in place, but that institutions empower citizens to effectively exercise their rights.

4.3 International Legal Principles on Public Participation

The importance of public participation been recognised by the UNFCCC. It calls on Parties to promote and facilitate "public participation in addressing climate change and its effects and developing adequate responses."[33] Moreover, all Parties have a commitment to promote and cooperate in education, training and climate change awareness, and to encourage "the widest participation in this process, including that of non-governmental organisations."[34]

In the context of identifying, developing and implementing adaptation strategies through their NAPs, Parties should follow a "gender-sensitive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems."[35] Furthermore, the latest *"Technical Guidelines for the National Adaptation Plan"* Process recommend countries to "avoid negative transboundary impacts, especially on shared river basins or other ecosystems" through, *inter alia*, "broad inclusiveness and involvement of all relevant stakeholders."[36]

Rights related to participation in public matters are well recognised under international human rights law.[37] With regard to environmental matters in general, including water, there are three "pillars" that make up this human right: 1) access to environmental information; 2) the right of the public

33 UNFCCC, *supra* note 23, at Art. 6(a)(iii).

34 *Ibid.* at Art. 4(1)(i).

35 UNFCCC (2011). Conference of the Parties (COP) Decision 5/CP.17, para. 3, and Annex, para. 3. (FCCC/CP/2011/9/Add.1), *Report of the Conference of the Parties on its Seventh Session*, held in Durban from 28 November to 11 December 2011. These principle are applicable to country activities under the Cancun Adaptation Framework, which was developed under the UNFCCC to assist developing countries – particularly Least Developed Countries (LDCs) – to prioritise and plan for immediate, and long-term adaptation actions through the development implementation and implementation of NAPs and NAPAs.

36 *See* also Least Developed Countries Expert Group (2012). *National Adaptation Plans. Technical Guidelines for the National Adaptation Process* (UNFCCC Secretariat: Bonn, Germany), *available at* http://unfccc.int/2860.php.

37 *See* e.g., *Universal Declaration on Human Rights*, adopted 10 December 1948, Paris, G.A. Res. 217 A (III), U.N. Doc A/810 at 71 (1948), Art. 19; *International Covenant on Civil and Political Rights*, adopted 16 December 1966, New York, entered into force 3 January 1976, (993 U.N.T.S. 3), Art. 19; *International Covenant on Economic, Social and Cultural Rights*, adopted 16 December 1966, New York, entered into force 3 January 1976 (993 U.N.T.S. 3), Art. 13; and *American Convention on Human Rights*, adopted 22 November 1969, San Jose, Costa Rica, entered into force 18 July 1978 (9 I.L.M. 673), Art. 13.

to participate in decision-making on environmental matters; and 3) access to justice.[38] Another important procedural right that is enjoyed by indigenous peoples is the right to Free, Prior, and Informed Consent (FPIC).[39] These will be discussed in turn, below.

4.3.1 Access to environmental information

Access to information serves as an important precondition to meaningful participation in environmental decision-making. For instance, in order to develop meaningful opinions of various adaptation measures, stakeholders need relevant information on potential risks and benefits. Information also provides an important learning, transparency, and accountability function. For example, if governments must publish and explain planned decisions with citizens, they may be less likely to be influenced by corruption.[40]

There are a number of public international legal sources that support the right to timely and effective access to information related to water.[41] Furthermore, several regional international and bilateral treaties on water have incorporated requirements to provide information to the public in matters relating to water or the environment. For instance, the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and its Protocol on Water and Health both require Parties to ensure that the public has access to information regarding "the conditions of transboundary waters, measures taken or planned to be taken to prevent, control and reduce transboundary impact, and the effectiveness of those measures."[42] This information must be provided for inspection free of charge, and must be available at all reasonable times.[43] Similar provisions are contained in basin-wide treaties within the UNECE region.[44]

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38 *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* (Aarhus Convention), adopted 25 June 1998, Aarhus, entered into force 30 October 2001 (2161 U.N.T.S. 447).

39 Although not uncontested, FPIC has been elaborated in a number of normative international instruments. *See* e.g., *ILO Convention (No. 169) Concerning Indigenous and Tribal Peoples in Independent Countries*, adopted 5 September 1991, Geneva, entered into force 5 September 1991 (1650 U.N.T.S. I-28383); and the *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP), adopted 13 September 13 2007 (G.A. Res. 61/295 A).

40 U.N. Habitat (2004). "Transparency and Corruption," *Urban Governance Toolkit Series*, Section 1.3. UN Habitat and Transparency International: Nairobi, Kenya and Berlin, Germany.

41 *See* e.g., United Nations Rio Declaration on Environment and Development (Rio Declaration), adopted 13 June 1992, Rio de Janeiro (31 I.L.M. 874), Principle 10; The Committee on Economic, Social and Cultural Rights (CESCR) (2002). *General Comment No. 15, The Right to Water* (Arts. 11 and 12), (Geneva, January 20, 2003), Twenty-ninth Session, E/C.12/2002/11, para. 12(c)(iv); Aarhus Convention, *supra* note 38, at Arts. 4 and 5; and the *Convention on Environmental Impact Assessment in a Transboundary Context* (Espoo Convention), adopted 25 February 1991, Espoo, Finland, entered into force 10 September 1997, (1988 U.N.T.S. 310) Art. 3(8).

42 *UNECE Convention on the Protection of and Use of Transboundary Watercourses and International Lakes* (UNECE Water Convention), adopted 17 March 1992, Helsinki, Finland, entered into force 6 October 1996 (1966 U.N.T.S. 269; 31 I.L.M. 1312), Art. 16; *Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (UNECE Protocol on Water and Health), adopted, 17 June 1999, London, U.K., entered into force 4 August 2005, (MP.WAT/2000/1, EUR/ICP/EHCO 020205/8Fin), Arts. 5(i), 8(1)(iii), 9(4)(b) and 10.

43 UNECE Water Convention, Art. 16(2).

44 For instance, Article 14 of the *1998 Convention on Cooperation for the Protection and Sustainable Use of the Danube River* explicitly requires Parties to provide information to the public concerning the state or

Case Study 4.1 Access to information and transparency in the Volta River Basin

In July 2006, two of the riparian States in the Volta River Basin - Burkina Faso and Ghana - finalised a Code of Conduct for the Sustainable and Equitable Management of Shared Water Resources (Code of Conduct). It provides guidelines on enhancing cooperation and participation by encouraging the countries to involve stakeholders such as:

> *"civil society groups, private sector, NGOs, community based organizations, traditional and customary authorities, women and youth groups to play a key role in the management of the water resources of the Basin owing to their presence on the ground and their good understanding of the local situation."*[45]

The Code of Conduct places a high regard for knowledge and information that local stakeholders can provide in the planning and management of the Volta Basin. It tasks the States with ensuring that the public has access to available data and information regarding the basin and any measures taken on a regular basis.[46] Combined with other participatory initiatives to connect local, national, and transboundary aspects of water governance in the sub-basin shared between the two States, the Code of Conduct is now being utilised as a model for the development of a more comprehensive basin-wide Water Charter.[47]

4.3.2 The right of the public to participate in environmental matters

As mentioned above, the importance of public participation in matters that relate to the environment – particularly water – is well recognised.[48] Notably, the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention) provides a right of public participation:

> *"1. in decisions on activities that are likely to impact the environment;*
>
> *2. plans, programs, and policies related to the environment; and*
>
> *3. the preparation of executive regulations or legally binding instruments."*[49]

The Aarhus Convention requires Parties to allow for early public participation, while all options are open.[50] As with access to information, many water agreements have incorporated provisions that ensure the public can be involved in decision-making. At the regional level, the UNECE Water Convention and its Protocol on Water and Health include provisions on public participation in water

quality of the riverine environment, limited by stated exceptions.

45 *Code of Conduct for the Sustainable and Equitable Management of Shared Water Resources of the River Basin* (Code of Conduct for the Volta River Basin), July 2006. Article 15 (Principle of Participation), Article 24 (Principles of IWRM) and Article 3 (Objective) state that the Code of Conduct is to be "based on a participatory approach which involves all the stakeholders, mainly the local communities."

46 *Ibid.* at Art. 17, Principles of Information, education and sensitization of the public.

47 Welling, R. *et al*. (2012). "Volta River Basin Ghana & Burkina Faso: Transboundary water management through multi-level participatory governance and community projects," *IUCN WANI Case Study*, p. 6. The six Riparian States that make up the Volta River Basin are Ghana, Burkina Faso, Togo, Benin, Cote d'Ivoire, and Mali.

48 *See* e.g., CESCR (2002), *supra* note 41, at para. 24; Rio Declaration, *supra* note 41, at Principle 10; *Johannesburg Declaration on Sustainable Development*, adopted 4 September 2002, Johannesburg (A/CONF.199/20), para. 26; 1992 *Dublin Statement on Water and Sustainable Development*, International Conference on Water and the Environment, 26 – 31 January 1992, (U.N. Doc. A/CONF.151/PC/112), Principles 2 and 3; *see* also, Espoo Convention, *supra* note 41, at Art. 2(6), which applies in a transboundary context.

49 Aarhus Convention, *supra* note 38, at Arts. 6, 7 and 8.

50 Aarhus Convention, Art. 6.4.

management.[51] In order to assist States Parties in implementing their international commitments on public participation provisions, the UNECE has also developed several useful guidance documents.[52]

In Africa, at the regional level the Southern African Development Community (SADC) promotes public awareness and public participation in managing transboundary watercourses. While the Revised Protocol on Shared Watercourse Systems in the SADC calls for States to provide for input from other countries on planned measures, including sharing results of environmental impact assessments (EIAs),[53] there is no explicit reference to public participation. Nevertheless, both the SADC *"Regional Water Policy"*, and the *"Regional Water Strategy"* call for water management based on a participatory approach with effective involvement of all stakeholders, and empowerment to effectively participate at all levels.[54] These documents have provided a basis for implementation of public participation provisions for transboundary planning processes by several international river basin organisations (RBOs) throughout the SADC Region.[55] In 2010, a set of *"Guidelines for Strengthening River Basin Organisations"* was released in order to help transboundary RBOs in the SADC Region enhance institutional capacity to implement participatory processes.[56]

Case Study 4.2 Development of a framework for public participation in the Mekong River Basin

At the basin level, emphasis on participation is evidenced in the Mekong River Basin. As an accepted principle of IWRM, public participation is seen as a prerequisite for achieving the aims of the 1995 Mekong Agreement between its four Member Countries: Cambodia, Lao PDR, Thailand, and Vietnam.[57] In 1999, the Joint Committee of the Mekong River Commission (MRC), the body authorised to oversee cooperative management in the basin, outlined its approach to stakeholder participation, defining stakeholders as:

> *"any person, group of institutions that has an interest in an activity, project or programme. This includes both intended beneficiaries and intermediaries, those positively affected, and those involved and/or those who are generally excluded from the decision-making process."*[58]

51 UNECE Protocol on Water and Health, *supra* note 42, at Arts. 5(i), 6(2), 6(5)(b), and 16(3)(b).

52 *See* UNECE (2000). *Water Management: Guidance on Public Participation and Compliance with Agreements*, Geneva, March 2000; UNECE (2006). *Guidance on Public Participation in Environmental Impact Assessment in a Transboundary Context* (ECE/MP.EIA/7), as agreed in the *Report of the Third Meeting of the Parties to the Convention on Environmental Impact Assessment in a Transboundary Context*, Cavtat Croatia, 1-4 June 2004, Decision III, (ECE/MP.EIA/6); UNECE (2013a). *The Aarhus Convention: An Implementation Guide, Second Ed.*, April 2013; and UNECE (2013b). *Guide to Public Participation under the Protocol on Water and Health* (ECE/MP.WH/9), all *available at* www.unece.org/env/treaties/publications.html.

53 *Revised Protocol on Shared Watercourses in the Southern African Development Community*, adopted 7 August 2000, Namibia Art. 4(b), *available at* www.sadc.int/documents-publications/.

54 SADC (2005). *Regional Water Policy*; and SADC (2006). *Regional Water Strategy*, *available at* www.sadc.int/documents-publications/.

55 Troell (2010), *supra* note 8, at p. 11. *See* case studies from the Okavango and the Orange-Senqu in Kranz, N. and Vorwerk, A. (2007). "Public Participation in Transboundary Water Management," Paper submitted to the *2007 Amsterdam Conference on the Human Dimensions of Global Environmental Change*, Theme 4: Agency Beyond the State, Ecologic, Institut fur Internationale und Europäische Umweltpolitik, Brussels, Belgium.

56 SADC (2010). *Guidelines for Strengthening River Basin Organisations: Stakeholder Participation* (SADC Secretariat: Gaborone, Botswana), *available at* http://www.sadc.int/documents-publications/show/1037.

57 Mekong River Commission (MRC) (1998). *Public Participation in the Context of the MRC*, p. 1; and MRC (2003). *Action Plan for Public Participation*, both *available at* http://www.mrcmekong.org/assets/Other-Documents/BDP/SPCP-Final-July-2009-Final.pdf.

58 MRC (1998), *supra* note 57.

In 2001, the MRC began allowing partner regional organisations to participate at its meetings. Nevertheless, problems with realising effective public participation have been recognised, due to a lack of awareness and non-existence of practical implementation tools and process.[59] In 2009, the MRC developed a more comprehensive Stakeholder Participation and Communication Plan to address these issues. This has provided a basis for the MRC´s Strategic Plan 2011-2015, where it aims to enhance public participation and mainstream gender through more equal participation in strategy formulation, planning, and implementation of its programmes.[60] Specifically, the MRC is focusing on strengthening involvement of members of the public and civil society in implementing the MRC's Communication Strategy, and its Policy on Data Disclosure, Information and Knowledge, Basin Development Plan, and its Stakeholder Participation and Communication Plan, among others.[61] Furthermore, it has developed an *"IWRM Training Manual"*, which provides detailed guidance for officials and stakeholders on how to manage particular participation and stakeholder engagement processes throughout the basin.[62]

4.3.3 Access to justice

Access to justice is a term used to describe access to administrative and judicial review mechanisms.[63] Access to information and public participation rely on enforcement and review mechanisms to ensure efficacy, and oversight that other substantive and procedural norms are upheld. Access to justice can take many forms such as having disputes heard in domestic courts, engaging in international fact-finding and investigative bodies, or participation in international adjudication proceedings through the filing of briefs.

According to the Aarhus Convention, access to justice is designed to reinforce and ensure the integrity of concepts of access to information and public participation. Article 9 requires the signatories to provide access to free or affordable "review procedure before a court of law or another independent and impartial body established by law."[64] It also asserts that the public should have access to "administrative or judicial procedures to challenge acts and omissions by private persons," and that remedies should be adequate, equitable, and timely.[65] As such, citizens are able to use their domestic laws and courts to resolve grievances, and to participate in judicial or administrative proceedings of another country.[66]

There are not many examples of international water agreements incorporating a right of access to justice in participatory matters. The UNECE Protocol on Water and Health, however, does provide the public with the possibility to make communications to the Protocol's Compliance Committee

59 MRC (2009). *Stakeholder Participation and Communications Plan for Basin Development Planning in the Lower Mekong Basin*, MRC Basin Development Plan Programme Phase 2 (BDP2), *available at* http://www.mrcmekong.org/assets/Other-Documents/BDP/SPCP-Final-July-2009-Final.pdf.

60 MRC (2011a). *Strategic Plan 2011–2015, available at* http://www.mrcmekong.org/assets/Publications/strategies-workprog/Stratigic-Plan-2011-2015-council-approved25012011-final-.pdf.

61 *Ibid.* at p. 71.

62 *See* MRC (2011b). *Manual for Training Trainers in Integrated Resources Management in the Mekong Basin*. Office of the Secretariat to the MRC: Vientiane and Phnom Penh, *available at* http://www.mrcmekong/org/publications.

63 Bruch (2001), *supra* note 17, at p. 11405.

64 Aarhus Convention, *supra* note 38, at Preamble, Art. 9(1).

65 Aarhus Convention, Preamble, Art. 9(3), and Art. 9(4).

66 Bruch (2001), *supra* note 17, at p. 11405.

alleging non-compliance with provisions of the Protocol.[67] There are also a number of international human rights tribunals established under international human rights conventions that may receive complaints that States Parties have not implemented or complied with their obligations. Relevant for the right to participation, the Inter-American Court of Human Rights ruled in the case of *Claude-Reyes et al v. Chile*[68] that countries should provide legal recourse that is "simple, effective, quick, and that allows the challenging of decisions of public officials that deny the right of access to specific information or simply neglect to answer the request."

Case Study 4.3 The High Ross Dam Dispute between the US and Canada

Cases alleging transboundary harm are procedurally complicated and implicate issues such as sovereignty, *forum non conveniens*, and jurisdiction.[69] The U.S. and Canada were involved in a dispute regarding the High Ross Dam, located on the Skagit River, when the City of Seattle proposed increasing the height of the dam.[70] The International Joint Commission (IJC) prepared a draft environmental impact statement (EIS) for the proposed project, as required under the U.S. National Environmental Policy Act, where they reported that the negative impacts of the project would not be substantial.[71] Hearings took place with an administrative law judge, and environmental groups from both nations took part in the process. Ultimately, the EIS was upheld by the D.C. Circuit Court (*Swinomish Tribal Community v. Federal Energy Regulatory Commission*[72]) and the project was approved. In response, the IJC encouraged British Columbia and Seattle to reach a settlement.[73] Nevertheless, the *Swinomish Tribal Community* case established a precedent that citizens and organisations from another country were able to intervene in the U.S. over the management of a transboundary watercourse.

4.3.4 The right to Free, Prior, and Informed Consent

Due to their status as particularly vulnerable and marginalised groups, indigenous peoples enjoy special procedural rights in relation to decisions that affect them. The right to Free, Prior, and Informed Consent (FPIC) is considered a procedural obligation that is meant to protect other substantive rights of indigenous peoples. FPIC applies to particular decision-making processes that affect, *inter alia*, indigenous peoples' lands or natural resources, including water, and cultural property – both tangible and intangible.[74]

67 UNECE Protocol on Water and Health, *supra* note 42, at Art. 15; and UNECE (2007). *Report of the Meeting of the Parties to the Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes on its First Meeting*, Annex, section VI. Communications from the Public, ECE/MP.WH/2/Add.3, (3 July 2007), para. 16.

68 *Claude-Reyes et al. v. Chile*, Inter-American Court of Human Rights, Judgment of September 19, 2006. Series C No. 151, para. 137.

69 Bruch (2001), *supra* note 17, at p. 11405.

70 *Ibid.* at p. 11406.

71 The International Joint Commission was established in 1909 by the Boundary Waters Treaty to have jurisdiction over boundary water disputes between United State and Canada. During the High Ross Dam proposal, both the U.S. and Canada requested the IJC to investigate the project and its environmental impacts.

72 *Swinomish Tribal Community v. Federal Energy Regulatory Commission* (FERC), 627 F.2d 499 (D.C. Cir., 1980).

73 Bruch (2001), *supra* note 17, at p. 11407.

74 Rey, Roberts, Korwin, Rivera and Ribet (2013), *supra* note 9, at p. 57.

Indigenous peoples need to be effectively engaged in the development of climate change adaptation measures for several reasons. First, as local communities indigenous peoples are more likely to feel both the impacts of climate change and the impacts of adaptation measures. Moreover, due to their special relationship with nature, indigenous peoples often possess traditional knowledge that may be considered useful for adaptation, particularly with regard to ecosystem-based strategies. For instance, in response to climate change effects in the upper Mekong River Basin, Tibetan communities have adopted techniques to alter growing seasons by shifting the ranges between highland and lowland crops.[75] Furthermore, they have diversified the types of crops that they grow.

Although international instruments explicitly acknowledge the need to ensure FPIC is obtained, there is limited guidance and authority on what FPIC actually means. For instance, it is unclear to what degree consent must be obtained before a final decision is taken.[76] Nevertheless, indigenous peoples enjoy a right to retain their own representative institutions, which should be respected throughout consultations – particularly during adaptation planning.[77]

While individual States have signed on to, or endorsed international instruments on indigenous peoples' rights – Including FPIC – indigenous issues (e.g., participation, consent, and incorporation of indigenous knowledge) have largely been neglected under international transboundary water agreements.[78] Some transboundary agreements promote engagement of indigenous peoples, and domestic laws also provide opportunities for indigenous peoples to be represented.[79] Furthermore, the Berlin Rules ask States to:

> *"take all appropriate steps to protect the rights, interests, and special needs of communities and of indigenous peoples or other particularly vulnerable groups likely to be affected by the management of waters, even while developing the waters for the benefit of the entire State of group of States."*[80]

However, there is still a need for broader recognition of indigenous peoples' rights under international water law, and for adaptation specifically. It is now fairly well recognised that indigenous peoples need to have a special voice in matters that affect them. In order to ensure full and effective engagement of indigenous peoples in the transboundary context, therefore, FPIC should have a place in future water sharing agreements between States.

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75 Dreibelbis, C. (2012). "Adapting to Climate Change: Lessons from Indigenous Peoples," Blog, First Peoples Worldwide, *available at* http://firstpeoples.org/wp/adapting-to-climate-change-lessons-from-indigenous-peoples/.

76 *See* ILO (2009). *Indigenous & Tribal People's Rights in Practice – A Guide to ILO Convention No. 169*, which states that consent does not necessarily mean reaching an agreement over the proposed action or process.

77 ILO Convention No. 169, *supra* note 39, at Art. 6; and UNDRIP, *supra* note 39, at Art. 32(2).

78 Archer, J.L. (2012). *Transcending Sovereignty: Locating Indigenous Peoples in Transboundary Law*, Masters of Laws Thesis, p. 37. Faculty of Graduate Studies, University of British Columbia, Vancouver, *available at* https://circle.ubc.ca/handle/2429/40366.

79 *See* e.g., *Treaty Relating to the Development of the Water Resources of the Columbia River Basin* (with Annexes), established under the framework of the *1909 Boundary Waters Treaty* between Canada and the USA. *Ibid*. at pp. 46-75.

80 International Law Association (ILA) (2004). *The Berlin Rules on Water Resources*, Fourth, Report of the 71st Conference, 71 I.L.A. 337, 385 (2004), Art. 20.

Case Study 4.4 Indigenous peoples under the Amazon Cooperation Treaty

The Amazon Cooperation Treaty Organization (ACTO)[81] has tried to encourage active multi-stakeholder participation in its development of initiatives under the Amazon Cooperation Treaty – especially among indigenous peoples. A Special Commission of the Amazon Region on Indigenous Affairs oversees and coordinates indigenous aspects of the Treaty.[82] In 2004, ACTO entered into a Memorandum of Understanding (MoU) with the Coordination of Indigenous Organizations of the Amazon Basin (COICA), which promotes interests of other indigenous organisations throughout the Amazon Basin. The MoU was meant, among other things, to "promote proper levels of relationship and mutual participation in processes related to outlining and implementing ACTO's and COICA's Strategic Plans," and to contribute towards strengthening COICA as an institutional Indigenous Organisation.[83] A number of activities were identified to further these objectives, including participation in transboundary projects affecting local indigenous populations, and COICA has continued to participate in ACTO's activities.[84]

In 2010, the Parties to the Treaty approved the *"Amazon Strategic Cooperation Agenda"*, which identifies areas for cooperation on, *inter alia*, forests; water; management, monitoring and control of endangered wild fauna and flora species; protected areas; sustainable use of biodiversity; indigenous affairs; knowledge management and information sharing; regional health management; infrastructure and transport; commercial navigation; tourism; and emerging topics like regional development, climate, and energy.[85] Under this Strategic Agenda, activities have been planned to, *inter alia*: promote adaptation in water management, encourage participation of "vulnerable populations, indigenous peoples and other tribal communities on debates about water resources," protect indigenous peoples in voluntary isolation and initial contact; hold meetings related to the Convention on Biodiversity and ILO Convention No. 169 with active indigenous representation; support effective participation in Permanent National Commissions; reinforce ACTO's institutional mechanisms for indigenous peoples; promote recognition of ancestral knowledge and forest conservation; capacity building; and share experience on FPIC.[86]

It is probably too early to tell how these initiatives have helped to enhance indigenous peoples' rights, or their participation in transboundary water management in the Amazon Basin. Nevertheless, it serves as a potential model for efforts to formalise indigenous rights within institutional mechanisms under international water law.

4.4 Tools for Creating an Enabling Environment for Participatory Adaptive Governance

Adaptive governance is by no means straightforward. As highlighted by the challenges outlined above, it can be an inherently complex and time-consuming endeavour to get different stakeholders to collaboratively take actions towards building resiliency to climate change.

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81 Established under the *Treaty for Amazonian Cooperation* (Amazon Cooperation Treaty), adopted July 3, 1978, *available at* https://www.oas.org. Parties include Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Surinam and Venezuela.

82 UNDP-GEF (2011). "International Waters: Review of Legal and Institutional Frameworks," UNDP-GEF International Waters Project, Good Practices and Portfolio Learning in GEF Transboundary Freshwater and Marine Legal and Institutional Frameworks, p 16.

83 *Memorandum of Understanding Between the ACTO and COICA*, signed October 24, 2004, to be effective for two years, subject to renewal upon mutual agreement, *available at* http://www.internationalwatersgovernance.com/amazon-basin.html.

84 Hochstelter, K. (2011). "Under Construction: Debating the Region in South America," in Elliot, L. and Breslin, S. (eds.), *Comparative Environmental Regionalism*, (Routledge: New York, NY), p. 135.

85 ACTO (2010). *Amazon Strategic Cooperation Agenda*, Approved at the X Meeting of the TCA's Ministers of Foreign Affairs, November 2010, ratified March 2012, p. 13.

86 Hochstelter (2011), *supra* note 86, at pp. 25-26, and 34-37.

In order for relevant stakeholders to effectively engage throughout the development and implementation of adaptation strategies, an enabling environment for dealing with such issues needs to exist.[87] While every situation will be unique, there are general tools that can contribute to this. First, there needs to be an adequate legal and policy framework in place that can ensure that, at a minimum, there is a relative balance of legal, economic, and/or political power.[88] In addition, institutional platforms need to exist that can both operate in a balance between decentralised governance, and the ability to coordinate stakeholders both vertically and horizontally. Finally, institutions should be capable of adaptive knowledge and information management, fostering inclusiveness, and creating awareness.[89] Governance systems that demonstrate such attributes are more likely to be able to come to a shared understanding of issues faced, and more responsive to climate impacts and ever-changing circumstances. The following sections will highlight some tools that have been used to enable participatory adaptive governance.

4.4.1 Legal frameworks

Legal frameworks set out the ground rules for governance of natural resources. In the water sector, water law provides clear rules and procedures for allocation and water quality, societal goals for sustainable development and protection of the environment, and for the institutional machinery that facilitates its application.[90]

There is evidence that public participation in water management enhances governance.[91] Effective governance assumes that all relevant stakeholders stand on a relatively equal footing. However, in reality this is most often not the case, particularly for more vulnerable and underrepresented groups of society. Therefore, at a minimum, legal frameworks need to be capable of equally supporting the rights and interests of weaker or less-represented interests vis-à-vis more powerful stakeholders. This is particularly relevant in the context of adaptation to climate change, as it often seeks to target particularly vulnerable segments of society. In this sense, legal frameworks are also necessary for maintaining accountability between the government and its citizens, not just between various stakeholders.

More specifically, legal frameworks should ensure a right to participate in the development and implementation of adaptation measures. As outlined in Section 4.3, procedural rights in national jurisdictions should be in line with applicable international obligations, along with adequate enforcement mechanisms, to ensure that relevant individuals or groups are not denied the ability

87 By enabling environment, we mean that, *inter alia*: potentially affected individuals or groups have been notified of the process; that they have timely access to all pertinent information; institutions or mechanisms are in place to ensure awareness raising, capacity building for participation, and to ensure views are taken into account in the final decision-making process; and mechanisms are in place to ensure accountability, such as access to justice. *See* Rey, Roberts, Korwin, Rivera and Ribet (2013), *supra* note 9, at p. 15.

88 Duane, T.P. (1997). "Community participation in ecosystem management," *Ecology Law Quarterly*, Vol. 24, p. 771; and Kallis (2009), *supra* note 29, at p. 637.

89 Pahl-Wostl, C. *et al*., apply similar criteria/characteristics (formal institutional settings, regime architecture, and knowledge management), albeit more generally, into what they term as "regime characteristics expected to have a positive influence on [water governance] performance." Pahl-Wostl *et al*. (2012), *supra* note 7, at pp. 25–28.

90 Iza, A. And Stein, R. (eds.) (2009). *RULE – Reforming Water Governance*, pp. 49-50. IUCN: Gland, Switzerland.

91 *Ibid*. at p. 86.

to participate. In addition to being spelled out in many multilateral water-sharing agreements, participatory rights have been incorporated into numerous domestic legal systems. While these do not focus on adaptation per se, they are still highly relevant in such a context, because they assure accountability and transparency of decisions made around water management. They also contribute to inclusiveness and ownership, which has an impact on the effectiveness of implementation of adaptation measures.

In the European Union (E.U.), several Directives that impose requirements on all E.U. Member States are also potential mechanisms for ensuring participation in the development and implementation of adaptation strategies. In order to support public participation in Member States, the E.U. Water Framework Directive (WFD) requires Member States to "encourage active involvement of all interested parties in the implementation of [the] Directive, in particular in the production, review and updating of the River Basin Management Plan (RBMP)."[92] The E.U. Floods Directive (EFD) echoes this requirement, calling for active involvement of all interested parties in the production, review, and updating of Flood Risk Management Plans (FRMPs).[93] The WFD also provides the public with a right to access background documents and information during the development of RBMPs; [94] and under the EFD, Member States must provide access to preliminary flood risk assessments, flood hazard maps, flood risk maps, and FRMPs.[95]

In recent decades, a number of other countries, particularly in Latin America, have undergone domestic water and other environmental law reforms that incorporate participatory rights at the domestic level, with some relative success.[96] For example, in 2004 Uruguay amended its Constitution, which "defines water as a public good and guarantees civil society participation at every level of management of the country's water resources."[97] As a broader trend, participation is recognised as mandatory in Environmental Impact Assessment (EIA) laws throughout almost the whole of the Americas.[98] As scarcity and uncertainty becomes a more prominent, participatory rights will become all the more relevant for water management, particularly in assessing impacts of climate change on normal decisions, and adaptation-specific actions.

To support local approaches to adaptation, legislative frameworks should also support the creation and maintenance of participatory mechanisms at different levels. In addition to providing a legal

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92 Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (WFD), OJ L 327, 12.2.2000, Art. 14. *See* also the 14th and 46th Recital to the WFD.

93 Directive 2007/60/EC on the assessment and management of flood risks (EFD), OJ L288, 6.22.2007, p. 27, Art. 10(2). Article 9 also calls for involvement under Article 10 to "be coordinated, as appropriate, with active involvement of interested parties" in accordance with Article 14 of the WFD. To assist Member States in implementing these obligations, the European Commission developed *Guidance Document No. 8 on Public Participation in Relation to the Water Framework Directive*, *available at* http://ec.europa.eu/atoz_en.htm Alphabetical Index.

94 WFD, *supra* note 95, at Art. 14.

95 EFD, *supra* note 95, at Art. 10(1).

96 Economic Commission for Latin America and the Caribbean (ECLAC) (2013). "Access to Information, Participation and Justice in Environmental Matters in Latin America and the Caribbean: Situation Outlook and Examples of Good Practice," Working Document from the Second meeting of the focal points of the Declaration on the application of Principle 10 of the Rio Declaration, Guadalajara, Mexico, LC/L.3549/Rev.1, (12 April 2013), p. 9.

97 Constitution de la Republica Oriental del Uruguay de 1967, con Reformas hasta 2004, Art. 47.

98 ECLAC (2013), *supra* note 99, at p. 26.

basis for their creation, legislation can support institutions through enabling regulations, favourable tax treatment, laws of association, appropriate legal capacity, transparency, inclusive rules of procedure, and representational standing in various forums. Such legislation is important particularly because it signifies recognition and support of the role that local stakeholders have to play. As a practical matter, it can also provide a legal basis for allowing institutions to seek further political, financial and technical support for adaptation measures, as well as potential to enhance vertical coordination. For instance, in Tanzania the 2009 Water Resources Management Act provided for the establishment of water user associations, and sub-basin and catchment water committees.[99] Since their formation, these associations and committees have been able to participate in forums and gain access to technical information and other tools, which have helped empower them to develop their own adaptive water management plans.

In this context, it is also important to recognise the importance of the principle of subsidiarity, which holds that where appropriate, decision-making should take place at the lowest level of competent authority. While traditionally, transboundary water management tends to take place away from the local level, this principle has been gaining some recognition. For instance, the subsidiarity principle was adopted in the Code of Conduct for the Volta River Basin, whereby water management policies must be designed and implemented at "the appropriate decision making level," and "States shall particularly promote a decentralized management … by recognizing the key role that local institutions have in the conception and implementation of sustainable policies, development programmes or projects in the basin."[100]

At the transboundary level, stakeholders need access to forums in order to incorporate local interests into the decision-making process. Within the Orange Senqu River Basin, under a 1992 agreement between South Africa and Namibia, which established a Joint Irrigation Authority, water management is delegated directly to stakeholders.[101] Therefore, in addition to being made up of a State representative from each country, the Joint Irrigation Authority is also composed of representatives from agriculture. Furthermore, there have been discussions within the Authority to expand representation to other stakeholders, such as business owners and tour operators.[102]

Recently, a number of countries have considered or embarked on reforming domestic legislation in light of climate change, including mitigation and adaptation.[103] It is debatable as to whether this is a recommendable approach from a legal point of view, considering that legislative reforms may be time consuming in themselves and use up scarce resources. For instance, although the WFD does not explicitly deal with climate change, its step-wise and cyclical approach to river basin planning and management has allowed it to be used to pursue adaptive management in the face of climate

99 Barchiesi, S. *et al*. (2010). "Case Study No 2: Pangani Basin Water Board, Tanzania," from Hill, M. *et al*. (eds.), *Shifting Course: Climate Adaptation for Water Management Institutions*, p. 40. WWF-US: Washington, D.C.

100 Code of Conduct for the Volta River Basin, *supra* note 45, Art. 18.

101 Keller, K. (2012). "Critiquing Cooperation: Transboundary Water Governance and Adaptive Capacity in the Orange-Senqu Basin," *Journal of Contemporary Water Research & Education*, Issue 149 (December 2012), p. 48.

102 *Ibid*.

103 *See* e.g., Mexico's General Law on Climate Change (passed on April 19, 2012), and the United Kingdom's Climate Change Act 2008.

change.[104] Before choosing legislative reform as a solution, institutional or governance assessments should be conducted to see whether issues exist around legal gaps or implementation. It very well could be that current legal frameworks are simply not being implemented.

4.4.2 Institutional mechanisms

While legal frameworks help to ensure that all relevant stakeholders are brought to the table, they are not in themselves sufficient to ensure effective and successful collaboration.[105] In this sense, it is also important for institutions to have capacity to coordinate and promote effective participation and cooperation between interested stakeholders.[106]

Institutional mechanisms are key for ensuring effective participatory processes, as they can "provide formal structured means for engaging stakeholders on a continuous basis."[107] By providing a forum for the exchange of views in the decision-making process they can enhance opportunities for long-term learning, and help build relationships between different stakeholders. Providing such a long-term forum for engagement is particularly important for adaptive planning, since it is an iterative process that is likely to evolve over time.

The challenge is to find a middle ground between having freedom to address issues at the local level and to maintain a coordinated basin-wide approach. A balance needs to exist, whereby competent institutions are empowered to make decisions at the appropriate level in a decentralised way, but also recognising the value of coordination between stakeholders at different levels.

Where multiple levels of governance exist – particularly in the transboundary context – there are a number of institutional approaches that demonstrate a variation between top-down and bottom-up participatory governance. There is no template or predefined number of options. Nevertheless, below we look at three different approaches towards polycentric water governance structures that support participation: 1) those that demonstrate top-down coordination of lower level participation; 2) grass-roots approaches; and 3) mixed collaborative approaches.

High level approaches for coordinating bottom-up governance – coordination of river basin planning and adaptation in the Danube River Basin

Transboundary institutions can and do play a coordinating function, whereby they provide a focal point for representation in the decision-making across the basin. In particular they incorporate different types of data and information from national and local level stakeholders that need to be considered and coordinated at the highest decision making level.

The Danube River Basin represents a very unique and complex example of participatory water governance. It is home to 83 million people and contains the territories of 19 countries. This provides for a rich and diversified mix of cultures, languages, and historical contexts and backgrounds. Countries are also characterised by different governance systems and traditions, economic circumstances,

104 European Communities (2009). "River Basin Management in a Changing Climate: Guidance Document No. 24," *Common Implementation Strategy for the Water Framework Directive (2000/60/EC)*, Technical Report - 2009 - 040, p. 16.

105 Kallis (2009), *supra* note 25, at p. 637.

106 Aguilar G. and Iza, A. (2011). "Governance of Shared Waters: Legal and Institutional Issues," *IUCN Environmental Law and Policy No 58. Rev*, p. 75. IUCN Environmental Law Centre: Bonn, Germany.

107 Troell (2010), *supra* note 8, at p. 97.

and varying capacity to provide enabling environments for full and effective stakeholder engagement. Nevertheless, over time a coordinated, multi-level network of institutional mechanisms for managing water throughout the basin has evolved.

The Danube River Basin follows a multi-level coordinating structure that favours decision-making at the lowest level possible. Management coordination throughout the basin is broken down into three levels: 1) the "roof", or international, basin-wide level (Part A); 2) the national level and/or the internationally coordinated sub-basin level (Part B); and 3) the sub-unit level, defined as management units in the national territory (Part C). Management at the international level takes a broad approach, and is very much based on what is going on at the national and sub-basin levels. As required by the E.U. Water Framework Directive (WFD), there is a River Basin Management Plan (RBMP) for the entire Danube River Basin. However, there are also sub-basin management plans for the Danube Delta, the Tisza, the Sava and the Prut basins – all of which are more detailed. Furthermore, each country has its own national RBMP.

The International Commission for the Protection of the Danube River (ICPDR) serves as the overarching coordinating platform for water management in the basin. However, management structures exist at the other levels. For instance, in the Tisza sub-basin, national delegates from five different countries, technical experts, and members of civil society and the scientific community come together through the Tisza Group to coordinate management and exchange information.

Not all countries in the Danube River Basin are Member States of the E.U., and therefore are not required to abide by the WFD or the E.U. Floods Directive (EFD). Nevertheless, as States Parties to the Danube River Protection Convention, these countries committed themselves to implementing the Directives.

While domestic and regional institutions are required to ensure active involvement of all interested stakeholders, at the transboundary level the ICPDR's rules of procedure also allow for stakeholders to obtain "observer" status within the ICPDR itself, subject to stated criteria.[108] If granted observer status, the stakeholder gains certain entitlements to participate in the ICPDR's meetings, programs, and projects, including participation in ICPDR Expert Groups.[109] These Expert Groups all carry out and coordinate technical work on various issues dealt with by the Convention, including *inter alia*, flood protection, accident prevention, information management, and public participation.

This multi-level coordinated approach served as a framework for ensuring public participation at different levels during the development of the Danube's first RBMP. In 2003, a basin-wide stakeholder analysis was conducted for a basin-wide *"Strategy for Public Participation"*, in order to ensure participation at all levels. Specifically it provided guidance to national governments on how to comply with participation provisions of the WFD, as well as support guidance. Since then, the ICPDR has developed several strategy documents to guide participatory processes during the development of RBMPs, both at the national and international level, in accordance with applicable E.U. legislation.[110]

108 ICPDR (2006). *Rules of Procedure of the ICPDR*, IC/002, adopted at the 9th Ordinary Meeting of the ICPDR in Vienna (11-12 December 2006), Art. 6, *available at* www.icpdr.org/main/publications/legal-documents.

109 *See* ICPDR (2005). *Guidelines for Participants with Consultative Status and for Observers to the ICPDR*, IC/021 (26 April 2005).

110 ICPDR (2003). *Danube River Basin Strategy for Public Participation in River Basin Management Planning 2003-2009*, Elaborated Synthesis Report for the Public Participation Workshop, (April 4-5, 2003), Bratislava; ICPDR (2008). *Outline of the Public Participation Activities of the ICPDR in 2008-2009 – To Secure the Active Participation of Stakeholders in the Development of the Danube River Basin Management Plan*,

Within each national context, participation processes were carried out by competent authorities at sub-catchment, regional, and national levels. Once national management plans were developed, they were then fed back up to the basin level. Through coordination by the Expert Group on River Basin Management, the ICPDR served as a coordinating platform to bring together "multilateral and basin-wide issues," and facilitate the compilation of the Danube RBMP.

Through participatory development of the RBMP, it was recognised that there was a strong need to prioritise adaptation to climate change impacts in the basin. Building off the RBMP, a basin-wide *"Adaptation Strategy"* was finalised in 2012 through coordination of the ICPDR. This strategy will provide a basis for integrating adaptation issues in a participatory manner into the second RMBP process, as well as for the first Flood Risk Management Plans (FRMPs) that are required under the EFD. More on the development of the Adaptation Strategy for the Danube River Basin is explained in Chapter Five.

Finally, in order to enhance coordination and collaboration in the Danube River Basin, in 2010 the European Commission, together with Danube Region countries and stakeholders agreed on a *"E.U. Strategy for the Danube Region"*. The strategy is a macro-development plan for the entire Danube River Basin. Interestingly, it recognises different levels of rule of law, transparency, democracy, bargaining power, and institutional capacity among countries in the Danube Basin. It calls for action to address common challenges through multi-level cooperation, and effective multi-level governance, and improvement of civil society capacity to influence decision-making processes.[111]

Grass-roots governance approaches - water governance in the Goascorán River Basin

As has been already stressed, particularly in Chapter Three, cooperation and collaboration need not start at the national or transboundary levels. There is increasing evidence of ground-up approaches to cooperation and collaboration, particularly with regards to adaptation. Where local institutional structures have been empowered to take decisions, they can also serve as laboratories for innovation, which if successful can be scaled up to different areas with the basin, and can even serve as a basis for developing formalised binational cooperation. Local representation at higher levels can also improve adaptive capacity by enhancing access to additional resources. Here, higher up institutions at national and transboundary levels may be able to play more limited roles, for instance through the provision of support or recognition.

It is important to point out that the transboundary participatory cooperative mechanism in the Goascorán river basin still under development. The Goascorán River Basin spans the borders between El Salvador and Honduras. The border territories are recognised for having each of the countries' highest rates of socio-environmental vulnerability. The basin is located in the Central American dry corridor, characterised by prolonged high temperatures and droughts, while the lower

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Final, ICWD 317, (2 May 2008); ICPDR (2009). *ICPDR Strategy for the Public Participation Process 2009: Danube River Basin Management Plan incl. JPM*, FINAL, IC WD 378 (27 March 2009); and ICPDR (2012). *WFD & EFD: Public Participation Plan*, Outline of Activities of the ICPDR to Meet the Requirements of WFD (Directive 2000/60/EC) and EFD (Directive 2007/60/EC) regarding public consultation and communication in the course of developing the 2nd Danube River Basin Management Plan and the 1st Flood Risk Management Plan for the Danube River Basin, both for the implementation cycle 2015 to 2021, Final, IC WD 517, (December 18, 2012).

111 European Communities (2010). *Action Plan*, Accompanying document to the Communication on the E.U. Strategy for the Danube Region, COM(2010)715, pp. 77-78.

areas of the basin are exposed constantly and increasingly to floods. According to Germanwatch's *"2013 Global Climate Risk Index"*, Honduras was rated as the planet's most vulnerable country to climate change impacts.[112]

There are a series of institutional agreements, which although non-binding, make up the governance framework of the Goascorán River Basin. They include the following:

1. The Framework Agreement signed by both States and the E.U. for the implementation of the Honduras – El Salvador Trans-boundary Development Program Project (2004-2009), which created the Binational Management Group of the Goascorán River Basin (GGBCG) (2006);
2. Statues and regulations of the GGBCG;
3. 2008 Presidential Declaration (Nicaragua, Honduras and El Salvador) designating the Fonseca Gulf as a Peace and Sustainable Development Area, signed by the Presidents of all three countries and ratified in 2012;
4. Agreements between mayors of the border municipios, for cooperation in the environmental management of the basin;
5. Bilateral Agreement between the neighbouring municipios of Aramecina (Honduras) and Concepción de Oriente (El Salvador);
6. Agreement between the Local Development Agencies of Valle (Honduras) and Morazán (El Salvador).

The GGBCG was created in 2006 under the Framework Agreement between El Salvador, Honduras, and the E.U. to coordinate social, economic, and environmental development in the region. It was originally composed of three major coalitions of local governments from the border provinces (MAMSURPAZ and MAFRON in Honduras, and ASINORLU in El Salvador), which comprise the general assembly of the GGBCG. A number of NGOs (CARE, Caritas and Vida Foundation in Honduras, and ACUGOLFO and CRS in El Salvador) were also represented, serving as facilitators and technical experts.[113] The Tropical Agricultural Research and Higher Education Center (CATIE, in Costa Rica) was also hired to create an Integrated Basin Management Plan at the time.

Unfortunately, after the end of the E.U. project in 2009 the GGBCG nearly ceased to operate. Nevertheless, NGOs in both countries remained active in the region, and small investments continued towards local economic development, capacity strengthening, and environmental management. In effect, this managed to keep the binational participation mechanism in force, albeit informally. However, at that time communities and groups only played a passive role as beneficiaries, and were not yet playing a proactive role as associates.

112 Harmeling, S. and Eckstein, D. (2013). "Global Climate Risk Index 2013: Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2011 and 1992 to 2011," Briefing Paper. Germanwatch: Berlin, Germany, *available at* www.germanwatch.org/en/cri.

113 *Munucipios del sure de la Paz* (MAMSURPAZ); Union of Municipalities of the Border (MAFRON); *La Asociación de Municipios del Norte de La Unión* (ASINORLU); Cooperative for Assistance and Relief Everywhere (CARE); Association of Basins of the Gulf of Fonseca (ACUGOLFO); Catholic Relief Services (CRS).

Since the arrival of the IUCN´s Building Rivers Dialogue and Governance (BRIDGE) Project[114] in 2011, there has been a focus on strategic strengthening of the governance structure of the GGBCG through a participatory planning framework. From the beginning, the process has been conducted through shared efforts by different actors. The GGBCG has acted as a decision-maker on financial issues, while NGOs have focused on technical and operational issues. For instance, the *Vida* Foundation is in charge of the technical assessment of the GGBCG Strengthening Process.

The re-engineering process of the GGBCG involves new organisations that have been identified as dynamic and relatively powerful actors in the region. They have been integrated to the GGBCG with a view of securing financial autonomy for the sustainability of territorial development, adaptation and management. Another important feature of the process has been the inclusion of local communities as part of the formal decision-making structure of the GGCBG. This has been done through the creation of "Good Neighborhood Committees", as a local territorial unit for public participation.

The GGBCG is now articulated as a Public–Private Territorial Platform, based on four groups of actors in both countries:

1. Central Government;
2. Local Governments (Groups of Communities and *Municipios* Associations);
3. Local Economic Development Agencies; and
4. NGOs and Cooperation Agencies.

It is important to point out that the GGBCG now insists on both vertical coordination between all the territorial levels (local, municipal, community, regional, national and transboundary), and horizontal coordination between development actors from various sectors (economic, social, and environmental). All actors from these different levels and sectors have access to all available data and information, and are involved in decision-making and strategic planning. In its new form, the GGCBG is now providing a more formal inclusive participation processes to develop climate change adaptation measures, which is currently under development.

Mixed collaborative approaches – stakeholder collaboration in the Sacramento-San Joaquin Delta

The existence of complicated multiple levels of governance may also require both government and non-government stakeholders to come together in a more collaborative fashion, in what could be seen as a mix between a top-down and a bottom-up model. The characteristics of such a relationship between stakeholders would ideally demonstrate, *inter alia:*

> *"the presence of shared practical tasks; initial agreements; reliance on self-organisation rather than an externally imposed structure; the use of high-quality, agreed-upon information sources; proceeding with agreements when there is overwhelming support; external legitimacy of the process; resources and commitment to equalize power differences between*

114 The BRIDGE Project is an IUCN project that is focused on building water governance capacities in transboundary river basin contexts, primarily through learning, demonstration, leadership, and consensus building. In addition to the Goascoran River, the BRIDGE Project is being implemented in two other Mesoamerican transboundary river basins: the Coatan River (Mexico-Guatemala) and the Sixaola River (Costa Rica-Panama).

participants; continuous trust-building activities; and genuine engagement in productive dialogue."[115]

Due to jurisdictional constraints, such collaborative characteristics are hard to find in a transboundary context. However, there are instances where complex networks of stakeholders within national contexts have attempted to come together to "experiment" with more collaborative and adaptive governance structures.

The Sacramento-San Joaquin Delta is not transboundary; however, because of its highly complex web of interests and multiple levels of governance, it can still be particularly useful as an example of an attempt to create an integrated adaptive system of governance. The Delta is at the heart of California's water. As the largest estuary on the west coast of the Americas, it is a fragile, valued ecosystem, a hub of economic activity, and the source of drinking water for almost two-thirds of California's residents.[116] These elements, however, have made the Delta the epicentre of California's "water wars", and have left the ecosystem in a severely degraded state.

Conflicts over water use in the Delta date back to the nineteenth century. Furthermore, a fragmented patchwork of federal, state, and local legislation – and often competing regulatory bodies – has led to a virtual standstill over how to restore the Delta ecosystem and enhance resilience to changes, while ensuring a vibrant and sustainable economy and equitable access to water for users.

Around the early 1990's, several efforts between stakeholders on one side, and public agencies on the other, got under way to bring different interests together to develop solutions. After two historic years of drought, in 1994 an agreement called the Bay-Delta Accord established CALFED. As a platform, CALFED was intended to be a collaborative forum to bring together federal and state agencies, as well as other relevant stakeholders, to come up with an integrated program for the Bay-Delta. In a break from a step-wise and centralised approach to decision-making, different forums within CALFED were created in order to engage in discourse, and to develop, test, and improve new ideas.

The Accord established a high-level Policy Group made up of high-level members of state and federal agencies to lead the process, and serve as the main decision-making authority. Another four groups, composed of agency members and stakeholder representatives, shared real-time information on indicators that were monitored on a continuous basis. One group served as a coordinator, while another – the Operations Group – continued to coordinate operations of the water projects around the Delta. The two others evaluated water supply alternatives, and examined effects of water diversions on fisheries. Based on this information, these groups would provide advice on changes in operations of water projects to the high-level Policy Group, which usually took this advice.[117]

A number of other groups were designed to facilitate communication and generate new ideas. A forum for stakeholder communication, the Bay-Delta Advisory Council (BDAC), served as a forum for stakeholders to informally discuss a number of important issues, such as ecosystem restoration, finance, water-use efficiency, water transfers, drinking water, and watersheds. A number of ad hoc task groups were also formed to engage large numbers of stakeholders, in order to develop real-time knowledge laboratories for new ideas on adaptive policymaking.

115 Kallis (2009), *supra* note 25, at p. 637.

116 *Ibid*. at p. 631.

117 Booher, D.E. and Innes, J.E. (2010). "Governance for Resilience: CALFED as a Complex Adaptive Network for Resource Management," *Ecology and Society*, Vol. 15(3), pp. 35-50, at p. 39.

During the early 2000's, a budget crisis in California, and disengagement by the George Bush Administration changed the dynamics of CALFED's governance structure. Hence, much of the progress made towards new collaborative governance arrangements was set back. Nevertheless, CALFED provided a unique example of how to rethink water governance arrangements for dealing with incredibly uncertain and complex issues.

Regional support for collaboration in adaptation

Institutions at the regional level can also play a coordinating role in supporting participatory adaptation efforts in various transboundary river basins. The UNECE Water Convention is probably the best example of this. The framework for transboundary cooperation on adaptation to climate change, which has been developed under the Convention, has seen the development of *"Guidance on Water and Adaptation to Climate Change"*, the establishment of a Task Force that has facilitated and supported a number of pilot projects on transboundary adaptation throughout the basin, and a platform for sharing local experiences, not just from the UNECE Region but globally. This programme has expanded to allow non-UNECE basins to participate, and serves as a good example of regional and international collaboration for learning how to approach transboundary adaptation issues.[118] Other regions are also beginning to focus on water and adaptation concerns, such as the South Asian Association for Regional Cooperation (SAARC).

4.4.3 Adaptive knowledge and information management

Due to the long-term and uncertain nature of adaptive decision-making, institutional mechanisms need to enable incorporation of relevant information over time. Such information needs to be geared towards closing data and information gaps in relation to climate change impacts. In addition, mechanisms should be in place to allow for improvements based on new and updated data and information. Furthermore, institutions need to ensure that all relevant stakeholders can input, and have access to this and other necessary information for effective engagement and awareness. For collaborative governance in particular, it is also vital for institutions to facilitate communication and engagement of stakeholders between different sectors and levels in order to build common understandings and trust, which can facilitate this information sharing over the long-term.

Cooperative approaches for generating information for adaptive management

As mentioned earlier, States are not the only holders of data and information that are necessary for developing adaptive responses to climate change. For a number of different reasons, a broad array of stakeholders will be valuable sources of data and information including, *inter alia*, hydraulic, environmental, and socio-economic. There are a number of participatory approaches that can help not just institutions but other stakeholders to respond to changes, enable innovation, and develop flexible and responsive water management systems.

Through institutional structures, stakeholders can partner with external government agencies of riparian States. For example, in the Salish Sea Basin, more than 70 indigenous groups came together to create a new governing body, the Coast Salish Aboriginal Council (The Council), in order to address a number of environmental issues that are negatively affecting salmon populations, including climate

118 More on the UNECE Water Convention's climate adaptation programme, particularly its Pilot Projects, is the focus of a stand-alone case study later in this publication.

change.[119] Since the Council has come together, it has partnered with federal agencies from the U.S. and Canada to test water quality.[120] The Council has also facilitated consultations with community members to create transboundary ecosystem indicators. These actions are contributing towards the cooperative development of an interactive map that includes traditional ecological knowledge from the region, and highlights priority areas of concern for the indigenous groups in the basin.[121]

Government and non-state stakeholders can also develop mechanisms for adaptive water management based on the collection and use of real-time information. These mechanisms may be formal or informal scientific bodies, which serve as laboratories to test out new methods of water allocation. Instead of taking a strictly regulatory approach, these mechanisms can allow for authorities and other stakeholders to play around with different arrangements without becoming locked into a situation. In order for such mechanisms to function effectively, actors should be able to meet face-to-face regularly, and assess real-time information. Furthermore, such mechanisms should be based on incentives for cooperation, for instance through the establishment of a common goal to maintain sustainable access to water. If a stable framework can be established, such participatory management arrangements can help build relationships between actors. They can also be useful for developing solutions on how to manage water in a changing environment.

Case Study 4.5 CALFED's Environmental Water Account

In 2000, through dialogue and sharing of real-time information based on continuously monitored indicators, stakeholders in the Sacramento-San Joaquin Delta were able to devise a scheme whereby water is acquired to protect endangered species through voluntary sales and contracts, to be held for a future time when it is needed the most.[122] This Environmental Water Account (EWA) was designed in order to avoid restrictions on water deliveries to agriculture and urban users through legislative restrictions. It is inherently multi-disciplinary, bringing together both government agencies at different levels (e.g., California Game and Fish, NOAA Fisheries, U.S. Fish and Wildlife Service, the California Department of Water Resources, the U.S. Bureau of Reclamation, a Science Review Panel of the EWA, and other state and federal agencies), and different affected stakeholders (e.g., water sellers, project beneficiaries, and environmental NGOs). The programme depends on extensive data gathering and inputs from multiple stakeholders, and detailed modelling of water flows and fish impacts. By sharing this data in a transparent way, stakeholders are able to question assumptions, test models through different scenarios and games, and provide additional views and insights.

This provided an exercise to bring both conservationists and water users together to share and collaborate in devising mutual solutions for competing interests. It also improved reliability, because it provided assurances to rights holders that they would receive their allocations, while ensuring that water needs would be met in order to protect endangered species. While not without its critiques, it also provides an example of how stakeholders can come together to make timely, reasonable decisions in light of scientific uncertainty in a model that is based on continuous improvement as more information becomes available.

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119 The Salish Sea Basin is shared between the state of Washington in the United States, and the province of British Colombia in Canada.

120 Norman, E. (2012). "Cultural Politics and Transboundary Resource Governance in the Salish Sea," *Water Alternatives*, Vol. 5(1), pp. 138-160, at p. 153.

121 *Ibid*.

122 *See* Lejano, R.P and Ingram H. (2009). "Collaborative Networks and New Ways of Knowing," *Environmental Science and Policy*, Vol. 12, pp. 653-662.

Again, it is important to highlight that regardless of their formality or experimental nature, adaptive management should be subject to a framework of accountability towards the public and towards other participants.

Another innovative approach, which utilises members of the public, includes the use of mobile technology to collect data at the local level. Rapid advancements in low cost mobile technology and crowd-sourcing approaches provide opportunities to collect and monitor water data with a cheaper, more efficient approach.

Box 4.1 Innovative Monitoring & Modelling for Better Environmental Resources Management

The Innovative Monitoring & Modelling for Better Environmental Resources Management ("iMoMo") looks at the use of mobile technology in collecting, analysing and dispersing information on water that can be used for water management planning in different basins. The project is exploring the development of basic mobile technology that places data retrieval and transmission into the hands of communities. Specifically, iMoMo looks into how to create incentives to participate in collective data retrieval efforts. Several methods for incentivizing people to use the technology are being explored, the most promising of which is "serious gaming". Serious games are those that are designed for the purpose of solving a problem rather than pure entertainment. Such an approach has an additional beneficial aspect in that it can help educate people about freshwater issues, and provide information on the most appropriate time to begin irrigating crops.

The project is being developed in partnership between the Haute Ecole Arc Ingénierie of the University of Applied Sciences of Western Switzerland (focusing on Hardware and software technology), Hydrosolutions Ltd. (focusing on hydro-climatological modelling, optimizing resources management and planning), IUCN (focusing on institutional aspects), and the Zurich University of the Arts (focusing on serious gaming and social interfacing). It is being funded by the Swiss Agency for Development and Cooperation through their Water Diplomacy and Governance in Key Transboundary Hot Spots project.

Informing stakeholders and creating awareness

In order to support participation, institutions need to ensure that information is communicated and made available and accessible to various actors.[123] At the outset, it is important to assess data and information needs of various stakeholders. For instance, marginalised members of communities may require special information regarding their rights (e.g., statutory rights, and rights under international law), or information that can help them build capacity to participate effectively. This should be done through a stakeholder analysis.

Dissemination of relevant and understandable information can also help build public and stakeholder awareness and understanding around technical issues related to, *inter alia*: the freshwater ecosystems in which they live; impacts of climate change on water; issues related to particular projects; the ins-and-outs of institutions and decision-making processes; and important information that is necessary for water management. For private sector actors in particular, it may be necessary to have access to information on issues that affect their sector, such as interests of other stakeholders in the basin that may conflict with their own.[124] This can also have the added value of encouraging members of the public to get involved in the process.[125]

123 Timmerman and Langaas (2005), *supra* note 3, at p. 181.

124 Troell (2010), *supra* note 8, at p. 51.

125 *Ibid*. at p. 49.

For instance, in order to promote ecosystem-based solutions, such as mangrove restoration, local stakeholders need to understand relationships between climate change, sea level rise, and land use patterns, including benefits of restoration and consequences of degradation. Furthermore, if laws are going to be passed that integrate elements related to climate change, such as disaster risk reduction, policy and lawmakers need to understand these links.

In order to effectively engage in decision-making processes, stakeholders need information prior to the commencement of participatory processes far enough in advance to develop a proper understanding of different options, including potential benefits and trade-offs. Information must also be accessible. In particular, information dissemination should be sensitive to particular circumstances, such as power imbalances (e.g., gender), and difference in capacity (e.g., of literacy or language). Information dissemination also needs to be culturally sensitive in order to effectively communicate with certain stakeholders, particularly indigenous peoples and local communities. For instance, the Internet may be an effective tool for communicating with the public generally, but be inappropriate for communicating with local communities that do not have regular Internet access. Depending on the context, a number of different tools may be useful, such as mobile technology, exhibits or displays, mail, television, and radio.

There need to be effective communication channels, for instance through early warning systems, for disseminating information in a timely and accessible manner so that people can react in the case of emergency. Scientific data may need to be translatable so that non-technical users of such information can make informed decisions. For example, in response to increasing uncertainty of rainfall patterns, the Volta River Bain Authority partnered with the University of Bonn to train experts in the use of informational tools in order to facilitate communication of relevant information to farmers throughout the basin regarding the onset of the rainy season.[126]

Ongoing inter-communication between stakeholders

Due to the potentially large number of different stakeholders involved, access to information does not just consist of top-down communication between government bodies and stakeholders. It also consists of horizontal communication between stakeholders themselves. Establishing mechanisms for open exchanges of information and communication between stakeholders can allow for trust building between competing interests, and can lead to a better likelihood of compromises on tough decisions. Dialogues that result from effective stakeholder engagement can also become a social learning process that can lead towards production of better information.[127] Moreover, dialogue and communication makes it possible to construct other adaptive management tools and structures.

126 Global Water System Project (2012). "The Global Dimensions of Change in River Basins: Threats, Linkages and Adaptation," Proceedings from the Conference of the Global Catchment Initiative (6-8 December 2012), p. 113, *available at* http://www.gwsp.org/fileadmin/GCI_conference/Products/GWSP-GCI%20conference%202010%20Proceedings.pdf.

127 Timmerman and Langaas (2005), *supra* note 3, at p. 185.

Case Study 4.6 The Delta Dialogues

In 2010, the Sacramento-San Joaquin Delta Conservancy was established as a primary state agency to implement ecosystem restoration, and to support efforts to promote both environmental protection and the economic well-being of the Delta and its residents.[128] Its mission is "to create broad partnerships to benefit the citizens of California," and "to focus on protecting, enhancing and restoring the Delta's environment, agriculture, landscapes, heritage, and regional economy for the benefit of the Delta's own communities." To this effect, the Delta Conservancy is directed to collaborate and cooperate with local governments and interested stakeholders.

One of its first tasks has been to convene a session of talks, known as the "Delta Dialogues". Recognising that longstanding conflicts in the Delta have been moving at a snail's pace, the conveners of the Delta Dialogues felt the need to initiate an open-ended discussion with every major Delta interest, simply with the goal of developing enough shared understanding to move forward. In a break from the past, interests that had been excluded from past dialogues, particularly people and interests living in the Delta, were included. A first round of dialogues took place from May–October, 2012, and consisted of six meetings, five phone calls, and a number of field trips to various locations in the Delta – each led by a different stakeholder. A mapping tool was also used during the meetings, in order to slow down the conversation, and to accurately validate different positions and concerns.

While the process was far from perfect, it provided a comfortable space for often-conflicting interests to come together and better understand each other. In the end, these interests were speaking to each other informally outside the process. There was also a shared understanding of the problems that stakeholders throughout the basin face, and that many goals and interests were the same, if only articulated in a different way. While differing interests still prevail, the stakeholders have begun Phase II of the Dialogues, which includes even more stakeholders. Recognising that Phase I was about building relationships, participants have begun to dig into more contentious issues around proposed solutions that are concurrently being planned, and have aimed to produce results that can have an external impact.

4.4.4 Stakeholder inclusiveness

There are several tools that are commonly used to locate and analyse relevant stakeholders, including the *Stakeholder Mapping Tool* and the *Power Relations Matrix*. These matrices are useful in understanding the types of stakeholders that should be involved in decision making, as well as their abilities, objectives, and relative positions vis-à-vis each other.[129]

The Stakeholder Mapping Tool is usually a starting point. It yields a list of potential stakeholders, which can later be subdivided into categories based on whether the stakeholder has direct responsibilities in managing basin management plans, and whether the group directly feels the impacts of the decision.[130] Once the stakeholders have been identified, the Power Relations Matrix assesses their relationships, and organises them according to their relative positions of power and interests. This tool can be used to identify stakeholders whose concerns have not received sufficient attention, and to design targeted outreach initiatives to engage with more marginalised groups.

Multi-directional feedback among a varied group leads to improved discourse and better-informed decision-making. As such, identifying and continuously engaging a diverse base of stakeholders is essential in formulating climate change adaptation measures. Groups will put forth their vantage point, and careful consideration must incorporate their concerns.

128 Delta Conservancy (2013). *Delta Dialogues – The Story of the 2012 Multistakeholder Process to Build Shared Understanding of Water Issues in the Sacramento-San Joaquin River Delta* (February 2013), p. 1.

129 Sadoff, C. *et al*. (2008). *Share: Managing Water Across Boundaries*, pp. 39-41. IUCN: Gland, Switzerland.

130 *Ibid*.

Case Study 4.7 The Nile River Basin

The *Stakeholder Mapping Tool* and *Power Relation Matrix* were used in the Nile River Basin in order to better understand public and civil society views towards the Nile Basin Cooperative Framework Agreement – specifically, whether or not these groups felt represented or connected to the process. In partnership with the Nile Basin Discourse,[131] IUCN developed different questionnaires aimed at different actors in different countries throughout the basin, with the aim to get views at national, local, and micro-level. In order to identify who to engage, relevant actors were mapped out with the help of the Nile Basin Discourse's basin-wide Secretariat, country consultants, and representatives, which function as a coordination mechanism between the basins and national-level activities. Through these coordinators, different stakeholders were mapped out, and their interests and relative positions were classified as either having a relatively high level of power or having a relatively low level of power, according to the Power Relations Matrix. This served as a roadmap/guidance for developing a general impression of how different actors across levels felt about the deadlocked process of cooperation in the Nile River Basin, and how to move forward in working with different stakeholders in the future on a number of issues, one of which is adaptation to climate change.

Once stakeholders have been identified and their interests are well understood, institutions need to ensure that they are brought into the decision-making process. If certain groups are left out legitimacy problems are likely to arise, which can impede long-term action or particular solutions from being implemented. It may often be the case that certain interest groups are left out because they are perceived to be radical, or likely to block agreement. This was the case in the Murray Darling Basin in Australia. There, a centralised Authority was established for the basin with wide support. However, when it began operating its legitimacy was questioned due to its failure to adequately engage stakeholders, and its overly technical, "closed door" planning processes.[132]

4.5 Conclusion

Stakeholder and public participation are crucial at all stages of the adaptation cycle. Multi-stakeholder platforms enable sharing, understanding, interpretation and communication of climate information, and provide space for dialogue on local adaptation issues and options. The more inclusive, representative, and collaborative these institutional spaces are, the more likely they will be able to develop resilient and adaptive governance frameworks that can respond to environmental uncertainty and climate variability.

However, there are still a number of challenges that States face in promoting and ensuring full and effective stakeholder engagement in adaptive governance. These issues range from political in nature to lack of capacity. The complexity of multi-level water governance arrangements in transboundary rivers basins makes both vertical and horizontal coordination a tremendous challenge in adaptive policy-making and implementation, particularly where uncertainty and information gaps play such a large role. Furthermore, while international legal principles around participation rights (a right to access to information, a right to public participation, a right to access to justice, and a right to FPIC) have gained traction in both transboundary and national legal frameworks, challenges remain for creating enabling environments for ordinary members of the public, particularly underrepresented and vulnerable groups, to participate in water management.

131 The Nile Basin Discourse is a non-profit organization network of civil society organisations from the 11 different countries of the Nile River Basin.

132 Pittock, J. (2010). "Murray-Darling Basin Authority, Australia," in Hill, M. *et al.*, *supra* note 102, at p. 34.

Nevertheless, there are a number of tools that can contribute to the creation and enhancement of enabling environments for stronger stakeholder and public participation in adaptive planning. First, asymmetric power relationships can be mitigated by legal frameworks that support the rights and interests of weaker or less-represented groups, and maintain accountability between different stakeholders, for instance through access to courts. Furthermore, where legislation empowers communities to implement adaptive strategies at the local level, and provides for representation at higher levels (e.g., national and transboundary), communities are better able to respond to their needs, and successful strategies can be scaled up and receive further support.

Transboundary institutions can also play a coordinating role, ensuring that actions taking place at the local level do not have negative impacts in other areas of the basin. Furthermore, they can serve as a platform for different stakeholders throughout the basin to come together and address adaptation in a collaborative manner. As demonstrated by the examples provided, there are a number of approaches to collaboration and coordination of transboundary adaptation efforts that can contribute to effective adaptive governance. First, local action can be coordinated at the transboundary level, whereby local actions are fed into a larger process. Furthermore, adaptive governance can be largely bottom-up through grass-roots collaborative approaches, particularly if they enjoy support (political, financial, or other) from higher levels. Alternatively, adaptive governance can take the form of a more mixed collaborative approach between all stakeholders, including State and non-state actors from different sectors and different levels.

In addition, there are a number of practical tools that can help ensure all relevant stakeholders are involved in the development and implementation of strategies. At the outset, stakeholder analysis tools can help institutions to understand different actors, interests, and relative social and political dynamics, which can help inform the development of different adaptation strategies. However, this tool does not replace political will to bring all groups to the table, even those that may be seen by other stakeholders as obstructive. Institutions also need to promote awareness, and provide access to timely and understandable information in order to effectively enable public participation in decision-making and implementation of adaptation measures.

Due to the importance of uncertainty and incomplete information, adaptive governance requires information network platforms whereby all stakeholders from different disciplines can input relevant information into decision-making. Where processes provide for accountability between different stakeholders, collaboration can result in adaptive frameworks for decision-making that, in a break from rigid top-down bureaucratic systems, are more capable of responding in real-time to changing hydrological and environmental circumstances. Furthermore, local stakeholders can contribute towards closing information gaps through community monitoring schemes.

Where political situations are particularly charged, promotion of dialogue as a goal in itself can be used as a process to build understanding and create common visions between stakeholders. This can be key towards moving beyond impasses on sensitive issues in the short-term, and in developing collaborative relationships that are capable of reaching negotiated compromises on how to adapt to climate and environmental change in the long term.

Lastly, it is important to recognise that building collaborative and adaptive governance requires a great deal of time, as well as human, financial and technical resources. It also requires political will by government entities and other stakeholders to commit to developing collaborative relationships over the long-term – not just for short-term solutions. Furthermore, adaptive governance will not lead to resilience simply through formal implementation laws and policies that characterise good participative governance – performance must be at a high level.

Nevertheless, it is worth pointing out that “process” cannot be an end in itself. Indeed, most of the concepts that have been analysed in this chapter are related to process. Adaptation requires that stakeholders eventually reach a solution, or meet the goals that have been defined early on in the adaptation planning process. This will be one of the focuses of the next chapter.

Chapter Five

Adaptation Planning – Views towards Resilience and Up-scaling Success to Enhance Transboundary Water Governance

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5.1 Introduction

Up to this point, our globalised economy – and the governance frameworks that support it – has failed to adequately account for the economic value that natural resources provide in terms of services. In doing so, human populations have increased their vulnerability to climate change impacts and other environmental and socio-economic changes. Nevertheless, law and policy have the potential to facilitate a transition towards a new way of thinking. Understood as two of the main pillars of governance, they can help guide substantive ideas of change, for instance by promoting an ecosystem approach to basin water management.

Unfortunately, in the context of legal and policy preparedness for climate change, many governance systems (from local to global) have yet to fully utilise innovative approaches (i.e., those supporting social and ecological resilience in an integrated manner) to drive broader water governance reform. At the basin level in particular, there is still a major disconnect – or a gap – between lessons learned and best practices coming out of pilot projects at the local level, and up-scaling required for enhanced governance structures at higher levels. As such, current economic and governance paradigms are insufficient to deal with the complexities that future scenarios with climate change will pose.

This chapter aims to address that gap. It focuses on the formulation of law and policy to manage ecosystem services sustainably for adaptation to climate change. It also emphasizes the potential and the need for successfully tested hypotheses (i.e., on-the-ground projects) to play a stronger role in driving governance reform.[2]

This chapter builds upon the fact that there are a number of instances where local and international NGOs have piloted small- and medium-scale adaptation measures to collectively address local level challenges. In such cases, communities have agreed to discuss options and make decisions to buffer against changing climate change trends that pose – or may pose in the future – threats to their individual and communal livelihoods.[3] However, while these small-scale initiatives have resulted

1 Stefano Barchiesi, Project Officer, IUCN Global Water Programme; Juan Carlos Sanchez, Legal Officer, IUCN Environmental Law Centre; Katharine Cross, Programmes Coordinator, the International Water Association (IWA); Marta Pérez de Madrid, Regional Officer, IUCN; and Abby Muricho Onencan, Regional Manager, Nile Basin Discourse (NBD).

2 *See* Ruhl, J.B., Kraft, S.E. and Lant, L. (2007). *The Law and Policy of Ecosystems*. Island Press: Washington, D.C.

3 Sproule-Jones, M. (2005). "The Concept of Contingency and the Scholarship of Elinor Ostrom on the Commons: Commentary on Tom Dietz's 'the Darwinian Trope in the drama of the Commons,'" *Journal of Economic Behaviour & Organization*, Vol. 57, pp. 231-235; Mckean, M.A. (2000). "Common Property:

in positive changes at the community level, they have also led to piece-meal implementation of adaptation strategies at the national and transboundary level. Though there have been great strides towards adaptation, overall practice depicts a lack of clear strategy at the basin level to address climate change challenges.

This chapter will place a special focus on how up-scaling can be achieved. In particular, the sequential process known as the management cycle is presented as a methodology that allows for distilling lessons learned from project implementation in order to present them to policy and decision makers. This methodology was also selected given the fact that the management cycle promotes stakeholder participation from the very beginning of the adaptation planning process all the way through to implementation and reflection. To further illustrate this concept, the chapter illustrates how the development of vulnerability assessments and adaptation strategies can assist in building climate resilience, in particular those that incorporate ecosystem-based solutions. It also provides practical examples of participatory approaches that support adaptation planning, which through application of a resilience framework can ultimately result in improved adaptive water governance.

The management cycle is a means to an end; it is a mechanism capable of extracting best practices at the project implementation level and incorporating them into wider adaptation strategies, and institutionalising them into governance frameworks. In its entirety, this chapter builds a view towards better understanding how successful examples of adaptation can be up-scaled to build governance options.

5.2 Understanding Vulnerability and Resilience

There are a number of regions throughout the world where vulnerability to adverse water-related effects of climate change is high. These "hot spots" are the highest priority for adaptation. They include low-lying cities, where higher frequency flooding and coastal inundation will have the most acute impacts; drylands, where high susceptibility to more severe and/or frequent water scarcity will affect food security, health, and economic development; small islands, where sensitivity to coastal erosion, inundation, and saltwater intrusion is high at community and national levels; and mountains and their rivers, where glacier retreat and reductions in winter snow pack will increase disaster risk, and shift volume and timing of downstream water availability for irrigation, industry, and cities.[4]

What is It, What is It Good For and What Makes It Work?" in Gibson, C., McKean, M.A., Ostrom, E. (eds.), *People and Forests: Communities, Institutions, and Governance*. MIT Press: Cambridge, MA; Agrawal, A. (2001). "Common Property Institutions and Sustainable Governance of Resources," *World Development*, Vol. 29, pp. 1649-1672; Agrawal, A. *et al.* (2013). "Interactions between Organizations and Networks in Common-pool Resource Governance," *Environmental Science & Policy*, Vol. 25, pp. 138-146; Agrawal, A. and Gupta, K. (2005). "Decentralization and Participation: The Governance of Common Pool Resources in Nepal's Terai," *World Development*, Vol. 33, pp. 1101-1114; Ostrom, E. (2010). "Polycentric Systems for Coping With Collective Action and Global Environmental Change," *Global Environmental Change*, Vol. 20, pp. 550-557; and Wagner, R.E. (2005). "Self-governance, Polycentrism, and Federalism: Recurring Themes in Vincent Ostrom's Scholarly Oeuvre," *Journal of Economic Behaviour & Organization*, Vol. 57, pp. 173-188.

4 Smith, M. and Barchiesi, S. (2009). "Environment as Infrastructure: Resilience to Climate Change Impacts of Water Through Investments in Nature," Perspectives on Water and Climate Change Adaptation, p. 2. IUCN: Gland, Switzerland.

The Intergovernmental Panel on Climate Change (IPCC) defines "vulnerability" as:

> *"the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is thus a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity."*[5]

In accordance with the definition, there are three components of vulnerability, which can be described as follows:

1. Exposure – the direct danger (i.e., the stressor), and the nature and extent of changes to a region's climate variables (e.g., temperature, precipitation, and extreme weather events);
2. Sensitivity – the human-environmental conditions that can worsen the hazard, ameliorate the hazard, or trigger an impact; and
3. Adaptive Capacity – the potential or capability of a system to adapt to (to alter to better suit) climatic stimuli.

Vulnerability will be high where climate change increases exposure to more severe and higher frequency events with extreme impacts such as droughts, floods, or coastal inundation, and where the affected population's ability to cope is limited. Capacity to cope is most limited, and thus sensitivity highest, where livelihoods and economies are based on a narrow range of assets that are easily damaged by climate hazards, or where alternate options for managing risk are limited (e.g., where governance capacity is low). Vulnerability is therefore especially high for poor people located where climate change exacerbates exposure to natural hazards.

If vulnerability is a combination of these components, then reducing vulnerability demands actions that will: 1) reduce exposure to hazards; 2) reduce sensitivity to their effects; and 3) build capacity to adapt.[6] This latter component of vulnerability, "adaptive capacity", is a characteristic of communities' and nations' ability to mobilise the decisions and resources needed to reduce vulnerability and adapt to climate change.[7]

The IPCC defines adaptive capacity as "the ability of a [social or natural] system to adjust to climate change … to moderate potential damage, to take advantage of opportunities or to cope with the consequences."[8] If reducing vulnerability implies reducing sensitivity and exposure to threats, then *adaptive capacity* is building resilience to them. "Resilience" is understood as the amount of disturbance that can be withstood before a system changes its structure and behaviour – for example before it breaks down.[9] In essence, resilience looks at a system's capacity to withstand shocks and rebuild towards normality if needed.[10] For instance, in the case of a resilient agriculture-

5 Intergovernmental Panel on Climate Change (IPCC) (2007). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, *et al.*, (eds.), p. 6. Cambridge University Press: Cambridge, U.K.

6 *Ibid*. at p. 75.

7 Nelson, D.R., Adger, W.N. and Brown, K. (2007). "Adaptation to Environmental Change: Contributions to a Resilience Framework," *Annual Review of Environment and Resources*, Vol. 32, pp. 395-419, at p. 397.

8 IPCC (2007), *supra* note 5.

9 Folke, C., Colding, J. and Berkes, F. (2003). "Synthesis Building Resilience and Adaptive Capacity in Social-Ecological Systems," in Berkes, F., Colding, J., and Folke, C. (eds.), *Navigating Social-Ecological Systems: Building Resistance For Complexity and Change*, pp. 352-387. Cambridge University Press: Cambridge, U.K.

10 Smith, M. (2011). "Development and Application of a Resilience Framework to Climate Change Adaptation,"

based community, an abrupt change in the rainfall pattern might have little impact on household and livelihood stability, because farmers would take timely measures (e.g., crop substitution). However, where resilience is low, if the rainy season is delayed communities will not be able to cope with failed or delayed production, leading to market losses. In the context of climate change, unless steps are taken to build resilience, societies may have less ability to cope with other stresses as their effects mount.

Established approaches to climate change adaptation are highly "impact specific", and are designed to lower vulnerability to specific projected impacts of climate change across sectors. Such approaches are based on assessment of vulnerabilities, and subsequent action to address those that are highest priority. Building resilience is complementary to this impact-specific adaptation planning.[11] Climate resilient communities and nations need to take both impact-specific action for adaptation and improve institutional functions in response.[12] As both expected and unexpected impacts of climate change unfold, in locations where resilience is enhanced, development trajectories and poverty reduction will more likely be able to continue progressing. This will be due to higher capacities to cope with shocks and, when necessary, to readjust and rebuild according to new realities through, for example, making effective use of better climate information in adaptation strategies as they become available.[13]

Adapting to climate change by building resilience is therefore integral to addressing global priorities for security and development. As explained in Chapter One, because water dominates climate change impacts there is a particular demand for focusing on resilience to impacts on water.[14] To secure social-ecological resilience, management approaches must simultaneously sustain societal development and ensure progress with essential ecosystem services.[15] To maintain ecosystem health and livelihood sustainability, it is now widely accepted that complexity, variation, and uncertainty are inherent properties of linked social and natural processes. In order to ensure sustainable hydrological systems, water management strategies must therefore strive to reflect this uncertainty.[16]

At a basin-wide scale, applying a social-ecological systems approach for resilience has been defined as "the river basin's ability to absorb, cope and adapt to biophysical, social-economic, and political changes (or stressors) while still maintaining essential structure, feedbacks, and functional integrity."[17]

New and more integrated approaches to water management are being developed due to an increasing awareness of the complexity of environmental problems and of human-technology-environment connectivity.[18] In this context, Ecosystem-based Adaptation (EbA) is increasingly being regarded as

SEARCH Project - Briefing Paper, p. 3. Global Water Programme, IUCN: Gland, Switzerland.

11 *Ibid*.

12 Meinzen-Dick, R. (2007). "Beyond Panaceas in Water Institutions," *Proceedings of The National Academy of Sciences of the United States of America*, Vol. 104(39), pp. 15200-15205.

13 *See* Armitage, D., Marschke, M. and Plummer, R. (2008). "Adaptive Co-Management and the Paradox of Learning," *Global Environmental Change*, Vol. 18, pp. 86-96; and Smith (2011), *supra* note 10.

14 Smith and Barchiesi (2009), *supra* note 4, at p. 2.

15 Folke, Colding and Berkes (2003), *supra* note 9.

16 Medema, W., McIntosh, B.S. and Jeffrey, P.J. (2008). "From Premise to Practice: A Critical Assessment of Integrated Water Resources Management and Adaptive Management Approaches in The Water Sector," *Ecology and Society*, Vol. 13(2). *See* also Plummer, R. and Armitage, D.R. (2007). "Charting the New Territory of Adaptive Co-Management: A Delphi Study," *Ecology and Society*, Vol. 12(2).

17 MacQuarrie, P. R. (2012). "Resilience of Large River Basins: Applying Social-Ecological Systems Theory, Conflict Management, and Collaboration on the Mekong and Columbia Basins," *PhD Dissertation*, p. 20. Oregon State University: Corvallis, OR.

18 Dzwairo, B., Otieno, F.A.O. and Ochieng, G.M. (2010). "Making a Case for Systems Thinking Approach

a mechanism to cope with the intrinsic complexity of social-ecological systems. According to Barrow *et al.*, EbA can help alleviate major pressures from climate on ecosystems by managing and restoring ecosystems and the services they provide, in turn enhancing resilience of local communities.[19] What is argued in this chapter is that through adaptive planning and up-scaling, the main opportunities provided by EbA should become part of adaptive governance frameworks at a basin-wide scale.

Box 5.1 Main opportunities provided by EbA

The main opportunities provided by EbA include:

- Strengthening collaboration between sectors that are involved in managing ecosystems, and benefit from the services that ecosystems provide;
- Involving local institutions and stakeholders as a key actors in adaptation planning in order to enhance participation and compliance;
- Incorporating traditional knowledge and practices, and gender-sensitive tools and approaches to adaptation planning and activities;
- Reducing the risk of maladaptation by harnessing ecosystem resilience as part of a broader range of adaptation actions;
- Facilitating collaboration and financial transfer between developed and developing economies; and
- Providing intensified research and development, technology transfer, and infrastructure development.

In order to achieve up-scaling, climate resilience and adaptation cannot be treated as just another problem. Adaptation based solely on prioritisation of discrete actions – for example on infrastructure, institutions, or ecosystems – may lead to missed opportunities to build system-wide resilience towards a dynamically changing climate, where uncertainty and unknowns are expanding. EbA, thought of only as an adaptive measure to be applied on a small scale, runs the risk of running short as an adaptation strategy.

This is where (as presented in Chapter Two) adaptive water governance – that is, the ability to apply adaptation measures in practice from community to national and basin scale – is key. In turn, adaptive water governance is the result of a host of capacities such as local knowledge, access to resources, leadership, mobilisation, financing, and – potentially most important – adaptive planning embedded into governance reform. The above should pave the road for a new climate change governance system, using a mixed portfolio of engineered and natural solutions under a new water governance paradigm that incorporates transboundary dimensions of shared waters. As a new paradigm (supported through appropriate laws, policies and institutions), adaptive water governance is a multi-level process, incorporating bottom-up approaches; it builds on local capacities for local water governance, utilises sustained multi-stakeholder platforms that allow for adequate discussion of adaptation options, and promotes actions that reduce vulnerability. Through an overall framework, local adaptation processes (e.g., EbA) should inform public policies and laws at the national, and eventually regional or international levels.

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to Integrated Water Resources Management (IWRM)," *International Journal of Water Resources and Environmental Engineering*, Vol. 1 (5), pp. 107-113, at p. 108.

19 United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP) and IUCN (n.d.). *Making the Case for Ecosystem-based Adaptation: Building Resilience to Climate Change*, *available at* http://ebaflagship.org/images/ContentsForPublications/eba%20policy%20brochure%20web.pdf.

In conclusion, if adaptation to climate change should be the end goal, EbA can be seen as a very promising approach to reach that end. In this context, adaptive management (i.e., learning-by-doing) refers to “how” adaptation can be achieved, while adaptive planning refers to the process by which priorities and courses of action are decided. The framework through which all of this takes place is referred to as adaptive water governance.

The project management cycle explained in the next section provides a powerful tool for guiding this process.

5.3 The Management Cycle

Adaptation planning efforts benefit from good governance structures, particularly with an adequate and sustainable institutional base. However, as explained in the previous sections, in many regions of the world there is a strong need for governance reform, due to outdated laws and policies that are incapable of responding to climate change challenges in a cost-effective manner. In theory, governance frameworks can and should evolve based on experiences gained from the execution of adaptation projects and programmes that allow for learning, which feeds back into improved governance frameworks. In addition, as highlighted in Chapter Four, synergising across stakeholders is essential to responding to the challenge of unknown futures.

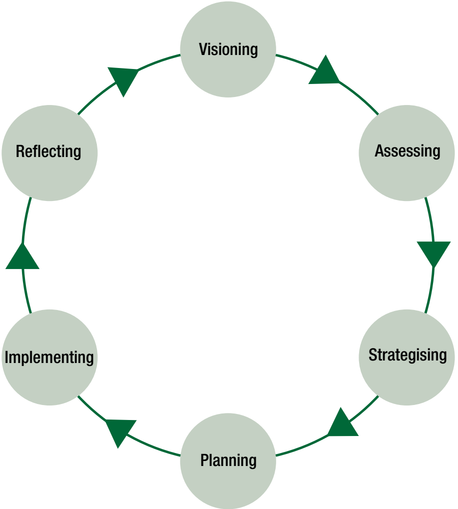
In order to facilitate incorporation of participatory and ecosystem-based approaches into adaptive water management, there is a need for a logical and sequential cycle. For adaptive planning purposes, this “management cycle” aims to ensure that intended practical outputs such as adaptation strategies, plans, and measures are realised in a systematic manner.

The management cycle approach to participatory adaptation planning provides communities with a logical process for clearly and collectively understanding where they stand with respect to climate change, before taking action. It also enables thoughtful identification of options for adapting, and for implementing innovative solutions. Importantly, it also helps reveal the big picture, ensuring that adaptation in one area is not achieved at the expense of another. Finally, through a reflective process the management cycle allows up-scaling of lessons and principles to strengthen and improve governance frameworks at different levels.

The EMPOWERS Partnership[20] proposes a phased approach towards the management cycle, in order to structure and guide work towards improving water governance through participatory planning. It focuses on stakeholder and concerted action, within the different phases described in Figure 5.1 below.

20 *See* the EMPOWERS Approach to Water Governance. Moriarty, P. *et al.* (2007). *EMPOWERS Guidelines, Methods and Tools*. Euro-Med Participatory Water Resources Scenarios. Egypt, Jordan and the West Bank/Gaza, *available at* http://www.ircwash.org/resources/empowers-approach-water-governance-guidelines-methods-and-tools.

Figure 5.1 The Six Phases of the Management Cycle[21]



1. **Visioning:** Stakeholder analysis, problem identification, initial vision development, initial scenario development, and awareness raising;
2. **Assessment:** Biophysical, socio-economic, policy and legal analysis, scenario analysis, information collection and analysis, quality control, information dissemination and awareness raising;
3. **Strategising:** Vision and scenario revision, initial strategy development taking account of scenarios, strategy testing, vision finalisation, and strategy agreement and finalization;
4. **Planning**: Agreement of priority activities, identification and agreement on potential projects, detailed plan development, sourcing of funds, tendering of works, and awareness raising;
5. **Implementation:** Execution of plans, supervision and quality control, trouble-shooting and maintaining dialogue, and information sharing; and
6. **Reflection**: Development of indicators, evaluation of progress, analysis and reporting, sharing and learning, and follow up on activities.

Source: Adapted from: “Empowers Guidelines, Methods ans Tool“, Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

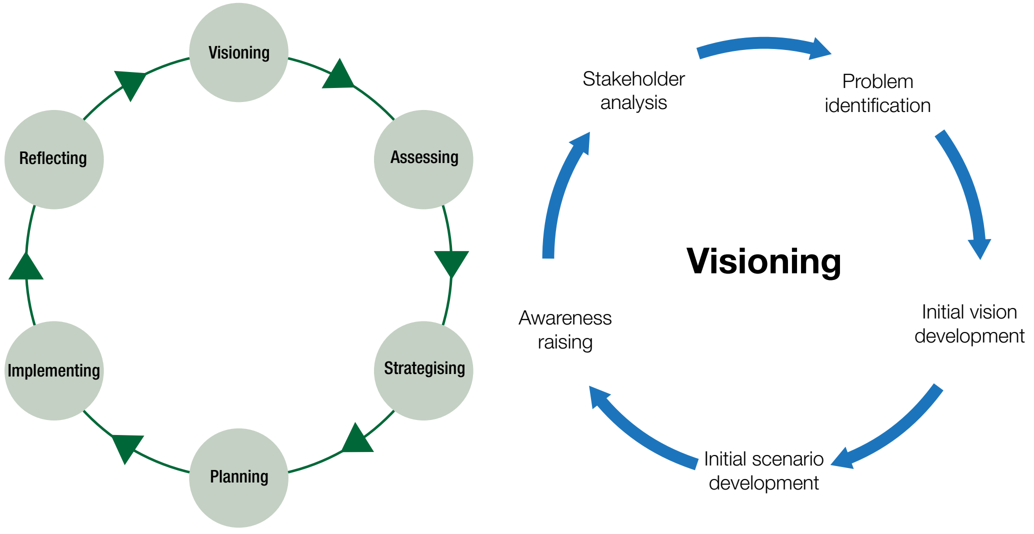
The EMPOWERS management cycle sets out a framework road map for the rest of this section. Its six phases will be discussed individually in the following subsections, particularly through a lens of adaptation planning and building resilience. This approach was selected for the following reasons: 1) it incorporates stakeholder involvement processes into all phases; 2) there is an explicit acknowledgment of the uncertainty that exists in nearly all aspects of water service delivery and water management, especially future water demands;[22] and 3) it helps direct the focus of the adaptation process from dialogue to implementation of specific activities that are designed to help communities adapt. The latter guides the implementation of the ecosystem approach based on the adaptive water governance paradigm, as explained in Case Study 5.3.

It should be pointed out that the steps in the management cycle are not meant to be a static step-by-step process, but a flexible framework designed to fit the contours of individual situations. Furthermore, the processes described in this chapter often occur more than once during the management cycle. Upon sharing lessons, visions and strategies can be adjusted, ultimately leading to a review of all the subsequent processes. Organising and institutionalising such a cycle is a major part of achieving improved water governance.

21 *Ibid*.

22 *Ibid*. This specific challenge is dealt with through incorporating scenario building into every relevant phase of the cycle.

Figure 5.2 Phase 1 – Visioning



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

5.3.1 Visioning

The management cycle for adaptive water management is initiated through the visioning phase. It starts by developing a clear picture of the future in a climate change context through the process of stakeholder analysis, identification of the problem, and development of an initial vision. It enables development of a precise and shared vision statement of how a society sees itself at some point in the future in a context of climate change. The visioning phase is important, because it takes the various actors out of their day-to-day problem solving realities into medium- and long-term thinking of the effects of their actions. Visioning may be done with different scopes and at different levels, which determines who will be involved in the process and how.

Scenario building is another important part of constructing a shared vision. Scenarios are based on the collection of local knowledge, data, and information by experts and stakeholders, and are used to develop plausible descriptions of the way their territories will appear in the future. Scenario building helps stakeholders begin outlining possible adaptation strategies. Scenarios are reviewed and sharpened further during the next two phases of the management cycle, after gathering and analysing new information (e.g., strengths, weaknesses, opportunities, and threats).

At this stage it is also important to consider all relevant stakeholders, as there might be differences in how different groups envision use and development of natural resources and in general, and how their territories should look in the future. Good governance mechanisms are also a tool for securing adequate representation in the adaptive planning process. For example, in the Sixaola River Basin, which is shared between Costa Rica and Panama, Internal Operations Regulations secure the participation and representation of indigenous associations – ADITIBRI (Integral Development Association of the Bri Bri Territory) and ADITICA (Integral Development Association of the Cabecar

Territory), as well as the Kekoldi, Ngobe, Naso and Bri Bri nations which are found on both the Costa Rican and Panama sides of the basin.[23]

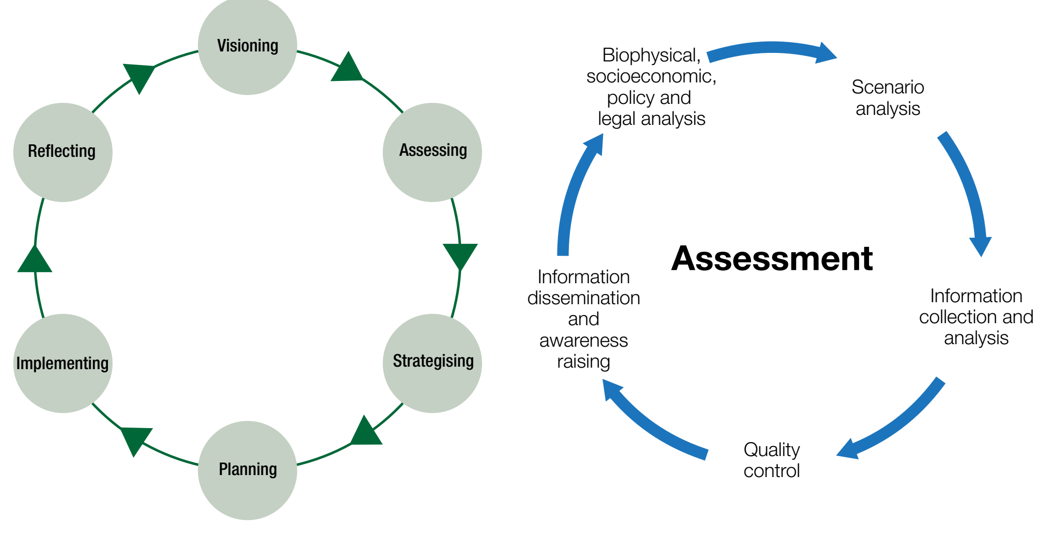
The visioning phase should also lead to increased stakeholder awareness of a process for enhancing livelihoods and increasing resilience to climate change. In particular, visioning should result in greater understanding of main stakeholder groups, and potential problems and conflicts between them; strengthening of stakeholder platforms; development of climate change problem trees by the stakeholders; and the development of the initial visions, scenarios, and eventual strategies.

Case Study 5.1 Broadening adaptation approaches to incorporate ecosystems

In the context of the Paz River, a transboundary basin shared between El Salvador and Guatemala, communities built a vision for the Garita Palmera Reserve (a wetland in the lowlands or the river basin). In this vision, stakeholders prioritised the restoration of mangroves in order to conserve ecosystem services (e.g., food and reproduction area for crabs and shrimps), and to restore fishing as a means of supporting sustainable livelihoods. This vision was promoted under the slogan "Paz River: life, shelter and food security."

The case highlights the importance of addressing EbA approaches during the initial stages of adaptation planning, such as visioning. In doing so, it is necessary to determine capacity building needs relative to climate change, ecosystems, and water management early on. If these issues are not approached together during this initial phase, it will be more difficult later on for adaptation strategies to utilise nature-based solutions.

Figure 5.3: Phase 2 – Assessment



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

23 Internal Operations Regulations for the Binational Commission for the Sixaola River Basin (BCSRB), Article 10.

5.3.2 Assessment

Once a common vision for adaptation has been agreed upon, in order to be achieved a strategy has to be developed, planned, and implemented. However, an adaptation strategy cannot be developed before an assessment is undertaken. This phase entails the collection of information, analysis, quality control, information dissemination, and awareness raising; and biophysical, socio-economic, policy, and legal analysis.

The purpose of the assessment phase is to help establish a clear baseline of the starting situation, and to understand and visualise possible courses of action. In this phase, it is crucial to ensure that all the important information is accessible to stakeholders. When talking about adaptive water governance, vulnerability and adaptive capacity become the focus of the assessment phase. Vulnerability assessments not only provide the vital information necessary for feeding the management cycle, but they also consolidate participation. Moreover, they shed light on how and where to best invest resources to strengthen adaptive capacity and therefore, build resilience.

Assessing vulnerability to climate change

As explained in Section 5.2, vulnerability can be determined by examining a community or ecosystem's level of exposure to water stress and climate variability, its degree of sensitivity, and its adaptive capacity. These variables can be accurately characterised through the use of participatory vulnerability assessments.

Vulnerability assessments are not only useful for defining climatic hazards and impacts, but also for specific capacities and potential responses of vulnerable populations in a particular location. Therefore, a vulnerability assessment is the process of formally identifying and analysing expected impacts, risks, and the adaptive capacity of a sector (e.g., agriculture), population, ecosystem, or a specified geographic area to changes in climate.[24] It also looks at the probability that risks of harmful events are likely to take place. In this way, they are also meant to identify impacts most likely to be felt in the near future, so that various adaptation strategy options can be prioritised. Over time, repetition of vulnerability assessments can help strengthen current adaptation efforts, and facilitate prioritisation of future vulnerabilities and measures to enhance resilience.

It is important to remember that vulnerability assessments aim to bring together diverse strands of knowledge in a way that is useful for future decision making. Assessments can be conducted across scales from local or national to transboundary, and also across sectors. Active data and information monitoring, and exchange between stakeholders are vital tools in this process. Ideally, vulnerability assessments should be multidisciplinary, and overlaid with wider scale biophysical, socio-economic, and legal and policy assessments as described in Table 5.1, below.

24 CARE International (2010). *Toolkit for Integrating Climate Change Adaptation into Development Projects. Available at:* http://www.careclimatechange.org/files/toolkit/CARE_Integration_Toolkit.pdf.

Table 5.1 Information to consider when assessing vulnerability of watersheds[25]

Biophysical	Socio-economic	Legal and Policy
• Land use, land cover, and river bank use (irrigation systems, location and type of dams); • Infrastructure - roads, trains, canals, river navigation, and water supply and health system infrastructure; • Possible future developments; • Topography, including river bed profiles; • Water levels and water flows; • Water level fluctuations; • Location of protection areas; and • Natural infrastructure used to buffer climate hazards (wetlands, flood plains, etc.).	• Assessment of the basin population, including ethnic groups, and how different groups react to climate change hazards; • Administrative divisions and maps; • Education levels and training programmes; • Economy (distribution of wealth and income, employment); • Literacy; • Urban-rural divisions; • Economic policies; • Ownership patterns; • Activities of civil society (levels of participation); • Water availability and use across sectors; and • Emergency and recovery plans for safeguarding human life, and the recovery of critical infrastructure.	• Environmental flow regulations; • Gaps within existing law and policy frameworks; • Regulations for specific issues (e.g., hydroelectric power, fisheries, etc.); • Extent to which existing laws and policies are being implemented; • Barriers to adaptation; • Measurement of compliance and enforcement (using indicators); • Liability coverage (if any); • Informal institutions that come into play when climate change policies, laws, decisions/ strategies and plans are being made with emphasis on relationships, networks and the organisation of collective action; • Transboundary agreements (if any and applicable); • Policies regarding distribution of multiple responsibilities and resources for climate change adaptation.

There are a large number of tools available for carrying out vulnerability assessment across scales from the community to the transboundary level.[26] Table 5.2 provides an overview of indicators that should be taken into consideration when carrying out this process.

25 Gooch, G.D., Rieu-Clarke, A. and Nhung, D.K. (2007). "A Multi-disciplinary Approach to Vulnerability Assessment and Transboundary Water Governance: The Case of the Sesan Basin," *Presentation at the Water Environmental Governance in Asia conference organized by The Water Environmental Partnership in Asia (WEPA)*, Bangkok, Thailand, 4-5th March, 2007. *Available at:* www.iges.or.jp/en/fw/0703wepa_sympo.html; *See* also United Nations Economic Commission for Europe (UNECE) (2009). *Guidance on Water and Adaptation to Climate Change*, UN Publication ECE/MP.WAT/30. United Nations: Geneva, Switzerland.

26 *See* e.g., a matrix of tools provided by Ecosystem-Based Management Tools Network, *available online at* http://www.ebmtools.org/search/node/Climate%20Change%20tools%20matrix. More broadly, under the Nairobi Work Programme, the UNFCCC has also put together a compendium on methods and tools to evaluate impacts of – and vulnerability and adaptation to – climate change, *available online at* http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5457.php. As with all tools, they do not provide complete solutions, and the best approach is to combine methods to match the context. The "*UNECE Guidance on Water and Climate Change*" also provides tips on methodologies for conducting vulnerability assessments in a transboundary basin.

Table 5.2 Relevant indicators for assessing vulnerability[27]

VULNERABILITY		
Exposure	**Sensitivity**	**Adaptive Capacity**
1. Wich climate hazards that affect livelihoods? **2. Changes in timing, frequency, and intensity of climate hazards?** **3. What is the „science“ saying about recent climate trends? Projections?** – How does it compare to community observations? **4. Reactions to scenarios?** – What do communities think will happen to their environment, livelihoods if future projections occur? – How will they cope? What can they do now to prepare?	**1. Indicators of sensitivity** – Dependence on livestock – Livestock type (resilient species?) – Dependence on rain-fed agriculture – Crop mix/types (resilient species?) – Environmental conditions (type, level, rate of degradation) **2. Livelihoods resources most affected by climate** – which resources are most affected by climate hazards?	**1. Determinants of adaptive capacity (e.g.)** – Economic wealth – Technology – Literacy rate – Access to info – Institutions **2. Experiences with risk management and coping** – What activities are undertaken in preparation of anticipated hazard/deal with impact of hazard? – Which resources are key? **3. Enabling conditions and barriers to adapting** – National; Local; Household
Disaggregated by location, gender, age, wealth, etc.		
Drivers of vulnerability • **Non-climate hazards that affect livelihoods: How do they interact with climate-related hazards/stress?**		

Ideally, methodologies should be able to accommodate assessment at different scales including local, national, regional, and international levels. While information on transboundary and national impacts of climate change exists at higher levels, community level approaches can provide hotspot analysis of specific areas and people. These efforts can complement higher-level international efforts, setting the stage for a more comprehensive assessment of vulnerability throughout the basin.

Ideally, there also need to be follow-up assessments to determine how vulnerability changes over time. This can be undertaken by ensuring that there is a robust monitoring and evaluation framework that includes integration of climate change indicators.[28]

Community vulnerability assessments at the micro-basin scale in Mesoamerica

The IUCN project Climate Change Governance Capacity: Building regionally- and nationally- tailored ecosystem-based adaptation in Mesoamerica[29] aimed to test and learn from EbA demonstration sites in transboundary basins of Mesoamerica. Additionally, the project intended to scale up results and recommendations to other levels of decision and policymaking, including the binational and

27 CARE International (2009). *Climate Vulnerability and Capacity Analysis Handbook, First Ed*., *available online at* http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf.

28 For example, CARE has developed the "*Toolkit for Integrating Climate Change Adaptation into Projects*," which provides guidance for integrating climate change adaptation into the design, implementation, monitoring, and evaluation of development projects. *See* CARE International (2010), *supra* note 24.

29 Further information *available online at* www.iucn.org/aguayadaptacion.

regional level. Since 2010, the project has developed and implemented six EbA strategies that rely on Integrated Water Resource Management (IWRM) tools, and the generation of capacities for improving local water governance and livelihoods. For the project, it was important to incorporate information from different scales into the vulnerability assessment process. In particular, the methodology for the vulnerability assessment integrated analysis of three key components:

1. *Climate science – analysis of climate change impact scenarios:* For the climate scenario analysis, downscaled scenarios at a river basin scale were not available. Indeed, hydrological studies were unavailable, and data that were available were very poor. Nevertheless, official information from National Communications reports to the UNFCCC was a valuable source. In close collaboration with regional climate change authorities, such as the National Meteorological Institute of Costa Rica, this information served as a basis for further information collection and analysis – including traditional and local knowledge through observation and scenario validation by local stakeholders.

2. *Livelihood impact analysis:* Scenarios of climate change impacts on livelihoods were elaborated for each of the six pilot sites based on two complementary approaches. With the help of the Regional Committee for Hydraulic Resources (CRRH) of the Central American Integration System (SICA), national level information was collected. Furthermore, through use of the participatory Community-based Risk Screening Tool – Adaptation & Livelihoods (CRiSTAL), information on climate vulnerabilities was compiled at the local level.

   The first approach, carried out by the CRRH, considered both economic and social impacts on livelihoods such as agriculture (e.g., coffee beans, corn, vegetables such as cabbage, cacao and plantain crops), and artisanal fishing. In the Yorkín micro-basin,[30] for example, more rainfall and higher temperatures due to climate change will contribute to the proliferation of the monilia fungus, which will most likely impact cacao plantations due to increased humidity.

   The second approach to vulnerability assessments in the micro-basin communities[31] utilised CRiSTAL. This tool was developed to support decision making at the community level in the context of adaptation and mitigation measures against climate change. Specifically, CRiSTAL employs the use of an Environmental Impact and Sustainable Livelihood Screening model. Participatory diagnosis at the community level can assist in gaining a better understanding of links between climate change risks and people's livelihoods. Furthermore, it assesses whether certain adaptation or mitigation projects would have positive or negative impacts on the community (e.g., on resources depended upon by the community for their livelihoods). It also analyses opportunities and challenges for the project´s implementation. Upon completion of the assessment, it is possible to identify, elaborate, and adopt appropriate adaptation measures for the community concerned.

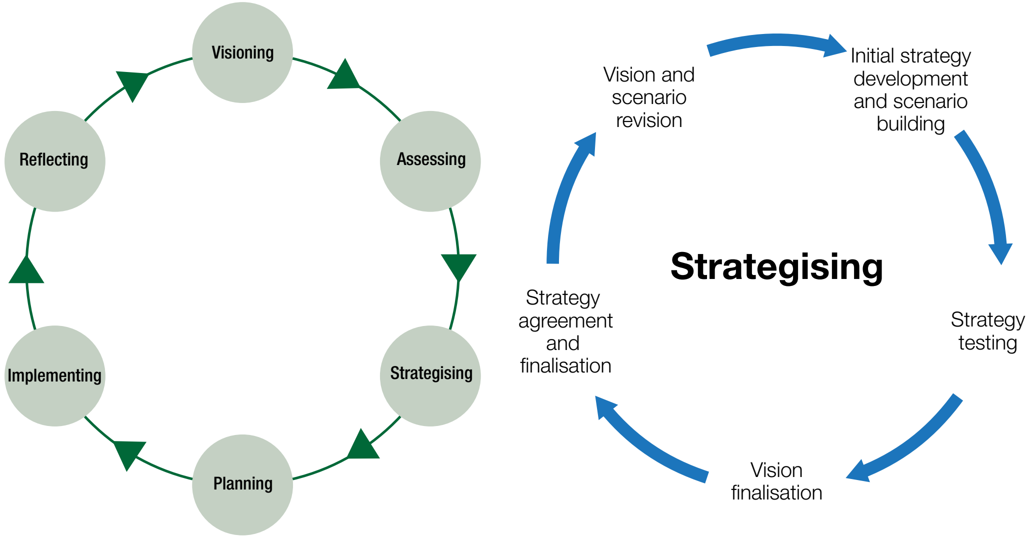
30 The Yorkín micro-basin is part of the upper Sixaola, shared between the Republic of Costa Rica and the Republic of Panama. For further information see the standalone Case Study in the Annex to this publication.

31 In Guatemala, "micro-basin" or "micro-watershed" councils encompass 10 to 20 communities who share water in the watersheds of tributary streams. Cartin *et al*. (2012). Tacaná Watersheds, Guatemala & Mexico: Transboundary Water Governance and Implementation of IWRM Through Local Community Action. IUCN: Gland, Switzerland, *available at* http://www.iucn.org/dbtw-wpd/edocs/2012-011.pdf.

3. *Governance analysis – water governance study and advocacy roadmap:* A governance study on climate change adaptation in the context of water management was also conducted. This assessment documented information on policies, regulations, and institutional arrangements related to water management, analysing their potential to help cope with climate change impacts. The study, which included field visits and interviews with key actors, and validations through national expert focus groups, provided a clear overview of governance structures in place at local, national, and binational levels. The assessment was a great source of information for a comprehensive mapping of stakeholders. It also provided a road map for potential up-scaling of EbA actions in the framework of local water governance.

With information obtained through different strands of the vulnerability assessment, the different project communities where able to identify specific locations for pilot EbA strategies and actual adaptation measures. In all of the cases, the adaptation measures were tailored to the needs shown in the assessments. These varied from mangrove restoration in coastal areas (Paz River Basin) to sustainable management of natural resources and production diversification (Sixaola River Basin).

Figure 5.4 Phase 3 – Strategising



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

5.3.3 Strategising

Adaptation strategies normally build on the outputs of a climate change vulnerability assessment. Therefore, there is a strong connection between assessment and strategizing. Understanding vulnerabilities and sensitivities at the local level is essential when formulating strategies to empower collective action. In order to fully leverage strengths between levels and across stakeholders, it is also crucial to understand the different forms of capacities and the interdependencies between them.

Strategizing allows stakeholders to decide on a broad range of practical steps or measures that should be taken in order to attain their vision. As the third phase of the management cycle, it entails developing a medium- to long-term planning framework through which specific adaptation policies and measures may be chosen and subsequently implemented. These activities include the development of an initial strategy; scenario building; strategy testing; vision finalisation; strategy agreement and finalisation; and vision and scenario revision.

At the conclusion, there should be a consensus on a comprehensive climate adaptation vision, and a set of scenarios against which a set of strategies to achieve the vision are assessed. At this stage, the information derived from assessments is analysed against the vision, evaluating risks, potential negative trade-offs, and the viability of certain strategic approaches. After the analysis, stakeholders should have finally reached consensus on a certain adaptation strategy that will then be taken forward for planning and implementation.

In general, adaptation strategies are broad plans of action that include various measures that can be implemented over the short-, medium-, and long-term.[32] They should aim to address key elements of adaptive water governance such as laws, regulations, policies, market instruments, and measures to increase capacity and enable stakeholder participation.

Adaptation strategies should consist of measures covering various steps in the process of adaptation, including prevention, improving resilience (in order to deal with gradual changes and extreme events), preparation, reaction, and recovery (mostly relevant to extreme events). Furthermore, strategies and measures should account for different time scales, such as short-term measures, measures planned for the medium-term, and long-term actions. A wide range of measures should also be chosen, in order to account for inherent uncertainty in climate projections.

Case Study 5.2 Analysing water allocation scenarios in the Pangani River Basin

In the Pangani Basin, in Tanzania, a series of vulnerability assessments were undertaken at the community level, and the outputs were used to inform decisions on adaptation approaches across the basin. These outputs were then translated into a series of water development scenarios. Looking to 2025, each scenario determined how different water allocations would impact economic growth, environmental health, and societal well-being in the basin. They included strategies such as maximising agriculture, optimising present day flows with hydroelectric power, and storage.[33] Climate change will have a negative impact for the three major sectors, with all three scenarios experiencing worse situations than present day.

Focus has now switched to stakeholders and the government to agree on how to best reallocate water. The decision (chosen allocation scenario) will be integrated into the basin's water management plan, which is legally binding. A monitoring program will aim to ensure that the desired river status is achieved and maintained irrespective of climate change.[34]

There is now a better understanding of the environmental, economic, and social implications of different river flow scenarios under possible future climatic conditions, and increased capacity to collect and analyse such information. Furthermore, water sector vulnerability to climate change is now better understood by those at risk. Perhaps most importantly, the lessons learned from establishing water users associations and sub-catchment forums in the Pangani are being up-scaled to strengthen national support, and to inform other communities, basins, and countries.[35]

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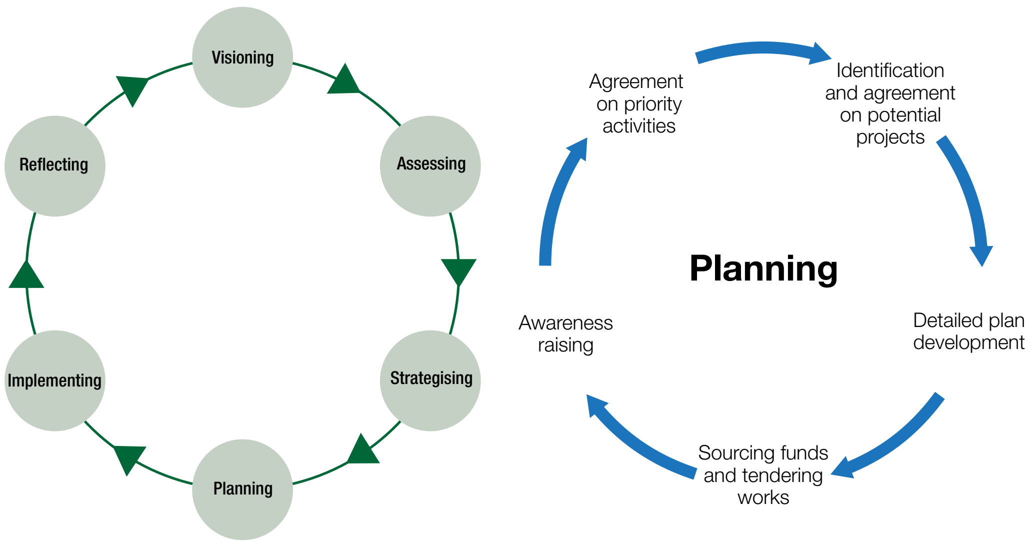
32 UNECE (2009), *supra* note 25, at p. 77.

33 Ostfeld, A. *et al.* (2012). "Climate Change Impacts on River Basin and Freshwater Ecosystems: Some Observations on Challenges and Emerging Solutions," *Journal of Water and Climate Change,* Vol. 3(3), pp. 171-184.

34 Barchiesi, S. *et al*. (2010). "Case Study No 2: Pangani Basin Water Board, Tanzania," from Hill, M. Cook, J., Freeman, S., Levine, E. (eds.), *Shifting Course: Climate Adaptation for Water Management Institutions.* WWF-US, University of Geneva.

35 *Ibid.*

Figure 5.5 Phase 4 – Planning



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

5.3.4 Planning

The planning phase of the management cycle entails high level and local level climate adaptation planning. At this point, priority activities should have been agreed upon, and potential projects identified. The objective of the planning phase is to prioritise and schedule different agreed activities, develop detailed plans, and secure financing, while maintaining stakeholder ownership of the process and outcome. It should be noted that undertaking vulnerability assessments and preparing adaptation strategies are also part of the planning process, albeit at the strategic level. Nevertheless, this section will focus on local level planning as it pertains to more practical aspects of planning, referring later to spatial planning as an effective planning tool for adaptation processes.

A participatory approach to adaptation planning on the ground

Local level adaptation planning is complicated, because it is fairly hard to realise a cohesive and inclusive process that caters to all social and sub-groups, and ensures that the benefits and costs are shared equitably.

Nevertheless, the planning stage is very important for ensuring a smooth transition from the general strategy, which serves as a framework, to specific project plans. During the planning process, activities that should be undertaken need to be ranked and prioritised. In particular, stakeholders need to be engaged in order to get their buy-in, and to help identify and prioritise potential projects. Once priorities have been determined, project-specific goals, objectives, activities, expected outputs, key stakeholders, roles and responsibilities, budgets, and funding requirements need to be identified.

A cost and benefit analysis is also an important part of the planning process, as it is a basis upon which activities will ultimately be adopted. A smaller group is normally constituted to develop action plans and funding proposals.

EbA planning in practice

For the IUCN Climate Change Governance Capacity Project introduced in subsection 5.3.1, a participatory planning approach for implementation of the EbA strategies on a micro-basin scale was considered crucial. This was particularly so in light of the three-pillared approach used by the project, which integrates governance, improved livelihoods, and conservation of ecosystem services.

Results of the vulnerability assessment (i.e., climate scenarios, CRiSTAL results assessing a list of nature-based adaptation measures, results of the governance study, and an advocacy road map) were analysed between local leaders of each of the sites and water management experts. At six different pilot sites, local stakeholders defined a series of objectives for the EbA strategies. Taking factors into consideration such as implementation capacity of the selected measures, these objectives were discussed for validation with a wider stakeholder constituency at each pilot site.

The different strategies (shown in Table 5.3 below) have three objectives that underpin specific measures:

1. Improve conservation and restoration of ecosystems to provide ecosystem services;
2. Strengthen local livelihoods; and
3. Improve local water governance.

The adaptation plans in these demonstration sites included a common component of building capacity for ownership of nature-based solutions.

Table 5.3 Examples of adaptation strategies and specific measures

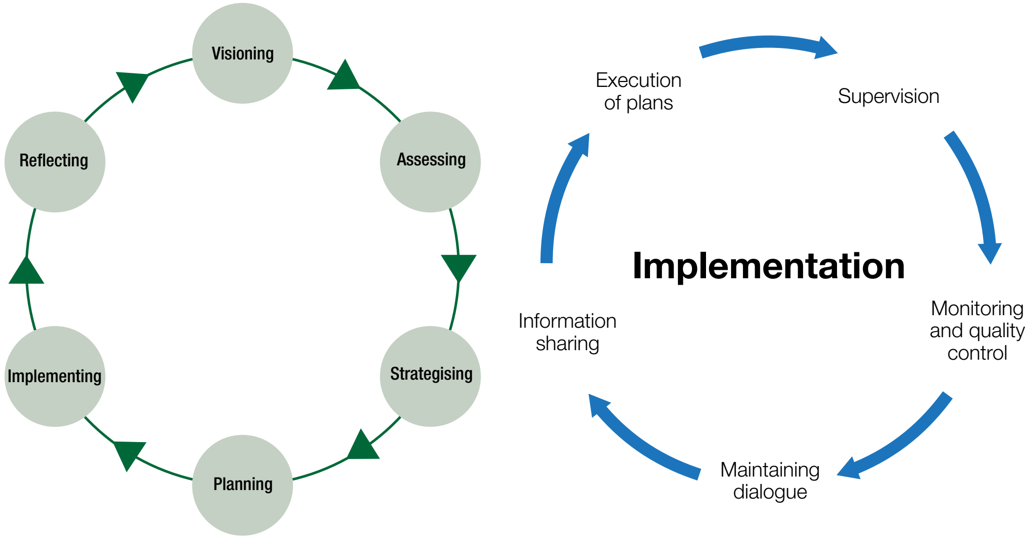
Ecosystem based adaptation strategy				
Site	**River basin / micro-basins**	**Conservation and restoration of ecosystems**	**Livelihood strengthening**	**Improvement of local water governance**
1.	Sixaola River Basin – *Yorkín micro-basin*	– Soil conservation practices in slopes to prevent erosion. – Reforestation of shores of the river to prevent erosion.	– Recovery of cacao plantations with resistant varieties and shade management. – Recuperation of local seeds used in subsistence agriculture.	– Capacity building on IWRM, adaptation, EbA, water governance. – Technical exchanges to Guatemala to know the experience of the micro-basin committees.[36]
2.	Sixaola River Basin – *Lower part and Quebrada Rosa micro-basin*	– Integration of agroforestry models in plantain farms.	– Family greenhouses for vegetable production.	– Establishment of the Quebrada Rosa Micro-basin Committee.
3.	Paz River Basin – *Coastal communities*	– Reforestation with mangrove species. – Surveillance efforts to avoid illegal deforestation.	– Improved health of the mangroves to increase the crab population.	– Establishment of a local surveillance committee for the mangroves.

It is important to note that the planning phase is continuous. First, there are many activities in the strategy that are prioritised and implemented over an extended period of time. Furthermore, priorities and/or funding may change, requiring additional planning as the climate adaptation programme

36 Cartin *et al.* (2012), supra note 31.

matures. At the end of each planning phase, in accordance with the management cycle, planners should be able to attain three major objectives. First, they should be able to agree on the prioritisation and scheduling of the different activities that make up the strategy. Second, they should develop plans for activities, and identify and secure financing. Third, throughout the planning process, they should maintain a sense of stakeholder ownership over the larger process (high level strategic planning) while focusing on specific actions (local level climate change adaptation planning).

Figure 5.6 Phase 5 – Implementation



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

5.3.5 Implementation

Imlplementation entails the execution of plans while actions are monitored for quality control, and dialogue and information sharing with stakeholders is maintained. It is where visions and plans developed that have been refined during previous phases should begin to become a reality.

Successful project implementation at the local level (e.g., as shown in the standalone Sixaola River Basin case study provided in the Annex to this publication) demonstrates the existence of several "success factors". These include:

- Community ownership;
- Social organisation;
- Stakeholder involvement; and
- Iterative learning processes linked to monitoring and evaluation schemes.

The latter is particularly relevant as it links project implementation to longer-term adaptive water governance. However, ensuring that lessons learned from local processes inform legal and institutional processes to build better frameworks for adaptive governance has been a significant challenge.

Case Study 5.3 Implementing adaptation measures in Jordan

In the SEARCH project,[37] detailed strategies and policy recommendations were generated in order to increase the resilience of local communities to climate change. Adaptation measures were identified and developed for each component for building resilience (e.g., diversity, infrastructure, self-organisation, and learning). They were then tested against applicable futures and selected for their potential to build resilience or enhance adaptive capacity.

In the Zarqa watershed of Jordan, interventions to enhance adaptive capacity have included water harvesting in local areas; reuse of grey water; greater public awareness of water management; the production and use of local seeds; greater energy efficiency with the use of solar heating; and implementation of drip irrigation. These last two adaptation measures were funded in the framework of a community organisation project for the middle stretch of the basin, which aimed to introduce environmentally friendly best practices to farmers in order to help increase water management efficiency and limit agricultural losses.[38]

Jordan faces great burdens when dealing with climate change impacts and the Zarqa governorate is the third most densely populated governorate in Jordan. Being an industrial city, Zarqa has the largest number of factories in Jordan, hosting Jordan's only oil refinery; the environmental, social, and agricultural status of the area makes it a pollution hotspot.

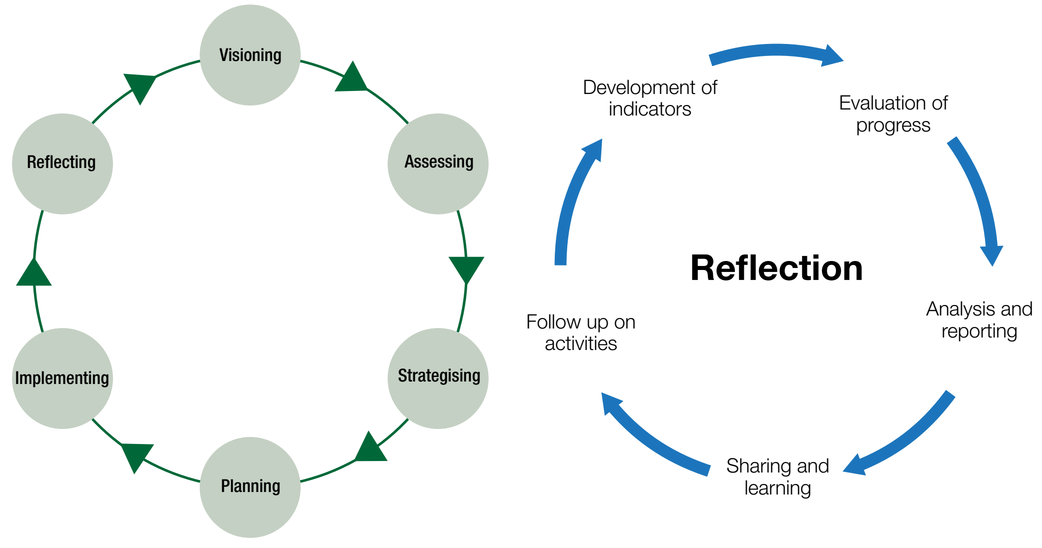
Capacities are also being strengthened through increased use of natural fertilizers, and local-level enforcement of environmental regulations. Women's community-based organisations have also played a critical role in promoting leadership, learning, and self-organisation. Not only have these community-based organisations facilitated the formulation of adaptation strategies with the farmers, but they have also served as a link between communities and national ministries of health, agriculture, and environment in helping for law and policy advocacy.[39]

37 More information *available online at* http://www.iucn.org/about/union/secretariat/offices/rowa/iucnwame_ourwork/iucnwame_reward/search_2/jordan_search/.

38 More information *available online at* http://www.iucn.org/about/union/secretariat/offices/iucnmed/?9169/HSBC-and-IUCN-support-Water-and-Energy-Management-for-the-Zarqa-River-Basin-in-Jordan.

39 More information *available online at* http://www.iucn.org/about/union/secretariat/offices/rowa/?10030/Climate-Change--Dry-Land-Restoration-in-Jordan.

Figure 5.7 Phase 6 – Reflection



Source: Adapted from: "Empowers Guidelines, Methods ans Tool", Patrick Moriaty, Charles Batchelor, Firas T. *et al.*, 2007

5.3.6 Reflection

Reflection refers to the evaluation of progress during and after all the stages of the management cycle are concluded. Reflection is essential for benchmarking climate change adaptation measures that are successful, and eliminating those that are not. In particular, reflection should be conducted with a view towards strengthening policy and legal frameworks at the national and transboundary levels. It involves monitoring and evaluating results of where key stakeholders are in the process of adaptation, and where they want to go (i.e., making adjustments, or re-visioning). In this way, reflection prepares for the future by providing critical information required to make adjustments in order to stay on course towards building resilience.

Monitoring should be used to validate decisions made during the planning phase. It is particularly important to regularly monitor factors related to chosen scenarios to identify whether they are indeed most likely. If validated, the existing strategy can continue to be followed. On the other hand, where factors point to an alternative scenario it may be necessary to return to and update the strategy. Identification of critical environmental factors beyond the immediate influence of the stakeholders, and of key trends that are taken into consideration during the development of scenario development also need to be monitored with a view towards re-validating or updating the various scenarios, if necessary.

It is important to keep in mind that local and district-level interventions also serve as pilots, or laboratories, for what may or may not be appropriate for up-scaling. "Up-scaling" refers to concepts tested on the ground, such as Integrated Water Resource Management (IWRM) or EbA, which might be new approaches to natural resources management, with the view that if successful, they can be part of broader strategies, policies, and legal frameworks to manage uncertainty and other risks posed by climate change.

Innovative approaches to adaptation, such as EbA, are particularly complex to implement at the basin level. While much experience has been gained using EbA at lower levels of governance, implementation at the basin level can create many more challenges. For instance, in such a context the project implementation cycle may require very different methods for implementation. Therefore, when testing out EbA in a basin-wide context, there is a special need for analysis and reflection so that stakeholders can understand the transboundary impacts.

The next section deals with the transboundary aspect of adaptation planning and how to rethink adaptive water governance at the basin scale. As the starting point, this section looks at some of the learning gained from testing and implementing planning frameworks, which serve as a basis for up-scaling and influencing broader policy frameworks.[40]

5.4 Transboundary Institutions in Adaptation Planning – Roles and Challenges

As has been explained throughout this publication, particularly in Chapter One, the transboundary nature of water means that risks and challenges are shared. It also means that adaptation solutions need to be coordinated, firstly by all States that share the basin,[41] but also including all relevant stakeholders, to the extent possible. This next section aims to provide some insights into the development and implementation of adaptation strategies at the transboundary level, with a view to bridging the gap between lessons learned at the project level, and the development of basin-wide governance frameworks to climate change adaptation.

The focus of the section, therefore, is to support policy and decision makers from the local to the transbsoundary level by offering advice on some of the challenges to be expected when developing adaptation strategies, particularly when based on an ecosystem approach. There is an emphasis on the specific problems and requirements of transboundary basins, with the objective of preventing, controlling, and reducing the transboundary impacts of national adaptation measures.

The framework for presenting and discussing different issues and problems in the following subsections reflects the progression of the project management cycle and its different phases from Section 5.3. However, each phase will be developed from a more practical angle, with a view towards providing practitioners with a better grasp of solutions that have been tested and implemented.

5.4.1 Integrating visions at multiple scales

Visioning, as a part of a broad planning and management cycle, has normally been conducted without integrating different governance levels, or inclusion of relevant actors. This has resulted in great disparities between local and national adaptation strategies. In addition, many adaptation programmes are nationally focused and do not consider transboundary aspects. In turn, basin level strategies have been developed without considering local vulnerabilities and capacities. In fact, building a vision under a basin-wide approach continues to be a major challenge for adaptive planning processes. This is a region-wide problem that has led to disconnected strategies, and to weak or fragmented planning and implementation of adaptation measures.

40 Adapted from EMPOWERS (2005). “EMPOWERS Participatory Cycle for IWRM,” EMPOWERS Working Paper No. 3, p. 15.

41 UNECE (2009), *supra* note 25.

These challenges may have a better chance of being addressed if there is a cooperative transboundary mechanism (e.g., river basin organisation (RBO) or commission) that plays a facilitative and coordinating role in addressing current climate variability challenges and longer-term impacts. For instance, multi-stakeholder platforms within joint institutions can facilitate communication of different visions between governance levels.

Case Study 5.4 Developing joint visions in the Drin River Basin

Albania, the former Yugoslav Republic of Macedonia (FYROM), Greece, Kosovo, and Montenegro share the Drin River Basin in the western Balkans. Around 1.5 million people rely on the basin for drinking water, agriculture, fisheries, industry, and hydropower. Each riparian State, however, has its own priorities, interests, and systems for water management. Throughout the Drin River Basin water quality and biodiversity are threatened by pollution from agriculture, untreated urban wastewater, and solid waste.

However, awareness of the value of cooperation on water is growing. This cooperation is now being formalised to explore synergies and share benefits. Under the United Nations Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) and the European Union (E.U.) Water Framework Directive (WFD), there was an opportunity to bring the countries together to talk about how they could cooperate. After wide consultation with countries, stakeholders, and international agencies, the UNECE and Global Water Partnership (GWP) Mediterranean launched the Drin Dialogue in 2009.

The Drin Dialogue built on legally binding agreements already in place signed by countries sharing the transboundary Prespa, Ohrid, and Skadar lakes. The consultations have been important in bringing together ministries, sub-basin commissions and committees, and stakeholders, and have led to a shared vision for sustainable management of the whole basin. Through the dialogue, water users in the region now have a growing understanding of transboundary water cooperation as a way to open up opportunities.

The dialogue also garnered political support for further cooperation. A Memorandum of Understanding (MoU) for the management of the Drin Basin, founded on the shared vision, was signed in 2011 by ministers and was seen as a turning point. The MoU set out the main transboundary issues and steps to integrate management of the basin in the short, medium and long term, paving the way for a legally binding agreement. A basin authority, for which GWP Mediterranean provides a secretariat, is the mechanism for riparian States to cooperate and coordinate action to follow through on the MoU. Under the MoU, the first step is to assess how water is managed in each country. This will set the stage for preparing a river basin management plan for the part of the Drin River in each of the five riparian States, and making sure they harmonise water management approaches.

In addition to encouraging further cooperation, creating a transboundary institution at the basin level also supports the development of joint adaptation strategies, from the initial visioning phase to the development of common and beneficial strategies and their implementation. Nevertheless, challenges may still remain. At the strategy level it has also been difficult in practice to agree on key adaptation strategies for the drainage basin, because of differing investment priorities or adaptation approaches between riparian States. Furthermore, while participatory stakeholder platforms have in principle helped to merge different levels of governance, in practice it has been difficult to integrate local perspectives into decision-making at the transboundary level.

5.4.2 The role of transboundary cooperative mechanisms in assessing vulnerability

In the transboundary context, both downstream and upstream States may experience vulnerability vis-à-vis each other.[42] Consequently, transboundary vulnerability assessments need to be developed

42 UNECE (2009), *supra* note 25.

with the participation of all riparian countries (often through a basin commission or other transboundary cooperative mechanism) and relevant stakeholders to create a common understanding of the vulnerabilities that impact the shared basin, and how actions taken in the basin (usually upstream) can have repercussions across the system.

Transboundary cooperative mechanisms can help to balance regional coherence with local priorities by helping facilitate transboundary vulnerability assessments. Such approaches recognise that climate change and its economic, social, and environmental impacts will vary across the drainage basin, and hence the necessity of developing locally relevant adaptation responses. Transboundary cooperative mechanisms can also facilitate coordination of basin-wide action, whereby local vulnerability assessments can be integrated into higher basin-level adaptation planning, and considered in regional and international priorities.

Case Study 5.5 Joint mechanisms for transboundary vulnerability assessments

In the Danube River Basin, the International Commission for the Protection of the Danube (ICPDR) was tasked in 2010 to develop an Adaptation Strategy for the entire basin. Development of the Strategy was based on a step-by-step approach that included collection of all available and relevant research and data to develop an overview of vulnerability throughout the basin. In partnership with Ludwig-Maximilian-Universitaet Munich and stakeholders and experts from the basin countries, the ICPDR oversaw the development of a Danube-wide study to understand future impacts of climate change resources and suitable responses. The outputs from this study then allowed for development of the Adaptation Strategy, which was finalised at the end of 2012 (see subsection 5.4.3, below).

In the La Plata Basin, which is shared between Brazil, Paraguay, Uruguay, Bolivia, and Argentina, climate change vulnerability is being assessed as part of the 2010-2015 Framework Program for the Sustainable Management of the Water Resources of the La Plata Basin, in Relation to the Effects of Climate Change and Variability.[43] In addition, the Intergovernmental Coordinating Committee (ICC), the body responsible for organising cooperative and integrated development of the basin, has added a special unit to develop action plans for regional problems caused by climate change. Once this assessment is completed, it will feed into a basin-wide Strategic Action Plan. In 2012, the basin States began developing an agenda to assess the water vulnerability of the agricultural sectors in the basin and to identify possible measures, in particular how to incorporate knowledge of climate variability in the decision making of farmers.[44]

Transboundary cooperation can also facilitate adaptive monitoring and communication of data and information throughout the basin. For example, the Lake Victoria Basin Commission (LVBC) has developed a data sharing protocol to enable exchange of information between countries. The East African countries who are members of the LVBC have made a commitment to work together and collect data on the agreed key sectors, which should feed into a LVBC decision support system.

This is not to say that transboundary cooperative institutional mechanisms do not experience challenges in assessing vulnerability at a transboundary level. For instance, while a data sharing protocol exists, individual countries in the Lake Victoria Basin have not followed through with laws or policies to domestically operationalize information and data sharing. This has made implementation of the protocol difficult, because it is based on a regional commitment by all riparian States, but without domestic legal or institutional backup. As a consequence, the LVBC uses its national contacts

43 This is funded by the Global Environmental Facility (GEF), implemented by UNEP, and executed by the Intergovernmental Coordinating Committee (CIC) for La Plata with administrative and technical support from Organization of American States (OAS).

44 More information *available online at* http://water-l.iisd.org/news/la-plata-basin-countries-consider-agenda-on-water-risk-management-in-agricultural-systems/.

to obtain data on an ad hoc basis. For a decision support system to work, data must be collected regularly and on a continuous basis across the entire basin. In this case, the LVBC can be a conduit for information between countries. However, there is still a lack of available data due to weak multi-level integration between institutions within the LVBC riparian States.

Even where sufficient capacity exists, conducting basin-wide vulnerability assessments will continue to be a challenge. A good example is illustrated in the Danube Adaptation Strategy. In explaining its methodology, the ICPDR stated that while a basin-wide vulnerability assessment would be helpful, it did not appear to be a feasible option, "taking into account the necessary resource input and expected added value."[45] Instead, the ICPDR compiled national and local vulnerability assessments, as well as other climate studies covering the Danube River Basin. This is not to say that the ICPDR is taking an incorrect approach; its approach was in fact collaborative and resourceful. Nevertheless, it highlights challenges of balancing and prioritising limited resources in adaptation planning.

Finally, too often in both national and transboundary contexts, decision makers are usually detached from local communities or from the regional context. This is connected to the difficulties of mapping vulnerabilities across scales for entire river basins in which assessments do not directly consider every level of governance. This oversight can lead to uncoordinated national strategies that consider differentiated local focus, and subsequently weak planning, implementation, and reflection of adaptation measures on the ground.

5.4.3 The role of transboundary cooperative mechanisms in developing adaptation strategies

Transboundary cooperation on adaptation strategies aims to minimise the implementation of unilateral measures that may have unintended consequences on riparian neighbouring countries leading to increased vulnerability. On the other hand, transboundary cooperation in developing adaptation strategies can lead to mutual benefits. For example, upstream States can increase storage within the catchment through the use of upstream retention areas (wetlands and/or dams), which can benefit downstream States by reducing flood risk. Additionally, cooperative development of strategies can encourage broader cooperation in water management, for instance incentivising better communication between riparian States, and collaboration between stakeholders. This has been demonstrated through IUCN and the UNECE's work on water and adaptation, in particular through their pilot projects.[46]

EbA can be applied at multiple scales, including at the river basin level. Being part of a comprehensive adaptation strategy, EbA allows for a coordinated approach to adaptation at the basin level. It promotes ownership of adaptation strategies, particularly for rural and local communities highly dependent on natural resources, and where environmental pressures are high. This is because activities and measures may require modification of livelihoods, for example, by changing land use for conservation.

45 International Commission for the Protection of the Danube River (ICPDR) (2012a). *ICPDR Strategy on Adaptation to Climate Change*, FINAL, IC 171 (11 December 2012), p. 25. ICPDR Secretariat: Vienna International Centre, Austria.

46 These pilot projects are dealt with in separate standalone case studies, contained in the Annex to this publication.

In this context, there is a mutual and reinforcing link between EbA measures as a strategy to build resilience. This link is best captured through a resilience framework, which integrates four different key areas:

- Diversity of livelihoods, economy, and nature;
- Infrastructure and management;
- Self-organisation in ways that empower people to make needed decisions – with appropriate roles for different stakeholders and institutions; and
- Learning and adaptiveness.[47]

Climate resilience frameworks integrate consideration of "what" actions are needed, with "how" they should be implemented in order to build resilience. In the transboundary context, an ecosystem approach can be seen as the "what", while the "how" is the cooperative mechanism or platform for pursuing an ecosystem approach. As such, EbA should be considered and prioritised in a transboundary context when the scale is appropriate.

Development of climate change adaptation strategies that include EbA as an integral component under a transboundary cooperative mechanism is illustrated in the Sixaola River Basin, which is highlighted in the Annex to this publication. In particular, it demonstrates how the existence of transboundary cooperative mechanisms can play a coordinating role in developing basin-wide adaptation strategies (including the adoption of EbA), and ensure coherence between national strategies within a resilience framework.

Indeed, transboundary cooperative mechanisms can strengthen the work of national level efforts to tackle adaptation issues. Ideally, however, they should be provided with a sufficient legal basis or mandate to address such issues.[48] In some instances, such as with the North American Great Lakes Commission, although there has not been a specific mandate, efforts have focused on exploring how to respond to climate change with no regrets actions that will generate net social and/or economic benefits irrespective of whether or not climate change occurs.[49]

The Danube strategy on adaptation to climate change

Through the International Commission for the Protection of the Danube River (ICPDR), which serves as a coordinating platform for water management throughout the entire basin, the countries sharing the Danube River Basin were recently able to agree on a basin-wide *"Strategy on Adaptation to Climate Change"*.

Through a multi-stakeholder process that included information sharing, consultations, and active involvement of Observers in the ICPDR and its expert groups, the First River Basin Management Plan (RBMP) for the Danube was adopted in 2009. Through this process, it was recognised that as a matter of basin-wide concern, climate change impacts, in particular flood risk management, should be addressed.[50] This led to a Ministerial Declaration requesting the ICPDR to develop a Climate

47 *See* Smith (2011), *supra* note 10.

48 UNECE (2009), *supra* note 25.

49 Thoman, D. *et al*. (2010). "Great Lakes States and Provincial Climate Change Mitigation and Adaptation: Progress, Challenges and Opportunities," *Issue Brief, No. 2*. Great Lakes Commission: Ann Arbor, MI.

50 ICPDR (2009). *Danube River Basin District Management Plan, Part A – Basin-wide Overview*, adopted by the Contracting Parties to the Danube River Protection Convention at their 12th Ordinary Meeting on 10

Change Adaptation Strategy. The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) was nominated to steer the development of the Adaptation Strategy. Within the ICPDR, the River Basin Management Expert Group and a number of other national experts were chosen to collaborate inputs throughout the process.

The decision to develop the strategy was made within the context of enhancing coordination and collaboration in the Danube River Basin. The strategy recognises different levels of rule of law, transparency, democracy, bargaining power, and institutional capacity among countries in the Danube Basin. It calls for action to address common challenges through multi-level cooperation, and effective multi-level governance, and improvement of civil society capacity to influence decision-making processes.[51]

First, the *"Danube Study – Climate Change Adaptation"* was conducted in order to help generate a joint understanding of water-related climate change issues and potential measures. It analysed "commonalities, contradictions, dependencies, knowledge gaps and competing interests for possible conflicts in order to provide an overview and assessment of state-of-the-art knowledge for the Danube River Basin."[52] Preliminary results were shared at Meetings of the ICPDR, River Basin Management Expert Group Meetings, a Stakeholder Workshop, and other conferences. Interestingly enough, in one of the Expert Group Meetings, national experts provided feedback on interplays between agreed climate change impacts, and whether prioritised adaptation actions should take place at international or sub-basin levels.[53]

The objectives of the finalised Adaptation Strategy are to: 1) integrate climate change adaptation issues into the Danube's Second RBMP, and its First Flood Risk Management Plan (FRMP); and 2) provide a basis for broader cooperation through implementation of the E.U. Danube Strategy.[54] In this sense, the aim of the "Strategy on Adaptation Climate Change" was to compile the best knowledge available throughout the basin, using the ICPDR and its Expert and Task Groups as a focal point, to provide a basis for further action in compliance with the Water Framework Directive (WFD) and the E.U. Floods Directive (EFD).

The *"Strategy on Adaptation to Climate Change"* explicitly acknowledges the reality that the RBMP and the FRMP will provide general measures for adaptation, transboundary aspects of which are to be coordinated by the ICPDR. However, more detailed planning should take place at sub-basin and/or national level and sub-unit levels, while maintaining communication and coordination between different levels within the basin.[55] The ICPDR envisions vertical coordination and communication via continuing participation of national experts in ICPDR working groups, while horizontal coordination should take place through involvement of ICPDR Observers in various WFD and EDF planning processes, as well as broad public participation.

December 2009, Final Version, IC/151 (14 December 2009), p. 89. ICPDR Secretariat: Vienna International Centre, Austria.

51 European Communities (2010). "Action Plan," *Accompanying document to the Communication on the EU Strategy for the Danube Region*, COM(2010)715, pp. 77-78.

52 ICPDR (2012b). "The Future of the Danube River Basin," Danube Watch, 2/2012.

53 Mauser, W. (2012). *Danube Study – Climate Change Adaptation*, developed by Ludwig-Maximilian-Universitet, Munich, Department of Geography, p. 12.

54 The E.U. Strategy for the Danube Region is a macro-development plan for the entire Danube River Basin. European Communities (2010), *supra* note 51, at pp. 77-78.

55 ICPDR (2012a), *supra* note 45, at p. 10.

5.4.4 Spatial planning at the basin level[56]

Spatial planning is a key instrument for establishing long-term, sustainable frameworks for social, territorial, and economic development – both within and between countries. Its primary role is to enhance the integration between sectors such as housing, transport, energy, agriculture, and industry. Spatial planning should also help to improve national and local systems of urban and rural development, taking into account environmental considerations. For these reasons, it can be applied as a territorial planning tool for the implementation of the ecosystem approach, particularly within a river basin.

Spatial planning has a regulatory and a development function. As a regulatory mechanism, government (at local, regional and/or national levels) must give approval for given activities before they may commence. As a development mechanism, governments use spatial planning to, *inter alia*, elaborate tools for providing services and infrastructure, establish directions for urban development, preserve national resources, and establish incentives for investment.

Spatial planning aims to:

(a) Promote territorial cohesion through more balanced social and economic regional development, and improved competitiveness;

(b) Encourage development generated by urban functions, while improving relationships between towns and the countryside;

(c) Promote more balanced accessibility;

(d) Develop access to information and knowledge;

(e) Reduce environmental damage;

(f) Enhance and protect natural resources and natural heritage;

(g) Enhance cultural heritage as a factor for development;

(h) Develop energy resources while maintaining safety;

(i) Encourage high-quality, sustainable tourism; and

(j) Limit the impact of natural disasters.

Effective spatial planning also helps to avoid the duplication of efforts by actors such as government departments, commercial developers, communities, and individuals. This is of great importance, as many of the above issues are cross-sectoral in nature. Spatial planning is also a public sector activity that takes place at all levels. Hence a clear distribution of responsibilities is needed between the different levels of administration.

The implementation of effective spatial planning depends upon the development of relevant laws, policies, guidance, procedures, and incentives. Implementation requires that both short-term considerations and constraints be taken into account, and that the work be guided by a long-term vision. Nevertheless, most countries have rigidly defined departments that pursue individual agendas, making it difficult to have an interdisciplinary approach to implementation.

56 Adapted from UNECE (2008). *Spatial Planning: Key Instruments for Development and Effective Governance with Special Reference to Countries in Transition*. United Nations: Geneva, Switzerland.

Clear legislation and funding policies, and improved organisational infrastructure are critical, as experience has shown that these issues are frequently more complex to solve than technical issues. High-level support for the development of these plans is essential to ensure that they are effectively implemented and regulated at the local level.

5.4.5 Implementation challenges

There are a number of challenges that actors face in trying to effectively implement plans and strategies. In particular, transboundary planning and implementation continues to be a major challenge. This stems from practical challenges of working across jurisdictions, particularly when there are no agreements among countries for cooperation in these topics, or when national level strategies have not been harmonised. Ensuring effective public involvement across boundaries, as highlighted in Chapter Four, also remains difficult.

Moreover, there is evidence that centralised and fragmented State-led frameworks contribute to weak or slow implementation of adaptation strategies.[57] These State-led frameworks usually hinder public participation, and lack sectoral coordination. This is particularly clear when looked at in the context of river basin and national water planning and adaptation. In reality, national water planning is often articulated through processes that are detached from separate climate change processes, and without involving all governance levels.

In addition, actual implementation still remains a challenge. While the 2008 U.N. Water Status Report acknowledged that there have been recent improvements in the planning process at national level (out of the 53 countries reviewed, the percentage of countries having plans completed or under implementation increased from 21 percent to 38 percent), it stated that much more is needed on implementation. Other research tends to support this position.[58] In particular, Organisation for Economic Cooperation and Development (OECD) research on multi-level governance frameworks identifies a number of key implementation gaps that still persist, while at the same time suggesting solutions (see Table 5.4).

57 Swatuk, L.A. (2005). "Political Challenges to Implementing IWRM in Southern Africa," *Physics and Chemistry of the Earth*, Parts A/B/C, Vol. 30, pp. 872-880; Lautze, J. *et al*. (2011). "Putting the Cart Before the Horse: Water Governance and IWRM," *Natural Resources Forum*, Vol. 35, pp. 1-8; Fatch, J.J., Manzungu, E. and Mabiza, C. (2010). "Problematising and Conceptualising Participation in Transboundary Water Resources Management: The Case of Limpopo River Basin in Zimbabwe," *Physics and Chemistry of the Earth*, Parts A/B/C, Vol. 35, pp. 838-847; Graefe, O. (2011). "River Basins as New Environmental Regions? The Depolitization of Water Management," *Procedia- Social and Behavioral Sciences*, Vol. 14, pp. 24-27; U.N.-Water (2012). *Status Report on the Application of Integrated Approaches to Water Resources Management 2012*. UNEP: Nairobi, Kenya; and Koudstaal R. and Paranjpye, V. (2011). *Involving Communities: A Guide to the Negotiated Approach in Integrated Water Resources Management*, Koudstal, R., Nooy, C., and Paranjpye, V. (eds.). Both Ends, Gomukh Environmental Trust for Sustainable Development: Amsterdam, Netherlands.

58 Charbit, C. and Michlaun, M. (2009). "Mind the Gaps: Managing Mutual Dependence in Relations Among Levels of Government," *OECD Working Papers on Public Governance*, Vol. 14; Organisation for Economic Cooperation and Development (OECD) (2011a). *Making the Most of Public Investments in a Tight Fiscal Environment: Multi-level Governance Lessons from the Crisis.* OECD Publishing: Paris, France; OECD (2011b). *Water Governance in OECD Countries*. OECD Publishing: Paris, France; Cofree-Morlot, J. *et al*. (2009). *Cities, Climate Change, and Multilevel Governance*. OECD Publishing: Paris, France; and Charbit, C. (2011). "Governance of Public Policies in Decentralized Contexts: The Multi-Level Approach," *Regional Development Working Papers*, Vol. 04.

Table 5.4 The OECD Multi-level Governance Framework: key implementation gaps in water policy[59]

Key Implementation Gap	Elaboration of the Implementation Gap	Suggested Solution
Administrative gap	Geographical "mismatch" between hydrological and administrative boundaries. This can be at the origin of resource and supply gaps.	Need for instruments to reach effective size and appropriate scale.
Information gap	Asymmetries of information (quantity, quality, type) between different stakeholders involved in water policy, either voluntary or not.	Need for instruments for revealing and sharing information.
Policy gap	Sectoral fragmentation of water-related tasks across ministries and agencies.	Need for mechanisms to create multidimensional/systemic approaches, and to exercise political leadership and commitment.
Capacity gap	Insufficient scientific, technical, infrastructural capacity of local actors to design and implement water policies (size and quality of infrastructure, etc.) as well as relevant strategies.	Need for instruments to build local capacity.
Funding gap	Unstable or insufficient revenues undermining effective implementation of water responsibilities at sub-national level, cross-sectoral policies, and investments requested.	Need for shared financing mechanisms.
Objective gap	Different rationales creating obstacles for adopting convergent targets, especially in case of motivational gap (referring to the problems reducing the political will to engage substantially in organizing the water sector).	Need for instruments to align objectives.
Accountability gap	Difficulty ensuring the transparency of practices across the different constituencies, mainly due to insufficient users' commitment, lack of concern, awareness, or participation.	Need for institutional quality instruments. Need for instruments to strengthen the integrity framework at the local level. Need for instruments to enhance citizen involvement.

While the above mainly focuses on challenges that States experience as the custodian of water, there is also a need to focus on key implementation gaps for including stakeholders as part of adaptive water governance. In particular, a civil society review reported the following challenges:

1. Weak sectoral linkages within government;
2. National plans not being translated into local plans;
3. Lack of clarity among the public about who is responsible for what in government;

59 Adapted from OECD methodology presented in OECD (2011b), *supra* note 58.

4. Weak institutional mandates;
5. International focus on financial arrangements and economic benefits, rather than on social and environmental issues;
6. Lack of public access to relevant and timely information; and
7. Citizens lack the capacity to participate effectively in decision-making processes.[60]

In response to the above mentioned challenges, there is a need to promote governance reforms aimed at enhancing decentralised decision making; meaning that at the transboundary level, there is a stronger need for agreements between States and stakeholders for transboundary adaptation cooperation.

In addition, as has been presented throughout this chapter, mechanisms that promote meaningful adaptive capacity need to be developed based on innovative approaches that have been tested on the ground (e.g., EbA).[61] The next – and last – section attempts to illustrate how the gap between high-level decision making on adaptation policies and local level adaptation interventions can be bridged. Reflection and up-scaling strategies are at the centre of this key process.

5.5 A Framework for Up-scaling

When attempting to catalyse and institutionalise change in extremely complex systems, there is always a risk of oversimplification through theoretical approaches. However, there are some key elements that are inherent to water and climate governance, particularly EbA.[62]

Implementation of EbA calls for a paradigm shift from static regimes to more adaptive governance systems that are capable of remaining functional amidst unprecedented climatic changes. Examples from IUCN´s projects, where adaptive governance regimes have been tested on the ground, show progress in up-scaling. These have been realised through coordinated actions that have brought together knowledge, lessons, evidence, and changes in behaviours, institutions, and policy.[63]

60 Koudstaal and Paranjpye (2011), *supra* note 57.

61 Lenton, R.A. and Muller, M. (2009). *Integrated Water Resources Management in Practice: Better Water Management for Development*. Earthscan: London, U.K.

62 Padt, F.J.G. (2008). "Scaling up Water Management Practices: White Paper for the IUCN Water and Nature Initiative," *WANI Internal Working Document*. IUCN: Gland, Switzerland.

63 Smith, M. and Cartin M. (2011). *Water Vision to Action: Catalysing Change through the IUCN Water and Nature Initiative*. IUCN: Gland, Switzerland. *Available online at* http://cmsdata.iucn.org/downloads/final_wani_results_report_lr.pdf.

Case Study 5.6 Up-scaling adaptive capacity in Jordan

In the Zarqa watershed of Jordan, national policy prioritised municipal water supply over agriculture by pumping water from the basin into holding tanks. This resulted in the destruction of hundreds of wells that farmers used for irrigation, and the loss of agriculture in the lower basin. In addition, non-climate-related factors, such as population growth and high-density development in the middle part of the basin, have negatively impacted agriculture productivity, health, and water management. There was a lack of communication between and across stakeholders, which led to counter-productive measures.

With SEARCH, recommendations to the Zarqa Governorate Development Fund and Environmental Fund are taking into consideration local communities through participatory adaptation planning. In addition, stakeholder platforms that are being created have the support of the Ministry of Agriculture (MoA), Ministry of Environment, Ministry of Health, Ministry of Planning & International Cooperation, Lower Parliament (Water & Environment Committee), and the Zarqa Governor.[64]

In Zarqa it is clear that a basic tool for learning and reflecting, including process documentation and monitoring frameworks, is the existence of a stakeholder platform. Creating awareness of the importance of structured learning and adaptation in such platforms should begin at the start of the whole adaptation policy formulation process, as part of the visioning phase. In Jordan, SEARCH did so through national policy workshops and the national steering committee. These were important for facilitating the flow of appropriate and accessible information between stakeholders at different levels.[65]

In successful projects, most actors have usually engaged in project implementation without developing a habit of reflection as part of the project management cycle, particularly on how their day-to-day activities impact overall resilience. This has presented a particular challenge to resilience thinking. Nevertheless, true adaptation efforts should encourage habitual learning and modification of approaches towards how project actions are conducted.

The examples presented in this chapter speak to ways in which these barriers can be overcome. The SEARCH Project has shown that integration of resilience thinking into governance frameworks is best achieved through arrangements that promote self-organisation, combined with action to strengthen diversity, learning, and use of sustainable infrastructure and technologies. Through a management cycle that encourages participation, these components of resilience can be reinforced across sector plans and strategies, and up-scaled into laws and policies at the transboundary level.

The Mesoamerican Good Governance and EbA Project demonstrates how successful implementation of the management cycle in water and climate adaptation projects is key for learning, consolidating experiences, and enabling evidence of EbA in real-world systems facing real-world problems and constraints. The EbA projects have not only led to learning and increased resilience, but have also led to the influencing of changes in policies and laws. In partnership, different national and local country organisations and institutions are using innovative and well-targeted activities to guide future investments, and to catalyse wider changes needed to facilitate sustainable management of water and ecosystems.

In both cases, the objective was and continues to be an increased scale of impact by further “institutionalising” verified best practices from demonstration and pilot projects. The idea is to catalyse change at multiple levels and across inter-related sectors (multi-level governance), with a view towards having an impact at larger scales and over longer time periods.

64 More information *available online at* https://cms.iucn.org/fr/nouvelles_homepage/nouvelles_par_date/2012/?10030/Climate-Change--Dry-Land-Restoration-in-Jordan.

65 Moriarty, P. *et al.* (2007), *supra* note 20.

5.5.1 Key aspects

From successful experiences, it is possible to develop some (non-exhaustive) recommendations aimed at national and basin authorities on how to build governance frameworks for climate change adaptation from a freshwater ecosystem perspective:

1. Demonstration actions and processes supporting changes in the legal, policy, and institutional architecture of natural resource governance should go hand in hand. Over the long-term, processes for consensus building, dialogue, and policy formulation must be put in place to make the results and evidence from demonstrations the basis for scaled-up implementation working at national, basin, or regional levels.
2. Scaling up of implementation is supported by better consensus among stakeholders. Policies, strategies, and financing programmes for water management need to incorporate actions that bring stakeholders together to exchange ideas, concerns, and knowledge of what works and what does not.
3. Scaling up of implementation also benefits from dialogue among key actors from across sectors, leaders, and stakeholders who are represented from local to national and multi-State levels. Focus should be on how to resolve high priority issues in natural resource management jointly and with territorial planning. Expectations from dialogue platforms should focus on the translation of evidence and experience of practical action into national and regional agendas. Dialogue should be complemented by communication that explains these agendas and showcases results at national, basin, or regional levels.
4. Explicit acknowledgment should be given to the uncertainty that exists in nearly all aspects of water service delivery and water management, especially future uncertainties around the entire water and development management cycle.
5. Formulation of policies and strategies for water management that set up country- and region-wide implementation programmes have to be informed by evidence for action that works, and for processes that build consensus on action. Demonstration projects and dialogue platforms need to work through alliances and partnerships that are positioned to provide evidence, knowledge, and recommendations from stakeholders to policy and decision makers.
6. Long-term up-scaling of EbA implementation depends on coherent strategies that link and align joint action through demonstration, consensus building, dialogue, and partnerships and alliances to inform policy making. Piece-meal programmes that omit elements or fail to coordinate will have poorer rates of success. Country- and region-wide initiatives that result from up-scaling will then need to be rolled out using principles for change that build further cycles of practical action, learning, planning, innovation, adaptation, consensus building, and dialogue in an on-going process of social change. The capability to self-organise around these cycles is an essential component of resilience.

5.6 Conclusion

In most regions of the world, there is a lack of legal and policy preparedness to climate change, particularly through innovative approaches (i.e., those supporting social and ecological resilience in an integrated manner). This means that there is an urgent need for governance reform. This reform should be based on evidence of solutions that work, and which are usually framed as lessons learned and best practices coming out of different pilot projects. Unfortunately, while the gap between innovative approaches and governance frameworks remains, policy and decision makers will continue to miss opportunities and information for better formulation of water policy and law.

A failure to incorporate all key stakeholder views into climate change adaptation processes has contributed to a weak strategic focus at all levels. This has translated into poor integration of local visions, strategies, and plans into planning at national, regional, and international levels. Likewise, in this publication Ecosystem-based Adaptation (EbA) has been proposed as a means of reducing vulnerability to climate change impacts through conservation and restoration of ecosystems, while improving resilience of the most vulnerable people and communities.

At the project level, there are many examples of successful adaptation to climate change. However, while these small-scale initiatives have resulted in positive changes at the community level, they have also resulted in piece-meal implementation of adaptation strategies at the national and transboundary level. Though there have been great strides towards individual instances of adaptation, overall practice depicts a lack of clear strategy at the basin level to address climate change challenges.

To build climate resilience at the country or basin level, policy makers must figure out how to integrate success stories from local level project implementation into more strategic planning instruments at broader scales. This remains one of the crucial challenges of adaptation. Adaptation based solely on prioritisation of discrete actions – for example on infrastructure, institutions, or ecosystems – may lead to missed opportunities to build resilience towards a dynamically changing climate, where uncertainty and unknowns are expanding. This is where adaptive water governance capacity – that is, the ability to apply adaptation measures in practice from community to national and basin scale – is key. In turn, adaptive water governance capacity is the result of a host of assets such as local knowledge, access to resources, leadership, mobilisation, and financing.

The management cycle described throughout this chapter is a tool to enhance adaptive water governance and build adaptive water governance capacity. It can be used as an up-scaling mechanism, which allows for extending and disseminating results and lessons learned from pilot project into higher-level planning and governance reform. Furthermore, it creates a framework for participation, self-organisation, and learning for greater resilience.

Key Messages and Recommendations

Adaptive water governance is an evolving field that has arisen due to the need to better respond to climate change challenges – particularly uncertainty. Adaptive water governance is supported by enhanced collaboration and coordination, local empowerment, and flexible learning-by-doing approaches that are supplemented by up-to-date information. It is a very promising approach for dealing with water management issues, because it shifts emphasis from structures to performance, and thus towards effectiveness.

At the basin level, it is unclear whether riparian States sharing transboundary waters will be capable of developing or adapting cooperative mechanisms to enhance flexibility, take into account climatic uncertainty and unpredictability, and account for other social, environmental, and economic pressures. At the global level, it is also uncertain what collective action is possible, for example under the United Nations Framework Convention on Climate Change (UNFCCC), to encourage and support adaptive governance, particularly novel approaches such as Ecosystem-based Adaptation (EbA).

Despite the shape that adaptation efforts take at the global and basin level, many details must be dealt with at lower levels (e.g., national, provincial, local). As such, national leaders and decision-makers face the complex challenge of developing adaptive responses to climate change at multiple scales. On one hand, they need to ensure cooperation and coordination within their respective States for the revision or development of agreements to provide sufficient flexibility for dealing with climate change impacts at the basin level. On the other hand, decision-makers need to bring together relevant stakeholders, provide an enabling environment for the development and implementation of practical adaptation strategies on the ground, and support up-scaling of best practices.

In recent years, there have been substantial developments in the understanding and conceptualisation of various entry points between the water sector and climate change adaptation. Critical advances have been made in different fields of scientific study, particularly in understanding the role of freshwater ecosystem services vis-à-vis vulnerability and resilience. These new “fields” are now beginning to intersect with laws, policies, and institutions, as it becomes more evident that they have a major role to play in supporting effective adaptation and conservation of freshwaters.

In light of the above, we would like to highlight key concepts and messages from lessons that have already been learned through experimentation of different adaption approaches. Together they can provide insight and guidance for policy makers as they move forward with their own adaptation frameworks. For ease of understanding, these key concepts and messages have been clustered following the major themes covered by each chapter of this publication, with a view to differentiating areas where progress has been more clearly demonstrated: freshwater ecosystems and adaptation; adaptive water governance; principles of international environmental and water law; cooperative transboundary water mechanisms; stakeholder and public participation; and the adaptation planning cycle.

Freshwater Ecosystems and Adaptation

Impacts of climate change, in combination with other drivers of global change, are compromising the international community's ability to address global economic, security, and social priorities. Given the importance of water in climate change impacts, its management is fundamental to reducing vulnerability. Ecosystems play a significant role in the hydrological cycle, and hence the supply and use of water for people – including for irrigation, energy, and transport.

1. Adaptation

According to the Intergovernmental Panel on Climate Change (IPCC), adaptation is understood as the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation is primarily concerned with reducing vulnerability of biological systems to climate change effects by enhancing their resilience. Adaptation occurs at a range of interlinking scales, and can either occur in anticipation of change, or be a response to those changes.

a) Vulnerability

According to the IPCC, vulnerability to climate change is the degree to which a system is susceptible or unable to cope with adverse effects of climate change, variability, and extremes. It can be determined by examining the level of exposure to water stress and climate variability, and the degree of sensitivity, and the adaptive capacity of a community or ecosystem. Exposure is defined by the magnitude, character, and rate of climate change in a specific area. Exposure to climate variation is primarily a function of geography. For example, communities in semi-arid areas may be most exposed to drought. Sensitivity is the degree to which a community (or basin) is adversely or beneficially affected by climate-related stimuli. This mainly depends on livelihood activities, key livelihood resources, and impacts of climate hazards on these resources.

b) Adaptive capacity

In the context of both social and natural systems, adaptive capacity can be understood as the ability of a system to adjust to climate change, to moderate potential damage, to take advantage of opportunities, or to cope with consequences. Adaptive capacity relates to the ability of addressing vulnerability (sensitivity, exposure and capacity to respond), and enhancing resilience.

c) Resilience

In the context of withstanding impacts of climate change, vulnerability and resilience are factors of each other. According to the IPCC, resilience refers to the amount of disturbance that can be withstood before a system changes its structure and behaviour, for example, before it breaks down. Building climate resilience means integrating the social and economic dimensions of development with environmental restoration and management. In particular, environment is a key to climate resilience because well-functioning watersheds and intact floodplains and coasts provide ecosystem services (e.g., water storage, flood regulation, and coastal defence) that reduce vulnerability to major climate change impacts (e.g., drought, floods, and coastal inundation).

2. Ecosystem-based Adaptation

Human well-being is dependent upon not one, but often multiple and interrelated ecosystem services. Climate change can adversely affect the stock of services an ecosystem provides, for instance through the breakdown of water regulation services and food security. This implies that where ecosystem services are lost or degraded, so are the services that people use. A decline in ecosystem health often translates into fewer benefits for people.

There is growing recognition and use of Ecosystem-based Adaptation (EbA), which capitalises on the ability of healthy ecosystems to assist human adaptation to climate change. EbA "integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. EbA includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both current climate variability, and climate change."

EbA includes sustainable water management, where river basins, aquifers, flood plains, and their associated vegetation are managed to provide water storage and flood regulation services. River basins, floodplains, and coastal ecosystems are "natural infrastructure" for climate change adaptation. Focusing on these natural solutions can help sustain the environment and people who rely on these ecosystem services, strengthening resilience of communities and States in a cost-effective manner. Therefore, infrastructure portfolios for adaptation need to encompass both engineered and natural infrastructure, according to assessments of their cost-effectiveness and long-term resilience.

Adaptive Water Governance

Water Governance refers to the range of political, social, economic, and administrative systems that are in place to develop and manage water, and the delivery of water services at different levels of society. It develops and sets the rules, roles and responsibilities of all involved stakeholders regarding ownership, administration, and water management. Well developed law, policies, and institutions are integral to good water governance.

Water governance and management systems tend to have rules or tools to cope with normal ranges of uncertainty, and moderate deviations from the norm. However, climate change embodies a more unpredictable uncertainty that may lie outside traditional coping ranges of water governance regimes. Adaptive water governance can be seen as an approach to move from the traditional notion of static rules based on rigid and fixed institutions to one that is more dynamic, adaptive, and flexible for coping with future uncertainties posed by climate change. It is therefore a means to enhance adaptive capacity.

1. Challenges

Uncertainty of timing, scale, intensity, and character of impacts is the most significant water governance challenge presented by climate change. Development and implementation of policies, laws, and management frameworks should shift from traditional paradigms that attempt to reduce uncertainty to ones that acknowledge and embrace change and continuous learning as cornerstones of adaptive water governance.

The second major challenge regarding climate change adaptation from a governance perspective is the system's complexity vis-à-vis multiple administrative levels and sectors. Adaptive governance addresses this challenge through coordination, mainly suggesting that water, agriculture, health, energy, industry, and other sectors should jointly develop resilient and cost effective management of natural resources and sustainable development.

2. **Opportunities**

The benefit of applying an adaptive water governance approach is that it provides a framework for best addressing uncertainty and complexity, and therefore creating institutional resilience to climate change.

These benefits can be pursued by:

a) Creating or emphasising policies, laws, management practices, and institutional mechanisms that are flexible (understood as the ability to effectively respond to changing circumstances based on sound information, e.g., changing water flows or scarcity), and facilitate social and institutional learning and knowledge exchange;

b) Building mechanisms for effective multi-level governance that address coordination through:

   - *Horizontal integration*, or inter-institutional and inter-sectoral coordination. Criteria for achieving such integration may include identifying trade-offs and synergies among sectors and their water needs; addressing the lack of finances for coordination and financial asymmetries across sectors that undermine coordination; enhancing capacity (staff time and expertise); improving data and information coordination; establishing clear lines of accountability among sectors; political commitment to effective coordination; and strategic planning.
   - *Vertical integration*, or coordination among different levels of water governance. Vertical integration takes into account basin wide planning, and incorporates local, national, regional, and international contexts. A major challenge for achieving vertical integration is reconciling the disparate approaches and different levels of progress across borders.

c) Fostering broad-based and institutionalised participation of diverse stakeholders in adaptation decision-making, implementation, and monitoring and evaluation; and

d) Supporting EbA to maintain freshwater flows into allocation and infrastructure decision making to ensure ecosystem resilience and support for the sustainable provision of ecosystem services.

Principles of International Water Law

Principles of international law are considered fundamental criteria that provide for the origin and development of custom and treaties, expressed as maxims and aphorisms, and which have their own standing and effectiveness independently from the rules that they inform. They serve two functions: On one hand, in the absence of law, international treaty, or custom, they act as sources of law; and on the other hand, they provide a framework for interpreting the meaning and scope of provisions and norms.

Equitable and reasonable utilisation and prevention of significant transboundary harm are two fundamental principles that inform part of international water law. The duty to cooperate could also be considered as a basic principle that is applicable to this particular field. These principles are particularly relevant to transboundary adaptive water governance.

1. Equitable and reasonable utilisation

The legal principle of equitable and reasonable utilisation supports the development and management of shared waters through common management arrangements or joint cooperative institutions as the best framework for achieving implementation. Nonetheless, adaptive water governance necessitates a more broad understanding of this principle, and clarity on how to factor climate change considerations (i.e., uncertainty, vulnerability, and adaptation) into sharing and managing transboundary waters.

- Article 6(a) of the 1997 U.N. Watercourses Convention, which contains factors relevant to equitable and reasonable utilisation (i.e., geographic, hydrographic, hydrological, climate, ecological, and other factors of natural character) provide ground for these considerations.
- The requirement to adhere to the precautionary principle, and the critical nature of procedural obligations, such as prior notification, consultation, and information sharing, support the inclusion of climate change considerations in the balancing of factors to determine what can be equitable and reasonable use of shared waters.

2. **Prevention of significant transboundary harm**

The principles of equitable utilisation and the duty to prevent significant harm are linked by the need to take into account environmental concerns. Due diligence, as required by the duty of no harm, should take into account climate impacts in the context of transboundary adaptive planning.

- Environmental Impact Assessment (EIA) is a requirement under international law, which provides a specific mechanism for the practical application of precaution, prevention of environmental harm, and sustainability may be applied.

3. **Cooperation**

The principles of international environmental law lay a foundation for the efficient and cooperative management of transboundary waters. While many of these principles are still developing, several of them can inform and support adaptive water governance in a basin-wide context. In particular, States should consider principles of sustainability, the precautionary principle, and ecosystem approaches when engaging and interacting within the basin.

Current and evolving principles of international water law already provide a framework (as seen above) necessary to achieve adaptive water governance systems in transboundary basins. However, their implementation will likely require more specific elaboration of how they should be applied in light of climate change in order to achieve truly adaptive outcomes and increase the resilience of shared watercourses and their dependent populations.

Cooperative Transboundary Water Mechanisms

1. **Cooperative mechanisms defined**

Cooperative transboundary water mechanisms refer to frameworks or arrangements between two or more administrative units (from the transboundary, national or local levels) for the purposes of facilitating engagement and collaboration on water-related issues (i.e., management of international watercourses). They can be treaty-based (e.g., river basin organisation), or formed through some other type of agreement (e.g., water cooperation agreement between border communities). They can range from addressing single issues (e.g., joint monitoring of water quality on a transboundary river) to comprehensive basin management. They are the vehicles through which cooperation is implemented.

2. Trust building for flexible negotiation

International cooperation can take decades to evolve and materialise into treaties or other types of international agreements. However, the pace of adjustments necessitated by climate change can increase the demands placed on the flexibility and adaptability of these agreements. Flexibility in this context is important because it reduces constrains for reaching agreement. If parties approach negotiations with a more flexible attitude, there will be less constrains regarding loss of sovereignty. This is best achieved through a step-wise approach that builds trust through measures such as data sharing, coordinated research projects, technical and financial cooperation, and the development of multiple consultation fora. Communication channels between riparians should also be in place, in order to ensure that similar perceptions about existing uncertainties form the basis for cooperative undertakings.

A focus on water rights allocation can create zero-sum outcomes and adversarial relationships, which are not conducive for establishing trust between parties. In particular, where parties have not institutionalised any forms of communication and do not share the same data, an exclusive focus on allocating existing waters can lead to mistrust and conflict, rather than resolve outstanding issues between them.

Developing adequate procedural rules is a good first step for facilitating the creation of a good working environment. In cases where the parties cannot agree on water rights, or can only agree on general principles of water allocation, precise procedural mechanisms can also provide clearer guidelines and commitments for the parties. Therefore, procedural rules are of particular significance for addressing the effects of climate change, as they can create a framework for responding to unexpected circumstances in an effective and structured way, which contributes to adaptive water governance.

3. Key elements for adaptive cooperative mechanisms

While there is no ideal model for institutional mechanisms, there are a number of factors that are relevant for maximizing the usefulness and operations of such entities: 1) the extent and scope of authority assigned to the institution; 2) the degree of flexibility afforded the institution in its operation, planning, and project implementation; 3) stakeholder participation; 4) the legal nature of the agreement; 5) the political level of implementation; and 6) financial and other support provided to the institution by the riparian governments.

Scope and authority: Ideally, an institutional mechanism would be a joint riparian effort with jurisdiction over the entire hydrological basin, and the mandate to engage all basin riparians in ongoing dialogue; produce and exchange relevant data and information; and coordinate activities designed to prevent and mitigate the impacts of climate change. Moreover, it should also be entrusted with assessing and identifying the most effective preventative and mitigatory measures, crafting appropriate steps that each Basin State would take to implement such measures, and authority to resolve disputes as they arise.

Institutional flexibility: To meet the challenges of climate change, transboundary cooperative water mechanisms should have a broad mandate that allows them to adapt their operations, planning, and implementation activities to changing conditions. This can be achieved through a framework of adaptive management, which incorporates uncertainty into the planning process for water governance. Cooperative mechanisms should also have channels for feedback and updated information, both of which are dependent on coordinated data sharing, project monitoring, and project review processes.

Stakeholder participation: Because climate change adaptation mechanisms are predominantly implemented on a local scale, stakeholder participation in adaptive responses to climate variability cannot be limited to transboundary and/or national institutions only. Rather, they should also account for local institutions, such as cross-border water user associations, micro-watershed committees, and other related entities.

Political level of implementation: Following the principle of subsidiarity, the management of transboundary waters should be pursued at the lowest level of competent authority.

Legal nature of the agreements: Cooperative mechanisms can be crafted utilising a variety of institutions. Such arrangements, especially at the local level, do not necessarily have to contain all of the requisites of bureaucratic provisions found in treaties. Memoranda of Understanding and other similar frameworks are often justified where the needs for simplicity, lower public profile, speed, and flexibility outweigh the customs and procedures required for treaties and other international agreements.

Financial issues: Regardless of the authority granted to an institution, the absence of financial and other mechanisms to support and sustain the institution's activities can render the institution ineffective and irrelevant. Hence, to ensure that an institutional mechanism can produce the expected benefits and promises, it must have the appropriate resources to carry out its mandate.

Stakeholder & Public Participation in Adaptive Water Governance

In order to adapt to climate change, institutions need to shift from rigid hierarchical structures to more flexible arrangements that focus on social learning. In order to make this goal a reality, relevant stakeholders from different sectors and levels of governance need to be able to establish adaptive information networks where they collect, share, analyse, and collaboratively incorporate relevant data and information into adaptation policies and implementation strategies. Nevertheless, there can be a tension between forming flexible institutional arrangements and accountability – both internally and externally – raising issues around equity and asymmetric power relationships between different actors.

1. **Benefits and challenges**

Stakeholder and public participation, especially within the context of a complex and multifaceted issue such as climate change, is crucial. Involvement of non-state actors can serve to: supplement State-gathered data and information; help decision makers understand and consider different interests that exist (e.g., economic, cultural, recreational and religious); contribute to public ownership and participatory approaches to implementation (e.g., EbA); help communities access additional resources for further work on adaptation; up-scale effective measures; and help to improve accountability.

However, there are also a number of challenges to effective stakeholder and public participation in developing and implementing adaptation measures, particularly in the transboundary context. These include: lack of resources or institutional capacity to engage all stakeholders – both vertically and horizontally; existing power asymmetries between water user interests, particularly at different levels; conflict between different stakeholder groups; reluctance towards devolving governance to the local level; the absence or inadequate implementation of participatory access rights in domestic legal frameworks; and lack of awareness or capacity by groups or individuals of their ability to exercise their participatory rights.

2. Tools for enhancing enabling frameworks for participation in adaptive governance

In general, there are a number of tools or approaches that can contribute to creating enabling environments for achieving participatory adaptive governance structures. These include: 1) adequate legal and policy frameworks (i.e., the right to access information, the right to participation, the right to access justice, and the right to Free Prior and Informed Consent (FPIC) for indigenous peoples); 2) effective polycentric institutional platforms that are balanced both between decentralisation and the ability to coordinate stakeholders both vertically and horizontally; 3) collaborative mechanisms for adaptive knowledge and information management; and 4) tools to ensure inclusiveness of all relevant stakeholders.

a) Legal Frameworks

Legal frameworks set out the ground rules for governance of natural resources. Effective governance assumes that all relevant stakeholders stand on a relatively equal footing. However, in reality this is most often not the case, particularly for more vulnerable and underrepresented groups of society. Therefore, at a minimum, legal frameworks need to ensure basic access rights, in particular:

- The public's right to access information;
- The right to participate in matters that relate to the environment;
- For indigenous peoples, FPIC in decision-making processes that affect their natural resources or cultural property; and
- Access to justice where other participatory rights are not respected.

Legal frameworks also need to support the creation and maintenance of participatory mechanisms at different levels, particularly at lower levels. In addition to providing a legal basis for their creation, legislation can support institutions through enabling regulations, favourable tax treatment, laws of association, appropriate legal capacity, transparency, inclusive rules of procedure, and representational standing in various forums. It is also important to recognise the importance of the principle of subsidiarity.

b) Institutional mechanisms

Institutional mechanisms provide a formal structured means for stakeholder engagement and collaboration on a continuous basis. Providing such a long-term forum for engagement is particularly important for adaptive planning, since it is an iterative process that is likely to evolve over time. Nevertheless, there is a need for balance, whereby competent institutions are empowered to make decisions at the appropriate level in a decentralised way, while recognising the value of coordination between different stakeholders, both at the same level (horizontal coordination) and across different levels (vertical coordination). There also need to be mechanisms at national and transboundary levels so that local interests can be represented and incorporated into higher decision-making processes.

There are several approaches to multilevel participatory governance at the transboundary level. First, transboundary institutions can play a coordinating function, where they incorporate decisions and information from lower level institutions for consideration of interests to the entire basin. Second, where empowered, local level institutions can provide a basis for transboundary cooperation and participatory decision-making, where higher level institutions play more limited roles, for instance through provision of support or recognition. Third, in a mix between top-down and bottom-up models, government and non-state stakeholders can come together to create collaborative decision-making structures. This list is not exhaustive, and there is no defined model of success. Rather, the institutional makeup must be driven by local circumstances and needs.

c) Adaptive knowledge and information management

Due to the long-term and uncertain nature of adaptive decision-making, institutional mechanisms need to enable incorporation of relevant information over time, close data and information gaps, and allow for improvements based on new and updated data and information. For this, institutions must facilitate communication and engagement of stakeholders between different sectors and levels in order to build common understanding and trust, which can help facilitate development of adaptive information and decision-making networks.

When different stakeholder groups cooperate, they can partner with government institutions to close particular information gaps, and prioritise specific areas of concern. Joint fact finding between government and non-state stakeholders can also result in the design and operation of real-time collaborative planning and decision-making mechanisms that are inherently adaptive to changing conditions. Instead of taking a strictly regulatory approach, these mechanisms can allow for authorities and other stakeholders to play around with different arrangements without becoming locked into a losing situation. These arrangements can serve as laboratories to review and test out new information, and build trust between different stakeholders. Furthermore, through more innovative approaches, such as the use of mobile technology, individuals at the local level can collect and monitor water data, which can be fed into real-time decision-making processes.

Nevertheless, in order to realise effective adaptive information and knowledge management, all stakeholders need access to meaningful and pertinent information. Furthermore, decision-making and information-gathering processes need to be accompanied by open and transparent forums where stakeholders can dialogue with each other.

d) Stakeholder inclusiveness

Finally, in order to ensure that all interested stakeholders are effectively represented, decision-making processes need to ensure all relevant stakeholders are included. Through tools such as stakeholder mapping and power relation matrices, different actors can be identified, and their needs vis-à-vis other participants can be properly assessed. It is particularly important to recognise factors that may contribute to disparities in bargaining power, such as lack of information and capacity to participate. Moreover, institutions need to ensure that all stakeholders are aware of their ability to participate in adaptation processes. All relevant stakeholders should be able to participate, particularly to uphold accountability, to build the trust necessary for engaging in long-term actions to address vulnerability, and to enhance overall territorial resilience to climate change.

Translating Governance into Action for Up-scaling Adaptation

In most regions of the world, there is a general lack of legal and policy preparedness for climate change, particularly through innovative approaches (i.e., those supporting social and ecological resilience in an integrated manner). As such, there is an urgent need for governance reform. Such reform should be based on evidence of solutions that work – usually framed as lessons learned and best practices – on the ground. However, while a gap between innovative approaches and governance frameworks remains, policy and decision makers will continue to miss opportunities and information for better policy and law formulation.

Failure to incorporate all relevant stakeholder views into climate change adaptation processes leads to weak strategic focus at all levels. This results in poor integration of local visions, strategies, and plans into national, regional, and international levels.

At the project level, there are many successful demonstrations of adaptation to climate change. In particular, Ecosystem-based Adaptation (EbA) is emerging as a means of reducing vulnerability to climate change impacts through conservation and restoration of ecosystems, while improving resilience of vulnerable people and communities. As a promising participatory approach to vulnerability and resilience, it is being incorporated regularly into adaptation planning.

However, while these small-scale initiatives have resulted in positive changes at the community level, they have also led to piece-meal implementation of adaptation strategies at the national and transboundary level. Though there have been great strides towards adaptation, overall practice depicts a lack of clear strategy at the basin level to address climate change challenges.

To build climate resilience at the national or basin level, policy makers need to determine how to translate success stories from local-level project implementation into more strategic planning at broader scales. Indeed, this is one of the crucial challenges to successful adaptation. Adaptation based solely on prioritisation of discrete actions – for example on infrastructure, institutions, or ecosystems – may lead to missed opportunities to build broader resilience towards an increasingly dynamic and uncertain climate. In turn, adaptive water governance aims to learn from local level adaptation measures for management, planning, and regulation at the national and basin scale.

The management cycle described throughout Chapter Five is a tool to enhance adaptive water governance. It creates a framework of participation and self-organisation for greater resilience. Furthermore, it may be used as an up-scaling mechanism that allows for integration of results and lessons learned from pilot projects into higher level planning.

1. Understanding vulnerability and resilience

Adapting to climate change is key to addressing global priorities for security and development, with a particular demand for focusing on resilience to impacts on water. To adapt effectively, water management needs to reflect the complexity, variation, and uncertainty of hydrological systems. This is particularly challenging in a transboundary context, where ecosystems boundaries do not necessarily follow State borders.

Basin-wide resilience calls for new and more integrated approaches to water management. These approaches continue to be developed as awareness of the complexity of environmental problems and of human-technology-environment connectivity increases. They include consideration of mixed portfolios of engineered and natural infrastructure, application of ecosystem thinking to river basin management under a new water governance paradigm (supported through appropriate laws, policies and institutions), and incorporate transboundary dimensions of shared waters. This new paradigm (understood as adaptive water governance) is a bottom-up approach that builds on local capacities for water governance and sustained multi-stakeholder platforms, allows for adequate discussion of adaptation options, and promotes actions that reduce vulnerability. Through an overall framework, local adaptation processes (e.g., EbA) should inform public policies and laws at the national, and eventually regional or international levels, which in turn can strengthen basin-wide resilience.

2. The management cycle

Adaptation planning benefits from good governance structures with a strong institutional set up. As approaches evolve, experiences gained from the execution of adaptation plans and programmes allow for learning that will feed back into improved governance frameworks. In order to facilitate this learning process for adaptive water management, there is a need for a logical and sequential cycle. The management cycle presented in Chapter Five can be used as a tool for guiding this process.

The management cycle approach to participatory adaptation planning provides communities with a logical process for clearly and collectively taking action to adapt to climate change. It enables thoughtful identification of options, and for implementing innovative solutions. Importantly, it is also designed to be holistic, ensuring that adaptation in one area is not achieved at the expense of another. Finally, through a reflective process the management cycle allows lessons and principles to be up-scaled to strengthen and improve governance frameworks at different levels.

a) Vulnerability assessment

Assessment is one of the most important phases of the management cycle for the adaptive planning process. The purpose of any assessment is to help establish a clear baseline of the starting situation, and to understand and visualize possible courses of action. In the context of developing new approaches to adaptive water management, it is crucial to ensure that all relevant information is accessible to stakeholders. Particularly when talking about adaptive water governance, vulnerability and adaptive capacity become the focus of the assessment phase. Vulnerability assessments not only provide vital information necessary for feeding the management cycle, but they also consolidate participation. Furthermore, they shed light on where and how to prioritise investment of resources to strengthen adaptive capacity.

In the transboundary context, vulnerability assessments need to be developed with the participation of all riparian States (often through coordination of a basin commission or other transboundary cooperative mechanism) and relevant stakeholders. It is particularly important to create a common understanding of vulnerabilities that impact the shared basin, and how actions taken by one State (usually upstream) can have repercussions across the system. This is quite challenging due mainly to jurisdictional issues. Nevertheless, it is a crucial aspect of developing a basin-wide adaptation strategy.

b) Adaptation strategies and Ecosystem-based Adaptation

Adaptation strategies should include measures covering various steps in the process of adaptation, namely: prevention; improving resilience (in order to deal with gradual changes and extreme events); preparation; reaction; and recovery (mostly relevant to extreme events). Furthermore, strategies and measures should account for different time scales, (i.e., as short-, medium-, and long-term). A wide range of measures should also be chosen, in order to account for inherent uncertainty in climate projections.

In the case of many effective adaptation strategies, EbA plays an important role within a broad portfolio of strategic options. Because EbA uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people deal with adverse impacts of climate change, it can be applied at multiple scales – including at river basin level. EbA is also a win-win adaptation strategy, because it addresses climate change while contributing to other social and environmental objectives. Therefore, when the scale is appropriate EbA should be considered and prioritised in a transboundary context.

In a transboundary context, cooperation and development of joint adaptation strategies aims to minimise unintended consequences of increasing vulnerability for neighbouring riparian States as a result of implementation of unilateral measures. Cooperation can also lead to mutual benefits. For example, upstream retention areas (e.g., wetlands and/or dams) can benefit the upstream country by increased catchment storage, while reducing the risk of flooding to downstream countries.

In this publication, transboundary cooperation under the framework of a joint institution for development of climate change adaptation strategies is illustrated in the Sixaola River Basin Case Study. It demonstrates how the existence of joint cooperative mechanisms can play a coordinating role in developing basin-wide adaptation strategies, and ensure coherence between national adaptation efforts.

3. Reflection and up-scaling

Reflection is essential for benchmarking successful climate change adaptation measures, and for eliminating those that are unsuccessful. In particular, reflection should be conducted with a view towards strengthening policy and legal frameworks at the national and transboundary levels. This involves monitoring and evaluating results of current adaptation measures, and determining whether adjustments should be made. In this way, reflection prepares for the future by providing critical information required to build resilience over the long term.

“Up-scaling” refers to incorporation of specific approaches tested on the ground (such as Integrated Water Resource Management (IWRM) or EbA) into broader adaptation strategies, plans, policies, and legal frameworks. Successful up-scaling depends on coherent strategies to enable successful adaptation measures to link up with, and inform, higher level policy making. For this to happen, demonstration projects need to be able to provide evidence of benefits, knowledge, and recommendations from stakeholders to policy and decision makers. If provided the right channels, these successes can then serve as a bridge for integrating multi-level adaptive water governance.

Case Study

The UNECE Water Convention and its Program of Adaptation to Climate Change in Transboundary Basins

Els Otterman and Sonja Koeppel[1]

1 Introduction

Water can be strongly affected by climate change, with serious negative impacts on dependent sectors such as agriculture and hydropower generation, among others. Transboundary cooperation in adaptation helps to prevent negative impacts of unilateral adaptation measures, and to maximize benefits of cooperation. Recognising the urgency of cooperation on climate change issues, the Parties to the United Nations Economic Commission for Europe (UNECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) have engaged in a range of activities on adaptation to climate change in a transboundary context.[2] These include the establishment of a Task Force on Water and Climate Change, the development of *"Guidance on Water and Adaptation to Climate Change"* (the Guidance), creation of a programme of pilot projects, and the formation of a platform for exchanging experience on adaptation to climate change in transboundary basins. This framework of actions on adaptation to climate change was recently transformed into a global platform, where the UNECE Water Convention was opened to non-UNECE States for membership in 2013.

This case study provides a short introduction to the UNECE Water Convention as a useful framework for climate change adaptation in an international context, and shows the most important lessons learned from the work that has been done under the Convention's framework for adapting water management to climate change.

2 The Contextual Setting of Climate Change and the UNECE Region

Transboundary waters play a key role in the UNECE region. Transboundary basins cover more than 40 percent of the UNECE, and are home to over 50 percent of the European and Asian population of the region.[3]

Today the UNECE region is the most advanced global level mechanism in terms of cooperation on transboundary waters. Almost all concerned UNECE countries have taken measures to establish

1 Programme of Climate Change Activities, UNECE Water Convention.

2 UNECE (2008). Report of the Fourth Meeting of the Parties Held from 20 to 22 November 2006, Bonn, Germany, Addendum Part Three: Programme of work for 2007-2009, (ECE/MP.WAT/19/Add.2), Section 2.1.3, p. 7.

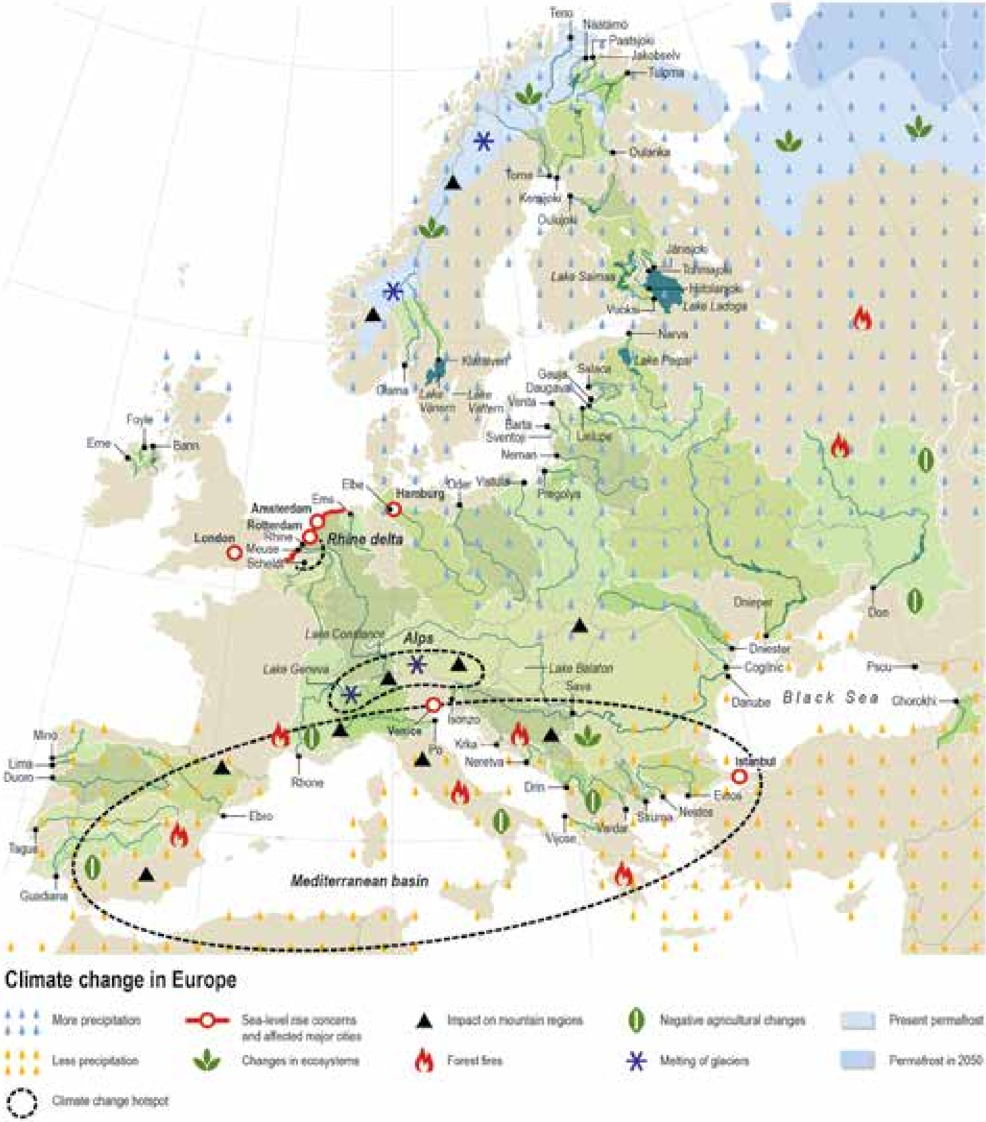
3 UNECE (2011). *Second Assessment of Transboundary Rivers, Lakes and Groundwaters*, p. 2. U.N.: Geneva, Switzerland. *Available at* http://www.unece.org/index.php?id=26343&L=0.

transboundary water cooperation on their shared waters, much of which has been facilitated by the UNECE Water Convention. Since its entry into force in 1996, remarkable progress has been made in reducing transboundary impacts associated with overexploitation, contamination, droughts, and floods. Nevertheless, some problems still persist and new issues, such as climate change, will need to be tackled.

Climate change introduces additional challenges on water management in the UNECE region. While most impacts will vary from basin to basin (see Map 1, below), impacts such as increased precipitation intensity and variability will be widespread, and will increase the risks of floods and droughts. These uncertainties and risks call for even stronger cooperation. Other challenges in transboundary basins include, for example:

- Risks of upstream-downstream conflicts attached to water sharing among riparian countries;
- Overuse of groundwater resulting from increasing abstraction for agricultural purposes and drinking water supply;
- Contamination of drinking water supplies by pollution from point sources, such as municipal sewage treatment and old industrial installations in Eastern Europe, the Caucasus and Central Asia, and South-Eastern Europe; and
- Heavily modified and artificial water bodies, and pollution from diffuse sources (e.g., agriculture, urban areas) in Western and Central Europe.

Map 1 Climate change impacts in UNECE region (Western Europe)



Map produced by ZOI Environment Network, July 2011
Source: Intergovernmental Panel on Climate Change (IPCC) – www.ipcc.ch

Map 2 Climate change impacts in UNECE region (Russia and Central Asia)

The UNECE Water Convention started as a regional convention, negotiated by the Member States of UNECE. In February 2013, however, the Convention turned into a global convention by allowing access to all United Nations (U.N.) Member States. This "going global" was driven by the aim to share the UNECE Water Convention's experience worldwide. Recognising its relevance and role beyond the UNECE region, since 2009 more than 30 non-European countries have participated in activities under the Water Convention, some of which have been directly related to climate change.

3 Legal Framework

The UNECE Water Convention aims to protect and ensure the quantity, quality, and sustainable use of transboundary waters by facilitating and promoting cooperation.[4] The Convention was adopted in Helsinki, Finland, in 1992 and entered into force in 1996. Since then, it has provided

4 *Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (UNECE Water Convention), signed March 17, 1992, Helsinki, Finland, entered into force 6 October 1996 (1966 U.N.T.S. 269; 31 I.L.M. 1312).

an overarching framework for transboundary water cooperation across the UNECE region, and has proved its effectiveness in different economic, social, and environmental conditions. Like the 1997 U.N. Convention on the Law of Non-Navigational Uses of International Watercourses, the UNECE Water Convention is based on, and reflects, customary international law. Many countries in the UNECE region are Parties to both instruments. In the 20 years since its adoption, the UNECE Water Convention has provided an active intergovernmental platform for the promotion of stable and reliable cooperation and the sustainable water management.

There are three central obligations of the UNECE Water Convention (also referred to as its three pillars). They are:

1. The prevention, control and reduction of transboundary impacts;
2. To ensure reasonable and equitable use; and
3. Cooperation through agreements and joint bodies.

3.1 Prevent, control, and reduce transboundary impacts

Parties are required to take measures to prevent, control, and reduce any transboundary impact on the environment, human health and safety, and socio-economic conditions.[5] Such measures include, *inter alia*: conducting environmental impact assessments (EIAs) or other means of assessment;[6] prevention and reduction of pollution at source;[7] licensing and monitoring wastewater discharges;[8] and developing and applying best environmental practices to reduce inputs of nutrients and hazardous substances from agriculture and other diffuse sources.[9]

Along these lines, Parties should use waters sustainably, taking into account the ecosystem approach.[10] They are also required to set water quality objectives and criteria, draw up contingency plans, and minimise the risk of accidental water pollution.[11]

3.2 Ensure reasonable and equitable use

Parties are required to ensure that transboundary waters are used in a reasonable and equitable way.[12] Whether the use of a watercourse can be considered reasonable and equitable depends on the specific characteristics of the basin, the population dependent on its waters, the existing and potential uses, the impact of such uses, the availability of alternative uses, and other factors. In any case, the use of water must be "sustainable"; that is, it should take into account the needs of future generations, the precautionary principle, and the polluter pays principle.[13]

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5 UNECE Water Convention, Art.2.1.

6 UNECE Water Convention, Art. 3.1(h).

7 UNECE Water Convention, Art. 2.3.

8 UNECE Water Convention, Art. 3.1(b).

9 UNECE Water Convention, Art. 3.1(g).

10 UNECE Water Convention, Art. 3.1(i).

11 UNECE Water Convention, Art. 3.3. *See* also Annex III to the UNECE Water Convention for Guidance on developing water quality objectives and criteria.

12 UNECE Water Convention, Art. 2.2.

13 UNECE Water Convention, Art. 2.5(a), (b) and (c).

3.3 Cooperate through agreements and joint bodies

In order to effectively implement the other two central obligations, the UNECE Water Convention requires Parties to conclude transboundary agreements, and establish joint bodies for cooperative management and protection of their transboundary waters.[14] The Convention encourages such cooperation on the basis of the river basin approach. Joint bodies (e.g., river or lake commissions), are tasked with the following:

- Providing a forum for the exchange of information on existing and planned uses of waters, and on pollution sources and environmental conditions of waters;
- Providing a platform for regular consultations;
- Setting up joint monitoring programmes;
- Carrying out joint or coordinated assessments of the conditions of shared waters and of the effectiveness of the measures taken to address transboundary impacts;
- Deciding on emission limits for wastewater and setting up joint water quality objectives;
- Developing concerted action plans for the reduction of pollution loads; and
- Establishing warning and alarm procedures.

An important strength of the UNECE Water Convention is its institutional framework, which is composed of its Meeting of the Parties (MOP), subsidiary bodies such as working groups and task forces, and a permanent Secretariat. The institutional framework assists Parties implement provisions of the UNECE Water Convention by providing guidelines, recommendations, capacity building, and development of legally binding protocols. In 2007, the Task Force on Water and Climate Change started its activities by developing *"Guidance on Water and Adaptation to Climate Change".*[15]

Although the UNECE Water Convention does not explicitly mention climate change, it represents one of the most essential legal frameworks in the UNECE region for cooperation on transboundary aspects of climate change, particularly in the development of adaptation strategies. Provisions of the UNECE Water Convention that are especially relevant for climate change include:

- Prevention, control, and reduction of transboundary impacts, including those related to adaptation or mitigation measures;
- Reasonable and equitable use of waters;
- Cooperate on the basis of equality and reciprocity;
- The precautionary principle; and
- The establishment of joint water quality objectives, use of best available technology, information exchange, and development of joint monitoring and common research.

14 UNECE Water Convention, Arts. 9.1 and 9.2.

15 During the fourth MOP in 2006 it was decided that: "The Flood Task Force will be transformed into a Water and Climate Task Force, and will prepare a guidance on water and climate adaptation for presentation and possible adoption by the Meeting of the Parties at its fifth session" ... "The work will address possible impacts of climate change on flood and drought occurrences, health-related aspects as well as practical ways to cope with the transboundary impacts through adaptation." UNECE (2008). Report of the Fourth Meeting of the Parties Held from 20 to 22 November 2006, Bonn, Germany, Addendum Part Three: Programme of work for 2007-2009, (ECE/MP.WAT/19/Add.2), Section 2.1.3, p. 7.

These provisions are an important starting point for climate change adaptation.

> *"Implementing integrated water resources management [IWRM] and transboundary water management is an important step towards more resilient water management. There is no better way to prepare for climate change than addressing the current climate variability and vulnerability in a sustainable way."*[16]

4 Programme of Work on Water and Climate Change in Transboundary Basins under the UNECE Water Convention

The UNECE Water Convention provides a sound framework for transboundary cooperation in the context of adaptation to climate change. As mentioned above, the Convention is supporting the development of transboundary adaptation strategies through the development of guidance, capacity building, projects on the ground, and exchange of experience.

4.1 Guidance on Water and Adaptation to Climate Change

The *"Guidance on Water and Adaptation to Climate Change"* (the Guidance)[17] is a unique tool that explains how to develop and implement a step-by-step adaptation strategy in the transboundary context. Based on the concept of Integrated Water Resources Management (IWRM), the Guidance provides advice to decision makers and water managers on how to, inter alia, assess impacts of climate change on water quantity and quality; perform risk assessment, including health risks; gauge vulnerability; and design and implement appropriate adaptation strategies.

4.2 Programme of pilot projects

In 2009, the MOP decided that the implementation of the Guidance, as well as dialogue and cooperation in climate change adaptation, should be promoted through a programme of pilot projects on adaptation to climate change in transboundary basins.[18] This programme supports joint efforts by countries in adapting water management to climate change. The eight pilot projects developed under the programme aim to strengthen capacity to adapt to climate change, and to create positive examples demonstrating the benefits of, and possible mechanisms for, transboundary cooperation in adaptation planning and implementation. They include joint impact and vulnerability assessment and the development of basin-wide adaptation strategies. Representatives of the pilot projects meet annually to exchange experience, some of which will be described in the following sections.

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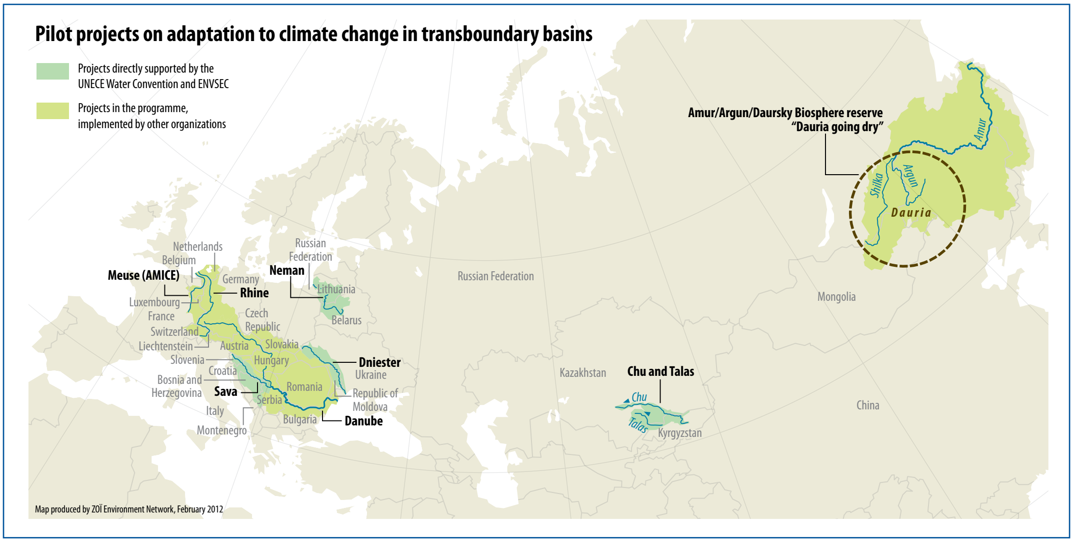
16 UNECE (2012). *Conclusions of the Third Workshop on Water and Adaptation to Water and Adaptation to Climate Change in Transboundary Basins: Making adaptation work,* Geneva, 25-26 April 2012, p. 3, *available at* www.unece.org/env/water/transboundary_adaptation_workshop_2012.

17 UNECE (2009a). *Guidance on Water and Adaptation to Climate Change*, (ECE/MP.WAT/30) U.N.: Geneva, Switzerland. The Guidance was adopted by the Fifth MOP of the UNECE Water Convention in 2009. *Report of the Meeting of the Parties on its Fifth Session, Part One: Proceedings*, Geneva 10-12 November 2009, (ECE/MP.WAT/29) p. 10, para. 41(a), *available at* http://www.unece.org/index.php?id=11658.

18 During the fifth MOP in 2009, the Parties "invited the Parties and non-Parties to the Convention to implement the Guidance in the framework of cooperation on transboundary water management and to the extent appropriate in the national context, in particular through the development of pilot project." UNECE (2009b). Report of the Meeting of the Parties on its Fifth Session, Part One: Proceedings, Geneva, 10-12 November 2009, (ECE/MP.WAT/29), p. 10, para. 41(b).

Map 3 Map of pilot projects



4.3 Platform for the exchange of experience

The platform for sharing experience consists of regular workshops and a web-based platform.[19] A range of annual workshops on water and adaptation to climate change bring together water and climate experts from around the world to share experience and lessons learned. During these workshops, different examples and approaches for adaptation to climate change are discussed, such as dealing with uncertainty, using and preserving ecosystems for adaptation, structural measures, reducing water use, integrated flood management, and economic analysis for evaluating adaptation options, among others. This regional platform recently transformed into a global platform following the official opening of the UNECE Water Convention to allow access to all U.N. Member States.

5 Examples of Good Practice and Lessons Learned from the Pilot Projects

The transition towards adaptation to climate change as a provision for sustainable water management implies a change towards understanding management as learning rather than control. Therefore, learning-by-doing and gaining knowledge from others will become more and more crucial for climate change adaptation in transboundary waters. In this regard, some important lessons can be learned from the UNECE pilot projects and platform for exchange of experience.

Below is a short description of several experiences from basins that are trying to adapt transboundary water management to climate change within the UNECE. The following pilot projects were chosen due to several considerations, including: their stage of development, the diversity of issues faced by the basins, and the variety and unique nature of the responses, particularly in light of the concepts that have been covered throughout this publication.

19 *See* http://www1.unece.org/ehlm/platform/display/ClimateChange/Welcome.

5.1 Reducing vulnerability to extreme floods and climate change in the Dniester River Basin

The Dniester River flows 1,380 kilometres from its source in the Carpathian Mountains in Ukraine through Moldova before discharging into the Black Sea. While the river is mostly shared between Ukraine and Moldova, a short section of the Stryazh River lies within Poland. The Dniester River Basin sustains over seven million people, and also supports growing industrialisation in the region.

Climate change and climate variability are likely to increase the risk of occurrence and intensity of floods in the Dniester River Basin. The main goal of this pilot project was to reduce these risks by improving the adaptive capacity of the two riparian countries. Nevertheless, the project also aimed to enhance cooperation in the overall management of the Dniester River. The project took place from 2010 to early 2013 and was a spin-off from three former projects in the basin that took place between 2004 and 2011, which focused on general improvement of water management. A follow-up project will now help the countries to develop a transboundary adaptation strategy and to implement some measures.

During the Soviet Union, the Dniester was governed as one system. Subsequently, transboundary cooperation between the countries was governed through a 1994 agreement, which established plenipotentiaries between the countries. However it only applied to border waters – not the entire basin. On 29 November 2012, the Republic of Moldova and the Ukraine signed the Bilateral Treaty on Cooperation on the Conservation and Sustainable Development of the Dniester River Basin during the Sixth Session of the MOP to the UNECE Water Convention in Rome, Italy.[20]

The pilot project on the Dniester addresses cross-border management of floods, taking into account both current climate variability and long-term impacts of climate change on flood risks. This has been done by analysing the expected impacts of climate change in the region, and by jointly analysing the impacts of these changes on the waters of the Dniester. Modelling and scenario building has helped to assess transboundary climate change impacts, in particular the occurrence, frequency, and magnitude of extreme floods.

Many activities and data regarding climate change already existed prior to the project, and therefore a baseline study was considered very important. To the extent possible, an assessment of already existing information was carried out at the basin level. Nevertheless, even when sufficient information was available, this assessment posed challenges to experts in the Dniester pilot project due to "simple" inconsistencies between national data, as it is the case in many transboundary projects. For instance, there were differences in map scales, and differences in incomparable administrative resolutions (e.g., the difference between oblast in Ukraine and rayon in Moldova in the Dniester Project), which often provide great challenges to transboundary projects.

Based on the results of the analysis and additional information, a first transboundary vulnerability assessment was carried out in the Dniester River Basin. This resulted in different types of flood risk maps. These flood hazard and risk maps will help to prioritise measures and regions where actions are needed most. Based on the results of the vulnerability assessment, further adaptation reduction measures will be identified, prioritised, and planned by the riparian States together, including the financial aspects.

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20 For Treaty text (in Russian), *see* http://dniester.org/wp-content/uploads/2013/01/rus.pdf.

In order to gain political support it is important to link the political level, the policy-making level and the experts' level. This was considered to be particularly crucial in the Dniester pilot project, where a working group on flood management and adaptation to climate change was created to steer the pilot project.

During the Dniester pilot project, the participating countries learned to understand that flood protection does not necessarily only consist of engineering and "hard" infrastructure. Climate change adaptation should also include "soft" management and communication issues, and general environmental conservation activities. In the Dniester River Basin, capacity building on flood alerts and flood communication is still ongoing, and public awareness of actions that are needed before, during, and after flooding needs to be further improved. Local early warning plans are being developed so that the local population can be informed about flooding risks at an early stage. Furthermore, a geoportal was created to exchange information between the riparian countries, and to facilitate public access to the (geo-)data that is generated.

Last but not least, this project has also been supporting on-going efforts in the Republic of Moldova and Ukraine to improve monitoring and forecasting of transboundary floods. As part of the project, new automated flow monitoring stations were installed in the upper part of the basin, which allows for direct transmission of data to Ukraine's Dniester-Prut Water Basin Management Board. In the future, information and data will also flow in real-time to other downstream users, including those in Moldova and the city of Odessa in the Ukraine, which have a population of over a one million people.

5.2 Pilot project on river basin management and climate change adaptation in the Neman River Basin

The Neman River Basin covers the territory of the Republic of Belarus, Republic of Lithuania, and the Kaliningrad Region (Oblast) of the Russian Federation. The river plays an important role in the socio-economic life of all these countries. There is a high level of water use in the Neman River Basin due to a great number of industrial and agricultural activities and pipelines. Today there are several bilateral agreements regarding environmental protection in force between Belarus, Lithuania, and the Russian Federation.[21] The three countries of the basin and the European Union (E.U.) are also negotiating the signing of a trilateral agreement on "Cooperation in the field of use and protection of the water bodies in the Neman River Basin."

The overall objective of the Neman project is to improve integrated river basin management and transboundary cooperation in a changing climate. The project takes place from 2010 to 2013, and aims to develop a common understanding between the riparians on future water availability and water use in the Neman River Basin, taking into account possible climate change impacts, and to strengthen capacity to adapt to these challenges.

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21 There is the Bilateral *Agreement Between the Government of the Republic of Belarus and the Government of the Russian Federation "On cooperation in the fields of environment protection and sustainable use of transboundary water bodies"* (entered into force on October 25, 2002), a *Bilateral Agreement Between the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus and the Ministry of Environment of the Republic of Lithuania "On environment protection cooperation"* (signed on April 14, 1995), an *Agreement between the Government of the Russian Federation and the Government of the Republic of Lithuania "On Environment Protection Cooperation"* (June 29, 1999), and a *Technical Protocol "On cooperation in the field of monitoring and data exchange on transboundary surface waters"* (signed by the Ministry of Environment of the Republic of Lithuania and the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus in 2008).

Map 4 Representation of summer runoff forecast for the Neman River Basin until 2035 (mean value of 2021 – 2050)

The pilot project has resulted in a first joint assessment of quantitative and qualitative characteristics of water and climate change impacts in the Neman Basin, as well as a vulnerability assessment of water resources and different sectors of the economy to climate change impacts. Expected changes in meteorological and hydrological characteristics of the river were analysed, as well as expected changes in water use in the basin.

This joint assessment has enabled a renewal of cooperation between experts from the riparian countries on the shared river basin. The project has led to a common understanding among riparians in the basin that in the future they will likely suffer from stronger droughts in summer (increased air temperature combined with reduced flow), and more occurrence of earlier floods in the lower part of the basin. It also became clear that climate change will have a stronger influence on runoff than expected changes in water use – at least in the Belarusian part of the Neman River Basin.

Climate change will also affect agriculture, industry, water quality, and other sectors. Some regions within the basin are especially vulnerable, such as the delta region in Kaliningrad (Russian Federation), which is located partly below sea level. The expected impacts may require countries to revisit their flood protection measures and infrastructure.

The project clearly shows the need for a transboundary approach to river basin management and climate change adaptation, which is the main aim of the project. It was noted that a basin-coordinated approach to operating Lithuanian water reservoirs could support flood protection in the lower-lying Russian part of the basin. Lithuania also recognised the importance of incorporating information from the entire basin, including the upper Belorussian section, into its river basin management plans to be revised in 2013–2014, and the important and useful role that the group of experts and officials created through the project could play in that regard. The project and its outcomes are also expected to support and strengthen the negotiations of the Neman Basin agreement between the three countries of the basin and the E.U. Concluding a trilateral agreement would be very helpful for solving the most important challenges in jointly managing waters, particularly in adapting to climate change in the transboundary context.

For a basin-wide vulnerability assessment it is important to create a joint group to perform the assessment; to harmonise the tools, models and scenarios used; to communicate knowledge to the political level; to exchange information; to cooperate with international organisations; and to closely involve all stakeholders. In the Neman project, stakeholders were involved through participation in seminars with discussion on vulnerability assessments and on adaptation measures.[22] These stakeholders were identified due to their importance in the decision-making process.

The example of the Neman pilot project shows that climate change is not only a challenge, but also an opportunity; it can be a starting point for better communication between riparian countries, and it can serve as a driver for transboundary cooperation. In the Neman, through joint assessment of problems, it is also possible for priorities and solutions to also be developed in a cooperative fashion.

5.3 The Adaptation of the Meuse to the Impacts of Climate Evolutions (AMICE) Project

The Meuse River is shared by France, Luxembourg, Belgium, Germany, and the Netherlands. The basin is home to 8.8 million people, and supplies drinking water to another six million people in the surrounding regions outside the basin.[23] The Meuse has always been a pillar for local economies and livelihoods. In 2002, the International Agreement on the Meuse (The Treaty of Gent)[24] was signed. At the same time, the International Meuse Commission was established to assure the sustainable and integrated water management in the International Meuse River Basin.

The AMICE Project is a transnational INTERREG project that focuses on the adaptation of the Meuse River Basin and its catchment to the impacts of flooding and low waters from climate change. The AMICE Project aims to minimise the economic, social, and ecological impacts of climate change for densely populated and built-up floodplains, which are among the most vulnerable areas in Europe as they are at risk from storms, intense rainfall and flash floods. Failure to respond is likely to bring about a reduction in external investment and depopulation.

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22 The main stakeholders in this project are the Central Research Institute for Complex Use of Water Resources (CRICUWR, Minsk, Belarus), Vilnius University (Lithuania), and the Hydrometeorological Services of these two countries. Other important stakeholders in Belarus are The Ministry of Natural Resources and Environmental Protection, the Ministry of Emergency Situations of the Republic of Belarus, and other ministries including the Ministry of Housing and Communal Services, and local Administrations. Similar stakeholders can be identified in Lithuania. The Nevsko-Ladojskoye Basin Administration is the main stakeholder in the Kaliningrad Region of the Russian Federation.

23 *See* AMICE website: http://www.amice-project.eu/en/.

24 *Accord International sur la Meuse* (International Agreement on the River Mass, or Treaty of Gent), signed 3 December 2002, entered into force 1 December 2006, Article 4. *Available* (text only available in French, Dutch and German) *at* http://www.ecolex.org/ecolex/ledge/view/RecordDetails?id=TRE-001376&index=treaties.

The AMICE Project started in 2009 and runs until mid-2013. Working together are 17 partner organisations (five river basin managers, seven universities/research centres, three public administrations, and an NGO crisis centre) from Germany, Belgium, France, and the Netherlands. The French basin manager, l'Establissement Public d'Aménagement de la Meuse et de ses Affluent (EPAMA) was the lead partner; the Dutch (Waterboards Aa en Maas and Brabantse Delta), Flemish (nv De Scheepvaart) and the German (Wasserverband Eifel-Rur) basin managers carried out pilot projects.

The partner organisations in the river catchment are defining a common basin-wide adaptation strategy to the impacts of climate change, particularly with regard to floods and droughts. To further this goal, they are working towards a flood-proof, drought-proof understanding of how the Meuse will respond to future extreme water events.

The project also provides an opportunity to strengthen and widen the partnership of stakeholders in the international Meuse Basin, and to raise awareness of flood and drought risks among the population and the public bodies. This was conducted through eight visits to pilot projects that were organised within the project, which were open to participation by all interested people. A public meeting on climate scenarios was also organised, as well as some workshops with stakeholders, with the aim of designing a "roadmap to climate change" in the Meuse Basin. Moreover, an international flood crisis management exercise was organised in France, Wallonia, and the Netherlands.

In the AMICE project it was recognised that while there are often many possible adaptation measures that have been identified and designed among technical professionals, at the same time implementation of such measures is still lacking or in its infancy. At the implementation stage, political attention and support is very important. This entails the need for improved communication between political and decision-making levels. Most possible measures have clear benefits, but lack of political will is a real constraint to action; political support and a willingness to act is a prerequisite for implementation. Communication at all levels was therefore an important focus of the AMICE project.

An overall communication plan with general outlines and actions was elaborated, and input was requested by each of the partners. Through a series of meetings, the communication plan was presented and discussed, and partners provided goals and views regarding communication. The communication plan was then adapted to reflect the partners' input. This was a first crucial step towards developing a good partnership and a good understanding between partners. During the project the communication plan[25] was carried out and updated on a regular basis. At the local level, the six "on the ground" pilot projects included within the AMICE Project each conducted their own local communication projects, or campaigns.

The AMICE Project has also utilised what can be seen as ecosystem-based approaches. The project distinguishes so called "soft" projects and technical projects. For the soft projects,[26] the

25 Pillars of the AMICE communication plan were the AMICE logo and company-style that were developed, the AMICE slogan that was chosen by the partners, the site visits that were organised to the different pilot projects, the AMICE newsletter, *"Meuse and Climate"*, in which input from partners was used and which appeared every six months, the AMICE internet-film on the different aspects of the river Meuse, the AMICE song that testifies of the strong partnership that was built, the AMICE participation in international events and indeed the final conference in March, 2013. On the AMICE website (www.amice-project.eu), the progress of the project can be followed (also through news-items that appeared on a regular basis), and all the important reports and presentations can be found there.

26 The pilot projects were/are: natural water retention in the Ardennes (Be), river and wetland restoration in Hotton (Be), and changing land use from agriculture into nature in the Steenbergse Vliet (NL).

main message is that water management is not only about technical fixes, but also about smaller local measures that make use of ecological qualities – or nature's capacities – of the sites, and can enhance the resilience of the entire basin. However, soft measures are not always possible or sufficient, and sometimes it is necessary to carry out more technical measures. This was an approach utilised by the AMICE project, and in many cases an approach of "adapting by improving existing infrastructures" was chosen.[27]

Specifically, the AMICE Project has undertaken projects aimed at improving natural water retention (NWR) by restoring wetlands, whereby river valleys are brought back to a natural state in order to retain water in the soil for longer periods of time, and create natural buffers. Originally focused on flood prevention, efforts turned out to have a positive effect on the restoration of the natural vegetation and the reduction of low flows in the summer.

Conservation of water retention areas is thus a good way of combining climate adaptation, sustainable development, and involvement of local communities. This underlines an important lesson from the AMICE Project: it is easier to implement measures when they serve broader purposes than just adaptation to climate change. The experience of another project within the context of AMICE, the Rur reservoirs, emphasises this. The Rur dams in Germany, originally built for hydropower, now also turn out to be very useful in managing the flow of the Dutch part of the Meuse Basin.

Using NWR projects as an example of Ecosystem-based Adaptation (EbA) is a promising but still rarely used approach. This is recognised by the partners in the AMICE Project, and by many other water managers who have participated in the UNECE water and climate change platform in the past few years.

5.4 Water scarcity is an increasing problem: The revision of the Albufeira Agreement

Another important trend in water management is increasing water scarcity. Droughts are natural phenomena that are expected to intensify, leading to more severe water scarcity situations, even in regions previously considered as water-abundant. Water scarcity is, however, not just induced by climate change; an important cause of the problem is inadequate water management. Action is needed to counter these situations of inefficient or unwanted water uses. Governments need to deal with droughts through better water management, better water supply, and decreasing water demand. This can be done, for example, by investigating new sources of water, such as in the Nile River Basin, where research is conducted to develop new schemes for improving the water supply in the region.

Groundwater withdrawal and underground water storage are becoming increasingly important measures to address water scarcity. However, groundwater use needs to be sustainable. The reuse of water is increasingly considered to address water scarcity.

In situations of water scarcity, establishing priorities for water use is necessary. This is even more so in transboundary basins. Criteria need to be defined for this. In water-scarce regions, agriculture practice needs to be adapted, for example by diversification of crops. Pricing of water can be an important tool to decrease water demand but is a measure that should be implemented in normal

27 The three pilots in this series are the pumping installation and water power plant on the Albert Canal (Be), The adaptation of flow control of the Rur reservoirs (DE) and the HOWABO project (High Water Plan for the city of Hertogenbosch in the Netherlands).

times to make it acceptable in times of crises. Other measures to address water scarcity and droughts include structural and awareness-raising measures.

In the transboundary cooperation between Spain and Portugal, the problems of drought and floods led to a revision of the Albufeira transboundary agreement, which addresses climate change and flow variability. The Convention on Cooperation for the Protection and Sustainable Use of the Waters of Portuguese-Spanish River Basins (The Albufeira Convention, 1998) regulates the transboundary waters in the shared basins between Spain and Portugal. It includes the transboundary Tagus, Minho, Duero/Douro, and Guadiana Rivers. The Convention covers themes such as bilateral information exchange, information to the public, assessment and dialogue on transboundary impacts, pollution control and prevention, water uses, droughts and resource scarcity, assignment of rights, and dispute resolution. The Convention defines, for each river basin, the amount of water that should be received by the downstream riparian State, and river boundaries control sections by week and every three months.

The discharge of the river is subject to the precipitation conditions in the Spanish part of the basins, and in the case of the Tagus River in the Portuguese part of the basin. Discharge is also complemented, in the case of the Guadiana River Basin, to the water storage conditions in six Spanish reservoirs. When the precipitation in a basin becomes extremely low and falls below certain thresholds, the defined flow regime might not apply, but during these exceptional periods the water should be managed in such a way as to ensure its priority uses.

So far, the annual flow regime has been operating well, and at the same time a good collaboration atmosphere between the Parties allowed them to overcome difficult situations, such as water shortages in an exceptional drought period, 2004-2005, recorded in the Douro, Tejo and Guadiana Basins. In March 2013, the Iberian Peninsula experienced a lot of rainfall, and thanks to the continuous communication between Spain and Portugal, no severe problems arose.

In February 2008, the bilateral Convention was amended to desegregate the annual flow regime into smaller integration time-steps. This new regime determines a quarterly (Minho, Douro, and Guadiana), weekly (Douro and Tejo) and daily (Guadiana) discharge flow, depending on the rainfall conditions in each basin. This agreement became effective on August 5, 2009.

6 Conclusion/Summary

The examples described in this chapter (AMICE, Dniester, Neman and the Albufeira Agreement) underline the importance of transboundary cooperation in water management, particularly within a larger regional context. Climate change introduces additional challenges on water management; impacts such as increased risks of floods and droughts will be widespread. However, through an extended regional platform such as the UNECE Water Convention, countries can have access to a number of tools that allows them to build capacity to adapt to climate-associated challenges.

The Pilot Projects that have been undertaken through the UNECE's framework on water and adaptation to climate change are starting to generate a number of valuable lessons for further adaptation activities. Sustainable water management is a prerequisite for adaptation to climate change in transboundary basins, and a mixture of soft and hard measures will be needed to tackle these challenges. The Pilot Projects on the ground, which were described in this case study, also show that apart from cooperation between countries, cooperation and communication between different sectors, and between scientists and policy makers, is also very important in order to be able to implement adaptation measures. Moreover, implementation of measures will be easier when serving more purposes than climate change alone.

Decision-makers from all riparian countries need to be involved right from the start of the vulnerability assessment. If the approach and the outcomes of the vulnerability assessment can be agreed upon by all stakeholders, it will be easier to agree on adaptation measures based on the assessment. Making the link between these levels can be done, for example, by creating a working group composed of experts and policy makers that meets regularly during the project.

Challenges related to climate change call for even stronger cooperation between riparian countries than before. And although transboundary cooperation is often challenged by simple inconsistencies of data, and by diplomatic difficulties, these examples also show that progress can be made and that climate change can even serve as a driver for improved transboundary cooperation in general. The UNECE Water Convention will also continue to serve as a useful framework for climate change adaptation, and will do so on a global level, due to the fact that as of 2013 all U.N. Member States can become parties to the Convention.

Case Study

The Senegal River Basin: Adapting to Climate and Environmental Changes

Ben Parker and Lauren Michelle-Killeen Parker[1]

1 Introduction

The Senegal River Basin covers a surface area of roughly 300,000 square kilometres, and spans the four West African nations of Guinea, Senegal, Mali, and Mauritania.[2] The basin is home to roughly 3,500,000 inhabitants, 85 percent of whom rely on the river for domestic use, farming, raising livestock, and fishing.[3]

All of these uses were significantly impacted during long and harsh droughts that plagued the region from the late 1960's into the early 1980's.[4] Between 1968 and 1973, an estimated 50-70 percent of the cattle population perished, virtually all crops were destroyed, and up to 100,000 local inhabitants died.[5] These environmental crises provided a backdrop for the initial development of what has come to be known as one of the more advanced cooperative transboundary water agreements in West Africa, resulting in the formation of the Senegal River Basin Development Authority (OMVS).

The OMVS was created in 1972 with the mandate of "securing [the Member States'] economies and reducing the vulnerability of peoples' livelihoods through water resources and energy development."[6] As part of their strategy to achieve this goal, the Member States authorised construction of two major dams, the Diama and Manantali, completed in 1986 and 1988, respectively. The dams were built to improve water management in the basin, and more specifically, to enlarge irrigable farmland in the delta and harness hydropower in the upper basin.[7] Although they achieved some success, by the 1990's the dams had also contributed to a number of adverse impacts including: proliferation of water-borne diseases; water pollution caused by increased agricultural development; proliferation of water weeds clogging water courses; dramatic changes to the ecosystem and hydrology; degradation of the fish population; reduction of pasture land; riverbank erosion; and the disappearance of wetlands.[8]

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1 Ben Parker, Licensed Attorney and International Development Consultant, Development Alternatives, Inc. (DAI); Lauren Michelle-Killeen Parker, Licensed Attorney, International Environmental Law.

2 UNESCO (2003). "Water for People Water for Life," *The United Nations World Water Development Report* – Senegal River Basin, Guinea, Mali, Mauritania, Senegal, at p. 358.

3 *Ibid.* at p. 450.

4 Encyclopedia Britannica online (2013). "Sahel (region, Africa)," *available at* http://www.britannica.com.

5 *Ibid.* (These statistics are from the entire Sahel region during this time).

6 Mcmillan, S. (2013a). "Africa Region - Guinea, Mali, Mauritania and Senegal," *Report No. AB214, Senegal River Basin Multi-Purpose Water Resources Development Project,* p. 2. The World Bank: Washington D.C., U.S.A., 6 February 2006.

7 *See* World Bank and UNDP (2009). "Implementation Completion and Results Report (TF-52900) On A Grant From The Global Environment Facility (GEF) Trust Fund to The Organisation Pour La Mise En Valeur Du Fleuve Sénégal," Report No. ICR0000883, *Senegal River Basin Water and Environmental Management Project.*

8 *Ibid.* at p. 10

By the late 1990's, the Member States – through the OMVS – had begun collaborating with international donors, multilateral development institutions, and civil society organisations to address the harmful consequences of the dams, and to augment some of their agricultural achievements. Since then, cooperation has focused on mitigating environmental and health impacts; ecosystems restoration; strengthening the core functions of agriculture, hydropower and navigation; and modification of the legal and institutional framework to allow countries in the basin to adapt to future challenges like climate change.[9] These efforts also included the development of an Integrated Water Resources Management (IWRM) Strategy, the implementation of which resulted in the signing of the Water Charter of the Senegal River (Water Charter) in 2002.[10]

These actions have helped contribute towards a more holistic vision of water and development in the Senegal River Basin. While countries in the basin still face a number of development challenges, including the task of enhancing capacity to address climate variability, the tools that have been developed under this framework provide a unique example of how to address past environmental degradation, and how to prepare for future environmental changes.

2 Ecological and Environmental Context of the Senegal River Basin

2.1 The hydrological and seasonal cycles of the basin

The source of the Senegal River begins in the Fouta Djallon mountainous region of Guinea. Here, the main tributaries – the Bafing, the Bakoye, and the Faleme – merge, contributing to 80 percent of the flow of the 1,800 kilometre long river, the second longest in West Africa.[11] The river continues to flow through Mali before forming the international border between Mauritania and Senegal, finally emptying into the Atlantic Ocean at the city of Saint Louis.[12] The basin contains three prominent parts: the mountainous upper basin; the valley (itself divided into high, middle, and lower); and the delta.[13] In particular, the delta is rich source of biological diversity and wetlands.[14]

Much of the water flow of the basin derives from the heavy rainy season (June to September), while the rest of the year is usually dry.[15] Influenced by the north-south migration of the Inter-Tropical Convergence Zone, these seasonal levels of precipitation have largely corresponded with a flood cycle that has existed in the delta region for centuries.[16] The resulting seasonal floodplains also

9 *Ibid*.

10 *Charte des Eaux du Fleuve Sénégal* (2002 Water Charter), signed 18 May 2002, OMVS Resolution 005, Art. 24, *available at* http://bd.stp.gov.ml/padelia/pdf/CHARTEDESEAUXDUFLEUVESENEGAL.pdf.

11 World Bank and UNDP (2009), *supra* note 7, at pp. 72-73.

12 *Ibid*.

13 Mcmillan, S. (2013b). "Integrated Safeguards Data Sheet (Concept Stage)," *Senegal River Basin Multi-purpose Water Resources Development Project: Report No. ISDSC1395*, p. 5. The World Bank: Washington D.C., U.S.A., 3 March 2013.

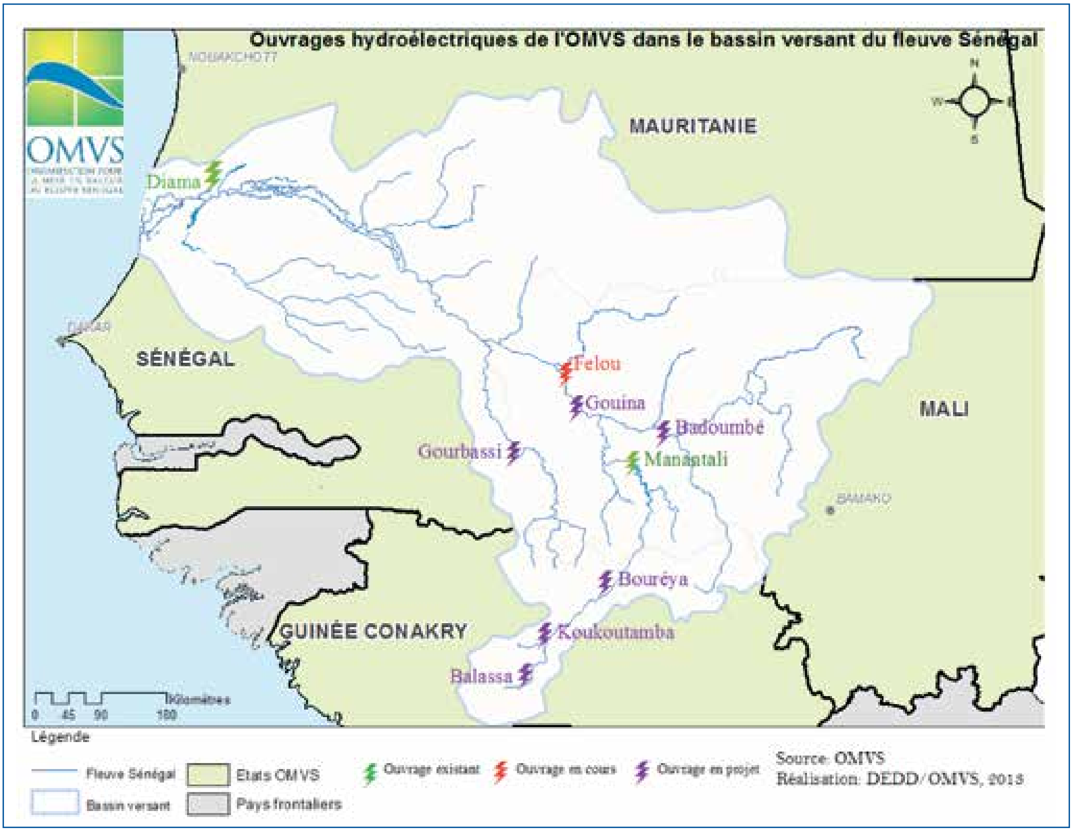
14 The Senegal River Basin contains many important wetlands, five of which are Ramsar sites located along the coast of Mauritania and Senegal. *See* Flink, S. (2013). *Ramsar Sites*, *available at* http://ramsar.wetlands.org.

15 Mcmillan (2013b), *supra* note 13.

16 Oyebande, L. and Odunuga, S. (2010). "Climate Change Impact on Water Resources at the Transboundary Level in West Africa: the Cases of the Senegal, Niger, and Volta Basins," *The Open Hydrology Journal*, Vol. 4, pp. 163-172, at p. 165.

helped to regulate saltwater intrusion between seasons.[17] For instance, during the dry season, saltwater naturally flowed into the deltas forcing some freshwater species to move inland, while also permitting some habitats like mangrove forests to flourish up to 70-100 kilometres inland.[18] Prior to severe droughts and construction of the Diama Dam, these floodplains and their rich ecosystems did much to support surrounding populations.[19]

Map 1 Map of the Senegal River Basin[20]



Seasonal drought has always been part of the hydrological cycle in the Senegal River Basin. However, the drastic reduction in precipitation during the prolonged drought between the late 1960's and the 1980's disrupted the harmonious relationship between the floodplains and natural levels of saltwater intrusion. The territories of Senegal and Mauritania were flooded as far as 200 kilometres inland, resulting in uncharacteristic damage to agricultural production, disruption to the hydrological flow, and disturbances in the habitats of many plant and animal species.[21] To help mitigate saltwater intrusion,

17 *Ibid*.

18 *Ibid*.

19 Thieme, M. (2013). *Fresh Water Ecoregions of the World*. WWF: Washington D.C., U.S.A., *available at* http://www.feow.org/ecoregion_details.php?eco=509.

20 Prepared for the World Water Assessment Programme (WWAP) by AFDEC, 2002.

21 Amani, A. Thomas, J.-P. and Moussa Na Abou, M. (2007). "Climate Change Adaptation and Water

control flooding, and increase access to year-round freshwater, the Diama Dam was constructed. Unexpectedly, this resulted in a proliferation of water-borne diseases connected to large amounts of sitting freshwater, declining fish supplies due to lack of access to estuarine environments for breeding, and alteration of recession agriculture traditionally used by local populations for centuries.[22]

Today, the hydrological cycle remains modified by the dams. For example, "the ecological system of the lower valley and delta have transformed from a salty and brackish aquatic environment with significant seasonal changes to a freshwater ecology with continuous moderate flux."[23] These changes have resulted in the proliferation of invasive plant and animal species, which have disrupted fluvial ecosystem functions and socio-economic activities, such as irrigated fishing and livestock farming.[24] Moreover, it has been argued that increased monoculture farming has diminished biodiversity.[25]

2.2 Climate change projections

According to the Intergovernmental Panel on Climate Change (IPCC), climate change will have a greater impact in Africa than any other part of the world.[26] The highest rates of temperature increases will occur in the Western Sahara region (+4°C), although slightly less in the costal zones (+3°C), both nevertheless affecting the Senegal River Basin.[27] On the other hand, West Africa's climate is very diverse and will be affected differently depending on local conditions.[28] This variation makes predicting systemic effects upon the basin difficult, thus making prescriptions more challenging and complex. The flow of the Senegal River has dropped by 60 percent since 1971, but climate change projections are uncertain as to whether this trend will continue or reverse somewhat, at least in more tropical regions.[29] Coastal areas will be at risk due to projected seawater rise, which will impact productive ecosystems (e.g., mangrove swamps, deltas, and estuaries) that support important economic sectors such as fishing, farming, and tourism.[30]

Resources Management in West Africa," *Synthesis Report*, at p. 29.

22 Vick, M.J. (2006). "The Senegal River Basin: A Retrospective and Prospective Look at the Legal Regime," *Natural Resources Journal*, Vol. 46, pp.211-243, at p. 218, 219, and 223.

23 Senegal River Basin Development Authority (OMVS) (2008). "Strategic Action Plan for the Management of Priority Environmental Problems in the Senegal River Basin," *GEF Project/Senegal River Basin*: *Component 3*, p. 17.

24 *Ibid*. at p. 28.

25 *Ibid*. at p. 39.

26 Economic Community of Western African States (ECOWAS), Sahel and West Africa Club (SWAC) and the Organization for Economic Cooperation and Development (OECD) (2008). *Atlas on Regional Integration in West Africa: Climate and Climate Change*, p. 7. OECD: Paris, France.

27 *Ibid*. at p. 8.

28 *Ibid*. at p. 12.

29 *Ibid*. at pp. 13-14.

30 *Ibid*. at p. 19.

3 Legal and Institutional Framework

The legal and institutional framework of the Senegal River Basin is a unique example of international cooperation evolving over time to address and adapt to new challenges. Starting with the treaty that created the OMVS, and later through the Convention concerning the Legal Status of Jointly-owned Structures (the JOS Convention),[31] the basin States handed over sovereign control of portions of the Senegal River and associated projects within their own boundaries to the OMVS.[32] Later, in response to the need for cooperative mechanisms better suited to protect the environment, the Member States were able to come together and agree on the progressive 2002 Water Charter. Combined with finance and technical support from the international community, through the OMVS' coordination efforts this legal and institutional framework has helped enhance the region's commitment to sustainable development and IWRM principles, all of which provide a way forward for adapting to climate change.

3.1 The 1972 OMVS Convention

After gaining independence in the 1960's, the four riparian countries declared the Senegal River to be an "international river" to be shared for their equitable benefit.[33] This progressive declaration was made in the context of the establishment of the Organisation of States Bordering the Senegal River (OÉRS) in 1968, aimed to create:

> *"a common vision among the [S]tates, and encouraged [sic] their cooperation and need to consult in managing the water resources for socio-economic development and the maintenance of environmental integrity anywhere in the basin."*[34]

In 1972, shortly after Guinea withdrew from the OÉRS due to political upheaval, the three remaining riparian States decided to scale back the scope of their cooperation, and agreed to specifically focus on basin-related water management.[35] This resulted in the Convention to Create the OMVS (OMVS Convention).[36] The OMVS Convention instituted a "flexible and functional legal framework enabling collaboration and a co-management of the basin."[37] Mali, Mauritania, and Senegal agreed to the principals of equitable utilisation and coordinated development – including prior notification – well before they became established international law principals, or were prominently featured in the U.N. Convention on the Law of the Non-Navigational Uses of International Watercourses (1997 U.N. Watercourses Convention).[38] These principles were demonstrated through three main objectives outlined at the inception of the OMVS: 1) to generate over 800 gigawatt-hours of electricity per year, with benefits to be shared proportionally among the riparian States; 2) increase the irrigated land from

31 *Convention Relative au Statut Juridique des Ouvrages Communs* (JOS Convention), signed December 21, 1978 at Bamako, Mali, *available at* http://faolex.fao.org/docs/texts/mul16005.doc.

32 UNESCO (2003), *supra* note 2, at p. 456.

33 Vick (2006), *supra* note 22, at p. 227.

34 *Convention Portant sur le Statut de l'Organisation des Etats Riverains du Sénégal* (Labé Convention), 24 March 1968, Labé Guinea. *See* Ayibotele, N.B. (2008). *Establishing a Transboundary Organization for IWRM in the Senegal River Basin: Case #45*, p. 10. Global Water Partnership: Senegal.

35 *Ibid.* at p. 2.

36 *Convention Portant Création à l'Organisation de la Mise en Valeur du Fleuve Sénégal, OMVS* (OMVS Convention), signed 11 March 1972, Nouakchott, Mauritania, Art. 1, *available at* http://bd.stp.gov.ml/padelia/pdf/CHARTEDESEAUXDUFLEUVESENEGAL.pdf.

37 *Ibid.* at p. 6.

38 *Ibid.* at p. 5.

50,000 hectares to 375,000 hectares to develop the region economically; and 3) to provide landlocked Mali with direct access to the sea by maintaining a constant depth and flow for navigability.[39]

The OMVS is charged with the implementation of the OMVS Convention, including the promotion and coordination of studies to enhance basin resources, and any other economic missions that the Member States request.[40] To this effect, the OMVS has full legal capacity "to enter into contracts, acquire and dispose of property, receive donations, subsidies, legacies and other gifts, request loans, apply for technical assistance, and institute legal proceedings."[41]

The Conference of Heads of State of Government is the "supreme body" of the OMVS, and it "defines the policy of cooperation and development [sic] and decides the general economic policies."[42] Its decisions are established through unanimity of its members, and its decisions are binding on all Member States.[43]

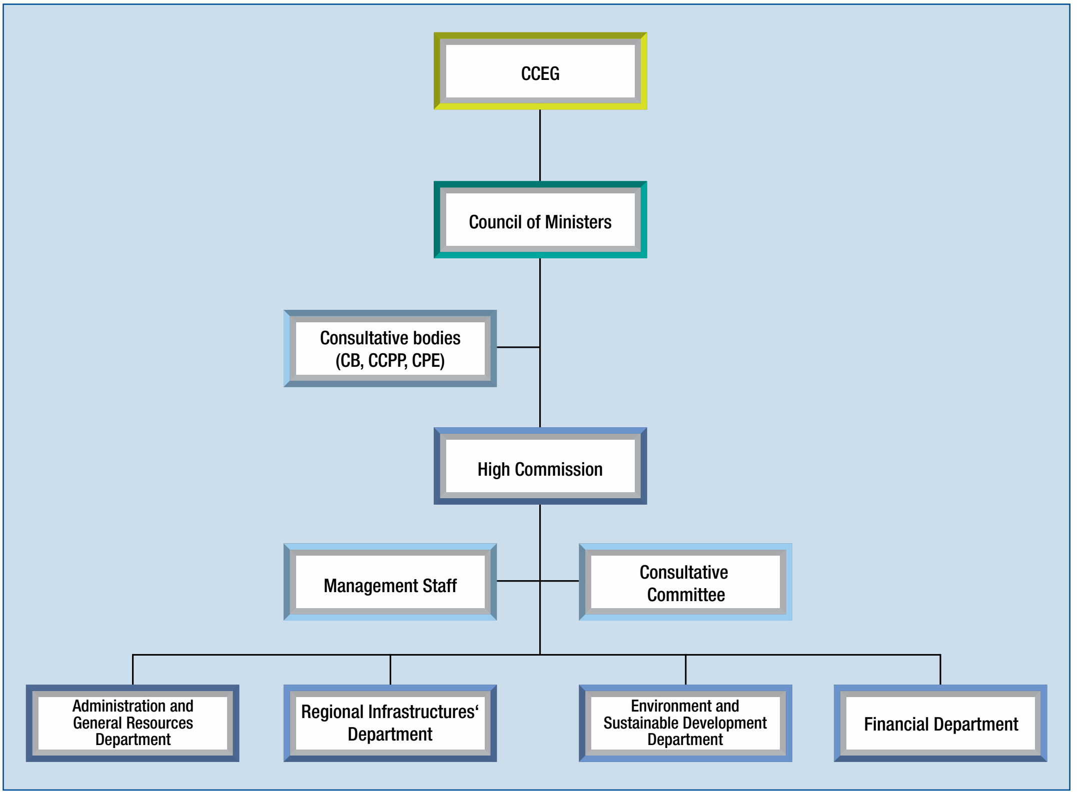
The Council of Ministers acts as the controlling and supervising body of the OMVS. It is responsible for defining general development policies and priorities over river management in the basin.[44] Under the OMVS Convention, there was a requirement for Member States to gain approval from the Council of Ministers before beginning execution of development programmes.[45] The Council is composed of one minister per Member State, and it holds ordinary sessions twice a year, attended by representatives of the Member States, although an extraordinary meeting may be called if requested.[46] The Council of Ministers has competence to delegate legal authority to the High Commissioner necessary to achieve the OMVS' objectives.[47]

The High Commissioner acts as the executive body tasked with implementing directives of the Council of Ministers, natural resources exploitation, project development, and other management duties including financial, budgetary, and personnel.[48] The High Commissioner is also responsible for data collection, and submission of a common work plan for the coordinated value and rational exploitation of the resources of the basin to the Council of Ministers.[49]

One of the most important consultative bodies is the Standing Committee on Water (Standing Committee), a technical body "responsible for defining the principles and modalities of distribution of [water] between the States and between sectors of water use," including industry, agriculture, and transport.[50] The Standing Committee is also responsible for considering and providing opinions on proposed projects and programmes.[51] As seen below, since its establishment the Standing Committee's responsibilities have evolved, providing it an important advisory role in basin efforts to adapt to variability brought on by climate change.

39 *Ibid.* at p. 6.
40 OMVS Convention, *supra* note 36, at Art. 1(1)-1(2).
41 OMVS Convention, Art. 1(3).
42 OMVS Convention, Art. 3.
43 OMVS Convention, Art. 5.
44 OMVS Convention, Art. 8.
45 OVMS Convention, Art. 8.
46 OMVS Convention, Arts. 8 and 10.
47 OMVS Convention, Art. 12.
48 OMVS Convention, Art. 11.
49 OMVS Convention, Art. 13; and 2002 Water Charter, *supra* note 10, at Art. 24.
50 *La Commission Permanente des Eaux* in French. OMVS Convention, Art. 20; and 2002 Water Charter, Art. 19.
51 2002 Water Charter, Arts. 11 and 21.

Figure 1 Organisational Structure of the OMVS[52]



3.2 Agreements related to construction and maintenance of dams in the basin

As part of their original plan to promote coordinated development in the basin, particularly through the construction and maintenance of dams in the basin, in 1978 the OMVS Member States signed the Convention concerning the Legal Status of Jointly-owned Structures (JOS Convention). Specifically, the JOS Convention solidified cooperation, and joint and indivisible ownership of all structures, particularly dams, connected to the basin. A supplemental Convention on Financing Modalities of the Joint Owned Structures in 1982 also institutionalised mechanisms for calculating investment costs and operating expenses, and repayment of loans.[53] These agreements laid the framework for the establishment of the Agency for the Operational Management of the Diama Dam (SOGED),[54] and

52 OMVS Website, *available at* http://www.omvs.org.

53 *Convention relative aux Financements des Ouvrages Commun*, signed 12 March 1982, Dakar, Senegal.

54 *Convention Portant Création à la Société de Gestion et d'Exploitation du Barrage de Diama* (SOGED) (the Diama Convention), 7 January 1997, Dakar, Senegal.

the Manantali Dam Operation and Management Agency (SOGEM),[55] sub-agencies responsible for managing the two main dams, the Diama and Manantali.[56]

Despite the prestige of these institutions relative to the region and era, the original legal framework for the basin did not provide for consideration of potential environmental consequences. Instead, it was aimed towards promoting development and economic productivity. Poor decision making, based on lack of consideration for environmental and social impacts in constructing the dams, along with mismanagement of water in the basin during the 1980's and 1990's, led to economic and environmental problems in the region as fisheries fell apart, agriculture became inefficient, and water-borne and other tropical diseases proliferated. Distribution issues also contributed to conflict among competing local users in the basin.

3.3 The 2002 Water Charter

In response to mounting environmental, economic, and social problems in the basin, there was an eventual recognition among the OMVS Member States that a more holistic approach was needed. Subsequent to implementation of a number of standalone initiatives to address immediate impacts of the dams in the late 1990's and strengthen IWRM, negotiations then led the Member States to revise the legal framework for the Senegal River Basin, and to sign the 2002 Water Charter. The Water Charter formally expressed the OMVS Member States' growing commitment to sustainable development. Changes were intended to supplement the original OMVS framework with an enhanced planning and decision-making process, particularly with regard to adequate consideration of benefits and consequences of proposed projects. This was a significant development, because under the previous legal framework other goals for river management (e.g., to protect the health, environment, or ecology of the region) could not conflict with the primary goals of the OMVS, which up to that point were mainly hydropower production, expanded irrigation, and navigation.[57]

The 2002 Water Charter expanded the OMVS' scope and purpose through four main aims:

1. *"To fix the principles and the methods of the distribution of water of the Senegal River [for] various sectors of use…;*
2. *To define the methods of examination and approval of the new uses or projects affecting the quality of the waters;*
3. *To determine the rules relating to the safeguards and environmental protection, particularly with regard to fauna, flora, ecosystems of easily flooded plains, and wetlands; and*
4. *To define the framework and the methods of participation of the users of water…"*[58]

Article 2 of the Water Charter also explicitly expanded upon the list of uses that should receive priority within the basin, including breeding, continental fishing, pisciculture, sylviculture, fauna and flora, hydroelectric energy, water supply of urban and rural populations, health, industry, and the environment. Moreover, Article 4 articulated guiding principles for distribution to ensure that:

55 *Convention Portant Création à la Société de gestion de l'Energie de Manantali* (SOGEM) (the Manantali Convention, 7 January 1997, Dakar, Senegal.

56 UNESCO (2003), *supra* note 2, at p. 457.

57 *Ibid*.

58 2002 Water Charter, *supra* note 10, at Art. 2.

> *"the River's water will guarantee to the populations of the riparian States, the full pleasure of the resource, with respect to the safety of the people and the works, as well as the basic human right to clean water, in the perspective of sustainable development."*

Therefore, while the previous OMVS framework was already based on equitable and reasonable use and cooperation, the 2002 Water Charter added a new element to be considered in the application of these guiding principles – that of the human right to water. Notably, the principles of distribution contained in Article 4 were to apply between uses of water across sectors, rather than between States.[59]

Under the Water Charter, the institutional framework of the OMVS was also enhanced. In particular, the Standing Committee was provided with the following guiding principles for distribution: reasonable and fair use of the river water; preservation of the basin's environment; the obligation to negotiate in cases of water use disagreement or conflict; and the obligation of each Member State to inform the others before undertaking any action that could affect water availability.[60] Representation of local stakeholders was also enhanced through the establishment of participatory institutional structures.[61]

These advances have gone some way towards addressing gaps in the previous legal framework, which hindered the OMVS from sustainable water management in the basin. The OMVS' ability to address climate change comes from the Standing Committee, which reviews data collected by the High Commissioner, strategizes goals, and advises decision-making for the basin.[62] Moreover, by placing higher regard for the environment in decision-making based on scientific data and information,[63] and through enhancement of public participation, the 2002 Water Charter has helped to lay the foundation for regional, national, and local climate change adaptation efforts.

4 Current Mechanisms to Manage Present and Future Climate Variability

Because the OMVS was founded during a period of extreme drought, climate and precipitation variation has always been fundamental to cooperation in the basin.[64] The negotiation and ratification of the 2002 Water Charter sought to create a procedural framework better suited to prioritise uses – including the environment, human consumption and agriculture – in times of scarcity. Most notably, the Water Charter improved the OMVS' procedural framework for decision-making by outlining more elaborated principles of prior notification with regard to significant impacts on waters. Furthermore, the Water Charter articulated non-prioritisation principles of water allocation, except when water shortages necessitate special allocation for drinking water and other domestic uses.[65] Combined with a number of projects that have been pursued by the OMVS in cooperation of the international

59 Vick (2006), *supra* note 22, at p. 235.

60 UNESCO (2003), *supra* note 2, at p. 458.

61 2002 Water Charter, *supra* note 10, at Art. 23. More on public participation is discussed in Section 5.

62 *Ibid*.; OMVS Convention, *supra* note 36, at Art. 13.

63 In 2000, the Directorate of Environmental Observatory for the Senegal River Basin (the Observatory) was established in order for the OMVS to better monitor environmental and hydrological conditions. While not established as part of the 2002 Water Charter, it has still been instrumental in assisting Member States assess potential environmental impacts of new development projects. For more on the Observatory, please *see* Section 6.

64 Encyclopedia Britannica Online (2013). "Sahel (region, Africa)," *available at* http://www.britannica.com.

65 *Ibid*.

community to enhance capacity, this framework places the basin States in a better position to deal with future climate variability.

4.1 Notification regulations in the 2002 Water Charter

The 2002 Water Charter revised the procedural framework governing prior notification between the Member States of the OMVS. Article 4 of the Water Charter explicitly incorporates an obligation of each Member State to inform the others before undertaking any action or project that could have a significant impact on the availability of water.[66] For uses that require construction or operation of installations, or for activities that may present danger to public health or safety, reduce the amount or flow of water, or affect biodiversity or the quality of the aquatic environment, authorisation by the Council of Ministers is required.[67] For projects "likely to have significant effects" in particular, the State concerned has an obligation to notify the High Commissioner "in good time," accompanied by all relevant technical data, including impact assessments.[68] Once the High Commissioner has been notified, the Council of Ministers makes a decision, informed by an opinion provided by the Standing Committee.[69] Other uses and operations are subject to a simple declaration to the High Commissioner. If a State must take unilateral emergency measures in response to floods, natural disasters, or periods of shortages, it must immediately notify the other Member States. Negotiations then take place at the level of the Council of Ministers, informed by the High Commissioner and the Standing Committee.[70]

From the foregoing, it can be implied that projects that may impact waters must undergo a sufficient level of investigation with regard to their social and environmental impacts. While the Water Charter did not explicitly require an Environmental Impact Assessment (EIA) prior to construction or implementation of major works, its mention of relevant impact assessments would suggest that an EIA is required, at least for projects likely to have significant impacts upon the watercourse. Furthermore, the Water Charter requires the OMVS to create an Environmental Action Plan, which is meant to evaluate "water quantity and quality annually in order to alter the distribution of water in times of shortage, to regulate and monitor water use, and to identify and monitor sources of pollution."[71]

Together, these notification and planning requirements can help enable the OMVS to manage multiple and increasing uses of water over time. The enhanced procedural framework set up by the Water Charter can also provide an important tool to reduce the potential for conflict, and maintain a cooperative atmosphere between Member States of the OMVS, particularly with regard to monitoring and assessment of new uses within the basin, as climate variability and other environmental issues become more pronounced.

66 2002 Water Charter, *supra* note 10, at Art. 4.

67 2002 Water Charter, Arts. 10 and 24.

68 2002 Water Charter, Art. 24.

69 2002 Water Charter, Arts. 11, 25 and 26.

70 2002 Water Charter, Arts. 6 and 24.

71 2002 Water Charter, Art. 17.

4.2 Distribution and allocation regulations in the 2002 Water Charter

The 2002 Water Charter also established specific principles and methods for allocating water between different "sectors of use" within the basin. Specifically, Article 5 maintains that the distribution of water between uses should be established through a flexible system based on the OMVS' determination of proportional priorities, once requisite needs are weighed against existing availability of supply. Certain considerations for this determination include, *inter alia*: the potential effects on income and resources of the basin populations; food safety; reduction of poverty; the effects on the production of agriculture, energy, mining, and other industries; the integration of water management and sustainable maintenance of positive ecological conditions; flood risks; and navigability.[72] Determinations should also incorporate integrated management. Furthermore, Article 7 contains a number of social, environmental, and economic principles that should be taken into account in making determinations of how to distribute water between uses.

However, there is an explicit standout exception for human consumption. Under Article 8, the OMVS must aim to satisfy drinking water requirements, particularly for the most vulnerable. Importantly, in times of shortage drinking water and domestic uses are prioritised above other uses.[73] This significant provision institutionalises a safety net to account for lower yields due to variability in the availability of water, in essence prioritising a human right to water. As discussed below, an evolving public participation system within the OMVS has only begun to incorporate local concerns. This practical reality has arguably limited the OMVS' effectiveness in implementing the human right to water, or ensuring equitable allocation of water to more vulnerable and disenfranchised groups. Nevertheless, inclusion of these provisions within the legal framework of the OMVS provides an important procedural basis on which to ensure equitable access to water for human consumption.

5 Stakeholder and Public Participation in the Senegal River Basin

Prior to the 2002 Water Charter, opportunities for stakeholder and public participation and engagement were very limited.[74] A 2001 report summarized the lack of true dialogue and information sharing between the OMVS and the local community, stating that:

> *"the rural communities, [and] the urban communes of the watershed of the Senegal River are not involved in water management and have no information and data at their disposal on the river management..."*[75]

The Water Charter provided a new institutional framework to allow stakeholder and public involvement in the operations and decision-making of the OMVS, and to enhance decentralised water management. Furthermore, a number of cooperative efforts between the OMVS and the international community have helped to enhance local stakeholder engagement with the OMVS. While in practice stakeholder and public participation remains somewhat limited – mainly due to domestic institutional capacity and a lack of opportunities to participate – this framework has provided a basis for enhanced representation and support for local adaptation efforts.

72 2002 Water Charter, Art. 5.

73 2002 Water Charter, Art. 9.

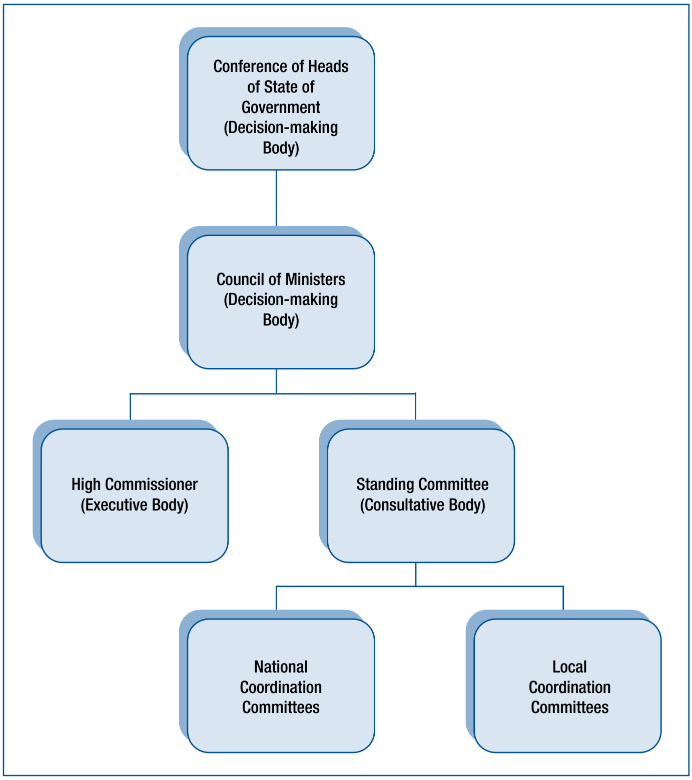
74 Vick (2006), *supra* note 22, at p. 235.

75 Sene, A.M. *et al*. (2007). "Watershed Regulation and Local Action: Analysis of the Senegal River Watershed Management by Regional Organization and Public Participation," *Hydrology and Earth System Sciences Discussions No. 4*, pp.1917-1946, at p. 1925.

5.1 Observer status under the 2002 Water Charter

Under Article 23 of the 2002 Water Charter, certain representative groups are given the right to petition to become observers to the Standing Committee, the central consultative body for decision-making in the basin. Specifically, observer status can be provided to users, local authorities, non-governmental organisations (NGOs), and Boards of Decentralized Management.[76] Observer groups have official status, either as National Coordination Committees (NCCs) or Local Coordination Committees (LCCs), both of which are decentralised from the OMVS Council of Ministers and the High Commission.[77] There are four NCCs – one from each Member State – that represent different users, local authorities, and NGOs, while 28 LCCs each represent a separate district within the basin. Each State's NCC has a Secretariat with permanent staff and equipment provided by the OMVS, while the LCCs have offices and representatives in each of the 28 administrative districts within the basin.[78] The NCCs and the LCCs help foster public participation and increase the interface between the OMVS and the remaining stakeholders in the region.

Figure 2 Organisational Chart for public participation in OMVS



While the creation of an institutional framework for observers formally enhanced stakeholder representation in the basin, a number of factors initially limited its practical significance. First,

76 2002 Water Charter, *supra* note 10, at Art. 23.

77 *Comités Nationaux de Coordination*, and *Comités Locaux de Coordination*, respectively, in French.

78 Vick (2006), *supra* note 22, at p. 235.

observer groups must navigate bureaucratic processes at different levels, including a requirement for approval by the High Commissioner in order to become an Observer.[79] Opportunities for input are also restricted to providing opinions in an advisory capacity to programmes that have already been developed and are being implemented.[80] In addition, members of the Council of Ministers, the main decision-making body of the OMVS, are not elected, and their decisions as a body are not subject to review, creating an accountability gap.[81] The above created a scenario where marginalised voices are the least likely group to navigate the process, even though they are often the most affected by the decisions of the OMVS.

5.2 Capacity building efforts to enhance representation and local management

A number of internationally funded initiatives have focused on enhancing public participation and stakeholder engagement in the basin. In particular, through the Senegal River Basin Water and Environmental Management Project (GEF Project),[82] and the successive Multi-purpose Water Resources Development Project (MWRD Project), donors and other partners have worked with the OMVS to institutionalise stakeholder and public participation within the legal framework of the basin.[83]

The main goals of the GEF Project in particular were to increase public information and awareness, civil society participation, and to link and encourage the scientific community to interact with the OMVS.[84] The GEF project boasts certain achievements, including:

- Regular broadcasting of basin management topics in all four countries;
- Annual newsletters, translated into local dialects;
- 30 OMVS road signs posted at strategic points raising awareness of environmental concerns;
- Webpage improvements for access to the Directorate of Environmental Observatory;
- Informational meetings;
- Setting up LCCs and conducting workshops (local and national) for each water sector and economic sector;
- Dissemination of the Water Charter amongst various stakeholders; and
- 16 signed partnership agreements with universities and research institutions, joint action plan, and establishment of scientific advisory group.[85]

Since 2008, the MWRD Project has continued the work of the GEF Project. The overall vision of the MWRD Project was to:

79 *Ibid*. at p.236.

80 Padt, F.J.G. and Sanchez, J.C. (2013). “Creating New Spaces for Sustainable Management in the Senegal River Basin,” *Natural Resources Journal*, Vol. 53(2), pp. 265-284.

81 *Ibid*.

82 The GEF Project ran from 2003-2008. Ayibotele (2008), *supra* note 34, at p. 9.

83 World Bank and UNDP (2009), *supra* note 7, at p. 13.

84 *Ibid*. at p. 30.

85 *Ibid.*

> *"scale up institutional capacity building for environmental management at regional, national, and local levels, strengthen the regional data and knowledge base, and institutionalize local stakeholder participation in water resources management."*[86]

NGO efforts have also made an important contribution towards improving decentralised management and dialogue between different stakeholders in the basin. One particular IUCN initiative, the Water and Nature Initiative (WANI), focused on knowledge sharing between research institutions, civil society, local communities, and the LCCs. Stakeholders were informed and made aware of the institutional structure of the OMVS, in order to enhance engagement. Importantly, IUCN also worked with LCCs to build bottom-up action plans to implement IWRM principles locally, which were eventually formally approved by the OMVS.[87]

5.3 Remaining challenges

The addition of observer groups has greatly enhanced the transparency of the OMVS, and representation of public and stakeholder concerns. Furthermore, efforts to build capacity of local stakeholders to take management decisions into their own hands should lead to more equitable development, and greater ability for local communities to adapt to environmental changes.

However, a number of practical challenges still remain. The OMVS is still heavily centralised, and while information sharing has been enhanced, there is still limited opportunity for participatory exchanges between local stakeholders and decision-makers within the OMVS. First, the region is comprised of diverse groups, different users with different needs, and multiple activities for the use of water.[88] Furthermore, industry stakeholders tend to be favoured over local or poor urban users. For example, the Senegalese Sugar Company was granted power to regulate the bridge-dam located in Richard Toll according to its water needs without having to take into account the needs of other users in the area.[89] The Company has since dumped refuse into the surrounding lake and river, which has had a significant negative impact on other local users in the form of pollution and reduced fishing and farming.[90]

While challenges still remain, it is worth noting that a lot of work has been done to enhance public participation and local water governance in the basin. With further capacity building of marginalised actors within the Coordinating Committees, and enhancement of rule of law and accountability, the framework for participation created by the 2002 Water Charter has potential to help local communities address pressing water issues related to climate change.

6 Data and Information Management and Communication

Since recognising the need for a stronger focus on informed decision-making and ecosystem approaches to water management, the OMVS has engaged in a number of efforts to enhance capacity to monitor hydrological and ecological conditions in the basin. In 1998, with international assistance the OMVS began implementing the Environmental Impact Mitigation and Monitoring Plan

86 Mcmillan (2013a), *supra* note 6, at p. 13.

87 Padt and Sanchez (2013), *supra* note 80.

88 Sene *et al*. (2007), *supra* note 75, at p. 1929.

89 *Ibid*. at p. 1924.

90 *Ibid*. at p. 1932.

(PASIE), which was designed to address and mitigate social and environmental impacts from the Manantali Dam.[91]

In 2000, the Directorate of Environmental Observatory for the Senegal River Basin (the Observatory) was established to allow the OMVS to better understand environmental impacts of development projects, particularly those related to the two dams.[92] The Observatory also seeks to reduce the vulnerability of Member States to climactic risks affecting the hydrological cycle, and to maintain a coordinated and equitable approach toward management and apportionment.[93] The Observatory seeks to accomplish this through coordinating efforts to monitor various data on environment, hydrology, and human health. Upon collecting information from Member States, it then analyses and disseminates it to other Members for use in decision-making.

6.1 The 2002 Water Charter and subsequent capacity building efforts

At the time the Observatory was established, technological capacity was still insufficient to accurately monitor hydrological conditions in the basin. Starting with the 2002 Water Charter, the OMVS has worked extensively with international partners on the ground to collectively improve the Member States' technological capacities to monitor hydrological and environmental conditions in the basin. Under Article 13 of the Water Charter, the Member States and the High Commissioner are tasked with encouraging the development of programs aimed at educating the public about the rational use of water in the basin. In order to ensure that stakeholders are informed, Article 13 also imposes an obligation to ensure that information relating to the river flow and water quality is made publicly accessible. The Water Charter is somewhat open regarding which types of data and information must be communicated as part of the prior notification process for project proposals, other than for projects that are likely to have significant impacts. Nevertheless, a significant amount of effort has been directed towards improving technological capability of OMVS Member States through restoration of aging early warning systems, and the introduction of newer systems to monitor hydrological conditions.

Subsequent capacity building efforts have helped to improve regular communication and exchange of transboundary information and knowledge in the basin.[94] In particular, the GEF Project resulted in an improved framework that has allowed the OMVS to:

- Base water management and resource planning on accurate information on water and environmental trends from the upstream headwaters until the lower coastal basin;
- Create new partnerships with relevant academic institutions to further ensure scientific accuracy;
- Develop and strengthen multidisciplinary teams at national and regional levels; and

91 Ayibotele (2008), *supra* note 34, at p. 8.

92 Tamsir, N. (2010). "An Observatory for Environment and Sustainable Development Senegal River Basin: A Strategic Tool For Monitoring the Environment and Natural Resources," Presentation, World Water Week, Stockholm at p. 6. As of 2010, the Observatory is now known as the Department of Environment and Sustainable Development (*la Direction de l'Environnement et du Developpement Durable*).

93 *Ibid.*

94 World Bank and UNDP (2009), *supra* note 7, at p. 4.

- Develop a fully completed Transboundary Diagnostic Analysis of the region that was published and widely disseminated that included detailed maps showing broad environmental conditions in the basin.[95]

Additionally, hydrological and meteorological equipment were provided, and gathered data began to be made available through the Observatory's website.[96] In 2004, the Guinean Data Network on Water and Environment was established through collaboration with the Observatory, which focused on institutionalising information exchanges.[97] After Guinea joined the OMVS in 2006, early warning systems were installed and rehabilitated in the upper basin to account for flood threats, and 19 rehabilitated and fully equipped hydrological monitoring stations were set up throughout the basin.[98] Regionally, capacity building among local water managers, the High Commissioner, and the two Dam monitoring organisations, SOGED and SOGEM, included numerous training sessions on the use of multiple types of resources management software.[99]

Building on notions of public accessibility of information in the Water Charter, bimonthly and annual reports of hydrological developments began to be disseminated.[100] Information sharing between stakeholders has improved, as initiatives such as WANI have focused on building knowledge networks to incorporate information from different stakeholders and disciplines. In 2007, a Memorandum of Understanding (MoU) was prepared between members of the scientific community, and since then strategies have been developed on how to conduct integrated studies, and develop an educational programme on transboundary interdependencies.[101]

International support throughout the basin has continued steadily, contributing towards project stability and improvement of adaptive capacity in order to maintain the basin for future generations. While not yet funded, a second phase of the MWRD Project would aid efforts to continue strengthening "institutional knowledge and technical capacity [as well as] strengthening of the legal, institutional, and financial frameworks."[102] These technological advances will be crucial for the region's ability to keep up with changes to the ecosystem created by management of the dams, pollution from irrigation runoff, and climate change.

7 Vulnerability Assessments

In partnership with the international community, the OMVS has developed a sophisticated and progressive set of projects to deal with environmental degradation and poverty within the basin, especially over the past decade. Nevertheless, water issues remain critical, and allocation of limited water between users continues to be a challenge.[103] On-going unsustainable practices caused by short-sighted development projects, slash and burn agriculture techniques, and variability in water

95 *Ibid*. In particular, the Transboundary Diagnostic Analysis, completed in 2006, formed the basis of development for the Strategic Action Plan for the basin.

96 *Ibid*.

97 *Ibid.* at p. 10.

98 Ayibotele (2008), *supra* note 34, at p. 11.

99 World Bank and UNDP (2009), *supra* note 7, at p. 27.

100 *Ibid.*

101 Padt and Sanchez (2013), *supra* note 80.

102 Mcmillan (2013b), *supra* note 13, at p. 3.

103 Oyebande and Odunuga (2010), *supra* note 16, at p. 168.

flows make assessment processes more complex.[104] Additionally, assessments based on climate change predictions continue to be problematic because of the basin's diverse ecosystems, each of which will be impacted differently by climate change.[105] For example, increased rains from the West African Monsoon will be felt most in Senegal and Mauritania, resulting in flash floods and locust infestation.[106] At the same time, increased rains may have a "greening effect" further up the basin.[107] Nevertheless, "even if predictions of a strengthened monsoon prove accurate, rainfall within the basin is likely to remain highly variable both temporally and spatially beyond 2030."[108]

In 2008, the OMVS began work on the Strategic Action Plan to categorise and prioritise environmental problems, all of which anticipate climate change as a root cause or aggravating factor.[109] The Strategic Action Plan also assessed these categories, and created a structured system to prioritise allocation of resources based on degree of need (see Figure 3).

Figure 3 Prioritisation of environmental problems under the Strategic Action Plan[110]

• Deforestation • Erosion/sand invasion • Riverbank degradation (and headwaters) • Soil salinization • Overgrazing • Bush fires • Desertification	***1. Land degradation/ desertification***
• Problems linked to surface water supply • Problems linked to groundwater supply • Water quality: pollution/siltation • Water quality: pollution/mining operations • Change in estuarine hydrodynamics	***2. Low water quality and supply***
• Prevalence waterborne diseases	***3. Prevalance of waterborne diseases***
• Proliferation invasive species	***4. Proliferation of invasive species***
• Degradation of fish fauna • Wetlands degradation	***5. Threats to biodiversity***

104 *Ibid.*

105 *Ibid.* at p. 170.

106 *Ibid.* at p. 165.

107 *Ibid.*

108 *Ibid.*

109 Development of the Strategic Action Plan was part of the first phase of the MWRD Project, funded by the GEF. OMVS (2008), *supra* note 23, at p. 49.

110 *Ibid.* at p. 20.

Subsequently, stakeholders (including local, national, and basin-wide) participated in various meetings and consultations to establish long-term goals.[111] By categorising existing problems, it became easier to establish tailor-made solutions to regional and local climate change impacts. This fact is demonstrated through the formulation of a Long-Term Environmental Quality Objective (LTEQO).[112] Through the LTEQO, vulnerability assessments will be necessary to carry out its five main objectives centered on sustainable restoration of degraded areas.[113]

To assist with the development of future flexible adaptation strategies for the basin, the Strategic Action Plan includes a detailed strategy to improve standards for conducting vulnerability assessments and harmonisation with Water Charter provisions, particularly the requirement of prior notification.[114] Additionally, the Strategic Action Plan seeks to "harmonize the principles and practice of environmental impact studies in the Basin countries and align them with international standards."[115] The Strategic Action Plan also notes ambitions to:

- Establish a baseline for regulating impact studies in the basin countries;
- Organise information seminars on international standards and practices;
- Lead dialogue with the Ministries of Environment of the concerned countries;
- Implement reforms for procedures for impact studies;
- Train professionals in the Ministries of Environment and the OMVS in preparing Terms of Reference and invitations to tender environmental impact studies; and
- Host training seminars for professionals (consultants and scientists) on conducting environmental impact studies.[116]

In parallel to the Strategic Action Plan, the OMVS focused on the development of a regional multi-purpose and multi-sectoral plan called the Comprehensive Senegal River Basin Master Plan (Master Plan). In particular, the Master Plan contains various activities related to preparing vulnerability assessments, a major breakthrough for future OMVS planning.[117] In preparing the Master Plan, the OMVS intended to:

> *"Evaluate and prepare several assessment studies which take into account technical, policy, economic, environmental and social concerns (including health), over the range of potential multi-purpose and multi-sectoral investments in the Basin."*[118]

Furthermore, the Master Plan envisions the development of sub-basin development plans aimed at enhancing decentralised water management in the Member States of the OMVS.[119]

These goals are ambitious, and their success will require significant legal and institutional cooperation among the Member States. Nevertheless, the OMVS and the international community recognise

111 *Ibid*. at p. ii.
112 *Ibid*. at p. 5.
113 *Ibid*.
114 *Ibid.* at p. 54.
115 *Ibid.* at p. 72.
116 *Ibid.*
117 Mcmillan (2013b), *supra* note 13, at p. 2.
118 *Ibid*.
119 *Ibid*.

that the changing conditions of the ecosystem and the hydrological cycle of the basin necessitates certain steps to ensure that future projects that may affect the environment and the basin waters are informed by full EIAs. The OMVS and its international partners have planned a number of additional activities that would continue to "mutually reinforce integrated water resource management and development to improve community livelihoods."[120] Of particular importance is the renewed focus that must be placed on adaptation to climate change and implementation of the Strategic Action Plan, stemming from data and analysis gathered during the assessments that have already been conducted. These activities were expected to begin during May-July, 2013, as part of the second phase of the MWRD Project, although they have not yet received funding.[121]

8 Adaptation Strategies

Over the past decade, the OMVS has been building a foundation for climate change adaptation strategies through multilateral collaboration. However, it is well recognised among the international community that developing countries generally experience more difficulty adapting to climate change for various reasons, including financial constraints, lack of good governance, and a lack of capacity to generate and disseminate necessary technical data for more informed decision making.[122] Indeed, the basin countries are among the 25 most impoverished countries of the world.[123] Nevertheless, the OMVS has been able to secure large amounts of financial and technical support from international donors to help increase capacity to adapt to climate change and to expand sustainable development practices.

For example, as least developed country (LDC) Parties to the United Nations Framework Convention for Climate Change (UNFCCC), OMVS Member States have been able to access funding through the National Adaptation Programmes of Action (NAPA) process. These planning efforts will be incorporated into the OMVS' Strategic Action Plan and other relevant development programs.[124] Moreover, the World Bank is currently funding a study, *"Responding to Climate Change in West Africa"*, which will help develop a strategy and policy framework for adaptation to climate change in the Senegal and Niger River Basins.[125]

The Strategic Action Plan has also laid out a basin-wide roadmap for combating climate change:

> *"First, a forecasting study on the probable progression of climate change in the basin will be conducted by downscaling to the basin level to assess scenarios of climate change using atmospheric circulation models. Based on plausible scenarios for climate changes in the basin, appropriate adaptation measures can be taken that address the size of construction*

120 *Ibid*.

121 *Ibid*.

122 *See* e.g., United Nations Framework Convention on Climate Change (UNFCCC) (2007). *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries*, p. 5. Climate Change Secretariat, UNFCCC: Bonn, Germany.

123 *Ibid.* at p. 13.

124 *Ibid*.

125 *Ibid*. This initiative is currently being led by the IUCN in collaboration with the *Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle* (AGRHYMET), the Global Water Project West Africa (GWP/WA), the Niger Basin Authority (NBA), and the OMVS.

projects and protection of existing ones as well as safety in communities, choices about investments in agriculture and other economic sectors, etc."[126]

To support the implementation of the Strategic Action Plan, project activities have been planned that would:

"Support improved environmental management, identify a series of measures and actions to be aligned with the climate change adaptation strategy of each Member State; improve the data quality on climactic variability, including long-term trends, and the possible future impacts on water resources in the river basin. The project will also support community mobilization and promote adaptation measures to reduce the vulnerability of livelihoods in the river basin."[127]

In addition, with cooperation and support from the international community the OMVS will engage in both top-down and bottom-up mitigation efforts, seeking involvement of local affected communities using traditional methods and those implemented by smaller aid groups.[128] These methods include reforestation, promoting alternative energy, changing agriculture approaches, and other river related mitigation techniques.

Moreover, the OMVS created the Special Initiative on Climate Change with a coordinated effort from the international community to build a framework for all projects in the basin to proceed in a collaborative manner. The Special Initiative on Climate Change has broken the adaptation process down into four components:

- **Component 1 -** Improve the quality of climate information (predicting future climate and its impacts on water resources);
- **Component 2 -** Promote adaptation measures to reduce the vulnerability of production systems for basin communities (while taking into account measures selected by the basin States in their National Communications and NAPAs);
- **Component 3 -** Ensure climate-proofing of hydraulic and hydro-agricultural infrastructure. Adapt technical design standards for structures (dams, levees, irrigation systems and port infrastructure) to climate change conditions; and
- **Component 4 -** Develop capacities of basin actors to obtain carbon funds.[129]

All of the above efforts help pave the way for adaptation strategies using both man-made solutions and ecosystem-based solutions.

8.1 Ecosystem-based Adaptation

The ecosystem approach is not new to the Senegal River Basin. Since the environmental impacts of dam building in the basin became apparent, a number of initiatives have aimed at reversing degradation, as well as adapting to drought and climate variability through restoration and enhancement of ecosystems. In the mid-1990's, there was a particular emphasis on restoring the delta region, where saltwater intrusion had altered ecosystems and disrupted many livelihoods. In particular, Diawling National Park was established in Mauritania, and a Management Plan was

126 *Ibid.* at p. 49.

127 *Ibid.*

128 *Ibid.*

129 *Ibid.* at pp. 50-51.

adopted. Through managed flood releases, efforts focused on, *inter alia*, inundation of pre-existing flood plains, and bringing back important estuary ecosystems to pre-dam functionality.[130] At the community level, projects aimed at local communities focused on rehabilitating natural ponds through the ecosystem approach, and protection of increasingly rare fish species. These efforts have helped to enhance fish stocks, which have led to improved livelihoods. They have also helped contribute to the reappearance of species that had once disappeared, a restored food chain, and creation of natural barriers to erosion.[131]

The ecosystem approach continues to gain momentum in the basin as attention towards climate change adaptation increases. For example, UNDP, GEF, and UNESCO completed a pilot study for implementing effective coping mechanisms for reducing impacts of climate change in costal management.[132] The study has projected increased frequency and intensity of tidal waves, which will exacerbate existing anthropogenic-created erosion and sediment issues in the delta of the basin.[133] Pilot projects have been undertaken to stabilize coastal erosion through rehabilitation of vegetative cover; implementation of soil conservation measures; reintroduction of local plants to protect against coastal erosion; forest management; eco-tourism; mangrove restoration; and development of alternative livelihood strategies.[134] There have also been efforts to reform environmental and fisheries laws in order to incorporate integrated and ecosystem approaches to environmental management, which aim in particular to increase resilience to climate change.[135] Under the second phase of the MWRD Project, efforts would further undertake to control/reduce invasive aquatic plants; restore and protect riverbanks; and protect watersheds using Ecosystem-based Adaptation (EbA) approaches.[136]

9 Conclusion

In contrast to most successful river basin organisations (RBOs), the OMVS is composed of LDCs. The Senegal River Basin is also located in an area that has already experienced extreme periods of drought and poverty. Nevertheless, its cooperative and progressive legal and institutional framework continues to be a model for other RBOs.

In its early stages, the OMVS made a number of poor development decisions by failing to consider negative consequences on local populations or the ecosystem. In retrospect, dams were built with an aim of promoting economic activity and to control nature, but without systematic and holistic approaches. On the other hand, these short-sighted development priorities were common among other countries during that period.

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130 *See* Hamerlynck, O. and Duvail, S. (2003). *The Rehabilitation of the Delta of the Senegal River in Mauritania: Fielding the Ecosystem Approach*. IUCN Wetlands and Water Resources Programme: Gland, Switzerland.

131 GEF (2010). *Experiences from SGP: Protecting International Waters through Climate Resilient and Community-based Actions*, GEF Small Grants Programme, p. 19. UNDP: New York, NY, U.S.A.

132 Kurukulasuriya, P. (n.d.). *Responding to Shoreline Change and its Human Dimension through Integrated Coastal Area Management*. UNDP, GEF, and UNESCO.

133 *Ibid*.

134 *Ibid*.

135 *See* Adaptation Fund (2011). *Adaptation to Coastal Erosion in Vulnerable Areas*, *available at* https://www.adaptation-fund.org/project/1327-adaptation-coastal-erosion-vulnerable-areas. In particular, the Adaptation Fund under the UNFCCC is helping to finance this project.

136 Such efforts would take place under the second phase of the MWRD Project. *Ibid*.

In an effort not to repeat the mistakes of the past, the OMVS and its Member States have embarked on a number of institutional and legal reforms to ensure equity between uses, and that social and environmental considerations are taken into account to achieve sustainable development. Through these and a number of projects pursued with multilateral cooperation, the OMVS has managed to take a number of steps towards adapting to unstoppable climate forces already set in motion. These efforts can point to a number of successes at the local, national, and international level. For example, the basin has seen a 13 percent increase in fish stocks, 4,400 acres of rehabilitated land for agriculture and irrigation use, a return of migrant workers, and significant improvement of local health through preventative measures reducing the rates of parasitic schistosomiasis and malaria.[137] The World Bank estimates that nearly 83 percent of children under five years old now sleep under mosquito nets, and in some areas, anti-parasitic medicine has almost entirely eliminated parasitic schistosomiasis.[138]

These accomplishments are a direct result of informed solution-based planning achieved through local, national, regional, and international coordination. The development of the comprehensive Master Plan and the Strategic Action Plan will be instrumental in allowing the OMVS and its Member States to begin to ensure that environmental considerations are integrated further into decision-making over water management, particular in considering specific issues such as climate change. Through its legal and institutional framework, and continued efforts to enhance pragmatic, holistic and well thought out policies and projects, the OMVS will likely be a leader in climate change adaptation in the region.

137 World Bank, 2013, Transforming Lives in the Senegal River basin. http://www.worldbank.org/en/news/feature/2013/04/03/transforming-lives-in-the-senegal-river-basin.

138 *Ibid*.

Case Study

Incorporating Climate Adaptation into Transboundary Ecosystem Management in the Great Lakes Basin

Victoria Pebbles[1]

1 Introduction

The Great Lakes Basin lies within the United States (U.S.) and Canada and is the largest surface freshwater system in the world, containing nearly 20 percent of the earth's fresh surface water.[2] The basin faces many environmental threats, such as persistent, bioaccumulative, and toxic pollutants; invasive species; aging water and sewer infrastructure; excessive nutrient loading; and habitat degradation and loss. Regional climate change impacts can exacerbate these problems and bring about new challenges, including increase in air and lake surface temperature, seasonal variation, and an increase in extreme precipitation events.[3]

While not without its challenges, the Great Lakes region is endowed with a rich legal and institutional framework that enables governments and non-governmental stakeholders to collaborate in order to meet shared water management and environmental restoration goals – and increasingly, climate adaptation goals.

This case study describes and assesses the progress, challenges, and opportunities associated with incorporating climate adaptation into major legal, policy, and associated institutional transboundary ecosystem management frameworks in the Great Lakes Basin. The Great Lakes Basin provides a useful case study for international audiences because the region boasts a longstanding history of bilateral environmental cooperation; and yet, the challenges associated with climate change are relatively new. An examination of climate change adaptation in the Great Lakes Basin from institutional and governance standpoints can reveal successes to be built on or replicated, and gaps and unmet needs to inform future adaptation efforts. It also creates potential for other regions to learn from successes and mistakes, and thereby build capacity and enhance efficiencies for climate adaptation in other parts of the globe, particularly large bilateral and multilateral freshwater ecosystems.

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2 U.S. Environmental Protection Agency (U.S. EPA) (2012). *Basic Information on the Great Lakes*, *available at* http://www.epa.gov/greatlakes/basicinfo.html.

3 Great Lakes Integrated Sciences and Assessments Center (GLISA) (2012). *Great Lakes Climate Change in the Great Lakes Region* (Video and Fact Sheet), *available at* http://glisa.umich.edu/resources/summary.

2 Ecological and Environmental Context

2.1 Hydrologic, physical and ecological context

The Great Lakes Basin formed about 10,000 years ago at the end of the last ice age as retreating ice sheet scoured the land, creating ridges, valleys and depressions, the largest of which eventually became the Great Lakes. The Great Lakes today include Lake Superior, Lake Huron, Lake Michigan, Lake Erie, and Lake Ontario (see Figure 1).[4] Although part of a single basin, each of the five lakes has its own distinctive traits. The Great Lakes Basin – the watershed that drains into these five lakes and their connecting channels (including Lake St. Clair) – covers 295,000 square miles (76,405,000 hectares). Of that, 94,000 square miles (24,346,000 hectares) is water and 201,000 square miles (52,059,000 hectares) is the surrounding watershed (see light blue on Map 1).[5]

The Great Lakes Basin hydrological system is dominated by precipitation, evaporation, inflows, and outflows. Westerly winds bring humidity from the rest of the continent. Depending of the soil type, precipitation returns to the lakes as tributary base flow from groundwater reservoirs, or as surface runoff.[6] In the intermediate- to long- term (years to millennia), climate and geological processes have driven water level changes.[7]

Map 1 Great Lakes Basin

4 Lakes Michigan and Huron are hydrologically connected and considered by scientists as a single lake basin, but they are managed as separate lakes.

5 U.S. EPA & Environment Canada (1995). *The Great Lakes: An Environmental Atlas and Resource Book*, *available at* www.epa.gov/glnpo/atlas/glat-ch1.html#Understanding%20The%20Lakes.

6 *Ibid*.

7 Booth, R.K., Jackson, S.T. and Thompson, T.A. (2002). "Paleoecology of a Northern Michigan Lake and the Relationship among Climate, Vegetation, and Great Lakes Water Levels," *Quaternary Research*, Vol. 57(1), pp. 120-130, at p. 130.

Generally, the climate of the lakes is colder in the north and warmer in the south, as is the average annual temperature. Lake stratification occurs during the summer months due to water temperature and density fluctuations, whereby the bottom layer stays cool while the well-oxygenated upper layer is readily penetrated by the sun and supports algae production. At the end of autumn a turnover of lake water occurs, leaving the lakes mixed during the winter, an essential process that oxygenates the deep water layer formed during summer months, preventing total anoxia.[8]

Significant portions of indigenous coniferous forests dominate the northern terrain of the basin. However, the highly fertile lands that once supported deciduous forests in the south have been replaced by agricultural and urban landscapes.[9] In particular, Great Lakes coastal areas represent a unique variety of natural community types, including coastal wetlands, islands, alvars, cobble beaches, and sand dunes.[10] Coastal wetlands play a particularly important ecological role, providing nourishment and shelter for waterfowl, small fish, and aquatic mammals. Wetlands also provide ecosystem services such as fish spawning, water storage, and purification.[11]

2.2 Environmental issues and water management

Drastic ecosystem changes began in the nineteenth century with commercial logging and fishing, industrialisation, agricultural intensification, and expanding urbanisation. Major engineering projects also permanently altered the natural hydrology of the Great Lakes Basin. The most famous example is the Chicago Diversion, which takes water from Lake Michigan to serve the Chicago metropolitan area, and discharges it through the Chicago Sanitary and Ship Canal into the Mississippi River Basin. The Welland Canal created a navigable bypass around Niagara Falls (between lakes Erie and Ontario), and the Erie Canal (New York Barge Canal System) was built to provide navigation between the Niagara River and Lake Ontario. Water is also diverted into Lake Superior from the Ogoki River and Long Lac in Ontario, Canada.

By the early twentieth century, the Great Lakes region was a hotbed of industrialisation and manufacturing for the steel, automobile, pulp, paper and chemical industries. Most of these industries grew up on or near the Great Lakes, which provided freshwater needed for industrial processes and a means for transportation. By-products and wastes, notably human sewage and discharges from factories and other businesses, were released directly into the water, land, and air. During the same time, the use of chemical and nutrient support for agriculture also intensified, vastly increasing pollution loadings from the agricultural sector, with little attention to the ecological consequences. Overdevelopment near the water's edge and the construction of dams also altered the basin's hydrology and degraded ecosystem functions. Collectively, these pressures led to widespread habitat fragmentation and destruction, as well as pollution of the basin's land, air, and water. The associated decline and extinction of native species, and the introduction of invasive species, have significantly altered the Great Lakes food web.[12]

8 U.S. EPA & Environment Canada (1995), *supra* note 5.

9 *Ibid*.

10 U.S. EPA & Environment Canada (2009). *State of the Great Lakes 2009 – Highlights*, p. 2, *available at* http://binational.net/solec/sogl2009/sogl_2009_h_en.pdf.

11 Wilcox, D.A. *et al.* (2007). "Lake-level Variability and Water Availability in the Great Lakes," *Environmental Science and Biology Faculty Publications, Paper 25* (The College at Brockport: State University of New York), p. 13, *available at* http://digitalcommons.brockport.edu/env_facpub/25.

12 U.S. EPA & Environment Canada (1995), *supra* note 5.

Nearshore waters, habitats, and coastal processes have been particularly degraded, and despite some restoration efforts, restrictions on nearshore water uses still exist in many parts of the basin (e.g., beach closures, and restrictions on fish and wildlife consumption). Efforts to reduce phosphorus since the 1970's have been positive, but the concentrations are now increasing in some nearshore areas, often leading to nuisance and harmful algae blooms. While the release of targeted toxic chemicals, such as mercury, DDT,[13] and PCBs[14] has decreased over the past 30 years, other substances with unknown human health and ecological effects have emerged, such as flame retardants and pharmaceuticals.[15]

There are more than 36 million people living in the Great Lakes Basin, and more than 26 million of these people rely on the Great Lakes for their drinking water.[16] In addition to industrial uses, Great Lakes water is also used for agriculture (livestock and irrigation), thermo-electric power (fossil fuel and nuclear), and hydroelectric power generation. Hydroelectric power vastly dominates, representing 95 percent of all water uses, but is not considered a water withdrawal because no water is physically removed from the system. Excluding hydropower, thermo-electric power is the largest water user, followed by domestic and municipal, industrial, and agricultural uses.[17] Commercial shipping, recreational boating, and tourism also depend on vast quantities of water, even though these industries do not withdraw any water. Also, many U.S.-based Native American tribes and Canadian First Nations use the Great Lakes and their tributaries for subsistence fishing, hunting, and agricultural activities.[18]

Industrial water use has decreased since the 1980's due to the decline of major manufacturing sectors (i.e., automobile, iron, steel). However, future pressures on water could come from population growth and new water-intensive industrial uses, such as biofuels and oil sands refining.[19]

2.3 Climate change projections, drivers and impacts

Instrumental climate records for the U.S. Midwest show that annual mean temperature, despite inter-annual variability, increased by ≈0.059°C from 1900 to 2010.[20] Over the last 50 to 100 years,

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13 DDT was a manufactured chemical mainly used as a pesticide on agricultural crops. DDT attacks the nervous system, and many animals, such as birds, died as a result of spraying the pesticide on fields and trees. Because of damage to wildlife and the potential harm to human health, DDT was banned in 1972 in the U.S., although the chemical still persists today in soil and water contamination and in the fatty tissues of fish, birds and other animals.

14 PCBs are a class of chemical compounds that are produced by replacing hydrogen atoms in biphenyl with chlorine. PCBs have various industrial applications and are poisonous environmental pollutants, which tend to accumulate in animal tissues. The U.S. banned the manufacture, processing and distribution of PCBs, but they are highly persistent chemicals that continue to present ecological risks today.

15 U.S. EPA & Environment Canada (2009), *supra* note 10.

16 *Ibid*.

17 Pearson, R. (2011). "Representing 2009 Water Use Data," *Annual Report of the Great Lakes Regional Water Use Database, Issue No. 18*, p. 41. Great Lakes Commission: Ann Arbor, MI.

18 U.S. EPA & Environment Canada (1995), *supra* note 5.

19 International Upper Great Lakes Study Board (IUGLS Board) (2012). "Lake Superior Regulation: Addressing Uncertainty in Upper Great Lakes Water Levels," in *Final Report to the International Joint Commission*, p. 24.

20 Andresen, J.A., Hilberg, S. and Kunkel, K.E. (2012). "Historical Climate and Climate Trends in the Midwestern USA," in *U.S. National Climate Assessment Midwest Technical Input Report*, *available at* http://glisa.msu.edu/docs/NCA/MTIT_Historical.pdf.

there has been an overall increase in annual precipitation and frequency of extreme precipitation and temperature.[21] However, the intensification of precipitation and temperature over that period has not been the same across time of day or season. Climate projections for the U.S. Midwest indicate that temperature (both annual and seasonal) will increase for the U.S. Midwest, even though intensity of that warming varies greatly. Future precipitation intensity is projected to increase overall, but these predictions remain highly uncertain.[22]

Climate change drivers and impacts in the Great Lakes region can be described as a cascade of events (illustrated in Figure 1). Changes in precipitation and temperature lead to certain physical effects, which in turn exacerbate existing environmental stressors and can have an impact on human well-being.[23] For example, warmer temperatures have increased the length of the frost-free growing season, and have reduced the duration and quantity of ice cover on the lakes.[24] Water levels are not included since current best evidence suggests that average Great Lakes water levels will stay within historic ranges of variation over the next few decades.[25]

21 Groisman, P.Y. and Easterling, D.R. (1994). "Variability and trends of Precipitation and Snowfall over the United States and Canada," *Journal of Climatology*, Vol. 7(1), pp. 184-205; Kunkel, K.E. *et al*. (2003). "Temporal Variations of Extreme Precipitation Events in the United States: 1895–2000," *Geophysical Research Letters*, Vol. 30, p. 1900; Kunkel, K.E. (2003). "North American Trends in Extreme Precipitation," *Natural Hazards*, Vol. 29, pp. 291-305; Andresen, J.A. (2012). "Historical Climate Trends in Michigan and the Great Lakes Region," in Dietz, T., Birdwell, D. (eds.), *Proceedings of the International Symposium on Climate Change in the Great Lakes Region: Decision making Under Uncertainty*; and DeGaetano, A.T. and Allen, R.J. (2002). "Trends in Twentieth-Century Temperature Extremes across the United States," *Journal of Climate*, Vol. 15, pp. 3188-3205.

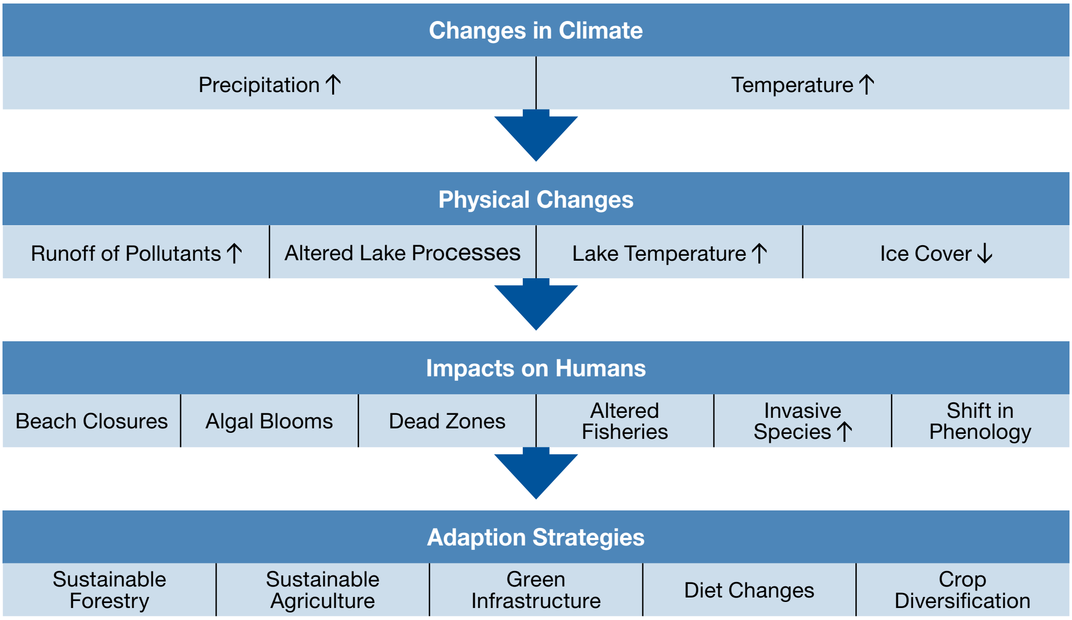
22 Winkler, J.A., Arritt, R.W. and Pryor, S.C. (2012). "Climate Projections in the Midwest: Availability, Interpretation and Synthesis," *White Paper Prepared for the U.S. National Climate Assessment: Midwest Technical Input Report*, p. 3, *available at* http://glisa.msu.edu/docs/NCA/MTIT_Forestry.pdf.

23 Gregg, R.M. *et al.* (2012). *The State of Climate Change Adaptation in the Great Lakes Region*, p. 34. EcoAdapt, Brainbridge Island: Washington D.C.

24 Magnuson, J. *et al.* (2000). "Historical Trends in Lake and River Ice Cover in the Northern Hemisphere," *Science*, Vol. 289, pp. 1743-1746, at p. 1743; and Wang, J. *et al.* (2010). "Severe Ice Cover on Great Lakes During Winter 2008 – 2009," *Eos, Transactions American Geophysical Union*, Vol. 91, pp. 41-42.

25 IUGLS Board (2012), *supra* note 19, at p. vi.

Figure 1 Great Lakes Climate Change Impacts[26]



3 Legal, Policy, and Institutional Framework for Adaptation

The Great Lakes Basin is part of a shared U.S.-Canada boundary that includes the entire 8,900-kilometre (5,500-mile) border stretching from shared waters between the province of British Columbia, Canada, and the U.S. state of Washington, across the continent to the headwaters of the Gulf of Maine.[27] About 43 percent of this boundary area is water.[28] Governance over the waters and related natural resources of the Great Lakes Basin is shared among two federal governments, eight U.S. states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin), two Canadian provinces (Ontario and Quebec), several regional institutions, more than 100 Native American and First Nation authorities, and thousands of local units of government.[29] A broad range of non-governmental entities – including citizen-based environmental organisations, business associations, industry coalitions, and academic institutions – actively engage these institutions to effectuate Great Lakes governance. Neither the U.S. nor Canada is signatory to the 1997 U.N. Convention on the Law of the Non-Navigational Uses of International Watercourses.

Water management in the U.S. and Canada was governed traditionally by riparian rights under common law (originally based on English common law) and associated statutes. Under a riparian

26 Adapted from GLISA (2012), *supra* note 3. *See* also Andresen, Hilberg and Kunke (2012), *supra* note 20; Gregg *et al*. (2012), supra note 23; and Winkler, Arritt and Pryor (2012), *supra* note 22.

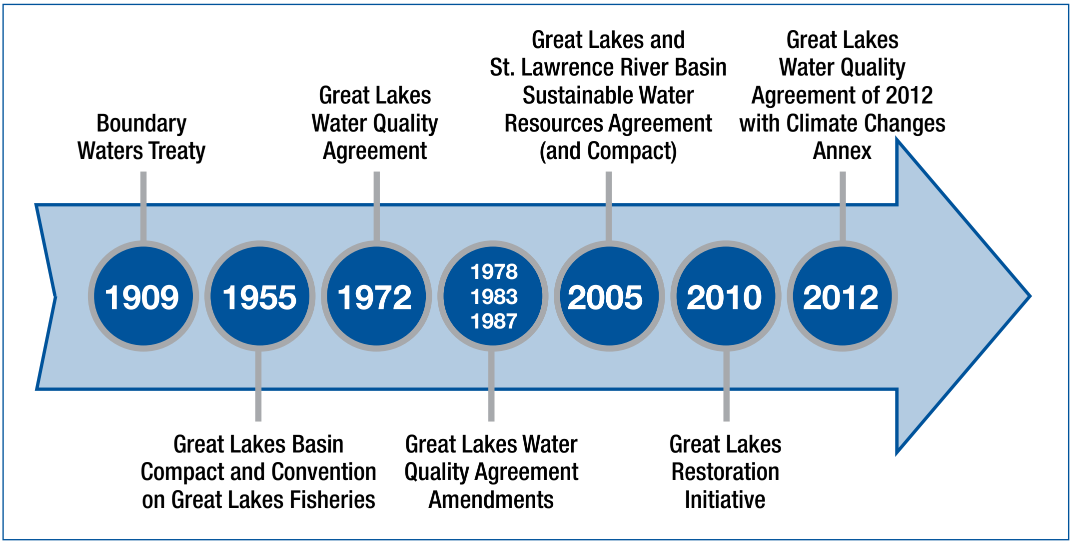
27 The Boundary Waters Treaty also governs management of shared waters between the Alaska (U.S.) and Yukon (Canadian) border.

28 IUGLS Board (2012), *supra* note 19, at p. 4.

29 Hildebrand, L.P., Pebbles, V. and Fraser, D.A. (2002). "Cooperative Ecosystem Management Across the Canada-U.S. Border: Approaches and Experiences of Transboundary Programs in the Gulf of Maine, Great Lakes and Georgia Basin/Puget Sound," *Ocean and Coastal Management*, Vol. 45, pp. 421-445.

rights legal system, water use rights are tied to ownership of (or other legal access to) the land through or under which the water flows. On the U.S. side, adjudication of riparian rights under common law has established a legal "reasonable use" doctrine that obliges water users not to cause harm to other users. Similar principles have been incorporated into statutes on the Canadian side of the basin. The practical effect of this legal regime is that the vast majority of water users in the basin are not regulated.

Figure 2 Great Lakes Governance Timeline



3.1 Binational policies and institutions

Formal transboundary cooperation for water management in the Great Lakes began with the 1909 International Boundary Waters Treaty (see Figure 2) between the U.S. and Canada, which established the International Joint Commission (IJC) to prevent and settle disputes over the boundary waters between the two countries.[30] The IJC also has authority to approve and manage structures that affect levels and flows in the boundary waters, a role that has recently become pivotal in regional discussions about climate adaptation.[31]

The Great Lakes Water Quality Agreement

The IJC's role in the Great Lakes expanded significantly with the 1972 Great Lakes Water Quality Agreement (GLWQA),[32] a bilateral Executive Agreement which heralded a more ecosystem-based

30 *Treaty Between the United States and Great Britain (Canada) and the United States Relating to Boundary Waters and Questions Arising Between the United States and Canada* (1909 International Boundary Waters Treaty), signed June 11, 1909, Art. X. The IJC is comprised of six Commissioners who are appointed by the President of the US and the Prime Minister of Canada (three each).

31 1909 International Boundary Waters Treaty, Arts. IV and VI.

32 *1978 Great Lakes Water Quality Agreement between the United States and Canada*, signed Nov. 22, 1978, Ottawa (as amended Oct.16, 1983, and Nov. 18, 1987), *see* IJC, Treaties and Agreements, www.ijc.org/rel/agree/quality.html.

approach by committing both countries to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes. The GLWQA also established a separate Great Lakes Regional Office of the IJC to coordinate and oversee implementation of the GLWQA. Subsequent amendments to the GLWQA in 1978, 1983, and 1987 further strengthened the ecosystem focus. Although the GLWQA is a bilateral Executive Agreement between the two federal governments, and therefore does not have treaty status, its goals and objectives have been incorporated into federal, state and provincial laws and policies on both sides of the border.[33]

The GLWQA was amended once again in 2012.[34] These latest amendments include a Climate Change Annex, and call for the creation of new multi-stakeholder task forces to provide guidance on implementation of the 2012 amendments, including one for the Climate Change Annex. The 2012 amendments also created a Binational Great Lakes Executive Committee (GLEC) that will include the two lead federal agencies (U.S. Environmental Protection Agency, or EPA, and Environment Canada), the eight U.S. states, and the two Canadian provinces in the Great Lakes Basin. The GLEC will replace an ad-hoc Binational Executive Committee that had been in operation for more than a decade but without formal authority.

IJC Boards and the International Upper Great Lakes Study

In addition to topic-specific task forces, which generally operate for a certain period of time, the IJC also has standing advisory boards and regulatory boards. Great Lakes advisory boards include a permanent Science Advisory Board, a Water Quality Board, and a Council of Research Managers, all of which have representatives from both countries. Despite a sometimes cumbersome bureaucracy, IJC advisory boards and task forces are generally provided with adequate resources, and are empowered to leverage appropriate expertise in order to fulfil their charges.

Additionally, the IJC has three boards of control, which have authority to manage structures that affect levels and flows in the boundary waters for hydropower navigation purposes. These include the Lake Superior Board of Control, the International Niagara Board of Control, and the International St. Lawrence River Board of Control. Lakes Erie, Huron, and Michigan are indirectly controlled through decisions of the Lake Superior and the International Niagara Boards of Control.[35] Historically, this control system has been managed to satisfy shipping and hydropower production needs as priorities over other economic sector or ecological needs – an approach that has been challenged over the past decade.

Of particular importance is the most recent work of the IJC's International Upper Great Lakes Study Board, the *"Lake Superior Regulation: Addressing Uncertainty in Upper Great Lakes Water Levels"* (the IUGLS).[36] The IUGLS was launched by the IJC in 2007 to review the regulation of Lake Superior

33 Hildebrand, Pebbles and Fraser (2002), *supra* note 29.

34 *The Great Lakes Water Quality Protocol of 2012*, signed Sept. 7, 2012, Washington D.C., *available at* http://www.ec.gc.ca/grandslacs-greatlakes/A1C62826-72BE-40DB-A545-65AD6FCEAE92/1094_Canada-USA%20GLWQA%20_e.pdf.

35 Thurber, N.E. (2003). "Water Level Management as an Option for Implementing the Coastal Zone Management Act in the Great Lakes Basin," *Proceedings of the 13th Biennial Coastal Zone Conference*, Baltimore, MD (July 13-17, 2003), *available at* http://www.csc.noaa.gov/cz/CZ03_Proceedings/pdf_files/posters/thurber.pdf.

36 The International Upper Great Lakes Study Board also issued a first report in 2009, *Impacts on Great Lakes Water Levels: St. Clair River*.

outflows and to assess the need for improvements. Initially, the IUGLS was mainly focused on water losses in the St. Clair River, but regional advocacy groups pressed for a broader focus to consider climate impacts, which eventually became a key focus of the study. Even though it covered only four of the five Great Lakes and their connecting channels, the IUGLS is the most significant and comprehensive assessment of climate change impacts on the Great Lakes to date.[37] The methods used as part of the IUGLS, and the strategies it recommended, will be discussed in sections 7 and 8, below.

State-Provincial and Interstate Policies and Institutions

There are several laws, institutions and policies governing transboundary water cooperation at the U.S. state and Canadian province level; these will be described below. Most of the Great Lakes states and provinces also have some type of climate change policies or programmes, but state and provincial adaptation programmes are not universal and they are generally not part of water management policy.[38]

The need for a more robust regional water framework arose in 1999 when a pre-existing regional agreement, known as the Great Lakes Charter, proved inadequate to prevent a single jurisdiction from permitting a bulk water export out of the Great Lakes.[39] In response, the 2005 Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement (Water Resources Agreement), signed by the governors of the eight U.S. Great Lakes states and premiers of the two Canadian Great Lakes provinces, established a common standard within a new water management framework.[40] It is a hallmark regional agreement that allows signatories to implement the terms of the agreement through their own legislation (see Box 1).

Box 1 The Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement

- Bans new diversions of water from the basin, with limited exceptions;
- Sets a consistent standard to review proposed uses "to prevent significant adverse impacts from water withdrawals and losses on the basin ecosystem and its watersheds;"
- Supports collection and sharing of technical data and information;
- Requires assessment of cumulative impacts; and
- Requires establishment of water conservation and efficiency programs

37 The IUGLS did not include the watershed of Lake Ontario or any part of the St. Lawrence River. Other reasons included the desire to consider new scientific information and to consider a broader range of interests. Reflecting the Boundary Waters Treaty of 1909, the 1990 Lake Superior Regulation Plan gives preference to domestic and sanitary water users, navigation, power, and irrigation.

38 Thoman, D., Pebbles, V. and Eddy, S. (2010). "Great Lakes State and Provincial Climate Change Mitigation and Adaptation: Progress, Challenges and Opportunities," *Issue Brief, Issue No. 2,* p. 3. Great Lakes Commission: Ann Arbor, MI.

39 Annin, P. (2006). *Great Lakes Water Wars*, p. 232. Island Press: Washington, D.C.

40 *2005 Great Lakes–St. Lawrence River Basin Sustainable Water Resources Agreement* (2005 Water Resources Agreement), signed Dec. 13, 2005, *available at* www.cglg.org/projects/water/Agreement-Compact.asp.

The Water Resources Agreement established a new institution to coordinate and monitor implementation of that policy: the Great Lakes-St. Lawrence River Water Resources Regional Body (Regional Body). The creation of the Regional Body would seem a logical and necessary step if a rich institutional framework were not already in place, including an existing legally based interstate compact agency, the Great Lakes Commission, whose members include the same ten jurisdictions that are party to the Water Resources Agreement. In 2005, when the Water Resources Agreement was signed, the Great Lakes Commission had been operating for more than 50 years under the authority of the Great Lakes Basin Compact, which established the Great Lakes Commission in 1955 "to promote the orderly, integrated and comprehensive development, use, and conservation of the water resources of the Great Lakes Basin."[41] The Great Lakes Commission's broad mandate and longstanding institutional ties to Canada's Great Lakes provinces was unarguably sufficient to accommodate the new directives established under the Water Resources Agreement of 2005.

The Water Resources Agreement is a non-binding good faith agreement; as such, there are no formal mechanisms in the Agreement itself that can be used to force compliance between the two countries. Nevertheless, enforcement mechanisms have been established within each country. Importantly, at the same time the states and provinces signed the Water Resources Agreement, the eight U.S. governors signed a complementary interstate compact, the Great Lakes-St. Lawrence River Basin Water Resources Compact (Water Resources Compact), which mirrors the requirements of the Water Resources Agreement and provides a legally binding mechanism to ensure compliance among the eight U.S. states that are party to the Water Resources Agreement.[42] On the Canadian side, enforcement mechanisms are built into each province's implementing legislation; either of the provinces could use the Canadian justice system to enforce compliance with their sister province.

Native American Tribes and First Nations are not signatories to the Water Resources Agreement; however, the document sets forth that states and provinces must consult with Tribes and First Nations in their review of water use or diversion proposals. It also calls on the states and provinces to "seek to establish mutually agreed upon mechanisms or processes to facilitate dialogue with, and input from, First Nations and federally recognized tribes."[43]

Notwithstanding the added institutional complexity and risks of redundancy, the Water Resources Agreement responded to the need for a more robust legal and policy framework to manage Great Lakes waters. While it is too soon to tell, if implemented successfully, the Water Resources Agreement (and associated Water Resources Compact) should reduce reliance on individual cases to adjudicate water use conflicts, and enhance capacity for water management to incorporate climate adaptation measures.

Great Lakes Restoration Initiative

A third major policy framework influencing water management and climate adaptation in the Great Lakes region is the U.S.-based Great Lakes Restoration Initiative (GLRI). The GLRI is not a legal

41 *Great Lakes Basin Compact of 1955*, agreed 1955, granted congressional consent in 1968, *available at* www.glc.org/about/.

42 *2005 Great Lakes–St. Lawrence River Basin Water Resources Compact* (2005 Water Resources Compact), signed Dec. 13, 2005, (U.S. Public Law 110–342, (Oct. 3, 2008)). *See* also Hall, N.D. (2010). "Interstate Water Compacts and Climate Change Adaptation," *Environmental and Energy Policy Journal*, Vol. 5(2), pp. 237-324, at p. 290.

43 2005 Water Resources Agreement, *supra* note 40, at Art. 504.

framework, but rather a U.S. federal policy initiative led by the U.S. EPA in coordination with ten other federal agencies. Beginning in 2010, the GLRI has become a formidable force for obtaining federal funds and leveraging, state, sub-regional, local, and private funds to implement a suite of restoration priorities. Climate change was not a core priority in the foundational documents establishing the GLRI, and consequently is not one of the five GLRI focus areas.[44] That said, the GLRI Action Plan, which guides GLRI implementation, mentions the importance of adaptive management, noting that "projected impacts of climate change on the Great Lakes have implications across all focus areas," and that "climate change impacts and the needs of the Great Lakes community to adapt to those impacts will be assessed and addressed by GLRI projects and programs where appropriate."[45]

The GLRI has provided more than USD$3.7 million for climate change projects since its inception, most of which has gone to federal agencies, and only a portion being dedicated to adaptation.[46] Although climate change was more of an afterthought than a fundamental principal of the GLRI, the initiative is the most significant source of U.S. federal funds for climate change adaptation and mitigation across the U.S. side of the Great Lakes Basin to date. Many stakeholders on both sides of the Great Lakes would like to see an initiative similar to the GLRI on the Canadian side of the lakes. However, the political leadership and momentum have not been forthcoming to date.

4 Mechanisms to Deal with Variability/Uncertainty

The institutions described herein have both varying capabilities to deal with the uncertainties associated with climate change. Canadian and U.S. institutions are, by global comparison, relatively stable and effective, with built-in checks and balances. The longstanding history of successful cooperation between the U.S. and Canada on a vast majority of public policy issues has the potential to foster future binational collaboration. History notwithstanding, the impact of political leadership on the ability of these institutions to deal with uncertainties associated with climate change cannot be overstated.

4.1 The IJC

Because much of its work in the Great Lakes involves responding to and advising the two federal governments, the constraints imposed by the political will and bureaucracies of two large countries can result in institutional inertia. For example, the GLWQA is supposed to be reviewed every six years, but after the 1987 amendments, it was not seriously reviewed for nearly 20 years. That being said, IJC studies have been among the most informative and influential. The IJC's IUGLS was the first binational effort to conduct robust assessment of climate change impacts on the Great Lakes (albeit, excluding Lake Ontario Basin) and assess the management alternatives *with a focus on*

44 The principal GLRI foundational document is the 2005 *Strategy to Restore and Protect the Great Lakes (Strategy)*, *available at* http://webcache.googleusercontent.com/search?q=cache:http://www.glrc.us/documents/strategy/GLRC_Strategy.pdf. The five GLRI Action Plan focus areas are: 1) clean up toxics; 2) combat invasive species; 3) prevent polluted runoff to protect nearshore health; 4) restore wetlands and other habitats; and 5) track progress and ensure accountability.

45 GLRI (2010). *Great Lakes Restoration Plan Initiative Action Plan, FY2010–FY2014*, p. 17, *available at* http://yosemite.epa.gov/sab/sabproduct.nsf/fedrgstr_activites/Review%20of%20GLRI%20Action%20Plan?OpenDocument.

46 Other funds have gone toward filling data gaps and improving downscaled regional modelling which are important components to support effective adaptation strategies.

adaptive management (see Figure 4). Although adaptive management (i.e., learning while doing) is different from adaptation (planning and acting in response to known risks), the two are connected; at a minimum, adaptive management provides a pathway to ensure appropriate climate change adaptation measures.

Figure 3 Elements of an Adaptive Management Strategy

Source: Adapted from IUGLS Board, 2012.

The new Climate Change Annex to the GLWQA holds promise for the IJC to play an even greater role in advising the U.S. and Canada on adaptive management. Specifically, the Climate Change Annex calls for the two governments to "use their domestic programs to address climate change impacts to achieve the objectives of [the GLWQA]."[47] Furthermore, the Annex calls for the two countries to develop a coordinated science program that includes developing and improving regional climate models and other analytic tools.[48] The effectiveness of the Climate Change Annex to support adaptation at the binational level will depend on political leadership within the IJC as well as the two individual countries.[49]

4.2 State-provincial institutions

Financial support is a chronic challenge for both the Great Lakes Commission and the Regional

47 Great Lakes Water Quality Protocol of 2012, *supra* note 34, at Annex 9, Section B.

48 Great Lakes Water Quality Protocol of 2012, Annex 9, Section C.

49 Whether the IJC's advice is incorporated into policy and practice in the U.S. and Canada depends, in part, on the extent to which the political leadership in the States consider: a) climate adaptation a priority; and b) the IJC a valuable binational institution to advise on that issue.

Body. When it comes to climate change, however, the Great Lakes Commission has some inherent advantages over the Regional Body in addressing adaptation due to its broader mandate, greater degree of insulation from political influence, more proactive leadership, and entrepreneurial approach to Great Lakes issues. For example, climate variability and climate change are identified as distinct priorities in the Great Lakes Commission's current (and previous) work plan. This enables Great Lakes Commission staff to leverage institutional strengths (information management and outreach, coordination and facilitation, analysis and reporting, and advocacy) and staff expertise to pursue resources and funding to support climate priorities.

The Regional Body could, however, have a significant role in climate adaptation, specifically through guiding implementation of the Water Resources Agreement (and Water Resources Compact), a mandate that requires states and provinces to assess cumulative impacts of water use, withdrawals, and diversions.[50] Indeed, if implemented properly, the cumulative impact assessment process should become the primary mechanism for addressing variability and uncertainty in tributary water availability and flows, and attendant impacts on water and water-dependent resources of the Great Lakes Basin. However, the litmus test for the cumulative impact assessments will likely be within individual states and provinces. The Regional Body, other regional institutions, and watchdog organisations (e.g., environmental non-governmental organisations, or NGOs) should hold states and provinces accountable to ensure that cumulative impact assessments under the Water Resources Agreement are conducted with climate change in mind (e.g., more extreme variations in precipitation, water levels, increased temperatures). Although strict enforcement mechanisms do not exist under the Water Resources Agreement, enforcement could be compelled under the Water Resources Compact, which is legally binding among the states.

4.3 The GLRI Task Force

The GLRI Task Force has showed institutional flexibility by specifically calling for adaptive management in the GLRI Action Plan and with subsequent action to fund climate change activities. Additionally, the U.S. National Oceanic and Atmospheric Administration (NOAA) was specifically identified as the lead agency for climate change under the GLRI early on for two reasons. First, climate change is a gradual process and not universally recognised as legitimate by political leaders in the region, or the public. Second, there has been accentuated political pressure to demonstrate measureable progress in light of the relatively large amounts of GLRI funding that were being provided during a national and global economic crisis.

5 Data and Information Gathering

The GLQWA gives responsibilities to the IJC to share information, determine progress, and advise the U.S. and Canada on science, policy, and action. As noted earlier, the 2012 Climate Change Annex further commits the two nations to develop a coordinated science program that includes developing and improving regional climate models and other analytic tools to better understand climate change impacts.

Numerous entities collect Great Lakes physical, biological, and ecological data that support ecosystem management at every scale across the basin. Key federal research entities include the

50 The first cumulative impact assessments are not due until December 31, 2013.

Great Lakes Environmental Research Laboratory under NOAA; the U.S. Geological Survey Great Lakes Science Center (part of the U.S. Department of the Interior); two research stations under the U.S. EPA; and research arms within Environment Canada, and Fisheries and Oceans Canada. These agencies also own and operate research vessels to collect some of the data. Hydrologic data (including wind, air temperature, water temperature, atmospheric pressure, dew point and wave measurements) are collected at buoy stations owned by many agencies,[51] and are maintained by NOAA's National Data Buoy Center. NOAA and Environment Canada also collect weather data daily in order to create a climate record over time. Additionally, each of the Great Lakes states and provinces collects Great Lakes data as part of their implementation programme.

5.1 Hydraulic and hydrologic data

Prior to 1953, hydraulic and hydrologic data were collected by the U.S. and Canada independently and with little coordination, with different bases and datum planes. Following very high lake levels in 1952, and impending navigation and hydroelectric developments, both U.S. and Canadian federal agencies recognised the need for coordinated data collection. Established in 1953, the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data (CCGLBHHD) advises the federal bodies in charge of collecting and compiling hydraulic and hydrologic data, enabling more effective binational monitoring.[52] The CCGLBHHD also coordinates the residual Great Lakes net basin supply database, one of the two most commonly used water balance methodologies for the Great Lakes. The other principal method for calculating net basin supply is the component method. Both methods and their uncertainties were investigated by the IUGLS. Evaporation data has been identified as a key gap and the IJC has indicated it will continue field observations at numerous locations throughout the basin to gain better evaporation datasets.[53]

5.2 Ecological and biological data

Ecological and biological data are collected by countless governmental organisations, NGOs, academic institutions, and associated researchers. Of note are natural heritage agencies within state and provincial governments that collect data on species and natural communities (i.e., habitats) of concern. Since 1994, the U.S. EPA and Environment Canada have hosted the biennial State of the Lakes Ecosystem Conference (SOLEC) in support of the GLWQA, where basin-wide assessments are released for a series of key physical, biological, and chemical indicators. Relatively formal, but woefully underfunded, this conference has been a primary means for assessing ecological conditions and sharing ecological information across the basin.

5.3 Climate data

Climate data, such as air temperature and precipitation, are collected by numerous regional and

51 NOAA's National Data Buoy Center, NOAA's National Ocean Service, GLERL, Environment Canada, Michigan Technological University, University of Michigan, National Weather Service (Central and Eastern Regions), University of Minnesota, Chicago Park District, NOAA's National Estuarine Research Reserve System.

52 *See* U.S. Army Corps of Engineers (USACE), Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data, *available at* www.lre.usace.army.mil/Missions/GreatLakesInformation/CoordinatingCommittee.aspx.

53 IUGLS Board (2012), *supra* note 19, at p. 41.

national data networks both in the U.S. and Canada. These data are then collated and archived by NOAA's National Climatic Data Center (NCDC), as well as the Regional Climate Centers for the American states bordering the Great Lakes. NCDC is the largest climate data archive in the world and maintains both U.S. data and international data via the Global Observing Systems Information Center.

5.4 Data management, communication and use

There are numerous online, searchable databases that manage and present data on certain topics or particular areas of the Great Lakes Basin. Much more data is housed within individual agencies and organisations – some searchable, and some not. The institutions listed in this case study have been generally willing to share synthesized data and results of reports or analyses that use the data, but raw data sharing faces challenges on many levels. Data management is time and labour intensive, and often only supported for a specific project as opposed to data management as a means in itself. Sharing sensitive data (i.e., specific locations of water intakes, or endangered species) can be overcome by the use of sharing agreements, which allow the data to be shared in a limited way (e.g., for another agency's analysis), but that requires additional time and diligence. Even when data is not sensitive, raw data is often buried in the bowels of multiple agencies and organisations. Furthermore, it is not always managed according to a single protocol, and metadata are often non-existent. U.S. federal protocols exist for managing geospatial data, but numeric and other data still suffer from these broader challenges. Data sharing is recognised as an on-going challenge. Many efforts have been undertaken, and data sharing and coordination across the border and among stakeholders continues to improve.

Physical, climate, biological, ecological, and socio-economic data are used by many governmental agencies, NGOs, and academic researchers for hundreds of ecosystem-based management, climate adaptation and other projects, programmes, and initiatives which are far too many to note here.

6 Stakeholder and Public Participation

Great Lakes Basin stakeholders are as wide and varied as the population therein. The primary governmental stakeholders include: 1) the local or municipal governments (cities, towns and villages); 2) the eight U.S. states and two Canadian provinces bordering the Great Lakes; 3) the national governments of the U.S. and Canada; and 4) a multitude of U.S.-based tribes and Canadian-based First Nations. Industry associations and environmental and citizen-based organisations are also critical stakeholders, and several are highly organised and play key roles in developing and implementing environmental and economic policy in the region. Collaboration among these stakeholders exists at many levels. Each of the Great Lakes policy and climate change initiatives described herein has its own stakeholder and public participation process. While they are described separately, there is considerable coordination among these institutions, and many of the same individuals participate on the boards or committees of regional organisations.

The internet-based Great Lakes Information Network (GLIN) is managed by the Great Lakes Commission, and hosts a popular email listserv, *GLIN-announce*, for subscribers to share information about all things Great Lakes (e.g., news, conferences, meetings, new studies and reports, new policies, and programmes, etc.). *GLIN-announce* has more than 1,500 subscribers from all sectors across the binational Great Lakes Basin, and is widely known and used by regional institutions as a key vehicle for public and stakeholder outreach. Additionally, individual institutions host and manage their own email and mailing lists to communicate with the public about their work and related events.

6.1 The IJC

The International Boundary Waters Treaty of 1909 provides that all interested parties in any proceeding before the IJC be given a "convenient opportunity to be heard."[54] The IJC has provided this opportunity through widely publicised biennial meetings where stakeholders and members of the public are invited to provide comments and feedback. Up until the 1990's, these biennial meetings were the most prominent events for the governments to get feedback on Great Lakes programme implementation. However, these biennial meetings have been complemented by other binational and national Great Lakes forums, including a binational biennial State of the Lakes Ecosystem conference. For the IUGLS, the IJC appointed a specific Public Interest Advisory Group (comprised of diverse stakeholders to advise the IUGLS Board on outreach and communication). This structure has resulted in more than 40 formal meetings, workshops and other opportunities for the Study Board to engage the public. In all, nearly 2,000 people have participated in these events.[55] Of note, the new Climate Change Annex in the 2012 GLWQA could be attributed in large part to extensive stakeholder engagement that was part of the formal GLWQA review process.

6.2 State-provincial institutions

The Water Resources Agreement establishes formal ground rules for public participation, but they are triggered only when there is a specific proposal for water use or diversion.[56] Article 504 of the Agreement provides similar opportunities for engaging Tribes and First Nations in proposals that are undergoing a regional review. The Regional Body meets twice a year. Public comments are invited but are limited to five minutes each, so there is virtually no flexibility for a more open dialogue about broader issues. Informal advisory and technical resource groups comprised of interests outside of state and provincial government have been assembled to provide input to the Regional Body and Compact Council, but their engagement has been more formal than collaborative.

The Great Lakes Commission holds formal meetings twice a year that are widely promoted among its extensive network of official Observers and partners that includes multiple U.S. and Canadian federal agencies, environmental NGOs, and other regional institutions and associations, including one institution from another region: the Helsinki Commission. The Great Lakes Commission's formal Observer programme provides an opportunity for those entities to provide information and feedback to the Great Lakes Commission at every meeting. Any organisation can request to be an Observer to the Great Lakes Commission through a written request. To date, the Commission has received very few stakeholder comments related to climate adaptation, other than updates on work underway by other entities. However, these updates help the Great Lakes Commission to stay abreast of what other entities are doing and help to scope its role in adaptation.

54 1909 International Boundary Waters Treaty, Art. XII.

55 IUGLS Board (2009). "Impacts on Upper Great Lakes Water Levels: St. Clair River," *Final Summary Report to the International Joint Commission*, p. 12.

56 2005 Water Resources Agreement, Arts. 501 and 503.

6.3 The GLRI

Although a tremendous amount of outreach and stakeholder engagement led to the development of the GLRI and its implementing vehicle, the GLRI Five-Year Action Plan, there is no formal public or stakeholder engagement process associated with GLRI implementation. Interested stakeholders and the public can go on the GLRI website and sign up for updates, and stakeholder groups apply for and receive GLRI funding. A coalition of environmental NGOs has been hosting an annual Great Lakes Restoration Conference since 2004 where the GLRI Task Force members, grant recipients, and other stakeholders report on progress toward achieving restoration goals. Members of the public and other stakeholders are welcome at this event, and the format is designed for participants to share information and receive input on the topics discussed. The past three conferences have included "adaptation for restoration" workshops that provide information on climate science and how to integrate it into a GLRI project. However, adaptation should play a larger role at these conferences, since GLRI funding has supported and will continue to support numerous climate change and adaptation projects.

7 Vulnerability Assessments

7.1 Scenarios and models for projecting climate impact

The IJC's IUGLS is the most extensive regional analysis and modelling effort of climate change impacts on water levels in the Great Lakes Basin. Although focused on a specific climate change impacts (i.e., lake levels), the IUGLS engaged in a thorough analysis and associated modelling of past, present and future hydro-climatic conditions, and in-depth analysis of how impacts on lake levels would affect six key stakeholder interests:

1. domestic, municipal and industrial water users;
2. commercial navigation;
3. hydroelectric generation;
4. ecosystems;
5. coastal zones; and
6. recreational boating and tourism.

Considering that the Boundary Waters Treaty gives precedence to domestic and sanitary water uses, navigation, power (hydroelectric), and irrigation, the IUGLS' consideration of additional water users and ecosystem needs – and the specific focus on adaptive management – was a significant and deliberate acknowledgement of the need for a more comprehensive and integrated approach to managing lake levels.

Three types of modelling and analysis were conducted by the IUGLS (see Table 1). First, new observational data was collected, and parameters were refined that were used to test and compare two models to develop a more robust understanding of the water balance of the Great Lakes. Results of this effort indicate that climate change impacts on net basin water supply (including evaporation and precipitation) is not as great as noted in previous studies.[57] Second, paleo-analyses and

57 IUGLS Board (2012), *supra* note 19, at p. 48.

stochastic modelling were used to assess the reliability of historic recorded and estimated data.[58] Third, multiple downscaling runs of Global Climate Models, a Canadian Global Climate Model, and a Coupled Hydrosphere-Atmosphere Research Model (CHARM) were used to assess the plausibility and scope of climate change.[59] Despite these analyses, the study concluded that Great Lakes water levels "remain almost entirely unpredictable more than a month ahead."[60] Nonetheless, the IUGLS hydroclimatic analyses established a new standard to guide future work on the relationship between climate change and Great Lakes water levels.

Table 1 Summary of International Upper Great Lakes Study Modelling and Analysis

Modelling Effort	Model Type or Name	Purpose
Component Method Analyses	Great Lakes Environmental Research Laboratory (GLERL) Model; Modélisation Environnementale – Surface et Hydrologie (MESH) (Environment Canada)	Determine the water balance of the hydrological cycle for each Great Lake
Paleo-analyses and stochastic modelling		Assess the reliability of historic recorded and estimated data; estimate likelihood of extreme lake levels and plausible scenarios
Downscaling	Global Climate Models; Canadian Global Climate Model; Coupled Hydrosphere-Atmosphere Research Model (CHARM) (simulates the atmosphere as well as land and lake surfaces)	Assess the future climate variability and the plausibility and scope of climate change impacts

7.2 Vulnerability assessments

Dozens of vulnerability assessments have been undertaken in the region at many scales, although most of them have been conducted at a sub-regional level (e.g., state level), or have focused on a particular habitat or species.[61] Three major initiatives are highlighted here. First, the IUGLS technical working groups engaged in a type of vulnerability assessment when applying the concept of coping zones to evaluate regulation plan options. Each working group developed performance indicators to identify critical thresholds and coping zones to help assess the vulnerability to water level fluctuations and other forces.[62]

Second, NatureServe has created a Climate Change Vulnerability Index that provides a common methodology for state-level species vulnerability assessments, which has been used in Illinois,

58 *Ibid*. at p. 51.

59 *Ibid*. at p. 55.

60 *Ibid*. at p. 58.

61 Thoman, Pebbles and Eddy (2010), *supra* note 38, at p. 10; and Greg *et al. (2012)*, *supra* note 23, at p. 28.

62 IUGLS Board (2012), *supra* note 19, at p. 20.

Michigan, Minnesota, Ohio, and Wisconsin.[63] They are also developing a Climate Change Vulnerability Index for ecosystems and habitats.

Third, a Midwest regional team (that includes the U.S. portion of the Great Lakes) provides technical input to the U.S. Global Change Research Program for their impact assessments every four years. This work is led by the Great Lakes Integrated Sciences and Assessments Center (GLISA) and the U.S. National Laboratory for Agriculture and the Environment.[64]

8 Adaptation Strategies

There are numerous climate change adaptation projects in the Great Lakes region, ranging from policy and planning initiatives to local efforts on the ground. A 2012 report by EcoAdapt provides a fairly comprehensive description of more than 50 of these case studies.[65]

Several states, provinces, and cities in the basin have developed Climate Action Plans.[66] For example, London (Ontario) is developing a long-term adaptation strategy for the city's infrastructure and floodwater capacities based on an analysis of climate-related impacts to critical facilities, dams, pollution control plants, buildings, roads, and bridges.[67] NGOs such as the U.S.-based National Wildlife Federation (NWF) are also getting involved. The Climate-Smart Restoration Partnership (CSRP), created by NWF in collaboration with NOAA and EcoAdapt, is developing technical guidance and providing training to support the planning and implementation of regional restoration projects that incorporate climate change information. The framework is being piloted at several on-the-ground restoration projects around the Great Lakes.

8.1 The IUGLS

Basin-wide adaptation strategies are being led by the IJC. In spring 2012, shortly after release of the IUGLS, the IJC established an International Great Lakes-St. Lawrence River Adaptive Management Task Team (Task Team) "to develop a detailed Adaptive Management Plan for the Great Lakes–St. Lawrence River Basin," which was completed in May, 2013. The Task Team was charged with evaluating and prioritising adaptive management activities in the Great Lakes and St. Lawrence River system that address future extreme water levels. To reach a basin-wide plan, the Task Team considered IUGLS recommendations and collaborated with another IJC group engaged with Lake Ontario and the St. Lawrence River. Additionally, the Adaptive Management Plan will evaluate the linkages between water quality and quantity, and make recommendations to the IJC regarding a more detailed examination of an overall water quantity and water quality adaptive management strategy for the Great Lakes-St. Lawrence River System. The IJC has correctly reached out to the

63 NatureServe is a non-profit conservation organization whose network of natural heritage programs is a leading source for information about rare and endangered species and threatened ecosystems. NatureServe's international network of biological inventories operates in all 50 U.S. states, Canada, Latin America and the Caribbean.

64 GLISA funds climate research projects that address climate impacts, vulnerabilities and adaptive management and also hosts a Resource Portal that enables researchers and other stakeholders to collaborate to address specific problems related to climate change in the Great Lakes region.

65 Gregg *et al.* (2012), *supra* note 23, at pp. 34-36 and Appendix D.

66 Thoman, Pebbles and Eddy (2010), *supra* note 38, at p. 2.

67 *Ibid*. *See* also Gregg *et al*. (2012), *supra* note 23, at pp. 171-173.

leadership of the Great Lakes Commission, the Regional Body, and more than a dozen additional regional stakeholder groups and institutions to participate on this Task Team.

The Lake Superior Regulation Plan recommended by the IUGLS, and adopted by the IJC in April, 2013, is the basin's first transboundary water management activity that deliberately acknowledges climate change impacts, however uncertain, and the associated need for regulating Lake Superior outflows in a way that maximizes environmental, economic, and riparian community benefits in light of those uncertainties.[68] Because the IJC Lake Superior Board of Control has direct authority to manage Lake Superior outflows, and receives funding to implement this authority, implementation is likely to be uncomplicated. However, implementation of more comprehensive adaptation efforts across the basin that may come out of the Task Team will likely face greater challenges. Participation on the Task Team is voluntary and funding for implementation of the basin-wide plan is extremely limited. Instead, it is anticipated that existing institutions will volunteer to implement parts of the plan. This purely voluntary, additive approach will likely face challenges when it comes to implementation, because the region's agencies and organisations already have numerous competing priorities that are unfunded or underfunded. Implementation is more probable among those agencies and organisations with programmes that are well funded and/or that align with the recommendations of the Task Team (e.g., they already have a climate adaptation priority). Political and institutional leadership to coordinate implementation regionally, secure appropriate financial resources, and support capacity (e.g., staff) among diverse regional institutions will be critical to long-term success.

9 Conclusion

Transboundary agreements in the Great Lakes Basin have only begun recently to address the way riparian jurisdictions (i.e., the Great Lakes states and provinces) will adapt to altered lake conditions and associated impacts of climate change. The region has a rich history of transboundary ecosystem cooperation that can be readily leveraged to advance climate adaptation, but much remains to be done.

The IJC's IUGLS established a new standard to guide future work on the relationship between climate change and Great Lakes water levels, and pioneered a new level of climate change dialogue that engages a broad group of stakeholders. Nonetheless, the study left many in the region puzzled by the overriding conclusion that Great Lakes water levels remain "almost entirely unpredictable" in the medium- to long-term.[69] Moving inland, several local efforts have examined climate change impacts on tributary flows and functions, and related adaptation measures. However the way riparian states and provinces will adapt to altered flow timing and availability remains largely uncharted at the basin level. If implemented effectively, the Water Resources Agreement (and associated Water Resources Compact) should provide an overarching framework for assessing climate impacts on water flows and water availability in tributaries as well as attendant impacts on riparian and ecological functions. It should also provide a framework for the states and provinces, and the communities therein, to develop appropriate measures to adapt to altered timing and availability of flows.[70]

68 In furtherance of its adoption of the Regulation Plan, the IJC is currently updating its Order of approval and preparing for implementation.

69 IUGLS Board (2012), *supra* note 19, at p. 58.

70 Cooley H. and Gleick, P.H. (2011). "Climate-proofing Transboundary Water Agreements," *Hydrological Sciences Journal*, Vol. 56(4), pp. 711-718, at 714.

Political leadership is needed to effectuate the work of transboundary institutions, and to catalyse the region to more fully embrace climate adaptation as a priority — especially in a region where those institutions are largely advisory. A predominant political climate on the U.S. side of the basin that is focused on restoring ecological functions will need to adapt in order to more fully embrace the risks and uncertainties associated with climate change. Leadership coming from cities on both sides of the border could provide an impetus for the states, provinces, and both national governments. With appropriate and decisive political leadership, Great Lakes transboundary governance institutions can accelerate adaptation efforts to minimise impacts of climate change and build resiliency to adapt to changing conditions.

Case Study

Up-scaling Adaptation in the Sixaola River Basin

Mario Peña Chacón and Marta Pérez de Madrid[1]

1 Introduction

The Sixaola River is shared between the Republic of Costa Rica and the Republic of Panama. It is located in the area of confluence between the Costa Rican South Caribbean and the Panamanian North Caribbean. While relatively small, it is home to a number of small communities and indigenous peoples that rely heavily on nature for their livelihoods. It is also globally significant in terms of its rich biodiversity.

Communities living within the Sixaola River Basin are highly vulnerable to the effects of climate change. Some of these vulnerabilities are due to increasing environmental degradation caused by high impact human activities, such as deforestation for agriculture. Furthermore, the Sixaola River Basin experiences a number of governance challenges. First, a strong agro-industry has created great power asymmetries, marginalising vulnerable groups such as indigenous and local communities, while large transnational banana companies remain dominant actors in the basin. Another challenge has been the development of binational cooperation between Costa Rica and Panama.

For these reasons, the Climate Change Governance Capacity: Building regionally- and nationally-tailored ecosystem-based adaptation in Mesoamerica Project[2] has supported a number of adaptation efforts in the Sixaola River Basin that are currently underway. These actions, which have been performed throughout the basin, have focused in particular on enhancing participatory water governance, ecosystem-based adaptation (EbA) strategies, and improving resilient livelihoods.

While at a relatively early stage of development, a number of measures have already been put in place to support Integrated Water Resource Management (IWRM) principles, particularly through enhancement of the institutional framework governing the basin, and the creation of mechanisms for local and participatory water governance. Furthermore, EbA is being carried out and tested the Yorkín micro-basin, in the Bri Bri indigenous territory,[3] and in the flood plain of the lower Sixaola River Basin. At the very least, these cooperative efforts offer huge potential for transboundary adaptation efforts in the Sixaola River Basin, and serve as a positive example for adaptation planning in other shared basins in Central America.

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1 Mario Peña Chachón, Member of the IUCN World Commission on Environmental Law; and Marta Pérez de Madrid, Regional Officer, International Union for Conservation of Nature (IUCN).

2 The project is being led by IUCN, with the support of the International Climate Initiative by the German Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU). This project complements the objectives of another IUCN project in the basin called Building River Dialogue and Governance (BRIDGE).

3 The BriBri are an indigenous people that live in various areas in the mountains of southern Costa Rica and northern Peru. The Bribri still largely maintain its own culture lifestyle, and is quite removed from public life.

2 Ecological and Environmental Context

2.1 Hydrologic, physical, and ecological context

The Sixaola River Basin extends from the Talamanca mountain range in Costa Rica and the central mountain range in Panama to the Caribbean coast. The drainage area of the basin is 2,848 square kilometres, 81 percent of which is located in Costa Rica, with 19 percent being located in Panama. The entire basin is composed of three sections, identified as high (204,000 hectares), middle (51,000 hectares), and low (34,000 hectares). The Sixaola River also has five tributaries: the Yorkín, the Uren, the Lari, the Coen, and the Telire.[4]

Temperatures vary throughout the year between 21°C to 30.8°C, and average rainfall is approximately 3,000-5,000 millimetres per year. In total, it rains approximately 200 days per year, with May and December being the most wet (receiving 11 percent and 13 percent of annual rainfall, respectively).

The Sixaola River's most unique feature is the wide alluvial valley, which forms at the confluence of the Sixaola and its tributaries, and spans up to 10 kilometres wide.

The Sixaola River Basin delivers major environmental functions including sediments that provide rich soils for agriculture, filtration, water storage, aquifer recharge, energy dissipation, and habitat for vast biodiversity. Forest cover in the basin, which is composed mainly of secondary forest and some primary forest, protects the fragile soil of the mountain areas. Together, the forest and soil regulate impacts of storms, acting as a sponge against heavy rain, and reducing impacts of sudden floods and landslides. Forest cover also retains and stabilises steep slopes and highland areas during earthquakes. In conjunction with indigenous agro-forestry systems, forests capture a considerable amount of carbon every year, which contributes to climate change mitigation.[5]

Finally, the natural beauty associated with the rich diversity of ecosystems contributes to cultural values represented in the basin, and to a thriving tourism industry.[6] The Talamanca mountain range, which comprises much of the Sixaola River Basin in Costa Rica, covers eight of the twelve "life zones"[7]

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4 Durán, L. R. and Majano, A.M. (2011). *Estado Actual del Marco de Adaptación al Cambio Climático a Través de la Gestión de los Recursos Hídricos en Mesoamérica [Current state of the Framework for the Adaptation to Climate Change through Water Resources Management in Mesoamerica]; See* also Inter-American Development Bank (IDB) (2003). *Estrategia de Desarrollo Sostenible de la Cuenca Binacional del Río Sixaola*. IDB: Washington, D.C., U.S.A, *available at* http://documentos.mideplan.go.cr/alfresco/d/d/workspace/SpacesStore/9c2f3f25-52f6-4dc1-876d-9c1b0c2f87cd/ESTRATEGIA%20DE%20DESARROLLO%20SOSTENIBLE-SIXAOLA,%202004.pdf.

5 Carbon sequestration may vary depending on the type of forest, and land use, among other things. *See* Polzot, C. (2004). *Carbon Storage in Coffee Agroecosystems of Southern Costa Rica: Potential Applications for the Clean Development Mechanism*, Master's Thesis. Faculty of Environmental Studies: York University, Ontario, Canada.

6 Durán and Majano (2011), *supra* note 4.

7 The *life zones system* is a global classification of the world according to climatic conditions; each life zone comprise a definite range climatic conditions and it consists of a group of associations (or communities), where there is uniformity of climatic, edaphic and atmospheric conditions which determines a set of plant and animal life. Holdridge, L.R. (1967). *Life Zone Ecology*. Tropical Science Center: San Jose, Costa Rica.

that exist in the country.[8] Altogether, Talamanca contains two percent of the entire biodiversity on the planet, hosting around 100 reptiles and around 60 species of migratory birds.[9]

Most of the Sixaola River Basin could be considered as being in good conservation condition. Of the entire area of the basin, 83 percent (235,790 hectares) is protected.[10] Specifically, protected areas include the Chirripó National Park, the Hitoy Cerere Biological Reserve, and the Gandoca-Manzanillo National Wildlife Refuge in Costa Rica; and the San San-Pond Sack Wetland (RAMSAR wetland), and the Palo Seco Protected Forest in Panama. Furthermore, the La Amistad International Park holds the status as a binational conservation area, a Biosphere Reserve (since 1982), and a World Heritage Site (since 1983).

2.2 Environmental issues and water management

As of 2010, the total population of the Sixaola River Basin was around 34,000 people, of which 58 percent reside in the Costa Rican *cantón* of Talamanca, and 42 percent in the *corregimiento* of Guabito, in the Panamanian district of Changuinola.[11]

The Sixaola River Basin contains a number of recognised indigenous territories (112,789 hectares). In particular, six indigenous territories act as buffer zones for protected wild areas that contain vast extensions of forest and high levels of biodiversity.[12] These six territories constitute an area of 1,128 square kilometres, equivalent to 39.5 percent of the basin's territory.[13]

In terms of economic activity, people rely on agriculture and trade. The lower section of the Sixaola is dominated by large banana plantations managed by transnational companies, and cooperatives and small growers also produce plantains and bananas.[14] This activity has been made possible by the transport of rich sediments from upper portions of the basin, which are then deposited in the area. While some growers produce their crops through traditional and organic means, others – particularly those developed by transnational companies – rely heavily on chemical pesticides and fertilizers.

In indigenous territories located in the middle and upper sections of the basin, land is mainly dedicated to the production of organic cacao, subsistence agriculture, and organic bananas, which are characteristic of the tropical wet forest.

The Sixaola is also used for navigation. River transportation is necessary not only for transporting goods to markets, but also for transporting people between different segments of the basin.

8 Rojas, N. (2011). *Cuenca del Río Sixaola. Estudio de Cuencas Hidrográficas de Costa Rica* [Sixaola River Basin: Costa Rica's Watersheds Study]. Instituto Meteorólgico Nacional (IMN): San Jose, Costa Rica.

9 Ministerio del Ambiente y Telecomunicaciones (2012). *Plan de Manejo Parque Internacional La Amistad Talamanca [Management Plan of the International Park La Amistad – Talamanca]* (MINAET, Sistema Nacional de Áreas de Conservación, ACLAP y Comisión Nacional del PILA).

10 Durán and Majano (2011), *supra* note 4.

11 *Ibid*. *Cantones* in Costa Rica, as well as corregimientos in Panama are known locally as municipalities.

12 In Costa Rica: Talamanca's Bribri and Cabécar, Keköldi's Bribri and Telire's Cabécar are legally constituted as Reserves; and in Panama: Bribri and Naso-Teribe are not legally constituted as *Comarcas* (shires).

13 Durán and Majano (2011), *supra* note 4.

14 UNESCO International Hydrological Program: Hydrology for the Environment, Life and Policy (HELP) (2011). *Proceedings from the Second International Symposium on Building Knowledge Bridges for a Sustainable Water Future*, 21-24 November 2011. Panama Canal Authority and UNESCO: Panama City, Panama.

In addition, the river is used as a source of drinking water among the inhabitants of the basin. Rural aqueducts divert water to cover the needs of some communities, while others that do not have access to aqueducts take water directly from the bodies that constitute the basin.[15]

One of the most significant problems in the basin relates to poor water quality, which is directly related to the use of chemical pesticides and consequential environmental degradation. Capacity to deal with this issue is limited due to inadequate management and treatment at the source, and poor management in storage tanks. In the lower Sixaola floodplain, damage is also a result of deforestation and chemical inputs, which have degraded ecosystems that have traditionally provided water filtration services. These deficiencies have resulted in a number of public health issues – particularly increased infant mortality rates, and diarrheal and skin diseases.[16]

2.3 Climate change scenarios and impacts

Currently, climatic threats (extreme events) relate mainly to heavy rains, and to a lesser extent, periods of severe drought. In the past, rains have caused severe floods and have damaged the livelihoods of communities and resources, the most recent occurring as recently as 2005 and 2008. Climate change scenarios that have been conducted for the region match with the testimony of its inhabitants, for whom rains as well as droughts have increased in intensity, and climate variability has and will become more unpredictable.

The socio-economic impacts caused by these phenomena are likely to vary depending on the associated ecosystems and the livelihoods of the communities.[17] In 2011, the National Meteorological Institute of Costa Rica (MINAE) assessed the vulnerability of Costa Rica's water systems to climate change. It was measured using 14 different social, economic, and environmental indicators, which looked at infrastructure,[18] services,[19] and human condition.[20] Through the assessment, Talamanca´s water system was determined to be one of the most vulnerable *cantones* in Costa Rica to climate change. This was mainly due to low scores in categories of infrastructural and human conditions.[21]

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15 Sanabria, A. (2010). "La Cuenca Binacional del Río Sixaola" [The Sixaola River Binational Basin], in *Construyendo Caminos de Conocimiento para un Futuro con Sostenibilidad Hídrica* [Building Knowledge Paths for a Future with Hydric Sustainability]. UNESCO, International Hydrological Program, *available at* http://www.cich.org/publicaciones/Memoria-HELP-2011.pdf.

16 *Ibid*.

17 Amoroso, A. (2011). *Medidas de Adaptación al Cambio Climático en la Cuenca Binacional del Río Sixaola: Construyendo Capacidad de Gobernanza Desde el Nivel Local al Nacional y Regional* [*Measures for the Adaptation to Climate Change in the Sixaola River Binational Basin: Building Governance Capacity from the local to the National and Regional Levels*].

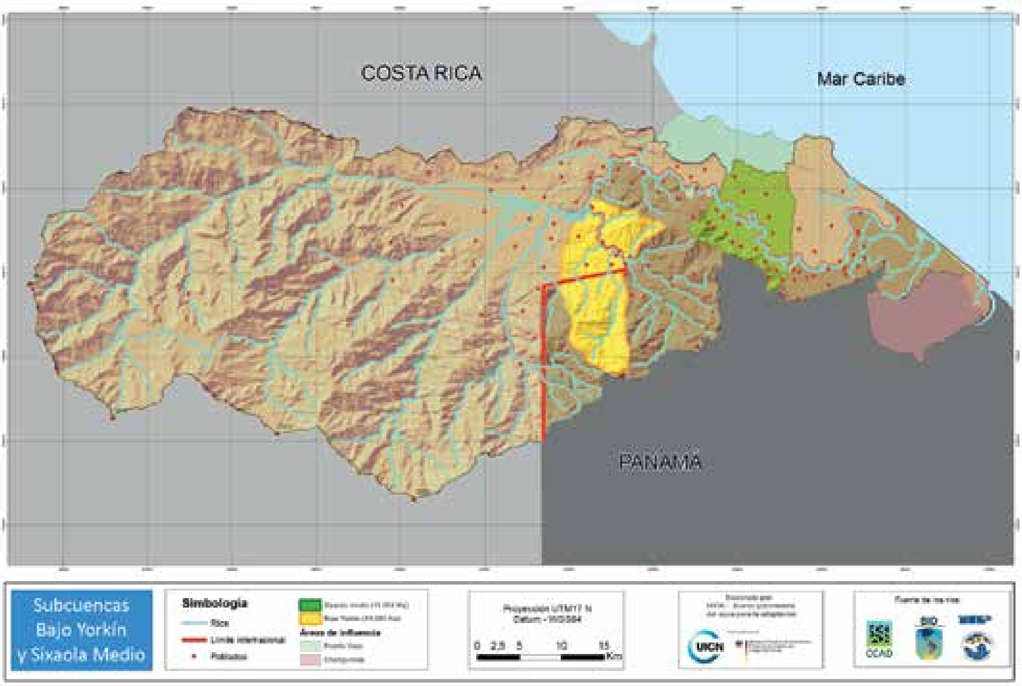
18 The following indicators were used to characterise infrastructure: 1) homes in bad conditions; 2) homes without aqueduct; 3) homes with septic tank; and 4) road infrastructure.

19 The following indicators were used to characterise services: 1) homes without electricity; 2) inhabitants per local health centre; 3) water availability per capita; 4) territory without protected area; and 5) water consumption by the agricultural and livestock sector.

20 The following indicators were used to characterise human conditions: 1) dependent population; 2) population with disabilities; 3) development human index; 4) unsatisfied basic needs; and 5) deaths due to IRAS. The integrated vulnerability index indicated medium-high vulnerability (or 4 in a 5 scale where 5 is the maximum).

21 MINAE/IMN, UNDP (2012). *Análisis de Vulnerabilidad del Sector de Recursos Hídricos. [Climate Change Risk Assessment of the Water Sector in Costa Rica]*.

Map 1 Map of the Binational Sixaola River Basin[22]



3 Legal, Policy, and Institutional Framework for Adaptation

Governance in the Sixaola River Basin is shared between the governments of Costa Rica and Panama, the *canton* of Talamanca in Costa Rica, and the *corregimiento* of Changuinola in Panama. In order to improve governance around the binational border zone, in 1992 Costa Rica and Panama entered into the Treaty between the government of the Republic of Costa Rica and the Government of the Republic of Panama regarding cooperation for border development (the Borders Treaty).[23] The Borders Treaty seeks to widen, deepen, and improve cooperation between the two countries' shared "border zones"[24] in a number of different areas, particularly social, economic, commercial, environmental, and political spheres around the border region, and to strengthen integration between the two nations. Specifically, the Treaty covers the following areas: agriculture and farming; public roads and transportation (infrastructure); health; natural resources (environment); municipalities;

22 Designed by Eduardo Rodríguez, on the basis of information provided by the Mesoamerican Information System (*Sistema de Información Ambiental Mesoamericano*, SIAM).

23 Signed 3 May 1992, ratified 10 July 1995. Law No. 17518 of the 10 of July, 1995, in force from 24 July 1995, and published in the La Gazette No. 140, 24 July 1995, San Jose Costa Rica.

24 The Borders Treaty defines "bordering zone" as the territorial areas adjacent to both countries, for which programs, projects, joint or coordinated activities shall be adopted and executed, in order to widen, improve and deepen their cooperation relations in all fields, and to strengthen the integration process between them. In the Republic of Costa Rica, this includes the *cantones* of Talamanca, Corredores, Coto Brus, and Golfito; and in Panama it includes the *corregimientos* of Changuinola, Barú, Renacimiento, and Bugaba.

agriculture; education; tourism; planning; integrated rural development; and other areas as agreed by the Parties.

The Borders Treaty also established a framework for institutionalised cooperation between Costa Rica and Panama. While existing on paper, this framework was largely unused between the two countries during its first years of existence. Nevertheless, increasing threats from climate and other environmental changes, and development challenges in the border region, have provided further impetus to strengthen these cooperative governance mechanisms. Through a number of projects and initiatives, institutional bodies such as the Binational Commission of the Sixaola River Basin (BCSRB) have begun to address capacity and governance issues, and look for ways to cooperatively adapt to climate change.

3.1 Binational policies and institutional structure

Costa Rica and Panama are enabled to jointly execute programmes, projects, investment activities, and provide technical assistance under the Borders Treaty through a number of different institutional mechanisms (see Figure 2).

According to Article 2 of the Borders Treaty, final decision making authority is reserved to each State's Ministry of Planning, who are also the overall responsible entities for general coordination, follow up, and evaluation of programmes, projects and activities developed under the Treaty. Also, according to Article 3, programmes projects, and activities executed in the territory will be defined and specified through execution of plans subscribed by the Ministry of Foreign Affairs and Planning of both countries. Formal decision making under the Treaty may be done through the use of an "exchange of diplomatic notes" mechanism, also referred to as "minutes".[25] If the Parties wish to act in other areas not covered explicitly by the Treaty, they may do so through the exchange of diplomatic notes.

In order to facilitate implementation of programmes, projects, or activities under the Treaty, the following institutions were created:

a) The Permanent Binational Commission (PBC);

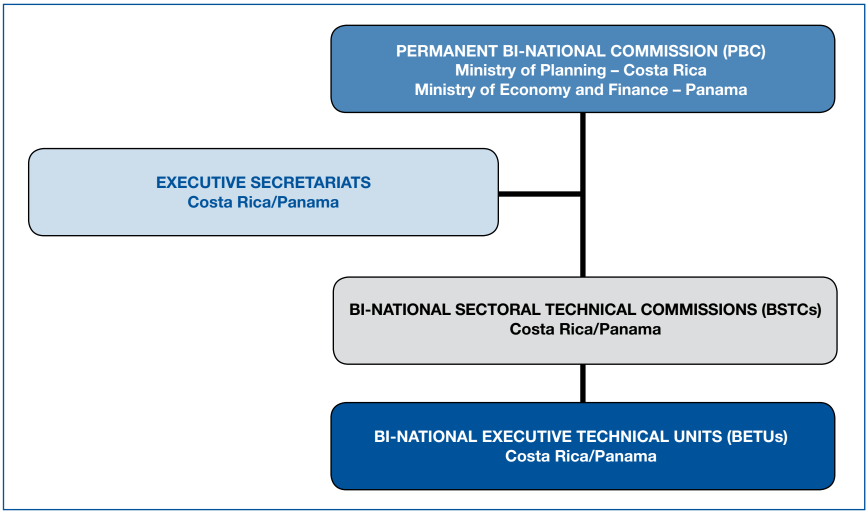
b) The Executive Secretariats (one for each country);

c) Ordinary and Special Binational Sectorial Technical Commissions (BSTCs); and

d) Binational Executive Technical Units (BETUs).

25 Borders Treaty, *supra* note 22, at Art. 4.

Figure 1 Basic Structure of the Borders Treaty[26]



The Permanent Binational Commission

The Permanent Binational Commission (PBC) is the overarching decision-making body under the Borders Treaty, with legal capacity to act in the name of both countries in their respective territories in the areas and matters of its competence. It is subject to the national laws of both Costa Rica and Panama.

The PBC is composed of representatives from institutions involved in border zone programmes, projects, and activities under the Treaty; and representatives from bordering provincial governments, including: the governments Bocas del Toro and Chiriquí in Panama, the mayor of Talamanca, and the three mayors of the border *municipios* in the province of Puntarenas in Costa Rica.[27] The PBC is presided over by the Planning Ministers of each State (the Ministry of National Planning and Economic Policy in Costa Rica, and the Ministry of Economy and Finances in Panama), which act as Presidents of the PBC. Decisions taken by the PBC are officially communicated through the diplomatic exchange of notes.

The Executive Secretariats

The Executive Secretariats are auxiliary bodies intended to support and monitor implementation of decisions made by the PBC in each State. In this regard, the Executive Secretariats may make decisions necessary to coordinate and comply with the Borders Treaty. In presiding over the PBC, the Ministers of Panama and Costa Rica have the authority to delegate representation within the PBC to their corresponding Executive Secretariat. Furthermore, when expressly provide by the PBC, the Executive Secretariats shall be considered the legal representatives in all aspects of the Treaty.

26 Executive Secretariats to the Borders Treaty (2012). Copy on file with author.

27 Borders Treaty, *supra* note 22, at Annex I.

The Binational Sectoral Technical Commissions

Cooperative technical assistance for jointly executed programmes, projects, and investment activities under the Treaty is provided through a number of Binational Sectoral Technical Commissions (BSTCs). Established through the exchange of diplomatic notes, there is a BSTC for each programme dealt with under the Treaty.[28] The BSTCs' functions and activities are coordinated and facilitated by the PBC through the adoption of decisions, either directly or via the Executive Secretariats.

The PBC also has the authority to create "special" BSTCs for areas or issues not foreseen by the Borders Treaty, as long as the Presidents of the PBC endorse the decision.[29] These decisions can also be made through the use of diplomatic notes. Special BSTCs were provided for due to the Parties' foresight that the original Borders Treaty might need to evolve over time. This was instrumental in allowing the creation of a special BSTC, the Binational Commission of the Sixaola River Basin (BCSRB),[30] to deal with river basin water management. This platform discusses climate change and adaptation for the communities of the basin, and it is building its capacities to take the lead on future adaptation processes in the territory.

Along with the BCSRB, the two other special BSTCs that have been created are: the Security and Migration Binational Technical Commission, and the Binational Executor Technical Unit for the La Amistad International Park (BETU-LAPI).

Both original and special BSTCs and are governed by the Borders Treaty and its Annex. Each BSTC is overseen by relevant State Ministries in charge of that sector, and a sector representative. The rest of the BSTC's representatives are made up of institutional delegates that make up the respective sector, local government representatives, and relevant civil society organisations.

Binational Executive Technical Units

Each BSTC has a Binational Executive Technical Unit (BETU) that is in charge of executing and monitoring the programmes. The BETUs are designated by the PBC, one for each programme or project carried out in the border zone.[31] To achieve this, each BETU's particular conditions are established according to the programme or project's needs, and to the area where it takes place. Their functions terminate at the end of the programme or project for which they were constituted. BETUs are authorised to develop an Annual Operative Plan (AOP) for their particular programmes, plans, or activities, which are then approved by the BSTC.[32] BETUs may also provide for participation of people, institutions, companies, organisations, or consortiums in the execution of each programme or project, as defined by the BSTC.

28 This means that there is BSTC for: threat and risk; natural resources (environment); tourism; public roads and transportation (infrastructure); agriculture and farming; health; education; social development; inter-municipal issues; customs and migratory issues; and energy.

29 Borders Treaty, *supra* note 22, at Annex I.

30 The BCSRB is discussed more fully below in Section 2.2.

31 Borders Treaty, *supra* note 22, at Annex I, paras. 6 and 7.

32 Internal Operations Regulations for the Sixaola River Basin Binational Commission (Internal Regulations for the BCSRB), Art. 11. Copy on file with author.

3.2 The Binational Commission of the Sixaola River Basin

In 2007, the PBC established the Binational Commission of the Sixaola River Basin (BCSRB) through the exchange of diplomatic notes.[33] Specifically, the BCSRB was created as an entity for the strategic management of the Integrated Ecosystem Management of the Sixaola Binational River Basin Project (the Integrated Ecosystem Management Project). The BCSRB is appointed to the BSTC of Natural Resources, and it does not have its own separate legal capacity. Therefore, the BCSRB has no formal decision making authority.

The BCSRB is governed according to its Internal Regulations, which establishes the following functions:

- To coordinate and approve operative policies and strategies for the integrated management of the basin and of the Integrated Ecosystem Management Project;
- To promote the territorial organisation and the application of the Functional Plan for the Basin's Territorial Organization (FPBTO);
- To approve the AOPs prepared by the Integrated Ecosystem Management Project's BETU;
- To monitor and evaluate the appropriate execution of the coordinated investments budget, as approved in the AOP;
- To review the annual reports of physical execution and the financial states of affairs prepared by the Integrated Ecosystem Management Project's BETU;
- To act as a space and a forum for conflict and/or controversy resolution, by providing elements for consensus between the different actors;
- To ensure integrated management of the Project, and maintain its links to the Bocas del Toro and Sixaola Basin's Sustainable Development Programme; and
- Other functions required by the Integrated Ecosystem Management Project.[34]

The BCSRB is a supranational body that enjoys wide participation throughout the Sixaola River Basin. Under Article 10 of its Internal Regulations, its members include: the National Environment Authority of Panama (ANAM) and the Costa Rican Ministry of Environment and Energy (MINAE); the Panamanian Ministry of Agriculture and Farming Development; and the Costa Rican Agriculture Ministry; both countries' Ministries of Health; the Costa Rican National Commission for Risk Prevention and Panamanian National System of Civil Protection; the Municipalities of Changuinola and Talamanca; three civil society representatives from each country; the two Executive Secretariats of the Borders Treaty (as representatives of the PBC); the indigenous governments within the basin; and representatives from any projects that are being implementation under the framework of the Borders Treaty, albeit as observers only.

The BCSRB members are required to meet at least once per year, although additional extraordinary meetings may be called when necessary. Meetings are called by the BETU Coordinator for the Inte-

33 *Operative Agreement of the Costa Rica-Panama Convention on Cooperation for Border Development and its Annex* (Operative Agreement to the Borders Treaty), agreed through the exchange of Diplomatic Notes between both countries, on the days of April 11th, 2007 and June 12, 2007.

34 Internal Regulations for the BCSRB, *supra* note 32, at Art. 11.

grated Ecosystem Management Project, and must be attended by at least one of the two Executive Secretariats. Meetings are also supposed to be held alternatively in both countries.[35]

4 Public Participation

4.1 Public participation in the PBC

The Border Treaty does not explicitly recognise stakeholder involvement in decision making. Nevertheless, Article 18 of the Operative Agreement to the Treaty (an official agreement made between Costa Rica and Panama to further develop and clarify the scope of the 1992 agreement) provides a general framework for public participation.

Article 18 recognises the role of the public in complementing relevant actions and activities, and the potential for border cooperation to strengthen technical and operational capacities of non-state actors and institutions. It indicates that programmes, projects, and activities must protect and promote democracy, and assure the greatest participation possible from citizens or duly organised citizen groups, including indigenous communities. Furthermore, AOPs must be implemented in a manner that is consistent with relevant mechanisms and institutions established under the Borders Treaty, each country's Constitution, signed international instruments, and corresponding national legislation.[36]

Furthermore, the Operative Agreement grants citizens or groups of citizens with access to information related to programmes, projects, and activities within the scope of the AOPs. Technical and administrative operations should be transparent, and cooperation and exchange of information between authorities and public or private institutions at the local, regional, national, and binational level is promoted.[37] Mechanisms should also be created to facilitate participation of civil society, indigenous communities, women, private entities, and other national and international organisations that have a role to play in and around the border zone.[38] This is necessary for ensuring sustainable outcomes once the projects and activities under the Borders Treaty have officially concluded.

For their part, BSTCs must grant opportunities for participation and representation of civil society organisations in carrying out programmes, projects, and activities within their competence.[39] The BETUs must also coordinate and facilitate participation of interested parties within the execution of their activities.

4.2 Public participation in the BCSRB

The minutes contained in the exchange of diplomatic notes that created the BCSRB, as well as the BCSRB's Internal Regulations, provide for public participation and subsidiarity. Specifically, the BCSRB was meant to include six civil society representatives (three for each country) from the upper, middle, and lower sub-basins of the Sixaola. This idea evolved to include three members of civil

35 Internal Regulations for the BCSRB, Art. 12.

36 Operative Agreement to the Border Treaty, *supra* note 33, at Art. 18.

37 *Ibid*.

38 *Ibid*.

39 Operative Agreement to the Borders Treaty, *supra* note 33, at Art. 29, para. d.

society from each country representing producers, development organisations, and entrepreneurs and the business sector.[40]

While a framework for public participation of local stakeholders in decision making has been established both by the PBC and the BCSRB, practical challenges still exist in realising effective engagement. First, discrepancies in expertise between members of the BCSRB – for instance between the Executive Secretariats, and representatives of indigenous communities and rural farmers – tends to result in an imbalance in negotiating power. While civil society representatives are often knowledgeable of issues being discussed, they tend to be overshadowed by better-resourced interests.

Other issues relate to capacity of stakeholders to participate. For instance, some representatives are not always able to attend the sessions, because they have full time jobs on which their livelihoods rely. Moreover, there is a lack of public awareness of the BCSRB and its functions among local stakeholders. This is due in part to the relatively new nature of the BCSRB itself, and a lack of institutional capacity to effectively communicate with the wider public. Members of the BCSRB are also still figuring out how transboundary water institutions function and operate, and it has experienced problems in choosing members and deciding on rules of procedure.

Therefore, while space has been formally guaranteed for public participation, the BCSRB has experienced serious practical difficulties in making full and effective participation of relevant local stakeholders a reality. Addressing the above issues will be imperative to achieving effective representation from civil society and other local stakeholders within the BCSRB in the long term.

4.3 Public participation under domestic legal frameworks

Public participation is also provided for in the domestic legal frameworks of Panama and Costa Rica.

In the case of Costa Rica, Article 34 of Law No. 7.779 for "Soils Use, Management and Conservation" of the 30 April 1998, provides for the establishment of Management Area Committees. These Committees, although not widely used, are intended to create multi-stakeholder platforms, which would include academia and environmental organisations, among others. Within their competence, the Committees would consider, operate, manage, and conserve soils for given territories. The area of operation of each Committee was defined in a national plan for soil management and conservation based on the different river basins of the country.

In the case of Panama, under Law No. 44 of 2002,[41] the country takes a decentralised, participative approach towards access, use, and benefits of hydrologic resources.

Under the law, the National Environment Authority of Panama (ANAM) is in charge of administration, management, protection, and conservation of Panama's river basins, in order to allow sustainable social, cultural, and economic development. ANAM is also charged with administering the Environmental Territorial Organisation Plan for the basin, which is:

40 Internal Regulations for the BCSRB, *supra* note 32, at Art. 10.

41 Republic of Panama, *Special and Modern Law* (No. 44, August 5th, 2002).

"the main management instrument for planning, evaluation and control … of human activities concerning the use and management of the basin's natural resources … in order to preserve and restore the ecologic balance and to protect the environment, as well as to grant the present and future population's well-being."[42]

In order to ensure local representation and participation, ANAM is required to coordinate its activities with relevant local bodies, including Environmental Consultation Commissions and Water Basin Committees. Environmental Consultation Commissions are independent bodies composed of representatives from the local or national government, civil society, and relevant private sector interests.[43] These Commissions may exist at the national, provincial, or district level.

Water Basin Committees were created as multi-sectorial, regional entities to address environmental management needs of particular sub-basins. Membership within the Committees includes actors from the public and private sector, and civil society coexisting in the basin.

These Committees have been used to address climate change issues within the Sixaola River Basin. Specifically, a group of organisations from the bordering communities of Barranco and Las Tablas in Panama created the Quebrada Rosa Micro-basin Committee, whose aim is to monitor the management of the sub-basin. This effort arose out of concern for the quality and supply of drinkable water, and vulnerability of these resources due to climate change. With the support of the International Climate Initiative of the German Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU), and technical support from IUCN, the Quebrada Rosa Micro-basin Committee has established an EbA strategy to deal with climate change.

The Committee has already begun recovering riverbank ecosystems through reforestation activities. More than 1,000 trees have been planted since its creation, and a considerable number of students from the local high school have participated actively within these activities.[44] It has been suggested that this model could be reproduced in other sectors, such as agriculture and fisheries, in order to enhance representation and participation.

4.4 Linking local participation with representation at the binational level

As mentioned above, at the binational level one of the members of the Quebrada Rosa Micro-basin Committee sits as a participatory member on the BCSRB. This provides a unique example of linking multiple scales of governance through representation of local entities at higher levels. It has yet to be seen how the efforts at the local level within the Quebrada Rosa Micro-basin Committee will feed into the BCSRB. At the local level, the Water Basin Committees in Panama have already achieved legitimacy and recognition from indigenous peoples' communities. However, they are a relatively new construct, and the Quebrada Rosa Micro-basin Committee is still building its own capacity – both financial and technical – to effectively participate at both the national and transboundary level.

Nevertheless, Panama's example of a decentralised national legal framework and representation at the transboundary level is a unique example of multi-level water governance. Micro-basin

42 *Ibid*.

43 Environmental Consultation Commissions were created through the *General Law of Environment*, and developed from the *Executive Decree No. 57*, year 2000.

44 IUCN (2012). "Se Formaliza el Primer Comite de Microcuenca en Panama," News Story 18 June 2012, *available at* http://www.iucn.org/news_homepage/all_news_by_region/news_from_central_america/?10179/primer-comite-microcuenca-Panama-capacidades-adaptacion.

Committees such as the Quebrada Rosa Micro-basin Committee have the potential to serve as a bridge between national and local areas. Not only is it able to implement decisions and strategies approved jointly at the transboundary level by the BCSRB, but it is also capable of serving as a laboratory for development and implementation of adaptation actions, which if successful can then be scaled up and replicated in other parts of the basin, where relevant.

In the future, it will be necessary to support the existence of River Basin Committees, and to further enhance their technical capacity to decide how the basin should be managed in a participatory manner. This could be complimented by further decentralisation of both the decision-making and coordination of projects under the Borders Treaty, and by providing local governing bodies with a large role in implementation.

The BCSRB's coordination role also needs to be enhanced, in order to reduce dispersion of projects, actions, and entities. This could be done through creating dialogue tables and other inter-institutional spaces that are inclusive of all stakeholders, to facilitate agreement over projects, resolve disputes, and promote learning from different projects.

More broadly, awareness needs to be raised towards building an identity of the basin and citizen empowerment, and to develop work that transcends the possibilities of articulating actions exclusively from the BCSRB. Furthermore, the BCSRB will need to actively disseminate information on its internal operations, the Borders Treaty, and different projects where local stakeholders can participate. It will also be necessary to promote the work of different actors, and to further integrate consultation processes into territorial planning and environmental impact assessments (EIAs).

Most importantly, it will be vital to foster a culture among citizens that demands accountability from both the BCSRB and their own representatives, who ultimately end up also being users and beneficiaries of water. This could be done through the elaboration of instruments that allow for evaluation and monitoring of projects and participatory structures under the Borders Treaty, so that civil society participation can be measured. There also needs to be strengthened action towards recognition of the human right to healthy water and sanitation within the context of IWRM.

5 Local Adaptation Planning in the Sixaola River Basin

There are currently two adaptation initiatives being conducted in the Sixaola River Basin. They are both part of an IUCN-led project called Climate Change Governance Capacity: Building regionally- and nationally- tailored ecosystem-based adaptation in Mesoamerica.[45] One initiative has been taking place in the Yorkín micro-basin, within the Bri Bri indigenous territory, while the other is being conducted in the floodplain of the lower Sixaola River Basin. Both adaptation initiatives have been developed, validated, and implemented with local communities.

The adaptation process in the Sixaola River Basin has hinged a great deal on mainstreaming IWRM principles. Formal basin-wide water management has technically been pursued through the institutional framework of the Borders Treaty. However, a lack of understanding of the Treaty and its cooperative mechanisms by stakeholders and local communities throughout the basin, and a lack of capacity to coordinate water management, has hampered effectiveness. As such, adaptation strategies have strongly focused on increasing local capacity to manage natural resources, and enhancement of local water governance.

45 This project has been implemented with the support of the International Climate Initiative from BMU.

Based on assessments of vulnerability, there has also been a strong emphasis on EbA strategies, and increasing resilience of local livelihoods to climate change impacts.

5.1 Vulnerability assessments

In both initiatives, climate modelling and scenarios were analysed, and vulnerability was assessed using and the Community Risk Screening Tool for Adaptation and Livelihoods (CRiSTAL). In the Yorkín micro-basin, results showed a high dependency of local communities to nature and ecosystem services. It also showed a high degree of vulnerability to climate change impacts such as flooding, which is likely to be more pronounced with the continuation of unsustainable activities, such as deforestation for cattle grazing. Furthermore, climate variability in the micro-basin is likely to affect rainfall, which will impact agriculture, a dominant source of livelihoods, and navigation, which is necessary to conduct trade and to transport people.

In the lower floodplain of the Sixaola River Basin, modelling and vulnerability assessment demonstrated a high degree of vulnerability, particularly in the agricultural sector, where banana and plantain crops (both corporate and small) dependent on chemical pesticides are dominant. These livelihoods, which are dependent on a few crops, are likely to be impacted by increased sedimentation due to deforestation, which has degraded the floodplain, and increased flooding brought on by climate change. Moreover, due to increased precipitation over the next 20-30 years, plantain crops are likely to suffer from sigatoka fungus.[46] However, precipitation is also likely to become more sporadic, and therefore drought is also likely to affect crops in the lower basin.

5.2 Adaptation Strategies

After conducting vulnerability assessments, stakeholders in both sections of the basin analysed results and agreed on an adaptation strategy. The strategies that were ultimately developed both focused on three main aspects of adaptation: 1) improving water governance capacity; 2) conservation and restoration of ecosystems; and 3) improvement of local livelihoods. Table 1 below demonstrates the specific measures that were prioritised for each of the projects.

46 Comité Regional de Recursos Hidráulicos (2011). *Análisis sobre escenarios de cambio climático aplicados a medios de vida de cuencas transfronterizas en Mesoamerica*. [Climate change and livelihoods scenarios analysis in transboundary basins of Mesoamerica].

Table 1 Adaptation measures for the Yorkín micro-basin and the lower floodplain of the Sixaola River Basin

Adaptation strategy objectives	Yorkín micro-watershed *Communities of Yorkín, Shuabb, El Guabo, Dacle*	Sixaola floodplain *Communities of Paraíso and Las Tablas*
Strengthen capacities for local water governance and ecosystem management	Creation of a binational water committee as a participatory structure for micro-basin management	Creation of a water committee as a participatory structure for water management of the Quebrada Rosa River
Conserve and restore the watershed ecosystem services	Protect steep slopes from erosion through soil conservation practices and green barriers	Recovery of freshwater sources
	Create local capacity for nursing local timber and fruit trees through the establishment of two nurseries	Create local capacity for nursing local timber and fruit trees through the establishment of a nursery managed by the micro-basin committee
	Reforestation of the river shores to prevent erosion in the Tskuy and the Yorkín rivers	Reforestation of the alluvial plain
Improve and diversify local livelihoods	Cacao farm management	Diversification of plantain farms with timber and fruit trees
	Recovery of local seeds for improving food security	Increasing capacities for local organic agriculture production

In the Yorkín micro-basin, there was a particular emphasis on community governance. Home to Bri Bri indigenous community, it has an interesting tradition of local governance through community-based organisations, most of them led by women. As such, efforts have focused on building capacity of these actors, so that they are able to promote transboundary cooperation with other communities along the border between Costa Rica and Panama.

In the lower floodplains, some communities showed particular interest in EbA strategies. Specifically, communities have realised that they must diversify their crops in order to reduce vulnerability to acute effects of climate change that will impact traditional varieties. Without entirely abandoning the cultivation of bananas and plantains, these communities are now trying to move towards growing other types of fruits and basic grain crops. They have also started to engage in agro-forestry to compensate for losses of other crops, improve water recharge, enhance water quality, and mitigate negative impacts of flooding.

6 From Local Experiences to Binational Cooperation: Up-scaling Solutions

There is much to be learned from local adaptation efforts around the Sixaola River Basin that can be up-scaled to reinforce binational cooperation between Costa Rica and Panama. Specifically, lessons learned on how to adapt through enhancement of local water governance capacity, the ecosystem approach, and improvement of livelihoods contain success stories that can be replicated in other areas throughout the border regions of the two States.

Since the very beginning of the adaptation planning process in the Sixaola River Basin, strategies for responding to risks and vulnerability aimed to build coordinated and empowered approaches where local, regional, and binational institutions all played a role. As can seen from the above, local level actions have dealt with implementing adaptation strategies through participatory approaches, whereby community-based organisations and indigenous peoples' communities play a major role in enhancing local environments and strengthening local water governance.

At the regional and binational levels, the Borders Treaty between Costa Rica and Panama has a strong role to play. The BCSRB, which was provided a coordination role through the Integrated Management of the Ecosystems Project, is a potentially ideal mechanism for up-scaling these local adaptation solutions. However, there is still a need to develop a better understanding of the role that the Borders Treaty and coordinated management of the Sixaola have to play in supporting adaptation strategies.

Together with other non-state actors in the basin – and through several dialogues with the PBC – IUCN has supported the development and strengthening of the BCSRB. In terms of adaptation, this engagement has been pursued with the objective of more firmly embedding IWRM principles and the ecosystem approach into a more coordinated and long-term adaptation process.

However, connecting lower levels of the adaptation process with the binational level, even in a small basin such as the Sixoala, faces several challenges. Experience to date has demonstrated that in order to effectively implement adaptation measures and produce sustained results, communities and other agencies need to design an integrated strategy that not only includes ecosystem conservation and restoration efforts, but also assures local participation, a better understanding of water and natural resources legal frameworks, and means to secure sustainable livelihoods.

While communities may be somewhat organised at the community level, there is a need to enhance capacity of local representatives to engage effectively at the binational level. As mentioned above, discourse within the BCSRB currently tends to be dominated by well-trained and financed State representatives. In practice, actual engagement of civil society, indigenous communities, and river basin committees with the BCSRB remains quite limited due to a lack of time and financial resources of local actors to engage full-time on issues that are discussed. This has resulted in a disparity in bargaining power, whereby more powerful interests have been able dominate agenda items at the expense of less powerful interests. In order to reorient this balance, community representatives need to have better access to financial resources and adequate time and to engage with the BCSRB. Furthermore, communities need to be empowered so that they are able to speak up and have their interests more fully represented and advocated at higher levels.

7 Conclusion

While the adaptation process in the Sixaola River Basin is still in relatively early stages of development, there is much to be learned from experiences both at the local and transboundary level.

First, adaptation occurs locally. While adaptation efforts need to be coordinated at the basin level, the local or micro-basin level may be a more ideal territorial scope for designing and implementing adaptation measures. If effectively coordinated at the basin level, local action at this scale facilitates learning, while also promoting community empowerment to implement, monitor, and improve upon adaptation solutions. While existing on paper prior to the IUCN-led project, the BCSRB is now being more fully developed into a coordination mechanism, while local level governance processes are being empowered to manage water in a sustainable manner. The newly created Quebrada Rosa Micro-basin Committee, which sits as a representative to the BCSRB, is a prime example of bottom-up governance linking up with the binational level.

Legal frameworks play a significant role in empowering communities and individuals. Cooperative mechanisms that integrate institutions and civil society cannot be effective unless supported by a legal framework that supports rights to participate, and ensures accountability. Domestic legislation, such as Panama's Special Administrative Law for the management, protection, and conservation of hydrological basins, as well international requirements, such as the Border Treaty's provisions for ensuring public participation, provide a first logical step for ensuring space to engage.

More importantly, however, adequate capacity for community actors to engage needs to be ensured. While on paper communities are guaranteed the ability to engage at the binational level, a number of additional actions will need to be pursued to allow for full and effective participation. These include raising awareness around participation issues and the Borders Treaty's institutional structure, development of means to participate, development of a stronger culture of accountability, promotion of more participatory dialogue, and support for more decentralised approaches to water management, among others.

Capacity building will also be essential for effective and sustainable development, and implementation of effective adaptation strategies. Adaptation is only possible if communities have a solid foundation for understanding environmental change and how to develop solutions. There is no single adaptation strategy, and adaptation efforts must ultimately respond to local realities – ones that must be well understood in order to be effective. In the Yorkín micro-basin and the lower floodplains of the Sixaola River Basin, through participatory climate modelling and assessment of vulnerabilities, communities have been able to settle on a variety of adaptation strategies aimed at enhancing local governance, improving ecosystems, and sustaining livelihoods.

Glossary

Adaptation: Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.[1]

Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.[2]

Climate change: Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).[3]

Climate variability: Deviations of climatic statistics (such as the occurrence of extremes) over a given period of time (e.g., a month, season or year) from the long-term statistics relating to the corresponding calendar period.[4]

Due diligence: The obligation of States that requires them to introduce policies, legislation and administrative controls applicable to public and private conduct that are capable of preventing or minimising the risk of transboundary harm to other States or the global environment.[5] It also entails an evolving standard of technology and regulation based on "best available techniques", "best practicable means", or "best environmental practices".[6]

Ecosystem services: The benefits people obtain from ecosystems. These include: products obtained from ecosystems (e.g., freshwater, food, fuel, genetic resources, natural medicines, etc.); benefits obtained from the regulation of ecosystem processes (e.g., water, erosion, waste, climate, and natural hazards); cultural services (e.g., cultural diversity, educational values, social relations, heritage, etc.); and services that are necessary for the production of other ecosystem services (e.g., primary production, nutrient cycling, and water cycling).[7]

Ecosystem Approach (EA): A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way.[8]

Ecosystem-based Adaptation (EbA): Ecosystem-based Adaptation integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation, and restoration

1 IPCC (2007). "Fourth Assessment Report," Working Group II, Appendix 1, Glossary.

2 *Ibid*.

3 *Ibid*.

4 *Ibid*.

5 *Pulp Mills on the River Uruguay* (Argentina v. Uruguay), *Judgment*, I.C.J. Reports 2010, p. 14, para. 197). ILC 2001 Articles, Art. 3 and commentary, ILC Report (2001) GAOR A/56/10, 393-5, paras. (10) – (17).

6 Birnie, P., Boyle A. and Redgwell C. (2009). *International Law & the Environment, Third Ed*. Oxford University Press: New York, U.S.A.

7 Millennium Ecosystem Assessment (2005). *Ecosystems and Human Well-being: Synthesis*. Island Press: Washington, D.C.

8 CBD (2004). *The Ecosystem Approach: CBD Guidelines*. Secretariat of the CBD: Montreal, Canada.

of ecosystems to provide services that help people adapt to both current climate variability, and climate change.[9]

Environmental Flows: The water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated.[10]

Equitable and Reasonable Utilisation: The principle that a State is entitled to an equitable and reasonable share of the beneficial uses of the waters of an international basin. This is not a right to an equal share of the resource but rather access to utilise the waters beneficially, in such a way that does not causes significant harm to another State.[11]

Flexibility: The ability of traditional structures to change as they attempt to adapt to evolving circumstances.

Water Governance: The process of managing and developing water by engaging and interacting with social, political, economic, and legal institutions.

Information Management: The traditional process of determining information needs and then collecting, interpreting, exchanging, and then utilizing that information.

Institutional Flexibility: A core component of adaptive capacity that embraces the possibility of gradual and sudden changes in transboundary waters through various mechanisms. Such mechanisms include: response provisions, amendment and review mechanisms, and revocation clauses.

Integrated Water Resources Management (IWRM): Process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.[12]

Maladaptation: Any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.[13]

No Harm Principle: The historic principle of customary law that holds that a State is obligated to prevent, reduce, and control the risk of environmental law to other States.

Polycentric (Multi-level) Governance: Distinct from classic conceptions of government, this theory holds that management is undertaken by a multitude of actors on a range of differing levels and sectors.

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9 *Ibid*.

10 Dyson, M. Bergkamp, G. and Scanlon, J. (*Eds*) (2008). "Flow – The Essentials of Environmental Flows," IUCN, Gland Switzerland.

11 International Law Association (ILA) (2004). *The Berlin Rules on Water Resources*, Fourth Report of the 71st Conference, 71 I.L.A. 337, 385 (2004).

12 Global Water Partnership (GWP) (2000). "Integrated Water Resources Management," *Global Water Partnership Technical Advisory Committee, Background Paper No. 4*.

13 IPCC (2007). "Fourth Assessment Report," Working Group II, Appendix 1, Glossary.

The Duty to Cooperate: The obligation of States to cooperate in mitigating transboundary environmental risks and emergencies, through notification, consultation, negotiation, and in appropriate cases, environmental impact assessment.[14]

Resilience: The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.[15]

Subsidiarity: A principle governing decision making, whereby decisions are taken at the lowest level possible. In terms of management of transboundary freshwater, and adaptation, subsidiarity would allow for local and informal initiatives, where appropriates, at the lowest level of competent authority.

Devolution: The act by which the government transfers core powers, rights, and duties to individuals or groups of individuals that are located within or outside the government.

Vulnerability: The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.[16]

Vulnerability Assessment: The process of identifying and analysing expected impacts, risks, and the adaptive capacity of a sector, population, ecosystem, or a specified geographic area to changes in climate.[17]

Adaptation Strategies: Broad plans of action that include various policies and measures that can be implemented over the short-, medium-, and long-term.[18]

Public Participation: The overarching concept of targeting the public and stakeholders in decision making. For the purposes of this publication, we use the terms “involvement”, “engagement”, and “participation” interchangeably.

Transboundary Cooperative Mechanisms: Cooperative transboundary water mechanisms refer to arrangements or frameworks between two or more administrative units (from the transboundary, national or local levels) for the purposes of facilitating engagement and collaboration on water related issues (i.e., management of international watercourses). They can be formal (e.g., river basin organisation) or informal (e.g., water cooperation agreement between border communities). They can range from addressing single issues (e.g., joint monitoring of water quality on a transboundary river) to comprehensive basin management. They are the vehicles through which cooperation is implemented.

Up-scaling: Moving scientific or technical knowledge on local adaptation measures from the local or regional level to the national or international level.[19]

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14 Birnie, P., Boyle A., Redgwell C. (2009). *International Law & the Environment, Third Ed*. Oxford University Press: New York, U.S.A.

15 IPCC (2007). “Fourth Assessment Report,” Working Group II, Appendix 1, Glossary.

16 IPCC (2007). “Fourth Assessment Report,” Working Group II, Appendix 1, Glossary.

17 CARE International (2009). *Climate Vulnerability and Capacity Analysis Handbook, First Ed*.

18 United Nations Economic Commission for Europe (UNECE) (2009). *Guidance on Water and Adaptation to Climate Change*. United Nations: New York, U.S.A. and Geneva, Switzerland.

19 Burton, I., Dickinson, T. and Howard, Y. (2008). “Upscaling Adaptation Studies to Inform Policy at the Global Level,” *The Integrated Assessment Journal*, Vol. 8(2).

Downscaling: A method that derives local- to regional-scale (10 to 100 km) information from larger-scale models or data analyses.[20]

Adaptive knowledge and information management: Where stakeholders collaborate to incorporate relevant data and information into the development and implementation of adaptation policies and measures.[21]

National Adaptation Plan (NAP): Under the UNFCCC, NAPs are national medium- to long-term plans for reducing vulnerability, and integrating climate change adaptation into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate.[22]

National Adaptation Programme of Action (NAPA): Under the UNFCCC, NAPAs were designed to help Least Developed Countries (LDCs) to gain access to support in order to address urgent and immediate (i.e., short-term) adaptation needs.

Precautionary Principle: Where there is risk of serious environmental damage, States must take action to prevent, minimise, or mitigate that damage even where there is a lack of scientific certainty with respect to the cause, seriousness, or inevitability of the damages.[23]

20 IPCC (2007). "Fourth Assessment Report," Working Group II, Appendix 1, Glossary.

21 Pahl-Wostl C. et al. (2012). "From Applying Panaceas to Mastering Complexity: Toward Adaptive Water Governance in River Basins," *Environment Science and Policy*, Vol. 13.

22 UNFCCC Decision 5/CP.17, para. 1.

23 McIntyre, O. (2007). *Environmental Protection of International Watercourses under International Law*. Ashgate: Hampshire, U.K.

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