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Transboundary Water Governance

Adaptation to Climate Change

Juan Carlos Sanchez and Joshua Roberts (Eds.)



IUCN Environmental Policy and Law Paper No. 75

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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

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]

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]

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

51 Fitzmaurice, M. (1998). "The Gabčíkovo-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 Gabčíkovo-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

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).

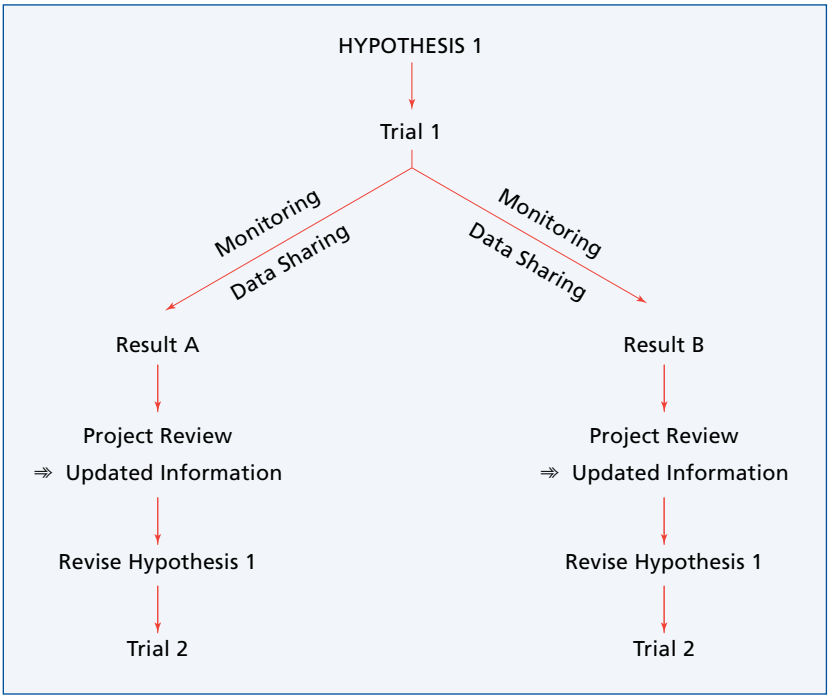
68 Intergovernmental Panel on Climate Change (2008). *Technical Paper on Climate Change and Water*, Doc. IPCC-XXVIII/Doc.13 (8.IV.2008) (Apr. 10, 2008), p. 32.

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]

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.