GOVERNANCE OF WATER RESOURCES SHARED BY INDIA AND PAKISTAN UNDER THE INDUS WATERS TREATY: SUCCESSFUL ELEMENTS AND ROOM FOR IMPROVEMENT

SAHANA RAO*

TABLE OF CONTENTS

INTRODUCTION

Water is the root of civilization. The great empires of the past rose up around lakes and river systems, from the Yangtze to the

Nile to the Tiber.[1] Water resources bolstered the power of world leaders, but water mismanagement had the potential to lead to their downfall. Even now, water availability is a significant constraint on development—the magnitude of this constraint is particularly felt in arid and semi-arid regions as climate change builds upon the impact of consistent overexploitation to promote scarcity.[2] Access to safe drinking water is a matter of human survival and promotes productivity and dignity. Moreover, water is a necessary element of agriculture and electricity generation. The many ways water is used contribute to a complex calculus of resource allocation that attempts to account for all of these needs to the extent possible. This calculus becomes even more complicated when the scope of a hydrological resource transcends political boundaries.

Just as water has been the cause of conflict for centuries, transboundary water management techniques permeate history. For instance, the United Nations Department of Economic and Social Affairs traces the first international water treaty to a 2500 B.C. agreement between two Sumerian city-states ending a dispute over the Tigris River.[3] Transboundary water management agreements have proliferated in the years following the institutionalization of the international community.[4] In recent years, much of the focus on transboundary water management has shifted to governance of shared water resources in light of the effects of climate change on water availability.[5] Considerations of existing discrete bilateral and

* New York University School of Law Class of 2016. I would like to thank the staff of the NYU Environmental Law Journal for their hard work and assistance.

1 *See* L.A. TECLAFF, THE RIVER BASIN IN HISTORY AND LAW 15 (1967).

2 *See* Rajagopalan Balaji et al., *The Water Resource: Variability, Vulnerability, and Uncertainty*, *in* 1 UN-WATER, MANAGING WATER UNDER UNCERTAINTY AND RISK: THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 4, at 87 (2012).

3 *See Transboundary Waters*, UNITED NATIONS, http://www.un.org/waterforlifedecade/transboundary_waters.shtml (last visited Sep. 12, 2016).

4 About 295 international water agreements have come into being since 1948, around the time the United Nations was established. *See* Julia Black & Céline Kauffmann, *Transboundary Water Management*, *in* OECD, INTERNATIONAL REGULATORY CO-OPERATION: CASE STUDIES, VOL. 3: TRANSNATIONAL PRIVATE REGULATION AND WATER MANAGEMENT 60 (2013).

5 *See, e.g.*, IUCN, TRANSBOUNDARY WATER GOVERNANCE: ADAPTATION TO CLIMATE CHANGE (Juan Carlos Sanchez et al. eds., 2014); R. Quentin Grafton et al., *Global Insights into Water Resources, Climate Change, and Governance*, 3 NATURE CLIMATE CHANGE 315 (2013); Jaroslav Tir & Douglas M. Stinnett, *Weathering Climate Change: Can Institutions Mitigate International Water*

multilateral agreements regarding water management often bring up the Indus Waters Treaty. It is one of the longest-standing multistate agreements concerning water sharing to date, and its cooperation provisions have been used to resolve water-related disputes.[6] However, even the Indus Waters Treaty requires updating to deal with problems such as impending climate change effects, groundwater exploitation, and new modes of water use. The tempestuous political relationship between India and Pakistan further complicates modern water management under the Indus Waters Treaty.

Part I of this Note outlines the current need for water resource management in the Indus River basin. Part II elucidates the existing international regime for cooperative transboundary water use and its bearing on the agreement between India and Pakistan. Part III examines successful cooperation fostered under the Indus Waters Treaty, including two recent cases of dispute resolution addressed through treaty mechanisms. Part IV explores weak points of the treaty and potential improvements to further bolster the tenuous collaboration between two countries with a contentious, quarrelsome history.

I. CURRENT STATE OF WATER RESOURCES IN THE INDUS RIVER BASIN

The Indus River originates in the Tibetan Plateau and flows through India and Pakistan, collecting drainage from the highest mountain ranges in the world along the way.[7] The Indus River basin refers to land drained by the river and its tributaries, and lies above groundwater aquifers associated with the river system.[8] The full Indus River basin lies in India, Pakistan, China, and Afghanistan;[9] however, references to the Indus River basin (or Indus Basin) in this paper are limited to the portions of the basin

Conflict?, 49 J. PEACE RES. 211 (2012).

6 *See infra* Section III.C.

7 *See* D. R. Archer, *Sustainability of Water Resources Management in the Indus Basin under Changing Climatic and Socioeconomic Conditions*, 14 HYDROLOGY & EARTH SYS. SCI. 1669, 1670 (2010).

8 *See Indus Basin*, FOOD AND AGRICULTURE ORG. OF THE UNITED NATIONS [hereinafter FAO] http://www.fao.org/nr/water/aquastat/basins/indus/index.stm (last visited Sep. 12, 2016).

9 *See id.*

that are located within India and Pakistan.[10] The plains into which the river descends are considered arid or semi-arid, making the Indus a primary source of water for irrigation as well as other basic necessities.[11] More recently, the Indus River has also become the foundation for several hydroelectric power generation projects.[12] Water use in this region overwhelmingly supports agricultural and energy-related activity.[13] Irrigation performance is of particular concern in the Pakistani portion of the lower Indus Basin, as the Indus system is Pakistan's primary source of water and agriculture the primary source of income in that region.[14] However, the Indus system also supports agriculture in the region known as India's breadbasket.[15] Thus, both countries are very protective of the resource.

The Indus Basin is experiencing a combination of "resource stresses, development pressures, ecological insecurity, and management challenges" that make it a highly vulnerable water

10 Ideally, management of this basin would entail a cooperative effort between all four countries. However, the scope of this paper is limited by the existing agreement between India and Pakistan. These states are the largest users of water from the Indus Basin, and measures dealing with new issues such as groundwater management and climate change are more likely to be incorporated into the existing agreement than to trigger creation of a completely new agreement and accompanying institutions.

11 *See* Archer, *supra* note 7, at 1670. Though water access is improving in South Asia, over 160 million people in the region still lack safe drinking water. Nearly 89% of Pakistanis have access to drinking water from improved sources (meaning sources protected from outside contamination). *See* MINISTRY OF PLANNING, GOV'T OF PAK., PAKISTAN MILLENNIUM DEVELOPMENT GOALS REPORT 96 (2013), http://www.undp.org/content/dam/pakistan/docs/MDGs/MDG2013Report/UNDP-Report13.pdf. Meanwhile, 88% of India's population has access to drinking water from improved sources. *See* MINISTRY OF STATISTICS AND PROGRAMME IMPLEMENTATION, GOV'T OF INDIA, TOWARDS ACHIEVING MILLENNIUM DEVELOPMENT GOALS INDIA 21 (2013), http://mospi.nic.in/mospi_new/upload/MDG_ pamphlet29oct2013.pdf. In 2013, the combined population of India and Pakistan was about 1.46 billion. *See Data: Population Total*, WORLD BANK, http://data.worldbank.org/indicator/SP.POP.TOTL (last visited Sept. 12, 2016).

12 *See* Biswajit Mukhopadyay & Aniruddha Dutta, *A Stream Water Availability Model of Upper Indus Basin Based on a Topologic Model and Global Climatic Datasets*, 24 WATER RESOURCE MGMT. 4403, 4404 (2010).

13 *See* UNITED NATIONS ENVIRONMENT PROGRAM [hereinafter UNEP], FRESH WATER UNDER THREAT: SOUTH ASIA, at x (2008).

14 *See* Asad Sarwar Qureshi, *Water Management in the Indus Basin in Pakistan: Challenges and Opportunities*, 31 MOUNTAIN RES. & DEV. 252, 253 (2011).

15 *See* Neda A. Zawahri, *India, Pakistan, and Cooperation Along the Indus River System*, 11 WATER POL'Y 1, 4 (2003).

resource system.[16] In general, South Asia is both one of the poorest and fastest-growing regions in the world, which places enormous strain on the water systems used to sustain the population's basic health and energy needs.[17] The Indus River supports at least 215 million people.[18] Users are faced with increasing salinity, nutrient content, untreated sewage, and other forms of chemical pollution.[19] In addition to quality concerns, quantity is a growing issue.[20] Most of the river system's flow is derived from snowmelt and monsoon rains.[21] Increasing risk of drought and anticipated glacial retreat due to climate change may reduce the flow of the Indus by thirty to forty percent in the next hundred years.[22] However, some scientists have predicted that climate change will increase monsoon rainfall.[23] The uncertainties inherent in anticipating these and other impacts on the Basin, such as changing seasonal extremes, make it difficult to predict a net impact of climate change on water availability.[24] The uncertainty associated with future water availability contributes to potential conflict in a region where tensions are often high, which only emphasizes the need for cooperative water management between India and Pakistan.[25]

16 *See* UNEP, *supra* note 13, at 9.

17 *See id.* at 9.

18 *See* Madhav Bahadur Karki et al., *Enhancing Knowledge Management and Adaptation Capacity for Integrated Management of Water Resources in the Indus River Basin*, 31 MOUNTAIN RES. & DEV. 242, 242 (2011) (citing a 2008 report by the United Nations Environment Programme).

19 *See* JOHN BRISCOE & USMAN QAMAR, PAKISTAN'S WATER ECONOMY: RUNNING DRY, at xv-xvi (Oxford Univ. Press 2005).

20 *See* UNEP, *supra* note 13, at 22 (listing groundwater depletion as one of the key issues facing the Indus River basin).

21 *See* Qureshi, *supra* note 14, at 256.

22 *See* BRISCOE & QAMAR, *supra* note 19, at xv.

23 *See* Qureshi, *supra* note 14, at 256.

24 *See generally* Santosh Nepal & Arun Bhakta Shrestha, *Impact of Climate Change on the Hydrological Regime of the Indus, Ganga, and Brahmaputra River Basins: A Review of the Literature*, 31 INT'L J. WATER RES. & DEV. 201 (2015).

25 *See generally* Nicole Livanos, *Grab for Water Could Spark Conflict Between Pakistan and India*, 19 PUB. INT. L. REP. 24 (2013). Tension between the two countries, rooted in religion and muddied by desire for geopolitical power, dates back to their partition in 1947, when Britain divided the subcontinent into Hindu-dominated India and Muslim-dominated Pakistan. *See* Asad Hashim, *Timeline: India-Pakistan Relations*, AL JAZEERA (May 27, 2014), http://www.aljazeera.com/indepth/spotlight/kashmirtheforgottenconflict/2011/06/20116151130582241 15.html. Certain territories were able to decide which country to join; in particular, India and Pakistan quarreled fiercely over the

II. PERTINENT GLOBAL AGREEMENTS ON TRANSBOUNDARY WATER RESOURCE MANAGEMENT

The management of international water resources is determined by the principle of equitable utilization.[26] This principle frames the transboundary watercourse as a distinct legal and managerial unit and allows for limited sovereignty whereby each riparian nation simultaneously has the right to use the resource and the duty to manage use so as to avoid interference with the uses of other nations.[27] This concept was codified by the International Law Association in the Helsinki Rules on the Uses of the Waters of International Rivers (Helsinki Rules) and the Berlin Rules on Water Resources, as well as by the United Nations in its Convention on the Law of Non-Navigational Uses of International Watercourses (Convention or Watercourse Convention).[28] The Convention is the only potentially universally applicable treaty on transboundary water resource management;[29] though it was adopted in 1997, the convention did not enter into force until August 17th, 2014, upon ratification by 35 countries.[30] The

accession of the states Jammu and Kashmir. *See India-Pakistan: Troubled Relations*, BBC, http://news.bbc.co.uk/hi/english/static/in_depth/south_asia/2002/india_pakistan/timeline/default.stm (last visited Sep. 12, 2016). These states also form part of the Indus River basin. *See* FAO, *supra* note 8. Since 1947, the two countries have fought four wars (though the 1999 events at Kargil are termed a 'conflict'). *See* Hashim, *supra*. Control of Kashmir was the issue underlying most of these wars, and the region saw plenty of violence and brinkmanship in the interim. *See id.* For further discussion of the India-Pakistan conflict, see generally T.V. PAUL, THE INDIA-PAKISTAN CONFLICT: AN ENDURING RIVALRY (2005); SUMIT GANGULY, CONFLICT UNENDING: INDIA-PAKISTAN TENSIONS SINCE 1947 (2013).

26 *See* Joseph Dellapenna, *The Sources of International Law Applicable to Water Resources*, *in* WATERS AND WATER RIGHTS § 49.04 (2014). Equitable utilization has been codified in various international agreements as well. *See id.*

27 *See id.* at § 49.05.

28 *See* G.A. Res. 51/229, Convention on the Law of the Non-Navigational Uses of International Watercourses [hereinafter UN Watercourse Convention] (May 21, 1997), http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf.

29 *See Transboundary Waters*, *supra* note 3.

30 *See* STEPHEN MCCAFFREY, CONVENTION ON THE LAW OF NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES (2008), http://legal.un.org/avl/ha/clnuiw/clnuiw.html (listing the date of entry into force under "Status" and the number of parties required to ratify under "Procedural History"). There are currently 36 parties to the Convention. *See Convention on the Law of Non-Navigational Uses of International Watercourses*, UN TREATY COLLECTION, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&lang=en (last visited Mar. 25, 2017).

"watercourses" to which this convention applies are surface water systems and the groundwater aquifers hydrologically connected to those systems that are located in more than one member state.[31] The convention seems far-reaching—it incorporates an obligation not to cause significant harm and requires consideration of vital human needs—but lacks teeth in a practical sense due to the small number of member states and reservations many of them have stipulated with regard to their ratification.[32] Since the Convention is a framework agreement that has only recently come into force, its guidance on shared resource management is relatively vague; no protocols that would provide for specific procedures and controls have yet been added to the framework. Moreover, the Convention explicitly states its subordination to existing allocation agreements, such as the Indus Waters Treaty.[33]

The UN has recently begun to address the issue of transboundary groundwater resource management.[34] Historically, groundwater has taken a backseat to surface water on the legislative and policy fronts.[35] This may be attributed to an "out of sight, out of mind" problem; groundwater does not visually confront decision-makers in the same way as a body of surface water, so these decision-makers are not compelled to reach the same level of scientific understanding for groundwater resources as they have for surface water bodies.[36] The issue of transboundary groundwater management arises in the Watercourse Convention, since the definition of "watercourse" mentions groundwater.[37] Groundwater sources for the purposes of the Convention are aquifers that are "connected hydrologically to a system of surface waters, parts of which are situated in different states."[38] This does

31 *See* UN Watercourse Convention, at art. 2.

32 *See* UN Watercourse Convention, at art. 7 (obligation not to cause significant harm); *id.* at art. 10 (consideration of vital human needs).

33 *See* UN Watercourse Convention, at art. 3.

34 *See infra* notes 41–50 and accompanying text.

35 *See* Dante A. Caponera & Dominique Alheritiere, *Principles for International Groundwater Law*, 18 NAT. RESOURCES J. 589, 590 (1978).

36 *See* Gabriel Eckstein, *A Hydrogeological Perspective of the Status of Ground Water Resources Under the UN Watercourse Convention*, 30 COLUM. J. ENVTL. L. 525, 527–28 (2005); Albert E. Utton, *The Development of International Groundwater Law*, 22 NAT. RESOURCES J. 95, 98 (1982).

37 *See* UN Watercourse Convention, at art. 2(a) ("'Watercourse' means a system of surface waters and groundwaters constituting . . . . a unitary whole . . .").

38 CTR. FOR WATER LAW, POLICY, AND SCI., UNESCO, UN WATERCOURSES

not necessarily mean that the Convention's reach with respect to groundwater is limited; many aquifers interact in some way with surface water systems.[39] However, the terms of the Convention and subsequent interpretative work by the UN International Law Commission (ILC) point to a clear exclusion of solitary, confined aquifers.[40]

In 1994, the ILC sought to fill this gap by adopting a Resolution on Transboundary Confined Groundwater and recommending the document to the UN General Assembly.[41] This Resolution provided that transboundary groundwater management, where not directly governed by the Watercourse Convention, should still be guided by the principles of that Convention.[42] The ILC stated that continuing efforts were required, and in 2008 they presented a Resolution proposing nineteen articles that would comprise the Law on Transboundary Aquifers.[43] This Resolution was adopted by the UN General Assembly, and represents the latest international law instrument concerning transboundary groundwater resources.[44] However, UN General Assembly resolutions, other than those dealing with budget issues, are non-binding.[45] The 2013 General Assembly resolution dealing with the Law on Transboundary Aquifers mainly has the effect of commending the draft articles to the attention of governments as guidance for their own bilateral or multilateral agreements.[46] Further action to codify these articles has been tabled until the 71st session in September 2016.[47]

The Law on Transboundary Aquifers differs from the

CONVENTION USER'S GUIDE 66 (2012); *see also* UN Watercourse Convention, at art. 2(a)-(b).

39 *See generally* Marios Sophocleous, *Interactions Between Groundwater and Surface Water: The State of the Science*, 10 HYDROGEOLOGY J. 52 (2002).

40 *See* Eckstein, *supra* note 36, at 550–51.

41 *See* Int'l Law Comm'n, Rep. on the Work of Its Forty-Sixth Session, U.N. Doc. A/49/10 (1994), http://legal.un.org/ilc/publications/yearbooks/english/ilc_1994_v2_p2.pdf.

42 *See id.*

43 *See* Stephen C. McCaffrey, *The International Law Commission Adopts Draft Articles on Transboundary Aquifers*, 103 AM. J. INT'L L. 272, 274 (2009).

44 *See* G.A. Res. 63/124 (Dec. 11, 2008) [hereinafter 2008 Resolution].

45 *See What We Do: The General Assembly*, UN FOUNDATION, http://www.unfoundation.org/what-we-do/issues/united-nations/the-general-assembly.html.

46 *See id.*

47 *See id.*

Watercourse Convention in three main ways. First, it applies to "utilization" rather than "use," extending the scope of this instrument to the methods of extraction and delivery as well as actual use of water from transboundary aquifers.[48] Second, the scope of the Law on Transboundary Groundwater also extends to consideration of activities other than utilization of the resource that "have or are likely to have an impact upon those aquifers and aquifer systems."[49] In addition to promoting management under the principles cited in the Convention, the Law reiterates that each state has sovereignty over the portion of the aquifer underlying its territory.[50] This introduces a tension between sovereignty and cooperation that was not present in the earlier Convention.[51] The UN's adoption of the draft articles has brought the issue of transboundary groundwater management to the table for discussion, but as of yet there are no answers regarding how such management should be undertaken in the context of international environmental law.

III. INDO-PAKISTANI GOVERNANCE OF INDUS WATER RESOURCES

A. *A Brief History of the Indus Waters Treaty of 1960*

When India and Pakistan gained independence and achieved partition in 1947, both countries were adamant that their water management systems be entirely distinct.[52] However, partition had the effect of separating the Punjabi irrigation system so that the headworks were situated in India and the dependent canals in Pakistan.[53] Existing tensions between the countries and instances of water stoppage by East Punjab on the India side prompted the creation of a bilateral agreement assuring Pakistan that India would not withhold water without allowing time for Pakistan to develop alternate sources.[54] Pakistan remained dissatisfied with

48 Eckstein, *supra* note 36, at 545.

49 Int'l Law Comm'n, Rep. on the Work of Its Fifty-Eighth Session, U.N. Doc. A/61/10, ¶ 75, art. 1 (2006).

50 *See* Int'l Law Comm'n, Rep. on the Work of Its Sixtieth Session, Draft Articles on the Law of Transboundary Aquifers, U.N. Doc. A/63/10, at 3 (2008).

51 *See* Int'l Law Comm'n, Rep. on the Work of Its Fifty-Eighth Session, ¶ 75, art. 3; Eckstein, *supra* note 36, at 560.

52 *See* Asit K. Biswas, *Indus Water Treaty: The Negotiating Process*, 17 WATER INT'L 201, 203 (1992).

53 *See id.*

54 *See* Manav Bhatnagar, *Reconsidering the Indus Waters Treaty*, 22 TUL.

this agreement, but India refused to countenance third-party adjudication and a stalemate ensued until 1950.[55] The World Bank, which had been unable to grant requested development funding to either country while the dispute was ongoing, offered to mediate.[56] The World Bank's involvement was founded on three principles: that the Indus Basin contained enough water for both countries; that upon resolution, the Basin would be treated as one unit inclusive of all rivers in the Indus system; and that negotiations would eschew politics to retain a technical focus.[57]

The World Bank's initial attempt, the 1954 Plan, proposed that India get exclusive rights to the three eastern rivers—the Sutlej, Beas, and Ravi—while Pakistan would get nonexclusive rights to the three western rivers—the Chenab, Jhelum, and Indus.[58] Under this arrangement, India retained access to approximately twenty percent of the system, while Pakistan gained access to the remaining eighty percent.[59] India accepted this plan, but Pakistan objected on the grounds that it required storage facilities and lacked the resources for unilateral construction of those facilities.[60] The World Bank proposed the 1956 Aide-Memoire, an addendum to the Plan that contemplated Pakistani storage facilities along the western rivers.[61] This raised concerns

ENVTL. L.J. 271, 273 (2009); Undala Z. Alam, *Questioning the Water Wars Rationale: A Case Study of the Indus Waters Treaty*, 168 GEOGRAPHICAL J. 341, 342–43 (2002); Inter-Dominion Agreement between the Gov't of India and the Gov't of Pakistan, on the Canal Water Dispute between East and West Punjab, India-Pak., May 4, 1948, 54 U.N.T.S. 45, http://www.internationalwaterlaw.org/documents/regionaldocs/punjab-canal.html

55 *See* Biswas, *supra* note 52, at 204. Pakistan requested that the dispute be submitted to the International Court of Justice, but India refused. *See* Alam, *supra* note 54, at 343.

56 *See* Bhatnagar, *supra* note 54, at 275. In 1951, David Lilienthal (a former head of the Tennessee Valley Authority) paid a visit to the subcontinent to learn more about the Indus Basin dispute, and the article he wrote on the subject drew the attention of the World Bank President. *See* Zawahri, *supra* note 15, at 4.

57 *See* Alam, *supra* note 54, at 344.

58 *See* Bhatnagar, *supra* note 54, at 276.

59 *See id.* Though it seems strange that India would accept a plan under which it was allocated so little of the shared resource, India was quite happy with this proposal for two reasons: 1) its exclusive access to the Eastern rivers removed any obstacle Pakistan might have previously raised under international legal principles to India's plans for significant irrigation projects, and 2) India could retain its advantages of being upper riparian on the Western rivers as long as it kept control of Kashmir. *Id.* at 277.

60 *See* Alam, *supra* note 54, at 344.

61 *See id.*

on India's part about being financially committed to projects in Pakistan.[62] This back-and-forth continued until 1958, when the Pakistani government changed hands due to a *coup d'etat* and the emergent president immediately agreed to the 1954 Plan and 1956 Aide-Memoire.[63] As India had already accepted both documents by this point, the stage was set for the Indus Waters Treaty. The agreement took two years to draft and was signed by both parties on September 19th, 1960.[64]

B. *Governance Under the Indus Waters Treaty: An Overview*

As proposed in the 1954 Plan, the Indus Waters Treaty allows India unrestricted access to the three eastern rivers.[65] The treaty also allows Pakistan unrestricted access to the western rivers.[66] Because these rivers also flow through India before entering Pakistan, the Treaty sets out restrictions on India's upstream uses and the amount of water India may draw for the permitted uses.[67] Pakistan's use of tributaries that flow into the eastern rivers is similarly restricted.[68] Both parties agree that any non-consumptive use (including use for navigation, flood control, and fishing but not including agricultural use or use for hydropower) will not be undertaken in a way that materially changes the flow in the other party's channels of interest.[69] The parties also agree to use best efforts to maintain the natural channels of the rivers covered by this treaty, and to avoid obstructions in flow that would cause material damage to the other party.[70]

The treaty also sets the stage for cooperation between the two countries. The first component of this cooperative scheme is financial in nature. Since Pakistan had to develop new sources of water for its canals that were previously fed by the eastern rivers, the treaty sets up an installment system whereby India was required to contribute a fixed sum towards the development of new

62 *See id.*
63 *See id.*
64 *See id.*
65 *See* Indus Waters Treaty art. II, Sept. 19, 1960, 419 U.N.T.S. 6032.
66 *See id.* at art. III.
67 *See id.* at art. III, annexure C.
68 *See id.* at art. II.
69 *See id.* at art. IV(2).
70 *See id.* at art. IV(6).

Pakistani headworks.[71] The treaty also provides for sharing of data with respect to river flow and utilization.[72] To promote cooperation, India and Pakistan agreed to create a Permanent Indus Commission (PIC) with one high-ranking engineer appointed by each party.[73] These Commissioners were given a mandate to undertake periodic inspections of the rivers, investigate problems relating to development of the rivers, and settle questions arising about these issues.[74] Finally, the agreement includes a provision regarding the settlement of disputes, which requires disputes to be dealt with in a court of arbitration.[75] In addition to these mechanisms for encouraging cooperation, the Indus Waters Treaty also contains an explicit joint affirmation whereby both parties state their understanding of their common interest in these waters and their intent to cooperate in the future.[76]

The Indus Waters Treaty has been lauded as an example of cooperative water governance in the face of longstanding political conflict.[77] From partition to the present, India and Pakistan have never quite achieved harmony. Even days of proclaimed peace tend to conceal an uneasy tension. The existence of the treaty at all is surprising, in that it represents a joint limitation of territorial sovereignty in recognition of the widespread effects of water use in this region.[78] Despite the tension and the imbalance that favors India in both the riparian and military contexts—India is the upstream state and has the more powerful military force of the two countries, though both now have nuclear weapons at their disposal[79]—the Indus Waters Treaty has governed a shared

71 *See id.* at art. V. The headworks mentioned in the treaty refer to canal systems that Pakistan needed to build in order to replace supply it previously took from the eastern rivers. *See* Biswas, *supra* note 52, at 206.

72 *See id.* at art. VI.

73 *See id.* at art. VIII.

74 *See id.*

75 *See id.* at art. IX.

76 *See id.* at art. VII.

77 *See* Hamid Sarfraz, *Revisiting the 1960 Indus Waters Treaty*, 38 WATER INT'L 204, 205 (2013); Bhatnagar, *supra* note 54, at 278.

78 In particular, India and Pakistan limit their territorial sovereignty by agreeing not to undertake uses that would materially affect the flow of the western rivers in Pakistan and the eastern rivers in India respectively. *See* Indus Waters Treaty, *supra* note 65, at art. IV.

79 *See Nuclear Weapons: Who Has What at a Glance*, ARMS CONTROL ASS'N, https://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat (last updated Jan. 2016).

resource of these states for over fifty years without allowing conflicts to escalate or negotiations to be informed by the current political context.[80] This achievement in terms of cooperation is mainly attributable to the PIC, which has fulfilled its requirement to meet once yearly even during full-scale wars between India and Pakistan.[81] The treaty's relative success also reflects the use of a dispute resolution mechanism that requires third party mediation where the PIC cannot decide on a disagreement between the two states.[82]

Though the Indus Waters Treaty does not represent a holistic approach to basin management, the agreement between India and Pakistan regarding governance of the Indus Basin promotes active, rather than merely passive cooperation. Many scholars have written on the passivity with which India and Pakistan approach the management of their shared resource.[83] They point to the division of resources between India and Pakistan under the treaty as a severance of responsibilities that can be undertaken separately and with as little consultation as possible, to reflect the fledgling partition of the two countries themselves.[84] However, a truly passive system of resource management would disintegrate when parties act on conflicting interests. The Indus Water Treaty system has instead withstood the test of conflict over time, and has adapted to reflect each party's concessions to the interests of the other.

Active cooperation is defined as "adjust[ment] of behavior to the actual or anticipated preferences of others."[85] This description seems to fit the way that India and Pakistan have dealt with development in the Indus Basin under the Treaty. Pakistan has

80 *See* Bhatnagar, *supra* note 54, at 278.

81 *See* Sarfraz, *supra* note 77, at 211. The PIC met in 1965 despite the Second Kashmir War, in 1971 despite the Bangladesh Liberation War, in 1999 despite the Kargil War, and in 2001 and 2002 despite the military standoff following terrorist attacks in both countries. *Id.*; *see also* Alam, *supra* note 54, at 342.

82 *See* Zawahri, *supra* note 15, at 9; Thomas E. Robins, *Defusing Hydroelectric Brinkmanship: The Indus Waters Treaty's Alternate Dispute Resolution Provisions and their Role in the Tenuous Peace Between India and Pakistan*, 5 Y.B. ON ARB. & MEDIATION 389, 392 (2013).

83 *See* Zawahri, *supra* note 15, at 9, 2 n.5.

84 *See id.* at 2 & n. 5.

85 *See* Zawahri, *supra* note 15, at 5 (citing R.O. KEOHANE, AFTER HEGEMONY (1984)).

consented to Indian projects that affect the western rivers, while India has avoided simple solutions to continuous water shortages in Punjab in order to uphold the Treaty and prevent material harm to Pakistan's water supply.[86] Both states have changed their behavior in response to the requirements of the Treaty and knowledge of each other's preferences.[87] However, much of the development subject to interstate discussion has been occurring in the past two or three decades.[88] For much of the period in which the Indus Waters Treaty has been effective, India and Pakistan have undertaken water management separately, each with some tolerance for the activities of the other. Now that these activities (specifically the projects India plans for the states of Jammu and Kashmir currently under its control) have eclipsed the threshold of tolerance, the cooperation fostered by the Indus Waters Treaty is being put to the test.

C. *Cooperation in Action: Article IX and the Baglihar and Kishenganga Disputes*

Article IX of the Indus Waters Treaty addresses resolution of disagreements regarding interpretation or application of the agreement to the PIC in the first instance.[89] These issues are referred to as "questions."[90] If the PIC cannot agree, the issue becomes a "difference" and a Neutral Expert may settle the matter.[91] Should these measures fail to achieve a solution, a "dispute will be deemed to have arisen" and a resolution may either be negotiated between the Indian and Pakistani governments or handed down by a court of arbitration.[92] Recourse to alternative dispute resolution mediated by a third party has been and will continue to be essential for the success of the Indus Waters Treaty, particularly in the context of the ongoing conflict over Kashmir. Moreover, this provision helps even the balance between India and

86 *See id.*

87 *See infra* Section III.C for a discussion of the two countries' active cooperation.

88 *See* Shaheen Akhtar, *Emerging Challenges to the Indus Waters Treaty: Issues of Compliance & Transboundary Impacts of Indian Hydroprojects on the Western Rivers*, 28 REGIONAL STUDIES 3, 3–4 (2010).

89 *See* Indus Waters Treaty, *supra* note 65, at art. IX(1).

90 *Id.*

91 *Id.* at art. IX(2).

92 *Id.*

Pakistan in light of India's status as upper riparian.[93] The layers contained in this robust dispute resolution mechanism provide Pakistan with multiple opportunities to challenge India's upstream actions where bilateral negotiations fail.[94]

The mechanisms of dispute resolution under article IX (not including PIC conference) have twice been invoked by Pakistan, both within the past ten years. In 2005, Pakistan requested that a Neutral Expert step in to determine whether India's Baglihar dam project was consistent with the Treaty.[95] This was the first time that a "difference" was brought to the World Bank for resolution.[96] In 2010, Pakistan filed to challenge India's Kishenganga Dam project before the Permanent Court of Arbitration, after bilateral negotiations failed to yield a solution.[97] This was the first time a "dispute" arose under the Treaty.[98] The Baglihar and Kishenganga episodes showcase the successful application of the Treaty's dispute resolution mechanisms, and they illuminate India and Pakistan's distinct approaches to treaty administration.

1. *The Baglihar "Difference"*

In 2005, Pakistan used article IX to call for a Neutral Expert determination regarding India's Baglihar Dam project.[99] The Baglihar Dam was one of several major hydroelectric projects that India envisaged for the contested Jammu and Kashmir regions in the early 1990s.[100] The location was extremely politically

93 *See* Bhatnagar, *supra* note 54, at 277.

94 *See* Alam, *supra* note 54, at 342.

95 *See* Salman M. A. Salman, *The Baglihar Difference and its Resolution Process—A Triumph for the Indus Waters Treaty?*, 10 WATER POL'Y 105, 108–09 (2008).

96 *Id.*

97 *See* Jawad Ahmad, *The Indus Waters Kishenganga Arbitration and State-to-State Disputes*, 29 ARB. INT'L 507, 508 (2013); *see, e.g.*, *Kishanganga Dam – Another Set of Failed Water Talks*, DAWN (Dec. 5, 2015), http://www.dawn.com/news/168442/kishanganga-dam-another-set-of-failed-water-talks.

98 Shashank Kumar, *The Indus Waters Kishenganga Arbitration (Pakistan v. India)*, ASIL INSIGHTS (May 13, 2013), https://www.asil.org/insights/volume/17/issue/13/indus-waters-kishenganga-arbitration-pakistan-v-india (noting that the Kishenganga dispute was the first time that an Indus Waters Treaty dispute was heard by a court of arbitration).

99 *See* Amer Rizwan Khattak, *World Bank Neutral Expert's Determination on Baglihar Dam: Implications for India-Pakistan Relations*, 61 PAK. HORIZON 89, 94 (2008).

100 *See id.* at 92.

sensitive: the Baglihar Dam sits on the Chenab River, which is one of the western rivers allocated to Pakistan.[101] India's plans detailed a dam 144 meters high and nearly 320 meters long with a capacity of 450 megawatts, to be doubled on addition of a second phase power station.[102] Beginning in 1992 when the project was conceived, Pakistan and India conducted negotiations regarding its scope—first at the PIC level and then at the national government level.[103]

Pakistan objected to the height of the dam, the number and position of its power intake tunnels, and the design of the spillways.[104] Meanwhile, India viewed Baglihar as a "run of the river" dam and contended that its design specifications were no different from twenty other such dams that had been constructed elsewhere in India.[105] Discussions failed to yield results, and work

101 *See* ROBERT G. WIRSING & CHRISTOPHER JASPARRO, SPOTLIGHT ON INDUS RIVER DIPLOMACY: INDIA, PAKISTAN, AND THE BAGLIHAR DAM DISPUTE 5 (2006); *Indus Waters Treaty*, *supra* note 65, at art. III. India is permitted to use the upstream waters of the Chenab River for generation of hydroelectric power subject to certain restrictions outlined in Annexure D to the Indus Waters Treaty. Indus Waters Treaty, *supra* note 65, at art. III(2)(d), annexure D.

102 *See* Wirsing & Jasparro, *supra* note 101, at 5.

103 *See* Khattak, *supra* note 99, at 93. When several rounds of discussion within the PIC failed to yield a solution, bilateral talks were undertaken by members of each state government; after a final attempt by the Water Secretaries and Water Commissioners of both countries failed to produce results, Pakistan resorted to the article IX provision. *See id.* Construction on the dam had already begun at this point. *See id.* at 92.

104 Pakistan believed the pondage capacity afforded by the height of the dam exceeded that allowed by the treaty. *See* RAYMOND LAFITTE, BAGLIHAR HYDROELECTRIC PLANT EXPERT DETERMINATION: EXECUTIVE SUMMARY 4 (2007), http://siteresources.worldbank.org/SOUTHASIAEXT/Resources/223546-1171996340255/Baglihar Summary.pdf. Pakistan also worried that the power intake tunnels were not located high enough and allowed too much Indian discretion regarding discharge as a result. *See id. See also* WIRSING & JASPARRO, *supra* note 101, at 5. In addition, Pakistan objected to the gated spillways, which would provide India with further control over the amount of water reaching the Pakistani portion of the river. *See* LAFITTE, *supra* note 104, at 4; Khattak, *supra* note 99, at 92–93.

105 *See* Wirsing & Jasparro, *supra* note 101, at 5. India countered Pakistan's objections by arguing that naturally silty conditions at the site necessitated inclusion of gated spillways; moreover, the position of the power intakes was based on sound engineering. *See id.*; LAFITTE, *supra* note 104, at 4. India saw Baglihar as a "run of the river" dam, meaning it lacked live storage other than pondage or surcharge storage. *See* Aardraa Upadhyay & Tamojit Chatterjee, *The Kishenganga Hydro-Electric Project Arbitration Dispute – Partial Award (Pakistan V. India): An Analysis*, 2 INDIAN J. OF ARB. L. 1, 4 (2013).

on the dam continued all the while.[106] Pakistani officials accused India of dragging its feet on negotiations while expediting construction.[107] In 2005, Pakistan applied to the World Bank for designation of a Neutral Expert under article IX to examine this "difference" and determine whether India's actions contravened the Treaty.[108] Following consultation with both parties, the World Bank appointed Raymond Lafitte, a civil engineer and professor at the Federal Institute of Technology in Lausanne, Switzerland, to the post of Neutral Expert for the Baglihar Dam issue.[109]

Lafitte made his determination in 2007 after a visit to the Baglihar site and five meetings with delegations from both countries.[110] The decision overruled Pakistan's objections regarding the designation of the maximum design flood and the necessity and design of gated spillways.[111] With regard to the dam crest elevation, pondage level, and power intake level, the Neutral Expert made minor changes to India's plans to bring them into compliance with the Treaty.[112] Both parties viewed this decision as a victory.[113] Pakistan claimed that merely invoking article IX showed India that Pakistan would not meekly bow down to its development agenda; moreover, the changes required by the Neutral Expert determination substantiated Pakistan's claims regarding inconsistencies with the Treaty.[114] Meanwhile, India declared that the determination only required minor changes and its Baglihar plans would, for the most part, proceed as intended.[115]

2. *The Kishenganga "Dispute"*

In addition to the Baglihar dam, India contemplated the construction of another hydroelectric facility on the Neelum River, a tributary to the Jhelum River.[116] The Jhelum River is also

106 *See id.*

107 *See* Khattak, *supra* note 99, at 93.

108 *Id.* at 94.

109 *See* LAFITTE, *supra* note 104, at 1.

110 *See id.* at 3.

111 *See id.* at 1–3.

112 *See id.* at 4–6.

113 *See* Khattak, *supra* note 99, at 96.

114 *See* Wirsing & Jasparro, *supra* note 101, at 6 ("[F]or Pakistan to compromise on Baglihar, [Pakistani officials] say, would set a precedent that India could invoke whenever it liked . . . ."); Khattak, *supra* note 99, at 96.

115 *See* Khattak, *supra* note 99, at 96.

116 *See id.* at 92.

counted within the western rivers allocated to Pakistan.[117] The Kishenganga Hydro-Electric Project (KHEP) involves the construction of a dam 37 meters high that will divert the flow of the Kishenganga River (a tributary to the Neelum) away from the Neelum River by tunnel.[118] The KHEP utilizes this inter-tributary diversion to generate up to 330 megawatts of electricity in a region strapped for power.[119] However, without the flow from the Kishenganga, Pakistan anticipated a 21 percent shortfall in flow to its own 969-megawatt Neelum-Jhelum Hydroelectric Project downstream and a resulting 10 percent drop in energy generation.[120]

When bilateral negotiations pursuant to article IX(4) of the Treaty failed to yield a solution, Pakistan filed a Request for Arbitration before the Permanent Court of Arbitration in 2010.[121] Pakistan's objections were twofold. First, it alleged that India's proposed diversion of the Kishenganga River violated the obligations India owes Pakistan under the Treaty.[122] Second, it questioned whether India could bring the plant's reservoir level below Dead Storage Level (DSL) outside of emergency situations.[123] India raised a challenge to the admissibility of the second point, stating that Pakistan must be required to show it exhausted the other dispute resolution mechanisms in article IX

117 *See* Indus Waters Treaty, *supra* note 65, at art. III.

118 *See* Upadhyay & Chatterjee, *supra* note 105, at 3.

119 *See* Ahmad, *supra* note 97, at 508; Asiya Raheem, *Why Is Kashmir Still Facing Unscheduled Power Curtailments?*, KASHMIR OBSERVER (Feb. 18, 2016), https://kashmirobserver.net/2016/melange/why-kashmir-still-facing-unscheduled-power-curtailments-3357; Zofeen T. Ebrahim, *Pakistan's Energy Crisis Could Topple Government, Experts Warn*, DAWN (Mar. 5, 2015), http://www.dawn.com/news/1167563.

120 *See* Yoshifumi Tanaka, *Note on the Interim Measures in the Indus Waters Kishenganga Arbitration*, 11 L. & PRAC. INT'L CTS & TRIBUNALS 555, 556–57 (2012).

121 *See In re* Indus Waters Kishenganga (Pak. v. India), Final Award, at 1 (Perm. Ct. Arb. 2013).

122 *See id.*

123 *See id.* Pakistan was concerned that India's practice of 'draw-down flushing' at the KHEP (lowering the water level to flush sediment out of the reservoir) would adversely impact the Neelum's flow into Pakistan. *See id*. The depletion of a reservoir below DSL necessarily indicates the potential for discontinuation of water discharge other than for the purposes of sediment control, so Pakistan was worried that such action taken by India at the KHEP would further reduce the inflow to its own Neelum-Jhelum Hydroelectric Project. *See* Upadhyay & Chatterjee, *supra* note 105, at 3.

and that the question of reservoir levels was not a technical one that should properly be addressed to a Neutral Expert.[124] According to specifications laid out in the Treaty, seven arbitrators were appointed to a court of arbitration to hear the case.[125]

The court conducted site visits to the KHEP and the junction of the Neelum and Jhelum rivers.[126] Following the first site visit (and perhaps having learned from the Baglihar experience), Pakistan applied to enjoin India from further work towards the diversion of the Kishenganga River until the court made its decision.[127] In 2011, the court issued an Order on Interim Measures stating that India could not proceed with any permanent works for the KHEP that could inhibit restoration of natural flow in the channel; barring this, India was free to continue work on the dam and use temporary means of diversion subject to periodic joint inspections with Pakistan.[128]

The court then issued a Partial Award in 2013, detailing in part its findings on the merits of the case.[129] With regard to the first objection raised by Pakistan, the court found that KHEP was a "run of the river" dam and therefore permitted by treaty to conduct inter-tributary diversions for the purpose of hydroelectric power generation.[130] However, India was required to maintain a minimum flow at a level determined by the court in the Final

124 *See* Ahmad, *supra* note 97, at 509. India did not challenge the admissibility of Pakistan's first objection regarding the diversion of the Kishenganga. *Id.*

125 *See* Indus Waters Treaty, *supra* note 65, at art. IX(5). Annexure G to the treaty provides that, of the seven arbitrators, two are to be appointed by each party; of the remaining three (the umpires), one must be a highly qualified engineer, another must be well-versed in international law, and the third must be qualified by status and reputation to be chairman of the court. *Id.* at annexure G(4)(a)-(b).

126 *See* Ahmad, *supra* note 97, at 508.

127 *See* Uphadyay & Chatterjee, *supra* note 105, at 3. Pakistan requested that the court issue an Order stating that India must cease work on the KHEP until the court decided on the merits; requiring India to inform Pakistan and the court of developments in the KHEP that might adversely affect the status quo, and warning India that any further development on the KHEP would risk court-ordered modification or dismantling in the final decision. *See* Tanaka, *supra* note 120, at 558.

128 *See In re* Indus Waters Kishenganga (Pak. v. India), Final Award, at 2 (Perm. Ct. Arb. 2013).

129 *See In re* Indus Waters Kishenganga (Pak. v. India), Partial Award, at 201–02 (Perm. Ct. Arb. 2013).

130 *Id.*

Award.[131] The court, after ruling the second objection admissible, then decided that depletion of reservoir levels below the DSL was prohibited except for unforeseen emergencies.[132] As with the Baglihar determination, both countries declared victory following the court's decision. India considered the decision a green light for the KHEP.[133] On the other hand, Pakistan touted the minimum flow restriction and prohibition of drawdown flushing as signs that the decision fell overwhelmingly in its favor.[134]

D. *Future Implications of the Baglihar Difference and the Kishenganga Dispute*

It is difficult to say how the outcomes of the Baglihar difference and the Kishenganga dispute will impact future development in the Indus Basin. These are the first two instances in which either party has invoked the article IX provisions;[135] however, some scholars believe more frequent article IX activity is in the cards for India and Pakistan.[136] Pakistan recently reiterated

131 *See id.* The court came to this decision in part because it determined that India had priority, having begun work to actualize the KHEP before Pakistan had put in work on its Neelum-Jhelum project. *See* Ahmad, *supra* note 97, at 521. However, it noted that future projects should undergo full discussion under the treaty's dispute resolution provisions *before* construction to avoid instigating a race to construct. *See In re Kishenganga*, Partial Award, at 167. The minimum level of flow India had to allow through to Pakistan, to fulfill its obligations under the principle of transboundary harm as stated in the Pulp Mills arbitration, was set at 9 cubic meters per second. *See In re* Indus Waters Kishenganga, Final Award, at 43.

132 *See In re* Indus Waters Kishenganga, Partial Award, at 201. The court found that the treaty did not preclude it from considering a technical question instead of having that question presented to a Neutral Expert. *See id.* at 183. The court then determined that existing restrictions on water storage within the treaty indicate that drawdown flushing would not be in keeping with the intent of the treaty, particularly when other methods were available for sediment removal. *See id.* at 191, 193.

133 *See* Ravish Tiwari, *India Wins Kishanganga Case at the Hague Court*, INDIAN EXPRESS (Feb. 19, 2013), http://archive.indianexpress.com/news/india-wins-kishanganga-case-at-the-hague-court/1076239.

134 *See Permanent Court of Arbitration: Kishanganga Ruling Seen' in Pakistan's Favour'*, EXPRESS TRIBUNE (Mar. 16, 2013), http://tribune.com.pk/story/521653/permanent-court-of-arbitration-kishanganga-ruling-seen-in-pakistans-favour/.

135 *See* Salman, *supra* note 95, at 109 (noting that the Baglihar difference was the first time that the World Bank was called on to exercise its dispute resolution role under art. IX of the treaty); Kumar, *supra* note 98.

136 *See* Robins, *supra* note 82, at 406; Khattak, *supra* note 99, at 105; Wirsing & Jasparro, *supra* note 101, at 6.

its objection to the design of the Kishenganga dam, and voiced concerns over India's plans for four other dams that would divert water from the Chenab before it reaches Pakistan.[137] As water scarcity and seasonality escalate in the region, the lack of adaptable provisions in the Treaty could lead to an increase in gamesmanship between India and Pakistan as one tries to corner as much of the resource as possible and the other tries to protect its share.[138]

IV. USING AN OLD TREATY TO ADDRESS NEW CHALLENGES: INCORPORATING GROUNDWATER AND CLIMATE CHANGE WITHOUT UPENDING THE INDUS WATERS TREATY

A. *Challenges of Shared Groundwater Resources*

The problem of allocating and protecting shared groundwater resources has garnered increasing attention in the sphere of international law, as evidenced by the recent General Assembly adoption of the Law on Transboundary Aquifers.[139] Due to the relatively recent focus on this subject, the Indus Waters Treaty does not explicitly contemplate management of shared groundwater; as written, it only focuses on the surface water sources within the Indus Basin.[140] In other words, this agreement is not founded on the currently favored integrated basin development model.[141] However, India and Pakistan also share the Indus River

137 *See India Accused of Violating Indus Water Treaty*, DAWN (Aug. 25, 2014), http://www.dawn.com/news/1127556. India's planned hydropower projects in the Indus Basin include the Ratli Dam (690 megawatts), Pikkal Dam (1,000 megawatts), Karthai Dam (1,190 megawatts), and Kero Dam (600 megawatts). *Id.* Discussions regarding these dams are still at the PIC stage; no article IX action has yet been taken. *Id.*

138 *See* UNEP, *supra* note 13, at 9.

139 *See Articles on the Law of Transboundary Aquifers*, AUDIOVISUAL LIBRARY OF INT'L LAW (2008), http://legal.un.org/avl/ha/alta/alta.html.

140 *See* Mary Miner et al., *Water Sharing Between India and Pakistan: A Critical Evaluation of the Indus Water Treaty*, 34 WATER INT'L 204, 209, 211 (2009).

141 *See* Bhatnagar, *supra* note 54, at 295. When the World Bank helped broker the Indus Waters Treaty between India and Pakistan, it had initially hoped both countries would agree to integrated development on the Indus Basin. *See id.* Integrated basin models are touted as the most effective and efficient method of resource management because they emphasize management according to the natural boundaries of the hydrological feature rather than administrative or political boundaries. *See id.* Rather than accounting for natural boundaries, the Indus Waters Treaty merely splits the rivers within the basin for each country's

Plain Aquifer, an unconfined/semi-confined groundwater source located beneath the Indus Basin that is currently experiencing several problems associated with overexploitation.[142] Groundwater abstraction has boomed in the Indus Basin since the Treaty came into force, as farmers developed the capacity to draw groundwater through cheap tube wells to supplement variable surface water supplies.[143] A substantial portion of irrigation in the region is supported by groundwater, particularly following the agricultural expansion known as the "green revolution."[144] Groundwater sustains a significant amount of domestic and industrial activity as well.[145] NASA satellite data indicates severe water table decline in the transboundary aquifer underlying the region, particularly beneath the Indian states of Rajasthan, Punjab, and Haryana—these states are collectively the breadbasket of India.[146] Significant groundwater extraction is also occurring in Pakistani Punjab, but resource depletion seems to be less of a concern than on the India side.[147] As a whole, the aquifer underlying the Indus Basin is the second-most overstressed aquifer in the world.[148] Groundwater

use. *See id.*

142 *See* Matthew Rodell et al., *Satellite-based Estimates of Groundwater Depletion in India*, 460 NATURE 999, 1000 (2009). The unconfined nature of the aquifer and its location beneath the Indus River system results in interactions between groundwater and surface water. *See generally Groundwater and Surface Water: Understanding the Interaction*, CONSERVATION TECH. INFO. CNTR., http://www2.ctic.purdue.edu/KYW/Brochures/GroundSurface.html (last visited Sept. 8, 2016) (describing how unconfined aquifers often interact with nearby surface water bodies).

143 *See* Asad Sarwar Qureshi et al., *Challenges and Prospects of Sustainable Groundwater Management in the Indus Basin, Pakistan*, 24 WATER RES MGMT. 1551, 1554 (2009).

144 Rodell et al., *supra* note 142, at 1000.

145 *See id.*

146 *See id.*

147 *See* M.J.M. Cheema et al., *Spatial Quantification of Groundwater Abstraction in the Irrigated Indus Basin*, 52 GROUNDWATER 25, 31, 33 (2014). Pakistan's use of groundwater in the Indus basin, though rapidly developing, is not yet on par with India's use. *See* Rodell et al., *supra* note 142, at 1000. As the downstream entity, Pakistan also receives greater recharge to the portions of the aquifer lying within its borders; however, the contaminants present in the recharge have led to increasing pollution and salinity of groundwater in Pakistan. *See* Qureshi et al., *supra* note 143, at 1558; Miner, *supra* note 140, at 211. Moreover, India's abstraction of groundwater is sparking Pakistani concerns that water availability on Pakistan's side of the aquifer will diminish in response to activity on India's side. *See* IUCN, BEYOND INDUS WATER TREATY 3–5 (2010).

148 *See Study: Third of Big Groundwater Basins in Distress*, NASA (June 16, 2015), http://www.jpl.nasa.gov/news/news.php?feature=4626.

overexploitation is a significant concern for both countries, since the region falls relatively low on the scale of global long-term average groundwater recharge estimates by region.[149] As replenishment of the resource fails to keep up with use, both countries will find themselves increasingly strapped for the water they need to maintain necessary domestic and industrial activities. Incorporating aquifer management into the Indus Waters Treaty would also encourage both parties to account for the effects of aquifer depletion on river flow.

Since the Indus River Plain Aquifer is connected to the Indus River system, India and Pakistan could potentially govern the management of this resource under the UN Watercourse Convention. Said management would be subject to the principle of equitable utilization, the obligation not to cause significant harm, and the general obligation to cooperate.[150] These guiding principles have already been worked into the Indus Water Treaty's treatment of surface water resources within the Indus Basin.[151] The law of transboundary aquifers adds a complicating element: the principle of sovereignty for aquifer states.[152] Though these instruments provide general principles that may guide cooperative aquifer management, both parties will likely require more specific parameters that take into account the needs of both countries and capacity of the underlying groundwater resource. India and Pakistan are free to take alternative, particularized action because the Indus Waters Treaty already suborns the Watercourse Convention and the Law on Transboundary Groundwater is effectively guidance for separate agreements entered into by states outside any treaty regime.

India and Pakistan will face certain challenges should they decide to undertake a cooperative aquifer management program under the Indus Waters Treaty. The greatest obstacle hindering these countries from coming to the table in the first place is the

149 *See* TUSHAAR SHAH, THE GROUNDWATER ECONOMY OF SOUTH ASIA: AN ASSESSMENT OF SIZE, SIGNIFICANCE, AND SOCIO-ECOLOGICAL IMPACTS 409–10 (2007). "Recharge" refers to the addition of water to an aquifer, such as through precipitation. *See Groundwater Definitions*, N.Y. DEP'T. OF ENVTL. CONSERVATION, http://www.dec.ny.gov/lands/76322.html (last visited Sept. 9, 2016) (providing a basic definition of both 'recharge' and 'recharge rate').

150 *See* UN Watercourse Convention, *supra* note 28, at art. 5–8.

151 *See* Indus Waters Treaty, *supra* note 65, at arts. II, III, IV(2), VII.

152 *See* 2008 Resolution, *supra* note 44, at art. III.

tangled imbalance of incentives. Actual groundwater depletion is much more severe on India's side of the Basin than in Pakistan; however, this does not account for relative dependence on groundwater resources.[153] Both countries face significant political incentive to manage their groundwater struggles at the domestic level because there is no bilateral instrument requiring interstate cooperation in the context of groundwater. In addition, India's groundwater problems are mostly of its own making;[154] management of the aquifer on the Pakistan side is not a necessary condition for rehabilitation on the Indian side. Conversely, Pakistan is becoming increasingly apprehensive about the effects that India's overexploitation of the aquifer will wreak on its own groundwater availability.[155] Its concern might make Pakistan more amenable to discussions regarding the incorporation of groundwater into the Indus Waters Treaty, or even creation of a separate bilateral agreement concerning aquifer management. The current status quo resembles the power allocation that predated the Indus Waters Treaty itself; Pakistan's position as the affected (but not affect*ing*) country mirrors its position as downstream riparian. Just as with the creation of the Treaty, third party interference may be necessary to commence discussion of transboundary groundwater management in the Indus Basin.

Yet another challenge facing India and Pakistan is that once they initiate the agreement process, there are not many transboundary groundwater agreements to use as precedent. One recent example is the Agreement on the Guarani Aquifer, which Argentina, Brazil, Paraguay, and Uruguay ratified in 2010.[156] The Guarani Agreement came about after the UN General Assembly had adopted the draft articles on the Law of Transboundary Aquifers.[157] Its first article incorporates the main principles set out

153 *See* Rodell et al., *supra* note 142, at 999, 1001.

154 The most heavily depleted parts of the Indus Aquifer underlie the Indian states of Punjab, Haryana, and Rajasthan. *See id.* at 1000. These states are considered the main drivers behind the agricultural expansion in India, which relies more and more on groundwater for irrigation. *See id.* at 999–1000; *see also India*, FAO, http://www.fao.org/nr/water/aquastat/countries_regions/ind/index.stm (last visited Sept. 8, 2016).

155 *See* IUCN, *supra* note 147, at 3–5.

156 *See* Pilar Carolina Villar & Wagner Costa Ribeiro, *The Agreement on the Guarani Aquifer: A New Paradigm for Transboundary Groundwater Management?*, 36 WATER INT'L 646, 651 (2011).

157 *See id.* at 646.

by the Law.[158] The agreement places heavy emphasis on the principles of equitable utilization and cooperation—principles that are also present to some extent in the Indus Waters Treaty.[159] Though this agreement may provide an abstract example of transboundary groundwater management, it has not been in force for long enough to determine whether its provisions are effective. Moreover, the agreement was signed in the absence of conflict, whereas other agreements in the past were more reactive to looming conflict; therefore, the Guarani Agreement might not be the most helpful precedent for India and Pakistan to follow.[160]

India and Pakistan may instead look to the European model. Any agreement reached by India and Pakistan would necessarily depart from the European structure, since the European Union contains several surface water conventions governed by an overarching Water Framework Directive.[161] However, the EU Water Framework Directive contains several principles and underlying acknowledgements that India and Pakistan would do well to incorporate into either the Indus Waters Treaty or a separate bilateral agreement. For instance, the Directive acknowledges the importance of groundwater management to avoid poor quality and maintain quantity in light of factors such as natural recharge rates, surface and groundwater interaction, and the connection between hydrological and terrestrial ecosystems.[162] The Directive encourages such management to take place within integrated programs coordinated at the river basin level, incorporating both quantitative and qualitative analysis of surface

158 *See id.* at 654.

159 *See id.*; *see generally* Zahwari, *supra* note 15 (discussing the incorporation of cooperation and equitable utilization, as represented in the UN Watercourse Convention, into the Indus Waters Treaty).

160 *See id.* at 647. The Guarani Aquifer is not currently facing overexploitation and contains a large quantity of available groundwater. *See* Bryan A. Green, *The Guarani Aquifer and International Groundwater Law*, 13 U. DENV. WATER L. REV. 361, 385 (2010).

161 *See*, *e.g.* Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Mar. 17, 1992, 1936 U.N.T.S. 269 [hereinafter Helsinki Water Convention]; Convention on Cooperation for the Protection and Sustainable Use of the Danube River, June 29, 1994, Int'l Comm'n for the Protection of the Danube River; Convention on the Protection of the Rhine, Jan. 22, 1998, FAO; Council Directive 2000/60, 2000 O.J. (L 327) (EC) [hereinafter EU Water Framework Directive].

162 *See* EU Water Framework Directive, *supra* note 161, at Preamble ¶¶ 20, 33.

and groundwater systems.[163] In terms of groundwater use, the Directive requires that abstractions not exceed the amount of overall recharge not needed by the surrounding ecology.[164] Perhaps the most laudable aspect of the Directive is that it adopts a view of general discharge into aquifers that seems to be informed by the precautionary principle. Nearly all direct discharges into aquifers are prohibited, while monitoring is required to detect any chemical changes in groundwater and reverse the influence of potential indirect discharge.[165] Groundwater recharge rates, which affect both water quality and quantity, vary based on a multitude of factors, including topography, geology, and climate.[166] The recharge rate for a specific aquifer can be difficult (and often resource-intensive) to determine.[167] The EU's approach embodies the precautionary principle by taking action to mitigate the risk of anthropogenic discharge into aquifers despite the relative uncertainty regarding the magnitude of harm associated with this risk.[168]

Ideally, an Indo-Pakistani groundwater management program would find a similar basis in the precautionary principle. Particularly in the absence of basin-wide research, quantification of recharge rates and differentiation between the management needs for aquifers around the Indus Basin will be difficult.[169] Moreover, overexploitation is and will continue to be a major problem in the Basin. In this context, a precautionary approach is appropriate for governance of both abstraction from and discharge into aquifers, to prevent the situation from worsening. Unfortunately, the political implications of implementing the

163 *See id.* at pmbl. ¶¶ 33–34.

164 *See Introduction to the New Water Framework Directive*, EUROPEAN COMM'N, http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm (last visited Sept. 8, 2016).

165 *See* EU Water Framework Directive, *supra* note 161, at arts. 11(3)(j), (5).

166 *See* Sophocleous, *supra* note 39, at 53. The groundwater recharge rate affects not only the quantity of water available within the aquifer, but also the concentrations of pollutants in the aquifer. *See id.*

167 *See generally* Bridget R. Scanlon et al., *Choosing Appropriate Techniques for Quantifying Groundwater Recharge*, 10 HYDROGEOLOGY J. 18 (2002).

168 The precautionary principle is defined as follows: "[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation." PHILIPPE SANDS ET AL., PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 218, 220 (3d ed. 2012).

169 *See infra* Section IV.C.

precautionary approach will hamper any attempt at bilateral discussion—Pakistan will likely balk at being asked to take action on a problem it believes is caused by India in the face of growing national water scarcity, while India could very well claim that its needs from this aquifer are greater than Pakistan's needs and that restrictions on use should be allocated accordingly. Moreover, it will be difficult to incorporate this type of approach to groundwater management in a way that is consistent with the Treaty's current approach to surface water allocation. Though India and Pakistan could potentially set quantitative abstraction limits for each country, this approach would still need to account for factors like seasonality and recharge rates to ensure availability of enough water for both states.

The most likely solution, if anything, is that relatively soft groundwater protections—some level of monitoring or reporting, for instance—be incorporated into the existing Indus Waters Treaty. For instance, India and Pakistan could define groundwater in Article I such that the cooperation provisions in Articles VII and IX apply to groundwater as well as surface water. The two countries could go further and define allowable use of groundwater by each party in an Annexure to the Treaty, much as Annexures C, D, and E place requirements and restrictions on India's use of the Western rivers for agriculture, hydroelectric power generation, and water storage.[170] This approach would allow for a more detailed consideration of the technical aspects of groundwater management. Unfortunately, it would create an opening for conflict that the first option does not—platitudes of cooperation are much more palatable to both parties than mandates on allowable use of natural resources. In any case, as long as control over Jammu and Kashmir remains a sore subject, both parties will likely avoid reopening of the Treaty for any greater overhaul (such as integrated basin development) for fear that the other will use the opportunity to its advantage.

B. *Adaptation to Climate Change*

Climate change poses another significant obstacle for both countries in the quest to ensure an adequate supply of water for human, agricultural, and industrial use. The Intergovernmental Panel on Climate Change (IPCC) reports that South Asia is

170 *See* Indus Waters Treaty, *supra* note 65, at annexures C–E.

experiencing a decreasing general trend in streamflow and that river systems dependent on snowmelt will see greater changes in future seasonal distribution of flow.[171] For glacier-fed sources such as the Indus River system, researchers predict an increase in flow as glacial melt rises, followed by a decrease reflecting the lowered capacity of glaciers to contribute to headwaters.[172] This could be problematic for incorporation of climate change mitigation into the Indus Waters Treaty, as the temporary increase in water availability could induce both countries to put off consideration of mitigation measures. The rising temperatures predicted for this region will contribute to greater evapotranspiration rates and increasing aridity.[173] Climate change impacts will likely exacerbate the consequences of overexploitation already being felt in the Indus Basin due to population growth, technological advances, and subsequent changes in the nature of regional demand.[174] The IPCC highlights management and understanding of climate change risks as the key to adaptation going forward.[175]

As far as adaptation goes, the Indus Waters Treaty is ill equipped to deal with climate change. The most glaring problem is that surface water is currently allocated by tributary.[176] This leaves little flexibility to account for the changes in quantity that may arise due to climate change impacts on each tributary. Furthermore, addressing climate change bilaterally will require a great deal more cooperation than India and Pakistan have thus far undertaken. At the outset, both states must facilitate a joint study of climate change effects in the Indus Basin as a whole. As with groundwater, existing studies tend to focus on discrete portions of the Indus river system; however, any plan to mitigate climate change effects must account for these effects as experienced at the

171 *See* Jimenez Cisneros et al., *Freshwater Resources*, *in* CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 236, 243 (2014).

172 *See* Jayashree Vivekanandan & Sreeja Nair, *Climate Change & Water: Examining the Interlinkages*, *in* TROUBLED WATERS: CLIMATE CHANGE, HYDROPOLITICS, AND TRANSBOUNDARY RESOURCES 4–5 (David Michel & Amit Pandya, eds., Henry L. Stimson Center 2009).

173 *See* Mannava V.K. Sivakumar & Robert Stefanski, *Climate Change in South Asia*, *in* CLIMATE CHANGE AND FOOD SECURITY IN SOUTH ASIA 18 (Rattan Lal et al., eds., 2011).

174 *See, e.g.*, Bhatnagar, *supra* note 54, at 281.

175 *See id.* at 253.

176 *See* Indus Waters Treaty, *supra* note 65, at arts. II, III.

basin scale.[177] Measures that are too focused on local climate change impacts run the risk of causing externalities that intensify climate change impacts elsewhere in the Basin.[178] In addition to determining what measures will be taken, both states will need to establish procedures for updating these measures to mitigate climate change impacts as new information becomes available.

Since addressing climate change inherently requires flexibility to adapt to a phenomenon that is relatively unpredictable, addition of a climate change annexure to the Treaty might only create more work for India and Pakistan whenever new information necessitates an amendment. Since substantive changes to the Treaty can easily become contentious, the procedural route may be a better alternative; India and Pakistan could enlarge the scope of PIC duties and empower the PIC to propose and enforce climate change impact mitigation measures. The institutional solution to climate change adaptation in the context of river basins is gaining general acceptance, and the United Nations has promoted the creation of river basin organizations in its Integrated Water Resources Management system.[179] Broadening the institutional powers of the PIC by adding experts chosen by both parties and allowing these experts to come up with creative solutions would lower the number of gates that could potentially open to conflict. By allowing the institution to come up with reasoned measures in the first instance without an official determination from either country until these measures are fully formed, the Treaty would remove opportunities for either country to scupper discussions before they even get started.

177 *See, e.g.*, Pratap Singh & Lars Bengtsson, *Hydrological Sensitivity of a Large Himalayan Basin to Climate Change*, 18 HYDROLOGICAL PROCESSES 2363 (2004) (exploring climate change impacts on the Sutlej River basin); H.J. Fowler & D.R. Archer, *Conflicting Signals of Climatic Change in the Upper Indus Basin*, 19 J. OF CLIMATE 4276 (2005) (focusing on climate change in the Upper Indus Basin).

178 *See generally* U.N. ECON. COMM'N FOR EUROPE & INT'L NETWORK OF BASIN ORGS., WATER AND CLIMATE CHANGE ADAPTATION IN TRANSBOUNDARY BASINS: LESSONS LEARNED AND GOOD PRACTICES, U.N. Sales No. E.15.II.E.1 (2015) (discussing the importance of cooperation between riparian countries because of the complications climate change introduces into an already-entangled water system).

179 *See* U.N. ENV'T PROGRAMME, TOWARDS INTEGRATED WATER RESOURCES MANAGEMENT: INTERNATIONAL EXPERIENCE IN THE DEVELOPMENT OF RIVER BASIN ORGANISATIONS 9–10 (2014).

C. *The Potential for Procedural Improvements*

If the Indus Waters Treaty is updated, the changes are more likely to be procedural than substantive. Negotiations are easier to settle when the issue involves method rather than matter.[180] There are several relatively minor and politically palatable changes at the procedural level that, if incorporated into the Indus Waters Treaty, could further facilitate the extension of cooperation into new areas and streamline existing endeavors under the Treaty. In particular, these changes may help India and Pakistan work towards incorporation of issues like groundwater management and climate change so that they can bring the Indus Waters Treaty into the 21st century.

Effective management at the basin level requires up-to-date technical and scientific information regarding the status of the Basin.[181] Thus far, studies of the Indus Basin have been mostly piecemeal, leading to a dearth of data encompassing the Basin as a whole.[182] This can be attributed to several factors, including the politically sensitive nature of the area in question, the rough and remote terrain, and a general lack of resources allocated to such endeavors.[183] India and Pakistan should agree to set up and fund a joint research team to undertake a full study of the Basin that will account for all of its, both on and below ground. In practice, such a study will at least approach the complexity of studies underlying economic models for integrated basin development.[184] The initial study should lead to adaptation and extension of monitoring so that it fully accounts for all hydrologic features within the Basin.

180 Negotiators of an international agreement often face a similar tradeoff between facilitating cooperation and strengthening enforcement mechanisms. *See* Andrew T. Guzman, *The Design of International Agreements*, 16 EUR. J. INT'L L. 579, 580–81, 588 (2005). An agreement with a broad substantive scope is more likely to take the form of "soft law" without mechanisms for monitoring or review. *Id.* at 581. The Indus Waters Treaty could benefit from either substantive or procedural updating. However, opening up substantive provisions could destroy the balance that the World Bank was able to forge between the two countries in 1960. *See generally* Biswas, *supra* note 52. In contrast, small procedural updates could be contained to the mechanical provisions discussed in this Note without upending the treaty system entirely.

181 *See* Mukhopadyay, *supra* note 12, at 4406.

182 *See id.* at 4405.

183 *See id.*

184 *See* Ariel Dinar & Donna J. Lee, *Review of Integrated Approaches to River Basin Planning, Development, and Management* 12 (The World Bank, Working Paper No. 1446, 1998).

Monitoring is one of the most important aspects of a functioning cooperative institution, because it maintains transparency and reduces incentive for either party to cheat the other.[185] Such a significant element of the agreement's success must be informed by accurate data to the fullest extent possible. Removal of this informational barrier could encourage India and Pakistan to expand the reach of the Indus Waters Treaty so that it accounts for water use at the basin level rather than use as restricted by political boundaries. However, the job of creating a task force and undertaking a holistic study requires a large initial investment. Neither country has an incentive to begin a discussion regarding the setup and financing of such a study—which might be interpreted as taking responsibility for the study—and any discussion would invariably involve haggling over each party's contribution. Third party intervention and use of carrots and sticks to incentivize this discussion, on the order of the World Bank's original intervention that led to the Indus Waters Treaty in the first place, will likely be necessary to get the ball rolling.

Alterations to the PIC structure will also contribute to improved function and a better chance of adaptation to new obstacles. The PIC's two decision-makers already possess significant responsibility, mainly in terms of reviewing the monitoring required under the treaty and settling disputes before they require outside interference.[186] Incorporating other elements into the Treaty, like groundwater and climate change impacts, will require a simultaneous expansion of institutional capacity. The existing minimal design of the PIC allows for streamlined and frequent communication.[187] However, the adaptations described above require a balance between ease of communication and ability to carry out increased monitoring responsibilities and to process greater amounts of data for planning purposes. The current PIC structure could probably accommodate the additional responsibility of groundwater management; at most, adjustment on that score would mean adding more hydrogeological experts to the cadre of experts already contributing to the PIC, or integrating capacity-building training measures for current experts.[188]

185 *See* Zawahri, *supra* note 15, at 9.

186 *See* Indus Waters Treaty, *supra* note 65, at art. VIII.

187 *See* Zahwari, *supra* note 9, at 14.

188 *See* U.N. ENV'T PROGRAMME, *supra* note 179, at 29 (discussing the nature of capacity-building and its use in organizations).

However, India and Pakistan should consider creating a sub-group of experts reporting to the PIC that would focus specifically on climate change impacts. Allowing a smaller group of experts to engage solely with the medium- to long-term effects of climate change on regional water quantity and quality ensures a greater level of certainty for the PIC in planning for future use and allocation.

CONCLUSION

Cooperative water management in the Indus River basin is and will continue to be crucial for both India and Pakistan to maintain an adequate water supply for their growing needs, including household use, agricultural needs, and electricity generation. Thus far, the Indus Waters Treaty has been able to head off potential conflict through dispute resolution provisions designed to foster cooperation. However, India and Pakistan are confronted with two significant problems relating to water supply in the Indus region: unchecked groundwater exploitation and climate change impacts on water availability and seasonality in the Indus River system. These issues should be incorporated into the Treaty before complications arise that the treaty is unable to address. Options to adapt the Treaty include new substantive treaty provisions, additional annexures, and procedural alterations. Though the former two options constitute the most holistic response to two serious threats to water, the tenuous political relationship between India and Pakistan precludes any major overhauls to the treaty.

The motivation to adapt the Indus Waters Treaty lies mainly with Pakistan, because it has less agency over the water use that ends up affecting its supply—not only is it the downstream state, it is facing groundwater depletion issues that may be related to India's use of the shared Indus aquifer. This is borne out in the way the two parties have approached the treaty; India tends to proceed with its plans unilaterally, while Pakistan must monitor those plans in order to protect its share of the resource. Indeed, Pakistan initiated both of the disputes discussed above, and has since warned India that it will continue to be vigilant and to take advantage of the Treaty's dispute resolution mechanisms.[189] The

189 *See Pakistan Asks India to Honour Indus Waters Treaty*, THE ECON. TIMES (Mar. 9, 2015), http://articles.economictimes.indiatimes.com/2015-03-

Pakistani Senate recently voted on a resolution to review the Indus Waters Treaty with an eye to attempting to claim more water for Pakistan.[190] With future disagreements over water allocation looming between the two parties, a change in focus to specific procedural updates to deal with groundwater depletion and climate change impacts, which will have an effect on both India and Pakistan, could serve to bring both parties more willingly to the table and diffuse the tension inherent in discussions of actual water allocation. Updates to the structure and function of the Permanent Indus Commission will be a useful short-term measure to tackle these problems until a joint agreement on substantive matter can be reached in good faith between the two countries.

09/news/59931632_1_indus-waters-treaty-water-rights-water-flow.

190 *See Senate Resolves to Review Indus Water Treaty*, THE NEWS INT'L (Mar. 8, 2016), http://www.thenews.com.pk/print/103709-Senate-resolves-to-review-Indus-Water-Treaty.