Combating Climate Change in the Indus River Basin

Waseem Ahmad Qureshi
Advocate Supreme Court of Pakistan

Follow this and additional works at: https://uknowledge.uky.edu/kjeanrl

Part of the Environmental Law Commons

Recommended Citation
Available at: https://uknowledge.uky.edu/kjeanrl/vol10/iss1/3

This Article is brought to you for free and open access by the Law Journals at UKnowledge. It has been accepted for inclusion in Kentucky Journal of Equine, Agriculture, & Natural Resources Law by an authorized editor of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.
COMBATING CLIMATE CHANGE IN THE INDUS RIVER BASIN

Waseem Ahmad Qureshi*

The Indus Waters Treaty (IWT) of 1960 governs water apportionment of the Indus River Basin between India and Pakistan. Both countries continuously compete over the stressed waters of the Indus River Basin. India is securing its interests by constructing hundreds of projects that increase its capacity to manage the waters of the western rivers; consequently, Pakistan believes that India is stealing water by increasing its water management capacity over the western rivers in order to control all of Pakistan's water supplies. Though India acknowledges that water flows are decreased in the western rivers, it argues that decreased water flows are not due to Indian water diversions but to climate change. And despite the IWT requiring India to share with Pakistan all relevant data on western river inflows, outflows and projects, there is a significant amount of vagueness in the data exchanged. The two countries use outdated techniques and often Pakistan receives incomplete data. As a result, the main cause of decreased water flows of western rivers remains unexplained. This paper investigates this issue by exploring the effects of climate change on the water flows of the Indus River Basin. To provide context, this paper will meticulously examine the countries' relevant obligations under the IWT. Furthermore, within the existing legal framework of the IWT, this paper will attempt to provide recommendations to placate water conflicts and establish trust between the states.

* Advocate Supreme Court of Pakistan.
INTRODUCTION

Climate change theorizes that the global environment is changing, in part, because of human acts against nature. Stated simply, humans are increasing aerosols and greenhouse gases (GHG) in the atmosphere, which trap heat and raise the global temperature. "Global warming," the earth's warming over time, is also a large component of climate change. Collectively, this rise in global temperature is considered to be responsible for the increased occurrence of devastating floods, hurricanes, droughts, and monsoon rainfalls. Undisputedly, climate change is the only scientific theory that takes global civilization to task for its negative effects on the planet.

This theory has sparked international debate, political conflict, and scrutiny of humanity. Resolving these tensions necessarily call for an examination of the relationship between humanity and the planet. One organization examining the relationship, the Intergovernmental Panel on Climate Change (IPCC), claims the evidence to support climate change is undeniable. The IPCC has noted that, in the last century, the global temperature and sea level have increased by 0.8°C and 22 cm respectively. The IPCC has also estimated that by the end of this century, even if we are able to mitigate future GHG production, the global temperature and sea level will still

---

2 Matthias Ruth & Fang Rong, Research Themes and Challenges, in Smart Growth and Climate Change: Regional Development, Infrastructure and Adaptation 9, 10 (Matthias Ruth ed., 2006).
6 Ingrid Boas, Climate Migration and Security: Securitisation as a Strategy in Climate Change Politics 80-86 (2015); see also, Machin, supra note 5.
increase by 1.1°–6.4°C. 28–79 cm respectively.⁹ (Other reports suggest that sea levels will rise by 52–98 cm.¹⁰) In addition to these increases, it is predicted that the world’s floods, hurricanes, rains, and droughts will increase in severity, magnitude, and frequency.¹¹ Though most environmentalists argue that climate change will not abruptly destroy the world,¹² they do believe it will continue to affect billions of people.¹³

Consequently, reducing GHG emissions is of primary importance and is the only way to successfully ease the effects of climate change.¹⁴ Sadly, efforts of leaders and scientists over the past three decades have failed to substantially reduce emissions.¹⁵ The most notable international setback was the failure of the 2009 Copenhagen Conference to establish standards for global GHG reductions.¹⁶ Such international failures have become common. For the most part, rather than cooperating based on their mutual interest in protecting the planet, individual countries only take responsibility for their own emissions.¹⁷ But there are exceptions. Notably, China and the United States lead the world in GHG emissions.¹十八 And both countries, fortunately, are working on carbon trading schemes and regulating carbon emissions for environmental protection.¹⁹

---


¹⁰ See MASLIN, supra note 8.

¹¹ JENNIFER WELLS, COMPLEXITY AND SUSTAINABILITY 233 (2013).


¹³ SHANNON O’LEAR, ENVIRONMENTAL POLITICS: SCALE AND POWER 52 (2010); see also, MASLIN, supra note 8.

¹⁴ Robert E. Baron, W. David Montgomery, & Sugandha D. Tuladhar, Black Carbon Mitigation, in SMART SOLUTIONS TO CLIMATE CHANGE: COMPARING COSTS AND BENEFITS 142, 144 (Bjørn Lomborg ed., 2010).


¹⁶ See id. at 1; FRANKLIN DEHOUSSE & TANIA ZGAJEWSKI, THE EU CLIMATE POLICY AFTER THE CLIMATE PACKAGE AND COPENHAGEN—PROMISES AND LIMITS 14 (2010).


¹⁹ See generally Laurie Ristino & Katherine Hannon Michel, Carbon trading in the United States, in RESEARCH HANDBOOK ON CLIMATE CHANGE MITIGATION LAW 476, 476 (Geert Van Calster, Wim Vandenberghe & Leonie Reins eds., 2013) (describing United
In Asia, climate change affects water flow from the Indus River Basin and, consequently, millions of people. Historically, the Indus River Basin has been sustained by glacial melt from the Himalayas. This may not be sustainable, however, much longer. Although water flow may increase in the short term due to the effects of climate change (e.g., temperature increase, monsoons, precipitation, and snowmelt), it is actually projected to decrease by twenty-seven percent, due to glacier ebbing, over time. This will affect three hundred million Pakistani and Indian people depending on the basin for survival. That point cannot be overstated as it is estimated that millions will die as a result of climate change by the end of the century.

As made evident by the number of those affected, Pakistan and India are the largest beneficiaries of the Indus River Basin. The Indus Water Treaty of 1960 (IWT) governs the apportionment of basin waters between the two countries. The IWT is recognized by most authorities as an enduring hallmark of successful water apportionment. Its survival, even in times of war between the two countries, is largely attributed to necessity. For example, both countries rely heavily on
agriculture as a major source of gross domestic product, and water is essential for irrigation.

This cooperation, however, has become strained over the last several decades as India and Pakistan increasingly fight over basin water allocation. A key point of conflict has been India building water management projects over western rivers originally allocated for Pakistan's unrestricted use; an action that has decreased Pakistan's water supply. In the past, Pakistan has successfully halted such projects, citing violations of the IWT. Undeterred, however, India has recently resumed construction on several water management projects. One such project, the Kishanganga, is predicted to be particularly devastating as it is estimated to decrease Pakistan's water supply by eight to nine percent. And India is now further stoking tensions between the two countries by not only acting in disregard of the IWT, but by publicly threatening to scrap it altogether. India's efforts to increase its capacity for control over the western rivers in pursuit of its national interests has led Pakistan to believe that: (1) India is stealing Pakistan's water supply; and (2) India's increase in water management capacity

PEACEBUILDING 163, 178 (Erika Weinthal, Jessica Troell & Mikiyasu Nakayama eds., 2014).

Sahni, supra note 26, at 155.

WATER QUALITY AND STANDARDS - VOLUME II xv (Shoji Kubota & Yoshiteru Tsuchiya eds., 2010).

BINAYAK RAY, CLIMATE CHANGE: IPCC, WATER CRISIS, AND POLICY RIDDLES WITH REFERENCE TO INDIA AND HER SURROUNDINGS xx (2011).


See Hill, supra note 33.


is motivated by its desire to control Pakistan's water supply. In response, India argues that the decreased water flow to western rivers is a result of climate change rather than Indian water diversions. By making such an argument, however, India has implicitly verified the material decrease in western river flow.

Note that the IWT requires India to provide Pakistan with all relevant data regarding inflow and outflow from all projects on the western river. The exchanged data, however, tends to be vague and incomplete due to the outdated data collection techniques used by both countries. Consequently, the question of whether the decreased water flows are a result of Indian construction projects or climate change remains unanswered. This Article suggests answers to this question by exploring the effects of climate change on water flows in the Indus River Basin. To provide context, this Article will discuss obligations under the IWT. Finally, it attempts to recommend a transparent system to share data regarding water flows while remaining in compliance with the IWT.

This Article is divided into four sections: Section I discusses the Pakistan-India relationship in the context of water rights and summarizes the relative water rights and legal obligations of both countries. It also reviews key provisions of the IWT regarding water rights, water distribution, and national obligations. Section II clarifies Indian and Pakistani political perspectives by exploring the intermingled spheres of water conflicts, national interests, and hidden motives. Section III explores the effects of climate change on water runoffs from the Indus River Basin. It further explains how climate change also effects the hydrological cycle, water and food availability, and India-Pakistan relations. Section IV explains the duty to exchange data and establish observation stations under the existing legal framework of the IWT. It also recommends methods to investigate decreased water flows of western rivers and resolve water conflicts.

40 See Parenti, supra note 38.
41 See id.
44 See id. at 106-08.
I. CONTEXTUALIZATION OF WATER RIGHTS

In 1947, British India was divided into the Republic of India and the Islamic Republic of Pakistan. As a result, the Indus River Basin and its canals were geographically divided and shared by the two countries. The new borders that divided these countries did not incorporate Kashmir into Pakistan, which violated a rule requiring that Muslim majority states be a part of Pakistan. Consequently, Kashmir became a disputed land between the countries—occupied by India while its population was comprised mostly of Pakistani Muslims. It is pertinent to note that all sources of Pakistan’s water supply lie in the territories of Kashmir. Inevitably, Pakistan was subverted to the upper riparian state of India, as water flows south to Pakistan from India. To secure its water interests, Pakistan formed a one-year bilateral water apportionment contract, the Standstill Agreement, with India. The chief engineers of East and West Punjab signed the agreement on December 20, 1947. When the agreement expired a year later, India stopped all water flows to Pakistan. India claimed that, by agreeing to pay for water flows under the Standstill Agreement, Pakistan had acknowledged India’s superior water rights. In response, Pakistan argued that the payments made under the agreement were to cover maintenance costs, not to purchase the water rights

46 See id.
48 See id.
50 See id.
52 See id.
53 Id.
themselves. Pakistan also argued it maintained rights to the water because it had used the water for centuries. This water stoppage weakened Pakistan during the sowing season and affected agriculture, power, industry, and domestic production. India, in what some consider a political maneuver, used its control over the water supply to cripple nearly all aspects of Pakistan’s economy and, consequently, brought Pakistan to the bargaining table. Water supply issues, combined with the problematic partitioning of Kashmir, have sparked an enduring, seven-decade-long conflict between India and Pakistan.

In 1960, the World Bank attempted to settle this water conflict by proposing the Water Apportionment Treaty (IWT). Based on the proposition that the Indus River Basin, including all its tributaries, is capable of providing water for both countries, the treaty attempted to objectively apportion waters without being influenced by the political relationship between India and Pakistan.

India and Pakistan agreed to the IWT's reasonable regulation of apportionment and affirmed the legal rights of both countries. The IWT regulates the Indus River Basin by dividing it into two parts: the eastern rivers (the Ravi, Sutlej, and Beas), allocated to India, and the western rivers (the Jhelum, Chenab, and Indus), allocated to Pakistan. Moreover, it contains five key provisions:

1) India can use the western rivers for domestic and non-consumptive uses;
2) India can construct runoff water projects on the western rivers to produce electricity;

Id.
Id.
Zawahri, supra note 28, at 173.
See generally Amita Batra, REGIONAL ECONOMIC INTEGRATION IN SOUTH ASIA: TRAPPED IN CONFLICT? 78 (2013).
See generally id.
See Nax, supra note 23, at 3.
The Indus Waters Treaty 1960, supra note 42, at 125.
Id. at art. III.
See Deepa Viswam, ROLE OF MEDIA IN KASHMIR CRISIS 289 (2010).
3) India can only construct storage facilities on the western rivers within proscribed limits;\textsuperscript{66}

4) India must regularly exchange data with Pakistan regarding water runoff and water supply from all the western rivers and Indian projects over them;\textsuperscript{67} and

5) India and Pakistan must cooperate with each other to establish observation stations to study the hydrological cycle.\textsuperscript{68}

In summary, the IWT authorizes India to use waters from the western rivers for domestic, non-consumptive uses and power plant construction so long as: (1) such uses do not decrease the river's water supply; and (2) construction projects are limited to storage facilities that fall within prescribed limits.\textsuperscript{69}

The IWT's glaring flaw, however, is its lack of specificity regarding the limits on India's construction of power plants.\textsuperscript{70} This ambiguity allows India to construct as many power plants as it sees fit.\textsuperscript{71} Now, Pakistan claims India has violated the IWT by changing the volume of water flow from western rivers, diverting water from its natural course, and exceeding the limits placed on storage facilities.\textsuperscript{72}

II. POLITICAL PERSPECTIVES

The rivalry between the two countries stems from Pakistan's partition in 1974, and has worsened as a result of continuing conflicts and the region of Kashmir.\textsuperscript{73} The unresolved water

\textsuperscript{66} Id.

\textsuperscript{67} The Indus Waters Treaty 1960, \textit{supra} note 42, at art. VI. \textit{See} Iqbal, \textit{supra} note 43.

\textsuperscript{68} Id.


\textsuperscript{71} \textit{See} id. \textit{See also} JAIN ET AL., \textit{supra} note 39, at 940.

\textsuperscript{72} ARIEL DINAR ET AL., BRIDGES OVER WATER: UNDERSTANDING TRANSBOUNDARY WATER CONFLICT, NEGOTIATION AND COOPERATION 331 (2007).

\textsuperscript{73} \textit{See} THE INDIA-PAKISTAN CONFLICT: AN ENDURING RIVALRY (T.V. Paul ed., 2005).
conflicts between India and Pakistan are predicted to evolve into full-scale wars in the near future.\textsuperscript{74} This is due to rapid population growth in both countries and a corresponding decrease in per capita water availability.\textsuperscript{75} In order to control the region's water, India began rapidly developing water management and storage projects over Pakistan's western rivers—a move which simultaneously violated the IWT and triggered a zero-sum race for resources.\textsuperscript{76}

\textit{A. Water Conflicts}

The IWT is considered a water apportionment success story because of its survival of ongoing conflicts between India and Pakistan,\textsuperscript{77} the majority of which concern the occupied lands of Kashmir—an area of great strategic value as it is the source of Pakistan's water supplies.\textsuperscript{78}

The IWT has also survived conflicts caused by India's construction over Pakistan's western rivers.\textsuperscript{79} India's race to increase management of Pakistan's water supply is motivated by its goal of establishing hydro-hegemony.\textsuperscript{80} That is, a desire to establish dominance over the region's water. In pursuit of this goal, India has already constructed hundreds of water management projects over the western rivers.\textsuperscript{81} In fact, India is currently working on 67 projects aimed at controlling Pakistan's "headworks"—the area in Kashmir where water is diverted to western rivers.\textsuperscript{82} This is the primary basis of Pakistan's complaints against India.\textsuperscript{83} Pakistan is specifically alleging IWT
violations due to the construction of the Kishanganga and Baglihar Dams over Pakistan’s headworks. Decades ago, the Kishanganga Dam was held to be in violation of the IWT and construction was halted; nevertheless, India resumed construction of the dam last year.

B. Political Hegemony

States that enjoy political, economic, and military strength tend to gain hydro-hegemony by poaching international river basins. By definition, hydro-hegemony is the forceful control of water by more powerful states in order to gain political superiority over their weaker counterparts. Hydro-hegemony inevitably creates conflict between states. India is pursuing hydro-hegemony by increasing water management capacity while simultaneously engaging in a broad exercise of diplomacy to placate states harmed by its aggressive behavior. India’s pursuit of hydro-hegemony, by poaching international river basins and exploiting its upper riparian position, is not only directed at Pakistan; rather, it is also targeting Nepal and Bangladesh.

Control over Pakistan’s water supplies gives India the ability to cause both floods and droughts in Pakistan. Studies estimate India could potentially withhold all of Pakistan’s water for at least twenty-eight uninterrupted days. In times of conflict, India could withhold water from Pakistan as a political tool to assert its supremacy. India’s ability to do so will only increase as its water-withholding capacity grows due to rapid continued construction of water management projects.

---

84 See id.
85 Arbitrators Again, supra note 34.
87 Id.
88 See id.
89 Indus Waters Treaty and Resolution, supra note 70.
90 Kokab & Nawaz, supra note 76.
91 GUZMAN, supra note 74, at 159.
93 See Iqbal, supra note 43.
C. Indian Perspective

The IWT protects Pakistan's legal right to water supplies, forbidding India from decreasing or diverting water from western rivers. This restriction obstructs India's goal of establishing hydro-hegemony, leaving India eager to modify, if not nullify, the IWT. In its pursuit of hydro-hegemony, India aims to divert water away from Pakistan, decrease the water supply naturally flowing to Pakistan, and increase its own water storage capacity. Despite the IWT's restrictions, India continues to intentionally violate the treaty by monopolizing Pakistan's water supply. Eventually, if it continues on its current course of action, India will hold the reins to a crucial resource for Pakistan and will have effectively nullified the IWT.

If the IWT is not nullified completely, India advocates for modification of the existing restrictions. India disguises its desire for modification by claiming that changes to the existing IWT would allow the countries involved to better share the benefits of the region's water.

D. Pakistani Perspective

Contrary to India's desire to modify or nullify the IWT, Pakistan maintains that it only demands its right to water guaranteed by the treaty. Pakistan also fears reevaluation of the IWT would be detrimental to its vulnerable state. The water conflicts between the two countries stem from the decreased water supply of the western rivers and their exchange.

---

95 DINAR ET AL., supra note 72.
96 See Chandio, supra note 92.
97 See Iqbal, supra note 43, at 104-105.
98 DINAR ET AL., supra note 72; VISWAM, supra note 65; see also The Indus Waters Treaty 1960, supra note 42, at art. 1 & 2: Id.
99 See Iqbal, supra note 43; see also Chandio, supra note 92.
101 See Iqbal, supra note 43, at 104.
103 See Iqbal, supra note 43 at 121.
of vague and incomplete data. Both India and Pakistan admit that the water supply in the western rivers is decreasing. Pakistan argues that India is diverting waters away from their natural course in violation of the IWT. India maintains that decreased water flows are not a result of Indian construction works, but rather because of the natural effects of climate change.

III. IMPACTS OF CLIMATE CHANGE

Unfortunately, the decrease in water resources cannot be reversed without reestablishing the natural hydrological cycle, which is inversely affected by water management projects. Climate change alone has already begun to negatively affect water resources and will cause further conflicts in the future. Unfortunately, co-riparian states cooperating to find solutions to climate change is rare. And, though the prospect of an outright water war due climate change alone is low, this lack of cooperation will increase tensions and, consequently, the devastation of water resources so vital to India and Pakistan.

Both countries are facing water scarcity, which will only worsen...
as both populations continue to grow at a staggering pace. Studies suggest that Pakistan will face severe droughts by 2025.

Accordingly, India and Pakistan have both begun to worry about securing their national interests. The continuum of conflict between these two countries suggests that neither nation is working toward cooperating on addressing causes of water shortages, such as climate change, but are instead interested in ensuring their own short-term national interests. Pakistan maintains that India continues to steal its waters in violation of the IWT, while India argues they are merely harnessing energy and clearing the path for water navigation. India's threats, however, to nullify the IWT while resuming the construction works on halted projects suggests otherwise. Pakistan fears that India is trying to manage all water flows by building dams. India is building the majority of its projects on waters allocated for Pakistani use while deliberately disregarding more than ninety-three percent of other surface waters suitable for dams. If both countries could pool their resources to investigate the cause of decreased water flows in the Indus River Basin, as opposed to fighting each other, conflicts could be avoided. Consequently, both countries should aim to cooperate and explore the perilous consequences of climate change on the Indus River Basin. But this is only possible if both countries decide to put their historical prejudices aside and work toward a cooperative future.

---

114 Wirsing, supra note 75.
117 See Iqbal, supra note 43.
118 GUZMAN, supra note 74, at 161.
119 See Parenti, supra note 38, at 45.
120 See id.
121 News Desk, supra note 36.; see also Arbitrators Again, supra note 34.
122 See Jain et al., supra note 39.
A. Climate Change and the Water Cycle

The time to work together is now. According to NASA, climate change and its effects on the water cycle are among the most serious issues facing environmental policy.\(^{124}\) Scientists around the globe agree that GHGs and aerosols in the earth’s atmosphere have caused an increase in temperature,\(^{125}\) which in turn has altered precipitation, water runoffs, evaporation, cloud formation, rainfalls, and snowfalls (i.e., the entire global water cycle).\(^{126}\) For now, increased temperatures have caused rainfall instead of snowfall,\(^{127}\) and early snowmelts have led to increased water flows in the spring.\(^{128}\) This has led to decreased water flows in the summer.\(^{129}\) Conversely, tropical regions are experiencing increased monsoon rainfalls and water flows during the summer.\(^{130}\)

As noted, climate change is altering the water cycle and increasing water shortage susceptibility in particular areas.\(^{131}\) For example, precipitation patterns in the winter determine water flows from glacier melting in the summer.\(^{132}\) Precipitation is decreasing in the winter and increasing in the summer due to climate change.\(^{133}\) The result is increased rainfall in the summer and decreased rainfall and snowfall in the winter.\(^{134}\) While overall water supply is actually estimated to increase due to

---


\(^{125}\) Ruth & Rong, supra note 2.

\(^{126}\) The Water Cycle and Climate Change, supra note 124.

\(^{127}\) The Org. for Econ. Co-operation and Dev., Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters 217 (2013) [hereinafter OECD].


\(^{129}\) Id.


\(^{131}\) Mountains: Witnesses of Global Changes: Research in the Himalaya and Karakoram: SHARE-Asia Project 336 (Renato Baudo, Gianni Tartari & Elisa Vuillermoz eds., 2007); The Water Cycle and Climate Change, supra note 124.

\(^{132}\) Regional Assessment of Global Change Impacts: The Project GLOWA-Danube 534 ( Wolfram Mauser & Monika Prasch eds., 2015) [hereinafter Regional Assessment].

\(^{133}\) See id.

\(^{134}\) Climate Change, Glacier Response, and Vegetation Dynamics in the Himalaya: Contributions Toward Future Earth Initiatives 95 (RB Singh, Udo Schickhoff & Suraj Mal eds., 2016).
increased precipitation and glacier melt,\textsuperscript{135} higher temperatures have actually increased global water evaporation.\textsuperscript{136} This is exacerbated by the fact that the air is capable of holding more water in warmer weather conditions.\textsuperscript{137} This causes intense rainfalls and erratic floods around the globe.\textsuperscript{138}

But this is not the whole picture. Somewhat oddly, climate change simultaneously causes flooding and continuous droughts.\textsuperscript{139} Droughts are created by dry air and soil.\textsuperscript{140} Warmer temperatures evaporate more water,\textsuperscript{141} leaving the soil in certain areas dryer than normal.\textsuperscript{142} Furthermore, water management structures keep streams from running into surrounding soil.\textsuperscript{143} Such structures are typical of urban areas, causing cities to become warmer and dryer.\textsuperscript{144}

Through global climate models, experts have forecasted increased rainfalls in the Indus River Basin due to global warming,\textsuperscript{145} resulting in erratic droughts and floods in India and Pakistan.\textsuperscript{146} This unpredictable flooding will gravely affect populations inhabiting the Indus River Basin,\textsuperscript{147} including decreasing agricultural output by harming soil fertility.\textsuperscript{148}

Asim Rauf Khan, a civil engineer, suggests that climate change will create an enormous negative effect on the hydrological cycle, and thus encourages a prompt, detailed examination of its causes.\textsuperscript{149} Collaborative research between

\textsuperscript{135} Id. at 119.
\textsuperscript{137} Id. at 85.
\textsuperscript{138} See DAWSON & SPANNAGLE, supra note 130.
\textsuperscript{139} CLIMATE CHANGE AND MANAGED ECOSYSTEMS 50 (Jagtar Bhatti, Rattan Lal, Michael J. Apps & Mick A. Price eds., 2005) [hereinafter MANAGED ECOSYSTEMS].
\textsuperscript{140} Id.
\textsuperscript{141} Letcher, supra note 136.
\textsuperscript{142} See MANAGED ECOSYSTEMS, supra note 139.
\textsuperscript{143} Id.
\textsuperscript{144} Id. at 541.
\textsuperscript{145} CLIMATE CHANGE AND FOOD SECURITY IN WEST ASIA AND NORTH AFRICA 3 (Mannava V.K. Sivakumar, Rattan Lal, Ramasamy Selvaraju & Ibrahim Hamdan eds., 2013).
\textsuperscript{146}CLIMATE CHANGE AND WATER RESOURCES IN SOUTH ASIA 279 (M. Monirul Qader Mirza & Q.K Ahmad eds., 2005).
\textsuperscript{147} See id.
\textsuperscript{148} JOHN R. RUBERSON, HANDBOOK OF PEST MANAGEMENT 49 (1999).
\textsuperscript{149} ASIM RAUF KHAN, SEARCHING EVIDENCE FOR CLIMATIC CHANGE: ANALYSIS OF HYDRO-METEOROLOGICAL TIME IN SERIES IN THE UPPER INDUS BASIN iv (Int'l Water Mgmt. Inst., 2001).
NASA and a number of universities (e.g., the University of Washington and the University of California) has shown the negative effect of humans on the water cycle.\textsuperscript{150} The study concludes that manmade structures, such as dams, have the largest adverse impact on the water cycle (as opposed to other, lesser causes such as industrial and global consumption).\textsuperscript{151} Increased droughts and floods caused by climate change affect the quality of water,\textsuperscript{152} resulting in the decreased availability of fresh water.\textsuperscript{153}

### B. Climate Change and Water Availability

With the surge in population, withdrawals from surface and ground water for agrarian, industrial, and domestic use have increased.\textsuperscript{154} Ironically, while the overall water supply in the Indus River Basin is predicted to increase, water quality is systemically decreasing.\textsuperscript{155} The natural rate of freshwater renewal is outpaced by human water management programs and climate change.\textsuperscript{156} At the same time, global warming caused by human pollution is disturbing the natural hydrological cycle, resulting in either flood or drought depending upon geographic location.\textsuperscript{157} Despite efforts to control water resources, humans have actually created global hydrological chaos.\textsuperscript{158}

Currently, the Indus River Basin is officially "closed,"\textsuperscript{159} meaning that the water supply has fallen short of water

\textsuperscript{150} See Terrestrial Water Cycle and Climate Change 138 (Qiuhong Tang & Talkan Oki eds., 2016).

\textsuperscript{151} See id. at 67.


\textsuperscript{153} Jan C. Van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes 16-18 (Jan C. van Dam ed., 1999).


\textsuperscript{155} See Climate Change and Agriculture over India 279 (G.S.L.H.V. Prasada Rao, G.G.S.N. Rao & V.U.M. Rao eds., 2010).

\textsuperscript{156} See Terrestrial Water Cycle and Climate Change, supra note 150, at 62.

\textsuperscript{157} See id.

\textsuperscript{158} See id. at 67.

\textsuperscript{159} Abdul Rauf Iqbal, Environmental Issues of Indus River Basin: An Analysis, 5 ISSRA Papers 99 (2013), http://www.ndu.edu.pk/issra/issra_pub/articles/issra-
demand. Not only has it fallen short, but some rivers, canals, and sub-basins are completely dry. In fact, flow to the Indus River Basin has decreased so dramatically that, at times, the water does not reach the sea. This may seem counterintuitive because overall Indus River water flows are actually increasing as a result of climate change.

But with increased water management, demand, and extraction, there is rarely any water left for the Indus River Basin's ecosystem. Hydrologists and environmental scientists say that a certain fixed amount of water is required to maintain the natural cycle. Included in this fixed amount is the water necessary to support life, such as animals and plants, and environmental cycles, such as diluting pollution and transporting nutrients. There is no formula for keeping the water level above the fixed amount, which is unique to each river. In the Indus River Basin, an average of at least twenty-five percent of annual runoff must be left for environmental use, and at least another twenty-five percent for the ecosystem.

Unfortunately, this basic water level is not maintained by Pakistan. In 1991, Pakistan promised its provinces that it would maintain basic environmental flows, ensuring a 12.3 km³ runoff to preserve fisheries, sediment transportation, and other uses. In practice, the target has never been met. In fact, the runoff from the Indus Delta has been consistently recorded at below 12 km³. This shortage in water supply is mainly due to

---

160 Id.
161 Id.
162 Id.
163 See id. at 99.
164 See generally RAFIK HIRJI & RICHARD DAVIS, ENVIRONMENTAL FLOWS IN WATER RESOURCES POLICIES, PLANS, AND PROJECTS: FINDINGS AND RECOMMENDATIONS (World Bank Pub., 2009).
165 Id. at 100.
166 See Rauf Iqbal, supra note 159, at 99–100.
167 Id. at 99–100.
168 See id. at 100.
169 Id. at 100.
170 See id.
171 Id.
the decreased amount flowing from the Indian headworks in Kashmir.\textsuperscript{174}

There has been little research conducted on climate change and its effects on glacier melt and resultant runoff in the Indus River Basin. This is mostly due to harsh environmental conditions in the upper part of the region, making it nearly inaccessible, and low governmental interest.\textsuperscript{175} It is known, however, that glaciers contribute approximately 110 Mass Air Flow ("MAF") of water flows to the Indus River Basin; this is more than double the amount of water flows contributed by naturally generated runoff in the downstream waters.\textsuperscript{176} Out of all glacial melt waters—110 MAF in the Indus River Basin—eighteen percent is said to be derived from the ablation zone; the remaining eighty-two percent from dense snow packs.\textsuperscript{177}

The glaciers of the Indus River Basin lie in the Hindu Kush Himalayan region.\textsuperscript{178} These glaciers are the third largest ice body in the world, behind the polar ice caps of the North and South Poles,\textsuperscript{179} and are mammoth natural water reservoirs. They store large quantities of water in the form of ice during the winter which melts and discharges into various basins all over Asia during the summer.\textsuperscript{180} The Indus River Basin is the largest in the region and holds more glaciers than almost any other basin in the world.\textsuperscript{181} There are about 18,495 glaciers in the Indus River Basin, containing 2,696 km\textsuperscript{3} of ice; this amount is equal to forty-four percent of the total ice reserves in the Hindu Kush Himalayan region.\textsuperscript{182} As noted, glaciers are the source of more than fifty percent of the annual water supply to the Indus River Basin.\textsuperscript{183} This percentage reaches seventy percent in the

\begin{itemize}
\item \textsuperscript{174} See Rauf Iqbal, supra note 159, at 99–100.
\item \textsuperscript{176} See Rauf Iqbal, supra note 159, at 103.
\item \textsuperscript{177} Winston Yu et al., \textit{Hydrology and Glaciers in the Upper Indus Basin, in THE INDUS BASIN OF PAKISTAN: THE IMPACTS OF CLIMATE RISKS ON WATER AND AGRICULTURE 57–76, 71} (World Bank Publ'ns, 2013).
\item \textsuperscript{178} Id. at 59.
\item \textsuperscript{179} VIJAY P. SINGH ET AL., \textit{ENCYCLOPEDIA OF SNOW, ICE AND GLACIERS, 128} (SPRINGER SCIENCE & BUSINESS MEDIA, 2011).
\item \textsuperscript{180} See Rauf Iqbal, supra note 159, at 106.
\item \textsuperscript{181} See Yu et. al., \textit{supra note 177, at 57–67}; SINGH ET AL., \textit{supra note 179, at 128}.
\item \textsuperscript{182} Id.
\item \textsuperscript{183} See Rauf Iqbal, \textit{supra note 159, at 106}.
\end{itemize}
summer. In Pakistan, these melts make up an average seventy-five to eighty percent of the water supply. Climate change, however, is changing the water cycle by altering precipitation rates, which is increasing the runoff waters in the Indus River Basin.

Hydrological modeling and glacial mass-based studies have projected that the overall water supply in the Indus River Basin will increase in the short run due to the increased rate of snow melt in the Northern Hemisphere. Environmentalists suggest that, for a period of time, climate change will cause a larger water supply; not smaller. This transitory impact is estimated to last for decades. Eventually, however, the same water supply from snowmelt will drastically decrease due to glacial retreats. A Dutch study in 2010 found that glacial retreat would decrease water supply in the Indus River Basin by eight percent by 2050. Some reports indicate that this decrease will reach twenty-seven percent after the short-term increase. Other predictions show that overall water supply will decrease by thirty to forty percent in the long run. Regardless of which is accurate, each projection contradicts India’s argument that climate change has caused decreased water flows. In reality, climate change has increased water supply for the last couple of decades.

The variability of water flows is problematic, as the waters of the Indus River Basin feed 300 million Indian and Pakistani citizens. The Asian Development Bank has noted that Pakistan

---

184 Id.
185 Id.
186 See CLIMATE CHANGE AND AGRICULTURE OVER INDIA, supra note 155; see also DAWSON & SPANNAGLE, supra note 130, at 393.
187 See CLIMATE CHANGE AND AGRICULTURE OVER INDIA, supra note 155.
188 See id.
191 See Nax, supra note 23.
192 See Roohi, supra note 190.
193 Husain, supra note 189.
194 Id.
has the lowest water availability per capita in the world.\textsuperscript{196} Renewable water in Pakistan has been reduced to 1,329 m$^3$ of water per capita. Though this is partly because of a surge in population,\textsuperscript{197} the estimated reduction in per capita water availability of 545 m$^3$ by 2050 is contributed to climate change alone.\textsuperscript{198}

While aquifer water levels are dependent on river water supplies, they are also vulnerable to increased water extraction.\textsuperscript{199} Water extraction from aquifers in the Indus River Basin has increased drastically due to increased water demands and decreased water supply.\textsuperscript{200} Satellite imaging has revealed that aquifers dependent on the Indus River Basin are losing an average of 10 km$^3$ of ground water per year, and a drop in the water table of two to three meters per year.\textsuperscript{201} This rate of depletion is equal to the amount of water held by six large Indian dams; Pakistan only has the capacity to store half of the total amount of depletion.\textsuperscript{202}

In short, human water management, especially the construction of dams, is significantly contributing to climate change.\textsuperscript{203} This climate change has upset the balance of the hydrological cycle through increased precipitation, snowmelt, floods, and droughts.\textsuperscript{204} Climate change has increased global temperatures leading to intensified snowmelts.\textsuperscript{205} As a result, water flows in the Indus River Basin have increased for several decades and will continue to do so for the next half-century.\textsuperscript{206} In the future, however, the overall water supply of the Indus River

\begin{footnotesize}
\begin{enumerate}
\item See YASMIN SIDDIQI & EELCO VAN BEEK, ASIAN WATER DEVELOPMENT OUTLOOK 2016: STRENGTHENING WATER SECURITY IN ASIA AND THE PACIFIC (2016).
\item Rauf Iqbal, supra note 159, at 96.
\item See id. at 102-03.
\item See id. at 95-96, 102-03.
\item See id.
\item Id. at 100-101.
\item See Zhou et al., supra note 109, at 67; see also The Water Cycle and Climate Change, supra note 124.
\item Roohi, supra note 190: see also The Water Cycle and Climate Change, supra note 124.
\item Markus Weber & Monika Prasch, The Influence of Snow Cover on Runoff Regime and Its Change, in REGIONAL ASSESSMENT OF GLOBAL CHANGE IMPACTS 534 (Wolfram Mauser & Monika Prasch eds., 2015). See also DAWSON & SPANNAGLE, supra note 130.
\end{enumerate}
\end{footnotesize}
Basin will decrease, resulting in lower food production due to low-quality water and dry soil.

C. Climate Change and Food Production

The Indus River Basin has the largest canal system in the world, irrigating millions of hectares of land. It offers 168.4 MAF of water to India and Pakistan. The Pakistan Bureau of Statistics has noted that water from the Indus River Basin cultivates approximately 22 million hectares of arable land in Pakistan. Also, ninety-four percent of Pakistan water usage is solely for agrarian purposes. Similarly, through the Indus River Basin, India irrigates millions of hectares of land primarily for agrarian purposes. This agrarian use of water in India and Pakistan makes the Indus River Basin the largest food producer in the world. In addition to the rest of the world, the food produced by water from the Indus River Basin feeds more than 300 million people in India and Pakistan alone.

Due to decreased water supply, farmers in Pakistan and India depend on ground water for irrigation. This dependence has led to both countries depleting their ground water at a very high rate. With regard to Pakistan, one-third of all its irrigation is sustained by waters from aquifers. This is causing Pakistan aquifer water tables to drop at a rate of two to three

---

207 Husain, supra note 189.
208 See Nax, supra note 23, at 16-17.
212 Water Report 37, supra note 211.
213 See Nax, supra note 23, at 13.
214 See id. at 17.
216 ANDRÉS SAHUQUILLO ET AL., GROUNDWATER INTENSIVE USE: IAH SELECTED PAPERS ON HYDROGEOLOGY 7, 60 (CRC PRESS, 2005).
217 See id.
meters per year, with some falling to dead levels.\textsuperscript{218} That is, when
the water levels drop, the salinity of aquifer water increases, leaving water both undrinkable and harmful when used for
irrigation.\textsuperscript{219} Accordingly, farmers are forced to irrigate their
fields with salinized water, decreasing productivity and food
quality.\textsuperscript{220} This forms a cycle: salinized water used to irrigate
fields re-salinizes land, which continues to reduce the land’s
fertility.\textsuperscript{221} It is estimated that 4.5 million hectares of Pakistani
land are affected by salinization, roughly twenty-two percent of
all arable land area.\textsuperscript{222}

The IPCC has found that climate change will destabilize
water infrastructure, which will in turn affect food production.\textsuperscript{223}
The impact of water scarcity will not only affect Pakistan, but
will be felt around the world,\textsuperscript{224} as the food produced by the
waters of the Indus River Basin is exported to numerous other
countries.\textsuperscript{225}

\textbf{D. Climate Change and India–Pakistan Relations}

Climate change is diminishing water quality and quantity
through floods and droughts.\textsuperscript{226} This in turn inevitably
deteriorates conditions of contingent resources, such as land,
food, industries, cattle and health.\textsuperscript{227} Climate change affects the
hydrological cycle, which causes environmental scarcity; a term
used for when all contingent resources are materially and
qualitatively diminishing.\textsuperscript{228}

\begin{itemize}
  \item \textsuperscript{218} See Rauf Iqbal, \textit{supra} note 159, at 100.
  \item \textsuperscript{219} \textsc{John Stenhouse} \& \textsc{Jacob W. Kijne}, \textit{Prospects for Productive Use of Saline Water in West Asia and North Africa} 5 (2006).
  \item \textsuperscript{220} \textit{Id.}
  \item \textsuperscript{221} \textit{Id.}
  \item \textsuperscript{222} \textsc{Agdish Chander Dagar} \& \textsc{Paramjit Minhas}, \textit{Agroforestry for the Management of Waterlogged Saline Soils and Poor-Quality Waters} 98 (2016).
  \item \textsuperscript{223} \textit{Id.}
  \item \textsuperscript{224} \textit{Id.}
  \item \textsuperscript{225} \textsc{Mohammad A. Razzaque} \& \textsc{Yurendra Basnett}, \textit{Regional Integration in South Asia: Trends, Challenges and Prospects} 261 (2014).
  \item \textsuperscript{226} \textsc{OECD}, \textit{supra} note 127, at 23.
  \item \textsuperscript{227} See \textit{Types of Drought Impacts}, \textsc{Natl. Drought Mitigation Ctr.},
  \item \textsuperscript{228} See \textit{Nax}, \textit{supra} note 23, at 18.
\end{itemize}
Environmental scarcity can result in violence.\textsuperscript{229} Professor Homer Dixon provides an excellent piece of scholarship on the matter in his book, \textit{Environment, Scarcity, and Violence}.\textsuperscript{230} He explains that environmental scarcity “often acts as a deep underlying stress of social systems, and it produces its effects by interacting with other contextual factors unique to the society.”\textsuperscript{231} This interconnection between social features and the environment shows that no faction is immune to the effects of environmental scarcity. In fact, a single global event can create a domino effect. Therefore, violence is not a mere failure of diplomatic dialogues between two or more states; rather, it is an amalgamation of state failures and environmental consequences.\textsuperscript{232}

The relationship between scarcity and political discord, illustrated perfectly by Pakistan’s indignation at India’s purported storage and diversion of its water, has caused violence between India and Pakistan.\textsuperscript{233} Although a water apportionment treaty exists between India and Pakistan, it is likely that attempts to secure diminishing resources will result in war.\textsuperscript{234} Pakistan maintains it can and will go to war with India to preserve its water rights.\textsuperscript{235} Therefore, it is highly probable that India’s aggressive storage and diversion of Pakistan’s water could have damaging consequences.\textsuperscript{236} As climate change continues to cause decreases in agricultural production as well as water quantity and quality, conflict between India and Pakistan will be exacerbated.\textsuperscript{237} The effects of climate change will only increase,\textsuperscript{238} making it all the more imperative that India and Pakistan cooperate to address the causes of climate change.

\textsuperscript{229} See generally THOMAS F. HOMER-DIXON, ENVIRONMENT, SCARCITY, AND VIOLENCE (1999).
\textsuperscript{230} See Water Report 37, supra note 211, at 257.
\textsuperscript{231} See HOMER-DIXON, supra note 229, at 81.
\textsuperscript{232} Nax, supra note 23, at 18.
\textsuperscript{233} OECD, supra note 127, at 23.
\textsuperscript{234} See PARENTI, supra note 38, at 127–128.
\textsuperscript{236} Id.; see also SATISH KUMAR, INDIA’S NATIONAL SECURITY: ANNUAL REVIEW 2012 265 (Routledge, 2016).
\textsuperscript{237} Tikhonova, supra note 235.
\textsuperscript{238} Id.; see also KUMAR, supra note 236.
IV. RECONCILIATION THROUGH THE IWT

The existing legal framework under the IWT is adequately capable of resolving all water conflicts between India and Pakistan.\(^{239}\) The conflict between the two centers around the decrease in water flow and the vagueness of the data exchanged regarding that decrease.\(^{240}\) The vague data exchanged appears to violate several IWT mandates which require that India: (1) exchange data regarding water flows with transparency (i.e., Article 6);\(^{241}\) (2) share all relevant information and data on power projects with Pakistan (i.e., Paragraph 9 of Annexure D);\(^{242}\) and (3) share with Pakistan all data on storage facilities (i.e., Paragraph 4 of Annexure E).\(^{243}\) Specifically, India is required to share with Pakistan comprehensive data, regarding the inflows and outflows of water runoffs, on all of its western river projects.\(^{244}\) Further, in addition to data sharing, Article 7 of the IWT encourages both parties to reach mutually agreed upon solutions to river basin threats such as climate change.\(^{245}\) Thus, both issues can easily be resolved through adhering to the existing provisions and mutually agreeing on the treatment of individual issues not addressed by the IWT.\(^{246}\)

A. Duty to Exchange Data

Pakistan has a legal right to receive data on the western rivers' water flows. The IWT requires India to exchange data with Pakistan under Article 6 as follows:\(^{247}\)

(1) The following data with respect to the flow in, and utilization of the waters of, the Rivers shall be exchanged regularly between the Parties:

---

\(^{239}\) Anwar Iqbal, supra note 102.

\(^{240}\) See Iqbal, supra note 43, at 106.

\(^{241}\) The Indus Waters Treaty 1960, supra note 42, at art. VI.

\(^{242}\) Id. at annex. D para. 9.

\(^{243}\) Id. at annex. E para. 4, 12.

\(^{244}\) Id. at annex. D para. 9: annex. E para. 12.

\(^{245}\) See id. at art. 7.


\(^{247}\) The Indus Waters Treaty 1960, supra note 42, at art. VI; see also Iqbal, supra note 43, at 106.
(a) Daily (or as observed or estimated less frequently) gauge and discharge data relating to flow of the Rivers at all observation sites.
(b) Daily extractions for or releases from reservoirs.
(c) Daily withdrawals at the heads of all canals operated by the government or by a government agency (hereinafter in this Article called canals), including link canals.
(d) Daily escapages from all canals, including link canals.
(e) Daily deliveries from link canals.

These data shall be transmitted monthly by each party to the other as soon as the data for a calendar month have been collected and tabulated, but not later than three months after the end of the month to which they relate. Provided that such of the data specified above as are considered by either Party to be necessary for operational purposes shall be supplied daily or at least frequent intervals, as may be requested. Should one Party request the supply of any of these data by telegram, telephone, or wireless, it shall reimburse to other Party for the cost of transmission.

(2) If, in addition to the data specified in Paragraph (1) of the Article, either Party requests the supply of any data relating to the hydrology of the Rivers, or to canal or reservoir operation connected with the Rivers, or to any provision of this Treaty, such data shall be supplied by the other Party to the extent that these are available.248

Article 6 makes clear India’s obligation to deliver data to Pakistan.249 Nearly all water conflicts between Pakistan and India are concerned with decreased water flows from India to Pakistan. Pakistan believes that India is stealing its water and strategically concealing it by providing vague or incomplete

248 The Indus Waters Treaty 1960, supra note 42, at art. VI.
249 Id. at art. VI, annexures D & E.
data. While the data remains obscure, India is able to argue that the decreased water flows are due not to their behavior, but to climate change.

The delayed exchange of incomplete data results in conflict between India and Pakistan. This vagueness is mainly due to outdated data sharing systems and techniques. The vague nature of any data received by Pakistan renders Pakistan unable to discover and address the cause of decreased water flows. This lack of transparency continues to foster mistrust between the two countries.

Modern technology and data collection methods could alleviate mistrust between India and Pakistan. For example, telemetry systems along rivers would allow real-time data sharing of both water supply and flow in a matter of seconds. Because of its expediency, the developed world is using telemetry systems to share water data. In addition to monitoring real-time water supply values, telemetry systems allow sharing of data on water "quality, [water] quantity, sediment flow, snow and ice melt, weather forecasting, meteorological data, water shed forecasting, [and] flood warning." The installation of sophisticated technology would provide each country the ability to track overall water supply and share real-time seasonal water flows in order to measure the effects of climate change. This system would even allow the states to monitor the effects of climate change and forecast floods and droughts, which could diminish the after-effects of natural devastation.

In 2010, India and Pakistan mutually agreed to install a telemetry system to monitor all aspects of water quality and

---

250 See Parenti, supra note 38, at 129.
251 See id.
253 See id.
254 See id. at 121.
255 See id. at 107.
260 See id.
quantity. Sadly, seven years have passed without the telemetry system being installed in the Indus River Basin.\textsuperscript{261} It is not difficult to understand why India is uninterested in installing the system. As previously explained, climate change is currently increasing rather than decreasing river flows.\textsuperscript{262} The installation of a telemetry system would prove that the decreased water flows from India to Pakistan are not due to climate change, making it all the more likely that they are in fact caused by Indian water management projects.

\textit{B. Duty to Cooperate and Establish Observation Stations}

India wishes to nullify or modify the IWT because it contends that the existing legal framework does not incorporate growing modern water concerns.\textsuperscript{263} For example, Indian scholars argue that the IWT does not touch upon environmental aspects of water apportionment and fails to account for transboundary aquifers.\textsuperscript{264} It criticizes the IWT’s lack of ability to address climate change and its effects.\textsuperscript{265}

Interestingly, India uses climate change as a scapegoat to justify decreased water flows, while advocating for nullification of the IWT in order to stop climate change.\textsuperscript{266} The real motivation behind India’s demands for the modification or nullification of the IWT is that the IWT prohibits poaching Pakistani waters, impeding India’s efforts to gain political supremacy over Pakistan.\textsuperscript{267}

In addition to the duty to exchange transparent data, the IWT also offers ways to counter emerging water conflicts between India and Pakistan.\textsuperscript{268}

Article 7 of the IWT provides a mechanism under the existing legal framework to resolve growing tensions over water conflicts between India and Pakistan.\textsuperscript{269} Article 7 states:

\begin{itemize}
  \item \textsuperscript{262} See CLIMATE CHANGE AND AGRICULTURE OVER INDIA, supra note 155, at 279.
  \item \textsuperscript{263} See Chandio, supra note 92.
  \item \textsuperscript{264} INST. FOR DEF. STUD. AND ANALYSES, WATER SECURITY FOR INDIA: THE EXTERNAL DYNAMICS 39-40 (IDSA, 2010).
  \item \textsuperscript{265} See Iqbal, supra note 43, at 107, 111–12.
  \item \textsuperscript{266} See id. at 103.
  \item \textsuperscript{267} See id. at 104.
  \item \textsuperscript{268} The Indus Waters Treaty 1960, supra note 42, at art. VI & VII.
\end{itemize}
The two Parties recognize that they have a common interest in the optimum development of the rivers and they declare their intention to cooperate by mutual agreement, to the fullest possible extent. In particular:

a) Each Party, to the extent it considers practicable and on agreement by the other Party to pay the costs to be incurred, will, at the request of the other Party, set up or install such hydrologic observation stations within the drainage basins of the Rivers, and set up or install such meteorological observation stations relating thereto and carry out such observations thereat, as may be requested, and will supply the data so obtained.270

Article 7 explicitly allows both states to cooperate to construct hydrologic and meteorological observation stations on the Indus River Basin. These observation stations can be used to investigate the hydrological cycle, water flows, factors affecting water quality, and the impact of climate change.271 Doing so would lead to a diplomatic resolution that served the interests of both parties. Furthermore, the observation stations could be used to predict floods and droughts, minimizing damage to both countries as a result.272

By providing explanations for decreased water flows, observation stations could diffuse conflicts between India and Pakistan.273 Such stations could be used to monitor the effects of climate change on glacial movements and snow melt. Similar measures are being taken by The International Centre for Integrated Mountain Development in Nepal. The Centre has already taken a central role in investigating the effects of climate change in the Himalayas and its effects on downstream water

269 THE XIAMEN ACADEMY OF INTERNATIONAL LAW, COLLECTED COURSES OF THE XIAMEN ACADEMY OF INTERNATIONAL LAW 460 (Brill 2011).
270 The Indus Waters Treaty 1960, supra note 42, at art. VII.
273 See id. at 106.
Concerned states like India, Pakistan, and China have also collaborated with the Centre to investigate the effects of climate change on water flows in the Indus River Basin. The key to peacefully investigating decreased water flows and the effect of climate change is mutual agreement and cooperation among those countries that depend on the Indus River Basin.

VI. CONCLUSION

India is racing to increase its capacity to manage Pakistan’s water supply in order to establish hydro-hegemony and thus enjoy political supremacy. It is an established narrative that hydro-hegemony generates conflict and violence. India is working on sixty-seven water management projects in Kashmir, where the headworks of Pakistan’s water supply are located. India continues to construct facilities that manage water allocated for Pakistan’s unrestricted use. Pakistan continues to protest the major Indian water management projects that will considerably effect Pakistan’s water supplies; these include the Kishanganga, Ratle, Pakul Dal, Miyar and Local Kalnai projects. All of these projects are in direct violation of the IWT.

Gradually, India has increased its capacity to manage Pakistan’s water supplies to assure its political supremacy and safeguard its national interests. Management of Pakistan’s water supply gives India the ability to cause floods and droughts in Pakistan whenever it is politically advantageous to do so. During a conflict, India could withhold all of Pakistan’s water for at least twenty-five uninterrupted days.

---

275 See id.
276 See id.
278 KEITH W. HIPEL ET AL., CONFLICT RESOLUTION IN WATER RESOURCES AND ENVIRONMENTAL MANAGEMENT 140 (Springer 2015).
279 Singh, Statement, supra note 32, at 1368.
280 See Iqbal, supra note 43, at 106.
282 Id.
283 See Iqbal, supra note 43, at 120–21.
284 GUZMAN, supra note 74, at 159.
285 Chandio, supra note 92.
The existing legal structure under the IWT protects Pakistan's legal rights to water supplies, which do not allow India to decrease Pakistan's water supplies or divert waters of the western rivers from their natural course. The IWT, while largely disregarded by India, still prohibits India's construction over Pakistan's water supplies and grants Pakistan exclusive rights in the water. India would like to modify or nullify the IWT in order to conclusively remove all restrictions on its construction over the Indus River Basin.

Pakistan maintains it only demands the legal water rights granted under the IWT, to which India mutually agreed. Pakistan argues the existing legal framework of the IWT is capable of resolving all water conflicts and issues between India and Pakistan. Both countries admit and acknowledge that water supply in the western rivers has decreased, yet the cause remains unexplained. Pakistan argues India is diverting its waters; India maintains the decreased water flows are a result of climate change.

Climate change has already begun to adversely affect the hydrological cycle and is, according to NASA, one of the most serious issues facing the fields of earth sciences and environmental policy. Increased temperatures caused by global warming result in increased rainfall, earlier springs, rapid snowmelts, and tropical monsoons. These changes affect the Indus River Basin by increasing the region's rainfall during the summer and decreasing snowfall during the winter. Increases in precipitation cause erratic floods and droughts which disturb the hydrological cycle and cause irregularities in the region.

---

286 DINAR ET AL., supra note 72, at 331.
287 Id.
288 See Chandio, supra note 92.
289 Anwar Iqbal, supra note 102.
290 Id.
291 See id. at 107.
292 See PARENTI, supra note 38, at 129.
293 See id.
295 The Water Cycle and Climate Change, supra note 124.
296 See SINGH ET AL., supra note 163, at 95.
297 See DAWSON & SPANNAGLE, supra note 130, at 393.
298 See SINGH ET AL., supra note 163, at 95.
299 See Letcher, supra note 136, at 35.
which is exacerbated by manmade structures such as dams. These structures have a significantly greater adverse impact on the water cycle than industrial and domestic consumption.

Extreme conditions limit research on the effects of climate change on glacier melt and subsequent runoff into the Indus River Basin. Glacial melts make up around seventy-five to eighty percent of Pakistan's water supply. Hydrological modeling and glacial mass studies have calculated that, short term, the overall water supply in the Indus River Basin will increase due to more rapid snow melt in the upper hemisphere. Glacial retreat, however, will eventually cause this water supply to decrease. Regardless of the underlying cause, it is illogical for India to argue water flows to the Indus River Basin have decreased, as credible research clearly demonstrates the opposite.

The floods and droughts caused by climate change also diminishes water quality and deteriorates contingent resources like land, agriculture, and livestock.

Accordingly, despite the water apportionment treaty between India and Pakistan, water conflicts persist and will only be exacerbated by the cumulative effects of climate change. The only way for India and Pakistan to resolve this fundamental disagreement regarding water rights is for both to pool their resources to investigate the decreased water flows in the Indus River Basin and develop a plan to halt the decrease and peacefully share the available water. Without this compromise, neither will be able to avoid the perilous consequences of climate change in the Indus River Basin.

This cooperative plan is possible under the existing legal framework of the IWT. The IWT requires India to transparently exchange data regarding water flows and allows for the incorporation of other mutual agreements as well as hydrologic observations to be constructed on the Indus River Basin. Climate change could easily be incorporated into the IWT.

---

300 See id.
301 See id.
302 See Dawson & Spannagle, supra note 130, at 106.
303 See Climate Change and Agriculture Over India, supra note 155, at 279.
304 Dawson & Spannagle, supra note 130, at 393.
305 See Climate Change and Agriculture Over India, supra note 155, at 279.
306 van Dam, supra note 153, at 16.
307 Kumar, supra note 236.
308 Iqbal, supra note 127.
through additional agreements. Installation of telemetry systems would allow Pakistan and India to monitor water flows and exchange data with transparency, resulting in fewer conflicts. Observation stations could be installed to observe the impact of climate change and predict natural disasters.

Making such changes under the IWT's existing framework would allow Pakistan to determine whether decreases to its water supply are a result of Indian construction or climate change. India's reluctance toward installing such systems and its desire to nullify the IWT entirely does not inspire much confidence in its purported lack of fault. If nothing is done to deter the effects of climate change or incite cooperation between India and Pakistan, conflicts will continue, and both countries will face a devastating lack of resources.

309 The Indus Waters Treaty 1960, supra note 42, at art. VII.
310 See NATIONAL RESEARCH COUNCIL ET AL., supra note 246, at 86.
311 Id.