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DEDICATION

I dedicate this thesis to my beloved parents, whose endless prayers, sacrifices, and unwavering support have been the foundation of my academic journey. Their constant encouragement and belief in me made this achievement possible. I also dedicate this work to my respected teachers and mentors, whose guidance, wisdom, and patience shaped my intellectual growth and inspired me to pursue research with sincerity and discipline.

Ultimately, this thesis is dedicated to all those who strive for knowledge despite challenges and believe in the transformative power of education to bring about positive change in society.

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ABSTRACT

Water remains one of the most critical and sensitive resources in South Asia, particularly between India and Pakistan, whose relations have been historically shaped by political rivalry and territorial disputes. The Indus Waters Treaty (IWT), signed in 1960 with the mediation of the World Bank, is considered one of the most successful water-sharing agreements in the world. However, changing geopolitical dynamics, India's upstream hydropower development, climate change, and growing water scarcity have increasingly strained this treaty framework. This study critically examines the Indo-Pakistan water dispute with a focus on the evolving challenges to transboundary water governance under the Indus Basin system.

The research analyzes how India's control over upstream rivers, the construction of dams and hydropower projects, and the declining spirit of cooperation have affected Pakistan's water security, agricultural productivity, and socio-economic stability. It further explores the legal, political, and strategic dimensions of the dispute within the framework of international water law and regional power asymmetry. Special attention is given to the impacts on Pakistan's small farmers, rural livelihoods, food security, and public health.

Using a qualitative research methodology based on secondary data, official documents, treaty provisions, legal cases, and scholarly literature, the study highlights the growing politicization of water and its transformation into a tool of strategic pressure. The findings suggest that while the Indus Waters Treaty has helped prevent large-scale conflict for decades, its effectiveness is being challenged by climate-induced hydrological changes, weak dispute-resolution mechanisms, and deteriorating bilateral relations.

The study concludes that sustainable peace and long-term water security in South Asia require modernization of the Indus Waters Treaty, confidence-building measures between India and Pakistan, climate-resilient water governance, and stronger regional cooperation to prevent water from becoming a trigger for future conflict.

Keywords: Indo-Pak water dispute, Indus Water Treaty, Hydro Politics, Food Security, Agricultural impact, Internal displacement, Climate change impact, Irrigation crisis, Bilateral tensions.

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CHAPTER 1

INTRODUCTION

1.1. INTRODUCTION:

In South Asia's shifting geopolitical landscape, water has emerged as a critical driver of conflict transformation. Today, the world is divided into regions with abundant and scarce water resources, and Pakistan is currently facing severe water challenges. Pakistan is a semi-arid nation with an economy greatly dependent on agriculture; thus, managing and distributing water has long been a crucial yet challenging task. Unfortunately, Pakistan has faced a water crisis since gaining independence, and the obstruction of its canals by its eastern neighbor is the primary cause of this issue.[1] Given how significantly Pakistan's economy, food security, and social stability depend on the Indus River system, water is one of the most disputed and strategically important resources in South Asia. In addition to dividing people and land, the 1947 division of British India also interfered with the Indus Basin's integrated management, laying the groundwork for a long-running dispute between India and Pakistan over water distribution. To ease tensions, the World Bank mediated the 1960 Indus Waters Treaty (IWT), which gave India rights over the three eastern rivers (Ravi, Beas, and Sutlej) and gave Pakistan rights over the three western rivers (Indus, Jhelum, and Chenab), while allowing India limited non-consumptive uses like hydropower production.[2]

Pakistan's main economic activity is farming, and both the public and the government are deeply concerned about ensuring that people have access to water. This mostly entails controlling the use of the Indus, which serves as the nation's primary source of electricity generation and water for irrigation. There is competition between farmers, industrialists, and urban consumers as a result of Pakistan's expanding cities and population, which are putting a tremendous amount of strain on the Indus.[3]

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[1] Saqib Riaz and Waseem Ishaque, "Indian Aqua Aggression: Investigating the Impact of Indus Water Treaty (Iwt) on Future of India-Pakistan Water Dispute," Research gate, December 2020.
[2] Salman M. A. Salman and Kishor Uprety, *Conflict and Cooperation on South Asia's International Rivers: A Legal Perspective*, Brill Book Archive Part 1, ISBN: 9789004472495 8 (Brill | Nijhoff, 2002), https://doi.org/10.1163/9789004480216.
[3] Michael Klare, "Climate Change, Water Scarcity, and the Potential for Interstate Conflict in South Asia," *Journal of Strategic Security* 13, no. 4 (2020): 109–22, https://doi.org/10.5038/1944-0472.13.4.1826.

Beyond the external geopolitical arena, Pakistan is affected by the Indo-Pak water issue. Internal conflicts are made worse by inadequate governance, antiquated infrastructure, and unfair interprovincial water allocation, especially between Punjab, Sindh, KPK, and Balochistan. [4] The nation has seen a rise in public protests, some of which have turned violent, as electricity and water shortages have become increasingly common occurrences. Following a prolonged power outage in June 2012, an especially severe rioting incident occurred, in which demonstrators set fire to trains, blocked highways, looted stores, and damaged gas stations and banks[5]. The combination of transboundary conflicts and internal governance shortcomings hampers Pakistan's capacity to implement a cohesive and sustainable water management strategy. To develop policies that can protect Pakistan's water future in a time of growing scarcity and instability, it is crucial to comprehend these issues holistically—across geopolitical, environmental, and human security dimensions.

1.2. LITERATURE REVIEW:

The Indo-Pak water dispute, rooted in the legacy of colonial partition and influenced by geopolitical rivalry, continues to impact Pakistan's economic, environmental, and strategic stability. Riparian states, particularly those with agricultural economies in arid regions, rely heavily on freshwater for their livelihoods. However, some neighboring states do not receive equitable access to shared water resources, making current global water policies often unfair. Countries see water as a matter of national interest rather than a basic human right. This self-centered approach increases regional instability and fuels water disputes.

1.2.1 Historical Evolution and The Indus Water Treaty:

In many developing nations, population growth, water scarcity, and inadequate management have significantly increased water demand, often leading to both intrastate and international conflicts. In South Asia, Pakistan, Bangladesh, and Nepal—countries with largely agrarian economies—face persistent water-sharing disputes with India. These tensions not only hinder national development but also obstruct the region's integration into the global economy. While scarcity has occasionally fostered cooperation, as seen in the Indus Waters Treaty (1960) and the Ganges Waters Treaty, unresolved grievances threaten

[4] Hafiz Qaisar Yasin et al., "Climate-Water Governance: A Systematic Analysis of the Water Sector Resilience and Adaptation to Combat Climate Change in Pakistan," *Water Policy* 23, no. 1 (2021): 1–35, https://doi.org/10.2166/wp.2020.113.
[5] Michael Klare, "Climate Change, Water Scarcity, and the Potential for Interstate Conflict in South Asia," *Journal of Strategic Security* 13, no. 4 (2020): 109–22, https://doi.org/10.5038/1944-0472.13.4.1826.

to turn current collaboration into future conflict[6]. The origins of the Indo-Pak water dispute trace back to the division of British India in 1947, which left the headworks of major rivers in India and the command areas in Pakistan, creating an immediate water security dilemma for the newly formed state. The first major flashpoint occurred in April 1948 when India cut off water supplies from the Ferozepur headworks to Pakistan's Punjab, disrupting irrigation and electricity generation, and setting the stage for decades of hydropolitical tension.[7]This early crisis showed how control over headworks might be exploited as a political tool and emphasized the strategic significance of transboundary water management.

In 1960, the World Bank mediated the Indus Waters Treaty (IWT), which aimed to establish a sustainable framework for water sharing. It gave India control over the three eastern rivers (Ravi, Beas, and Sutlej) and Pakistan control over the three western rivers (Indus, Jhelum, and Chenab)[8]. Despite being praised as one of the longest-lasting water-sharing pacts in history, the treaty has encountered numerous difficulties. Although the IWT protected Pakistan's rights over western rivers, detractors contend that it failed to fully account for upcoming political, demographic, and environmental challenges, creating loopholes that India has occasionally taken advantage of by building run-of-the-river hydroelectric projects.[9]

Conflict over treaty interpretation has grown in recent years, especially about India's hydropower projects in Kishanganga and Ratle, which Pakistan says go beyond the IWT's rules on legal construction[10].India objected to Pakistan's official 2022 submission of these disputes to the Permanent Court of Arbitration (PCA) in The Hague, claiming that impartial expert procedures were to be used first.[11]India disputed the PCA's July 2023 ruling that it had the authority to consider Pakistan's concerns, demonstrating a hardening of stances.[12]

In the aftermath of the April 22, 2025, terror attack in Pahalgam, India's Cabinet Committee on Security announced the unprecedented step of suspending the Indus Waters Treaty. This

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[7] David Gilmartin, *Blood and Water: The Indus River Basin in Modern History* (University of California Press, 2015).
[8] Daniel Haines, *Rivers Divided*, vol. 1 (Oxford University Press, 2017), https://doi.org/10.1093/acprof:oso/9780190648664.001.0001.
[9] Daanish Mustafa, "Hydropolitics in Pakistan's Indus Basin," *United States Institute of Peace Special Report*, no. 261 (2010): 5–7.
[10] Madison Condon et al., "Challenge and Response in the Indus Basin," *Water Policy* 16, no. S1 (2014): 58–86, https://doi.org/10.2166/wp.2014.004.
[11]Pakistan Approaches Hague Court over Indus Water Dispute," *Dawn*, August 20, 2022.
[12] Hague Court Rules It Can Hear Indus Water Treaty Dispute," *Reuters*, July 6, 2023

action, framed as a national security measure, marked the first time in the Treaty's history that its implementation was formally put on hold.[13]One could claim that New Delhi used water as a strategic leverage weapon to coerce Pakistan in reaction to cross-border militancy by suspending the Indus Waters Treaty. But it also jeopardizes decades of peace in water sharing, raising the possibility of humanitarian and regional security consequences.

1.2.2 Geopolitical Tensions and India's Hydro-Hegemony:

The amount of water available per person in Pakistan has reduced by 70% since the 1950s, and estimates suggest that within 25 years, it may reach scarcity levels (1,000 cubic meters per capita). This decline highlights the growing imbalance in the Indus River Basin, where water flows are heavily regulated by India, the upstream riparian state. Although Pakistan is allocated water shares under the 1960 Indus Waters Treaty, India's dam and hydro projects on western rivers have limited Pakistan's access, as evidenced by the reduced water flow in 2009. The scholar argues that the upstream actor (India) proposes projects that become the agenda, while the downstream actor (Pakistan) must mobilize legal-technical scrutiny to preserve reliability.[14]This upstream-downstream dynamic affects the transaction costs Pakistan must pay to protect its allocations through technological and legal knowledge, but it does not violate the Treaty. India's control over water flow, due to its upstream position, could lead to floods or droughts in Pakistan. This control seriously threatens Pakistan's agriculture and national stability and intensifies its concerns about Indian hydro-hegemony.

Pakistan's concerns about upstream control have increased over time due to India's hydro power developments on western rivers, especially the Baglihar, Kishanganga, and Ratle.[15] Though some of these projects were deemed legal under IWT provisions, critics argue that they enable India to manipulate the timing and volume of water flows into Pakistan, especially during critical irrigation seasons.[16] Events that occurred after 2016, such as the

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[13] Hindustan Times, *Pahalgam attack: India suspends Indus Waters Treaty, downgrades diplomatic ties with Pakistan*, April 23, 2025

[14] Mark Zeitoun and Naho Mirumachi, "Transboundary Water Interaction I: Reconsidering Conflict and Cooperation," *International Environmental Agreements: Politics, Law and Economics* 8, no. 4 (2008): 297–316, https://doi.org/10.1007/s10784-008-9083-5.

[15] Munawar Hussain et al., "Hydro-Hegemony Framework: A Study of the India Pakistan Trans-Boundary Water Competition and Cooperation," *Liberal Arts and Social Sciences International Journal (LASSIJ)* 5, no. 1 (2021): 537–53, https://doi.org/10.47264/idea.lassij/5.1.35.

[16] Zahra Gardezi et al., "The Effectiveness of the Indus Waters Treaty 1960: A Case Study of the 1999 Baglihar Hydroelectric Project and 2007 Kishenganga Hydroelectric Plant," *The Interdisciplinary Journal of International Studies*, The Interdisciplinary Journal of International Studies, December 9, 2020, 17 Pages, 17 Pages, https://doi.org/10.5278/OJS.IJIS.V10I1.6347.

attacks in Pulwama and Uri, gave the conflict a more securitized tone. The diplomatic basis of the treaty was undermined when Indian political leaders publicly vowed to "review" or "suspend" it. In bilateral rivalry, water has shifted from a technical to a geopolitical asset due to this strategic messaging.[17]

1.2.3 Climate Change and Environmental Insecurity:

Recent studies show that climate change acts as a threat multiplier in the Indo-Pak water conflict. The Indus Basin is fed by the Hindu Kush–Himalayan glaciers, which are melting rapidly. According to ICIMOD studies, glacier loss could reach 75% by 2100. Hydrological unpredictability is further worsened in northern Pakistan by increased monsoon variability and a rise in glacial lake outburst floods (GLOFs). Some scholars believe that Pakistan's agricultural sector is heavily dependent on the Indus Basin irrigation system and transboundary waters. This sector faces serious threats from climate change, especially due to the impact on water resources from the Hindu Kush–Karakoram glaciers. Some experts highlight the failure of the IWT to adapt to certain environmental disturbances. The two riparian nations are competing more violently as water flow becomes more unpredictable. This is due to the rapid shrinking of the Himalayan glaciers, which are the main sources of the Indus River system. The treaty has been further strained by India's construction of hydroelectric projects like the Baglihar and Kishanganga dams on the western rivers. This is particularly problematic since Pakistan considers these developments strategic threats to its agriculture and water security, which are highly dependent on the Indus Basin.[18]

Climate change has a significant impact on groundwater recharge patterns, water quality, and evapotranspiration rates in addition to changing river flows. This is particularly true in arid regions like Tharparkar, Cholistan, parts of Balochistan, and even the tail-end regions of Sindh, where groundwater quality is deteriorating due to over-extraction and seawater intrusion. For instance, in Tharparkar, diminishing groundwater levels have already started to jeopardize conventional well systems and intensify drought cycles.[19]Like this, decreased aquifer recharge in the drylands of Balochistan fuels escalating conflicts over access to

[17] Panic in Pakistan as India Vows to Cut Off Water Supply Over Kashmir," *Reuters*, April 27, 2025.
[18] Rubina Khan et al., "Pakistan-India Water Conflict: A Causal Analysis," *ANNALS OF SOCIAL SCIENCES AND PERSPECTIVE* 3, no. 1 (2022): 43–51, https://doi.org/10.52700/assap.v3i1.141.
[19] Saqib Ashraf et al., "Impacts of Climate and Land-Use Change on Groundwater Recharge in the Semi-Arid Lower Ravi River Basin, Pakistan," *Groundwater for Sustainable Development* 17 (May 2022): 100743, https://doi.org/10.1016/j.gsd.2022.100743.

drinking water and irrigation, rendering these regions more susceptible to conflict and water scarcity.

Additionally, the IWT is outdated given changing ecological realities because it lacks provisions for environmental sustainability, transboundary groundwater exploitation, or climate-induced variability. The risks of water-related instability in South Asia are expected to grow without immediate reforms and regional cooperation focused on climate-resilient water management, especially for downstream Pakistan, which already faces severe water scarcity and limited storage capacity.[20]

1.2.4 Consequences for Pakistan: Inter-Provincial Tensions in Pakistan

Internal conflicts over interprovincial water distribution worsen the Indo-Pak water dispute. The author provides a detailed analysis of Pakistan's internal water issues, highlighting the weakening situation caused by poor leadership, political mistrust, and outdated infrastructure. The 1991 Water Apportionment Accord aimed to distribute Indus waters fairly among Punjab (37%), Sindh (37%), KPK (14%), and Balochistan (12%). However, ongoing disputes over water allocation have strained relations between provinces. While KPK and Sindh oppose dam projects like the Kalabagh Dam due to concerns about water control and land submersion, provinces like Sindh accuse Punjab of taking more than its fair share. On the other hand, provinces like Sindh accuse Punjab of taking more than its fair share of water resources. In response, Balochistan claims that Sindh does not provide it with its allocated portion. Inter-provincial conflicts continue because the Indus River System Authority (IRSA), established to implement the 1991 Accord, often fails to act fairly or effectively. For instance, Balochistan states that Sindh withholds its rightful water share, while Sindh accuses Punjab of diverting more water through connection canals than permitted. Concerns over water diversion, loss of arable land, and environmental damage fuel opposition to large dam projects like the Kalabagh Dam in Sindh, KPK, and Balochistan. Misunderstandings, mistrust, and the lack of an integrated water policy all contribute to these ongoing conflicts.

To preserve its agrarian economy, control water flow, and produce hydroelectric power, Pakistan has constructed several significant dams on the Indus River. Among these are the Mangla Dam on the Jhelum River and the Tarbela Dam on the Indus, both of which were

[20] Khan et al., “Pakistan-India Water Conflict,” 2022.

built with support from foreign partners under the terms of the Indus Waters Treaty (IWT). Given Pakistan's vulnerability as a lower riparian state, these dams have been essential for agricultural and water storage.[21] Scholars argue, however, that the nation's dam infrastructure is still inadequate to fulfill the nation's expanding energy and agricultural needs, especially in light of the strains posed by population expansion and climate change.[22] Progress has been further slowed by the inability to agree on new dam projects, like the contentious Kalabagh Dam, because provinces like Sindh and KPK are afraid of upstream control and ecological devastation.[23] Intra-national water disputes in Pakistan, particularly between Punjab and Sindh, are critical to understanding the Indus Basin's hydro-politics. Punjab is frequently accused by Sindh of monopolizing water, particularly during dry seasons, which results in shortages for drinking water and food production. Due to the dominance of large landowners in water access and the lax implementation of water-sharing agreements, small farmers are at a disadvantage. Reduced freshwater flow is also harming the Indus Delta, leading to shoreline deterioration and increased salinity. Pakistan's ability to present a united front in international discussions is further hindered by internal political divisions and poor water governance, highlighting the necessity of addressing domestic water concerns for the sake of equality and effective diplomacy.[24]

Pakistan is vulnerable to flooding and water scarcity due to seasonal variations in river flow and inadequate storage capacity. This underscores the pressing need for better dam management, interprovincial cooperation, and investments in sustainable water infrastructure.[25]

The already unstable water-sharing arrangement has become much more complicated due to climate change. Conflicts have been exacerbated by the unpredictability of water availability brought on by the melting of the Himalayan glaciers and erratic monsoons. Numerous academics support the development of a thorough national water strategy as well

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[21] Zahra Gardezi et al., "The Effectiveness of the Indus Waters Treaty 1960: A Case Study of the 1999 Baglihar Hydroelectric Project and 2007 Kishenganga Hydroelectric Plant," *The Interdisciplinary Journal of International Studies*, The Interdisciplinary Journal of International Studies, December 9, 2020, 17 Pages, 17 Pages, https://doi.org/10.5278/OJS.IJIS.V10I1.6347.

[22] Khubaib Rehman and Raheela Shafique, "Inter Province Water Conflict in Pakistan: Perception and Misperception," preprint, Unpublished, 2020, https://doi.org/10.13140/RG.2.2.33856.56325.

[23] Robina Khan, Muhammad Muzaffar, and Ghulam Mustafa, "Pakistan-India Water Conflict: A Causal Analysis," *Pakistan Perspectives* 26, no. 1 (2021): 37–53.

[24] Sahera Khatoon, Sana Taj, Humaira Fayaz, Mr. Zeeshan Naseer, and Ms Rabail Tanveer. 2025. "The Hydro-Politics of Indus River Basin: The Role of Water in Pak-India Relations". *Journal of Social Signs Review* 3 (06):200-218. https://socialsignsreivew.com/index.php/12/article/view/294.

[25] Munawar Hussain, Munazza Khalid, and Sameera Imran, "Hydro-Hegemony Framework: A Study of the India-Pakistan Trans-boundary Water Competition and Cooperation," *Liberal Arts and Social Sciences International Journal (LASSIJ)* 5, no. 1 (June 2021): 539–555, https://doi.org/10.47264/idea.lassij/5.1.35.

as more robust institutional frameworks to settle conflicts, improve data transparency, and encourage water conservation.[26]

The Western Rivers are crucial for hydropower production in addition to agriculture. Multipurpose reservoirs like Tarbela and Mangla, which are the result of the Indus Basin Replacement Works funded by the IWT, are essential to Pakistan's energy policy.[27]Pakistan's ongoing energy shortages can be made worse by any interruption or perceived risk to inflows, particularly during periods of high demand. Furthermore, siltation in reservoirs lowers storage capacity and generation potential and is enhanced by glacial melt and poor sediment management.[28]Although the Treaty permits Pakistan to protect inflows for its hydropower requirements, its inaction on sediment management and storage optimization results in a structural energy vulnerability that is exacerbated by hydrological changes brought on by climate change.

1.3. RESEARCH GAP:

While extensive literature addresses the geopolitical, legal, and environmental aspects of the Indo-Pak water dispute and the inter-provincial tensions within Pakistan, a critical research gap remains in understanding the human security impacts of these hydro-political dynamics at the grassroots level. Existing studies primarily focus on state-centric perspectives, emphasizing treaty negotiations, hydropower projects, and strategic water control.

However, they often overlook the lived experiences of vulnerable populations in the lower riparian region. The socio-economic impacts of water scarcity, such as reduced agricultural productivity, livelihood disruption, and internal displacement, are inadequately explored, particularly among marginalized groups like farmers. Specifically, insufficient attention has been given to:

- The post-2015 phase, where securitization of water politics and hydropower expansion intersect with climate stress.

[26] Hussain, Munawar, Munazza Khalid, and Sumeera Imran. "Hydro-Hegemony Framework: A study of the India-Pakistan trans-boundary water competition and cooperation." *Liberal Arts and Social Sciences International Journal (LASSIJ)* 5, no. 1 (2021): 537-553.
[27] Salaman, M., and K. Uprety. "Conflict and Cooperation on Asia's International Rivers" (2002).
[28] Qureshi, Asad Sarwar, Peter G. McCornick, Asrar Sarwar, and Bharat R. Sharma. "Challenges and prospects of sustainable groundwater management in the Indus Basin, Pakistan." *Water resources management* 24, no. 8 (2010): 1551-1569.

- The interaction between transboundary water control and domestic governance failures
- The impacts of water insecurity on livelihoods, food security, and displacement among marginalized populations.

Furthermore, there is not enough academic attention on how poor local water governance, sociopolitical inequality, and climate-induced vulnerability interact to exacerbate these issues. This disconnect between high-level policy discourse and ground-level human insecurities presents a significant gap that must be addressed to formulate inclusive, just, and sustainable transboundary and domestic water management strategies.

1.4. PROBLEM STATEMENT:

Both internal and external forces are putting more strain on Pakistan's water security. Externally, concerns about decreased water availability for provinces downstream are triggered by India's upstream control over the Indus River system, as well as the construction of dams and hydropower projects. Agriculture, food security, and human welfare are all directly impacted by this, particularly in rural and lower-riparian areas. Pakistan's water security is increasingly strained by the interaction of India's upstream control of the Indus Basin since 2015, climate-induced hydrological variability, and Pakistan's own governance failures. While India's hydropower projects do not necessarily violate the Indus Waters Treaty, their cumulative and strategic effects reduce the predictability of downstream water flows, intensifying agricultural, food, and energy insecurity in Pakistan.

The absence of coordinated internal water governance limits Pakistan's ability to respond effectively to external pressures. Without addressing both transboundary hydro-political tensions and internal governance deficiencies.

Persistent political tensions between India and Pakistan exacerbate the situation by limiting possibilities for collaboration on shared water management. Without addressing both the hydro-political tensions and internal governance failures, Pakistan risks deepening water insecurity, undermining livelihoods, and fueling socio-political instability.

1.5. RESEARCH OBJECTIVES

1. To examine how inter-provincial water disputes and weak governance structures affect equitable water access at the community level in Pakistan.

2. To evaluate how India's upstream control of Indus Basin waters since 2015 has affected displacement and food security in Pakistan's downstream provinces.
3. To analyze the combined effects of Pakistan–India water disputes and climate change on the stability and predictability of Indus River water flows into Pakistan.

1.6. RESEARCH QUESTIONS:

1. How has India's control of the Indus Basin waters since 2015 impacted displacement and food security in Pakistan's downstream provinces?
2. How do inter-provincial water disputes and poor governance affect access to water at the community level?
3. How do Pakistan–India water disputes and climate change together impact the consistent supply of Indus River water to Pakistan?

1.7. HYPOTHESIS:

The Indo-Pakistani water crisis poses a significant threat to Pakistan's water security and has significant consequences for food security, agriculture, and human well-being. It is intensified by India's upstream control over water resources, made worse by Pakistan's poor domestic governance and climate change.

1.8. SIGNIFICANCE OF THE STUDY:

The combined effects of transboundary water disputes and domestic governance shortcomings on Pakistan's water security—a topic at the nexus of environmental change, human security, and geopolitics—make this study noteworthy. The study provides a broader understanding of the factors delaying sustainable water management in Pakistan by linking high-level hydro-political tensions to local access issues. By emphasizing the significance of resolving both interstate relations and domestic policy deficiencies, the findings will add to scholarly discussions on water diplomacy and governance.

The study provides evidence-based insights for policymakers, researchers, and students to create more efficient frameworks for water governance that guarantee equitable distribution, bolster institutional capacity, and incorporate adaptation strategies that are climate resilient. It also highlights the necessity of cooperative water-sharing arrangements between Pakistan and India, which might improve regional stability and lower the likelihood of violence. The goal of the research is to assist in the creation of policies that

preserve Pakistan's water resources, advance provincial equity, and protect the means of subsistence for marginalized populations.

1.9. METHODOLOGY:

The systematic way to analyze the complex facts of "The India-Pakistan water dispute and its consequences for Pakistan (2015-2025)" is outlined in this chapter. To analyze the objectives of the study, the research method, research design, data collection method, data analysis technique, and research ethics and limitations are considered. A framework is navigating through the academic literature, policy documents, official statements, reports, and other textual resources that are essential for exploring the intricate relationship between water disputes and their consequences for Pakistan.

1.10. RESEARCH METHODOLOGY:

The link between the water dispute between India and Pakistan and its consequences for Pakistan is complex. This study adopts a qualitative research approach to examine the complex relationship between transboundary water disputes, climate change, and human security in Pakistan. A case study research design is employed, with Pakistan as the primary unit of analysis.

1.11RESEARCH DESIGN:

The study focuses on Pakistan as an analytical unit. Case study research design is used to explore the water disputes and their consequences for Pakistan. This makes it easier to study the country's actions, vulnerabilities, and policies related to the changing climate and the Indus Water Treaty. It also allows for the integration of contextual factors, such as geography, political dynamics, and economic development, that influence the outcomes of Indo-Pak water disputes on the relations between the countries.

1.12.DATA COLLECTION

The data is collected from different sources. The main sources include official statements, publications, reports, academic literature, and other textual material related to the Indo-Pak water dispute. These sources served as the source of thematic analysis. Thematic analysis is used to identify patterns related to hydro-hegemony, governance failures, climate stress, and human security outcomes.

1.13. RESEARCH ETHICS:

The research maintains high ethical standards throughout the study. All secondary data sources used are publicly available and properly cited to ensure academic integrity. No primary data involving human participants has been collected; therefore, issues related to informed consent, confidentiality, and participant protection do not arise. However, care has been taken to represent information accurately, avoid bias, and represent intellectual property rights.

1.14. THEORETICAL FRAMEWORK:

This research uses Hydro-Hegemony Theory and the Human Security Framework to study the Indo-Pak water dispute and its results for Pakistan. Hydro-Hegemony Theory explains the politics and power differences, and the Human Security Framework looks at the results for people in Pakistan. Zeitoun and Warner (2006) say Hydro-Hegemony Theory explains how power relations in river basins let upstream states control water governance using material, bargaining, and conceptual influence. In the Indus Basin, India's upstream location, along with hydropower infrastructure like the Baglihar, Kishanganga, and Ratle projects, gives it control over water flows. Its bargaining power comes from interpretations of the Indus Waters Treaty (IWT) that allow upstream projects. It uses ideational power by saying these projects are lawful and good for the environment. These advantages leave Pakistan, the downstream country, vulnerable, despite the IWT.

While Hydro-Hegemony accounts for the geopolitical and structural origins of the dispute, the Human Security Framework captures its multidimensional implications for Pakistan's population. By shifting the focus from state-centric to people-centered security, this framework reveals how fluctuations in water availability undermine economic security through reduced agricultural productivity and farmer incomes, food security through declining crop yields and rising prices, and health security through increased incidence of waterborne diseases driven by contamination and salinity intrusion. It further exposes environmental insecurity through ecosystem degradation, community insecurity through intensified inter-provincial disputes over water allocation, and political insecurity as shortages fuel protests and social unrest.

Integrating these perspectives enables a holistic analysis in which Hydro-Hegemony explains the mechanisms of upstream–downstream power asymmetry, and the Human Security Framework traces the pathways through which these asymmetries translate into tangible threats to livelihoods, public health, and social stability. Together, they bridge the

gap between high-level hydro-political dynamics and grassroots vulnerabilities, demonstrating that the Indo-Pak water dispute is both a geopolitical challenge and a profound human security concern.

CHAPTER 2

HISTORICAL BACKGROUND OF THE DISPUTE AND ITS CAUSES

2.1 INTRODUCTION:

Throughout history, human civilization has been shaped not only by cooperation but also by recurrent wars and conflicts, many of which were rooted in the struggle for natural resources. Water, as one of the most essential yet unevenly distributed resources, has frequently been at the center of such rivalry.[29] From ancient civilizations along the Nile and Mesopotamia to modern clashes in South Asia and the Middle East, control over water has often determined political power, economic survival, and interstate relations, thereby making it a recurring driver of conflict.

South Asia is one of the most heavily inhabited regions in the world, and its economy depends heavily on agriculture. However, the region has faced serious challenges in water management and river basin governance. According to scholars, these weaknesses have created a severe water crisis that affects both underground and surface water. Managing surface water is particularly complex, since river basins are the main source of water for households, agriculture, industry, and hydro-power projects, while also receiving most of the wastewater. In the case of the Indus Basin, poor management has further complicated relations between India and Pakistan, as upstream actions often threaten water availability and security for downstream users.[30] With very low water flows in the winter and peak water drifts during the summer monsoon (June–August), Pakistan's river system is highly seasonal. Effective reservoir management and storage are essential to guaranteeing year-round water availability because most of the water arrives in a brief amount of time. Effective water management became even more crucial after the 1960 Indus Basin Treaty, which made Pakistan's water supply mostly reliant on the western rivers (Indus, Jhelum, and Chenab).[31]

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[29] Adil Khan and Nazakat Awan, "Inter-Provincial Water Conflicts in Pakistan: A Critical Analysis," *Journal of South Asian and Middle Eastern Studies* 43, no. 2 (2020): 42–53, https://doi.org/10.1353/jsa.2020.0000.

[30] Rubina Khan et al., "Pakistan-India Water Conflict: A Causal Analysis," *ANNALS OF SOCIAL SCIENCES AND PERSPECTIVE* 3, no. 1 (2022): 43–51, https://doi.org/10.52700/assap.v3i1.141.

[31] Kahlown, Muhammad Akram, and Abdul Majeed. "Water-resources situation in Pakistan: challenges and future strategies." *Water Resources in the South: present scenario and future prospects* 20 (2003): 33-45.

The agricultural and economic underpinnings of both India and Pakistan depend heavily on water supplies. Almost 40–50% of Pakistan's workforce is employed in agriculture, which also accounts for 20–25% of the country's GDP. In India, on the other hand, agriculture employs more than half of the population and generates 15–20% of GDP.[32]Both countries have an agrarian nature, and through exports like rice, cotton, and sugarcane, agriculture not only provides food security but also acts as a major source of foreign exchange profits.[33]Rivers and groundwater supplies are essential to rural livelihoods and economic stability since agricultural output is heavily dependent on water availability.

Agriculture in Pakistan and India is largely reliant on irrigation. Nearly all of Pakistan's irrigated agriculture, which uses more than 90% of the nation's water, is supported by the Indus Basin system, which is fed by the Indus, Jhelum, and Chenab rivers.[34]In contrast, India uses between 70 and 80 percent of its freshwater withdrawals for agricultural purposes, mostly through groundwater and canal irrigation systems.[35]These water-related issues have broad economic ramifications. Any interruption in river flows or lack of irrigation in Pakistan has a direct impact on Kharif and Rabi crop production, threatening food security, rural livelihoods, and export earnings. Variations in water supply can impact industries closely linked to agricultural output, such as food processing and textiles.[36] Water scarcity can have significant economic impacts in India, as agricultural performance continues to influence industry output, rural consumption, and national economic growth.[37]Water stress has increased in both countries due to climate change, unpredictable monsoon patterns, glacial melting, and recurrent droughts, endangering food security and agricultural resilience.

2.2. PRE-PARTITION SCENARIO:

Although sometimes presented as a sign of modernization and scientific progress, the British colonial reorganization of the water system in the Indus basin primarily benefited imperial interests rather than the well-being of the indigenous population. When a

[32] Water Resources and Conservation Strategy of Pakistan. (2007). *The Pakistan Development Review*, *46*(4II), pp.997-1009. https://doi.org/10.30541/v46i4IIpp.997-1009
[33] Muzammil, Muhammad, Azlan Zahid, and Lutz Breuer. 2020. "Water Resources Management Strategies for Irrigated Agriculture in the Indus Basin of Pakistan" *Water* 12, no. 5: 1429. https://doi.org/10.3390/w12051429
[34] Akram, Nida, Shahla Andleeb, Khalil ur Rehman, Muhammad Waqar Akram, and Muhammad Zubair Tariq. "Does CPEC benefit the sustainable agricultural development in Pakistan: a comparison with open investment policy 1997." *Environment, Development and Sustainability* (2024): 1-21.
[35] Kundu, Rashmi, Somya Mathur, and Badri Narayanan. "Modelling the Impact of Power Subsidies in Agriculture on Water Use in India." In *Practical Economic Analysis and Computation: A Festschrift in Honor of Professor Kirit Parikh*, pp. 241-259. Singapore: Springer Nature Singapore, 2025.
[36] Finance Division, *Pakistan Economic Survey 2023–24*.
[37] World Bank, "How India Is Addressing Its Water Needs".

centralized irrigation bureaucracy was established, water was turned from an ecological and communal resource into a tool of commercial and political domination. This procedure mirrored the logic of colonial capitalism, in which the building of infrastructure was dictated by the need for stability and income rather than by environmental sustainability or equitable development. To accomplish fiscal, political, and administrative goals—namely, boosting land revenue, solidifying political power, and demonstrating technological and bureaucratic dominance—the British colonial state converted the traditional, locally run irrigation methods in the Indus Basin into a centralized, government-controlled system in the mid-1800s.[38]In addition to being an administrative or infrastructure change, the British colonial restructuring of the water resources in the Indus basin was a calculated move to strengthen imperial power through political dominance, social engineering, and economic exploitation. The British state transformed water, a vital resource for agricultural subsistence, into a tool of territorial authority and financial exploitation by centralizing irrigation management and incorporating it into the colonial bureaucracy. Control over natural resources was closely linked to the consolidation of colonial power and legitimacy because of this centralization, which also undermined local autonomy, supplanted indigenous water management practices, and solidified state authority.

By legally redefining irrigation and water infrastructure as government property, the British colonial state replaced traditional, community-based administration with state power. They also established a centralized bureaucratic system where engineers and administrators controlled water allocation. [39]Between the 1880s and 1940s, the British established an extensive canal network across Punjab that dramatically expanded irrigated acreage. Massive projects — for example, the Chenab, Jhelum, and Bari Doab schemes and the Lyallpur (now Faisalabad) canal colony — converted millions of acres of arid "bar" lands into irrigated farms. Canal colonies were planned settlements: land was surveyed, classified, allotted (often to peasant settlers from other districts), and tied to land revenue assessments that assumed dependable irrigation supplies. The settlement rules, marketing infrastructure, and transportation links created entirely new agrarian economies that were directly integrated with the colonial fiscal system. To foster loyalty among specific settlers and integrate Punjab's agricultural economy into imperial markets, the British utilized irrigation infrastructure. In addition to uprooting indigenous tribes and escalating rural

[38] Gilmartin, David. *Blood and water: the Indus river basin in modern history*. University of California Press, 2020.
[39] Qureshi, Waseem Ahmad. "Indus Basin Water Management Under International Law." *U. Miami Int'l & Comp. L. Rev.* 25 (2017): 63.

inequality, this method solidified class hierarchies by favoring wealthy landowners and devoted peasants. Furthermore, local inhabitants became economically dependent and ecologically fragile due to the concentration on cash crops for export rather than subsistence farming; this legacy still affects Pakistan's agrarian and water politics today.

This does not negate the existence of tail-reach complaints, revenue court lawsuits, and local water tensions in colonial Punjab. The key distinction lies in the institutional framing. Before 1947, these complaints were often supervised through judicial or administrative processes rather than interstate diplomacy or pressure. Administrative unity collapsed after partition. The colonial irrigation departments and provincial budgets were no longer applicable across the newly established frontier; departmental registers and settlement agreements lost their legal force across the border. Moreover, major headworks and canals were divided by international borders. Therefore, former administrative issues were transformed into interstate claims, which in turn generated the diplomatic crisis and negotiations that led to the signing of the Indus Waters Treaty in 1960. This political-institutional shift from administrative distribution to international negotiating is highlighted in modern summaries of the Treaty's foundation.[40]

2.3. PARTITION OF 1947 AND IMMEDIATE CHALLENGES:

The political and hydrological landscape of South Asia had been drastically changed by the August 1947 Partition of British India. Long-standing river basins and irrigation systems were disrupted when British India was partitioned along communal lines in August 1947. The Radcliffe Line separated Bengal into East Bengal (now Pakistan) and West Bengal (now India). It similarly also separated the province of Punjab into West Punjab (which became part of Pakistan) and East Punjab (which became part of India). Command districts, headworks, and canal networks were split between two newly independent states on the resulting map, rather than remaining entirely inside a single administrative unit. Internal administrative allocations and shared technical arrangements have become potential causes of interstate conflict as a result of this territorial fragmentation.[41] The separation of Bengal and Punjab, two areas with vast rivers and irrigation systems, led to the disintegration of cohesive water systems. Punjab, which spanned the Indus River

[40] Mantoo, Shahnawaz. "Indus Water Treaty: Past Present and Future." *Journal of Global Economy* 16, no. 4 (2020): 65-87.

[41] Brooks, Leonard, L. Dudley Stamp, C. B. Fawcett, E. S. Lindley, W. G. East, Mushtaq Ahmad Bajwa, and O. H. K. Spate. "The Partition of the Punjab and of Bengal: Discussion." *The Geographical Journal* 110, no. 4/6 (1947): 218–22. https://doi.org/10.2307/1789951.

system and its five principal tributaries—the Jhelum, Chenab, Ravi, Beas, and Sutlej—was split between India and Pakistan. Punjab had been the center of British India's canal irrigation construction. The Radcliffe Commission, which focused on demographics rather than hydrology, did not consider irrigation command regions or canal networks when drawing the new boundaries.[42] Upstream control and downstream reliance were the outcomes of this split. While the canal networks irrigating large areas of agricultural land were in Pakistan, the headworks of the eastern rivers, which are crucial facilities that control water flow, were primarily located within Indian territory. [43]The demarcation of the Radcliffe Line had serious geographical repercussions. While the downstream canals, such as the Upper Bari Doab Canal (UBDC) and the Dipalpur Canal, served sizable command areas in Pakistan's Punjab state, the majority of the important headworks, such as the Madhopur on the Ravi and Ferozepur on the Sutlej, were situated in India. [44]As a result, a special asymmetry emerged: the downstream state (Pakistan) was affected by operational choices, while the upstream state (India) controlled the means of control.

India claimed it was not legally required to keep providing water to Pakistan without an agreement, based on the idea of sovereign control over waters inside its borders.[45]However, under the formerly united irrigation system, Pakistan saw the rivers as a logical extension of pre-Partition rights. Pakistani authorities maintained that their cities and farms, especially Lahore, which relied on the UBDC for municipal supply, needed water to survive.[46]A common technical system became a political and strategic concern due to this geographic reality. India was able to impact Pakistan's water security by using its control of headworks as leverage. Later, Pakistan's support for international mediation and the final drafting of the Indus Waters Treaty (1960) would be based on this upstream–downstream arrangement.

When India momentarily halted the water supply from the Madhopur and Ferozepur headworks in April 1948, the tensions reached a breaking point,s and supplies to Pakistan's UBDC and Dipalpur canals were disrupted. [47]Shortly after the standstill agreement, which

[42] David Gilmartin, *Blood and Water: The Indus River Basin in Modern History* (Oakland: University of California Press, 2018), 126–128.
[43] Alam, Undala Z. "Questioning the water wars rationale: a case study of the Indus Waters Treaty." *Geographical Journal* 168, no. 4 (2002): 341-353.
[44] Akhtar, S. "Water sharing conflicts and management in the Indus River Basin." *J Aqua Sci Oceanography* 1 (2019): 202.
[45] Mustafa, Daanish. *Hydropolitics in Pakistan's Indus Basin*. Washington, DC: US Institute of Peace, 2010.
[46] Briscoe, John. "India's water economy, bracing for a turbulent future." (2005).
[47] Wolf, Aaron T., and Joshua T. Newton. "Case study of transboundary dispute resolution: The Indus water treaty." *Department of Geosciences, Oregon State University: Corvallis, OR, USA* (2008).

permitted interim water sharing, ended on March 31, 1948, the decision was made. The administration of East Punjab shut down the canal gates on April 1, cutting off water to a sizable portion of West Punjab (now in Pakistan). [48]There were serious humanitarian and agricultural repercussions from this abrupt decision. Water shortages occurred in the city of Lahore, and thousands of acres of farmland dried up just before the planting season. [49]Political figures and newspapers in Pakistan denounced the action as an act of aggression and claimed it was an attempt to "choke" the country's economy. Conversely, India insisted that it had the right to complete control over the waterways within its borders and defended the cutoff by claiming that Pakistan had not agreed to pay for upkeep and operation. [50]The crisis revealed that there was no official system in place for managing water resources across states. Additionally, it was the first major diplomatic conflict between India and Pakistan following Partition, portending more. This incident "laid the foundation for the securitization of water in South Asia," according to Salman Akhtar, turning a technical problem into one of national survival and sovereignty.[51]

Both governments recognized the necessity of prompt communication following the April crisis. The British High Commissioner mediated negotiations in Delhi, leading to the signing of the Inter-Dominion Agreement on Canal Waters on May 4, 1948.[52] In exchange for specific promises, the deal restored Pakistan's water supply. Pakistan committed to paying India on an as-needed basis to maintain the headworks' operation, and it recognized India's right to build additional irrigation projects on its side of the border.[53]It was made clear that the Inter-Dominion Agreement was just temporary. Although it did not address water ownership, it offered a temporary fix to keep Pakistan's agriculture from collapsing.[54] The agreement was significant because it emphasized the geographical imbalance in the basin and the absence of a legislative framework managing transboundary rivers between the two new governments.[55]This incident signaled the start of formalized South Asian River diplomacy. It proved that unilateral authority over common seas might

[48] Indian Law Institute. *Journal of the Indian Law Institute*. Vol. 10. The Institute, 1968.
[49] Haines, Daniel. "Disputed rivers: Sovereignty, territory and state-making in South Asia, 1948–1951." *Geopolitics* 19, no. 3 (2014): 632-655.
[50] Choudhury, Golam Wahed. "India, Pakistan, Bangladesh, and the major powers: politics of a divided subcontinent." *(No Title)* (1975).
[51] Akhtar, S. "Water sharing conflicts and management in the Indus River Basin." *J Aqua Sci Oceanography* 1 (2019): 202.
[52] Government of India, Ministry of External Affairs, *Inter-Dominion Agreement on Canal Waters*, May 4, 1948.
[53] Alam, "A Case Study of the Indus Waters Treaty," 166.
[54] Haines, Daniel, 'Introduction', *Rivers Divided: Indus Basin Waters in the Making of India and Pakistan* (2017; online edn, Oxford Academic, 18 May 2017), https://doi.org/10.1093/acprof:oso/9780190648664.003.0001
[55] Mustafa, "Hydropolitics in Pakistan's Indus Basin," 14.

quickly turn into a political crisis that would require outside intervention. After this development, the two countries agreed to involve the World Bank in their discussion. This mediation eventually led to the Indus Water Treaty of 1960, through which the Indus River water was permanently divided the eastern and western rivers each allocated permanently between India and Pakistan.

2.4 THE INDUS WATERS TREATY (1960):

An important turning point in South Asia's transboundary water relations was the ratification of the Indus Waters Treaty (IWT) in 1960. It was not just a technical agreement; rather, it was a meticulously negotiated framework that emerged from colonial legacies, geopolitical need, and the dynamics of international mediation during the Cold War. The Treaty divided the six rivers of the Indus Basin into two categories — allocating the eastern rivers (Ravi, Beas, Sutlej) to India and the western rivers (Indus, Jhelum, Chenab) to Pakistan. Yet it appeared to be a straightforward division; this arrangement was, in fact, a complex political compromise designed to ensure long-term stability while granting each country sovereign control over distant sections of the basin.

The distribution reflected the post-Partition geopolitical landscape. Pakistan desired safe and continuous flows to support its predominantly agrarian economy, whereas India, the upstream state, sought complete authority over the eastern tributaries that originated in its territory. A decisive victory for Pakistan's food and irrigation security was that the ensuing agreement guaranteed it access to roughly 80% of the Indus Basin's overall flow. However, the basin was hydrologically fractured due to this divide, which made a cohesive ecological or cooperative management strategy unlikely. According to academics like David Gilmartin and Daanish Mustafa, this division solidified the political lines within the natural river system, turning a shared natural resource into a depiction of divided sovereignty. [56] This division not only hindered effective resource management but also fostered tensions among the communities dependent on the river. As competing interests emerged, the potential for collaborative stewardship diminished.

A unique technocratic element was added to the negotiation process by the World Bank's mediation of the Treaty. Under President Eugene Black, the Bank viewed the conflict as an engineering issue rather than a political one, one that could be resolved through institutional

[56] David Gilmartin, *Blood and Water: The Indus River Basin in Modern History* (Oakland: University of California Press, 2018).

channels, financial agreements, and infrastructure. Pakistan was able to move away from reliance on the eastern rivers by building new canals, connecting systems, and reservoirs such as Mangla and Tarbela, thanks to the Bank's sponsorship of the Indus Basin Development Fund. [57]As the U.S.-led axis sought to stabilize South Asia through economic cooperation during the Cold War, this strategy not only protected Pakistan's source of irrigation but also aligned with Western objectives. yet, this "engineering diplomacy," as some researchers describe it, came at a cost: it prioritized structural solutions over the long-term biological balance of the basin.[58]

The Permanent Indus Commission (PIC), a framework for sharing information, monitoring, and resolving disputes, was established as a key part of the Treaty's most enduring accomplishments. Even at times of intense political stress, such as the 1965, 1971, and 1999 wars, the Commission established a system of communication between the two nations. This continuity shows how the IWT was able to "depoliticize" water management by moving it into a more technical and administrative realm.[59]When most other avenues for communication between India and Pakistan had failed, the PIC emerged as a unique forum. It supported the claim that shared environmental management can serve as a stabilizing factor in areas prone to conflict by establishing that institutionalized collaboration might endure in the face of embedded hostility.

However, the long-term limits of the IWT have become more apparent. The Treaty was not designed to address modern issues like population expansion, climate change, and ecological degradation because it was based on the developmental backdrop of the 1950s. The strict distribution of rivers disregarded the ecological interconnectedness of the basin and left out groundwater management, environmental flow, and hydrological variability adaptation mechanisms.[60]Large-scale hydropower production was also not anticipated under the Treaty, which is now a major point of controversy. Conflicts have frequently arisen over projects like Baglihar on the Chenab and Kishanganga on the Jhelum. Pakistan has accused India of controlling water flow through "run-of-the-river" dams, which could

[57] World Bank, "Fact Sheet: The Indus Waters Treaty (1960) and the World Bank's Role," (Washington, DC: World Bank, 2018).
[58] John Briscoe, "War or Peace on the Indus?" *Water Policy* 12, no. 2 (2010): 146–164
[59] Undala Z. Alam, "Questioning the Water Wars Rationale: A Case Study of the Indus Waters Treaty," *The Geographical Journal* 168, no. 4 (2002): 342–353.
[60] Qamar, Muhammad Uzair, Muhammad Azmat, and Pierluigi Claps. "Pitfalls in transboundary Indus Water Treaty: a perspective to prevent unattended threats to the global security." *npj Clean Water* 2, no. 1 (2019): 22.

potentially lower the downstream supply.[61] They demonstrate the Treaty's incapacity to adapt to shifting hydrological and technical realities, even if most of these issues have been settled through the PIC or impartial expert arbitration.

The Treaty's fundamental power imbalance is the subject of another important analytical consideration. India had more financial and technical capabilities and held upstream control at the time of signing, whereas Pakistan was the more vulnerable partner due to its reliance on agriculture and downstream flows. This balance has been further skewed over the decades by India's economic growth and infrastructure development, which enable it to pursue hydroelectric projects within the legal parameters of the treaty, albeit against its cooperative spirit.[62] According to some academics, this disparity reflects both the changing strategic and economic capabilities of the two governments, as well as geographic realities. It supports the more general claim that transboundary water treaties are rarely static and instead change—or don't change—in response to the political and power structures of the parties to the treaty.

India publicly announced in April 2025 that it will "abeyance" the Indus Waters Treaty (IWT) of 1960, so suspending its treaty-based responsibilities to Pakistan. In response to a terrorist attack in Indian-administered Kashmir that India blamed on militant help from Pakistan, India said on April 23, 2025, that Pakistan had to "credibly and irrevocably abjure" cross-border terrorism before treaty procedures could resume.[63] Therefore, rather than being the consequence of procedural infractions within the treaty itself, this unilateral suspension was politically motivated.

Pakistan, which depends on hydrological data for irrigation planning, flood control, and water management, no longer receives hydrological data from India. According to reports, India altered dam operations at key reservoirs like Baglihar and Salal, including gate openings to control internal water storage, without giving Pakistan advance warning. Concerns over unplanned flooding or shortages downstream have been raised by this withholding of vital hydrological data.[64] The Permanent Court of Arbitration (PCA)

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[61] Toufiq A. Siddiqi, "The Baglihar Dispute and Its Implications for the Indus Waters Treaty," *Asian Affairs* 39, no. 1 (2008): 45–53.
[62] W. A. Qureshi, "The Indus Waters Treaty: A Legal and Political Analysis," *South Asian Studies* 34, no. 2 (2019): 508–522.
[63] Akanksha Singh and Tobias von Lossow, *Indus Water Treaty 2025: A pause of cooperation, not an end* (Clingendael Alert, July 2025).
[64] 'India Can Starve Us': Farmers in Pakistan Decry Suspension of Crucial Water Treaty," *The Guardian*, April 29, 2025.

reiterated in August 2025 that it has jurisdiction over issues originating under the IWT and that arbitral rulings are binding on both sides, despite India's unilateral suspension. Pakistan has formally asked for enforcement, stressing that treaty commitments are not legally nullified by India's unilateral conduct. [2] However, India disagreed with the PCA decision, arguing that the suspension was appropriate given the current state of security.[65]

Due to decreased flows, especially from the Chenab River, the Pakistani Indus River System Authority (IRSA) estimated a possible 21% water shortage in the early Kharif season (May–June). Concerns regarding crop losses, water scarcity, and the effects on food security were voiced by farmers in Sindh and Punjab. Pakistan's capacity to control flood management, reservoir levels, and irrigation scheduling is significantly hampered by the absence of real-time data exchange.[66]In addition to arguing that the treaty is out of date given demographic, climatic, and energy concerns, India has framed the suspension as contingent on Pakistan ceasing alleged cross-border terrorism.[67]According to Pakistan, this is "hydro-securitization," which transforms water from a communal resource that is managed cooperatively into a strategic tool. Political and food security threats are increased by the suspension's unilateral nature, which brings about a structural change in regional water governance.[68]

The Indus Waters Treaty is one of the most robust water-sharing agreements in the world, notwithstanding its flaws. Given the ongoing hostility between India and Pakistan, its effectiveness rests on its ability to distinguish water cooperation from more general political antipathy. The Treaty has withstood numerous wars, boundary disputes, and diplomatic rifts, proving that states can put practical cooperation ahead of conflict when crucial resources are at risk. However, the Treaty's ability to adapt may determine how stable it remains in the future. Emerging problems that the IWT's original planners could not foresee include glacier retreat, decreased river flow, and seasonal unpredictability brought on by climate change.[69]The Treaty risks becoming a relic of the past rather than a

[65] "Press Release: The Indus Waters Western Rivers Arbitration," Permanent Court of Arbitration, August 11, 2025.
[66] Akanksha Singh and Tobias von Lossow, *Indus Water Treaty 2025: A Pause of Cooperation, Not an End* (Clingendael Alert, July 2025).
[67] India Says It Will Never Restore Indus Waters Treaty with Pakistan," Reuters, June 21, 2025.
[68] Abid Hussain, "Can India Stop Pakistan's River Water — and Will It Spark a New War?" *Al Jazeera*, July 9, 2025.
[69] Khizar, M., Nawaz, S., Bashir, H., & Aqeel, M. (2025). Climate Change Impacts on the Indus River Basin: Hydrology, Water Quality, and Treaty Implications. *IRASD Journal of Energy & Environment*, *6*(1), 112–126. https://doi.org/10.52131/jee.2025.0601.0058

dynamic framework for sustainable water governance if it is not updated or supplemented with new procedures to reflect these realities.

CHAPTER 3

INDIA'S UPSTREAM CONTROL AND ITS IMPACT ON PAKISTAN

3.1 INDIA'S UPSTREAM CONTROL AND ITS IMPACT ON PAKISTAN

Pakistan's food systems, society, and economy all depend heavily on water. The Indus Basin River system, which primarily originates on the Indian side of the watershed, is crucial to approximately 80% of Pakistan's irrigated agriculture. The governance climate of the basin has changed since 2015 due to increased infrastructure development in areas of the basin controlled by India, legal and diplomatic conflicts (particularly over the Kishanganga and Ratle projects), treaty suspension episodes, and reduced collaboration. Together with catastrophic floods (most notably the monsoon floods of 2022) and increased climate variability, these changes have created a compound risk environment that puts downstream Pakistani regions at greater risk of exposure, hazard, and susceptibility. This chapter illustrates how food insecurity and relocation are exacerbated throughout Sindh, Punjab, Khyber Pakhtunkhwa, and Balochistan due to upstream control and inadequate cooperative river management.

3.1.1 Displacement:

Displacement is the term used to describe the involuntary relocation of people from their usual site of residence as a result of hydrological threats (like floods, flash floods, or uncontrolled reservoir releases) or gradual degradation of their means of subsistence (like irrigation failure or soil salinization). They are categorized as internally displaced people (IDPs) while they stay inside Pakistan's borders.[70] This comprises those who have been temporarily evacuated, are undergoing a lengthy internal relocation, or have moved permanently when it is no longer possible to return or recover. In this context, displacement is not just a location change; it also corresponds with a loss of productive assets, a disruption of livelihoods, and increased vulnerability.

3.1.2 Food security:

Food security is defined as "all people, at all times, have physical, economic, and nutritional access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life," according to the framework put forth by the

[70] Internal Displacement Monitoring Centre, *Global Report on Internal Displacement 2024*, (Geneva: IDMC, 2024), 34.

Food and Agriculture Organization (FAO) and the World Food Program (WFP).[71] A) availability (food supply, production, and inventories); B) access (income, markets, and pricing); C) usage (nutrition, health, and sanitation); and D) stability (continuity over time and during shocks) are the four dimensions recognized by the framework. When any one of these aspects is weakened, food insecurity results.

3.2 MECHANISMS LINKING UPSTREAM CONTROL TO DISPLACEMENT AND FOOD INSECURITY:

India has had upstream control over the eastern tributaries (Ravi, Beas, and Sutlej) and partial control over the western rivers (Indus, Jhelum, and Chenab) for irrigation and hydroelectricity since the Indus Waters Treaty (IWT) was signed in 1960. India's expanding water infrastructure, especially its dams and hydroelectric projects in Jammu and Kashmir, has, however, caused concern in Pakistan in the past ten years (2015–2025) due to decreased water flows, elevated flood risks, and the ensuing socioeconomic vulnerabilities, particularly in downstream provinces like Punjab, Sindh, and Khyber Pakhtunkhwa (KPK).The new fact is that Pakistan's internal displacement and food security are impacted both directly and indirectly by India's upstream control.

India has constructed a number of hydroelectric projects on the western rivers of IIOJ&K, including the Baghliar, Kwar, Dul Hasti, Burser, Tulbul/Wuller Barrage, Kishanganga Dam (330 MW), and Rattle Dam (850 MW). Pakistan claims that by changing river flows and lowering its water share, these projects violate the 1960 Indus Waters Treaty. India was eventually permitted to proceed under specific treaty stipulations, but Pakistan took the matter to the Permanent Court of Arbitration (PCA) and then the World Bank after the Kishanganga project diverted water from the Neelum (Kishanganga) River to the Jhelum basin. In the same way, Pakistan claimed that the Rattle and Baghliar dams, despite Pakistan's legal and diplomatic challenges, would negatively impact its highly Indus-reliant irrigated agriculture. India is still building several dams despite Pakistan's legal and diplomatic challenges, which shows its increasing upstream control and raises serious questions about Pakistan's water security and IWT compliance.[72] Despite being officially run-of-the-river, these projects allow India to temporarily store and control water flows,

[71] Food and Agriculture Organization, *The State of Food Security and Nutrition in the World 2022* (Rome: FAO, 2022), 13.
[72] Raazia, Izzat, and Kishwar Munir. "Geopolitics of Water in South Asia: A Case-Study of Indus Water Treaty as a Conflict Resolution Mechanism for Pakistan-India Water Security Dilemma." *J. Pol. Stud.* 29 (2022): 47.

which leads to downstream hydrological imbalances. [73] For Pakistan, where 90% of agriculture depends on the Indus Basin irrigation system, such manipulations can drastically affect sowing and harvesting cycles, crop yields, and rural livelihoods.[74]

India's heightened authority since 2015 has been accompanied by a trend of unpredictable water releases and decreased river flows. Due to lower flows from upstream catchments, Pakistan's Indus River System Authority (IRSA) reported a 28% decrease in inflows during the 2018–2019 Rabi season.[75]On the other hand, flash floods have been brought on by abrupt water releases from Indian reservoirs during the monsoon season, especially in northern Punjab and KPK.

This twin threat is best illustrated by the floods of 2019 and 2022. In August 2019, India unexpectedly released water from the Himachal and Ladakh reservoirs, flooding downstream communities in Nowshera, Sialkot, and Narowal.[76]Similar to this, in 2022, when Pakistan was already experiencing record-breaking monsoon rains, increased water releases made Sindh and KPK flooding worse, hurting over 33 million people and forcing over 8 million people to relocate across the country.[77]The upstream state, India, uses its geographic advantage to strategically pressure the downstream state, Pakistan, through this manipulation of river flow, which is a type of "hydro-hegemony."[78]

One of the most obvious human effects of India's upstream control is displacement and migration, especially when paired with Pakistan's own infrastructure shortcomings. Floods and droughts caused frequent displacements in Pakistan between 2015 and 2025, disproportionately hurting rural people who depended on agriculture.

3.3 FLOOD-INDUCED DISPLACEMENT:

Throughout the reviewed decade, floods have continued to be the leading cause of disaster-related displacement in Pakistan. Over 1.6 million people were impacted by the 2015 floods, which temporarily displaced 250,000 people, mostly in Punjab and KPK.[79]According to the National Disaster Management Authority (NDMA), that year's flash floods in Gilgit-Baltistan and Chitral destroyed over 4,000 homes and interfered with

[73] John Briscoe, *War or Peace on the Indus?* (World Bank, 2019).
[74] FAO, *Pakistan: Water and Agriculture Overview* (Rome, 2020).
[75] IRSA Annual Report 2019.
[76] Dawn News, "India Releases Excess Water into Sutlej," August 2019.
[77] UN OCHA, *Pakistan Floods Situation Report*, September 2022.
[78] Mark Zeitoun and Jeroen Warner, "Hydro-Hegemony: A Framework for Analysis," *Water Policy* 8, no. 5 (2006
[79] National Disaster Management Authority (NDMA), *Pakistan Annual Flood Report 2015* (Islamabad: NDMA, 2016), 12–14.

vital infrastructure.[80]The number of people displaced by floods increased steadily in the years that followed. Around 400,000 people were forced to flee Sindh and southern Punjab due to monsoon floods in 2020, which disrupted lives and crops.[81]The most devastating displacement, however, happened in 2022 when the nation was virtually completely drowned by floodwater that had never been seen before. One of the biggest human displacements in Pakistani history, 8.2 million of the approximately 33 million impacted were relocated, according to the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA).[82]60 percent of the displaced were from Sindh alone, with South Punjab and Balochistan coming in second and third.

Over 2.2 million dwellings were demolished, and 4.4 million acres of agriculture were damaged by the flooding, forcing rural residents to relocate to temporary shelters or the outskirts of cities. [83]In the months that followed, almost 10 million people were left without proper shelter, and the World Bank's Pakistan Floods 2022 Damage Assessment Report estimated that the total economic losses exceeded $30 billion. [84] Over 3.02 million individuals had been rescued in 5,768 operations nationwide by September 21, 2025, according to the NDMA, and 12,569 homes had been damaged (4,128 destroyed, 8,441 partially). [85] The National Disaster Management Authority (NDMA) reports that as of September 9, 2025, flooding brought on by high monsoon rains has resulted in 93,886 displaced persons living in 1,631 relief camps, 922 fatalities, and 1,047 injuries.[86]Nearly 250,000 people were relocated and approximately 1.2 million people were impacted in the river-bursting region along the Ravi, Sutlej, and Chenab rivers in eastern Punjab province alone, according to a report dated August 28, 2025.[87]According to the NDMA, 150,000 people have been relocated in Sindh province and 2.4 million people had been evacuated from Punjab state by September 11, 2025. [88]Thousands of internally displaced people (IDPs) in Sindh and Balochistan remained in makeshift settlements during the post-

[80] National Disaster Management Authority (NDMA), *Pakistan Annual Flood Report 2015* (Islamabad: NDMA, 2016), 12–15
[81] World Food Programme (WFP), *Pakistan Monsoon Emergency Situation Report 2020* (Islamabad: WFP, 2020), 8.
[82] United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), *Pakistan Floods Response Plan 2022* (Geneva: UNOCHA, 2022), 4.
[83] Food and Agriculture Organization (FAO), *Assessment of Agricultural Losses: Pakistan Floods 2022* (Rome: FAO, 2023), 6–8.
[84] World Bank, *Pakistan Floods 2022 Damage and Needs Assessment* (Washington, DC: World Bank, 2023), 10.
[85] "Pakistan: Monsoon Floods 2025 Flash Update #3 — As of 26 August 2025," UN OCHA, 26 August 2025.
[86] National Disaster Management Authority (NDMA), *Monsoon 2025 Final Consolidated Situation Report No. 87* (Islamabad: Government of Pakistan, Prime Minister's Office, NDMA, 2 October 2025).
[87] "Pakistan: Flash Floods — Jun 2025," ReliefWeb (GLIDE: FL-2025-000100-PAK), posted 10 September 2025
[88] Hillol Sobhan and CARE Staff, "2025 Pakistan Monsoon Floods Impact Millions: CARE Launches Emergency Response," CARE News & Stories, 22 September 2025

recovery period of 2023–2025, where they faced health issues, food shortages, and lost possibilities for employment. Flood-related displacement has not only been a humanitarian crisis but also a driver of long-term socioeconomic disruption.

Over 12 million people were displaced by the floods in 2015, 2019, and 2022 combined, according to the National Disaster Management Authority (NDMA).[89]Homes, irrigation canals, and agriculture were destroyed as a result of "sudden upstream releases from India intensifying flood levels in northern catchments of the Indus system," according to the UNHCR 2023 Pakistan Displacement Report.[90]In some areas, displacement is permanent. Long-term resettlement issues for many internally displaced people (IDPs) include food shortages, economic instability, and loss of land titles. Repeatedly destroying agricultural land deters people from returning, which leads to persistent rural depopulation and increased urban pressure in cities downstream.

3.4 DROUGHT-INDUCED DISPLACEMENT:

In addition to flooding, rural communities have also been displaced by drought, especially in southern Sindh, Balochistan, and portions of Tharparkar. Severe droughts were documented by the Pakistan Meteorological Department (PMD) in 2018–2019 and 2024, which drastically decreased crop output and water availability in these already parched areas.[91]In contrast to floods, drought-induced displacement is typically seasonal and slow-onset, frequently requiring whole families to temporarily relocate during the driest months of the year. Approximately 20–25 percent of all internal displacements reported annually between 2016 and 2021 were attributed to droughts, according to the UNHCR's Pakistan Internal Displacement Review (2021).[92]By 2025, the probability of long-term migration from southern Sindh and Balochistan is expected to increase due to ongoing water scarcity resulting from declining Indus River flows and reduced monsoon rainfall. According to a 2024 prediction by the Pakistan Council of Research in Water Resources (PCRWR), Pakistan may experience complete water scarcity by 2025. If upstream water control and mismanagement continue, this scenario may exacerbate patterns of rural displacement.[93]

[89] NDMA Flood Impact Assessment Report 2022.
[90] UNHCR, *Pakistan Displacement Tracking Report*, 2023.
[91] Pakistan Meteorological Department (PMD), *Drought Monitoring Bulletin 2024* (Islamabad: PMD, 2024), 3.
[92] UNHCR, *Pakistan Internal Displacement Review 2021* (Islamabad: UNHCR, 2021), 7.
[93] Pakistan Council of Research in Water Resources (PCRWR), *National Water Policy Review 2024* (Islamabad: PCRWR, 2024), 9

In contrast, Sindh and southern Punjab had drought-like conditions due to decreased inflows from upstream during dry years like 2018 and 2021. The 2021 Kharif season had a 45% drop in water availability, according to the Sindh Irrigation Department.[94]Wheat and cotton crops failed as a result of severe irrigation shortages experienced by farmers in Badin, Thatta, and Tharparkar.[95]As a result, many people moved periodically to Hyderabad and Karachi in search of work.

Water scarcity downstream is made worse by India's "upstream control," which intensifies socioeconomic vulnerabilities already present and forces families to relocate inside. [T]he trends suggests that population changes in Pakistan are caused by both excessive and insufficient water inflows, which are a result of India's water management.

Compound displacement dynamics are created when flood-displaced populations return to drought-stricken areas just to be displaced once more. This is because floods and droughts frequently occur in alternating cycles. Communities are kept in a state of chronic poverty by this recurrent susceptibility. As shown in the districts of Dera Ismail Khan and Charsadda in KPK, the loss of infrastructure and crops due to flooding in 2022–2023 was followed by a decrease in irrigation flow in 2024, which forced small farmers into debt and forced them to migrate.[96]These patterns of displacement show that Pakistan's mobility trends are structurally related to transboundary water difficulties and climate change, rather than being random. Flood and drought displacement cycles downstream have been indirectly reinforced by India's upstream management of the Indus Basin rivers, irregular monsoons, and glacier melt, which have changed flow timings, increased flood peaks, and decreased dry season flows.[97]

Food security is significantly impacted by flood and drought-related displacement because migrant communities are deprived of farmland and sources of income. According to the FAO Pakistan Food Security Assessment (2023), moderate to severe food insecurity was reported by 36% of displaced households in Sindh and Balochistan, mostly as a result of the loss of livestock and agricultural output.[98]Additionally, stunting and malnutrition rates were higher than the national norm for children under five and households headed by

[94] Sindh Irrigation Department Annual Report, 2021.
[95] The Express Tribune, "Water Shortage Threatens Sindh's Agriculture," June 2021.
[96] NDMA, *Khyber Pakhtunkhwa Flood Impact Assessment 2023* (Peshawar: NDMA, 2023), 8.
[97] World Bank, *Indus Basin Water Security and Regional Cooperation Report* (Washington, DC: World Bank, 2023), 23–24.
[98] Food and Agriculture Organization (FAO), *Pakistan Food Security Assessment 2023* (Rome: FAO, 2023), 15.

women.[99]Nearly ten years of development progress were reversed when the 2022 floods alone drove over 9 million people into poverty and severe food insecurity.[100]The World Bank issued a warning in mid-2025 that another 2-3 million people may become chronically vulnerable by 2030 as a result of repeated displacements caused by hydrological shocks unless adaptive water governance measures are put in place.[101]

3.5 FOOD SECURITY IMPLICATIONS:

In Pakistan, where agriculture employs 38% of the workforce and contributes 19% to the GDP, food security and water are closely intertwined.[102]More than 80% of the nation's arable land is irrigated by the Indus Basin, which yields basic crops like sugarcane, rice, and wheat. However, food production has become unstable due to changes in river flow resulting from upstream control and unpredictable weather events.

For the planting and harvesting of important crops like wheat, rice, and cotton, Pakistan's irrigation system—one of the biggest in the world—requires steady river flows.[103]This fragile system can be upset by even slight changes in the yearly flow regime. India's higher upstream water use may lower downstream water availability in the Indus Basin by as much as 8–12% during low-flow months, according to empirical research in Hydrology and Earth System Sciences. This would especially impact Pakistan's Rabi agricultural season (November–April).[104]Furthermore, unpredictable canal inflows downstream have been caused by timing mismatches brought on by hydropower peaking, in which India releases water largely for electrical generation rather than irrigation.[105]Particularly in Punjab and Sindh, where irrigation schedules depend on consistent flows during critical development stages, this instability lessens the water reliability for Pakistani farmers. "Abrupt upstream releases and low-flow periods significantly undermine irrigation management efficiency and canal water distribution fairness," according to a 2021 Water Policy Report.[106] Additionally, as surface flows have become less consistent, groundwater dependency has

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[99] UNICEF, *Nutrition and Food Security Snapshot: Pakistan Flood-Affected Regions 2023* (New York: UNICEF, 2023), 6.
[100] World Bank, *Pakistan Floods 2022 Damage and Needs Assessment*, 9.
[101] World Bank, *Climate Vulnerability and Human Displacement in South Asia* (Washington, DC: World Bank, 2025), 3
[102] Pakistan Bureau of Statistics, *Economic Survey of Pakistan 2023–24*.
[103] FAO, *GIEWS Country Brief: Pakistan*, 2025.
[104] Smolenaars, Wouter Julius, Wout Jan-Willem Sommerauer, Bregje van der Bolt, Muhammad Khalid Jamil, Sanita Dhaubanjar, Arthur Lutz, Walter Immerzeel, Fulco Ludwig, and Hester Biemans. "Spatial adaptation pathways to reconcile future water and food security in the Indus River basin." *Communications Earth & Environment* 4, no. 1 (2023): 410.
[105] Janjua, “Water Management in Pakistan’s Indus Basin,” 1430.
[106] Ibid., 1433.

increased. Aquifer levels and salinity in important agricultural zones are dropping as a result of groundwater providing more than 50% of irrigation water by 2024, up from 37% in 2015, according to data from the Pakistan Council of Research in Water Resources (PCRWR).[107]The problem of food security is made worse by this overexploitation, which raises production costs and diminishes long-term viability.

3.6 IMPACT ON CROP YIELDS AND PRODUCTION PATTERNS:

Pakistan's agricultural productivity showed a downward trend between 2015 and 2025; the Ministry of Food Security reported that key crop yields decreased by 15–20% in low-flow years.[108]The Food and Agriculture Organization (FAO) noted a sharp decline in wheat production in 2018 as a result of less irrigation in Sindh and Punjab.[109]Furthermore, conventional crop calendars are disrupted by the unpredictable nature of water supplies. Farmers frequently postpone planting or convert to low-water crops like millet and pulses because they are unsure of when to use irrigation.[110]Despite being adaptable, this shift increases reliance on food imports and threatens national food self-sufficiency, which exacerbates inflationary pressures.

Pakistan's main crops, cotton, rice, and wheat, had significant variations in relation to water availability between 2015 and 2025. Water stress and irregular irrigation were major factors in the decrease in wheat yields from 3.1 tons per hectare in 2016 to 2.8 tons in 2021.[111]In Sindh and lower Punjab, as shortages on the Chenab and Jhelum decreased canal discharges, rice harvests fell by over 9% during the same time period.[112]"Unpredictable water inflows and delayed sowing schedules have reduced wheat output by approximately 6 percent relative to potential yields," according to the FAO's 2025 Global Information and Early Warning System (GIEWS) report.[113]This yield gap translated into higher cereal imports, making Pakistan one of the world's top wheat importers in 2022–2024, despite historically being self-sufficient.[114]

FAO/GIEWS and USDA reporting for Following a push for policy and favorable weather, the 2024–2025 harvest was estimated to be around 29 million tons, which is more than the

[107] PCRWR, *National Water Quality and Groundwater Assessment*, 2024.
[108] Ministry of Food Security, *Agricultural Performance Report 2022*.
[109] FAO, *Pakistan Crop Monitoring Bulletin*, 2018.
[110] UNDP, *Climate Adaptation and Agriculture in South Asia*, 2021.
[111] FAO, *GIEWS*, 2025.
[112] Pakistan Bureau of Statistics, *Agriculture Statistics of Pakistan*, 2023
[113] FAO, *GIEWS*, 2025.
[114] World Bank, *Pakistan Development Update*, 2023.

five-year average.[115] There was notable variation in rice yields and production from year to year. According to national reporting and FAOSTAT, output peaked around 2021 and then sharply declined in 2022. According to various sources, the combination of flood damage, localized drought, and input limits resulted in a nearly 20% decline in rice production in 2022 compared to 2021.[116]The two provinces that produce the most rice, Punjab and Sindh, have contrasting shock experiences. While Punjab has seen increased yields in some years as a result of varietal changes and incentives, Sindh has been more vulnerable to floods and salinity.[117]

Pakistan experienced several major floods (notably 2019 localized floods and the very large 2022/2023 and 2025 flood events) and drought episodes that directly reduced yields and damaged standing crops. FAO, USDA, and national agencies attribute a significant portion of the 2022–2023 production declines to these events.[118] Furthermore, Grain filling and sowing are impacted by canal deliveries and timing issues, notably those brought on by upstream operations changes in the Indus system. This results in yield losses, particularly in wheat and rice. Studies from the World Bank and basins highlight that timing, not just volume, is important for yield results.[119]

Approximately 37% of Pakistan's workforce is employed in agriculture.[120]Smallholder farmers, especially in southern Punjab and Sindh, were compelled to either decrease the area under cultivation or convert to lower-value but less water-intensive crops like millet or pulses as irrigation reliability declined.[121]This shift made poverty worse and reduced rural earnings. The International Organization for Migration (IOM) found that seasonal labor migration rose, particularly in drought years (2018, 2020, and 2023).[122]

The province of Punjab, which is the agricultural center of Pakistan, is particularly susceptible to changes in the flow patterns in the command areas of Ravi, Sutlej, and Chenab. Wheat and rice harvests are directly impacted by reduced or unpredictable flows during critical crop windows; abrupt flood pulses destroy infrastructure and standing Kharif

[115] World Bank, *Indus Basin of Pakistan: Impacts of Climate Risks on Water and Agriculture* (2023).
[116]CEIC / FAOSTAT series for production and yield time series (rice, wheat, cotton data series).
[117] Pakistan Ministry of Finance, *Economic Survey / Agriculture Chapter* (2023–24 chapter; base 2015–16 series)
[118] Food and Agriculture Organization (FAO), *GIEWS Country Brief — The Islamic Republic of Pakistan*, March 6, 2025.
[119] United States Department of Agriculture (USDA) Foreign Agricultural Service, *Grain and Feed Annual / Pakistan*, April 2025.
[120] Government of Pakistan, *Economic Survey of Pakistan*, 2024.
[121] PIDE, *Rural Poverty and Food Insecurity*, 2024.
[122] IOM, *Pakistan Migration Profile 2023*, 7.

crops. Localized food shortages, an instant loss of farmer income, and migration to peri-urban areas are the outcomes. Punjab can mobilize aid due to its comparatively greater administrative capacity, but recurring shocks weaken resilience and force impoverished households to relocate. [123]The lower basin of Sindh is susceptible to upstream-exacerbated floods that breach embankments and submerge towns and farms, as well as decreased dry-season flows that increase salinity and damage irrigated crops. Long-term base flow declines jeopardize the fisheries and biodiversity of the Indus delta, resulting in livelihood losses that drive migration into urban centers like Karachi and increasing food insecurity among coastal populations.[124]KPK's vulnerability differs much of the province is upland, with narrower valleys and greater exposure to flash floods and landslides. Sudden releases or extreme rainfall events can cause intense, localized flooding that destroys orchards, terrace agriculture, and infrastructure, producing rapid displacement and acute food supply interruptions in affected districts. KPK's limited irrigation dependency on large canals masks the fact that local livelihoods are highly sensitive to flood shocks, leading to internal displacement and rural-to-rural migration. [125]Balochistan is less directly reliant on Indus flows, but when the agricultural output of neighboring provinces declines, it is nevertheless affected by intra-provincial migration dynamics and food markets (price spikes).[126]

3.7 FOOD PRICES AND INFLATION:

Changes in agricultural production have directly impacted on the price of food. Between 2015 and 2023, the price of staple foods increased by 60%, according to data from the Pakistan Bureau of Statistics (PBS). [127]Food inflation surpassed 40% in early 2023 as a result of the 2022 floods, which damaged 4.4 million acres of crops due to upstream water mismanagement. This resulted in shortages of rice and wheat. [128]The number of households experiencing food insecurity increases when inflation reduces their purchasing power. According to estimates from the World Food Program (WFP), in 2023, more than 36% of Pakistan's population had moderate to severe food insecurity, with Sindh and KPK having the largest concentrations. [129]Despite food supply disruptions brought on by the floods, a government estimate from September 2025 predicted that inflation might stay between

[123] Provincial assessments and agricultural statistics (Punjab Economic Survey; FAO).
[124] UNDP and FAO reports on Sindh delta vulnerability (UNDP water security; FAO flood response)
[125] Regional studies and KPK-focused analyses of floods and displacement (local academic literature, humanitarian reporting 2022–2025).
[126] FAO. "Pakistan at a Glance." FAO in Pakistan. Accessed Oct. 24, 2025.
[127] Ministry of Food Security, *Agricultural Performance Report 2022*.
[128] World Bank, *Pakistan Post-Flood Impact Assessment*, 2023.
[129] WFP, *Food Security Assessment: Pakistan*, 2023.

3.5% and 4.5%. [130] According to recent reports, in October 2025, Pakistan's headline inflation rate increased by approximately 5.6% year over year, primarily due to rising food costs brought on by supply shocks (such as floods and border interruptions) and interference with commerce. [131] Upstream water disruptions thus indirectly drive both economic displacement (through loss of income) and nutritional insecurity (through rising prices and reduced availability)

3.8 Analytical Synthesis: Linking India's Upstream Development to Downstream Flooding and Food Security:

Pakistan is impacted by India's upstream management in three interconnected ways: flow prediction, flow timing, and flow regulation. Although India's hydropower projects on the western rivers are formally designated as run-of-the-river under the Indus Waters Treaty (IWT), the evidence discussed in this chapter demonstrates that these projects allow temporary storage and operational control, permitting India to influence downstream hydrology without violating treaty volume limits. This distinction is important because flood danger and food security depend on the time and consistency of flows in addition to the overall volume of water.

First, flood amplification in Pakistan is a result of upstream flow management. Flood maxima in downstream catchments, especially in Punjab and Khyber Pakhtunkhwa, are increased by sudden or unplanned releases from Indian reservoirs during the monsoon season. These discharges, combined with heavy rainfall to overflow embankments, ruin standing crops, and uproot millions of people, as evidenced by the flood disasters in 2019, 2022, and 2025. According to the analysis, floods in Pakistan are therefore not exclusively caused by climate change but rather are exacerbated by operational choices made upstream that raise exposure and risk levels downstream.

Second, dry-season water shortage is made worse by India's upstream growth, which directly affects food supply and agricultural output. During Rabi seasons, reduced and erratic flows interfere with irrigation schedules, postpone sowing, and lower yields of staple crops like rice and wheat. In a system where more than 90% of agriculture relies on irrigation from the Indus Basin, even little changes in dry-season inflows result in

[130] Pakistan Bureau of Statistics, *Monthly Price Indices for June 2025*, Press Release, Islamabad. Accessed
[131] Ariba Shahid, "Pakistan's central bank likely to hold rate at 11% on … food prices in the South Asian nation," Reuters, October 24, 2025.

substantial output losses, as shown by IRSA and FAO data mentioned previously in the chapter. This mechanism explains why, even in years without significant floods, food insecurity increases.

Furthermore, Displacement serves as a critical transmission mechanism linking upstream control to food insecurity. Flood-induced displacement removes households from productive land, while drought-induced migration reflects the slow erosion of livelihoods caused by declining water availability. The recurrence of these displacements creates a cycle in which affected populations are unable to rebuild assets, leading to long-term poverty and dependence on food assistance. The evidence from Sindh, southern Punjab, KPK, and Balochistan illustrates that displacement is no longer episodic but increasingly structural, driven by repeated hydrological shocks linked to transboundary water management and climate change.

Third, the unpredictability of river flows—caused by hydropower peaking and altered release schedules—weakens Pakistan's irrigation governance and farmer decision-making. In response, farmers reduce planted acreage, switch to lower-value crops, or rely too much on groundwater, all of which compromise long-term food security. Particularly among smallholders and landless laborers, this instability exacerbates rural poverty and causes both temporary and permanent displacement.

When considered collectively, the data bolsters the claim that India's upstream control operates as a type of structural hydro-hegemony, whereby infrastructure development and geographic advantage enable the upstream state to influence downstream vulnerability without overtly violating treaties. Therefore, Flooding and food insecurity in Pakistan are best understood as compound outcomes produced by the interaction of upstream water management, climate change, and domestic capacity constraints.

This chapter shows how India's upstream development converts hydrological unpredictability into human insecurity rather than only causing environmental stress. Water governance is a key factor in determining Pakistan's food security and social stability because of the linked effects of changed flow regimes, which include displacement, decreased agricultural production, and increased food prices. Without cooperative basin management, transparent data-sharing, and climate-adaptive governance, these dynamics are likely to intensify, further destabilizing food systems and human security in downstream Pakistan.

CHAPTER 4

INTER-PROVINCIAL WATER DISPUTES AND GOVERNANCE IN PAKISTAN

4.1 INTRODUCTION:

Hydrological, political, institutional, and socioeconomic issues interact intricately in Pakistan's water management. Interprovincial conflicts have persisted because the nation relied on the Indus River System, unequal provincial competencies, and historical injustices. These conflicts are exacerbated by governance issues, such as dispersed authority, unstable political environments, lax enforcement, and a lack of financial and technical resources, which have a substantial influence on livelihoods, agricultural output, and water access at the community level.

4.2 MAJOR INTER-PROVINCIAL WATER DISPUTES:

Pakistan has consistently faced a variety of social, political, and economic challenges. However, some of these issues are becoming more severe every day since they are at the mercy of provincial governments and their political agendas. One such issue is interprovincial water sharing, which is getting worse over time as Pakistan's subsurface water levels rapidly decline and the provinces, motivated only by political considerations, are not making any progress. Other interprovincial issues are also being impacted by this ongoing dispute between the provinces, particularly after the 1991 Water Apportionment Accord. [132]Since the signing of the 1991 Water Apportionment Accord (WAA), Punjab and Sindh have engaged in a protracted contest over water sharing from the Indus River basin. The Accord allocated approximately 69.03 km³ per year to Punjab and 60.17 km³ per year to Sindh. [133]The Water Apportionment Accord (WAA), which was signed in 1991 to resolve persistent conflicts, assigned precise volumes to Punjab (69.03 km³/year), Sindh (60.17 km³/year), Khyber Pakhtunkhwa (7.13 km³/year), and Balochistan (4.78 km³/year). The Indus River System Authority (IRSA) was created in 1992 to oversee distribution and guarantee adherence. [134]An act of Parliament in 1991 established the autonomous Indus River System Authority (IRSA) in accordance with the terms of the Water Accord. The

[132] Imran, Khadeeja. "Water Sharing Issues in Pakistan: Impacts on Inter-Provincial Relations." *Journal of Development and Social Sciences* 2, no. 4 (2021): 947-959.
[133] Khadeeja Imran, "Water Sharing Issues in Pakistan: Impacts on Inter-Provincial Relations," *Journal of Development and Social Sciences* 2, no. 4 (2021): 947–959.
[134] Khadeeja Imran, "Water Sharing Issues in Pakistan: Impacts on Inter-Provincial Relations," *Journal of Development and Social Sciences* 2, no. 4 (2021): 947–959, https://jdss.org.pk/article/water-sharing-issues-in-pakistan-impacts-on-inter-provincial-relations

IRSA's member board consisted of five people: one representative from each province and one from the federal government. For a duration of one year, the chairman had to be selected in alphabetical order from among these five members. The members served three-year terms. The IRSA's primary goal was to implement the agreement. The IRSA for each province decided how to divide the available water supply for each season. The Water and Power Development Authority (WAPDA) appropriately released these supplies from the reservoirs.[135]Water resource management is a shared duty under Pakistan's federal system, with overlapping federal and provincial powers. Provinces oversee regional irrigation systems, while federal organizations like WAPDA oversee large dams and storage facilities. Further decentralization was brought about by the 18th Amendment, which strengthened provincial control over water but made interprovincial cooperation more difficult. [136]The primary points of contention between the provincial governments of KPK, Punjab, and Sindh were the reservoirs of Mangla and Tarbela. These three provinces were the primary users of irrigation water for agriculture. Punjab wasnb accused by the Sindh government of stealing water from these reservoirs. The provincial government of Punjab believed that it had been utilizing less water than necessary to accommodate the provincial governments of Sindh and KPK.[137]In Pakistan, the issue of water sharing has currently taken the form of a dispute between the lower and higher riparian provinces. Sindh, a lower riparian, accuses KPK and Punjab, a higher riparian, of stealing its share from the Indus Basin via the Chashma-Jehlum and Taunsa-Panjnad canals. Sindh further charged Punjab with excessive water use and persistent violations of international water regulations and associated treaties. It also opposes the building of the Kalabagh Dam, citing concerns that the project will lead to a severe water shortage that would cause problems for the province's economy and agriculture. It further asserts that Manchare Lake and Haleji Lake's capacity to store water would be further limited by the Kalabagh water reservoir. [138]The upstream provinces of Khyber Pakhtunkhwa and Punjab (Pakistan) highlight their developmental requirements, claiming that initiatives like the Kalabagh Dam are crucial for the country's hydropower production, flood control, and water storage. In the meantime, the downstream Pakistani province of Sindh argues that these projects unfairly diminish its water share,

[135] Janjua, Shahmir, Ishtiaq Hassan, Shoaib Muhammad, Saira Ahmed, and Afzal Ahmed. "Water management in Pakistan's Indus Basin: challenges and opportunities." *Water Policy* 23, no. 6 (2021): 1329-1343.
[136] Khan, Tariq Anwar, and Gulshan Majeed. "Water management in Pakistan: roots of interprovincial conflicts." *Journal of Politics and International Studies* 6, no. 02 (2020): 103-113.
[137] Janjua, Shahmir, Ishtiaq Hassan, Shoaib Muhammad, Saira Ahmed, and Afzal Ahmed. "Water management in Pakistan's Indus Basin: challenges and opportunities." *Water Policy* 23, no. 6 (2021): 1329-1343.
[138] Imran, Khadeeja. "Water Sharing Issues in Pakistan: Impacts on Inter-Provincial Relations." *Journal of Development and Social Sciences* 2, no. 4 (2021): 947-959.

endangering livelihoods, agriculture, and economic stability—and breaching the Water Act's principles of equitable water distribution. The main problem, according to the dam's supporters, is putting in place equitable and efficient interprovincial water governance that strikes a balance between local needs and national interests. They contend that with regulated water management, the project could benefit all provinces by increasing overall storage, mitigating floods, and providing energy. [139] Political disputes over Kalabagh demonstrate how deficiencies in interprovincial trust are linked to infrastructure development.

4.3 PUNJAB VS SINDH:

Being the largest province in terms of both land area and population, Punjab oversees a vast network of canal systems and has substantial irrigation needs. As the downstream riparian, Sindh argues that Punjab's abstractions and diversions often lower the water flows that reach its territory, aggravating water scarcity and endangering agricultural production.[140]The interpretation of the Water Apportionment Accord (WAA) 1991 is a major source of disagreement. Punjab contends that these percentages only apply to "additional" or "surplus" flows over historical baselines. At the same time, Sindh maintains that the allocated percentages—roughly 42% of the total allocable waters—should apply to all river flows.[141]For instance, according to the WAA, Sindh's share is roughly 60.17 km³ (48.76 MAF) while Punjab's is roughly 69.03 km³ (55.94 MAF). [142] Large-scale infrastructure projects continue to be a source of contention. The projected Kalabagh Dam is seen by Punjab as crucial for increasing storage capacity, controlling flows, and promoting national development. [143] The Punjab-Sindh case exemplifies the classic upstream-downstream tension: while downstream provinces are at risk of decreased flows, poor water quality, environmental degradation (such as in the Sindh delta), and less power in the allocation process, upstream provinces have greater control over abstraction and diversion.[144]

In 2024–2025, several canal initiatives supported by Punjab (often addressed under national irrigation or development programs and exemplified by projects like the

[139] Squabbles Continue over Sharing River Water in Pakistan," Anadolu Agency, Sept. 25 2021.
[140] Imran, Khadeeja, "Water Sharing Issues in Pakistan," 954.
[141] Revitalising water resource management," *Dawn*, August 21 2023.
[142] The 1991 Water Accord – brief," *Brief PK*, (date accessed) – indicating allocations of Punjab at 55.94 MAF & Sindh at 48.76 MAF.
[143] Punjab minister backs Kalabagh Dam, sparks backlash from Sindh," *Pakistan Today*, April 6 2025
[144] Khan, Tariq Anwar, Ihsan Ullah, and Iqra Jalal. "The Berlin Rules (2004) of International Water Law and Inter-Provincial Water Disputes in Pakistan." *Journal of Politics and International Studies (JPIS)* (2025).

Cholistan/Cholistan-area schemes) sparked persistent political and public opposition in Sindh. Large-scale demonstrations and political campaigns in Sindh ensued as Sindh authorities warned that the new canals would usurp Indus flows and exacerbate seawater intrusion in the delta. Following severe protests and political mobilization in Sindh, the federal government publicly declared in late April 2025 that no new canal projects would move forward without a majority provincial accord, thereby halting approvals.[145]

Sindh, on the other hand, is concerned that the dam and linked canal projects will further reduce its downstream share, harm agriculture, and deteriorate the environment of the Indus Delta. The impression that upstream infrastructure advancements may come at the expense of downstream entitlements has been strengthened by the acceleration of canal projects in southern Punjab, such as those under the "Green Pakistan Initiative," which has sparked protests in Sindh.

4.4 SINDH–BALOCHISTAN:

Within Pakistan's larger Indus Basin governance structure, water sharing between Sindh and Balochistan has been a recurring and underappreciated interprovincial issue. The primary source of contention is the distribution of canal water from the Indus River, specifically via the Guddu and Sukkur barrages, which serve the irrigated areas of Balochistan through the Kirthar and Pat Feeder canals.[146] Although the 1991 Water Apportionment Accord governs both provinces, Balochistan has long accused Sindh, the upstream riparian in this relationship, of failing to release its fair share of water, especially during times of scarcity.[147]Weak monitoring systems and restricted telemetry coverage exacerbate the structural issue by making water flow data subject to disagreement.[148]The Indus River System Authority (IRSA), which is responsible for distributing water fairly among the provinces, frequently has to mediate conflicting, politically sensitive, and technically unclear demands.[149]

Long-lasting dry spells, deteriorating infrastructure, and a rise in provincial politicization of water all contributed to the escalation of tensions starting in 2019. Balochistan formally accused Sindh of withholding its allotted share in 2023–2024, filing applications with

[145] Al Jazeera, “Why is Pakistan’s new canal project sparking water-shortage fears,” March 27, 2025.
[146] Pakistan Council of Research in Water Resources (PCRWR), *Annual Report on Water Availability in the Indus Basin* (Islamabad: PCRWR, 2023), 45.
[147] Government of Pakistan, *Water Apportionment Accord, 1991*, Ministry of Water Resources, Islamabad.
[148] Simi Kamal, “Managing Water in the Indus Basin: The Case of Balochistan,” *LEAD Pakistan Policy Brief* (2020): 12–14.
[149] IRSA, *Provincial Allocations and Monitoring Report* (Islamabad: Indus River System Authority, 2022).

federal bodies such as the Ministry of Water Resources and the Council of Common Interests (CCI). [150]According to media and parliamentary sources, Balochistan authorities engaged in heated discussions and made political threats, claiming that the province's drinking water and irrigation systems were failing as a result of restricted releases. [151]As leverage against Sindh, the government of Balochistan has occasionally issued symbolic counterthreats, proposing limitations on the release of the Hub Dam, a structure shared by both provinces. [152]Even though they are rarely carried out, these measures show how interprovincial service rivalries are influenced by hydro-political disagreements, illustrating how control over water becomes an instrument of larger political negotiations.

Significant water scarcity was confirmed in important Balochistan districts like Lasbela, Kech, and Gwadar during 2024–2025, according to reports from the Pakistan Council of Research in Water Resources (PCRWR) and field assessments conducted by the Asian Development Bank (ADB). In these districts, irrigation channels frequently run dry because of inconsistent canal deliveries.[153]IRSA bulletins and parallel reporting in Sindh media revealed severe shortages at the Guddu, Sukkur, and Kotri barrages, which ranged from 25 to 35 percent below allocations in some months. Sindh utilized these shortages as justification for lowering downstream releases.[154]

Balochistan claims that Sindh consistently fails to maintain adequate conveyance infrastructure for channels feeding its areas and withholds its allotted portion of canal water.[155]The Pat Feeder Canal, which irrigates much of Jaffarabad, Nasirabad, and Bolan, frequently receives less than its quota, according to officials, which leads to crop failures and rising rural hardship.[156]Due to IRSA's limited ability to oversee Sindh's canal network, the provincial irrigation department has frequently requested federal action to guarantee equitable distribution, but in reality, enforcement is still weak.[157]

Sindh argues that it has little flexibility to satisfy downstream provincial contributions because its own inflows from upstream Punjab are insufficient, especially during the Kharif season. [158] Sindh authorities stress that shortages are frequently technical rather than

[150] "Balochistan Accuses Sindh of Withholding Water Share," *Dawn*, June 17, 2023.
[151] ibid
[152] Hub Dam Politics: Balochistan Warns Sindh over Water Supply," *The Express Tribune*, March 4, 2024.
[153] Asian Development Bank, *Balochistan Water Resources Development Project Review* (Manila: ADB, 2024), 22–24.
[154] IRSA, *Monthly Water Distribution Bulletin* (May 2024), 5–7.
[155] "Balochistan Seeks Federal Intervention over Water Shortage," *The News International*, August 8, 2024.
[156] Ibid
[157] PCRWR, *Annual Report on Water Availability in the Indus Basin*, 47.
[158] Sindh Blames Punjab for Shortfall in Indus Flows," *Dawn*, April 23, 2024.

intentional since siltation, canal inefficiencies, and illicit extractions restrict discharge capacity.[159]In addition, Sindh contends that discharges into the ocean are necessary to stop saltwater intrusion in the Indus Delta, a long-standing ecological issue.[160]

4.5 PUNJAB–KHYBER PAKHTUNKHWA (KPK):

Although the Punjab–Khyber Pakhtunkhwa (KPK) water dispute is less well-known than the Punjab–Sindh or Sindh–Balochistan disputes, it nevertheless represents significant conflicts over hydropower development, interprovincial equity, and upstream water control. The main points of contention are canal diversions from the Upper Indus that supply both provinces, reservoir operations (most notably Tarbela Dam), and distribution from the Indus River system.[161]KPK has strategic hydropower locations, such as Tarbela, Warsak, and the projected Munda/Mohmand Dams, because it is upstream of Punjab on multiple Indus tributaries. Punjab, which is downstream and has extensive irrigation systems, is still reliant on controlled releases from these lakes. Compensation for drowned lands, royalties for hydropower production, and water distribution delays to southern KPK, especially Dera Ismail Khan and Kohat, are also points of contention. [162]Although KPK contends that Punjab's significant canal withdrawals and federal control over dam operations harm smaller provinces, the problem also has a connection to interprovincial enmity. Punjab, on the other hand, insists that national and technical irrigation requirements, not regional prejudice, are what drive operations. [163]The Punjab-KPK water dispute came back into the spotlight between 2019 and 2025 as a result of continued negotiations regarding Tarbela operations, talks about reviving Kalabagh Dam, and delays in KPK's internal southern canal project.

The KPK Assembly approved several resolutions in 2020 denouncing federal and Punjab-based attempts to revitalize the Kalabagh Dam, claiming that it would imperil thousands of livelihoods and drown vast portions of the districts of Nowshera, Charsadda, and Swabi.[164]KPK's viewpoint, which portrayed the project as a representation of Punjab's dominance over the country's water resources, was in line with Sindh's long-standing resistance.

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[159] Ibid
[160] Simi Kamal, "The Indus Delta and Water Scarcity," *LEAD Pakistan Working Paper* (2021), 18.
[161] Pakistan Council of Research in Water Resources (PCRWR), *National Water Resource Assessment Report* (Islamabad: PCRWR, 2023), 33–35.
[162] KPK Voices Concern over Punjab's Water Policies," *The Express Tribune*, February 17, 2023.
[163] Government of Pakistan, *Water Apportionment Accord, 1991*, Ministry of Water Resources, Islamabad.
[164] Khyber Pakhtunkhwa Assembly Adopts Resolution against Kalabagh Dam," *Dawn*, March 16, 2020.

Conflicts over Tarbela reservoir operations reappeared in 2022–2023. KPK accused the Water and Power Development Authority (WAPDA), which was seen to be dominated by Punjab, of giving Punjab priority for irrigation releases at the expense of KPK's local water and royalty rights. [165] Delays in paying KPK populations displaced by Tarbela's development phases, particularly the Tarbela 5th Extension Project, were also noted in reports published by the Pakistan Council of Research in Water Resources (PCRWR). [166]In addition, internal KPK conflicts over intra-provincial water sharing between southern districts (D.I. Khan, Bannu, Tank) and upper districts (Swat, Mardan, Charsadda) intensified throughout 2024–2025. Farmers of South KPK staged demonstrations calling for the completion of Phase III of the Chashma Right Bank Canal (CRBC), accusing provincial authorities of favoring northern areas over their irrigation requirements. [167]Pakistan's federal-provincial disparity in resource governance is embodied in the Punjab-KPK issue. KPK is strategically important due to its upstream hydropower assets, but Punjab's supremacy in water-intensive agriculture guarantees its leverage. However, mistrust is sustained by opaque operational data and sluggish compensation systems.

4.6 POOR GOVERNANCE INFLUENCES COMMUNITY-LEVEL WATER ACCESS IN PAKISTAN:

Water insecurity at the community level in Pakistan is primarily caused by poor governance, which includes weak institutions, opaque decision-making processes, politicized allocation, inadequate monitoring, and underfunding for maintenance. Provincial irrigation departments, local water-user organizations, and the nation's national allocation framework (the 1991 Water Apportionment Accord and IRSA) create a multi-layered governance system that often fails to convert formal entitlements into dependable deliveries at the tail-end distributaries and domestic taps. Provincial quotas are either paper entitlements or water at the field gate due to governance problems. [168] Furthermore, Accountability is weakened by fragmentation because it is challenging to ascribe responsibility when allocations do not reach field gates. Agencies and provinces may place the blame on one another (IRSA vs. provincial canal managers vs. WAPDA), which can lead to paralysis, delayed remedies, and recurring local shortages. One of the main causes

[165] Tarbela Operations Dispute between KPK and WAPDA," *The News International*, July 12, 2022.
[166] Asian Development Bank (ADB), *Tarbela 5th Extension Hydropower Project Report* (Manila: ADB, 2023), 18
[167] Farmers Protest Delays in Chashma Right Bank Canal," *The Express Tribune*, May 8, 2025.
[168] Pakistan Council of Research in Water Resources (PCRWR), *National Water Conservation Strategy for Pakistan (2023–27)* (Islamabad: PCRWR, 2023).

of Pakistan's water governance shortcomings, according to both national and international evaluations, is institutional fragmentation.[169]Water efforts are disrupted or abandoned as a result of short political cycles, frequent government changes, and shifting agendas. Political opposition and a lack of persistent commitment frequently lead major ideas, like the resurrection of huge storage projects like Kalabagh, to fail; similarly, multi-year efforts like telemetry, desilting, and local reservoir schemes are disrupted when political backing changes. Short political horizons lessen the motivation to finish technically challenging, politically sensitive projects, according to accountability reports and policy briefs.[170]Long time horizons are needed for water infrastructure and governance improvements. Projects that are abandoned result in buried costs, lost institutional learning, and ongoing risks. For instance, Pakistan's incapacity to manage seasonal variations is directly impacted by the sluggish progress made on increasing storage capacity.[171]

Enforcement is inconsistent even in cases where laws or policies are in place (e.g., WAA allocation guidelines, groundwater controls in certain provinces). Weak financial controls, anomalies in project finances, and a restricted ability to prosecute unauthorized tube-wells or illegal diversions are all mentioned in audit reports and governance reviews. Smallholders' access is compromised, and elite water capture (illegal headworks, favored gate timings) is made possible by inconsistent enforcement.[172]Rules that are not credibly enforced encourage noncompliance and undermine public confidence. This intensifies social tensions at the local level and boosts the transaction costs of water governance (litigation, protests, federal arbitration).[173] This environment allows elite water capture, influential landowners secure preferential access to canal headworks and manipulate gate timings while smallholders and tail end farmers face frequent shortages.

Siltation, mechanical wear, and obsolescence affect major reservoirs (Tarbela, Mangla, Chashma) and their downstream networks. Continuous renovations (such as Tarbela's fifth extension and Mangla's renovation) are necessary but costly and frequently politically delicate. Pakistan's water security is structurally hampered by the lack of sufficient storage capacity. Seasonal unpredictability will continue to result in devastating floods and debilitating droughts in the absence of additional, well-designed storage and updated

[169] Water and Power Development Authority (WAPDA), "About WAPDA," WAPDA.gov.pk, accessed 2025
[170] Pakistan Council of Research in Water Resources (PCRWR), *Annual Report 2023–24* (Islamabad: PCRWR, 2024)
[171] World Bank, *Pakistan: Getting More from Water* (Washington, DC: World Bank, 2019
[172] Pakistan Accountability Lab, Muhammad Zeshan, *Water Governance in Pakistan: Policy Brief* (Islamabad: Accountability Lab Pakistan, 2025),
[173] E. D. R. Muhammad, "Indus Telemetry Project," paper (Pakistan Engineering Congress conference), 2025

release regimes.[174]Operational flexibility is diminished by aging assets. Inadequate storage increases interprovincial competition for limited seasonal flows and necessitates timely monsoon rains; on the other hand, poorly controlled discharges during floods intensify the effects of disasters. Thus, both technical and governance concerns include investments in sediment management and renovation.[175]

Technical solutions, such as meters, new dams, desilting, or telemetry, are essential but insufficient. Technical investments can be taken by elites, justify disputed allocations or just transfer scarcity to weaker groups in the absence of institutional reform that guarantees transparency, independent auditing, accountability for managers who divert water illegally, and grievance redress mechanisms. Therefore, infrastructure investment must be accompanied by governance reform. [176] Infrastructure investment must therefore be accompanied by governance reforms. The government should ensure equitable water access that empowers the local water user associations. Moreover, they should depoliticize water management decisions and strengthen the complaint management system. Ultimately, Pakistan's water insecurity is not merely a problem of physical scarcity, but a governance crisis rooted in weak institutions, inconsistent enforcement, and fragmented authority. Only by addressing this systematic governance failure can the country achieve equitable and sustainable community-level water access.

4.7 COMMUNITY-LEVEL CONSEQUENCES OF GOVERNANCE FAILURES:

Social tensions, decreased productivity, and unequal access are some of the ways that weak governance and interprovincial conflicts show themselves at the local level. The most severe shortages are experienced by rural areas near the ends of canals, especially in southern Punjab, Sindh, and Balochistan.[177]Crop planning is hampered by unstable water supplies, which can lower yields and increase smallholders' debt.[178]

Due to upstream diversions and local corruption, tail-end farmers in Sindh's Badin and Thatta districts often claim receiving only a portion of the water to which they are allocated.[179]Similar trends may be seen in the districts of Nasirabad in Balochistan and

[174] ResearchGate, A. Ishaque et al., "Revisiting Telemetry in Pakistan's Indus Basin Irrigation System," research article, 2019,
[175] IPRI / Policy papers on storage and Kalabagh debates, "Water Storage Challenge of Pakistan: Reviving Kalabagh Dam Project,"
[176] Policy briefs: LEAD Pakistan; PIDE; Accountability Lab, *Water Governance in Pakistan: Challenges & Way Forward* (2025).
[177] PCRWR. *Community Water Access and Irrigation Shortages in Pakistan.* Islamabad: PCRWR, 2022.
[178] Qureshi, Asad. *Water Scarcity and Rural Livelihoods in Pakistan.* Karachi: Oxford University Press, 2021.
[179] Sindh Irrigation Department. *Annual Irrigation Report 2024–25.* Karachi: Government of Sindh, 2025.

Dera Ismail Khan in KPK, where provincial disagreements over distribution worsen local scarcity.[180]Declining surface flows cause communities to rely on deeper, frequently saline groundwater, which disproportionately affects women, who are frequently in charge of collecting water in rural families.[181]

Community cohesion is directly impacted by water scarcity as well. Conflicts between farmers, tribes, or communities are often caused by local complaints about unjust distribution or unlawful diversion of water.[182]These regional disputes reflect the larger interprovincial rivalries that predominate in national discourse, demonstrating how everyday fights at the village level are a direct result of higher-level government failings.

Additionally, inadequate governance restricts communities' ability to adapt to climate change.[183] Farmers are unable to invest in water-saving technologies or plan planting patterns in the absence of transparent and predictable water allocation.[184]Communities are left reliant on unofficial agreements and patronage-based systems when there are no active water-user groups, which reduces local responsibility and participation.[185]

[180] Balochistan Irrigation Department. *Water Supply Assessment 2024–25.* Quetta: Government of Balochistan, 2025.
[181] UN Women Pakistan. *Gendered Impacts of Water Scarcity in Rural Pakistan.* Islamabad: UN Women, 2021.
[182] Asian Development Bank. *Social Tensions and Water Governance in Pakistan.* Manila: ADB, 2021.
[183] UNDP Pakistan. *Climate Change, Water, and Community Resilience.* Islamabad: UNDP, 2020.
[184] PCRWR. *Climate Adaptation and Irrigation Planning Reports.* Islamabad: PCRWR, 2022.
[185] Rahman, Tariq, and Asad Qureshi. *Integrating Governance Reforms with Water Infrastructure Development.* Islamabad: Sustainable Development Policy Institute (SDPI), 2021.

CHAPTER 5

INDIA-PAKISTAN WATER DISPUTE: ENVIRONMENTAL AND CLIMATE CHANGE DIMENSIONS

5.1 INTRODUCTION:

The Indus River system, which supplies water for domestic use, energy production, and agriculture, is nearly the only source of water security in Pakistan. Although previous chapters have covered historical treaties and interprovincial allocations, the current era poses new issues as the constant flow of Indus waters is threatened by the intersection of geopolitical tensions with India and climate change. Climate variability, including extreme floods and prolonged droughts, increases uncertainty in river flows, while recent disruptions in transboundary cooperation exacerbate these challenges.

Pakistan's agriculture, energy, and drinking water are largely dependent on the Indus River system.[186]However, the long-term dependability of this water source is threatened by both shifting environmental circumstances and political conflicts with India. Climate change is changing the relatively steady hydrological system that the Indus Waters Treaty (IWT) of 1960 was intended to create.[187]The Himalayan, Karakoram, and Hindu Kush glaciers, which supply a significant portion of the Indus system, are melting more quickly, changing the amount and timing of river flow.[188]Although this melt can temporarily increase river discharge, it eventually reduces glacier bulk and dry-season flows, endangering Pakistan's downstream water supply.[189]Furthermore, more unpredictable rainfall due to climate change—particularly during the monsoon—causes droughts and floods that the IWT was never intended to withstand.[190]

Water governance between India and Pakistan is increasingly precarious as a result of these hydrological changes. Environmental uncertainty exacerbates the political risk: decisions made by one party over upstream infrastructure during hard times may have greater effects when river flow is becoming more erratic.[191]Experts contend that the IWT lacks specific

[186] Muhammad Khizar et al., "Climate Change Impacts on the Indus River Basin: Hydrology, Water Quality, and Treaty Implications," *iRASD Journal of Energy & Environment* 6, no. 1 (2025): 112–26
[187] Zia Hashmi, "Can India and Pakistan's Indus Waters Treaty Endure Climate Change?" *Foreign Policy*, September 21, 2023.
[188] Yale 360, "As Himalayan Glaciers Melt, a Water Crisis Looms in South Asia.
[189] Global Legal Studies Review, "Melting Glaciers and the Indus Water Treaty: A Looming Crisis."
[190] The Diplomat, "Climate-Proofing the India-Pakistan Indus Water Treaty.
[191] iRASD Journal, "Climate Change Impacts on the Indus River Basin.

provisions to address climate-driven variability, such as methods for managing extreme flood or drought events or data exchange on glacier melt.[192]Without change, Pakistan's reliance on the Indus could become more dangerous, and the pact might find it difficult to guarantee water security in the face of shifting climatic conditions.[193]

5.2 CLIMATE CHANGE IMPACTS ON THE INDUS RIVER:

The glaciers that supply the Indus River basin are being significantly impacted by climate change. In the Hindu Kush–Himalayan region, rising temperatures are speeding up glacier melt, which might temporarily increase river flow but eventually jeopardize its stability as glacial mass decreases.[194]Recent measurements, according to Pakistan's national disaster management authority, indicate a considerable loss of glacier volume; one assessment notes a 23.3 percent reduction in snow cover and roughly 3 percent yearly loss of glacier mass in recent years.[195]More concerning, as of 2025, more than 3,000 glacial lakes have developed in the area, 33 of which were categorized as "highly volatile."[196]The potential of Glacial Lake Outburst Floods (GLOFs), which can unexpectedly erupt and unleash devastating floods downstream, is greatly increased by these unstable water bodies.[197]Because of the danger, the Pakistan Meteorological Department (PMD) issued a GLOF advisory in June 2025, cautioning that very high temperatures (5–7°C above normal) could cause lake outbursts in Gilgit-Baltistan and Khyber Pakhtunkhwa's vulnerable regions.[198]The severity and/or likelihood of extreme monsoon rainfall events have increased in portions of the Indus basin due to human-driven warming, according to climate attribution studies and observations. Large portions of the Indus plain were catastrophically inundated by very intense, concentrated rainfall during the 2022 floods in Pakistan and more recent extreme monsoon seasons. According to attribution analyses, climate change probably increased the severity of the intense rainfall and, thus, the risk of floods. This intensification damages

[192] Hanns Seidel Foundation report, *Telescoping Indus Waters Treaty Through the Lens of Climate Change*
[193] CSIS blog, "Climate-Proofing the Indus Water Treaty." csis.org

[194] Muhammad Khizar, Shah Nawaz, Hassan Bashir & Muhammad Aqeel, "Climate Change Impacts on the Indus River Basin: Hydrology, Water Quality, and Treaty Implications," *iRASD Journal of Energy & Environment* 6, no. 1 (2025): 112–26.
[195] Lt. Gen. Malik (NDMA) in "Glacial melt in Indus River basin rising at dangerous rate: NDMA head," *Dawn*, accessed November 2025.
[196] Amir Wasim, "Rising temperatures have led to formation of over 3,000 glacial lakes, NA informed," *Dawn*, May 20, 2025.
[197] ibid
[198] Government of Pakistan, Pakistan Meteorological Department, *GLOF Alert* (June 6, 2025).

irrigation equipment, overwhelms river channels and embankments, and raises flood peaks.[199]

The stability of Indus flows directly affects Pakistan's irrigation system, which is among the biggest in the world. Early-kharif flows are already less reliable due to climate change, and frequent heatwaves increase evapotranspiration losses, requiring more water to maintain crop yields. At the same time, periodic shortages in Punjab and Sindh's canal systems are exacerbated by changes in flows resulting from water disputes, particularly during low-flow months.[200]At the same time, periodic shortages in Punjab and Sindh's canal systems are exacerbated by changes in flows resulting from water disputes, particularly during low-flow months. Pakistan worries that its vital crop cycles, particularly wheat, rice, and cotton, may see output losses during drought and low-flow years as India builds upstream storage and diversion.[201]This risk is increased by climate change, which causes unpredictable monsoons and early snowmelt, making it impossible for Pakistan to properly plan reservoir operations. The result is a growing problem for food security, with water scarcity endangering rural livelihoods and escalating tensions between Pakistan's provinces.[202]

Due to its heavy reliance on the Indus and its tributaries, Pakistan's hydroelectric capacity is increasingly impacted by both disputed upstream development and climate variability. The reliability of the national grid is weakened by reduced flows throughout the winter, which reduce power at large dams like Mangla, Tarbela, and Ghazi Barotha.[203] By increasing excessive sedimentation from glacier erosion, decreasing reservoir storage capacity, and decreasing turbine efficiency, climate change exacerbates this instability. Even though they are not intended for extensive storage, India's upstream run-of-river hydropower projects have the ability to alter the schedule of water flows, which could have an impact on Pakistan's generation patterns during dry spells.[204]This twin pressure makes Pakistan's energy security more vulnerable, particularly as heatwaves raise the electricity

[199] World Weather Attribution, "Climate change likely increased extreme monsoon rainfall, flooding highly-vulnerable communities in Pakistan," World Weather Attribution (Sept. 14, 2022)
[200] Pakistan Council of Research in Water Resources (PCRWR), *Water Situation Report*, 2022–2024.
[201] Arif Anwar, "Agriculture and Water Scarcity in Pakistan," *Agricultural Water Management* 263 (2022): 107–113.
[202] FAO, *Food Security and Water Stress in Pakistan*, 2023.
[203] WAPDA, *Hydropower Development Plan of Pakistan*, 2023.
[204] International Rivers, "Hydropower and Sedimentation in the Indus Basin," Report (2022).

demand. The combined stressors show how Pakistan is facing an energy-water nexus catastrophe as a result of water disputes and climate change.[205]

Pakistan is not equally affected by the combined effects of upstream water issues and climate change. The parts of the Upper Indus Basin, such as Gilgit-Baltistan and Khyber Pakhtunkhwa, are particularly vulnerable to GLOF events, temperature extremes, and glacier melt, which disrupt river systems and infrastructure.[206] Pakistan's agricultural heartland, Punjab, depends on steady Indus flows for canal irrigation systems; even little drops in flow during the Rabi and Kharif seasons have a direct impact on the country's food supply. As the lowest riparian region, Sindh suffers the worst effects: decreased freshwater imports worsen seawater intrusion in the Indus Delta, deteriorate soil quality, and exacerbate water scarcity in cities like Thatta and Karachi.[207]Prolonged droughts devastate cattle and agriculture, while climate-induced monsoon unpredictability exacerbates flooding in southern districts. This uneven vulnerability shows how the geopolitical restrictions already imposed by the Indo-Pakistan water issue are exacerbated by climate change, posing multifaceted threats to Pakistan's human and environmental security.[208]

Because of increased rainfall, quick melting, and unstable slopes, climate change raises sediment loads. In Pakistan's main reservoirs, especially Tarbela and Mangla, these circumstances hasten the deposition of sediment.[209] Pakistan's potential for buffering irregular flows declines significantly as live storage capacity decreases. Siltation weakens the system's resistance to both meteorological and geopolitical stressors by reducing its ability to retain extra water during peak flows and release it during shortages.

Due to their strained political ties, India and Pakistan do not cooperate in monitoring the accumulation of soil, sand, and sediments in rivers, dams, and canals. Additionally, they don't come up with a common strategy to manage erosion throughout the entire Indus Basin.[210] Countries can better manage reservoir longevity in areas with cooperative sediment budgeting, like the EU or the Mekong Basin. Political tensions in the Indus region

[205] Ahmad Rafay Alam, "The Energy–Water Nexus in Pakistan," *Journal of Environmental Policy*, 2023.
[206] WWF-Pakistan, *Indus Delta Under Threat*, 2022.
[207] Government of Sindh, *Water Scarcity and Agriculture Report*, 2023.
[208] Ayesha Siddiqi and Atta ur Rehman, "Climate Disasters and Regional Vulnerability in Pakistan," *Environment and Planning A*, 2022.
[209] Pakistan Water and Power Development Authority (WAPDA). *Sediment Management Report for Tarbela and Mangla Reservoirs*. Lahore: WAPDA, 2024.
[210] International Crisis Group. *Transboundary Rivers and Political Tensions in South Asia*. Brussels: ICG, 2024.

hinder such collaboration, worsening sedimentation caused by climate change, and limiting Pakistan's supply stability.

One of the world's fastest rates of groundwater loss is occurring in Pakistan. Aquifer levels in Punjab and Sindh are rapidly declining, according to recent GRACE assessments.[211]In the past, groundwater served as a buffer when river flows were inadequate. Pakistan is more susceptible to even small changes in Indus flows as this buffer erodes. Seasonal shortages have a direct impact on hydropower production, the drinking water supply, and agriculture, particularly in areas where groundwater is not adequately replenished.

5.3 POLITICAL AND INSTITUTIONAL STRESS FROM PAKISTAN–INDIA WATER DISPUTES:

Although many people commend the Indus Waters Treaty (IWT) for its longevity, its design was influenced by the climate of the late 1950s and early 1960s. It presupposes:

- The steady flow patterns
- The consistent links between glaciers
- and hydrology are severe hydrological episodes with little variability.

These presumptions are challenged by climate non-stationarity. However, there is no mechanism in the pact to incorporate current hydrological conditions.[212]The inflexibility of the treaty framework makes it more difficult for Pakistan to adapt to changing flows as climate change creates greater unpredictability and fluctuation.

Cooperation under the Permanent Indus Commission (PIC) has periodically decreased as a result of tensions between the two nations. Hydropower project design evaluations, data exchange on upstream releases, and early flood warning systems have frequently been postponed or disputed. [213]Hydrological data must be shared promptly during unpredictable climate-driven occurrences such as flash floods or immediate snowmelt. Pakistan's reservoir operators are unable to adjust releases effectively in the absence of comprehensive and up-to-date data, which raises the possibility of seasonal shortages or uncontrolled surges. Political mistrust exacerbates the effects of data scarcity in the context of climate change.

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[211] Daanish Mustafa. *Hydropolitics in the Indus Basin: The Future of Transboundary Water Governance*. London: Chatham House, 2024.
[212] Astha Nahar. “Waters of Reconciliation: Modernizing the Indus Waters Treaty for Climate Resilience.” *New York University Journal of International Law and Politics*, 2025.
[213] Clingendael Institute. *Indus Water Treaty 2025: Outlook and Risks*. The Hague: Clingendael, 2025.

Although technically allowed by the treaty's run-of-river clauses, India's expanding portfolio of hydroelectric projects on the western rivers continues to worry Pakistan. These projects become more strategically important as climate change increases flow variability. Pakistan worries that in low-flow years, even temporary pondage or technical changes could lower flows during crucial agricultural times.[214]Therefore, by eroding confidence in upstream operations, political issues exacerbate the effects of climate variability.

Pakistan's capacity to maintain steady flows is weakened by the interplay between political strain and climate change, which produces a multi-layered risk system:

- Natural buffers such as groundwater, snowfall, and glaciers are diminished by climate change.
- Artificial storage capacity is decreased by sedimentation.
- Planning for reservoirs is hampered by the unpredictability of the monsoon.
- Conflicts over hydropower exacerbate the effects of flow fluctuation.
- Cooperative adaptation is hampered by political mistrust.
- Infrastructure is still susceptible to increasing extremes.
- Misalignment and ineffective policies are increased by fragmented modeling.

These elements interact in a way that is reinforcing rather than additive. The Indus becomes an increasingly unstable and politically sensitive water system as each stressor exacerbates the vulnerabilities caused by the others.

[214] Daanish Mustafa. *Hydropolitics in the Indus Basin: The Future of Transboundary Water Governance*. London: Chatham House, 2024.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION:

The water dispute between India and Pakistan remains one of the most complicated and consequential hydro-political challenges in South Asia. Originating from the structural imbalances established during the Partition and intensified by India's upstream geographical advantage, the dispute has developed into something that extends well beyond mere technical disagreements. It now overlaps directly with issues of food security in Pakistan, weaknesses in internal governance, climate vulnerability, and human security. The Indus Waters Treaty (IWT) has traditionally served as a stabilizing framework. Yet, ongoing political tensions persist, particularly in areas administered by India, and hydropower development is underway. Additionally, India's occasional suspension of cooperation under the treaty has significantly diminished mutual trust and made water flow into Pakistan less predictable.

Research indicates that India's upstream control, particularly post-2015, has led to hydrological irregularities, seasonal shortages, crop instability, and intensified disaster exposure in the downstream provinces of Pakistan. These disruptions extend beyond environmental or technical realms; they have directly influenced patterns of internal displacement, rural impoverishment, and food insecurity. Climate change exacerbates the risks generated by hydro-hegemonic power structures, as demonstrated by the disastrous floods of 2022 and the ongoing droughts. A decline in agricultural productivity, increasing food prices, and reliance on groundwater have led to a multifaceted crisis impacting both the stability of the national economy and the resilience of households in daily life.

Concurrently, the shortcomings of Pakistan's internal governance—characterized by fragmented institutions, politicization of inter-provincial disputes, aging infrastructure, inadequate storage capacity, and ineffective enforcement—significantly curtail its capacity to manage external pressures. The contentious relationships among Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan led to significant disputes over even domestic water allocation. Smallholders, tail-end farmers, and marginal communities carry the heaviest burden of mismanagement and scarcity. At its core, Pakistan faces a dual challenge:

safeguarding its rights as a lower riparian state while also addressing internal inequities that weaken its negotiating power and threaten domestic water security.

These findings strongly support the main hypothesis: The water crisis in Pakistan is generated by the interplay of India's upstream hydro-hegemony, weak internal governance in Pakistan, and the accelerating impacts of climate change. Without coordinated reforms, Pakistan risks worsening food insecurity, heightened inter-provincial tensions, and increased socioeconomic vulnerability—particularly among its most marginalized communities.

6.2 RECOMMENDATIONS:

6.2.1 STRENGTHENING TRANSBOUNDARY WATER DIPLOMACY:

To focus on the evolving water challenge between India and Pakistan, Pakistan needs to adopt a more proactive diplomatic approach grounded in technical expertise. While the Indus Water Treaty has been a stabilizing factor for many years, its limitations are becoming increasingly apparent due to climate change, the rise of hydropower developments upstream, and the shifts in geopolitical dynamics. Pakistan should advocate for a structured dialogue with India—ideally mediated by unbiased third parties such as the World Bank or UN agencies—to update the treaty by adding provisions on climate variability, environmental flows, glacial melt, and real-time data sharing. The establishment of a joint scientific advisory committee, along with increased transparency in dam operations, can help diminish mistrust and improve cooperative management of the river basin. Pakistan's status as a responsible lower riparian state will be bolstered, and the chances of escalation amid political tensions will diminish through a diplomatic approach grounded in data, technical expertise, and international environmental norms.

6.2.2 REFORMING NATIONAL WATER GOVERNANCE AND INSTITUTIONAL COORDINATION:

Pakistan's internal water governance requires structural reforms to improve efficiency, transparency, and accountability. To ensure the equitable enforcement of the 1991 Water Apportionment Accord, it is crucial to bolster institutions like the Indus River System Authority (IRSA) and guarantee their independence. To mitigate the political controversies that often arise around water allocation decisions, federal and provincial governments must enhance coordination mechanisms and standardize data-sharing practices. It is possible to significantly reduce mistrust between provinces by strengthening IRSA's monitoring

capabilities, investing in telemetry systems, and ensuring compliance at both the provincial and canal levels. Furthermore, a restored National Water Policy should clearly define the responsibilities of federal and provincial agencies, establish enforceable water management standards, and ensure fair resource distribution across all regions.

6.2.3 EXPANDING WATER STORAGE, UPGRADING INFRASTRUCTURE, AND IMPROVING SYSTEM EFFICIENCY:

Due to Pakistan's reliance on the Indus Basin and its exposure to seasonal variations, it is essential to prioritize the enhancement of water storage capacity. Due to siltation, the capacity of Pakistan's primary reservoirs—Tarbela, Mangla, and Chashma—is diminishing quickly. Meanwhile, the development of additional medium- and small-scale dams has not kept pace with population growth and climate pressures. To reduce conveyance losses and increase reliability, Pakistan ought to invest in new storage facilities, systems for recharging groundwater, and modernized canal infrastructure. By performing routine maintenance, removing sediment, and upgrading technology at major dams, the country will enhance its ability to manage extreme events such as floods and droughts. In addition, promoting water-efficient techniques of irrigation that use water efficiently—such as drip irrigation, laser leveling, and sprinkler systems—can significantly reduce waste and enhance agricultural productivity.

6.2.4ENHANCING INTER-PROVINCIAL COOPERATION AND BUILDING TRUST BETWEEN PROVINCES:

Pakistan needs to strengthen its inter-provincial water-sharing mechanisms to address the deep-rooted mistrust among Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan. This involves a transparent implementation of the 1991 Water Apportionment Accord, enhanced oversight of canal withdrawals, and prompt reporting of shortages or surplus flows. A permanent, independent Water Dispute Mediation Council can help to mitigate the politicization of provincial conflicts and offer a structured forum for technical dispute resolution. To address the concerns of downstream provinces, particularly Sindh's vulnerabilities linked to reduced water flows, delta degradation, and seawater intrusion, a balanced approach that considers both ecological and developmental needs is necessary. To achieve sustainable water management domestically and to present a united national front in international negotiations requires building trust between provinces.

6.2.5 ADDRESSING COMMUNITY-LEVEL WATER INSECURITY AND SUPPORTING VULNERABLE POPULATIONS:

Policies should go beyond state-level agreements and address the needs of communities that are most severely impacted by water scarcity. Farmers at the end of the supply chain, rural households, and communities in areas susceptible to floods and droughts need specialized assistance to manage ongoing crises. Enhancing equitable water access can be achieved by bolstering Water User Associations (WUAs), refining local irrigation management, and diminishing elite capture in canal systems. Concurrently, Pakistan must broaden its social protection initiatives for families displaced by floods, droughts, and agricultural failures. Vulnerable groups can rebuild their resilience through the introduction of crop insurance schemes, livelihood restoration programs, and community-based disaster preparedness initiatives. It is crucial to ensure women's involvement in water governance, given that household water shortages and agricultural uncertainties disproportionately impact them.

6.2.6 BUILDING CLIMATE RESILIENCE THROUGH ADAPTATION AND EARLY WARNING SYSTEMS

As the Indus Basin undergoes swift hydrological shifts driven by climate change, there is a need for an approach that combines water management with climate adaptation. To improve its early warning systems for floods, glacial lake outburst floods (GLOFs), and droughts, Pakistan must enhance coordination among the Meteorological Department, NDMA, provincial disaster authorities, and irrigation departments. Flood intensity can be mitigated and groundwater recharge enhanced by implementing watershed restoration, afforestation, and soil conservation initiatives in upstream catchments. In addition, implementing agricultural methods that can withstand climate change—such as drought-resistant seed types, different cropping strategies, and advanced water management systems—will mitigate the effects of unstable water flows on food security.

6.2.7 PRIORITIZING HUMAN SECURITY THROUGH FOOD SYSTEM STABILITY:

Lastly, Pakistan needs to tackle the ramifications for food security that are directly caused by water shortages and hydrological shocks. To mitigate dependence on imports and safeguard against price volatility in years of drought or flooding, it is advisable to bolster domestic food supply chains, allocate resources to local seed production, and enhance storage infrastructure. Ensuring stable irrigation for staple crops, providing subsidies to

smallholder farmers, and improving agricultural extension services will enhance national food security and mitigate the socioeconomic vulnerabilities that lead to displacement and poverty.

6.3 ANALYTICAL DISCUSSION: CLIMATE CHANGE, UPSTREAM CONTROL, AND THE TRANSFORMATION OF THE INDIA–PAKISTAN WATER DISPUTE:

This chapter demonstrates that the India–Pakistan water dispute has entered a qualitatively new phase in which climate change acts as a threat multiplier, intensifying the strategic consequences of upstream control and exposing the limitations of the Indus Waters Treaty (IWT). While earlier disputes centered on allocation and infrastructure legality, contemporary tensions are increasingly shaped by hydrological uncertainty, environmental non-stationarity, and asymmetric adaptive capacity between the two riparian states.

The empirical evidence presented in this chapter—accelerated glacier melt, increased frequency of extreme rainfall events, rising sedimentation, groundwater depletion, and declining dry-season flows—confirms that the Indus Basin is no longer governed by stable hydrological patterns. Climate attribution studies, glacier mass balance assessments, and monsoon variability data indicate that river flows are becoming more volatile in timing rather than simply reduced in volume. This shift is analytically significant because it undermines the foundational assumption of the IWT: that predictable flows can be managed through fixed legal allocations.

India's upstream position becomes more strategically consequential under these conditions. In a climate-stressed basin, even legally permissible infrastructures such as run-of-the-river hydropower projects—acquires enhanced political leverage. Temporary storage, flow regulation for power generation, and operational discretion gain importance when downstream states face shrinking buffers. Pakistan's declining groundwater reserves, sediment-filled reservoirs, and limited alternative water sources reduce its resilience to upstream-induced variability. Thus, climate change transforms upstream control from a technical issue into a structural power asymmetry.

Flood risk provides a clear example of this interaction. Climate change has increased the intensity of monsoon rainfall and glaciers melted, raising baseline flood risk across the basin. However, the downstream impact of these climatic forces is amplified when upstream flow regulation lacks transparency and coordination. The absence of real-time data sharing and joint flood management mechanisms under the IWT increases Pakistan's

exposure to sudden surges, overwhelming embankments and reservoirs. The result is not merely environmental damage but human insecurity, manifested in displacement, food shortages, and infrastructure loss.

Similarly, drought risk illustrates how environmental stress and political tension intersect. During low-flow years, reduced snowpack and early glacier melt diminish dry-season availability. In such contexts, Pakistan perceives upstream storage and diversion—even within treaty limits—as existential threats to agriculture, energy production, and drinking water supply. Climate variability thus intensifies distrust, while political mistrust prevents cooperative adaptation. This feedback loop deepens the dispute and raises the stakes of every upstream development project.

From an energy–water nexus perspective, the data presented in this chapter show that Pakistan's hydropower vulnerability is driven not only by climate change but by the interaction between sedimentation, flow variability, and transboundary governance failure. Sediment accumulation reduces reservoir storage precisely when climate change demands greater buffering capacity. Meanwhile, upstream operational decisions during dry spells can compound shortages at Pakistan's major dams. These pressures collectively weaken national energy security, especially during climate-induced heatwaves that raise electricity demand.

Institutionally, IWT's rigidity emerges as a central analytical concern. Designed for a stationary climate, the treaty lacks mechanisms for adaptive management, climate-responsive flow adjustments, sediment coordination, or joint glacier monitoring. The Permanent Indus Commission (PIC), while valuable, is structurally limited by political tensions and does not function as a basin-wide climate governance body. As a result, climate risks are managed unilaterally rather than cooperatively, increasing the likelihood that environmental shocks translate into diplomatic crises.

This chapter therefore reframes the India–Pakistan water dispute as a compound environmental security dilemma. Climate change weakens natural and artificial buffers, while upstream control magnifies downstream vulnerability. Political mistrust prevents adaptation, and institutional inflexibility locks both states into reactive rather than preventive strategies. These dynamics are mutually reinforcing rather than additive, producing escalating risks for Pakistan's water, food, and energy security.

In analytical terms, the Indus dispute is no longer solely about treaty compliance or infrastructure legality. It is increasingly about who bears the costs of climate change in a transboundary river basin characterized by power asymmetry. Without climate-sensitive treaty evolution, enhanced data sharing, and cooperative basin management, environmental variability is likely to further destabilize Indo-Pakistan relations and deepen human insecurity in downstream Pakistan.

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