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# Climate Change and Water Insecurity in Pakistan: Implications for Federal Governance and Internal Stability

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## ABSTRACT

*Climate change has now become one of the most significant non-traditional security threats of the twenty-first century and its impacts are highly disproportionately placed in the developing countries that are environmentally vulnerable like Pakistan. Pakistan is located in the Indus Basin and it depends on one of the most developed irrigation systems in the world, which is exposed to some of the most devastating water crisis due to the disappearance of the glaciers and the changing monsoon patterns, frequent droughts and disastrous flooding. These ecological incursions are not determined in a vacuum but they overlap a federal form of governance that has always been historically contentious, institutionally fractured and constitutionally unclear in regard to water resource management. This paper explores the connection between water insecurity in Pakistan due to climate change and the stability of federal governance, based on the argument that climate change is a threat multiplier that exacerbates the underlying structural vulnerabilities in interprovincial water governance and endangers national unity. Based on the environmental security theory and the academic literature of federalism, the paper uses qualitative research methods using thematic analysis of the provisions in the constitution, policy documents, institutional mechanisms and secondary academic sources. The results show that the 1991 Water Apportionment Accord and the Council of Common Interests are no longer effective as adaptive governance tools with increasing climate stress. The interprovincial water distribution conflicts, especially between the Punjab and Sindh, have become more pronounced and the food insecurity in rural areas and migration as a result of climate have extended the social aspects of the crisis. The paper suggests institutional reforms that are climate adaptive, greater federal collaboration, open governance of water information, and mainstreaming of water security in national security plans.*

## 1. Introduction

Water is not just a natural resource in Pakistan, it is the framework on which the Pakistani agriculture, economy and political order is based. The Indus Basin Irrigation System (IBIS) is one of the largest continuous irrigation systems in the world, with supply to around 22 million hectares of agricultural land and supports over 130 million people living in rural Pakistan.[1] Almost a quarter of the gross domestic product of the country comes through agricultural production and about one-third of the national labor force is involved in agriculture, therefore, water security cannot be discussed outside the context of economic feasibility and social stability.[2] But it is the activating impacts of climate change that are systematically undermining the conditions which have historically allowed agricultural productivity.

The per capita supply of water in Pakistan has fallen drastically in the last seven decades, as in 1951 it was around 5,260 cubic meters per capita but in recent years it has been less than 1,000 cubic meters per capita.[3] The 1,000 cubic meter mark is accepted worldwide as the indicator of complete water shortage, a term that has dramatic consequences on food production, human health, and political stability. This downward spiral does not occur mainly due to natural drought cycles; it is the cumulative impact of high population growth, institutional failure to manage water resources and the increasingly destabilizing impact of climate change on hydrology systems that millions of Pakistanis rely on to sustain them.

The Hindu Kush-Karakoram-Himalayan (HKH) glacial system that supplies the great rivers of the Indus Basin is receding at a pace that scientists state as one of the quickest in any non-polar area on Earth.[4] Glacial melting is already increasing the river runoff in the near to medium term, which is one of the factors causing the type of disastrous floods experienced in 2010 and 2022. Over a longer time, with the shrinking of glaciers, the seasonal supply of water to the rivers of Pakistan will decrease significantly, which will lead to a scarcity crisis that will develop gradually, thus changing the agricultural system and the water economy of the country.[5] In the meantime, the variability of the monsoons has been increasing and the effect of this is erratic rain distribution that has weakened the predictability of water supply in various provinces already having competing claims.

These environmental pressures are not placed on a governance system that is well-prepared to handle the pressures. The federal system in Pakistan, which was created by the Constitution of 1973, puts water management responsibility in a manner that created a longstanding lack of clarity and lack of intergovernmental cooperation. The Water Apportionment Accord of 1991 that aimed to control the sharing of the Indus waters among the four provinces was bargained under relative hydrological stability. It was not made to suit the type of climate-driven variability and scarcity that the current and future water scenario is.[6] This has led to provincial governments becoming more contentious over allocation decisions, accusations of each other engaging in upstream diversion and unwillingness to submit to federal arbitration via the Indus River System Authority

[1] Food and Agriculture Organization, *Aquastat Country Profile: Pakistan* (Rome: FAO, 2021),
[2] Government of Pakistan, *Pakistan Economic Survey 2023–24* (Islamabad: Finance Division, 2024).
[3]Pakistan Council of Research in Water Resources, *Water Availability Report* (Islamabad: PCRW, 2023).
[4] Walter W. Immerzeel et al., "Importance and Vulnerability of the World's Water Towers," *Nature* 577, no. 7790 (2020): 364–69
[5] Arthur F. Lutz et al., "Climate Change Impacts on the Upper Indus Hydrology: Sources, Shifts and Extremes," *PLoS ONE* 11, no. 11 (2016)
[6] Akhtar Memon, "Water Apportionment and the Politics of Scarcity in Pakistan," *Contemporary South Asia* 28, no. 1 (2020): 31–47

(IRSA). These tensions have intensified mistrust, especially between Punjab which dominates the upstream infrastructure and Sindh which suffers the downstream effects of the reductions in flows.

The paper explores the role of water insecurity, which is brought about by climate in changing the federal governance issues in Pakistan and leading to internal instability threats. The main thesis is that climate change is not merely an environmental issue but a threat multiplier, which interacts with and exacerbates structural vulnerabilities in the institutional and federal structure of Pakistan that exist prior to it. Combining the environmental security theory with the federalism scholarship, the paper offers a conceptual frame, according to which it is possible to analyze the political aspects of water insecurity more specifically. It is followed by the analysis of the current literature, description of the methodology applied in the study, thematic results, analysis of the implications and policy recommendations that are aimed at institutional modification and climate adaptation.

### 1.1 Research Gap

The academic sources of information on the water problems in Pakistan are numerous and disjointed. The environmental scientists have generated precise studies on the melting of glaciers, monsoon fluctuations and the varying river flows.[7] Scholars of governance and political scientists have studied issues of constitutional conflict over water allocation, the functioning of federal institutions and the nature of interprovincial conflict.[8] There has been increased tendency by security analysts to recognize water as a strategic resource that can create social conflict and destabilize states.[9] But these lines of research have been inclined to grow relatively independent of each other, handling various aspects of a problem which is essentially holistic.

The consequence is an analytic divide to which this study has responded; a lack of insight into the functioning of climate-induced water stress both inside and upon the federal governance system in Pakistan, both contributing to the lack of governance and increasing the risk of interprovincial political tension. Although the individual studies recognize the political consequences of water scarcity or the political environment of the environmental vulnerability, not many studies have been systematic in linking the two components in a whole analytical framework. The paper has filled that gap by considering climate change as a threat multiplier that increases the existing institutional vulnerabilities and federal strains, with implications on the effectiveness of governance and the stability of the nation. This question is important not only in Pakistan, but as the process of climate change deepens all around the world, the processes by which environmental stress is mediated by systems of governance in developing federal states represents an ever-growing field of scholarly and policy interest.

## 2. Literature Review

### 2.1 Hydrological Vulnerability and Climate Change in Pakistan

South Asia has always been cited by the Intergovernmental Panel on Climate Change (IPCC) as one of the areas that are most susceptible to climate-related hydrological disruption.[10] Pakistan is in a very weak situation in this regional profile owing to its over-reliance on glacier-fed rivers.

[7] H. G. Rees and D. N. Collins, "Regional Differences in Response of Flow in Glacier-Fed Himalayan Rivers to Climatic Warming," *Hydrological Processes* 20, no. 10 (2006)

[8] Daanish Mustafa, *Water Resource Management in a Vulnerable World: The Hydro-Hazardscapes of Climate Change* (London: I.B. Tauris, 2013).

[9] Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999).

[10] Intergovernmental Panel on Climate Change, *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report* (Cambridge: Cambridge University Press, 2022).

Hindu Kush-Karakoram-Himalayan glaciers in total store about 3,000 cubic kilometers of ice that contributes to the melting ice, which supports rivers during the dry months, when the snowfall and rainfall do not suffice to sustain agricultural water supply.[11] Research has shown that these glaciers have been receding at increasing speeds since the 1980s, and according to some of the projections, the HKH region may lose over half of its existing ice levels by the end of the century in high-emission scenarios.[12]

According to latest research a paradox underlying the future of water in Pakistan: the melting of stored ice at high rates at the start of the glacier retreat results in a so-called period of peak water followed by a long-term decrease in the mass of glaciers.[13] It is such that these flood events which Pakistan has had in the past decades are not only a manifestation of the same climatic process that would later lead to severe water shortage. The 2022 floods which covered about one-third of the total land area of the country and resulted in the loss of the economy estimated to be over thirty billion dollars, demonstrated the almost catastrophic aspect of this course in the short term.[14] A study by Lutz et al. also shows that the future of the Indus Basin is more one of increased hydrological variability with extreme events becoming more frequent and severe.[15]

In addition to the dynamic processes in the glaciers, the Pakistan water condition is influenced by the increasing monsoon variability. Some studies report about severe shifts in the spatial and temporal distribution of monsoon rainfall in Pakistan, where in some places the rainfall events are more intense but short lived and in other places the dry spells are so prolonged.[16] The drought conditions have especially hit Balochistan and Sindh where groundwater recharge has been impacted and rain-fed agriculture has been compromised in places where irrigation systems are not in place.[17] The interaction between the glacial processes and the monsoon variability forms the most unpredictable hydrological environment and puts colossal strain on the governance structures that are devised under a more stable setting.

### 2.2 Water Governance and Institutional Structures

The academic belief on water governance in Pakistan is that it is not an absence of water in the country but a deficit of governance which does not allow the available water to be utilized in an efficient and fair manner. A thorough evaluation prepared by Briscoe and Qamar on behalf of the World Bank added that the water economy of Pakistan was being run dry not so much due to physical scarcity but due to institutional fragmentation, political interference in the distribution of water, chronic underinvestment in the storage and conveying systems and almost a complete lack

[11] Kenneth Hewitt, "The Karakoram Anomaly? Glacier Expansion and the Elevation Effect, Karakoram Himalaya," *Mountain Research and Development* 25, no. 4 (2005): 332–40

[12] Philip D. A. Kraaijenbrink, Marc F. P. Bierkens, Arthur F. Lutz, and Walter W. Immerzeel, "Impact of a Global Temperature Rise of 1.5 Degrees Celsius on Asia's Glaciers," *Nature* 549, no. 7671 (2017): 257

[13] Walter W. Immerzeel et al., "Importance and Vulnerability of the World's Water Towers," *Nature* 577, no. 7790 (2020): 364–69

[14] United Nations Development Programme, *Pakistan Floods 2022: From Relief to Resilience* (Islamabad: UNDP Pakistan, 2022).

[15] Arthur F. Lutz et al., "Climate Change Impacts on the Upper Indus Hydrology: Sources, Shifts and Extremes," *PLoS ONE* 11, no. 11 (2016)

[16] Hammad Sajjad and Abdul Ghaffar, "Observed, Simulated and Projected Extreme Climate Indices under Climate Change Scenarios in Pakistan," *Climate Dynamics* 37, nos. 11–12 (2011): 2169–94.

[17] Asad Sarwar Qureshi, Peter G. McCornick, Abdul Sarwar, and Bharat R. Sharma, "Challenges and Prospects of Sustainable Groundwater Management in the Indus Basin, Pakistan," *Water Resources Management* 24, no. 6 (2010): 1551–69

of cost recovery in the irrigation sector.[18] Such institutional pathologies have continued to exist decades after such an evaluation and were further enhanced by the increased pressure of climate change.

The PCRWR has also highlighted the need to reform governance in order to tackle the water crisis in Pakistan, saying that agricultural water use in Pakistan is around 40 percent, meaning that most of the water extracted out of rivers and aquifers does not make it to crops due to seepage, evaporation and mismanagement.[19] Kahlown and Azam reported how decades of under-investment in irrigation infrastructure of Pakistan had caused a drastic reduction in the efficiency of lining of the large canals and that millions of hectares of formerly productive agricultural land were now affected by waterlogging and salinity.[20] The interactions of these physical governance failures and political governance failures lead to a water management system that is ill-equipped to withstand climate shocks.

The Water Apportionment Accord of 1991 reflects the main federal tool of Pakistan in the management of the water distribution of the interprovincial water. The Accord, agreed upon after decades of conflict and intermittent violence over river water shares, introduced fixed shares of Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan basing it on historical usage patterns and future projected water requirements.[21] But as the climate-induced variability has become more evident the constraints of the Accord have become more evident. It offers no system of realigning allocations in light of lower total flows, offers no institutional capability of real-time supervision and enforcement and lacks an arbitration process with binding force.[22] The agency that is in place to enforce the Accord, the IRSA, has been accused on numerous occasions of not carrying out its business in a transparent manner; being influenced by politics and not implementing the rules of allocation in a consistent manner.

### 2.3 Federalism and Resource Politics

The theory of federalism provides some helpful analytical tools for thinking about the relationship between resource disputes and governance structures in multiethnic, multiregional states. Watts suggests that resource disputes are especially likely in federal systems because these systems establish multiple sites of political authority with conflicting claims over resources.[23] In these systems, the political viability of the federal order is dependent on the existence of legitimate and trusted institutions that are able to resolve resource disputes in a way that all parties to the dispute accept as fair. In the absence of such institutions resource disputes are likely to spill over into political conflicts about the legitimacy of the federal system as a whole.

This point is applied to Pakistan which has a federal order undermined by smaller provinces' perceptions of being disadvantaged vis-à-vis Punjab in the allocation of federal resources and political power. Water disputes are an important aspect of this story of federal injustice. Sindh's

[18] John Briscoe and Usman Qamar, *Pakistan's Water Economy: Running Dry* (Washington, DC: World Bank and Oxford University Press, 2006).

[19] Pakistan Council of Research in Water Resources, *Water Availability Report* (Islamabad: PCRWR, 2023).

[20] Muhammad Arshad Kahlown and Muhammad Azam, "Individual and Combined Effect of Waterlogging and Salinity on Crop Yields in the Indus Basin," *Irrigation and Drainage* 51, no. 4 (2002): 329–38

[21] Akhtar Memon, "Water Apportionment and the Politics of Scarcity in Pakistan," *Contemporary South Asia* 28, no. 1 (2020): 31–47

[22] Daanish Mustafa, *Water Resource Management in a Vulnerable World: The Hydro-Hazardscapes of Climate Change* (London: I.B. Tauris, 2013).

[23] Ronald L. Watts, *Comparing Federal Systems*, 3rd ed. (Montreal and Kingston: McGill-Queen's University Press, 2008).

grievances about upstream diversions by Punjab, Balochistan's perennial under-representation in water allocation, and Khyber Pakhtunkhwa's concerns about downstream impacts of dam construction are all part of a broader narrative of water disputes as a symbol of broader concerns about provincial autonomy and federal equity.[24]

The Council of Common Interests (CCI), set up under Article 153 of the Constitution of Pakistan (1973) was designed to serve as an interprovincial forum for consultation on matters of common interest, including water. But researchers have observed that the CCI has operated irregularly, with fewer meetings and limited mandate to enforce its decisions.[25] The Eighteenth Constitutional Amendment of 2010 was designed to enhance provincial autonomy and delineate federal-provincial roles, but it left water governance in a state of confusion, with roles and responsibilities for water governance spread across federal and provincial irrigation departments, not through coordinated management.

### 2.4 Environmental Security and Threat Multiplication

Homer-Dixon's pioneering work on environmental scarcity and violence laid down the theoretical groundwork for the role of resource scarcity in creating social conflict and institutional breakdown. He showed that environmental scarcity typically operates via two pathways: it can trigger direct resource-related conflicts when groups compete for scarce resources, and it can combine with other social stresses to undermine political institutions and trigger social grievances that are eventually expressed through political mobilization.[26] These two pathways are evident in the case of Pakistan, as water scarcity both causes direct interprovincial conflict and increases rural poverty, displacement and political activism.

Salehyan challenged deterministic views of the climate-conflict nexus by demonstrating that the relationship between environmental scarcity and conflict is mediated by political institutions, economic factors and the actions of political leaders.[27] This more sophisticated view is helpful for Pakistan because it implies that the consequences of climate-induced water stress are not inevitable; political reform and institutional strengthening can break the link between environmental stress and political violence. Barnett and Adger also highlight that climate change threatens human security primarily by affecting livelihoods, resource access and the ability of governments to provide essential services, all of which are impacted by water insecurity in Pakistan.[28]

More recent work has further refined the notion of climate change as a threat multiplier, showing that the impacts of climate change are most destabilizing when they happen in settings where governance is weak, there is significant economic inequality, and social contracts between people and states are weak.[29] Pakistan's vulnerability is heightened in each of these regards. It scores

[24] Robert G. Wirsing, "Hydro-Politics in South Asia: The Domestic Roots of Interstate River Rivalry," *Asian Affairs: An American Review* 35, no. 1 (2008): 3–22

[25] Ali Cheema and Shandana Khan Mohmand, "Local Government Reforms in Pakistan: Legitimacy, Participation and Social Capital," *Pakistan Development Review* 44, no. 4 (2007): 647–78.

[26] Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999).

[27] Idean Salehyan, "From Climate Change to Conflict? No Consensus Yet," *Journal of Peace Research* 45, no. 3 (2008): 315–26

[28] Jon Barnett and W. Neil Adger, "Climate Change, Human Security and Violent Conflict," *Political Geography* 26, no. 6 (2007): 639–55

[29] Marshall Burke, Solomon M. Hsiang, and Edward Miguel, "Global Non-Linear Effect of Temperature on Economic Production," *Nature* 527, no. 7577 (2015): 235–39

poorly on international governance measures, has high regional income inequality, and a history of poor governance and political instability that has led to low trust in state institutions.[30]

## 3. Research Methodology

This research project undertakes a qualitative research design that involves descriptive, analytical and exploratory methods to explore the connections between climate-related water insecurity and federal governance in Pakistan. This is a suitable approach for this research because the key questions relate to institutional interactions, political processes, and governance relationships that are not amenable to quantitative analysis. The aim is not to determine statistical relationships but to examine how climate stress affects federal governance processes and what the effects of those processes mean for national stability and security. The conceptual approach builds on two strands of research. The theory of environmental security offers insights into how the effects of climate change compound vulnerabilities and governance issues.[31] Theory about federalism, especially the research on resource politics in federal systems offers insights on how water disputes interact with the design of Pakistan's intergovernmental system.[32]

The analysis is based on a variety of data sources. Primary documents include the Constitution of Pakistan (1973), the 1991 Water Apportionment Accord, reports from IRSA and the CCI, policy papers from the Ministry of Water Resources, and reports from international agencies such as the IPCC, World Bank, Asian Development Bank and UNDP. Secondary academic data sources include peer-reviewed journal publications, book chapters and monographs that relate to climate change, water governance and federal politics in Pakistan and other countries. This study uses thematic content analysis. This method entails careful reading and coding of sources to identify themes, patterns and relationships that are relevant to the research questions. The analysis is structured around four clusters of themes: climate change as a threat multiplier in the water sphere; institutional deficiencies in water governance; interprovincial and federal political dynamics; and impact on food security, migration and domestic security. Themes were inductively identified from the literature and are derived from the theoretical framework, rather than imposed on the data.

## 4. Findings

### 4.1 Climate Change as a Threat Multiplier in the Indus Basin

The most basic finding of this study is that climate change is more than adding complexity to the water problem in Pakistan; it is fundamentally changing the nature of the water problem and the way it needs to be governed. The distinction is significant. Governance institutions that have evolved to cope with a stable hydrological system, in which the challenge is to allocate a more or less stable volume of water among users, have a different challenge when volumes, timing, and distribution of water availability are suddenly highly variable from year to year and decade to decade.

Scientific studies suggest the future of water in Pakistan is one of increased variability, not just decreased water availability. Water availability in the Indus basin will increase in the short term as glaciers melt more quickly, and will then decline rapidly as the mass of glaciers reduces. Against this backdrop, years will vary between floods and droughts with greater intensity and frequency. The 2022 floods, following on the heels of a few years of lower-than-average rainfall in many

[30] Transparency International, *Corruption Perceptions Index 2023* (Berlin: Transparency International, 2023).
[31] Ronald L. Watts, *Comparing Federal Systems*, 3rd ed. (Montreal and Kingston: McGill-Queen's University Press, 2008).
[32] Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999)

areas of Pakistan, are a case of climatic whiplash that makes traditional planning assumptions redundant.[33]

The problem with groundwater is only making matters worse. The aquifers underlying Pakistan, especially in Punjab and Sindh, have been severely over-extracted with farmers and cities tapping groundwater to supplement their water use in the absence of surface water. The simultaneous impact of climate change on surface water and groundwater is a water security crisis worse than the sum of the two. Water security in Pakistan has two layers that are being diminished by climate change, and the system hasn't adapted accordingly.[34]

### 4.2 Governance Weaknesses and Failures

Pakistan's water governance institutions display a recurring set of institutional weaknesses that climate change is bringing to the fore. The most important institutional weakness is the lack of an effective, neutral, and well-funded federal institution to manage water allocation on a dynamic basis, enforce the 1991 Accord, arbitrate disputes between the provinces in a credible manner, and update the allocation rules to suit the changing hydrology. The current design of IRSA makes it incapable of performing any of these roles.

Official reports and scholarly writing have documented the shortcomings of IRSA. The authority does not have independent monitoring capabilities, and is dependent on data collected by provincial irrigation departments who have a strong political interest in reporting their water needs as higher than reality, and their diversions as lower. Its decision-making is vulnerable to provincial political influence, and its power to enforce decisions is weak - it has little recourse to compel compliance if provincial governments disagree with its decisions.[35] In a water-scarce environment, these institutional deficiencies have increasingly serious consequences, with provinces having greater incentives to divert water ahead of downstream uses.

The CCI also has not been an effective institution for cooperative water management. Despite its constitutional role in dealing with matters "of national interest" that cut across provincial lines, the CCI has not met often and has failed to foster the ongoing intergovernmental relationships needed to collaborate on shared resources.[36] The more generalized trend for provincial governments to regard water as a "political resource" rather than a common resource that needs to be managed is an institutional failure of cooperative federalism that must be resolved.

Water storage and conveyance has long been under-invested Pakistan has one of the lowest storage capacities among major agricultural economies, in terms of the number of days of river flow that it can store. Pakistan has a storage capacity of around 30 days of river flow, as compared to India's 120 days and the US's 900 days.[37] This makes the country unable to effectively manage water variability, particularly during floods when a large amount of water goes wasted that could be stored and used in the dry season. The effects of climate change on these costs will be exacerbated as dry and wet periods grow more extreme.

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[33] United Nations Development Programme, *Pakistan Floods 2022: From Relief to Resilience* (Islamabad: UNDP Pakistan, 2022).

[34] Asad Sarwar Qureshi, Peter G. McCornick, Abdul Sarwar, and Bharat R. Sharma, "Challenges and Prospects of Sustainable Groundwater Management in the Indus Basin, Pakistan," *Water Resources Management* 24, no. 6 (2010): 1551–69

[35] Abdul Rehman, "Environmental Degradation of the Indus Delta and Downstream Flow Reduction," *Pakistan Journal of Environmental Studies* 28, no. 3 (2019): 1421–35.

[36] Ministry of Water Resources, *National Water Policy 2018* (Islamabad: Government of Pakistan, 2018).

[37] World Bank, *Pakistan Water Security: Addressing the Growing Challenge* (Washington, DC: World Bank, 2021).

### 4.3 Political Relations and Federal Politics

The combination of climate change-driven water scarcity and the institutional governance problem has extended interprovincial tensions to the point where they now pose a major threat to federal unity. The most politically sensitive aspect is the Punjab-Sindh water relationship, which is in turn a reflection of historic tensions, geographical and political power imbalances that make water sharing and management extremely challenging.

Sindh, being downstream in the Indus system, is at the mercy of Punjab, which controls the water that flows through its many barrages, headworks and irrigation canals. For decades, the Sindh government and civil society groups have accused Punjab of diverting more water than its share during low-flow periods of the river, resulting in a shortage of water for agriculture and domestic needs in downstream Sindh.[38] Such claims have been hard to substantiate due to the lack of independent real-time data monitoring, which in itself is a governance failure that favours upstream provinces.

The development of reservoirs and dams is a major flashpoint in federal relations. Sindh has repeatedly opposed major water storage facilities proposed for upstream construction in the Indus, on the grounds that they would result in decreased downstream flows and the ecological degradation of the Indus Delta, which has already suffered badly from water scarcity.[39] Such concerns have been dismissed by federal and Punjab authorities as parochial, but to Sindh, federal water policy is inherently biased in favour of the upper provinces. This perception of inequity is reflective of and reinforces interprovincial distrust that limits the cooperative federalism that is essential to effective climate adaptation.

The water conflicts in Balochistan and Khyber Pakhtunkhwa reveal different aspects of the federal water conflict. Balochistan, the most water-stricken province of Pakistan, and the province most impacted by drought, has long claimed that its allocation of water under the 1991 Accord is less than its potential for food production and the needs of its burgeoning population.[40] Khyber Pakhtunkhwa, as the province through which the Indus enters Pakistan from Afghanistan, is concerned with the way federal policy factors in the needs of people in the upper watershed of the Indus, who are social and environmental victims of the dams but only receive a small portion of the benefits.

### 4.4 Food Security, Migration and Internal Stability

The impacts of climate-related water insecurity are not just limited to the realm of water policy, but have implications for food security, rural livelihoods, internal displacement and political stability. Pakistan's food production is largely dependent on irrigation, with 90 percent of the country's food grown on irrigated lands.[41] Water scarcity that shrinks the availability of irrigation water, in turn, depresses food production, with flow-on effects for rural livelihoods, food prices and human nutrition.

The 2022 floods and the subsequent loss of crops on 4.4 million acres and livelihoods of around 33 million people are a clear example of how climate-related water events can quickly erode food

[38] Mujtaba Hassan, "Interprovincial Water Disputes in Pakistan," *Journal of Political Studies* 27, no. 2 (2020): 55–72.

[39] Abdul Rehman, "Environmental Degradation of the Indus Delta and Downstream Flow Reduction," *Pakistan Journal of Environmental Studies* 28, no. 3 (2019): 1421–35

[40] H. G. Rees and D. N. Collins, "Regional Differences in Response of Flow in Glacier-Fed Himalayan Rivers to Climatic Warming," *Hydrological Processes* 20, no. 10 (2006): 2157–69

[41] Food and Agriculture Organization, *Aquastat Country Profile: Pakistan* (Rome: FAO, 2021),

security on a large scale.[42] But the more gradual water security threats of groundwater depletion and irrigation declines are in some ways more pernicious, as they gradually undermine agricultural productivity, rather than producing the dramatic headlines generated by floods. Research by the International Food Policy Research Institute shows that under high greenhouse emissions scenarios, food production in South Asia (including Pakistan) would diminish by 10 to 40 percent by 2050, with irrigated farming being the hardest hit.[43]

Lack of agricultural productivity and water security in rural areas is a major driver of domestic migration, as rural families whose livelihoods have been destroyed by crop failure, water scarcity or flooding relocate to cities. Pakistan's urbanization rate is among the highest in South Asia at approximately 3 percent per year and a large proportion of this urban growth is due to distress migration from rural areas with water and agricultural insecurity.[44] Economic migrants to major urban areas, especially Karachi, Lahore and Faisalabad are putting pressure on already stressed urban water supply, housing and labour markets. The social tensions caused by unplanned urbanization are another dimension of the risks to domestic stability from climate-induced water insecurity.

The political effects of water insecurity are evident in the politicization of water through the mobilization of provincial governments, civil society and rural communities over water rights. Provincial government opposition to federal water allocation policies not only reflects the concerns of their rural electorate, but also reinforces regional identities that can undermine national integration.[45] Politicization of water, while in some ways a natural and healthy expression of democratic politics, can also rule out the collaborative governance arrangements essential to sound water governance. When the status of water is reduced to a political bargaining chip rather than a resource that needs to be managed in a co-operative fashion, the institutional environment for rational allocation and adaptation is further compromised.

## 5. Discussion

This analysis supports and adds nuance to the conclusion that climate change has a multiplier effect on Pakistan's federal governance system, by exacerbating existing institutional weaknesses and establishing feedback loops between environmental change, governance failure and political instability. There are a number of aspects of this phenomenon that need to be explored.

First, it is important to understand that the governance failures identified in this analysis reflect not so much malice or ineptitude. They are the result of structural dynamics of Pakistan's federal system that have been shaped by historical patterns of political development, resource allocation and intergovernmental relations. The water tensions between Punjab and Sindh, for instance, reflect long-held grievances that predate the country's independence, as well as a long history of political experience in which smaller provinces have, at times, had the right to feel that federal institutions are dominated by the dominant province. To change these dynamics, reform is needed not only to the technical aspects of the system, but also to the political processes that can foster the kind of intergovernmental trust that is essential for cooperative federalism.

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[42] Government of Pakistan, *Pakistan Floods 2022: Post-Disaster Needs Assessment* (Islamabad: Planning Commission, 2022).

[43] Asad Sarwar Qureshi, Peter G. McCornick, Abdul Sarwar, and Bharat R. Sharma, "Challenges and Prospects of Sustainable Groundwater Management in the Indus Basin, Pakistan," *Water Resources Management* 24, no. 6 (2010): 1551–69

[44] United Nations Population Fund, *Pakistan: State of World Population Report* (New York: UNFPA, 2022).

[45] Shahid Javed Burki Altaf, *So Much Aid, So Little Development: Stories from Pakistan* (Washington, DC: Woodrow Wilson Center Press, 2011).

Second, the analysis points to the fact that while the 1991 Water Apportionment Accord (WAA) was a major achievement in its time, it is no longer suitable as the primary instrument for federal water governance. The Accord was based on historical water-usage patterns and percentages that are incapable of adjusting to the type of inter-annual variability that climate change is creating in the Indus system. An approach to water governance commensurate with the current and future challenges would need to include dynamic allocation formulas able to adapt to changing river flows, real-time monitoring and reporting systems able to provide reliable data to all stakeholders, and dispute resolution mechanisms with the authority and credibility to deal with disputes without escalating them into federal crises.

Third, the analysis of threats to Pakistan's internal stability should be considered carefully. Climate change and political violence do not necessarily go together. Pakistan has suffered from water stress for years without this exercising a direct influence over armed conflict around water resources, and there is no reason to assume it will do so. Rather, the analysis indicates that climate-induced water insecurity is increasingly constraining the political space for collaborative governance by sharpening distributional battles, increasing regionally-based political identities that are based on resource grievances, and undermining rural economies on which agricultural societies depend for political stability. These are threats to good governance and federation, not direct forecasts of violence.

Fourth, the implications of this analysis need to be informed by the institutional capacities and political economy of Pakistan. The resources, political commitment, and governance capacity for massive infrastructure building, institutional reform, and increased intergovernmental cooperation are limited in Pakistan. International financial resources from multilateral institutions and technical assistance from countries that have experience in implementing climate-adaptive water governance structures will be required. The categorization of Pakistan as a country vulnerable to climate change but with low greenhouse gas emissions, also provides a foundation for international support for climate finance that specifically targets the governance aspects of climate vulnerability.

## 6. Recommendations

### 6.1 Institutional Reform and Strengthening

The most pressing institutional reform challenge is to convert IRSA from a politically subservient allocation authority into an independent, technically competent and well-managed federal agency with enforcement authority. This would require reform of IRSA's mandate through legislation, the creation of an independent monitoring and information system, and a political understanding among the provinces to accept the decisions of IRSA, even when they are not in their short-term interests. The CCI should be convened regularly, and provided with a permanent technical secretariat to inform its deliberations of water governance issues. Decisions on water policy issues should have constitutional weight to ensure that provincial and federal agencies abide by them.

### 6.2 Climate Adaptation in Water Governance

Pakistan's water governance regime needs to incorporate climate adaptation considerations, which are currently absent. The 1991 Accord should be renegotiated to include flexible allocation rules that reflect real-time flows, rather than long-term averages and allow allocation rules to dynamically respond to measured river hydrology. Water storage infrastructure investment should be prioritized as a national security imperative with adequate resources brought in through federal budgetary allocation and international climate finance to increase water storage capacity by at least 50% in the coming decade. Programs should be introduced to encourage irrigation efficiency

through canal lining and the use of new technologies that measure water needs for precision irrigation.

### 6.3 Federal Cooperation and Transparency

To restore the intergovernmental trust required for cooperative water federalism, political effort needs to be made to enhance information exchange. A nationally-based, interprovincially governed water data portal that includes real-time monitoring of river flow, diversions, and aquifer levels available to all provincial governments and the public would go a long way to overcoming information asymmetries that feed into allegations of secret water diversions and the lack of legitimacy in allocation decisions. Provincial forums dedicated to water governance, operating at the technical rather than political level below the CCI, would help build trust and confidence between water officials that can underpin cooperative problem solving as political tensions rise.

### 6.4 Mainstreaming Water Security in National Planning

Water security should be integrated into national security planning in Pakistan, with the National Security Council and other relevant civil-military planning bodies considering water governance issues in their security assessments and contingency plans. This would not constitute a militarization of water but ensure that the security dimensions of water stress are given due attention and resources at the highest level. International advocacy on climate finance should, in particular, focus on the governance aspects of water insecurity, seeking resources that enable institutional reform and capacity building, rather than physical infrastructure, in this context.

## 7. Conclusion

This paper has suggested that climate change and water insecurity in Pakistan are not merely environmental problems that can be solved by technical means; they are issues of governance that intersect with the institutional features of Pakistan's federal constitution in a way that could risk political unity and national integrity. The reviewed evidence suggests that climate change is acting as a threat multiplier in terms of its effects on institutional weakness, inter-provincial distrust, food security and the social factors of water insecurity through climate-induced migration and rural economic degradation.

Pakistan does not have the governance arrangements to meet the challenge. The 1991 Water Apportionment Accord is an anachronism. IRSA does not have the independence, capability and authority to manage allocation in a context of growing scarcity and variability. The CCI has not been the cooperative federal body needed for effective water management. And the political realities of interprovincial relations, with their historical legacy and power imbalances, present challenges to the cooperative problem solving required to adapt to climate change.

The solution will be a mix of institutional reform, infrastructure funding, political will to embrace cooperative federalism and international assistance. Each of these must be complemented by the others. Reforms without investment result in capacity without facilities. Infrastructure investment without institutional reform leads to poorly functioning and inequitably distributed infrastructure. Political will to work together without institutional arrangements results in promises without action. And domestic reforms without international support may be beyond the financial and technical resources available to Pakistan.

The stakes of this challenge are high. The consequences of poorly governed water insecurity will be to diminish Pakistan's agricultural outputs, exacerbate regional disparities, strengthen grievances among the country's provinces, and provide fertile ground for political instabilities. In

contrast, effective adaptation to the hydrologic consequences of climate change can turn a potential source of conflict into a basis for intergovernmental cooperation and resilience. Pakistan's decision-making on which of these outcomes to pursue will be influenced, at least in part, by the effectiveness of its federal water governance over the next decade.

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