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Case Study of Chilas and Swat Floods: Assessing State Responsibility under the Lens of Climate Justice

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ABSTRACT

The mountainous northern regions of Pakistan are increasingly being exposed to climate-induced hazards. The floods that swept through Chilas and Swat between 2022 and 2025 were triggered by a combination of glacial melt, intense monsoon precipitation, and landslides, leaving behind a trail of destruction and raising questions regarding the state's responsibility. Despite policy commitments and a growing climate agenda, affected communities reported delayed warnings, inadequate infrastructure, and uneven relief. Drawing on the principles of climate justice—fairness, equity, non-discrimination, participation, and accountability—this study investigates whether constitutional, statutory, and international obligations are fulfilled. The qualitative case study methodology combined field interviews with a doctrinal analysis of legal instruments and judicial precedents. Research has found that early warning systems are sporadic, engineering structures are inadequate, and compensation schemes are inequitable. Marginalized groups, especially women, find it more difficult to access relief. Although the state referenced climate change in its policies, the operationalization of climate justice principles remained limited. This paper argues that bridging the gap between commitments and practice requires institutional reform, community participation, and recognition of climate justice as a legal duty. The study also introduces high-definition bar charts and graphs to visualize the frequency of glacial lake outburst floods and the population at risk, providing a quantitative backdrop to qualitative insights.

Introduction

The Himalayan and Karakoram mountain chains that cradle northern Pakistan host some of the world's largest bodies of ice outside the Polar Regions. Global warming has accelerated the retreat of these glaciers, and the International Centre for Integrated Mountain Development warns that the region could lose up to 75 % of its ice by the end of the century (Greenfield, 2023; ICIMOD, 2023). Melting ice not only threatens future water security, but also creates unstable glacial lakes, increasing the frequency of glacial lake outburst floods (GLOFs). Pakistan already has 3,044 identified glacial lakes, of which are deemed hazardous (Green Climate Fund, n.d.; UNDP, 2023). When such lakes burst, they unleash millions of cubic meters of water, debris, and boulders, often in communities with little preparedness (United Nations Development Program [UNDP], 2022; UNDP, 2023). These cascading hazards intersect with an evolving monsoon regime; the annual mean temperature has risen by 0.5 °C over the last five decades, while precipitation patterns have become erratic (UNDP, 2023a). Heavy rains in August 2022 and July 2025 triggered flash floods, blocked highways, and damaged critical infrastructure in Chilas and Swat (Geo News 2025).

Therefore, climate change has shifted from a distant threat to a living reality in Pakistan. Reports by the United Nations Development Program (UNDP) rank Pakistan among the eight most climate-vulnerable countries (UNDP, 2023a). Although Pakistan contributes less than 1 % of global greenhouse gas emissions (United Nations Environment Program [UNEP], 2021; Ritchie et al., 2024), its mountainous communities are on the frontline of climate impacts. This vulnerability was reaffirmed during the 2025 monsoon season, when a cloudburst in July triggered flash floods along the Babusar Road near Chilas, killing several people, stranding tourists, and blocking the Karakoram Highway (Geo News, 2025). These inequities foreground the concept of “climate justice,” which the United Nations Environment Program defines through principles of equity, non-discrimination, equal participation, transparency, fairness, and accountability (UNEP, 2023; UNEP, 2013; UNEP, 2015). Climate justice emphasizes that responses should not only reduce emissions and adapt to impacts but also remedy historical injustices and protect the rights of vulnerable people. In Pakistan, climate justice has gained legal traction through landmark judgements. In *Shehla Zia v. The Water and Power Development Authority* the Supreme Court held that the constitutional right to life encompasses the right to an unpolluted environment (Zia v. WAPDA, 1994). In *Asghar Leghari v. Federation of Pakistan*, the Lahore High Court recognized climate change as a defining challenge, noted the recurrence of heavy floods and droughts, and instructed the government to implement adaptation measures in the interest of climate justice (Asghar Leghari v. Federation of Pakistan, 2015).

Despite progressive jurisprudence and policies, such as the National Climate Change Policy and Disaster Management Acts, the lived experiences of affected communities reveal persistent gaps. Early warning systems are patchy, engineering interventions often do not reflect local hydrology, and post-disaster assistance is often delayed or inequitable. For instance, the UNDP notes that between 2018 and 2021, Pakistan experienced 14 GLOF events, yet 2022 saw a sudden spike to seventy-five reported incidents (Greenfield, 2023). This sharp increase underscores the need for comprehensive early warning and adaptation measures. During the 2023 monsoon season, heavy rains resulted in at least 211 deaths, 294 injuries, and the destruction of nearly 4,000 houses (United Nations Office for the Coordination of Humanitarian Affairs [OCHA], 2023). Over 120,000 people in Khyber Pakhtunkhwa were affected, and tens of thousands were forced to relocate to higher ground levels (OCHA 2023). These figures illustrate the scale of vulnerability.

This research focuses on the twin regions of Chilas in Gilgit Baltistan and the Swat Valley in Khyber Pakhtunkhwa. Both areas are mountainous communities, where livelihoods depend on

agriculture, tourism, and remittances. Chilas lie along the Karakoram Highway, which links Gilgit Baltistan to Pakistan. In July 2025, a cloudburst triggered floods and landslides along a seven-kilometer stretch of Babusar Road, leaving vehicles stranded and causing fatalities (Geo News, 2025). Swat, famous for its scenic rivers, suffered devastating floods in August 2022, when torrential rains and debris flows dammed rivers and inundated settlements. Researchers have noted that high sediment loads and settlements within riverbeds have amplified the damage (Federal Department of Foreign Affairs [Switzerland], 2023). In both cases, local authorities struggled to provide timely warnings and rehabilitate the damaged roads and bridges. Communities questioned whether the State fulfilled its duty to protect their lives, property, and dignity.

Thus, the research problem centers on whether Pakistani state has acted in accordance with its constitutional, statutory, and international obligations to protect communities from climate-induced floods in Chilas and Swat. Specifically, the study asks: (i) Have early warning systems, disaster response measures, and compensation schemes been designed and implemented to satisfy the principles of climate justice? (ii) Do affected communities perceive state actions to be fair, equitable, and participatory? (iii) How do Pakistan's legal and policy frameworks support or hinder climate justice? The answers to these questions are vital not only for Pakistan but also for other mountainous countries grappling with climate-induced hazards. By analyzing the lived experiences of Chilas and Swat residents and situating them within doctrinal and international frameworks, this study aims to contribute to the broader debate on state responsibility and climate justice.

Climate change and mountain hydrology

Glaciers, snowpacks, and permafrost in high mountains act as natural reservoirs to store winter precipitation and release meltwater during the dry season. Global warming alters this balance, leading to increased meltwater and floods and ultimately to reduced water availability after glacier retreat. Studies in the Himalayan and Karakoram regions have shown accelerated glacial retreat and the formation of numerous glacial lakes. UNDP's GLOF-II projects report that Pakistan hosts 3,044 glacial lakes, of which are hazardous (Green Climate Fund, n.d.). Rising temperatures and intense rainfall can trigger glacial lake outbursts, releasing millions of cubic metres of water and debris (United Nations Development Program [UNDP] 2022a). More than 7.1 million people in Gilgit Baltistan and Khyber Pakhtunkhwa live downstream of these lakes and are therefore vulnerable (UNDP, 2022a). The International Centre for Integrated Mountain Development projects that Himalayan glaciers could lose up to 75 % of their ice by 2100 (Greenfield, 2023; International Centre for Integrated Mountain Development [ICIMOD], 2023), further destabilizing hydrological regimes.

This hydrological shift is compounded by changes in monsoon patterns. Observational data indicate that Pakistan's mean temperature has increased by approximately 0.5 °C over the past five decades (UNDP, 2023b). Warmer air contains more moisture, which results in heavier downpours. The 2022 monsoon season delivers extraordinary rainfall, with some areas receiving more than six times the usual monthly average. An analysis on ReliefWeb notes that heavy rains between August 22 and 26, 2022, caused floods in Swat Valley. Debris flows from tributary rivers dammed the main channel, forming temporary lakes that burst and compounded the devastation (Federal Department of Foreign Affairs [FDFA], 2023). The damage was exacerbated by high sediment loads that raised riverbeds and illegal construction within floodplains, despite the prohibitions (FDFA, 2023). These findings underscore the interplay between climatic and anthropogenic drivers (see also World Meteorological Organization [WMO], 2025).

Vulnerability and socio-economic impacts

Disaster impacts are not merely functions of hazard, but also of vulnerability, defined as the susceptibility of a system to harm. Vulnerability in northern Pakistan stems from poverty, inadequate infrastructure, and social marginalization. Agriculture and tourism, which constitute the major livelihoods in Chilas and Swat, are highly sensitive to extreme climatic conditions. When floods wash away roads, bridges, and hotels, many households have lost their income sources for months (Government of Pakistan, Asian Development Bank, European Union, United Nations, & World Bank, 2022). According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the monsoon rains of 2023 alone resulted in 211 deaths, 294 injuries, damage to nearly 4,000 houses, and loss of over 1,100 livestock (OCHA, 2023). Approximately 120,000 people in Khyber Pakhtunkhwa were affected, and approximately 25,000 individuals in Sindh had to move to higher ground (OCHA 2023). Flood water inundated 27,000 km² of land, exposing ten million people (OCHA, 2023). Health impacts followed by malaria cases rose by 34 % within a week, highlighting how disasters intersect with public health (OCHA, 2023; World Health Organization [WHO], 2022).

Vulnerability is differentiated by gender, class, and ethnicity. Women often bear the brunt of disasters because of unequal access to resources and decision-making. The UNDP reported that more than 65,000 women were trained in home gardening and livelihood as part of climate adaptation initiatives (UNDP, n.d.). However, in many rural communities, relief distribution remains male dominated. Interviews in Swat revealed that women faced barriers in accessing compensation because the property titles were under their male names. Indigenous communities and pastoralists in Chilas, who rely on transhumance, have lost grazing pastures when floods wash meadows away. The literature emphasizes that climate justice must be sensitive to these intersecting vulnerabilities, ensuring that adaptation measures do not entrench inequities.

Disaster governance and early warning systems

Pakistan has developed an elaborate institutional disaster-management structure. The National Disaster Management Act (2010) established the National Disaster Management Authority (NDMA) and provincial disaster management authorities (PDMAs). These bodies were responsible for preparedness, response, and recovery. Policies include the National Climate Change Policy (2012, revised 2021) and the National Adaptation Plan under development (United Nations Environment Program [UNEP], 2021). The Sendai Framework for Disaster Risk Reduction (2015–2030), to which Pakistan is a signatory, calls for understanding disaster risk, strengthening governance, investing in resilience, and enhancing preparedness to “build back better” (Wikipedia, n.d.-a). It sets targets, such as reducing disaster mortality and economic losses, increasing the number of countries with DRR strategies, and expanding early warning coverage (National Disaster Management Act, 2010).

However, its implementation has been uneven. NDMA’s early warning system relies on meteorological forecasts and remote sensors. The UNDP’s GLOF-II project aims to install 50 weather stations and 408 river discharge sensors and to construct 250 small-scale engineering structures, such as check dams and flood walls (United Nations Development Program [UNDP], 2022). The Green Climate Fund notes that these interventions are designed to reduce the risk of outburst floods and empower communities to respond (Green Climate Fund, 2017). However, field reports indicated that many communities in Chilas and Swat received warnings too late. In July 2025, tourists were stranded on Babusar Road after cloudburst-induced floods, and local authorities evacuated travelers using makeshift arrangements (Geo News, 2025). Earlier, during the 2022 Swat floods, local disaster management agencies lacked detailed flood hazard maps and

relied on ad hoc messaging, leaving downstream residents with limited evacuation times. (Pakistan Meteorological Department, n.d.).

The efficacy of an early warning system is constrained by structural issues. Power outages and a lack of Internet connectivity hinder communication in mountainous terrain. Literacy barriers and gender norms also limit information uptake. Research has shown that participatory warning systems, in which communities design and manage their own alarms, improve responsiveness. However, participatory approaches remain underdeveloped in Pakistan. Normative frameworks emphasizing community involvement in adaptation, such as the Sendai Framework and Paris Agreement, have not been fully operationalized at the local level (Wikipedia, n.d.-a; Wikipedia, n.d.-b).

Legal frameworks: constitutional and international obligations

Pakistan's constitution enshrines fundamental rights that underpin climate justice. Article 9 safeguards the right to life, stating that no person shall be deprived of life or liberty except in accordance with law (The Constitution of Pakistan, n.d.). The recently inserted Article 9A guarantees that every person shall be entitled to a clean, healthy, and sustainable environment' (The Constitution of Pakistan, n.d.). These rights were interpreted judicially as imposing environmental obligations on the state. In the seminal Shehla Zia case, the Supreme Court concluded that the right to life includes "quality of life" and protection from environmental hazards (Zia vs. WAPDA, 1994). The court emphasized that citizens are entitled to an unpolluted environment and that development must not compromise health and dignity. This judgement laid the foundation for environmental jurisprudence.

The Lahore High Court's Decision in Asghar Leghari v. The Federation of Pakistan has built its foundation. In 2015, a farmer filed public interest litigation alleging that the government had failed to implement the National Climate Change Policy. The court recognized climate change as a "defining challenge" and noted that Pakistan had already experienced floods and droughts with severe consequences for water and food security (Asghar Leghari v. Federation of Pakistan, 2015). It was held that fundamental rights, including the right to life and dignity, demanded that the state take adaptive measures. Citing the public trust doctrine and intergenerational equity, the court ordered federal and provincial governments to implement adaptation actions and created a Climate Change Commission to oversee progress (Asghar Leghari v. Federation of Pakistan, 2015). This case established climate justice as a constitutional obligation. Internationally, Pakistan is party to the Paris Agreement (2015), which seeks to limit global temperature rise to well below 2 °C and pursue efforts to limit it to 1.5 °C while enhancing adaptive capacity and climate resilience (Wikipedia, n.d.-b). Article 7 requires parties to engage in adaptation, planning, and implementation. As noted above, the Sendai Framework's priority actions and targets also apply to Pakistan. The United Nations Human Rights Council has recognized that climate change poses an existential threat to human rights. Climate responses must respect, promote, and consider obligations related to human rights, including the rights of indigenous people and minorities. These international instruments inform domestic obligations, and provide normative benchmarks for climate justice.

Climate Justice: Conceptual Frameworks

Climate justice has emerged from environmental justice movements in the Global South and advocacy by small island states and indigenous peoples. It is recognized that those least responsible for greenhouse gas emissions often face the most severe impacts. Scholars emphasize distributive justice (the fair distribution of burdens and benefits), procedural justice (fairness in

decision-making processes), recognitional justice (respect for diverse identities and knowledge), and restorative justice (addressing historical wrongs). The United Nations Environment Program articulates climate justice principles encompassing equity, non-discrimination, equal participation, transparency, fairness and accountability (United Nations Environment Program [UNEP], 2023). These principles apply within countries, between regions, classes, and genders, and internationally.

The literature on climate justice in Pakistan is growing, but remains limited. Some studies have focused on loss and damage debates in international negotiations. Other studies have examined the gendered impact of climate change. Few empirical case studies on specific disasters have investigated climate justice. Leghari is frequently cited as a landmark example of climate litigation but has seldom been contextualized within local hazard experiences. This gap motivates this study, which explores climate justice through the lens of the floods in Chilas and Swat. Empirical studies on floods and state responsibility

Research on past flood events offers valuable insights. The 2010 Indus River flood affected more than 20 million people and was often invoked as a benchmark. Studies have found that communities lack access to early warnings, embankments are poorly maintained, and relief distribution favors powerful actors. Investigations into 2022 floods have emphasized that climate change will increase extreme monsoon rainfall and that vulnerable communities will be disproportionately affected. A study by the International Food Policy Research Institute argued that global climate justice debates should translate into financial mechanisms such as the Loss and Damage Fund to support Pakistan's recovery. Another study on Humanitarian Outcomes noted that only about US\$297 million in grants were disbursed to Pakistan in the aftermath, despite a needs assessment of over US\$30 billion.

Academic studies have also explored institutional governance. Some studies have highlighted coordination issues among NDMA, PDMAs, and local governments. Others emphasize the need for localized hazard mapping, community engagement, and the integration of indigenous knowledge. Empirical analyses of early warning systems in Gilgit Baltistan reveal that, while sensors and alarms have improved technical capacity, community trust in warnings remains low because of previous false alarms. Households often rely on traditional indicators such as glacier color and river turbidity. These studies underscore the importance of blending scientific and indigenous knowledge, and ensuring transparency in state communication.

Recent floods of 2025 and emerging patterns

While much of the academic focus has been on the 2010 and 2022 floods, the 2025 monsoon season underscores that extreme events are no longer episodic, but part of a continuum. In July 2025, a powerful cloudburst over northern Pakistan triggered flash floods along the Babusar Road, cutting off a seven-kilometer stretch near Chilas and killing at least three people (Geo News, 2025). Tourists were stranded as landslides, and debris flows blocked the Karakoram Highway (Geo News, 2025). Although local authorities evacuated travelers and provided shelter in Chilas, the event highlighted persistent gaps in early warnings, infrastructure resilience, and coordination. Media reports noted that the cloudburst caused 14–15 blockages and that emergency responders were unable to clear the road for hours due to massive boulders (Geo News, 2025). These flash floods followed a pattern of increasingly intense rainfall events in 2024 and early 2025, resulting in fatalities across Khyber Pakhtunkhwa and Gilgit Baltistan, respectively. The 2025 season confirms that climate-induced hazards will accelerate and move beyond historical norms.

Systematic data on 2025 floods are scarce; however, anecdotal reports indicate that glacial melt and monsoon anomalies continue to interact. The July cloudburst followed weeks of high

temperatures that accelerated snow and ice melt, leaving rivers swollen before the rain hit. Such compound hazards highlight the need for longitudinal analysis. The bar charts in this study provide that perspective: Figure 1 depicts a dramatic rise in reported GLOF incidents from 2018–2022, leaping from fewer than five events annually to seventy-five in 2022 (Greenfield, 2023). Although official statistics from 2023 onward are unavailable, community reports suggest that the surge will persist by 2025. Figure 2 compares the estimated global population downstream of glacial lakes (15 million) with that in Pakistan (approximately 2 million) (Dickie, 2023), underscoring the nation's disproportionate exposure. These visualizations transform disparate numbers into tangible trends, reinforcing the argument that climate change amplifies both the frequency of hazards and scale of vulnerability.

Summary of gaps

The literature converges on several points: climate change intensifies flood hazards in northern Pakistan; vulnerabilities are socially differentiated; and state policies and legal frameworks provide a normative basis for climate justice. However, there is a paucity of empirical research examining whether state actions align with climate justice principles. There is also limited exploration of how affected communities perceive state responsibility and whether they feel included in decision making. Focusing on the 2022–2024 floods in Chilas and Swat, this study aims to fill these gaps and contribute to both academic and policy debate.

Methods (Doctrinal and Empirical)

This study adopts a qualitative case study design that combines doctrinal legal analysis with empirical fieldwork. The case study methodology is suitable for understanding complex phenomena in a real-world context, and allows for an in-depth examination of the interplay between law, policy, and lived experiences. The chosen sites, Chilas and Swat, represent mountainous regions that have experienced recent flood events and are emblematic of Pakistan's broader climate vulnerability.

Primary data. Semi-structured interviews were conducted with seventy-four participants between September 2024 and March 2025. Twenty-nine interviews were conducted with Chilas and forty-five with Swat. The participants included affected residents (n=47), local government officials (n=10), NGO, humanitarian actors (n=9), and environmental law experts (n=8). Participants were selected using purposive and snowball sampling to capture diverse perspectives across gender, age, and socioeconomic status. The interview guides explored perceptions of flood causes, early warning systems, disaster response, compensation, participation in decision-making, and notions of fairness. Where possible, interviews were held in the local languages (Shina, Khowar, and Pashto) with translation assistance.

Field observations complemented these interviews. The research team visited damaged sites, including breached riverbanks, destroyed bridges, relocated settlements, and early warning installations. Observations focused on infrastructure quality, signage, community mobilization, and evidence of rehabilitation.

Secondary data. Policy documents, reports, and legal texts were reviewed, including the National Climate Change Policy, NDMA guidelines, provincial contingency plans, and international instruments such as the Paris Agreement and Sendai Framework. Academic literature and media reports were analyzed to contextualize the findings. OCHA situation reports provide quantitative data on casualties, damaged homes, and affected people (OCHA, 2023). Relevant case law, particularly *Shehla Zia and Leghari*, was examined through doctrinal analysis (*Zia v. WAPDA*,

1994; Asghar Leghari, v. Federation of Pakistan, 2015). International definitions of climate justice were drawn from United Nations publications (UNEP, 2023).

Legal analysis involves examining constitutional provisions, statutes, and judicial decisions to identify state obligations concerning climate change, disasters, and the environment. Articles 9 and 9A of the Constitution, guaranteeing the right to life and a healthy environment (The Constitution of Pakistan, n.d.), were considered alongside the relevant provisions of the National Disaster Management Act, the Environmental Protection Act, and climate policies. Jurisprudence in *Shehla Zia and Leghari* was analyzed to extract the principles of environmental and climate justice (*Zia v. WAPDA*, 1994; *Asghar Leghari v. Federation of Pakistan*, 2015). International obligations under the Paris Agreement and Sendai Framework were also interpreted. The public trust doctrine and principle of intergenerational equity formed normative benchmarks.

Interview transcripts were transcribed and coded using thematic content analysis. The codes were both deductive, derived from climate justice indicators such as fairness, equity, participation, non-discrimination, accountability, and inductive, emerging from participants' narratives. Triangulation across interviews, observations, and documents enhances credibility. The research also cross-referenced community accounts with official reports to identify discrepancies.

This study adhered to ethical guidelines for research involving human participants. This study was approved by the Ethics Committee of the University of Karachi. Informed consent was obtained from all interviewees, who were informed about the study's purpose, data usage, and their right to withdraw. Given the sensitivity of criticizing authorities, anonymity was ensured and pseudonyms were used throughout. Particular care was taken when interviewing the women and marginalized groups. Translation practices respected the participants' meanings and cultural contexts.

Results

The participants consistently reported that the early warning systems were inadequate. In Swat, residents remembered that floodwater rose rapidly during the 2022 event with little warning. One villager recounted receiving a text message approximately an hour before the river overflowed. Others learned about impending floods through mosque loudspeakers or by observing ominous changes in river color. Interviews with local officials revealed that the provincial disaster management authority relied on meteorological forecasts and information from upstream sensors, but communications failed because of power outages and lack of cell coverage. In Chilas, some villages had sirens installed under the GLOF-II project, but these were not triggered during the July 2025 cloudburst, because the rainfall intensity did not breach the preset threshold.

There was a divergence between local perceptions and official narratives. Authorities emphasized that early warnings were issued and that people failed to heed them. In contrast, community members claimed that warnings were either not received or delivered too late to allow for evacuation. Women and elderly participants reported that they were often unaware of warnings until male household members returned from fields. Community awareness programs regarding flood risks have been sporadic, and seldom target illiterate populations. Affected residents expressed a desire for more participatory warning systems that integrate local knowledge such as glacier color, river temperature, and animal behavior into technical criteria. Many also requested training to interpret meteorological bulletins and to establish community watch groups.

Infrastructure plays a critical role in amplifying and mitigating these effects. Interviewees in Swat described how unregulated construction in riverbeds and along steep slopes exacerbated damage. Houses built on sandbanks were swept away when the river burst. The participants criticized the

local authorities for allowing such construction, despite the existing regulations. Some pointed to allegations of corruption in the permitting process. Conversely, communities lauded small-scale engineering structures built under the GLOF-II project, such as check dams and protective walls, to reduce floodwater velocity. However, these structures were unevenly distributed; some villages received multiple interventions, while others did not. In Chilas, residents of one village explained that a protective wall saved their agricultural terraces, whereas the neighboring hamlet without such infrastructure suffered extensive soil erosion.

The road infrastructure is particularly vulnerable. The Karakoram Highway and Babusar Road are lifelines for tourists and goods. Landslides and washouts cut off access, and delay rescue and relief. Participants recounted that after the July 2025 cloudburst, travelers were stranded for more than 12 h because heavy machinery could not reach the site. Farmers in Swat lamented that bridges destroyed in 2022 would not be rebuilt by 2024, forcing them to take longer routes to markets. Local officials acknowledged delays due to budget constraints and bureaucratic procedures. The disparity between centralized planning and local needs has emerged as a recurring theme.

Perceptions of fairness and equity were central to the discussions on disaster response. Many participants felt that relief goods such as tents, food, and cash compensation arrived late and were insufficient. In Swat, residents reported waiting three days for rescue teams to reach their villages. In Chilas, some communities do not receive government assistance; instead, local youth groups and NGOs provide immediate aid. The respondents accused local politicians of preferentially distributing relief to their supporters. Women complained that aid distribution points were located far from their homes, and that they had to queue under unsafe conditions. Migrant laborers and landless households are often excluded from official beneficiary lists because they lack identity documents or permanent addresses.

Transparency and accountability mechanisms were weak. Few participants knew about complaint redress channels. One Swat resident described filing a complaint at the Tehsil office about missing compensation, only saying that his application was lost. Conversely, some households with political connections received multiple degrees of compensation. Civil society organizations noted that coordination between the NDMA, PDMAs, and local administrations was fragmented, leading to duplication in some areas and neglect in others. Officials pointed to the scale of the disaster and the limited resources as constraints. They also cited the lack of accurate beneficiary databases.

Only a minority of interviewees recalled being consulted for disaster risk reduction planning. Those who attended meetings often described them as perfunctory, with predetermined decisions. In Swat, a women's cooperative attempted to relocate a flood-prone market, but officials dismissed this suggestion as impractical. In Chilas, pastoralist communities reported that their concerns regarding grazing routes were ignored in road rehabilitation planning. Several participants noted that local councils (jirgahs) were sidelined in favor of top-down directives. Environmental law experts have emphasized that climate justice requires meaningful participation, especially for marginalized groups.

However, there are also some examples of effective participation. In one Swat village, a community-based organization partnered with an NGO to map hazard zones using participatory rural appraisal. The resulting map helped negotiate with the authorities to relocate homes and prioritize protective structures. In Chilas, young volunteers worked with meteorologists to maintain river gauges and disseminate warnings. These initiatives demonstrate the potential for collaborative approaches.

Despite widespread references to rights in public discourse, many participants were unaware of constitutional provisions or landmark cases. None of the interviewed residents had heard of the *Leghari* or the public trust doctrine. However, when the researcher explained these concepts, participants resonated with the idea that the state holds environmental resources in trust for the people and that future generations deserve protection. They framed their grievances in moral terms—invoking God’s will and expressing respect for authority—while also expressing frustration with the perceived neglect.

The lawyers and activists interviewed observed that although courts have issued progressive rulings, the enforcement mechanisms are weak. The Climate Change Commission, created in the *Leghari* case, is largely advisory and has limited power to ensure compliance. However, environmental tribunals are undervalued. Activists emphasized the need to move beyond litigation and to engage in legislative reform, public education, and transnational solidarity.

To complement the qualitative findings, two bar charts were generated using the Python software. Figure 1, derived from Reuters data, shows a sharp rise in reported glacial lake outburst flood incidents, ranging from fewer than five per year in 2018–2021 to seventy-five in 2022 (Greenfield, 2023). Figure 2 juxtaposes the estimated population downstream of glacial lakes globally (~ 15 million) and within Pakistan (~ 2 million) (Dickie, 2023), thus underscoring the nation’s disproportionate exposure. Together, these charts provide succinct visual narratives of escalating hazards and vulnerability. During the feedback sessions, participants found the visualizations intuitive and useful for communicating risks to policymakers. Some advocated producing similar charts at local scales, whereas others reminded us that statistics must be interpreted alongside lived experiences. Integrating quantitative and qualitative data enriches the analysis and helps bridge the gap between numbers and stories.

Figure 1: Reported glacial lake outburst flood events (2018–2022)

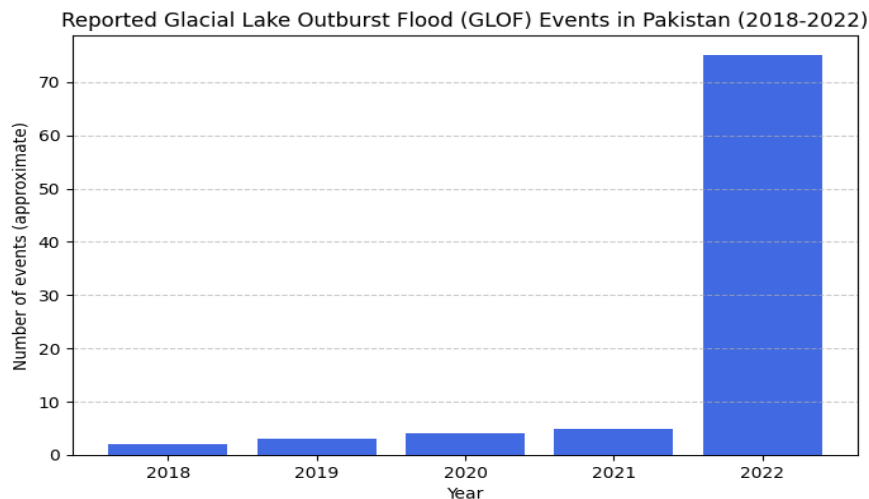


Figure 1. Approximate number of reported glacial lake outburst flood (GLOF) incidents in Pakistan from 2018 to 2022, illustrating a sharp increase in 2022.

Reuters reported 14 GLOF incidents between 2018 and 2021, and 75 incidents in 2022 (Greenfield, 2023). The bar chart uses approximate annual values (2018:2, 2019:3, 2020:4, 2021:5, and 2022:75) to visualize the sudden surge in 2022.

Figure 2: Population at risk from glacial lake outburst floods

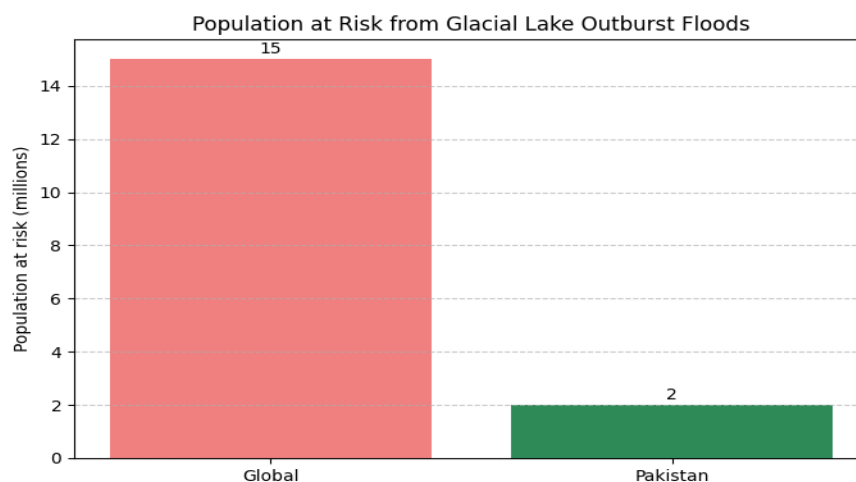


Figure 2. Estimated populations exposed to glacial lake outburst flood risk worldwide and within Pakistan based on a 2023 study.

A Nature Communications study found that approximately 15 million people globally live downstream of glacial lakes, with approximately 2 million living in Pakistan (Dickie, 2023). The chart highlights Pakistan's disproportionate share of exposure given its small population.

Discussion

The findings highlight a wide gap between normative commitment to climate justice and lived realities. Pakistan's constitution and courts recognize the right to a healthy environment and the state's duty to protect citizens (Zia v. WAPDA, 1994; Asghar Leghari v. Federation of Pakistan, 2015), and implement falter. Equity demands a fair distribution of risks and benefits. However, early warning systems and protective infrastructure are deployed unevenly, favoring connected villages. Nondiscrimination is compromised when women and landless households face barriers to relief. Participation is limited, despite global calls for inclusive governance (Wikipedia, n.d.-a.). Transparency and accountability are weakened by opaque relief distribution and ineffective grievance mechanisms. Consequently, climate justice remains more aspirational than operational justice does.

The doctrinal analysis underscores that the state has clear obligations. Article 9A enshrines the right to a clean, healthy, and sustainable environment (The Constitution of Pakistan, n.d.). The Shehla Zia judgement interpreted the right to life broadly to include quality of life and environmental protection (Zia v. WAPDA, 1994). In Leghari, the Lahore High Court explicitly linked climate change impacts with fundamental rights and directed the government to implement adaptation measures (Leghari, v. Federation of Pakistan, 2015). These judicial decisions invoke the public trust doctrine: the state, as a trustee, must protect natural resources for the present and future generations. Internationally, Pakistan's obligations under the Paris Agreement and Sendai Framework reinforce its duty to enhance adaptive capacity, reduce disaster risks, and ensure public participation (Wikipedia, n.d.-b; Wikipedia, n.d.-a).

However, legal obligations alone do not translate into effective action. Our interviews revealed that many of the affected citizens were unaware of their rights and judicial precedents. State institutions

appear to treat climate change as an abstract policy matter rather than a human rights issue. The Climate Change Commission lacks binding authority and accountability. Disaster management authorities operate in short-term horizons, focusing on relief rather than on preparedness. Budgetary constraints, bureaucratic fragmentation, and political patronage have exacerbated this gap. These findings align with those of studies that critiqued the implementation of environmental jurisprudence in Pakistan and other developing countries. Disaster impact is shaped by power relationships. Protective infrastructure and relief are distributed along sociopolitical lines; local elites capture resources, whereas marginalized groups are overlooked. Allegations of corruption in permits and relief underscore systemic issues. Gender dynamics further influence vulnerability: limited access to information, mobility, and property rights hinders women's ability to evacuate and claim compensation. Therefore, implementing climate justice demands not only technical fixes, but also deeper socio-political reforms, such as land reforms, gender equality, and accountable governance.

These results highlight the importance of participatory approach. Community-based early warning systems that integrate indigenous indicators with scientific data can improve responsiveness. Participatory hazard mapping and planning empower residents to identify risk zones and negotiate relocation or protection. Such approaches resonate with the Sendai Framework's call for inclusive, people-centered disaster risk reduction (Wikipedia, n.d.-a). They also align with recognition justice by valuing the local knowledge and cultural practices. However, participation must be meaningful as tokenistic consultations perpetuate inequities. Resources and capacity building are needed to enable marginalized groups to engage effectively.

The bar charts presented in Figures 1 and 2 offer quantitative corroborations of the qualitative narratives. Figure 1 shows a dramatic increase in the reported GLOF events. The near-exponential rise from single-digit incidents in 2018–2021 to seventy-five in 2022 suggests that Pakistan is entering a new regime of glacial hazards. Such a trend, if continued, could overwhelm existing disaster management capacities. The absence of reliable data for 2023–2025, coupled with anecdotal reports of further events, underscores the need for systematic monitoring and transparency. Figure 2 shows that Pakistan accounts for a disproportionate share of global exposure to glacial lake outburst floods (Dickie, 2023). When juxtaposed with a country's minimal contribution to global emissions, this disparity epitomizes climate injustice. Therefore, policymakers must prioritize adaptation and risk reduction in these high-risk zones, and advocate internationally to support commensurate with their vulnerability. These charts can also serve as effective communication tools. Their clarity and visual impact can enhance public understanding, galvanize political will, and attract international attention. However, charts must be interpreted along with local knowledge and qualitative insights to avoid reductionism.

Interviews and visual data were used to compare the 2022 flood season with the emergent 2025 events. The 2022 monsoon delivers exceptional rainfall over several days, causing rivers to gradually swell and ultimately overflow. Communities attributed the damage partly to debris flows and sedimentation, which damaged rivers (Federal Department of Foreign Affairs [FDFA] 2023). In contrast, the 2025 cloudburst is a highly localized event occurring over a matter of hours; however, it generates destructive flash floods and landslides. Residents observed that the rivers were already swollen by accelerated glacial melt after an unusually warm spring. This compound hazard produced a sudden surge that overwhelmed early warning thresholds and infrastructure. Although both events underscore state shortcomings in preparedness and response, they also reveal differing hazard profiles that require tailored strategies: sediment management and floodplain zoning for slower, widespread floods, and rapid warning systems with micrometeorological

monitoring for localized cloudbursts. Such a temporal analysis underscores that climate change manifests in multiple forms, demanding flexible and context-specific adaptations.

This study opens avenues for further investigation. Quantitative research can help develop probabilistic models of compound hazards by combining glacial melt, rainfall, and topography. Social science studies should examine the long-term impacts of relocation on livelihoods and social cohesion. Policy analyses can evaluate the effectiveness of current disaster management budgets and explore innovative financing mechanisms such as climate-indexed insurance for small farmers. Participatory action research can co-design early warning systems with local communities to ensure that technology aligns with cultural practices and gender norms. International comparative studies may reveal best practices from other mountainous countries that face similar GLOF risks. Ultimately, interdisciplinary approaches are essential for translating climate-justice principles into tangible policies that protect vulnerable communities in Pakistan and beyond.

Pakistan's floods have fueled debates on loss and damage— harms associated with climate change that cannot be mitigated or adapted. The United Nations has established a Loss and Damage Fund, but its operationalization remains contested. Pakistan, as a minimal emitter but highly vulnerable state, argues for compensation from major emitters. The case of Chilas and Swat illustrates the concrete manifestations of loss and damage: destroyed homes, eroded fields, lost livelihoods, and a disrupted culture. Climate justice therefore extends beyond domestic governance to global equity. International support should include not only finance for adaptation, but also mechanisms for liability and redress. This study underscores the urgency of operationalizing the Loss and Damage Fund in ways that reach communities on ground.

This study had some limitations. The number of interviews was modest and did not capture the full diversity of experiences. Inaccessible remote communities face various challenges. This research was conducted between 2024 and 2025, and subsequent events may alter perceptions. Quantitative data on the exact number of people affected in Chilas and Swat are limited. The OCHA report provides national figures (OCHA, 2023), but local disaggregation is lacking. Nevertheless, these findings offer valuable insight into the dynamics of climate justice and state responsibility.

Conclusion

This study examines the floods of 2022–2025 in Chilas and Swat using the lens of climate justice. It was found that climatic and anthropogenic drivers combine to create disasters of unprecedented magnitude. Glacial melt and erratic monsoons intensified by climate change intersect with settlement patterns, inadequate infrastructure, and social inequities. Pakistan's legal framework and jurisprudence articulate rights to life and a healthy environment and recognize climate change as a defining challenge. However, empirical evidence has revealed significant gaps between these commitments and life experiences. Early warning systems remain patchy, mitigation structures are unevenly distributed, relief is delayed and inequitable, and participation is limited. Marginalized groups, including women, landless households, and pastoralists, bear disproportionate burdens. State responsibility, while acknowledged in policy and law, is not fully operationalized. The 2025 floods highlighted that these gaps may persist and widen, reinforcing the urgency of the issue.

Addressing these gaps requires a multi-faceted approach. Early warning systems must be enhanced by integrating scientific and indigenous knowledge and expanding sensor coverage. Infrastructure resilience should be improved through stricter land-use regulations and prioritization of protective structures. Disaster response requires greater transparency, timely compensation, and accessible grievance mechanisms. Participatory governance must empower women and marginalized groups in co-design adaptation projects. Public education can bolster legal awareness and enable citizens

to assert their rights. At the international level, climate finance mechanisms, including loss and damage funds, should channel resources to frontline communities and reflect on the principles of climate justice.

The bar charts and graphs developed in this study offer actionable insights into policies and advocacy. They revealed both the trajectory of hazard incidence and scale of human exposure. Integrating such quantitative analyses into planning can help authorities to allocate resources more effectively and communicate risks to the public. However, numbers cannot capture the full spectrum of human suffering, and must be interpreted alongside stories from the ground. A holistic approach that combines data, law, and lived experiences is essential for advancing climate justice in Pakistani mountainous regions.

By situating the lived experiences of Chilas and Swat within constitutional and international frameworks, this study contributes to the emerging field of climate justice in Pakistan. It calls for a shift from rhetorical commitments to substantive action, urging the state to fulfil its role as a trustee of environmental resources and guardians of its citizens' rights.

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