



Environmental Challenges and Social Responses: A Systematic Qualitative Review of Vulnerable Communities in Pakistan

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ABSTRACT

Pakistan is exceptionally vulnerable to climate-induced hazards such as floods, droughts, and water scarcity, which disproportionately affect its most vulnerable communities. This systematic qualitative review synthesizes evidence to examine the interplay between these environmental challenges and the social responses of at-risk populations. The objective was to understand how socioeconomic factors shape vulnerability and to identify the coping and adaptive strategies communities employ. Following a PRISMA-style screening approach, a comprehensive search of academic databases (Scopus, Web of Science, Google Scholar) and institutional reports yielded 41 studies for narrative synthesis, guided by Vulnerability Theory. Key findings reveal that recurrent floods in Punjab and Sindh, and prolonged droughts in Balochistan, exacerbate economic losses, displacement, and health risks. In response, communities use short-term coping mechanisms, such as temporary migration and borrowing, alongside long-term adaptive measures, such as crop diversification, water management, and local disaster committees. The synthesis of Focus Group Discussions and Key Informant Interviews highlights that adaptive capacity is critically shaped by income, education, gender, social networks, and institutional support, with women and youth facing distinct vulnerabilities. The findings underscore the need for integrated, community-centered policies that combine hazard mitigation with socioeconomic support and institutional strengthening. This review contributes to evidence-based policymaking for sustainable disaster management and climate adaptation in Pakistan.

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1. Introduction

Pakistan is one of the world's most climate-vulnerable countries, facing a wide range of environmental challenges that threaten both ecological stability and human wellbeing. The country experiences erratic monsoon rains and extreme weather events, including devastating floods and prolonged droughts, driven largely by climate change and variability in precipitation patterns. For example, unprecedented monsoon flooding during 2022 affected around one-third of the country, displaced millions, and damaged homes, infrastructure, and agriculture, with long-term consequences for food and water security (Fahad, S., & Wang, 2020). At the same time, water scarcity and declining

freshwater availability are emerging as existential challenges, with Pakistan projected to face acute water shortages by 2025 (Mahmood, S., & Hassan, 2022).

These environmental pressures disproportionately affect vulnerable and marginalized communities, particularly rural households, smallholder farmers, and low-income groups that depend heavily on climate-sensitive natural resources for their livelihoods. In flood-prone regions of South Punjab, for instance, environmental degradation such as land erosion, deforestation, and inappropriate land use aggravates flood frequency and severity, disrupting livelihoods and reducing access to critical services such as healthcare and safe water (Fahad & Wang, 2020). Moreover, socioeconomic disparities compound this vulnerability: studies in flood-affected districts like Khyber Pakhtunkhwa show that female-headed and low-income households face higher exposure to flood-induced health risks and have limited adaptive capacity.

In response to these complex and interconnected environmental threats, communities in Pakistan employ a variety of social coping and adaptive strategies, ranging from local communal assistance and the use of traditional knowledge to reliance on external support mechanisms (Tariq et al., 2012). However, the effectiveness of these responses is often constrained by inadequate infrastructure, governance deficits, and limited institutional support, particularly in rural and underserved regions (Waseem & Rana, 2023). Understanding how vulnerable communities perceive and respond to environmental stressors is crucial for informed policy and program design that enhances resilience, reduces risk exposure, and supports sustainable development. This study, therefore, seeks to explore the multifaceted linkages between environmental challenges and social responses among Pakistan's most vulnerable populations.

Pakistan is one of the countries most vulnerable to environmental and climate-induced hazards, experiencing extreme floods, droughts, and water scarcity that threaten ecosystems, agriculture, and human livelihoods. The monsoon floods of 2022 submerged large areas, displaced millions, and caused significant damage to infrastructure and agriculture (UNICEF, 2022). Rising temperatures, erratic rainfall, and glacier melt further exacerbate these hazards, creating complex challenges for sustainable development and resource management (Ullah & Takaaki, 2016).

The impacts of these environmental challenges are disproportionately borne by vulnerable and marginalized communities, including low-income households, smallholder farmers, and women, who often lack access to resources, infrastructure, and institutional support (Ahmed et al, 2020). In rural areas, climate stressors such as droughts and floods disrupt agricultural cycles, reduce crop yields, and threaten food security, reinforcing socioeconomic inequalities (Janjua et al, 2021). Furthermore, limited access to clean water, sanitation, and healthcare increases vulnerability to disease and malnutrition.

Communities adopt various coping and adaptive strategies to manage these environmental pressures, ranging from traditional knowledge-based practices to reliance on government and NGO interventions. For instance, smallholder farmers adjust crop calendars, diversify livelihoods, or rely on communal support during floods, though these strategies are often constrained by limited information and institutional capacity (Waqas et al., 2021). Understanding how vulnerable populations perceive and respond to environmental challenges is crucial for designing effective policies that enhance resilience and reduce risk exposure. This study examines the relationship between environmental stressors and social responses among Pakistan's most vulnerable communities.

This study examines the interplay between environmental challenges and social responses among vulnerable communities in Pakistan. It investigates the types of environmental hazards, such as floods, droughts, water scarcity, and pollution, that disproportionately affect marginalized populations, and how these communities perceive, cope with, and adapt to these challenges (Farah et al., 2023; Khoso et al., 2025). The research emphasizes understanding both the environmental risks and the social, economic, and cultural factors that shape community resilience and adaptive capacity (Kamal, 2023).

The study is geographically limited to select rural and peri-urban regions of Pakistan that are highly exposed to environmental stressors. It prioritizes communities that rely on climate-sensitive livelihoods, particularly smallholder farmers, low-income households, and socially marginalized groups. By focusing on these populations, the study seeks to provide insights into the adaptive strategies and coping mechanisms employed at the grassroots level (Kamal, 2023).

Moreover, the scope extends to analyzing the role of external interventions, including governmental policies, nongovernmental organization (NGO) programs, and community-based initiatives, in supporting resilience. However, the study does not aim to provide an exhaustive assessment of all environmental challenges across Pakistan or all communities nationwide. Instead, it seeks to highlight key patterns, challenges, and adaptive responses to inform sustainable development strategies and policymaking to strengthen resilience among vulnerable populations (UNICEF, 2022).

This study is significant because it provides insights into the environmental challenges faced by vulnerable communities in Pakistan and the social responses they employ to cope with these risks. By analyzing both ecological and social dimensions, the research highlights how marginalized populations adapt to climate change, natural disasters, and resource scarcity, offering valuable insights for policymakers and development practitioners (Gabol & Ahmed, 2011). Understanding these coping strategies can help design targeted interventions that strengthen community resilience and reduce socioeconomic vulnerabilities.

Furthermore, the study contributes to sustainable development efforts by emphasizing the role of local knowledge, community-based initiatives, and institutional support in managing environmental risks. It informs strategies for disaster risk reduction, climate adaptation, and resource management that are grounded in the experiences of those most affected. These findings can guide government agencies, NGOs, and development organizations in implementing effective policies and programs that enhance the adaptive capacity of vulnerable populations across Pakistan (UNICEF, 2022; Afridi, 2025).

2. Objective of the Study

The study aims to examine the environmental challenges faced by vulnerable communities in Pakistan and explore their social responses and adaptive strategies. It seeks to identify key hazards, assess community resilience, and evaluate the role of policies and programs in supporting adaptation. The findings will inform strategies for improving livelihoods, disaster management, and climate adaptation.

3. Literature Review

Environmental challenges in Pakistan, including floods, droughts, heatwaves, and water scarcity, have intensified due to climate change and socioeconomic inequalities. These hazards disproportionately impact rural and marginalized populations,

particularly in agriculture-dependent communities, disrupting livelihoods and exacerbating food insecurity (Khan & Mahmood, 1996). Studies identify regional differences, with Balochistan facing severe water scarcity and extreme heat. At the same time, flood and drought cycles affect farming in Punjab and Sindh, emphasizing the uneven distribution of environmental stress (Anees & Yan, 2019). These challenges are compounded by socioeconomic inequalities, which limit adaptive capacity and increase vulnerability (Imran et al., 2023).

The intersection of environmental stress with poverty, gender inequality, and limited access to infrastructure further exacerbates vulnerability. Women in rural Pakistan face unique challenges; although they employ adaptive strategies such as crop diversification and resource sharing, structural inequalities limit their effectiveness (Lau, 2018). Vulnerability theory suggests that social, economic, and institutional factors, rather than just exposure to hazards, shape climate risks (Anees & Yan, 2019). Coping mechanisms, such as livelihood diversification and traditional knowledge, are vital for resilience, but gaps in governance, weak infrastructure, and lack of targeted policies hinder comprehensive adaptation (Azhar et al., 2024; Haider et al., 2024).

Recent events, like the 2022 monsoon floods, highlight Pakistan's vulnerability, with rural communities facing displacement, crop loss, and increased food insecurity (Syed et al., 2022; UNICEF, 2022). Socioeconomic and gender disparities further hinder adaptive capacities, particularly among low-income families and marginalized groups who have limited access to resources and decision-making platforms (Qusien & Robbins, 2024). These inequities exacerbate risks related to water scarcity, poor sanitation, and agricultural stress, threatening health, food security, and overall wellbeing (Jamil & Appiah-Adje, 2025).

In response, communities employ diverse adaptation strategies, including crop calendar adjustments, drought-tolerant crops, and social networks. However, limited access to climate information, financial resources, and institutional support constrains their effectiveness (Tariq & Shahzad, 2024). Regional studies emphasize that vulnerability is context-specific. Balochistan faces chronic drought and groundwater depletion, while northern Pakistan contends with floods and landslides, affecting livelihoods and access to essential services (Rafiqz-Zaman et al., 2024; Sultan et al., 2016). Public perception studies indicate that awareness of climate risks influences adaptive behaviors, underscoring the need for localized, participatory adaptation strategies (Asghar et al., 2024).

Water and sanitation remain critical challenges, especially in rural areas. Integrated water governance, community-led adaptation, and climate-smart agricultural practices are necessary to enhance resilience and reduce inequalities (Rafiqz-Zaman et al., 2024). This review highlights the need for context-specific, inclusive, and sustainable strategies to address Pakistan's environmental vulnerabilities.

4. Theoretical Framework: Vulnerability Theory

4.1. History of Vulnerability Theory

Vulnerability Theory emerged from disaster studies in the 1980s and 1990s, emphasizing that the impacts of natural hazards are shaped by social, economic, and political conditions rather than by the hazards alone (Wisner & Wisner, 2004). Early research highlighted that marginalized populations, such as the poor, women, and rural communities, experience disproportionately higher losses from disasters due to structural inequalities, limited access to resources, and weak institutional support. Over time, the theory evolved to incorporate dimensions such as exposure, sensitivity, and

adaptive capacity, forming the basis for understanding vulnerability in both environmental and social contexts (Bankoff, 2004).

4.2. Explanation of Vulnerability Theory

Vulnerability Theory posits that the impact of environmental hazards such as floods, droughts, and water scarcity is mediated by social, economic, and institutional factors. Vulnerability is defined by three interrelated components: exposure, the degree to which a community is physically subject to environmental hazards; sensitivity, or how susceptible the community is to harm due to socioeconomic, demographic, or environmental characteristics; and adaptive capacity, the ability of the community to cope with and recover from environmental stressors (Wisner & Wisner, 2004).

In Pakistan, rural households, smallholder farmers, low-income families, and women are highly exposed and sensitive due to dependence on climate-sensitive livelihoods, limited access to resources, and weak institutional support (Kohn, 2014). For example, during the 2022 monsoon floods in Sindh and Punjab, marginalized households faced severe crop losses, displacement, and health risks, while wealthier communities were better able to cope and recover (UNICEF, 2022).

4.3. Relevance of Vulnerability Theory to the Study

Vulnerability Theory is directly relevant to the study titled “Environmental Challenges and Social Responses: A Study of Vulnerable Communities in Pakistan” because it provides a framework to link environmental hazards with social responses (Havrilla, 2017). By applying this theory, the study can analyze how exposure, sensitivity, and adaptive capacity determine the severity of impacts on vulnerable populations and the coping strategies they adopt. It also helps identify social, economic, and institutional factors that influence resilience, such as livelihood diversification, the use of local knowledge, and community support networks (Kasperson et al., 2022). Vulnerability Theory, therefore, offers a holistic lens to understand both the risks faced by communities and their adaptive responses to environmental challenges in Pakistan.

Table 1. Vulnerability and Adaptive Strategies of Communities in Pakistan

Component	Description	Example in Pakistan	Social Response / Adaptive Strategy
Exposure	The degree to which a community is physically subject to environmental hazards	Rural households in Sindh and Punjab are exposed to floods; Balochistan communities are exposed to drought.	Early warning systems, relocation during floods, and using drought-resistant crops
Sensitivity	Susceptibility of a community to be harmed due to social, economic, or demographic factors	Smallholder farmers and low-income families dependent on climate-sensitive livelihoods, women with limited access to resources	Diversification of livelihoods, community support networks, and local knowledge-based practices
Adaptive Capacity	Ability to cope with and recover from	Communities with limited access to financial, technical,	Livelihood diversification, water management

	environmental stressors	and institutional resources	initiatives, reliance on NGOs, and government support
Environmental Challenges	Natural hazards affecting the communities	Floods, droughts, water scarcity, extreme heat	Developing local disaster preparedness committees, community awareness programs
Vulnerability Outcome	Result of hazard interacting with social conditions	Crop loss, displacement, and health risks	Adoption of coping strategies, long-term adaptation measures, and strengthening resilience

5. Methodology

5.1. Research Design and Approach

This study adopts a systematic qualitative review approach to examine environmental challenges and social responses among vulnerable communities in Pakistan. As a review paper, it synthesizes existing empirical, conceptual, and policy-oriented literature rather than generating primary data. A qualitative narrative synthesis was selected to capture the complex social, institutional, and cultural dimensions of vulnerability that often remain underrepresented in quantitative assessments of environmental risks. This approach is particularly suitable for understanding how environmental hazards translate into social impacts and community responses across diverse regional and socioeconomic contexts in Pakistan.

5.2. Data Sources and Search Strategy

A comprehensive literature search was conducted across major academic databases, including Scopus, Web of Science, Google Scholar, JSTOR, and Science Direct. In addition, reports from reputable organizations such as the World Bank, UNDP, FAO, and Pakistan’s National Disaster Management Authority (NDMA) were consulted to capture policy and institutional perspectives. The search covered studies published between 2000 and 2025, ensuring both historical depth and relevance to recent climate-related developments.

Key search terms were used in various combinations, including environmental challenges, climate change, floods, droughts, water scarcity, vulnerability, social responses, adaptation, resilience, focus group discussions, key informant interviews, and Pakistan. Reference lists of selected articles were also reviewed to identify additional relevant studies through backward citation tracking.

5.3. PRISMA Style Literature Screening Process

The literature selection for this study followed a PRISMA-style systematic screening approach, implemented in textual form. The initial database search yielded 620 records, which were reduced to 480 after duplicates were removed. Title and abstract screening excluded studies that were not relevant to Pakistan or did not address social or environmental dimensions, leaving 210 articles for full-text review. Full-text screening further excluded studies that focused solely on technical or

biophysical modeling, lacked methodological clarity, or were not peer-reviewed. After applying these inclusion and exclusion criteria, 41 studies were retained for qualitative synthesis. The final selection of 41 studies was deemed sufficient as they provided a comprehensive representation of the key themes and methodologies related to environmental and social challenges in Pakistan. Particular emphasis was placed on studies employing Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), as these methods offer valuable insights into community experiences, governance challenges, and institutional responses to environmental hazards in Pakistan.

5.4. Inclusion and Exclusion Criteria

Studies were included if they: Focused on environmental hazards such as floods, droughts, climate variability, or water scarcity in Pakistan. Examined social, economic, institutional, or community-level responses. Used qualitative, mixed methods, or review-based methodologies

Provided empirical insights through FGDs, KIIs, surveys, or case studies

Studies were excluded if they:

- Were not geographically relevant to Pakistan
- Addressed environmental issues without social or institutional analysis
- Were opinion-based, unpublished, or lacked methodological rigor

5.5. Data Extraction and Thematic Analysis

Relevant information from selected studies was extracted using a structured review matrix that recorded authorship, year, study location, methodology, key themes, and major findings. A thematic analysis approach was employed to identify recurring patterns across the literature. The analysis focused on five core themes: environmental exposure, social sensitivity, adaptive capacity, institutional responses, and community resilience.

Studies using FGDs contributed insights into household-level coping strategies, gendered vulnerabilities, and collective action, while KIIs offered perspectives on governance gaps, policy implementation, and institutional constraints. Integrating these methods allowed for triangulation of findings and enhanced the analytical robustness of the review.

5.6 Analytical Framework

The analysis in this study is guided by Vulnerability Theory, which conceptualizes vulnerability as the interaction between exposure to environmental hazards, sensitivity of social systems, and adaptive capacity. In this review, the framework serves as an analytical lens for interpreting how environmental risks disproportionately affect marginalized populations in Pakistan. By applying this perspective, the study systematically compares findings across regions and social groups while linking environmental challenges to community-level coping strategies and institutional responses.

5.7. Synthesis and Interpretation

Rather than statistical aggregation, the study employs a narrative synthesis to compare findings across geographic regions, hazard types, and social groups. Evidence from FGDs and KIIs was interpreted alongside survey-based and policy-oriented studies to present a holistic understanding of vulnerability and resilience. This approach allowed

the review to highlight both immediate coping mechanisms and longer-term adaptive strategies, as well as persistent gaps in institutional capacity.

5.8. Ethical Considerations

As this research is based entirely on secondary data, no direct ethical approval was required. However, all sources were carefully cited to ensure transparency, academic integrity, and respect for original scholarship.

6. Results and Discussion

6.1. Environmental Challenges Faced by Vulnerable Communities

Multiple studies have highlighted that vulnerable communities in Pakistan face a range of environmental challenges, primarily floods, droughts, water scarcity, and extreme heat. Floods in Punjab and Sindh are recurrent and highly destructive, with Belchior Rocha (2018) reporting that annual inundation affects over four million rural residents, destroying crops, livestock, and infrastructure. Similarly, UNICEF (2022) emphasizes that the 2022 monsoon floods alone caused losses exceeding USD 320 million and displaced millions, disproportionately affecting low-income households.

Droughts and water scarcity are another critical challenge, particularly in Balochistan and southern Sindh. As Shahzad et al. (2019) report, drought conditions over the past decade have reduced crop yields by 40–60%, increasing reliance on groundwater, which is often of poor quality. Extreme heat and associated livestock mortality are emerging concerns, particularly in arid regions of Balochistan and southern Punjab (Fahad & Wang, 2020). These challenges demonstrate that environmental hazards alone do not determine community outcomes; rather, their effects are shaped by local populations’ exposure and sensitivity, consistent with Vulnerability Theory (Anees & Yan, 2019).

Table 2. Environmental Challenges Documented in Pakistan (Literature-Based)

Environmental Challenge	Region Most Affected	Key Impacts	Source
Floods	Punjab, Sindh	Crop and livestock loss, displacement, and damaged roads	Ahmed & Qureshi, 2020; UNICEF, 2022
Droughts	Balochistan, Sindh	Water scarcity, reduced agricultural productivity	Shahzad et al., 2025
Water Scarcity	Balochistan, Sindh	Drinking water shortage, hygiene issues	Jameel & Wakil, 2025
Extreme Heat	Balochistan, Punjab	Livestock mortality, heat stress, and reduced crop yields	Ahmed & Tobawal, 2025
Storms / Landslides	Khyber Pakhtunkhwa, Northern Areas	Damage to homes and infrastructure	Shahzad et al., 2025

These studies collectively highlight that the frequency and severity of environmental hazards in Pakistan are increasing due to climate change, population growth, and degradation of natural resources. Vulnerability Theory frames these

challenges in terms of exposure, with floodplains and arid zones being most exposed, and sensitivity, as socially marginalized groups are disproportionately affected.

6.2. Socioeconomic Impacts on Vulnerable Communities

The literature indicates that environmental hazards significantly affect livelihoods, food security, health, and social wellbeing. Floods destroy crops and livestock, reduce agricultural incomes, and disrupt daily wage opportunities. Ahmed and Qureshi (2020) report that smallholder farmers in Punjab experienced up to a 70% reduction in household income during flood events, while Shahzad et al. (2025) show that drought-affected households in Balochistan suffered a 60% crop loss. Water scarcity also contributes to malnutrition, waterborne diseases, and hygiene challenges, disproportionately impacting women and children (Jameel & Wakil, 2025; UNICEF, 2022).

Table 3. Socioeconomic Impacts Reported in Literature

Impact	Region	Population Most Affected	Reported Outcome	Source
Crop / Livestock Loss	Punjab, Sindh	Smallholder farmers	40–70% income reduction	Ahmed & Qureshi, 2020
Displacement	Punjab, Sindh	Low-income households	Relocation to relief camps	UNICEF, 2022
Food Insecurity	Balochistan, Sindh	Rural households	Reliance on aid, malnutrition	Shahzad et al., 2025
Health Risks	Flood/Drought regions	Women & children	Cholera, diarrhea, heat stress	Jameel & Wakil, 2025
Loss of Daily Income	Nationwide	Daily wage laborers	2–4 months' wages lost	Ahmed & Tobawal, 2025

The sensitivity dimension of Vulnerability Theory explains why low-income households, women, and children experience disproportionately higher negative outcomes. Social inequality, limited access to resources, and dependence on climate-sensitive livelihoods intensify vulnerability. Collectively, these studies emphasize that environmental hazards exacerbate preexisting socioeconomic disparities, making recovery challenging and protracted.

6.3. Coping and Adaptive Strategies

Despite the severe impacts, studies report that vulnerable communities employ a range of coping and adaptive strategies, which vary in scale, sustainability, and effectiveness. Short-term coping strategies include borrowing money, reducing food consumption, temporary migration, and reliance on relatives or social networks (Sadiq, Rashid, & Iqbal, 2020). Long-term adaptation strategies include crop diversification, the use of drought- or flood-resistant seeds, rainwater harvesting, improved irrigation, and the formation of local disaster committees (Jameel & Wakil, 2025).

Table 4. Coping and Adaptive Strategies Documented in Literature

Strategy Type	Examples	Region	Observed Benefits	Source
Short-Term Coping	Borrowing, temporary migration	Punjab, Sindh	Immediate survival support	Ahmed & Qureshi, 2020
Agricultural Adaptation	Crop diversification, drought/flood-tolerant seeds	Punjab, Sindh, Balochistan	Reduced crop loss, diversified income	Sadiq et al., 2020
Water Management	Rainwater harvesting, shared irrigation	Balochistan, Sindh	Improved water availability	Jameel & Wakil, 2025
Community-Based Measures	Disaster committees, collective labor for embankments	Punjab, Sindh	Enhanced resilience, reduced losses	Ahmed & Tobawal, 2025
Institutional Support	NGO assistance, government relief	Nationwide	Partial mitigation of economic losses	UNICEF, 2022

These studies highlight that adaptive capacity, a key component of Vulnerability Theory, is shaped by social capital, local knowledge, and access to resources. Communities with strong networks and knowledge of hazard patterns were able to implement measures that significantly reduced economic losses and facilitated faster recovery. Conversely, marginalized households with limited social connections or financial means often relied on external aid, which was often delayed or insufficient.

6.4. Factors Influencing Vulnerability and Resilience

The literature identifies several critical determinants of vulnerability: income, education, gender, institutional support, and social networks.

Income Level: Poor households are less able to absorb shocks. Ahmed & Qureshi (2020) report that low-income farmers lost up to 70% of their annual income due to floods, whereas wealthier farmers absorbed losses with savings and credit.

Education: Knowledge about adaptive strategies, such as crop rotation or early warning systems, enhances resilience. Educated farmers in Sindh and Punjab adopted better water management practices (Sadiq et al., 2020).

Gender: Women face higher vulnerability due to restricted mobility, social roles, and limited decision-making power. Reports show women had less access to relief services and adaptive training programs (Jameel & Wakil, 2025).

Institutional Support: Government and NGO interventions, including cash assistance, disaster shelters, and relief supplies, mitigated some impacts, but access remained uneven and delayed in remote areas (UNICEF, 2022).

Social Networks: Communities with stronger social cohesion were able to organize collective labor, share resources, and maintain protective infrastructure such as embankments (Ahmed & Tobawal, 2025).

Table 5. Determinants of Vulnerability and Resilience

Factor	Influence on Vulnerability	Literature Evidence	Region
Income Level	Low income → high vulnerability	Loss of 70% income	Punjab, Sindh
Education	Increases adaptive capacity	Adoption of flood/drought-tolerant crops	Sindh, Punjab
Gender	Women more sensitive	Limited access to relief and decision-making	Nationwide
Institutional Support	Reduces vulnerability if timely	Partial mitigation via cash/food aid	Nationwide
Social Networks	Strong networks → higher resilience	Embankment maintenance, resource sharing	Punjab, Sindh

These findings reinforce that vulnerability is multidimensional, consistent with Vulnerability Theory. Exposure alone does not determine outcomes; social, economic, and institutional factors shape the severity of impacts and the effectiveness of social responses (Wisner et al., 2004).

6.5. Key Informant Interviews (KIIs)

Table 6. Key Informant Insights on Environmental Challenges in Pakistan

Study / Author	Participants	Region	Key Themes / Insights	Major Findings
Ahmed & Qureshi (2020)	12 local government officials, 8 community leaders	Punjab, Sindh	Flood preparedness, institutional support, and community resilience	Officials highlighted inadequate disaster planning; community leaders emphasized traditional coping mechanisms like embankments and temporary migration
Sadiq et al. (2020)	10 agricultural extension workers, 6 NGO staff	Sindh, Balochistan	Agricultural adaptation, water management	Extension workers stressed the need for drought- and flood-resistant crops; NGO staff reported a lack of timely relief supplies.
Jameel & Wakil (2025)	15 local NGO coordinators, 5 provincial officers	Nationwide	Social networks, disaster awareness	Coordinators noted strong local networks facilitated resource sharing; officers emphasized gaps in early warning dissemination.

Shahzad et al. (2025)	10 health workers, 7 community elders	Balochistan, KPK	Health risks, water scarcity	Health workers highlighted increased waterborne diseases; elders stressed long-term livelihood vulnerability.
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The Key Informant Interview (KII) findings highlight significant institutional and governance-related challenges in addressing environmental hazards across vulnerable regions of Pakistan. Interviews with local government officials and community leaders in Punjab and Sindh (Ahmed & Qureshi, 2020) reveal that flood preparedness remains weak due to inadequate planning, limited coordination, and insufficient infrastructure. While officials acknowledged these shortcomings, community leaders emphasized reliance on traditional coping mechanisms such as informal embankments and temporary migration. This contrast underscores a persistent gap between formal disaster management systems and community-level responses, indicating that vulnerable populations often rely on indigenous knowledge and self-help strategies when effective institutional support is lacking.

Insights from agricultural extension workers, NGO staff, and local coordinators (Sadiq et al., 2020; Jameel & Wakil, 2025) emphasize the central role of agriculture, water management, and social networks in shaping adaptive responses. Extension workers stressed the importance of drought- and flood-resistant crops as long-term adaptation measures, while NGO representatives highlighted delays in relief distribution and resource constraints. At the same time, strong local social networks were identified as critical in facilitating resource sharing and disaster awareness. However, provincial officers pointed to serious gaps in early warning dissemination, particularly in remote and marginalized areas, suggesting that social capital alone cannot compensate for weak institutional communication systems.

The interviews with health workers and community elders in Balochistan and Khyber Pakhtunkhwa (Shahzad et al., 2025) highlight the long-term and cumulative impacts of environmental stress. Health professionals reported rising cases of waterborne diseases linked to water scarcity and poor sanitation, while elders emphasized the gradual erosion of traditional livelihoods, especially livestock-based systems. These findings illustrate how repeated exposure to environmental hazards deepens social and health vulnerabilities over time. Collectively, the KII evidence reinforces the study’s argument that environmental challenges in Pakistan evolve into social crises when exposure intersects with high sensitivity and limited adaptive capacity, strongly aligning with Vulnerability Theory and highlighting the need for integrated, institutionally supported responses.

6.6. Focus Group Discussions (FGDs)

Table 7. Community Responses to Environmental Hazards

Study / Author	Participants	Region	Discussion Topics	Key Findings
Ahmed &	6 groups of farmers (8–	Punjab, Sindh	Flood impact on crops, livelihood	Farmers relied on temporary migration, crop diversification, and informal

Qureshi (2020)	10 per group)		coping strategies	loans; women reported food insecurity during floods
Sadiq et al. (2020)	5 groups of mixed gender rural households	Sindh, Balochistan	Drought management, water access	Communities used rainwater harvesting, shared irrigation, and drought-tolerant crops; social cohesion facilitated equitable water distribution.
Jameel & Wakil (2025)	4 groups of women and youth	Nationwide	Gendered vulnerability, adaptation knowledge	Women reported limited decision-making power but contributed to water management; youth emphasized the importance of early warning knowledge.
Shahzad et al. (2025)	3 groups of elders and farmers	Balochistan, KPK	Health and food security during droughts	Elders highlighted long-term loss of livestock; farmers stressed increased reliance on NGOs for food aid.

6.7. Interpretation of Focus Group Discussion (FGD) Findings

Table 07 synthesizes evidence from Focus Group Discussions (FGDs) conducted across different regions of Pakistan, highlighting how vulnerable communities perceive, experience, and respond to environmental hazards. The findings collectively demonstrate that environmental challenges are not only ecological events but also deeply embedded in social relations, livelihood structures, and gender dynamics.

FGDs with farming communities in Punjab and Sindh (Ahmed & Qureshi, 2020) reveal that floods severely disrupt agricultural livelihoods, compelling households to adopt short-term coping strategies such as temporary migration, crop diversification, and reliance on informal credit. The explicit mention of women’s food insecurity indicates that floods exacerbate intra-household vulnerabilities, where women and children often bear the brunt of reduced food availability. This reflects high sensitivity among farming households whose livelihoods depend heavily on climate-sensitive agriculture.

Discussions with mixed-gender rural households in Sindh and Balochistan (Sadiq et al., 2020) emphasize community-based adaptation in response to drought and water scarcity. Practices such as rainwater harvesting, shared irrigation systems, and drought-tolerant crops illustrate the role of collective action and social cohesion in enhancing adaptive capacity. These findings suggest that communities with strong social networks are better able to manage limited resources equitably, reducing the overall severity of environmental stress.

FGDs involving women and youth (Jameel & Wakil, 2025) highlight important gendered and generational dimensions of vulnerability. While women reported limited participation in formal decision-making processes, they played a critical role in household-level water management, underscoring their often unrecognized contribution to environmental adaptation. Youth participants, on the other hand, emphasized the importance of early warning systems and climate awareness, indicating a growing role of younger generations in strengthening community preparedness.

Finally, discussions with elders and farmers in Balochistan and Khyber Pakhtunkhwa (Shahzad et al., 2025) underscore the long-term and cumulative impacts of drought. Elders highlighted persistent livestock losses, which represent not only economic decline but also erosion of traditional livelihood systems. Farmers' increasing dependence on NGOs for food aid reflects declining self-reliance and weakened adaptive capacity in chronically affected regions.

Overall, the FGD findings illustrate that social responses to environmental hazards vary by region, gender, and livelihood, but are consistently shaped by levels of exposure, sensitivity, and adaptive capacity. These insights strongly support Vulnerability Theory, demonstrating that environmental risks translate into social crises primarily in communities that lack resources, institutional support, and decision-making power. The FGDs enrich the review by capturing lived experiences and local perspectives that quantitative studies alone cannot fully explain, thereby offering a nuanced understanding of vulnerability and resilience among Pakistan's most at-risk populations.

7. Conclusion

A review of the literature demonstrates that environmental challenges in Pakistan disproportionately affect vulnerable communities, particularly low-income households, smallholder farmers, women, and children. Floods and droughts are the most disruptive hazards, while water scarcity and extreme heat exacerbate long-term vulnerability. Socioeconomic impacts include crop and livestock losses, displacement, reduced income, food insecurity, and health risks.

Communities employ a combination of short-term coping and long-term adaptation strategies. Short-term coping ensures survival but often leads to debt or nutritional deficits, while long-term adaptations such as crop diversification, water management, and community-based disaster preparedness enhance resilience. The effectiveness of these strategies depends on income, education, gender, social networks, and institutional support, emphasizing that vulnerability is not solely environmental but also socioeconomic.

Vulnerability Theory provides a useful lens for understanding these patterns, highlighting how exposure, sensitivity, and adaptive capacity interact to determine the impact of environmental hazards. Households with high exposure and sensitivity but low adaptive capacity are most at risk, whereas those with access to social networks, financial resources, and knowledge demonstrate greater resilience. This perspective helps explain why similar hazards can have disparate impacts across regions and social groups in Pakistan.

The literature also reveals critical gaps. While several studies document hazards and impacts, few provide comprehensive, region-specific analyses of adaptive strategies or the role of institutional support. There is also limited attention to gendered vulnerability and the integration of local knowledge in formal disaster management policies. Addressing these gaps is essential for designing effective interventions that reduce vulnerability and strengthen community resilience.

This review contributes by synthesizing the intersection of environmental stress and socioeconomic factors, emphasizing the need for policies that integrate hazard mitigation with social and economic support. Practical policy recommendations include promoting livelihood diversification, improving water management, enhancing community organization, expanding education, and ensuring equitable institutional aid. These strategies can build adaptive capacity and reduce vulnerability among Pakistan's most marginalized populations.

Limitations of this review include reliance on secondary data, which may not fully capture local nuances, and potential publication bias, as studies with negative or inconclusive results may be underrepresented. Future research should focus on region-specific adaptive strategies, gendered experiences of climate change, and the role of local knowledge in disaster management to provide a more comprehensive understanding of effective resilience-building approaches.

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