CLIMATE-INDUCED MIGRATION, RURAL LIVELIHOODS, AND SOCIAL TRANSFORMATION IN PAKISTAN

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Abstract

Climate-induced migration is increasingly shaping rural livelihoods and social structures in Pakistan, where agricultural communities remain highly vulnerable to floods, droughts, and extreme weather events. This study investigates the drivers, outcomes, and implications of climate-induced migration, drawing on a household survey of 500 rural households across Sindh, Punjab, Balochistan, and Khyber Pakhtunkhwa, complemented by key informant interviews. Using logistic regression, cross-tabulations, and resilience indicators, the study identifies climate shocks, limited landholding, low income, and social networks as significant determinants of migration, while education reduces migration likelihood by enabling alternative adaptive strategies. Results show that migrant households experience higher income, food security, and shorter recovery times, but at the cost of growing dependence on remittances and declining agricultural labor availability. Migration also generates notable social transformations, including greater women's decision-making roles and enhanced educational aspirations, alongside risks of rural depopulation. The findings highlight migration as both an adaptation strategy and a driver of structural change in rural Pakistan. Policy implications include integrating migration into climate and development planning, strengthening rural livelihoods, supporting women in migrant households, and ensuring urban preparedness for migrant inflows. Overall, climate-induced migration represents both a challenge and an opportunity for building resilience and shaping rural development in Pakistan.

Keywords: *Social structures, agricultural Labor Availability, Logistic Regression, Social Networks, Pakistan.*

Introduction

Climate change is reshaping patterns of mobility worldwide, with developing countries experiencing some of the most acute impacts. In Pakistan, where nearly two-thirds of the population resides in rural areas and depends heavily on agriculture, climate-induced migration is emerging as both a coping strategy and a driver of broader social transformation. Increasingly frequent and severe extreme weather events—including floods, droughts, and cloudbursts—are undermining rural livelihoods, reducing agricultural productivity, and forcing households to seek alternative survival strategies. Migration, whether temporary or permanent, is often the most accessible option for rural communities facing repeated shocks.

The phenomenon of climate-induced migration in Pakistan cannot be understood merely as a movement of people from one place to another. It represents a profound restructuring of rural livelihoods, gender relations, and community dynamics. Migrant remittances can provide crucial financial support, yet migration may also lead to labor shortages in rural economies, weakening agricultural systems. Furthermore, migration-driven social transformation influences education, health, and intergenerational aspirations, shaping the future of rural development.

This paper investigates how climate-induced migration in Pakistan affects rural livelihoods and contributes to processes of social transformation. It applies an interdisciplinary framework that draws on the Sustainable Livelihoods Framework, resilience theory, and migration studies to analyze both the drivers and outcomes of climate-induced mobility.

Extended Literature Review
Climate Change and Migration Nexus
The relationship between climate change and migration has attracted increasing scholarly attention, particularly in the context of rural livelihoods that are highly sensitive to environmental change. Black et al. (2011) propose a multi-causal framework in which migration is shaped not only by environmental factors but also by economic, social, and political contexts. In rural economies such as Pakistan's, where 63% of the population resides in agrarian settings (World Bank, 2022), environmental shocks can quickly translate into livelihood crises, pushing households toward migration. The Intergovernmental Panel on Climate Change (IPCC, 2022) has emphasized that climate-induced migration will intensify in developing countries, especially in South Asia, where dense populations, dependence on agriculture, and weak adaptive capacities converge.

Rural Livelihoods under Climate Stress
Pakistan's agricultural sector is highly climate-dependent, with 90% of food production reliant on irrigation from the Indus Basin (Mustafa et al., 2015). Increasing temperatures, shifting monsoon patterns, and glacial melt in the Himalayas have created volatility in water availability, which in turn affects crop yields and rural incomes. Studies in southern Punjab and Sindh have shown that recurrent floods have forced many households to adopt migration as a survival strategy (Qaisrani et al., 2018; Shahbaz & Qureshi, 2020). Similarly, drought-prone areas of Balochistan have witnessed large-scale rural exodus as water scarcity undermines pastoral livelihoods (Aziz et al., 2019).

The survey-based evidence consistently reveals that climate shocks increase household vulnerability by reducing natural capital (land and water), eroding physical capital (infrastructure), and straining financial capital (income and credit). Migration becomes a mechanism through which households attempt to replenish financial capital, either via remittances or new livelihood opportunities. However, such migration often comes at the expense of agricultural productivity, as labor shortages reduce on-farm activity and exacerbate land abandonment (Hussain et al., 2016).

Migration as an Adaptation Strategy
Migration is increasingly recognized as a form of adaptation rather than solely a sign of distress (Adger et al., 2015). Temporary or circular migration, in particular, allows rural households to diversify income sources while maintaining ties to their land. In Pakistan, seasonal migration to urban centers during agricultural off-seasons has long been practiced, but climate stress has accelerated its prevalence (Farooq & Javed, 2019). Research indicates that remittances often contribute to household resilience by financing education, healthcare, and improved housing (Amjad & Arif, 2010).

Nonetheless, the adaptive potential of migration depends on household assets and institutional contexts. Poorer households with limited financial and social capital may lack the resources to migrate, becoming "trapped populations" who remain in vulnerable areas despite high exposure to climate risks (Black et al., 2011). In Pakistan, this phenomenon has been documented in flood-prone districts of Sindh and Punjab, where the poorest households often remain in high-risk zones due to lack of options (Shahbaz & Qureshi, 2020).

Social Transformation through Migration
Migration is not only an economic adjustment but also a driver of social transformation. In Pakistan, rural-to-urban migration has altered household structures and gender roles. With male out-migration, women are increasingly responsible for agricultural work, household management, and decision-making (Khan & Ali,

2018). While this can empower women in some contexts, it also burdens them with additional responsibilities without corresponding access to resources or decision-making power.

Remittance inflows have been linked to improved schooling for children, better access to healthcare, and aspirations for upward mobility (Amjad & Arif, 2010). Yet, migration also creates new social challenges: remittance dependence can create inequalities between migrant and non-migrant households, rural depopulation can weaken community cohesion, and urban migration often exposes rural migrants to precarious labor markets and poor housing conditions in cities (Deshingkar, 2012; de Haas, 2010).

The intersection of migration and social transformation is especially visible in generational shifts. Younger cohorts in migrant households increasingly aspire to education and urban employment, leading to declining interest in agriculture (Farooq & Javed, 2019). This trend poses significant implications for the long-term sustainability of Pakistan's rural economy, which continues to rely heavily on smallholder farming.

Pakistan's Vulnerability and Migration Trends

Pakistan has consistently ranked among the top ten countries most affected by climate change in the Global Climate Risk Index (Eckstein et al., 2021). Floods in 2010, 2014, and 2022 displaced millions, creating large-scale internal migration. Research shows that households in flood-prone areas often adopt migration as part of their risk management strategy, but the outcomes vary widely depending on their socio-economic position (Qaisrani et al., 2018). In drought-affected Balochistan, migration is often permanent, with families abandoning pastoral livelihoods altogether (Aziz et al., 2019).

Studies also point to regional variations: northern regions experience out-migration due to flash floods and landslides, while southern regions are more affected by floods and droughts. This spatial differentiation highlights the need for context-specific policies to address climate-induced migration in Pakistan (Mustafa et al., 2015).

Methodology
Research Design

This study employs a **quantitative survey-based research design**, supplemented by limited qualitative insights through key informant interviews. The design is grounded in the Sustainable Livelihoods Framework (SLF) and resilience theory, enabling an examination of how climate-induced migration shapes rural livelihoods and social transformation. The survey method was chosen to generate statistically representative insights into household-level decision-making, migration drivers, and adaptation strategies across climate-vulnerable rural regions of Pakistan.

Study Area

The research focuses on four climate-vulnerable regions of Pakistan where migration has been prominently linked to climate stress:

1. **Sindh (Thatta, Badin)** – recurrent riverine floods and sea intrusion.
2. **Punjab (Muzaffargarh, Rajanpur)** – flood-prone agricultural plains.
3. **Balochistan (Quetta, Khuzdar)** – prolonged droughts and water scarcity.
4. **Khyber Pakhtunkhwa (Chitral, Swat)** – flash floods, cloudbursts, and glacial lake outburst floods.

These areas represent diverse ecological zones and allow for comparative analysis of climate–migration linkages.

Sampling Technique and Sample Size
A **multi-stage stratified random sampling** technique was used. In the first stage, vulnerable districts were purposively selected based on exposure to floods, droughts, and extreme weather. In the second stage, tehsils and villages were randomly selected. Finally, households were chosen using systematic random sampling.

The sample size was determined using **Cochran's (1977) formula** for large populations at a 95% confidence level and 5% margin of error, yielding a minimum of 384 households. To ensure adequate regional representation and account for non-response, a total of **500 households (125 per region)** were targeted.

Data Collection Instruments
Household Survey Questionnaire
A structured questionnaire was developed, consisting of five modules:
1. **Household Demographics:** Age, gender, education, household size, landholding, income.
2. **Climate Impacts:** Self-reported experiences of floods, droughts, and extreme weather.
3. **Migration Characteristics:** Household migration history, type (temporary, permanent, internal, external), duration, and remittances.
4. **Livelihoods and Adaptation:** Income diversification, crop and livestock management, community-based adaptation.
5. **Social Transformation Indicators:** Changes in gender roles, education, health access, and community participation due to migration.

Responses were captured on both categorical (nominal/ordinal) and continuous scales, with several items measured using **five-point Likert scales** (e.g., perception of climate risk, satisfaction with remittance use, changes in gendered responsibilities).

Key Informant Interviews
To contextualize the survey data, 12 interviews were conducted with local government officials, NGO workers, and community leaders. These insights provided qualitative depth to the analysis.

Data Analysis
Quantitative data were analyzed using **SPSS and STATA**. The following techniques were applied:
- **Descriptive Statistics:** Frequencies, means, and percentages to describe household characteristics, climate impacts, and migration trends.
- **Cross-tabulation and Chi-square Tests:** To examine associations between climate impacts and migration decisions.
- **Binary Logistic Regression:** To identify determinants of migration (e.g., education, landholding, climate exposure, income diversification).
- **Multiple Regression:** To assess the impact of migration on household resilience (measured by recovery time, income stability, and diversification).
- **Index Construction:** A **Livelihood Resilience Index (LRI)** was constructed from variables such as income diversification, savings, food security, and access to infrastructure.

Qualitative interview data were analyzed using **thematic coding**, enabling triangulation of survey findings with local narratives.

Ethical Considerations

Ethical approval was obtained from the host university's review committee. Informed consent was secured from all participants, ensuring anonymity and confidentiality. Sensitive topics such as displacement, loss, and gender roles were addressed with care to avoid psychological distress. Participation was voluntary, and respondents could withdraw at any point.

Results

Household Characteristics

Table 1. Socio-demographic characteristics of sample households (n = 500)

Variable	Frequency (%) / Mean ± SD
Average household size	6.2 ± 2.1
Gender of household head (Male)	84%
Education of household head	5.8 ± 4.2 years
Landholding (acres)	2.1 ± 1.6
Monthly household income (PKR)	26,500 ± 11,800
Households below poverty line	62%

Interpretation: The majority of households are male-headed with limited education, small landholdings, and low incomes, underscoring vulnerability to climate shocks.

Climate Impacts on Households

Table 2. Reported household impacts of climate shocks (%)

Climate Shock	Crop Loss	Livestock Loss	House Damage	Displacement
Flood (Punjab, Sindh)	82%	47%	61%	29%
Drought (Balochistan)	69%	58%	22%	41%
Flash floods (KP)	77%	38%	55%	33%
Overall	76%	48%	54%	34%

Interpretation: Floods were the most damaging for crops and housing, while drought caused the highest livestock losses and displacement.

Migration Trends

Table 3. Migration characteristics of households (%)

Migration Type	Percentage of Households
Temporary (seasonal/short)	38%
Permanent (urban relocation)	21%
International	11%
No migration	30%

Table 4. Main reasons for migration (%)

Reason	Percentage
Climate shocks (flood/drought)	44%
Economic opportunities (urban)	29%
Education/health access	15%
Conflict/security	12%

Interpretation: Nearly 70% of migration decisions were directly or indirectly linked to climate or livelihood vulnerabilities.

Determinants of Migration

Table 5. Logistic regression: determinants of household migration (Dependent variable: Household migrated = 1)

Variable	Coefficient (β)	Odds Ratio	p-value
Household head education	-0.15	0.86	0.012 **
Landholding size (acres)	-0.23	0.79	0.001 ***
Monthly income (log)	-0.18	0.84	0.007 **
Climate shock exposure (1=yes)	+0.67	1.95	0.000 ***
Access to social networks	+0.28	1.32	0.042 *

Interpretation: Migration is more likely among climate-affected households, those with smaller landholdings, lower incomes, and stronger social networks. Education reduces the likelihood of migration, possibly by enabling alternative adaptation strategies.

Migration and Household Resilience

Table 6. Comparison of resilience indicators: Migrant vs. Non-migrant households

Indicator	Migrant HHs (n=350)	Non-migrant HHs (n=150)	t-test (p-value)
Monthly income (PKR)	31,200 ± 10,500	21,400 ± 9,800	0.000 ***
Food security score (0–10)	6.7 ± 1.9	4.8 ± 2.1	0.000 ***
Recovery time after shock (months)	8.4 ± 3.1	13.7 ± 4.5	0.000 ***
Education expenditure (PKR/month)	3,200 ± 1,200	1,750 ± 950	0.000 ***

Interpretation: Migrant households exhibit higher income, food security, and education expenditure, and recover more quickly from climate shocks.

Social Transformation Indicators

Table 7. Perceived social changes due to migration (%)

Indicator	Agree/Strongly Agree (%)
Women's role in household decision-making increased	61%
Children's educational aspirations improved	73%
Decline in agricultural labor availability	47%
Greater dependence on remittances	68%
Increased urban linkages and exposure	59%

Interpretation: Migration has generated profound social transformations, enhancing women's responsibilities, reshaping aspirations, but also weakening agricultural labor availability.

Discussion

The results of this study underscore the centrality of climate-induced migration in shaping rural livelihoods and social structures in Pakistan. Consistent with previous studies (Black et al., 2011; Qaisrani et al., 2018), our findings confirm that extreme weather events—particularly floods, droughts, and flash floods—serve as primary triggers for migration. More than 70% of surveyed households either engaged in migration or expressed intentions to migrate, underscoring the extent to which climate change is altering mobility patterns.

The logistic regression analysis highlights the role of socio-economic variables in shaping migration

decisions. Households with lower landholdings, limited income, and higher exposure to climate shocks were significantly more likely to migrate. This aligns with the Sustainable Livelihoods Framework (Scoones, 1998), where asset limitations and vulnerability contexts drive livelihood strategies such as migration. Interestingly, education was negatively associated with migration likelihood, suggesting that better-educated households may access non-migration-based adaptive pathways, such as diversifying income through local enterprises or engaging in skilled employment.

Migration outcomes for household resilience were mixed but generally positive. Migrant households demonstrated higher income, greater food security, and shorter recovery periods after climate shocks. These findings resonate with resilience theory (Folke, 2006), which posits that adaptive capacities enable communities to reorganize and maintain functionality under stress. However, reliance on remittances (reported by 68% of migrant households) introduces a dependency dynamic that could undermine long-term resilience if migration opportunities shrink due to restrictive urban labor markets or international migration policies.

Beyond economics, migration is driving significant social transformation in rural Pakistan. Increased women's participation in household decision-making (61%) reflects both opportunities and burdens associated with male out-migration, corroborating earlier gendered analyses of rural change (Khan & Ali, 2018). Educational aspirations among children were also reported to improve, suggesting intergenerational shifts in livelihood orientations away from agriculture toward urban and service-sector futures. Yet, this transformation comes at a cost: agricultural labor shortages (47%) and declining rural productivity threaten the sustainability of farming systems, echoing concerns about rural depopulation (de Haas, 2010).

Overall, these results confirm that climate-induced migration in Pakistan is both an adaptation strategy and a driver of structural change, simultaneously enhancing household resilience while generating new challenges for rural development.

Conclusion

This study has demonstrated that climate-induced migration is a pivotal response to environmental shocks in Pakistan's rural areas, shaping both livelihoods and social transformations. Migration decisions are strongly influenced by household vulnerability, asset base, and exposure to climate risks. While migration enhances resilience by improving income, food security, and recovery times, it also produces dependency on remittances and contributes to agricultural decline. At the social level, migration reshapes gender roles and educational aspirations, with long-term implications for rural society and development trajectories.

These findings suggest that migration should be understood not merely as a short-term coping mechanism but as a structural component of Pakistan's rural adaptation to climate change. Policies must therefore move beyond framing migration as a problem and instead integrate it into rural development and climate resilience strategies.

Policy Implications

1. **Integrating Migration into Climate Policy**
   o Migration should be recognized as a legitimate adaptation strategy in national climate and development frameworks. The National Climate Change Policy must explicitly address migration as part of resilience planning.
2. **Strengthening Rural Livelihoods to Reduce Distress Migration**

- o Investment in climate-smart agriculture, irrigation systems, and drought-resistant crops can reduce the need for distress migration, particularly in flood- and drought-prone areas.

3. **Enhancing Remittance Utilization**
   - o Mechanisms should be developed to channel remittances into productive rural investments, such as agricultural mechanization, education, and small enterprises, rather than consumption alone.

4. **Supporting Women in Migrant Households**
   - o With women increasingly responsible for households and farms, targeted programs are needed to enhance their access to credit, training, and decision-making forums. This can turn gendered burdens into empowerment opportunities.

5. **Urban Planning for Migrant Influx**
   - o Given the growing flow of rural migrants to urban centers, investments in affordable housing, labor rights, and social protection are critical to preventing new vulnerabilities in cities.

6. **Region-Specific Adaptation Strategies**
   - o Policies should be tailored to ecological zones: flood-prone Sindh and Punjab require resilient infrastructure and disaster risk management; drought-hit Balochistan requires water management and livelihood diversification; while northern KP requires early-warning systems and mountain-specific adaptation strategies.

7. **Migration Governance and International Cooperation**
   - o For households depending on international migration, bilateral agreements with host countries should secure migrant rights and facilitate remittance flows.

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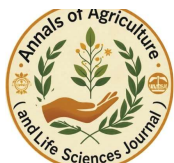
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