

Climate Change and Women's Vulnerability: Traditional Coping Mechanisms and Adaptive Capacity in Rural Jammu & Kashmir

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Abstract: *Climate change has emerged as one of the most crucial socio-environmental challenges of the twenty-first century. In ecologically fragile regions such as Jammu and Kashmir (J&K), climatic variability has begun to significantly affect agriculture, water resources, public health, and livelihood systems. Women in rural communities experience disproportionate vulnerability due to gendered division of labour, unequal access to productive resources and limited participation in institutional decision-making. This study examines the gendered impacts of climate change in selected blocks of the Samba district and assesses the role of traditional coping mechanisms in strengthening women's adaptive capacity. This study adopted a mixed-methods research design to frame this paper and analyse the field data. Quantitative data were collected from 50 women respondents using a structured interview schedule, while qualitative data were obtained through Focus Group Discussions conducted among four groups. The major findings revealed a high awareness of climate change (86%) and widespread reporting of reduced crop yield, income instability, water scarcity, and climate-related health concerns. Traditional coping mechanisms and practices, such as seed preservation, crop diversification, herbal medicine, seasonal food storage, and community-based water management, contribute meaningfully to resilience. However, these strategies are constrained by financial insecurity, weak insurance coverage, declining social cohesion, and insufficient policy integration. The study argues that sustainable climate adaptation in Himalayan regions requires the institutional recognition of indigenous knowledge systems, expansion of gender-responsive social protection frameworks, and strengthening of women's decision-making power at the community and governance levels.*

Keywords: Climate Change, Women's Vulnerability, Traditional Knowledge, Adaptive Capacity, Jammu & Kashmir

1. INTRODUCTION

Climate change has moved beyond being a purely environmental concern and has become a multidimensional developmental challenge. Rising temperatures, irregular rainfall, prolonged heat waves, and extreme weather events increasingly disrupt agricultural cycles and rural life. In mountainous ecosystems, such as Jammu and Kashmir, even small climatic shifts can generate profound ecological and socio-economic consequences.

Agriculture is the backbone of most rural livelihoods in Jammu and Kashmir. Households depend directly or indirectly on crop production, livestock rearing, and agricultural wage labour. When rainfall becomes unpredictable or water sources for irrigation decline, the economic vulnerabilities of communities' increase. In mountainous regions, women are deeply engaged in farming, household management, and caregiving, often bearing the invisible costs of climatic stress. This gendered vulnerability arises from structural inequalities embedded in access to land ownership, agricultural extension services, financial credit, institutional platforms, and participation in decision-making. While women contribute substantially to the economic means of production and household resilience, they are rarely recognised in policy frameworks and other decision-making processes. Consequently, adaptation strategies often overlook women lived experiences and Indigenous coping practices.

Existing research acknowledges the gendered dimensions of climate change; however, micro-level empirical evidence and documentation from the Western Himalayan region remain limited. This study addresses the following research question:

1.1. Research Questions

1. How does climate change affect women in rural Jammu and Kashmir?
2. What traditional coping mechanisms do women adopt in response to climate stress in this region?
3. What are the strengths and limitations of these adaptive strategies for managing climate stress among women?

2. REVIEW OF LITERATURE

The impacts of climate change are not uniformly distributed across populations. Instead, they are socially differentiated and shaped by gender relations, economic status, political representation and institutional access. The

vulnerability framework increasingly emphasises that climate risk is not only a function of environmental exposure but also of social structures that determine access to resources, decision-making power, and adaptive capacity. Within this framework, gender emerges as a central element of this study.

Agarwal (2000) argues that environmental governance and collective action cannot be effective unless gender is integrated into the institutional frameworks. Her work on environmental collective action demonstrates that women's participation in decision-making bodies enhances sustainability outcomes and resource management. She further emphasises that gendered power imbalances in access to land, forest resources and water governance significantly influence environmental outcomes. In contexts where women lack land ownership rights or representation in village councils, their capacity to influence adaptation strategies is insignificant. Thus, gender is not merely a demographic variable but also a structural determinant of vulnerability. Dankelman (2002) further develops this argument by highlighting the gendered division of labour in rural societies. In agrarian mountainous communities, women are primarily responsible for water collection, fuel gathering, food preparation, livestock care and subsistence farming. Climate variability, particularly in the form of water scarcity and prolonged dry periods, intensifies these challenges. As natural resources become scarce, women must travel longer distances to collect water, fuel, and fodder for livestock, thereby increasing their physical burden and time poverty. This intensification of unpaid labour reduces opportunities for education, income diversification and participation in local governance. Therefore, climate change deepens pre-existing gender inequalities and enhances health vulnerability. Sorensen et al. (2018) argued that women experience disproportionate health risks because of climate-related stressors. Heat exposure during agricultural work increases the risk of dehydration and fatigue. Poor air quality resulting from dust storms, forest fires, and biomass burning affects respiratory health. Water contamination increases the risk of gastrointestinal illnesses. Moreover, women's caregiving roles expand during climate-induced disease outbreaks, further increasing their emotional and physical strain. This intersection between environmental stress and gendered health burdens underscores the multidimensional nature of climate vulnerability.

In the Indian context, climate change is increasingly framed as a developmental challenge intertwined with poverty, inequality, and livelihood insecurity (Dubash 2015). India's agrarian economy is highly dependent on monsoon patterns. Any disruption in precipitation cycles directly affects agricultural productivity, employment, and food security. In mountain states such as Jammu and Kashmir, climatic variability has more severe consequences owing to ecological fragility. Glacier retreat, shifting snowfall patterns, and rising temperatures have disrupted traditional irrigation cycles and hydrological systems. Such environmental changes threaten smallholder farmers who lack technological support. Agarwal and Chhatre (2006) demonstrated that community-based resource governance enhances ecological resilience in the Himalayan region. Their research on forest governance highlights how participatory management systems

strengthen sustainable resource utilisation. This is particularly relevant for climate adaptation, as decentralised institutions can integrate local knowledge to ensure context-specific solutions. However, such systems require inclusive participation, including women's representation, to function effectively.

Traditional Ecological knowledge (TEK) has emerged as an important adaptation resource in climate change discourse. McLean (2012) emphasised that Indigenous forecasting techniques, seasonal calendars, and ecological observations provide valuable insights into environmental variability. In many rural communities, farmers interpret wind direction, cloud formation, and plant behaviour to anticipate the rainfall patterns. Historically, these systems have enabled communities to adjust their cropping cycles and manage risks. Riedlinger and Berkes (2001) argue that traditional knowledge systems often detect environmental shifts earlier than formal scientific institutions because they are embedded in daily lived experiences. Elders and local farmers possess intergenerational memory of climatic patterns, allowing them to distinguish between natural cycles and abnormal changes. Despite the recognition of TEK in the global climate discourse, technological advancement and policy centralisation have diminished its institutional legitimacy. Agricultural extension systems increasingly prioritise high-input technological solutions while often neglecting indigenous seed varieties and organic farming practices. Market-oriented agriculture often replaces diversified cropping systems with monocultures, thereby increasing vulnerability to climatic shocks. Consequently, the erosion of traditional practices has weakened their long-term adaptive capacity. Another important theme in the literature is intersectionality. Gender vulnerability does not operate in isolation; it intersects with caste, class, age, and geographic marginality. Rural women in fragile and arid mountainous regions face economic hardships and compounded vulnerability due to limited mobility, financial exclusion, and infrastructural deficits. The Sendai Framework for Disaster Risk Reduction 2015, specifically under the Sendai Framework Action on Gender, indicates that women-headed households are particularly vulnerable to climate-induced livelihood disruptions. However, despite the growing scholarship on gender and climate change, both globally and nationally, localised evidence from rural Jammu and Kashmir in the Himalayan region remains limited. Much of the existing literature focuses either on macro-level climate trends or on policy frameworks, but does not deeply document women lived experiences of uncertainty in adapting to climate change. There is limited empirical exploration of the traditional coping mechanisms of women in the mountainous communities of the western Himalayan region under contemporary climate stress.

This study addresses these gaps by documenting the lived experiences and indigenous adaptation strategies of women in the Samba district of Jammu and Kashmir. By adopting mixed methods, this study situates women not merely as passive victims but as central, active knowledge holders and resilience agents. The literature highlights that integrating gender-sensitive governance with TEK can strengthen adaptive capacities. However, empirical evidence from Jammu and Kashmir is needed to validate and

contextualise these theoretical insights. Existing research provides three critical insights. First, climate vulnerability is socially structured and gendered in nature. Second, TEK enhances adaptation but is marginalised institutionally. Third, participatory and community-based governance improves resilience when it is inclusive in nature. Building on these foundations, the present study contributes region-specific evidence and advances the understanding of how gender, climate variability, and traditional coping mechanisms intersect in rural Himalayan contexts.

3. METHODOLOGY

3.1. Research Design: This study adopted a descriptive research design to examine how climate change affects women's lives and to document the traditional coping mechanisms they use to manage these challenges. A convergent mixed-methods approach was employed to triangulate statistical patterns of vulnerability against women's accounts of coping and adaptation.

3.2. Study Area: The study was conducted in the Samba district of Jammu and Kashmir. Four administrative blocks, namely Samba, Purmandal, Sumb, and Vijaypur, were purposively selected because they represent different geographical and socioeconomic conditions within the district. The area is largely rural, hilly, arid, and agriculture-dependent, making it well-suited for studying climate-related vulnerabilities among women.

3.3. Study Population: The study focused on women aged 30–60 years. These women were engaged in agricultural systems and household work, such as water collection, food preparation, and caregiving. This age group was selected because women in this category are actively involved in livelihood activities and household management, making them directly exposed to climate-related changes.

3.4. Sampling Technique and Sample Size: The study used purposive sampling. This method was chosen because the research specifically required women with experience in agriculture and natural resource management. A total of 50 women respondents were selected from the four blocks of the study area. FGDs were conducted for qualitative data collection, Focus Group Discussions (FGDs) were conducted. Four groups were formed from each block to ensure representation and diversity in experiences.

3.5. Data Collection Methods: This study collected both quantitative and qualitative data. Quantitative data were collected using a structured interview schedule that ensured uniformity in responses across the sample. The schedule covered demographic characteristics, awareness of climate change, perceived impacts of climate change, health issues related to climate variability, coping and adaptation strategies, and economic and livelihood challenges, allowing the systematic capture of measurable dimensions of vulnerability. Qualitative data were collected through Focus Group Discussions (FGDs), which explored women lived experiences of climate change, indigenous knowledge practices, traditional coping mechanisms, community-level adaptation strategies, and the challenges faced in sustaining traditional practices.

3.6. Data Analysis: Quantitative data were analysed using descriptive statistics. This included percentages, frequency distributions, and basic demographic analyses. This helped identify patterns such as awareness levels, health concerns, insurance coverage, and livelihood impacts. The qualitative data from the FGDs were transcribed, organised systematically, and analysed using thematic analysis.

3.7. Ethical Considerations: The study followed ethical research principles by ensuring that participation was voluntary, respondents were informed about the purpose of the study, confidentiality and anonymity were maintained, and no personal identifying information was disclosed. The study primarily focused on community-based knowledge and shared experiences of women, rather than individual private data. The ethical norms of respect, inclusion, and non-exploitation were strictly followed.

3.8. Objectives of the Study

- ◆ To analyse women's vulnerability to climate change.
- ◆ To explore the traditional coping mechanisms used by women.
- ◆ To understand the intersection of gender and climate change.
- ◆ To examine the strengths and limitations of traditional adaptation strategies.
- ◆ To suggest possible policy intervention measures for gender-responsive climate adaptation.

4. RESULTS

Climate Change Awareness

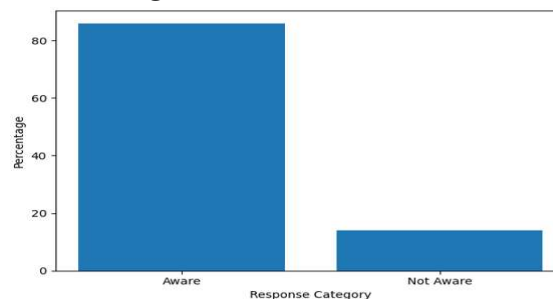


Figure 1. Climate Change Awareness Among Respondents

The quantitative findings indicate that 86 percent of respondents are aware of noticeable changes in climate patterns over the past decade. As shown in Figure 1, only 14 percent reported limited or no awareness. This high level of awareness suggests that climate change is an observable lived experience rather than an unrelatable scientific concept.

Women reported delayed monsoon onset, irregular rainfall distribution, prolonged dry spells, drought conditions, and increased summer heat over time. Several participants stated that traditional seasonal indicators, such as wind direction and cloud movement, no longer function as reliable forecasting tools because their timing has shifted. This shift demonstrates a disruption in intergenerational environmental knowledge systems due to the changing climate.

Major Climate Change Impacts

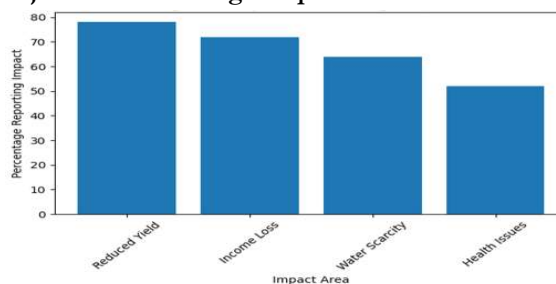


Figure 2. Major Climate Change Impacts

Figure 2 illustrates that 78 percent of respondents reported reduced crop yield and market price fluctuations, making it the most significant impact. Income loss was reported by 72% of the respondents, while 64 percent identified water scarcity as a major concern, and 52 percent reported climate-related health issues. Read together, these figures reveal a cascading impact structure rather than four independent problems: reduced yield directly affects income stability, which in turn constrains food security and household expenditure. Many women noted that traditional cropping cycles have become unpredictable, with crops that previously matured within fixed seasonal timelines now experiencing moisture stress or sudden heavy rainfall damage.

Economic and Insurance Vulnerability

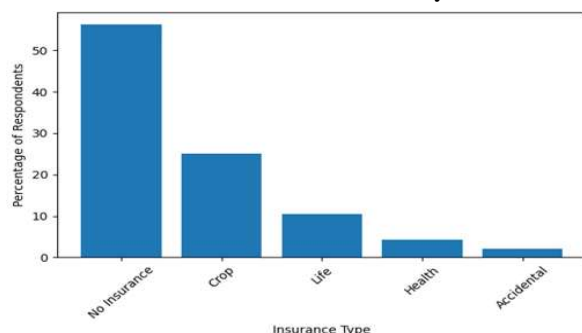


Figure 3. Economic and Insurance Vulnerability

Figure 3 highlights that 56.3 percent of respondents lack any form of insurance coverage. Only 25 percent of farmers possess crop insurance, while health and accidental insurance coverage remains extremely low. This indicates limited financial protection against climate-induced losses. In the absence of insurance, households absorb shocks through debt, asset liquidation and reduced consumption. Women often compensate for this by reducing their personal nutritional intake or increasing their unpaid labour. The lack of financial buffering mechanisms reduces adaptive capacity and transforms temporary climate shocks into long-term poverty.

Health Impacts

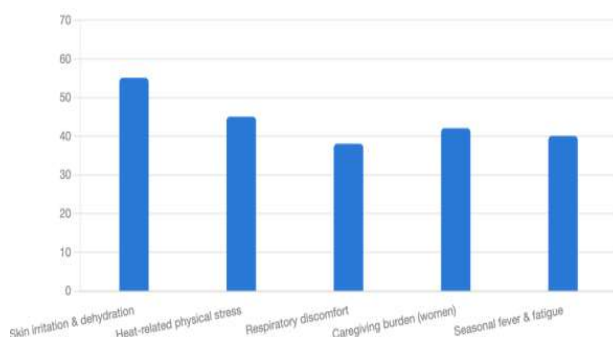


Figure 4. Health Impacts

Figure 4 shows that more than half of the respondents reported skin irritation and dehydration during the peak summer months. Heat exposure during agricultural labour increases physical stress. Respiratory discomfort is linked to dust storms and fluctuating humidity levels. Importantly, women highlighted the invisible burden of caregiving during

climate-related illness outbreak. The increased incidence of seasonal fever and fatigue increased the domestic workload, reinforcing gendered vulnerability.

Adoption of Traditional Coping Mechanisms

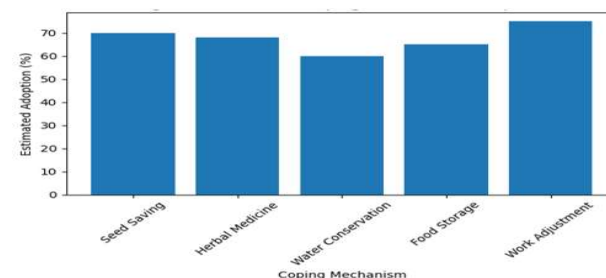


Figure 5. Adoption of Traditional Coping Mechanisms

Figure 5 demonstrates the high adoption of traditional coping practices. Work schedule adjustment (75%) and seed saving (70%) were the most common strategies used. Herbal medicine usage (68%) and seasonal food storage (65%) were also widely practiced. Water conservation techniques, such as drip irrigation adoption and food diversification affecting nutritional intake, were observed in 60 percent of the cases. Although informal and small-scale, these strategies indicate endogenous adaptation efforts in the region. These practices reflect localised resilience, but they remain limited in terms of scale and institutional support.

5. DISCUSSION

The results can be analytically interpreted using a vulnerability framework comprising sensitivity, exposure, and adaptive capacity.

Table 1: Climate Vulnerability Indicators

Dimension	Key Indicator	Percentage (%)	Interpretation
Awareness	Climate Awareness	86	High experiential recognition
Sensitivity	Reduced Yield	78	Agricultural instability
Exposure	Water Scarcity	64	Resource vulnerability
Economic Risk	No Insurance	56.3	Limited financial buffering
Adaptive Practice	Seed Saving	70	Indigenous resilience

Sensitivity

In the Samba district, economic dependence on agriculture increased sensitivity. As 78 percent of farmers reported yield decline, agricultural productivity emerged as the central vulnerability axis. Women's dual roles as producers and household managers intensify their sensitivity. When crops fail, women compensate by managing food scarcity, adjusting consumption patterns, and seeking alternative livelihood support, such as wage labour.

Exposure

Rain-fed agriculture increases direct exposure to rainfall variability. Limited irrigation infrastructure and declining groundwater levels exacerbate water insecurity. The data show that 64% of the population faces water scarcity. This directly increases women's workload, as water

collection remains gendered labour. Thus, environmental exposure translates into physical and temporal burdens.

Adaptive Capacity

The widespread adoption of traditional coping mechanisms demonstrates localised and adaptive knowledge. Seed preservation enhances crop resilience to climatic uncertainty. Indigenous seed varieties often require less water and demonstrate higher tolerance to temperature variations. Herbal medicines provide low-cost healthcare alternatives, reducing dependency on formal medical systems for minor climate-induced ailments. Work schedule adjustments reflect behavioural adaptation to heat stress. Women begin agricultural activities earlier in the morning to avoid exposure to midday heat. However, limited financial protection constrains their adaptive capacity.

Structural Constraints

Despite high awareness and coping efforts, structural barriers remain. Limited participation in Gram Sabha decision-making reduces women's influence on climate adaptation planning and decision-making. Financial exclusion limits access to credit for technological upgrades in agriculture. Social cohesion also appears to be weakened. Several respondents reported declining community cooperation compared with previous decades. Weak social networks reduce the potential for collective adaptation.

Integrated Analytical Interpretation

The data suggest a cyclical vulnerability structure

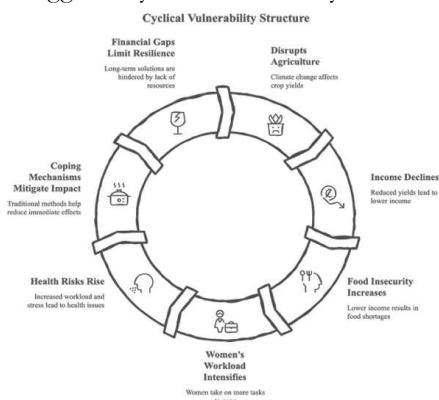


Figure 6. Cyclical Vulnerability Structure

Figure-6. presents a cyclical vulnerability structure, illustrating how climate change generates a continuous and self-reinforcing cycle of socioeconomic and gendered vulnerability, particularly affecting rural women in agrarian communities. The diagram symbolically emphasises that climate impacts are not isolated events but interconnected processes that repeatedly intensify existing inequalities, leaving women with fewer resources to withstand each round of stress.

The cycle begins with climate variability disrupting agricultural systems through irregular rainfall, extreme heat, pest infestations, diseases, and water scarcity. Because agriculture is the primary livelihood source in rural Jammu and Kashmir, such disruptions immediately reduce crop yields and weaken household economic stability. This agricultural instability leads to declining income, limiting families' purchasing power, and reducing their capacity to invest in future production. As income declines, food insecurity also increases. Households experience reduced

dietary diversity, seasonal shortages, and greater dependence on public distribution systems (PDS). This nutritional strain does not affect all members equally; women often absorb the shock by prioritising children and elderly family members, which intensifies their own vulnerability. With shrinking resources, women's workloads have increased significantly. They spend more time managing household food supplies, collecting water from distant sources, engaging in subsistence farming, and caring for sick relatives. Often, male out-migration further shifts economic and caregiving responsibilities to women. This intensification of unpaid labour exposes women to prolonged stress.

Increased exposure to heat, poor water quality, and physical exhaustion contribute to skin disorders, respiratory problems, fatigue, and mental stress. At this stage, communities attempt to stabilise their situation through traditional coping mechanisms such as seed preservation, herbal remedies, water conservation practices, livelihood diversification, and collective resource sharing. These indigenous strategies demonstrate resilience and cultural knowledge, temporarily mitigating the immediate impacts.

Climate Vulnerability and Resilience Model

While Figure 6 presents vulnerability as a self-reinforcing cycle, Figure 7 disaggregates it into a linear sequence of stages, making explicit where intervention could break the pattern.

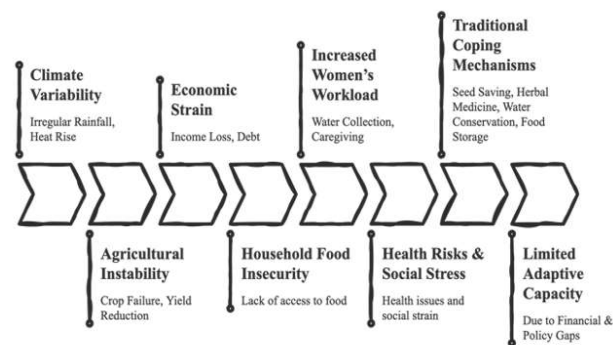


Figure 7. Climate Vulnerability and Resilience Cycle

The above resilience cycle visually represents a linear yet interconnected sequence of climate-induced vulnerabilities and adaptive responses within rural communities, particularly affecting women's health. The diagram is structured horizontally, using arrow-linked segments to demonstrate how one climate-related event triggers a cascade of socioeconomic and health consequences, eventually leading to constrained resilience.

The cycle begins with climate variability, characterised by irregular rainfall and rising temperatures. These environmental changes disrupt established weather patterns, which historically guided agricultural planning. As rainfall becomes unpredictable and heat stress intensifies, agricultural instability emerges. Crop failures and reduced yields undermine farming systems that depend heavily on seasonal regularity. Given that agriculture is the backbone of rural livelihoods in the Samba district, such instability directly threatens household survival. This agricultural disruption leads to economic strain, reflected by income loss, debt accumulation, and reduced employment opportunities. When crop productivity declines, families lose both subsistence food sources and market income, creating

fragile financial conditions. Household food insecurity increases as economic strain deepens. Limited purchasing power restricts access to nutritious food, and dependence on ration systems and external support becomes more pronounced.

Food insecurity and economic hardship contribute to an increased workload for women. Women assume greater responsibility for water collection, caregiving, food management, and supplementary livelihood activities, especially in the context of male outmigration. This intensified burden exposes women to prolonged physical labour and environmental stress, which leads to health risks and social stress. The image highlights the emergence of skin disorders, respiratory illnesses, heat-related conditions, and mental stress as consequences of climate-induced stress.

In response to these pressures, communities rely on the traditional coping mechanisms already discussed in relation to Figure 6. These practices function as immediate buffers, but Figure 7 shows that they intervene only in the later stages of the cycle, after workload and health effects have already increased. Despite these adaptive efforts, the cycle culminates in limited adaptive capacity because the earlier links in the chain, such as economic strain, food insecurity, and the absence of insurance or credit, remain largely unaddressed. This sequencing suggests that policy support targeted at these earlier stages, particularly financial protection and women's representation in decision-making, would do more to convert short-term coping into durable resilience than support directed at the coping stage alone.

6. CONCLUSION

Climate change in mountainous rural Jammu and Kashmir is not only an environmental concern but also a serious social justice issue, particularly for women whose lives are closely linked to natural resources and agriculture. As discussed in this manuscript, women's vulnerability arises from a combination of environmental changes and deep-rooted gender inequalities. Rising temperatures, irregular rainfall, and water scarcity increase the workload of women in farming, water collection, and household management. Simultaneously, limited access to land, credit, insurance, and decision-making power further restricts their ability to respond effectively to these challenges. Traditional coping mechanisms, such as seed preservation, herbal medicine, seasonal food practices, and community-based adaptation strategies, play an important role in enhancing resilience. These practices reflect the indigenous knowledge passed down through generations and help families manage climate-related stress. However, these strategies alone are insufficient to overcome structural barriers such as poverty, weak infrastructure, and lack of institutional support. As the sample was purposively drawn from 50 women in one district, the findings are indicative rather than statistically generalisable, although the consistency between the survey and FGD data lends confidence to the patterns identified. Therefore, sustainable adaptation requires strengthening women's participation in local governance, expanding insurance and financial protection schemes, integrating TEK into climate planning, and investing in climate-resilient infrastructure at the micro level with a bottom-up approach.

ACKNOWLEDGEMENT

The authors sincerely thank all the women participants from the Samba, Sumb, Purmandal, and Vijaypur blocks who generously shared their experiences and insights during the field study. Their valuable contributions made this study possible.

DECLARATION

Artificial Intelligence tools were used only for generating charts and visual representations of the data. AI was also used for minor grammatical corrections and for language editing.

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