

Climate Change in a Mountain City: Impacts, Perceptions, and Vulnerabilities of Informal Workers in Shimla, Himachal Pradesh



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Executive Summary

This report examines the understanding, impacts, and lived experiences of climate change among informal workers in Shimla, Himachal Pradesh. Situated within a climate justice framework, the study recognises that climate change disproportionately affects socially and economically marginalised populations, particularly those engaged in informal work. In a fragile mountain urban context such as Shimla—characterised by ecological sensitivity, terrain constraints, and tourism-dependent livelihoods—these vulnerabilities are further intensified. The study seeks to document how informal workers perceive climate change, how it affects their livelihoods and living conditions, and how they cope with these changes in the absence of adequate institutional support.

Context and Scope

This study examines the understanding and impacts of climate change among informal workers in Shimla, Himachal Pradesh, situating the analysis within a climate justice framework. As a hill city, Shimla is characterised by ecological fragility, terrain constraints, and increasing urban pressure driven by tourism and service-sector growth. These factors interact with changing climatic conditions—such as erratic rainfall, rising temperatures, and increased frequency of extreme weather events—to create a complex landscape of risk. Informal workers, who constitute a significant segment of the urban workforce, are particularly vulnerable due to their dependence on daily wages, insecure employment, and limited access to social protection.

The scope of the study is to understand how informal workers perceive changes in weather patterns, how these changes affect their livelihoods and living conditions, and how they respond to these challenges. By focusing on both rural and urban areas within Shimla district, the study captures the intersection of environmental change with socio-economic marginalisation in a mountain urban context. The findings contribute to a deeper understanding of climate vulnerability as a lived experience shaped by both ecological and structural factors.

Study Design and Methodology

The study is based on primary data collected from 200 respondents across selected locations in Shimla district, covering both rural and urban areas. The sample includes workers engaged in a range of informal occupations, including construction, street vending, tourism-related services, sanitation work, and other forms of daily wage labour. These sectors were selected due to their high exposure to environmental conditions and their central role in the local economy.

A structured survey instrument was used to collect quantitative data on socio-economic conditions, livelihood patterns, housing, access to services, and experiences of climate-related impacts. In addition, the survey captured respondents' perceptions of changes in weather patterns and their coping strategies. The methodology emphasises both measurable indicators and subjective experiences, recognising that climate change is understood not only through environmental data but also through everyday interactions with changing conditions.

The analysis combines descriptive statistics with interpretive insights, allowing for a nuanced understanding of how climate variability is experienced across different dimensions of life. The approach is grounded in a climate justice perspective, highlighting the uneven distribution of risks and the importance of addressing structural inequalities.

Socio-economic Conditions of Informal Workers

The socio-economic profile of respondents reflects a workforce characterised by precarious livelihoods, limited financial security, and uneven access to basic services. Most respondents are engaged in informal occupations that offer irregular incomes and lack formal contracts or labour protections. Migration is a prominent feature, with many workers having moved to Shimla in search of employment, often due to limited opportunities in their places of origin.

Housing conditions reveal a pattern of partial adequacy combined with insecurity. While many households reside in permanent or semi-permanent structures, a majority live in rented accommodation, often located in environmentally vulnerable areas such as steep slopes or poorly serviced settlements. These locations expose residents to risks such as landslides, water seepage, and drainage-related issues. Access to water, sanitation, and electricity is present but not uniformly reliable, contributing to everyday vulnerability.

Access to social protection is fragmented. While some respondents benefit from schemes related to food security or health insurance, a significant proportion remain excluded from welfare programs. Migrant workers face additional barriers due to documentation requirements and lack of portability. Income patterns further highlight economic precarity, with low and irregular earnings, limited savings, and constrained access to formal credit. These conditions form the baseline from which climate-related vulnerabilities emerge and intensify.

Community Perceptions of Climate Change

The study finds that informal workers possess a strong and experience-based understanding of climate change, shaped by their daily interactions with the environment. Respondents consistently report that weather patterns have become more erratic, with changes in rainfall, temperature, and seasonal cycles. A defining feature of their perception is the increasing unpredictability of weather, which disrupts established expectations about seasons and makes it difficult to plan work and household activities.

Respondents describe a noticeable increase in extreme weather events, including heavy rainfall, landslides, flash floods, and periods of intense heat. These events are often experienced simultaneously, creating overlapping risks that amplify their impact. The coexistence of increased rainfall with experiences of water scarcity reflects an understanding of climate variability as uneven and inconsistent rather than uniform.

Importantly, respondents interpret climate change primarily through its impacts on their lives rather than through abstract environmental concepts. Their understanding is grounded in tangible experiences such as disrupted work, increased illness, and rising costs. This highlights the role of local ecological knowledge in shaping perceptions of climate change and underscores the importance of incorporating such knowledge into policy and planning processes.

Impacts on Livelihoods and Well-being

The findings demonstrate that climate change has significant and multidimensional impacts on the livelihoods and well-being of informal workers. One of the most immediate effects is the disruption of work and income. Extreme weather events such as heavy rainfall and landslides interrupt daily labour, while rising temperatures reduce working hours and productivity. Even when work continues, earnings are often reduced due to lower demand or limited mobility. Over time, these disruptions contribute to income instability and uncertainty.

Changes in climate are also associated with shifts in livelihood patterns. Many respondents report a decline in traditional activities such as agriculture, alongside an increased reliance on informal urban occupations such as construction and vending. While these shifts provide alternative income sources, they often involve greater exposure to environmental risks and do not necessarily reduce vulnerability.

Housing and living conditions are similarly affected. Respondents report both direct and indirect impacts on housing, including structural damage, dampness, and water seepage during heavy rainfall. The financial burden of repairs is significant, and many households are unable to fully restore their homes. Livelihood assets, such as tools and vending equipment, are also affected, either through physical damage or disruption of use.

The impact on consumption and financial stability is marked by a dual pressure of reduced income and increased expenditure. Households report rising costs related to food, transport, healthcare, and livelihood maintenance. While many manage to maintain basic consumption, some reduce food intake during periods of stress. Borrowing, often from informal sources, emerges as a coping mechanism, though it contributes to longer-term financial strain.

Health impacts are also significant, with respondents reporting increased incidence of illness associated with changing weather conditions. Limited access to healthcare services and the prevalence of out-of-pocket expenditure further exacerbate vulnerability. Children's education is affected primarily through loss of school days due to disrupted mobility, highlighting the indirect but important effects of climate change on human development outcomes.

Policy Implications

The findings underscore the need for integrated policy responses that address both climate risks and socio-economic vulnerabilities. In a context like Shimla, where environmental fragility intersects with urban inequality, climate adaptation cannot be separated from broader development challenges. Improving housing conditions and infrastructure is essential, particularly in terms of slope stabilisation, drainage, and water management. At the same time, enhancing livelihood security through diversification, skill development, and income support during periods of disruption is critical.

Strengthening social protection systems is equally important. Expanding access to food security programs, health insurance, and pensions, while ensuring portability for migrant workers, can provide essential safety nets. Financial inclusion measures, including access to affordable credit and savings mechanisms, can reduce reliance on informal borrowing and enhance resilience.

Healthcare systems need to be strengthened to address climate-related health risks, particularly in underserved settlements. Finally, governance frameworks must become more inclusive and participatory, incorporating the perspectives of informal workers into climate planning and decision-making processes. Such an approach is essential for developing context-specific and equitable responses to climate change.

Conclusion

The study highlights that climate change in Shimla is experienced not as an isolated environmental phenomenon but as a process that intensifies existing socio-economic inequalities. Informal workers face a combination of environmental exposure and structural disadvantage, which limits their capacity to cope with and adapt to changing conditions. While households employ a range of coping strategies, these are largely short-term and insufficient to address underlying vulnerabilities.

Addressing these challenges requires a shift toward integrated and justice-oriented approaches that combine climate adaptation with social protection, inclusive urban planning, and livelihood security. Recognising informal workers as central to the urban economy—and as key stakeholders in climate resilience—is essential for building more equitable and sustainable responses to climate change in mountain cities like Shimla.

Chapter 1: Context

1.1 Urban Development, Inequality, and Precarity

Urbanisation has become one of the most significant socio-economic transformations of the twenty-first century, reshaping patterns of settlement, production, and livelihoods across the globe. According to the United Nations, more than half of the world's population currently resides in urban areas, and this proportion is projected to increase substantially in the coming decades (UNDESA, 2023). Much of this growth is concentrated in countries of the Global South, where cities are expanding rapidly in response to industrialisation, economic restructuring, and migration. While urbanisation has generated opportunities for employment and economic mobility, it has also intensified inequalities and produced new forms of socio-economic precarity.

Urban economies are characterised by a dual structure in which formal and informal sectors coexist. The informal economy, which includes activities such as street vending, construction labour, domestic work, waste picking, and small-scale services, constitutes a dominant share of employment in many developing countries. In India, nearly 90 percent of the workforce is engaged in informal employment (International Labour Organization [ILO], 2019). These workers play a vital role in sustaining urban systems by providing essential goods and services, often at low cost. However, their contributions are not matched by adequate recognition or protection within policy and planning frameworks.

Informal employment is typically characterised by irregular wages, absence of formal contracts, lack of job security, and limited access to social protection. Workers often depend on daily earnings, making them highly vulnerable to fluctuations in demand and external shocks. This economic insecurity is closely linked to broader patterns of urban inequality. The benefits of urban growth are unevenly distributed, with wealth and resources concentrated among higher-income groups, while low-income populations experience persistent deprivation.

Housing is a key dimension of this inequality. Rapid urban expansion has outpaced the provision of affordable housing, leading to the proliferation of informal settlements. UN-Habitat (2020) estimates that over one billion people globally live in slums or informal settlements, often characterised by overcrowding, insecure tenure, and inadequate access to basic services such as water, sanitation, and electricity. These settlements frequently emerge in marginal or hazard-prone areas where land is available but environmental risks are high.

The spatial distribution of urban poverty reflects the structural inequalities embedded in urban development processes. Low-income households are often pushed to the peripheries or to environmentally vulnerable locations such as floodplains, riverbanks, or areas near waste disposal sites. These patterns are not accidental but are shaped by planning systems that

prioritise formal development while excluding informal populations (Davis, 2006; Roy, 2005).

Working conditions within the informal economy further reinforce precarity. Many informal workers perform physically demanding labour in outdoor or hazardous environments without adequate safety measures. Construction workers, sanitation workers, and waste pickers are exposed to risks such as extreme weather, pollution, and occupational hazards. These risks are compounded by limited access to healthcare and social security systems.

Social hierarchies such as caste, gender, and migration status further shape the experiences of informal workers. Women are disproportionately represented in low-paid and insecure occupations and often bear the additional burden of unpaid care work (Chen et al., 2005). Migrant workers frequently face barriers related to documentation, housing, and access to public services. These intersecting inequalities create a layered structure of vulnerability that defines the everyday realities of the urban poor.

Thus, urbanisation, while generating economic growth, has simultaneously produced conditions of exclusion and precarity for a large segment of the urban population. Understanding these structural inequalities is essential for analysing how environmental challenges such as climate change intersect with urban poverty.

1.2 Uneven Impact: Urbanisation and Climate Change

Cities are central to the global climate crisis, both as major contributors to greenhouse gas emissions and as sites of increasing climate vulnerability. Urban areas account for a significant share of global energy consumption and carbon emissions due to their concentration of infrastructure, industry, and transportation systems (IPCC, 2022). At the same time, the processes of urbanisation themselves alter natural ecosystems, making cities more susceptible to climate-related risks.

The transformation of land for urban development involves the replacement of natural vegetation, wetlands, and permeable surfaces with built infrastructure. This has several ecological consequences. One of the most significant is the urban heat island effect, whereby cities experience higher temperatures than surrounding rural areas due to heat absorption and retention by concrete and asphalt surfaces (Oke, 1982). This effect intensifies the impact of heatwaves, making them more severe in urban environments.

Urbanisation also disrupts natural hydrological systems. The conversion of land reduces groundwater recharge and increases surface runoff, leading to higher risks of flooding during periods of intense rainfall. Encroachment on water bodies and inadequate drainage infrastructure further exacerbate these risks. As a result, many cities experience a paradoxical combination of water scarcity and flooding, often within the same year.

Climate change amplifies these challenges by increasing the frequency and intensity of extreme weather events. Scientific evidence indicates that rising global temperatures are contributing to more frequent heatwaves, erratic rainfall patterns, and extreme precipitation events (IPCC, 2022). These changes place additional stress on urban infrastructure systems and public health.

However, the impacts of climate change are not experienced uniformly across urban populations. The urban poor and informal workers face disproportionately higher levels of exposure and vulnerability due to their socio-economic conditions. This uneven distribution of risk is shaped by several interrelated factors.

First, the location of informal settlements often exposes residents to environmental hazards. These settlements are frequently situated in low-lying or flood-prone areas, on marginal lands, or near environmentally degraded zones. Housing structures in such areas are typically constructed with temporary materials, offering limited protection against extreme weather events.

Second, the nature of informal employment increases exposure to climate risks. Many informal workers are engaged in outdoor occupations that require prolonged exposure to environmental conditions. Heat stress, for example, can significantly reduce labour productivity and increase the risk of illness. The ILO (2019) estimates that heat stress could lead to substantial losses in working hours globally, particularly in regions such as South Asia.

Third, limited access to resources constrains the ability of the urban poor to cope with climate shocks. Low-income households often lack savings, insurance, and access to formal support systems. As a result, climate-related disruptions—such as loss of income, damage to housing, or health emergencies—can have long-lasting impacts on household well-being.

These dynamics highlight the concept of “urban climate vulnerability,” which emphasises the interaction between environmental risks and socio-economic inequalities (Satterthwaite et al., 2007). Addressing climate change in urban contexts therefore requires not only environmental interventions but also policies that address underlying structural inequalities.

1.3 Climate Justice and the Need to Protect Informal Workers

The unequal distribution of climate impacts has led to the emergence of climate justice as a critical framework for understanding and addressing the climate crisis. Climate justice emphasises that climate change is not only an environmental issue but also a social and political one, shaped by historical inequalities and power relations (Schlosberg, 2007).

At its core, climate justice highlights the disparity between those who contribute to climate change and those who bear its consequences. Marginalised populations, including the urban

poor and informal workers, typically have low carbon footprints yet face the greatest exposure to climate risks. This imbalance raises fundamental questions of equity, responsibility, and rights.

In urban contexts, climate justice draws attention to the vulnerabilities of informal workers whose livelihoods are closely tied to environmental conditions. Changes in temperature, rainfall, and air quality can directly affect their ability to work and earn income. For instance, heatwaves can reduce working hours and productivity, while floods can disrupt transportation and market access.

Climate justice also emphasises the importance of recognising and addressing differential adaptive capacity. Informal workers often lack access to resources, infrastructure, and institutional support that could help them cope with climate risks. This limited capacity makes them more vulnerable to both immediate and long-term impacts of climate change.

Another key dimension of climate justice is participation. Vulnerable communities are often excluded from decision-making processes related to climate policy and urban planning. Their knowledge, experiences, and priorities are rarely incorporated into policy frameworks, resulting in interventions that may not adequately address their needs (Bulkeley et al., 2014).

A climate justice approach therefore calls for inclusive and equitable policy responses. This includes extending social protection systems, improving access to basic services, and ensuring safe working conditions for informal workers. It also involves investing in climate-resilient infrastructure, such as improved housing, drainage systems, and urban green spaces, which can reduce exposure to environmental hazards.

Importantly, climate justice shifts the focus from viewing vulnerability as an individual condition to understanding it as a product of structural inequalities. It recognises that addressing climate change requires systemic changes that promote social equity and inclusion alongside environmental sustainability.

1.4 Vulnerability of Informal Workers in Shimla, Himachal Pradesh

Shimla, the capital of Himachal Pradesh, presents a distinct urban context shaped by its mountainous geography, ecological sensitivity, and dependence on tourism and service-led economic activities. Unlike rapidly expanding metropolitan cities, Shimla's urbanisation is constrained by topography, resulting in dense settlement patterns along slopes and limited scope for horizontal expansion. While the city has historically functioned as an administrative and tourist hub, recent decades have witnessed increasing demographic pressure, infrastructural strain, and environmental stress. These dynamics intersect with climate variability in ways that produce unique vulnerabilities, particularly for informal workers.

The urban economy of Shimla relies significantly on sectors such as tourism, hospitality, construction, transport, and small-scale services. A large proportion of workers engaged in these sectors operate within the informal economy, characterised by seasonal employment, absence of formal contracts, and limited access to social protection. Migrant workers from other parts of Himachal Pradesh and neighbouring states form a substantial segment of this workforce, often engaged in construction labour, street vending, waste management, and portering activities. Despite their essential role in sustaining the city's economy, these workers remain socially and economically marginalised.

Shimla's environmental context amplifies the vulnerability of informal workers in multiple ways. The city is highly sensitive to climate variability, with observed changes including rising temperatures, altered precipitation patterns, reduced snowfall, and an increase in extreme weather events such as intense rainfall and landslides. These changes are closely linked to broader processes of climate change, which are particularly pronounced in Himalayan regions. The decline in snowfall, for instance, has implications not only for water availability but also for tourism patterns, which directly affect employment opportunities for informal workers dependent on seasonal tourist inflows.

One of the most significant environmental risks in Shimla is the increasing incidence of landslides and slope instability. Unregulated construction, deforestation, and road expansion have weakened the ecological stability of the region, making it more susceptible to disasters triggered by heavy rainfall. Informal settlements and worker housing are often located on marginal lands or unstable slopes due to affordability constraints, exposing residents to heightened risks of displacement, housing damage, and loss of assets. These risks are further exacerbated by inadequate urban planning and limited investment in resilient infrastructure.

Water scarcity is another critical challenge shaping vulnerability in Shimla. The city has experienced recurring water crises, particularly during peak summer months when tourist inflow increases demand. Climate variability, including reduced snowfall and erratic rainfall, has affected natural water sources and reduced the reliability of supply systems. Informal worker households, which often lack access to secure and regular water connections, are disproportionately affected. Dependence on shared or distant water sources increases the time and physical burden of water collection, with significant gendered implications.

Changing temperature patterns also contribute to vulnerability, albeit in ways that differ from plains cities. While Shimla has traditionally had a moderate climate, rising temperatures are altering seasonal comfort levels and affecting both living and working conditions. Warmer summers and reduced winter severity are reshaping tourism cycles, which in turn influence income patterns for workers dependent on seasonal demand. At the same time, extreme weather events such as heavy rainfall disrupt daily work, particularly in outdoor occupations such as construction and vending.

Livelihood insecurity is deeply intertwined with these environmental changes. Informal workers in Shimla rely heavily on daily earnings linked to tourist activity and construction

cycles, both of which are sensitive to climatic conditions. Erratic weather can lead to sudden declines in tourist footfall, suspension of construction work, and disruptions in transport services, all of which translate into immediate income loss. The seasonal nature of employment further compounds this instability, as workers must navigate periods of low demand alongside climate-related disruptions.

Housing conditions play a crucial role in shaping vulnerability. Many informal workers reside in rented rooms, temporary shelters, or informal settlements with limited structural stability and inadequate access to basic services. The constraints of mountainous terrain often result in overcrowded and poorly ventilated housing, increasing exposure to both environmental risks and health hazards. In areas prone to landslides or water runoff, even moderate rainfall can lead to significant damage to housing structures.

Health risks are also heightened in this context. Exposure to cold, damp conditions during extended monsoon periods, combined with inadequate housing and sanitation, increases the incidence of respiratory and waterborne diseases. At the same time, limited access to healthcare services and financial constraints restrict the ability of workers to seek timely treatment. As in other urban contexts, health shocks often translate into financial distress due to out-of-pocket expenditure.

Social factors such as gender and migration further shape vulnerability. Women engaged in informal work often balance income-generating activities with household responsibilities, including water collection and caregiving. Climate-related stresses such as water scarcity and irregular supply increase their workload and reduce time available for paid work. Migrant workers, on the other hand, face barriers related to documentation, housing access, and eligibility for welfare schemes, limiting their capacity to cope with environmental and economic shocks.

Overall, the vulnerability of informal workers in Shimla reflects a complex interaction between ecological fragility, climate variability, and socio-economic marginalisation. The city's environmental challenges are not isolated phenomena but are deeply embedded within its patterns of urban development and resource use. Climate change acts as a multiplier of existing vulnerabilities, and in Shimla this process is mediated through the specific risks associated with mountainous terrain, tourism-dependent livelihoods, and constrained urban infrastructure. Addressing these challenges requires context-specific approaches that integrate climate adaptation with inclusive urban planning and strengthened social protection systems.

1.5 Community Knowledge and the Lived Experience of Climate Change

While climate change has been extensively studied at global and national levels, there remains a significant gap in understanding how it is experienced at the level of everyday life, particularly among vulnerable urban populations. Informal workers represent one of the most affected yet least documented groups in climate research.

Existing studies often rely on macro-level indicators and technical assessments, which may overlook the lived realities of communities facing climate risks. Informal workers, however, experience climate change directly through its impacts on their livelihoods, health, and living conditions. Their daily interactions with the environment provide valuable insights into localised patterns of climate variability.

Understanding community perceptions of climate change is important for several reasons. First, it helps identify how individuals interpret environmental changes and the factors they consider important. Second, it provides insights into the coping strategies adopted by households in response to climate-related disruptions. Third, it highlights gaps between policy frameworks and ground realities.

Informal workers often develop adaptive strategies such as adjusting work schedules, diversifying income sources, or relying on social networks during periods of crisis. While these strategies provide short-term resilience, they are often insufficient to address long-term vulnerabilities. Without adequate institutional support, households remain exposed to recurring climate shocks.

In the context of Shimla, where rapid urbanisation and environmental change are occurring simultaneously, understanding these lived experiences becomes particularly important. The city's informal workforce plays a critical role in sustaining its economy, yet their perspectives are rarely incorporated into climate planning processes.

This study is therefore motivated by the need to document and analyse how informal workers understand, experience, and respond to climate change. By foregrounding their voices and lived realities, the research aims to contribute to a more inclusive and grounded understanding of urban climate vulnerability. Such an approach aligns with the principles of climate justice and can inform policy interventions that are both equitable and effective.

Chapter 2: Study Design and Methodology

Understanding the impacts of climate change on informal workers requires a research approach that captures both measurable patterns and lived experiences. Informal workers operate in complex socio-economic and environmental conditions where livelihood security, housing, health, and urban infrastructure intersect with climatic variability. Traditional quantitative indicators alone are often insufficient to fully capture these multidimensional vulnerabilities. For this reason, the present study adopts a mixed-methods research framework that combines quantitative surveys with qualitative engagement with workers and communities.

2.1 Scope of Study

The present study examines how climate change and extreme weather events are affecting the livelihoods, working conditions, and living environments of informal workers in Shimla, Himachal Pradesh. The research is situated within a climate justice framework, recognising that climate change disproportionately affects socially and economically marginalised populations. Informal workers, who constitute a significant segment of Shimla's urban workforce, face heightened vulnerability due to insecure and seasonal employment, limited access to social protection, and precarious housing and living conditions.

Shimla, a prominent hill city and administrative capital, has experienced increasing urban pressure over recent decades driven by tourism, construction, and the expansion of service-sector activities. Unlike large metropolitan centres, the city's growth is constrained by its mountainous terrain, leading to dense and often unplanned development along slopes. Economic activity in sectors such as tourism, hospitality, transport, small-scale services, and construction has generated employment opportunities, attracting migrant workers from within Himachal Pradesh and neighbouring states. However, a substantial proportion of this workforce is engaged in informal occupations characterised by irregular incomes, absence of formal contracts, and limited labour protections. Informal workers involved in construction, street vending, waste management, portering, and tourism-related services play a crucial role in sustaining the city's economy, particularly during peak tourist seasons.

Despite their contributions, these workers often experience precarious living and working conditions. Many reside in rented rooms, temporary shelters, or informal settlements located on environmentally vulnerable land such as steep slopes or areas prone to water runoff and landslides. Access to basic services such as water supply, sanitation, drainage, and secure housing remains uneven. Their occupations frequently involve physically demanding labour, often carried out in outdoor or hazardous environments, exposing them directly to climate-related risks such as intense rainfall, cold and damp conditions, landslides, and increasing temperature variability.

Climate variability in Shimla has intensified these risks in recent years. Changes in precipitation patterns, including erratic rainfall and reduced snowfall, along with rising temperatures, have significant implications for workers whose livelihoods depend on stable environmental conditions. Heavy rainfall events frequently trigger landslides, disrupt transport networks, and damage housing structures, while also reducing work opportunities for daily wage labourers. At the same time, changing seasonal patterns affect tourism cycles, leading to fluctuations in demand for labour and contributing to income instability among workers dependent on tourist inflows.

Shimla also faces growing challenges related to water availability, particularly during peak summer months. Variability in rainfall and declining natural water sources, combined with rising demand, have resulted in periodic water shortages. Informal worker households are particularly affected, as they often rely on shared or irregular water sources that are time-consuming, unreliable, and costly. These conditions further increase the vulnerability of households, with significant gendered implications in terms of labour and time use.

Within this context, the scope of the present research is to document and analyse how climate change is affecting the everyday lives and livelihoods of informal workers in Shimla. The study focuses on workers engaged in sectors such as construction, tourism-linked services, waste collection, street vending, and other forms of daily wage labour, as these occupations involve high levels of exposure to environmental conditions and seasonal fluctuations.

The research is conducted across selected informal settlements and worker clusters in different parts of Shimla where informal workers live and work, including areas characterised by high concentrations of migrant labour and tourism-related economic activity. By focusing on these communities, the study seeks to capture the intersection of climate risks, ecological fragility, and socio-economic marginalisation within a mountain urban context.

The study aims not only to document the impacts of climate variability but also to understand how informal workers perceive environmental change and respond to its effects. Through this approach, the research seeks to generate insights that can inform more inclusive and context-sensitive climate adaptation policies, particularly for ecologically fragile hill cities where informal labour plays a central role in sustaining urban economies.

2.2 Objectives of the Study

- To study the forms of vulnerabilities and disruptions faced by marginalised urban communities, including impacts on housing, employment, access to basic services, and livelihood stability in the context of climate change.
- To document how these communities experience and perceive climate change in their everyday lives, including its impacts on livelihoods, income security, health, and consumption patterns across different climatic regions.

- To generate policy insights that foreground the lived experiences and knowledge of marginalised urban populations, contributing to more inclusive and justice-oriented climate adaptation strategies in urban governance.

2.3 Research Methodology

The study adopts a mixed-methods research design that integrates quantitative and qualitative approaches to examine the impacts of climate change on informal workers. This methodological approach allows the research to capture both statistical patterns and detailed narratives about how climate variability affects livelihoods and daily life.

Quantitative data provides measurable indicators related to household demographics, employment patterns, housing conditions, and climate-related impacts. Qualitative data, on the other hand, provides deeper insights into the experiences, perceptions, and coping strategies of workers. Combining these two forms of data allows for a more comprehensive understanding of climate vulnerability.

The research design involved the collection of primary data through structured surveys and focus group discussions conducted with informal workers across selected settlements in Shimla. Secondary data from policy documents, climate assessments, and academic literature was also reviewed to contextualise the findings within broader climate and urban development debates.

A total of 200 informal workers were surveyed as part of the quantitative component of the research. The survey captured information on employment patterns, housing conditions, access to basic services, health impacts, and experiences related to extreme weather events. The respondents were selected from various informal settlements in Shimla where large numbers of informal workers reside.

In addition to the survey, the study conducted ten focus group discussions with informal workers representing different occupations, including construction workers, sanitation workers, and daily wage labourers. These discussions provided an opportunity for participants to share their experiences of climate change, discuss the challenges they face in their work environments, and identify the strategies they use to cope with environmental disruptions.

The combination of surveys and group discussions enabled the research to capture both individual experiences and collective perspectives on climate impacts. While survey data helped identify patterns across the sample population, qualitative discussions revealed the social and economic contexts in which these impacts occur.

Data analysis involved the use of descriptive statistical techniques for quantitative data and thematic analysis for qualitative data. Survey responses were analysed using frequencies and percentages to identify patterns related to housing conditions, occupational characteristics, and climate-related disruptions. Qualitative narratives from focus group discussions were

analysed to identify recurring themes related to vulnerability, livelihood impacts, and coping strategies.

Ethical considerations were an important component of the research design. All participants were informed about the purpose of the study and their rights as respondents. Participation in the survey and group discussions was voluntary, and respondents were assured that their identities would remain confidential. Data collected during the research was used solely for academic and policy analysis purposes.

2.4 Data Collection Tools

To capture the diverse dimensions of climate vulnerability among informal workers, the study employed multiple data collection tools. These tools were designed to gather both quantitative and qualitative information on the experiences, perceptions, and coping mechanisms of workers.

Structured Survey

The primary quantitative tool used in the study was a structured questionnaire administered to 200 informal workers across informal settlements in Shimla. The survey collected detailed information on household characteristics, employment patterns, income levels, housing conditions, and access to basic services such as water, sanitation, and electricity.

The questionnaire also included questions related to climate-related experiences, including exposure to extreme heat, heavy rainfall, water scarcity, and environmental disruptions affecting livelihoods. The survey was conducted through face-to-face interviews to ensure clarity of questions and accuracy of responses. This approach also enabled researchers to engage with respondents who may have limited literacy or familiarity with formal survey formats.

The structured format of the questionnaire ensured consistency across interviews, allowing the research team to collect comparable data from different settlements and occupational groups. The survey provided a quantitative overview of the socio-economic conditions of informal workers and the extent to which climate change affects their livelihoods.

Focus Group Discussions

Focus group discussions formed the primary qualitative component of the study. Ten focus group discussions were conducted with informal workers residing in the selected settlements. Each group consisted of participants engaged in different occupations such as construction labour, sanitation work, waste picking, and daily wage labour.

The discussions were facilitated by trained researchers using semi-structured discussion guides. These guides included open-ended questions designed to encourage participants to share their experiences of climate change and discuss how environmental changes affect their work and daily lives.

Focus group discussions allowed participants to collectively reflect on issues such as changing weather patterns, disruptions to livelihoods, health risks, and challenges related to housing and infrastructure. The group setting encouraged participants to build upon each other's responses, generating richer insights into community experiences and shared concerns.

Key Informant Interactions

In addition to surveys and group discussions, the study also involved informal interactions with community leaders and representatives of worker groups within the selected settlements. These interactions helped provide contextual information about the socio-economic conditions of the communities and the institutional environment in which informal workers operate.

Key informants provided insights into local labour dynamics, migration patterns, housing conditions, and the availability of government welfare schemes. Their perspectives helped contextualise the experiences of workers within broader urban governance structures.

Secondary Data Review

The research also incorporated secondary data sources to complement the primary data collected during the field study. These sources included government policy documents, climate action plans, labour statistics, and academic studies related to urban vulnerability and climate change.

Secondary data helped situate the findings of the study within broader debates on climate adaptation, urban development, and labour rights. Reviewing policy frameworks also enabled the research to identify gaps between policy commitments and the lived experiences of informal workers.

Together, these data collection tools provided a comprehensive understanding of how climate change affects informal workers in Shimla. By combining quantitative indicators with qualitative narratives, the study captures both the measurable impacts of climate variability and the lived realities of workers navigating environmental and economic uncertainty.

Chapter 3: Data Analysis

3.1. Respondent Profile

Understanding the socio-economic profile of respondents is essential for analysing how climate change affects informal workers. Informal workers often experience multiple layers of vulnerability related to employment insecurity, housing conditions, limited access to public services, and financial instability. These conditions shape their capacity to cope with environmental shocks and climate variability.

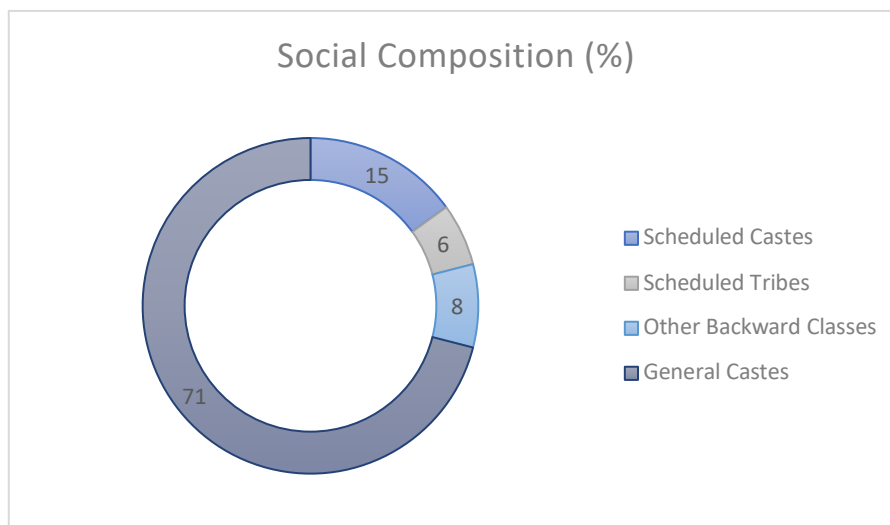
The findings are based on a survey of 200 respondents across different locations within Shimla district, covering areas like Summer Hill, Totu, Tutikandi, and Sangti among others. The respondent profile highlights key socio-economic characteristics of the surveyed households, including social background, livelihood patterns, access to housing and services, and financial conditions. These factors provide an important context for understanding how climate change interacts with existing urban inequalities to influence the vulnerability of informal workers.

Social and Livelihood Composition

The social and livelihood composition of respondents reflects the complex intersection of demographic characteristics, migration patterns, and labour market structures that define informal work in Shimla. The surveyed population is predominantly composed of individuals in the working-age group, with 63% being between 30 and 50 years old. This indicates that the sample largely represents economically active individuals engaged in income-generating activities. At the same time, the presence of respondents across a wider age range, including 22% respondents being less than 30 years old and 9% respondents older than 60 years. Individuals, suggests that informal work spans multiple stages of the life cycle.

Household size and composition patterns further highlight the dependency responsibilities carried by respondents. A majority (70%) are married, implying that most workers support family units and are responsible for household sustenance. Household size data shows that most families consist of 3 to 5 members, indicating moderate dependency ratios. However, even within these relatively small household units, the burden of ensuring income stability remains significant, especially in the absence of secure employment or social protection.

The social composition of respondents reveals both diversity and inequality. While the majority belong to the General category (71%), a significant proportion of respondents come from Scheduled Castes (15%), Other Backward Classes (8%), and Scheduled Tribes (6%). This indicates that socially marginalised groups are present within the informal workforce, though their representation may vary by region and type of work. While religious diversity is limited with 95% being Hindu, caste-based differences remain an important dimension of socio-economic stratification.



Educational attainment among respondents points to structural disadvantages in access to human capital. A substantial proportion of respondents have low levels of formal education, with many having completed only primary (20%) or secondary schooling (12%), and a notable segment of 14% never having enrolled in formal education. While a small number have attained higher education (12%) or vocational training (9%), these remain exceptions rather than the norm. Limited education restricts access to formal employment opportunities, effectively confining workers to low-skilled and informal occupations. This reinforces a cycle in which low education leads to precarious work, which in turn limits opportunities for upward mobility.

Livelihood patterns are strongly concentrated in informal occupations. Street vending (31%), construction work (24%) and operating petty shops (15%) dominate the occupational structure, together accounting for almost three-quarters of the respondents. Additionally, a wide range of other occupations, including sanitation work, domestic work, portering, repair services, and tourism-related activities are reported.

A defining feature of these occupations is their precarity. Most respondents rely on daily or irregular income, with little or no job security. Employment is often seasonal, particularly in tourism-linked sectors, where demand fluctuates based on tourist inflows and weather conditions. Workers engaged in outdoor activities such as construction and vending are directly exposed to environmental conditions, making their livelihoods highly sensitive to climate variability. Even those engaged in petty shop operations or tourism related activities, face income instability due to fluctuating demand.

Migration emerges as a central feature shaping the workforce. A large majority (69%) of respondents are migrants, highlighting Shimla's role as a regional employment hub. The primary reason for migration is the lack of employment opportunities in native areas (52%), followed by the search for better income prospects and distress in agriculture. These findings suggest that migration is largely driven by economic compulsion rather than choice. Migrants

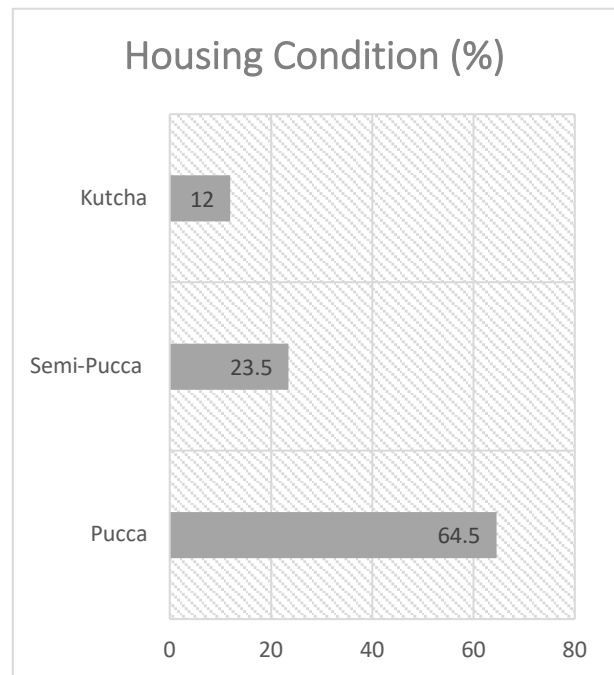
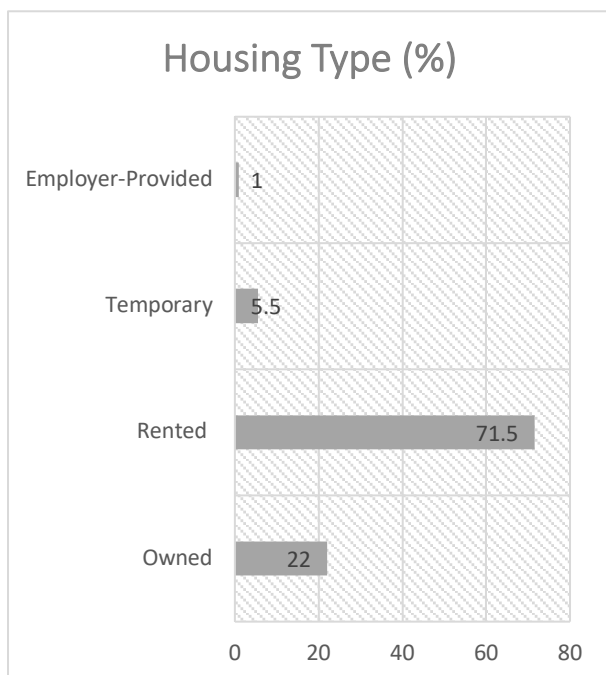
often relocate with limited resources and networks, entering urban labour markets under conditions of uncertainty. A smaller proportion of respondents commute daily from nearby rural areas, indicating the presence of circular migration patterns.

Overall, the social and livelihood composition of respondents highlights a workforce characterised by limited education, high levels of migration, and dependence on precarious informal employment. These factors collectively shape the baseline vulnerability of informal workers, influencing their capacity to cope with climate-related disruptions and economic shocks.

Conditions of Housing, Water, and Sanitation Facilities

Housing and access to basic services are critical determinants of vulnerability among informal workers. The findings reveal that a majority of respondents (72%) live in rented accommodation, while only 22% own their homes. A small proportion reside in temporary housing or employer-provided accommodation. This high dependence on rental housing indicates limited tenure security, which can lead to instability in living arrangements, particularly for migrant workers who may face eviction or frequent relocation.

In terms of housing quality, the majority of respondents live in permanent structures (65%), followed by semi-permanent (24%) and kutcha housing (12%). While this suggests a relatively better structural quality compared to some urban informal settlements, it does not necessarily translate into secure or adequate living conditions. Many of these houses are located in environmentally vulnerable areas such as steep slopes or poorly serviced neighbourhoods, exposing residents to risks such as landslides, water runoff, and damp conditions.



Access to electricity is relatively high, with 94% of households reporting connections. This indicates a certain level of infrastructural penetration. However, access alone does not guarantee reliability or quality. In informal settlements, electricity supply may be irregular, shared, or dependent on informal arrangements, limiting its effectiveness in improving living conditions.

Water access shows a mixed picture. A majority of households (80%) have access to private taps, while 17% rely on community taps. A small proportion depend on natural sources such as rivers or ponds. While the prevalence of private taps suggests relatively better access, issues of reliability, seasonality, and quality remain important concerns. In a context like Shimla, where water availability is affected by climatic variability, even households with nominal access may face shortages during certain periods.

Sanitation facilities reveal significant disparities. Although a large proportion (76%) of respondents report access to private toilets, a considerable number depend on community (9%) or shared facilities (8%). Around 5% still practice open defecation, indicating gaps in sanitation coverage. Qualitative responses highlight that community toilets are shared among multiple households, often with inadequate maintenance and water supply. Such conditions can lead to overcrowding, reduced hygiene, and increased health risks.

Cooking fuel usage reflects a partial transition to clean energy. LPG is the primary cooking fuel for 86% of households, indicating widespread adoption. However, a segment of the population continues to rely on kerosene, firewood, and coal, often due to affordability constraints or inconsistent access to LPG. The use of traditional fuels has implications for both health and environmental sustainability, particularly in poorly ventilated housing conditions.

These highlight the precarious living conditions faced by many informal workers. Informal settlements frequently lack planned infrastructure, reliable drainage systems, and durable housing structures. As a result, residents are particularly vulnerable to flooding, waterlogging, and extreme cold. Poor ventilation and densely built neighbourhoods further intensify the effects of cold waves, especially during winter months.

Overall, the conditions of housing, water, and sanitation reveal a pattern of partial access combined with underlying insecurity. While basic services are present to some extent, their quality, reliability, and equity remain uneven. These conditions contribute to everyday vulnerability, particularly in the face of climate-related risks such as water scarcity, heavy rainfall, and environmental degradation.

Access to Social Security and Welfare Measures

Access to social protection and welfare measures plays a critical role in shaping the resilience of informal worker households, particularly in contexts characterised by livelihood insecurity and exposure to climate-related risks. The findings from the Shimla survey indicate that while

some forms of welfare support are present, overall access remains uneven, fragmented, and insufficient to address the multidimensional vulnerabilities faced by informal workers.

A key finding is that a significant proportion of respondents (23%) are not enrolled in any welfare scheme. This indicates a substantial level of exclusion from institutional support systems among a population that is already economically vulnerable. Even among those who report some level of access, enrolment is typically limited to one or two schemes rather than reflecting a comprehensive safety net. This pattern suggests that social protection coverage is not only incomplete but also unevenly distributed across different types of support.

A particularly important concern emerging from the data is the relatively low and uneven access to the Public Distribution System (PDS) in the context of a highly migrant workforce. Although around half of the respondents report PDS enrolment, this still leaves a significant proportion excluded from one of the most critical food security mechanisms in India. This gap is closely linked to the high levels of migration observed in the sample, with nearly 69% of respondents having migrated to Shimla in search of work. Migrant workers often face structural barriers in accessing PDS due to issues such as lack of locally valid ration cards, portability challenges, documentation requirements, and limited awareness about entitlements under schemes like One Nation One Ration Card. As a result, many migrant households remain dependent on market purchases for food, exposing them to price volatility and income shocks. In a context of irregular earnings and climate-induced livelihood disruptions, the absence of reliable access to subsidised food grains significantly heightens vulnerability, forcing households to adopt coping strategies such as reducing food consumption, borrowing, or reallocating expenditure from other essential needs.

Health insurance coverage is relatively higher compared to other welfare schemes, with 48% of respondents reporting some form of enrolment. This suggests a certain degree of penetration of government-supported health insurance programs. However, coverage does not necessarily translate into effective financial protection. Informal workers often face barriers in accessing healthcare services, including lack of awareness about entitlements, administrative complexities, and limited availability of empanelled healthcare facilities. As a result, many households continue to rely on out-of-pocket expenditure for medical treatment, particularly for outpatient care or services not covered under insurance schemes. This gap between nominal coverage and effective utilisation limits the protective role of health insurance.

In contrast to food security and health insurance, access to other forms of social protection remains extremely limited. Old-age pension schemes reach only 5% of respondents, indicating that a large majority of workers lack support in later stages of life. Given that informal workers typically do not have access to retirement benefits or savings, the absence of pension coverage has significant implications for long-term economic security. Similarly, access to widow pensions and other gender-specific support schemes is negligible, suggesting that vulnerable groups within the population are not adequately supported.

Employment-related schemes also show limited reach. Labour welfare schemes, which are specifically designed to support workers in sectors such as construction, cover only 7% of

respondents. This is particularly striking given the high proportion of respondents engaged in construction and other labour-intensive occupations. The low coverage suggests barriers such as lack of registration, complex eligibility criteria, and limited awareness among workers.

Access to schemes related to education, child welfare, and human development is similarly limited. Less than 5% of respondents report benefiting from scholarship programs or children's education assistance schemes. Participation in ICDS or mid-day meal schemes is also minimal, despite their importance in addressing nutritional and developmental needs. These gaps are significant because such schemes play a crucial role in breaking intergenerational cycles of poverty. Their limited reach indicates that social protection systems are not adequately addressing the broader developmental needs of informal worker households.

A particularly notable finding is the complete absence of coverage under targeted schemes for vulnerable social groups such as Dalits, Adivasis, widows, and persons with disabilities. This suggests that intersectional vulnerabilities are not being adequately addressed through existing welfare frameworks. Informal workers who belong to these groups may therefore face compounded disadvantages, with limited access to both general and targeted forms of support.

The findings point to structural barriers in accessing social protection, particularly for migrant workers who often lack valid local documentation. Limited awareness and complex administrative procedures further restrict enrolment, especially among workers with low education and time constraints. Even when enrolled, access to welfare schemes is fragmented, with households receiving only partial support that fails to address interconnected risks such as health, income loss, and housing insecurity.

These gaps are especially critical in the context of climate change, where informal workers face heightened exposure to environmental and livelihood shocks. In the absence of adequate institutional support, households rely on coping strategies such as borrowing or reducing consumption, which often deepen long-term vulnerability. Overall, social protection in Shimla remains partial and inadequate, highlighting the need for more inclusive, accessible, and integrated systems tailored to the needs of informal workers.

Income and Debt Profile

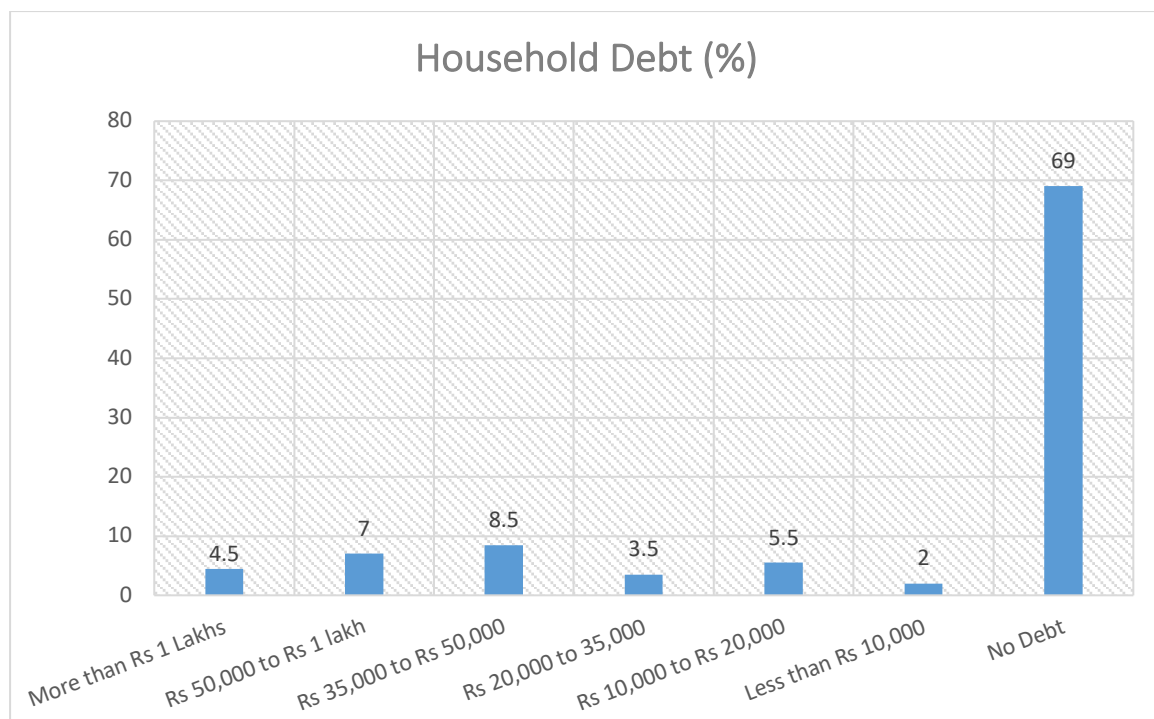
The income and debt profile of respondents provides critical insight into the economic conditions of informal workers in Shimla, revealing a pattern of instability, limited financial security, and constrained coping capacity. These financial characteristics are central to understanding how households experience and respond to climate-related and economic shocks.

The distribution of monthly household income indicates that a large proportion of respondents fall within low and lower-middle income categories. Around 12% of households report earning up to ₹5,000 per month, while an additional 14% fall within the ₹5,001–₹10,000 range. Around 22% report incomes in the ₹25,001–₹50,000 bracket and only a small

proportion (6%) report earnings above ₹50,000. It should be noted that many workers are unable to estimate a fixed monthly income due to fluctuating daily wages, seasonal employment, and variability in work availability.

These income patterns reflect the inherent precarity of informal employment in Shimla. Workers engaged in street vending, construction, tourism-related activities, and small-scale services often depend on daily earnings, which are highly sensitive to external factors such as weather conditions, tourist inflows, and local demand. Seasonal fluctuations are particularly important in a hill economy like Shimla, where tourism cycles significantly influence employment opportunities. During off-peak seasons or periods of adverse weather, many workers experience sharp declines in income or complete loss of workdays. As a result, income is not only low for many households but also highly unpredictable, making financial planning extremely difficult.

The limited income base has direct implications for household consumption, savings, and investment. Most households operate with minimal or no savings, relying on daily earnings to meet immediate needs such as food, rent, utilities, and transportation. This leaves little scope for long-term investments in housing, education, or health. Even relatively small disruptions—such as illness, temporary unemployment, or climate-related events—can significantly destabilise household finances. The absence of financial buffers means that households are often forced to prioritise short-term survival over long-term well-being.



Debt patterns further illustrate the financial vulnerability of respondents. While 69% of respondents report no outstanding debt, this does not necessarily indicate financial security.

Rather, it may reflect limited access to credit or an inability to take on loans due to unstable incomes. Among those who do report debt, the levels vary considerably. Around 8.5% of respondents have debts in the range of ₹35,000 to ₹50,000, while 7% owe between ₹50,000 and ₹1 lakh. Smaller proportions report debts in the ₹10,000–₹20,000 and ₹20,000–₹35,000 ranges, and 4.5% have debts exceeding ₹1 lakh.

The reasons for incurring debt reveal both productive and distress-driven borrowing. Livelihood-related investment is the most commonly reported reason, indicating that some households borrow to sustain or expand income-generating activities such as setting up small businesses, purchasing tools, or maintaining working capital. Housing-related expenses, including construction and repair, also account for significant borrowing, reflecting the need to maintain or improve living conditions in a context of limited savings. Other reasons include consumption needs, healthcare, education, and repayment of existing loans. These patterns suggest that debt is not only a tool for economic activity but also a coping mechanism for managing everyday expenses and unexpected shocks.

Healthcare-related borrowing, although reported by a smaller proportion, is particularly significant in understanding vulnerability. In the absence of comprehensive health coverage and accessible services, medical expenses often lead to out-of-pocket expenditure, which can quickly escalate into debt. Similarly, borrowing for consumption indicates that household incomes are often insufficient to meet basic needs, forcing families to rely on credit even for routine expenditures.

The sources of debt highlight the limited integration of informal workers into formal financial systems. While 20% of respondents report borrowing from banks, a majority rely on informal or unspecified sources, as well as self-help groups and social networks such as friends and relatives. Informal borrowing is typically characterised by easier access and fewer documentation requirements, but it often comes with higher interest rates and less favourable repayment terms. This can lead to cycles of indebtedness, where households struggle to repay loans and may need to take on additional debt to manage repayments.

Borrowing from social networks, such as friends and relatives, plays an important role as a coping mechanism, particularly for smaller amounts or short-term needs. However, the capacity of these networks is often limited, as they are typically composed of individuals facing similar economic constraints. Self-help groups provide an intermediate source of credit, offering relatively more structured lending mechanisms, though their reach remains limited within the sample.

The interaction between income instability and debt is a key feature of the financial profile. Low and irregular incomes limit savings, increasing reliance on borrowing during periods of stress, while repayment obligations further strain household finances. This creates a cycle where financial vulnerability both drives and is reinforced by indebtedness.

In the context of climate change, these challenges intensify. Climate-related disruptions such as extreme weather, landslides, and fluctuations in tourism reduce income while increasing expenses, pushing households toward borrowing or consumption adjustments. Although these strategies offer short-term relief, they often deepen long-term insecurity.

Asset ownership patterns further reinforce the picture of limited economic resilience. While most households own basic assets such as mobile phones (93%) and some own televisions (54%), ownership of higher-value assets such as vehicles or land is relatively low. Only a small proportion report owning residential land or housing. This indicates that most households lack assets that could serve as financial security or collateral in times of crisis.

Overall, the income and debt profile of respondents highlights a condition of structural economic precarity. Households operate within tight financial margins, with limited savings, unstable incomes, and constrained access to formal credit. Debt functions both as a coping mechanism and a source of vulnerability, reflecting the absence of robust financial and institutional support systems. These conditions significantly shape the capacity of informal workers to respond to climate variability, underscoring the need for integrated interventions that address income security, financial inclusion, and social protection.

3.2. Perceptions on Weather Patterns Changes

Understanding how communities perceive environmental change is an important component of climate research, particularly when examining the impacts of climate variability on vulnerable populations. Unlike meteorological data, these perceptions are grounded in lived experience and everyday interactions with the environment. For informal workers, whose livelihoods are directly dependent on weather conditions, such perceptions are shaped not only by environmental changes but also by their immediate impacts on income, work continuity, and living conditions.

The perceptions of respondents regarding changing weather patterns offer critical insight into how climate change is experienced at the local level in Shimla. The findings indicate a strong and consistent recognition among respondents that weather patterns have become more extreme, erratic, and difficult to predict over recent years.

Incidence of Extreme Weather Events

Informal workers in Shimla understand and interpret climate change primarily through their repeated encounters with extreme weather events that directly affect their livelihoods, health, and living conditions. Respondents report a high and widespread incidence of extreme weather events over the past three years, indicating that such events have become frequent and, in many cases, routine. Irregular rainfall is the most reported phenomenon, experienced by 95% of respondents. This near-universal reporting suggests that rainfall is no longer predictable in terms of timing, intensity, or duration. Respondents frequently associate irregular rainfall with disruptions to work, especially in sectors such as construction, vending, and transport, where even short periods of heavy rain can halt economic activity.

Landslides emerge as another dominant hazard, reported by 94% of respondents. In a mountainous region like Shimla, landslides are not new, however, their increasing frequency and intensity are perceived as significant changes. Respondents link landslides to heavy and

prolonged rainfall, as well as to construction activities and environmental degradation. The high reporting of landslides reflects both direct exposure through damage to housing or surroundings and indirect impacts, such as blocked roads and restricted mobility, which disrupt livelihoods and access to markets.

Cloudbursts and flash floods are reported by 82% of respondents, highlighting the growing prevalence of sudden and high-intensity rainfall events. These events are often described as abrupt and destructive, leaving little time for preparation or response. In many cases, they lead to immediate disruptions such as road closures, damage to temporary structures, and loss of goods for street vendors. Similarly, 66% of respondents report experiencing flooding or waterlogging, indicating that urban infrastructure is increasingly unable to cope with heavy rainfall, even in a hill city context.

Heatwaves are reported by 68% of respondents, reflecting a notable shift in thermal conditions. Traditionally, Shimla has been associated with moderate and cooler climates, however, respondents now perceive an increase in extreme heat conditions. This is particularly significant for informal workers engaged in outdoor labour, who report difficulties in working during peak heat hours. Heat stress not only reduces productivity but also poses health risks, especially for those without access to protective infrastructure or rest periods.

Drought conditions are reported by 65% of respondents, suggesting that alongside intense rainfall events, periods of water scarcity are also becoming more frequent. This duality experiencing both excessive rainfall and water scarcity highlights the increasing variability and unpredictability of the climate. It is important to note that what respondents might refer as drought are basically periods of reduced water availability, affecting both household consumption and livelihood activities, particularly for those with rural linkages or dependence on agriculture.

In contrast, heavy snowfall or blizzards are reported by only 13% of respondents, indicating a relative decline in such events. This aligns with broader perceptions of reduced snowfall in the region and reflects changing winter conditions. The decline in snowfall has implications not only for water resources but also for tourism, which is an important source of income in Shimla.

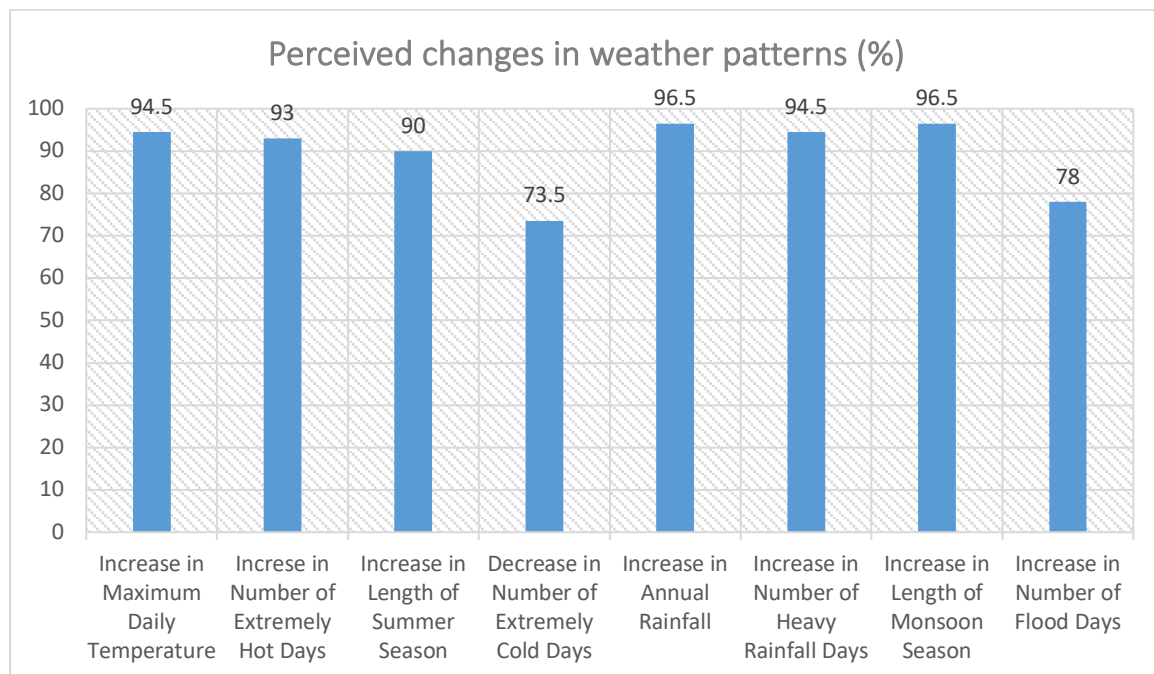
An important feature of the data is that respondents often report experiencing multiple extreme events simultaneously. The most common response categories include combinations of irregular rainfall, landslides, flash floods, heatwaves, and drought. This clustering of risks suggests that households are not dealing with isolated hazards but with overlapping and compounding events. Such multi-hazard exposure significantly increases vulnerability, as the impacts of one event can exacerbate the effects of another.

The impacts of these events extend beyond immediate disruptions to include longer-term economic and material consequences. Respondents reported damage to their housing, particularly roofs and walls, reflecting the vulnerability of semi-permanent and informal housing structures to rainfall and storms. More significantly, respondents reported substantial numbers of days without income due to extreme weather. These prolonged interruptions

reinforce the association between climate change and livelihood insecurity, as workers are forced to cope with repeated income shocks. Thus, for informal climate change, in this context, is defined by the intensification of everyday risks that directly affect survival and stability.

Changes in Seasonal Patterns

In addition to extreme events, respondents report significant changes in seasonal patterns over the past seven years, indicating a broader shift in the local climate system. These changes are perceived across all major seasons—summer, monsoon, and winter—and are characterised by increasing temperatures, altered rainfall patterns, and shifting seasonal durations.



One of the most consistent findings is the perception of rising temperatures. A vast majority of respondents (94%) report an increase in maximum daily temperatures, while 93% report an increase in the number of extremely hot days. This suggests that warming is not only gradual but also reflected in more frequent extreme heat conditions. For informal workers, this translates into greater difficulty in working during peak hours, increased fatigue, and heightened health risks.

The summer season, in particular, is perceived to have become longer and more intense. Around 90% of respondents report an increase in the length of summer, indicating that hot conditions now persist for extended periods. This change disrupts traditional seasonal expectations and affects work patterns, especially for those engaged in outdoor occupations. Data on workdays lost during summer further reinforces this perception, with many

respondents reporting an increase in the number of days they are unable to work due to unbearable heat conditions.

Winter patterns show a contrasting trend. Approximately 73% of respondents report a decrease in the number of extremely cold days, indicating milder winters. While some respondents report an increase in the length of winter, this appears to reflect a shift toward longer but less intense winters. The reduction in cold extremes is also consistent with the reported decline in snowfall, suggesting a broader transformation of winter conditions.

Rainfall patterns exhibit some of the most pronounced changes. An overwhelming majority of respondents (96%) report an increase in annual rainfall, along with a similar proportion reporting an increase in the number of heavy rainfall days. Additionally, 96% perceive that the monsoon season has become longer. These changes indicate that rainfall is not only increasing in volume but also becoming more concentrated in intense events.

The increase in flood days, reported by 78% of respondents, further supports the perception of intensified rainfall and its impacts. However, the simultaneous reporting of drought conditions indicates that rainfall distribution is uneven. Respondents often describe situations where prolonged dry spells are followed by sudden and intense rainfall, making it difficult to manage water resources effectively.

Seasonal changes are also closely linked to shifts in livelihoods. A significant proportion of respondents report that traditional livelihood sources, particularly agriculture, have been reduced or discontinued over the past seven years. At the same time, there is an increase in engagement with alternative livelihoods such as construction work, daily wage labour, and street vending. This suggests that changing climatic conditions are influencing not only environmental patterns but also economic behaviour and livelihood strategies.

Another important dimension of seasonal change is the increasing unpredictability of weather. Respondents frequently emphasise that seasons no longer follow predictable patterns, making it difficult to plan work, travel, or household activities. This unpredictability is particularly challenging for informal workers, whose livelihoods depend on anticipating and adapting to seasonal cycles.

Overall, respondents perceive a clear shift toward warmer temperatures, more intense and prolonged rainfall, and less severe winters. These changes disrupt established seasonal rhythms and create new forms of uncertainty. The combination of altered seasons and increased extreme events contributes to a heightened sense of vulnerability, as workers must continuously adapt to a changing and unpredictable environment.

Importantly, this sense of vulnerability reflects a form of grounded knowledge that captures dimensions often overlooked in formal climate data, particularly the lived consequences of variability and uncertainty. For informal workers, climate change is not just about rising temperatures or changing rainfall averages, but about the erosion of predictability that once allowed them to plan their work and manage risks.

3.3. Impact of Changing Weather Patterns on Livelihood and Living Conditions

The survey findings indicate that respondents perceive changing weather patterns as having a significant influence on both their livelihoods and their everyday living conditions. Informal workers in Shimla are particularly sensitive to climatic variations because most of their occupations involve outdoor labour and depend heavily on environmental conditions. As a result, respondents often interpret climate change not only through extreme weather events but through the ways these events disrupt their ability to work, earn income, and maintain stable household conditions.

Participants in the study frequently described climate variability as something that directly shapes their daily routines. Floods, unpredictable rainfall, and increased heat exposure were commonly cited as conditions that make it difficult to continue work for long hours. These disruptions affect employment opportunities, household finances, and consumption practices, creating multiple layers of vulnerability for already marginalised communities.

Income Days and Livelihood Patterns

Respondents overwhelmingly associate increased extreme weather events, particularly irregular rainfall, landslides, heatwaves, and intense monsoon conditions with a direct reduction in income days and growing instability in livelihoods. For most informal workers, work availability is closely tied to weather conditions, and any disruption, whether due to heavy rainfall, excessive heat, or blocked roads translates immediately into lost earnings.

A large proportion of respondents report that extreme weather leads to frequent work stoppages. While around 20% report no loss of workdays, around 40% respondents report losing between 20 and 90 days annually, with some reporting even higher losses.

Respondents commonly link prolonged or erratic monsoon periods with extended spells of unemployment, often reporting loss of up to 2 months of workdays in a season, and in some cases higher in a year. Rainfall and landslides during the monsoon make it physically impossible to work, especially for those engaged in construction, street vending, and transport-related activities.

Heatwaves and extreme heat are similarly perceived as reducing work capacity. Respondents note that rising temperatures and longer summers make it difficult to work during daytime hours, particularly in physically demanding outdoor occupations such as construction. While 42% report no work loss in summer, majority report either reducing working hours or skipping work entirely on extremely hot days, leading to cumulative income losses.

Importantly, respondents do not only emphasise complete work stoppage but also highlight reduced income days. Even when work continues, earnings are often lower due to fewer customers, reduced productivity, or shorter working hours. For example, street vendors report lower sales during extreme weather, while daily wage labourers report fewer available jobs.

Similarly those working in tourism or transport related sectors, report lower incomes when extreme weather events like flooding or landslides disrupt tourist inflows. This distinction reflects a nuanced understanding of how climate variability affects income—not only by eliminating work but by eroding its returns.

Respondents also perceive long-term changes in livelihood patterns as a consequence of changing weather. Many explicitly link the decline of agriculture to erratic rainfall, drought conditions, and land degradation. Around 33% report that agriculture on their own land has been reduced or stopped, with additional respondents reporting reductions in agriculture on others' land and allied activities such as animal husbandry.

At the same time, respondents note a shift toward more precarious forms of work such as construction labour (26%), daily wage work (34%), and street vending (32%). While these occupations provide alternative income sources, respondents recognise that they are themselves highly vulnerable to weather disruptions. This creates a situation where workers move away from climate-sensitive livelihoods like agriculture, only to enter other forms of work that remain equally exposed to climate risks.

Migration for work is heavily linked to these changes. 64% respondents report that more family members are seeking livelihood opportunities through migration, often due to declining livelihood opportunities in their original occupations. This reflects an adaptive response, but also signals increased economic pressure on households.

Overall, respondents clearly perceive a strong and direct relationship between changing weather patterns and declining livelihood security. Increased frequency of extreme events, longer and harsher summers, and unpredictable monsoons are seen as key drivers of reduced workdays, unstable incomes, and shifting livelihood strategies.

Housing, Assets and Livelihood Infrastructure

Respondents consistently associate the increasing frequency and intensity of extreme weather events, particularly heavy rainfall, landslides, and prolonged damp conditions with growing vulnerability of their housing, assets, and livelihood infrastructure. While only 10% of respondents report direct structural damage to their houses, the way respondents describe these impacts suggests that the actual experience of housing stress is far more widespread and continuous.

Among those reporting direct damage, respondents identify wall damage, roof damage, and in some cases structural collapse as key impacts. These are often attributed to intense and prolonged rainfall, water seepage, and slope instability. However, beyond these measurable damages, many respondents emphasise recurring issues such as damp walls, leaking roofs, and water accumulation inside homes during heavy rains. These conditions are perceived as becoming more frequent and severe over time, reflecting changes in rainfall intensity and duration.

A significant concern raised by respondents is the location and quality of housing. Many informal workers live in rented or semi-permanent structures situated on slopes or in areas prone to water runoff. Respondents link these conditions directly to increased exposure to landslides and drainage-related problems. Even when houses are classified as permanent, respondents note that construction quality, maintenance, and surrounding infrastructure are often inadequate to withstand extreme weather. As a result, housing is perceived not as a secure asset but as a space of ongoing risk.

The financial implications of housing damage are substantial. Respondents frequently report that even minor repairs such as fixing leaks or reinforcing walls require significant expenditure relative to their income. Reported repair costs commonly range from ₹10,000 to ₹50,000, with some households incurring expenses exceeding ₹1 lakh. For households dependent on irregular daily wages, such costs are perceived as extremely burdensome and often unaffordable.

A particularly striking aspect of respondents' perceptions is the complete absence of institutional support. None of the respondents report receiving government compensation for housing damage. This reinforces a strong sense that climate-related losses are borne entirely at the household level. Respondents often express frustration at having to manage repeated damages without any external assistance, which further limits their ability to invest in more resilient housing. Respondents describe living in partially damaged or poorly repaired homes, which continue to expose them to further risks during subsequent weather events. This creates a cycle of vulnerability, where households are unable to fully recover before facing the next shock.

In addition to housing, respondents also associate extreme weather with damage and disruption to livelihood-related assets. Around 13% report damage to shops and 9% report direct damage to assets such as vending carts, tools, and stored goods. For street vendors, heavy rainfall often leads to spoilage of perishable goods or physical damage to carts and stalls.

However, respondents emphasise that the impact on livelihood infrastructure extends beyond physical damage. Even when assets are intact, extreme weather often prevents their use. For example, vendors report being unable to set up stalls during heavy rain, while transport disruptions limit access to markets and work sites. In hilly terrain, landslides and road blockages further restrict mobility, effectively cutting off access to income opportunities.

Overall, respondents perceive that changing weather patterns are making both housing and livelihood infrastructure increasingly fragile. The combination of physical exposure, high repair costs, incomplete recovery, and lack of institutional support creates a condition of persistent vulnerability. Rather than being isolated events, extreme weather impacts are experienced as recurring shocks that continuously erode the stability of both living conditions and income-generating assets.

Consumption, Expenses and Debt

Respondents consistently associate changing weather patterns and the increasing frequency of extreme weather events with rising living costs, unstable consumption patterns, and growing financial stress. These impacts are not always experienced as acute crises but are often described as cumulative pressures that gradually erode household well-being. Informal workers emphasise that the combined effect of income loss and increased expenditure creates a persistent strain on already limited resources.

In terms of consumption, a majority of respondents (85%) report that they are able to maintain their usual level of food intake. Among those reporting reduced consumption, the duration of impact varies considerably. Some respondents report reducing food intake for 10–20 days annually, while others report 30–50 days or more, with a few cases indicating even longer durations. Respondents explicitly link this reduction to loss of income days caused by heavy rainfall, landslides, and extreme heat, which limit their ability to earn daily wages.

Beyond food consumption, respondents strongly emphasise the rise in household expenditure associated with changing weather patterns. Approximately 47% of respondents report an increase in overall expenditure due to extreme weather events. These increases are perceived as both direct and indirect consequences of climatic changes.

The most commonly reported increase is in food expenditure (36%), which respondents attribute to rising prices during periods of supply disruption caused by heavy rainfall, landslides, and transport interruptions. Transport costs themselves are reported to increase by 21% of respondents, reflecting longer travel routes, higher fares, or the need for alternative modes of transport when regular routes are disrupted. Healthcare expenditure increases are reported by 15% of respondents, often linked to illness caused by extreme weather conditions. Additionally, 12% report increased expenditure on livelihood inputs, such as repairing tools, replacing damaged goods, or maintaining business operations under difficult conditions.

An important aspect of respondents' perception is that these increased costs are not one-time events but recurring expenditures. For example, repeated rainfall events may lead to repeated spending on repairs or maintenance, while fluctuating prices may continuously affect food and transport costs. This creates a situation where households are unable to stabilise their finances over time.

Debt emerges as a coping mechanism in response to these pressures, though it is not uniformly reported across all households. Around 6% of respondents explicitly report incurring debt due to extreme weather events. While this proportion may appear small, respondents indicate that borrowing is often used selectively for urgent needs, and not all financial stress results in formal debt.

Among those who do borrow, the amounts vary from relatively and these loans are typically used to meet immediate consumption needs such as food, rent, or healthcare, as well as to cover losses incurred due to disrupted livelihoods. Respondents emphasise that borrowing is often a necessity rather than a choice during periods of extreme stress.

An important dimension is the uneven impact of these changes across households. While some households are able to absorb shocks without significant changes in consumption or borrowing, others experience repeated and compounding stress. This variation reflects differences in income levels, access to social support, and existing financial buffers.

Overall, respondents perceive a clear and direct relationship between changing weather patterns and increasing economic strain. Extreme weather events are seen as simultaneously reducing income and increasing expenditure, creating a dual pressure that is difficult to manage within already constrained financial systems. While coping strategies such as adjusting consumption or borrowing provide temporary relief, they often contribute to longer-term vulnerability, reinforcing cycles of economic insecurity among informal worker households.

Healthcare and Children's Education

Respondents strongly associate extreme weather events and changing climatic conditions with increased health risks and related economic burdens. Around 30% report that they or their family members have experienced illness in the aftermath of extreme weather events, indicating a significant perceived connection between environmental conditions and health outcomes.

The most commonly reported illnesses include frequent fever (13.5%) and persistent cough (7.5%), along with other conditions such as respiratory problems and infections all frequently linked by respondents to changing weather patterns, particularly increased rainfall, damp conditions, and temperature fluctuations. Some also report more severe illnesses and injuries, including those resulting from accidents during extreme weather events.

The duration of illness varies, with most reporting up to 2 weeks of illness, and some reporting longer periods. Around 10% report hospitalisation, indicating more severe health impacts. Respondents emphasise that illness has a dual impact - it not only increases healthcare expenses but also reduces the ability to work, thereby compounding income loss. Even short periods of illness are perceived as significant, given the dependence on daily earnings.

Access to healthcare is also perceived as constrained with only 23% reportedly receiving the required tests, medicines, and diagnosis. This reflects significant gaps in healthcare access and quality.

Healthcare expenses are a major concern. Longer periods of hospitalisation and even at-home care lead to increased out-of-pocket expenditure, sometimes reaching substantial amounts of up to Rs 50,000. These expenses are particularly burdensome in the absence of savings or insurance, and in some cases contribute to borrowing.

Additionally, respondents note gendered impacts, such as challenges in meeting women's menstrual health needs during periods of disruption, indicating that climate-related stress affects different members of the household in distinct ways.

Respondents indicate that changing weather patterns and extreme weather events are causing notable disruptions in children's education, primarily through loss of school days. A significant 41% report that children have lost school days due to weather-related factors, which account for almost four-fifth of respondents with children of school-going age.

The extent of disruption is substantial. About half of affected households report that children lost more than 30 school days annually over the past three years, while another quarter report losses of 10–20 days.

Respondents commonly associate these losses with heavy rainfall, landslides, and disrupted transport, which make commuting to school difficult in hilly terrain. In contrast, direct damage to school infrastructure is minimal, with only 2% reporting damage to school buildings and 2% reporting loss of books.

Overall, respondents perceive a strong link between climate change and declining health security, which in turn affects household stability and long-term human development outcomes. the impact on education as indirect but significant—driven by access constraints and environmental disruptions rather than institutional damage—raising concerns about continuity in learning and long-term educational outcomes. The combined effects of illness, healthcare costs, and education disruptions reinforce cycles of vulnerability and limit the capacity of households to recover from shocks in the long term.

Chapter 4: Discussions

The analysis presented in the previous chapter demonstrates that informal workers in Shimla face multiple, interconnected risks arising from changing weather patterns. These risks are shaped not only by climatic variability but also by structural inequalities related to employment insecurity, inadequate housing, limited access to services, and weak social protection systems.

The findings reinforce a well-established understanding in the literature that climate change operates as a “risk multiplier,” intensifying pre-existing vulnerabilities rather than creating entirely new ones (IPCC, 2022). Informal workers in Shimla already face structural disadvantages arising from insecure employment, unstable incomes, limited savings, and constrained access to social protection. Climate variability compounds these conditions, creating a layered and cumulative form of vulnerability.

The following sections discuss three key dimensions emerging from the analysis: the relationship between climate change and increased vulnerability among informal workers, community perceptions of climate change, and the coping mechanisms adopted by households facing environmental disruptions.

4.1. Climate Change and Increased Vulnerability of Informal Workers

A central dimension of this vulnerability is livelihood insecurity. Informal workers’ dependence on daily earnings makes them particularly sensitive to environmental disruptions. Extreme weather events such as heavy rainfall, landslides, and heat stress directly interrupt work, reducing both the availability of employment and the capacity to work. This aligns with insights from the International Labour Organization, which emphasise the growing impact of climate change on labour productivity, especially in sectors reliant on outdoor work. In the context of Shimla, these risks are further shaped by the city’s mountainous terrain, where environmental disruptions not only affect work conditions but also limit mobility and access to markets.

The transformation of livelihood patterns observed in the study reflects broader processes identified in climate adaptation literature. The decline of agriculture and the shift toward informal urban occupations such as construction, vending, and daily wage labour represent adaptive responses to environmental change. However, these shifts often lead workers into forms of employment that remain highly exposed to climatic variability. This reflects what scholars describe as “maladaptive adaptation,” where coping strategies reduce immediate risks but increase long-term vulnerability.

Housing conditions further illustrate how environmental and socio-economic vulnerabilities intersect. Informal workers often reside in rented or semi-permanent structures located in environmentally fragile areas, such as steep slopes or zones prone to water runoff. Even

where housing appears structurally adequate, its location and surrounding infrastructure expose residents to recurring risks such as dampness, seepage, and instability. This corresponds with findings from UN-Habitat, which highlight how the urban poor are systematically pushed into hazard-prone spaces due to constraints in access to affordable and secure housing.

Financial vulnerability is another key dimension through which climate impacts are mediated. Irregular incomes and limited savings constrain the ability of households to absorb shocks, while rising expenditures associated with climate-related disruptions further strain household budgets. In such contexts, even relatively small shocks can have disproportionate effects. Existing literature on climate and poverty emphasises how repeated shocks can trap households in cycles of vulnerability, preventing recovery and reinforcing long-term insecurity.

The limited reach and fragmented nature of social protection systems further exacerbate these challenges. Informal workers often face barriers in accessing welfare schemes due to documentation requirements, lack of awareness, and administrative complexity. Migrant workers are particularly affected, as mobility disrupts their eligibility for place-based entitlements. This reflects broader critiques of social protection systems in India, which are often not designed to accommodate the realities of informal and mobile labour.

Overall, the findings demonstrate that vulnerability among informal workers in Shimla is not simply a product of environmental exposure but is deeply embedded in structural inequalities related to labour markets, housing, and access to resources. Climate change intensifies these inequalities, producing a condition of compounded vulnerability that is both economic and environmental in nature.

4.2. Community Perception of Climate Change

The study highlights that informal workers possess a nuanced and experience-based understanding of climate change, shaped by their daily interactions with the environment. Their perceptions closely align with scientific observations, while also capturing dimensions that are often overlooked in technical assessments.

Respondents interpret climate change primarily through changes in weather patterns and the increasing frequency of extreme events. Rather than focusing on long-term averages or abstract indicators, they emphasise unpredictability as a defining feature of environmental change. Seasons are no longer experienced as stable or reliable, making it difficult to anticipate work opportunities, plan household activities, or manage risks. This perception resonates with findings from the Intergovernmental Panel on Climate Change, which highlight increasing variability and uncertainty as key characteristics of climate change.

An important aspect of community perception is the recognition of multiple and overlapping risks. Respondents do not view climate events in isolation but describe experiencing combinations of hazards such as heavy rainfall, landslides, heat stress, and water scarcity.

This reflects the concept of “compound risk” in climate research, where different hazards interact to amplify overall vulnerability. Such an understanding demonstrates that communities are attuned not only to individual events but also to the broader patterns of environmental instability.

Respondents also demonstrate an awareness of shifting seasonal patterns, including changes in temperature, rainfall, and snowfall. These changes are interpreted in relation to their impacts on livelihoods, health, and daily life. For instance, longer summers are associated with reduced working capacity, while prolonged monsoons are linked to extended periods of work disruption. This highlights the practical and experiential basis of climate knowledge among informal workers.

The coexistence of perceptions such as increased rainfall alongside experiences of water scarcity further illustrates the complexity of local climate understanding. Rather than viewing these as contradictions, respondents interpret them as part of a broader pattern of variability, where intense rainfall events are interspersed with dry periods. This aligns with emerging literature that emphasises the importance of intra-seasonal variability in shaping climate impacts.

These findings also underscore the value of “local ecological knowledge,” which recognises that communities develop sophisticated understandings of environmental change based on lived experience. Such knowledge is particularly important in contexts like Shimla, where formal climate data may not fully capture the micro-level impacts of environmental change.

At the same time, the study reveals a gap between community knowledge and institutional frameworks. While respondents have a clear understanding of how climate change affects their lives, their perspectives are rarely incorporated into planning and policy processes. This reflects broader critiques of top-down approaches to climate governance, which often overlook local experiences and priorities (Bulkeley et al., 2014).

Overall, the findings suggest that informal workers are not passive recipients of climate impacts but active interpreters of environmental change. Their perceptions provide critical insights into how climate variability is experienced and managed at the ground level, highlighting the importance of integrating community knowledge into climate adaptation strategies.

4.3. Coping with Climate Change

The study reveals that informal workers employ a range of coping strategies to manage the impacts of climate variability. However, these strategies are largely short-term, reactive, and constrained by limited resources, reflecting what the literature describes as “autonomous adaptation”.

One of the most immediate responses is the adjustment of work patterns. Workers alter their schedules, reduce working hours, or temporarily shift occupations in response to extreme weather conditions. While these adjustments help mitigate immediate risks, they often result

in reduced income and increased instability. The shift away from agriculture toward urban informal work can also be seen as a coping strategy, though it frequently leads to continued exposure to climate-sensitive employment.

Households also rely on consumption-based coping strategies, such as adjusting food intake or reallocating expenditure across essential needs. These strategies enable short-term survival but can have longer-term implications for nutrition and well-being. Such patterns are widely documented in literature on poverty and risk, where households prioritise immediate consumption smoothing in the absence of formal safety nets.

Borrowing and reliance on social networks constitute another important coping mechanism. Informal credit from friends, relatives, and local networks provides quick access to resources during periods of stress. However, these sources are often limited in scale and can contribute to longer-term financial strain, particularly when incomes remain unstable.

In the absence of adequate institutional support, households are often forced to absorb losses related to housing and assets. Damage to homes or livelihood infrastructure is frequently managed through partial repairs or temporary adjustments rather than full recovery. This reflects the limited capacity of households to invest in long-term resilience and highlights the constraints of individual-level adaptation.

Health-related coping strategies are similarly constrained. Limited access to healthcare services often leads households to delay treatment or rely on informal care, which can exacerbate health conditions and increase long-term costs. The interaction between health shocks and income loss further reinforces vulnerability.

At the household level, labour adjustments also play a role in coping. Increased participation in the labour force, migration, and diversification of income sources are common strategies used to manage economic stress. While these approaches can provide additional income, they often come at the cost of increased precarity and reduced social stability.

A notable feature of the findings is the limited presence of collective or institutional coping mechanisms. Community-based organisations, formal support systems, and state interventions play a relatively minor role in shaping resilience. This places the burden of adaptation largely on individuals and households, who operate within constrained economic and social conditions.

Overall, coping strategies among informal workers are primarily oriented toward managing immediate shocks rather than building long-term resilience. This aligns with broader literature that distinguishes between coping and adaptation, emphasising the need for systemic interventions that enhance adaptive capacity.

In conclusion, the discussion highlights that climate change in Shimla is experienced as a process that intensifies existing socio-economic inequalities. Informal workers navigate this reality through a combination of perception, adaptation, and coping, but their capacity to respond is limited by structural constraints. Addressing these challenges requires integrated approaches that combine climate resilience with social protection, inclusive urban planning, and recognition of informal workers within policy frameworks.

Chapter 5: Policy Recommendations

The findings of the Shimla study demonstrate that climate change acts as a multiplier of existing vulnerabilities among informal workers, affecting livelihoods, housing, health, and financial stability. In a hill-city context, these impacts are further shaped by ecological fragility, terrain constraints, and seasonal economic dependence on tourism. The effects of extreme weather events—such as landslides, erratic rainfall, and temperature variability—are closely intertwined with structural gaps in urban planning, service delivery, and social protection systems. Addressing these challenges requires an integrated policy approach that combines climate adaptation with social equity, in line with the principles of climate justice.

Policy responses must therefore address both environmental risks and socio-economic inequalities. Strengthening resilience among informal workers in Shimla requires improvements in housing, infrastructure, livelihoods, financial security, healthcare access, and governance systems, while also accounting for the unique vulnerabilities of mountain urban settlements.

5.1 Housing and Infrastructure

Improving housing quality and infrastructure is critical in a terrain where slope instability, rainfall intensity, and drainage challenges heighten vulnerability.

Housing

- Expand climate-resilient housing under schemes such as the Pradhan Mantri Awas Yojana by prioritising informal worker households living in environmentally vulnerable locations such as steep slopes and landslide-prone areas.
- Promote hill-sensitive and climate-resilient building designs, including slope stabilisation, improved drainage around structures, insulation, and ventilation to address both dampness and temperature variability.
- Encourage retrofitting of semi-permanent housing using state housing programs, with a focus on strengthening structural stability against heavy rainfall and landslides.
- Facilitate in-situ upgrading of informal settlements while ensuring secure tenure and safe land-use planning suited to mountain ecosystems.

Water Supply and Sanitation

- Strengthen piped water supply systems under the Jal Jeevan Mission, particularly in areas facing seasonal water scarcity.
- Improve storage and local distribution infrastructure to reduce dependency on irregular water sources.

- Upgrade sanitation facilities by ensuring reliable water supply and maintenance, especially in high-density informal settlements.

Urban Infrastructure and Climate Resilience

- Strengthen drainage and stormwater systems to manage intense rainfall and reduce waterlogging and slope erosion.
- Invest in climate-resilient infrastructure under programs such as Atal Mission for Rejuvenation and Urban Transformation, with a focus on hill-specific needs.
- Improve road connectivity and maintenance to ensure access during landslides and extreme weather events.
- Create shaded public spaces and cooling centres in areas with high concentrations of outdoor workers as part of city Heat Action Plans.

Nature-based and climate-sensitive planning

- Promote watershed management, slope stabilisation, and afforestation under state climate action plans.
- Encourage rainwater harvesting and groundwater recharge to address water variability in line with Himachal Pradesh's climate strategies.

5.2 Livelihood and Finances

Strengthening livelihood security and financial resilience is essential for reducing the economic impacts of climate variability on informal workers.

Employment and Livelihood Support

- Expand livelihood support under the National Urban Livelihoods Mission, focusing on skill diversification beyond climate-sensitive occupations.
- Promote climate-resilient livelihood training, including tourism services, repair work, and green jobs suited to hill economies.
- Introduce urban wage employment programs during periods of climate disruption to stabilise incomes.
- Provide temporary income support or compensation during extreme weather events through disaster relief mechanisms.

Occupational Safety and Labour Protection

- Integrate informal workers into local climate and disaster preparedness plans, including heat and rainfall-related safety measures.
- Ensure provision of safe working conditions—such as shaded rest areas, protective gear, and safe vending spaces—particularly for outdoor workers.
- Develop shaded vending zones and climate-safe workspaces through local urban livelihood programs and street vendor policies
- Strengthen labour welfare boards, particularly the Building and Other Construction Workers Welfare Board, to ensure access to welfare benefits for construction labourers.

Reducing debt vulnerability

- Expand access to low-interest credit through schemes such as Pradhan Mantri Mudra Yojana and self-help group networks.
- Promote financial inclusion and savings mechanisms to reduce reliance on informal borrowing.
- Introduce climate risk insurance for informal workers to cover income loss and housing damage.
- Simplify documentation requirements for migrant workers to access financial and welfare schemes.

5.3 Social Protection and Healthcare

Improving access to social protection measures and healthcare is essential for strengthening long-term resilience among informal worker households.

Expanding social protection coverage

- Improve access to food security through the Public Distribution System, ensuring portability under One Nation One Ration Card for migrant workers.
- Expand coverage of health insurance schemes such as Ayushman Bharat to include all informal worker households.
- Increase inclusion in pension and welfare schemes, particularly for elderly, women, and vulnerable groups.
- Strengthen nutrition programs through Integrated Child Development Services and Poshan Abhiyan.
- Introduce emergency food support measures during periods of extreme weather.

Improving Healthcare Services

- Strengthen primary healthcare systems in informal settlements, including mobile clinics for remote or inaccessible areas.

- Conduct regular health camps focusing on climate-related illnesses such as waterborne diseases and respiratory conditions.
- Ensure availability of essential medicines and services during periods of climate disruption.

5.4 Governance

Strengthening governance systems is essential for ensuring that climate adaptation policies effectively address the needs of informal workers.

Participatory Climate Governance

- Include informal worker representatives in local climate planning processes, particularly in city-level climate action plans.
- Strengthen partnerships between municipal bodies, civil society organisations, and worker collectives.
- Promote community-based adaptation initiatives tailored to local environmental conditions.

Institutional Coordination

- Improve coordination between departments responsible for housing, labour, health, and urban development to address climate risks holistically.
- Integrate informal worker concerns into state-level frameworks such as the Himachal Pradesh State Action Plan on Climate Change.

Data and Monitoring

- Develop local monitoring systems to track climate impacts on informal workers.
- Encourage collaboration between research institutions and government agencies for evidence-based policymaking.
- Use community-level data to identify high-risk areas and prioritise adaptation investments.

Overall, the study underscores the need for context-specific, integrated policy responses that recognise the unique vulnerabilities of informal workers in mountain urban environments. Addressing these challenges requires coordinated interventions that improve housing conditions, strengthen livelihood security, expand access to healthcare and education, and ensure that informal workers are included in climate governance processes.

Strengthening resilience requires aligning climate adaptation strategies with social protection, inclusive urban planning, and livelihood security, ensuring that informal workers are not only protected from climate risks but are also included in shaping adaptive futures. By aligning climate adaptation strategies with existing national and state schemes, policymakers can develop more effective and inclusive responses to climate change.

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