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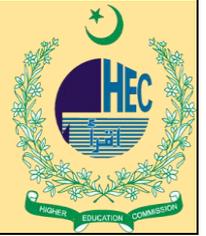
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### Experience of Rural Communities Facing Climate Change In Khyber Pakhtunkhwa Pakistan

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#### Abstract

*Climate change is a major environmental and socio-economic problem to rural population, Especially in those areas where agriculture and natural resources are the main source of income. This paper examines the social lives of rural families in Swat, Mansehra, and Lower Dir in Khyber Pakhtunkhwa province in Pakistan and how they experience climate fluctuation, handle its effects, and embrace the localized means of adaptation. A qualitative research design was employed, which allowed gathering data by means of semi-structured interviews with 30 people who had a variety of social and occupational backgrounds, such as students, teachers, former housewives, and farmers. The thematic analysis suggested 8 major themes, including perception of climate change, agricultural effects, economic vulnerability, water scarcity and management, health challenges, gender roles in adaptation, community networks and social support, and institutional support and government assistance. Results show that climate variability affects agriculture, income, health, and water resources and that adaptation practices are influenced by socio-economic status, gender role, indigenous knowledge and believability. The household resilience of women has a leading role, and the inadequate institutional support augmented the dependence on the local coping strategies. The paper brings out the interaction between the social vulnerability and sustainable livelihood models in the concept of rural adaptation. The findings of this study can inform the development of inclusive, community-based, and gender-sensitive climate change adaptation policies that can be used to enhance resilience and sustainable rural livelihoods in Pakistan.*

**Keywords:** climate change, rural livelihoods, Adaptation strategies, Social vulnerability, Sustainable livelihoods, Pakistan.

#### Introduction

The health and socio economic risks of climate change on the rural populations are increasing especially in areas that heavily rely on natural resources and the agricultural sector. Climate variability in the form of erratic rainfall, rising droughts and floods in Pakistan has added to the livelihood insecurity and environmental pressure among rural households (Soomro and Sher, 2025; Jameel and Wakil, 2025). Such climatic problems negatively affect agricultural production and food security, particularly among smallholder farmers who do not have formal system of adaptive support and highly dependent on weather based livelihood. According to scholars,

climate change effects are highly mediated by socio economic systems, social relations, and institutional processes, rather than environmental exposure. Recent studies emphasize that there are various adaptive and coping mechanisms that rural populations use to deal with climatic stress, such as the diversification of livelihoods, social cooperation, as well as indigenous knowledge systems (Khan et al., 2024; Soomro and Sher, 2025).

These researches demonstrate that variables such as education, income, access to advisory services, social cohesion have a significant impact on household responses to climate risks, which influence their adaptive capability unevenly. Structural gender inequalities, lack of access to productive resources, and involvement in decision making mean that in the rural setting of Pakistan, climate change has had a disproportionate impact on the livelihoods of women. A study of socio economic effects on women farmers revealed that climate change leads to the exacerbation of economic insecurity and unpaid labour and limitations on access to land, credit and agricultural inputs (Habib et al., 2025).

The women vulnerability highlights the need to be provided with inclusive climate policy frameworks that acknowledge the role of women in adaptation and resilience building. Moreover, the adaptation to climate change depends on more general livelihood patterns including sustainable rural development and resilience creation. In Punjab and other parts of Pakistan, there are studies on the effect of climatic induced hazards on rural livelihoods as well as how the farm families adapt to them through adjusting planting dates, crop diversification, and off farm work to maintain livelihoods (Ali et al., 2025; Sustainable rural livelihoods research, 2024). These results indicate that individual and group based approaches are key in uncertainty management of the environment and rural livelihoods. However, although the literature on climate change effects and adaptation in Pakistan is increasing, there is relative dearth of qualitative studies that focus in-depth the lived experiences of rural households; how and which ways people experience climate change, how it alters their daily lives and how they cope with these uncertainties through socially and culturally embedded adaptation.

The paper fills that gap by examining community perceptions, livelihood disruption, coping strategies locally derived and discussing social aspects of resilience in Khyber Pakhtunkhwa which provide context specific data to consider in inclusive and community based climate adaption planning.

### **Research Objectives**

- Explore how rural households in Swat, Mansehra, and Lower Dir perceive and interpret climate change impacts on their daily lives and livelihoods.
- Analyze locally based adaptation measures, coping practices used by rural populace in such districts.
- To study the association between social relations, gender roles, and community networks and how they impact the adaptive capacity of Khyber Pakhtunkhwa household.

### **Research Questions**

- How do rural households in Swat, Mansehra and Lower Dir describe and make sense of climate variability in relation to their livelihoods?
- What are the adaptive practices and coping mechanisms of the rural men, women and youth in these districts to cope with climate risks?
- What is the role played by social relationships, gender roles and community networks in Khyber Pakhtunkhwa in influencing the adaptive capacity of households?

### **Significance of the Study**

This paper is important because it examines how rural people in Swat, Mansehra, and Lower Dir in Khyber Pakhtunkhwa are coping with climate change in terms of perceptions, locally-based adaptation methods and the impact that social networks and gender relations have. Most of the studies focus on quantitative changes in climate and agricultural damages; this paper identifies socially-enclosed, context-based adaptation patterns, which offer an understanding of resilience and susceptibility to rural Pakistan. The results can be useful to policy makers and development practitioners who want to develop inclusive, community based, and gender sensitive adaptation strategies that can enhance the capacity and sustainable livelihoods of locals.

### **Scope of the Study**

The research is concerned with rural populations in Swat, Mansehra and Lower Dir districts of Khyber Pakhtunkhwa, Pakistan in terms of climate change and its effects on livelihood, agriculture and day-to-day lives. It looks into perceptions, locally-rooted adjustment practices, coping, social networks and gendered vulnerabilities in men, women and the youth. It is a qualitative and context-specific study that attempts to give insight into the social mediated resilience and not the quantitative modeling of climatic conditions. The results will be used to educate comprehensive, community-based adaptation policies and emphasize workable measures to improve resilience of the rural to climatic variability in analogous socio-ecological settings.

### **Literature Review**

International Attitudes to rural vulnerability and climate change adaptation. Climate change brings serious and far reaching dangers to the rural populations of the world especially to those who rely on agriculture and natural resources. As it has been shown, climate variability, such as the increase in temperatures, the changes in precipitation, extreme weather conditions, and long-term climatic changes, adversely affect agricultural productivity, food security, and rural livelihood at the global level (Atkinson, 2023; Bryan et al., 2009; Prayitno et al., 2025). Literature in a wide range of geographical settings demonstrates that rural populations are more at risk due to financial, technological, and institutional resource deficits over their urban counterparts (Atkinson, 2023; Bryan et al., 2009). Adaptation literature pays attention to social capital, indigenous knowledge systems, livelihood diversification, and community cohesion in achieving rural populations to deal with climatic uncertainty in the low resource environment (Prayitno et al., 2025). Scholars across the world claim that adaptation measures include agronomic adjustments and crop diversification, market participation and livelihood diversification, which are influenced by socioeconomic conditions, information access, and educational level (Bryan et al., 2009; Prayitno et al., 2025). The pivotal nature of social and human capital in improving adaptive capacity is also researched by the fact that good networks of social networks and cooperation and collective action allow communities to distribute resources and act during climatic disasters (Chikowore, 2025). The other theme of significance in world literature is the social identity conflicted with climate vulnerability, particularly in aspects of gender, classes and age. Intersectional responses indicate how socio economic inequalities mediate the effects and outcomes of adaptation to climate change because they define differences in exposure and adaptation potentials among rural people (Chikowore, 2025). Such international lessons give the theory underpinning climate adaptation as a social activity that is formed by various interacting components not just environmental exposure.

### **Regional Perspectives on Climate change and livelihood of rural South Asia**

Climate variability is a relatively new issue in South Asia where it is becoming a leading security threat to the rural livelihood. Research in India, Bangladesh, and Nepal shows that families in the

upper rural areas are under increasing pressure due to shifting monsoon dynamics, temperature extremists, drought and floods that are interrupting the agricultural supply chain and driving food insecurity (Rankoana, 2023). The focus of regional research is the vulnerability framework which takes into consideration social, economic, and institutional factors to describe the varying adaptation abilities of rural populations (Rankoana, 2023). The literature emphasizes that the rural adaptation strategies should be locally based and context specific which means they require the incorporation of both the indigenous knowledge and formal mechanisms of offering adaptation support. In addition, the regional studies list the factors that determine adaptation including access to credit, education, extension services and gendered norms, which affect the manner in which smallholder farmers react to climate threats (Rankoana, 2023). Community level coordination and local institutions are also stressed since the rural actors tend to use collective action to control the water resources, to share labor, and to organize the responses of the community in relation to the climate shock.

### **Sensitivity and Climate Change Adaptation in the Rural Pakistan Society**

In Pakistan, it is Noteworthy that climate change has led to evident effects on the livelihoods of rural people especially in agribusiness which is vulnerable to climatic changes. In Pakistan, it is reported that the rural households are facing more risks due to prolonged droughts, unpredictable rain, water scarcity, floods, and rising temperatures which put pressure on agricultural production systems and house economies (Khosro et al., 2024). Pakistan specific literature emphasizes the fact that rural adaptation encompasses the management of crops, changes in irrigation, adjustments in the timing of planting, off farm diversification, and short term migration as a typical strategy employed by farming households (Khosro et al., 2024). Recent findings indicate that socio economic factors include education, income, access to credit, and exchange of climate information influence the adaptation process in Pakistan with education and more endowed households being more adaptive to the adoption of adaptation (Khan et al., 2024). Gender based studies emphasize that the resiliency of women is achieved through structural inequalities such that women are the major players in the survival of households but cannot access resources and power to make decisions hence restricting their resiliency (Zafar et al., 2025). Pakistan has also reported literature on adaptation that social cohesion and network of communities are also resilience factors, with villagers organizing their workforce, distributing resources, and using informal safety nets brought by climate hassles (Soomro and Sher, 2025).

### **Rural Adaptation Practices Empirical Studies.**

The rural- based empirical research in One such study was conducted by Khan et al. (2024) who found that the rural households respond to the pressures of climate by livelihood diversification, the involvement of small businesses and non-farming work coupled with education, household size, income and access to advisory services to take a central role in adaptation decisions in rural households (Khan et al., 2024). The other studies report on how climate has created food insecurity and socio psychological stress, which dictate local adaptation stories along with referencing to the importance of social networks, informal credit system, and community support in reducing food risks (Khan et al., 2025). Gender disaggregated studies highlight the fact that women encounter distinct difficulties in the adaptation practices based on knowledge gaps, resource restrictions, and decreased state assistance, which supports the call to implement gender sensitive adaptation interventions (Memon et al., 2025). Such empirical understandings are congruent with larger vulnerability models to the effect that adaptation is not merely a technical reaction: it is mediated by socio economic processes, structural inequalities and community association.

**Theoretical Framework**

**The Social Vulnerability Theory**

According to the Social Vulnerability Theory, environmental hazards seldom cause vulnerability, but rather social, economic, political, and cultural factors influence vulnerability to environmental hazards. Adaptive capacity differences are caused by the inequalities in resources, education, gender, and institutional support. Marginalized families living in rural areas tend to be more affected and fail to cope with it. The theory aids in the process of explaining the lives of rural families in Khyber Pakhtunkhwa and the way in which the general social systems impact the reaction of rural families to climate change. Sustainable Livelihoods Structure.

**Sustainable Livelihoods Framework (SLF)**

Considers the ways in which households use five categories of capital, including human, social, natural, physical, and financial capital to maintain livelihoods under stress. Adaptive capacity is determined by access to financial resources, social networks, and natural resources. Using the SLF enables such a field to investigate the ways in which rural households in the region of Khyber Pakhtunkhwa mobilize resources and strategies to deal with climate variability.

**Relevance to the Study**

By incorporating these frameworks, vulnerability determinants are linked. Organizational sense of livelihood strategies. The Social Vulnerability Theory identifies the Disparities and socio-cultural characteristics, whereas the SLF demonstrates how in-home Assets are used to adjust the household. The two of them give a sound lens through which rural Adaptation and coping practices can be analyzed.

**Conceptual framework**

The two theories that are incorporated in the conceptual framework are the Social Vulnerability Theory and the Sustainable Livelihoods Framework in an effort to understand how rural people in Khyber Pakhtunkhwa can adapt to climatic change. It focuses on vulnerability through socio-economic status, gender roles and community networks as well as mobilization of financial, natural, human and social resources by households in the face of climate stress.

As Figure 1 shows, the theoretical frameworks used in the study help to direct the research on adaptation and coping strategies of rural households

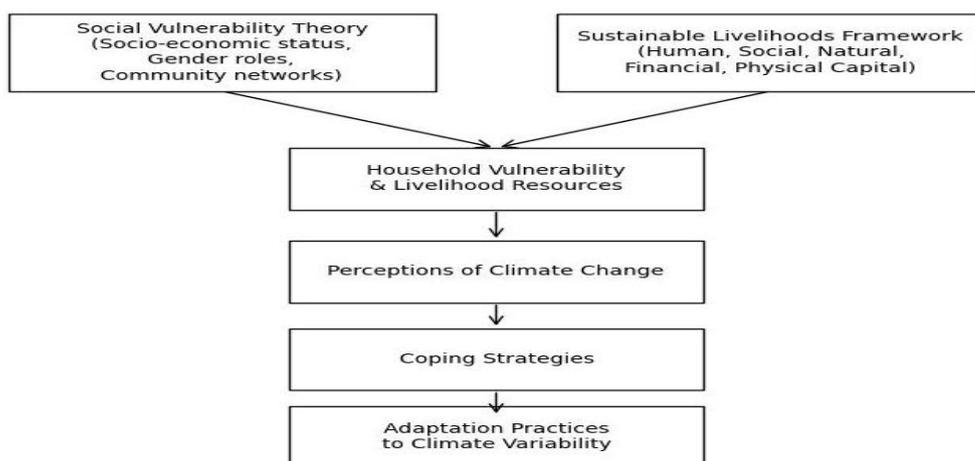


Figure 1: The framework shows that the perceptions of rural households, coping strategies as well as adaptation practices to climate variability are affected by socio-economic inequalities, gender roles, community networks, and livelihood capitals.

## **Research Methodology**

### **3.1 Research Design**

The research design embraced in this study is qualitative research in a bid to investigate the extent to which rural households in Swat, Mansehra, and Lower Dir believe that they have been affected by climate change and the manner in which they cope with the effect. The qualitative design gives a detailed account of experiences that participants live, views and social settings. Specifically, it is most appropriate in examining how social structures, gender roles and community networks impact on adaptation practices because the participant is allowed to speak out their experiences in their words.

### **3.2 Population of the Study**

The sample of this research was rural households in Swat, Mansehra, and Lower Dir districts in Khyber Pakhtunkhwa. A wide range of men and women was also represented including students, teachers, former housewives, and farmers alike and provided representation of all the groups within the rural society. This variety enabled the study to be inclusive of various experiences, perceptions, and adaptation means in regard to climate variability.

### **3.3 Sampling Technique**

Purposive sampling was used to identify participants who have firsthand experience regarding the challenges and adaptation practices associated with climate. Ten respondents were picked in each district (5 male and 5 females), and they were representing various social and professional backgrounds such as students, teachers, former housewives, and farmers. This methodology was very appropriate as it gave the study robust and valuable data of the participants with best understanding of the local adaptation strategies.

### **3.4 Data Collection Methods**

Semi-structured interviews were used to collect data, but the duration of the interview took between forty and sixty minutes. Interviews were done using local languages (Pashto and Urdu) and translated into English to be analyzed. Before the interviews, the participants received information regarding the purpose of the study, informed consent was obtained and the confidentiality guaranteed. The interviews covered the perceptions of the participants to climate change, local-based adaptation strategies, coping mechanisms, and the influence of social structures, gender roles, and community networks to develop resilience.

### **3.5 Data Analysis**

Thematic analysis was used to analyze the data collected as it is the process of identifying, analyzing, and reporting patterns in qualitative data. This involved transcribing and translating interviews, re-reading transcripts until familiar with them, coding important statements and classifying them into meaningful topics. These themes were then applied to the research objectives and theoretical frames and then the study was able to capture the experiences, perceptions and coping strategies of the rural households in a systematic manner.

### **3.6 Ethical Considerations**

The research also adhered to ethical research practices. The participants gave informed consent, were told about confidentiality and anonymity, and that participation was voluntary and could be terminated anytime. Interviews were conducted with respect to cultural and social norms of participants with ethical and sensitive engagement without losing trust and comfort of the participants during the study.

## **Findings of the study**

### **Theme 1: There is a Perception of Climate Change.**

Rural families in Swat, Mansehra and Lower Dir are more conscious of the changing weather conditions, they are experiencing hotter summers, unpredictable rainfall, shorter winters, and

season change, which they believe that this impacts directly on their livelihoods. Participant F1 (IDI Balakot, Mansehra) *responded, and told us that we could not predict the seasons anymore, the rains are late and our wheat is not growing, and we are starving as a family. Participant M2 (IDI Matta, Swat) expressed the same feeling in the quote below: Even planting times are now doubtful, what we were told as children would no more.* These observations were initiated by the fact that rural communities are very dependent on agriculture and environmental signals in their day to day and seasonal planning thus are sensitive to weather effects. The participants talked about watching domestic signs, including river levels, soil moisture, and animals behavior, to predict changes in the environment, which proved that they use indigenous knowledge to make decisions. It was verified that households actively monitor these patterns and change their activities accordingly as confirmed by the observations of the researcher. These results are consistent with Ahmad et al. (2021), who found that in rural communities of Khyber Pakhtunkhwa, the perception of climate change is more based on direct observation and direct experience instead of the formal scientific data. Objective 1 is dealt with in this theme, investigating the perception of households of climate effects, and the Research Question 1, which is how rural households explain and conceptualize climate variability concerning their livelihoods. Theoretically, it is an expression of Social Vulnerability Theory as the perception and response capacity depend on socio-economic status, gender, education, and access to information, which cause disparate vulnerability of households. Generally, the understanding of and awareness about climate variability by the participants gives them the basis upon which they undertake adaptation and coping behaviors, in which local perceptions should be considered when designing effective intervention to promote rural resilience.

### **Theme 2: Impact on Agriculture**

The participants indicated that the climate variability has had a profound impact on agricultural activities leading to crop failures, low yields as well as soil degradation, which has a direct impact on household income and food security. Participant M3 (IDI Balakot, Mansehra) *replied as follows, our crops of wheat and maize did not bear this year because of uncertain rains, we had to take food on loan.* On the same note, Participant F4 (IDI Matta, Swat) testified, *“In the instances that we planted in good time, rains came late and killed the seedlings leaving us with barely anything to market or even to family.* These problems were due to the fact that majority of the households depend on rain-fed agriculture and access to irrigation and modern farming technologies is limited hence making them very sensitive to the changes in seasons. Farmers innovated by trying out drought resistant crops, changing the time of sowing and relying on local acquired knowledge to predict rainfall patterns. Observations by the researcher confirmed that losses of crops were particularly high in fields that did not have water retention systems, and diverse livelihood households experienced relatively low levels of stress. These results are consistent with those by Khan et al. (2020) who highlighted that rural communities in Khyber Pakhtunkhwa are becoming more vulnerable since agricultural difficulties are becoming climate-dependent. This theme works on Objective 2, which considers the locally based strategies of adaptation, and it answers Research Question 2, which is how rural households cope with climate risks. Theoretically, it is indicative of the Sustainable Livelihoods Framework, which emphasizes the role of natural and human capital in the establishment of adaptive approaches and livelihoods in the face of environmental pressure. On the whole, the challenge of climate change on agriculture forces rural households to come up with new coping mechanisms and locally knowledge-based practices, which manifest vulnerability and resilience in rural communities.

**The theme 3: Economic Vulnerability.**

The participants added that climate variability has made them more economically vulnerable because crop failures and unpredictable weather have a direct relationship on the household income and financial stability of the participants. Participant F5 (IDI Mingora, Swat) *said, When our crops fail, we are not able to pay school fees, purchase medicines on children, we are obliged to take money over relatives.* Equally, Participant M6 (IDI Balakot, Mansehra) *told, that there are times when we had to make ends meet but following consecutive poor harvests, there is no way to save up or invest anything and our household was always on the brink.* Such circumstances arose due to the fact that the majority of rural households depend mainly on agriculture as a source of income and little financial savings or access to credit which hinders their ability to absorb shock that may be posed by climatic disturbance. The observations of the researchers showed that poorer families are affected more severely in cases when they have to resort to borrowing, selling livestock, or lowering food consumption, which also is consistent with Ali and Rahut (2019) who claimed that poverty is one of the factors worsening climate vulnerability in rural Pakistan. This is the theme that deals with Objective 3, which is learning about the effect of social and economic organization on vulnerability and resilience, and provides the answer to Research Question 3, how adaptive capacity of households is shaped by the socio-economic conditions. Conceptually, it is portraying the Social Vulnerability Theory, which shows that the economically disadvantaged and socially unsupported households are overburdened by climate-related economic pressures. In general, the economic vulnerability factor is a significant factor defining the way communities react to climate stress, and it should be highlighted that the interdependence between financial, social, and environmental contexts is prominent when defining the strategies of adaptation.

**Theme: 4 Scarcity and management of water.**

The participants underscored that water scarcity has been a significant issue towards maintaining agricultural production and household demands particularly during dry seasons. Participant M7 (IDI Lower Dir) *said, "The stream that surrounds our village is drying up faster each year we have to share the water with our neighbors to survive.* In the same way, Participant F8 (IDI Matta, Swat) *confessed that they collect rainwater in small tanks and alternate to consume water, failing which they do not have enough to water their crops and even home tasks.* The following problems arose due to the fact that the availability of water is adversely affected by low rainfall and the absence of irrigation systems, so households had to devise their own management systems. Findings by the researcher proved that those villages where there was community-based water management systems including community storage tanks and water sources exploitation had greater resilience to droughts. The results are consistent with Hussain et al. (2022), who emphasized the use of traditional water management methods in rural Pakistan as a way of dealing with environmental stress. This theme deals with Objective 2, which deals with adaptation strategies based on locally rooted adaptation, and Research Question 2, how households deal with climate risks by managing resources. In theoretical terms, it indicates the Sustainable Livelihoods Framework that reveals how natural and social capital is vital in the facilitation of adaptive practices and livelihood maintenance amid climatic stress. All in all, water scarcity has been one of the factors that have caused rural households to develop innovative, cooperative, and locally informed approaches, which underscore the relevance of community-based management of resources in resilience development.

**Theme 5: Health Challenges**

Respondents claimed that climate variability has caused various health issues not only to children and adults but also to worsen the vulnerability of households. Participant F9 (IDI Mingora, Swat),

said that, children usually become sick due to floods or excessive heat and medicines are costly, unavailable at times. Likewise, Participant M10 (IDI Balakot, Mansehra) told that, in the hot months the elders were heat-exhausted and in the rainy seasons most of them had diarrhea or other illnesses. These were health issues that occurred as a result of exposure to more environmental risk, inability to receive medical care on a timely basis and the rural setting lacked adequate sanitation services. Observations of the researcher indicated that there were common instances of water borne diseases and heat illnesses when they were in the field of work which concurs with Ahmed et al. (2021), who claim that climate variability increases the risk to health in rural Pakistan. This theme follows Objective 3, which is the knowledge of the effect of social and environmental factors on vulnerability and resilience, and answers Research Question 3, the effect of climate stress on household well-being. Theoretically, the theme is based on the Social Vulnerability Theory, which explains that households that have low resources, inadequate infrastructure, and social support are disproportionately vulnerable to health risks related to climate changes. Altogether, health issues are a direct implication of climatic variability, as well as something that limits further the adaptive ability of households, which is why health considerations should be considered when adopting strategies related to rural adaptation.

#### **Theme 6: Gender Roles in Adaptation.**

The participants pointed out that women are at the center of adaptation strategies in the household, to control the necessary resources and guarantee the survival of the family in the face of climatic stress. Respondent F11 (IDI Matta, Swat), said, *I handle food, water and domestic requirements when my husband works in the fields during droughts.* Participant F12 (IDI Balakot, Mansehra) also confessed that *it is the women in the family who determine how to make use of our limited resources to feed everyone even during crop failure.* These roles arose due to the fact that it is the women who are mainly charged with managing domestic resources whereas men tend to make the changes related to agriculture hence offering a gendered division of labor in adaptation practices. The findings of the researcher observation indicated that the role of women cannot be ignored in day-to-day coping mechanisms, so that the household still operates despite environmental pressures. Such results are consistent with those of Khan et al. (2020), who highlighted the great role women played in maintaining a rural livelihood amid climatic disruptions. It touches upon Objective 3, which focuses on the study of how social structures and gender roles are connected with vulnerability and resilience, and provides answers to Research Question 3, which is about the impact of gender on adaptive capacity. Theoretically, it represents the Social Vulnerability Theory, and it shows that gender relations are a decisive factor in determining the level of responsiveness of households to climate variability. On the whole, the active participation of women in decision-making and management of household resources increases the resilience of the community and the necessity to pay attention to gender when developing climate adaptation interventions.

#### **Theme 7 Community Networks & Social Support**

The participants also noted that communities have a strong sense of network and support in overcoming climate related issues, as a result of which households are able to share their resources, labor, and knowledge when in crisis. Participant M13, (IDI Balakot, Mansehra) answered, *we do not leave anyone alone in case of tough times, we all assist one another with labor, tools and food when crops fail.* In a similar manner, Participant F14 (IDI-68, Mingora, Swat) added, *when one family is in need, the neighbors would lend their hand to help with whatever they have such as water, food or manpower to work the fields.* The practice was due to cultural requirements of group accountability and collective weaknesses inviting joint measures to survive. Observation by the researcher established that the villages that had active social

network could respond to food shortages, labor needs and environmental pressure, which was in line with the findings reported by Norris et al. (2008) who noted that social capital played an important role in enabling communities to overcome disasters. This theme responds to Objective 2, which looks at the locally based adaptation policies and answers Research Question 2, which looks into how people use social networks to cope with climate risks. Theoretically, it is a manifestation of the Social Vulnerability Theory, which proves that the negative impact of climate stress and the possibility of adaptation can be alleviated with the help of social relations and community solidarity. All in all, community support and group action can be highlighted as essential coping strategies to cope with environmental challenges, which ensures resiliency at the household and community levels.

#### **Theme 8: Institutional Support and Government Support**

Participant emphasized that there was a tendency to support climate-related issues institutionally and through government aid that is insufficient, delayed or inadequate, and households were largely left to find their own resources and local coping mechanisms. *According to participant in (IDI Lower Dir), government help is hard to come by and is usually not timely; we can rely primarily on our resources to get us going in cases of flood or failure of crops.* Equally, Participant M16 (IDI Balakot, Mansehra) also said, *sometimes when the damage has been caused the help arrives and it is too late to help and so losses are suffered.* These difficulties arose due to the fact that formal institutions and aid programs are not always present in remote rural regions and time-sensitive help is often not possible due to logistical or bureaucratic obstacles. The observations made by the researcher proved that households mainly relied on the community networks, local savings, and personal resourcefulness to survive, which is consistent with Ali and Rahut (2019) who noted that low institutional support heightens the need to rely on local adaptation practices in rural Pakistan. The theme will deal with Objective 2, which will look at local-based adaptation strategies, and Research Question 2, which will look at how external support can be used to deal with climate risks. Theoretically, it represents the Sustainable livelihoods Framework in emphasizing the role that financial and institutional capital access has on adaptive capacity and livelihood sustainability. In general, the scant institutional backing highlights the fortitude and resourcefulness of rural families highlighting the essentiality of community-based approaches to closing the gaps that existed between the official assistance initiatives.

Summary of Eight Themes with Participants, Key Findings, Objectives, Research Questions, and Theory

Theme	Participants (Village)	Key Findings / Quotes (Why & How)	Objective / Research Question	Theory
1. Perception of Climate Change	F1 (Balakot), M2 (Matta)	<i>"We cannot predict the seasons anymore; the rains come late and our wheat fails."</i> Weather changes interfere with the planning; the households depend on agriculture and indigenous knowledge.	Obj 1 / RQ1	Social Vulnerability Theory.
2. Impact on Agriculture	M3 (Balakot), F4 (Matta)	<i>"Our wheat and maize crops failed due to unpredictable rains."</i> Reduced irrigation & rain-fed agricultural practices augment susceptibility	Obj 2 / RQ2	Sustainable Livelihoods Framework.
3. Economic Vulnerability	F5 (Mingora), M6 (Balakot)	<i>"Economic Vulnerability F5 (Mingora), M6 (Balakot) When the crops fail, we are unable to pay school fees; we are being forced to borrow."</i> Dependence on agriculture + low savings increases economic stress	Obj 3 / RQ3	Social Vulnerability Theory
4. Water Scarcity & Management	M7 (Lower Dir), F8 (Matta)	Water Scarcity & Management M7 (Lower Dir) F8 (Matta) <i>"Stream is drying up earlier, we share water amongst our neighbours."</i> Minor rainfall and no irrigation compel households to live locally	Obj 2 / RQ2	Sustainable Livelihoods Framework
5. Health Challenges	F9 (Mingora), M10 (Balakot)	<i>"Children fall sick after floods; medicines expensive."</i> Exposure to hazards + limited health access increase vulnerability	Obj 3 / RQ3	Social Vulnerability Theory
6. Gender Roles in Adaptation	F11 (Matta), F12 (Balakot)	<i>"I manage food and water when husband works in fields."</i> Women control resources, ensuring household survival	Obj 3 / RQ3	Social Vulnerability Theory
7. Community Networks & Social Support	M13 (Balakot), F14 (Mingora)	<i>"Community Networks and social support M13 (Balakot), F14 (Mingora) We assist one another in work, equipment, and food when the crops are ineffective. Collective responsibility &amp; cooperation strengthen resilience"</i>	Obj 2 / RQ2	Social Vulnerability Theory
8. Institutional Support & Government Aid	F15 (Lower Dir), M16 (Balakot)	Government Aid F15 (Lower Dir) M16 (Balakot) <i>"Government aid is infrequent and slow, we have to depend on our resources. Weak institutional provisions augment dependence on regional arrangements"</i>	Obj 2 / RQ2	Sustainable Livelihoods Framework.

### Explanation

This table will discuss the key results of 30 participants in eight themes and demonstrate the relevance of their experiences to the objectives of the study, research questions, and theories.

**Discussion**

Results of this study indicate that rural families in Swat, Mansehra and Lower Dir consider climate variability as a major menace to their livelihood especially to agriculture, income, health and water resources. The interrelation of the environment, social, and economic variables was noted by the participants as they identified various adaptive measures, including changing crop cycles, saving water, using communal networks, and domestic resource management. These findings are consistent with the literature (Ahmad et al., 2021; Khan et al., 2020) and consistent with the Social Vulnerability Theory, which highlights that socio-economic status, gender, and institutional support influence the different vulnerability. The women were found to be central figures in the adaptation of household, they controlled the fundamental resources and provided food security and community networks and social support were critical in sharing work and resources in times of crisis. The impacts of climate variability were aggravated by economic vulnerability and health challenges particularly the households with limited financial and natural resources. Weak institutional support also contributed to dependence on local coping strategies, and therefore the relevance of community-based strategies to adaptation is emphasized, which is in line with the Sustainable Livelihoods Framework. In general, the research will respond to Objectives 1-3 and address all the research questions demonstrating how households experience and make sense of climate effects, seek locally based adaptation strategies, and depend on social structures and gender roles to enhance resilience. The evidence shows that the successful implementation of adaptation interventions should focus on local perceptions, gender relations, and community support structures to make rural areas more resilient and livelihood maintained.

**Conclusion, Limitations and Recommendations****Conclusion:**

This paper examined the perception of climate variability among rural households in Swat, Mansehra and Lower Dir and the ways these households cope with climate variability to sustain themselves. Results indicated that climatic effects, including unpredictable rainfall, variation in temperatures, and water shortages, have a considerable influence on agriculture, livelihood, health and wellbeing. Households depend on various interventions of indigenous knowledge, community networks and gendered resource management to be changed with women mostly at the centre of household resilience. Inadequate institutional support and funding make people more vulnerable whereas cohesion within the community enhances adaptability. The research determines that the socio-economic, cultural and environmental factors of rural adaptation are consistent with the Social Vulnerability Theory, as well as the Sustainable Livelihoods Framework. In general, to adapt successfully, local perceptions, gender processes and social structures are to be incorporated into planning interventions and policy interventions.

**Limitations:**

There are some limitations in this research. First, it did not cover all districts but only three, which can be a weakness when trying to generalize it to other areas of Khyber Pakhtunkhwa or Pakistan. Second, information was gathered by semi-structured interviews based on self-reported experience of participants which can bring subjective bias. Third, 30 respondents were considered, but not all of their personalities could be reflected in the themes, which might have missed some details. Lastly, the study did not develop longitudinal observations as in resources and time constraints, which would have helped give more profound insights into the changes in adaptation seasonally or regarding years.

**Recommendations:**

The findings can be used to make a number of recommendations. To start with, there should be an enhancement of institutional support whereby timely and convenient assistance can be

accorded to the rural households that are experiencing climate stress. Second, the community-based adaptation programs must be encouraged with the attention to local knowledge, networks of cooperation, and resource-sharing mechanisms. Third, gender sensitive measures should be included, in acknowledgement that women play a very important role in household adaptation and resilience. Fourth, the accessibility to financial resources, irrigation and health services should be improved in order to make the economic and health circumstances less vulnerable. Lastly, more research is also suggested to involve more samples, longitudinal studies, and other districts to support and extend the information on rural adaptation in Khyber Pakhtunkhwa.

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