

CLIMATE CHANGE AND SOCIO-ECONOMIC IMPACTS ON WOMEN FARMERS' LIVELIHOODS IN RURAL PAKISTAN

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Abstract

Climate change has emerged as a critical challenge for rural Pakistan, where agriculture forms the backbone of livelihoods and women farmers constitute a significant yet often overlooked labor force. This study examines the socio-economic impacts of climate change on women engaged in smallholder farming, focusing on how environmental stressors—such as drought, floods, water scarcity, soil degradation, and shifting crop patterns—intersect with gendered vulnerabilities. Drawing on a mixed-method approach combining household surveys, focus group discussions, and key informant interviews across selected rural districts, the research highlights how climate variability intensifies women's economic insecurity, increases their unpaid labor burden, and constrains access to resources such as land, credit, and agricultural inputs. Findings reveal that women farmers are disproportionately affected due to limited decision-making power, structural inequalities, and inadequate policy support, which collectively exacerbate poverty and food insecurity at the household level. At the same time, the study identifies indigenous adaptation strategies and informal coping mechanisms that women employ to sustain livelihoods under climate stress, though these remain insufficient without institutional support. The research underscores the urgent need for gender-sensitive climate policies, targeted social protection, and capacity-building programs that enhance women's economic resilience while strengthening climate adaptation in rural agriculture. By situating women at the center of climate-livelihood discourse, the study contributes to a more inclusive understanding of climate change impacts and policy responses in Pakistan.

INTRODUCTION

One of the biggest challenges facing the world today in the 21st century is climate change, whose impacts are far-reaching to the economies, societies, and ecosystems. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), climate change is both a development and human security problem and not a purely environmental one. Global warming, erratic precipitation patterns, glacial melting, droughts, and severe weather conditions

have augmented exposure of the population that relies on climate-sensitive economic systems like agriculture. Climate change effects are not evenly spread among the people and geographical locations; hence, developing countries are the most affected as they have a poorer adaptive capacity, poor infrastructure and socio-economic disparities (Barnett, 2003).

The United Nations Development Programme (UNDP, 2007) has conceptualized climate change as a menace to human development, with the UN warning that it compromises poverty reduction, gender equality and sustainable growth. Environmental instability is a direct threat to food security, health and livelihoods posing new types of insecurity. The convergence of climate change and structural inequalities create multi-dimensional risks as O'Brien and Barnett (2013) suggest these risks are social, political and as much environmental as they are social. This view sheds light on the immediate need to be holistic and inclusive towards climate adaptation to areas that rely heavily on agriculture.

Pakistan is the country that is the most susceptible to climate change and is always among the top ten in the Global Climate Risk Index (Germanwatch, 2021). Agriculture is still the primary sector of the Pakistani economy as it contributes approximately 19 percent to the GDP and provides almost 37 percent of labor (Government of Pakistan, 2023). The industry does not only provide food security but also supports the livelihoods of millions in rural locations where about 63 percent of people are located.

Nonetheless, the agricultural sector in Pakistan is very sensitive to climate. Unpredictable rainfall, long droughts, flooding and high temperatures damage agricultural production. According to Qureshi (2020), water scarcity caused by melting glaciers and uncontrolled extraction of groundwater is an existential threat to agriculture in many provinces, including Sindh and Balochistan. In a similar case, Khan et al. (2021) state that the alterations in the pattern of monsoons have contributed to crop failures, yield losses, and loss of livelihood. Since rural households are already struggling with poverty, climate stress increases their susceptibility, not only to income but also to food and well-being of the household.

Pakistan is therefore at the center stage of the climatic challenges because agriculture forms the basis of the rural economy. Climate change has potential impacts of overturning all the gains made in decades of development in the absence of adaptation and resilience-building policies and actions, which would increase socio-economic inequalities.

Pakistan is predominantly an agrarian economy with women as the backbone of the agricultural industry. They contribute in various aspects, which include sowing of seeds, weeding, harvesting, processing of harvest after harvest, livestock and water and fuel harvesting. According to the Food and Agriculture Organization (FAO, 2019), it is estimated that women occupy close to 70 percent of the agricultural labour force in rural Pakistan, even though most of their efforts are unpaid, informal, or not acknowledged.

Women farmers are still visibility-less in the discourse of agricultural policy and development practice despite their indispensable nature. Naz et al. (2012) also note that the female contribution to agricultural labor is usually classified as home help and not as a part of the economy, which hides its worth in the national statistics. Moreover, women do not have access to resources, including land, credit, technology, and agricultural extension services due to structural inequalities (Sadaf, 2021). Few rural women possess agricultural land with majority of them serving as family labourers and seasonal wage earners.

This invisibility is enhanced by the policy environment. Only agricultural programs and extension services are male dominated and hardly ever do they address the needs and constraints of women. This exclusion does not only curtail the output of women, but also deprives them of participation in the decision-making processes both at household, community and institutional levels. Women farmers therefore experience a paradox, whilst they are indispensable to rural livelihoods they are not provided with resources, training and policy support that can strengthen them.

Statement of the Problem

Climate change increases the gendered differences that prevail in rural Pakistan. Women growers are disproportionately impacted by the environmental stressors due to marginalization in the social-economic sphere, and their failure to adjust to the situation. Women receive additional responsibilities because the climate-related problems such as droughts, floods and varying crops trends slowly grow. These include the management of agricultural products that are in the state of decline, the

management of water resources that are limited and scarce, as well as household food sources that are often less resourceful and institutionally supported.

The researches indicate that structural reasons make women more susceptible to livelihood shocks, such as lack of land ownership, unequal access to credits and movement. As an example, women are not very mobile and their cultural beliefs, in certain circumstances, do not give them the freedom to seek refuge or transfer to other safe locations during floods. Similarly, in droughts, women will increase their distance to acquire water and fodder, so it will increase their unpaid labour and reduce the time spent on income-earning activities.

These gendered vulnerabilities have general impacts on the households and communities. The inability to cope with a loss in the means of adaptation worsens the food insecurity, malnutrition and intergenerational poverty among women. This will result in perpetuation of vulnerability cycles as Huq and Reid (2004) assert that the failure to incorporate gender perspectives in climate adaptation will involve cycling vulnerability. Women farmers are already marginalized in Pakistan and climate change only exacerbates this situation, thus establishing a policy gap that is critical in nature.

Research Objectives

This study seeks to explore the intersection of climate change, gender, and rural livelihoods in Pakistan by focusing on women farmers. The specific objectives are:

To analyze the environmental stressors (drought, floods, water scarcity, soil degradation, shifting crop patterns) impacting rural women farmers.

To examine the socio-economic consequences of climate change on women's livelihoods, labor burden, and access to resources.

To document indigenous adaptation strategies and coping mechanisms employed by women farmers.

To evaluate policy and institutional responses to climate change from a gender-sensitive perspective.

To recommend strategies for enhancing women's resilience and ensuring inclusive climate adaptation policies in Pakistan.

Research Methodology

This research employed a mixed-method methodology that combines quantitative and qualitative approaches to assess the multi-dimensional impacts of climate change on women farmers in rural Pakistan. Household surveys provided quantifiable data on socio-economic status, while focus group discussions (FGDs) and key informant interviews offered comprehensive insights on gendered experiences and adaptation techniques. This combination facilitated statistical analysis and nuanced insights, hence ensuring the validity of the findings through triangulation.

The selected areas of study were determined by the rural districts of Sindh, Balochistan, Punjab, and Khyber Pakhtunkhwa, which are susceptible to climatic conditions, to exemplify agro-ecological diversity. In these districts, a study was conducted including 300-350 smallholder farming households, focusing on indicators such as income, food security, labor division, land access, credit availability, and susceptibility to climate threats. Additionally, 8-10 focus group discussions were conducted among cohorts of women farmers to examine their concerns and coping mechanisms.

Surveys were examined using descriptive and inferential statistics to identify patterns and the correlation between climatic stress and female socio-economic position. Focus group discussions and interviews yield qualitative data that was thematically examined, revealing trends in susceptibility and adaptability strategies. Rigorous ethical safeguards were implemented: participation in the study was voluntary, informed consent was obtained, confidentiality of information was maintained, and female enumerators were employed to ensure gender sensitivity and cultural appropriateness. These procedures facilitated the establishment of trust, enabling participants to share their experiences on the livelihood challenges caused by climate change.

5. Literature Review

Global context: Gendered climate impacts on agriculture and livelihoods

There is an increasing body of literature demonstrating that different genders are more vulnerable to climate change, and that vulnerabilities are informed by already existing gender inequalities

including access to land, credit, information, mobility, and decision-making (IPCC, 2022; UN Women, 2020). The world evaluations focus on the fact that although women are at the center of food production and a food security in the household, there are structural obstacles to their adaptive capacity (FAO, 2017; UN Women, 2020). As an illustration, reports by FAO and UN reveal that female headed and women managed farms are usually disproportionately affected by extreme heat and floods which translates to reduced productivity and less institutional support in adopting adaptation strategies including irrigation, hardy seed types, and credit (FAO, 2017; UN Women, 2018). Massive household studies suggest that the income of female-headed households is more likely to be lost when there is a climate shock than the male-headed households, and this generates massive economic losses at the aggregate level in low-income nations (FAO, 2020).

The region-specific case studies explain how gendered roles interact in a way generating ecological change. Studies indicate that rain-fed smallholders, where women make up a large population, lose labor time, change their crops and livelihoods, and have more unpaid care due to floods and droughts in sub-Saharan Africa (UN Women, 2020; GGCA, 2016). Multiple studies on Africa report the key roles of women in seed saving, food processing, and local maintenance of agro-biodiversity - or the skills essential to resilience that may not be incorporated into official adaptation strategies (GGCA, 2016). Assessments of programs like female-led agroforestry initiatives reveal that, when women have access to land and technical education as well as finances, the result of resilience is much better (WEDO, 2018).

In Latin America and Asia, works point out the feminization of agricultural roles as a result of male out-migration, with the increasing production of farms under the control of women, though possessing fewer land rights and access to the market (IDRC, 2019; WEDO, 2018). Such tendencies create vulnerabilities, with women commonly undertaking subsistence production together with labor intensification caused by climate and getting distributed less extension and climate finance (FAO, 2020). The web map of climate-agriculture-gender hotspots indicate that there is spatial overlap

between regions with high female participation in agri-food systems and high risk of climate change, and presents priority areas to implement gender-sensitive adaptation (Frontiers, 2021).

Altogether, the literature of the world has come to two conclusions: (1) women are disproportionately vulnerable to climatic change in agrarian settings due to structural inequalities, and (2) gender-sensitive actions, including land tenure security, specific financing, and woman-oriented climate-sensitive agriculture, can substantially enhance the adaptive capacity (IPCC, 2022; FAO, 2020).

5.2. South Asian perspective: Women farmers in India, Bangladesh, Nepal

The gendered vulnerabilities in South Asia are significant as the country has a large rural population, relies on monsoon agriculture, and women have limited agency because of socio-cultural norms (ADB, 2021; UN Women, 2020). Comparative reviews also note that women do a significant portion of agricultural work, but they usually are unwaged workers, but in terms of land tenure, access to credit and markets, and relief in times of climatic stress they have less of it (FAO, 2017).

In India, research indicates that climate shocks, including droughts and heatwaves, have risen the time burden of collecting water and fuel (when women are the ones heading to collect it) and the majority of the programs of adaptation aim at men (Agarwal, 2018; Rao et al., 2019). Male out-migration has led to feminization of agriculture, thereby increasing the level of decision making by women but without the availability of resources to access them thereby making the act of adaptation incomplete (IDRC, 2019).

Bangladesh is a good example to be used as a way of understanding how adaptation is influenced by cyclones and saline intrusion. Women have developed approaches including diversified production homestead and saving of seeds yet are usually not encompassed in infrastructural programs or credit programs (Jahan et al., 2020). Gender-sensitive microfinance and DRR initiatives have been inconclusive: when women are trained and given resources to manage, they have worked, and when they are targeted at the household level, less so

when it is assumed that they get equal benefits (ADB, 2021).

The studies of Nepal focus on internal variations in the groups of women (age, caste, ethnicity) and record the impacts of glacial melting and unpredictable precipitation on shaping the agricultural calendar and movement (Sugden et al., 2014). The intersectional analyses underline the ways caste and ethnicity are combined with gender to mediate adaptation and program accessibility (Rao et al., 2019).

To empower women, regional reviews suggest scaling gender-responsive climate-smart agriculture, enhancing women land rights, and developing extension services to fit the mobility and time constraints of women (ADB, 2021; UN Women, 2020).

5.3. Pakistan-specific studies: Women in agriculture and adaptation

In Pakistan, agricultural work, especially subsistence-level labor and care of livestock and post-harvest processing, is predominantly occupied by women, whereas land ownership and access to credit is still a male privilege (FAO, 2017; IWMI, 2021). They have been demonstrated by floods in 2010 and 2022, numerous cases of droughts, which have resulted in more unpaid care burdens and food insecurity among women, and the obstacles to accessing relief (PreventionWeb, 2022; UN Women, 2022).

Research records the indigenous activities of women like seed saving, kitchen gardening, fodder control, and small-scale water harvesting (IWMI, 2021; Jabeen, 2020). However, such practices have restrictions due to the absence of formal recognition, insecure rights to resources, and insufficient support in extensions (PreventionWeb, 2022).

It is also reported that there is statistical invisibility: the work of women is usually undervalued either as domestic or assistive, which undermines the construction of policies (IWMI, 2021). The coverage of NGOs and media after the 2022 floods highlights the gendered effects of humanitarian urbanization and the necessity to address the issue through gender-sensitive resilience (UN Women, 2022).

Climate Change and Environmental Stressors in Rural Pakistan

7.1. Overview of climate change in Pakistan

Pakistan is one of the most vulnerable countries in the world in terms of climate, and it is always in the top ten on the list of Global Climate Risk Index (Germanwatch, 2021). The average temperatures have increased, the precipitation patterns have become erratic, the glaciers have melted, and the extreme conditions like the droughts and floods have been more severe in the last three decades (IPCC, 2022). Over 150 extreme climatic events such as frequent floods and drought-cycles have occurred in Pakistan between 1999 and 2018 leading to huge losses to the socio-economic system (Eckstein et al., 2021). The 2010 and 2022 floods displaced millions of people, devastated crops, and destroyed rural infrastructure and chronic droughts in Sindh and Balochistan have worsened food insecurity (Mustafa et al., 2015). Rise in temperature- already 0.6degC above the 20th century average- is estimated to diminish agricultural output, change the cycle of crops and increase water stress (World Bank, 2021).

7.2. Regional distribution of stressors

The climate stressors vary depending on the province of Pakistan. The falling flows of the Indus River often cause drought and water deficits in Sindh, where smallholder farmers are extremely reliant on the variability of rainfall (Rasul et al., 2012). The agricultural center of the country, Punjab, is exposed to changing monsoon cycles and river floods, which destroy such crops as wheat, rice, and sugarcane. Balochistan is an arid land with a long-term scarcity of water, desertification, and subsistence agriculture due to crop failures as a result of drought (Ahmad et al., 2019). In the meantime, Khyber Pakhtunkhwa (KP) is susceptible to flash floods and glacial lake outbursts (GLOFs), particularly in the mountainous areas of the North, which pose a danger to agriculture and rural population (Rahman et al., 2018). This local difference highlights the necessity of localized adaptation policy that should address specific province vulnerability.

7.3. Effects on agriculture

The agricultural sector is the main source of rural livelihood in Pakistan and it is suffering due to climate stress. Increased temperatures and imbalanced rainfall have caused soil degradation, salinity and soil erosion which have decreased the soil fertility in both irrigated and rainfed regions (Lal, 2015). Climate change is making the water scarcity, which is already severe in terms of over-extraction and improper governance, even worse, and the per capita water availability has dropped to below 1,000 cubic meters of water, which puts Pakistan in the list of countries with a water shortage (Qureshi, 2020). There is also the necessity of the shift in climatic patterns, which requires farmers to switch to the type of crops that are resistant to drought or have a short germination period, but these shifts tend to lower the yields and profitability (Hussain et al., 2016). These transformations have a direct negative bearing on food security, incomes in rural areas, and sustainability.

8. Socio-Economic Impacts on Women Farmers

Pakistan rural women farmers have a direct and drastic economic impact on climate change. The random rainfall, extended drought and frequent flooding often cause crop failure, causing a decrease in the income of agricultural-dependent households (Abid et al., 2016). Women farmers, who tend to be under subsistence agriculture and keep small numbers of livestock, are especially hit because they do not have crop insurance or savings to absorb shocks (Hussain et al., 2016). Furthermore, the disasters are caused by climate, which affects the rural markets and supply chains and restricts access to buyers and reduces the profitability of agricultural products (Amir and Habib, 2015). The access to the market by women is further limited by gender norms that limit their movements, and hence their opportunities to get equitable prices of the produce they produce as compared to men. Consequently, climate stress does not only affect the individual income of women but also the household income, which supports the poverty cycles.

Climate variability increases the labor burden on women both in agricultural and the domestic domain. Women already do most of the unpaid care work in the rural homes such as fetching water,

cooking, child care, and fuel collection (Naz et al., 2012). As droughts and water shortages intensify, the period of collecting water has grown significantly, and in many cases, women and girls have to travel a long distance (Mustafa et al., 2015). Simultaneously, agricultural problems due to climate, which include soil erosion, pest infestation and changes in crop pattern, require increased manual effort, especially in the weeding, planting and after harvesting. Women have fewer access to mechanized tools, unlike men, thus their work is more labor-intensive (FAO, 2019). This two-fold task of unpaid household and farm work means that women have minimal time to get an education, sleep, or any other income generating activity beyond subsistence farming, entrenching gender inequalities in rural labor relations.

The disadvantage of women farmers is also worsened by structural barriers. Pakistan has almost 70 percent of the total agricultural workforce as women, but very few of them legally control land (Sadaf, 2021). Women have been systematically marginalized when it comes to agricultural loans, formal credit and government subsidies, which in many cases are linked to land ownership without land titles (Naz et al., 2012). Likewise, gender disparities in productivity are upheld by the fact that extension services, quality seed access, access to fertilizers, and farm implements are mainly targeted at men (Qureshi, 2020). Women farmers also do not access the information regarding the climate-smart agricultural practices as much, which makes them less prepared to respond to the changing conditions (Ali and Erenstein, 2017). Such institutional restrictions do not only decrease productivity, but it also maintains reliance on male family members when it comes to decision making and access to resources.

Climate change has social effects on the women in the rural areas, which are closely associated with the gender norms. In most communities in rural areas, culture makes the mobility of women limited and they can not move about to take part in markets, training, or in any other adaptation programs in the communities (Arora-Jonsson, 2011). The lack of representation in local decision-making institutions, including village councils and water user associations, is an addition to the marginalization of women in policy making that directly impacts their livelihoods (Mustafa et al., 2015). The issue of

gender roles, in which women are held liable to the household food security, under the pressure of climate, because women are supposed to cope with scarcity whereas they have no control over resources and decision-making capacities (Rao et al., 2017). Such social constraints do not only destroy the agency of women but also weaken the efficacy of community based climate adaptation programs.

Implication at the household level: effects of food insecurity, cycles of poverty, and intergenerational effects.

Stressors related to climate are experienced at the household level through aggravated food insecurity and poverty cycles. The effect reduced agricultural yields and income have a direct impact on dietary diversity, and women tend to consume less or last, so that other family members can eat (FAO, 2019). The intergenerational effects of food insecurity are severe and irreversible such as child malnutrition, malnutrition stunting and inadequate school education, mostly girls are often pulled out of school to help with the household chores in the periods of crisis (Naz et al., 2012). These dynamics form poverty traps, in which climate shocks not only affect the livelihoods at the time but also destroy the resilience of rural households in the future. To women farmers, this vulnerable cycle strengthens structural inequalities and places them in a vicious cycle of vulnerability making them vulnerable to climatic change disproportionately to their male counterparts. To counter these implications, it is necessary to have policies that can effectively address food security, access to resources by women and education to eliminate intergenerational poverty.

9. Women's Coping and Adaptation Strategies

Rural women farmers in Pakistan have traditionally used natural adaptation measures to counter the impact of climatic variability. Popular techniques include crop diversification, where the risk is shared among various crops, and the traditional seeds are physically stored to be utilized later on (Ali and Erenstein, 2017). Women also control small-scale water storage systems such as earthen pond and household level conservation, which keep household food and water secure during times of shortage (Qureshi et al., 2019). Moreover, women tend to change their livestock management, including

downsizing their herds in times of droughts or changing to cattle to goats and poultry that demand fewer resources and are more likely to survive in the changing climate (Nawab and Nyborg, 2009). Although modest, these practices portray the importance of women in supporting livelihoods in the house as a result of resource management.

Rural women depend greatly on informal systems of coping in the absence of formal institutional support. The survival strategies revolve around community-based mutual support networks, such as sharing food or labor in times of crisis (Sadaf et al., 2020). Barter systems, in which women trade in small, agricultural goods or services, also assist in the resource redistribution once the market access has been interrupted. In more radical situations, families turn to seasonal or permanent migration of men, and women have to work more on farms and in households, with remittances becoming a major survival strategy (Rasul et al., 2019). These non-institutional structures indicate both the tenacity and the constraints of the adaptive capacity of women in that they tend to be short-lived and non-institutionalized.

Women innovatively work toward gendered innovations in agricultural and domestic resiliency, despite structural constraints. To highlight, the use of kitchen gardens by women does not only offer dietary variety, but it also is participating in household income by selling small-scale (Fatima & Khan, 2021). Women usually lead the pack in testing out new climate-resistant crops such as millet or pulses that need less water and can withstand heat stress. Their seed preservation and food processing are essential in time of lean seasons, which shows the importance of women as guardians of biodiversity (Naz et al., 2020). These donations indicate that women are not mere climate change victims but agents of adaptation and resilience-building.

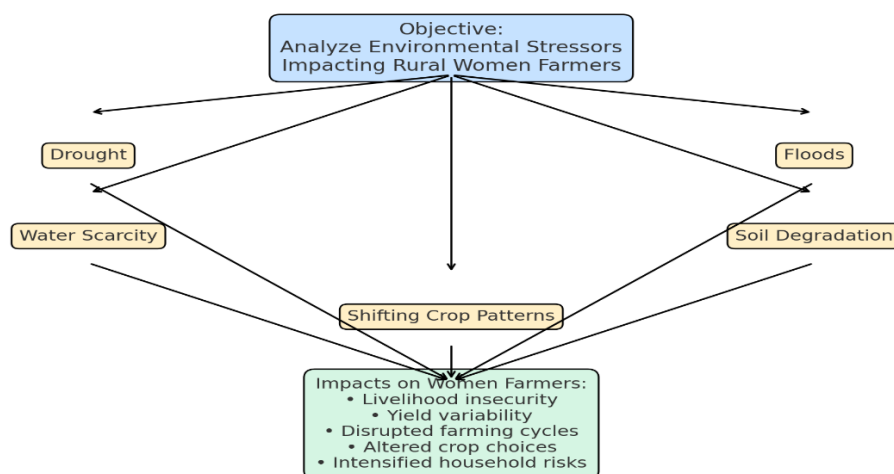
Regardless of these coping mechanisms, women are still confronted with systemic factors that restrict their adaptive capacities. Their contributions are not always reflected in the agricultural policies and climate adaptation programs due to their lack of institutional recognition (Mustafa et al., 2019). The lack of resources, especially limited access to land, water, credit, and agricultural inputs, compromises their capacity to pursue resilience plans on a large

scale (FAO, 2021). Besides, women often cannot receive training on climate-smart agriculture or disasters preparedness because of gender norms, mobility limitations, and male-dominated extension services (Haris et al., 2022). Such obstacles continue to create a cycling situation where the resilience plans of women are limited and local in dealing with escalating climate demands.

10. Discuss and Analysis of Study Objectives

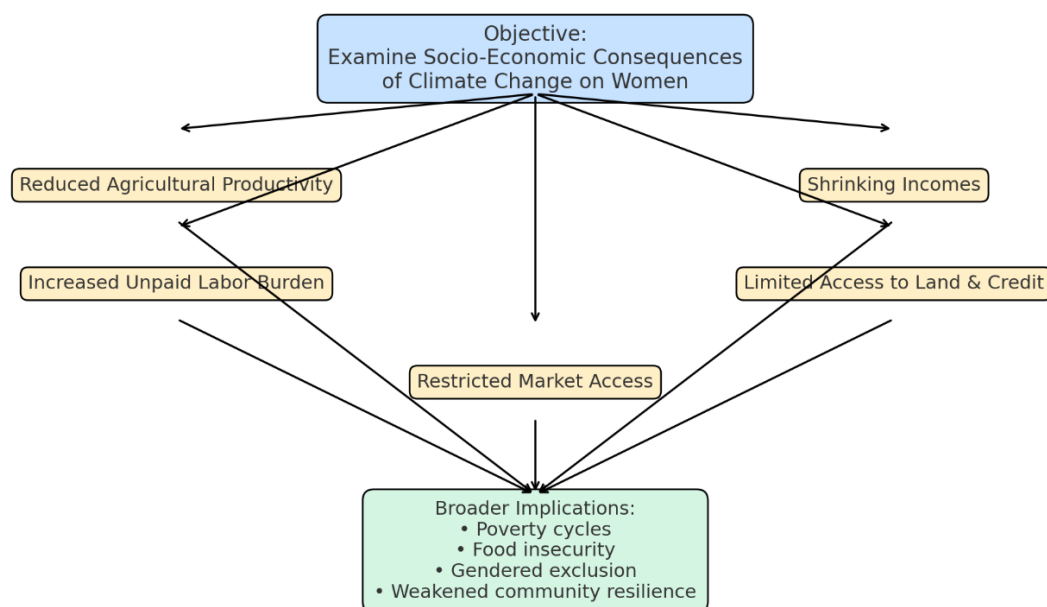
To analyze the environmental stressors (drought, floods, water scarcity, soil degradation, shifting crop patterns) impacting rural women farmers
This goal deals with the immediate climatic-related issues of rural Pakistani women farmers. Livelihood insecurity is a condition caused by environmental stressors like long droughts, frequent floods, and water shortages in rural Pakistan. The increased

vulnerability of women farmers who are mostly subjected to rain-based agriculture and smallholder farming is associated with soil erosion and fluctuation in crop production (Qureshi et al., 2019). In examining these stressors, the study places women agricultural labor in the context of a larger environment of environmental instability, and in which changes brought about by climate affect production cycles and crop preferences, and increase the risks faced at the household level. This discussion is vital in that it is hard to plan sustainable adaptation strategies of women farmers without knowing the particular ecological forces affecting them.



To examine the socio-economic consequences of climate change on women's livelihoods, labor burden, and access to resources
The second goal broadens the discussion past environmental effects to socio-economic outcome. Besides lowering agricultural output, climate variability further increases the economic insecurity of women by decreasing incomes and increasing their unpaid labor workload, including collecting water and looking after children during climate disasters. The vulnerabilities are complicated by limited access to land, credit, agricultural inputs, and

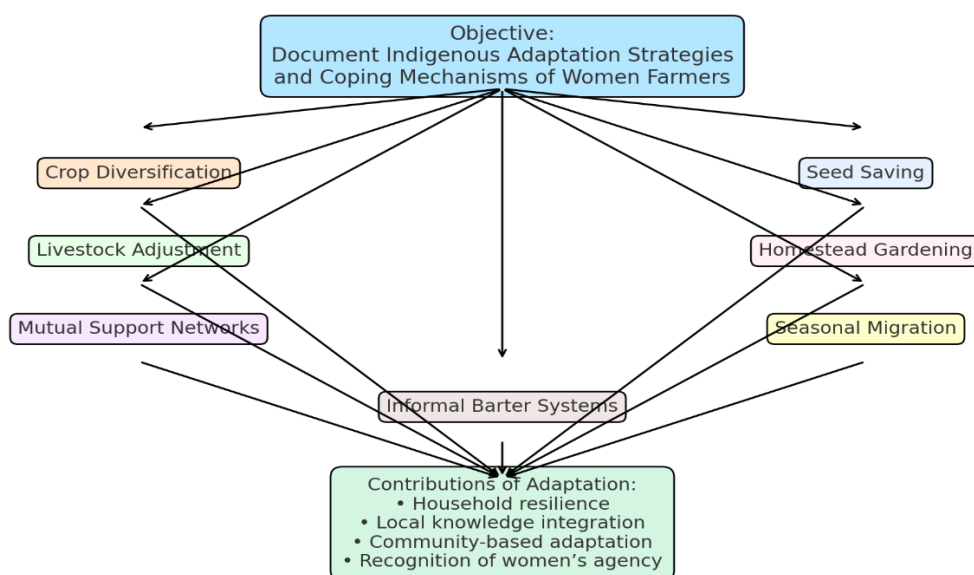
markets, providing women with little possibilities to diversify their income or invest in resilience (Mustafa et al., 2019). This goal acknowledges that climate change reinforces structural inequalities that are already inherent in the rural economy of Pakistan. Through these connections, the research feeds into a subtle description of the way climate change perpetuates poverty cycles, food insecurity and gendered exclusion, which ultimately influence general community resilience.



To document indigenous adaptation strategies and coping mechanisms employed by women farmers

Although the women are usually depicted as victims of climate change, they also contribute to the process of adaptation, coming up with new ways of carrying out practices to support their household. This goal anticipates the indigenous knowledge and coping mechanisms of women, that is, crop diversification, seed saving, livestock adaptation, homestead gardening, and mutual-support networks. Recording

such practices would not only consider the role of women in resilience, but also establish channels through which local level of knowledge can be integrated in official climate policy. In addition, the study, based on measures of coping strategies such as seasonal migration or barter networks, illuminates the appropriateness of the adaptive capacity of women, as well as its constraints. This goal highlights the significance of shifting to a deficit approach of vulnerability and acknowledgement of agency, resourcefulness and possible leadership of women in the adaptation at the community level.



To evaluate policy and institutional responses to climate change from a gender-sensitive perspective

The last objective connects the empirical results with the policy field. Although Pakistan is a signatory to climatic adaptation frameworks, majority of the strategies are gender blind, with little acknowledgement of the special needs of women farmers. This goal critically analyzes how agricultural extension services, disaster management frameworks and climate resilience programs respond to or do not respond to gendered vulnerabilities. A gender-sensitive assessment of these institutional responses can enable the study to identify the implementation failures, including the absence of female extension workers, the exclusion of women in training programs, and the absence of social protection measures specifically addressing women smallholders (Haris et al., 2022). This discussion is directly applicable to policy discussions as it illustrates the necessity of inclusive and gender responsive systems that enable women as equal voices in climate adaptation.

Objective 1: To Analyze Environmental Stressors Impacting Women Farmers

The results of FGDs have shown that women farmers are constantly on the receiving end of environmental stressors. Prolonged droughts were reported to be the most apparent danger as they resulted in the reduction of water tables and agricultural losses. Repeated flooding swept the fields and homes in flood prone areas forcing women into temporary shelters. The theme of water scarcity was also a topic that was repeated, as women narrated the hard work of walking far distances to acquire water to use both at home and in the farms.

Women also attributed degradation of soil to over-cultivation, no fertilizers and unreliable rainfall which decreased yields and necessitated changes to less lucrative crops. FGDs pointed out that women not only saw these changes as environmental disturbances, but also as outright threats to their domestic food security and the wellbeing of their children. Notably, women described the ways in which climate pressures changed the usual farm cycles, compelling them to test planting schedules and types of crops despite having minimal technical advice.

Key FGD Insight: Environmental stressors are lived realities for women farmers, experienced daily in the form of shrinking resources, longer labor hours, and disrupted food systems.

Objective 2: To Examine the Socio-Economic Consequences of Climate Change on Women's Livelihoods

FGD discourses highlighted the fact that climatic changes have severely undermined the economic security of women. Reduction in agricultural productivity will decrease the income of farm-related households. Women stressed that their household labor extended considerably - such as getting scarce water, taking care of members of the family who were ill during floods or addressing food shortages.

There were also gendered disparities of accessing resources as discussed. Women have little to recover after climate shocks through land ownership, credit systems and markets, which they are mostly locked out of. The same theme was the dual burden: women should be able to work in the field as well as to provide housewifery.

Some FGDs observed that such disparities increase poverty cycles and food insecurity. Women shared their experiences with less frequent eating to allow children to eat, or taking advances in favor of loans when they did not get enough income. Women were complaining as young women were saying that they had little other options to livelihood diversification since they lacked assets and mobility.

Key FGD Insight: Climate change exacerbates structural inequalities in rural economies, increasing women's vulnerability while reducing their socio-economic agency.

Objective 3: To Document Indigenous Adaptation Strategies and Coping Mechanisms

Contrary to the image of women as passive victims, FGDs highlighted women's active adaptation strategies. Commonly mentioned practices included: **Crop diversification** (shifting from water-intensive crops like rice to drought-resistant ones).

Seed preservation and exchange among women farmers.

Livestock adjustment, where small ruminants were prioritized over cattle during droughts.

Homestead gardening for food self-sufficiency.

Mutual support networks, including food sharing and informal savings groups.

FGDs also revealed coping mechanisms with limitations. Seasonal migration was described as disruptive to family life, while barter systems broke down during widespread shocks when everyone was equally vulnerable. Women acknowledged that while their indigenous knowledge sustained households, they lacked external support to scale up these practices.

Key FGD Insight: Women are not just vulnerable but are also agents of resilience, using indigenous knowledge and networks to navigate climate challenges. However, these strategies remain constrained by structural barriers.

Objective 4: To Evaluate Policy and Institutional Responses from a Gender-Sensitive Perspective

FGDs were highly suspicious of the government and institutional support system. According to women farmers, there was little or no interest amongst women in the agricultural extension services mainly due to the fact that these services are dominated by males and are mostly inaccessible to women. Disaster relief was also said to be unequal and politicized where women were often not included in the channels of distribution.

The participants of FGD complained that the climate resilience programs have little to do with their own needs, including access to seeds, small credit, or women-specific training. The lack of female extension workers was also mentioned as a multiple time impediment to valuable involvement. There was also a lack of social protection schemes that target smallholders and the women would be vulnerable in times of crisis.

Nevertheless, these issues did not stop women who expressed their strong advocacy of inclusive, gender sensitive policies. They demanded a training program that is feminine and an appreciation of adaptation strategies by indigenous people and establishment of women cooperatives so as to enhance access to the market.

Key FGD Insight: Policy responses remain largely gender-blind. Women farmers feel invisible in official adaptation frameworks, despite being central to agricultural survival.

Policy and Institutional Dimensions

A number of frameworks have been worked out in Pakistan to meet the climate issues, such as the National Climate Change Policy (NCCP 2012; revised 2021), the National Agriculture Policy, and provincial adaptation plans. These papers focus on climate-resistant agriculture, water management and disaster preparedness. Nonetheless, they do not neglect the vulnerability of rural communities, but are not as gender-sensitive as they should be, and are more likely to view women as a vulnerable group in the process of adapting than as active agents of the process (Abid et al., 2016). The high awareness on women in rural development initiatives is a strength, though gaps have been identified on the lack of operational guidelines and resources to find the way of putting promises into actions.

Non-governmental organizations (NGOs), donor-funded initiatives and women cooperatives have tried to fill policy gaps by proposing climate-smart agriculture, microfinance, and women-focused livelihood initiatives (FAO, 2021). As an example, UNDP and Oxfam have initiated projects to test women as leaders in disaster risk reduction, community-based management of natural resources. The result of these small-scale interventions is in pointing to the possible mainstreaming of women resilience in climate policy via grassroots and donor-funded models.

In spite of such efforts, there are still a number of barriers. Women are still restricted on decision-making at the community and national level due to institutional prejudices and patriarchal standards (Mustafa et al., 2019). Women farmers are challenged by weak agricultural extension systems that are dominated by male employees, who limit women farmers to training, credit, and new technologies (Haris et al., 2022). In addition, there is also a lack of systematic monitoring and accountability mechanisms that support gender integration across the policies. The solution to these challenges is gender-sensitive reforms, as well as institutional reforms and restructuring to have women representation, capacity building and equal distribution of resources in climate and agricultural governance.

Recommendations

Mainstream Gender in Climate Policies

Integrate gender-sensitive approaches into the National Climate Change Policy and Agriculture Policy, ensuring that women farmers are recognized as active contributors rather than passive beneficiaries.

Establish gender-responsive monitoring frameworks to track implementation outcomes.

Strengthen Women's Access to Resources

Ensure secure land tenure rights for rural women to enhance decision-making power and investment in sustainable farming.

Expand women's access to credit, subsidies, quality seeds, fertilizers, and irrigation technologies through simplified procedures and women-friendly financial products.

Enhance Agricultural Extension and Training

Recruit and train more female extension workers to bridge gender gaps in agricultural knowledge transfer.

Develop women-focused training programs on climate-smart agriculture, water management, and disaster preparedness.

Promote Women's Collectives and Cooperatives

Encourage the formation of women-led cooperatives, seed banks, and self-help groups, modeled on successful practices in India and Bangladesh.

Support collective marketing strategies to improve women's market access and bargaining power.

Strengthen Social Protection and Safety Nets

Expand cash transfer programs, crop insurance schemes, and disaster relief packages targeted at women-headed households and smallholders.

Integrate food security and child nutrition initiatives into climate adaptation planning.

Recognize and Scale Indigenous Knowledge

Document and institutionalize women's traditional practices—such as crop diversification, seed saving, and homestead gardening—through partnerships with NGOs, research institutions, and local governments.

Combine indigenous strategies with modern climate-smart technologies for holistic adaptation.

Institutional Reforms and Representation

Ensure women's representation in local water user associations, disaster management committees, and agricultural boards.

Reduce institutional bias by implementing gender audits across ministries and provincial departments.

Conclusion

The present paper has proven that climate change in rural Pakistan is a problem not only on the environment but also a gendered development and human security problem. Women farmers who are the main breadwinners in agriculture have been left behind in dealing with droughts, floods, water scarcity, soil drains and crop changes. Such stressors heighten their economic insecurity, labor unpaid workloads, and land, credit, and agricultural input access. Meanwhile, the indigenous coping mechanisms practiced by women, including crop diversification and seed preservation, and mutual support between women, emphasize women agency and their strength.

Nevertheless, these efforts are not sufficient and institutionally acknowledged to address the climate threats. Current policy frameworks such as the National Climate Change Policy and the Agriculture Policy do not exclude the vulnerabilities, but they do not have operational gender mainstreaming. Female marginalization is still entrenched in the lack of representation of women in the governance, poor extension services and structural resource imbalances.

The solution is embracing gender sensitive climate policies, reinforcing access of resources by women, improving their services in extension and institutionalizing their traditional knowledge. Through placing women not as victims but as frontiers in resilience and adaptation, Pakistan can be able to accomplish more inclusive climate governance, enhance food security, and cycle out rural poverty. Finally, women farmers empowerment is not a question of fairness but of strategic importance in developing sustainable and climate resilient rural livelihoods..

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