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Exploring Climate Change Awareness and Perception among Faisalabad Pakistan

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Abstract: This study explores the impact of climate change in Faisalabad–Jaranwala, a critical agricultural region in Pakistan. It aims to evaluate public awareness, assess socio-economic effects, and examine adaptation strategies adopted by the local population. A cross-sectional survey design was employed, gathering data from 170 respondents representing diverse demographic groups, including farmers, laborers, and business owners. The structured questionnaire, administered through Microsoft Forms, focused on key areas such as demographic details, awareness of climate change, agricultural impacts, and socio-economic factors influencing adaptive capacities. Data analysis utilized count and unique functions to identify trends, with visual representations like graphs and charts aiding interpretation. Key findings reveal that 75 respondents attributed climate change to human activities, while 12 lacked understanding of its causes. Rising temperatures emerged as the most significant environmental change, alongside erratic rainfall and water scarcity. Agricultural impacts included wheat yield declines due to heat stress, reported by 77 respondents. Adaptation strategies, such as changing crop varieties and altering planting schedules, were noted but faced barriers like insufficient knowledge (70 respondents) and inadequate government support (49 respondents). Recommendations include launching awareness campaigns and integrating climate education into school curricula to address knowledge gaps. Financial incentives, such as subsidies for climate-resilient seeds and advanced irrigation systems, are critical for supporting farmers. Infrastructure development for efficient water management and empowering marginalized groups through training programs are also essential steps. By highlighting vulnerabilities and responses, the study provides valuable insights for designing informed climate resilience policies in the region.

Keywords: Climate change, Faisalabad–Jaranwala, Pakistan, Agriculture, Public awareness, Socio-economic impact, Adaptation strategies.

Research Paper

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INTRODUCTION

Background and Context of Global Environmental Variability

The past century has witnessed unprecedented changes in global climatic patterns. These transformations stem primarily from human induced factors such as industrialization, deforestation, rapid urbanization, and the extensive burning of fossil fuels. With increasing levels of carbon dioxide, methane, and nitrous oxide in the atmosphere, planetary warming has accelerated, causing shifts in seasonal behavior, erratic precipitation, and rising sea levels. Communities more reliant on natural resources, such as agricultural societies, are highly sensitive to these environmental shifts, yet their awareness and perceptions remain underexplored. In rural agricultural areas, the loss of yield due to unpredictable weather patterns has been estimated at 10-20% annually, further stressing the need for localized understanding and action (Jamshed *et al*., 2024).

The concept of environmental perceptions refers to how individuals and communities comprehend and interpret these changes based on their local experiences, socio-economic conditions, and cultural frameworks. While scientific evidence provides macro level insights, public understanding often shapes societal responses and the effectiveness of mitigation strategies. For instance, surveys conducted by the Pew Research Center indicate that 60% of individuals in developing countries perceive environmental challenges as a major threat, compared to 58% in developed nations. Additionally, atmospheric carbon dioxide levels have reached a record high of 419 ppm as of 2023, compared

to 280 ppm in 1850. This increase correlates directly with rising sea levels, which have surged by 3.7 millimeters annually over the past three decades, as reported by the Intergovernmental Panel on Climate Change (Yasin *et al*., 2024).

Impact of Changing Environmental Patterns in Pakistan

Pakistan ranks among the most vulnerable nations to environmental variations. Geographically positioned in South Asia, the country is exposed to significant seasonal and climatic shifts that affect its agrarian based economy, natural resources, and rural livelihoods. With approximately 20% of its population directly employed in agriculture, variability in rainfall patterns, intensifying heatwaves, and prolonged droughts are pushing farmers towards uncertainty and economic insecurity (Nasir Mahmood et al., 2015).

The study of Faisalabad-Jaranwala

Faisalabad-Jaranwala, located in Punjab, plays a pivotal role in Pakistan's agricultural economy. Known for its fertile lands and diverse cropping systems, the region contributes significantly to the production of wheat, rice, sugarcane, and vegetables. With approximately 70% of the population engaged in agriculture, climatic variability has a profound impact on livelihoods, food security, and economic stability (Hussain *et al.,* 2018).

The region's socio-economic profile reveals both opportunities and challenges. While Faisalabad stands as an industrial hub, neighboring Jaranwala retains a predominantly rural character. Literacy rates are relatively moderate, with rural communities largely dependent on traditional farming methods. This dependence amplifies their vulnerability to environmental variations, as smallholder farmers lack access to modern technologies, financial resources, and timely information (Mahmood *et al*., 2015).

Global Perceptions:

Around the world, perceptions of environmental variability vary significantly based on geographic, socio-economic, and cultural factors. In developed countries such as Germany and Sweden, public awareness is often driven by scientific research, government initiatives, and proactive environmental policies. For example, Sweden's success in achieving carbon neutrality stems from widespread societal understanding and trust in institutional frameworks. On the other hand, developing regions such as sub-Saharan Africa and South Asia present a contrasting picture. Communities heavily reliant on natural resources often face challenges related to poverty, illiteracy, and limited access to information. Despite these barriers, case studies demonstrate inspiring resilience and community-driven adaptation (Khan *et al*., 2020).

Bangladesh, for instance, provides a notable example of how vulnerable communities can adapt to rising sea levels and flooding. Through the adoption of floating agriculture, tidal irrigation systems, and local awareness programs, Bangladesh has empowered its rural population to respond effectively. Lessons from such initiatives can serve as a foundation for similar interventions in Faisalabad-Jaranwala (Arshad *et al*., 2017)

Objectives:

- To evaluate the awareness and perceptions of climate change among different demographic groups in Faisalabad–Jaranwala.
- To analyze the specific impacts of climate change on crop yields and agricultural practices in the region.
- To assess the socio-economic factors influencing the adaptive capacity of smallholder farmers.
- To recommend targeted strategies and policy interventions to enhance climate resilience and sustainable agricultural practices in Faisalabad–Jaranwala.

LITERATURE REVIEW

Theoretical Framework

Understanding how individuals and communities interpret environmental shifts requires a theoretical foundation rooted in psychological, social, and behavioral frameworks. According to Rana *et al*., (2023), the Risk Perception Model explains how individuals assess environmental risks based on their experiences, cognitive biases, and socio-cultural values. It emphasizes that perceptions are shaped not merely by scientific information but also by emotional and contextual factors. For example, farmers in agrarian regions often perceive risks differently compared to urban populations due to their direct exposure to resource variability. A study conducted in rural Pakistan by Nadeem *et al*., (2024) found that 72% of smallholder farmers believed erratic rainfall posed a greater risk to their livelihoods than temperature increases, indicating how localized experiences influence risk perception.

Similarly, the Environmental Belief Systems Theory explores the role of values, beliefs, and norms in shaping environmental awareness. As highlighted by Ali *et al*., (2017), communities with strong ecological worldviews are more likely to adopt sustainable practices. These frameworks provide a lens for analyzing disparities in perceptions across diverse socio-economic and cultural contexts. For example, research in Central America by Ahmad *et al*., (2024) revealed that regions with robust environmental education programs experienced a 40% higher adoption rate of conservation practices compared to areas lacking such programs.

Global Case Studies on Perceptions Towards Environmental

Europe serves as a model for high levels of environmental consciousness and proactive strategies. According to Shah et al. (2022), nearly 92% of Europeans recognize the importance of environmental issues, with countries like Sweden and Denmark at the forefront of public engagement. Scandinavian nations have successfully implemented green energy initiatives by aligning public perceptions with institutional frameworks. For instance, Sweden's transition toward carbon neutrality by 2045 is largely attributed to its education campaigns, financial incentives, and technological innovation, leading to a 20% reduction in carbon emissions over the past decade.

Environmental Perceptions in Developing Regions

Perceptions in developing nations are often influenced by socio-economic disparities, limited education, and inadequate access to resources. Manzoor *et al*., (2019) argue that poverty and illiteracy hinder proactive responses, with marginalized groups disproportionately affected. In South Asia, for example, 75% of farmers cited economic insecurity as the primary barrier to adopting resource-efficient practices (Qaisrani *et al*., 2018).

Role of Indigenous Knowledge

Indigenous knowledge systems contribute significantly to environmental adaptation. According to Ali and Erenstein (2017), communities in sub-Saharan Africa and South Asia integrate traditional practices, such as crop rotation and rainwater harvesting, to mitigate risks. In Nepal, for instance, 65% of rural farmers rely on indigenous weather forecasting methods to plan agricultural activities, illustrating the importance of cultural frameworks in shaping perceptions. In India, tribal communities in Odisha have revived agroforestry techniques, improving local biodiversity and increasing crop yields by 15% over five years (Zareen and Akhtar, 2023). These examples demonstrate the untapped potential of indigenous practices in promoting resilience.

Environmental Perceptions in Pakistan

Pakistan, ranked among the most vulnerable countries to resource variability, showcases diverse environmental perceptions across its provinces. According to Ahmed and Luqman, (2024), 65% of respondents in Sindh attribute agricultural losses to unpredictable rainfall patterns, while 57% of respondents in Khyber Pakhtunkhwa link their challenges to deforestation and water scarcity.

Faisalabad-Jaranwala: Regional Context in Literature

Agricultural Dependence and Resource Challenges

Faisalabad-Jaranwala, located in central Punjab, is highly dependent on agriculture, with approximately 72% of its population engaged in farming (Usman *et al*., 2024). The region faces multiple challenges, including erratic rainfall, water shortages, and rising input costs. According to Ahmed *et al*., (2020), 60% of farmers reported crop failures in the past decade due to inconsistent weather patterns. A similar study revealed that 55% of households faced food insecurity due to economic and environmental challenges.

Socio-Economic and Educational Factors

Socio-economic conditions further exacerbate these challenges. The literacy rate in rural Faisalabad is estimated at 58%, which limits access to information regarding sustainable practices. Additionally, resource constraints and lack of infrastructure hinder the adoption of modern technologies, as highlighted by Ricart *et al*., (2018).

Gaps in Education and Awareness

Studies reveal that only 30% of farmers in Faisalabad-Jaranwala have received formal training on adaptive strategies. Educational campaigns and community outreach programs remain largely underdeveloped, emphasizing the need for targeted interventions. Expanding access to mobile based technologies and resource management training can significantly improve resilience (Mazhar and Shirazi, 2020).

METHODOLOGY

This study employed a quantitative research approach to evaluate the awareness and perceptions of climate change, analyze its impacts on agriculture, and assess socio-economic factors influencing adaptive capacities in Faisalabad–Jaranwala. The methodology involved a structured approach to data collection, analysis, and interpretation, detailed as follows:

Study Area

The research was conducted in Faisalabad–Jaranwala, a significant agricultural region in Punjab, Pakistan. This area was selected due to its critical role in the country's agricultural productivity and its susceptibility to climate change impacts.The region's reliance on agriculture makes it particularly vulnerable to climate variability, such as erratic rainfall, temperature fluctuations, and extreme weather events.

The diversity of the population in Faisalabad–Jaranwala further supported the objectives of this study. The area encompasses a range of socio-economic groups, from smallholder farmers to urban business owners, providing a unique opportunity to capture diverse perspectives on climate awareness and adaptive capacities. Additionally, the agricultural dependency of this region made it a pertinent case for examining resilience strategies against climate-induced challenges.

Research Design

A cross-sectional survey design was adopted to gather data at a specific point in time. This design

allowed the study to assess current levels of awareness, perceptions, and the socio-economic impacts of climate change. The approach was chosen for its ability to provide a snapshot of prevailing conditions while facilitating the analysis of trends and patterns across different demographic groups. By using a structured survey, this methodology enabled the collection of standardized data, ensuring consistency and reliability.

This design was deemed particularly effective given the study's focus on quantifying key indicators such as awareness levels, perceived impacts, and adaptive capacities. It also allowed for the identification of correlations between socio-economic factors and climate change resilience, offering valuable insights into regional adaptation needs.

Sample Size

A sample size of 170 respondents was determined using convenience sampling. While this non-probability sampling technique limits the generalizability of the results, it was deemed suitable given the constraints of time and resources. Efforts were made to include a diverse range of participants to capture a comprehensive understanding of the region's dynamics.

Data Collection Tools

Data were collected using a structured questionnaire designed and administered through Microsoft Forms. This digital platform was chosen for its ease of use, accessibility, and ability to efficiently compile and organize responses. The questionnaire comprised closed-ended questions to ensure clarity, ease of response, and standardization of data collection.

Development of the Questionnaire

The questionnaire was meticulously developed based on the study's objectives and informed by an extensive review of existing literature on climate change, agriculture, and socio-economic resilience. Questions were tailored to capture the nuances of the regional context, with a focus on:

Demographics: Gathering data on age, gender, education, occupation, and income levels to contextualize responses.

Climate Change Awareness: Assessing participants' knowledge, sources of information, and perceptions of climate change.

Agricultural Impacts: Documenting changes in crop yields, challenges faced by farmers, and observed environmental shifts.

Socio-Economic Factors: Exploring access to resources, financial stability, and the socio-economic constraints influencing adaptive capacities.

Recommendations: Soliciting policy suggestions and sustainable practices to enhance regional resilience.

Data Analysis

Collected data were analyzed using count and unique functions to summarize key characteristics and identify patterns. Microsoft Excel was employed for organizing and processing the data, with visual representations such as bar graphs, pie charts, and line graphs generated to illustrate findings effectively.

Analysis Techniques

- **Count and Unique Functions**: Used to determine the frequency of responses and identify distinct patterns in the dataset.
- **Visualization**: Graphical tools enhanced the accessibility and interpretability of results, facilitating comparisons across demographic groups.

Ethical Considerations

Ethical research practices were prioritized throughout the study to ensure the integrity of the process and the well-being of participants.

RESULTS AND DISCUSSION

The majority of respondents, 162, belong to the 18–30 years age group, highlighting that a significant portion of the surveyed population consists of young adults. This demographic represents a dynamic and active group likely to be more aware of environmental challenges, including climate change, due to their exposure to education and digital platforms. In contrast, only 8 respondents fall within the 31–45 years age group, indicating lower participation from older individuals. The predominance of younger individuals in the survey suggests their growing role in understanding and addressing climate issues, particularly as they face the long-term impacts of climate change on their livelihoods and communities.

The gender distribution shows that 126 respondents are male, while 44 are female, indicating that men dominate participation in the survey. This disparity could reflect traditional roles in agriculture and business, where men are often seen as primary earners and decision-makers, particularly in rural settings. Women, while often playing crucial roles in farming, are underrepresented in formal surveys due to cultural, societal, or logistical barriers. Encouraging female participation in discussions about climate change is essential, as women are often disproportionately affected by environmental changes and can contribute valuable insights and solutions.

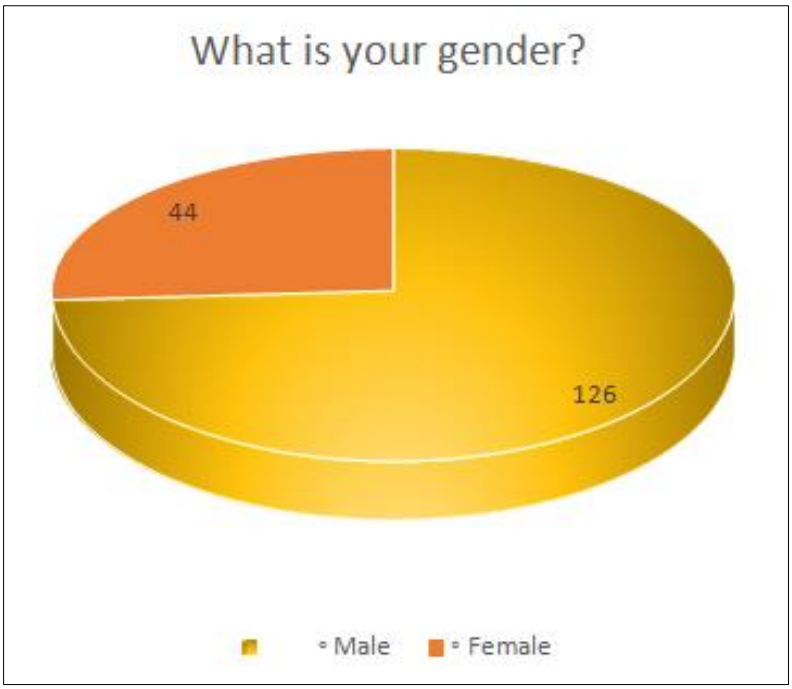

Figure 1: Gender Distribution

What is Your Primary Occupation?

The survey reveals that respondents are engaged in various occupations, with 73 individuals identifying as farmers, making it the largest group. This highlights the critical role of agriculture in the community and its vulnerability to climate change. 61 respondents are businesspersons, reflecting their involvement in trade, services, or entrepreneurial ventures that may also face environmental challenges. Additionally, 32 respondents fall into the other category, representing diverse occupations such as students, professionals, or informal workers. A small group of 4 individuals are laborers, likely involved in wage-based agricultural or construction activities. The predominance of farmers underlines the urgency of addressing climate change's impact on agricultural productivity and livelihoods.

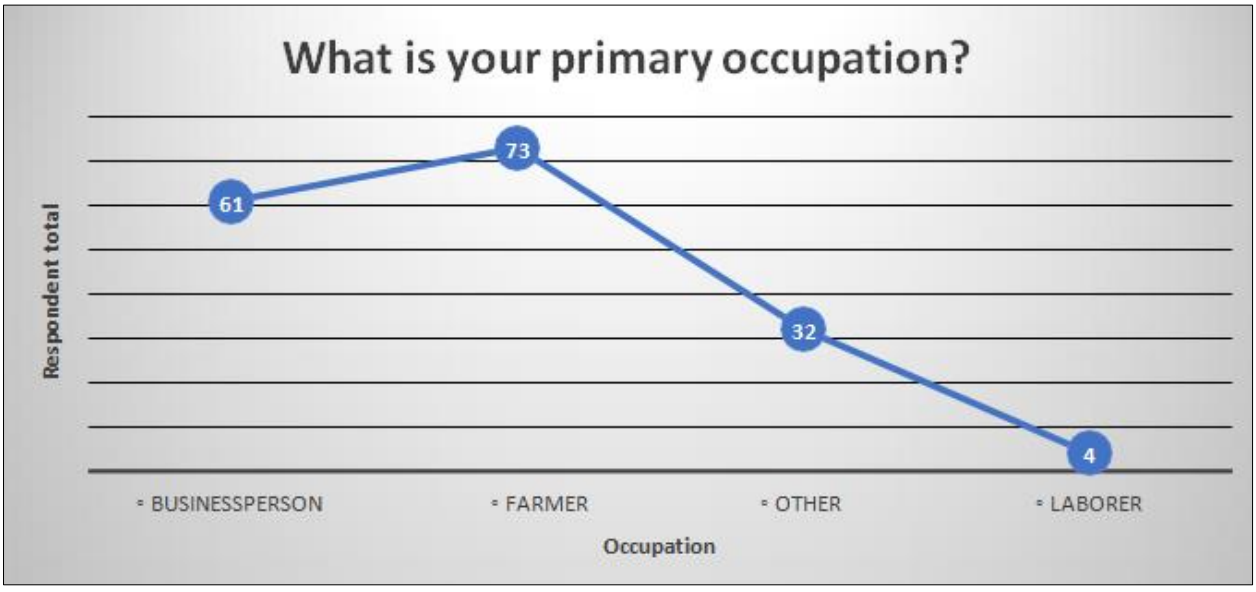

Figure 2: Occupation

What is Your Highest Level of Education?

The majority of respondents, 151, have attained higher education, reflecting a well-educated population with the potential to understand and address climate-related challenges. Education plays a key role in raising awareness about sustainable practices, modern agricultural techniques, and climate adaptation strategies. However, 12 individuals reported having only secondary education, while 3 completed primary education. Alarmingly, 4 respondents have no formal

education, indicating a small but significant gap in educational access. Bridging this gap through targeted outreach programs, workshops, and community-based education initiatives can empower individuals at all literacy levels to adopt climate-smart solutions.

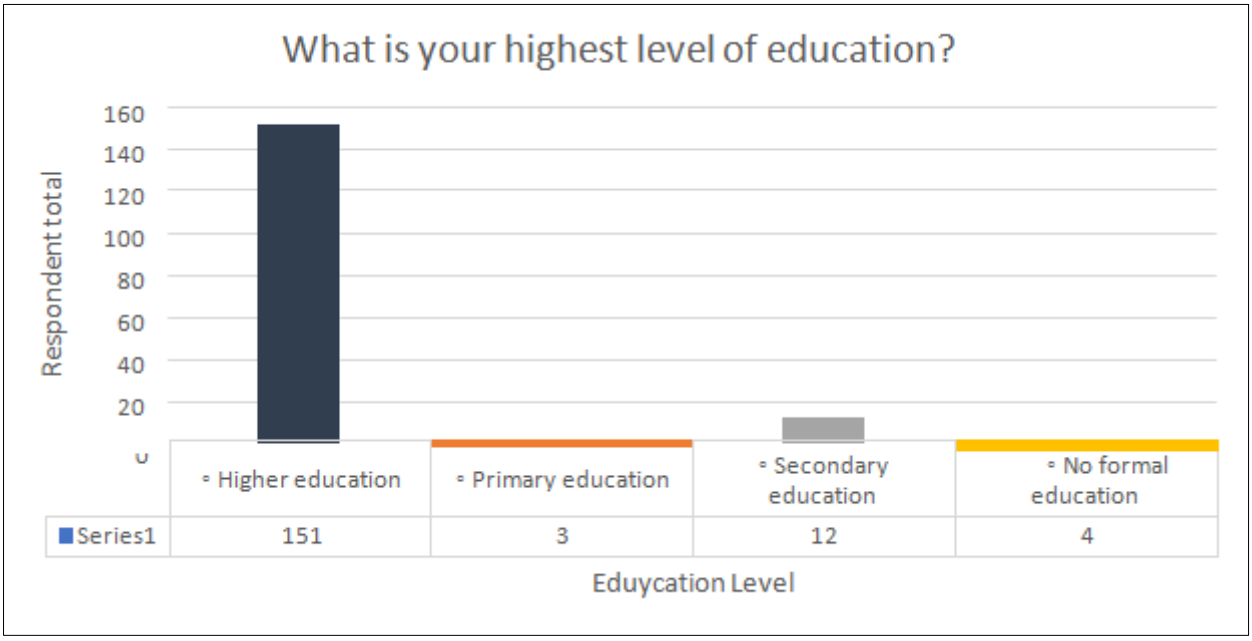

Figure 3: Education Level

What is your Monthly Household Income Range?

Respondents reported varying income levels, reflecting economic diversity within the community. 57 households earn above PKR 100,000, positioning them in the higher-income category, which may provide better resilience to climate-related challenges. 55 respondents fall within the PKR 20,001–50,000 range, indicating moderate income levels but possible struggles with rising costs of living and farming inputs. 44 respondents reported earning between PKR 50,001–100,000, a mid-tier group with relatively stable incomes. Notably, 14 respondents earn below PKR 20,000, highlighting economic vulnerability, especially among small-scale farmers or laborers. These income disparities suggest that lower-income households are more susceptible to the financial impacts of climate change, such as crop losses and rising farming costs.

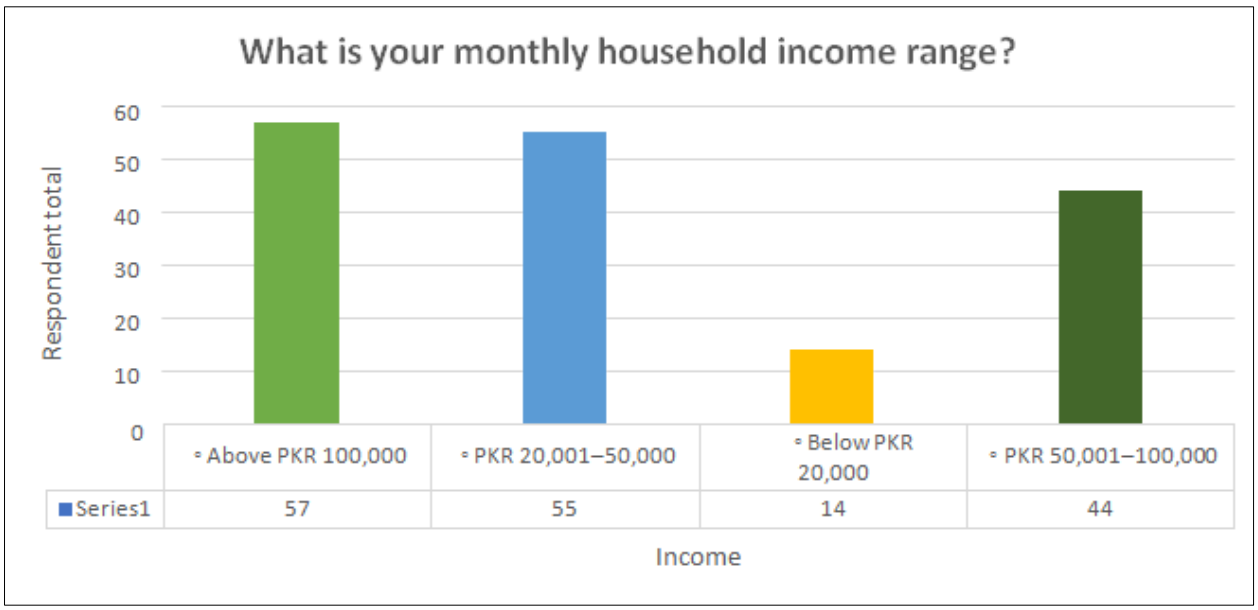

Figure 4: Monthly Household Income

What do you believe is the Primary Cause of Climate Change in Your Region?

The majority of respondents, 75, believe human activities are the primary cause of climate change, highlighting a strong awareness of deforestation, industrial emissions, and unsustainable agricultural practices. Another 60 respondents view climate change as a combination of both human activities and natural processes, acknowledging the complex interplay between anthropogenic factors and natural climate variability. 23 respondents attribute it solely to natural processes, reflecting limited understanding of human influence on global warming. Lastly, 12 individuals are not sure, indicating a need for targeted educational campaigns to clarify misconceptions about climate change causes. These insights emphasize the importance of raising awareness about sustainable practices and the role of human activities in exacerbating climate issues.

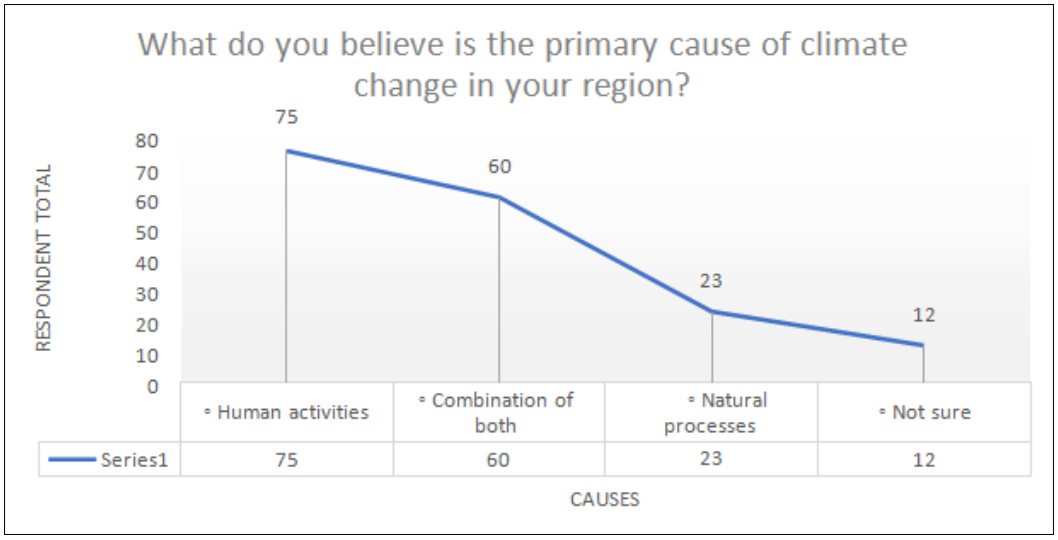

Figure 5: Primary Causes of Climate Change

You Perceive the Overall Impact of Climate Change on Your Life?

The majority of respondents, 94, report that climate change has had a major impact on their lives. This includes disruptions in farming, reduced water availability, rising costs, and adverse health effects. 42 respondents perceive the impact as moderate, while 25 see it as minor, indicating varying levels of resilience to climate shocks. A small group of 9 respondents claim that climate change has no impact on their lives, possibly due to limited awareness or indirect exposure to its effects. The predominance of respondents acknowledging major impacts underscores the urgency of implementing climate adaptation and mitigation strategies to protect livelihoods.

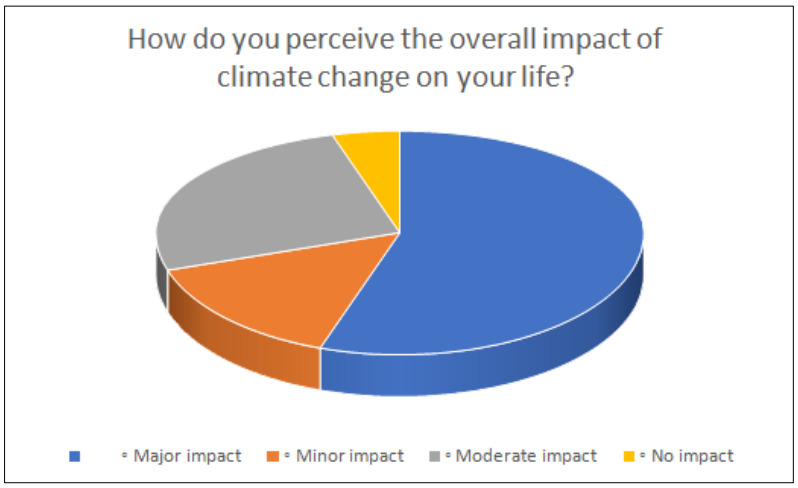

Figure 6: Climate Change

What is the Most Visible Environmental Change in Your Area Due to Climate Change?

The most visible environmental change reported by 56 respondents is the reduction in crop yield, highlighting the direct impact of climate variability on agricultural productivity. 46 respondents noted a decline in soil fertility, likely caused by erosion, salinity, and nutrient loss due to changing weather patterns. 32

respondents observed decreasing water availability, reflecting the challenges of water scarcity and irrigation demands. Lastly, 36 respondents reported the loss of biodiversity, pointing to disappearing plant and animal species due to habitat degradation. These visible changes demonstrate the far-reaching effects of climate change on ecosystems, agriculture, and water resources.

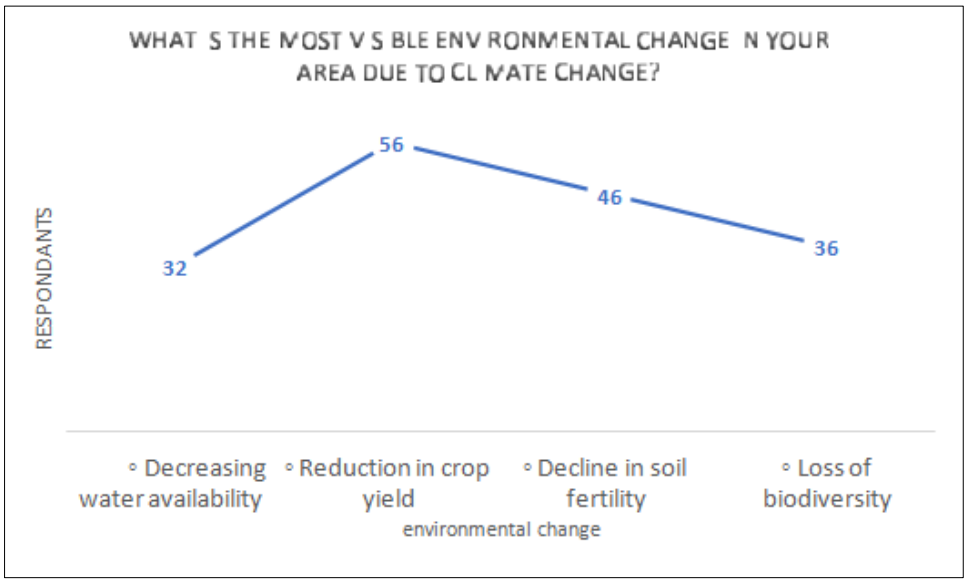

Figure 7: Environmental change

Which Crop Has Been Most Affected by Climate Change in Your Area?

The survey highlights wheat as the most affected crop, with 77 respondents identifying it as vulnerable to rising temperatures, erratic rainfall, and soil degradation. 47 respondents noted that vegetables are also severely impacted, likely due to their sensitivity to temperature changes and water stress. 36 respondents reported rice as being affected, especially in areas facing water scarcity since rice is a water-intensive crop. Lastly, 10 respondents identified sugarcane, which, while more resilient, also requires significant water inputs. These responses underscore the need for crop diversification and climate-resilient varieties to safeguard agricultural productivity.

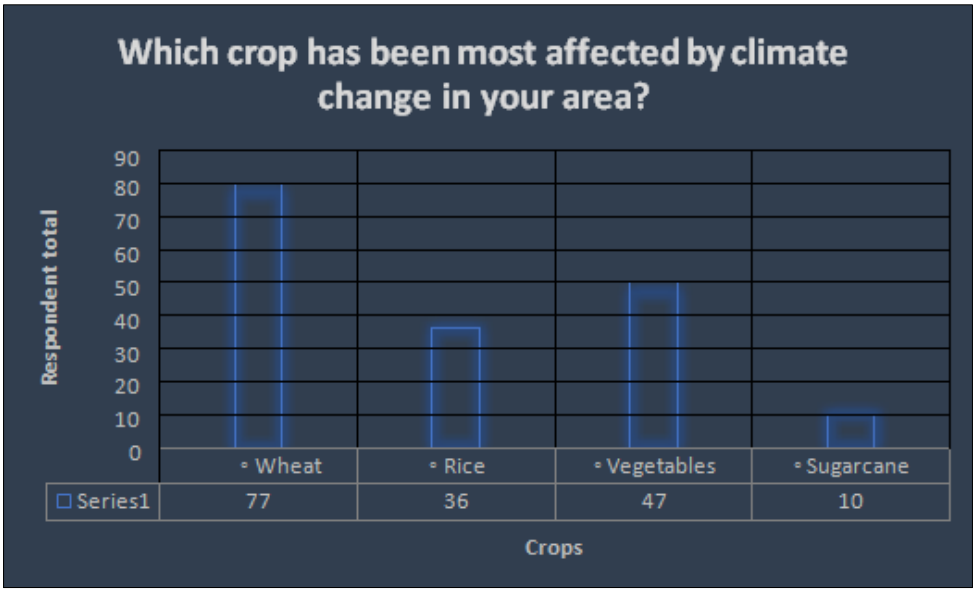

Figure 8: Crops

What is the Primary Challenge Faced by Farmers Due to Climate Change?

The most significant challenge reported by 86 respondents is the decline in crop productivity, which directly affects food security and income. 33 respondents highlighted the rising cost of farming inputs, such as fertilizers, seeds, and irrigation systems, as a growing concern. 27 respondents pointed to an increase in pest

attacks, a phenomenon exacerbated by changing temperatures and humidity levels that create favorable conditions for pests. Lastly, 24 respondents cited reduced water availability as a major issue, impacting irrigation and crop sustainability. Addressing these challenges requires innovative solutions such as efficient irrigation, integrated pest management, and subsidies for farming inputs.

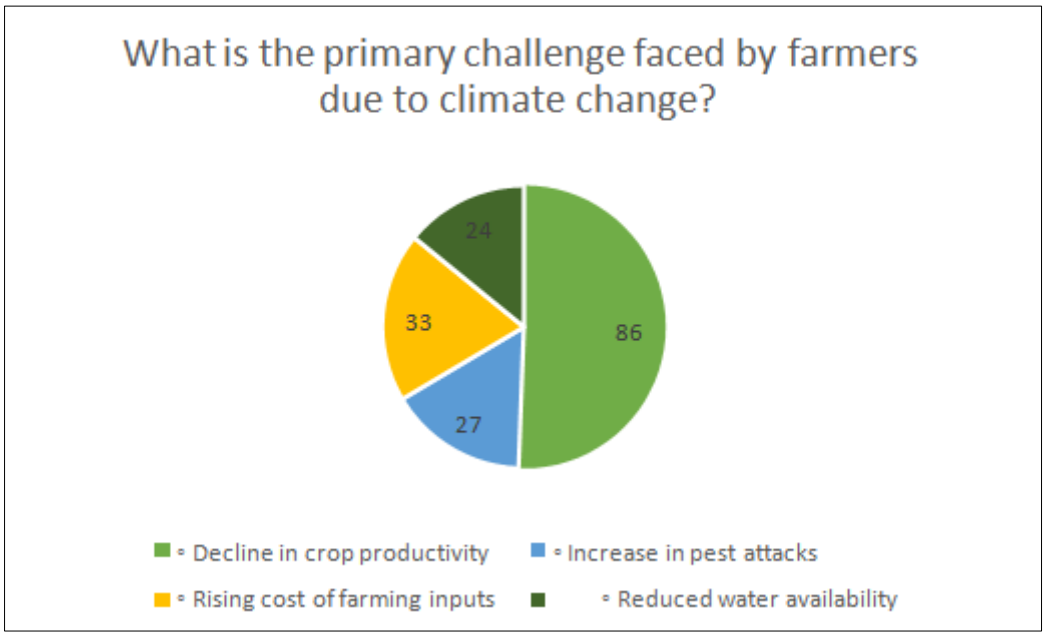

Figure 9: Primary Challenges

Which farming practice is most affected by erratic weather patterns?

The survey reveals that 67 respondents identified sowing and harvesting times as the most affected practice due to unpredictable weather patterns. Shifts in rainfall or temperature force farmers to alter traditional schedules, impacting yields and crop quality. 37 respondents noted disruptions in fertilizer application, as erratic weather affects nutrient uptake and timing. 33 respondents reported challenges in both irrigation scheduling and crop rotation, as inconsistent rainfall complicates water management and soil recovery cycles. These findings emphasize the need for climate-resilient farming practices, improved weather forecasting, and adaptive strategies to minimize disruptions caused by erratic weather patterns.

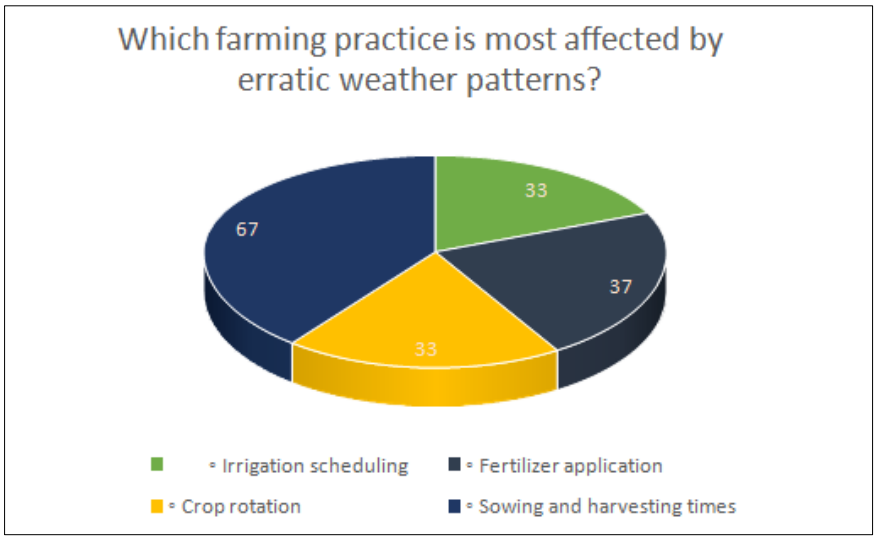

Figure 10: Farming Practices

What is the Most Common Adaptation Strategy Used by Farmers in Your Area?

The most common adaptation strategy reported by farmers is changing crop varieties, with 70 respondents choosing this option. This strategy reflects the adoption of climate-resilient seeds and crops better suited to withstand heat, drought, or pests, helping farmers minimize losses. 39 respondents reported

altering planting schedules, indicating an effort to align sowing and harvesting with unpredictable rainfall or temperature changes. 37 respondents rely on additional irrigation, highlighting the importance of water management to combat inconsistent weather patterns. Lastly, 24 respondents have opted to reduce the area under cultivation, likely as a last resort due to resource scarcity or unsustainable farming conditions. These strategies demonstrate a mix of proactive measures and coping mechanisms used to mitigate climate change's impact on agriculture.

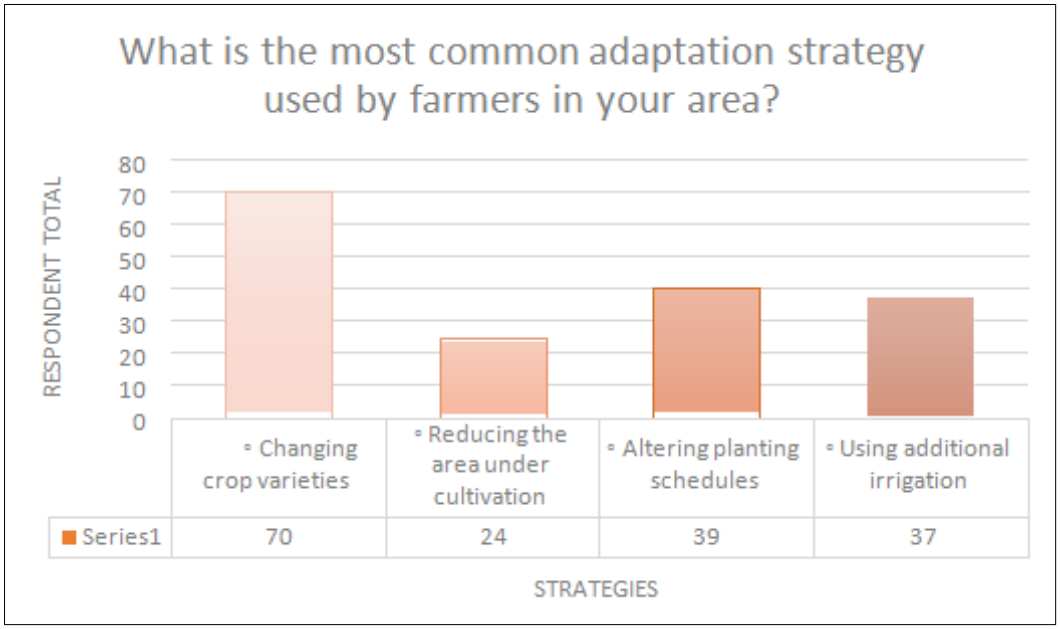

Figure 11: Adaptation Strategy

What is the Primary Source of Income for Your Household?

The majority of respondents, 67, reported business as their primary source of income, reflecting a significant reliance on entrepreneurial ventures and trade activities. 58 respondents rely on farming, highlighting agriculture's critical role in livelihoods, particularly in rural communities vulnerable to climate change. 31 respondents earn through non-agricultural labor, such as wage-based jobs in construction or services, showcasing economic diversification in households. Lastly, 14 respondents depend on remittances, emphasizing the role of family members working abroad or in other cities to support households. This economic diversity indicates that while farming remains essential, alternative income sources play a growing role in enhancing resilience to climate risks.

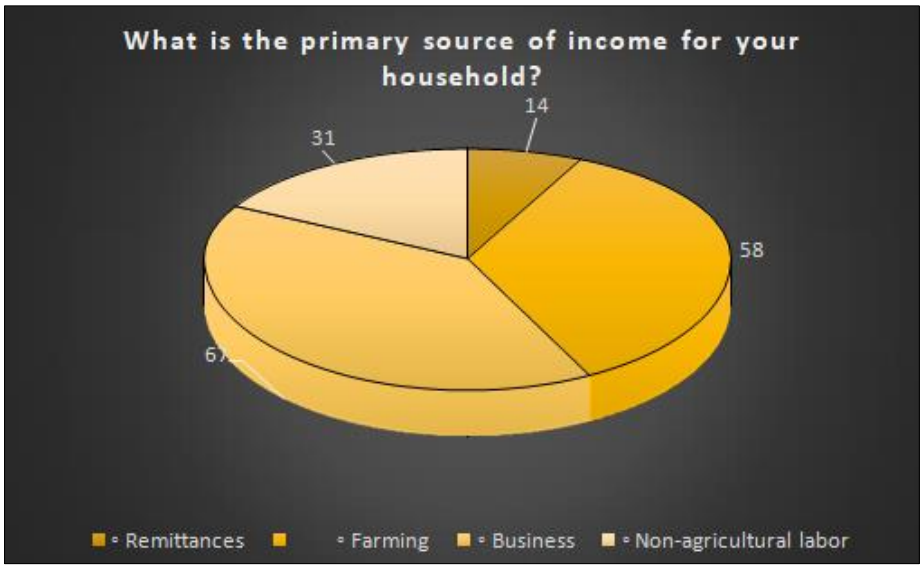

Figure 12: Primary Source of Income

Which Socio-Economic Factor Has the Greatest Influence on Your Ability to Adapt to Climate Change?

The most influential socio-economic factor reported is education level, cited by 79 respondents. Education empowers farmers to adopt innovative practices, access information, and make informed decisions about climate adaptation. 37 respondents identified land ownership as a key factor, as landowners have greater control over resources and decision-making compared to tenant farmers. 31 respondents mentioned community support, highlighting the importance of collective action and knowledge-sharing in strengthening resilience. Lastly, 23 respondents cited access to credit, as financial resources enable investments in climate-resilient technologies and inputs. This indicates that improving education, financial accessibility, and community collaboration can significantly enhance farmers' capacity to adapt.

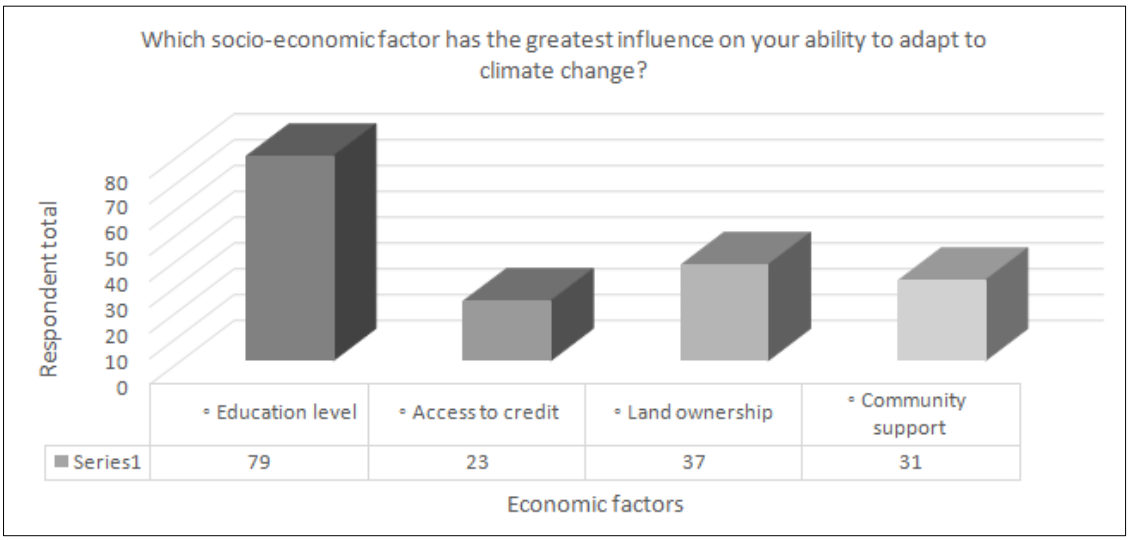

Figure 13: Economic Factors

Who in Your Household is Most Involved in Making Decisions about Climate Adaptation?

The survey shows a balanced decision-making approach in many households, with 81 respondents stating that decisions are made equally by both male and female members. This reflects progress toward gender inclusivity in agricultural adaptation strategies. However, 72 respondents report that male members are primarily responsible for decision-making, which aligns with traditional gender roles in many rural households. 10 respondents indicated that female members take the lead, showcasing examples where women play central roles in climate adaptation. Lastly, 7 respondents selected other, potentially involving extended family members or elders. Promoting joint decision-making and empowering women can improve household resilience to climate challenges.

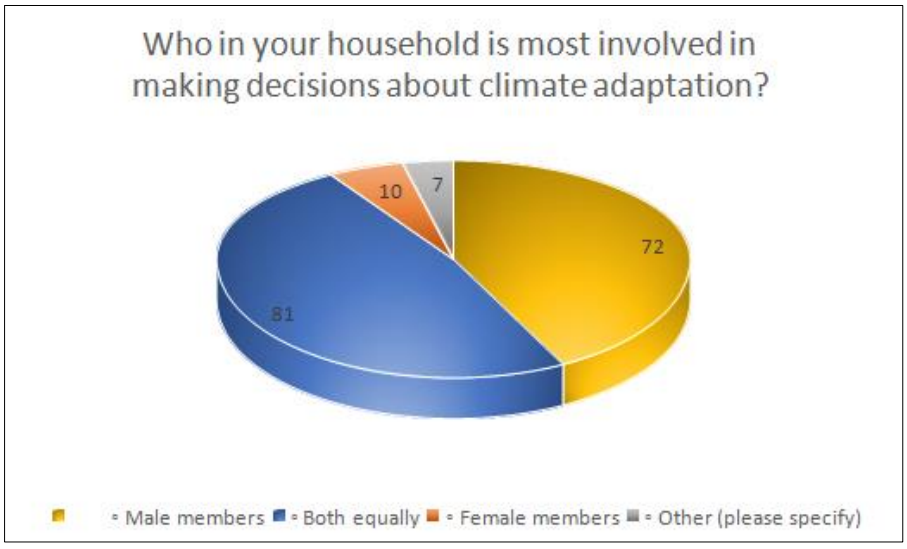

Figure 14: Decision Making

What is the Primary Role of Women in Agricultural Adaptation in Your Household?

The roles of women in agricultural adaptation are diverse, with 48 respondents stating that women contribute as labor in the fields, playing an active role in farming activities. 42 respondents noted that women are involved in decision-making, reflecting their growing influence in managing agricultural strategies and household planning. 36 respondents identified women's role in financial management, such as budgeting or managing farming expenses. However, 44 respondents reported that women have no role in agricultural adaptation, highlighting gender disparities in some households. Recognizing and supporting women's contributions through training and empowerment programs is crucial for enhancing overall adaptation efforts.

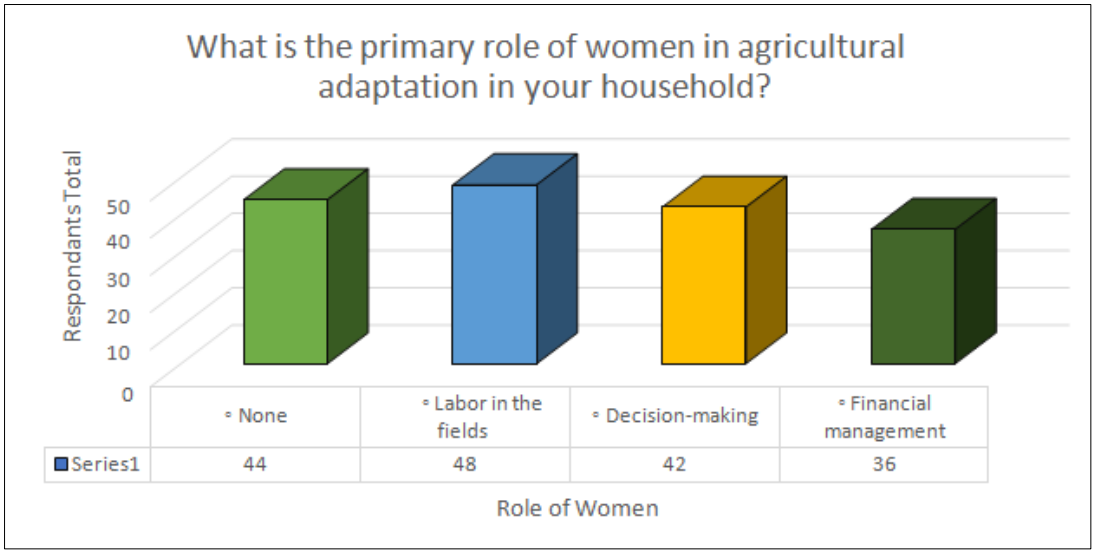

Figure 15: Primary Role of Women

What Type of Government Policy Would Most Benefit Farmers in Your Area?

Respondents highlighted various government policies that could support farmers, with 55 respondents prioritizing climate change awareness programs to educate farmers about adaptation strategies. 42 respondents identified the need for improved irrigation infrastructure, as access to reliable water systems is critical for farming resilience. 37 respondents favored crop insurance schemes, which provide financial security against climate-related losses. Lastly, 36 respondents supported subsidies for climate-resilient crops, enabling farmers to invest in seeds and inputs that can withstand climate variability. These responses emphasize the need for a combination of education, financial support, and infrastructure development to benefit farmers effectively.

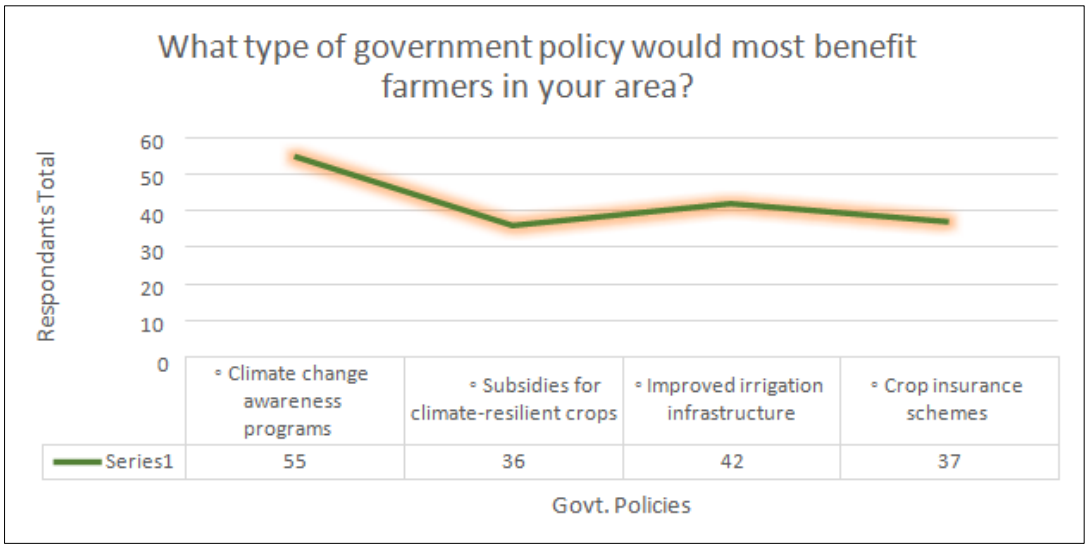

Figure 16: Govt Policies

What is the Most Effective Way to Improve Water Management in Your Area?

Respondents overwhelmingly selected implementation of modern irrigation systems as the most effective water management solution, with 75 respondents highlighting its importance. Efficient irrigation systems like drip or sprinkler irrigation can help conserve water and ensure its optimal use. 37 respondents favor the construction of water storage facilities, which can address seasonal water scarcity and improve availability during droughts. 33 respondents believe in the importance of awareness campaigns, which can educate communities on water-saving practices. Lastly, 25 respondents support community-led water distribution systems, emphasizing the role of collective efforts in equitable water access and management.

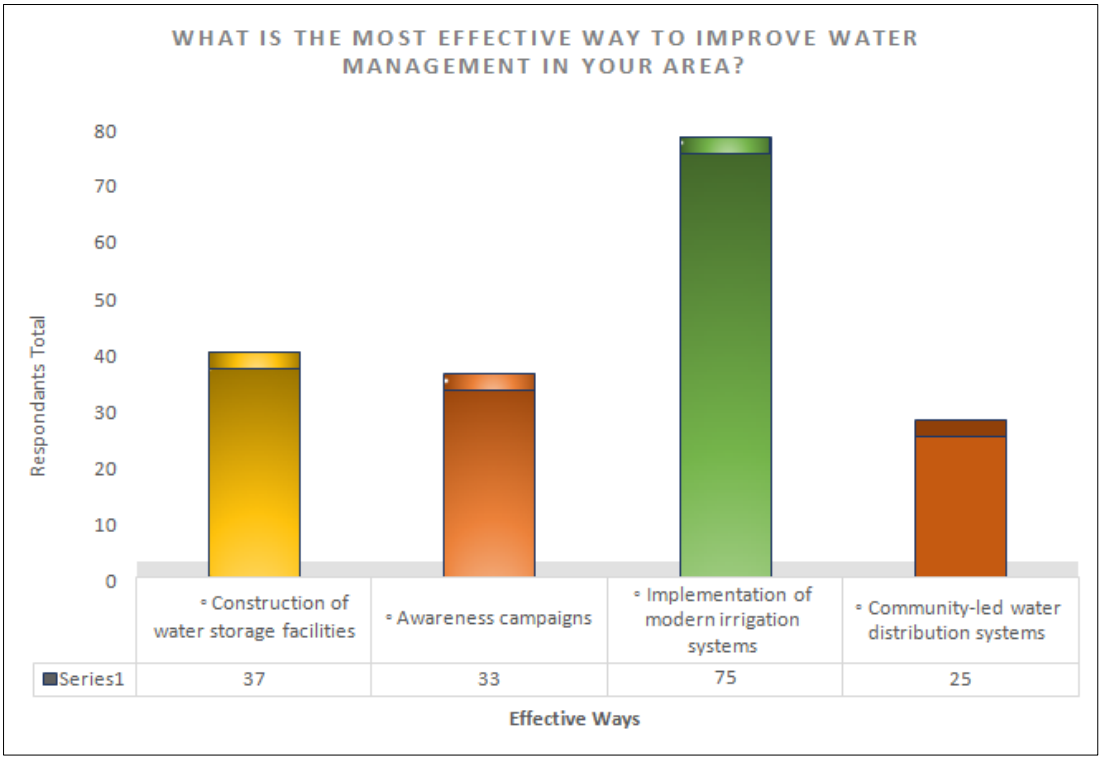

Figure 17: Effective Ways

Socio-Economic Factors Influencing Adaptive Capacity

Role of Government and Organizations

The survey identifies agricultural research institutions as the most suitable organizations to address climate challenges (80 respondents), followed by local governments and NGOs. This reflects the need for a collaborative approach involving research, policy implementation, and grassroots initiatives. Research institutions can develop climate-resilient crop varieties and innovative farming technologies, while local governments can ensure their dissemination and adoption through extension services.

Government policies such as climate change awareness programs, improved irrigation systems, and subsidies for climate-resilient crops were highlighted as critical interventions. These recommendations align with global best practices for enhancing agricultural resilience (Ward, 2022). Effective policy implementation requires a participatory approach, ensuring that farmers' voices are heard in the decision-making process. Establishing platforms for farmer-government dialogue can enhance policy relevance and effectiveness.

NGOs and community-based organizations can complement governmental efforts by mobilizing resources, building capacity, and fostering community-driven initiatives. Public-private partnerships, involving agribusinesses and financial institutions, can also play a vital role in scaling up climate-resilient practices and technologies. For example, partnerships between research institutions and private seed companies have successfully introduced drought-tolerant maize varieties in Sub-Saharan Africa (Oikeh *et al*., 2024), illustrating the potential of collaborative approaches.

The role of international organizations, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Green Climate Fund (GCF), is also crucial in providing technical and financial assistance to developing countries. These organizations can facilitate the transfer of climate-smart technologies and support capacity-building initiatives.

CONCLUSION

The study emphasizes the significant impact of climate change on the urban population of Faisalabad,

with growing awareness and concerns about its consequences. While many participants recognize the threats posed by rising temperatures and unpredictable rainfall patterns, their understanding of the broader implications on public health, agriculture, and economic stability remains limited. Findings reveal that a substantial portion of the population is aware of climate change, but their understanding is often localized rather than global. This highlights the need for targeted educational programs to enhance their comprehension of interconnected environmental issues and broader global trends. Socioeconomic factors significantly influence perceptions and adaptive behaviors. Individuals with access to better education and resources show a greater ability to cope with climate risks. Meanwhile, marginalized and vulnerable groups face disproportionate challenges, underscoring the urgency for inclusive and equitable policy measures. The study calls for proactive engagement from governmental and non-governmental organizations to address knowledge gaps, promote sustainable practices, and build resilience. Collaborative efforts focusing on education, resource accessibility, and infrastructure development are crucial in mitigating the adverse effects of climate change on Faisalabad's population.

Recommendations

Raising awareness and enhancing education on climate change are essential for fostering a proactive and informed society. Comprehensive public awareness campaigns should be launched to educate citizens about the global and local impacts of climate change. These efforts can be reinforced by integrating climate change education into school and college curricula, ensuring that future generations are well-equipped to address environmental challenges. Community-based programs should also be conducted to engage local populations in developing and implementing localized climate change adaptation strategies, promoting collective action at the grassroots level.

Appendix

Ethics Check List for Students conducting research under an approved class protocol (Student Guidance)
Programme of Study Msc environmental management for agriculture
Ethics UH Protocol number (provided by supervisor)
acLMS/CL/UH/05062(6)/EMS

RESEARCH PLAN: Specific information

Title of your study	Analysis of the Perceptions Towards Climate Change Amongst a Population of Faisalabad-Jaranwala, Pakistan
What is the total number of participants you are collecting data from?	JOO
What methods of collecting data are you using? (E.g. interviews, observations etc)	Online data collection via Microsoft Fonns
Do you intend to collect data from minors or others unable to give informed consent on their own behalf?	No (If yes, please consult your supervisor to ensure this is pennitted under this protocol)

You should be able to answer 'Yes' to all these questions, where they are relevant to your research. If unsure of their relevance, you should consult your supervisor/module leader. Please complete the last section and return to your supervisor before starting your research.

ENTERING THE FIELD:

I will explain clearly in writing/by email/verbally to participants the aims, purpose and methods of my research.	**Yes**
I will obtain written/email permission to carry out the research	**Yes**
I will ensure the participants give informed consent for their participation.	**Yes**

COLLECTING THE DATA

I will ensure that my data collection methods are adequate and not excessive.	**Yes**
I will make sure that I ask no unnecessary questions/collect no unnecessary data.	**Yes**
I will make sure that no aspect of my research will cause distress to my respondents.	**Yes**
I will check my methods of data collection and general approach against the UH ethics protocol.	**Yes**

HOLDING AND PROCESSING (ANALYSING) THE DATA

I will ensure that all material that could identify individuals will be kept secure in password-protected files /locked file drawers.	**Yes**
I will ensure that nobody other than myself will see or hear any video/tape recordings I make ***OR*** I will obtain written permission to show such material to specified other people.	**Yes**
I will ensure that the categories of analysis are presented in ways that are not damaging to others.	**Yes**

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