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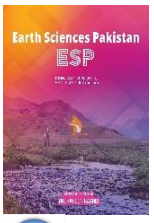

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RESEARCH ARTICLE

ASSESING THE IMPACTS OF CLIMATE CHANGE ON PAKISTAN'S SOCIAL-ECOLOGICAL SYSTEMS: AN ANALYSIS

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ABSTRACT

Climate change impacts communities worldwide and is Pakistan's top social-ecological challenge. As a predominantly agricultural country in a vulnerable region, Pakistan faces rising temperatures, sea level rise, glacier melting, and increased flooding. These changes pose a threat to social and ecological stability. A survey assessed public understanding and the impacts of climate change across different regions. Respondents reported suffering from floods, droughts, heatwaves, shifting rainfall patterns, displacement, and the need for coping strategies. Many, 33.3%, are dissatisfied with government policies and call for increased awareness to address human causes. Forecasts show these problems will worsen. Understanding these impacts and implementing effective adaptation and mitigation are crucial. The government should launch awareness programs and policies to reduce climate risks.

KEYWORDS

Natural resources, livelihood, healthcare, strategies, adaptation and mitigation measures

1. INTRODUCTION

Numerous studies have demonstrated the profound and far-reaching impacts of climate change on human life and underscoring the urgent need to address this critical issue (Cuni Sanchez et al., 2025). Temperatures are rising, precipitation patterns are changing, solar radiation is intensifying, and extreme weather events are being brought on by climate change (IPCC, 2023). Approximately 971 million people reside in areas at high risk of climate change, with the majority belonging to the Global South (Ajani, 2021). Pakistan is among the top 10 countries most affected by climate change (Hussain et al., 2020). Nearly every region of the world has been impacted by climate change, but South Asia has been particularly heavily hit (Hussain, 2018). Pakistan has previously experienced several natural disasters, including high temperatures, changes in monsoon seasons, floods, droughts, and sea level rise due to the melting of glaciers; it is therefore more difficult for the state to adapt to these new circumstances. Among them are long-term floods and droughts. Climate change's enormous social, environmental, and economic effects are causing problems in Pakistan. Although Pakistan emits relatively low levels of greenhouse gases, it is home to several animal species that are at risk of extinction. Some notable examples include the Markhor, Siberian Ibex, and Indus River dolphin, Marsh Crocodile, Freshwater Turtles, Snow Leopard, Blue Coral, and Bigeye Tuna (Haq et al., 2023). Pakistan is an agricultural country. Climate change has negatively impacted the country's food supply, crop yield, and overall well-being. Severe weather conditions and altered seasons cause damage to crops. This assessment aims to explore the complex relationships between climate change and Pakistan's social-ecological systems, identifying key vulnerabilities, opportunities, and strategies for building resilience and promoting sustainable development.

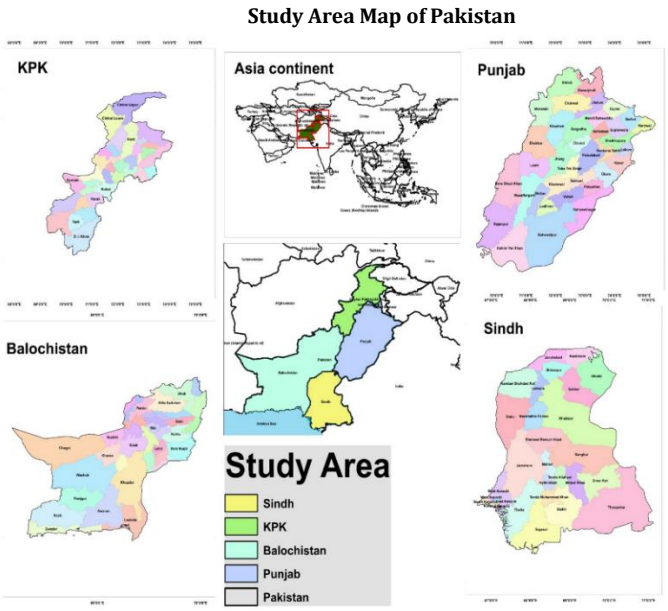

Figure 1 : Participants from all over Pakistan

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1.1 Understanding of Socio-Ecological System

Heraclitus might have been referring to change when he said, "Change is the only constant." Today, anthropogenic change occurs faster, more intricately, and uncontrollably worldwide, affecting communities with unique histories and futures across different social-ecological contexts (IPCC 2023, Steffen et al., 2023). Various forces- environmental, climatic, economic, technical, sociocultural, demographic, and governance- drive these changes at different scales (Millennium Ecosystem Assessment 2005; Zou and Wei 2010; Bennett et al., 2014). Communities face direct and indirect effects, experiencing diverse outcomes due to simultaneous socioeconomic and biophysical changes (Turner et al., 2003; Perry et al. 2010; O'Brien and Leichenko 2003; Tuler et al., 2008; Brklacich et al., 2009). Research and policy on vulnerability and adaptation often focus only on climate change or global shifts, adopting a problem-centred instead of community-centred approach. Understanding the interconnected factors influencing social-ecological systems is vital for sustainability and well-being. Scholars in resilience, livelihoods, fisheries, risk research, agriculture, and climate change emphasise considering multiple exposures and interactions. Early discourse was mostly conceptual (Turner et al., 2003; Brklacich et al., 2009). Emerging empirical studies exploring local drivers and interactions (O'Brien and Leichenko 2000; Bunce et al. 2010; Bennett et al. 2014). However, many bottom-up studies lack a comprehensive investigation of community changes and interactions, which limits their understanding and leads to simplistic policies that overlook complexity and uncertainty. A survey in Pakistan aimed to assess public understanding of climate impacts, vulnerabilities, and potential adaptation measures, seeking to improve resilience and sustainability.

2. Material And Methods

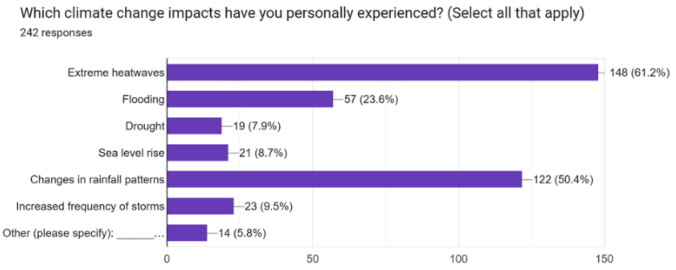
2.1 Field Data Collection and Analysis

The researcher developed a questionnaire using Google Forms to gather insights from the people of Pakistan regarding their experiences and perceptions of climate change. The survey included responses from individuals of diverse backgrounds, encompassing both urban and rural areas, as well as those who have been directly affected by climate change.

The questionnaire focused on the following key areas: the level of awareness regarding climate change among the population, the extent to which people have suffered due to its impacts, and the importance of government policies in addressing the challenges presented by this issue. Acknowledging the various factors that influence the lives of ordinary citizens, the researcher distributed the questionnaire link via WhatsApp, utilizing personal networks of academicians, colleagues, and researchers across different cities and provinces in Pakistan. The responses collected included demographic information, such as age group, urban or rural residence, and the specific city of origin. The questions were crafted to reflect the pressing realities of the country, emphasizing the growing severity of climate change and the urgent need to assess public understanding of the problem. Many respondents with knowledge in the area urged the government and policymakers to take the issue seriously and implement effective measures to mitigate its effects. Through this initiative, the researcher aimed to capture a comprehensive view of public perception and the necessary steps stakeholders should take to address climate change effectively.

2.2 Issue of Climate Change in Pakistan

Pakistan ranks fifth worldwide in terms of the impact of climate change. Pakistan is home to various landscapes, including the hilly regions of KPK and Baluchistan, Karachi and Gwadar coastal areas, and the Thal and Thar deserts of Punjab and Sindh. As a result, Pakistan's various regions deal with diverse climate change-related issues. Since agriculture accounts for a significant portion of Pakistan's economy, variations in the country's climate, water availability, or monsoon patterns can have a profound impact on the lives of millions of people. Pakistan's existing dire food security and safety issues are worsening due to climate change and abrupt weather variations. There have been roughly 152 significant weather-related disasters in Pakistan, which have claimed 9,989 lives and cost the nation $3.8 billion (Sulehria, 2023).



Source: Conducted by the researcher

Figure 2: (Impacts of climate change, e.g., extreme heatwaves, Drought, Sea level rise, Changes in Rainfall patterns, Increased Frequency of storms)

2.3 International Climate Change

Climate change can result from various factors, including natural disasters, human activities, the release of greenhouse gases such as carbon dioxide and methane, and changes in land use. Climate change affects the duration and intensity of weather by increasing temperatures, altering precipitation patterns, and increasing the frequency and intensity of rain. The Intergovernmental Panel on Climate Change's fifth report shows that human activity has an evident effect on the climate system.

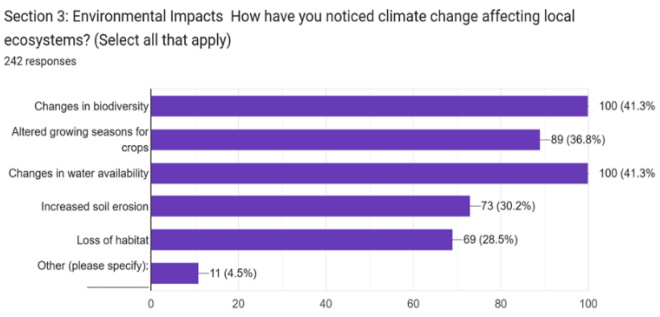
2.3.1 Discussion text

As stated in this report:

"Climate change will make risks bigger and create new ones for animals and people" (Vermeulen, 2014). Climate change-related risks can arise from extreme weather events, including prolonged heatwaves, excessive rainfall, and persistent flooding. Heat waves are becoming more severe in much of Europe, Asia, and Australia. Likewise, heavier rainstorms are now occurring more frequently on land compared to the past (Oppenheimer, 2016).

2.4 Impact of Climate Change on Pakistan's Social-Ecological System

Pakistan is highly susceptible to societal calamities. Both poverty and malnutrition are prevalent. Out of 169 countries, Pakistan is ranked 125th in the Human Development Index. It is vulnerable to more extreme natural disasters and climate change than usual, which puts it at risk. Over ten years, earthquakes in Pakistan have increased the country's death rate. However, flooding has also had a significant impact in recent years. The excessive flood of 2010 caused the loss of lives of about 2,000 lives, damaged 2.2 million hectares of crops, and ruined 12 million houses. According to UNISDR (2014), almost 75% of the average $1.3 billion in losses resulting from natural catastrophes are related to floods (Natho et al., 2018).



Source: Conducted by Researcher

Figure 3: (Climate Change impacts on ecosystems)

Climate change is affecting local ecosystems. 41.3% of the people observed the changes in water availability. 41.3% of people have a view about changes in biodiversity. 36.8% of people observed the altered growing seasons for crops. 30.2% of people opined that it became the reason for

increased soil erosion. So, in this way, we can analyse how climate change affects local ecosystems.

2.5 People's Health Issues

People in both rural and urban areas are at a higher risk of contracting vector-borne diseases, which can exacerbate heat stress caused by fluctuating rainfall and temperatures. This is especially detrimental to young people, the elderly, and those in overcrowded or poorly ventilated spaces. Extreme weather events like floods, droughts, and high temperatures also contribute to vector-borne and waterborne diseases, disproportionately affecting migrants. Climate change may lead to increased child marriage, early pregnancies, and domestic violence, with many women and children facing hunger due to decreased food production.

Pakistan faces a significant issue with heat-related illnesses, particularly among older adults. According to a 2016 WHO report, heat-related mortality for those aged 65 and older rose from 10 to about 63 per 100,000. Vulnerable groups include workers in certain jobs, individuals with long-term medical conditions, and those living alone. A heat wave in June 2015 resulted in approximately 1,400 deaths in Karachi. The frequency and severity of heat waves are escalating in Pakistan, and climate change also affects communicable diseases.

Air pollution, primarily from burning solid fuels, is a major cause of mortality from lung cancer, heart disease, and respiratory infections. In Pakistan, 93% of households use solid fuels for cooking, with 91% relying on firewood for heating. Indoor air pollution leads to around 326,000 deaths annually, disproportionately affecting women and children. Acute lower respiratory infections from this pollution kill about 34,000 children each year.

2.6 Vector-Borne Diseases

Vector-borne diseases are extremely sensitive to variations in temperature, precipitation, and humidity and can have a significant impact on health. Furthermore, the manner that which vectors like mosquitoes live their lives is significantly impacted by these circumstances. Currently, Pakistan is experiencing dengue fever for almost one-third of the year. According to certain reports, the number of people who can spread the dengue virus may be slightly declining due to climate change (WHO 2016). According to some reports, more locations may become ideal for breeding as a result of rising temperatures (Asian Development Bank 2017). From July to November 2019, there was a four-month dengue fever outbreak. In 2019, there were 75 deaths and 47,120 cases, according to the WHO. Flooding and malaria have been implicated in Pakistan for a long time. The rain has an impact on malaria transmission, which increases the probability that Pakistan will have a larger malaria burden. In 2012, during the flooding, two million more people were infected with malaria (Shafi et al., 2020).

2.7 Problem of Water, Hygiene and Sanitation

Pakistan has made significant strides in improving its water supply, with 91% of the population having access to clean water. However, UNICEF reports that 70% still drink contaminated water, leading to a rise in waterborne diseases. Climate change exacerbates water challenges, with droughts reducing water availability and increasing pollution. Frequent floods damage water infrastructure, and high temperatures promote microbial growth. While 70% of households have improved toilets and urban areas have better sanitation access, 25 million people used public restrooms in 2019, leading to outdoor defecation, which harms the ecosystem and public health. Diarrheal diseases from poor sanitation kill 53,000 children under five annually. Climate change is projected to worsen disease risks; the WHO predicts an increase in diarrheal deaths from 11.7% to around 17% by 2050. Floods have also heightened cholera risks, with significant cases reported in previous years.

2.8 Factors Affecting the Environment

Similarly, despite faster economic expansion, Pakistan witnessed higher deforestation rates compared to other countries in the same income bracket over the last decade of the previous century. This deforestation has serious implications for biodiversity, local climate regulation, and livelihoods, as forests play a crucial role in maintaining ecological balance and supporting rural communities. The loss of forest cover not only contributes to climate change but also exacerbates soil erosion and impacts water availability, further stressing the already vulnerable ecosystems and communities across the country. Addressing deforestation in conjunction with sustainable economic growth is essential for Pakistan's long-term environmental health and social well-being. This indicates unequivocally that a state cannot "grow out" of its social or environmental problems just through economic growth. Rather, policy needs to tackle the negative externalities that cause harm to society, the environment, and natural resource depletion. To pursue both short- and long-term plans regarding sustainable development, this nation's planners must properly comprehend and consider these relationships.

2.9 Environmental Pressures and Trends

Misuse of resources has led to significant environmental issues in Pakistan, placing stress on it carrying capacity for short-term gains and worsening poverty due to declining resource ratios. Certain developments have increased pollution and resource degradation, making it hard to distinguish cause and effect. For example, it's difficult to determine whether poverty results from people's actions or reduced environmental capacity. Additionally, poorly maintained irrigation systems have caused severe ecological problems, such as waterlogging and salinity, degrading land and reducing water delivery efficiency from 35 to 40 percent due to aging and misuse (Faruqee, 1999).

Pakistan is classified as a "high stress" country with about 1000 m^3 per capita water availability. Vision 2030 predicts an additional need for 48 billion m^3 of water due to rapid population growth, rising agricultural demands, urbanization, and prolonged droughts. Effective water management and conservation are crucial, especially since river flows vary significantly. During the flood season, approximately 43 billion cubic meters of water flow into the sea, largely wasted due to inadequate storage capacity, which is currently only 9% of average annual flows. Additionally, water quality degradation from municipal and industrial waste, silt, and salt poses a major environmental challenge, with approximately 7,590 million cubic meters of wastewater released annually.

Pakistan's atmospheric ecology is significantly affected by declining urban air quality and climate change. Factors such as industrialization, increased chemical usage, rising traffic, and energy consumption have all contributed to this decline. Particulate matter (PM), especially PM 2.5, exceeds WHO standards in major cities, leading to high rates of respiratory illnesses. A World Bank study estimated the health costs linked to air pollution at Rs. 62 to Rs. 65 billion annually, about 1% of GDP. To foster economic growth, Pakistan must address these environmental costs and efficiently utilize its natural resources, emphasizing the need for effective pollution reduction strategies. Over the last century, Pakistan's average temperature has risen by 0.6°C, highlighting the effects of global climate change. Despite contributing minimally to global greenhouse gas emissions, Pakistan faces severe impacts that threaten its food, water, and energy security. The country's heavy reliance on agriculture increases its vulnerability to floods, droughts, and unpredictable monsoon rains. Recent natural disasters, such as the 2010 flood that affected over 20 million people, have worsened the situation. The agricultural sector suffered greatly during the floods of 1991–1992, leading to economic decline. Pakistan also experienced its worst drought from 1998 to 2001, impacting around 3.3 million people and resulting in significant livestock losses.

The societal effects of climate change include health problems, population displacement, and loss of income, which can increase starvation risks and instability. Vulnerable groups, such as small farmers and coastal communities, will be disproportionately affected. Policymakers must consider these challenges when developing adaptation strategies to mitigate the impacts of climate change.

2.10 Institutional and Legislative Developments

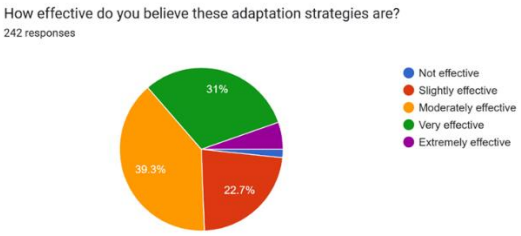
Following the United Nations Conference on Human Environment, a major step in the right direction was the 1973 adoption of a constitutional mandate for environmental preservation. During that period, the Pakistan Environmental Protection Ordinance (GOP, 1983) represented yet another novel concern (Nazir, N. 2004). The new ordinance formed the Pakistan Environmental Protection Council (PEPC) and the Pakistan Environmental Protection Agency (Pak EPA) in 1984. Establishing the National Environmental Quality Standards (NEQS) was among the Agency's initial responsibilities. With the Council's agreement, the Agency was mandated to update the standards as needed. The enforcement of the Environmental Protection Ordinance was the Agency's primary responsibility. The Pakistan Environmental Protection Act (PEPA) of 1997 superseded the Pakistan Environmental Protection Ordinance of 1983 (GOP, 1997). It was a framework law that provided a wide base upon

which to build normative standards and legislative tools for reducing pollution and promoting sustainable development. The Act delineated and differentiated the functions and accountabilities of the Pakistan EPA, PEPC, provincial EPAs, and Environmental Tribunals. (Zahid, M. Y., and Qamar, M. K., 2020).

3. Policies And Strategies

The Strategy highlights three dimensions of sustainable development: environmental, economic, and social. The NSDS document outlines key approaches for its execution. The main challenge for NSDS in Pakistan is achieving sustainable development, measured by economic growth and improved living standards. Engaging all stakeholders in the strategy's people-centred approach is another significant challenge (Ndione, M. 2020).

Involving major organizations like IUCN, Leads Pakistan, WWF, and universities in creating and executing NCS and other policies can greatly benefit sustainable development efforts. These groups contribute through research, education, advocacy, and environmental awareness campaigns, assisting the government in various initiatives. The media has also played a key role in highlighting environmental issues and raising public awareness. However, Pakistan's institutional, regulatory, and legislative frameworks remain inadequate; implementing proposals is challenging. Previous studies have highlighted these weaknesses, indicating a need for a significant overhaul of the institutional and regulatory framework to enhance economic growth and environmental performance.



Source: Conducted by Researcher

Figure 4: (Effectiveness of Adaptation Strategies)

According to 39.3% of the people, the aforementioned adaptation strategies are moderately effective. While 31% of the population thinks that these strategies are very effective, 22.7% of people consider them to be slightly effective. According to this, more strategies and practical measures are needed to address the issue of climate change.

3.1 Results

Results: A Questionnaire built by the researcher, and the responses of the respondents were collected

Table 1: Demographic Information of Respondents

Variable	Category	Percentage (%)
Age	Under 18	1.2
	18–24	93.0
	25–34	2.1
	35–44	2.9
	45–54	0.8
Gender	Male	0.8
	Female	99.2
	Non-binary/Third gender	0.0
Educational Level	No formal education	0.0
	Primary school	0.0
	Secondary school	0.0
	Undergraduate degree	88.5
	Postgraduate degree	9.5
	Doctorate	2.1
Occupation	Agriculture	1.6
	Fishing/Industry/Manufacturing	3.7
	Services	92.6
	Government	2.1
Location/City	Urban	58.8
	Rural	41.2
	Specific city (specified by respondents)	100.

Source: Conducted by researcher

3.2 Analysis

A diverse range of people participated in this survey, representing various aspects of life. Participants included individuals from all age groups, ranging from under 18 to those aged 54. They hailed from different regions of Pakistan, including all four provinces, and came from a variety of backgrounds, whether urban or rural. Additionally, participants had various levels of education and occupations. This diversity allowed the people of Pakistan to contribute valuable data for the successful conduct of this research. In section one, the demographic is collected, in which 1.2% were under 18 years of age, 93% were from the 18 - 24 age group, 2.1% from 25- 34, 2.9% 35-44 and 0.8% from the 45-54 age group, of which males were 0.8% and the females were 99.2%. People have

different professions, e.g., agriculture (1.6%), the fishing Industry/manufacturing services (3.7%), and others (2.15%). All the participants belong to various cities across Pakistan, representing all four provinces (Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan). As a result, participants from all over Pakistan comprised the entire group.

Table 2: Perceptions of Climate Change

Section 2: Perceptions of Climate Change How would you rate your awareness of climate change?	Very low	Low	Moderate	High	Very High		
Responses in %	4.5%	10.3%	65%	16.9%	3.3%		
In your opinion, how serious is the threat of climate change to Pakistan?	Not serious	Slightly serious	Moderately serious	Very serious	Extremely serious		
Responses in %	4.1%	7.4%	21.8%	42.8%	23.9%		
Which climate change impacts have you personally experienced?	Extreme heatwaves	Flooding	Drought	Sea level rise	Changes in rainfall patterns	Increased frequency of storms	Others (Please Specify)
Responses in %	60.9%	23.5%	7.8%	8.6%	50.6%	9.5%	5.8%

Source: Research conducted by the researcher

3.3 Results

This section examines people's understanding and perception of climate change in Pakistan. The researcher aimed to gauge awareness of the issue, its seriousness, and personal experiences with its impacts, such as extreme heat, flooding, and drought. The findings reveal that only 16.5% of people have a high awareness of climate change, while 65.3% possess some awareness. Moreover, 43% consider it a very serious issue, and 23.6% view the threat as extremely serious. There is an urgent need to enhance public awareness and encourage both government and community action to address the growing challenges of climate change.

Section 3: Environmental Impacts How have you noticed climate change affecting local ecosystems? (Select all that apply)	Changes in biodiversity	Altered growing seasons for crops	Changes in water availability	Increased soil erosion	Loss of habitat	Other (please specify)
Responses in %	41.2%	37%	41.2%	30%	28.4%	4.5%
How has climate change impacted the availability of natural resources (e.g., water, forests, fisheries)?	No impact	Minor impact	Moderate impact	Significant impact	Severe impact	
Responses in %	1.2%	4.9%	24.7%	45.7%	23.5%	

Source: The research conducted by the researcher

3.4 Results

To examine the environmental impacts on the people of Pakistan, and to understand how climate change has affected the local ecosystem in terms of changes in biodiversity, they experienced altered growing seasons for crops, changes in water availability, increased soil erosion and loss of habitat. The researcher found that climate change has impacted the availability of natural resources (e.g., water, forests, fisheries), and many people have suffered a lot due to climate change. Although climate change has many impacts on the people of Pakistan. Many people have experienced personally some of the issues particularly impacted by climate change. 61.2% of people suffered from extreme heat waves, whereas 50.4% observed changes in rainfall patterns. 23.6% of people opined that it became the reason for flooding in Pakistan. So, this is the personal experience of the people who faced all these calamities due to the impacts of climate change.

Section 4: Social Impacts How has climate change affected your livelihood?	No effect	Minor effect	Moderate effect	Significant effect	Severe effect
Responses in %	2.9%	9.9%	41.6%	32.1%	13.6%
Have you or your community experienced any migration due to climate change impacts?	Yes	No	Not Sure		
Responses in %	18.5%	63.8%	17.7%		
How has climate change influenced your access to basic services (e.g., healthcare, education)?	No influence	Minor influence	Moderate influence	Significant influence	Severe influence
Responses in %	8.2%	18.1%	39.5%	25.1%	9.1%

Source: The research conducted by the researcher

3.5 Results

Section four examines the social impacts of climate change on livelihoods. The effects are categorized as follows: 2.9% report no impact, 9.9% minor effects, 41.6% moderate effects, 32.1% significant effects, and 13.6% severe effects. Additionally, 18.5% of the community migrated due to climate change, while 63.8% were not displaced, and 17.7% are unsure. Climate change also affects access to basic services like healthcare and education: 8.2% report no influence, 18.1% minor influence, 39.5% moderate influence, 25.1% significant influence, and 9.1% severe influence.

Table 5: Adaptation and Resilience

Section 5: Adaptation and Resilience What strategies are you or your community employing to adapt to climate change? (Select all that apply)	Improved water management	Changes in agricultural practices	Investment in infrastructure	Community-based adaptation projects	Migration or relocation	Other (please specify)
Responses in %	39.5%	33.7%	37.4%	36.6%	9.1%	4.9%
How effective do you believe these adaptation strategies are?	Not effective	Slightly effective	Moderately effective	Very effective	Extremely effective	
Responses in %	1.6%	22.6%	39.1%	31.3%	5.3%	
What additional support or resources would help enhance your or your community's resilience to climate change?	Financial assistance	Training and Education	Infrastructure development	Policy support	Technological solutions	Other (please specify)
Responses in %	32.1%	49.4%	37.9%	42%	37%	2.1%

Source: The research conducted by the researcher

3.6 Results

Section five discusses Adaptation and Resilience, outlining community strategies to address climate change. The community is employed to adapt to climate change different strategies are used to address the problem of climate change. 39.5 % of people adopted improved water management. 33.7 % of people adopted the agricultural practices, and 37.4 % of people made the investment in infrastructure. 36.6 % participated in community-based adaptation projects, and 9.1% of people migrated or relocated due to climate change. Additionally, when asked about support for resilience, 32.1% seek financial assistance, 49.4% prioritise training and education, 37.9% focus on infrastructure development, 42% want policy support, and 37% favour technological solutions.

Table 6: Policy and Action to address the issue of climate change in Pakistan						
Section 6: Policy and Action How satisfied are you with Pakistan's current climate change policies?	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied	
Responses in %	14.8%	33.3%	41.6%	9.9%	0.4%	
What actions do you believe the government should prioritize to address climate change impacts?	Strengthening disaster preparedness	Promoting renewable energy	Enhancing environmental regulations	Supporting research and innovation	Increasing public awareness	Other (please specify)
Responses in %	32.1%	44.4%	58.8%	42.4%	55.6%	0.8%

Source: The research conducted by the researcher

3.7 Results

Section six addresses the Policy and Action. In this section, the researcher analyzed how much the people of Pakistan are with the current climate change policies and actions. The government should give priority to addressing climate change impacts these strengthening disaster preparedness, promoting renewable energy, enhancing environmental regulations, supporting research and innovation and increasing public awareness, are the best options to resolve the issue of climate change. According to the report, for the whole country to thrive sustainably, the government must become involved. This can be achieved by ensuring that the rules and regulations that were previously implemented are closely monitored and utilized to develop a practical mechanism for the implementation of climate policy. 58.8 % of people believe the government should focus on enhancing environmental regulations. 55.6 % of people believe that the Government should increase public awareness regarding the impact of climate change, and 42.4 % of people support research and innovation.

3.7.1 Future Viewpoint

Pakistan's Environment and Climate Change highlight urgent sustainability needs due to deteriorating conditions. Main issues include lack of funding, technology, capacity, unsustainable consumption, population growth, poverty, and inequality. Gaps in knowledge, limited R&D, and the need for consumer support for eco-products are evident. Policy gaps involve poor resource efficiency, waste reduction, and social-environmental cost regulation. There's also a lack of demand-stimulating frameworks and limited institutional capacity in technology transfer, education, and awareness.

As we look to the future, factors like population growth, economic activity, and changing lifestyles are expected to strain Pakistan's ecosystem, with projections indicating the population may exceed 265 million by 2050. This growth, alongside increased material inputs, is likely to heighten pollution from factories, power plants, and transportation, adversely affecting human health. Establishing effective policies and incentives for personal and organizational development is crucial, as is enforcing environmental laws. Pakistan faces global environmental challenges like climate change and must enforce its national policy across sectors, considering frameworks like the Kyoto Protocol. Building a resilient socio-economic and ecological system requires strong governance focused on boundaries, resilience, and system linkages. Sectoral planning, especially in energy, must consider interdependencies with transportation, industry, and agriculture to ensure economic fairness and supply security, factoring in various energy sources and impacts. Environmental performance hasn't improved under the current command-and-control approach. Pakistan should adopt a new policy combining market-based and command methods, with the government as a facilitator. The private sector must play a larger role in delivering environmental goods through better management and pricing. This model, successful in some Southeast Asian countries, could help Pakistan address resource shortages and rising infrastructure costs for its growing population.

3.7.2 Pakistan's Plans to Address the Issue of Climate Change

The government of Pakistan has developed multiple plans to address climate change. On June 5, 2021, Pakistan hosted World Environment Day in collaboration with the UN Environment Programme. Preventing, stopping, and reversing ecosystem degradation on every continent and in every ocean was the major goal of "Ecosystem Restoration."

3.7.3 Policy Goals

Some of the goals of Pakistan's policy on climate change are:

- To make sure the country has enough water, food, and energy to deal with the difficulties caused by climate change.
- To increase the appropriate individuals' and groups' institutional capacity, knowledge, and skills.
- To promote natural resources' long-term viability and preservation (Shahid, 2021).

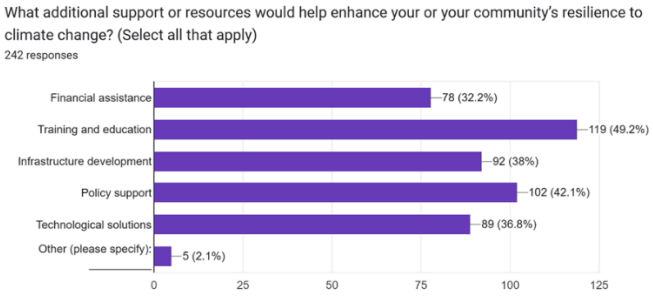


Figure 5: Additional support and resources required for the community's resilience to climate change

Source: Conducted by Researcher

49.2% of people feel that the training and education would enhance the community's resilience to climate change. 42.1% of people think that policy support would help enhance the community's resilience to climate change. 38% of people feel that there is a need for infrastructure development in this regard. 32.2% of people think that there is a need for financial assistance to address the issue of climate change.

4. Conclusion

Pakistan has been identified as one of the regions most affected by climate change. Natural calamities such as floods, droughts, cyclones, famines, and many more are causing adversities for people. By improving technical responses, the government has taken several actions to limit the harm caused by these variables. Much work was done to restore forest and wildlife resources by the TBTTP. The government will better manage Protected Areas through this initiative, benefiting the public by creating jobs through conservation efforts. Since global warming is one of the effects of climate change, scientists have been particularly interested in studying climate change over the past fifty years. The world's temperatures are rising due to rising greenhouse gas emissions, and Pakistan and other countries are experiencing more warm days and nights. This is leading to violent heat waves that harm many lives each

year. Pakistan's significant poverty and lack of material and financial resources hinder its ability to adapt to climate change. This change is causing erratic rainfall, unpredictable flooding, water shortages, heatwaves, earthquakes, and alterations in seasonal lifestyles throughout the country. It is also forcing the glaciers in the Himalayas to melt more quickly than they have in recorded history. Due to a lack of political will and administrative inefficiencies, Pakistan, although having signed multiple national and international agreements and projects to alleviate climate-related concerns, was unable to meet the set goals. Pakistan is unable to execute the targeted adaptation plans due to a lack of funding and international help, while the mitigation strategies also require a significant amount of money.

Recommendations

- The government's role in formulating policies, development, and implementation must be proactive by eliminating inefficiencies and ineffective methods.
- The elimination of harmful practices and environmentally responsible adaptation to climate change should be the main goals of a national sustainable development strategy.
- More contributions from the public should be made to mitigate climate change, and policies for adaptation.
- In forests and other natural places, government, grasslands, and ocean authorities, institutions, and the whole public ought to work together to create and execute regulations to restrict the involvement of humans.
- Since most current work concentrates on particular issues rather than examining sectoral consequences and causes, climate research ought to encompass a wider range of industries.
- To prevent the adverse effects of climate change, Pakistan must demonstrate administrative and political commitment to implementing adaptation solutions.
- Raising public awareness of the problem of climate change and its detrimental effects on Pakistan is also necessary.

References

Abbasi, A. M., Rafi, S., Naseem, S., and Rehman, Y. 2022. Hydrogeochemical evaluation of groundwater of SITE area, Karachi, Pakistan. Journal of the Chemical Society of Pakistan, 44(6).

Adger, W. N. 2010. Climate change, human well-being and insecurity. New Political Economy, 15(2), Pp. 275–292.*

Adopted, I. P. C. C. 2014. Climate change 2014 synthesis report. IPCC: Geneva, Switzerland, Pp. 1059–1072.

Ajani, A., and van der Geest, K. 2021. Climate change in rural Pakistan: Evidence and experiences from a people-centered perspective. Sustainability Science, 16(6), Pp. 1999–2011.

Assessment, M. E. 2005. Ecosystems and human well-being: Wetlands and water.

Bennett, C. L., Larson, D., Weiland, J. L., & Hinshaw, G. 2014. The 1% concordance Hubble constant. The Astrophysical Journal, 794(2), 135.*

Berkes, F. 2003, July. Can cross-scale linkages increase the resilience of social-ecological systems? In RCSD International Conference, Politics of the Commons, Chiang Mai Pp. 1–14.

Berkes, F. 2007. Understanding uncertainty and reducing vulnerability: Lessons from resilience thinking. Natural Hazards, 41, Pp. 283–295.

Brklacich, M., Chazan, M., and Bohle, H. G. 2009. Human security, vulnerability, and global environmental change.

Brøns-Petersen, O., and Gjedsted, S. H. 2021. Climate change and institutional change: What is the relative importance for economic performance? Environmental Economics and Policy Studies, 23(2), Pp. 333–360.

Ellis, F. 2000. Rural livelihoods and diversity in developing countries. Oxford University Press.

Eriksen, S., Aldunce, P., Bahinipati, C. S., Martins, R. D. A., Molefe, J. I., Nhemachena, C., and Ulsrud, K. 2011. When not every response to climate change is a good one: Identifying principles for sustainable adaptation. Climate and Development, 3(1), Pp. 7–20.

Faruqee, R. Ed. 1999. Strategic reforms for agricultural growth in Pakistan. World Bank Publications.

Gu, X., and Zhang, H. 2003, July. Implementing dynamic GOP in video encoding. In 2003 International Conference on Multimedia and Expo (ICME'03) Proceedings. Vol. 1, Pp. I-349. IEEE.

Han, S., Pan, Y., Mygrant, M., and Li, M. 2021. Differentiated environmental regulations and corporate environmental responsibility: The moderating role of institutional environment. Journal of Cleaner Production, 313, 127870.

Haq, S. M., Waheed, M., and Bussmann, R. W. 2023. "Traditional" use in a global world: Unsustainable harvesting drives species to extinction.

Hussain, M., Butt, A. R., Uzma, F., Ahmed, R., Irshad, S., Rehman, A., and Yousaf, B. 2020. A comprehensive review of climate change impacts, adaptation, and mitigation on environmental and natural calamities in Pakistan. Environmental Monitoring and Assessment, 192, Pp. 1–20.

Hussain, M., Liu, G., Yousaf, B., Ahmed, R., Uzma, F., Ali, M. U., and Butt, A. R. 2018. Regional and sectoral assessment on climate change in Pakistan: Social norms and indigenous perceptions on climate-change adaptation and mitigation in relation to the global context. Journal of Cleaner Production, 200, Pp. 791–808.

Kapwata, T., Gebreslasie, M. T., and Wright, C. Y. 2022. An analysis of past and future heatwaves based on a heat-associated mortality threshold: Towards a heat health warning system. Environmental Health, 21(1), 112.

Kittinger, J. N., Koehn, J. Z., Le Cornu, E., Ban, N. C., Gopnik, M., Armsby, M., and Crowder, L. B. 2014. A practical approach for putting people in ecosystem-based ocean planning. Frontiers in Ecology and the Environment, 12(8), Pp. 448–456.

Lee, H., Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P., and Park, Y. 2023. IPCC, 2023: Climate Change 2023: Synthesis Report, Summary for Policymakers. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee & J. Romero (Eds.)]. IPCC, Geneva, Switzerland.

Marshall, D. J., Monro, K., Bode, M., Keough, M. J., and Swearer, S. 2010. Phenotype–environment mismatches reduce connectivity in the sea. Ecology Letters, 13(1), Pp. 128–140.

Natho, S., and Thieken, A. H. 2018. Implementation and adaptation of a macro-scale method to assess and monitor direct economic losses caused by natural hazards. International Journal of Disaster Risk Reduction, 28, Pp. 191–205.

Nazir, N. 2004. A critique on Environmental Protection Ordinance (EPO) 1983 and Environmental Protection Act 1997. Journal of Law & Society, 30, 35.

Ndione, M. 2020. Project information document – Economic management and statistics development for policy making (P171777).

NDMA. 2024, October 14. Monsoon daily situation report No. 75 [Director Response No. F.2 (E)/2024-NDMA (MW/SITREP-75)]. https://www.ndma.gov.pk/storage/sitreps/October2024/gXzrhIenhaI38kbEdUFi.pdf

O'Brien, K. L., and Leichenko, R. M. 2003. Winners and losers in the context of global change. Annals of the Association of American Geographers, 93(1), Pp. 89–103.

Oppenheimer, M., and Anttila-Hughes, J. K. 2016. The science of climate change. The Future of Children, Pp. 11–30.

Paavola, J. 2008. Livelihoods, vulnerability and adaptation to climate

change in Morogoro, Tanzania. Environmental Science & Policy, 11(7), Pp. 642–654.

Perry, R. I., Cury, P., Brander, K., Jennings, S., Möllmann, C., and Planque, B. 2010. Sensitivity of marine systems to climate and fishing: Concepts, issues and management responses. Journal of Marine Systems, 79(3–4), Pp. 427–435.

Roiko, A., Hänninen, H., and Vuorikari, H. 2012. Anisotropic distribution of non-metallic inclusions in a forged steel roll and its influence on fatigue limit. International Journal of Fatigue, 41, Pp. 158–167.

Smith, K. 2013. Environmental hazards: Assessing risk and reducing disaster. Routledge.

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., and Sörlin, S. 2015. Planetary boundaries: Guiding human development on a changing planet. Science, 347(6223), 1259855.

Sulehria, F. 2023. Pakistan's climate migrants beyond mediatized fictions. In Environment, climate change and migration in South Asia Pp. 187–206. Routledge India.

Tuler, S., Agyeman, J., da Silva, P. P., LoRusso, K. R., and Kay, R. 2008. Assessing vulnerabilities: Integrating information about driving forces that affect risks and resilience in fishing communities. Human Ecology Review, Pp. 171–184.

Turner, B. L., Kasperson, R. E., Matson, P. A., McCarthy, J. J., Corell, R. W., Christensen, L., and Schiller, A. 2003. A framework for vulnerability analysis in sustainability science. Proceedings of the National Academy of Sciences, 100(14), Pp. 8074–8079.

Turner, R. K., Paavola, J., Cooper, P., Farber, S., Jessamy, V., and Georgiou, S. 2003. Valuing nature: Lessons learned and future research directions. Ecological Economics, 46(3), Pp. 493–510.

Vermeulen, S. J. 2014. Climate change, food security and small-scale producers: Analysis of findings of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). CCAFS Info Note.

Walker, B., Holling, C. S., Carpenter, S. R., and Kinzig, A. 2004. Resilience, adaptability and transformability in social-ecological systems. Ecology and Society, 9(2).

Webler, T., and Tuler, S. 2008. Organizing a deliberative participatory process: What does the science say? REFORM, 125.

Werema, C. G. 2014. Flood hazard assessment and associated impacts on public health.

Zahid, M. Y., and Qamar, M. K. 2020. The aspects of legislation in environmental management: Case study of Punjab Province (Pakistan). Pakistan Journal of Science, 72(2).

Zou, J. J., Wei, F. J., Wang, C., Wu, J. J., Ratnasekera, D., Liu, W. X., and Wu, W. H. 2010. Arabidopsis calcium-dependent protein kinase CPK10 functions in abscisic acid- and Ca2+-mediated stomatal regulation in response to drought stress. Plant Physiology, 154(3), Pp. 1232–1243.