



ORIGINAL ARTICLE

Climate change in rural Pakistan: evidence and experiences from a people-centered perspective

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Abstract

Pakistan is home to a wide range of geographical landscapes, each of which faces different climate change impacts and challenges. This article presents findings from a National Geographic Society funded project, which employed a people-centered, narratives-based approach to study climate impacts and adaptation strategies of people in 19 rural study sites in four provinces of Pakistan ($N=108$). The study looked at six climate-related stressors—changes in weather patterns, floods, Glacial Lake Outburst Floods, drought, heat waves, and sea-level rise—in the coastal areas of Sindh, the desert of Thar, the plains of Punjab, and the mountains of Hunza, Gilgit, and Chitral. Speaking to people at these frontlines of climate change revealed much about climate suffering and trauma. Not only is the suffering induced by losses and damages to property and livelihood, but climate impacts also take a heavy toll on people's psycho-social wellbeing, particularly when they are displaced from their homes. The findings further demonstrate that people try to adapt in various ways, for instance by altering their agricultural practices, but they face severe barriers to effective adaptation action. Understanding people's perceptions of climate change and incorporating their recommendations in adaptation planning can help policy-makers develop a more participatory, inclusive, and holistic climate resilience framework for the future.

Keywords Impacts of climate change · Adaptation constraints · Loss and damage · People-centered perspective · Climate narratives · Pakistan

Introduction

Recent IPCC reports have shown that the impacts of climate change can already be observed on natural and human systems (IPCC 2018, 2019; van der Geest and Warner 2020). Rising temperatures, changing precipitation patterns and increased frequency of extreme weather events due to climate change are adversely affecting food and livelihood security and leading to land degradation and increased displacement (Zommers et al. 2016; IPCC 2018, 2019). An estimated 971 million people worldwide currently live in places with high or very

high exposure to climate hazards (Global Peace Index 2019). Many of the most at-risk populations reside in Least Developed Countries, and within populations, women, the young, elderly and poor are the most disadvantaged and vulnerable to the effects of climate change (IPCC 2018, 2019). Pakistan is among the top nine countries that face the highest risk of climate hazards (Global Peace Index 2019).

People in different parts of the world perceive and experience climate impacts in unique ways. While there is a large volume of studies about impacts of climate change, there is a dearth of studies that shed light on people's diverse perceptions and experiences (Ayeb-Karlsson et al. 2016). This paper studies the impacts of climate change in Pakistan through people's accounts of their lived experiences. Pakistan has a diverse range of geographical landscapes which face different challenges in the context of climate change. To reflect this diversity, this study recorded accounts of people from the coastal areas of Sindh, the desert of Thar, the plains of Punjab and the mountain communities of Hunza, Gilgit and Chitral to understand their unique struggles, suffering, and adaptation practices.

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Climate change in Pakistan

Pakistan has been ranked the fifth most affected country in the world due to extreme weather events between 1999 and 2018 (Eckstein et al. 2020). Pakistan's economy relies heavily on agriculture (Rehman et al. 2015), and any changes in temperature and disruptions in water availability and monsoon patterns can wreak havoc on the livelihoods of millions of people. Impacts of climate change and extreme weather exacerbate the already severe problems of poverty and food security in the country. From 1998 to 2018, Pakistan witnessed 152 extreme weather events, lost 9989 lives and suffered economic losses worth \$3.8 billion (Abubakar 2020).

A substantial body of literature exists on climate change impacts in Pakistan, especially in terms of food security (Gorst et al. 2018; Tariq et al. 2014; Asif 2013; Rasul et al. 2011; Siddiqui et al. 2012; Ahmed and Schmit 2011). These studies show that climate impacts in Pakistan have started to manifest through a rise in temperature, unpredictable rainfall, accelerated glacial melt, and a negative impact on crop productivity. However, little is known about how people in Pakistan perceive the changes and extremes in the climate, how it impacts their lives and livelihoods, and what actions they take to cope and adapt. And even less is known about the limitations and constraints that people face while trying to deal with gradual climatic changes as well as sudden-onset disasters. This study aims to fill that gap using a people-centered and narratives-based approach that sheds light on the lived experiences of people at the frontlines of climate change in Pakistan.

Need for a narratives-focused people-centered approach

It is crucial to first understand peoples' attitudes, experiences, and behavioral responses to the current climate change impacts if we wish to build and enhance the future resilience of communities (Oakes 2019). Active involvement of local stakeholders, particularly those most vulnerable to climate change, is fundamental to enhance climate change decision-making and governance across all sectors and scales (IPCC 2019).

In climate change and energy research, stories and narratives can provide different and unique perspectives when compared with other traditional forms of data. Narratives can bring to light insights, constraints, misconceptions, beliefs, experiences, or perspectives that commonly exist but may have been systematically under-acknowledged. A people-centered research approach and methodology transforms who speaks, who gets heard, and even who hears, compared to more standard data collection forms. The stories that respondents share about their lived experiences

with climate change transcend disciplinary and sectoral jargon and boundaries and connect diverse stakeholders to foster collaboration and collective action (Moezzi et al. 2017).

Given the transdisciplinary nature of climate change, offering diverse perspectives using a people-centered and narratives-focused approach can help foster understanding and collaboration between actors for context-specific climate action and policy changes. This is important, because climate impacts vary based on context, sector, geography, and resource capacity. In addition, highlighting climate change narratives of under-represented people from developing countries is crucial to provide a more holistic picture of the global climate impacts and the different adaptation needs in different contexts and at different scales.

Research objectives

This study aims to describe and analyze how climate change is affecting individuals' lives, livelihoods and human potential in diverse geographical locations in Pakistan, such as coastal areas, deserts, flood plains and mountainous regions. Specifically, it looks at how people perceive the changes in the local climate, how it affects them, what they do to cope and adapt, and what constraints they encounter in the implementation of effective response measures. The paper presents qualitative, people-centered, and narratives-based findings to understand the impacts of climate change in Pakistan. The insights offered in the study can be valuable to regional and international communities dealing with similar climate stressors and constraints. This study identified and focused on six main climate stressors affecting various areas of Pakistan:

1. Changes in weather patterns
2. Floods
3. Glacial Lake Outburst Floods
4. Drought
5. Heat waves
6. Sea-level rise.

Methodology

This study was conducted as part of a project funded by a grant from the National Geographic Society. For this study, the researchers interviewed a total of 108 respondents, which included 97 community members (78 men and 19 women) and 11 environmental experts (10 men and 1 woman) from across the country. The research team tried to interview as many women as men, but this was not possible due to the highly patriarchal culture in the study sites. The community members included fishermen, farmers, orchard farmers,

Table 1 List of 19 study sites, grouped by district and province, showing the number of respondents and the most common climate stressor per study site

Location	District	Province	Number of respondents	Climate stressors
Kakapir village	Karachi	Sindh	7	Cyclones, seawater intrusion, heatwaves, change in rainfall pattern
Mubarak village	Karachi	Sindh	4	Heatwaves, drought
Soomar village	Karachi	Sindh	3	Sea-level rise, heat waves
Keti Bandar	Thatta	Sindh	6	Seawater intrusion, cyclones, change in rainfall pattern
Jamshoro	Jamshoro	Sindh	3	Change in rainfall pattern, floods
Nagarparkar	Tharparkar	Sindh	4	Drought, heat waves, change in rainfall pattern
Umerkot	Umerkot	Sindh	1	Drought, heat waves, change in rainfall pattern
Lake Manchhar	Dadu	Sindh	8	Change in rainfall pattern, heatwaves
Depalpur	Okara	Punjab	10	Heat waves, change in rainfall pattern, flash floods
Bumburet, Kalash valley	Chitral	Khyber-Pakhtunkhwa	10	Heatwaves, GLOF
Booni	Chitral	Khyber-Pakhtunkhwa	3	Change in rainfall pattern, GLOF, heatwaves
Reshun valley	Chitral	Khyber-Pakhtunkhwa	4	GLOF, change in rainfall pattern, flash floods
Sonoghar valley	Chitral	Khyber-Pakhtunkhwa	4	GLOF, heatwaves, change in rainfall pattern
Bagrote valley	Gilgit	Gilgit-Baltistan	3	Change in rainfall pattern, heatwaves, landslides
Badswat	Ghizer	Gilgit-Baltistan	9	GLOF, flash floods
Gilgit	Gilgit	Gilgit-Baltistan	3	Change in rainfall pattern, flash floods
Hassanabad	Hunza	Gilgit-Baltistan	3	GLOF
Karimabad	Hunza	Gilgit-Baltistan	8	Landslides, heatwaves
Passu	Hunza	Gilgit-Baltistan	4	Flash floods, change in rainfall pattern
Total	11 Districts	4 Provinces	97 Respondents	

pastoralists, school teachers, community health workers and social workers. The respondents were selected after consultations with local collaborators from each area, while some were identified during the community interview sessions. It was ensured that each respondent was a native of the area and reflected a diversity of socio-economic backgrounds, livelihood activities and climate change experiences. The methodology employed included a combination of semi-structured interviews and focus group discussions. The open-ended questions in the interviews allowed people to share their stories and lived experiences regarding climate change.

Before the interview, participants were given a general overview of the project and the intended use of the research findings and materials. The interviews were conducted in Urdu and each interview lasted between 30 and 90 min. In the areas where Urdu was poorly understood and spoken (e.g., in Badswat and Bumburet), we worked with local collaborators who helped us with translation (from Brushiski and Khowar into Urdu, respectively). The audio of each interview was recorded after taking verbal consent from the participants. Since the project was funded by the National Geographic Society, the participants also signed a media release form consenting to the publication of their stories, ideas, and photographs for non-commercial use. All research data were recorded using audio recorders, phone cameras,

and notebooks. The interviews were transcribed and translated into English after each field visit and later a thematic analysis of the interviews was carried out.

Research sites

The research sites were selected to cover a wide range of ecosystems and geographic landscapes in the country to examine the impacts of climatic changes and extremes on climate-sensitive livelihoods (e.g., rain-fed agriculture, orchard farming, fishing, herding). The selection of sites was based on previous field experience and recommendations of environmental experts and community focal points during a pilot study for this research project. The geographic spread and diversity of the study sites helped us cover the main climatic stressors that Pakistan faces, such as droughts, floods, sea-level rise, glacial melt, increased heat waves and changing rainfall patterns.

The project team conducted research at 19 locations in 11 districts in 4 provinces of Pakistan—Sindh, Punjab, Khyber-Pakhtunkhwa, and Gilgit-Baltistan (Table 1).¹

¹ Gilgit-Baltistan is not a province of Pakistan but an administrative territory. However, for readability and ease of understanding, it is grouped with the other provinces.

Results

In this section, we look at the six most commonly experienced climatic stressors in Pakistan. For each stressor, we first look at how respondents in different parts of the country perceive the changes in its frequency and severity. Then, we describe how these climatic stressors impact on people's lives, livelihoods, and safety. This is followed by an analysis of the actions respondents take to cope and adapt and the constraints they face in dealing with these stressors. The results section also discusses other stressors that—according to the study respondents—exacerbate climate change impacts. It ends with the recommendations shared by the respondents for improving climate resilience and policy in their respective areas.

Changes in weather patterns

Climate change directly influences weather patterns, especially precipitation. With rising temperatures, there is greater surface evaporation leading to a greater concentration of water vapor in the atmosphere which results in heavier downpours. This can cause devastating floods when it rains in the mountainous areas (Trenberth 2011). Alternatively, global warming can exacerbate drought conditions in arid areas due to higher evaporation.

People in all study areas had noticed the changing weather patterns and talked about the lack of rainfall as well as the changes in temperatures and onset of seasons in their areas.

Observations about the unpredictability of rain were shared by respondents from Punjab highlighting its impacts on harvesting times and crop yields:

“For the past few years, the rain has not come on time and the winds have become more aggressive. This has caused damage to our crops. Before, we used to cut the crop 10–15 days earlier, but the rains got late this year (2019). The rains have really become unpredictable now.” – [Hadil Sera, Male, Depalpur, Okara, 28 April 2019]

Farmers' survival depends on the rains and any change in their timing or intensity can jeopardize their livelihoods and plunge them further into a cycle of debt.

Precipitation patterns have also changed in the mountainous regions, as described by a respondent from Chitral:

“About 10 to 15 years back, there used to be at least 3 or 4 feet of snowfall in Booni. If I tell you about last year, there was no snow during the whole winter. Even rainfall patterns have changed. Because of it, now there are different kinds of diseases that affect the local fruits, crops and vegetables.” – [Imtiaz Alam, Male, Booni, Chitral, 2 May 2019]

This is an example of how changing weather patterns are leading to crop damage and providing more favorable conditions for new pests to emerge. Fruit from Chitral is exported all across Pakistan and abroad, so these crop losses can translate into significant losses to farmer incomes and export revenues.

The impacts of the changing weather patterns can also be observed on the reduced quality and yields of crops and delayed harvesting, as mentioned by one of the respondents:

“We used to harvest all our wheat in August and September. Now it's delayed because of the weather. The harvest also doesn't ripen properly. We cut and gather it, but the wheat is not of as good quality as before.” – [Nargis Iqbal, Female, Passu, Hunza, 7 May 2019]

Not only do untimely rains put people's livelihoods at risk, but they also pose an additional threat of flash floods even in areas that were previously considered safe,

“The monsoon has shifted in Chitral. Now, because of this change in rainfall, floods have started to affect even the safe zones. Last year, there was a flash flood in my village, Gasht. It was very surprising because no such incident had occurred there before.” – [Wali Mohammad, Male, Aga Khan Rural Support Programme, Chitral, 2 May 2019]

In some areas such as Kalash valley in Chitral, people rely on snowfall and rainfall to replenish water supplies and provide electricity. With reduced or unpredictable precipitation, their water and energy security are at risk,

“If there is no snow by December, we grapple with water shortage here as the springs shrink. After December if there's less water due to reduced or no snowfall, we also experience electricity shortage and load-shedding as every village depends on small hydropower plants.” – [Nazar Gill, Male, Kalash, Chitral, 1 May 2019]

In addition, as a result of the warmer weather and changed rainfall patterns, new crop diseases are emerging in many areas,

“The cotton crop is getting affected by the pink bollworm disease that was never seen here before. In the past 5 years, it has suddenly exploded due to the heat and erratic rainfall.” – [Hasan Anwar, Male, Depalpur, Okara, 28 April 2019]

People confronted with different climate stressors are adapting in different ways. For example, farmers have started growing new/different varieties of crops in Chitral and Gilgit as the climate warms,

“In the village ahead, growing wheat was not possible but these days because of the change in climate, wheat is being cultivated there.” – [Hanif, Male, Kalash, Chitral, 1 May 2019]

Some people also reported an increase in yields due to a warmer climate,

“There is more harvest of walnuts, pine nuts and pears and apples. Yields have increased because of the heat.” – [Muhammad Wazir, Male, Kalash, Chitral, 1 May 2019]

While farmers have been noticing these changes in rain patterns in recent years, they often lack the necessary knowledge and support to adapt. They also do not have access to crop insurance or alternate livelihood options. This leaves them and the agricultural sector extremely vulnerable to the current and future impacts of climate change.

Floods

Over the years, the occurrence of major floods has increased in Pakistan, causing huge losses to life and property. In August 2020, for example, just 3 days of heavy monsoon rains killed at least 90 people and damaged at least a thousand homes across Pakistan (Guardian 2020).

Flash floods due to heavy monsoons tend to generally affect Punjab and Sindh provinces, while floods resulting from hill torrents tend to affect mainly the hilly areas in Khyber Pakhtunkhwa, Baluchistan and Gilgit Baltistan (Sayeed and Gonzales 2014). Most of the flooding occurs in late summer months during the monsoon season but can also occur due to glacial lake outbursts caused by high summer temperatures (covered later).

In Pakistan, exposure and vulnerability to floods and other hazards are very high. A large part of the population lives in high-risk areas with inadequate infrastructure and warning systems, where literacy is low and poverty levels are high with minimal social safety nets in place, and there is little awareness at both government and community levels about disaster prevention and preparedness (Sayeed and Gonzalez 2014).

The shifting monsoon rains and increased melting of glaciers are leading to more frequent and intense floods in Hunza causing land erosion, as described by one respondent:

“Every year the river near our house floods due to increased glacial melt from the Batura glacier and heavier rains and it takes away a part of our land.” – [Nargis Iqbal, Female, Passu, Hunza, 7 May 2019]

In the North of Pakistan, people’s lands are their source of livelihood security. Many communities live in remote

locations cut off from the main cities and commercial areas, so growing crops for subsistence and income is the only way to survive. Therefore, when a flood destroys their land, their sole source of survival and livelihood is jeopardized,

“When the 2015 floods hit, people's expensive trees, like walnut trees, were all destroyed. You don't see the bigger trees now. They were near the river and were all taken away. Every man who previously had 15 sacks of walnuts now barely has one.” – [Muhammad Wazir, Male, Kalash, Chitral, 1 May 2019]

The floods also destroy crucial infrastructure which can hamper safety/rehabilitation efforts,

“In 2015 when there was a flood, the whole road was ruined, and even going by foot to Ayon or Chitral town was difficult. People's houses were washed away; their land and houses had to be abandoned and they had to move to other areas.” – [Meerkai, Female, Kalash, Chitral, 1 May 2019]

The monsoon rains in August 2020 left hundreds of households without drinking and irrigation water in Chitral (DAWN 2020).

As a result of frequent floods, some people have been forced to relocate to other areas to avoid repeated property damage and risk to lives,

“My shop and agricultural land were completely destroyed by the flood; my house was also partially damaged. The government told us not to rebuild our house in the same area as there was a high risk of flooding. I, therefore, had to migrate from my home of 40 years to a new village and start life from scratch.” – [Musharraf Khan, Male, Kalash, Chitral, 1 May 2019]

It is important to note that the cost of the floods is not merely physical—it also takes a mental toll on people, as related by a respondent in Chitral:

“After the flood, I became mentally ill. Occasionally, I would hear voices of people screaming about approaching floods and I would scream and run away. I would also wake up in the middle of the night, screaming. A person is left mentally distraught after these floods. It is very psychologically disturbing.” – [Sonia Kanwal, Female, Reshun, Chitral, 2 May 2019]

The climate disasters can not only disturb the psychological wellbeing of individuals but may also weaken community ties,

“Before the floods, all our families lived together. We would gather frequently and enjoy hanging out with all our cousins. Now, after the flood we have all dispersed. Some have rebuilt houses on this side of the river while

some have left the area altogether. We don't have the same community as before.” – [Sonia Kanwal, Female, Reshun, Chitral, 2 May 2019]

Without proper warning systems in place, people live with a sense of insecurity and fear during the summer months, as described by one respondent from Chitral:

“In June and July, we don't sleep at night. We stay up till 1 or 2 am and keep checking the river as it is right next to our house. After the 2015 floods, we are afraid. We don't want the flood to take us away. We also keep our documents ready so that when someone calls informing us of an incoming flood, we can just take them and go.” – [Imtiaz Ali Shah, Male, Reshun, Chitral, 2 May 2019]

To improve precautionary measures after the 2015 flood in Reshun, the district government ensured that no construction was allowed within 100 feet of the riverbank. Prior to this restriction, people would immediately rebuild their homes by the river,

“A higher, more stable protection wall has now been built along the river. Since the old trees were ripped away by the flood, new trees have also been planted along the river so they can prevent flood water from flowing over the protection wall” – [Imtiaz Ali Shah, Male, Reshun, Chitral, 2 May 2019]

It was observed that in many disaster-prone areas, there was no formal early warning system in place. For example, in Reshun valley, one of the respondents shared how they warn each other about floods:

“People who live higher up the mountain can tell early on that a flood is coming. They use a torch light to warn people living downstream. A lot of herders also move up the mountains from July to September because there is more pasture for the livestock. From there, they shine a light if they see or hear a flood approaching.” – [Sonia Kanwal, Female, Reshun, Chitral, 2 May 2019]

Where available, disaster awareness campaigns and informal early warning systems were mostly run by community organizations and NGOs. Most of the time government interventions and support are only activated after a disaster has occurred. One of the respondents working for an NGO describes the disaster preparedness efforts in Chitral in the following way:

“Currently, we run monsoon awareness activities. We give people early warnings through announcements

in masjids and jamat khanas.² The message is also spread through social media, and the local radio stations. In case of bad weather, our volunteers also send out information via a community WhatsApp group.” – [Wali Mohammad, Male, Aga Khan Rural Support Programme, Chitral, 2 May 2019]

Glacial lake outburst floods

A Glacial Lake Outburst Flood (GLOF) occurs when a lake formed by glacial melt overflows as the ice dam holding it suddenly bursts resulting in catastrophic flooding in downstream areas. As the climate warms, more and more glaciers around the world are experiencing increased melting (Zemp and Haeberli 2007).

Pakistan is home to three mountain ranges in the north, namely Himalayas, Karakoram and Hindukush (Ashraf et al. 2012), and has 7253 known glaciers, with 543 in the Chitral Valley alone. These glaciers feed rivers that represent 75% of the stored-water supply in the country (Craig 2016).

Pakistan's glaciers are fast receding due to climate change, especially those at lower elevations, including in the Hindu Kush Mountain range in northern Khyber Pakhtunkhwa province (Craig 2016). Climate change is also increasing the risk of glacier surges³ and formation of glacial lakes in Pakistan, especially in the Karakoram Mountain range (Quincy et al. 2011). The glaciers in the region have revealed irregular behavior and lack of stability during the last 5 decades. GLOFs pose increasingly serious threats to human lives, infrastructure, property, and livelihoods, particularly in the Karakoram region (Shah et al. 2019).

On 17 July 2018, Badswat and Bilhanz villages in Immit Valley in Gilgit-Baltistan were hit by a glacial lake outburst flood (GLOF) which killed two people, damaged over 40 houses, and submerged part of the Karakoram Highway, leaving around ten villages isolated (Payne 2018),

“When the flood came in the evening, we quickly evacuated to the mountains to save our lives, but our houses, cattle, land, everything got swept away by the water. It came so suddenly.” – [Janaan Khan, Male, Badswat, Gilgit, 9 May 2019]

“After our homes were destroyed by glacial outburst flood, we had to live in tents for months. Living with 8–10 people in one tent in the harsh November cold was the most difficult thing I had to do in my life.” – [Janaan Khan, Male, Badswat, Gilgit, 9 May 2019]

² Places of worship for Ismaili Muslims.

³ A glacier surge happens when a glacier advances very rapidly (10–100 times faster than normal) in a short period of time (lasting a few months to a few years)—Majeed and Rashid (2020).

When the research team visited the area in May 2019, Janaan Khan and other Badswat GLOF affectees were still living in temporary shelters.

As GLOFs also move huge boulders, rocks, and sediments, they can damage essential water and energy infrastructure, such as the 2010 GLOF did in the village of Booni in Chitral,

“When a glacier bursts, our whole system of water channels is affected, and everything is swept away. After the 2010 GLOF, there was no drinking water available. People who lived by the stream, their houses got badly damaged. Because of this, some people have left permanently.” – [Imtiaz Alam, Male, Booni, Chitral, 2 May 2019]

The surging of Shishpar glacier, called a ‘*disaster-in-the-making*’ by one respondent, had already damaged infrastructure in Hunza:

“The Shishpar glacier in Hassanabad surged in 2018 and blocked the drainage channel, forming a lake behind it. It has caused a lot of damage to infrastructure and has blocked the source of Aliyabad’s irrigation channel. If it continues to surge further, it can impact drinking water supplies and cause a major GLOF event.” – [Deedar Karim, Male, Aga Khan Agency for Habitat, Gilgit, 5 May 2019]

Oftentimes, GLOF-affected areas are destroyed to the extent that people are forced to migrate and rebuild a life elsewhere. People who can make the choice to migrate do so on their own, often without any government support. However, the effectiveness of migration as an adaptation strategy is often limited. After migration many remain in risk-prone situations, because truly safe places are often not accessible to them or because such places are unsuitable because of lack of water and arable land,

“This area I’ve migrated to isn’t safe either. There is a riverbed here and should a flood occur, we are in its path, so it is just a matter of time or fate.” – [Musharraf Khan, Male, Kalash, Chitral, 1 May 2019]

Many people are not able to migrate because of a lack of resources or a lack of support from the government. This was seen in Sonoghar valley, Chitral where people decided to rebuild their life in a high flood-risk zone after a major GLOF event in 2007,

“The government and geologists told us not to repopulate this area as it is very dangerous. They told us to plant trees here instead. But the government gave us nothing- no land or compensation. So, we all shifted back. Where else can we go?” – [Sahib Faraz, Male, Sonoghar, Chitral, 3 May 2019]

Another respondent from Reshun valley shared:

“We’re still at risk. People here are quite poor and cannot afford to make a house somewhere else. There’s land elsewhere but there’s water and more facilities here than other places. This has been my home since I was a child. I can’t just leave it. So, we live with the risk.” – [Imtiaz Ali Shah, Male, Reshun, Chitral, 2 May 2019]

One of the reasons most people cannot afford to relocate without government assistance or compensation is that land in Chitral is scarce and expensive. Therefore, they end up rebuilding their homes in the same location, making a conscious decision to accept the risk in the hope that the next flood will not affect them again.

Drought

Climate change and overexploitation of water resources exacerbate the frequency, severity and duration of drought events and associated impacts (Miyan 2015; Wilhite 2005). Drought is a common phenomenon in Pakistan, known to occur at least thrice every decade (Anjum et al. 2012). From the early 2000 onwards (Miyan 2015), severe droughts in the country have mainly affected the provinces of Sindh and Balochistan (Ashraf and Routray 2015).

Droughts tend to worsen food insecurity in semi-arid countries like Pakistan, where the economy depends on agriculture. Droughts can trigger undue migration, and cause famine and deaths (Miyan 2015). Whereas in some parts of Pakistan, excessive rainfall is causing floods, in other parts, there is not enough rain.

People in the desert of Thar have been noticing the increasing heat stress and water scarcity in the recent years:

“The heat is increasing every year. Intense hot weather has already arrived in April this year (2019). It used to rain more in the past, now it hasn’t rained properly in years.” – [Muhammad Saleem Khoso, Male, Nagarpakar, Thar, 6 April 2019]

Prolonged drought and increasing temperatures are a cause of severe water shortages in arid areas of Pakistan such as Thar,

“We don’t even have drinking water in the city. The livestock and animals are dying because they don’t have water to drink. If you go and see the wells, you will see some water only at the depth of 50-60 feet. The longer the dry spell lasts, the sooner these wells will completely dry up. Last year, there were no rains at all, and the heat is increasing every year.” – [Muhammad Saleem Khoso, Male, Nagarpakar, Thar, 6 April 2019]

People in these areas mostly depend on groundwater resources which are depleting at a rapid rate. One of the participants describes the struggles of people when collecting water from one of the tube wells in Nagarpakar:

“People come here from long distances to get water. Those who come in the evening will get water in the morning. They will have to sit through the night. The water level in this well is very low. To fill one bucket of water, we need to take out almost 50 buckets. It is very tiring and time-consuming work. If our day is spent in collecting water, we lose an entire day’s wages and don’t get to eat that day.” – [Anwar Ali, Male, Nagarpakar, Thar, 6 April 2019]

To meet the water demands of the people in arid areas, a new informal sector activity has sprung up. Suppliers sell water—sometimes of questionable quality—from tankers to water-insecure people at a high price,

“We, city folk, get water tankers from a nearby village where there is still groundwater, even though it is quickly depleting as well. We get a tanker for 3000 PKR (~18 USD) which lasts us for 10–15 days.” – [Muhammad Saleem Khoso, Male, Nagarpakar, Thar, 6 April 2019]

People from communities in the desert of Thar employ seasonal migration as a drought adaptation strategy. They temporarily move to big cities in search of work during drought periods. They only return to their homes during the monsoon season to cultivate crops, if the monsoons take place at all.

“People migrate because of the drought. It is mostly the Kohli and Bheel communities who migrate with their entire families. However, in other Muslim communities only the men go away to Karachi or other places to work in factories, leaving the women and children behind. The migration is seasonal. The men come back in April or May to prepare the fields for when it rains.” – [Sagar, Male, Nagarpakar, Thar, 6 April 2019]

The lack of adequate water infrastructure is a big constraint that adds to the water insecurity of people. There is a lot of potential for rainwater harvesting and building of small dams in drought-prone areas, but government interest and investment is sorely lacking. In addition, local people are rarely consulted when interventions take place which leads to the failing of well-meaning initiatives due to a lack of inclusive planning and community buy-in. An example was provided by one of the respondents:

“We have a few small dams built here and there, but these have been built without consultation with the

local people and instead of storing water cause more damage. One such dam has been built in the wrong location and it has redirected the seasonal river water which now poses a flood risk to nearby houses.” – [Muhammad Saleem Khoso, Male, Nagarpakar, Thar, 6 April 2019]

Heatwaves

Mueller et al. 2014 showed that it is heat stress (and not high rainfall or floods as was popularly believed) that is most strongly associated with long-term human migration in rural Pakistan. High temperatures have been shown to lower agricultural yields in Pakistan (Rasul et al. 2011) as well as to lower farm and non-farm income (Mueller et al. 2014). The study finds that the probability of a non-migrant, male moving out of the village is 11 times more likely when exposed to extreme high temperatures (Mueller et al. 2014).

In arid areas, the frequency and intensity of heat waves has increased which sometimes even results in loss of lives,

“The heat in Manchhar is already unbearable. It even went up to 55 degrees Celsius last summer (2018). As a result, many people in my village died from heat-stroke.” – [Moula Buksh Mallah, Male, Lake Manchhar, Dadu, 20 April 2019]

In the 2015 heatwave, at least 700 deaths occurred in Karachi alone (Masood et al. 2015). As the heat waves have become more common, people have started employing precautionary measures (such as staying hydrated and avoiding venturing out during the day) to prevent the loss of lives.

People’s daily lives and lifestyles have also been impacted because of the heat stress, and people and businesses in Chitral, for example, have had to adapt to the increasing summer heat, as described by one respondent:

“In the past, the hottest day in the summer recorded a temperature of 35 degrees Celsius, but for the past 2–3 years, the temperature goes up to 42 degrees. Before, there were no fans in our homes and hotels, and we used blankets in June and July. But now as the intensity of the heat has increased, we have had to install fans in our homes and hotels.” – [Imtiaz Alam, Male, Booni, Chitral, 2 May 2019]

The heat waves also pose risks to food security. Due to the intense heat, the produce starts rotting sooner and the cropping season has advanced in some areas,

“The cropping cycle hasn’t necessarily decreased, but the planting season has advanced by 15–20 days. In the last 5–6 years, the heat has increased a lot and has ruined our planting timetables.” – [Muhammad Tauseef, Male, Depalpur, Okara, 28 April 2019]

Apart from localized and often isolated adaptation strategies being employed, people have no awareness or direction on how to cope with the increasing heat. The people in urban areas usually cope by installing air conditioners and staying indoors, but the farmers and laborers usually do not have that choice or luxury. With greater heat stress also comes a risk of greater water and food insecurity.

Sea-level rise

Pakistan is among the countries most vulnerable to the impacts of rising sea levels with more than 10% of its population living in coastal areas (Rabbani et al. 2008). The average rate of sea-level rise in Pakistan's coastal regions has been calculated to be approximately 1.1 mm per year (Rabbani et al. 2008).

Sea-level rise along the coast of Karachi has resulted in coastal erosion in villages like Soomar,

"This mosque in Soomar village used to have huts next to it. My grandmother's home was next to the mosque. Now forget the house, even the land is not there now. The sea is encroaching every year." - [Ghulam Ali Abbas, Male, Soomar village, Karachi, 14 April 2019]

The government had built a sea wall in Soomar village in the 1990s, but since then, no further protective measure has been undertaken.

Sea intrusion as a result of sea-level rise is also an issue for the people of Keti Bundar, a village in the coastal belt of Sindh, where people have lost livelihoods and property as a result,

"In olden times the sea was very far from Keti Bundar; now it's close. Slowly, the sea is eating up our land. Our land has also become lower." - [Muhammad Siddique Roonjho, Male, Keti Bundar, Thatta, 17 March 2019]

When the land was no longer productive for farming due to salinity, many people in the area turned to fishing. However, sea intrusion and overfishing are now also threatening the livelihoods of fishermen.

Here is an example of how sea water intrusion is directly and adversely impacting people's livelihoods in Keti Bundar, on the coast of Pakistan:

"After construction of dams [upstream], the quantity of sweet water in river Indus decreased. The sea came in and turned the land and water salty. In the past, people would grow so much rice here that its scent would be all around. But now, the rice is finished, the fish is finished. The quality of fish such as Dangree and Sonee has also deteriorated, and many

fish species have gone extinct." - [Hakeema, Female, Keti Bundar, Thatta, 17 March 2019]

As a result, many people have chosen to permanently migrate from the area as an adaptation strategy,

"Don't ask me about the past, it makes me cry. This place used to be very populated. When the sweet water finished, so did the fertile land. Now all we see is people leaving Keti Bundar." - [Muhammad Siddique Roonjho, Male, Keti Bundar, Thatta, 17 March 2019]

Some NGOs are planting mangroves along the coast as an adaptation strategy to protect the communities against cyclones and storms, and to revive the diminishing fish and marine resources. The communities welcome the initiative and work with them to protect the mangroves from deforestation.

One of the main constraints in adaptation to sea-level rise is that many people in the coastal areas of Pakistan do not have access to alternative sources of livelihood. Most coastal villages depend solely on fishing which faces multiple threats such as sea intrusion, overfishing, and direct disposal of untreated wastewater. In addition, there is a lack of government support and investment to rehabilitate the people affected by sea-level rise and salinity intrusion.

Other stressors

In developing countries like Pakistan, climate change is often not the only stressor. Other stress factors like inadequate water and energy infrastructure, water pollution, and overfishing make adaptation to climate impacts more complex and harder to achieve. Therefore, to make climate adaptation or resilience-building strategies relevant and effective in these areas, it is important to consider and address these other stressors as well.

Deforestation was repeatedly mentioned in all the study sites as the most important factor exacerbating climate change impacts. Deforestation in Pakistan has increased because of population growth and increasing energy needs over the past decades. For example, in Chitral, rural communities do not have access to natural gas, while electricity supplies are highly unreliable and intermittent. Therefore, most people resort to burning firewood to keep their homes warm in sub-zero temperatures in the winters. Another example of deforestation comes from Thar where people cut down trees to use as cooking fuel and fodder for their livestock. Even though motivations may vary, poverty and lack of access to resources seem to be the underlying factor for the loss of tree cover.

Recommendations

For any policy or practical solution to contribute to successful climate change mitigation and adaptation, it should include local stakeholders. It is crucial to involve people at the early stages of adaptation planning as a lack of community needs assessment, or exclusion of communities in the decision-making processes usually leads to failed interventions (Dietz et al. 2013; Keeley and Scoones 2014; Pouw et al. 2017). People-centered research, such as this study, can provide policy-makers with valuable insights into social and environmental vulnerabilities (Keeley and Scoones 2014; Gardner and Lewis 1996) as well as the adaptation needs of people in different areas from a developing country perspective.

All of the recommendations presented here were proposed by the study participants themselves. In each of the provinces we visited, people recommended planting of trees and raising awareness to reduce deforestation. Reforestation efforts on deforested and overgrazed mountain slopes and in the desert of Thar were recommended and it was emphasized that preference be given to planting native species. It was also stressed that local communities should be involved in conservation efforts to prevent further deforestation. In addition, alternative sources of energy and gas should be provided to remote communities that are not yet connected to the grid. They also said that it is important to make good use of the huge renewable energy potential, such as micro-hydro and solar power, that is available in the country.

To deal with extreme drought in the desert of Thar, a respondent suggested to build dams to collect rainwater:

“So many rivers flow out of Jabal hill when it rains here during the monsoon season, but so much of our water is wasted. Dams should be built to collect this water. If we do that, our entire area will become lush and green and there will be no water shortage either.”
– [Muhammad Saleem Khoso, Male, Nagarpakar, Thar, 6 April 2019]

It was acutely pointed out that there is a lack of good and transparent governance and that climate change education needs to be strengthened at all levels in the country. The schools and faith-based organizations can play a pivotal role in increasing levels of awareness and adaptation. It was also recommended to make climate change awareness a part of the curriculum in all schools.

To avoid the worst impacts of floods, respondents further recommended the construction of protection walls near the rivers to protect property and lives:

“If protection walls were built in flood-risk areas such as in my village in Bumburet, then the destruc-

tion could have been avoided.” – [Musharraf Khan, Male, Kalash, Chitral, 1 May 2019]

Moreover, better, and effective early warning systems were suggested to be put in place in all areas at risk of climate-related disasters.

Providing crop insurance and additional sources of income to the farmers could improve their resilience and food security,

“If you can find a way to supplement the income of the farmers, they can reinvest in their farm and will be able to adapt better to climate change or the pressures they are facing from competitive export markets.” – [Hasan Anwar, Male, Depalpur, Okara, 28 April 2019]

In sum, these recommendations by the respondents offer local solutions to address climate change impacts, food and energy insecurity and lack of community awareness simultaneously. If such recommendations by people in affected areas are better incorporated in national and local adaptation policies, this can contribute significantly to a more context-specific and locally driven climate resilience.

Discussion and conclusion

In this section, we highlight some of the broader thematic patterns observed during the study and their implications for building better and more inclusive climate policies and solutions.

People across the study sites demonstrated a high level of awareness of changes in the local climate, even though in some locations, particularly in Sindh and Punjab, people were not so familiar with the term 'climate change' even when translated into Urdu. In contrast, most people in Gilgit, Hunza and Chitral were familiar with the term and could also point to its causes such as burning fossil fuels and deforestation. This gap in awareness can be attributed to higher levels of education and relatively better disaster awareness and management efforts by non-governmental organizations in the mountainous areas of the country.

The academic literature generally distinguishes two types of responses to climate change: mitigation and adaptation. However, Wapner (2014) states that a third dimension—climate suffering—is becoming increasingly familiar. The concept of climate suffering links closely to the issue of 'loss and damage from climate change', which is increasingly important in the climate negotiations and is now considered the third pillar—alongside mitigation and adaptation—of climate policy (Broberg and Martinez Romera 2020; Calliari et al. 2020).

Climate suffering is widespread in developing countries like Pakistan where awareness, resources and adaptive

Fig. 1 Map of study sites in Pakistan. Source: Authors, with graphic design support by Aileen Orate (UNU-EHS)



capacity are limited. While physical suffering is more visible, emotional trauma can stay under the radar for a long time. However, it can have long-lasting effects on the individual and society, as was related by several respondents. Speaking to those at the frontlines of climate change revealed much about climate suffering and trauma. Climate trauma may be induced by being directly impacted by disasters such as floods or by being displaced due to water shortages or unproductive soils. It can create feelings of chronic fear, deep sadness and yearning for the past and loss of a sense of safety.

Migration was observed as a common adaptation strategy that people used to deal with a loss of livelihood options due to climate change. Short-term migration can help cope with temporary livelihood insecurities, due to climatic stress and other disturbances (Black et al. 2011, 2013; Cattaneo et al. 2019; van der Geest and Warner 2015). Such seasonal or temporary migration was common in the desert of Thar. However, when people are unable to adapt locally, they are forced to permanently migrate to other areas for better livelihood opportunities. Permanent migration as well as displacement due to weather-related disasters was observed in many areas of Keti Bundar, Chitral and Gilgit. It is important,

however, to acknowledge that in some cases, being able to migrate is a privilege. Many people in low-income countries lack the resources, capabilities, support and networks needed to migrate successfully. As climate change puts more pressure on natural resources and exacerbates weather extremes, more and more people will be forced to live in places with severe habitability issues. Only some of them will have the means to move to greener pastures (Adams 2016; Navrotski and de Waard 2018; Ayeb-Karlsson 2020; Xu et al. 2020).

Employing a people-centered approach helps provide a much-needed perspective that sheds light on common—but often neglected or poorly prioritized—challenges. Examples of such challenges include the lack of climate awareness and community consultation for climate action, the role of other stressors like poverty and deforestation that exacerbate climate impacts, the current low level of adaptive capacity in communities and national institutions, psycho-social effects of climate disasters, and the non-economic losses and damages associated with climate change and displacement. Such deep, inter-sectoral and context-specific insights were only possible using a narratives-based approach centered on people's lived experiences.

The results from this study have relevance also for other countries and regions as people living in similar climates and development stages may face similar stressors and constraints. However, it is also important to bear in mind the unique context and circumstances of each place and community as it has its own environmental, social, cultural, political, and economic dynamics. Furthermore, the capacity for climate resilience varies between and within regions and nations due to different development contexts and systemic vulnerabilities (IPCC 2018). Studies like this one if replicated in a wide range of contexts can help prepare and implement more effective and integrated climate change adaptation programs. The experiences and voices of ordinary people, especially in developing countries, who are suffering first hand because of the already manifesting consequences of climate change should be reflected in inclusive and participatory climate policy and interventions aimed at building resilience.

Taking into account people's perceptions and experiences, understanding the limitations of local coping and adaptive capacity, and incorporating local recommendations about solutions can help policy-makers address present needs, anticipate future needs, and develop a participatory and holistic climate resilience framework that can be implemented at the local level where it is most needed.

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