

## Research Study

**Climate Vulnerability and Capacity Assessment of Coastal Communities in Sindh and Formulation of Community Adaptation Plan**

Under the "Climate Sensitive Livelihood Modeling (CSLM) Project" Implemented in District Thatta and Malir



## RESEARCH STUDY

# **Climate Vulnerability and Capacity Assessment of Coastal Communities in Sindh and Formulation of Community Adaptation Plan**

Under the “Climate Sensitive Livelihood Modeling (CSLM) Project” Implemented in District Thatta and Malir

**Study Conducted by  
Islamic Relief Pakistan**

## Credits

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## Disclaimer

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Relief, or its board of Executive Directors.

Though careful efforts have been made to ensure the correctness and accuracy of data, analysis and assessment presented in this report with proper references and quotes, readers must understand that future climate change events may not be realized as estimated, and the past occurrences may not necessarily guide the future scenarios.

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## Forward

Pakistan has been receiving wake up calls about the rapidly changing climate and extremely unpredictable weather patterns. The country has been hosting droughts, long dry spells, extreme rainfalls and snowfalls and most recently a flood that affected roughly 33 million people.

The country can't bear the financial, emotional and human cost of climatic changes happening at an alarming pace. Even the enchanting wilderness is being affected in a way no one ever imagined of. As it continues to reshape our planet, forecasts paint a disturbing image of the future.

In case of the recent floods, the recovery has been slow due to thin resources making lives more difficult for the poor. Considering it to be the biggest challenge of our time, Islamic Relief has been actively advocating for climate justice and rights of the people of Pakistan alongside putting in efforts to bring a lasting change in practices and behaviors.

Through 'Voices Organized for Climate Change, Advocacy and Lobbying' (VOCAL), a nationwide campaign, we are bringing all stakeholders including media, civil society, academia and government to unite for a decisive climate action.

Sindh being at the forefronts has been paying a big climate cost with communities migrating to safer areas and diminishing livelihoods making the poor poorer. 'Climate Sensitive Livelihood Modeling' (CSLM) aims to minimize the impact of

climate change in the coastal areas of Sindh by enabling the communities for climate adaptation.

This research under the CSLM project is the bedrock for future adaptation

plans and climate resilient frameworks to carve footprints for interventions in the coastal areas impacted by climate change. In addition to that, the study will improve the capacities of local government and communities simultaneously strengthening the coordination between different stakeholders for a lasting and tangible change.

This study is an embodiment of IR's commitment to knowledge creation for viable future planning and community empowerment initiatives for long term development in areas where it matters the most.

With challenges mounting, these efforts and contributions by Islamic Relief are directed to make Pakistan a Climate Resilient country and equipping it with the right skills and knowledge to create better and safer tomorrow.



Asif Sherazi  
Country Director,  
Islamic Relief Pakistan

## Acknowledgment

It is indeed a great privilege for us to present this report on "*Climate vulnerability and capacity assessment*", which was developed following series of focus group discussions, questionnaire surveys with the target communities in Malir and Thatta districts and key informant interviews conducted with number of government and non-governmental organizations within the province, districts, and local levels.

We are sincerely grateful to all those who contributed to the development of this report starting with the efforts made by the Consulting Firm, the Network of Disaster Management Practitioners (NDMP) and Department of Geography, University of Karachi for providing technical assistance and steering the process. It would not have been possible to develop this report without the technical backstopping of Mr. Zahid Ali Shah (Senior Research & Advocacy Officer IRP - Islamabad); Muhammad Raza Hussain Qazi (Advocacy and Campaigns Specialist, IRP-Islamabad); Mr. Bashir Ahmed Waseem (Programme Coordinator, IRP-Karachi office); & Sarmad Iqbal Manager (Strategic Partnerships & Business Development IRP-Islamabad); who provided valuable feedback and expert opinions to contextualize the report in accordance with IR Pakistan's requirements.

At the Islamic Relief Head office level, we are sincerely thankful to Mr. Raza Narejo, Mr. Farooq Masih, Ms. Shahida Parveen, Mr. Muhammad Asif Iqbal, Ms. Zahra Khan, &

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Additionally, the development of this report would not have been possible without the valuable cooperation and contributions of the target communities and key informants who shared their concerns and suggestions openly during the FGDs and KIIs. Thanks also goes to NDMP staff Mr. Abid Hussain research officer who were providing bridge between IRP field staff and responsible for providing logistic support for field staff.

Last but not the least, special thanks are due to Islamic Relief USA for providing financial support in the preparation of this report.

## List of Acronyms

<b>CO</b>	Community Organization
<b>CRI</b>	Climate Risk Index
<b>CSLM</b>	Climate Sensitive Livelihood Modeling
<b>CVCA</b>	Climate Vulnerability and Capacity Assessment
<b>FGD</b>	Focus Group Discussion
<b>GBV</b>	Gender Based Violence
<b>GHG</b>	Green House Gases
<b>GDP</b>	Gross Domestic Product
<b>IDR</b>	Indus Delta Region
<b>INGO</b>	International Non-Government Organization
<b>IPCC</b>	International Panel of Climate Change
<b>KII</b>	Key Informant Interview
<b>NGO</b>	Non-Government Organization
<b>NHN</b>	National Humanitarian Network
<b>NIC</b>	National Identity Card
<b>PMD</b>	Pakistan Meteorological Department
<b>PRA</b>	Participatory Rural Appraisal
<b>PWD</b>	Persons With Disabilities
<b>SCAN</b>	Sindh Climate Action Network
<b>UC</b>	Union Council
<b>UNDRR</b>	United Nation Office for Disaster Risk Reduction
<b>UNISDR</b>	United Nation International Strategy for Disaster Reduction



## Executive Summary

Pakistan ranks 5th in position worst affected by climate change. In terms of provinces within the country, Sindh is among the most affected province. Hydro-meteorological hazards such as torrential rainfall, flooding, cyclones, droughts, and heat waves have increased in frequency and severity as a result of changing trends in temperature and precipitation. In the current year, unprecedented rainfall and flooding have caused a wake-up call for policy and decision-makers to acknowledge the reality that climate change is real and will severely affect Sindh in the long run if concrete measures are not taken for climate change mitigation and adaptation.

In light of the importance of studying climate change issues, this specific study has been conducted to assess the vulnerabilities and capacities of coastal communities in district Malir and Thatta in relation to climate change. Ultimately, the purpose of the study is to analyze the existing vulnerabilities and community-based adaptation mechanisms to climate change, which will enable the design of community-based adaptation plans to address climate change issues.

In order to achieve the desired objectives, detailed field surveys were conducted in August-October 2022 in nine selected villages of district Malir and Thatta. To examine the vulnerability and adaptive capacities available at the local level, focus group discussions, questionnaire surveys

and key informant interviews were conducted. A total of 260 community respondents attended the FGDs and questionnaire surveys, including 138 males (53%), 99 females (38%), 23 persons with disabilities (8.84%). Aside from the FGDs and questionnaire surveys, detailed discussions were conducted with key informants who are involved directly or indirectly in climate change adaptation, disaster management, and coastal development. A total of 10 KIIs were also conducted with key representatives of government and non-government organizations to identify climate vulnerabilities, existing adaptive capacities, and note recommendations. After field surveys, detail analysis was carried out to assess vulnerable groups and elements with emphasis on impact of climate change on livelihood, food security and water resources, types of vulnerabilities observed due to these climatic changes and further to assess the adaptive capacities to examine the community resilience for climate change adaptation.

According to the key findings, certain recommendations have been made in the form of community adaptation plan to assist Islamic Relief Pakistan in drawing doable actions that need to be taken for reducing their vulnerabilities as well as strengthening their adaptive capacities to develop a climate-sensitive culture within the province.

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# 01

## Introduction



# 1. Introduction

## 1.1 Brief About the Islamic Relief

Islamic Relief is a UK based International Non-Governmental Organization (INGO) providing humanitarian aid during emergencies and working for the long-term development of the world's poorest people. In Pakistan, Islamic Relief started its operations in 1992 and is currently working through its offices in Azad Jammu & Kashmir, Khyber Pakhtunkhwa, Sindh, Balochistan & Punjab provinces. The main focus areas are sustainable livelihoods, water and sanitation, orphans' welfare, microfinance, health, climate change and disaster preparedness and response. Protection and Inclusion are cross cutting themes across all projects.

## 1.2 Introduction to the CSLM Project

Currently IRP-Pakistan is implementing a 30-months project on "Climate Sensitive Livelihood Modeling (CSLM)" in district Malir and Thatta of Sindh Province. The main objective of the project is to strengthen the communities living in the coastal belt of both districts, who have been impacted by climate change and are exposed to number of hydro-meteorological hazards intensified by the climate change. The project is working on three thematic areas including (a). Advocacy for climate change adaptation and governance (b). Livelihood and food security and (c). Water resource management, while climate change and disaster risk reduction are cross cutting themes in all three thematic areas mentioned above. Under the project, the key interventions are enlisted below:

### 1.2.1 Advocacy for Climate Change Adaptation and Governance

- Formation/reactivation of farmer groups under community structures having participation of vulnerable men and women in marginalized communities.
- Advocacy & social mobilization and capacity building of partners/stakeholders to effectively influence the governance structures for response to climate change.
- Community mobilization sessions and awareness campaigns on climate change and resilience at local levels.
- Awareness raising of/with CSOs on climate change, role of citizens, different tiers of governance and civil society organizations.
- Organizing district level seminars to develop case studies to be presented to policy makers and other stakeholders.
- Public dialogues on climate change and its impacts at UC, taluka and district levels.
- Awareness raising sessions on climate change with academia/universities.
- District level consultation and policy briefing for government on impacts of sea intrusion, desertification, heat waves, floods and other challenges on land and communities.
- Provincial consultations/interface meeting between community/farmers groups, civil society, media and government departments (to present community informed challenges to policy



makers and other stakeholders).

- Promoting farmer associations to effectively engage with district line departments.
- Establishing and strengthening networks with special focus to support youth from academia.
- Technical support extended to government on formulation of policy mechanisms/ response on impacts of climate change leading to food insecurity, water & its impacts on land and communities.
- Joint events with government for planning, reviews and reporting on climate change impacts and its adaptation including climate sensitive implementation plans.
- Developing and strengthening linkages between government and academia through joint initiatives on environmental awareness, protection and promotion of climate rights of vulnerable communities.
- National/Provincial Conference in collaboration with Government of Sindh for resource mobilization for their plans.
- Promotion of backyard poultry farming in rural areas through community participation.
- Promotion of saline resistant resilient crop varieties.
- Micro-enterprise development grants/vocational training and grants.
- Business associations capacity building and linkage development support.
- Exposure visits for resilient cropping awareness to academia and research centers.
- Formation of crab/shrimp farms to diversify livelihood sources.

### 1.2.2 Livelihood and Food Security

- Promotion of climate resilient home-based gardening practices for household level food self-sufficiency.
- Sustainable fodder management practices.
- Promotion of improved livestock breed.
- Promotion of saline agriculture practices including hurry plantation to be grown on slightly saline water and land.

### 1.2.3 Water Resource Management

- Demonstration and promotion of ecological use of water resources through installation of safe drinking water systems, provision of micro-irrigation system and conservation of rain water with emphasis upon use of saline water for cultivation and low water crops.
- Demonstration and promotion of furrow irrigation and raised bed agriculture techniques.
- Reduce seepage and leakages of water in existing irrigation channels, distributaries/ minors through appropriate conservation techniques.
- Engaging academia, line departments, counterparts and farming communities to review existing practices of water conservations and collect expert input for program continuity with respect to integrated water resources management and saline agriculture.
- Trainings of farmers on appropriate land

levelling practices and crop water requirements.

- Organizing village level seminars, meetings on water conservation and management.

### 1.3 Objective of the Climate Vulnerability and Capacity Assessment (CVCA)

The primary objectives of the CVCA are to:

- Evaluate vulnerabilities and community-based coping and adaptation mechanisms to climate change.
- Develop understanding on how climatic changes have affected the livelihoods, water resources, food security, and social services of coastal communities.
- Develop a community adaptation plan to improve the adaptive capacity and resilience of vulnerable coastal communities.
- In addition to the primary objective, the study has the following secondary objectives:
  - Improve the delivery of services and create close coordination with communities in order to acclimate the climate change adaptation plans in selected sectors, including food security, livelihood, water management, and social services, by strengthening local governments and line departments.
  - Additionally, the study will assist think tanks, researchers, civil society and academia in bridging the gaps and guiding local stakeholders in designing strategies to reduce the impacts of disasters, enhance resilience, and adapt

policy-supported interventions.

### 1.4 Key Research Questions

While designing the data collection tools and deriving key findings, the following questions were set forth:

- What are major climate induced hazards and its relationships with the climate change?
- What types of changes have been observed during last 20-25 years in terms of its severity, frequency and magnitude and mode of destruction?
- Who are most vulnerable to climate change and how and why they are more vulnerable?
- What is the impact of climate change on livelihood, food security, and water resources?
- What types of changes observed in land use pattern (for example, introduction of new type of crops or changing agricultural land to built-up areas or sea erosion etc.)?
- What is the community coping mechanism to the climate change?
- What types of adaptive measures were available 20-25 years back and what are resources available or missing at the local level?
- What are diversifying livelihoods sources that help in reducing dependency on climate-sensitive resources?
- What are sustainable measures that can help in protecting and managing food, water and livelihood resources?
- What should be the community plan to

adopt to climate change?

### 1.5 Selection of the Study Area

A simple random sampling techniques were used to select villages situated in the coastal areas of district Malir and Thatta. There are number of villages situated in the coastal areas that are at constant risk. However, we preferred to select villages where the Islamic Relief Pakistan is implementing various interventions with the Community Organizations (COs) and which are very vulnerable to climate change. Among 20

target villages in four UCs of district Thatta and Malir, nine villages were randomly selected, where the COs are actively working, and where climatic changes are threatening their food security, livelihoods, and access to fresh water. These FGD sessions and questionnaire surveys attracted 260 community members, including 138 males, 99 females, and 23 persons with disabilities. Table 1.1 and Figure 1.1 provide a list of villages selected from both districts.

*Table 1.1: List of villages selected for focus group discussions and questionnaire surveys in district Thatta and Malir*

District Thatta								
S. No	Name of Village	Union Council	Taluka	Male	Female	PWDs		Total
						Male	Female	
1	Habib Khaskheli	Khagan	Mirpur Sakro	14	04	-	-	18
2	Muhammad Sadiq Kathyaar	Kakran	Mirpur Sakro	20	08	01	-	29
3	Natho Khaskheli	Kakran	Mirpur Sakro	12	08	05	04	29
4	Ismail Mallah	Ghanghaar	Mirpur Sakhro	28	13	03	01	45
5	Longkhan Seekhio	Ghanghaar	Mirpur Sakhro	20	20	02	01	43
6	Gul Hassan Sammo	Khagan	Mirpur Sakro	17	04	-	-	21
<b>TOTAL RESPONDENTS</b>				<b>111</b>	<b>57</b>	<b>11</b>	<b>6</b>	<b>185</b>
District Malir								
7	Samo Goth (New Abaadi)	UC-07	Gadap	07	16	02	-	25
8	Samo Goth (Old Abaadi)	UC-06	Gadap	13	10	-	-	23
9	Kohat Colony	UC-06	Bin Qasim Town	07	16	04	-	27
<b>TOTAL RESPONDENTS</b>				<b>27</b>	<b>42</b>	<b>6</b>	<b>-</b>	<b>75</b>

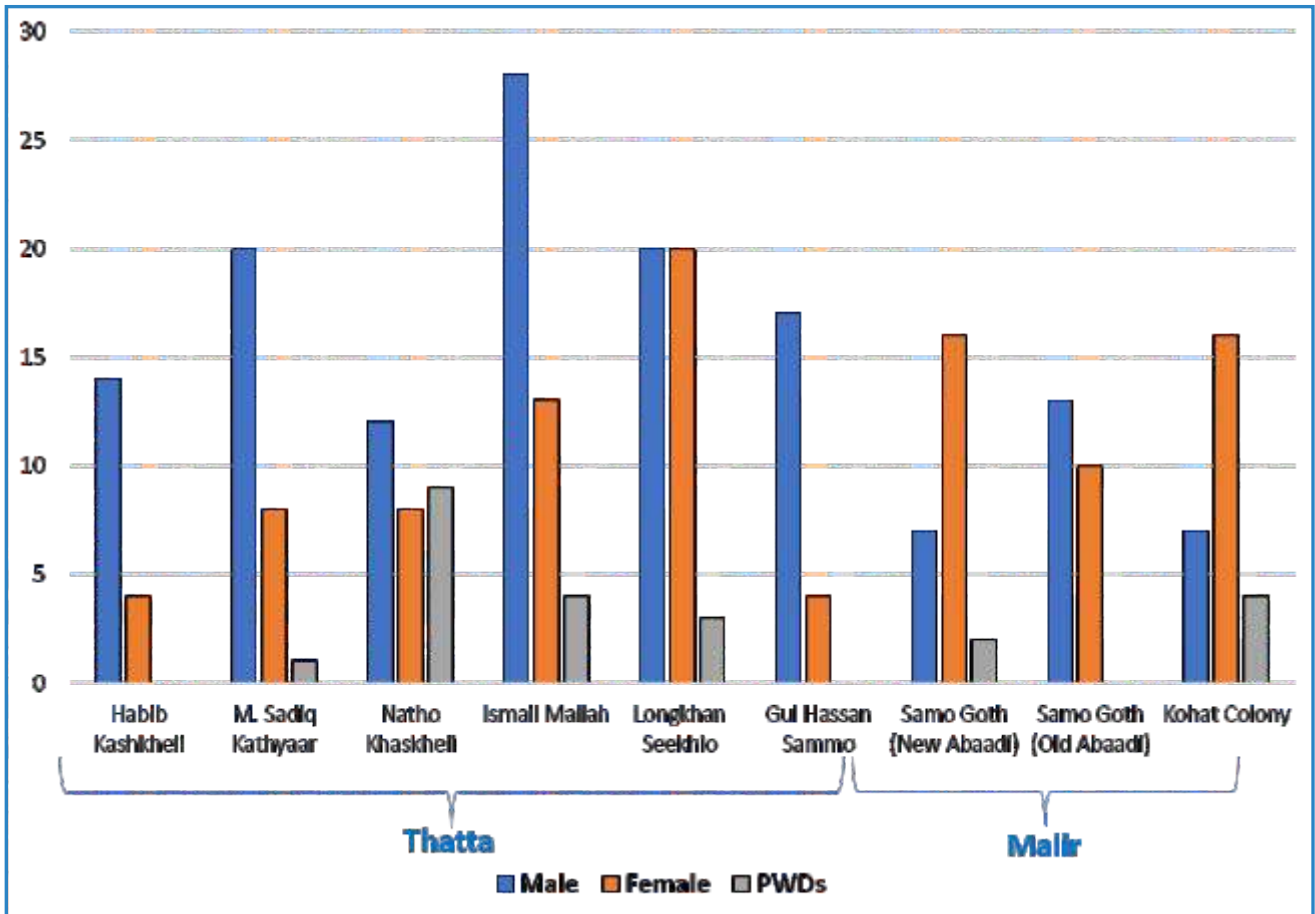


Figure 1.1: Number of community respondents attended the FGDs and questionnaire surveys in 09 selected villages

As far as, the Key Informant Interviews are concerned, those organizations were selected that are directly or indirectly dealing with the climate change adaptation, disaster management and coastal development issues. A total of 10 KIIs were conducted to know the climate vulnerabilities, existing adaptive capacities and their recommendations that can be included in the report. The key informants and organizations are listed below:

- Dr. Sardar Sarfaraz, Chief Meteorologist, Pakistan Meteorological Department Karachi
- Akhlaque Ahmed Qureshi, Director General, Environment Climate Change

and Coastal Development Department

- K. B. Behrani, Deputy Director, Social Welfare Department Thatta
- Dr. Waqar Ahmed and Dr. Zafar Iqbal Shams, Assistant Professors, Institute of Environmental Studies, University of Karachi
- Dr. Salman Zubair, Assistant Professor, Department of Geography University of Karachi
- Ghulam Mustafa Mirani, Chairperson, Pakistan Fisherfolk Forum Karachi
- Amjad Baloch, Regional Head Strengthening Participatory Organizations (SPO) and Sindh Climate

Actions Network (SCAN), Hyderabad

- Mir Muhammad Baloch, National Rural Support Programme Sindh
- Ahmed Khan Soomro, District Coordinator, Sindh Rural Support Organization Thatta
- Ilimuddin Rind, Ali Muhd Jat and Rehmat Ullah Bukero, Young Social Network Thatta

### 1.6 Research Team

An assessment of climate vulnerability and capacity was conducted by a multidisciplinary research team from the Network of Disaster Management Practitioners (NDMP), the lead consulting firm, together with the Department of Geography, University of Karachi as collaborating partner. The team included faculty member and research students of the Department of Geography under the supervision of team lead from NDMP. Data collections in the field were conducted by these researchers to promote quality research. Prior to send research team into the field, they participated in a one-day training workshop on the use of "participatory rural appraisal tools" and pilot testing. Overall, the research team was involved throughout the processes namely, desk review study, development of data collection tools, field surveys, data analysis and interpretations, participation in one-day lesson learns workshop at the University of Karachi, and the writing of this report.

### 1.7 Research Limitations

There were certain limitations that create hinderances while conducting the field work and writing this report:

- The major delay was caused due to unprecedented rainfall followed by the flooding in Sindh during the month of August and September, due to which the target communities in both districts were badly affected and they were forced to take shelters in the shelter places. Therefore, it was not possible to conduct FGDs and questionnaire surveys during those critical days.
- For conducting the scheduled KIs, the respective key stakeholders were not been able to give us time for interviews as they were all engaged to deal in flood emergency response and relief operations.
- Due to lack of awareness about climate change and further because of the recent flooding, the communities were mentally under stress, as result of which, some of community responders did not show enthusiasms and eagerness to share open information.
- The government capacities for climate change mitigation and adaptation are very limited and there was nothing important information to share at their end. Infact the latest data was not hardly available in concerned offices.

### 1.8 Ethical Considerations

While conducting survey in the field and writing report, there was utmost efforts to consider the ethical procedures. These considerations are as follows:

1. **Voluntary Participation** by the locals was observed while conducting this study. All community respondents were free to opt in or out of the study at any point of time.

2. **Informed consent:** The respondents were informed about the purpose, benefits, risks, institutional approval and about partner organizations behind the study before they agree or decline to join.
3. **Anonymity** was guaranteed by not collecting any personal information of the respondent e.g. Name, phone number, email, NIC number, and physical characteristics e.g., personal liking or disliking etc.
4. **Confidentiality:** All the participants were ensured that their data will be kept confidential and would not be shared nor disclosed in front of other participants
5. **Potential for harm:** All the participants were informed about all the possible sources of harm (emotional, psychological etc.,) prior to the questionnaire and FDG surveys were conducted.
6. **Results Communication:** All the results obtained by this study have been communicated with all the stakeholders and will be available for common people. It was strictly observed to avoid plagiarism and research misconduct at any point of time for this study.



# 02

Climate Risk Scenario in  
Pakistan with Focus on Sindh  
and Coastal Areas



## 2. Climate Risk Scenario in Pakistan with Focus on Sindh and Coastal Areas

### 2.1 Sindh Province at a Glance

Stretching over an area of 140,914 sq.km of land<sup>[1]</sup>, the province of Sindh has a population of 47.9 million people<sup>[2]</sup>. Sindh experiences hot weather in the summer and mild to warm weather in the winter. In the northern and higher altitude areas, temperatures frequently reach up to 46°C during May and August, while temperatures rarely reach 2°C during December and January. However, in some part of the province i.e., Jacobabad and Dadu, the daytime temperature frequently cross 50°C during summer months. The annual average rainfall is about seven inches, falling mainly during July and August. The southwesterly monsoon wind begins at the end of July and continues until the end of September. In the contrary, the cool northerly wind blows during the winter months from October to January<sup>[3]</sup>. The province has an around 320km coastline stretching eastward from the Hub River in Balochistan to Sir Creek along the Indian border. One of the peculiarities of the region is the Indus delta/creek system. This spreads over about 85% of the coastal area and is home of mangrove vegetations which considered among the world's top 10 mangrove forests. Furthermore, the coast provides a source of livelihood for those who have lived in the area for centuries. Some of talukas in district Malir, Keamari, Karachi South, Korangi, Thatta, Badin and Sujawal are situated along the coastline. These talukas are exposed to different types of threats related to the sea abnormalities and climate change.

The people living in the coastline are normally engaged with fish catching, though with a small percentage engaged with agriculture and allied professions. About 79% of population are estimated to live below the poverty line<sup>[4]</sup>. The region offers tremendous investment and development opportunities due to its picturesque mangrove forests, pristine natural resources, and fertile Indus delta. During the last 20-25 years, the region has been exposed to a number of climate and non-climate stressors, as well as experiencing a number of natural and human-induced disasters that are becoming more frequent and aggressive due to climate change and sea disturbances.

### 2.2 Impact Of Climate Change In Sindh Province

According to the Global climate risk index 2021, Pakistan is the 5<sup>th</sup> at risk country badly affecting by the climate change (Table 2.1)<sup>[5]</sup>, while Pakistan emits only 0.43% of the World's total greenhouse gases and is on 135<sup>th</sup> position in the world's ranking<sup>[6]</sup>.





Table 2.1: The long-term climate risk index (CRI) of top ten countries most affected by the climate change during 2000 to 2019 (annual averages)

CRI 2000-2019 (1999-2018)	Country	CRI score	Death toll	Deaths per 100,000 inhabitants	Total losses in million US\$ PPP	Losses per unit GDP in %	Number of events (total 2000-2019)
1 (1)	Puerto Rico	7.17	149.85	4.12	4149.98	3.66	24
2 (2)	Myanmar	10.00	7056.45	14.35	1512.11	0.80	57
3 (3)	Haiti	13.67	274.05	2.78	392.54	2.30	80
4 (4)	Philippines	18.17	859.35	0.93	3179.12	0.54	317
5 (14)	Mozambique	25.83	125.40	0.52	303.03	1.33	57
6 (20)	The Bahamas	27.67	5.35	1.56	426.88	3.81	13
7 (7)	Bangladesh	28.33	572.50	0.38	1860.04	0.41	185
8 (5)	<b>Pakistan</b>	<b>29.00</b>	<b>502.45</b>	<b>0.30</b>	<b>3771.91</b>	<b>0.52</b>	<b>173</b>
9 (8)	Thailand	29.83	137.75	0.21	7719.15	0.82	146
10 (9)	Nepal	31.33	217.15	0.82	233.06	0.39	191

Sindh is considered as the worst affected province by extreme weather events that are the classic manifestations of climate change. During the current year, the unprecedented rainfall and flooding in Karachi and overall, in Sindh is an eye opener for the policy and decision makers to accept the fact that climate change is reality and shall seriously affect Sindh in long term if concrete measures were not taken for climate change mitigation and adaptation. The following paragraphs discuss the visible impacts of climate change in Sindh<sup>[7]</sup>:

- **Sea level rise:** There is clear evidence that the sea level along the Karachi coast has raised approximately by 10 centimeters over the last century. Further, it is expected that the sea level will rise by 60 centimeters by the end of this century, which will most likely affect low-lying coastal areas in the south of Karachi toward Keti Bander and the Indus River delta<sup>[8]</sup>. There are approximately 10% of

Pakistan's population living in the coastal areas. These areas are at serious risk due to their marginalized status, primarily dependent on small scale fish catching and limited agricultural practices<sup>[9]</sup>. The other likely effects are coastal erosion, wetland and coastal plain flooding, inundation of deltaic plains, salinization of aquifers and soils, and a loss of habitats for fish, birds, & other wildlife and plants.

- **Tropical cyclones:** It is likely that tropical cyclones will become more frequent and intense as sea surface temperatures and wind systems become abnormal. It is possible for these cyclones to badly damage the coastal infrastructure, human and marine lives, which could adversely affect the exports from Pakistan that are largely dependent on Sindh province ports and its marine life. During the current and last centuries, some of major cyclones have reached in Sindh including May 1902, June 1926,

June 1964, November 1993, June 1998, May 1999, June 2007, and June 2014 cyclones<sup>[10]</sup>.

- **Unprecedented precipitation and flood disasters:** Over the past two decades, torrential rainfall and flooding

have significantly increased in magnitude and frequency. It is estimated that the province has been heavily affected by heavy rainfall and flooding during 2010, 2011, 2012, 2014, 2015, 2019, 2020, 2021, and most recently this year (Figure 2.1).

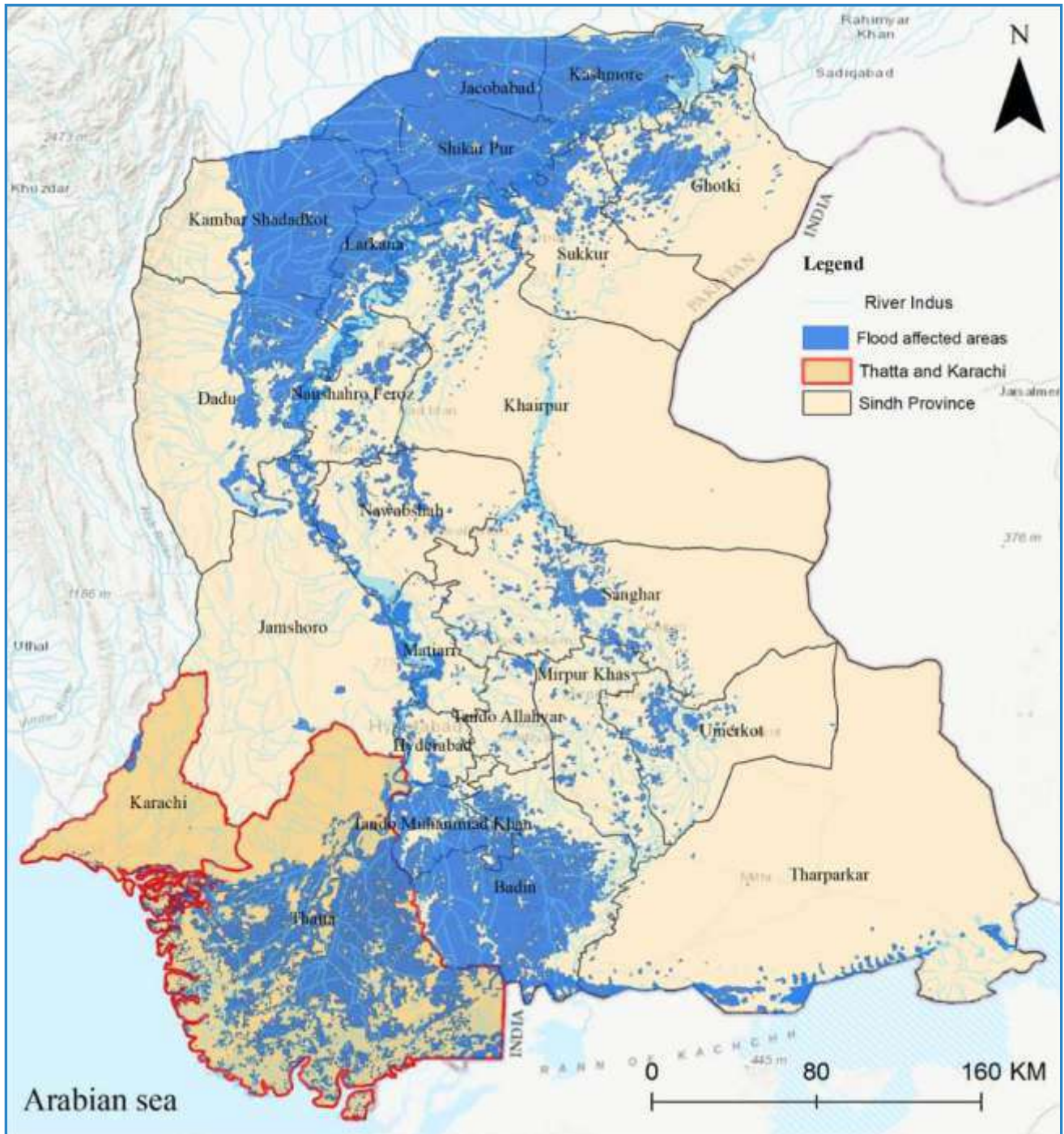


Figure 2.1: Map of Sindh showing the flood extent during September 2022<sup>[11]</sup>

Source: UNOCHA Website and Modified by the Department of Geography, University of Karachi - 2022

- **Increase in frequency of heat waves:** Over the past few years, Karachi has experienced a drastic increase in the frequency of heat waves during the hot summer season. It is expected that this trend will continue to increase during coming years. The city of Karachi experienced severe heat waves in June 2015, which resulted in over 1,200 deaths and over 50,000 cases of heat strokes<sup>[12]</sup>.
- **Sea water intrusion:** As sea level rises and storm surges originates, the saline water from the sea enters the rivers thus cause severe damages to the ecosystem. The impact includes threat to marine life, freshwater scarcity, erosion of agricultural lands, and damages to irrigation channels.
- **Coastal erosion:** Due to the frequent high tides and sea level rise, the fertile agricultural lands and infrastructure have been eroded along the coastal areas of Thatta, Sujawal and Badin districts. Because of continuous sea erosion as creeping hazard, the people live in these districts have lost their homes and agricultural lands as the sea has literally taken them away. According to the Geospatial Assessment carried out during period of 1989 to 2018, the Karachi coastline experienced  $2.43 \pm 0.45$  m/yr of erosion, while erosion on the western and eastern sides of Indus River reached  $12.5 \pm 0.55$  and  $19.96 \pm 0.65$  m/yr on average, respectively. Although the coastal erosion is widespread along the entire coastline, however, the rate of erosion is on increase from west to east in the Indus Delta Region (IDR), and the highest average erosion rate is 27.46 m/yr<sup>[13]</sup>.

## 2.3 Description of Study Area

As discussed above, the study was conducted in selected union councils of Malir and Thatta districts where Islamic Relief Pakistan has already undertaken project interventions. Therefore, we shall highlight some salient features of both districts in the following section:

### 2.3.1 District Thatta

District Thatta is located at a distance of 98 kilometers in east of Karachi on National Highway. It is divided into four talukas namely Thatta, Mirpur Sakro, Ghorabari, and Keti Bander (Figure 2.2). Due to the long coastline of about 107 kilometers, the district's southern part is saline and sea-affected. The district experiences a subtropical desert climate with hot climates throughout the year. Summers are long and last for about eight to nine months, whereas, winters are short and last for about three to four months. Summers are sweltering, humid, and windy. Winters are cool, pleasant, and dry; and the weather is mostly clear all year long. June is the hottest month while January is the coldest of the year. The average temperature during the course of the year fluctuates between 12°C and 39°C and rarely falls below 7°C or exceeds 42°C. Thatta typically receives about 15.77 millimeters of precipitation annually. According to the 2017 population census, the district had a population of 982,138, of which 510,143 were males and 471,958 were females. The rural population of the district was 805,662 (82.03%), while the urban population was 176,476 (17.97%). The total area of Thatta is approximately 8,570 sq.km while the population density is 114.60 person per sq.km<sup>[14]</sup>.



### 2.3.2 District Malir

Malir occupies almost 64% of Karachi Division's land area with an area of 2,160 sq.km, making it the largest district in the division. There are 1,924,346 inhabitants in the district, including 1,028,865 males and 895,329 females<sup>[15]</sup>. The density of population is 890.90 persons/sq.km. About 55.43% of the population of the district lives in urban areas. The district is characterized

by warm winters and hot summers due to its tropical climate. It has an arid climate, like the climate of Karachi, due to its location on the coast, which results in a relatively mild climate. The district receives heavy summer monsoon rains from July to September. The humidity levels are usually high between March and November (85%), while they are very low during the winter (58%) months.

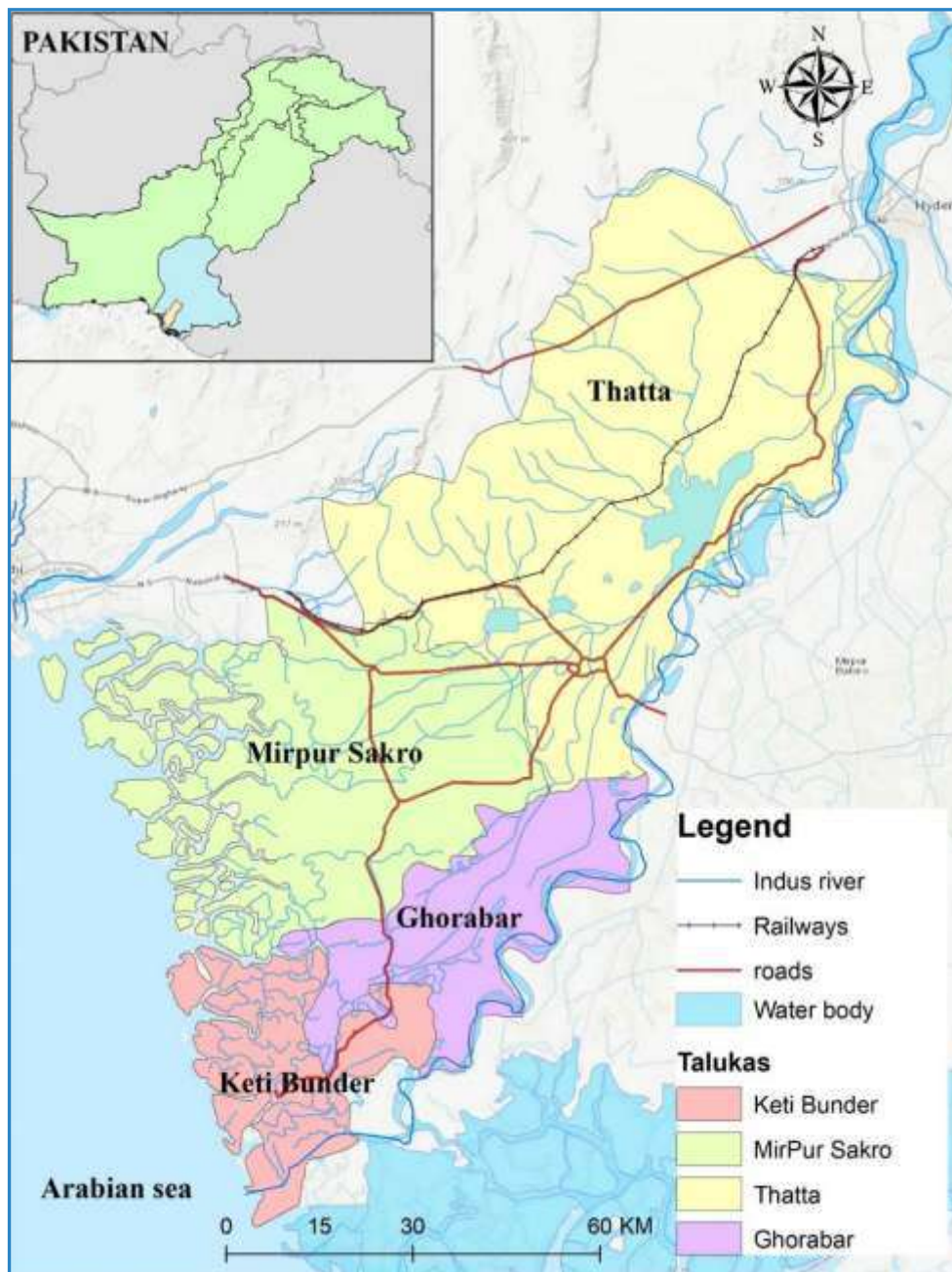


Figure 2.2: Geographical map of district Thatta

Source: Developed by the Department of Geography, University of Karachi - 2022



Figure 2.3: Geographical map of district Malir

Source: Developed by the Department of Geography, University of Karachi - 2022





# 03

## Process Followed for Climate Vulnerability and Capacity Assessment





## 3. Process Followed for Climate Vulnerability and Capacity Assessment

### 3.1. Explaining Basic Terms

It is necessary first to understand the basic terms of related to vulnerability and capacity assessment to gain clarity for further discussion.

**Vulnerability:** According to standard definition of the UNDRR; “vulnerability is the condition resulting from physical, social, economic and environmental factors or

processes that make an individual, a community, assets or systems more susceptible to the impacts of hazards”<sup>[16]</sup>. It is the result of exposure, sensitivity, and adaptive capability that determines vulnerability. To assess the vulnerability of an individual or a community, one must understand the factors that put dynamic pressures on people to live in hazardous areas.



*Figure 3.1: Living conditions at the household level*

**Exposure:** In accordance with the same source, exposure is defined as “the presence of people, livelihoods, species and ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, and cultural assets in areas

and settings that could be adversely affected”<sup>[17]</sup>. In other words, climate change impacts various elements such as geographical features, sectors, or populations to varying degrees.



**Sensitivity:** This is the degree to which a community will be positively or negatively affected by climate extremes. A location, a population, or a sector that is more susceptible to one or more climate stressors, namely exposure to hydro-meteorological conditions, such as temperature, precipitation, wind, etc., are likely to be more vulnerable<sup>[18]</sup>.

**Capacity:** As a general rule, capacity refers to the ability of an organization, community, or society to manage and reduce disaster risks and strengthen resilience in the face of disasters. There are several dimensions of capacity, including physical, social, economic, and attitudinal parameters.

A better word for the purpose of this study would be "adaptive capacity", which can be defined as the ability of individuals, communities, and institutions to reduce the adverse effects of climate extremes by taking appropriate actions using existing resources.



*Figure 3.2: Adolescent girls are more at risk of GBV and insecure conditions during the evacuation and at relief camps*



*Figure 3.3: Due to low adaptive capacities, the women and children are more exposed to extremes weather conditions*

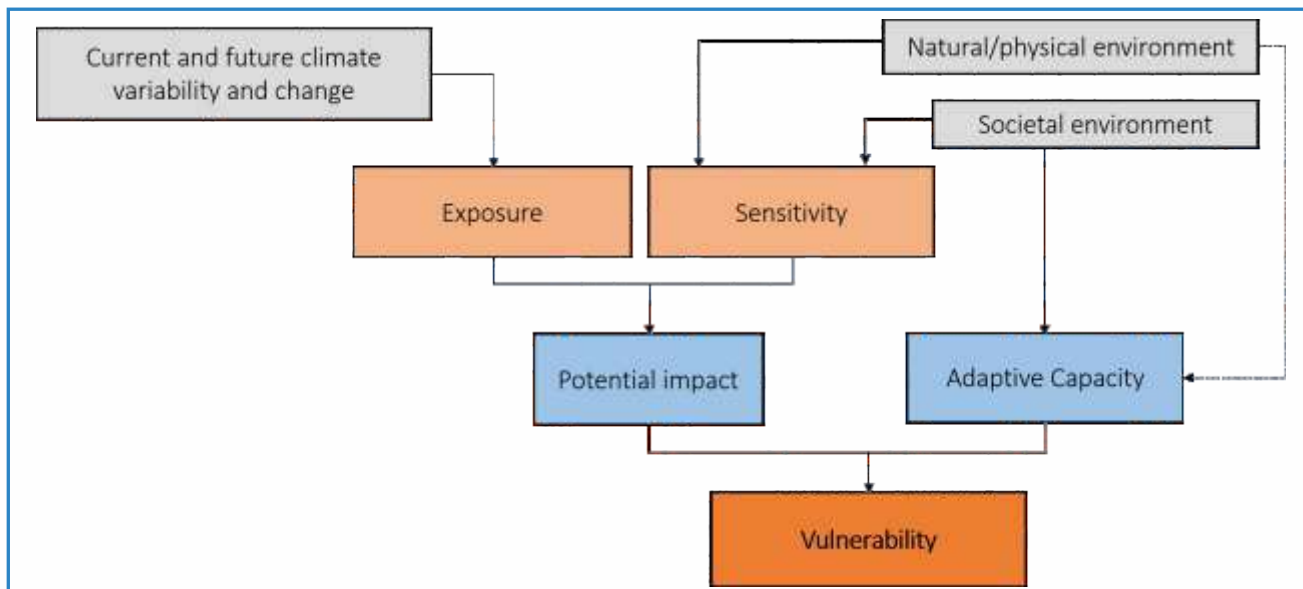


Figure 3.4: Components of vulnerability to climate change<sup>[19]</sup>

### 3.2 Methodology Adopted for Assessing Climate Vulnerabilities and Capacities

During the literature review, and consultation with various key informants, it was found that Sindh is one of the most affected provinces by the climate change. As such, visible impacts have already been identified and discussed in the previous section. The climate change has negatively impacted and thus tremendously increased the vulnerability of coastal communities. This has resulted in serious threats to their lives, properties, and livelihood sources.

Therefore, there is need to thoroughly assess and identify the root causes which are causing the communities to live in dilapidated conditions. In addition, it is imperative to assess the available coping mechanism of the affected communities. The detailed assessment of vulnerabilities and adaptive capacities will lead to suggest ways to enhance community resilience in response to climate change by strengthening their assets and adoptive

capacities. The figure 3.5 illustrates the methodology used for conducting the CVCA:



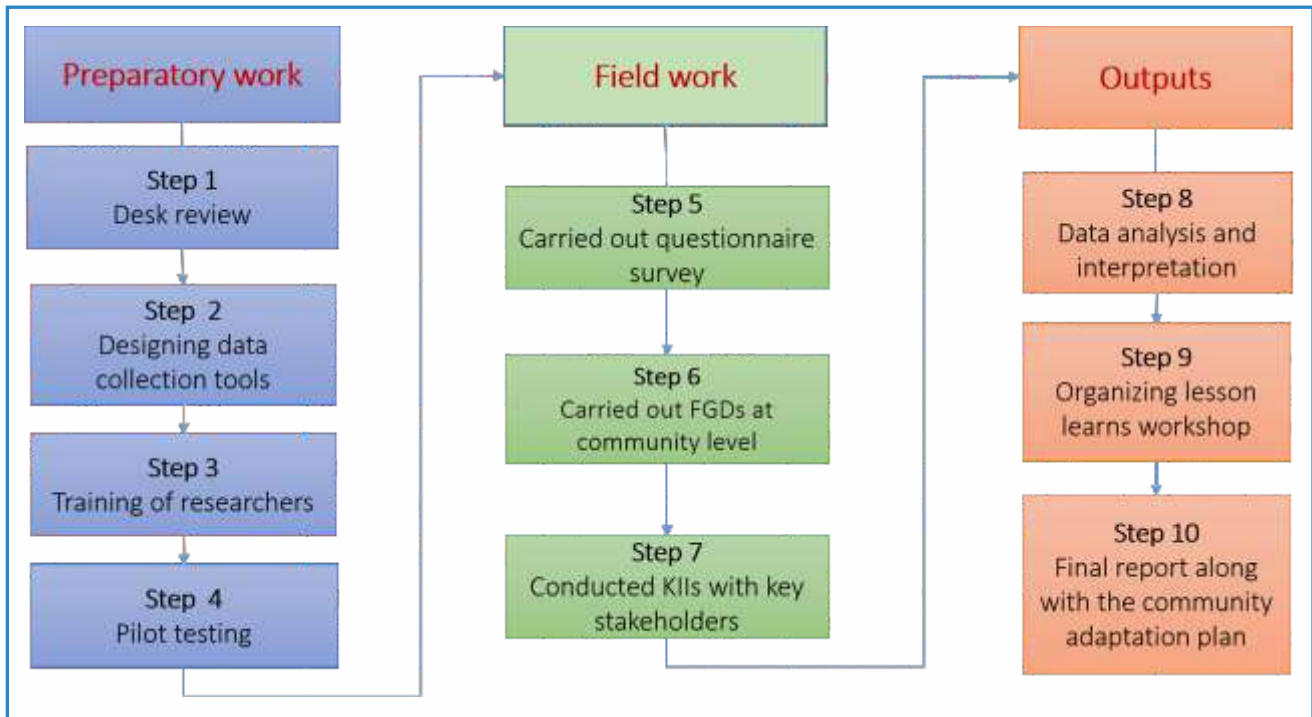


Figure 3.5: Schematic diagram for conducting the climate vulnerability and capacity assessment study

### 3.2.1 Desk review

A detailed desk review was conducted by reviewing the available project document, various research articles, international and national climate related strategies, action plans and assessment reports, etc. While reviewing the literature, key questions were in mind including;

- CVCA studies similar to those developed and conducted for a particular sector or area.
- Development of climate-related policies, strategies, and action plans for Pakistan and Sindh, particularly in relation to coastal development.
- Compilation of secondary sources of information such as physiographic features, demographic patterns, climate data, disaster profiles, and various types of maps.

- Publication of periodicals and research articles in international and national journals.
- Climate and disaster risk reports provide information on various risks associated with hydro-meteorological hazards in Sindh and the study areas.
- Study the historical records from past disasters which can provide useful information about the impact of disaster, vulnerabilities and coping mechanisms.
- Additionally, studying of various templates for designing questionnaires, focus groups discussion and key informant interviews.

### 3.2.2 Designing data collection tools

For this specific study, both the qualitative and quantitative data were derived using the following tools:



- The quantitative data were acquired through questionnaires survey, as well as reviews of statistical data available at various offices of Karachi, and Thatta and Malir districts. The questionnaire survey consists of both closed and open-ended questions which were used in nine villages with small group of community respondents. The quantitative analysis helped in drawing different graphs/charts and comparison of past and recent statistics.
- While the qualitative data were derived using focus group discussions and key informant interviews. In order to get maximum information about the climate related vulnerabilities and adaptive capacities, the well know Participatory Rural Appraisal (PRA) tools were used during the focus group discussions. For this purpose, the following PRA tools were used:

Name of Assessment Tool	Purpose	Sources of information
<b>Social and hazard mapping</b>	<ul style="list-style-type: none"> <li>• Become familiar with the physical characteristics and social characteristics of the community</li> <li>• Identify various hazards, specifically those related to climate change.</li> <li>• Determine the underlying causes of exposure and vulnerability</li> </ul>	<ul style="list-style-type: none"> <li>• Community respondents/volunteers</li> <li>• Members of the community organizations</li> </ul>
<b>Historical profile</b>	<ul style="list-style-type: none"> <li>• Observe and document the major changes caused by climate and weather disturbances, as well as the frequency and severity of disaster events in the community</li> <li>• Assess how diverse members of the community cope with and recover from shocks and stresses</li> <li>• Inform people about trends and changes over time</li> <li>• Keep a record of community observations regarding changes in hazards, exposures, and vulnerabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Community respondents/volunteers</li> <li>• Members of the community organizations</li> </ul>
<b>Seasonal calendar</b>	<ul style="list-style-type: none"> <li>• Analyze seasonal changes in activity patterns over time and document community observations</li> <li>• Identification of food security, livelihood and water management activities, as well as periods of stress and scarcity of livelihood resources</li> </ul>	<ul style="list-style-type: none"> <li>• Community respondents/volunteers</li> <li>• Members of the community organizations</li> </ul>

<p><b>Impact chain</b></p>	<ul style="list-style-type: none"> <li>Analyze the direct and indirect impacts of climate change on the target communities</li> <li>Analyze future trends and adaptation measures at the household and community levels</li> </ul>	<ul style="list-style-type: none"> <li>Community respondents/volunteers</li> <li>Members of the community organizations</li> </ul>
<p><b>Direct observation</b></p>	<ul style="list-style-type: none"> <li>Examine the changes that have occurred over time, specifically in agricultural, land use, livestock, and livelihood practices</li> <li>Evaluate the extent of recent and past floods and other major disasters</li> </ul>	<ul style="list-style-type: none"> <li>Community respondents/volunteers</li> </ul>

- Besides the FGDs, the qualitative data were also derived by interviewing key informants from the government and non-government sectors. As discussed above, total of 10 interviews were conducted with key informants by asking open ended questions and general discussions.

### 3.2.3 Organized one-day lesson learns workshop

During the consultation workshop, the team shared their learning while the audience also shared experiences on climate vulnerabilities and adaptive capacities, identified gaps, and shared case studies. The workshop was attended by 45 participants mainly from academia, district and taluka administrations, government and non-government stakeholders, and community representatives.

### 3.3 Validation of Data

It is extremely important to cross-check the validity of the data during the data collection, analysis and interpretation process. It was for this reason that the data were verified and triangulated with

secondary data sources obtained during visits to various government and non-government offices, KIIs, as well as through study of various research techniques. For example, the data and information collected from the coastal communities were verified with the local support organizations and community organizations. Specifically, perceptions and observations regarding climate change were compared to existing scientific data regarding climate change (data obtained from the Pakistan Meteorological Department regarding temperature and rainfall patterns, etc.).





Figure 3.6: (Above): Focus group discussion with women at the community level in district Thatta  
(Below): Direct Observation in District Thatta



# 04

Data Analysis,  
Interpretation and  
Key Findings



## 4. Data Analysis, Interpretation and Key Findings

This chapter will discuss the key points highlighted by community respondents during FGDs, questionnaire surveys and interviews with key informants from various government and non-government organizations.

### 4.1 Data Analysis and Interpretation

#### 4.1.1 General information about the impact of climate change on coastal communities

The questionnaire survey reveals that around 99% of the community respondents

agreed that the weather has changed over the last 20-25 years in the study areas of both districts (Figure 4.1). In addition, they responded that the rainy seasons have become more frequent, longer, and more aggressive as compared to the past years (Figure 4.2). Heavy rains are seriously damaging livelihood assets, especially the agriculture and livestock sectors. They also expressed that "Compared to the past, rainfall is now more unpredictable and can occur in months when it is not supposed to rain".

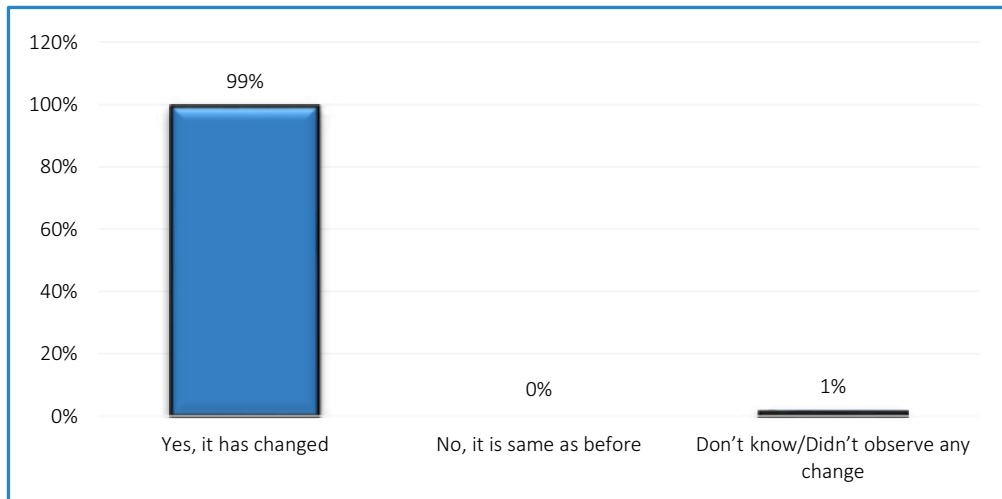


Figure 4.1: Observed changes in the climate and weather patterns

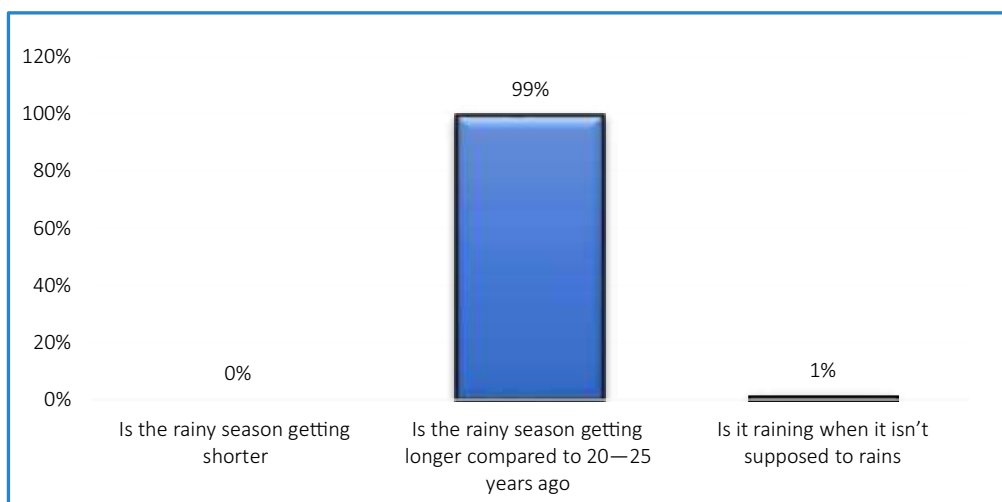


Figure 4.2: Observed changes in the rainy seasons



Besides, approximately 60% of respondents stated that the temperature in their villages and surrounding areas have been increasing over the past 20 - 25 years. Moreover, 40% of them expressed their concern that even though the winter season is shrinking by the

day, it is becoming cooler as compared to previous years. This is despite the fact that it is shrinking. In particular, they mentioned that January is particularly cold when cool breezes from the north enter the Karachi and Thatta areas (Figure 4.3).

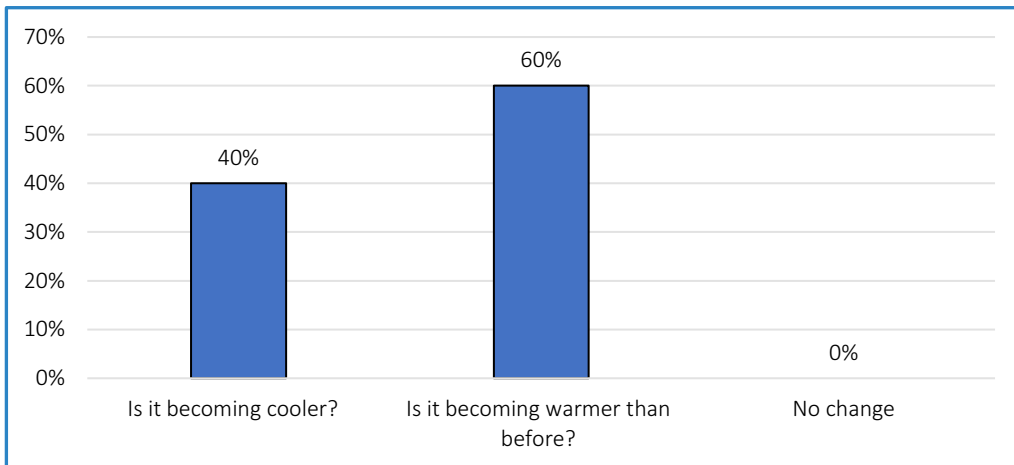


Figure 4.3: Changes in temperatures over last 20 – 25 years

Around 88% of the respondents mentioned about the sea level rise which has caused erosion in the coastal areas. Besides 13% of

the respondents mentioned that the sea has retreated at some places (Figure 4.4).

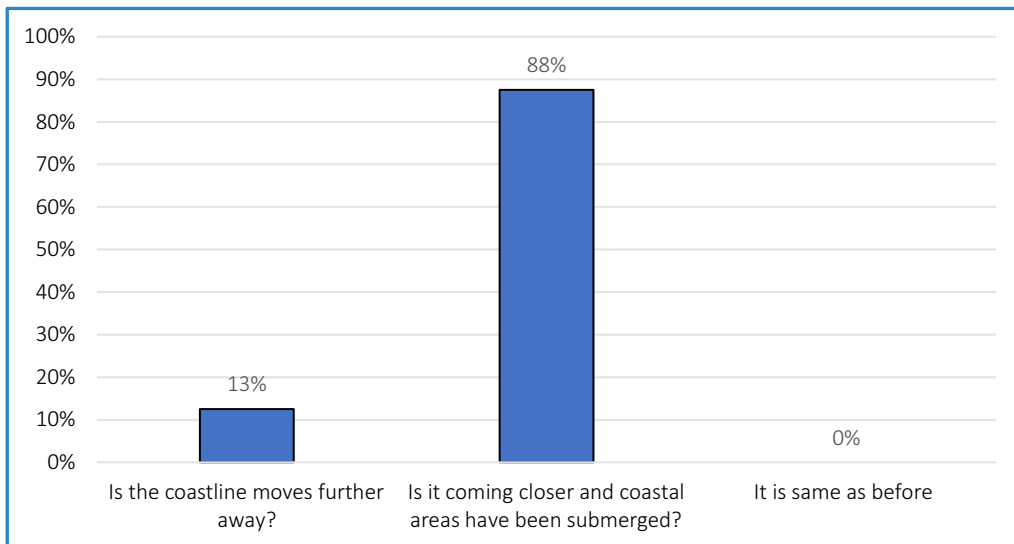


Figure 4.4: Observations about the sea level rise

#### 4.1.2 Climate induced hazards identification and prioritization

Besides the questionnaire survey, the

selected PRA tools were used during the FGDs in all nine target villages to assess potential hazards in the study areas,

including social and hazards mapping, direct observations, and historical profiles along with formal and informal discussion during the FGDs. The following observations were made:

The majority of respondents identified heavy rain and flooding as major hazards that severely affect their lives, properties,



Figure 4.5: Direct observations in Bin Qasim town, district Malir

and livelihoods. According to them, the frequency of heat waves and cyclones have increased in recent years, and these hazards are continuously threatening District Malir specifically. Community respondents said that they suffer from heatstroke more frequently during May and June due to the severe heat waves and high humidity.



Figure 4.6: FGDs with community respondents at village M. Sadiq Kathyar, district Thatta

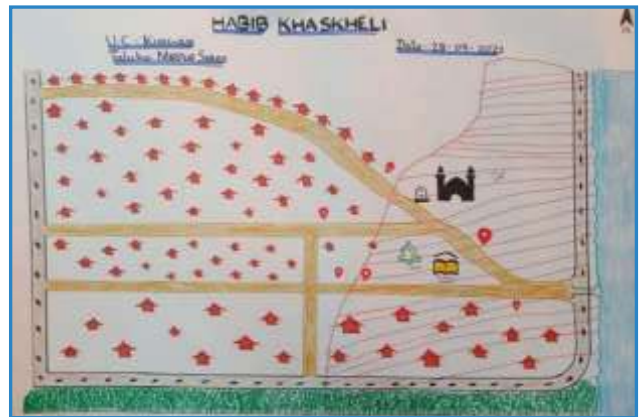


Figure 4.7: Social maps indicating hazard-prone areas in the study villages

During the hazard mapping and historical profiling exercises, they indicated that epidemics and locust attacks have become increasingly common over the last few years. In addition, snake bites, animal diseases, and human epidemics such as cholera, diarrhea, dengue, malaria, and typhoid are common during the monsoon season. In response to the question of

whether these hazards existed 20-25 years ago? It was mentioned that rain was equally prevalent in the past, but was not as aggressive as it is today. There are also more rainy days than previous years. In spite of the fact that 67% of the representatives indicated that hazards like cyclones and strong winds were more common in the past, the magnitude and

severity of cyclones are on the rise as a result of rising temperatures and sea disturbances. It was also mention that drought conditions prevailed more

frequently in the past than in recent days. Below is list of priority hazards identified during the FGDs exercise (Table 4.1).

S #	Type of hazard	No of villages considering these threats as the most affecting hazard (First in priority)	Whether the under mentioned hazards existed 20-25 years ago
<b>Primary Hazards</b>			
1	Heavy raining and flooding	9/9	Yes, in past it was not that much frequent and destructive as it is now
2	Heat waves and heatstroke	8/9	It was occasional hot days
3	Strong winds/cyclones	6/9	Occasional
4	Fire	5/9	Frequent
5	Drought	4/9	Yes, earlier it was more frequent though it is not that much frequent
<b>Other Secondary Hazards</b>			
1	Traffic accidents	8/9	Occasional
2	Epidemics including corona, & skin diseases	7/9	Frequent
3	Dengue	5/9	Frequent
4	Animal diseases	5/9	Occasional
5	Locust infestation	3/9	Occasional
6	Snake bites	3/9	Frequent
7	Thunderstorm/lightening	2/9	Occasional



Figure 4.8: Snake bite is serious threat during summer, flooding & raining season

The questionnaire survey indicates that approximately 26% of the community respondents mentioned that the quality of



Figure 4.9: Skin diseases are more common due to mosquito bites and allergies

water has changed as a result of frequent contaminations/water pollution and flooding. In addition, the community has

limited access to fresh water for drinking as well as for the irrigation practices. It was also reported that due to climatic changes;

fisheries trade has decreased by 22%, crop production by 26% and livestock grazing has decreased by 15% (Figure 4.10).

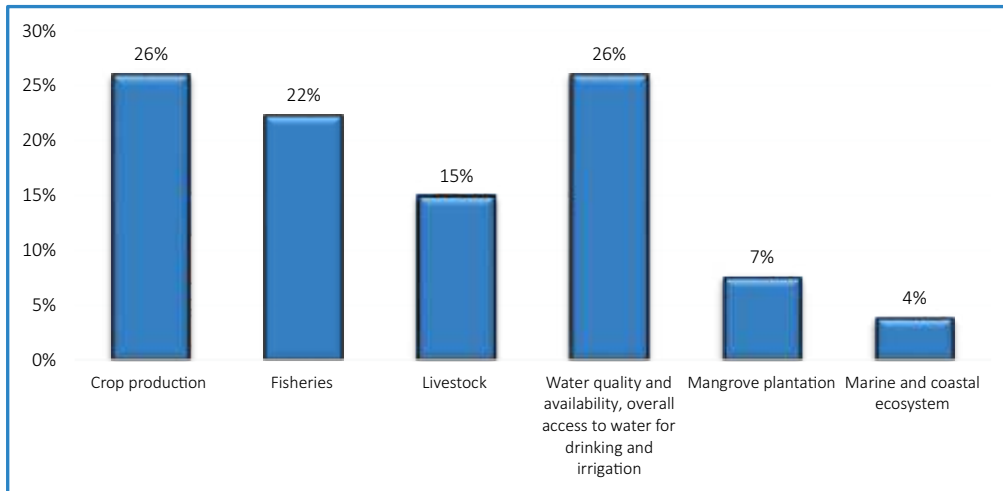


Figure 4.10: How climatic changes have affected the ecosystems

The figure 4.11 below summarizes the list of secondary hazards associated with the heavy raining and flood as primary hazards. The word primary hazards describe the major hazards which are main source of destruction and can trigger other secondary hazards e.g., earthquake is major hazard but collapse structures, aftershocks, landslides, fire, subsidence and epidemics can be secondary hazards which can generate due to primary hazard i.e., earthquake. The figure has been summarized based on the discussions during all 09 FGDs surveys.

### 4.1.3 Assessing vulnerabilities

According to the community respondents who participated in the questionnaire surveys, approximately 90% of farmers and fishermen are adversely affected by climatic changes. This causes them to migrate to urban or other areas to acclimatize and earn their livelihoods through other alternate sources. In addition, around 70% of elderly people were affected by the recent floods due to their exposure and sensitivity to extreme weather, the attack of epidemics caused by harsh weather, the evacuation, and limited financial resources (Figure 4.12).

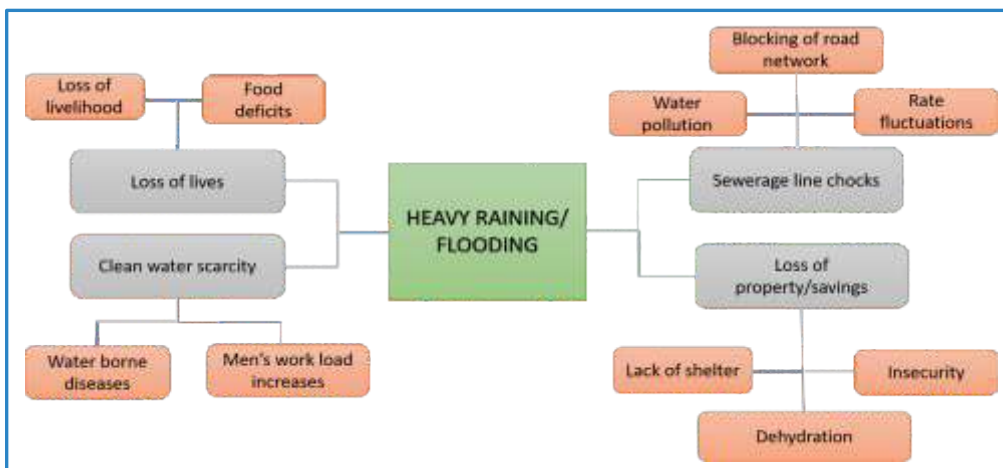


Figure 4.11: Impact chain exercise conducted with the community to find out primary and associated secondary hazards

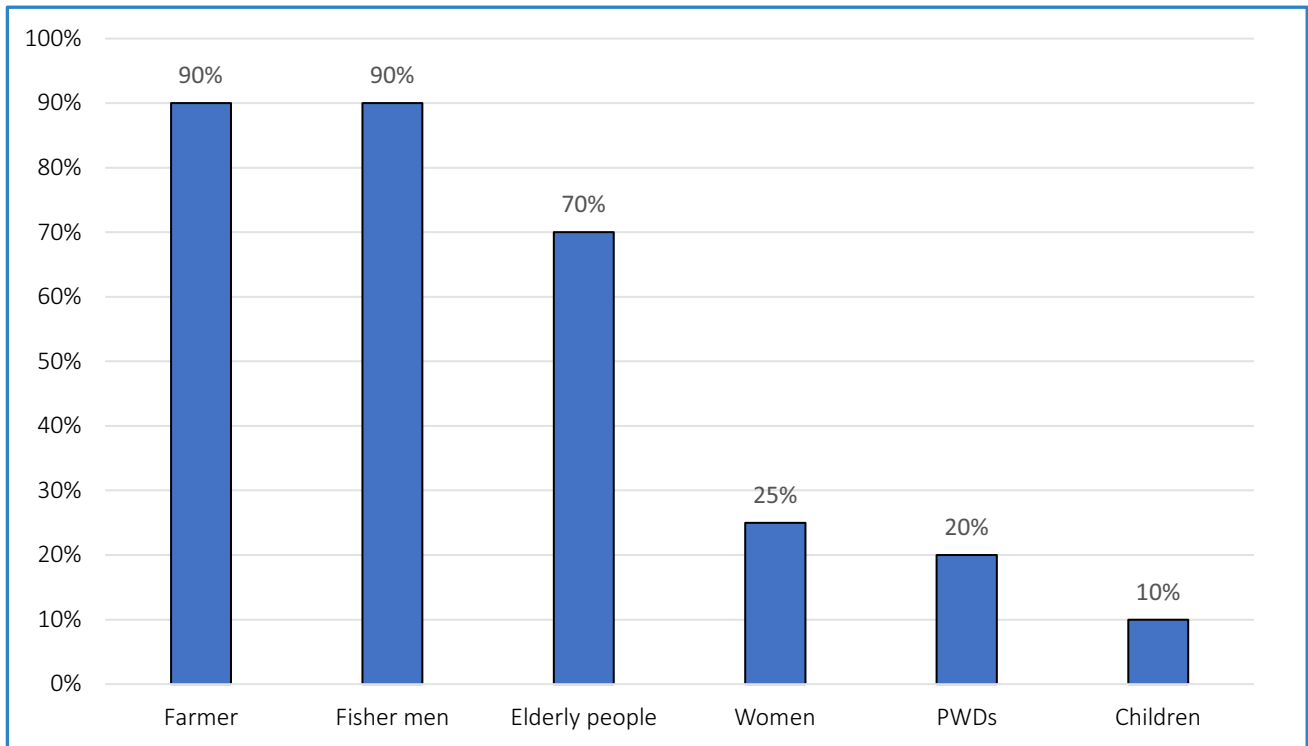


Figure 4.12: Identified vulnerable groups

The responsibilities of women have increased by 25% as they are not only responsible for looking after their families, but also supporting their male counterparts in earning their livelihood.

During recent unprecedented raining followed by flood exposed the vulnerabilities of persons with disabilities and elderly people also. According to the

survey analysis, 70% of elderly people and 20% of persons with disabilities were highly vulnerable to number of threats.

The housing conditions of the community respondents indicate that approximately 36% of residents live in straw and trash-made houses, 21% in Kacha houses, 29% in Semi-Pacca houses, and 14% in Pacca houses (Figure 4.13).

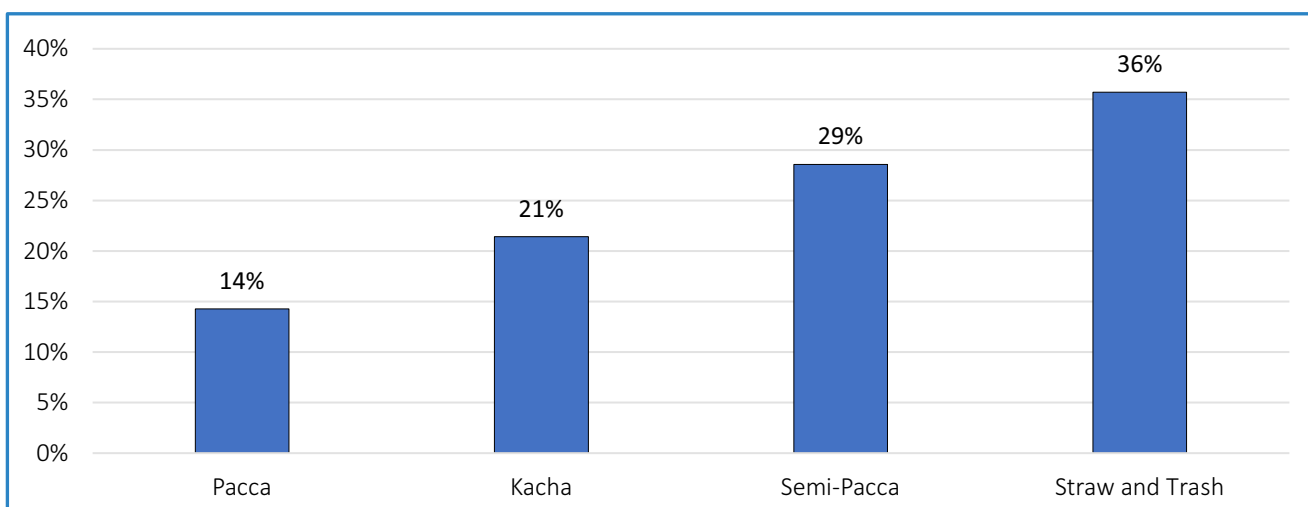


Figure 4.13: Types of houses at the community level





Figure 4.14: Fragile housing condition make people vulnerable to extreme weathers, strong winds and flooding



Figure 4.15: Children are more exposed to climate extremes

### Village-wise vulnerability index

According to the vulnerability index below, the villages are very vulnerable, and are at risk of hydro-meteorological hazards, particularly floods and heavy rains. Table 4.2 below gives details on the vulnerability index of the nine target villages. In general, all villages lack capacity compared to the

impact of the identified hazards. For calculating the vulnerability ranking of each village, the IPCC formula has been used. According to the formula, the value of exposure and sensitivity shall multiply, afterwards divided the results by the adaptive capacity. The resulting value is considered as vulnerability ranking of each respective village.

Table 4.2: The vulnerability index prepared during the PRA exercise with the community respondents

S #	Name of study village	Union Council	District	Exposure	Sensitivity	Adaptive capacity	Vulnerability Index	Vulnerability Ranking
1	Habib Khashkheli	Khagan	Thatta	4.5	5	2.5	9.0	Moderate vulnerability
2	Samo Goth (New Abaadi)	UC-7	Malir	5	6	4.5	6.7	Moderate vulnerability
3	Samo Goth (Old Abaadi)	UC-6	Malir	5	5	1	25.0	Very High Vulnerability
4	M. Sadiq Kathyaar	Kakran	Thatta	6	5	1.5	20.0	Very High Vulnerability
5	Natho Khashkheli	Kakrand	Thatta	4.3	3	1	12.9	High vulnerability
6	Ismail Mallah	Ghanghaar	Thatta	6	6	2	18.0	Very High vulnerability



7	Longkhan Seekhio	Ghanghaar	Thatta	5	5	3	8.3	Moderate vulnerability
8	Gul Hassan Sammo	khagan	Thatta	5	4	1.5	13.3	Moderate vulnerability
9	Kohat Colony	UC06	Malir	3	4	4	3.0	Less vulnerability

Legend

1 to 5	Less vulnerable	11 to 15	High vulnerability
6 to 10	Moderate vulnerability	16 and above	Very High Vulnerability

Samo Goth old abadi, out of nine target villages, has a vulnerability index value of 25, which falls into the very vulnerable category. Likewise, Muhammad Sadiq Kathyar and Ismail Mallah also falls into the same highly vulnerable category with a vulnerability index value of 20 and 18 respectively. Other villages can also be categorized as vulnerable due to their exposures and sensitivities. However, the Kohat Colony (3.0) has been categorized as less vulnerable due to the construction of new, pacca houses and available infrastructure in the area. The majority of people are working in nearby factories as laborers or running small businesses. Furthermore, they have better adaptive capacities due to living in urban peripheral area.

4.1.4 Assessing the adaptive capacities

**Capacities at the organization levels**

It was observed during the KIIs at various government offices that climate change is not considered as priority concerns. That was the reason that while asking about the available adaptive capacities, there was nothing to share at their end. With the recent unprecedented rainfall followed by flooding, deep concerns were found at the

government, and non-government levels as they accept the harsh reality of climate change. However, how to adopt to climate change? For that, they are either not fully aware and do not have any capacities used for climate change mitigation and adaptation. Therefore, it can summarize that there is severe lack of capacities specifically at the concerned government organizations and need thorough capacity enhancement at all levels to enable the stakeholders resilient to climate change.

**Capacities at the community levels**

Due to lack of education and awareness, the communities have no or limited knowledge about the climate change and its impact on their livelihood, food security and water resources. Despite the fact, that they have observed changes in the weather pattern and witness of increasing of the hydro-meteorological hazards during recent years, still they have no capacities due to poverty and lack of awareness. It was found that adaptive capacities are extremely poor and whatever local resources are available, are either dysfunctional and lack of repairing/retrofitting to make it stronger enough to resist to climate extremes (Figure 4.16).



Figure 4.16: Lack of awareness about caring the available facilities

#### 4.1.5 Climate change and livelihood sources

Following is a list of the main sources of livelihood prioritized during the field surveys:

1. Agriculture: Mainly cash crops and vegetables are grown
2. Fishing
3. Labor Work: Due to the fact that most of the population is uneducated, the majority are employed as daily wage workers in nearby factories and as mazdoor workers in urban areas
4. Cutting Wood: For domestic use and selling it outside on a limited scale
5. Several have their own shops and businesses, such as tailoring, tuck

shops, grocery stores or taxi/rickshaw services.

#### **Changes in livelihood sources**

The community respondents participated during the FGDs were previously engaged in agricultural and livestock activities. Nevertheless, the livelihood sources were still limited since the land was controlled by wealthy people and they were forced to work as their farmers. In recent years, the agricultural lands have been converted into built-up areas, primarily in District Malir. However, they were mostly growing vegetables in their homes or on parcels outside their homes. In consequence, some people have relocated to other nearby areas with better livelihood opportunities, while some have shifted to urban localities with

alternative sources of livelihood.

As a result of harsh climatic conditions and a lack of access to water for irrigation, agricultural production is decreasing day by day.

In Thatta, majority of the agricultural lands are abandoned due to water logging and salinity, as well as the effects of sea intrusion. The fishing business has also suffered as a result of rising water levels, sea intrusion and involvement of sea lords in fishery business on larger scale. As a result, fish are scarcely available, and due to

limited resources, they cannot afford to go to deeper sea.

**Women engagement**

According to the following data collected during the questionnaire surveys, although men play a dominant role in earning and supporting families, women too have an equally significant role to play. Their contributions in the agricultural activities are estimated to 80%; while, women are also contributing 30% to securing a livelihood for their families outside of the field (Figure 4.17).

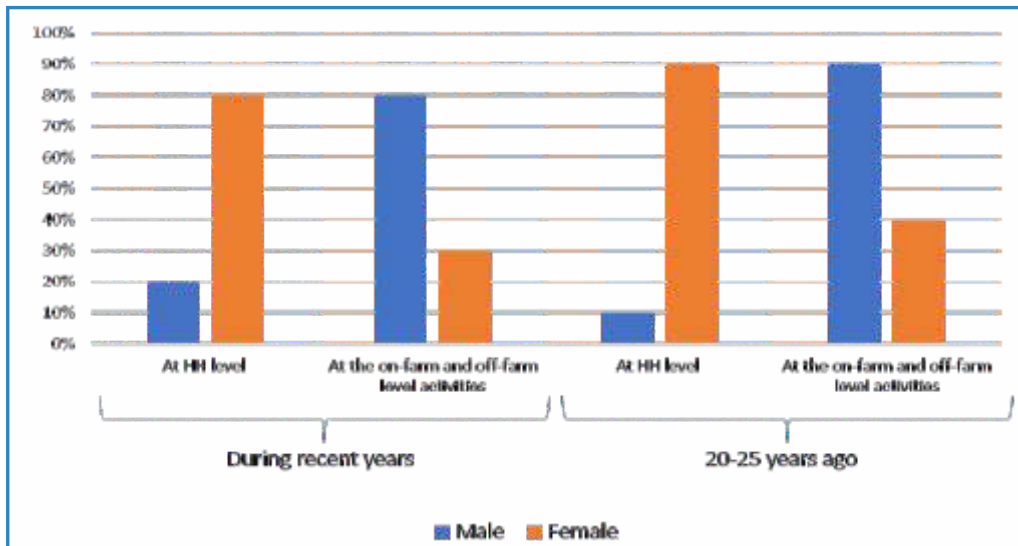


Figure 4.17: Men and women engagement at the household and outside in the field



Figure 4.18: Women actively support men at the agricultural fields



Figure 4.19: Women are involved in bringing water from outside for drinking purposes



In response to questions regarding the impact of sea level changes on fishermen's livelihood sources. It is pointed out that they are the ones who are negatively impacted by sea level rise, sea intrusion, and sea lords since larger companies are involved in fish catching. Due to which, their business has been severely damaged. According to key informant interviews, agriculture, fishing, and

livestock were categorized as priority livelihood sources over a decade ago. During recent years, the category replaced by fishing, agriculture, and livestock as major sources of livelihood. Dependence on agriculture has drastically decreased; however, there is still a challenge to meet livelihood requirements through fishing.



*Figure 4.20: Although fishing was major source of livelihood, however dependency on fish catching has been reduced*



*Figure 4.21: Due to climate change, it is difficult to provide fodder to livestock*

### Case study: Effects of climate change on the livelihood of vulnerable population

*Mr. Fida Hussain is voluntarily serving as General Secretary of the Community Organization founded by the IRP. He was born around 42 years ago in the village of Gul Hassan Samo of UC Khagan. According to him, his livelihood sources have changed for many reasons, including that his ancestors were primarily engaged in fishing as their main source of livelihood. He mentioned that "Fishing was the main source of livelihood for my forefathers. At that time, shrimp, crab, jelly fish, and laser fish were available in abundance but they were not commonly consumed as food. In Europe, shrimps were in high demand, while in Singapore and China, jelly fish, laser fish, and crabs were in high demand. We were unable to benefit from such precious sea creatures because we did not know how to supply to other countries. As we had very limited financial resources, we were unable to obtain them. Our resources were limited, but we were living a peaceful life."*

*Over my 42 years of life, I witnessed cyclones and sea storms in 1993, 2007, and 2015, causing serious damages to our assets and livelihood sources. This forced us to relocate to safer areas for a while. Nevertheless, we are left with no other option than to return to the village, repair the homes, and rebuild the village with the limited resources we have available.*

*Nowadays, we cannot survive with single source of livelihood as we cannot earn from single source due to its limited production. In addition to fishing, we also engage in limited agricultural practices, including growing vegetables, cash crops, livestock rearing, poultry raising. Due to climate change and the increase in population, it is becoming increasingly difficult to think about saving as we earn on day-to-day basis. Today, women are also helping us not only to our work in the fields but also looking after of kitchen gardening, which enables us to grow limited organic vegetables at home. However, climate change and frequent disasters continue to pose a constant threat to our livelihood assets. Due to climate change and the increase in population at household levels, our livelihood sources are frequently at risk and force us to shift them. Therefore, my life is very difficult.*



#### 4.1.6 Climate change and food security

Wheat, cotton, rice, tomato, pulses, and chilies are the main crops grown in the area, while fruit trees like bananas, coconuts, guavas, and papayas are also cultivated in limited scale. Historically, rice and wheat were common crops. However, due to shortage of irrigation water and erosion of land, the growth of these crops has been reduced. Even if these crops are grown nowadays, the quality and variety have been reduced.

According to community respondents in the Malir District, they previously had access to well water and canal irrigation for their agricultural lands. Farmers prefer to grow vegetables at that time to provide fresh supplies to the Karachi vegetable market as well as for domestic use. Due to climate change and population growth, agricultural

lands have been transformed into built-up and commercial lands, and as a result, agricultural practices have almost disappeared. In District Thatta, community respondents stated that agricultural practices have been restricted due to the lack of fresh water. In addition, the water table is fluctuating frequently, which has resulted in the replacement of fresh and sweet water with saline water that is unsuitable for agricultural use. Additionally, the land has also been eroded in coastal areas, thus causing the replacement of agriculture with other businesses. However, it has been observed that the growth of cotton as a cash crop has increased as compared to 20-25 years ago. The seasonal calendar in below figure summarizes different activities and threats in the study areas (Table 4.3).

Table 4.3: Summary of the seasonal calendar indicating different activities/events

Events/activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry season	X	X	X									
Rain season with flooding							X	X	X			
Heatwaves					X	X						
Cyclone							X	X				
Drought							X	X	X	X	X	X
Shortage of food					X	X	X	X			X	X
Shortage of drinking and irrigation water					X	X	X				X	X
Lean month						X	X	X	X			
Health issues	X				X	X	X	X	X			X

According to the community respondent's observations, there is a shortage of food during different months. This is especially true during the months of May and August and November, and December when there

is not much raining.

They further stated that they do not preserve food because they lack the necessary resources and space, and as they rely primarily on day-to-day earnings, due



to which, they cannot afford to buy food in advance for storage.

#### 4.1.7 Climate change and water resource management

Overall, 70% of community respondents stated that they used brackish water for drinking purposes, while 30% replied that they use fresh water for drinking purposes (Figure 4.22). These figures fluctuate from

time to time associated with raining, water table and aquifer charge. As mentioned by the respondents during the questionnaire surveys, the color of the water has also changed with the passage of time, becoming more yellowish in color, especially during rainy days. However, 90% of them mentioned that sweet water was available in abundance in the past, but it is not like that now.

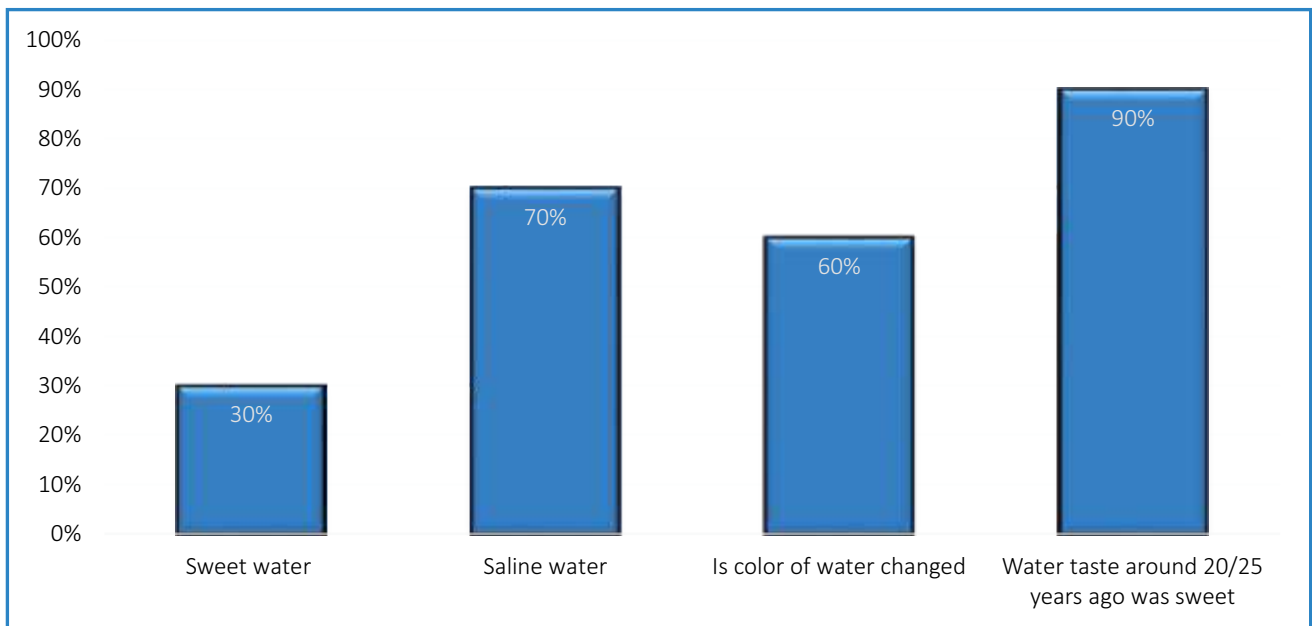


Figure 4.22: Qualities of water used for drinking purposes

Irrigation water is typically obtained from canals, while rain and bore waters are also other sources of irrigation. In urban periphery, the sewerage water used for agriculture purposes which contain wastes from factories as well as other toxic fluids coming from the drains (Figure 4.23).

#### 4.1.8 Climate change and migration

During the field visits, it was observed that new families had relocated from Sindh's interior to Malir as a result of heavy rain and flooding this year.



Figure 4.23: Sewerage water is in use for agriculture in district Malir

### Case study: Fostering climate migration as an adaptation strategy for climate change

*Until 1968, we lived a very happy life in the village Pir Syed Mahmood Allah Rakhio (Creek Kudi), until my parents relocated to another area for the first time due to the erosion of our agricultural land by the sea waves as well as a scarcity of fresh water for drinking and agricultural use. Although it was difficult to leave our homeland and move to other areas, we were forced to migrate three times due to tropical cyclones and sea erosion.*

*Previously, our lives were peaceful, with a surplus of food, livestock, and dairy products. Besides fishing, we also kept livestock, especially camels, for various purposes which provided additional source of income. As a result of frequent disasters, our properties and livelihood sources are damaged time and again and we have to rebuild them again and again.*

*Our family has lived in Usman Goth since 1975. As a result of a shortage of fishing, many people work in agricultural fields, growing vegetables, and staple foods. However, livestock grazing has become increasingly difficult nowadays as fresh water and fodder are becoming scarce.*

*Mr. Muhammad Juman Jat  
Village: Goth Usman Jat*



## 4.2 Key Findings

Based on the detail desk review, discussions during the FGDs, questionnaire surveys and interviews of the key informants, the following findings of the study have been derived;

### 4.2.1 General information about the impact of climate change

- *“Majority of the community respondents agreed that there are visible changes they have been observed while climate change and weather disturbances are the main causes for these changes”- Dr. Salman Zubair, Geography Department, University of Karachi on dated 25th September 2022.*
- *“There is no doubt that the weather is*

*becoming hotter, with more sunny days, more humidity, and Heat waves. Before 20-25 years ago, the weather was pleasant and cool breezes blew even in the summer time, so the weather was nice during hot weather”.* - Respondent from the FGDs.

- There are more rainy days with torrential rainfall accompanied with thunderstorm and lightening. Besides, the frequency and magnitude of rainfall have also increased. As compared to the past, the rainfall is now becoming more unpredictable and can occurs in months when it is not expected. The rainfall followed by flooding are responsible for more destruction, thus severely damaging their livelihood assets

especially it harms to agriculture, livestock and water resources sectors.

- *“Although, raining was commonly observed in earlier days, however, it was less aggressive than it is now-a-days, and there are more rainy days now than there used to be”- Mir Muhammad Baloch NRSP Sindh on dated 4th October 2022.*
- *“It is also observed that sea level has raised and it enters into rivers during storm surges and high tides thus causing sea water intrusion. Besides, due to sea level rise, the soil erosion is also common in some areas”. - Mir Muhammad Baloch NRSP Sindh on dated 4<sup>th</sup> October 2022.*

#### 4.2.2 Climate induced hazard identification and prioritization

- The heavy rainfall and flooding are two major hazards while other common climate induced hazards are drought, cyclones, wind storms, high tides, Heat waves, sea water intrusion, sea level changes and scarcity of fresh water. The community and government officials have fair understanding that these changes are occurring due to climate and non-climate stressors. Besides, the above-mentioned primary hazards, locust attack, snake bites, dengue, animal diseases, mangrove depletion, thunderstorm/lightening, epidemics and traffic accidents etc. can be considered as secondary hazards.
- Assuming only 2022 as a case study, the PMD published a monsoon forecast for the month of July to September. *“This forecast predicts that rainfall during the month of July to September will be above normal in Punjab and Sindh, and slightly*

*above normal in the rest of Pakistan. In Sindh, however, the only rainfall in August was excessively above average (+726%), thus making it the wettest August in the last 62 years” – Monthly weather report (August 2022), published by Pakistan Meteorological Department<sup>[20]</sup>.*

- *“With the increase of population, development activities and climate change factors, the depletion of Mangrove continues at an alarming rate” – Dr. Waqar Ahmed and Dr. Zafar Iqbal Shams, Institute of Environmental Studies, University of Karachi on dated 29<sup>th</sup> September 2022.*
- *“Mangrove plantation provides breeding grounds for marine fish, prawns, shrimps, lobsters, and crabs species that are important to the national economy. There are currently four types of mangrove species in the Indus delta, with Avicenna marina accounting for 90% of coastal areas' mangrove production. Ceriops tagal, Rhizophora mucronate, and Algeciras corniculatum are other important species” – Dr. Waqar Ahmed and Dr. Zafar Iqbal Shams, Institute of Environmental Studies, University of Karachi on dated 29<sup>th</sup> September 2022.*
- *“Sindh Forest Department, Port Qasim Authority, and Board of Revenue are responsible for conserving and managing mangrove forests. Three organizations are working together to increase the cultivation of Mangrove trees in response to the continued deforestation of the Mangrove Forest. However, there is a need to engage the community more actively to restore the Mangrove Forest and teach them how to maintain and sustain the*



*growth of the plantation” –Sindh Forest Department, dated 20<sup>th</sup> November 2022<sup>[21]</sup>.*

#### 4.2.3 Analyzing vulnerabilities

- It was observed during recent flooding that elderly people were badly affected

mainly due to their exposure and sensitivity to extreme weather conditions and attack of seasonal diseases mainly caused due to harsh weather, during the evacuation, at the shelter place with limited financial resources.



*Figure 4.24: Due to low capacities, the women and children are more exposed to extremes weather conditions*

- *“In the recent heavy rains and flooding, pregnant women faced severe problems as they need special attention and care during evacuation and at shelter places”- Respondents from Young Social Network Thatta on dated 29<sup>th</sup> September 2022.*



- Aside from the unprecedented rainfall, and flooding also exposed the vulnerabilities of persons with disabilities. Families had limited access to the basic necessities and medicines they needed to maintain their health issues on a regular basis. Therefore, so evacuating them and placing them in a shelter proved extremely difficult.
- Children are another vulnerable group exposed to climate change, particularly infants who cannot tolerate hot and humid weather and are therefore susceptible to various seasonal diseases.



*Figure 4.25: Children and adolescents are among the very vulnerable group exposed to climate change*

- Housing conditions in coastal communities are very poor, and the majority of residents live in straw and

trash-made houses. A large percentage of Kacha houses are at risk of sea storms, cyclones, Heatwaves, and flooding.



Figure 4.26: Housing conditions in coastal communities are very poor with majority of residents live in straw and trash-made houses

- Severe gaps were found among various organizations and at the community level to work together for facing the climate change implications and work for climate change adaptation.
- *“Although lot of research work has been carried out on various aspects of climate change in different department/institutes, however, there is need to continue research more at M.Phil/Ph.D level to conduct in-depth scientific research on climate change mitigation and adaptation” – Dr Salman Zubair, Geography Department, University of*

Karachi on dated 25<sup>th</sup> September 2022

#### 4.2.4 Analyzing adaptive capacities

- A severe lack of awareness and capacity exists at each level of government, non-government, and more importantly at the community level. Perhaps climate change was not considered a priority concern at all levels.
- *“The Sindh government has recently formulated a Provincial Climate Change Policy for 2022. The government is currently developing a framework of actions to implement climate change policy, which is a positive step that will*



*result in the development of a climate-resistant nation. At the moment, the government has limited capabilities for mitigating and adapting to climate change” – Akhlaque S. Qureshi, Environment, Climate Change and Coastal Development Department, Karachi on dated 4<sup>th</sup> October 2022*

- In order to increase adaptive capacities, although I/NGOs support the affected communities and local government to a certain extent in district Thatta. However, this support is mostly absent in District Malir, which is more semi-urban in nature.

#### 4.2.5 Sector specific key findings about vulnerability and capacity assessment

##### Livelihood

- *“Agriculture, fishing and livestock were categorized as priority livelihood sources more than 20-25 years ago. As a result, dependence on agriculture has significantly decreased, although fishing, agriculture and livestock have also faced challenges to meet their livelihoods. Currently, it is replaced by agriculture, fishing, and livestock in priority order” – Mir Muhammad Baloch NRSP Sindh on dated 4<sup>th</sup> October 2022.*
- During recent years, most of the agricultural lands have been converted into built-up area specifically in District Malir, which increased the vulnerability of those dependent on the agriculture as main sources of livelihood.
- *“In Thatta, some of the agricultural lands have been eroded or abandoned mainly due to the sea intrusion, sea erosion and sea level rise. Those who were associated with the fisheries business have also affected as due to water level rise and sea intrusion inside the river, the fishes are hardly available for catching while they cannot afford to go to deeper sea due to limited resources and sea lords” – Ilimuddin Rind, Ali Muhd Jat and Rehmat Ullah Bukero, Young Social Network Thatta on dated 4<sup>th</sup> October 2022.*
- *“As a result of the unemployment of men and the increased population at their household levels, the workload of women has increased in recent years. In District Malir, the majority of women work as maids or laborers in nearby factories for a daily wage. They support rural men in agricultural fields, livestock raising, dairy farming, kitchen gardening, and running businesses at home, among other activities”* Representatives from the FGD survey conducted in Kohat colony.
- During the recent years, many factories have been closed due to which the people lost their jobs resulting of shifting to other sources of incomes. With frequent change in jobs and further less opportunities of getting daily wage jobs, they are facing difficulties to meet the basic needs and there is no option for them except to live with one time food, which are ultimately forcing to compromise on health especially for their elders, children and lactating women as they are the one badly suffering.
- Earlier, jelly fish, laser fish, crab, shrimps were found in abundance which has been depleted due to sea lords' business to countries in Europe and South East Asian countries.
- Islamic Relief is actively working with the

COs and community members to build capacities including introducing resilient home-based gardening practices and



*Figure 4.27: Kitchen gardening on very limited scale though can be increased by creating awareness & training*

### **Water resources**

- The impact of climate change on water resources has greatly reduced the availability of sweet water for agriculture and drinking purposes. *“In addition, the aquifer and water table change from season to season. The water table rises with fresh water when it rains heavily for a number of days, resulting in the enjoyment of sweet and fresh water for months to come. They face a problem, however, if there is no rainfall for some time, as their bore wells supply brackish water”* - Ghulam Mustafa Mirani, Chairperson, Pakistan Fisherfolk Forum Karachi on dated 5<sup>th</sup> October 2022.
- The main sources of water in District Malir are tap water, and tube wells, and in many cases, people bore their own wells and share them with neighbors. The water in the well, however, is brackish and are using frequently for drinking purposes. Moreover, women and children are involved in bringing sweet water from filtration points as well as tap water from schools (Figure 4.29).

appropriate land levelling practices for food self-sufficiency.



*Figure 4.28: Agriculture land is available, however, are mostly barren due to non-availability of sweet water*

- *“Besides, hand pumps are also available mostly provided by the NGOs but the availability of fresh water is always uncertain. The depth of water in wells is changing from month to month; however*



*Figure 4.29: women are involved in bringing sweet water from filtration points*



average depth is 20-30 feet. The hand pumps in district Thatta are connected with sweet water pipelines which are further linked with the storage ponds away from villages. These ponds normally become dry or polluted as it requires proper maintenance and de-siltation” – Ghulam Mustafa Mirani, Chairperson, Pakistan Fisherfolk Forum Karachi on dated 5<sup>th</sup> October 2022.

- During recent years, there are frequent spread of various kinds of diseases associated with the drinking water. The common diseases pointed out by the communities are stomachache, diarrhea, itching, cholera, skin allergy, malaria, and hepatitis A etc. Some of the diseases are more common among children and elderly people and specifically originate during the rainy and flooding seasons.



Figure 4.30: The handpump is common source of drinking water, though the water is mostly brackish



Figure 4.31: Irrigation through sewerage water in district Malir

### **Food security**

- Previously wheat and rice were commonly growing crops but due to shortage of irrigation water and erosion of land, the growth of rice and wheat have been reduced. Furthermore, if these are grown even the quality, quantity and variety have been reduced.
- The community respondents mentioned that they have shortage of food during different months, subject to no or less raining during summer season.
- In response to preserving foods, the community respondents mentioned that

they do not preserve food as they do not have enough resources and place for preservation and are depending mostly on day-to-day earnings so they cannot afford to buy food in advance to store it.

- It was requested by community respondents that alternate seed varieties need to be introduced that can withstand against the harsh weather conditions but also grow in brackish water with greater yields production

### **Climate migration**

- “Many people have been forced to migrate to other areas because of climate change

phenomena. For example, the majority of the population of Keti Bander has migrated to Ibrahim Hyderi taluka in Malir. As a result of their relocation, they are also forced to change their livelihoods. Previously, they were largely engaged in agricultural practices, but now they predominantly work as daily wage laborers in urban areas or engage in fishing” – K.B. Behrani, Social Welfare Department Thatta on dated 3<sup>rd</sup> October 2022.

- It was found that the affectees normally

move to nearby urban centers and along the coastal areas within Sindh province.

- “The common reason for climate migration noted are lack of basic services, losing agricultural lands, crop failure, less opportunities of catching fishes, drought, flooding and more importantly poverty as main sources forcing for migration” – Ahmed Khan Soomro, Sindh Rural Support Organization Thatta on dated 3<sup>rd</sup> October 2022.



Figure 4.32: Due to climate change, the communities force to migrate to other areas for earning their livelihoods



# 05

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## Community Adaptation Plan for Climate Change



## 5. Community Adaptation Plan for Climate Change

### 5.1 Introduction

The assessment of climate vulnerabilities and capacities at the local level are the fundamental step to design a systematic action plan to suggest measures that can be implemented in reducing the impact of climate change. In this regard, an appropriate planning process is suggested hereby through the given schematic diagram explaining step by step planning process to conduct CVCA and suggestive measures at the individual and community levels (Figure 5.1). The community organizations and local government are advised to develop separate guidelines against each planning stage for effective implementation of the CVCA and community adaptation plan. However, in this section, we shall only focus to recommend various sector specific measures that can be implemented for developing climate resilient communities:



Figure 5.1: Suggested community adaptation planning process

### 5.2 General Recommendations about Climate Vulnerability and Capacity Assessment

- Formation of the “community-based climate adaptation team” at local levels. Such team can be formed by selecting community volunteers to work for climate change adaptation, and responsible for creating awareness among the general public about taking adaptation measures at the household and community levels. Moreover, the committee will also responsible to develop close coordination mechanism and conduct regular meetings with the key government and non-government stakeholders working for climate change and disaster risk reduction at local levels.
- Conduct detail climate induced hazards, vulnerability and capacity assessment with inclusion approach at local levels using the PRA tools. Built-upon on the CVCA results, develop community adaptation plans both at the village and UC levels. The community adaptation plan will highlight the strategies / interventions, suggested timeframe and resource mobilization for the implementation of the plan.
- Design new projects based on the CVCA reports prepared by the communities to formulate structural and non-structural adaptation measures climate change adaptation.
- With the support of government and non-government stakeholders, organize district and taluka level dialogues on the



CVCA and community adaptation plan which shall provide opportunities for mobilizing financial and technical resources for implementation of the plan.

- Encourage universities/academia about the need of conducting scientific research on the climate change, its causes and possible remedies in the form of different strategies to climate change mitigation and adaptation.
- Training of youth, community volunteers and community-based climate adaptation team's members on the disaster risk reduction and emergency response management. Conduct regular drills and simulation exercises before the onset of monsoon for safer evacuation and identification of rescue places in advance for safe sheltering.

### 5.3 Specific Recommendations about Enhancing Livelihood Sources

- Organize separate vocational trainings on "skills development" both for men, and women.
- Provide specialized trainings for persons with disabilities and arrange financial support in establishing business to earn their livelihood.
- Introduce small scale business interventions for women and develop market linkages for them to introduce their products for wide sale and market their products.
- Formation of crab/shrimp farms and give them proper trainings on ensuring its growth and production on sustainable basis.
- Launch awareness campaigns and

capacity building initiatives for communities, focusing on climate change impacts on agriculture, the specific impacts due to climate change and the importance of adaptation to address future challenges.

- Organize trainings for male/female on livestock management and backyard poultry farming.
- Provision of emergency vaccination and medicines for livestock care especially before and during the raining and flooding seasons.
- Introduce sustainable fodder management practices with focus on fodder arrangement during disasters and drought conditions.
- Aggressive growth of climate smart tree plantation along agricultural fields and grow more Mangrove trees along the coastline to protect from natural hazards and sea erosion.

### 5.4 Specific Recommendations about Water Resource Management

- De-siltation of channels/nullahs and sewerage drains in urban areas to ensure smooth flow of water during heavy raining and flooding.
- Install filtration points at appropriate places to ensure sweet and clean water for urban dwellings.
- Repairing and construction of water tanks and channelize to reach to individual homes through pipelines.
- Installation of hand pumps and water tanks with the support of government and non-government organizations at village levels.

- Apply new techniques of irrigation by introducing furrow, drip and sprinkle irrigation etc., to improve the water use efficiency.
- Develop linkages between academia, line departments, and farming communities to review existing practices of integrated water resources management, conservation and research on saline agriculture practices.
- Arrange trainings and awareness raising sessions on sweet water rationing for saving water and its effective use.

### 5.5 Specific Recommendations about Food Security

- Arrange training on climate resilient home-based gardening practices for food self-sufficiency.
- Introduce hurry plantation which can grow in slightly saline water and land.
- Develop and launch climate smart urban farming through vertical farming projects, with training of women to operate and manage at their houses.
- Introduce demand driven structural measures to protect lands from the sea erosion.
- Provide storage bins/drums for storage of grains and arrange trainings on how to store food grains during normal days and its usage when there is shortage of food.
- Arrange trainings for the fishermen communities on fishing, storage and marketing on the modern scales. Distribution of required inputs/ storage bins etc. for fishing will also be supportive for the fishing communities.

### 5.6 Specific Recommendations about Climate Migration

- Develop and maintain database of those shifted inside/outside and provide local services for their early settlement.
- Planning for safer relocation of climate migrants and arrange various capacity building initiatives.
- Introduce diversified sources of livelihood and engagement of both men and women to discourage climate migration.
- Introduce social protection schemes for climate migrants and provide trainings.

### 5.7. Study Team's Priority Recommendations

Based on the detailed field assessment and frequent interactions, the study team of NDMP and Department of Geography, University of Karachi would like to prioritize some of the priority recommendations for IRP for planning and implementation:

- Conduct detail climate induced hazards, vulnerability and capacity assessment with inclusion approach at local levels using the PRA tools. Built-upon on the CVCA results, develop community adaptation plans both at the village and UC levels. The community adaptation plan will highlight the strategies/interventions, suggested timeframe and resource mobilization for the implementation of the plan.
- Design new projects based on the CVCA reports prepared by the communities through a consultative process and interviewing key informant to formulate structural and non-structural adaptation measures for climate change adaptation.

- With the support of government and non-government stakeholders, organize district and taluka level dialogues on the CVCA and community adaptation plans which shall provide opportunities for mobilizing financial and technical resources for implementation of the plan.
- Promote urban forestry especially in Malir district and furthermore encourage communities for vertical kitchen gardening at household levels.
- Promotion of saline & drought resistant crop varieties and provide seeds to encourage its growth.
- Rehabilitation of the water supply schemes & sewerage schemes are another aspect to improve the health & hygiene of the urban communities.
- Need to adopt the latest technologies and techniques to improve the FSL & WASH related services for the communities to improve the WASH , food & nutritional conditions of the communities.
- Need to develop community level interactive strategies for government officials to strengthen their linkages.
- Encourage universities/academia about the need of conducting scientific research on the climate change, its causes and possible remedies in the form of different strategies to climate change mitigation and adaptation.
- Poverty, food security, safe drinking water supplies, nutritional needs were found common needs of the urban & rural areas in Malir and Thatta districts.
- Introduce green small scale business interventions for women and develop market linkages for them to introduce their products for wide sale and market their products.
- Proposed interventions suitable for introducing aqua culture.
- Formation of crab/shrimp farms and give proper trainings to local people to ensuring its growth and production on sustainable basis.
- Organize trainings for male/female on livestock management and backyard poultry farming.
- Aggressive growth of climate smart tree plantation along agricultural fields and grow more Mangrove trees along the coastline to protect from natural hazards and sea erosion.
- Repairing and construction of water tanks and channelize to reach to individual homes through pipelines.
- Installation of hand pumps, filtration plants for desalination of water and water tanks with the support of government and non-government organizations at village levels.
- Apply new techniques of irrigation by introducing furrow, drip and sprinkle irrigation etc., to improve the water use efficiency.
- Introduce hurry plantation which can grow in slightly saline water and land.
- Provide storage bins/drums for storage of grains and arrange trainings on how to store food grains during normal days and its usage when there is shortage of food.

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## Annexures: Glossary

**Adaptation:** The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects

**Adaptation to Climate Change:** Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected Climate Change effects is known as adaptation to climate change. Crucial to reducing vulnerability to Climate Change, understanding how individuals, groups and natural systems can prepare for and respond to changes in climate is known as adaptation.

**Biodiversity:** Variety of plant and animal life in the world or in a habitat or ecosystem.

**Climate:** The statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classic period for averaging these variables is 20 to 30 years. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

**Climate Change:** A change in the state of the climate that can be identified (for example, using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate

change may be due to natural internal processes or external forcing's such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use.

**Climate Change Adaptation:** Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities is known as Climate Change Adaptation.

**Climate Change Impacts:** The effect of climate change on natural and human systems is known as climate change impacts. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts

**Climate Change Mitigation:** Strategies and policies that reduce the concentration of greenhouse gases in the atmosphere either by reducing their emissions or by increasing their capture is known as climate change mitigation.

**Coastal Erosion:** Erosion of coastal landforms that results from wave action, exacerbated by storm surge and sea level rise.

**Community Respondents:** The term community respondents used in this report means those community volunteers who attended the FGDs meetings held in target villages for data collection.

**Disaster:** Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to

widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery. See UNISDR Global Assessment Report on Disaster Risk Reduction 2015.

**Drought:** A period of abnormally dry weather long enough to cause a serious hydrological imbalance.

**Early Warning System:** The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.

**Global Warming:** The gradual increase, observed or projected, in global surface temperature, as one of the consequences of radiative forcing caused by anthropogenic emissions.

**Greenhouse gases (GHGs):** Natural and industrial gases that trap heat from the earth and warm the surface. The Kyoto Protocol restricts emissions of six greenhouse gases: natural (carbon dioxide, nitrous oxide, and methane) and industrial (per fluorocarbons, hydro fluorocarbons, and sculpture hexafluoride).

**Greenhouse effect:** The insulating effect of certain gases in the atmosphere, which allow solar radiation to warm the earth and then prevent some of the heat from escaping.

**Migration:** Movement that requires a change in the place of usual residence and that is longer term. In demographic

research and official statistics, it involves crossing a recognized political/administrative border.

**Resilience:** The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.

**Stressor:** Event or trend that has important effect on the system exposed and can increase vulnerability to climate-related risk.

**Sustainable Livelihood:** Livelihood that endures over time and is resilient to the impacts of various types of shocks including climatic and economic.

**Taluka:** The term Taluka or Tehsil are the same words used for sub-division as an administrative unit of a district. Each Taluka is then sub-divided into number of union councils. It is worth to mention that in Sindh, the unit is called as "Taluka" while in rest of the provinces, the term "Tehsil" is more commonly used.

**Weather:** The state of the atmosphere with regard to temperature, cloudiness, rainfall, wind and other meteorological conditions. It is not the same as climate which is the average weather over a much longer period.







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