Journal of Positive School Psychology http://journalppw.com
2023, Vol. 7, No. 1, 273-287

As Assessment Of Socio-Economic Vulnerability In Flood-Prone Region Of South Punjab, Pakistan

Sumaira Bano[1] , Muhammad Imran[2] , Amber Ahsan[3] , Zoia Khan[4] , Shahabia Ahmed[5] , Shehzen Fatima[6]

[1]*Lecturer department of Sociology, Ghazi University, DG Khan*
[2]*Lecturer, Department of Economics, Ghazi University, DG Khan**
[3]*Visiting Faculty, department of Sociology, Ghazi University, DG Khan*
[4]*Visiting Faculty, department of Sociology, Ghazi University, DG Khan*
[5]*Visiting Faculty, department of Sociology, Ghazi University, DG Khan*
[6]*Mphil Scholar*

**Corresponding Author Email: milodhi@gudgk.edu.pk*

Abstract

Numerous natural disasters may occur in Pakistan, but recurring floods are the most frequent and result in significant loss of life and other property. Due to its geographic position, South Punjab especially has endured severe floods during the last ten years. Poor socioeconomic conditions among residents exacerbate the already present risks. Therefore, it was necessary to evaluate the socioeconomic vulnerability that flood-prone region people now experience and to pinpoint any possible risk factors. Dera Ghazi Khan District was chosen for this project due to its riverbank position and previous history of severe floods. Utilizing a multistage selection approach, 240 respondents were selected from the flood-affected regions and subjected to structured questionnaire interview questions. A Composite Index was developed to reflect respondents' vulnerabilities. The survey's results showed that 22.1% of respondents were very susceptible to flooding, while a staggering 57.6% of respondents were just moderately exposed. Family income, land ownership, home style, early warning, and access to a vehicle are just a few of the essential variables that determine how vulnerable a family is. It was determined that the study region had a high incidence of socioeconomic vulnerability and that a significant number of moderately susceptible persons were on the verge of falling into the highly vulnerable category in the event of a future flood. The research advised that the government act quickly to assist these vulnerable populations in South Punjab after consulting with all relevant parties.

01: Introduction

Changes in the world's environment pose significant threats to human health and welfare. Downpours, calamities, epidemics, and other catastrophic events are only some aspects in which climate change disrupts humankind and the economy. The long-term effects of these tragedies include reduced agricultural productivity and massively increasing insecurity in rural communities of emerging economies.

Natural catastrophes, which often cause widespread damage to agricultural facilities and lead to losses in both the value and quantity of agricultural production, can pose significant challenges for national food systems. (Food and Agriculture Organization of the United Nations 2017; FAO 2021). Drought, as well as acute weather, are occurring more often and are destructive as a result. The work of Athanasios L. and Michael C. Floods have been a significant natural catastrophe over the past two decades,

accounting for approximately one-third of all-natural calamities and impacting about half of all individuals afflicted by natural disasters (Adikari & Yoshitani, 2009).

Pakistan is one of the most susceptible countries in South Asia to natural calamities. Various natural disasters, including floods, droughts, and hurricanes, menace Pakistan periodically. Therefore, the 2021 Climate Vulnerability Index likewise incorporates Pakistan a perfect grade. Regarding the negative consequences of climate change, a recent German Watch Report on the Global Climate Risk Index 2021 ranks Pakistan as the eighth most impeded and fragile nation (German Watch, 2021). The German watch, a worldwide climate change think tank, evaluated and ranked countries based on the consequences of climate-related extreme weather events such as storms, floods, and due to rising temperatures from 2000 to 2019. (German Watch, 2021).

Natural disasters such as extreme weather events, droughts, river deltas, and torrential rains have transpired in the nation because of climate and climate variability. Numerous calamities have affected Pakistan and its economic expansion (ADRC, 2016). Damages and losses of over US$ 18 billion have been sustained over the previous decade (World Bank, 2017).

Experts believe that the massive flooding in 2010 was responsible for the loss of crops and cattle, the closure of highways, and a reduction in economic development. In addition, the floods badly damaged approximately 1.8 million homes, and 18 million people's lives were negatively impacted in the 78 affected areas (WHO, 2011). Following the Preliminary Damage and Needs Assessment, the total cost of the floods was anticipated to be US$ 10.1 billion, including US$ 6.8 billion in minimum extra expenses for rebuilding (Asian Development Bank, 2017; World Bank & the Government of Pakistan, 2010; World Bank & GFDRR, 2015; GFDRR, 2019).

South Punjab, which also experienced floods around the end of 2012 and early 2014, bore the brunt of the disaster. With a high percentage of its population living in poverty, South Punjab is one of the poorest regions in Pakistan's Punjab province. The people's suffering is exacerbated by the region's unfriendly environment and lack of industrial focus. Previous assessments of the region highlight poor health and educational facilities and widespread poverty (Ali et al., 2013). The area's history of flooding may have also exacerbated the area's socioeconomic vulnerabilities.

Like many other districts on the Indus River's lowlands, D.G. Khan is increasingly vulnerable to floods. The National Disaster Management Authority (NDMA) warns that flash floods are a greater danger in D G Khan, Muzaffargarh, Rajanpur, and Mianwali than in Punjab districts along the rivers themselves (GOP, 2019). Extreme and unexpected flooding has hit this region. Due to its unusual configuration, it is vulnerable to flooding from the Indus River and hill torrents from the Koh- e-Suleman mountains. Previous floods in the area have wreaked havoc, washing away thousands of homes and causing massive damage to the district's vital farming infrastructure.

Considering the regularity and severity of the flooding in Southern Punjab, it is crucial to plan and be ready in advance. Assessing rural people's socioeconomic susceptibility is an essential and critical step in reducing catastrophe risk. Considering a community's exposure to social and economic troubles is vital for several reasons, including improving the quality of policy decisions, enhancing planning and readiness in the face of hazards, and highlighting issues worthy of policy incentives. Critical to crafting an effective catastrophe risk reduction plan is an appreciation for the unique vulnerabilities of different socioeconomic groups (Abid, M. et al., 2016).

Essential to improving disaster management techniques is creating comprehensive social vulnerability maps that can pinpoint populations-of-concern and susceptible locations where adaptation tactics may be most effectively implemented (Cutter et al., 2003).

Despite frequent floods in Pakistan, no comprehensive risk assessment has been conducted, and response and recovery activities have been limited to the aftermath of disasters. The research aims to measure the degree of economic and social precarity in these high-risk regions.

For this reason, the current research aims to fill a gap by shedding new light on the socioeconomic vulnerability and flood consequences of at-risk areas. Dera Ghazi Khan is a significant district in South Punjab, serving as a gateway to the neighboring provinces of Sindh and Baluchistan. Located on the western bank of the Indus River, its economy is based mainly on farming. Repeated floods have severely impacted many riverside communities during the last decade. Thus, it is essential to gauge their vulnerability to comprehend the riverside community's and the district's capacity for bouncing back from adversity. With this information in hand, local governments can better prepare for the consequences of future floods and better protect the most vulnerable residents. In a nutshell, this research aims to assess the degree of vulnerability already present in flood-prone regions in the Dera Ghazi Khan district.

Our research aims to assess the vulnerability locals in our study region face. Thus, we must agree on what we mean when we use the word. Defined as a result of the interplay between exposure, sensitivity (susceptibility), and adaptability capacity (resilience), vulnerability has been theorized to be the capability to withstand a threat and recover from it (Balica & Wright 2010; IPCC, 2014). The term "exposure" refers to the likelihood that individuals and what they care about will be affected by climate change or fluctuation. How vulnerable a family or neighborhood is to the effects of climate change is measured by its exposure. The vulnerability or sensitivity measures how much weather fluctuations influence a family or community. The term "adaptive capacity" describes a person's, family's, or community's potential to deal with, adapt to, and recover from climate change and its consequences. A resilient system, community, or society can withstand, adapt to, and quickly recover from the negative impacts of exposure to risks by maintaining and restoring its fundamental structures and functions via proactive risk management (UN-ISDR, 2009). The availability of monetary, technological, instructional, and social assets are directly proportional to a population's resilience or adaptive capability (Cutter et al., 2002).

02: Methodology

District Dera Ghazi Khan's rural sections, which are more at risk of flooding, served as the study's primary location. Considering the area's history of flooding and its proximity to the river, this was an accurate conclusion. Most rural residents and urban enterprises still depend on prosperous agricultural outputs. Therefore, this area ideally exemplifies several characteristics that explain why it is appropriate for the current research. This area is well-suited for vulnerability research due to its high poverty rate, limited job opportunities, and extensive demographic traits.

Statistical information was gathered using a cross-sectional survey design. Primary data, in the form of a questionnaire and interviews with focus groups, formed the basis of the research. The form's questions included susceptibility indicators (exposure, sensitivity, and adaptation). To choose these indicators, we first conducted a comprehensive literature evaluation of vulnerability research (Wisner et al., 2004; Sayed & Gonzales, 2014).

This research employed a multistage sampling approach. Six rural union councils from three tehsils were chosen initially. Next, purposive sampling was applied to include flood-prone regions. Two to three flood-affected towns from each union council were randomly chosen to eliminate selection bias. In the last step, 240 respondents from the district were randomly selected using non-discriminatory snowball sampling. Before final data collection, 20 field respondents pre-tested the questionnaire and suggested adjustments.

A structured, focused group discussion was held in each tehsil's village to eliminate latent data-gathering errors. After the vulnerability assessment, randomly selected four households from each least, moderately, and highly vulnerable household and organized Focused Group Discussion to catch a collective narrative that researchers may have missed throughout individual survey data due to close-end questions.

Numerous intangible factors contribute to a person's susceptibility to flooding, and it may not be easy to quantify some of these elements. Therefore, using a Composite Index to achieve a quantitative vulnerability is well-recognized in the academic community (Rana & Routray, 2016). Creating a socioeconomic Vulnerability Index calls for careful consideration of which criteria to include and in which order. When vulnerability indicators were included in a SeVI following their relative importance, the measurement problems vanished. While it did not provide conclusive proof, it was instrumental in gaining a deeper, more credible understanding of the situation.

Parametric survey results were parsed and organized under the headings of Exposure, Sensitivity, and Adaptation, three critical indications of susceptibility. Normalization checks were performed on each parameter before weights were applied. Finally, as shown below, some prior work (Gain et al., 2015) was used to create a consolidated Vulnerability Index based on these factors.

$$CI = (W_1 + W_2 + W_3 \dots \dots \dots . W_n)/n$$
$$= \sum_{i=1}^{n} W_i/n$$

Where CI = Composite Index, W_1 to W_n are weights assigned to different indicators, n is the number of indicators used to calculate composite Index

2.1 Data Analysis

Data were evaluated descriptively and quantitatively. The Chi-square test found associations between variables. Excel was used to create exposure, sensitivity, and adaptability vectors, while SPSS was used to determine socioeconomic vulnerability. Highly, moderately, marginally, and least susceptible responders were categorized. Three FGDs were qualitatively assessed from these categorized homes.

3. Results & Discussions

There are four sub-sections in this portion. Section 1 discusses findings related to the demographic makeup of respondents and their utility access. In the second part, we see the effects of floods on people's lives. The chi-square test for investigating correlations between variables constitutes Section 3. Finally, section 4 concludes with findings from the Vulnerability Index and the Focused Group Discussions (FGD) concerning the respondents' vulnerability.

3.1 Socioeconomic and Demographic composition of sample Respondents

The findings showed that the sample included a wide variety of demographics and that most participants were between the ages of 46 and 60 (34.2%) or between the ages of 31 and 45 (37.5%). Unless too old to be unpleasant, age in a vulnerability assessment is often used as a proxy

for experience and additional knowledge about flooding (Browne and Hoyt, 2000).

Household size affects a family's susceptibility (Khan, 2012). Some scholars saw a big family as a hardship if there was a high dependence ratio (Phung et al., 2015). We projected huge household sizes for emergency and income reasons. According to vulnerability studies, nuclear families are more vulnerable to tragedy than combined or extended families (Flanagan et al., 2011). We hypothesized a similar flood-family type association for our investigation. 50% of the findings are blended families.

House type and age affect susceptibility. Mud houses are more vulnerable than concrete ones (Berkmann et al., 2013). 23% of homes had substantial dwellings, while 29% had mud houses, making them flood-prone. Income, savings, and debt are other major susceptibility factors.

More income and savings imply more disaster-coping capacity, and more debt means less disaster-coping and debt-acquiring ability (Wisner et al., 2004). This research also linked family income, savings, and debt to vulnerability. Most persons earned between Rs. 120,000-240,000(38.8%) or less than Rs. 120,000(30.8%). 53% of households had no savings, while 29% had just Rs. 20,000-30,000, or a month's expenses for a modest family. In addition, 70% of families have debt they must repay.

Land acquisition is a household adaption measurement (Boon, 2014). 45% of families had no land and were renters or agricultural workers. According to researchers, more educated household members might perceive a future calamity as a danger (Hahn et al., 2009). 51% of respondents were illiterate, placing them at risk. 5% of families had a graduate.

Access to healthcare is a crucial vulnerability indicator. This research utilizes hospital distance to measure access. 69% of homes have a preliminary health facility within one hour, independent of transit options. Diversifying a family's livelihood is also crucial in assessing its disaster resistance. Table 3.1 shows that most families (53% and 62%) are involved in agricultural cultivation and livestock. 40% worked on farms, and a comparable amount worked on non-farms. Despite living near rivers, just 1.7% earned a livelihood from fishing. Many persons had many income sources; thus, the aggregate proportion is misleading.

Characteristic	Group	F*	%	Mean (SD)	Characteristics	Group	F*	%	Mean (SD)
1) Age	18-30	54	22.5	2.233(0.86)	2) Maximum Education in the Household	Illiterate	123	51.3	2.47(1.04)
	31-45	90	37.5			Primary	64	26.7	
	46-60	82	34.2			Secondary	40	16.7	
	Above 60	14	5.8			Graduation	13	5.4	
3) Household Size	Small	46	19	1.48(0.56)	House Type	Mud House (Katcha)	69	28.8	1.95(0.72)
	Medium	93	39			Semi-Concrete House 4)	115	47.9	
	Large	101	42			Concrete House	56	23.3	
5) Family Type	Nuclear	101	42.1	1.66(0.62)	6) HH Land Ownership	Yes	126	54.6	0.48(0.50)
	Joint	120	50.0			No	109	45.4	
	Extended	19	7.9				109	45.4	
							93	38.8	
8) Household Income (Annual)	< 120,000	74	30.8	2.2(1.16)	7) Size of Land Ownership	No land			0.73(0.79)
	120001-240000	93	38.8			Less than 5 acres			
	240001-360000	44	18.3			6-10 acres	31	12.9	
	360001-480000	9	3.8			Above 10 acres			
	Above 480,000	20	8.3		9) HH Livelihood Choices	Crop Production	128	53.3	0.47(0.50)
10) Household Savings (Annual)	0	128	53.3	2.20(1.52)		Livestock & Poultry	150	62.5	0.38(0.48)
	1-10,000	7	2.9			Fisheries	19	7.9	0.98(0.128)
	10,001-30,000	70	29.2			Farm labor	4	40.0	0.60(0.491)
	30,001-50,000	15	6.3			Public/Private Job	47	19.6	0.80(0.398)
	50,001-70,000	2	.8			Trading/Shopkeeping	43	17.9	0.82(0.384)
Above 70,000		18	7.5			Industrial/Nonfarm labor	96	40.0	0.60(0.491)
						Any other/Pension/Remittances	28	11.7	0.88(0.322)
11) Household Debt	No HH debt	71	29.6	1.88(0.74)	12) Distance to health facility	Less than 1 Hour	166	69.2	1.31(0.463)
	Households In debt	169	70.4			Above 1 hour	74	30.8	

Table 01: Household Socio-Economic & Demographic Composition

3.2 Household Access to Utilities and Basic Services

The intensity to which a family is susceptible to a catastrophe relies on how effortlessly they can acquire certain facilities or services (Ahsan and Warner, 2014). Table 3.2 summarizes the findings of using several of these services. So, most households relied upon firewood as their primary heating source, even though 78% had access to electricity and just 1% had access to gas. Pakistan's rapidly expanding mobile phone industry has made it possible for over 93% of the population to access a telephone. While just 19% of the population had a ticket to the internet, around 51% had a television. About half of all homes had access to a car, while about 42 percent had access to flush toilets.

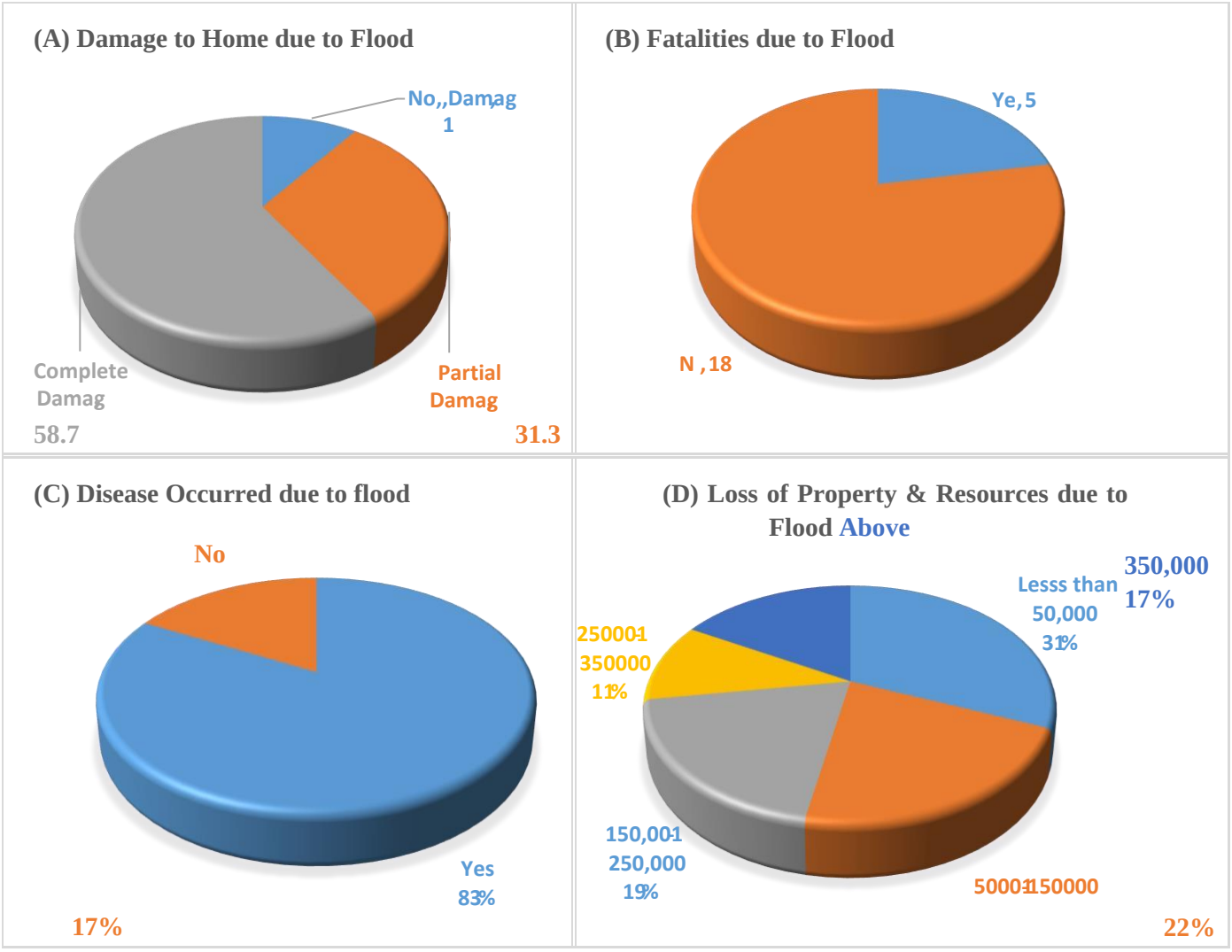
Table 3.2 Household Access to Utilities and Essential Services

Sr.	Access to HH utilities & Services	Response	F	%	Mean (SD)
1	Access to electricity	Yes No	188 52	78.3 21.7	0.413(0.17)
2	Access to Gas	Yes No	2 238	0.8 99.2	0.07(0.250)
3	Access to Telephone	Yes No	224 16	93.3 6.7	0.07(0.250)
4	Access to Internet	Yes No	46 194	19.2 80.8	0.81(0.394)
5	Access to TV	Yes No	122 118	50.8 49.2	0.49(0.501)
6	Access to Toilet	Yes No	101 139	42.1 57.9	0.42(0.495)
7	Access to Own Motorized Transportation	Yes No	127 113	52.9 47.1	0.53(0.500)

3.3 Information about Flood Experience, Early Warning, and Evacuation (n=240)

Table 4.3 shows that about 90% of all households were forced to evacuate their residences at the pinnacle of the flood. Over half (52%) of the victims had persisted in their evacuee condition for more than four weeks. Only around half of the homes claimed to have gotten an easy-to-understand notice about the flood, while around half said they had not been adequately notified. Twenty-four percent of homes said they had received a warning 1-3 days before the flood. About 37% of the residents live in homes that have made precautions for disaster because they fear floods. For every 100 people living in a home, 49 said they had made preparations for evacuating in the event of a flood.

Impacts of the previous flood on the community



3.4 Households Vulnerability Status estimated through Composite Index

The accuracy and quality of the home data were extensively examined. To mitigate the impact of abnormalities, the data was normalized. The variables were ordered for each vulnerability indicator (Exposition, Sensitivity, and Capacity) (table 3.5). The poor representative factors were dropped, leaving a total of 23 variables to be used to determine household fragility. Seven of these five exposure-related parameters were chosen for sensitivity and eleven for adaptive ability.

3.5 Classification of households based on the extent of vulnerability

Using the Composite Index method, we computed an overall vulnerability index for all of the families who participated in the survey utilizing the weighted averages of indicators for exposure, sensitivity, and adaptation capability. The probability density range was then used to classify the values of the vulnerability index. Tabulated 3.6 displays the outcomes of this categorization. Four tiers of household affluence were established. In terms of vulnerability, the classifications ranged from "least vulnerable" to "most susceptible" to "extremely vulnerable." To put it another way, the most susceptible households have a sensitivity index value of 0.01 to 0.25, the least vulnerable have a value of 0.26

to 0.50, the most sensitive has a value of 0.51 to 0.75, and the most fragile have a value of 0.76 to 1.

Table 3.6 Classification of households based on the extent of vulnerability

Vulnerability Class intervals	Vulnerability Index*	F	%
Least Vulnerable	0.01-0.25	15	6.3
Slightly Vulnerable	0.26-0.50	29	12.1
Moderately Vulnerable	0.51-0.75	143	59.6
Highly Vulnerable	0.76-1	53	22.1
Total		240	100.0

*Vulnerability Index values classified in quartiles

The results of this sensitivity study are rather enlightening. The most important conclusion was that a significant portion of homes in the research region was on the verge of entering the highly susceptible class, meaning that the area's fragility was high in present susceptibility and potential vulnerability.

3.6 Results of the Focused Group Discussion

To learn more about the vulnerability, we had three focused group talks in the research region, each with four randomly chosen families from each vulnerability class. You can see the outcomes of the discussion group in table 3.7. Based on the results of the focus groups, it was determined that the least susceptible families had the most incredible ability to evade a flood and paid the most heed to the preliminary warnings. They lose the most money, though, when their crops are ruined. Yet, relative to others, they are the most likely to return to the flood-ravaged community. This investigation uncovered a crucial fact: the social fabric of rural communities is so strong that even the most vulnerable people who were able to flee before the tragedy struck continue to return to their homes to aid their neighbors.

Table 3.7 Community views about vulnerability in the study area; results of focused group discussion

	Early Warning	Material Losses	Emergency Health	Evacuation	Return to village
Least Vulnerable	• Many people disregard official cautions in favor of their first-hand knowledge. • There has been a decline in public faith in the government because of misleading flood warnings in the past.	• On 17 acres, we had to abandon our harvest completely. When the crops were finally ready to be harvested, we had made well over seven lacs.	• When illness outbreaks in rural villages caused increasing numbers of residents to seek medical care in urban	• When it became clear that a flood was imminent, my family and I left the area a week in advance. • Using our tractor and trolley, we assisted some	• Until the flood, my father made regular trips to the village. However, we could not relocate some items from our home due to concrete and structural limitations.

		• Some homes were damaged because they were underwater for an extended period during the flood.	centers, most villagers fled to the care of relatives who lived there.	of our fellow villagers in leaving for another place.	• Those with property in the community, such as a plot of land, were more likely to return than those without such holdings.
Slightly Vulnerable	• We could salvage a lot of food and belongings from the previous flood because we had received what we thought were earlier warnings. • My son is a government employee for the city, so he keeps us apprised of the flood risk.	• Four cattle we had grazing in the open fields near the river died in flood. • Two of the walls of our concrete house collapsed, costing us over Rs. 2.5 lac.	• My family and I have since moved away from the hamlet, but my father has remained here regularly to provide a hand to the locals. He informed us that there was not enough medication for the sickening population. • Malaria, cholera, and diarrhea were rising among the young population.	• We were rescued by my uncle, who lives a certain distance from the flooded area, and he took us all to his house until the water subsided. • Families living abroad may send money home to assist with temporary housing costs during floods.	• My father insisted that we return to the hamlet, even though none of us desired to, for it is here that our forebears are laid to rest. • Once the water had subsided, the village elders had little interest in leaving.

Moderately Vulnerable	• The lack of a reputable source giving advance notice was a significant problem. We only heard the statement from the mosque's speakers; we put no stock in it.	• We lost two sheep to illness during the flood. Unfortunately, no veterinarian or treatment was available for our pets. • After the flood, we had to gut the home and start again completely. Since all of the cultivations we were tending had rotted and gone to seed, we were left without a source of income.	• There was a little medication in the tented infirmary, but no doctor was available to provide an accurate diagnosis. . While the hamlet was underwater for two months, a mobile medical van with physicians came only twice.	• Those who could afford to leave the hamlet in their vehicles did such days first before the water hit. • My brother went missing on the third day of the flood, but the rescue crews found him stuck in a neighboring area.	• Because of the help we could count on from our more well-off relatives, we decided to return to the village. • Coming back home was tricky since the water took the life of my disabled father.
Highly Vulnerable	There were rumors of a flood, but nowhere for us to go. So we were trapped in the community despite knowing about the impending flood for at least a month. In preparation for a possible financial crisis, we liquidated some personal belongings.	• People lived in mud huts, which were wiped out entirely by the water. • I worked as a laborer for a local landlord before the flood, but I was away for a while.	• One of my two-year-old daughters had cholera just after the flood and never got better; she passed away after two months of being unwell. • No doctors were in town. Therefore, there were no	• We have nowhere to go if a flood occurs, even if we get a heads-up. • Families stayed in makeshift camps on an exposed canal for two months as the floodwaters receded and our community dried out.	• We returned to the house even though there was still water in the basement and the yard. Our home provided a safer environment than the tents.

			excellent emergency treatment options.		

Prior misleading cautions have led people to trust their observations. The most vulnerable members of society were forced to evacuate regardless of how efficient the alert was since they had nowhere else to go. Even after the flood subsided, many villages continued to struggle since many landowners lost their standing crops and the peasants who had worked for them as workers lost their employment.

4. Conclusion and Policy Implications

Local homes' demographic and socioeconomic makeup led us to conclude that the people who live there have limited access to essential services like clean water and adequate healthcare, few economic possibilities, and low wages. Telecommunication is the only contemporary technology that has been thoroughly penetrated, yet its potential for productivity remains unrealized. While emergency alerts and home anticipation have been shown to be critical in disaster mitigation, their usefulness still has to be recognized at the household level. The assessment of vulnerability provided by the Composite Index leads us to the crucial conclusion that not only are existing exposures among dwellers high, but there is every chance. If due attention is not given to this issue, huge populations are on the brink of falling into high vulnerability. Focused Group Discussion (FGD) findings corroborated this finding by revealing the highly restricted options faced by low-income families.

On the other hand, the FGD made it clear that the community had a solid social fabric, which is encouraging. Incorporating this social fabric into regional policymaking is a viable option. In light of these findings, we urge assessing such vulnerability studies on a massive scale, most likely including the whole of the state and concentrating on shifting climatic patterns. Furthermore, we suggest using this research as a pilot example and intervening in the most disaster-prone areas.

References

1. Abid, M., Schilling, J., Scheffran, J. & Zulfiqar, F., (2016). Climate change vulnerability, adaptation and risk perceptions at farm level in Punjab, Pakistan. Science of the Total Environment, Volume 547, pp. 447-460.
2. Asian Development Bank (2017). Climate Change Profile of Pakistan, Manila: Asian Development Bank.
3. Ali, A. (2013). Indus Basin Floods: Mechanisms, Impacts, and Management. Asian Development Bank, Mandaluyong City, Philippines.
4. Athanasios L., Michael C. (1999). The Effect of Climate Change on Floods in British Columbia Hydrology Research (1999) 30 (3): 231–256. Https://doi.org/10.2166/nh.1999.0013
5. Asian Disaster Reduction Center (2005) Total Disaster Risk Management – Good Practices. Available online at: http://www.preventionweb.net/english/professional/ publications
6. Adger W.N. (2000). Social and ecological resilience: are they related?

Progress in Human Geography, 24(3): 347-364.

7. Adikari Y, and J. Yoshitani. (2009). Global trend in water-related disasters an insight for policymakers. Paris: UNESCO.

8. Balica, S.T., (2012). Applying the flood vulnerability index as a knowledge base for food risk assessment, UNESCO-IHE, Institute for Water Education, Delft, Netherlands.

9. Balica, S.F., Popescu, I., Beevers, L. & Wright, N.G., (2012). Parametric and physically based modelling techniques for flood risk and vulnerability assessment: A comparison, UNESCO-IHE, Institute for Water Education, Delft, Netherlands.

10. Balica, S.F., Wright, N.G. & Van Der Meulen, F., (2012). 'A flood vulnerability index for coastal cities and its use in assessing climate change impacts', Natural Hazards 64(1), 73–105. Https://doi.org/10.1007/s11069-012-0234-1

11. Bhatti S.S., N.K. Tripathi, V. Nitivattananon, I.A. Rana, C. Mozumder. A multi-scale modeling approach for simulating urbanization in a metropolitan region, Habitat

12. Birkmann, J., (2007). Risk and vulnerability indicators at different scales: applicability, usefulness and policy implications. Environmental Hazards, 7, pp. 20–31.

13. Browne, M.J. and R.E. Hoyt. 2000. The demand for flood insurance: empirical evidence, Journal of Risk and Uncertainty, 20: 291–306.

14. Cutter, S. L., B. J. Boruff, W. L. Shirley. (2002). Social vulnerability to environmental hazards. Social Sciences Quarterly, 84(2): 242–61.

15. Cutter S L, Boruff B J and Shirley W L (2003). Social vulnerability to environmental hazards Soc. Sci. Q. 84 242–61

16. German Watch, (2019). Global Climate Risk Index 2019, Berlin: German watch.

17. GFDRR (2011). Vulnerability, Risk Reduction and Adaptation to Climate Change: Pakistan Country Profile. Global Facility for Disaster Reduction and Recovery (GFDRR). Https://www.gfdrr.org/en/publication/climate-risk-and-adaptation-country-profile-pakistan

18. Government of Pakistan (2019). National Disaster Response Plan 2019. Https://app.adpc.net/sites/default/files/public/publications/attachments/SECTION%20I%20-%20Profile%20of%20Pakistan_0.pdf

19. Haris Khan, (2017). Improving Pakistan's fiscal resilience to natural disasters, published by End Poverty by World Bank Blog

20. Intergovernmental Panel on Climate Change (2007). Climate change: Impacts, adaptation and vulnerability, Cambridge University Press, Cambridge.

21. IFRC. World Disasters Report. Geneva: International Federation of Red Cross and Red Crescent Societies. (2001). Available from: www.ifrc.org/publicat/wdr2001/.

22. Khan, S. (2012). Vulnerability assessments and their planning implications: a case study of the Hutt Valley, New Zealand, Natural Hazards, 64: 1587–1607.

23. Kumpulainen, S., (2006). Vulnerability concepts in hazard and risk assessment. Geological Survey of Finland, Special Paper 42, pp. 65–74.

24. Khan, B., Iqbal, M. J., Yosufzal, M. A. K. (2009). Flood risk assessment of river

Indus of Pakistan. – Arab J Geosci 4: 115-122.

25. Phung, D., S. Rutherford, F. Dwirahmadi, C. Chu, C.M. Do, T. Nguyen, N.C. Duong. 2015.
26. The spatial distribution of vulnerability to the health impacts of flooding in the Mekong Delta, Vietnam. International. Journal of Biometeorology. http://dx.doi.org/10.1007/ s00484-015-1078-7.
27. Qasim, S., A.N. Khan, R.P. Shrestha and M. Qasim. (2015). Risk perception of the people in the flood prone Khyber Pukhthunkhwa province of Pakistan. International Journal of Disaster Risk Reduction, 14: 373–378.
28. Rahman, A. And A.N. Khan. (2011). Analysis of flood causes and associated socioeconomic damages in the Hindukush region, The International Society for the Prevention and Mitigation of Natural Hazards, 59:1239–1260.
29. Rana I, A. & Routray J K (2018) Multidimensional Model for Vulnerability Assessment of Urban Flooding: An Empirical Study in Pakistan Int J Disaster Risk Sci (2018) 9:359–375
30. Miceli, R., I. Sotgiu, M. Settanni. (2008). Disaster preparedness and perception of flood risk: a study in an alpine valley in Italy, Journal of Environmental Psychology, 28(2): 164–173.
31. Sayed, S.A. and P.A. Gonzales. (2014). Flood disaster profile of Pakistan: A review. Science Journal of Public Health, 2(3): 144-149.
32. Thieken, A.H., S. Mariani, S. Longfield and W. Vanneuville. 2014. Preface: Flood resilient communities – managing the consequences of flooding. Natural Hazards Earth System Sciences, 14, 33–39.
33. UN/ISDR, (2004). Living with risk: A global review of disaster reduction initiatives, United Nations, Geneva.
34. United Nations International Strategy for Disaster Reduction (UNISDR) Global assessment report on disaster risk reduction (2009) ISBN/ISSN/DOI 9789211320282 ;207 pages
35. United Nations Development Programme (2001). Report on Emergency Response Services in Pakistan, by United Nations Development Programme.
36. United Nations Development Programme (2004). Reducing disaster risk – a challenge for development. United Nations Development Programme, Bureau for Crisis and Recovery, New York.
37. USAID (2017). Pakistan Climate Change Risk Profile. United States Agency for International Development. Https://www.climatelinks.org/resources/climate-risk-profile-pakistan
38. United Nations Office for the Coordination of Humanitarian Affairs, Pakistan—Monsoon Floods, Situation Report #23, September 9, 2010. Hereafter referred to as OCHA Situation Sept. 9 Report. Thieken, A.H., S. Mariani, S. Longfield and W. Vanneuville. 2014. Preface: Flood resilient communities – managing the consequences of flooding. Natural Hazards Earth System Sciences, 14, 33–39.
39. World Conference on Disaster Reduction (2005). A Review of Disaster Management Policies and Systems in Pakistan. Available at: http://www.unisdr.org/ 2005/wcdr/wcdr-index.htm

40. Wisner, B., P. Blaikie, T. Cannon, I. Davis (2004). At Risk: Natural Hazards, People's Vulnerability and Disasters, 2nd ed., Routledge, London.
41. World Bank & the Government of Pakistan, (2010). Pakistan Floods (2010). Preliminary Damage and Needs Assessment, Islamabad: Government of Pakistan.
42. World Bank, (2017). Improving Pakistan's fiscal resilience to natural disasters. World Bank News, 6 13.
43. World Health Organization (2002).WHO, Floods: Climate change and adaptation strategies for human health. Report (EUR/02/5036813) on a WHO meeting London, United Kingdom 30 June – 2 July 2002
44. Word Bank, (2017). Improving Pakistan's fiscal resilience to natural disasters, published by End Poverty