

**COMMUNITY VULNERABILITY ASSESSMENT OF
TESHIL BEHRAIN DISTRICT SWAT
(Post Flood Vulnerability Assessment)**



By
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*A thesis is submitted in partial fulfillment of the requirements for the
degree of
Master of Science
in
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This is to certify that the
thesis titled

**“COMMUNITY VULNERABILITY ASSESSMENT OF
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(Post Flood Vulnerability Assessment)**

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DEDICATION

I dedicate the thesis to my teacher and friend who generously supported and guide me.

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ABSTRACT

Pakistan lists among those countries that are highly vulnerable to complex and diverse natural and anthropogenic hazards. Among other natural hazards flooding remains the most devastating throughout the country's history. The mega monsoon floods of 2010 are termed as the worst flooding disaster experienced in country's history. District Swat in Khyber Pakhtunkhwa was among the worst affected upstream areas during this event which left unprecedented impact on local communities. Four of the worst hit Union councils in Teshil Behrain of Swat valley are studied for quantitative analysis of the impact of flooding on local population and their vulnerability to flooding hazard in order to highlight the factors that results in high risk profile of these communities. Primary data collection included key informant interviews and Focus Group Discussion- FGDs with selected section of the community and administration to assess their exposure to flooding, coping capacity and vulnerability of the local community. The results of field data analysis infer high frequency of flooding in the valley, lack of coping capacity at local level with frequent exposure to the hazard, and increasing vulnerability of the community due to unplanned rapid expansion of settlements. Harsh climatic conditions, mountainous terrain and frequent hazards in Swat District stresses upon the need for immediate disaster risk reduction measures at community level for capacity building and strengthening institutional setup through public-private partnership.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
CCA	Climate Change Adaptation
DDMA	District Disaster Management Authority
DDMP	District Disaster Management Plan
DM	Disaster Management
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FGD	Focus Group Discussion
GoP	Government of Pakistan
KP	Khyber Pakhtunkhwa
KII	Key Informants Interview
NGO	Non-Governmental Organization
PDMA	Provincial Disaster Management Authority
SFDRR	Sendai Framework for Disaster Risk Reduction
TDMP	Teshil Disaster Management Plan
TDP	Temporary Dislocated People
UN	United Nations
UNISDR	United Nations Strategy for Disaster Reduction
VAI	Vulnerability Assessment Index

INTRODUCTION

1.1 Background

Swat is an administrative District situated in Malakand division of Khyber Pakhtunkhwa- KPK. The is located at 34⁰-40'' to 35⁰-55'' North Latitude and 72⁰-08'' to 74⁰-6'' East Longitude and the total area is 8220 square kilo meter. The old archeological structures and inheritance of Buddah are the evidence to animating past. The natural beauty, plenty of water, abundance of emeralds, forest, wild life, fertile land, pastures, range land and its geographical importance presents a history of evolution. The rich civilization however also attracted many invaders.

Pakistan has seen 7 major floods since its creation. Amongst, flood 2010 devastated the socioeconomic and environmental infrastructure in entire country generally and specifically in District Swat. The occurrences of natural disasters are common phenomenon due to geographic features and presence of active fault lines. However, such a catastrophic flood has never been seen in the history of Pakistan. It destroyed buildings, business centers, markets, houses, washed away agriculture land & vegetation cover, bridges, cut down roads and destroyed important life lines. It caused massive displacement and put constraints on food security, livelihood, educations and health facilities. The massive damages and losses were due to the fragile vulnerability conditions of people with lack of resilience to withstand flood disasters. Similarly, no mechanism of early warning was in-placed at any level to disseminate early warnings and facilitate safe evacuation.

Many studies including Pakistan flood 2010 by Asian Development Bank (ADB), District Swat Disaster Management Plan (DDMP) and Behrain Teshil Disaster Management Plan (TDMP)by Provincial Disaster Management Authority (PDMA), underscored scale of damages and losses from flood 2010. As a result, access to basic facilities, services and constrained livelihood options within the local

communities increased people vulnerability. The situation got worse in those areas of upper Swat where government and aid agency were unable to get access to flood affected people and serve humanity. In this harsh time, Pak Army reached to the out of access population and ensured emergency assistance.

In after math of emergency response, the Government of Pakistan-GoP, humanitarian, UN and aid agency initiated programmes for build back better. The dislocated households return back to their dwellings. The market steadily got function which gave a ray of hope for livelihood revival. However, disaster resilient development is essential for long term sustainability backed by research oriented policies and programmes.

1.2 Overview of the Study Area

Teshil Behrain is widely famous for the scenic natural beauty and moderate weather during summer season. District Swat has four Teshils (Sub-District or Administrative Unit) and Behrain is one of the administrative Teshil settled in north of the capital city Mingora of District Swat. There is multiple streams fall in the river Swat at catchment area of Behrain. River Swat is flowing in the middle of throughout Teshil. It is located at of distance of 316 KM from Islamabad. The total population 248,474 (census 2017-2018) is surrounded by mountains from all sides. It receives average rainfall 450-700 mm/year.

The moderate weather condition in summer attracts tourist from all parts of country and global tourist too. The average high temperate reach to 21°C in month of June and becomes harsh at 1 °C or -0°C in winter month January. The area does not count for monsoon season therefore occasional rainfalls in the monsoon season. The average rainfall is around 450-700 mm/year.

The limited livelihood opportunities, education and geographic features make it prone to multiple disaster effects. Flood 2010 notably affected the entire Teshil Behrain as people lost assets, livelihood sources, stranding crops and infrastructure.

The people in area mainly associated with agriculture, livestock's and tourism industry, however both sector substantially affected due to recurrent disasters in the area. People were practicing subsistence agriculture for survival; however, flood 2010 washed away the productive lands, standing crops, stored produce and damaged overall agriculture infrastructure of the village ADB Report (2010). The irrigation channels in some of the communities were also damaged which has resulted decrease in productivity (community assessment). Major crops grown are mostly cereals and vegetables, while apple, peach, persimmon are the major fruit orchards, that has employed a large number of people. The flood affected the livelihood of these people as they were not able to transport their fruits and vegetables to market for cash returns. The flood destroyed bridges and roads that restricted access to essential services, which resulted in increased in prices of the staple food items.

The major tribes living in the village are Yousafzai, Pakhtuns, Gujars, and Mians. The women use veil and generally not allowed to go out freely from their house boundaries. People live (d) in joint family system and have strong social bonds before flood disaster. The flood left in isolation, many became temporary dislocated people-TDP and many lost their native village and land. The social bond and cohesion weakened over time. To address the humanitarian needs by organization in early recovery and recovery phase left the local people in competition to get more out of it as individual rather a community. However, some best practices for instance sharing of accommodation, agriculture and other required tools also found in the study area.

Though people have high affiliation with politics to follow personal interest and have no or little understanding on their roles and responsibilities. The political leadership never made accountable owns self towards a progress and resilient society. The benefits for disaster affected people have often politicized very structurally and supported their party's workers to gain loyalty in future elections.

1.3 Problem Statement:

The devastation caused by flood 2010 in Pakistan will always be remembered. The flood 2010 affected more than 20 million people. The devastations of flood were though widespread but District Swat was particularly affected. The Upper District Swat is prone to multiple hazards including flood, earthquakes, heavy rain fall, snow fall and thunderstorm. High level of poverty, high population densities, environmental degradation, lack of political will and lack of coordination, planning and preparedness make the region highly vulnerable to natural disasters. The geographic obstacles such as steep, high mountains and harsh weather conditions restrict access to these locations.

In study area, DRR has not been mainstreamed into development which makes reasons for recurring disasters (natural and anthropogenic). This study aims to identify factors that increase people's vulnerabilities and reduce coping capacities. An indicator based study on exposure to flood, access to facilities, existing mitigation measures, socio-economic culture and weak relations will be evaluated for the in-depth understanding of vulnerabilities.

1.4 Objectives

- To carry out flood vulnerability assessment of Teshil Behrain District Swat.
- To suggest measures for mainstreaming DRR into development in Teshil Behrain District Swat.

1.5 Research Questions

- i. Is there any study conducted on Vulnerability Assessment in relation to flood?
- ii. What are the key factors behind increasing vulnerability in the area (Behrain upper Swat)?
- iii. What could be done, to reduce people's vulnerabilities and increase their capacities?

- iv. Does the projects/programs being implemented in the study area mainstream DRR into development?

1.6 Scope of study

The Khyber Pakhtun Khwa (KPK) province of Pakistan is prone to multiple disaster due to its unique nature of vulnerabilities. A number of disasters including the recent past earthquake 2005, major flood 2010, cyclone in 2014 (Peshawar region), insects attack (Dengu) and Glacier Lake Outburst Flood (GLOF) put the region at high risk. However, the devastation of flood in District Swat reversed the development pace. The govt. UN, NGOs and private sectors executed number of projects to meet their basic needs (food, shelter, cloth). Hence very limited projects embed DRR into development, executed in the region. Therefore, keeping in view the imminent disaster, identification of root causes and factors through in-depth vulnerability assessment was essential to recommend disaster risk reduction measures for sustainable development. There were very limited studies have been carried out which very briefly present the vulnerability situation of the area. In particular, no study has been carried out to identify the degree of people's exposure, fragility and lack of resilience to flood.

This study examines community vulnerability by vulnerability assessment index-VAI taking into account the three parameters including exposure, fragility and lack of resilience. The priority hazards identified in consultation include major flood, flash flood and heavy rain fall. These indicators used to identify community's exposure to flood. Similarly, income, education, health, social networking, houses structure and environment considered as indicators for identification of fragility and lack of resilience. There were number of underlying risk factors that increase vulnerability and contribute to the severity of disasters in the study area. These include:

- Poor construction practices and limited enforcement of existing building codes
- Weak early warning systems

- Lack of awareness and education on disasters and response
- Limited capacity and coordination between various government disaster response agencies
- Disaster susceptibility of large number of impoverished communities

Limited attention has been given to make analysis of the key reason of vulnerabilities causing widespread destruction at time of disaster. The analysis and results of vulnerabilities assessment provide foundations for effective planning to disaster risk reduction/management.

The insights from the study provide basis for effective planning at govt. level to combat disasters in future course of action. It also open new avenues for research studies and may serve as useful reference tool for future studies.

1.7 Organization of Thesis

- Chapter 1: The Introduction chapter describes the study background, provides overview of study, explained problem statement, objectives and scope of the study.
- Chapter 2: Literature Review chapter provides brief summary of the same research studies conducted and published by other authors.
- Chapter 3: This chapter provides an outline of research methods used in the current research study. It has presented research design and the tools used for data collection and analysis. The techniques applied in the study include percentage tables, Bar Chart and vulnerability equations.
- Chapter 4: In this chapter, different maps described target area for study and hazard zones. Provides analytical explanations to the three parameters with appropriate references.
- Chapter 5: The last chapter narrates the conclusions based on the findings of this study and suggests certain recommendations for future studies and researches.

LITERATURE REVIEW

Hong (2011) conducted a study on Pakistan flooding 2010 by examining the European, Russia blocking and the interaction of tropical monsoon surge. Their study presented that number of monsoon surge caused intense rain fall in Pakistan and triggered flood which devastated the country by affecting 20 million people and death toll near 3000 individuals.

According to Cutter (2003), disasters have become more devastating in nature than before. The reasons are that hazard's frequent interaction with the widespread distinct vulnerabilities in the US County. The hazards of place model were used in the study which concluded that vulnerability is a multifaceted phenomenon which identify a set of those conditions and characteristics that enable an individual, community to respond and recover from disasters.

Mehmood, (2016) conducted study, to assess flood 2010 causes and damages in Dir Valley Khyber Pakhtun Khwa. The study has discussed the reasons of intense of rain fall which turned into flood. The flood that interacted people's vulnerability in the area resulted massive damages and losses to socioeconomic and built environment. Zone wise (Balkot, Barikot, and Sharingal) damages to agriculture, infrastructure and economic losses have been presented in the study. The assessment of flood damages emphasis the vulnerability of District Swat which is adjacent to Dir and have similar geographic feature.

The Provincial Disaster Management Authority-PDMA KPK conducted two studies that are District Swat Disaster Management Plan-DDMP and Behrain Teshil Disaster Management Plan. In both study general profile of the vulnerability have been presented. In DDMP, Teshil Behrain has been marked at lower scale that is prone flood. The findings about the prevailing vulnerability assessed in the current study, put the entire Teshil at high vulnerable scale that is prone to multiple potential

hazard effects. Therefore, the authority should reassess the prevailing vulnerability and take action to reduce them.

The Asian Development Bank-ADB (2010) conducted post flood need assessment of the flood affected areas in Pakistan. The report has presented the extent damages and losses in different sectors throughout Pakistan. It has also provided insight about the gaps found in the preparedness and response measures. The report declared that flood 2010 was the most devastating flood in the history of Pakistan. However, the responsible institution couldn't timely disseminate flood information especially in the upper zone of Pakistan Qasim (2016). It also failed safe evacuation of people to safe zone. The report has recommended PKR 758 billion (US\$ 8.9 billion) for the rehabilitation and reconstruction needs.

Musah and Olaruntoba (2013) conducted similar nature assessment in Ghana which has assessed the effects of seasonal floods on livelihoods and food security. The study also in-place the definition of Inter Governmental Panel of Climate Change- IPCC (2014) that vulnerability is the susceptibility or propensity of a system to be negatively affected by an external hazard. It has discussed causes of floods and damages and its impacts on food security and livelihood. It has further elaborated the seasonal nature of flood usually happened in August to September. The susceptibility exposure of farmland, agriculture crops and soil nutrients were significantly affected which contributes in low crop yielding and food security. The recommendation suggested early response to the area so that avoid problems of food security.

Azeem (2016) has used multilevel model for assessing vulnerability of household to food in security in Punjab Pakistan. A sample of 90,000 household took in order to measure consumption of calories per person. The evidence showed that flood consumption was below 3000 kilo calories per person per day which indicated that more household were going to food insecure in nearer future.

To examine resilience to flood Qasim (2016) conducted community resilience assessment in District Charsadda, Nowhsera and Peshawar. In this study resilience flood resilience indicators and community resilience indicators. A sample of 280

household chose and random sampling technique were used for survey. The result presented that all the three sites were less resilient due to physical, social, economic and institutional factors which influence community vulnerability. Therefore, the study recommends policy makers to take concrete measure for increasing resilience of flood prone people in the selected Districts.

Climate change has widespread impacts on human being and it impacts varies from individual to individual. Shakeel (2019) has assessed gender vulnerabilities to climate change in three sub basin of Indus including Soan, Hunza and Chaj Doab in Pakistan. The findings presented as climate change has left drastic impacts on the entire community of the study area. However women and children were differently affected by the extreme weather events. Women were found more vulnerable due to limited access to power, education, information, extension services and different socially fabricated roles & responsibilities. The rain fed agriculture was the only source of income generation and getting food. The climate change has left negative impacts on the rain fed agriculture. Therefore, the men were compelled for searching of livelihood sources in other areas. In this case women were taking additional responsibilities in their absence. The study recommended that special attention should to improve women skills and capacities in terms of early warnings, credit facility and mainstream programmes with focus of women development. Furthermore, government and aid agencies should provide financial assistance to the farmer community so that they could invest in climate resilient crops and diversified livelihood sources.

Yadav (2017) has also pointed out that women confronted with many challenges created by climate change. Their health, education and livelihood means affected by the effects of climate change.

Keeping in view the increased frequency and magnitude of flood disasters, a press released by United Nations University (2004) predicted that 2 billion people would be exposed to flood disaster due to increased vulnerability to climate change, growing encroachment in flood prone areas and rising sea level. Though nature

provides equal opportunity and risks, however, the system of socio-economic conditions make some groups of people, class and community more exposed to natural events than other Cannon (1994). Similarly, Highfield, (2014) in the study of mitigation planning for hazard exposure, structural and social vulnerability has underscored that communities living near river bed were more exposed to flood hazards. Therefore, authors have stressed the need to prioritize high impact zones and take mitigation and recovery measures to avoid losses and damages.

Vink and Takeuchi (2013) conducted study to evaluate legal actions in Disaster Risk Management-DRM taken for the vulnerable people in Japan, Netherlands and United States. The authors have mentioned that in general some characteristics and set of conditions make people more susceptible to disasters in a community despite actions taken on account of recovery or reducing disaster effects. However, in the study countries definition of vulnerable people/group were not similar to each other as per respective DRM laws and policies. In respective laws of USA and Japan some characteristics of vulnerable groups were found similar which were elderly people, children and people with disability. Whereas, the Netherland has mentioned that not self-reliant people were vulnerable in the laws of DRM. The varying definition of vulnerable people sets different trends to approach vulnerable people in respective countries. Thus, it makes difficulties to set standards trend for measuring vulnerability in DRM laws. Therefore, the study suggests developing DRM tools in the perspective of DRM laws for vulnerable people. The study referred to Hyogo Framework for Action-HFA (2005) that has stressed on the development of indicators and indices which would evaluate vulnerability of different groups.

According to Morrow (1999) the social and economic conditions determine disaster vulnerability. The study indentify that disasters restrict resilience of a single headed household or households having large numbers of dependents who most of the time juggle with multiple jobs to meet family needs. The study has explained that vulnerable people such as poor, senior citizen, and women headed household suffers more from disasters. Mapping these groups within the communities is essential for effective response. The study also recommended engagement of these groups in

planning and response activities in order to promote local activism which will leave long lasting impact towards disaster resilience.

Fekete (2009) has used social vulnerability index with aim to develop and validate social vulnerability map of people prone to river flood in Germany. Composite index has been used with three indicators (fragility, socio-economic condition and region) took from the office of federal statistics. The households in the three federal states were surveyed and used logistic regression for analysis vulnerability. The results of the social vulnerability index has presented vary vulnerability conditions of different counties in Germany.

Sadia (2016) has examined women's health risks and vulnerability with reference to floods in Pakistan. The purposive and random sampling technique was used in the study. The flood 2010 most affected two UCs in District Nowshera were purposively selected and 386 household were selected randomly. The findings presented that women were found more vulnerable to access better health care assistance. Multiple factors including low education, socially fabricated roles, access to extended services, income and perception about disaster make them more vulnerable in terms of public health. According to Flanagan (2011) has also emphasized on the provision of early health services in post disaster situations. The limited available health services often increase mortality and prolong recovery from disasters. Thus, the study recommended, to take women mainstreamed structural and non structural measures.

Junaid (2019) has conducted study on the disaster management system in Pakistan. Example from the flood 2010 has been given as evidence to justify the fragility of the system was unable to address root causes of vulnerability. The lack of coordination and working in isolation worsened the situation in flood 2010. The responsible institutions have no plan in-placed for effective response. The solution exists in owning the business of DRM with coherent and effective coordination backed by guiding documents.

Jamshed (2019) conducted an empirical study to assess the relationship between capacity and vulnerability with reference to flood in two Districts- Muzaffargarh and Jangh Punjab Pakistan. In order to best capture vulnerability and capacity, a vulnerability index was developed. Similarly 24 indicators were selected for measuring vulnerability and 19 indicators were used for capacity assessment. A sample of 120 household was selected for survey. The result presented that the findings of vulnerability assessment were the same of two Districts. However, different findings of capacity assessment portrayed that Muzaffargarh had more coping capacity to flood than sub-District Jangh. Muzaffargarh has more capacity in terms good education, access to resources, livelihood skills, social assets and community networking.

Tapai (2017) conducted an indicator based study to assess vulnerability of 571 European cities to climate change. There were three risk factors for assessing climate change vulnerability which included flood, heat waves, and drought. The Floods cause widespread socio-economic problems, whereas drought cause issue of water management and heat wave affect health of population. A vulnerability index constructed to quantify respective cities vulnerability to climate change. The information took from the European audit database which also helped development of indicators. The result presented that vulnerability of the large cities were high due to the three risk factors of flood, heat wave and drought.

Mwape (2009) has conducted study on flood impacts on socio-economic condition of people and livelihood in Zambia. The study carried out qualitative and quantitative analysis. The critical elements including agriculture, health, education, access to water, assets/ property, housing and sanitation were found drastically affected by the flood. The damages and losses to the critical aspects increased the socio-economic vulnerability of the people. The study has presented some key recommendations to cope with disaster and its effect.

According to Busby (2013) identified that in vulnerability assessment, mapping remains one of the significant approaches to help understand the degrees of

prevailing vulnerability. In the study Teshil Behrain, the flood 2010 turned the lush green riverbanks into barren lands left with stone and sands Teshil Disaster Management Plan (2015). The study analyzed degrees of spatial vulnerability in the flood hazard maps of target union councils. Kira (2019) used participatory approach for developing of vulnerability. The feedback of different stakeholders in the participatory planning contributed understanding community perception and validating vulnerable location in the flood hazard map.

Kakanyo Fani Dintwa (2019) has carried out a study to quantify the prevailing vulnerability in Botswana. Many indicators were used for measuring vulnerability of people and places. In the study place vulnerability model and factors analysis used in order to measure social vulnerability to natural hazards. The Census Data 2011 about population and housing provided by the study Districts of Botswana. There has been a great consensus in the available literature that flood does not equally affect the people living in similar environmental and geographic setting Pongponrat (2017). The vulnerability index scores found that the high vulnerable Districts (Ngamiland West and Central Tutume) were due to low income, unemployment, social insecurity, low education level and high number of children and elderly people. The study recommended that the government should undertake integrated programmes with special attentions to women's employment and small scale business.

Blaikie, Cannon 1994 has explained the relationship between vulnerability and disaster through "pressure and release model". The model focus on the socio-economic pressure and physical exposure generate disasters. The division of upper class, lower class, and marginalized class/groups in a community determine unequal access to resources which create unsafe conditions and dynamic pressures and further makes them susceptible to the negative impact of natural events.

METHODOLOGY

This chapter provides an outline of research methods used in the current research study. This section gives overview about the respondents, key informant. It also presented research design and the tools used for data collection and analysis. The techniques applied in the study include percentage tables, Bar Chart and vulnerability equations.

3.1. Research Design

The research attempts to identify community vulnerability to flood using Vulnerability Assessment Index - VAI in Teshil Behrain District Swat. In the initial stages of the research design, all those villages in the respective Union Councils-UCs identified that has been affected by flood 2010. The tools/questionnaire prepared after in-depth study of available literature on vulnerability assessment and development of indices. To assess people vulnerability in the study area two approaches adopted 1) interviews conducted with the households by visiting their houses. 2) Another approach was conducting focus group discussion with selected groups of male and female. In study area women are consider most vulnerable due to restricted access and poor education. Therefore, keeping in view the cultural constraints and social taboos segregated sessions of interviews and focus group discussions conducted with women.

The vulnerability index was divided into three parameters and each parameter consisted of different indicator. These indicators were further divided into class/questions weighted with scale of 3, 2, and 1, as high, medium and low respectively. By this way information on vulnerability factors were easily extracted from the respective target groups. Qualitative information obtained from households and government stakeholders. The data was collected through Focus Group Discussion, Key informant interviews and households survey.

The vulnerabilities were identified by carrying out analysis of the collected information on level of exposure, fragility and lack of resilience and perception about the most prominent hazards. The analysis of the data made in Statistical Package for Social Sciences-SPSS and Microsoft Excel.

The preparedness, knowledge, and practices of the local administration /District Government assessed using open and closed ended questionnaires. The relevant available literature was reviewed and analyzed to identify the rationale of the study. Conclusion and recommendation were based on the result of the study.

3.2. Population, Target Groups and selection of Union Councils-UC

The total population of Teshil Behrain is 248,474 individuals (census 2017-2018). The target groups include men, women, people with disabilities, children, elected representatives, small business community and govt. representatives. The study was conducted in four UCs- Madyan, Beshigram, Behrain and Tirat of Teshil Behrain District Swat Khyber Pakhtun Khwa.

The catchment area of District Swat is diverse in view that there are glaciers melting in northern area of the District, all making their way through upper catchment. Similarly, monsoon period also cause heavy rain fall. Specifically, 27th-28thJuly 2010, the heavy rainfall caused a major flood after 80 years in Pakistan. The area/communities/villages hit by the 2010 flood were identified in consultation with local community people and local administration. It was therefore essential to specify the areas/communities prone to flooding. The low probability of flood also considered because it might affect at regional scale. The selected Union Council for the study includes Union Councils Behrain, Beshigram, Madyan and Tirat. In target villages flood zones were prepared in consultation with community and local authorities.

3.3. Sampling Design and Sample Size

The total population of study area is 148,392 individuals (Census 2017-18). The Raosoft sample size calculator was used for estimation of household survey and KII. The sample size with 90% confidence level chose and tolerated 10% margin of error. Thus more individuals than calculated sample size of 68 were surveyed during data collection. In total 80 households surveyed include 70 individuals from community household, 10 key informants. Moreover, 32 focus group discussions - FGD conducted for qualitative information.

Purposive sampling technique used in order to ensure that data collected only from the flood affected people and prone yet to flood impacts due to high vulnerabilities. Primary data obtained from surveying 70 individual, 32 FGDs, and 10 KII in the four flood affected Union Councils of Teshil Behrain.

3.4. Data Source and Development of Vulnerability Index:

The available literatures were reviewed for development of vulnerability index. The vulnerability index was developed comprised on three parameters exposure, fragility and lack of resilience. Indicators were selected for each parameter. In total nineteen relevant indicators were selected. Three indicators were selected for exposure, eight each for fragility and lack of resilience Jamshid. A (2017). Each indicator further weighted with three class/questions on scale of high, medium, low and numerically as 3, 2 and 1 respectively. Vulnerability Index-VI was developed from the previous study including Hahn (2009), Cutter (2003), Jamshed (2017). See table1, shows the relationship of parameters with indicators further weighted in high, medium and low. Table 3.1, is presenting vulnerability index with aforementioned parameters and indicators rationalized in the given scale.

Table 3. 1: Parameters, indicators weighted questions on scale 3,2,1 high, medium and low respectively

<u>Parameters</u>	<u>Indicators</u>	<u>Weighted Class/Questions</u>	<u>Scale</u>
Exposure of community to hazards (A)	1- Priority Hazard (Flood)	More than two thirds of the sub-communities exposed	3
		Between one third and two thirds of the sub-communities exposed	2
		Less than one third of the sub-communities exposed	1
	2- Priority Hazard (Heavy Rainfall)	More than two thirds of the sub-communities exposed	3
		Between one third and two thirds of the sub-communities exposed	2
		Less than one third of the sub-communities exposed	1
	3- Priority Hazard (Flash Flood)	More than two thirds of the sub-communities exposed	3
		Between one third and two thirds of the sub-communities exposed	2
		Less than one third of the sub-communities exposed	1
Sub total (A)	Total for section A divided by number of indicators in section A		
Fragility (B)	1- Access to Clean Water	Clean water not available to most (needs treatment)	3
		Clean water available but not for all	2
		Clean water always available locally	1
	2- Food Security	Day to day survival practice in community	3
		Some reserves of essential items kept (e.g grain)	2
		Reserve stocks covering all basic needs are available (e.g grain + seeds + food stocks until the next season)	1
	3 -Health Assistance	No Lady Health Worker (LHW) and no locally accessible health assistance (within 1 days travel)	3
		Limited health assistance for community (i.e. LHW)	2
		Basic accessible health facilities available locally (i.e. BHU/Clinic) within 1 days travel)	1
	4 - Community Support Structures	No system providing required support	3
		System able to provide partial support	2
		Strong system able to provide required support	1
	5- Housing	House poorly constructed and made only from traditional local materials – kacha	3
		Basic Block House (brick and mud mortar) – pokhta	2
		Brick & mortar or concrete housing with no building codes or structure reinforcement	1
	6- Education	No education facility within 1 Km distance	3
		Primary Education facility available within 1 Km distance	2
		Primary and Secondary Education facility available locally	1
	7- Basic Income	Regular means of income from one source of income (e.g. Agriculture for limited number of crops)	3
		Regular incomes from one source and irregular incomes from different sources (inside and outside of the community)	2
		Regular means of income from different sources (including outside of the community)	1

	8- Environment / Natural Resources	No/very limited availability of some essential natural resources	3
		Limited local availability of required natural resources (pasture land, irrigation water, cultivation land limited accessibility)	2
		Local availability of required natural resources (pasture land, rain fed cultivation land, forest accessible for all)	1
Sub total (B)	Total for section B divided by number of indicators in section B		
Lack of Resilience (C)	1- Access to clean water	Lacking relevant skills and resources to make repairs	3
		Some of the required skills & materials available to make repairs (Basic WASH O&M)	2
		Required skills & materials available to make repairs (WASH O&M)	1
	2- Food Security / Assets	Assets uncommon in the community	3
		Assets available in the community (e.g. livestock)	2
		Saving schemes utilised (banks, community saving schemes etc)	1
	3 - Health Assistance	Community lacks skills and knowledge for treating common diseases / health problems	3
		Effective community skills and knowledge for treating common diseases / health problems	2
		Effective community skills and knowledge for treating most diseases / health problems	1
	4 - Community Support Structures/ Preparedness	No community support system (dependent on outside systems)	3
		Part of the support system run by community	2
		Community has own mechanisms for responding and providing support	1
	5- Housing	Lacking relevant skills and resources to make repairs	3
		Some of the required skills & materials available to make repairs	2
		Required skills & materials available to make repairs	1
6- Education	Available Education facilities are unsafe	3	
	Available Education facilities in safe locations	2	
	Available Education facilities in safe locations with safe construction	1	
8 –Basic Income	No/very low education and vocational skills within community	3	
	Low education and vocational skills within community	2	
	Education and vocational skills common within community	1	
8 - Environment/ Natural Resources	Natural resources not managed	3	
	Some protection / management of some natural resources	2	
	All essential natural resources protected (e.g. forest protection committee, NRM Committee, etc)	1	
Sub total (C)	Total for section C divided by number of indicators in section C		
VULNERABILITY	A + B + C		

In total 19 indicators were developed with 57 sub-indicators used for assessing people's exposures to hazards, fragility and resilience in a comprehensive scale of high, medium and low. Community exposure to hazards was identified through indicators of three priority hazards including flood, heavy rainfall and flash flood. Similarly, fragile condition of community and lack of resilience was evaluated by assessing the indicators of access to clean water, food security, health assistance, house pattern, community support structure, education, family income, and environment/natural resources.

Besides, vulnerability index a detail vulnerability assessment form contained on open ended and closed ended questionnaire were also used during community vulnerability assessment. In total 80 interviews conducted i.e. 68 with community household and 12key informants' from government and locally elected representatives. The following government officials were interviewed include District Disaster Management Authority, Civil Defense officer, District Education officer, Teshil Headquarter Health Officer, District Pak Meteorological officer and Coordinator National Humanitarian Network.

Table 3. 2: List of villages surveyed for vulnerability assessment

Union Councils	Villages	# FGD with Female	# FGDs with Male	Household Survey
Madyan	1- Enger Aabad, 2- Badalai 3-Donkarai	03	03	17
Behrain	1-Jhail, 2-Niam Osha, 3- Pakhtoon abad, 4- Old Behrain, 5 Saatal	05	05	17
Beshigram	1-Chail, 2- Beshigram, 3- Shankoo Bala, 4 Shankoo, 5-Derai Qazi Abad	05	05	17
Tirat	1-Shagai, 2- Drub, 3- Damana	03	03	17
Total		16	16	68

3.5. Measuring Flood Vulnerability by the Parameters Exposure, Fragility and Lack of Resilience:

According to Smit, and co author Wandel (2006) Vulnerability is a function of three components, exposure to hazards, sensitivity to hazards and ability (capacity) to cope with hazards. The study assessed three parameters, community exposure to hazards, community's fragility and community's lack of resilience. The fragility of a system is all those unsafe condition which make a system susceptible to flood. Similarly, lack of resilience reflects the underlying causes that reduce system capacity to withstand flood disasters.

The vulnerability of respective UCs was assessed. The information entered into database. The following equations/criterion used to carry out analysis of exposure, fragility, lack of resilience and identify Union Council Vulnerability.

$$\text{UC Vulnerability} = \text{Exposure} + \text{Fragility} + \text{Lack of Resilience}$$

Where Exposure, fragility and lack of resilience calculated using following equations;

$$\text{Exposure} = \sum_i^n \text{Add exposure indicators Score} - \text{No of total indicators used in exposure}$$

$$\text{Fragility} = \sum_i^n \text{Add fragility indicators Score} - \text{No of total indicators used in fragility}$$

Lack of Resilience =

$$\sum_i^n \text{Add Lack of resilience indicators Score} - \text{No of total indicator used in LR}$$

The maximum vulnerability score calculated 9 in the vulnerability index. Whereas the lowest minimum vulnerability calculated 1. Table 3.3 explains Vulnerability Scoring Criteria.

Table 3. 3: Vulnerability scoring criteria

Categories	Community vulnerability Category	Criteria, Vulnerability score range
Low	1	1 to 1.49
	2	1.5 to 2.49
	3	2.5 to 3.49
Medium	4	3.5 to 4.49
	5	4.5 to 5.49
	6	5.5 to 6.49
High	7	6.5 to 7.49
	8	7.5 to 8.49
	9	8.5 to 9

3.6. Assessment and Analysis of Community Exposure, Fragility and Lack of Resilience:

The community prioritized that three hazards major flood, heavy rain fall and flash floods had adversely impacted their socio economic infrastructure. Thus, the study considers only the top 3 Hazards present in the community. The community feedback recorded on scale of three high, medium and low where the response best suited on scale.

The response of community's exposure recorded in the ranks from 1 to 3 (1=LOW, 2=MEDIUM, 3=HIGH). The score identified for three priority hazards under exposure. The score of three priority hazards summed and divide the total

number of indicators. For instance: a respondent response was identified 02 for major flood, 1 for flash flood and 3 for heavy rainfall. All the three indicators were summed as $2+3+1=6$. Then 6 was divided by 3 (total number of indicators) to get total exposure score of a respondent. By this way Community Exposure Score calculated was 2. Thus used following equations to identify mean exposure to hazards (flood, heavy rain fall and flash flood).

$$\text{Exposure} = \frac{\sum_i^n \text{AddexposureindicatorsScore}}{\text{Nooftotalindicatorsusedinexposure}}$$

Like to exposure, here too the indicators developed for fragility and lack of resilience were ranked as high-3, medium-2 and low-1. The above mentioned computation process was repeated for each response to get score of fragility and lack of resilience respectively. For example: Clean Water Access = 2, Housing= 3, Education= 2, Basic Income= 2, Food Security=1, Health= 2 Total: $2+3+2+2+1+2=12$. Divide 12 by 6 (number of indicators) = 2. By this way Community Fragility Score identified. Following equation used for identifying community fragility.

$$\text{Fragility} = \frac{\sum_i^n \text{Add fragility indicatorsScore}}{\text{Nooftotalindicatorsusedinfragility}}$$

For lack of resilience suppose that:

Clean Water Access= 3, Housing= 3, Education= 2, Basic Income= 2, Food Security=2, Health= 3 Total: $3+3+2+2+2+3+2+3=20$. Divide 20 by 8 (number of indicators) = 2.5. Thus, given equation used for figuring out mean lack of resilience.

Lack of Resilience =

$$\frac{\sum_i^n \text{Add Lack of resilience indicatorsScore}}{\text{Nooftotalindicator used in LR}}$$

3.7. Analysis of Community Vulnerability;

The summation of three parameters turned into Union Council Vulnerability. The score calculated for exposure, fragility and lack of resilience were added up. And consequently vulnerability of each UC was identified using following equation;

UC Vulnerability = Mean UC Exposure + Mean UC Fragility + Mean UC Lack of Resilience

For example, exposure score= 2, fragility score = 2, lack of resilience score = 2.5. total $2+2+2.5=6.5$ community vulnerability score at UC level.

3.8. Flow Chart Showing Study Process

The following Figure 3.1 presents the flowchart of research methodology and the proposed statistical methods used in this study.

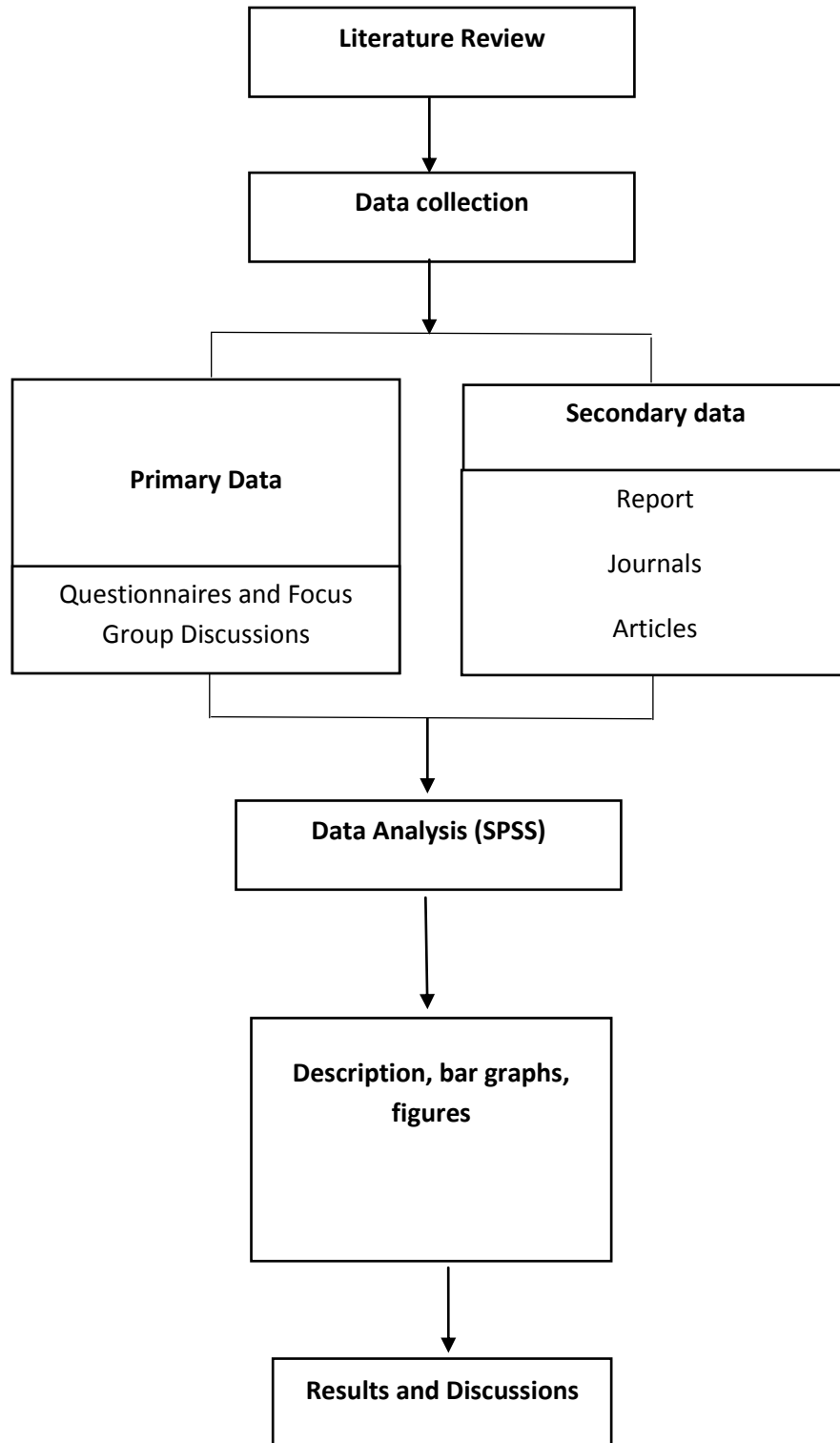


Figure 3. 1: Flow chart of research methodology

RESULTS AND DISCUSSIONS

In this chapter, area map and hazard map represented target area for study and hazard zones. Similarly, analytical information about the three parameters has been elaborated in detail with appropriate references. The information collected through Vulnerability Assessment Index-VAI entered in Statistical Package for Social Sciences (SPSS) IBMS version 20 as well as in Microsoft Excel 2007 for the purposes of analysis.

4.1. Maps

Figure 4.1, highlighted the study area in the map of Pakistan, KPK and District Swat.

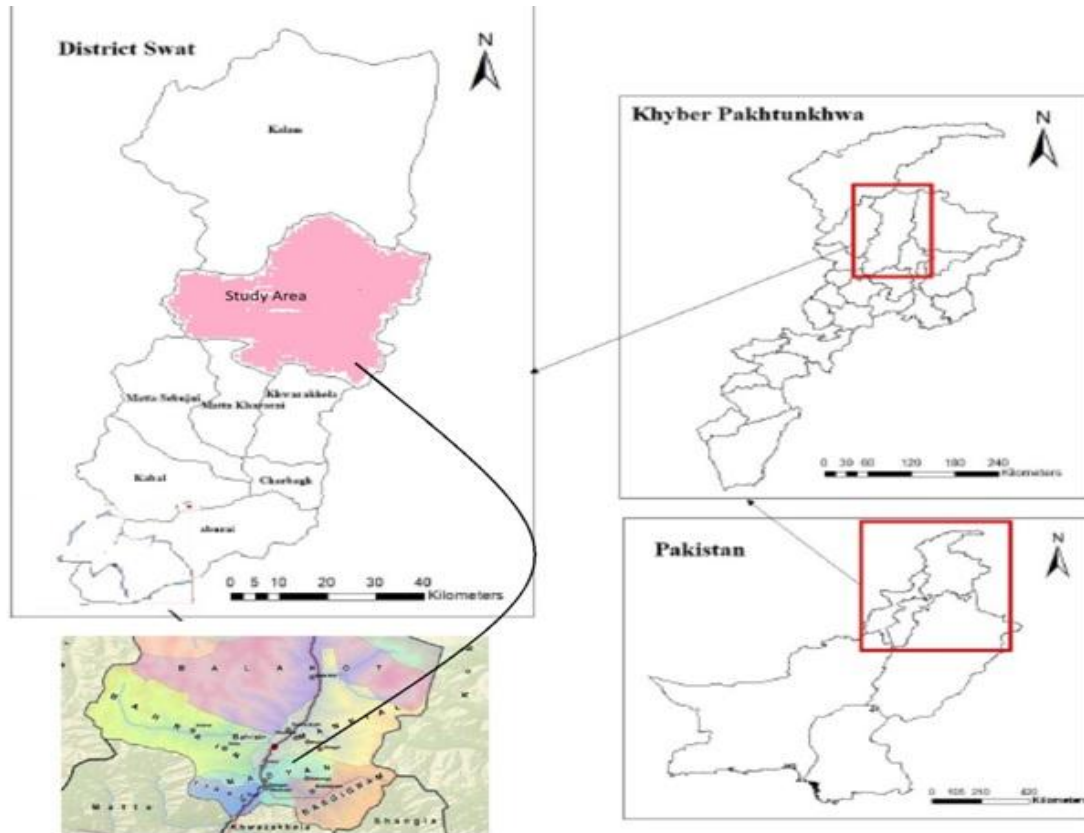


Figure 4. 1: Map of the study area

4.2. Map of Teshil

The Union Councils of Tehsil Behrain has been shown in figure 4.1

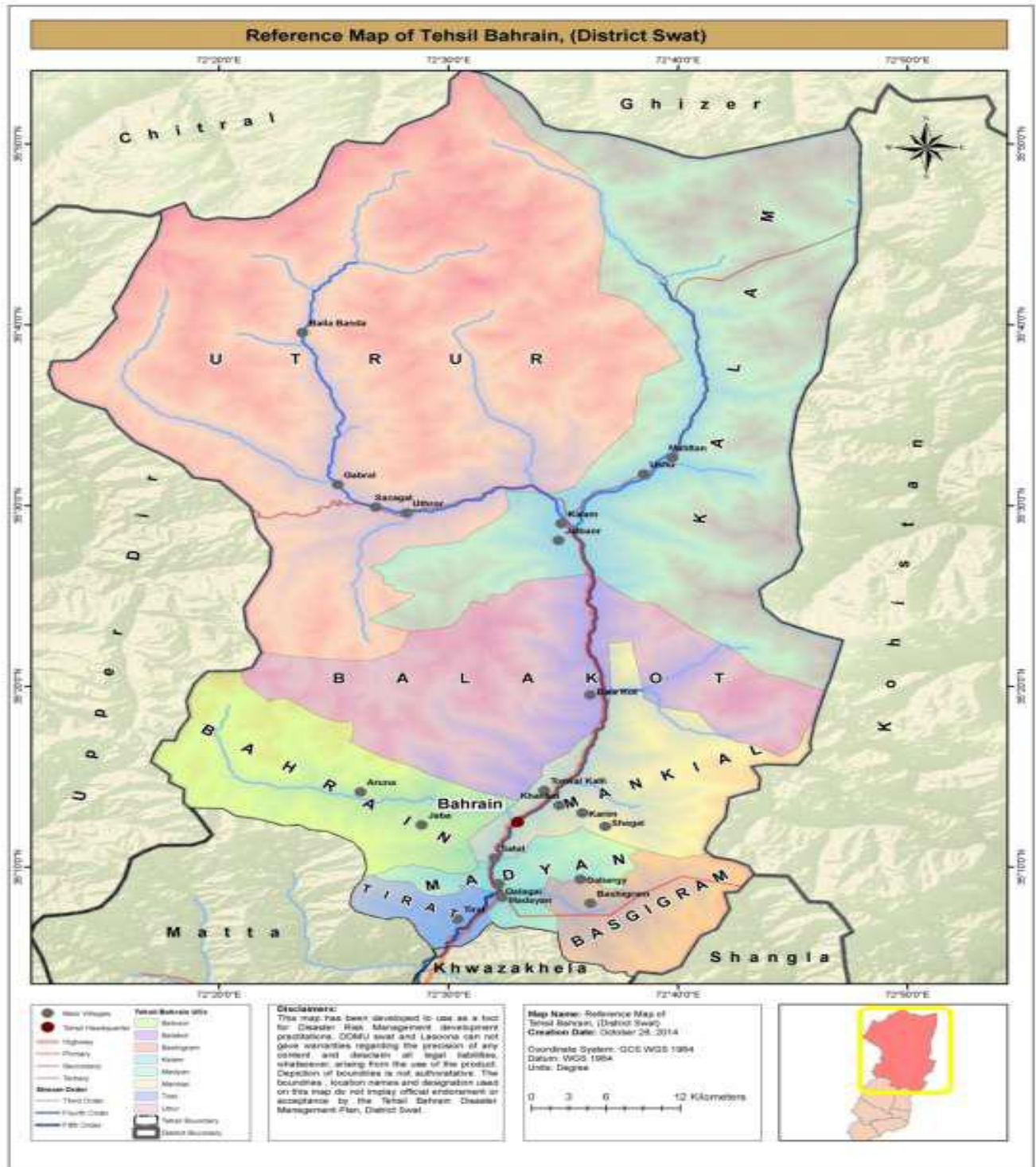


Figure 4. 2: Presented target UCs in the map of Teshil Behrain

4.3. Hazard Map of the Study Area:

In consultation with communities at risk and local authorities, hazards zone were identified. The zones exposed to multiple hazards and possess increased vulnerability were highlighted as high hazard prone zone with red color in the map. Similarly, medium hazard zone and low hazard zone highlighted orange and yellow respectively in the map. The flood 2010 was set as standard set for the calculation of zones. The criteria chose for high, medium, low hazards was the level inundations of flood water in the community. The washed away area and 4-6 –above feet inundation of flood water termed as highly vulnerable zone.

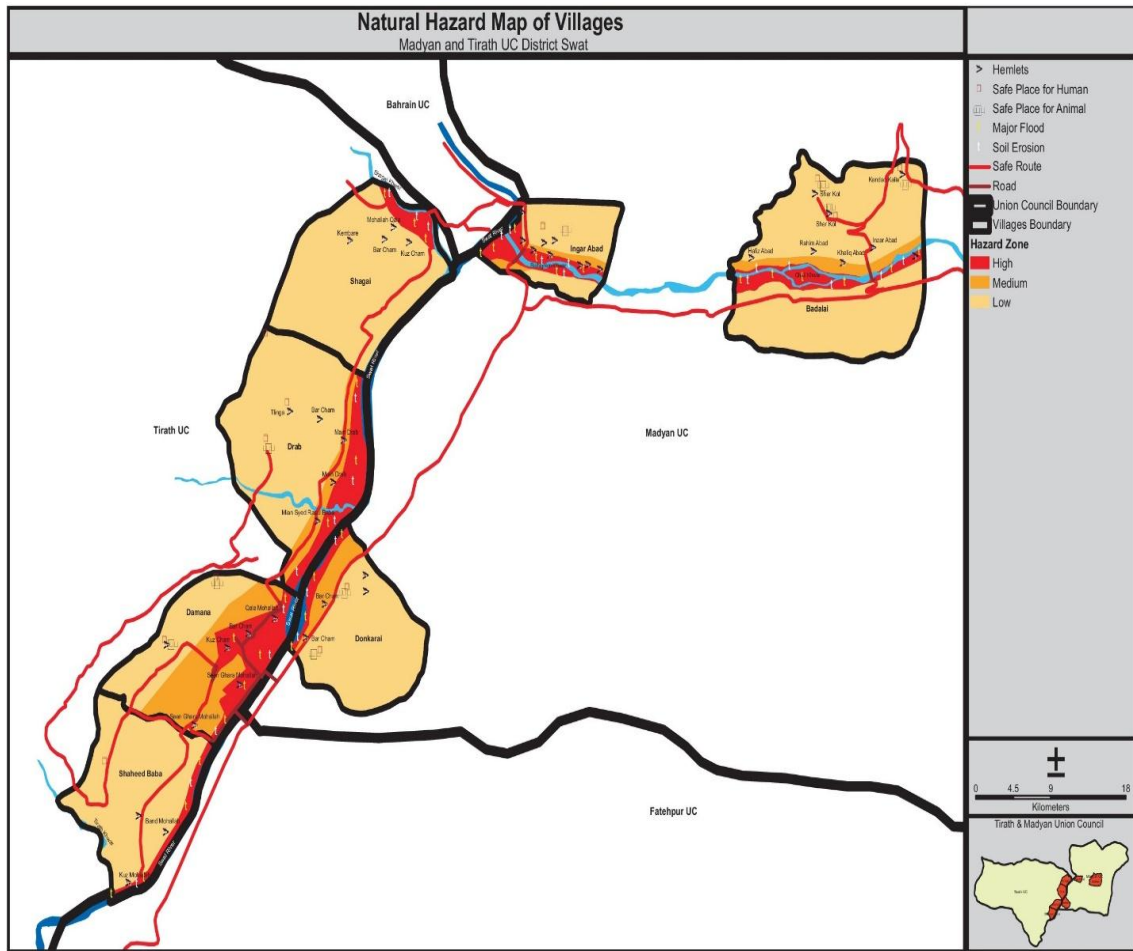


Figure 4. 3: Presented flood hazard zone

Balica (2009) highlighted the important consideration of the three factors resilience, exposure, and susceptibility while evaluating flood vulnerability of any origin. The exposure were found from the level of water inundated and damaged the overall infrastructure in local communities. The exposure was evaluated based on flood 2010 exposure to houses, building, agriculture land etc.

The likelihood of flood events that has the capacity to cause damages is called flood hazards (Schanze, 2006). However, the varying social dynamics, limited economic opportunities and political imbalances in the study area provide grounds for people's vulnerability which affects them in different ways and intensities (Balaiikie et al 1994).

4.4. Vulnerability Assessment:

Vulnerability index was developed based on available literature as discussed in Chapter 2. Hence three parameters exposure, fragility and lack of resilience adopted to assess people's vulnerability to flood. The characteristics of each parameter reviewed and based on revision indicators selected. The classification of indicators was adjusted that show suitability with characteristics of respective parameters. Each indicator was divided into three questions further weighted into low, medium and high as explained in chapter 3.

To assess people vulnerability in the study area two approaches adopted 1) interviews conducted with the entire households by visiting their houses. 2) Another approach was conducting focus group discussion with selected groups of male and female. The vulnerability of respective Union Council assessed and based on the analysis each Union Council's vulnerability identified using following criteria/equations.

UC Vulnerability = Exposure + Fragility + Lack of Resilience

Chapter 02 has explained methods and equations for calculation of community's exposure, fragility and lack of resilience.

4.5. Vulnerability Analysis:

Vulnerability analysis was done for the three parameters based on criteria and equations as mentioned in chapter 3. The UC Behrain's vulnerability score is 7.00 which counts for high vulnerability as per given scale mentioned in chapter 3 table 3.3. The findings show that the level of fragility is determined by the factors including poor of access to clean drinking water, health and education. Similarly, people are weak in networking and lacking in the neighborhood system for creation of social assets.

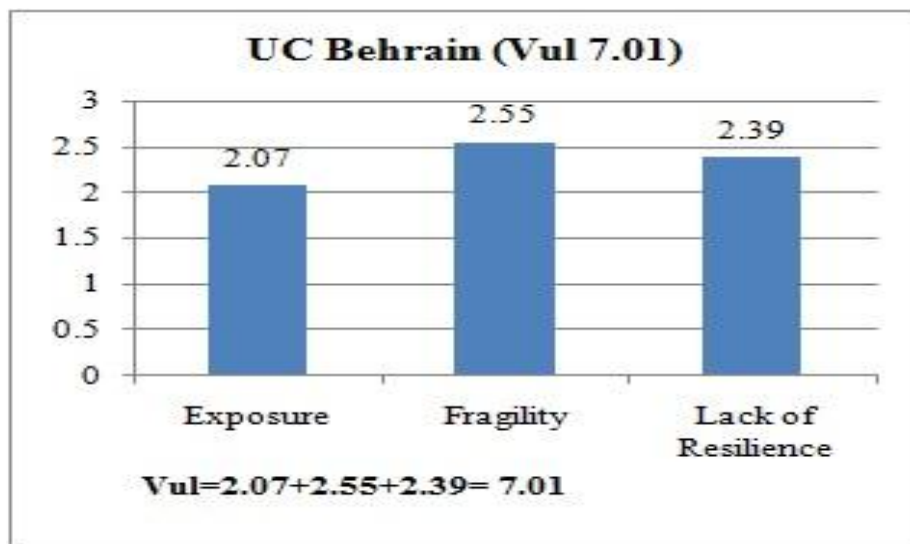


Figure 4. 4: Presented total vulnerability of UC Bahrain

The major income source is agriculture sector. The risky and subsistence agriculture practices only meet daily needs. Tourism is another source of income after agriculture. The armed conflicts of 2007 and devastated flood 2010 very negatively affected the tourism sector in the area. Majority of local people fall below poverty line. The houses are mostly constructed using poor and traditional material for construction. The villages are susceptible to multiple disaster impacts including flood, earthquake, soil erosion, rock falling etc. The UC Behrain exposure major flood, heavy rain fall and flash flood is comparatively low. However, the Doral Stream confluence with river Swat in the main city Behrain caused damages in village Jhall, Niamosha and old Behrain.

The vulnerability score of Union Council Madyan was calculated 7.52, which also counts for high vulnerability range. The high vulnerability is because of exposure to flood, heavy rain fall and flash flood. The high exposure is due to river Swat and Beshigram steam. A stream locally known as Beshigram Khwar (stream) is flowing from Beshigram which confluence with river Swat near Engerabad village. Similarly, people are lacking capacities to cope with or recover from the disaster situations. Fragility is comparatively low of the UC which reflects that maximum people has access to clean water, health assistance and multiple income sources. Figure 4.5: presented total vulnerability, level of exposure, fragility and lack of resilience.

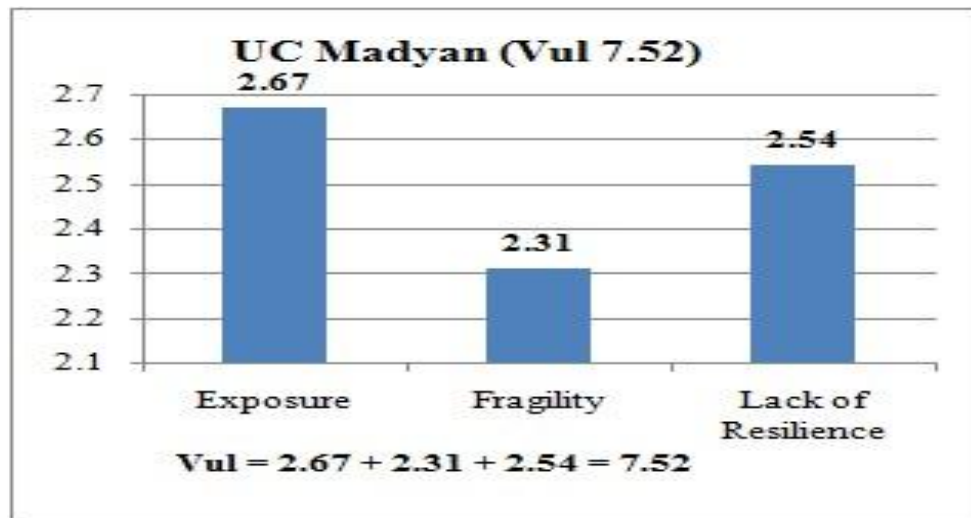


Figure 4. 5: Presented total vulnerability of UC Madyan

The vulnerability score of UC Beshigram figure out 7.47 which falls for the high range of vulnerability. The figure 4.6: presents the high level lack of resilience portray that people lacks skills and resources to withstand negative situation of flood disasters. Similarly, the high fragility score reveals that community lacks access problem to basic facilities, services and networking. Likewise, the irregular means of income from one source. The exposure to priority hazards is somehow low which reflect that maximum inhabitants are living in elevated locations.

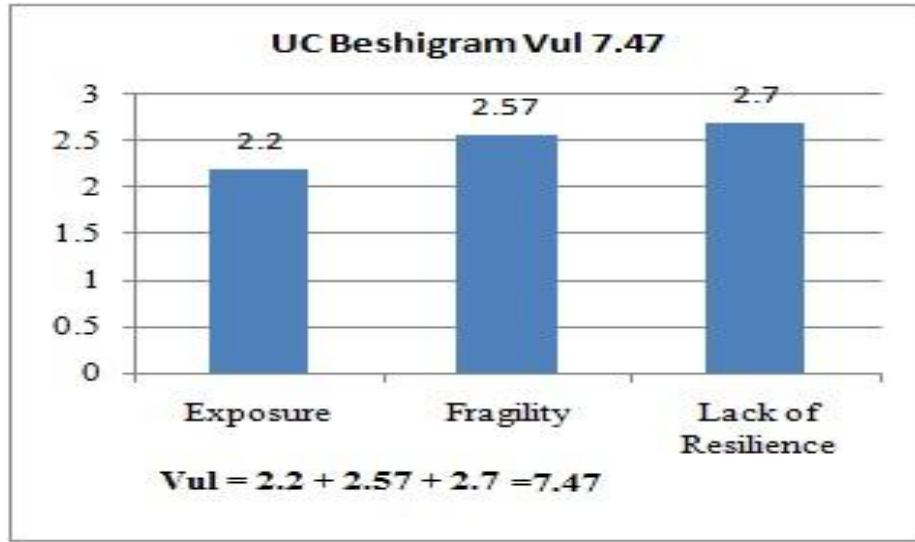


Figure 4. 6: Presented Vulnerability of UC Beshigram

UC Tirat vulnerability score counts for medium level in the given scale. The medium level vulnerability is due to low exposure, and fragility. A village Shagai is situated at elevated locations from the floods. Similarly, in “village drab” the 1200 rft protection wall protects community people from the floods.

The local people have access to spring water and education institutes. Similarly, a very strong organization structures in the village damana engage people in communal and social activities. They have mechanism for fund generation. The funds are used for addressing communal problems prioritized by people.

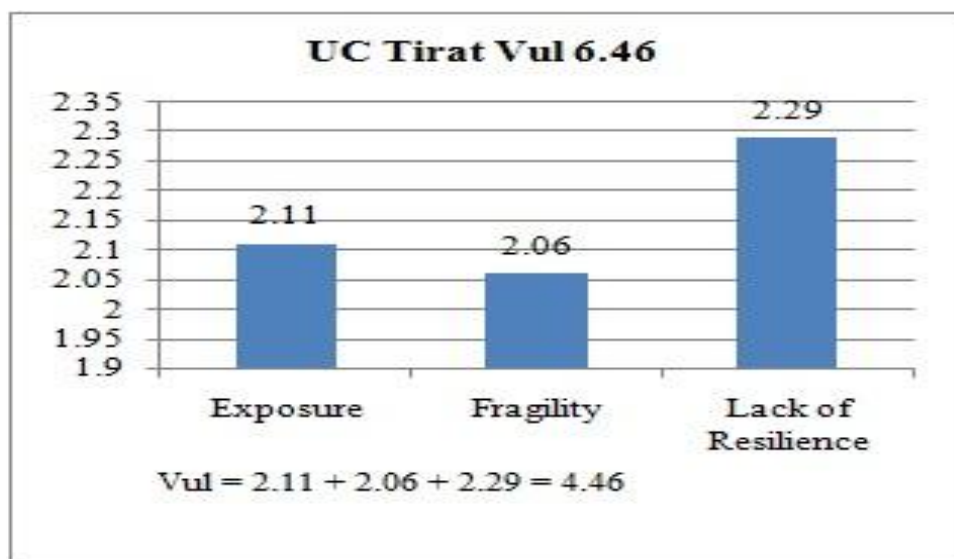


Figure 4. 7: Presented total vulnerability of UC Tirat

Lack of resilience is high because local people lack capacity and resources to construct resilient houses. The education institutes are located on the bank of river Swat. The loose protection walls seems not capable to withstand major flood. Similarly, more people are associated with one source of income.

4.6. Teshil Behrain Analysis with regard Exposure, Fragility and Lack of Resilience

4.6.1. Community Exposure

The July 2010 flood devastated the socioeconomic, physical and environmental infrastructure of Teshil Behrain. The people of sub-communities in respective UCswere interviewed through FGDs on susceptibility to flood, flash flood and heavy rain fall. The information was collected through FGD and KIIwhich were conducted both with men and women separately due to culture constraints.

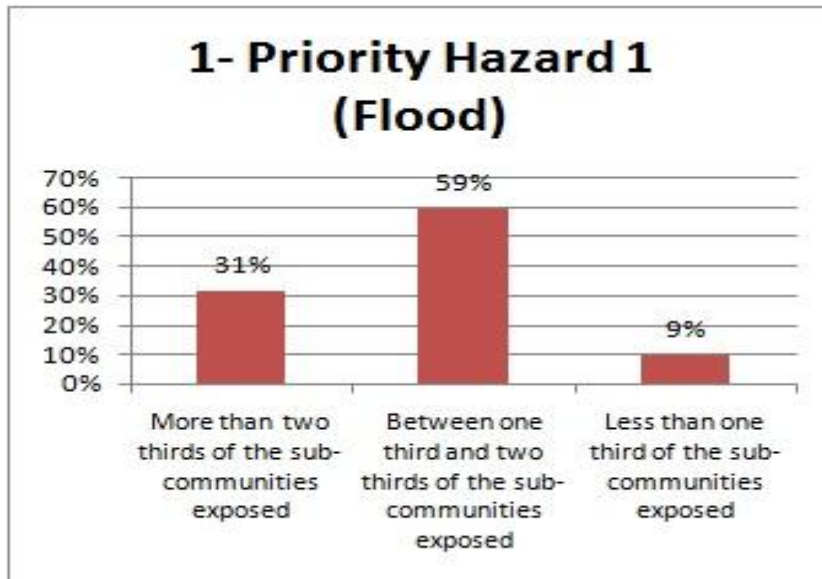


Figure 4. 8: Priority hazard (major flood)

The bar chart explains / figures 4.8 %age community response to different levels of indicated exposure to flood, flash flood and heavy rain fall. The 31% respondents expressed that more than two thirds of the sub communities were exposed to major

floods. Similarly, majority of the sub communities i.e. 59% of the respondents highlighted that between one third and two thirds of the sub-communities were exposed to major floods. However, only 20% of the respondents reported that less than one third of the sub-communities were exposed.

Heavy rainfall was identified as another priority hazard for the local people. The heavy rain fall over stream flow inundates local community, damage crops and settlements. Most of the houses are made of mud and local stone which cannot withstand heavy rain fall and flood inundation. Therefore, a major portion of 72% of respondent revealed that more than two thirds of the sub-communities were exposed to heavy rain fall. 22% respondents were of the viewed that between one third and two thirds of the communities were exposed to heavy rain fall. Similarly, 6% expressed that less than one third of the sub-communities were exposed to heavy rain fall.

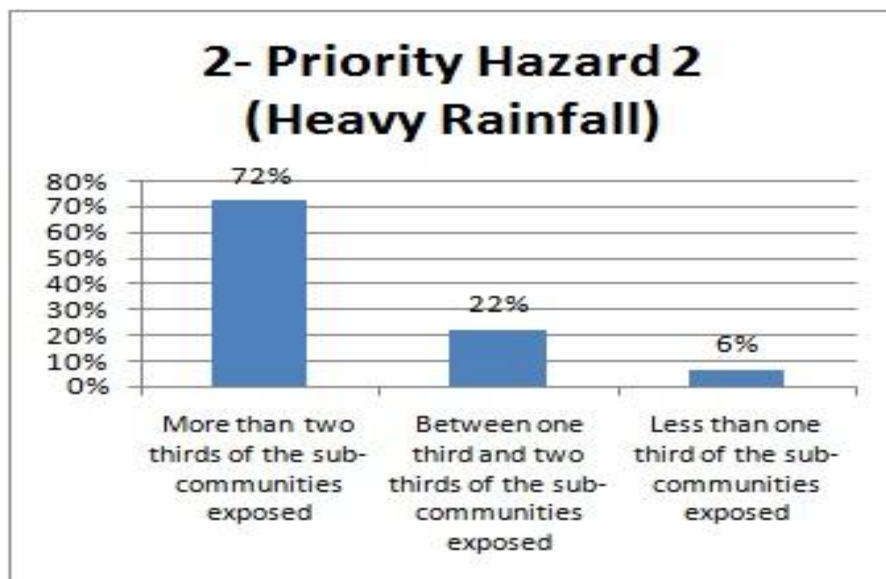


Figure 4. 9: Priority hazard (heavy rain fall)

The flash flood cause huge losses and damages to the society Barredo (2007), Gaume (2009) Marchi (2010). This is evident from the study that community sought flash flood on priority area 3 based on the disaster history of the area. Keeping in view the past destruction due to flash flood, 28% respondents expressed that more

than two third of the sub-community in position and expose to flash flood. Similarly, 31% of the community responded that between one third and two thirds of the sub-communities were exposed. And 41% of the respondents expressed during FGDs that less than one third of the sub-communities were exposed to flash flood.

The study indicates that majority of women scored high exposure to priority indicators which indicate their high vulnerability due to limited mobility exposure and attainment of power. The villages experienced flood 2010 and which were near riverside termed highly prone to exposure.

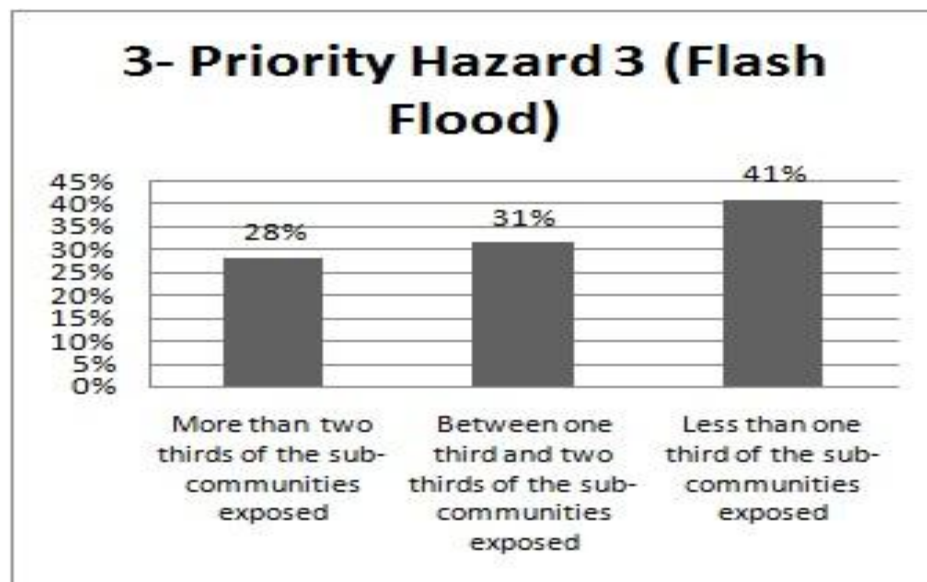


Figure 4. 10: Priority hazard (flash flood)

4.6.2. Community Fragility

The analysis shows that Union Council Behrain was highly fragile due to multiple reasons indicated as ‘Access to clean drinking water, food security, health assistance, community support structure, housing, education, sources of income and natural resources’. In the study area spring water was the only sources local people use for drinking and washing purposes. Access to clean drinking water was a major issues, argued by the 47% respondents that they clean drinking water was not available to majority of the local people. Therefore, waterborne epidemics remain the

issue before flood and the issue further increased after flood 2010. The flood 2010 washed away many of the sources, other were damaged and some got contaminated. Though the govt. and many development organizations provided support but no permanent solution in placed.

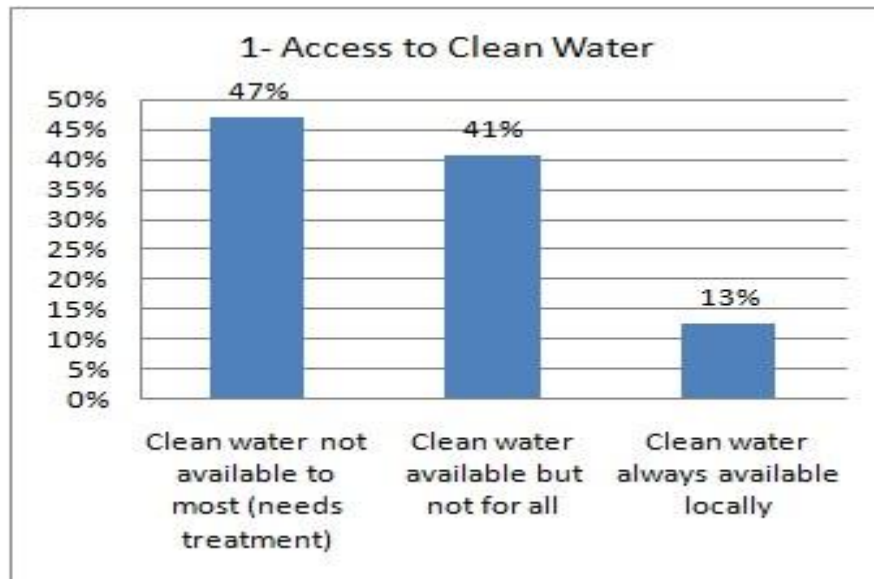


Figure 4. 11 Access to clean water/fragility

Food security was found to be another major challenge for the local people. The local people were dependant on subsistence agriculture. Therefore, 69% of the respondents chose a high weighted option which was only to meet day to day needs and community keep no stock reserved for easily meeting the needs. The agriculture and rearing livestock is major source of income for local people. However, the high peak mountains provide little space for greater production from agriculture sector and thus people were using subsistence agriculture practices for survival purposes. The flood 2010 adversely affected the agriculture sector and livestock. The access issue refrained people to get the standing crops into market and sell/purchase the yields. Similarly, most of the irrigation channels destroyed and damaged. Only 3% of the respondents expressed that available reserves stocks easily meet the community needs.

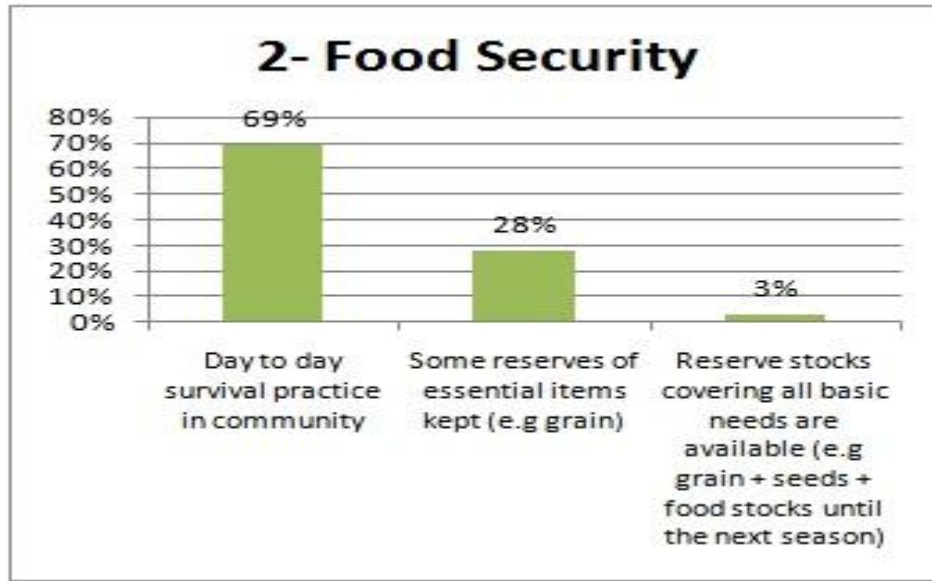


Figure 4. 12: Food Security / Fragility

The basic facilities in health sector were available as a BHU is functional in main urban zone where maximum of local people have access. However, 44% of the expressed that in most of rural villages accessibilities to health services is a major issue. No lady health workers provide services in most of rural area.

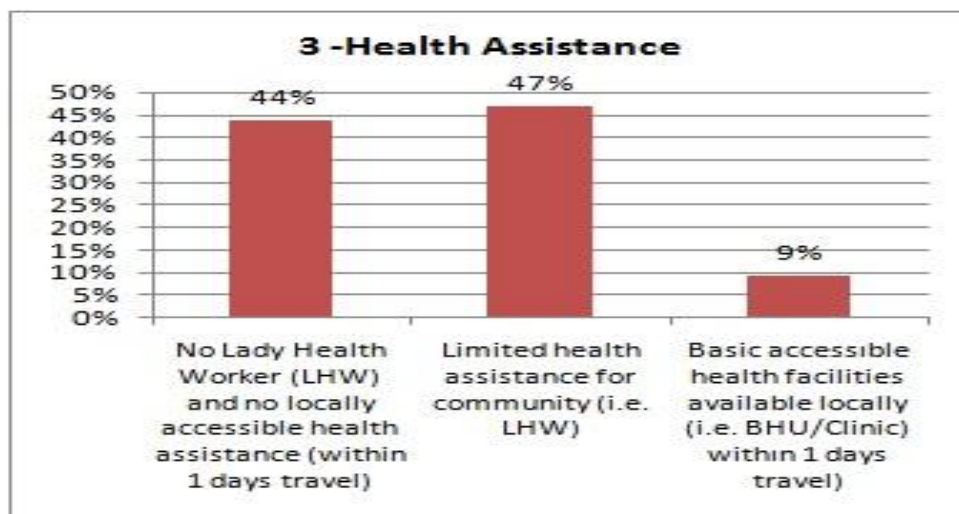


Figure 4. 13: Health assistance/ fragility

On other hand 47% respondent expressed that lady health workers provide services in urban or easily accessible villages and provide health care assistance specifically to pregnant women, newborn babies, polio vaccination and family planning.

Though, people were meeting basic health assistance from the available health facilities but some of the community claimed that limited technical medical staff, advance tools and equipment creates problems in provision of health assistance. Therefore, in serious or chronic illness they travel to the District head quarter and teaching hospital available in Mingora city and Saidu Sharif. It is away more than 60 km from Teshil Behrain and takes one day travel.

The UNISDR Sendai Framework for disaster risk reduction 2015–2030 (UNISDR 2015) is determined to reduce disaster risk, and protect “social, economic, physical, cultural and environmental assets of persons, communities and countries” Bedeaux (2018). It is evident from many studies that disaster weakens social support structure in the community being affected by disasters. For instance, the lack of social cohesion or insufficient institutional structure weakens individuals or households ability to raise voice for rights, take proactive actions and preventive measures for the impact of an event Casale R (2004). The analysis of the data showed that people lack

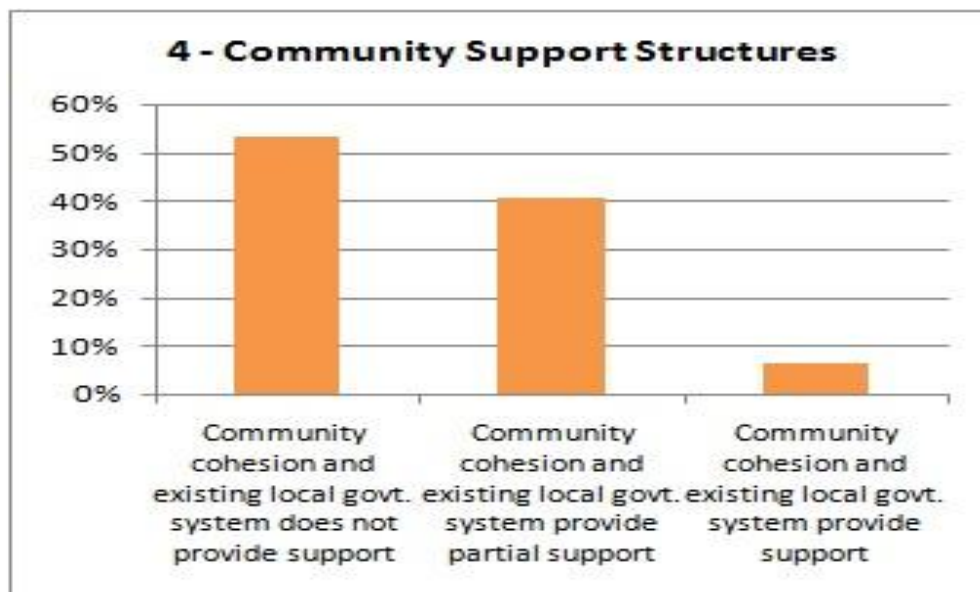


Figure 4. 14: Community support structure/ fragility

skills, resources, local institutional structure to strengthen the community support structure to reduce the impacts of disasters. Very limited community informally adopted the mechanism to save money or generate community fund and execute preparedness measures.

The local government system at community level has own limitations towards addressing community developmental priorities. The indicators of social support structure have been classified into three categories that ranged from high to low (3- high, 2 medium, 1- low). In response of the high category, more than 50% of the respondents quoted that they don't have system for social support structure. However, to answer medium category, 40% of respondents fostered that social cohesion and support structure was partially available. In few communities the structure of village organization exists which collects some funds and implements communal activities. Therefore, only 6% respondents agreed with the existence of social support structure functioning at local level.

The majority of houses have been constructed with use of mud and stones without taking into account minimum standards for building construction. The indicators weighted high, medium low as houses were poorly constructed, basic block houses and bricks & mortars houses respectively.

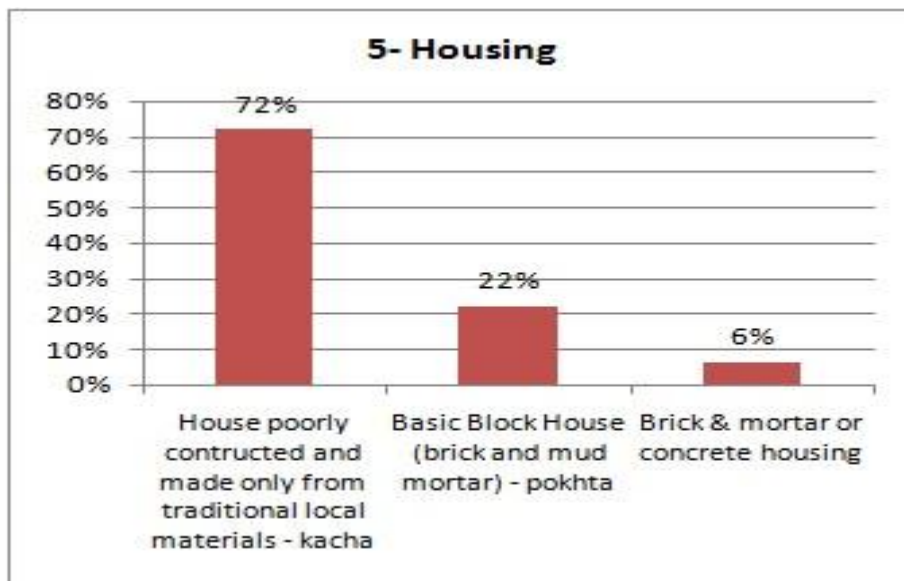


Figure 4. 15: Housing / fragility

The 72% of the responded quoted that majority of the people used traditional materials for construction purposes. 22% respondents argued that houses were also constructed with use of basic blocks and mud.

Table 4. 1 Teshil Behrain type of houses statistics / fragility

Union Councils	No of Pacca houses	# Semi Pacca houses	Kacha houses	Total
Behrain	2642	165	638	3445
Madyan	3896	159	169	4224
Tirat	2624	55	376	3055
Beshigram	2098	151	296	2545
Kalam	1837	1019	1089	3945
Balakot	2459	395	323	3177
Mankiyal	1595	175	87	1857
Utror	1672	623	238	2533

Source; Teshil Behrain Disaster Management Plan

10% of community expressed that houses were constructed with use of bricks & mortars.

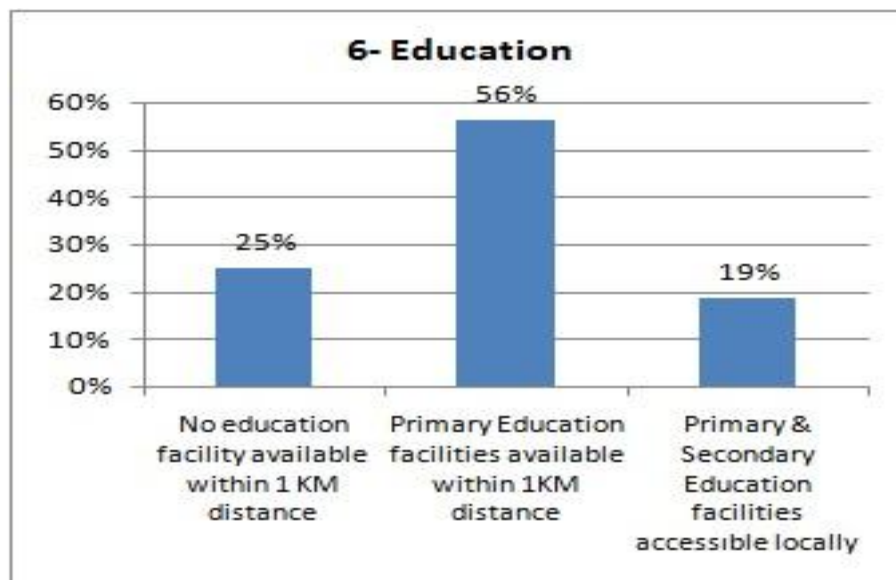


Figure 4. 16: Education / fragility

The analysis of the indicators showed that most of the houses are vulnerable enough to cope with floods and earthquake. The community buildings couldn't bear flood water in 2010 and destroyed the building where flood passed through. The community revealed that more than 700 houses have destroyed in flood 2010. This has also been observed and verified from the key informants that local people have scarcity of land or limited resources to afford resilient construction of their houses in safe location.

Education has a greater importance in individual success and national development. According to the Heinz (2000), education is vital for socioeconomic growth and resilient community. The low education restricts a community from understanding early warnings information and access to recover information. The overall picture of education in the study area is poor as a great proportion of the community responded that there is no education facility within 1KM radius. The children most of the time travel on hazardous routes e.g. along river side and gullies to get education. Majority of local people have acquired primary education specifically in those villages where primary education facilities available within 1KM radius informed by 56% respondents in study area. Access to secondary education facilities is a huge challenge for most of the community. The literacy rate among women/girls is comparative very low due to restricted mobility Cutter (2003) and limited secondary education facilities. Only 19% of the respondent quoted in the low weighted question that people has access to primary and secondary education facilities. The total education facilities available in the study area mentioned in below

Table 4. 2: Information about education facilities in target UCs

Union Council	Primary Schools (Girls & Boys)	Middle Schools (Girls)	Middle School Boys	High School (Girls)	High School (Boys)	Higher Secondary School (Girls)	Higher Secondary School (Boys)	Total
Behrain	34	1	1	1	1			38
Madyan	23	0	2	1	0	1	1	28
Tirat	22	1	2	0	1	0	0	26
Beshigram	13	0	2		1	0	0	16
Total	92	02	07	02	03	01	01	108

Source: Education Department District Swat 2018

According to Mehmood. (2010) and Teshil Behrain Disaster Management plan have described that local people mainly dependant on agriculture yields. And Tourism is the second main source of income after agriculture. The communities are doing subsistence and risky agriculture practices. The crops get damage either by flood or heavy rain fall. The flood 2010 severely affected agriculture yields.

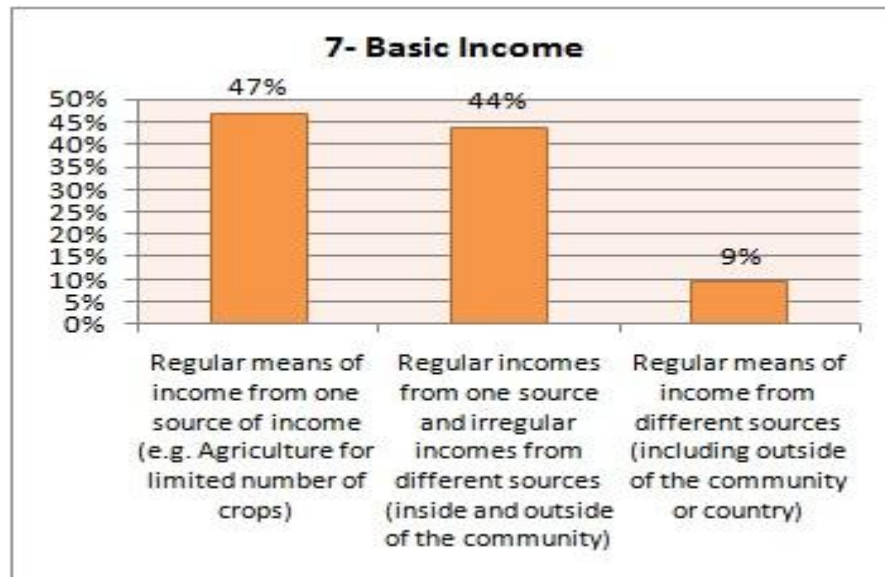


Figure 4. 17: Basic income / fragility

The revenue department in Teshil Behrain provided following information about agriculture sector losses and damages by flood 2010.

Table 4. 3: Presents statistics about agriculture and crops damages

Union Councils	Number of Farmers affected	Total crop land in Acre	Total damaged agri land/crops (Acre)	Percentage of total damaged crop	Undamaged crops	Percentage of undamaged crop
Behrain	1175	7947	3191	40.15	4756	59.85
Tirat	402	893	474	53.08	419	46.92
Madyan	336	915.4	764.4	83.50	151	16.50
Beshigram	705	726	705	97.11	21	2.89
Balakot	1500	1737	1439	82.54	298	17.16
Mankyal	2063	2456.78	2258	90.4	240.78	96.4
Kalam	715	1092.75	851.75	77.95	241	22.05
Utror	505	1427.75	992.5	69.51	435.25	30.49

Source: Revenue Department Assistant Commissioner Office Teshil Behrain

Subsistence agricultures is the only sources of income for majority of the people, according to 47% of the respondents and key informants. As per TDMP, around 70% of the local people are associated with agriculture sector. Potato, Turnip and Cabbage are grown as cash crops. Due to increasing pressure of rapid population growth, the people are struggling to get benefits with irregular means along with regular means of income, stated by 44% of the respondents. In response of low weighted question only 9% of the respondents added that some people are getting income from regular means of income. They are earning income from multiple regular means including agriculture, livestock, hoteling, government jobs and own business etc.

In study “Flood Vulnerability Index” by Paulo Fernandez (2016) used environment as an important dimension to assess flood impacts on natural assets and ecosystem. In vulnerability assessment natural assets/environment remained the important indicators rated with questions of high, medium and low. The natural resources include rivers, forest, ecosystem, glaciers, pastures, soil retention and water regulations etc. The depletion of natural resources triggers irregular climate events e.g. flood, heavy rainfall, droughts, landslide and disturb the ecosystem. While assessing this indicator 41% of the respondent informed, that very limited natural

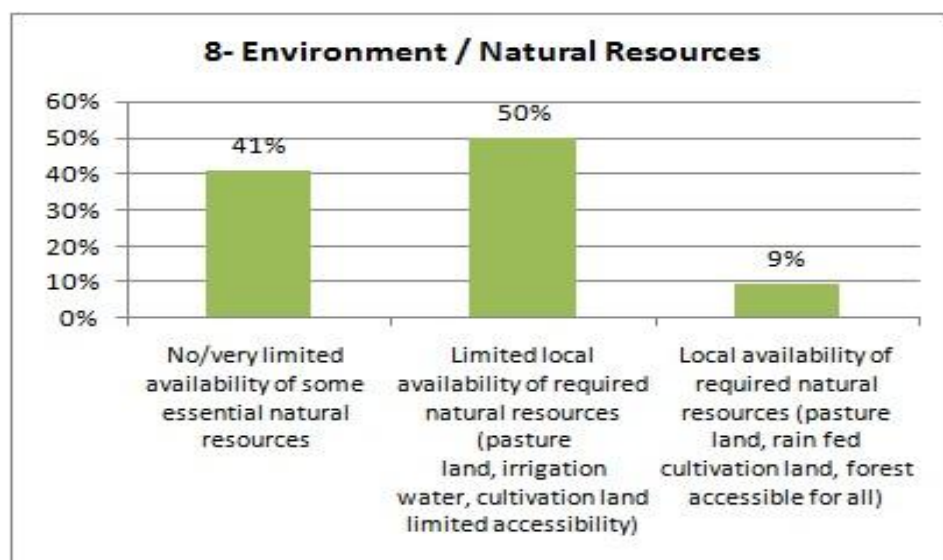


Figure 4. 18: Environment (Natural resources) / fragility

resources were available which include irregular irrigation system, limited forests, limited cultivation land and pasture.

However, 50% of the respondent chose medium level expression by adding that limited pasture, cultivable land with irrigation channel and rain fed system was available. On the contrary, 9% said that natural resources and built environment available. The variation in response is due to the difference of geographic location. In rural areas availability of natural resources and built environment was observed which condensed toward urban areas.

4.6.3. Community Lack of Resilience:

The analysis of the lack of resilience identifies the reasons people lack capacity to cope with disasters. The same indicators as used in fragility applied with different questions in order to assess the paramount parameter “lack of resilience”. Access to clean drinking water was identified as the prime issue faced by local people during flood 2010. Springs are the only source local people are using for drinking purposes. Most of these sources are not protected from contamination and are prone

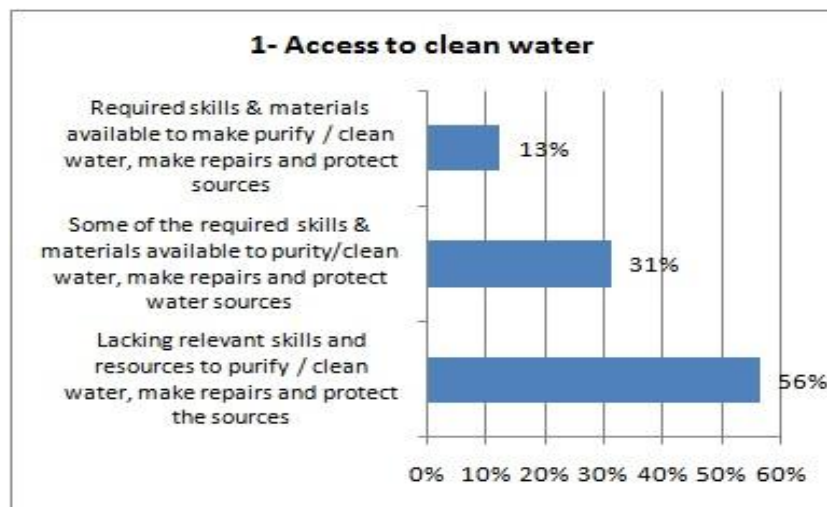


Figure 4. 19: Access to clean water / Lack of resilience

to flood water or animal waste. In response of high rated question 56% of respondents stated that local people lack skills and resources to repair water sources and purify water for drinking purposes. In response of medium scale question, 31% respondents added that some of the required skills and material available to make repair water sources and purify water for drinking purposes during disaster situation. In few communities the local people have skills and resources to make repair, protect water sources and make water drinkable, added by 13% of the respondents.

The Food security assessed as another dimension of lack of resilience which identifies availability of assets and saving schemes in the study areas. Un availability of assets at community level scaled high weighted question, availability of assets e.g. livestock medium scaled question whereas utilization of saving schemes scaled as low scaled question. The basic assets e.g. livestock and crops are available in the community that contribute to meet the daily needs of food, informed by 53% of respondents. On contrary, only 3% added that saving schemes including banks, community own mechanism for saving was also available for meeting the needs in case of any emergency/disasters.

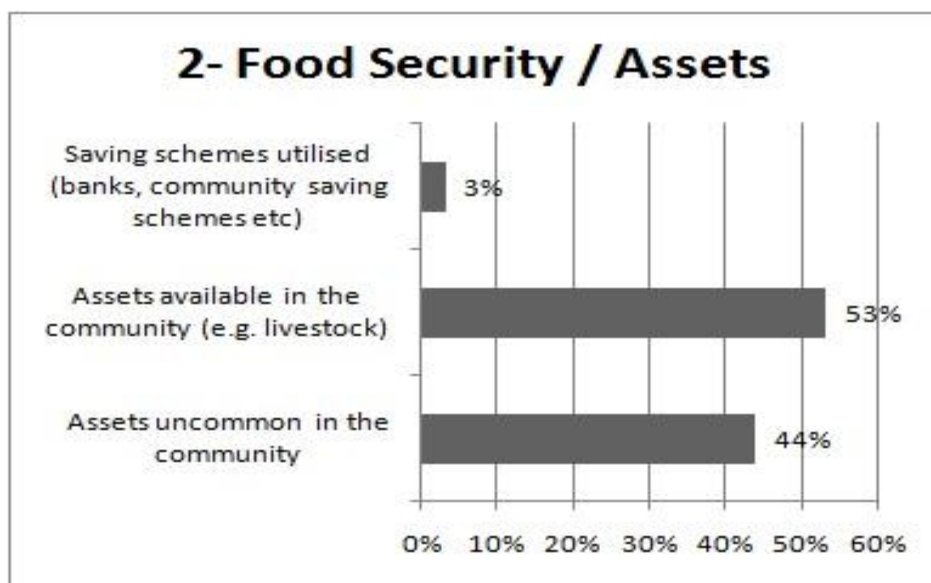


Figure 4. 20: Food security/assets/ lack of resilience

The urban areas of Teshil Behrain found to be capable to handle local scale health outbreaks due to the availability of medical staff and institutions. Women being a sensitive figure of the community perceive disaster in different ways. The losses of human being, physical infrastructure, and social disturbance often cause severe health problems in the women WHO (2002). The disasters can cause issues of primary health, maternity, reproduction, and psychological imbalances to women Maryam (2015). The Teshil Head Quarter Hospital Behrain reported fever, diarrhea and skin were the common health problems which caused an additional financial burden on poor households for medical treatment. Community's skills and knowledge in relation to health remained a paramount dimension to assess resilience of Teshil Behrain. The analysis identified that community lacks skills and knowledge for treating common health diseases/health problems as informed by 69% of the respondents. However, only 31% added that some required skills and knowledge exists for treating common diseases.

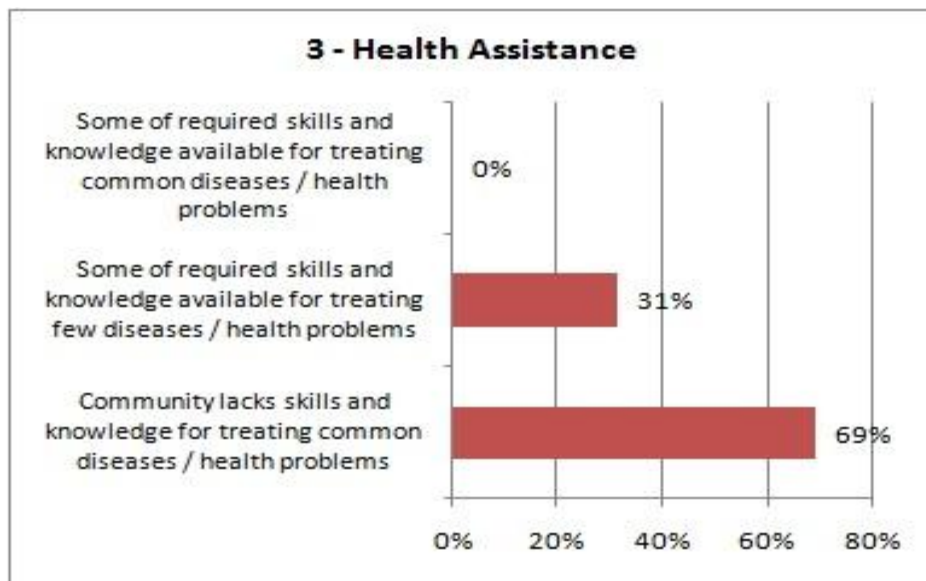


Figure 4. 21: Food security/assets/ lack of resilience

Teshil Behrain lags in terms of community support system and social networking within the neighborhoods. In rural areas partial existence of social connection found where local people have constituted village organization has

irregular mechanism of generating funds for the implementation of community prioritized schemes/interventions. The figure 4.22, explains respondent's feedback on the community support structure or preparedness level.

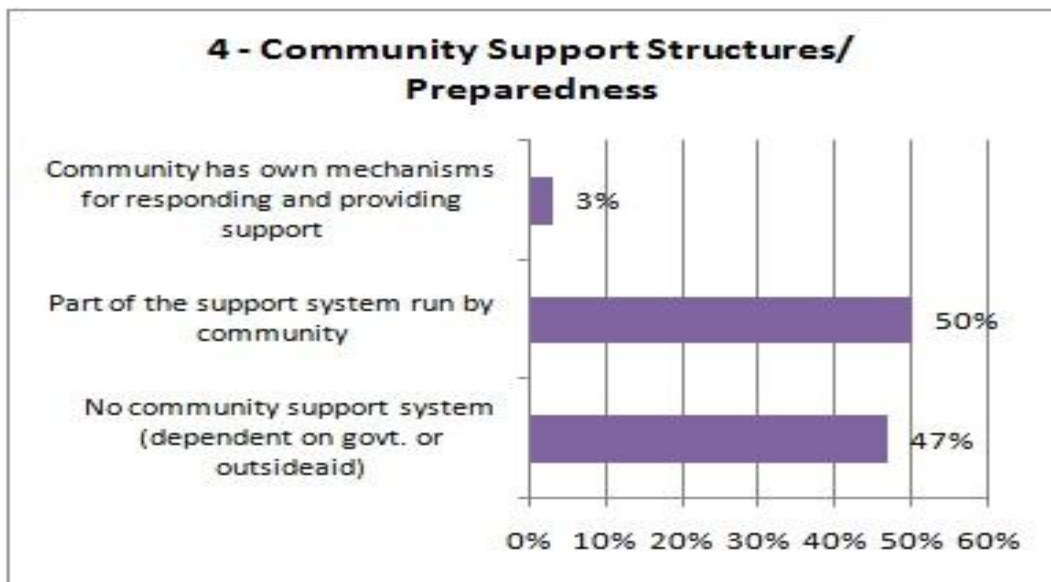


Figure 4. 22: Community support structure / Preparedness/ lack of resilience

Houses massively affected in flood 2010. Table 4.1 presented a good number of semi pacca and kacha houses were unable to withstand flood water as of 2010 flood. The lack of education and awareness further aggravate the problem to convince them on choosing suitable safe location for construction of their buildings with use of quality material and advance technology. Similarly, many other reasons include scarcity of land, lack of resources to afford reinforced construction and capacity to buy land at safer location.

More importantly the local people lack skills and resources to make necessary repairs for reinforcing houses structure as added by 28% of the respondents. However, a low proportion of people have skills and resources to make essential repairs/construction. Hence, lack of understanding, use of new technology for construction of resilient buildings added by 56% of respondents.

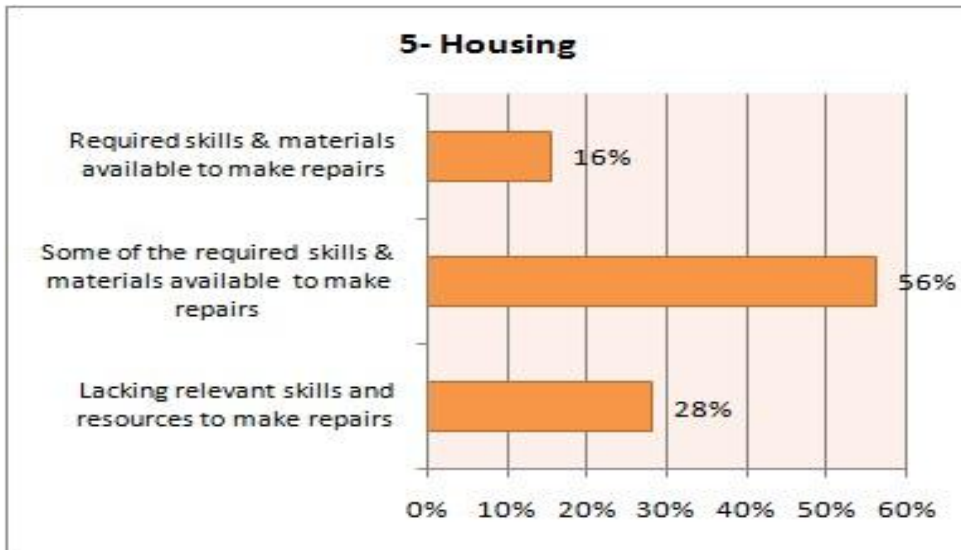


Figure 4. 23: Housing /lack of resilience

The education facilities were assessed with regard to safety situations. The available facilities were found to be unsafe due to poor construction, old buildings, and unsafe location. The constructions are not safe due to lack of seismic assessment, flood assessment and other hazard assessment.

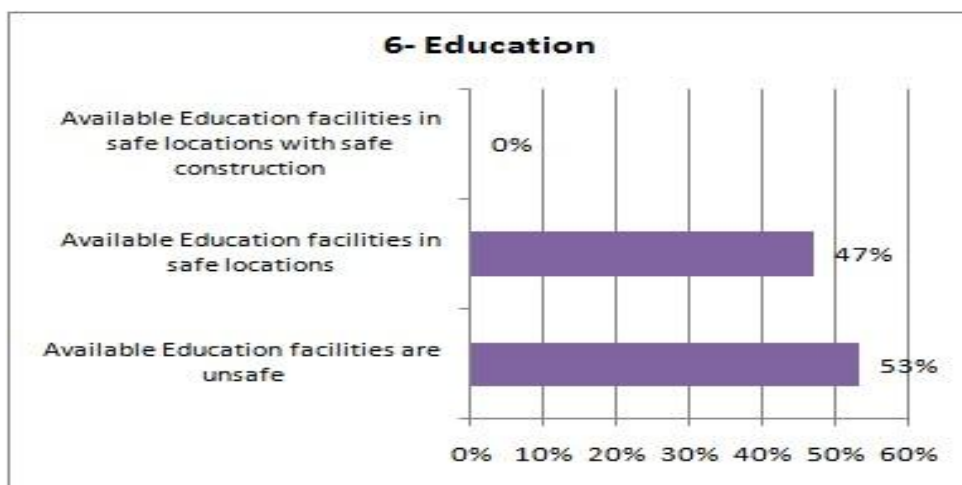


Figure 4. 24: Education / lack of resilience

Majority of education facilities are vulnerable to multiple hazard impact as per detail shared by education department. Similarly, 53% respondents also informed that maximum of the education facilities unsafe due to physical vulnerability. However, after 2010, the new construction of education facilities carried out in safe location. There is still need for disaster resilient construction use advance technology and building code for reinforcement of building as shared by education department.

Teshil Behrain was famous for embroidery and vocational products. Women were active to make use of quality wool and prepare shawls for men and women. The tourists contributed to their family income as they were buying handmade shawls. They had also established linkages with local markets. The flood 2010, negatively affected the vocational and education skills. The visits of tourist drastically declined since armed conflicts 2007 and flood 2010. The assessment of this important dimension after flood 2010 is significant to know the vocation skills and vocational education. A mix response was received from the respondents who added that vocational skills and education is decreasing after flood 2010. The community almost abandoned vocational skills as per 47% of respondents.

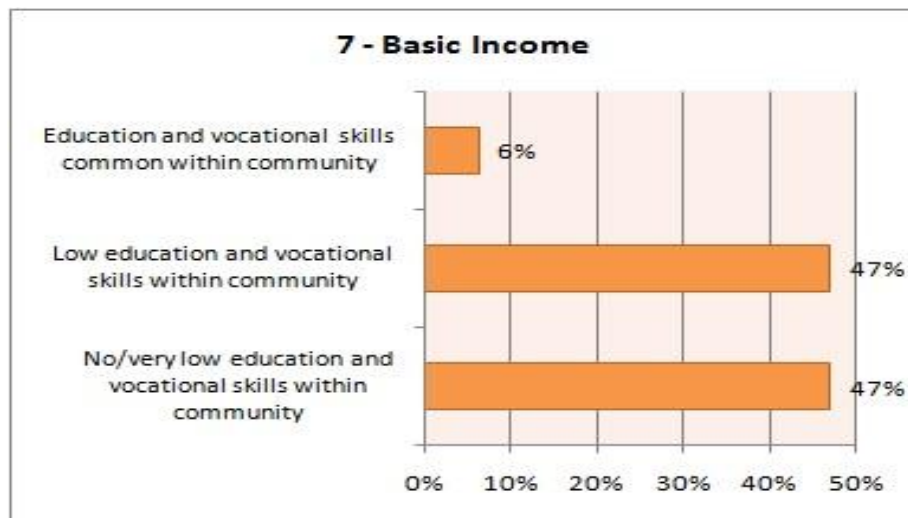


Figure 4. 25: Basic income / lack of resilience

The rapid growth of population and urban sprawl negatively affects the forest cover, rivers degradation, ecosystem, pastures etc. The government owned forest has been maintained to an extent. But, deforestation of community owned forests continued. Environment stability and natural resources protection is not a priority of the local people, added by 84% respondents.

Answering to low and medium scaled question, only 16% of the respondents shared that some protection measures have been taken to sustain the available natural resources. These measures include local forest committees comprised on forest department representative and community people devise plan for plantation. Similarly, reports to respective authorities for ruthless cutting of plants.

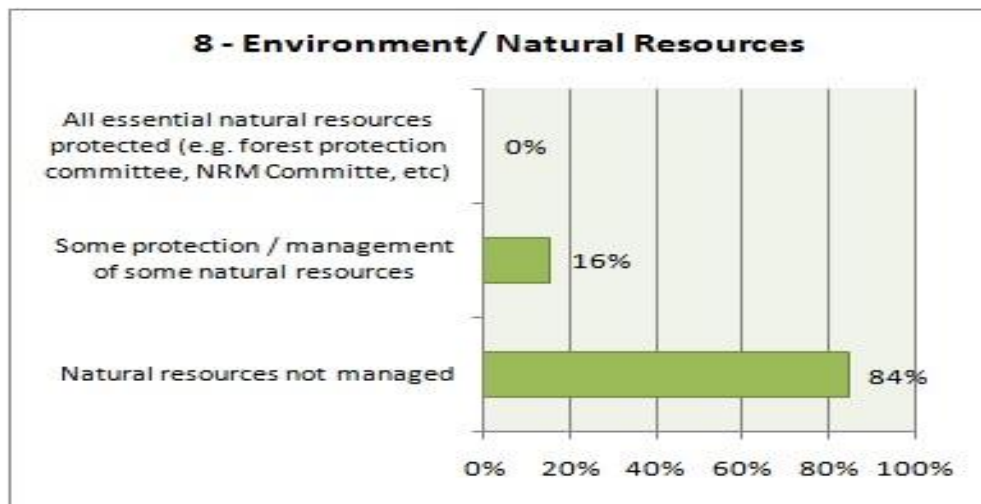


Figure 4. 26: Environment / natural resource / lack of resilience

CONCLUSION AND RECOMMENDATIONS

The study on vulnerability assessment identifies factors that influence vulnerability in the four union councils of Teshil Behrain. The study has been wrapped up based on findings the identified from study. Similarly, the study also presents key recommendation for decision makers, researcher to take in account the learning in policy making or further research.

5.1. Conclusions

The study used vulnerability index and key informant interviews to assess vulnerability by making analysis of the primary and secondary information. The analysis identify that the indicators used for exposure, fragility and lack of resilience show consistency in findings of respective union council vulnerabilities. Several studies including District Swat Disaster Management Plan and Teshil Behrain Disaster Management Plan developed by Provincial Disaster Management Authority give only brief overview of vulnerability in District or study area. In District Disaster Management Plan, Teshil Behrain has been categorized as low vulnerable Teshil whereas the analysis of study revealed all the four union councils are highly vulnerable and therefore expansion of research to remaining union councils is recommended. This reveal a policy gap for the decision makers and suggest on solid ground to revisit their plan's findings and change the status of Teshil Behrain as high vulnerable Teshil prone to multiple disaster effects.

The analysis of exposure component/variable/ parameter gives the insight that a major portion of the community exposed to the effects of flood hazards and the Union Council Madyan is highly expose to the priority hazards including major flood, flash flood and heavy rain fall. Capacity associated with exposure is limited as the area lacks retaining walls, check dams and vegetation cover which can deter to disaster effects in time of flood disasters.

The findings revealed that majority of population rely on spring water which is neither protected nor free from contamination. In rural areas women/girls use to pitch water from the springs mostly located far away in mountains. Analysis further reveals that pitching water by girls significantly reduces girl's education. In urban areas clean drinking waters channelized to houses by PVC pipes often passes through drains and cause contamination of drinking water.

Food security is another major factor of people's increase vulnerability. The local people mainly dependant on persistence agriculture yields hardly meets survival needs or merely covers the basic needs. The results reflect that people lacks capacity using advance technology for more yields and production from agriculture and livestock.

The fragility in health assistance identify that limited people has access to basic health assistance. In case of serious health problem, the people visits hospital in down Districts. In time of disasters limited medical facilities and staff become unable to provide health assistance to people affected by disasters.

The findings showed that recurrent disasters has weakened local support structure and networking. The isolation in thinking and actions significantly disturb the social cohesion in community. The findings indicate that fund generation and collective actions for resolving communal problems do not exist at any level in community.

The housing structures are vulnerable and unable withstands flood disasters. People lack capacities in terms of building resilient structure by using building regulation, technology and techniques. It has been observed that people are reconstructing building in flood prone area which indicates low awareness about disaster risk, and no implementation of land regulation implementation by govt.

The available education facilities were unsafe and beyond access for girls especially. Therefore, girls education was very low indicated by respective results. Moreover, the education facilities were located in flood prone areas and not resilient to withstand flood, earthquake, and rocks (fall from mountains).

Income from tourism was the 2nd largest sources for income after income from agriculture sector. Once, women were participating equally with their men to generate income from embroidery and handmade stuff. They had good linkages with local markets and even down District markets. The recurrent disasters including flood 2010 market setup and tourism

The findings revealed the vegetation cover and watershed also damaged by flood 2010. However, it has been noted that forest covers were drastically affected by timber business, household use of wood as fuel and abundant use in building structure.

5.2. Recommendations

The study has laid down baseline information for devising mitigation plan and conducting further research studies on vulnerability to flooding.

- Construction of dykes, check dams and vegetation cover is recommended for reducing vulnerability in the study area
- Teshil Behrain has been declared as low vulnerable teshil in Disaster Management Plan of Disaster Swat by PDMA. Therefore, its status needs to be high vulnerable Teshil prone to multiple disaster effects.
- Women being a sensitive figure in community needs special attention in terms of health care, financial support, protection and psychosocial support.
- Programmes should be designed on strengthening of community support structure and social cohesion by engaging local community and making their linkages with govt. and non govt. stakeholders.
- Implementation of land regulation is vital to avoid construction in flood prone area,
- The directorate of education is recommended to take concrete actions for making education facilities accessible and disaster resilient. Special education programmes should be designed for those girls who left attaining education due recurrent disasters.

- Revitalization of women entrepreneurs with adequate access to market within cultural boundaries.
- Local people need to be sensitized about the growing effects of climate change and should be prepared for meeting these effects through adaptations measures. Similarly, farmer's training on diversified livelihood sources need to be imparted particularly women capacity building is very necessary,

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