

FLOOD RISK ASSESSMENT IN SELECTED UNION COUNCILS OF DISTRICT SWAT, PAKISTAN

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Abstract: Almost every year millions of people suffered from flood worldwide generally, and in Pakistan particularly. Identification of flood risk is very important and it is need of the day. This study is carried out to analyze the risk of flood hazard for the most beautiful district of Pakistan (district swat). Risk of riverine flood is common in the area. Main objectives of the study are to identify the probability of a flood occurrence, assess level of vulnerability and exposedness to flood hazard and to quantify the flood risk in the study area. To achieve the purpose, data were collected from both primary and secondary sources, in which primary data includes questionnaire, focused grouped discussion, interview and personal observation while secondary data was collected from line agencies like irrigation department, housing departments, metrological office etc. Three Union Councils were selected. 50 questionnaires were filled by key-informants, in each Union Council (UC). Analyzed data presented in the form of graphs. Information reveals that the study area is prone flood hazard. Causes of floods include snow melting, monsoon rain and climate change. Vulnerability of the special people (vulnerable people) is high. There are limited capacities like swimming skills and trained people found in the area. On average farmland, settlements and water mills are considered as element at risk while Union Councils *Dhamghar, Dherai* and *Kanju* facing high, medium and low level of vulnerability respectively. it is suggested that key facilities should not be permitted in flood zone and appropriate flood preparedness and mitigation activities should be carried out to reduce the flood risk.

Keywords: Flood risk, risk assessment, vulnerability, capacities, river swat.

Introduction

Floods are always havoc to the life and property. Flood claims precious lives by drowning raze buildings which make people homeless, erosion of land, pollute drinking water and causes diseases. In terms of economic loss and spatial extent, flood is considered to be the most destructive natural disasters (White 1974; Changnon2005; Ali 2007). Damage resulting from slow rise flooding is generally

caused not only by the inundation of water, but, also by silt and debris passing through the affected. The meteorological factors include rainfall, intensive storms, and rise in temperature in summer and snowfall in winter. The second factor is hydrological factors such as soil moisture conditions, ground water level, natural surface infiltration rate, channel cross sectional shape and roughness, presence or absence of over bank flow, channel network, synchronization of runoff from various parts of watershed, high

tides impeding drainage etc. (Khan, 1995). Similarly the human factors also cause flood such as changes due to land use, migration to cities and deforestation increase runoff and sedimentation, enlarging lands for agricultural purposes, settling of mud, sand in the bottom of dams, defective infrastructure, too efficient drainage of upstream areas, climate change which disturb the frequency and magnitude of rain (UNISDR, 2001). It has been observed that mankind has a very important role in the magnitude and frequency of floods in many different ways. Actually; it is the human activities in water in water catchment which drastically intensify flood hazards. In this connection, human actions associated with land use change are the most important.

Risk is often associated with the occurrence of disaster. In general the word disaster refers to an event that significantly interferes with human and societal activity. More specific medical definitions exist that define disaster in term of the magnitude of negative consequences resulting from the exposure require the efforts to correct these causes (Combs et al. 1999; Boer 1990). The risk assessment includes the identification, quantification and evaluation of risks in the given system. It is carried out because involved parties (designers, managers, decision makers) want to identify and evaluate the risks and decide on their acceptability. Finding of risk assessment can be used for various purposes such as in the design process to decide on the required safety levels of new system or to support decisions on the acceptability of safety levels and the need for measures in existing systems. Risk assessment is the systematic process of identifying and ranking the potential risk from its source, its possible damaging impacts on a specific area and

consider outline design proposal to mitigate any potential risk. It not only describes that the event will happen in the future but also describes the type, magnitude and frequency of the hazard often during a calendar year. The main objective of risk assessment is to make aims a rational decision about risk bearing activities (Apostolakis, 2004).

Flood risk is the product of an interaction between flood hazard and vulnerable conditions of the community. It can be defined as the expected losses (casualties, loss of properties, damages to the environment and disruption of economic activities) due to a flood event for a given area in a specific time period. Flood Risk is the combination of probability of flood occurrence and potential adverse consequences on human health, the environment, cultural heritage and economic activities. Major components for measuring and assessing flood risk are analysis of flood hazard occurrence, vulnerability assessment, identification of capacity/resources and perception of people. Flood risk assessment describes the type and magnitude of flood as well as predicts the damages that may occur. Flood risk assessment should be conducted identify whether community and natural resources are at risk from flood or not, then flood zones are identified. It is scientific and technical basis in order to play its role to ensure flood loss reduction and identifying hazard. The assessment of flood risk needs to understand the source of water and its destination and its possible targets. (Gormley, et al., 2009). In terms of flood related damages, approximately 90 % is reported from the developing countries, where poverty is a major risk factor and holding low resilience. Pakistan has no exception to it, where flood is a frequently occurring adverse

event. Pakistan is one of the flood prone countries in the world because of its physical and climatic characteristics. Territory of Pakistan has been seriously affected by disastrous floods (Mirza 2003; Vuren et al. 2005; Dong et al. 2009). The floods were among the worst ever recorded in the past ten years and an estimated 2.5 million people were affected, in which 250,000 persons were made homeless. A total of 22,344 houses were demolished in Sindh and 57,640 in Baluchistan (KRT, 2007). After these the floods of 2010 broke all the previous records of floods in Pakistan, which affected

100,000sq.km area, the death toll was near to 2000 and the number of injured persons were 2946 (NDMA 2011). The flood of 2010 is one of the main devastating flood and ranked 1st in term of area affected, loss to physical economic and social infrastructure and deaths.

Like rest of the country, District Swat is also susceptible to floods because of its physiography and climate. The river swat which is the key source for irrigation and other water requirement is flowing in the study area. (Map1).

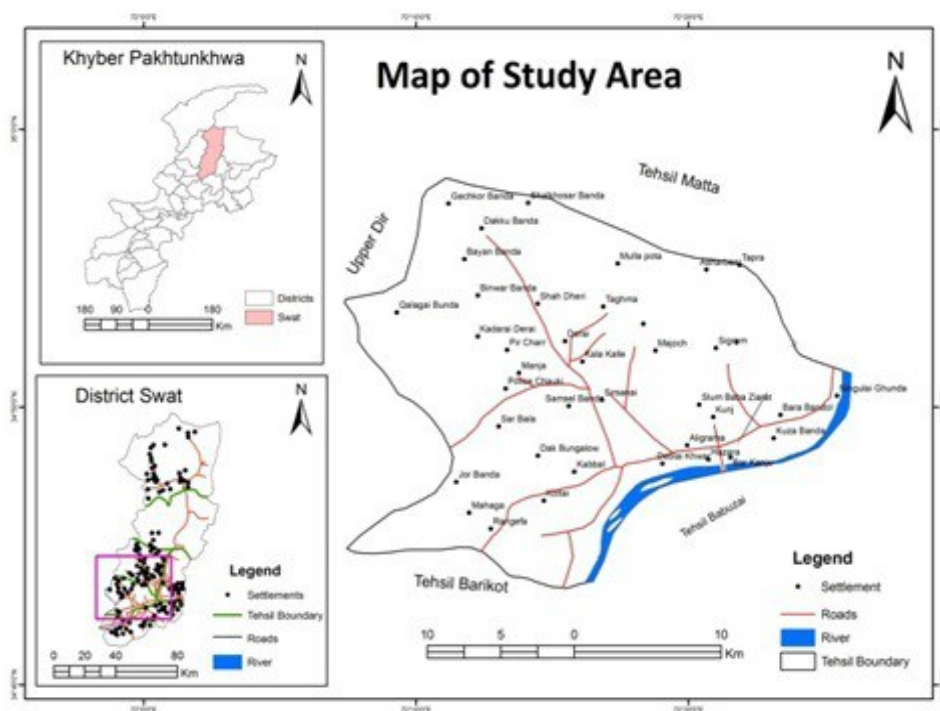


Fig.1. Location of the study area

The river swat water also used for water mills, which provide livelihood to the local people. Agriculture, tourism and handicrafts are the main stay of economy.

Other economic activities carried out by the local people *Damghar*, *Dherai* and *Kanju* are the most beautiful union councils in district swat, surrounded by mountains.

The population of selected UCs is 30000. The main source of earning is agriculture and fruit farming in the area. Due to rapid expansion of the built-up area, there is a great pressure on land particularly on agricultural land in the study area. People occupied, active floodplain for dwelling purpose which create flood risk in the study area. It is important to carry out a research, which will identify occurrence of flood hazard, vulnerability and element prone to flood in the study area.

Materials and Methods

Flood Risk Assessment requires certain scientific and technological processes. These processes play effective role in reduction of flood losses and damages. Flood hazard, vulnerability, and risk assessment are gaining importance because of its effective utilization in flood risk management. This study will specifically focus on flood risk assessment and will provide a platform for decision makers. This study is based on both primary and secondary data. Keeping in view the aims and objectives of the study, questionnaire and interviews are designed to collect the primary data. Data gathered from both primary and secondary sources. The Primary source considered as the most suitable tool for collecting data necessary for the study. Primary data collected directly from the study area. On the basis of location from river, elevation, livelihood, houses type and agricultural practices, Union councils *Damghar, Dheri* and *Kanju* are selected.

Methods for data collection were random sample method. Questionnaire and interview schedules were designed to collect baseline information about flood risk in selected union councils. In the study area total of 150 questionnaires were filled from key-informants, (50 in each UC). Respondents include farmers (20%), educationalists (60%), labors (10%) and businesspersons (10%). Secondary data were obtained from the flood related Government Departments, which include Irrigation department, Meteorological office, agricultural department and housing department. Furthermore, Secondary data was also collected from topographic sheets, maps, research articles, and reports which is helpful for information regarding early warning system in the study area. Both primary and secondary data were analyzed and presented in the form of graphs and description.

Results and Discussion

The study area is located in the active floodplain of river Swat. Here, flood is one of the serious and recurrent extreme natural events. This area has short mild summer and long cool winter. The data was collected from residence of village *Kanju, Dherai* and *Dhamghar* through questionnaires and interviews. After analyzing the collecting data presented in the form of as follows:

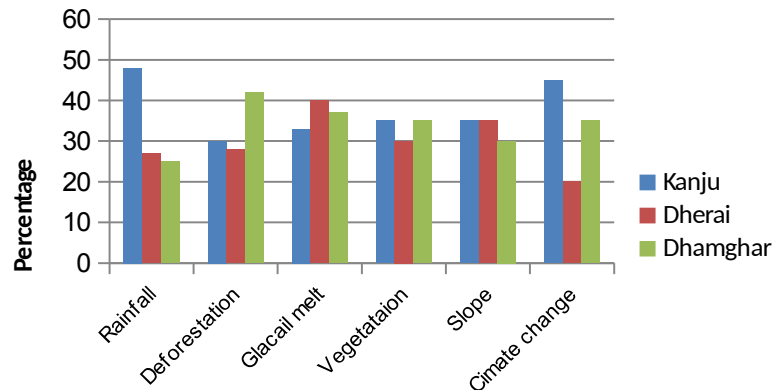


Fig. 2. Causes of Flood in the Study Area

Causes of Flood in the Study Area

Rainfall, deforestation, glacial melt, less vegetation cover and climate change are the main causes of flood (Fig. 2). One cause show direct or indirect relation to other reflects that just one factor is not responsible for the flood.

Exposurness to Flood Hazard

Much of the respondents 40% hold the view that *Dhamghar* is more prone to flood as compared to *Dherai* which show 21% and respondents of *Kanju* village which show little difference (1%) from *Dhamghar*. It is cleared from the graph that *Dhamghar* is more prone to flood as compared to *Kanju* and *Dherai*. The reason behind this is its location. Dhamghar is near to river hence more vulnerable having greater chances to be affect in flood events (Fig. 3)

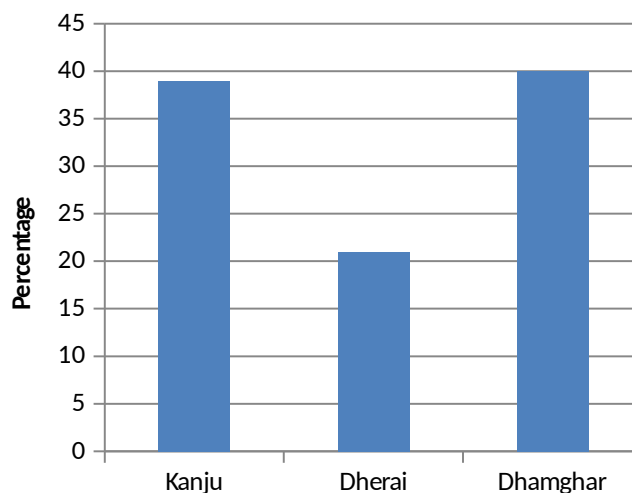


Fig. 3. Exposurness to Flood Hazard

Elements at risk in study area

Analysis revealed that in *Kanju* 40 % respondents said that farmland, watermill and infrastructure are equally exposed to flood risks as compared to livestock 20%. However, in *Kanju* 25% of the respondents replied that humans lives and houses are at risk. In

Dhamghar 65% respondents were of the view that their animals are at risk from flood as compared to farmlands 30%, while houses and infrastructure shows the same risk. In *Dherai* the 40% respondents hold the view that their houses are at risk as compared to animals which showed 15% (Fig. 4).

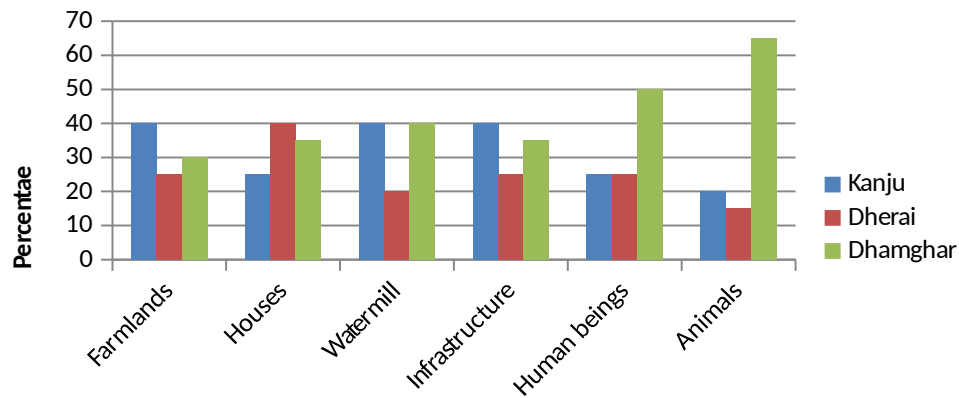


Fig. 4. Elements at risk in study area

Houses type

In *Kanju* most of the respondents 35% have concrete houses while 30% have semi *pakka* houses compared to *kacha* which have just 20%.Dhamghar and *Kanju* respondents have the same type of concrete houses (35%),

similarity was also found for respondents 30% of *Kanju* and *Dhamghar* semi *pakka* house. In *Dherai* most of the respondents 55% and 40 %have *kacha* and semi *pakka* house respectively (Fig. 5).

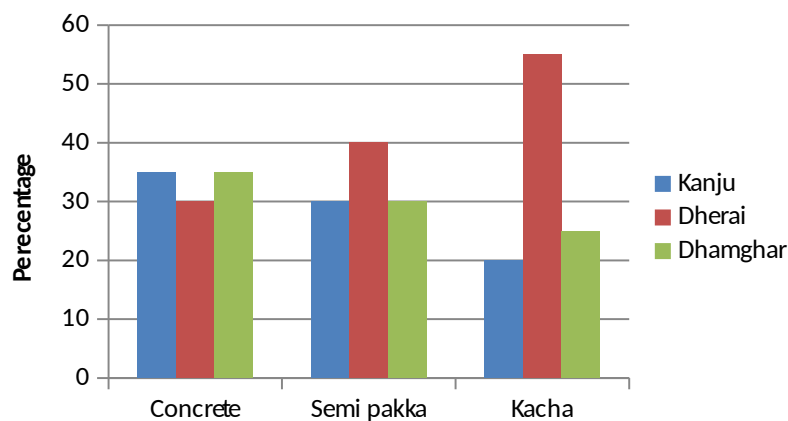


Fig. 5. House Type

Vulnerable people

Most of the respondents were of the view that 35% children are present as compared to disabled ones 22% in *Kanju*. In *Dhamghar* the respondents replied that aged people were 40% disabled 38%, children 35%

and women 38% which showed that the most vulnerable group are present in this village. The highest 40% of disabled were found in *Dherai* as compare to *Kanju* 22%. Equal numbers of children were found in *Dherai* and *Dhamghar* (Fig. 6).

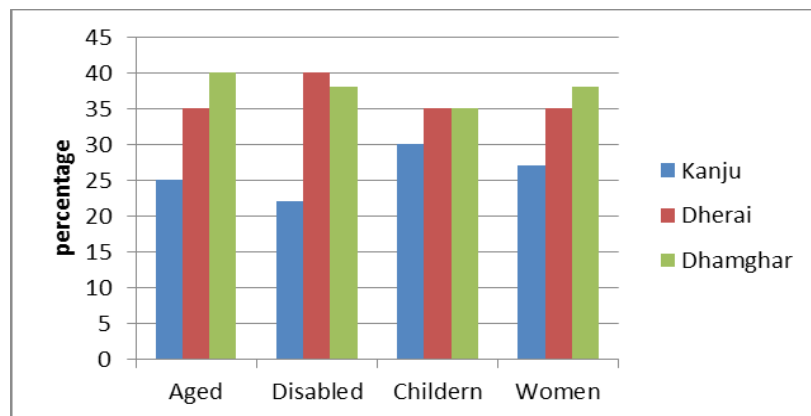


Fig. 6. Vulnerable people

Location of settlements from river

The below graph shows the starting point of residential area from river swat, the

Dhamghar residential area is 650meters from river whereas *Kanju* have 680meters as compared to *Dherai* which is 730meters(Fig. 7).

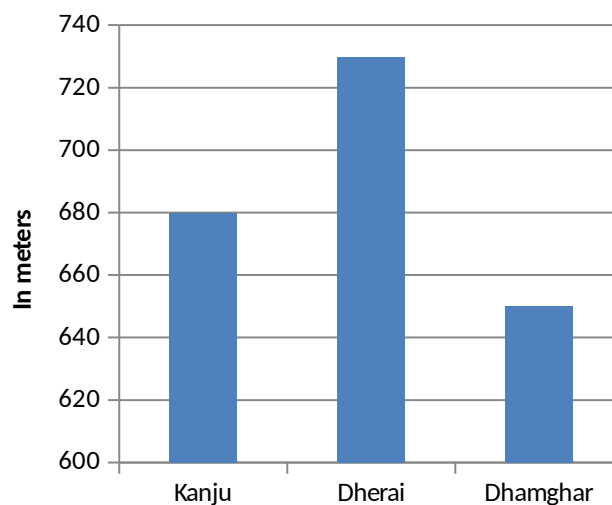


Fig. 7. Location of settlements from river

Preparedness level of local people

In *Kanju* most of the respondent 42% is educated as compared to *Dhamghar* and *Dherai* which is 30% and 28% respectively, because of its literacy rate more people in *kanju* read the newspaper and update them daily. In *Dhamghar* majority of the respondents 40% hear radio while *Kanju* and *Dherai* same respondents 30% were of the

view that they hear radio. Most of the respondents 49% in *Kanju* watch television as compared to 21% of *Dherai* while in *Dhamghar* 30% watch television. However in *Dhamghar* the community based organization play a vital role in bringing awareness in the village, most of the respondents 50% replied that organization bring the awareness as compared to *Kanju* respondents 20%. Much of the trained people 45% were found in *Kanju* as compared to *Dherai* and *Dhamghar* where just 20% and 35% trained people were shown respectively (Fig. 8).

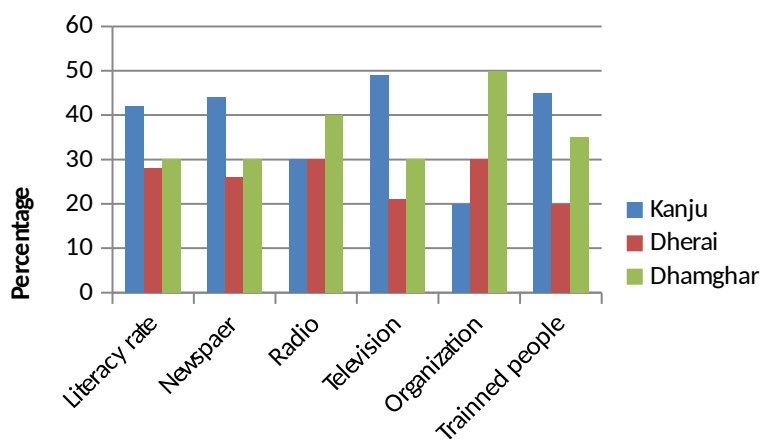


Fig.8. Preparedness level of local people

People Capacities in the study area

In *Kanju* much of the respondents 40% have the swimming skills to protect himself and other from water as compared to *Dherai* respondents where 25% respondents have swimming skills while *Dhamghar* have 35%. same respondents 35% replied that in *Kanju* and *Dhamghar* same vegetation cover are presents while *Dherai* have 30% vegetation. Highest numbers of trained people 45% were found in *Kanju* as compared to

Dherai 20% while in *Dhamghar* 35% people are trained. Because of the literacy rate in *Kanju* awareness about flood is 39% as compared to *Dhamghar* and *Dherai* which have 30 and 31% respectively. *Dhamghar* have more rich people 43% as compared to *Dherai* 22%. Equal numbers of respondents 35% were of the view that in *Kanju* and *Dhamghar* pakka house were present while in *Dherai* 30% houses are *pakka*. Majority of the villagers 40% have the opinion that in *Kanju* emergency plan is good because

hospitals and volunteers as compared to *Dherai* 25% and *Dhamghar* 35% (Fig. 9).

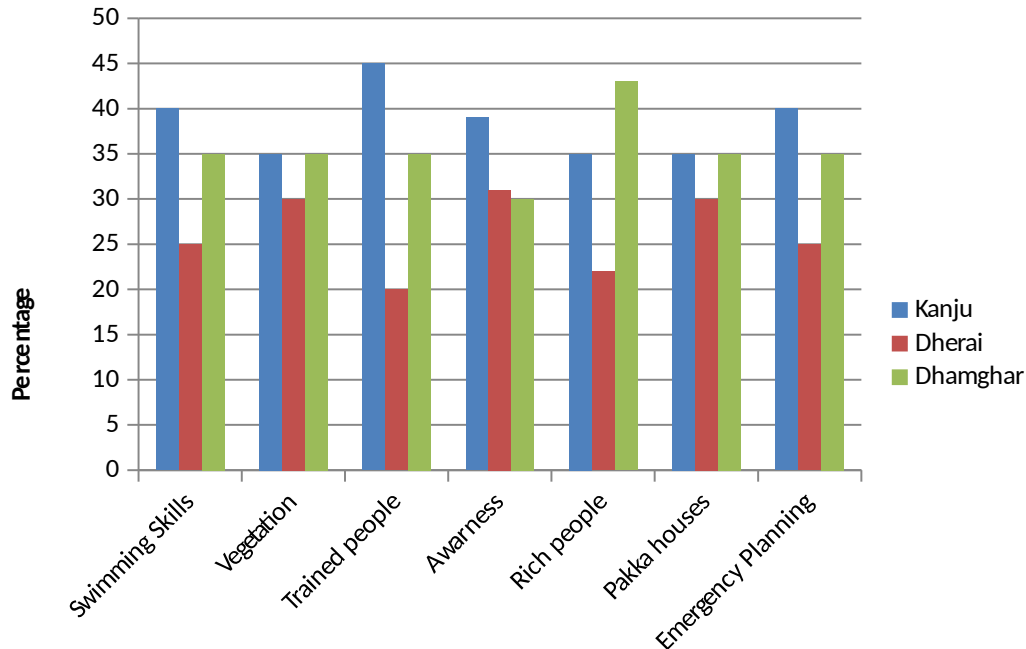


Fig.9. People Capacities in the study area

Conclusion

Analysis revealed that in the study area major causes of flood are rainfall, deforestation, glacial melt, and climate change. One cause show direct or indirect affect relation to other so just one factor is not responsible for the cause of flood. *Dhamghar* is more prone to flood as compare to *Kanju* and *Dherai* because it is nearer to river. Every UC has farmlands, houses, watermills, infrastructure and live stocks which are at risk. The concrete, semi *pakka* and *pakka* houses were found in the area. However *Kanju* shows some resistance to flood because of the houses type. There is mostly concrete and semi *pakka* as compared to *Dherai* which showed that mostly *kacha* houses at the top. *Dhamghar* shows high percent of vulnerable people as compared to

dherai and *kanju*. *Dherai* got second position in case of vulnerable group and *Kanju* found to be the less vulnerable as compared to other, also *Dhamghar* is more vulnerable to flood as compared to *Kanju* and *Dherai* because its locality were made in such a way that whenever the flood came a lot of injuries and damages is expected. In *Kanju* village awareness about flood is much higher as compared to *Dherai* and *Dhamghar* because of its literacy rate and source available to them. That's why much trained people were found in *Kanju* to fight and withstand with flood hazard. *Kanju* people have better capacities (swimming skills, trained people and emergency planning) because it is situated near the city and more literacy have found in *Kanju* as compared to *Dherai* where less people have capacities however

Dhamghar people ranked between *Kanju* and *Dherai*.

It is suggested that ecological aspects such as deforestation should be controlled. Flood damage and losses can be reduced by taking steps such as the making of parks, playground and planting trees in the area exposed to flood while those things which offer little resistance to flood should be concentrated in areas which are risk free areas and less exposed to flooding. To reduce flood damage the houses in the flood prone areas should be constructed from such materials available which offer high resistance to flood. No major development should be permitted in area found to be subject to flooding. It is recommended that relocation of elements at risk to protect the lives and damages to infrastructure and economic sectors. Various appropriate flood preparedness and mitigation action should be followed to reduce the social and economic impacts of flooding. Special measures like efficient forecasting mechanism, community based training and community awareness campaign be adopted to avert the loss of precious lives and property. Emergency services like first aid etc. may come into force to make people alert at various stages of emergency. To reduce the consequences which have adverse effects like flood risk management such strategies should be adopted, which are technically viable, socially feasible and economically, which can achieve the desired task of flood risk management. It is suggested that awareness should be created in the local people living in flood prone areas. Several communicative sources e.g. brochures, posters, calendar and public service announcement on radio and television should be mobilized and utilized for public awareness.

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