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Community Based Flood Risk Reduction: A Study of 2010 Floods in Pakistan

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Abstract

Rapid advancement in technology brought dramatic changes in population growth, which ultimately leads to natural and man-made disasters such as global warming, greenhouse gases, the rise in sea level, land sliding, floods etc. Among natural disasters, floods are most destructive and notorious. Floods are natural phenomena which cannot be stopped but its adverse effects can be reduced through structural and non-structural measures. Factors contributing to the vulnerability of local community can be addressed using indigenous knowledge. This study provides a vivid picture of problems arises due to floods being faced by the local community of district Charsadda. The focus of the study is to highlight all those factors, which directly or indirectly contribute to flood occurrence. The recommendations provided by this paper are solely based on indigenous knowledge and local community perceptions and suggestions. This study could be helpful to all the government departments and non-government organization to understand the major causes of floods. It will help them in development of risk reduction measures and policies.

Keywords

Vulnerability, Hazard, Mitigation, Local Community, Risk, Flood

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1. Introduction

From the last two decades, increase in natural disasters is observed throughout the world. Due to human interventions, various phenomena are observed such as global warming, greenhouse gases, melting of glaciers which further leads to rising above sea level [1]. With respect to Pakistan, natural disasters especially floods are very notorious [25]. It strikes severely and frequently almost all the regions of Pakistan [2] [7]. After the flood of 2010, improvement in flood prediction and risk assessment become essential to prevent future disasters [11]. Technology and management skill in this perspective started grooming and reached its zenith [3] [5]. Advance technology like remote sensing, geographical information based analysis, computer modeling and real-time forecasting become an effective and basic necessity of everyday life [19].

The basic reason behind the promotion of word disaster into risk disaster management is a risk factor [18] [20]. Identification of risk is an essential part of disaster management [1]. Those elements which are at high risk to a particular hazard are initially hidden, but exposed when a hazard is converted into disaster. All those elements which were at risk are cleared. So identification of risk is important to know which elements are at risk and how much they are at risk [5].

Previously, studies were conducted by various researchers of concerned departments on floods and its causes [2] [3] [8] [11] [17] [18]. On the basis of their experience and knowledge about disaster risk, policies were developed and

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implemented in a country. But the current scenario of disaster risk is different due to changing patterns of vulnerability and exposure [24]. Involvement of local community is highly encouraged and preferred rather than making polices and plans by the single acting body [20]. In the 1940s, it was observed that concentration on physical component of the risk and mitigation programs are not enough for the effective risk reduction assessments [26]. Involvement of local community in risk assessment plan or strategy is an essential part of the disaster management. For the reduction of damages up to the minimum level in disaster, the local community should be encouraged to participate and their suggestion must be considered while making plans for risk reduction [4].

1.1. Problem Statement

Khyber Pakhtunkhwa is considered as a lower developed province of Pakistan in term of education, health, income, and living standard. Actually, it lies in the proximity of Federal Administration Tribal Area (FATA) that is why it faces few manmade disasters such as terrorism. Apart from this it also encounters natural disasters such as floods, earthquake, and landslides etc. Among natural disasters, floods are considered more devastating and relatively notorious. District charsadda is at a distance of 17km from Peshawar, the capital city of Khyber Pakhtunkhwa. It is surrounded by Mohmand agency in the west, Mardan in the north and Nowshera in the south. It is considered as one the most fertile region and of mineral-rich soil [22] [23].

In Charsadda, union council Agra is lying on the edges of river Kabul. In 2010 floods, almost all the districts of KP were damaged completely or partially. Union council Agra of district Charsadda is the only UC where the flood is observed each year after 2010 at small or large scale. The basic reason of this annual flood is high rainfall but some human-induced activities also trigger the process of floods occurrence [14].

The basic purpose of this study is to highlight the causes which generate flood and cause damages. This study solely concentrates on the basic causes of the flood. If causes are explored then it is quite simple to mitigate and prevent damages, loss of human lives and livestock. On the basis of this study, decision-making ability would be enhanced which ultimately leads to taking reasonable and sensible mitigation measures. Based on the study findings it can easily be decided that a particular area needs mitigation measures or permanently evacuations.

1.2. Objectives of the Study

- To highlight basic causes, directly or indirectly trigger the vulnerability of the community.
- To devise disaster risk reduction strategies employing the views of a community prone to flood risk.
- To suggest local mitigation strategies and practices for mitigation of flood risk.

2. Literature Review

Floods are unwanted visitors, they can affect poor and rich, prepared and unprepared. They are considered most destructive in nature as compared to other natural disasters. It's impossible to stop them, but we can reduce its damages through different tactics such as early warning system, the formation of embankments on river banks, reforestation also play an important role in reducing damages by reducing runoff speed. Effective weather forecast system is also an efficient tool in flood risk reduction. So through these methods, we can easily cope up or reduce flood impacts up to minimum level [5].

2.1. Causes of Floods in Pakistan

Pakistan encountered 17 major floods but the flood of 2010 was quite destructive due to following reasons. Firstly, Due to low prices of land near the surrounding areas of the river and low lying areas, migration of people from commercial areas towards flood porn area is one of the major factors. Abrupt changes in patterns of rainfall and excess in a rainfall cause dramatic increase in the flow of water, so in short span of time enormous quantity of water was observed which ultimately create floods and cause heavy damages to life and property [3] [18].

Floods have the tendency to cause destruction and they are considered as a potential hazard in hilly and flat areas [27]. Floods of 2010 were considered as a most devastating flood of Pakistan history, it causes heavy damages to property, lives and even disturbed an entire infrastructure of all the provinces of Pakistan [11]. There are some well-known factors, which enhance the severity of floods throughout Pakistan. By considering all these factors, it may be easy to mitigate damages caused by floods.

2.1.1. Prolong Precipitation

Rainfall has a vital role in the context of floods. Pakistan receives two spills of rainfall each year, one in the summer season, starts from mid-June to mid of September and termed as a monsoon. The second spill starts from December to January and is termed as winter rain. Usually, most of the floods are observed in monsoon rains [22].

2.1.2. Lack of Awareness

A country like Pakistan, which is totally dependent on agricultural activities and has low literacy rate. Lack of

awareness of the community to the risk of floods create huge problems and destroy a large amount of infrastructure, buildings, and increase in a number of causalities. Due to lack of awareness and safety precautions, the severity of flood increased and became a laborious job for government to handle it properly and efficiently [13].

2.1.3. Infrastructure Development

Most of the adverse effects of floods are due to unplanned development in floods prone areas. This sort of phenomenon is usually observed in hilly or mountainous regions [15]. Flood of 2010 was considered as the most devastating flood of Pakistan history, cause great destruction due to unmanaged and unplanned growth or development. In this flood, most areas of KPK such as Swat, Charsadda, and Mardan faced the same problems. Due to rapid development in these areas, sedimentation creates another great issue. Water runoff carries all the sediments with it and deposits them into the river bed. Due to these sediments, the storing capacity of river decreased and cause floods [2] [18].

2.2. Brief Description of Floods in Khyber Pakhtunkhwa

The effects of the flood in KP were highly severed. Infrastructure such as road, houses, buildings etc was totally or partially damaged or destroyed. Loss of human lives and standing crops were at its zenith. Some of the adverse effects are as follows.

2.2.1. Losses of Human Life and Livestock

According to Provincial Disaster Risk Management cell, 1109 people were injured and 1068 were found dead. Apart from that, 75 percent of the total population was forced to displace, 507423 acres of standing crops were completely destroyed during 2010 floods. A number of 605 transformers and 305 electric poles vanished during the flood which created a problem in power supply [11].

2.2.2. Damages to Villages and Infrastructure

A high number of villages and infrastructures were damaged in KPK during 2010 floods. About 544 villages were affected and 191215 numbers of households were compelled to migrate from their villages. The damaged houses were distinguished on the basis of kacha (made of clay) and paka (made of brick kilns) houses. According to a report of Provincial Disaster Management Authority (PDMA), 82557 paka houses and 108664 kaccha houses were destroyed during floods. More than 885 number of education facilities were affected. 50 percent of infrastructure and roads were only opened from communication and transportation [9] [22].

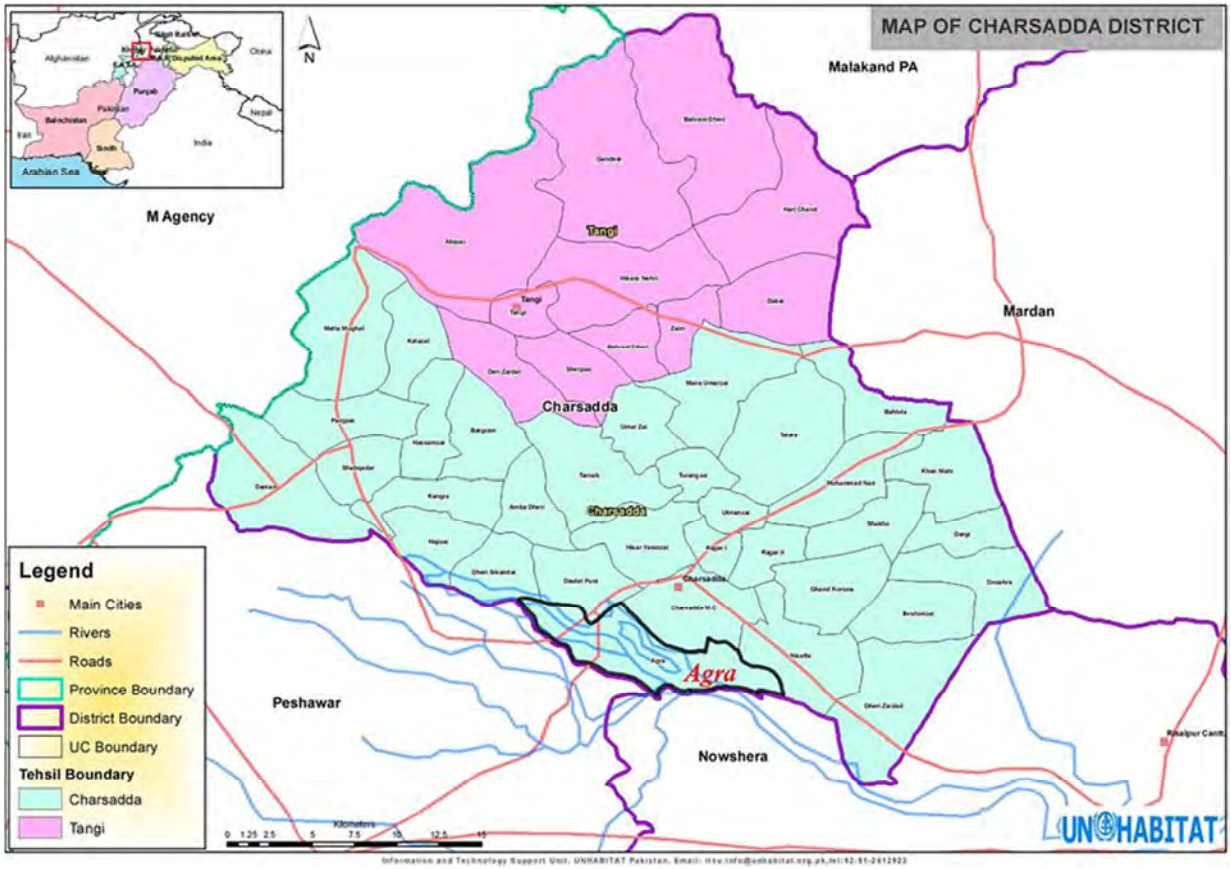

Figure 1. Map of district Charsadda and union council Agra (Source: Electronic Media).

Figure 1 map of district Charsadda, UC Agra is shown in blue boundaries. This map depicts that this union council is in the proximity of the river and it usually experiences floods in monsoon season.

2.3. Causes of Floods in District Charsadda (KPK)

There is a number of causes of floods in district Charsadda such as rainfall, encroachment, lag-time, sedimentation, lack of awareness etc. Other meteorological and physical conditions are also responsible for floods in district Charsadda. Factors which contribute to flood occurrence are categorized into two different forms.

2.3.1. Climatological Causes of Floods

In Pakistan usually, floods are observed in monsoon weather. Monsoon starts in July till August. In these two months heavy rainfall in observed within a short span of time. So due to increase in water supply, it becomes quite a difficult job to accommodate water. But if water is not managed property it may change into a flood and can destroy anything come in its path. Melting of snow in the upper areas such as Swat, Deer and Chatral also contribute in floods. Due to the melting of ice caps in these regions, the water level increased in river Kabul and river swat which ultimately leads to flood [6] [14].

2.3.2. Anthropogenic Causes of Floods

In a context of Charsadda floods, human-induced activities also play an important role in flood generation process. There are particularly three most important anthropogenic activities with contributing in context of floods [17]. Firstly, intensive agricultural activities are observed in flood-prone areas. Runoff water carries sediments from agricultural areas and deposits them into drains and river bed. Due to this process, the storing capacity of the drains decreased and become shallow. So in case of heavy discharge, overflow of water may cause a flood. Secondly, Population density also plays an important role. Due to dense population Encroachment towards flood-prone area is observed. Rapid development in flood-prone areas halts the flow of water. So water can also disperse or damages buildings in flood-prone areas. Thirdly, construction of narrow bridges throughout the drain at different locations also disturbed the natural flow of water. It may also cause flood [13].

3. Community-Based Flood Risk Reduction

The involvement of indigenous knowledge in planning processes and implementation of programs is a very important step. Through active participation of local community in flood risk management, it may reduce causalities and damages up to a minimum level. The local community should be encouraged to participate in disaster preparedness programs on the national, regional and local level. The role of local bodies, specifically in preparedness stage is very important. At this stage opinion and suggestions of local people should be considered. The local community is well aware of local problems and can suggest strategy on the basis of their previous knowledge and experience [19]. Specifically, in context of floods, evacuation, and public awareness should be conducted as per local people recommendation. The local community always Have sound knowledge about different communities and their vulnerability in the context of physical and social. So it can be easily decided, which community would be evacuated and which area is at high risk [9] [22].

4. Research Methodology

Data is collected from two major sources, one is called primary data source and other is termed as a secondary data source. Primary data was collected by performing field survey. A questionnaire survey was conducted in those regions, which were severely affected and damaged by floods. Questionnaires were also filled by those communities, who were victims of the flood because the real situation can only be better explained by those people who use to face flood. Interviews were also conducted from those official bodies that were in concerned government departments or international organizations which worked at the time of relief and recovery phase.

Figure 2. Research Methodology and Design

Data which is collected from articles, journals reports fall under secondary data. This data is generally published data and can be used from different sort of analysis. Data regarding water discharge at river Khaili was collect from Meteorological department of Peshawar. Reports of floods

damage assessment were also collected from Islamic International Organization, which is one the most active nongovernment organization in district Charsadda, Especially in the context of floods.

5. Results and Discussions

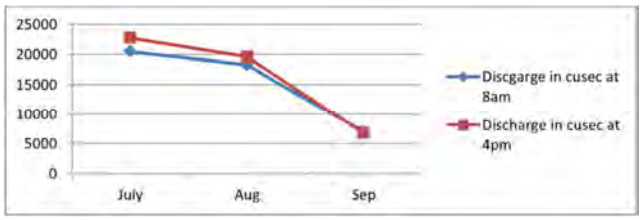

Figure 3. Discharge data of 2009 at Khaili River. (Source: Meteorological department Peshawar).

Figure-2 shows the discharge of river Khaili River. Khaili River was overflowed to cause a flood in union council Agra. We can observe from the above graph that discharge in the month of July is higher than that of August and September. So in the month of July maximum precipitation is observed an increase in water coming from Swat, Deer, and chaparral. The discharge in this is quite low as compared to 2010.

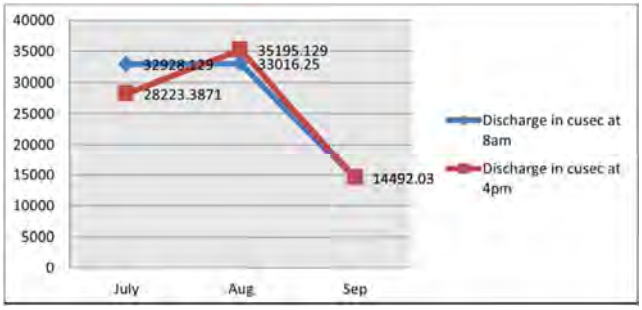

Figure 4. Discharge data of 2010 at Khaili River (Source: metrological department Peshawar).

The above-mentioned graph shows the discharge of Khaili River of 2010 in the month of July, August, and September. We can easily observe that the discharge in the month of August is at its zenith but from the start of July it in increasing order. Due to this continuous increase in water, cause floods in district Charsadda. In this year a huge flood was observed throughout Pakistan.

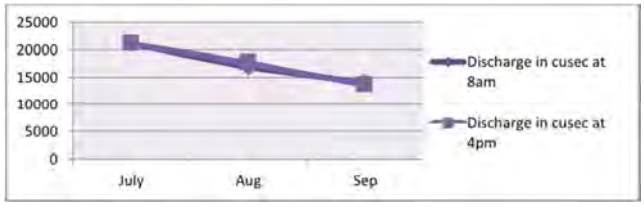

Figure 5. Discharge data of 2011 at Khiali River (Source: Meteorological department Peshawar).

This graph shows the discharge of 2011 which is quite low as compared to the discharge of 2010. After 2010 floods, in mid of 2011, the reduction in discharge was observed throughout the year.

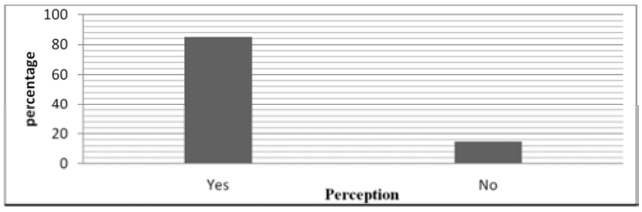

Figure 6. A community which encounters flood in district Charsadda.

The above-mentioned graph is showing that how much people are affected by a flood in district Charsadda. Most of the community in this district is also affected by floods of 2010. According to an estimated report, 85% of the local community was affected by the flood and about 15% remained unaffected.

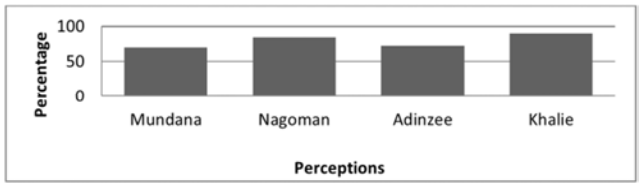

Figure 7. Community perception regarding early warning system.

Mundana, Nagoman, Adinzee, and Khalie are the names of the four villages of union council Agra. In the context of early warning system, the perception of the local community of each varies from village to village. 90% people of khalie village are satisfied with the early warning system. 85% people of Nagoman village are satisfied, while 72% of Alizee and 72% people of Mundana village are agreed with the early warning system. Right after 2010 flood efforts had been made to make the early warning system more effective and efficient in all aspects.

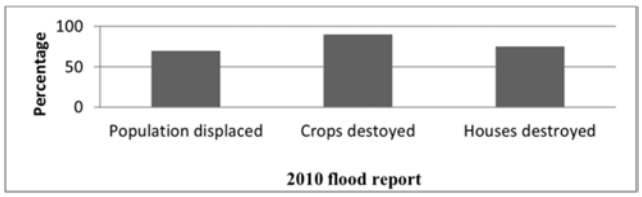

Figure 8. The affected population of district Charsadda (Source: Flood report, 2010).

According to the 2010 flood report which is generated by Islamic relief, which is one of the international non-government organization and working in this area up till now. According to their reports in union council Agra also 90% of the standing crops are destroyed. Houses in this area are made up of mud or single brick that's why almost 75% of houses are also destroyed. And the population which was displaced is 70 percent of the total population. The total

population of Agra is 28000 persons.

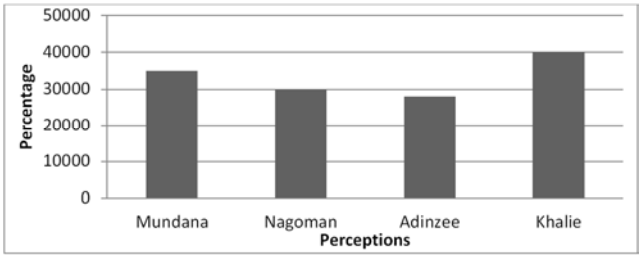

Figure 9. Rehabilitation cost per house in each village.

The above-mentioned bar graph shows the amount spend on rehabilitation cost per house in each village of Agra. Some 35000 PKR is spent on each house in Mundana. 30000 PKR is spent on each house in Nagoman, while 28000 PKR are spent in Adinzee and 40000 PKR in Khaili is spent on rehabilitation of each house in a village.

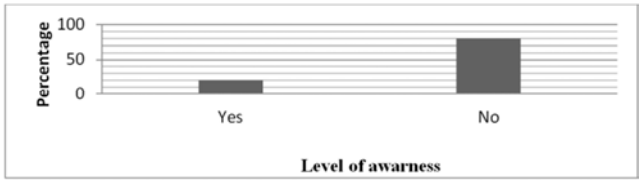

Figure 10. Local community at risk based on indigenous knowledge.

The above give table is totally based on local community perceptions. The level of awareness is at its lowest stage. People of Agra are still living in the flood-prone area but they are not aware of this. The activities which should be prohibited in flood-prone areas are at zenith. From above graph, we can easily understand that 20 percent of the local community is aware that they are at risk while the remaining 80 percent have no idea either they are at risk or not.

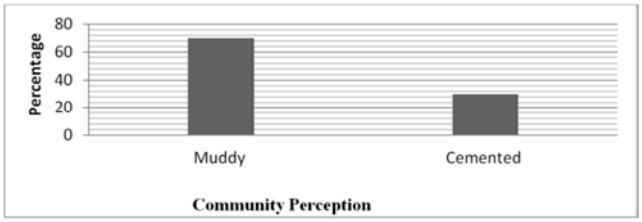

Figure 11. Community perception regarding prevailing construction pattern.

The above-mentioned graph is based on prevailing construction pattern of union council Agra. All the construction which lies in the proximity of river Kabul and river Swat are built with mud while in a central city scenario is different. Concrete is used in the foundation of the buildings while brick is used for the ground structure.

On the basis of indigenous knowledge causes of the floods are explored. Different suggestions are also made by a local community of reducing the risk of the flood and through which damages caused by floods can be reduced. On the basis of local knowledge, different aspects of floods are exposed through which its intensity and severity may be reduced up to the maximum level. Some of their suggestions are as follows.

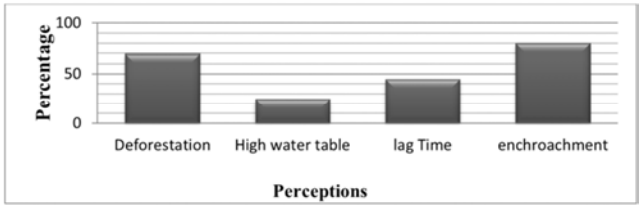

Figure 12. Causes of floods in Charsada based on community perceptions.

6. Measures to Mitigate Flood Risk

Interaction with a local community further vivid the idea of flood risk reduction. Different people suggest and recommend a different type of ideas which may be proved effective if they are implemented in the true order. Their areas are as follows.

6.1. Embankments

According to local community perception of UC Agra, embankments will play an effective role in flood risk reduction. Surprisingly, union council Agra lies right in the middle of the two rivers, river Swat, and Kabul. In 2010 when the flood occurred in river Swat, it creates a blockage at the meeting point of these two rivers which is termed as Dowaba in the local language. Due to blockage, water overflowed in river Swat and entered in the city. A non-government organization (Islamic relief) developed embankment at a small level in this area but the need of proper embankments is yet required for the effective prevention of flood adverse impacts.

6.2. Change in Construction Pattern

The current pattern of construction is highly risky in the context of floods. All the construction near river course is muddy and construction in the central city is of concrete. Construction in flood-prone areas should be avoided and it must be shifted toward those areas which are safe from floods or far away from river bodies. Local community needs to follow proper building codes because if a flood occurs only that sort of construction will be safe which is constructed through proper procedure and follow building codes.

6.3. Reforestation

Reforestation is a good technique to reduce the flow of water in union council Agra. Reforestation can reduce runoff water

because plants absorb water from the land surface which increases the absorption capacity of water of the surface of the earth. It further reduces the erosion of soil. Soil degradation creates problems of sediments deposition in the river bed which reduce water carrying capacity of rivers.

6.4. Early Warning System

The effective early warning system plays an important role flood risk reduction. Suggestions have been made to make a model specifically for district Charsadda on which bases the intensity of the flood could be evaluated. Flood is almost observed every year in this area. On the basis of rainfall and runoff, the model should be generated which make an ease in flood prediction.

6.5. Channelization of River Kabul

Channelization of the river bodies is a good technique to reduce the intensity of water. River swat is channelized throughout but on the other hand river, Kabul is not channelized. So if flood occurs in river swat excessive water can accumulate in channels but if a flood occurs in river Kabul then it's quite a difficult job to manage the excessive water, that why channelization of river Kabul will be a good initiate to prevent damage and it will also increase the availability of water for agricultural purposes.

7. Conclusion

Floods are the most prominent and notorious natural hazard in district Charsadda. Throughout the flood history of Pakistan, floods of 2010 were the most disastrous floods. The factors which contribute to flood generation are both natural and manmade. Natural factors include deforestation, the slope of the terrain, and deposition of sediments, erosion and excessive rainfall. While manmade factors which contribute to flood enhancement are lack of awareness, government inefficiency, and unplanned development etc. To prevent damages or to reduce the risk of floods in Charsadda is quite a simple task if the local community is encouraged to participate in policy-making and implementation. The local community is always aware of the prevailing problems in their society that's why their suggestion and recommendation must be proved effective and fruitful. So in the context of flood risk reduction of district Charsadda local community made some suggestion which is noteworthy and has the capabilities to reduce the risk of flood up to a minimum level.

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