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Societal impacts and vulnerability to floods in Bangladesh and Nepal

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ABSTRACT

Bangladesh and Nepal lie between the Himalayas and low-lying coasts of the Bay of Bengal and are traversed by hundreds of rivers and tributaries. Historical data shows that, since 1970, the scale, intensity and duration of floods have increased in Bangladesh and Nepal, causing grave human suffering; disruptions in normal life and activity, damages of infrastructure, crops and agricultural land with severe impacts on the economy. Bangladesh is affected by torrential rain, glacier melt, upstream water flow and tidal surges. In 1988, Bangladesh experienced one of the most severe floods of the twentieth century which aroused significant concern internationally and triggered the Bangladesh Action Plan for Flood Control. The Government of Bangladesh (GOB) has so far constructed a number of flood shelters and carried out 482 water and flood control projects involving flood protection embankments, drainage channels, sluice gates and regulators on different rivers and canals. These also provided safety measures against inundation by tidal waves, storm-surges and flooding. The Terai region of Nepal is highly prone to hydrological risks including torrential rain, floods, glaciers resulting in erosion and landslides. The Government of Nepal (GON) has implemented different mitigation measures mainly early warning awareness, rescue measure, relief, and post-flood rehabilitation programs etc. Disaster Management Bureaus of both the countries have already conducted many trainings, workshops and seminars to disseminate scientific knowledge and coping up practices to disaster managers and to create public awareness. Besides the contemporary approaches to mitigating flood effects, people of these countries have coped with floods through generations relying on traditional/indigenous knowledge and other local adaptation practices. It is crucial that along with scientific process, indigenous, traditional and conventional practices are to be integrated for a national and regional policy and this should be achieved through a participatory process that engages policy makers and relevant stakeholders. This paper has analyzed the vulnerability to floods, impacts and the coping strategies in Bangladesh and Nepal and focused on recommending a long-term mitigation policy.

1. Introduction

Among the oldest and known disasters, floods have been threatening humanities for ages (Ferreira, 2011). Around the world, acceleration in population growth and changes in land-use patterns have increased human vulnerability to floods. Harmful impacts of floods include direct mortality and morbidity and indirect displacement and widespread damage of crops, infrastructure and property (Doocy et al., 2013; IPCC, 2007). Every year floods take thousands of lives, leave millions homeless and cause significant loss to properties and infrastructures all over the world (Table 1).

Analysis of history of disasters in South Asia reveals that Bangladesh and Nepal are the two densely populated least developed countries (LDCs) that experience different types of flood every year with negative impacts on their economies. The plains of the foothills of Nepal and the entire floodplains of Bangladesh are mostly traversed by the rivers and tributaries mainly originated from the same source, the Himalayas. Both countries fall under the "Indian Monsoon" region with heavy precipitation during the wet monsoon that frequently cause severe floods destroying infrastructure, crops, vegetation and displacing millions of people (Mirza, 2010). The aftermaths of floods are water pollution, waterborne diseases and other epidemics. Loss of human life and livestock, escalation of prices, social insecurity and costs of rebuilding infrastructure are additional layers of constraints that affected regions have to bear after the floods along with resource diversion for immediate response, rescue, relief and early recovery activities (Ghatak et al., 2012). Scientific projections affirm that risks of flooding will increase considerably in the main river basins of India, Bangladesh and Nepal. In Bangladesh, a rapid shift in extent and depth of flooding will occur with a global mean temperature rise of 2.6 °C above pre-industrial levels. Wide spread-glaciations in the Himalayas are likely to adversely impact

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Table 1
Recent devastating flood incidents in different parts of the world.
Sources: http://en.wikipedia.org/wiki/2013_North_India_Floods; http://en.wikipedia.org/wiki/2010_pakistan_Floods; http://en.wikipedia.org/wiki/Floods_in_the_United_States:_2001%E2%80%93present.

Date	Place	Casualties	Estimated economic loss (USD)
May 2014	Balkans Flood	Died – 37 and displaced – tens of thousands	2.5 Billion
September 2013	Colorado, USA	Died – 8, missing – 6	1 Billion
June 2013	Uttarkhand, India	Died – 6500	45 Billion
July 2010	Indus Basin, Pakistan	Died – 2000, affected – 20 million	43 Billion
June-August 2010	Dadeldhura, Nepal	Died – 98, missing – 8 and 39,000 affected	294.4 Million
June 2007	Bangladesh	Died – 500, affected – 20 million	1.06 Billion

the hydrological regime of the region (Isaacs et al., 1998; Regmi et al., 2008).

This synthesis assesses available information and documental evidence to highlight the vulnerabilities and effects of floods on the socio-economic conditions of two neighboring LDCs under the same monsoon climatic region. Both Bangladesh and Nepal have many common rivers, similar agriculture-based economy and social structure. As a result this study ties similar characteristics of the two countries to better understand the nature of vulnerability to floods and helps establish sustainable national and regional flood management policies in these two LDCs. The study reflects on causes of floods, their impacts, coping strategies and national policies. It aims to identify gaps in knowledge for future work and places special attention to indigenous practices adopted to cope with floods, a common hazard in Bangladesh and Nepal for many years.

2. Methodology

This synthesis was done using the information from different peer reviewed scientific research and gray literature such as reports, media sources including, folklore etc. Information was also gathered through local and national workshops and seminars and also from attending different regional workshops and conferences. Research institutions, meteorological stations, rural and urban administrative bodies and Non-Government Organizations (NGOs) of both Bangladesh and Nepal also provided valuable information for the study. The information gathered was used to examine and document the societal impacts and vulnerability of Bangladesh and Nepal to floods specially reflecting on coping strategies.

3. Floods in Bangladesh and Nepal

3.1. Causes of floods

Accelerated retreat of glaciers and increased intensity of monsoon precipitation observed during recent years have contributed to increased frequency of floods in Bangladesh and Nepal (Agrawala et al., 2003). Monsoonal influences in particular are the major drivers of floods in South Asia. Changes in rainfall patterns of the Indian monsoon due to climate change have increased the frequencies of high-intensity and prolonged rainfall. Ghatak et al. (2012) stated that, generally Bangladesh and Nepal receive the southwest monsoon that accounts for 70–80% of the rainfall from June to September. This skewed distribution of rainfall, two-third of which is received in 4 months span, results in overflowing river banks leading to flooding.

Recent studies show that due to the effect of sea level rise the densely populated coastal zone of Bangladesh is getting highly vulnerable to coastal floods; whereas glacier melts in the Himalayan region cause flash floods in the mountainous regions and the foothills in Nepal and this extends to the northern region of Bangladesh. According to a report from the International Centre for Integrated Mountain Development (ICIMOD), glacier lakes in the mountains are becoming very large due to rapid melting of glaciers causing frequent and severe flood. In both the countries, due to localized meteorological conditions, continuous rainfall and cloud outbursts, incidences of flash floods events have significantly increased (Ghatak et al., 2012; Rahman, 2011).

Nepal has more than 6000 snow-fed and perennial rivers and rivulets. Most of those rivers, originated from the Himalayas and after sliding from hills, flow through the Terai plains making the entire Terai floodplain prone to severe floods. During wet monsoon, these rivers swell and cause damages to the floodplain habitats. In last five decades, the Terai region witnessed a tremendous growth and development with infrastructure roads, railways and urbanization which constrained drainage of rainwater and thereby causing frequent floods (Dixit et al., 2007). As a result, the impact of increasingly variable monsoons and intense rainfall in the floodplains of the Himalayas are catastrophic, affecting over 1.5 billion people in the Ganges river basin alone (Weisman and Chhetri, 2011).

The probability of potential damages due to floods is likely to increase as a consequence of the increase in the intensity of extreme precipitation events due to global warming; for example, up to above 100mm/day (Baida and Shrestha, 2007). The Global Circulation Model projects a wide range of precipitation changes, especially in the monsoon, 14–40% by the 2030s increasing to 52–135% by the 2090s (Dixit et al., 2009) and this is likely to cause more floods.

In Bangladesh, rapid population growth is creating an extra pressure on the land required for agriculture, settlements, and construction of roads and highways etc. and thus creating more flooding problems (Khalequzzaman, 1994). Due to unplanned urbanization, the towns and cities are most vulnerable to floods especially during the non-stop rainfall even if it is for a small period (Rahman, 2011).

It is known that South Asia's geography makes it particularly vulnerable to natural hazards and disasters. The World Risk report published in 2011 shows that Bangladesh and Nepal display a high level of vulnerability due to their lack of coping and adaptive capacities and high level of exposure. According to World Risk Index (WRI), among the 173 countries Bangladesh was ranked 6 and Nepal l99. Bangladesh has been declared the second most disaster-risk country in Asia with exposure of 27.52%, while Nepal is 9.97% (World Risk Report, 2011).

3.2. Flood disasters

3.2.1. Bangladesh

Among other South Asian countries, the geographical setting of flood risk is heavily concentrated in Bangladesh, causing high human and material losses. An average of 844,000 million cubic

meter of water flows into the country during the wet season (May–October) through the three key rivers; the Ganges, the Brahmaputra and the Meghna. Most part of the country is low-lying and 80% of the landmass is flood plain thereby leaving the country highly vulnerable to the threat of repeated floods (Ghatak et al., 2012; Chowdhury, 1988; Brammer, 1989; Islam, 1999).

Flooding in Bangladesh is a normal and frequently recurrent phenomenon. The common types of floods in Bangladesh include flash floods from the overflowing hilly rivers, rain floods due to poor drainage, monsoon floods in the flood plains of major rivers and coastal floods following storm surge. The IPCC Special Report on Extreme Events (SREX) (2012) estimated that in a normal year, river spills and drainage congestion cause inundation of 20–25% of the country's area, but in 1987, 1988 and 1998 floods inundated more than 60% of the country causing death toll to rise to thousands and leaving millions homeless. The 1998 flood resulted in 1100 deaths and 30 million people left homeless (IPCC, 2012). The flooding pattern in Bangladesh points towards an increase in frequency over the years. Historical and recent data show that during the past 40 years at least seven major floods have taken place in Bangladesh. Some of the worst ones have occurred during the years of 1987, 1988, 1998, 2004 and 2007, making an average of one in six years (Ghatak et al., 2012).

3.2.2. Nepal

Floods of 1985, 1993 and 2004 destroyed large tracks of land terraces, farm lands, pastures and orchards in Bhasedwa leaving the country food insecure (Dixit et al., 2007). Nepal witnessed major flood in Tinao basin (1978), Koshi River (1980), Tadi River Basin (1985), Sunkoshi Basin (1987) and devastating cloud outburst in Kulekhani area (1993) which alone claimed 1336 lives (Ghatak et al., 2012).

4. Impacts of floods

Floods in developing countries pose a greater threat to human life, health and well-being than in developed countries. In general two-thirds of deaths directly related to flood events are caused by drowning and one-third by physical trauma, heart attack and electrocution (Fitzgerald et al., 2010). The most vulnerable members of the community are the elderly and the youngest requiring special assistance (Dewan et al., in press). While economic losses are rising, direct deaths from flooding may be declining over time as measures to prevent flooding are increasingly being deployed.

The impacts of flooding in Bangladesh and Nepal are severe in both rural and urban areas affecting majority of the population, infrastructures, and family assets (Tables 2 and 3). The direct impacts are considered in this section. The tables below provide information on some of the impacts of floods that were registered during this synthesis.

Table 2
Historical floods of Bangladesh and its impact.
Source: http://www.preventionweb.net/english/countries/statistics.

Year	Affected people	People killed	Economic damage (US$ × 1000)
2007	13,771,380	1110	–
2004	36,000,000	–	2,200,000
1998	15,000,050	1050	4,300,000
1995	12,656,006	–	–
1993	11,469,537	–	–
1988	45,000,000	2379	2,137,000
1987	29,700,000	2055	727,500
1984	30,000,000	1200	–

4.1. Impacts on personal security

In Bangladesh, the major impact of floods is death, caused by drowning, water-borne diseases, diarrhea, snakebites, and in Nepal landslides and also by structural damages (Tables 2 and 3) (Few et al., 2004). During the 2007 monsoon floods in Bangladesh, snake bites were estimated to be the second most significant cause of death after drowning and contributed to more deaths than even diarrheal and respiratory diseases (ICHARM, 2008).

Other major impacts result from being traumatized by witnessing death, loss of employment and access to basic needs such as getting adequate supply of fuel required for cooking in urban, semi-urban and rural areas. Fuel such as cow dung, jute stick, wood that are used in rural areas are usually all washed away or become wet, making these unusable while in urban area, the water damages the gas pipe line leading to non-availability of gas for cooking (Dewan et al., in press; Ninno et al., 2001). Moreover, day laborers often starve to death due to staying a long period with no work or, due to sickness. During the 1988, 1998 and 1999 floods in Bangladesh hundreds of industries, especially garments factories went under water which destroyed raw materials, machineries worth millions of Dollars and some factories never recovered. Due to this, thousands of workers went unemployed leaving the country dependent on foreign aid (NAPA, 2005; Ahmed, 2012; Nishat et al., 2000).

Direct impacts occur through the increased floods, drainage congestion and water logging as well as infrastructure damage during extreme events. The important urban sectors that suffered severely by the floods include urban infrastructure, industry, trade, commerce and utility services etc. As a consequence, it hampered usual productivity during and after major floods and hence increased the vulnerability of the urban poor by many folds (Denissen, 2012).

Conversely in Nepal, the flood of August 2014 devastated much of Nepal. This emergency had affected at least 21,000 families in addition to a significant portion not been taken into account of due to having been cut off by floods, landslides and damaged roads. A significant number of women, new mothers and their newborn babies had to live in temporary shelters or even by the roads, with extreme safety risks from disease-carrying mosquitoes, contaminated water and a lack of personal security. In addition, many health posts units were also damaged (http://www.planusa.org/contentmgr/showdetails.php/id/3121299). A major tourism destination, Pokhara, in western Nepal faced increased risk of natural disasters following a devastating flood, on the Seti River, which killed more than 60 people and which brought changes in the course and flow-pattern of the river (Denissen, 2012).

4.2. Impacts on buildings and infrastructures

Research shows that the impact of flooding on housing and households can be extensive. Fast flowing flood waters are capable of washing away entire slums while the slow rising water damages buildings. In rural area of Bangladesh houses with “Mud Walls”, “Coconut leaf Walls” and “Tin Walls” collapse leaving people and assets exposed and vulnerable. About 32% of total population in Bangladesh lives in slums (Miyan, 2012; Rahman, 2011) and thus a large number of people is left homeless and stranded for days due to flooding. In Nepal 20% of Nepalese live in urban area and one of the direct impacts of flooding includes physical damage caused to buildings.

According to Jha et al. (2012), damages caused to public buildings such as hospitals, clinics, educational buildings, and significant cultural sites such as mosques and temples lead to further impacts. For example, the disruption to education contributes to disruption of academic sessions thus create an ongoing

Table 3
Impacts listings of floods in Bangladesh and Nepal.

Impacts	Bangladesh	Nepal
Personal security	• 75% of total flood victims die due to drowning • Experienced death due to diarrhea, dysentery, typhoid and cholera • Snakebites caused two-third of total death in any given flood • Loss of Income • Loss or unavailability of fuel-wood, gas	• 47% of total flood victims die due to drowning • Death due to diarrhea, dysentery, typhoid, gastroenteritis and cholera also experienced • Loss of income • Loss or unavailibility of fuel-wood, gas
Buildings and infrastructure	• Slums, mud huts, tin wall houses are washed away • Damage of Mosque, Temples and Churches • Damaging garments factories	• Physical damages to buildings and Temples • Significant damage of Kulekhani hydroelectric project and the Bagmati barrage • Damaging wool/cashmere industries
Crops and animals	• Loss of livestock • Grain shortage • Damages of vegetation	Loss of livestock Damages of vegetation

low literacy rates in both the countries. Similarly, a significant reduction is visible in the capacity for providing both immediate and long-term healthcare and support. It is a common phenomenon for both Bangladesh and Nepal to witness unusable and or partially destroyed roads due to flood which create barriers to commute. The city waste management system is negatively affected during flood, with garbage scattered all over clogging drainage system and polluting environment in both the countries (Jha et al., 2012; NAPA, 2005; Dasgupta et al., 2010).

In Nepal, cloud outburst in low monsoon weather system in 1993, affected the catchments of the Gandaki river system and caused great Bagmati flood which damaged the Kulekhani Hydroelectric project and the Bagmati barrage (Dixit et al., 2007; MoWR, 1993).

4.3. Impacts on crops and animals

Bangladesh and Nepal have large agrarian economy. In Nepal the agriculture sector provides over 30% of country's GDP and supports more than 86% of the population, whereas in Bangladesh agriculture comprises about 18.6% of the country's GDP and employs around 45% of the total labor forces (Weisman et al., 2011). Majority of the poor in these two countries live in areas of high risk to floods and landslides and are more reliant on local natural resources. In Nepal, monsoon floods result in inundation and sand deposition over large areas and thus damage crops and land resulting in long term food insecurity.

Rice and wheat are staple foods in both countries. A special type of rain fed rice; "Aman" grown in Bangladesh is highly susceptible to river floods and has been affected in all years of flooding (Baky et al., 2012). During the Bangladesh 1998 floods, 69% of *Aus* rice production, 82% of deep water *Aman* and 91% of transplanted *Aman* were lost leaving the whole country food insecure (Ninno et al., 2001). Usually most of the floods occur during the wet monsoon (July–August) and severely affect the summer vegetable crops specially the creeper and climbers e.g. cucumber and bitter gourd. Floods in Bangladesh also affect small agriculture farms such as mushroom industries. The whole mushroom industry was seriously affected by the floods of 1998 and 2007 causing huge loss of foreign currency (IPCC, 2007).

Within rural and semi-urban areas the impacts of flood are severe on domestic animals like poultry and dairy which are the major sources of earning in both Bangladesh and Nepal (http://www.heifer.org/join-the-conversation/blog/2014/August/heifer-mourns-loss-of-nepal-beneficiaries-killed-in-flooding.html). Cultivated fish (Catfish, Shrimp and Carps etc.) drift away due to erosion of embankments and boundaries of the lakes or ponds and resulting in economic losses to the export industry of Bangladesh. In both Bangladesh and Nepal a large portion of food supply depends on agricultural production. Due to flooding, losses in crop, dairy, poultry and fisheries are leading these countries dependent on foreign-aid (Weir, 2009).

5. Response to flood hazards and disasters

Government and non-governmental organizations both in Bangladesh and Nepal have initiated a number of activities to minimize the adverse effects of floods. According to the National Adaptation Programme of Action (NAPA) report (NAPA, 2005), the Government of Bangladesh (GOB) has established an inter-ministerial committee on climate change headed by Minister for Environment and Forest (MoEF) and with representation from relevant government ministries and department as well as Non-governmental organization (NGOs) and research institutions. The Department of Environment (DoE) under the MoEF has also set up a Climate Change related programme within the government to mitigate the effects of flood and other disasters.

In addition to constructing 5695 km of embankments including 3931 km long coastal embankments to protect coastal land from inundation, GOB has dug 4774 km of drainage channels for proper flow of flood water. They also constructed 200 flood shelters for evacuation of people threatened by floods (NAPA 2005). In Bangladesh, people along with their domestic animal usually take shelter in schools, colleges, Union-Council complex, and even on the embankments of the rivers. GOB and different NGOs have taken initiatives to build brick latrine with proper septic tanks to minimize water contamination. In Nepal tube wells have been built so that drinking water is available during floods (NAPA 2005). In the last decade, Bangladesh and Nepal Governments and NGOs organized different relief programs e.g. Gratuitous Relief (GR) in Bangladesh, Vulnerable Group Feeding (VGF) in Nepal to help the flood victims (Ninno et al., 2001).

In Bangladesh, authorities have been constantly building awareness among the farmers to adapt their farming systems to "normal floods" that typically inundate about a quarter of the country every year. For instance, farmers are encouraged to switch to high-yielding rice crops instead of low-yielding deep water rice. The Bangladesh Agriculture Research Institute (BARI) and Bangladesh Rice Research

Institute (BRRI) have developed salinity tolerant species to mitigate the flood impact on crops (Mondal, 2010).

Recently in Nepal, besides government efforts, NGOs have started different programs to build awareness within the community through different activities. Activities include immediate response during flood, training for preparedness, training for flood response activities, providing information on flood shelters and for post rehabilitation through distributing pamphlets, posters and other materials for assisting with emergency relief (monetary and non-monetary).

6. Indigenous coping practices

Although governments and NGO's in both countries have taken measures to cope with floods, the traditional and indigenous practices of coping with floods are as important and vital as the modern approaches. For example, in Nepal, indigenous flood forecasting, early warning system and community based flood management save many lives and properties. Some of the indicators for the people for forecasting heavy storms include position of the cloud in the sky, extent of rainfall in upper catchments, mobility of ants, abnormal fly bite, abnormal crying/voices of animals and birds, intensity of thunderstorm and wind, position of stars, and magnitude of hotness (Gautam et al., 2007). Strange sounds from river/torrents, muddy smell in the water, rising level of water flow are some indicators perceived as early warning of flood (ICHARM, 2008). This local knowledge is the most valuable asset for any flood management planning in Nepal.

Communities apply pre-flood preparations as part of the flood management. These include management of basic materials such as cooking utensils, dry foods, fuel, matches etc., advance psychological preparedness (building awareness on do's and don'ts during floods), collection of non-timber forest products (NTFPs) to treat livestock and other practices include storage of the valuables in Attaiya (attic), preparation of the khatiya/palang (wooden bed) of bigger height, Weaving Doko (big bamboo basket) to save poultry from flood, storage of grains and dry foods, arrangement of evacuation place, and management of livestock in advance through selling, transferring them to highland etc. Similarly, procurement of essential drugs in advance, management of firewood, storage of dry food for livestock, construction of pihan (cooking stand), filled sand bags to divert the flood, arrangement of evacuation place and plan, drainage improvements such as creation of small drainage in each plot of land, homestead raising, and increase of the height of hand pumps are other activities people perform as part of their preparedness to flood disaster. Immediately after the flood, there is a general practice to assess damage, construct/repair the houses, and manage food, dry grains and clothes.

Households adjust to the shock of a flood disaster in several ways such as reducing expenditure, selling assets. One major coping behavior is borrowing which is common among women although borrowing is not a long term solution (Ninno et al., 2001). In wet monsoon, Nepal farmers reduce flood impact by cultivating deep water rice known as “Jola Rice” a low yielding traditional variety, which has proven to be resilient to even to severe floods. To reduce the impact of flooding on homesteads, traditionally people raise the homes by digging ponds around the house. It is important to note that the pond that is dug to uplift land also serves the purpose of securing portable water for use during floods. Moreover, ponds hold excess water from the wet monsoon and are also used for fish and aquaculture (Dewan et al., in press). Besides ponds, other indigenous practices include uses of terracotta pitcher and bottle Gourd Shell pot for saving drinking water over the flood season in Bangladesh.

Regardless of their volume, floods affect infrastructures and leave citizens commuting less. In Bangladesh, traditional practices for commuting in rural and semi-urban is to build “Vela” a float made of either Bamboo or Banana tree, and/or using small hand rowed boats. In recent years a few motor driven boats are seen in flood season, but due to the high cost and non-availability of fuel, traditional “Vela” and small hand rowed boats during floods are still in practice in both the countries. To shelter flood victims, flood shelters are organized by the government, although often it is not enough to accommodate all the flood victims. Conversely, the traditional practice, to create “Matcha”, elevated surface made out of bamboo or woods or use of “Vela” to live on during flood are still valuable. In both the countries, despite governments organize relief including food, cloth, money and healthcare services, these usually do not reach the victims in time due to transportation problem; however, people in flood prone area store puff rice (Muri), flat rice (Chira) and jiggery as immediate food supply during the flooding period to protect them from starvation and these dry foods are safe and hygienic. Traditional practices show that green coconut water is consumed both in Bangladesh and Nepal to rehydrate the victims of waterborne diseases like diarrhea, cholera and dysentery (Dewan et al., in press). Due to its mineral and electrolyte content green coconut water is unmatched to any modern days rehydrate substitute and has proven 97% recovery rate of dehydration-related diseases: such as cholera and influenza (Fife, 2007).

7. Policy integration

The Hyogo Framework for Action 2005–2015 on “Building the Resilience of Nations and Communities to Disasters provides” the latest framework and strategy for disaster risk management. Both Bangladesh and Nepal signed the HFA and thereby committed themselves to achieve the HFA's objectives and priorities by 2015. Bangladesh Disaster Management Bureau prepared the Standing Orders on Disaster (SOD) in 1997 which was further developed in 2010. The key roles and responsibilities particularly of Disaster management Committees (DMCs) have been divided into two major categories: (1) risk reduction; (2) emergency response – during warning period, during hazard onset and the post hazard period (SOD, 2010).

Under the Disaster Management Regulatory Framework, there are provisions for preparing a short, medium and long term vulnerability reduction and capacity building action plan for the identification of high-risk people through a highly participatory approach. For effective implementation of SOD, the Union Disaster Management Committees (UDMCs) are needed to be made more functional and proactive by providing training and resources, and by establishing proper monitoring as well as follow up system. In time financial and other logistic supports are also needed to be ensured.

Moreover for long-term policy, the traditional and indigenous knowledge especially development of water ways, conservation and protection of natural and traditional water reservoirs have been overlooked during quick and unplanned infrastructure development especially for industrial, urban and agricultural expansion. During the development of road transportation system most of the river flows have been disturbed and the catchments have lost their water holding capacity; thus floods become more frequent.

In 2005, Bangladesh has prepared the National Adaptation Program of Action (NAPA) under the frame work of UNFCCC. NAPA has prioritized floods as the most challenging disaster as it affects about 80% of land in Bangladesh with an increasing economic loss from 1954 to 2004.

NAPA identified agriculture, water, infrastructure, human settlement, health, and energy as the vulnerable and impacted sectors and finalized 15 projects for coping with climate change effects

including floods (UNDP, 2013). But a detailed work plan on floods was not clear wherein very little attention was given to traditional knowledge, although people of this region are well adapted against flood disasters. The NAPA does not reveal the long-term mitigation practices, rather it is focused on policies on floods which did not show any significant result in reducing floods and damages. It needs a significant development of navigation system, preservation of natural and traditional water reservoirs and water-flows that are not obstructed.

Therefore, more work is needed in Bangladesh to adopt a policy frame that includes traditional knowledge and considers their scientific value for long-term sustainability. A bottom up policy should be developed covering the gaps and should be based on research with participation of communities with local knowledge and wisdom, policy makers, NGOs and other stakeholders. The findings should be incorporated in the policy frame through discussion, dialogs, workshops, seminar and symposium.

In Nepal, for mitigating flood, improvement of drainage, houses on silts, raising plinths of houses etc. and other systems like transport, fund management have been put in place to contribute towards building social resiliency; besides, an effective strategy for Disaster Risk Reduction (DRR) is in place too (Moench and Dixit 2004; Dixit, 2009). The Government of Nepal undertook a National Action Plan for disaster management in 1996. A National strategy for disaster risk management in 2009 and prepared a guidance note on disaster preparedness and response planning in 2011 (UNISDR, 2014).

Involvement of different organizations, civil societies, knowledge generation on vulnerability, impacts and coping up practices for managing floods, planning and learning both from social and scientific basis are suggested to tailor with the local conditions. Building resilience among the vulnerable groups like the poor, pregnant women, children, the elderly and disabled is also recommended for integration into the policy.

However, recently, in 2014 International Centre for Integrated Mountain Development (ICIMOD) in Nepal prioritized strengthening resilience to climatic risks and hydrological hazards, especially high intensity rainfall; glacial lake outburst floods (GLOFs), regional floods, and flash floods, with a focus on research, knowledge, policy, education, and enhancing capacity, community resilience, and regional cooperation. In order to address the risks facing mountain communities there is need to support their desire to better understand the flood hazards that might lead to disasters, and look at ways to mitigate the adverse impacts of floods and promote regional cooperation. ICIMOD has initiated a long-term programme on flood risk reduction with the aim for rapid discrimination of information (ICIMOD, 2014). In Nepal, nine hydrometeorological stations have been installed in the Koshi basin and eight in the Kailash Sacred Landscape. ICIMOD has outlined a series of activities to be undertaken as part of “Disaster Risk Reduction and community resilience” including the

- Assessment of vulnerability of communities and building their resilience to multi-hazards.
- Assessment of the impact of climate change on ecosystems, natural hazards, and human health.
- Delivery of training in disaster risk reduction.
- Provision of a platform for sharing knowledge and experiences within disaster risk reduction.

8. Conclusion

Regardless of place and events, floods have a negative impact on humans, crops, agricultural inputs, livestock, poultry, fish, other assets such as land and infrastructure thus impacting socio-economic condition of a country. Most of the damages are irreplaceable leaving humanity in distress. Floods are recurrent and cannot be avoided hence a preparedness would lessen the impact. The governments of both Bangladesh and Nepal have been trying to reduce the damages but their policies are seldom effective, rather the intensity of floods is increasing. It was found that traditional knowledge and indigenous practices were not considered important part of policies for mitigation of floods. Therefore, along with governmental and non-governmental initiatives, traditional knowledge and indigenous practices should also be incorporated to reduce the socioeconomic impacts and vulnerabilities. More researches on traditional wisdom and practices are required for evolving a long-term flood management policy.

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