



Flood Disaster and Its Impact on Livelihood: A Case of Kandra River Basin of Kailali District

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Abstract

This paper tried to highlights impact of flood disaster on local livelihood in Kandra river basin, Kailali District. The study also examined coping strategies of the members of flood affected village community. In so doing, required data and information were collected and generated through household survey, semi-structured interviews as well as focus group discussions, key informant interview and observations. There are almost 50 settlements in the river basin; whereas 15 settlements are along with Kandra River. Three settlements: Kanhaiyapur, Thengarpuruwa and Lalbojhi; are most frequently affected from flood disaster that were selected for the study purpose. Thirty households from each settlement have been selected for household questionnaire. Satellite images and aerial photos are used to analyze terrain, channel course. The study finds that all communities living in the low-lying area and along the riverbank are affected from flood disaster. However, not all people are vulnerable equally. To cope with this problem, local people have designed and practicing various adaptation techniques. The adaptation strategy differs based on their socio-economic condition, such as education, income, occupations and living conditions. Establishment of early warning system and capacity building of flood victims will help to cope with disasters.

Key words: Floods, disaster, livelihood, coping mechanism and Kandra River.

Introduction

The Terai region of Nepal is considered as one of the severest flood hazard zone in the world. The flood occurs almost every year in one part of the country or the other causing loss of life and heavy damage to physical properties (MOHA, 2009). It effects on the lives of the victims and human settlements. It is estimated that 1.6 million deaths occur globally in a year due to the inability to address floods challenges (Green & Penning- Row sell, 1989). Nepal is one of the frequently disaster affected countries in the world. Nepal ranked 23rd in the world in terms of the total natural hazard related deaths in two decades from 1988 to 2007 with total casualties above 7000 (MOHA, 2009). The major causes of flooding in Terai region are high rainfall, soil erosion, flat topography, debris flows and sedimentation, river channel migration, anthropogenic causes like blockage of drainage system, deforestation, poor planning, design and construction practices of roads, and massive increase of settlements along East-West highway (Talchabhadel & Sharma, 2014). Despite significant achievements in science and

technology and success stories on environmental management in the 20th century, people continuing to suffer the consequences of climatic hazards worldwide. Floods have always been a primary issue of concern for human populations. Although devastating droughts are harmful primarily for agriculture and terrestrial ecosystems, they can also lead to local water supply shortages. In terms of relative vulnerability, Nepal has been ranked as the 11th most at-risk country in the world to earthquakes and 30th most at-risk to floods and landslides (UNDP, BCPR, 2004). This vulnerability to natural disasters results in preventable deaths and injuries and puts investment made in development at risk.

Besides other, water related disaster is prominent in Nepal. It has been suffering from different types of water-induced disasters: soil erosion, landslides, debris flow, flood, riverbank erosion etc. Rugged topography, weak geological formations, active seismic conditions, occasional glacier lake outburst, concentrated monsoon rains and unscientific land utilization are some of the major reasons for water-induced disaster (DWIDP, 2013). These phenomena induce severe impacts on infrastructures of the nation such as roads, hydro power, irrigation and drinking water facilities causing loss of agricultural lands, properties and human lives posing a severe threat to the sustainable development of the country (ibid). The number of people at risk has been growing each year and the majorities are in developing countries with high poverty levels making them more vulnerable to disasters (ISDR, 2002). Local people have always developed their own ways and means to deal with floods. The measures and techniques employed are local specific, require no external help or support and are inherently scientific. These techniques helps to shape their lifestyles strengthened their adaptive capabilities (Musah BAN, Akai CY (2014). The objectives of this study is to examine the physical and socioeconomic losses of flood, to identify the most vulnerable people in the study area, and also to understand the local people's coping and adoptive strategies before, during and after the flood. The findings can help the government and the other organizations to take proper steps for improving the livelihood of the people.

The Study Area

Nepal is highly affected from water-induced disaster. Besides all, flood is prominent disaster in Tarai region of Nepal. Kailali is also a highly flood affected district in Nepal. Among different VDC and Municipalities, Bhajani Trishakti Municipality is highly flooding affected area. There are 73 different types of ethnic group in Nepal. The study area, Bhajani Trishakti Municipality lies to the southeast part of the Kailali district. The total area of this municipality is 142.2 sq. km (Department of Survey) and total population is 38,149 (CBS, 2011). The Northern latitudinal extend of this municipality is 270 30' to 280.36' and the eastern longitude is 800 54' to 810 00'. The total length of Kandra River is 35 km within the municipality.

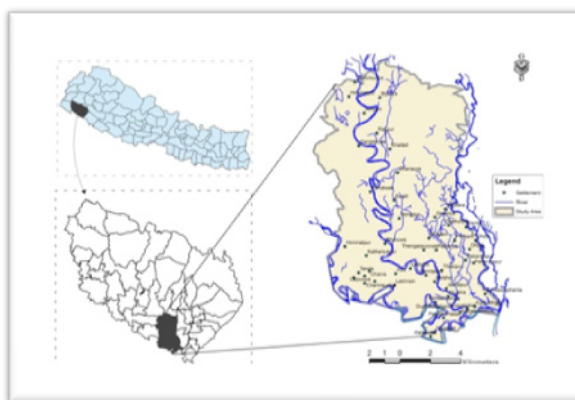


Figure 1. Location Map of the study Area

The study area lies within the subtropical monsoon climate where winter remains cool and summer is hot. Nearly 80 percent of rainfall occurs in the summer monsoon season between June to September and these months are the catastrophic months in terms of flooding. According to meteorological station, Aattariya Kailali about 15 percent rain occurs during the post monsoon (October) and pre-monsoon seasons (April to May) and the remaining 5 percent during the winter (November to February). The mean annual rainfall is 2400mm with about 90% falling in the monsoon from June to September. Monsoon rains cause dramatic floods and changes in the character and courses of rivers.

The Kandra River is the largest river running through municipality. It is the tributaries of the Mohana River. This is not a snow-fed river; it originates from the southern slopes of the Chure range. In the study area, this is the longest as well as the largest river and it is perennial in its type. The mean monthly wet season discharge (August) lies in the range between 90-500 m³/s and the mean monthly dry season discharge (April) ranges between 7-29 m³/s (Thapa, 2005). During the monsoon, the river transports large boulders and loose aggregates. As results, there has been an increase in the riverbed. In the Bhajani Trishakti Municipality, there are almost 50 settlements; Whereas 15 Settlements are along with Kandra River. Among them, based on secondary source, three settlements were found highly affected from the flood. Therefore, three settlements (Kanhaiyapur, Thengarpuruwa and Lalbojhi) were the targeted in this study.

Data and Methods

Basically, there are two ways of doing research: qualitative and quantitative methods in research (Crotty, 1998). Now a day mixed approach is being practicing in research (ibid). For this study, both qualitative and quantitative methods have been applied. The data is essential part of any research task. The study solely based on primary source of data, besides that secondary source of data also has been used to validate the primary data in some context. In other words, different secondary resources of information were obtained to triangulate the information gathered from primary source. Household survey, Focus Group Discussions (FGDs), Observation, and Key Informant Information (KII) were held to acquire primary data. Topographical map, Arial photographs, Google Map and satellite image are mainly used as secondary data. During two and half month field visit in the study area, basically, semi structured questionnaires were applied to collect primary data. Besides that, publications of different agencies such as Disaster Prevention Technical Central (DPTC), Central Bureau of Statistics (CBS), Department of Hydrology and Meteorology, Ministry of Home Affairs (MoHA), Nepal Red Cross Society (NRCS) and Department of Survey were also used wherever possible.

Ninety household were sampled from three settlements for detail data collection. Thirty household in each settlement had been selected for household questionnaire. Snowball sampling was applied to collect primary data from ninety household. From the local people, it was known that Khushi Ram Chaudary most affected old person in the settlement. So, the household survey was started from him. During his interview, he was asked to give the name of the person who is affected like him. Based on his suggestion, the second person for the sampling was taken and then to third and so on, finally all the 90 households were interviewed.

Remote sensing and geographic information system has been applied to delineate flood risk zone. Google image and topographic map were used to process image in Arc GIS environment to delineate flood risk map. During the field visit, community flood hazard maps were prepared during

focus groups discussion classified in to different hazard classes and were asked to participate to assign different ranking value accordingly. Final flood hazard map of study area was prepared combining these two weight maps. The ranking had been given based on the expert knowledge found in different literature. Frequently or yearly flooding areas were ranked as very high hazards; likewise never flooded areas were ranked as safe. From this, hazard map was prepared indicating very high, high, moderate, low and safe hazards areas. Finally, both map were compared and finalize the flood risk map. The collected data were processed using different computer software (Arc GIS, ILWIS, SPSS, Microsoft Excel, and RS tools) and processed data were tabulated and edited as to the purposes of the study. The result has been compared with others finding in some context to validate the result.

Results: Land Use and Land Cover Distributions

Land use and land cover has been defined in many ways. Land cover is the biophysical state of the earth surface. Land use involves both the manner in which the biophysical attributes of land are manipulated and the intent underlying that manipulation – the purpose for which the land is used. Land use and land cover is crucial in study of disaster. Basically, there are eleven types of land use category have found. These are Barren land, built up area, bush, cultivation land, forest, grassland, orchid, pond, river, sand, and swamp. Where more than fifty percent land has been covered by forest, and then cultivated land occupies more than forty percent of total areas.

River cutting, and channel shifting are common phenomena in the study area. Major bank cutting, river shifting, and inundation are found in the study area. The shift of river course, river bank cutting, siltation, and inundation etc. are creating problems to the people living near by the flood prone area, for an example, several authors proposed that the river has shifted its course for more than 133 km (83 mi) from east to west since last 200 years. But a review of 28 historical maps dating 1760 to 1960 revealed a slight eastward shift for a long duration, and that the shifting was random and oscillating in nature (Chakraborty, et. al. 2010) Change in river course, it has made direct livelihood disruption of the local people and to most fertile agricultural land and extensive damage to crops near by the flood prone areas.

The researcher with the assistance of the local people about physical barrier (man-made barbed with gabion structure stone masonry). In the field survey, there is only two small dams found with is made by stone otherwise, there all most river cutting part they made Bio-engineering because they have money problem. District Development committee also not supporting to make permanent dam. Near the Khailad settlement, we can see the drastic changes of river flow. In 2003 river morphology look like 'C' shape but in 2015 just change 'S' shape. According to Purna Prasad Joshi, (ward secretary of Khailad) most of the people used to change to river course by dong irrigation in agriculture land other area. According to Bimala Karki Treasurers of Red Cross, people make straight in rough or 'U' shape part of river. People used to join river by making small canal we can see in near the Dongupr settlement people joint small part than river make their way.

The great diversity of landscapes and climate in Nepal is reflected exceedingly complex and use options. The land surface itself is extremely dynamic by nature. Soil erosion is being a great figure challenge in the hill, which result sediment deposition in downstream. Sediment deposition in river bed and river meandering is also problem in Tarai region of Nepal. Besides that, the small amount of rainfall in hill can cause flood in Tarai region because river bed has uplifted due to sediment deposition

in river bed. Mass wasting, soil erosion and sediment transport by the rivers of Nepal from the hill has resulted in the riverbanks of the Tarai region rising from 15cm. to 30cm annually (Chhetri and Bhattarai, 2001).

Community Based Hazard Prone Area and Risk Assessment

According to the Oxford Advance Dictionary "Risk" is defined as the probability of meeting danger of suffering harm or loss. In relation to disaster, risk has been more specifically described as the probability that a disaster will occur, using relative terms such as high risk, average risk and low risk to indicate the degree of probability (Shailendra, et al., 1998). Risk assessment includes an evaluation of all the elements that are relevant to understanding of existing hazard and their effect on a specific environment. To turn risk assessment into a useful planning tool, accurate information must be gathered from numerous and diverse sources ranging from remote sensing of crop yields to the monitoring of volcanic activity, to the historical records of floods or earthquakes, and social surveys of livelihoods, living patterns and a community's perception of risk.

Table 1. Land at Risk in the Study Area

Land use	Very High		High		Moderate		Low and Safe	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Barren land	4.93	0.21	1.34	0.06	6.93	0.22	6.4	0.1
Built up area	0.00	0.00	0.37	0.02	2.26	0.07	0.5	0.0
Bush	58.52	2.49	50.27	2.42	37.31	1.17	135.5	2.1
Agriculture land	1019.47	43.34	1408.97	67.87	2317.67	72.75	1038.0	15.8
Forest	605.11	25.72	500.77	24.12	768.76	24.13	5237.9	79.6
Grass land	112.78	4.79	70.42	3.39	32.38	1.02	101.7	1.6
Orchard	0.00	0.00	1.02	0.05	1.45	0.05	0.3	0.0
Pond/Lake	5.24	0.22	0.47	0.02	1.96	0.06	59.6	0.1
River	227.10	9.65	2.20	0.11	1.91	0.06	0.0	0.0
Sand	312.50	13.28	20.87	1.01	14.39	0.45	0.0	0.0
Swapm	6.78	0.29	19.15	0.92	0.83	0.03	0.0	0.0
Total	2352.44	16.60	2075.85	14.60	3185.84	22.40	3643.0	46.4

(Community Based Hazard Map/FGDs).

During discussion, community members noted that in the study area, of the total land (14194 ha), about 16.60% falls under very high hazard zone where the share of land in high hazard zone is about 14.60%. The land falling under moderate hazard zone and low and safe zone constitutes 22.40% and 46.4 percent respectively. The result of my finding based on GIS/RS is same as the local people perception of the prone areas. When the settlement data was cross tabulated with hazard map it was found that 17% of total settlement falls in the very high hazards, followed by 25% settlement in high, 37% settlement in Moderate hazards and rest of the settlement are in the low or safe areas. According to figure, most of the settlements are vulnerable and few

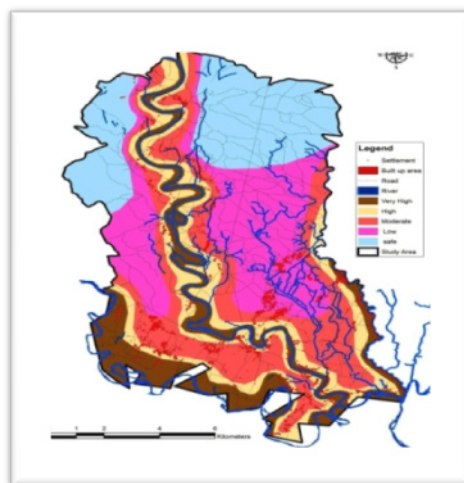


Figure 1. Flood Risk Map

settlements are not that affected as they reside in Tadi (high-elevated areas where the land is not that fertile and scarcity of irrigation). So, the people who live in Tadi mostly cultivate other crops than paddy, only very few household family who have access of well and generator cultivate paddy but that too only one season. During the field survey, most of the services centers (School, Road, and Temple) in the study area are fall in moderate hazard are

Flood Vulnerable Group

All communities living in the low-lying area and along the riverbank are affected from flood disaster. However, not all people are vulnerable equally. Based on the discussion with the people during the fieldwork, the following groups of people were identified as vulnerable. Low income source groups like landless, bonded labor are more vulnerable group and they are mostly living in the low-lying area both banks of riverside. Pregnant women, Children and elderly people are more vulnerable people of the study area. Uneducated people are also more vulnerable because they don't have knowledge about safety before, during and after a flood.

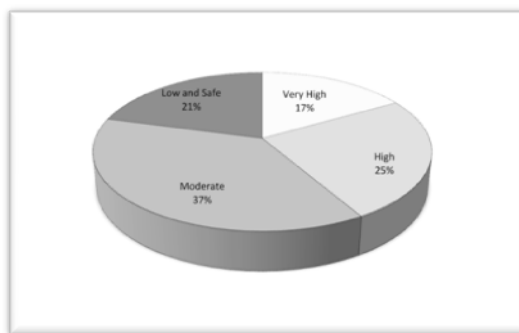


Figure 2. Settlements in Flood Hazard Zones

Frequency of Flood and its Effect

In 2008, a heavy rainfall in far western region affected the mountain districts with a series of landslides and the Tarai districts were affected by floods. All the rivers originating from the Churia hills overflowed with bank full discharges, eroded adjacent agricultural lands, deposited sands and silt on nearby houses, and inundated settlements for days.

Table 2. Historical Flood in the Study Area

Year of Flooding	Duration of Flood	Most Effected Settlements
1983	3 Days	Kaniyapur/Pachapuruwa
1983 (sep)	7 days	Kusumghat
1996	6-7 Days	Kaniyapur
1996 (july)	3 Days	Kusumghat
2005	3 Days	Pachapuruwa
2006	6-7 Days	Kaniyapur
2007	6-7 Days	Kaniyapur
2007	15 days	Kusumghat
2008	6-7 Days	Kaniyapur
2008	2 Days	Pachapuruwa
2008 (oct)	5 days	Thegarpur
2011 (Sep)		Thegarpur
2012 (Sep)		Pachapuruwa

(Participatory Disaster Risk Assessments of Kailali [PDRA], 2014).

According to table 2, the longest duration of flood occurred in 2007 and its high effect was on *Kusumghat* settlement. One-week longer flood came in four different years like 1983, 1996, 2006, 2007 and 2008 and most effected village was *Kaniyapur*. Less than five days duration flood came in 1983, 1996, 2005, and 2008 and it affect *Kaniyapur/Pachapuruwa*, *Kusumghat*, *Pachapuruwa*, and *Thegarpur* respectively. We can see present disaster impact in the study area in following table 3.

Table 3. Resent Flood Impact in the Study Area

Event	2070	2071	Total
Death	0	0	0
Injure	0	0	0
Damage House	4	2	6
Partially Damage House	9	206	215
Livestock loss	0	165	165
Affected family	525	49	574
Affected Population	3100	1386	4486
Displacement HH	175	11	186

(Focus Group Discussions, 2015).

According to Chetraj Upadhaya (President of Red Cross, VDC level), there is no any human death since 2050 B.S. but in between 2046 to 2049 there was three people died. Two peoples were student when they were crossing the river they fall down into the river and they died, and one is died by electric current during the flood.

In 2070 there were 4 houses destroyed, 9 houses were partially damage and 525 families were affected and 3100 people were affected from flood. Similarly, in 2071 there were 2 houses damaged, 206 houses were partially damaged, 165 livestock were died and 49 families or 1386 people were largely affected by flood hazards.

Emergency/Safety Instrument

In the flood zone area, safety instruments are the most important to keep in your houses.

In the study are, people are using different types of safety instrument like: life jackets, Boats, Hand mikes, ropes and Torch etc. we can see in below figure: number of instrument. In the study area, there are 251 life jackets; it is the largest number of Safety instrument. In the second largest instrument is Poli-mat; they have 130 and this trend

followed by Hassle, Helment and GAM Boot with 130, 113 and 90 respectively. There are 70 torches. 48 Carrier bags, 44 Primary treatment box, 42 Hand mike, 20 trough bag, 12 Metal box, 7 siren and

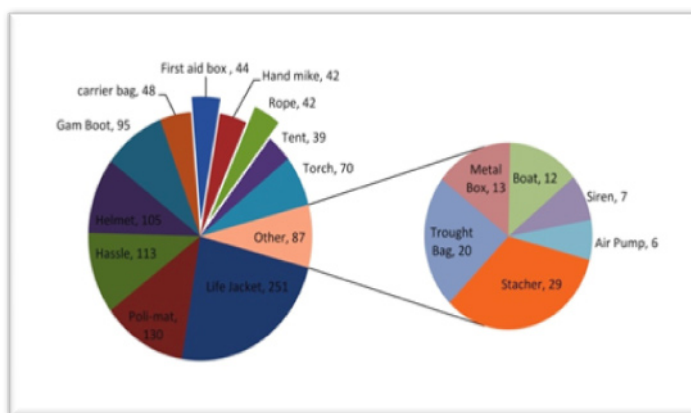


Figure 3. Emergency Instruments, KII (2015).

staches, 6 Air pump, and only 7 siren. Most of the respondent responded those instruments are most useful. They are feeling it is necessary for them.

Early Warning System and its Effectiveness

In the study area, there are different types of tools and equipment use for early warning system like as Telephone, Police/Army, Siren, Hand mike, Mobile etc. most of the respondent feel the need of installation of early warning system to be safe from the sudden happening of flood event. Among them which were more effective among the respondent see table 4.

Table 4. Early Warning System and its Effectiveness

Means	Number of the Respondents	Percentage
Telephone	8	9
Wireless radio-Police/Army	4	4
Siren	25	28
Hand mike	40	44
Mobile/SMS	10	11
Radio/FM	0	0
Television	0	0
other	3	3
Total	90	100

(Household Survey, 2015).

According to table 4, Hand mike is the most popular among the people. About 44 Percent of the respondents choose the hand mike as an effective means of early warning System. Similarly, siren is the second effective means of early warning system; 28 percent of respondents choose it. Likewise; 11 percent of respondent vote for Mobile/SMS as an effective early warning system and its rank is third. The fewer respondent said that telephone (9%) and police/army (4%) the means of early warning system.

Availability of Safe Places During Flood

In the study area, people are very careful with three months: the monsoon period. They put their food, clothes and other important material at *THATI*. There are two safe communities building in Kuti and Lalboji Settlements when the flood come most of the people go there. During my breakfast and lunch of field survey I used to ask some question informally to shopkeeper. Many shopkeepers said that when the monsoons start they close their shop for three month and after finishing monsoon they will start again. Similarly, I had asked to the respondent “where did you go during flood?” their answer is given table 5.

Table 5. Availability of Safe Places During Flood

Area	No. of respondent	Percentage
School	28	31.1
Forest	12	13.3
Safe house	10	11.1
Road	9	10.0
Upper floor/aati	5	5.6
Government building	22	24.4
Other	4	4.4
Total	90	100

(Household Survey, 2015).

According to table 8, 28 respondents respond that they used to school during a flood. In the study, most of the school in moderate zone and it is easy to go school. 22 respondents used to go government building (Health post, VDC building, post office etc). Most of the forest lands are higher place so 13% of the respondent used to go forest. Similarly, safe house (11%), Road (10%) and upper floor (5%) used to go as a safe place during flood.

Coping Capacity and Adaptation Strategies

People have lived with floods for years and thus have devised their own way to cope (short term strategy) or adapt (long term strategy) with them. Various flood management strategies taken by the local communities. The term coping capacity adds to the conceptualization of vulnerability from the perspective of those who are exposed to hazardous regions, and their ability to cope with a range of negative impacts. More specifically, coping capacity is defined in the disaster community as the means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster (UNISDR, 2009). "In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards (Bogardi et al., 2005, p. 6). A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID, 2000). Coping strategies are short term in nature. In order to reduce the effects of flood, people living in the flood prone area have demonstrated certain coping mechanisms as mentioned below:

- Preferring cheaper food at times of food shortage.
- Borrowing food on a barter system or buying on credit.
- Spending savings on food, clothes and treatments.
- Reducing the frequency and amount of food consumption by youth family members.
- Selling household assets like livestock, utensils, land and gold at the time of extreme need.
- Migrating to the nearby cities during monsoon by handing over the assets to close relatives.
- Changing food composition and practices, (in general, people take green vegetables, *daal* (lentil soup) with rice or *roti*).
- Preparing seed beds of paddy not at once but at installments with certain interval of time
- Adaptation strategies are for longer term and are more sustainable to manage the effect of flood. Examples include:
 - Cultivating water melon and *sakarkhanda* (*sweet potato*), peanuts, etc. in the area where the land is covered with sand as means of securing alternative livelihood.
 - Increasing the height of goat shed, as goats are considered highly vulnerable to be swept by flood.
 - Raising homesteads above the flood level of last ten years.
 - Shifting from mud made *deheri* to wooden *bhakari* for grain storage.
 - Constructing channel in the villages to divert flood water.
 - Raising height of newly installed hand pumps.

Conclusions

Based on the result and discussion the research concludes that the selected settlements are being affected from flood disaster almost every year. Based on community hazard map and flood risk mapping from GIS, we came to conclude that, mostly those households that located near to river are frequently affected from flood. The reason of selecting the risk zone for habitat is different. Division of landholding, after family separation and change of accommodation also found another reason that many household are still in risk zone. Besides, ex-bonded laborers, who are poorly settled in this area, have been frequently affected from flood disaster. Agricultural land has largely been affected from flood which is main source of local livelihood, whereas local people are diversifying their income source. Due to their economic condition they do not have other option to adhere. They are practicing different coping and adaptive mechanism, through which, local people believes, getting less suffered these years than before. They have built good coping mechanisms. Through which they can save lives and properties. Besides that, many local organizations have been working on improvement of local livelihoods as well as disaster management sector. Local NGOs support and youth club's active participation helped during disaster management.

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