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Flood Disaster in India: An Analysis of trend and Preparedness

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Abstract

Flood has been considered as one of the most recurring and frequent disaster in the world. Due to recurrent prevalence, the economic loss and life damage caused by the flood has put more burdens on economy than any other natural disaster. India also has continuously suffered by many flood events which claimed huge loss of life and economy. It has been found that the incidences of the flood are increasing very rapidly. Causes can be climate change, cloud bursting, tsunami or poor river management, silting etc. but devastation is increasing both in terms of lives and economies. Disaster management in India has very organised and structures programmes and policies but administration and implementation of these programs demand more efficiency. In last decade, flood damages more lives and economy than any other disasters. This paper is an analysis of the trend and preparedness of flood in India. Data from CRED has been used to analyse the trend of flood and other disasters in last ten years and damaged caused by these events.

Keywords: Disaster, Flood, India, Preparedness

Introduction

Flood is most prevalent and costliest natural disaster in the world which devastates both life and economy at a large extent. It is defined as, "High-water stages in which water over flows its natural or artificial banks onto normally dry land, such as a river inundating its floodplain." This usually local and short term event comes with little or no alarming. When the hazards, imposed by flood, exceed the coping capabilities of the affected population it become disaster. Centre for Research on the Epidemiology of Disasters (CRED), a research unit of the Université catholique de Louvain (UCL) situated at the School of Public Health of the Brussels campus of the university, Belgium, defines a disaster as "a situation or event [which] overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering."

Box : 1

For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:

1. Ten or more people reported killed
2. 100 people or more reported affected
3. Declaration of a state of emergency
4. Call for international assistance.

The number of people killed includes people confirmed as dead and people missing and presumed dead. People affected are those requiring immediate assistance during a period of emergency (i.e., requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance). People reported injured or homeless are aggregated with those reported affected to produce a „total number of people affected“.

The economic impact of a disaster usually consists of direct consequences on the local economy (e.g., damage to infrastructure, crops, housing) and indirect consequences (e.g., loss of revenues, unemployment, market destabilization). In EM-DAT, the registered figure corresponds to the damage value at the moment of the event and usually only to the direct damage, expressed in US dollars (2012 prices).

It analysed the occurrence of disasters in different nations and published data based on the analysis. Following box provides the basic conditions, suggested by CRED, to be called disaster. Due to recurrent prevalence, the economic loss and life damage caused by the flood has put more burden on economy than any other natural disaster. The damage caused by flood lasts several years from its advent. In the absence of an effective method to measure post impact of the flood, the assessment of loss and damaged is often not actual and far less than the actual cost. The compensations and aids provided by the government and non-government organisations do not meet the cost of damages which brings higher economic burden to the people affected by these floods. This destruction in growth is not restricted to the local level only but also brings loss in national economy. It is very difficult to control the flood; one can only reduce the vulnerability by adopting certain pre- and post- disaster measurements. As Phillip William, President of International Rivers Network has said, "you can never control the flood, you can

simply try to reduce the risk”. The impact of the flood on human lives goes beyond the immediate effect. In the report of working group on Management of flood accepted that, “The devastating floods not only result in loss of precious human lives, cattle and damage to public and private property but create a sense of insecurity and fear in the minds of people living in the flood plains. The after effects of flood like the agony of survivors, spread of epidemic, non-availability of essential commodities and medicines, loss of the dwellings make floods most feared among the natural disasters being faced by human kind” (Nandy, 2005)

Flood, an excess of water, can be caused by heavy rain fall followed by inadequate capacity of rivers to hold the water within their banks (NIDM, 2015). India receives major rainfall in only four months i.e. June to September. Distribution of rain in India is not similar at every place, some areas receive higher rainfall and some receives lower. The variation also varies time to time, the areas which are not traditionally prone to floods also experience severe inundation due to downpour and cloud-bursting. Urban flood has become one of the major problem now a days, the recent floods in Delhi, Mumbai, Kolkata and other metropolises around the country definitely points towards the poor management of drainage system. NIDM has enlisted following causes for floods India:

The primary causes for Floods are:

Intense rainfall when the river is flowing full.

Excessive rainfall in river catchments or concentration of runoff from the tributaries and river carrying flows in excess of their capacities.

Cyclone and very intense rainfall when the EL Nino effect is on a decline.

Synchronization of flood peaks in the main rivers or their tributaries.

Landslides leading to obstruction of flow and change in the river course.

Poor natural drainage system.

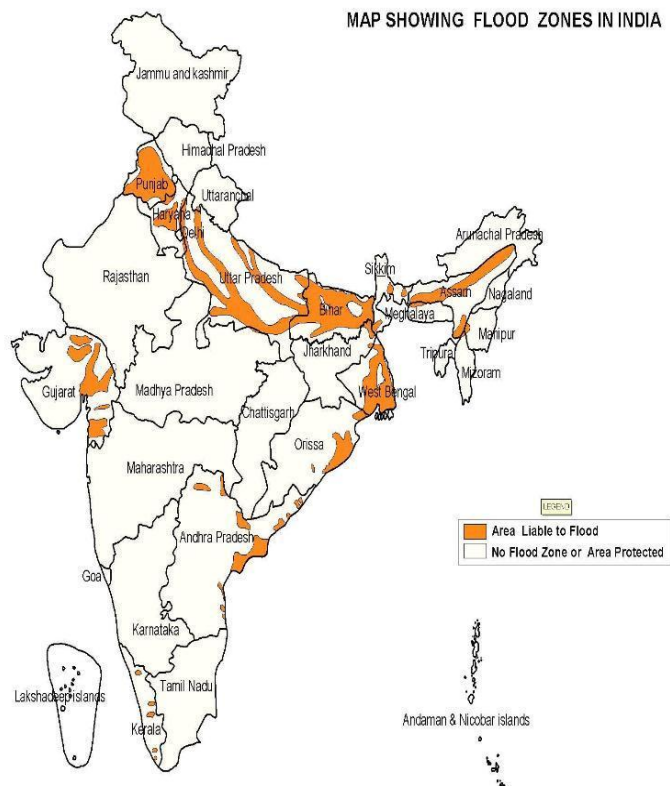
Backing water in tributaries at their confluence with the main river.

Along with these primary factors there are various factor which intensify the occurrence and impact of flood on the affected people. Parker et al, 2007 found that floods (in all their forms) were growing more frequent and in some cases reaching unprecedented size and impact, such as the Thai floods of 2011 (Komori et al., 2012).

Parker et al, 2007 suggested that, the number of flood disasters is growing, which is driven by:

- Changes to catchments (such as deforestation or urbanisation) that lead to increased run-off
- Population growth in areas at risk of flooding
- Climate change, which increases the variability and severity of weather, such as record-breaking rainfall and possibly more severe tropical cyclones.

Flood Prone Areas in India: Indian subcontinent has specific geographical structure which makes various part of the nation prone to the flood. The snow-clad Himalaya in the North encompasses one of the largest glaciers of the world which are source of various perennial rivers. These rivers constitute a large plain which is habituated by millions of the Indians. These gigantic plains are very prone to the flood brings by the rivers which swell due to heavy rainfall in Monsoon. According to NIDM, the average rainfall in India is 1150 mm with significant variation across the country. The annual rainfall



along the western coast and Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2500 mm. Most of the river floods occur during the monsoon period and are usually associated with tropical storms or depressions, active monsoon conditions and break monsoon situations. Besides the river flood, heavy rainfall, cloud bursting, out-burst of glacial lakes and tsunami is other causes of the flood. If we look at the Vulnerability atlas of flood zone in India, issued by Central Water Commission we finds that the flood prone areas in India are mainly the Indo-Ganga-Brahmaputra plain and the coastal areas in the Eastern and Western coastal regions. River flood is result of gathering of water from various tributaries of the river which brings huge silts and sands with them and deposits it on the bed of the river. The deposited silts reduce the pace of the flow of river and it starts expanding horizontally and submerging the nearby habitats. In most flood prone states, land depression, low-pressure areas are the two most important synoptic systems responsible for floods. NIDM mentioned in its document that in Bihar 100% and in U.P. 82% flood is caused due to land depression and well-marked low pressure. In W. Bengal main reason for flood is cyclonic circulation. Whereas in Punjab, Gujarat, Rajasthan & Jammu & Kashmir the main reason of frequent flooding is low pressure areas. Flood in Orissa and Andhra Pradesh is due to monsoon depression. Now days metropolitan cities are facing repeating episodes of the flood. This flood is caused by mismanaged drainage and sewer system which get choked due to careless dumping of the wastes in the drains and poor maintenance by the responsible agencies. The coastal flood is mainly because of the cyclones and tsunami.

Rashtriya Barh Aayog (1980), mentioned that India's 12 % land comes under the flooded areas which were comprised nearly 40 million hectare of land. This has exceeded upto 49.815 mha as per the database maintained by CWC based on the flood damage data reported by States for the period from 1953-2010 (**Report of Working Group on Flood Management and Region Specific Issues for XII Plan (2011)**). Annual average area and population affected due to flood: 7.2 M ha and 3.19 million respectively.

Occurrence of Flood in India

India has faced 649 disasters from 1915 to 2015. Out of these 649 events 302 disaster were caused by flood with on an average of 3 flood per year. This accounted approximately 47% of total disasters took place in India in the last 100 years. These floods can be further divided into Riverine Flood, Flash flood, coastal flood and other type of flood. The summary of the affected people, death and economic damage to the India is given in the following table.

Table 1: Flood and related damaged in India during 1915-2015

Subtype of Flood Disaster	Events count	Total deaths	Total affected	Total damage ('000 US\$)
Others	132	33611	462703212	11898059
Riverine flood	143	29810	333442962	41404929
Flash flood	23	7436	23443526	416200
Coastal flood	4	569	11500000	275000
	302	71426	831089700	53994188

Decadal change of flood in India distinguishes an alarming picture. If we look at the flood trend based on CRED data we find that in the last five decades India has witness continuous rise in flood disasters. The occurrence of flood disasters reached approximately 100 in the last decade. (It should be noted that the number mentioned here is talked about those incidences which turns as disaster as per the CRED conditions). The lives claimed by these floods have gone from an average of 1000 per year in the 1965-75 decade to 1700 per year in 2005-15 decade. The cumulative economic loss in the last decade i.e. 2005-2015 was nearly 2% of current GDP of India. Compare to previous decadal loss last decade shows a steep rise on economic burden caused by flood. The decadal economic burden burgeoned from USD 11.6 billion in 1995-2005 to USD 34.5 billion in 2005-2015. This because the most affected five floods took place in last five years only. Uttarakhand flood (2013), Leh-Laddakh flood (2010), Assam flood (2012), Jammu Kashmere flood (2014) and recently Manipur Flood (2015) are some example of the biggest floods in India. Following graph shows a decadal trend of flood in India.

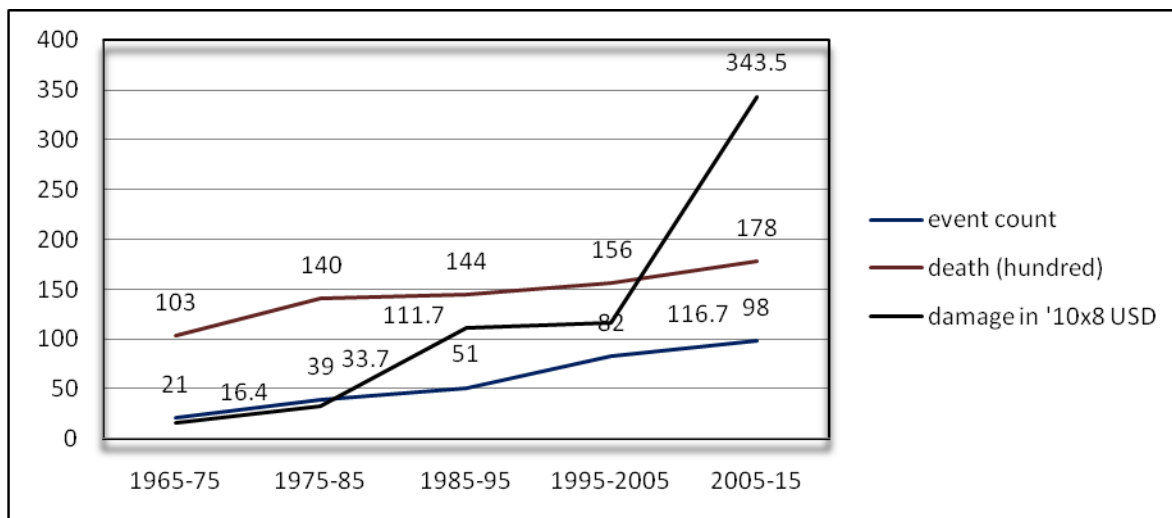


Fig: Decadal change of flood and its impact on the live and economy. (Data opted from CRED)

In the report of Working Group on Flood Management and Region Specific Issues for XII Plan, 2011, government of India also mentioned the total damaged done by the flood since 1953. The highlights of damage in India are shown in following table.

Table: Highlights of flood damages in India during the Period of (1953-2010)

S.No.	Item	Unit	Average Annual Damage
1	Area affected	mha.	7.21
2	Population affected	million	3.19
3	Human lives lost	Nos	1612.00
4	Cattle lost	Nos	89345.00
5	Cropped area affected	mha	3.70
6	Damage to the crops	Rs in crore	693.87
7	House damaged	nos (million)	1194637
8	Damage to houses	Rs in crore	275.48
9	Damage to public utilities	Rs in crore	814.60
10	Total damage	Rs in crore	1804.42

Source: Report of working group on Flood Management and Region specific Issues for XII plan (2011).

Situation getting worse:

The last ten (2004-14) years has brought more disasters caused by flood in India. The data provided in the above table does not represent the financial burden in the current value but the actual. If the value is estimated at the price level of 2010 then the estimated cost would be Rs. 812,500 million (WG report, 2011).

Table 1: Top 10 Disasters in last ten years (2005-14), sorted by no. of people killed

Disaster	Date	Damage (000 US\$)
Flood	12 -06-2013	6054
Earthquake (seismic activity)	08 -10-2005	1309
Flood	24 -07-2005	1200
Flood	03 -07-2007	1103
Flood	11 -06-2008	1063
Flood	Jul-09	992
Extreme temperature	Apr-13	557
Flood	25 -09-2009	355
Flood	28 -07-2006	350
Extreme temperature	Jun-05	329

Table 2: Top 10 Disasters in last ten years (2005-14), sorted by no. of people affected

Disaster	Date	Damage (000 US\$)
Flood	24-07-2005	20000055
Flood	03-07-2007	18700000
Storm	12-10-2013	13230000
Flood	12-07-2007	11100000
Flood	11-06-2008	7900000
Flood	22-09-2007	7200000
Flood	15-08-2011	5549080
Storm	25-05-2009	5100000
Flood	25-09-2009	4100000
Flood	28-07-2006	4000065

If we look at top ten disasters in the last ten years we find that Flood alone had killed nearly 84% of the total person killed by the top ten disasters. Seven out of ten events are of flood which claimed 11117 lives. Flood also affected more people than any other disaster. Data shows that eight out of top ten events affected highest number of people are of the flood and it affected more than 78 million Indians. In terms of economic damages in the last ten years, Eight out of ten disastrous events, are of the flood which damaged nearly 14 b \$ of Indian economy (The figures are given in the above tables). The damage is higher to the poor and marginal group of the society. It has found that in the developing nations, poor, female, children and elderly are disproportionately at the risk (Sommer and Mosley, 1972; Bern et al., 1993; Chowdhury et al., 1993; Jonkman and Kelman, 2005; Telford et al.,2006; Pradhan et al., 2007; Jonkman et al., 2009). The losses faced by the affected people are considered to be direct or indirect. Direct losses are difficult to quantify and it is even more difficult to evaluate indirect losses. Direct measures count the number of business and homes destroyed, for example. Indirect costs may include migration from the area as a result of the flood, tax losses as consumers shop outside the damaged area and the costs of outbreaks of waterborne diseases and health loss.

Structure of Indian Disaster management System:

In India the occurrence of flood and damage caused by it has increased over the time. To mitigate this disaster Indian “National Institute of Disaster Management” has opted various approaches time to time. India has not set up any separate institution for flood, but it comes under the Disaster management cell of Indian Government. Even in the colonial period an institutional framework was developed to mitigate disasters. After Independence, India followed the same system where managing disaster was rest with the Relief Commissioner at every state who functioned under the Central Relief Commissioner, with their role limited to delegation of relief material and money in the affected area which was termed as „Financial Reliefs” (Patwardhan & Ajit, 2007). The emergence of permanent and institutionalised set up for disaster management came into existence in 1990s when Disaster Management cell was set up in the Ministry of Agriculture. India was facing disasters continuously and financial reliefs were not a appropriate mitigation. India was eyeing on the a holistic approach which not only provide the post-disaster reliefs but also work on pre-disasters prevention and adaptation with the help of local to central stakeholders. Consequently, the disaster management division was shifted under the Ministry of Home Affairs in 2003 and a hierarchical structure for disaster management evolved in India. To analyse the various weather related hazards and for better monitoring different department and agencies viz. Indian Meteorological Department (For cyclone and weather related Hazards) and Central Water Commission (for flood) were created. Indian Parliament brought a Disaster Management Bill in 2004 which was implemented in August, 2005. Following flow chart shows the Disaster Management structure in India after the National Disaster Act, 2005.

After the implementation of the disaster Management Bill two agencies are co-existing and working together. National Disaster Management Authority (NDMA), Headed by Prime Minister, works at central, state and district level and it is responsible for "laying down the policies, plans and guidelines for disaster management" and to ensure "timely and effective response to disaster". In addition to this, the National Crisis Management Committee (NCMC), part of the earlier setup, also functions at the Centre. The nodal ministries, as identified for different disaster types function under the overall guidance of the Ministry of Home Affairs (nodal ministry for disaster management).

Preparedness and Mitigation:

Preparedness for disaster is critical to the affected household, community and government. This is cumulative endeavour to all sections of society. After a disaster a community goes through four phases that overlap: the emergency period, the restoration period, the replacement reconstruction period, and the commemorative betterment period (Haas, Kates and Bowden, 1977). Time taken by each phase is ten times longer than the previous one. The rate of recovery is directly related to the extent of damage, the available recovery resources, the prevailing pre-disaster trends, and community leadership and planning (Haas, Kates and Bowden, 1977). These phases can be used as general planning guidelines for community officials.

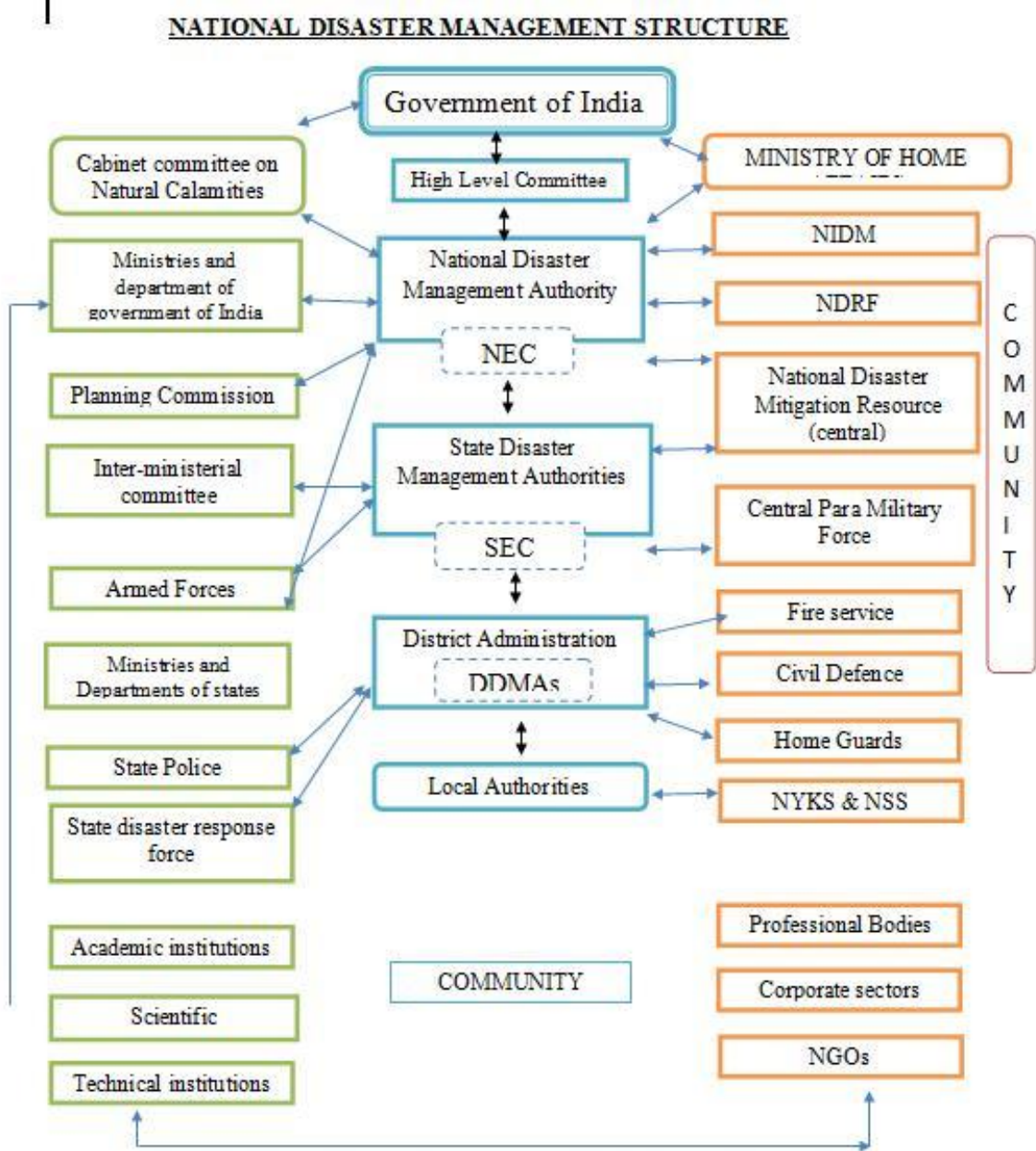


FIG: flowchart of National Disaster Management Structure for flood and water resources (opted from NIDM, India)

There is a need for individual responsibility, local coordination and governmental plans to ensure the ability to respond to and recover from major events. Preparedness consists of the pre- and post- events activities which enables coping abilities of the affected community to respond effectively and recover more quickly. Pre-disasters preparedness includes the development of warning systems, evacuation plans, disaster communications, and public education, which some sources (USACE; Waugh, 2000) view as mitigation because such practices must be implemented long before a hazardous events. Post disaster mitigation can be noted from a recent World Bank review of lessons learned which suggested that „the most immediate needs following a flood are for a safe water supply, food, shelter, and medical care“ (IEG, 2010: 3).

Government of India has opted both structural and non-structural measures to reduce the flood losses and protect the damage caused by flood. Structural measurement includes the artificial reservoir and dams, natural depression, by diversion of a part of the river to the area where water stagnation and water logging is not a problem, embankment of the river to restrict it to overflow the banks, channel improvements to increase the area of flow or velocity of flow or both, catchment area treatment through afforestation, construction of sea wall and other such works (WG report, 2011). Non-structural measurements includes flood plain zoning and restriction construction in the flood prone area to reduce the impact, flood forecasting and warning system, flood proofing etc. In the Twelfth Five Year Plan (2012-17) government of India passed ` 57575.00 crore in different programs and schemes for flood and its management.

Conclusion

Flood in India has become one of the biggest disaster which has killed thousands of the people in last few years. The recurrence and intensity has amplified over the time which damaged life and economy at a great extent. Government of India has taken up many measures to lessen the damage caused by flood and other disasters, but there is a long way to go. Use of science and technology, telecommunication and media for alarming and pre-disaster measures can be effective to reduce the devastations. To set up alarming system at the bank of rivers which can alert neighbouring dwellers about rising water level can also be an affective measure to minimise the damage. Along with it, awareness programmes and preparedness campaign at the flood affected areas can help in limiting losses. Rehabilitation of the neighbouring community to a safe and higher place before flood arrives can reduce the danger to life. Quick action in supply of goods and services like medicine, food and water supply helps in quick recovery and limited loss after the disaster. Analysis of flood trend and damage caused by it suggest that there is a need for effective pre-and post-disaster mechanism as the nature cannot be checked but disaster can be reduced.

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