

# “Effect of Flood on Lives and Livelihoods A Comparative Study India and Karnataka”

<sup>1</sup>Shivappa R. Handigund, <sup>2</sup>Dr.Chandrika K.B

<sup>1</sup>Assistant Professor, <sup>2</sup>Professor

<sup>1</sup>Department Sociology, <sup>2</sup>Department Sociology,

<sup>1</sup>Govt. First Grade College for Women Jamkhandi-587301, Karnataka, India, <sup>2</sup>Rani Channamma University Vidyasangama Belagavi-591156, Karnataka, India.

**Abstract:** The present study Effect of Flood on livelihoods Flood affected households in severely affected villages of Karnataka and other state. Study revealed that floods caused huge loss to the cultivated land, farm inputs, crop yields, and stored grains, and livestock compared to a normal situation in the study area. To overcome these huge losses to society and to the individual households, Governments need to promote futuristic studies on climate variability and their specific impacts, take precautions measures in preventing the damages. In the post event, it is necessary to modify the norms for compensation to provide greater social security to the affected people. State and District level natural disaster management units should be strengthened with skilled manpower, advanced knowledge and logistic facilities to forecast accurately and handle eventualities. Inadequate sub-national level information is a significant lacuna for planning spatially targeted climate change adaptation investments. A fixed-effect panel regression analyses of 19 states from 2001 to 2015 assess the impacts of exposure to floods and droughts on the growth of gross state domestic product (GSDP) and human development index (HDI) in India. The flood and drought exposure are estimated using satellite data. The 19 states comprise 95% of the population and contribute 93% to the national GDP. The results show that floods indeed expose a large area, but droughts have the most significant impacts at the sub-national level. The most affected GSDPs are in the non-agriculture sectors, positively by the floods and negatively by droughts. No significant influence on human development may be due to substantial investment on mitigation of flood and drought impacts and their influence on better income, health, and education conditions. Because some Indian states still have a large geographical area, profiling disasters impacts at even smaller sub-national units such as districts can lead to effective targeted mitigation and adaptation activities, reduce shocks, and accelerate income growth and human development. Climate change is a serious global environmental concern, which has led to increasing frequency of extreme weather events evident around the globe. Unusually heavy rain fall, which is due to climate change, is a significant cause of floods. Flood is the most destructive natural disaster which extensively damages livelihood.

**IndexTerms - floods; droughts; states; India, Floods, Livelihood, Livestock, livelihood; rural poor; climate change. Disaster, Flood, India, Preparedness.**

## I. INTRODUCTION

We know that water is necessary, both for sustainable human development and for the healthy functioning of the planet's ecosystem. Availability of freshwater globally however, is limited. Out of the 2.7 per cent of a total amount of 1 400 million km<sup>3</sup> of freshwater, the major portion occurs in the form of permanent snow cover or deep aquifers and only a small fraction is available for use.

Although India has to support 16 per cent of the world's population and 15 per cent of livestock, we have only 2.4 per cent of the land and 4 per cent of the water resources of the world. Out of about 4 000 km<sup>3</sup> of precipitation in a year, as much as 3 000 km<sup>3</sup> comes as rainfall in a short monsoon period of three to four months from June to September. The distribution of the water thus available is not uniform and is highly uneven in both space and time. The average annual water resource potential of the country is estimated to be 1 869 km<sup>3</sup>. Due to hydrological, topographical and geological limitations, however, only 690 km<sup>3</sup> of surface water can be utilized by conventional storage and diversion structures. The annual recharge of groundwater is 433 km<sup>3</sup>. 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 programmers 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.

Climate change is expected to have severe consequences for the world, some of which are already being felt. According to projections, in some regions, droughts will be more frequent and intense in the 21st century. This calls for purposeful interventions by governments to mitigate the impacts. Drought-affected communities are more vulnerable to famine. The effects of drought are felt in people's education levels,

nutrition, health, sanitation, and women and the safety of children in these communities. The impact of drought can be seen in the livelihoods of people affected by it. Against this backdrop, there is the need to document the effects of drought on women and children's health in the affected communities.

Such a study calls for a systematic approach. This study explores the various dimensions of the effects of droughts. It accessed electronic databases, including Google Scholar, Scopus, Pub-Med, JSTOR to identify a substantial number of studies using key words and expressions. To begin with, the word drought was kept constant in all combinations of keywords and phrases. The search was then refined by using the word drought with keywords, such as livelihood, vulnerability, sustainable development, adaption and mitigation, migration, health impact, and risk management to search the required articles.

Only studies conducted in the period 2000 – 2019 were considered for this review. The review's findings show that due to a lack of water during a drought, the burden of work on women and children increased considerably. Most faced severe health issues like malnutrition and anemia. The livelihoods of women were also affected because of which they were forced to adopt various strategies to overcome the problems posed by droughts. Droughts occur every year in different parts of India. Actions are required to mitigate the effects of drought, including the provision of drinking water, food, aid and relief aid to distressed farmers, employment support, support for changes in livelihoods, water security, and drought-proofing. State policies and actions must give particular attention to women and children because they are the most vulnerable. Employment-generation actions should also include youth by providing appropriate training for developing appropriate skills.

### 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.

<b>Table 1:Flood and Related damaged in india 1915-2015</b>				
<b>Subtype of Flood Disaster</b>	<b>Events Count</b>	<b>Total Deaths</b>	<b>Total affected</b>	<b>Total Damage</b>
Others	132	33611	462703212	11898059
Riverine flood	143	29812	333442962	41404929
Flash flood	23	7436	23443526	416200
Coastal Flood	4	569	11500000	275000
	<b>302</b>	<b>71426</b>	<b>831089700</b>	<b>53994188</b>

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.

Two major problems faced by the country are drought and floods, which are discussed in the succeeding paragraphs:

## II. Floods and drought

Today, droughts and floods are a common feature and their co-existence poses a potent threat, which cannot be eradicated but has to be managed. Transfer of the surplus monsoon water to areas of water deficit is a potential possibility. This would also help create additional irrigational potential, the generation of hydropower, as well as overcoming regional imbalances.

The recurrence of drought and famines during the second half of the 19th century necessitated the development of irrigation to give protection against the failure of crops and to reduce large-scale expenditure on famine relief.

## Floods in India

Floods are recurrent phenomena in India. Due to different climatic and rainfall patterns in different regions, it has been the experience that, while some parts are suffering devastating floods, another part is suffering drought at the same time. With the increase in population and development activity, there has been a tendency to occupy the floodplains, which has resulted in damage of a more serious nature over the years. Often, because of the varying rainfall distribution, areas which are not traditionally prone to floods also experience severe inundation. Thus, floods are the single most frequent disaster faced by the country.

Flooding is caused by the inadequate capacity within the banks of the rivers to contain the high flows brought down from the upper catchments due to heavy rainfall. Flooding is accentuated by erosion and silting of the river beds, resulting in a reduction of the carrying capacity of river channels; earthquakes and landslides leading to changes in river courses and obstructions to flow; synchronization of floods in the main and tributary rivers; retardation due to tidal effects; encroachment of floodplains; and haphazard and unplanned growth of urban areas. Some parts of the country, mainly coastal areas of Andhra Pradesh, Orissa, Tamil Nadu and West Bengal, experience cyclones, which are often accompanied by heavy rainfall leading to flooding.

### Area prone to flood

In 1980, Rashtriya Barh Ayog (National Commission on Floods) assessed the total area liable to flooding in the country as 40 million hectares (ha), which constitutes one-eighth of the country's total geographical area. The Working Group on Flood Control Programme set up by the Planning Commission for the Tenth Five Year Plan put this figure at 45.64 million ha. About 80 per cent of this area, i.e. 32 million ha, could be provided with a reasonable degree of protection.

### Damage from floods

More significant than the loss of life and damage to property is the sense of insecurity and fear in the minds of people living in the floodplains. The after-effects of flood, such as the suffering of survivors, spread of disease, non-availability of essential commodities and medicines and loss of dwellings, make floods the most feared of the natural disasters faced by humankind.

### Flood damage

	Maximum	Average
<b>Area Affected</b>	17.5 Million ha(1978)	7.63 million ha
<b>Crop area affected</b>	10.15 million ha(1988)	3.56 million ha
<b>Population affected</b>	70.45 million(1978)	32.92 Million
<b>Houses damaged</b>	3 507 542(1978)	1 234 616
<b>Heads of cattle lost</b>	618 248(1979)	91 242
<b>Human lives lost</b>	1 1316(1677)	1 560
<b>Damage to public utilities</b>	US \$ 1 255 million(1998)	US \$ 126 million

<b>Total damage</b>	US \$ 1 255 million(1998)	US \$ 307 million
---------------------	---------------------------	-------------------

Heavy flood damage was inflicted during the monsoon of 1955, 1971, 1973, 1977, 1978, 1980, 1984, 1988, 1989, 1998, 2001 and 2004.

### III. LIVES AND LIVELIHOODS IN KARNATAKA

#### 1. Rebuilding lives and livelihoods in Karnataka's Kodagu

The district received unprecedented rain last year, followed by landslides in nearly 40 villages; nine months later, lives of the affected families continue to be in disarray

Meenakshi still shudders when she thinks of the fateful night in August 2018. "When I recall that night, fear grips me even now. Even the elder people say that they have never seen such rainfall in their lifetime; they say they have not even heard of such a thing," she says.

Meenakshi and her husband Sundar belong to Masthota near Kaloor village in Kodagu district, Karnataka. They lost their home and belongings in the landslides that hit the district last year.

Last year, Kodagu district, also known as Coorg, received unprecedented rain, followed by landslides in nearly 40 villages across six Gram Panchayats. This hilly district on the Western Ghats has picturesque coffee and spices

plantations.

In the 40 villages that bore the brunt of the landslides, many families' lands and houses have been wholly or partly destroyed.

Besides destroying forest lands, the landslides also destroyed roads, power and communication infrastructure in these villages. As per reports of Myrada Kaveri Pradeshika Samsthe (MYKAPS), a Mysore-based non-profit, there were 20 fatalities.

#### The damage done

Around 2,568 houses were fully, severely or partially destroyed; while 6,996 persons were housed in 51 relief centers. Many more still moved to the houses of friends, relatives or to rented accommodation. Further, 805 kilometer of highway roads and 1,792 km of village roads were damaged.

As entire hillsides came crashing down, many people, including Meenakshi and Sundar, fled their homes with only clothes on their backs. They made their way to relief centres set up by government and civil society organizations.

In certain villages, mandatory evacuation orders were ordered. Disaster management teams from the state and central governments, besides local volunteers, were involved in the evacuation and rescue operations. An overwhelming amount of relief materials that flooded these centres, including food, clothes, footwear and even books and uniforms for children. Staff of government departments and civil society organisations as well as individuals worked tirelessly to ensure the smooth conduct of these relief camps.

Those who were involved in the relief operations feel that the quality of rescue operations minimised the loss of human lives compared to the scale of the disaster.

However, nine months after the disaster, lives of the affected families continue to be in disarray. Coffee, pepper and cardamom are the mainstay of most agricultural families in this district.

After the disaster, many of these families lost means of their livelihood: several pieces of lands have been completely wiped out. For such families, a return to agriculture seems nearly impossible. There are others whose lands are filled with six-eight feet of debris and soil.

The trees, that provided shade needed for coffee plants, have been uprooted. Streams and water sources have been filled up with silt. In several spots the landslides wiped out natural springs too. Once the relief camps closed, people whose houses were destroyed or severely damaged, moved to rented houses in nearby towns or villages.

Some families moved in with relatives or friends. The children too have been moved to schools in the village or town to where the family has shifted. Many of these families continue to live away from their villages because their houses are not inhabitable or because the land on which these houses stand continues to be unstable.



*Figure 1: women who lost livelihoods during Flood*

## Telangana

In Telangana, media report at least 15 people are thought to have died in flood and rain-related incidents after heavy downpours from around 12 October, 2020.

Heavy rains and floods across the state have disrupted power supply in many places. The state government declared a holiday for all government offices and private institutions for 14 and 15 October and urged people to stay indoors.

Telangana's capital, Hyderabad, is among the worst affected areas, with raging flood waters sweeping through city streets, damaging buildings and dragging away vehicles. Nine people died when a wall collapsed due to heavy rain in Chandrayangutta District, according to disaster authorities. Over 1,000 people have been rescued or evacuated in the city by teams from State and National Disaster Response Forces along with military personnel.

**Waters from the overflowing Musi river inundated the Chaderghat bridge in Hyderabad city.**



*Debris left by the overflowing Musi river after it swamped the Chaderghat bridge in Hyderabad city*

## 2. New homes for the victims of Karnataka flood 2019

The Karnataka flood triggered by the torrential rain destroyed thousands of houses with heavy loss of lives, personal belongings, houses, livelihood, etc. Most Rev. (Dr.) Peter Machado, Archbishop of Archdiocese of Bengaluru called a meeting immediately and worked out a strategy to rebuild the lives of the flood-affected families in the districts of Belthangady, Shivamogga, Chikmagalur, Uttara Kannada, Belagavi and Ballari. He also formed a task force committee consisting of lay people, priests and requested them to approach the religious centres, educational institutions, individuals, philanthropists, hospitals, religious congregations, etc., and motivated the public to show their generosity towards flood-affected families.

The Archdiocese has mobilized funds to rebuild the houses in 6 Dioceses of Karnataka and 1 Diocese in Kerala. Based on the severity of the damage, Archdiocese of Bengaluru allotted the number of houses to Dioceses Chikmagalur, Belthangady, Shivamogga, Uttara Kannada, Belagavi and Ballari in Karnataka and Calicut Diocese in Kerala.

Archdiocese of Bengaluru approached Caritas India to execute the housing project based on the technical and humanitarian expertise. Caritas India reached out to all the 7 Dioceses and extended her handholding support to the Dioceses.

Most Rev. Francis Serrao, Bishop of Shivamogga handed over the responsibility to the Shivamogga Multipurpose Social Service Society (SMSSS) to identify the most deserving families and construct the new houses for them.

While choosing the right and most needy families, Shivamoga Multipurpose Social Service Society (SMSSS) has given the priority and selected the 7 non-Catholic families for this project. 1. Mrs Ranjitha V. R. From Suguru, Shimoga taluk living with her husband and 3 little children, 2. Mrs. Uma from Annanagara, Shimoga living with her 3 sons. Her husband has deserted her long back, 3. Mrs Annu, a widow living in J. P. Nagara, Shimoga along with her 2 sons and 4 daughters, 4. Mrs Vanajakshi, a widow from Kumsi in Shimoga taluk is living with her 2 sons, 5. Mrs Nagarathna from Halkuni in Shimoga taluk living with her husband and daughter. She lost her son two years back due to accidental drowning in a pond, 6. Mrs Bhavani, a widow

from Hasudi Farm in Shimoga taluk is living with her 1 son, 2 daughters and 2 grandchildren, 7. Mrs Ranjitha, a widow from Nagar, Hosanagar taluk, Shimoga district, living with her 3 little children. SMSSS, Shivamogga motivated these families to share their part and helped them to have a decent house. The donors, St Joseph's College Institutions, Congregation of the Sisters of St Charles Borromeo, Infant Jesus Shrine, St Germain's Academy, Cluny Social Service Trust, Kannur and Society of Jesus, Mary and Joseph, Nagavara visited the families and handed over the houses to them. The families who have received the houses thanked the donors, Caritas India, Diocese of Shivamogga and SMSSS, Shivamogga for bringing new life to them.

### 3. Livelihood restored for Andhra Pradesh Flood victims

The major portion of Andhra Pradesh state is surrounded by the river Godavari and Bay of Bengal Sea. The rains at the upper region will cause floods in the state frequently. East and West Godavari districts which are severely affected by the heavy downpour during July to September 2019 monsoon which triggered the floods, lead the destruction is such as death tolls, house destruction, and crop damage and loss of livelihood to the Weaker communities such as women, Socially backward, migrant rural labourers and fishing communities. Results show that most impact occurred near the coastal and in agency areas. Poverty and social ordering puts on the risk in the face of the heavy floods. As per sources a total of 38749 people was affected by the floods in river Godavari, and 17,632 were shifted to relief camps from the 45 villages of Eight mandals in East and West Godavari districts. The effected region of tribal and coastal area lies below the Polavaram dam which also said to be a cause for submerging of the villages.

In this situation, Apart from the state Govt support, the Caritas India supported through an "Early recovery for the flood and landslide to the affected communities" project through the Social Service Centre, Diocese of Eluru, AP with a budget of 20.00 lakhs for duration of 3 months: (starting from 10th November 2019 – 10th February 2020) to a total of 230 Beneficiaries from 6 villages of five mandals for off farm livelihood support (193 nos) and to the repairing of the houses (37 nos). As part of this, sewing machines were distributed to the 31 women in 4 four villages such as Alavaram, Amalapuram, Inavilli. This support has bought confidence among the communities for future sustainability.

### IV. National water policy

The National Water Policy adopted by the National Water Resources Council in April 2002 highlights the provisions for project planning, surface- and groundwater development, irrigation and flood control.

Irrigation plays a major role in increasing the production of food grains. The policy provides following directives for irrigation management:

1. Irrigation planning either in an individual project or in a basin as a whole should take into account the irrigability of land, cost-effective irrigation options possible from all available sources of water and appropriate irrigation techniques for optimizing water- use efficiency. Irrigation intensity should be such as to extend the benefits of irrigation to as large a number of farming families as possible, keeping in view the need to maximize production;
2. There should be close integration of water- and land-use policies.
3. Water allocation in an irrigation system should be done with due regard to social equity and justice. Disparities in the availability of water between head-reach and tail-end farms and between large and small farms should be obviated by adoption of a rotational water distribution system and supply of water on a volumetric basis subject to certain ceilings and rational pricing;
4. Concerted efforts should be made to ensure that the irrigation potential created is fully utilized. For this purpose, the command area development approach should be adopted in all irrigation projects.

The following provisions exist in National Water Policy 2002 as regards flood control and moderation:

1. There should be a master plan for flood control and management for each flood prone basin;
2. An adequate flood cushion should be provided in water-storage projects, wherever feasible, to facilitate better flood management. In highly flood- prone areas, flood control should be given overriding consideration in reservoir-regulation policy, even at the cost of sacrificing some irrigation or power benefits;
3. While physical flood-protection works like embankments and dykes will continue to be necessary, increased emphasis should be laid on non-structural measures such as flood forecasting and warning,

floodplain zoning and flood-proofing in order to minimize losses and reduce recurring expenditure on flood relief.

### ***Approach to flood management***

Approaches to dealing with floods may be any one or a combination of the following available options:

- Attempts to modify the flood
- Attempts to modify the susceptibility to flood damage
- Attempts to modify the loss burden
- Bearing the loss.

The main thrust of the flood protection programme undertaken in India so far has been an attempt to modify the flood in the form of physical (structural) measures to prevent the floodwaters from reaching potential damage centres and modify susceptibility to flood damage through early warning systems.

### **Structural measures**

The following structural measures are generally adopted for flood protection:

- Embankments, flood walls, sea walls
- Dams and reservoirs
- Natural detention basins
- Channel improvement
- Drainage improvement
- Diversion of flood waters.

Of these measures, embankments are the most commonly undertaken in order to provide quick protection with locally available material and labour. The major embankment projects taken up after independence are on the rivers Kosi and Gandak (Bihar), Brahmaputra (Assam), Godavari and Krishna (Andhra Pradesh), Mahanadi, Brahmani, Baitarni and Subarnarekha (Orissa) and Tapi (Gujarat). These embankments play an important role in providing reasonable protection to vulnerable areas. Realizing the great potential of the reservoirs in impounding floods and regulating the flows downstream for flood moderation, flood control has been sought to be achieved as one of the objectives in multipurpose dams. Reservoirs with a specifically allocated flood cushion have been constructed on the Damodar system in Jharkhand and the Hirakud and Rengali dam in Orissa. However, many other large storage dams, e.g. Bhakra dam, without any earmarked flood storage, have also helped in flood moderation.

During the post-independence period, multi-purpose projects such as the Damodar Valley Corporation (DVC) reservoirs, the Bhakra-Nangal project, Hirakud dam, Nagarjuna Sagar project etc., have been constructed to increase food production, energy generation, drinking-water supply, fisheries development, employment generation, flood moderation, etc. These large dams have played a significant role in reducing damage by way of flood moderation. One of the important flood moderation examples achieved by dams is that of Damodar Valley, where four reservoirs were constructed with flood management as one of the objectives. During the 2000 monsoon, DVC reservoirs saved the life and property of people from a possible disaster through flood moderation.

Up to 2005, 34 398 km of new embankments and 51 318 km of drainage channels were constructed. In addition, 2400 town protection works were completed and 4 721 villages were raised above flood levels. Barring occasional breaches in embankments, these works gave reasonable protection to an area of some 16.5 million ha.

### **Non-structural measures**

Non-structural measures include:

- Flood forecasting and warning
- Floodplain zoning
- Flood fighting
- Flood proofing
- Flood insurance.

## 1. Flood forecasting and warning network in India

Of all the non-structural measures for flood management which rely on the modification of susceptibility to flood damage, the one which is gaining increased/ sustained attention of planners and acceptance by the public is flood forecasting and warning, which enable forewarning as to when the river is going to use its floodplain, to what extent and for how long. As for the strategy of laying more emphasis on non-structural measures, a nationwide flood forecasting and warning system has been established by the Central Water Commission.

Flood forecasting and flood warning in India commenced in a small way in the year 1958 with the establishment of a unit in the Central Water Commission, New Delhi, for flood forecasting for the river Yamuna at Delhi. This has now grown to cover most of the flood-prone interstate river basins. The Central Water Commission is currently responsible for issuing flood forecasts at 173 stations, of which 145 are for river stage forecast and 28 for inflow forecast. On average, about 6 000 flood forecasts are issued every year with a maximum of 7 943 forecasts in 1998. The forecasts issued by the Central Water Commission have been consistent with about 96 per cent accuracy as per the present norms of the Central Water Commission. A forecast is considered to be reasonably accurate if the difference between forecast and corresponding observed level of the river lies within  $\pm 15$  cm. In the case of inflow forecasts, variations within  $\pm 20$  per cent are considered acceptable, as a result of which the flood-forecasting and warning services have rendered immense benefit to those in flood-prone areas.

## 2. Modernization of flood forecasting services

The Central Water Commission is making a constant endeavour to update and modernize forecasting services on a continuous basis to make flood forecasts more accurate, effective and timely. Initiatives being taken for modernizing flood forecasting services are:

- The establishment and modernization of the flood forecasting network, including inflow forecast through automated data collection and transmission; use of satellite-based communication systems through very small aperture terminals; and improvement of forecast formulation techniques using computer-based catchment models;
- Development of a decision-support system for flood forecasting and inundation forecast model for the Mahanadi basin and flash flood forecasting for Sutlej basin;
- Development of a real-time flood-forecasting system for the Brahmaputra and Barak basin, envisaging data collection through automatic sensors and transmission through satellite and forecast formulation using a computer-based mathematical model.

## 3. Disaster management in India

India has traditionally been vulnerable to natural disasters on account of its unique geoclimatic conditions. Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena. About 60 per cent of the landmass is prone to earthquakes of various intensities; over 45 million ha are prone to floods; about 8 per cent of the total area is prone to cyclones and 68 per cent of the area is susceptible to drought. In the decade 1990-2000, an average of about 4 344 people lost their lives and 30 million were affected by disasters every year. The loss in terms of private, community and public assets was astronomical.

Over the past couple of years, the Government of India has effected a paradigm shift in its approach to disaster management. The new approach derives from the conviction that development cannot be sustainable unless disaster mitigation is built into the development process. Another cornerstone of the approach is that mitigation has to be multi-disciplinary, spanning all sectors of development. The new policy also emanates from the belief that investments in mitigation are much more cost-effective than expenditure on relief and rehabilitation.

Disaster management occupies an important place in this country's policy framework, as it is the poor and the underprivileged who are worst affected by calamities/disasters.

The steps being taken by the Government emanate from the approach outlined above. This has been translated into a National Disaster Framework (roadmap) covering institutional mechanisms, a disaster prevention strategy, early warning systems, disaster mitigation, preparedness and response and human resource development. The expected inputs, areas of intervention and agencies to be involved at the national, state and district levels have been identified and listed. There is now, therefore, a common strategy underpinning the action being taken by all the participating organizations/stakeholders.

#### **4. Institutional and policy framework**

The institutional and policy mechanism for carrying out response, relief and rehabilitation has been well-established since independence. These mechanisms have proved to be robust and effective.

At the national level, the Ministry of Home Affairs is the nodal ministry for all matters concerning disaster management. The Central Relief Commissioner in the Ministry of Home Affairs is the nodal officer to coordinate relief operations for natural disasters. The Central Relief Commissioner receives information relating to forecasting/warning of a natural calamity from the India Meteorological Department or the Central Water Commission of the Ministry of Water Resources on a continuous basis.

#### **5. National Crisis Management Committee (NCMC)**

The Cabinet Secretary, who is the highest executive officer, heads the NCMC. Secretaries of all the ministries/departments concerned, as well as organizations, are members of the Committee. The NCMC gives direction to the Crisis Management Group as deemed necessary. The Secretary, Ministry of Home Affairs, is responsible for ensuring that all developments are brought promptly to the notice of the NCMC. The NCMC can give directions to any ministry/department/organization for specific action needed for meeting the crisis situation.

#### **6. Crisis Management Group (CMG)**

The Central Relief Commissioner in the Ministry of Home Affairs is the Chairman of the CMG, comprising senior officers (called nodal officers) from various concerned Ministries. The CMG's functions are to review every year contingency plans formulated by various ministries/departments/organizations in their respective sectors and measures required for dealing with a natural disaster, coordinate the activities of the central ministries and state governments in relation to disaster preparedness and relief and to obtain information from the nodal officers on measures relating to above. In the event of a natural disaster, the CMG meets frequently to review relief operations and extend all possible assistance required by the affected states to overcome the situation effectively. The Resident Commissioner of the affected state is also associated with such meetings.

#### **7. Control Room (Emergency Operations Centre)**

An Emergency Operations Centre (Control Room) exists in the nodal Ministry of Home Affairs, which functions round the clock, to assist the Central Relief Commissioner in the discharge of his duties. The activities of the Control Room include collection and transmission of information concerning natural calamity and relief, keeping close contact with governments of the affected states, interaction with other central ministries/departments/organizations in connection with relief, maintaining records containing all relevant information relating to action points and contact points in central ministries etc., and keeping up-to-date details of all concerned officers at the central and state levels.

#### **8. Contingency Action Plan**

A national Contingency Action Plan (CAP) for dealing with contingencies arising in the wake of natural disasters has been formulated by the Government of India and is periodically updated. It facilitates the launching of relief operations without delay. The CAP identifies the initiatives required to be taken by various central ministries/departments in the wake of natural calamities, sets down the procedure and determines the focal points in the administrative machinery.

## 9. State relief manuals

Each state government has relief manuals/codes which identify the role of each officer in the state for managing natural disasters. These are reviewed and updated periodically, based on the experience of managing the disasters and the needs of the state.

## 10. Funding mechanisms

The policy and funding mechanisms for providing relief assistance to those affected by natural calamities are clearly laid down. They are reviewed by the Finance Commission appointed by the Government of India every five years. The Finance Commission makes recommendations regarding the division of tax and non-tax revenues between the central and state governments and also regarding policy for provision of relief assistance and their share of expenditure thereon. A Calamity Relief Fund has been set up in each state as per the recommendations of the 11th Finance Commission. The size of the Calamity Relief Fund was fixed by the Finance Commission after taking into account the expenditure on relief and rehabilitation over the past 10 years.

## 11. Cyclone forecasting

Tropical cyclones are intense low-pressure systems which develop over warm sea. They are capable of causing immense damage due to strong winds, heavy rains and storm surges. The frequency of a tropical cyclone in the Bay of Bengal is four to five times more than in the Arabian Sea. About 35 per cent of initial disturbances in the northern Indian ocean reach tropical cyclone stage, of which 45 per cent become severe.

The India Meteorological Department is mandated to monitor and give warnings of tropical cyclones. The monitoring process has been revolutionized by the advent of remote-sensing techniques. A tropical cyclone intensity analysis and forecast scheme has been worked out, using satellite image interpretation techniques which facilitate storm surge forecasting. The meteorological satellite has made a tremendous impact on the analysis of cyclones.

## V. CONCLUSION

India is a developing country which needs to take a balanced view of development. India has a long history of irrigation development. It continued at a slow pace until partition. Since independence, the Government has given highest priority to irrigation to offset severe food deficit and consequent import of food grains. Countrywide programmes were taken up for surface- and groundwater resources development through large and medium river valley projects. National water policy has been a good step in evolving national consensus on the planning, development and management of water resources in a comprehensive way.

There is an imperative need for harnessing and utilizing riverwater for irrigation supplies, generation of power and flood control on a sustained basis through these development projects.

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 neighboring dwellers about rising water level can also be an affective measure to minimize the damage. Along with it, awareness programmers and preparedness campaign at the flood affected areas can help in limiting losses. Rehabilitation of the neighboring 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.

## REFERENCES

- [1] Aggarwal, R.N.: Environmental concerns and role of dams in development with special reference to Bhakra and Beas Project. Indian Water Resources Society.

- [2] Central Water Commission, Ministry of Water Resources, Government of India, 2001: Report of the Working Group on Flood Control Programme for the Tenth Five Year Plan, New Delhi, India.
- [3] Central Water Commission, 2006: Water and Related Statistics, New Delhi, India.
- [4] Central Water Commission, 2006: Annual Report, New Delhi, India.
- [5] Chaskar, D.S. and H.K. Varma, 2007: Risk management of water related disaster, Disaster Management Congress, November 2006 New Delhi, India.
- [6] Document of High Powered Committee on Disaster Management Ministry of Irrigation, Government of India, 1980: Report of the National Commission on Floods.
- [7] Ministry of Water Resources, Government of India, 2002: National Water Policy.
- [8] National Commission for Integrated Water Resources Development Report (1997).
- [9] National Disaster Management Division, Ministry of Home Affairs: Disaster management—The Development Perspective, Tenth Five Year Plan Document (2002-07).
- [10] National Disaster Division, Ministry of Home Affairs, Government of India, 2004—Disaster Management in India—A Status Report, 2004.
- [11] Rangachari, R., 2007: Rising to the challenges posed by floods and droughts in India. Dr Kanwar Sain Memorial lecture on World Water Day 2007.
- [12] Sinha, S.K. and R. Shrivastava, 2006: Role of large dams in flood moderation—case studies, Disaster Management Congress, November 2006, New Delhi, India.
- [13] Bern, C., Snizek, J., Mathbor, G. M., Siddiqi, M. S., Ronsmans, C., Chowdhury, A. M., ... & Noji, E. (1993). Risk factors for mortality in the Bangladesh cyclone of 1991. *Bulletin of the World Health Organization*, 71(1), 73.
- [14] Chowdhury, A. M. R., Bhuyia, A. U., Choudhury, A. Y., & Sen, R. (1993). The Bangladesh cyclone of 1991: why so many people died. *Disasters*, 17(4), 291-304.
- [15] EM-Dat (2015). The International Disaster Database at <http://emdat.be>. Accessed 31 May 2015.
- [16] Haas, J. Eugene; Robert W. Kates and Martyn J. Bowden. (1977). *Reconstruction Following Disaster*. Cambridge, MA: MIT Press.
- [17] IEG (2010) *Responding to floods in West Africa: lessons from evaluation*. Washington, DC: IEG-World Bank.
- [18] Jonkman, S. N., & Kelman, I. (2005). An analysis of the causes and circumstances of flood disaster deaths. *Disasters*, 29(1), 75-97.
- [19] Jonkman, S. N., Maaskant, B., Boyd, E., & Levitan, M. L. (2009). Loss of life caused by the flooding of New Orleans after Hurricane Katrina: analysis of the relationship between flood characteristics and mortality. *Risk Analysis*, 29(5), 676-698.
- [20] Komori, D., Nakamura, S., Kiguchi, M., Nishijima, A., Yamazaki, D., Suzuki, S., ... & Oki, T. (2012). Characteristics of the 2011 Chao Phraya River flood in central Thailand. *Hydrological Research Letters*, 6(0), 41-46.
- [21] Messner, F. (2007). *Evaluating flood damages: guidance and recommendations on principles and methods*. Helmholtz Umweltforschungszentrum (UFZ).
- [22] Nandy, S. (2005). *Floods in India—Disaster and Management*. Convenar Moksha, Member Centre for Built Environment. 97 *Interdisciplinary Journal of Contemporary Research*, Vol. 2, No. 4, August-September, 2015 ISSN : 2393-8358
- [23] Parker, D. J., Tunstall, S. M., & McCarthy, S. (2007). New insights into the benefits of flood warnings: Results from a household survey in England and Wales. *Environmental Hazards*, 7(3), 193-210.
- [24] Patwardhan, A., & Ajit, M. (2007). *Disaster prevention, preparedness and management and linkages with climate change adaptation*. Technology Information, Forecasting and Assessment Council, New Delhi.
- [25] Sommer, A., & Mosley, W. (1972). East Bengal cyclone of November, 1970: epidemiological approach to disaster assessment. *The Lancet*, 299(7759), 1030-1036.
- [26] Telford, J., Cosgrave, J., & Houghton, R. (2006). *Joint evaluation of the international response to the Indian Ocean tsunami*. Synthesis Report.
- [27] Waugh, W. L. (1999). *Living with hazards, dealing with disasters: An introduction to emergency management*. ME Sharpe.