Kerala Deluge 2018: Ecological, Economic and Psychosocial Impacts and Management

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Abstract: *The great deluge in Kerala occurred in August 2018 with death toll of 483 and 10 lakh people in rescue camps affected the entire state of Kerala in Indian subcontinent had devastating impact and was the most severe disaster of the century. Although floods are generally considered as natural disasters the deluge in Kerala had significant causative factors that it could be defined as both natural and manmade. This paper is an attempt to analyse quantitatively and qualitatively the economic, psychological and social impacts of the tragic event so as to identify the criterion and indicators of precautionary measures to be adapted for future mitigation. Methodologically narrative and phenomenological approaches were adopted screening the secondary data sources from online and offline materials. The article depicted the causative factors and physical hazards that took place leading to indicators of the very nature of the mishap that club both natural and nurturing features contributed to the deluge. The analysis focused on the ecological and economic aftermath of the deadly flood leaving heavy economic burden on the affected individuals, families, properties, business activities, agriculture, environment and service sectors of government and nongovernment as well. The Psychological impact defined innovative avenues of resilience in individual, familial and social realms. It weaved a social effect through the network of dedication, hard work and coordination in rescue and relief operations spread over in the entire state of Kerala. The involvement of the 3000 fishermen with their boats in rescue operations and the coordination of the military, paramilitary, police and other forces with disaster management operations of the government and the commitment of numerous NGOs created a new saga in the history of disaster management and mitigation. The article also highlighted the role of social work professionals in the entire rescue, relief and rehabilitation activities in disaster management.*

Key Words: G*reat Deluge, Causative Factors, Ecological and Economic Burden, Psychological Impact, Social Effect, Management Strategies*

Introduction

Kerala one of the south Indian states was affected by severe floods from 9 August 2018, due to unusually high rainfall during the monsoon season. It was the worst flood in Kerala in nearly a century. Over 483 people died, and 14 were missing. About a million people were evacuated, mainly from Chengannur, Pandanad, Edanad, Aranmula, Kozhencherry, Ayiroor, Ranni, Pandalam, Kuttanad, Malappuram, Aluva, Chalakudy, Thiruvalla, Eraviperoor, Vallamkulam, N. Paravur, Chendamangalam, Eloor and few places in Vypin Island and Palakkad. All 14 districts of the state were placed on red alert. According to the Kerala government, one-sixth of the total population of Kerala had been directly affected by the floods and related incidents. The Indian government had declared it a Level 3 Calamity, or "calamity of a severe nature". It is the worst flood in Kerala after the great flood of 1099 (Malayalam year) that took place in 1924.

Thirty-five out of the fifty-four dams within the state were opened, for the first time in history. All five overflow gates of the Idukki Dam were opened at the same time, and for the first time in 26 years 5 gates of the Malampuzha dam of Palakkad were opened. Heavy rains in Wayanad and Idukki have caused severe landslides and have left the hilly districts isolated. The situation was regularly monitored by the Prime Minister, and the National Crisis Management Committee coordinated the rescue and relief operations.

The Damage Data as per Government Records (www.donation.cmdrf.Kerala.gov.in/assets)

1. More than 370 lives lost (Later updated on 30-8-2018 as 483);
2. More than 1 million people displaced (A total of 10, 28,000 people have been sheltered in the flood-hit districts),
3. 3,274 Relief Camps opened,
4. Lost crops in 54000 hectares,
5. 537 landslides,
6. 221 bridges damaged,
7. Preliminary estimates count a loss of more than 3 billion USD (20,000 plus crores in INR),
8. 10000 km of roads damaged,
9. 300000 farmers affected.

Local and National Response

The Central Government of India had released EUR 10 million under the State Disaster Response Fund (SDRF), as well as immediate relief funding of EUR 12.6 million from the National Disaster Response Fund (NDRF) in order to respond to the emergency. (DG ECHO 13.08.2018, Government of India 14.08.2018).

The Indian Army (ten columns of the Army, a unit of Madras Regiment, the Navy, the Air Force and NDRF) had been mobilised for rescue and evacuation in all districts affected by flooding and landslides. The State Government had provided food and shelter assistance, and offering approximately EUR 5,000 to families of deceased victims, and over EUR 24,000 to families having lost their home and land. (DG ECHO 13.08.2018) The State Government was planning on providing additional teams if needed. (DD News 13.08.2018, Government of India 14.08.2018).

National NGO CASA was operating in some of the flood affected areas, and was supporting the civil society group CARD in assisting people affected by the floods. (Act Alliance 11.08.2018).

International Response

A Unified Response Strategy (URS) and coordination mechanism between various organisations had been put in place by SPHERE India. Needs assessments were being conducted in affected districts by various humanitarian organisations including Caritas India, Oxfam India, CARE, Save the Children, World Vision India, Habitat for Humanity. (SPHERE India 11.08.2018, SPHERE India 12.08.2018)

All the international organisations on the ground had already implemented wash, shelter, food, livelihoods, and health response. (SPHERE India 12.08.2018).

There were several natural and manmade causes contributed to the severe flood situation in Kerala. The government departments and media reported those causes which could be analysed to know the severity of the impact of the deluge.

Literature

The Causes of Deluge in Kerala

Kerala received heavy monsoon rainfall, which was about 75% more than the usual rainfall in Kerala, on the mid-evening of August 8, resulting in dams filling to capacity; in the first 24 hours of rainfall the State received 310 mm of rain. Almost all dams had been opened since the water level had risen close to overflow level due to heavy rainfall, flooding local low-lying areas. For the first time in the State's history, 35 of its 54 dams had been opened. The deluge has been considered an impact of the global warming. The Government of Kerala argued in the Supreme Court that the very sudden release of water from the Mullaperiyar Dam by the Tamil Nadu government was one of the reasons for the devastating flood in Kerala. The Tamil Nadu government rejected the argument, saying that Kerala suffered the deluge due to the discharge of excess water from 54 reservoirs across Kerala, spurred by heavy rains from within the state; It also argued that the flood surplus from the Idukki dam is mainly due to the flows generated from its own independent catchment due to unprecedented heavy rainfall, while the discharge from Mullaperiyar dam was significantly less. Though it is difficult to attribute any single event to climate change, it's possible role in causing the heavy rainfall event over Kerala cannot be ruled out.

Table 1. District wise Data of Increased Rainfall in Kerala

(1 June 2018 – 17 August 2018)

District	Rainfall (mm)	Normal (mm)	% increase
Alappuzha	1648.1	1309.5	29%
Ernakulam	2305.9	1606.0	48%
Idukki	3211.1	1749.1	94%
Kannur	2450.9	2234.9	10%
Kasaragod	2549.94	2489.1	12%
Kollam	1427.3	985.4	56%
Kottayam	2137.6	1452.6	50%

Kozhikode	2796.4	2156.5	30%
Malappuram	2529.8	1687.3	52%
Palakkad	2135.0	1254.2	75%
Pathanamthitta	1762.7	1287.5	44%
Thiruvananthapuram	920.8	643.0	45%
Thrissur	1894.5	1738.2	16%
Wayanad	2676.8	2167.2	26%
Kerala	2226.4	1620.0	41%

Natural Causes

The great depression due to low pressure in the atmosphere led to heavy rainfall in the State. The amount of rain water in a short span of time was massive that created huge amount of water leading to flood. There was 237.87 cm rain fall in Kerala from the month of June to August.

Table 2. Data of Rainfall during Major Floods in Two Centuries

Year	June	July	August	September	Total rainfall
1878	93.6cm	54.8cm	85.5cm	58.6cm	292.54cm
1924	101.5cm	125.3cm	58.4cm	26.4cm	311.53cm
1961	96.1cm	95.2cm	63.7cm	39.2cm	294.34cm
2018	75.2cm	85.8cm	76cm (till 20th)	——-	237.87cm

(Meteorological survey, Indian Institute of Tropical Meteorology, Malayala Manorama, P.7, 21-08-2018)

The phenomenon in the sea; the higher level of the sea and the ocean was 25 cm high during the flood days. The difference between high tide and low tide was less and it was only 5 cm during flood days. The amount of water flowing to sea got reduced as a result of such phenomenon. There was wave and wind set up phenomenon on the shore leading to pushing back the rain water to the shore that was flowing towards the sea. (Balakrishnan Nair, 2018).

Manmade Causes

1. **The Sudden Opening of the Shutters in Major Dams**: If the Dams were opened gradually well in advance the effect of the mishap could have been lighter compared to what actually happened.
2. **Poor Waste Management and Drainage System:** The drainages were filled with effluents and it prevented free flow of rain water leading to flood.
3. **Deforestation:** Due to massive deforestation the rain water that falls on Western Ghats rush to the low lane area within short span of time. Afforestration is the solution to prevent such mishaps.
4. **Unscientific Disposal of Plastic Waste**: The plastic carry bags and pet bottles prevented free flow of water and preventing water to be absorbed underground
5. **Major Dams**: Construction of major Dams carry large amount of water and when released create a flood. Minor dams will be a solution to prevent such disaster.
6. **Unscientific Construction and Mining:** The unscientific construction of buildings in Western Ghats, mining of rocks in the same geographical area leaving the terrain into major disasters.
7. **Filling of Estuaries and Marshy Lands:** Land filling for development activities causes disappearance of marshy lands which were functioning as sponges to absorb excess water. The Chennai flood in 2017 was similar incident due to lack of sufficient estuaries. **Paddy fields** which acted as **water reservoir** and the **low lying flood plains** of many rivers made their way out in the name of development like airports, bungalows, villas and Malls.

As Kerala struggles to recover from its worst floods in a century, ecologist Madhav Gadgil's report that had warned against damage to the environment would be back in focus. A committee headed by Gadgil submitted a 500-page report in 2011 recommending a slew of measures to protect the fragile ecosystem of the Western Ghats—a mountain range that runs parallel to the coast across six Indian states, including Kerala. Zones marked out as ecologically sensitive in Gadgil's report were among the regions worst hit by the floods that took over 400 lives in the southern state. Gadgil had no doubt that if his report had been implemented, there would have been "substantially less" loss of human life and damage to property. Unscientific management of water in reservoirs by the Kerala government was one of the key reasons for the scale of devastation by the heaviest rainfall in a century, Gadgil said in an interview with Bloomberg Quint.

This year, the reservoirs were almost full halfway through the monsoon. When the last rainfall came, they suddenly released the water. Illegal stone quarrying was another reason that led to greater devastation in Kerala. Gadgil said rampant quarrying led to more landslides and rubble deposits, blocking streams and rivers. Kerala has this huge criminal economic enterprise. It's flourishing in Kerala and that has led to landslides especially in Idukki. The Gadgil report was rejected in the past over concerns that its implementation would hurt local economies. It recommended that 90% of the Western Ghats should be a "no-go area".

Gadgil said the only threat of implementing measures to protect the environment will be to "extensive profits, often through criminal means". Citing examples of illegal mining in Goa and polluting industries in coastal Maharashtra, the ecologist warned that ignoring or subverting existing laws and recommendations will only put the environment at a greater risk and pave the way for more disasters like what was seen in Kerala.

"I do not agree that economy and ecology are at loggerheads. What is at loggerheads is this greed for extensive profits and often through criminal means" (Madhav Gadgil, Ecologist, *Bloomberg Quint).*

Were There Early Signs?

One of the most severely affected areas is Ernakulum in Kochi, along the Periyar River, into which excess water from the Idamalayar dam was drained. Dam-safety expert N Sasidharan claimed that authorities waited till the water

level in the Idamalayar reservoir reached its capacity of 169 feet, and had it been opened sooner, would likely have spared the massive evacuation efforts in the vicinity.

MC Joseph of Kuttikkatt village near Eloor said that the authorities made a mistake by opening all four gates of the dam at once, flooding the underlying regions at a much faster rate than expected. "This is the result of poor planning by the disaster management authority," Sasidharan added.

"Sitting at Geneva, I had on 14 June cautioned that the reservoirs will be filled by July. I had made the prediction based on the experience in Thailand and Pakistan," Murali Thummarukudy, Chief of Disaster Risk Reduction in the United Nations Environment Programme (UNEP) said to *Malayala Manorama,* a Kerala daily. "Unfortunately, our engineers did not foresee this," he added.

Time for Retrospection

Commenting on the impact of the rains and ensuing damage, advocate Susheela Bhatt, former Government Pleader said, "It is the time for us to reflect". "I fought for preserving mother nature when I was overseeing Munnar officially. But nobody took it seriously. After seeing this rain havoc, I think it's high time to be retrospective," she said. Following the heavy rains and landslides, Munnar is cut off from other areas. Just last month, the government had disbanded the Munnar Special Tribunal, set up in 2011 by the then chief minister VS Achuthanandan to settle the controversial land disputes and encroachments in Munnar. Socialist Unity Centre of India leader M Shajir Khan said that the havoc was caused only because we ignored the Gadgil and a watered-down Kasturirangan report. "We allowed encroachments. We allowed deforestation. We allowed excessive quarrying. We kneeled and crawled in front of the land grabbing mafia. And eventually, we are suffering now. They built resorts on ecologically fragile land. They mined tones of rocks from ecologically fragile lands. They built skyscrapers on wetlands. And now the entire state is sinking. We are paying the price for our ineffectiveness in stopping the greedy land grabbers," Shajir said. "People-inclusive nature protection is not happening here. The public must utilise their democratic rights," he added.

Amendments and Uncontrolled Quarrying

Meanwhile, Dr M Kamarudeen, a Biodiversity Management expert, said that this government has given a free run to quarry lobbies for construction on

wetlands. "Recently, the government had amended the Conservation of Paddy Land and Wetland Act, 2008, diluting its original intention. As per the new version, if anybody wants to build a house on a paddy land, then there are a lot of hiccups. But if it is a corporate project, then there are no issues," Kamarudeen said. "The amendment is encouraging large-scale land reclamation, causing environmental degradation and groundwater depletion. Though the bill states that paddy fields and wetlands will be reclaimed only for 'projects that benefit the public', it does not provide a clear definition of such a project," he said, adding that such amendments have worsened the situation in the state following the rains. "According to a study, Kerala has about 6,000 quarries. The use of explosives to blast rock in quarries causes rapid landscape changes leading to landsides. Quarrying and construction should not be allowed in landslide-prone areas. Not only should the Western Ghats, but also the estuarine mangroves be preserved to minimise natural calamities," the expert added.

These were the causative factors leading to great deluge in Kerala. This paper would be focusing on the socio-economic and psychosocial impact of the deluge. It also would highlight the rescue, relief, rehabilitation and reconstruction attempts made in massive scale with government and NGO collaborations creating a model in disaster management and mitigation.

Methodology

Methodologically narrative and phenomenological approaches were adopted screening the secondary data sources from online and offline materials. The article depicted the causative factors and physical hazards that took place leading to indicators of the very nature of the mishap that club both natural and nurturing features contributed to the deluge. The analysis focused on the ecological and economic aftermath of the deadly flood leaving heavy economic burden on the affected individuals, families, properties, business activities, agriculture, environment and service sectors of government and nongovernment as well.

Rescue, Relief, Rehabilitation and Reconstruction in Kerala Deluge

The official machinery worked, with Armed Forces units and the National Disaster Response Force working in tandem with, and as coordinated by, the local administration for rescue and relief operations. Helicopters and naval and coastguard boats rescued people stranded atop homes and other elevations.

But the biggest rescue work was done by Kerala's fisher folk, who arrived with their boats, strong bodies and generosity of spirit and spent tireless hours moving people to safety.

A million or so people made it to schools, churches, community halls and other large buildings that turned into functional relief camps. Ordinary people ran the camps. Volunteers turned up in droves food and other essentials materials. The information technology-savvy had set up networks to register calls for help and guide rescue workers, supplementing the official call centre and help lines. No great leader had to order such work to be organised. Relief came into being, organised spontaneously, some under the auspices of some agency or the other, the rest with the unbidden ease with which seeds below the parched soil start sprouting once the rains arrive.

Why was Kerala's proactive response to the floods so sharply different from the passive victimhood that mostly characterises the flood-affected in the rest of India? The answer lies not in the State's superior level of literacy, but in the political empowerment of the people over generations. People united beyond class, cast and creed and save lives of their brethren.

The Details of the Rescue and Relief Operations

Table 3. District wise Rescue Camps during Flood (Malayala Manorama Daily P. 9, 08-20-2018).

Districts	Number of Camps Operated	Number of People in Camps
Kasargod	01	168
Kannur	06	1227
Wayanad	202	28,861
Kozhikode	150	23,060
Malappuram	155	32,743
Palakkad	80	7647
Trichur	721	2,04,181
Ernakulam	733	2,61,634
Kottayam	411	98,175

Idukki	211	33,636
Alappuzha	601	2,77,706
Pathanamthitta	528	69,505
Kollam	89	16,811
Thiruvananthapuram	42	3,285
Total	**3,930**	**10,58,639**

Rescue Operations

Fishermen Community: With the request of the Department of Fisheries, State of Kerala and the Liberal Federation of Kerala Fishermen, 2, 927 fishermen rescued 65,000 people using 667 boats.

Table 4. The Number of Boats and Fishermen Operated in Rescue Mission.

Districts	Number of boats operated	Number of fishermen
Kannur	42	72
Kozhikode	25	145
Malappuram	25	392
Palakkad	6	25
Trichur	31	114
Ernakulam	127	343
Kottayam	15	18
Alappuzha	118	706
Kollam	165	752
Thiruvananthapuram	113	360
Total	**667**	**2,927**

(Source. Malayala Manorama Daily, p.6, 08-23-2018)

The Government Forces

Chief Minister's Office

The Chief Minister cancelled his medical treatment trip to USA and stayed back to give leadership for Disaster Management operations. Full time observation cell was started and the representatives of various central and state forces, different government departments cooperated with the cell to organise and coordinate rescue operations. Every day morning and evening high power committee meeting was held under the chairmanship of the chief minister to assess the ongoing rescue and relief operations.

Army - about 1500 personnel in 70 teams rescued 31,000 people.

Air Force - about 2000 personnel in 92 teams using 26 Helicopters (Mi17 V5 type) rescued 16,005 persons and involved in distribution of food, clothes and other essential materials. They rescued several people through airlifting. Later the number of helicopters increased to 96.

Navy: Prepared food for 5000 affected people.

Coast Guard: About 575 experts involved in rescue operations in 36 teams with 21 boats and 36 Jiminy boats.

State Police force: 40,000 policemen using 2476 vehicles rescued 53,000 people.

The Fire force: 4100 firemen rescued 34,527 persons and helped 85,000 people.

Table 5. The Materials and Food Provided by Central Government

Materials			Food items		
548	–	Machine boats	Milk	-	6,00,000 tons
6,900	–	Life jackets	Food packet	-	3,00,000
3000	–	Lifebuoy	Drinking water	-	14,00,000 liters
167	–	Tower light	Water purifiers	-	150 - capacity to purify 1,00,000 liters of water
2100	–	Rain coats			
1300	–	Gumboot			
153	–	Chainsaw			

(Source: Malayala Manorama Daily p. 13, 08-20-2018)

Ordinary People

Private Torus Trucks: 400 numbers. **Prisoners**: distributed food for Rs. 4,00,000/-

Social Media

Step 1 : Call for help through social media such as Whatsapp, facebook, twitter, missed calls etc from those caught in houses flooded and transit the information to rescue team in operation

Step 2 : Sorting the emergency request using hash tags

Step 3 : Online control room; available information fed to excel sheets

Step 4 : Call centres; online call centres of volunteers to confirm the request for help and to coordinate with disaster management team for rescue operations

Step 5 : Local centres provided locations needed help and rescue operations and handover to rescue team

Step 6 : Rescue Operations: The helicopters and boats as they receive request for help reached on spot and rescued people to safe camps.

The Role of the Media in General

Both print, visual and electronic media played an active role in providing adequate information to the public particularly the disaster affected people in rescuing their lives and to coordinate relief activities in camps in which more than 10,00,000 people took shelter. The impressive role of the media is well appreciated nationally and internationally with higher end of social responsibility for the welfare of the affected people.

The televisions, radio and newspapers informed the instructions of the authorities about the cautions to be taken in the process of resettlement. The houses which were flooded with muddy water had to be carefully cleaned as there would be threats of snake bites, electro locution, health hazards and so on.

National and International Resource Mobilization

The state governments in India, various foreign governments, NGOs like world vision, Caritas India, Catholic Diocesan Social Services, Mata

Amritanandamai Matt and volunteers from different institutes mobilized manpower, materials and money for relief operations of deluge affected Kerala. Interestingly the students of JNU, Delhi conducted a strike against the poor fund given by central government were taken into custody by the Delhi police and the students collected Rs 4,00,000/- from the police towards flood relief activities. Various companies and corporate donated money and materials from their CSR fund.

Ecological, Economic and Psycho Social Impacts

Ecological Impacts

During the rains, water drains off to the rivers and lakes, and they in turn flow to the sea. Almost all the rivers in Kerala are choked with sand deposits, which reduce the capacity of the rivers to hold more water. The net result is, with the slightest increase in water level, there would be flood. The same thing applies to lakes also. Protecting the river bed is an urgent need. The most affected area is Kuttanad which is the agricultural part of Kerala. The Kuttanad area is fully inundated and all the crops are destroyed. Kuttanad is situated below the sea level; naturally we have to plan very carefully. It is an ecologically sensitive area and the government has to stop construction of buildings in this agricultural area. This area is a trigger factor for all the floods in the nearby areas. It is high time we have a master plan for Kuttanad and implement it aggressively in a time bound manner.

Floods cause extraordinarily large number of fatalities due to high population density and regularly un-enforced development requirements which keep on increasing day by day. It causes massive amounts of damage to humans' lives, property and critical infrastructure which are lifeline to a state.

After a flood, situation gets grimmer leaving behind a lot of development works to do and rebuilding. It reversed the current development gains and degrading the quality of life, and severely affected the future growth of the state. Floods not only affected life of humans but animals too as it destroyed their habitat thus bringing close encounter with man and animal. Agricultural lands are destroyed, crops gets submerged in water. Huge economic loss to farmers is seen in Kerala floods.

By September, the floodwaters had receded, but relief programs continued. Officials estimated that the cost of rebuilding would go over $3.7 billion.

Millions of jobs were impacted, while the tourism and agriculture sectors were severely hit. Over 57,000 hectares of farmland were ruined. That is equivalent to over 100,000 football fields. Infrastructure and healthcare facilities were damaged as well. Many people remained homeless and fears of contracting water-borne diseases increased. According to the NGO, People for Animals, at least 40,000 animals such as dogs, rats, and cows died in the floods. Their bodies then contaminate the water, increasing the risk of leptospirosis ("rat fever"), cholera, typhoid, diarrhea, and hepatitis among others. Cases of leptospirosis have been reported in at least five of the thirteen flood-hit districts.

To combat the spread, antibiotics were distributed at relief camps. According to the central government, Kerala has the best performing public health system among India's states. This infrastructure combined with education has helped to maintain the outbreak.

Since the disaster, many have commented on why the floods became so deadly. Although some praised the government for their fast response time, other experts criticized authorities for lack of preparation and for not releasing water from the dams earlier and gradually. Although Kerala's progress is high in many areas, in the month before the flooding the government ranked the state as one of the lowest performers in water resource management. In addition, the government has been criticized for refusing offers of foreign aid from Qatar and the United Arab Emirates. Authorities cite the desire to rely on domestic resources, which has been a traditional policy. But with a projected rebuilding cost of over $3.7 billion, they may have to reassess. A rethinking of preventative measures, of rebuilding plans, and of how land use affects the environment are needed for the population's health and future.

Flooding of areas used for socio-economic activities produces a variety of negative impacts. The magnitude of adverse impacts depends on the vulnerability of the activities and population and the frequency, intensity and extent of flooding. Some of these factors are shown below;

Loss of Lives and Property: Immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, non-functioning of infrastructure facilities and deterioration of health condition owing to waterborne diseases. Flash floods, with little or no warning time, cause more deaths than slow-rising riverine floods.

Loss of Livelihoods: As communication links and infrastructure such as power plants, roads and bridges are damaged and disrupted, economic activities come to a standstill, resulting in dislocation and dysfunction of normal life for a period much beyond the duration of the flooding. Similarly, the direct effect on production assets, be it in agriculture or industry, can inhibit regular activity and lead to loss of livelihoods. The spillover effects of the loss of livelihoods can be felt in business and commercial activities even in adjacent non-flooded areas.

Decreased Purchasing and Production Power: Damage to infrastructure also causes long-term impacts, such as disruptions to clean water and electricity, transport, communication, education and health care. Loss of livelihoods, reduction in purchasing power and loss of land value in the flood plains lead to increased vulnerabilities of communities living in the area. The additional cost of rehabilitation, relocation of people and removal of property from flood-affected areas can divert the capital required for maintaining production.

Mass Migration: Frequent flooding, resulting in loss of livelihoods, production and other prolonged economic impacts and types of suffering can trigger mass migration or population displacement. Migration to developed urban areas contributes to the overcrowding in the cities. These migrants swell the ranks of the urban poor and end up living in marginal lands in cities that are prone to floods or other risks. Selective out-migration of the workforce sometimes creates complex social problems.

Hindering Economic Growth and Development: Preliminary estimates cite a loss of more than 3 billion US dollars (about 20,000 crores in Indian Rupees). Rough surveys reckon over 10,000 km of roads are damaged. The states farmers, around 2.6 lakhs of them, have lost crops, cattle, goats and other livestock. The high cost of relief and recovery may adversely impact investment in infrastructure and other development activities in the area and in certain cases may cripple the frail economy of the region. Recurrent flooding in a region may discourage long-term investments by the government and private sector alike. Lack of livelihoods, combined with migration of skilled labour and inflation may have a negative impact on a region's economic growth. Loss of resources can lead to high costs of goods and services, delaying its development programmes.

An assessment of the destruction, the economic costs and impact of reconstruction would be a challenge given the scale and extent of the damages. The rebuilding and reconstruction of the 5 most affected districts and of the infrastructure destroyed is likely to be a long drawn out process, one which is likely to have a sizeable economic and financial costs attached to it.

CARE Ratings Limited attempted to analyse the likely impact of the disaster on the economy and the industries that are likely to be impacted.

Immediate Impact on Employment

The five worst-affected districts of the state's 14 districts i.e. Idduki, Ernakulam, Kollam, Kottayam and Pathanamthitta have an estimated population of 11.09 million which accounts for nearly 30% of the state's total population.

They estimated that the employment of nearly 4.13 million individuals of these districts had been affected on account of the deluge and the resultant disruptions.

Political Implications: Ineffective response to relief operations during major flood events may lead to public discontent or loss of trust in the authorities or the state and national governments. Lack of development in flood-prone areas may cause social inequity and even social unrest posing threat to peace and stability in the region.

Drought after Flood

A few days after receiving one of the highest rainfalls in a century, Kerala came under the threat of severe drought. Water level in wells, ponds and rivers had recorded lowest levels and some wells even collapsed. The water level in wells, especially in high ranges of Idukki district has come down by 20 feet in just a matter of 15 days. Chief minister Pinarayi Vijayan had directed the State council for Science, Technology and Environment to carry out studies on the phenomenon after floods across the state and suggest possible solutions to the problem.

A.B. Anita, Executive Director, Centre for Water Resources Development Management (CWRDM), an autonomous research institution under the State government, said heavy run-off of the top soil in the upland areas and the siltation in the rivers were the reasons for the falling water level. The top

soil in the hills and upland areas had been removed in the flash floods to a depth of up to two metres in many places. As the top soil was shaved off, it ruined the hills' capacity to sponge in rainwater, she said. Ms. Anita cited ecological destruction caused by deforestation, harmful land use in the upland areas and sand mining in the streams and rivers as having contributed to the top soil run-off and siltation. This was exacerbated by the impact of climate change at the macro level.

Echoing her views, experts at the National Institute of Technology, Calicut, (NIT-C) said it was usual for the water level in the rivers and domestic wells to fall after fluvial floods. However, this time the discharge had been full, taking the sand and the rocks in the youth-stage along with the floods. "So the water level in the rivers came down. And when the river water level got reduced, the groundwater table also did not get replenished since the rivers and groundwater table were connected," said K. Saseendran, geologist and professor at the NIT-C.

Psycho-social Effects

The huge psycho-social effects on flood victims and their families could traumatize them for long periods of time. The loss of loved ones can generate deep impacts, especially on children. Displacement from one's home, loss of property and livelihoods and disruption to business and social affairs could cause continuing stress. The stress of overcoming these losses could be overwhelming and produce lasting psychological impacts.

Psycho-social Management

The psycho-social management team of NIMHANS, Bangalore got involved in the process of psycho social care of the survivors by training and sending nearly 1000 volunteers across the state. Various social work colleges in Kerala and outside Kerala along with NGOs contributed for the same. Kerala Social Service Forum with the help of CARITAS India was also engaged in providing psycho-social care and rehabilitation to the victims through its Catholic Diocesan Social Service Departments.

Those who fall into grief reaction needs grief counselling by trained counsellors and if they were not diagnosed properly that they could be falsely diagnosed as depressive, or Bipolar or psychotic illness and false treatment could be administered. Hence adequate caution should be taken handling the mental health issues of the survivors in any disaster situation.

Deluge Mitigation

We all know what are the causes of floods, still we are not acting on a serious planned note to mitigate its effect. It's high time that we understand this underlying problem and act at the earliest.

Unplanned construction ignoring nature in the name of development should be avoided and seriously dealt with as it comes out to be the biggest villain in the scene.

Changing the course of river in the name of development should be avoided strictly because it will only a damage stored for the future.

Deforestation should be stopped and planting of trees should be encouraged. Cutting of Trees in such a large number affects the Pattern of monsoon and it becomes irregular. Climate change and reduced capacity of soil in storing water are the ill effects of Deforestation.

Participatory planning at every stage should be practiced towards flood mitigation where Centre and State works in coherence.

Sustainable development is the need of the hour where human development shouldn't disturb the nature's ability to provide natural resources and ecosystem services on which the society depends.

Early warning System should be strengthened. Help of Indian Space Research Organisation (ISRO) is of paramount importance in this, as it is happening now as their satellites are sending important pictures and data in detecting and monitoring of situations over large regions of Kerala floods.

National Disaster Management Plan (NDMP), 2016 which was the first of its kind of national plan prepared in the country for disaster management to mitigate any disaster related loss.

NDMP was along the lines of globally set standard of Sendai framework for disaster risk reduction of which India is a signatory. The objectives of National Disaster Management Plan (NDMP), 2016 had to be followed in letter and spirit.

Conclusion

The deluge in Kerala leaves behind massive responsibility for the Government, NGOs, and the society for rehabilitation and reconstruction. Huge financial

commitment would be required in rectifying the economic damages of houses, agriculture, cattle, roads, bridges, plantations, tourism and other business areas. The psycho social issues of survivors would be another major concern both health workers and social workers need to undertake. Every disaster would be a sign to reflect over the socio economic development plans to make it socially and economically sustainable. Although flood is a natural disaster in the contest of Kerala deluge the manmade reasons were highly attributed. Hence a long term development plan preserving the ecological concerns of the State would be a major fact in the process of mitigation. The role of the local resources particularly the fishermen was appreciated from all quarters. They should be rewarded for their commitment and should professionally train them for future. Further research studies should be done to analyse the micro, meso and macro impacts of the deluge to develop better disaster preparedness and management.

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