Chapter

15

Post Disaster Damage, Loss and Needs Assessment - with Reference to Climate Change Induced Extreme Events in India

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Introduction

Disasters due to extreme weather events are a cause of concern across the globe. Between 1998 and 2017 climate-related and geophysical disasters killed 1.3 million people and left nearly 4.4 billion injured, homeless and displaced. The direct economic losses by all the disasters across the globe are valued at US$ 2,908 billion. The economic loss due to climate-related disasters alone accounted US$ 2,245 billion (77% of the aggregate loss) (UNISDR, 2018). Ninety one percent of all the disasters were caused by floods, storms, droughts, heat waves and other extreme weather events.

India is extremely vulnerable to climate change impacts because of its wide geographical and demographic variations. Extreme weather events had caused catastrophic disasters across the country in recent years. According to a recent study by the Indian Institute of Tropical Meteorology, Pune, the intensity and frequency of extreme rainfall events had increased in India in the last few decades and south and central India are predicted as more sensitive to warming than north India, with more rainfall extremes in response to climate warming. (Mukherjee et al, 2018). According to the National Disaster Management Authority (NDMA), over 40 million hectares or 12% of the country's land is prone to floods and river erosion. The past decade the country witnessed several geophysical and climate change induced disasters (https ndma.gov.in). The floods in Jhelum and Chenab in in Kashmir in 2014, Cyclone Ockhi in 2017 and Kerala floods in 2018 are to name a few catastrophic disasters in the country. These disasters caused severe damage to the lives and livelihoods of the population apart from the huge economic losses.

Extreme events due to Climate change

Change in climate due to increased greenhouse gas emissions and aerosols in the atmosphere resulted in extreme weather events in most part of the world. Singha and Patwardhana (2012) in their study on the spatio temporal distribution of extreme events in India classified 10 key extreme events such as flood, tropical cyclone, heat wave, cold wave also gale, squall, lightning, dust-storm, hailstorm and thunderstorm. Analysis of long-term temperature and precipitation records has revealed changes in the mean climatic state with increase in atmospheric carbon dioxide (CO_2) levels which affect the frequency and intensity of extreme climatic events (Singha and Patwardhana, 2012).

The impact of anthropogenic activities on climate change is clearly evident with rising greenhouse gas emissions and the associated temperature, humidity and sea level rise. The warmer the world, the atmosphere will hold more water and result in intense and extreme rainfall .The heat and humidity also alter winds and circulation of the atmosphere and hence the oceans. This leads to changes in the rates of evaporation and the intensity and frequency of rainfall. (Easterling D.R *et al.*1997, Easterling D.R *et al*, 2000; Meehl G.A., *et al*, 2000).

Economic loss due to extreme events

The economic loss due to extreme events assumed greater significance with the increase in the frequency of events across the Globe. UNFCC (2012) defines losses and damages due to climate change impacts as 'the actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems'. The 'loss' consist of negative impacts in which restoration is impossible, and 'damage consist of negative impacts in which restoration is possible.The post disaster economic loss assessment is imperative for designing recovery and reconstruction strategies. Standard methodologies for assessment of economic loss have been developed by several international agencies following catastrophic disasters in several locations. **The Damage loss and needs assessments methodology (DaLA)** developed by the Economic Commission for Latin America and the Caribbean (ECLAC) in the 1970s has been recognized as a globally applied tool to quantify the impacts of disasters and to determine the financial resources to achieve the reconstruction and recovery. It is a flexible tool that can be adapted to specific disaster types and government ownership requirements. The DaLA Methodology uses the national accounts and statistics of the country government as baseline data to assess damage and loss. It also assesses the

impacts of disasters on individual livelihoods and incomes to estimate the needs for recovery and reconstruction.

The economic loss due to some of the recent extreme events are presented in Table 1. Among the catastrophic disasters due to extreme climatic events in the past 15 years, the Kerala floods in 2018 reported to cause the highest economic loss(Rs.25000 crores based on world bank report) followed by the Maharashtra floods in 2005(Rs.5000 crores).

Table 1.Economic loss due to extreme events in India in the recent years

Event	Period		Affected locations	Economic loss
Maharashtra floods	July 2005	994mm rainfall in 24 hours	Mumabi, Raigad, Chiplun, Khed , Ratnagiri, Kalyan, Kohlapur, Sagli and, Goa	Rs.5000crore
Cyclone, Alia	May, 2009	6.1m flood water inundated Sunderbans region	Est Midnapur, Howrah, Hoogly, South 24 Parganas, and Kolkotha in West Bengal	Rs.1500crore
Uttarakhad flash floods	June, 2013	385.1 mm rainfall	Uttakhand, Haryana, UP, HP	Rs.1000 crore
Jammu and Kashmir floods	Sept, 2014	585mm rainfall	Jammu and Kashmir	Rs.5700 crores
Cyclone, Okhi, Kerala	December, 2017		Tamil Nadu, Kerala and the Union Territory of Lakshadweep	Rs. 1000 cr (Tamil Nadu) Rs. 1843 cr (Kerala) and Rs. 500 cr (Laksh dweep)
Floods, Kerala	August, 2018	700mm rain fall	14 districts of Kerala state	Rs.25,046 crore

Source: www.downtoearth.org, www.newindian express.org, *www.times ofindia.com*

Steps in Damage loss and needs assessments methodology (DaLA)

The following steps are involved in assessing the damages and losses post disaster (Torrente, 2012).

Sector wise baseline data collection

The sectoral data collection need to be done based on discussions with Govt representatives, private or NGOs before undertaking field visits to the affected areas. This will provide a quantitative base for comparing the effects and impacts of the disaster.

Field visit to the affected areas

Sample surveys of affected enterprises and industries and other sectors will be conducted for extrapolating the results. Representative areas will be chosen based on discussion with relief personnel, various government and private agencies who had already visited the affected locations.

Extrapolation of results to entire affected area

The data collected from representative areas will be used to extrapolate the results to the entire affected area

Sector by sector assessment

The aggregation of damages and losses in each sector will be done for estimating the gross economic loss due the disaster

Damages

The assessment damage loss consist of the following

a.Total or partial destruction of assets, including buildings, infrastructure, stocks, natural resources, etc.

The Damage occurs during or immediately after the disaster will be included under this. Damage is measured in physical terms, and a monetary replacement value is assigned to it. Eg.The value of a totally or partially destroyed equipments/ machinery should be its market value just before it was destroyed and not the cost of a brand new one.

Losses

a. Production not obtained due to the disaster or higher production costs

b.Higher operational costs and lower revenues

c.Unexpected expenditures (humanitarian assistance, demolition and debris removal, relocation of human settlements).They are measured in monetary terms at current prices. The sum of damages and losses are termed as disaster effects.

Long term macroeconomic impacts on the local economy due to disasters

This consists of the impacts on GDP, Prices/inflation, employment, balance of payment, fiscal balance, national debts and repayments. In addition to this the economy will also be affected due to poverty, gender impact and impacts on environment.

Post disaster recovery and reconstruction needs

In DaLA methodology, the value of destroyed physical assets (damage) and resulting changes in economic losses for each sector in the affected area are assessed. For analyzing the disaster impact, the impact of the disaster on the national economy and the expected temporary decline in personal income are

estimated. The cost of reconstruction and recovery are then assessed to know its impact on the economy. Based on the quantitative estimates of the damage and losses, financial needs for the recovery, reconstruction and disaster risk reduction or management are estimated. The value of reconstruction needs will normally higher than the estimated value of damage.

Steps in identifying the recovery and reconstruction needs

1. Analyzing the impact of disasters based on damages and losses
2. Setting the recovery and reconstruction strategies
3. Identifying post disaster needs

Disaster needs consists of both recovery needs and reconstruction needs

Recovery needs

The recovery needs in the Agricultural sector designed to mitigate the adverse effects of disasters include subsidies for the purchase of inputs or equipments, supply of production inputs or financial assistance for repair of infrastructure. This can be in terms of purchase of seeds, fingerlings, fertilizers, insecticides, farm implements, and repair of ponds, fish cages or crafts and gears . Farmers also can be supported through production credit and tax exemptions.

Reconstruction needs

In general the reconstruction needs in the agricultural sector can be categorised under the following activities

- Reconstruction of heavily damages structures such as input or product storage buildings, irrigation facilities, research facilities, hatcheries etc.
- Relocation of important facilities to safer areas
- Replacements of Agricultural equipment's, crafts and gears in fisheries sector
- Research for developing plant, animal or fish varieties with capacity to adapt to disaster prone areas
- Disaster resilient standards for construction
- Disaster preparedness and mitigation projects: Development of climate smart villages

Economic impact of extreme events: A case study on damages and losses to cage fish farms during the Kerala floods, 2018

Kerala once considered a region of low climate vulnerabilities had witnessed serious catastrophic disasters due to extreme events in the recent years. Analysis of loss and damages due to extreme events in Kerala assumed greater

significance with the occurrence of Ockhi in December 2017 and the deluge of August 2018. Tsunami, Ockhi and the floods caused serious damages and economic loss to the agricultural sector and fisheries sector in particular.

During the devastating deluge of August, 2018, the unprecedented rains almost 170% above the normal caused serious destruction to the state in terms of loss of lives damage to infrastructure, electricity, businesses and farming sector (Irudayarajan *et al.,* 2018). The deluge of 2018 said to be the worst in the 100 years caused serious damage to the lives and livelihoods of the population in many parts of the state. A preliminary assessment by the joint team of World Bank and Asian Development Bank has estimated the economic loss due to the catastrophic flood and landslides at Rs.25,046 crore ($US3.5 billion). The agricultural sector assumed to be one of the worst affected sectors of the state and the estimated cost of recovery from damage to the tune of Rs.2,093 crore (www.weather.com).The Post Disaster Needs Assessment (PDNA) report prepared by the UN assessed the damage and loss due to the floods. It said the state would need about Rs. 31,000 crore for recovery and reconstruction. The highest amount would be needed for reconstruction of roads and transportation (Rs. 10,046 crore), followed by housing (Rs 5,443 crore), agriculture, fisheries and livestock (Rs.4, 498 crore), employment and livelihood (Rs.3, 896 crore), other infrastructure (Rs.2, 446 crore), irrigation (Rs. 1,483 crore) and water and sanitation (Rs.1, 331 crore) (www.timesofindia.com).

The deluge hit the state during August 2018 was a serious setback to the efforts taken by the Central Marine Fisheries Research Institute (CMFRI) along with several other institutional agencies to popularise cage farming activities in the state. Many fish farmers in the coastal districts of the state have already adopted this technology as a source of livelihood owing to its techno-economic feasibility and promotional activities by various institutional agencies. There was a gradual and consistent progress in the cage farming activities in other districts like Thrissur, Kozhikkode, Alappuzha, Malappuram, Kollam and Thiruvananthapuram. The flash floods caused considerable loss of fishes stocked in cages as well damage to cage structure and other related infrastructure.

Methodology

A rapid damage and loss assessment was done immediately after the flood waters had receded in the affected coastal districts of Kerala. The extent of damage and economic loss to cage farms and the need assessments were done based on data collected from fish farmers in the selected districts and data from

state department of fisheries. The deluge affected the cage farmers in terms of loss or damage to cage structures and loss of fishes stocked in the cages. The tangible direct losses to the cage farms alone is included in the analysis and the indirect losses such as loss of income, employment loss and long term macro-economic impact are not covered in the analysis. The direct tangible damage is the most important loss assessed in many of the previous studies on economic loss due to disasters (Hammond *et al.*, 2015). The economic loss to cage farms was assessed in terms of foregone value of output due to loss of fishes stocked in cages and damages in terms of input loss and infrastructure loss.

Damage

The economic loss was estimated based on partial or full destruction of cage structures based on the replacement cost of cage structure at its value prior to the disaster. This also includes the repair cost of cage structure prior to its destruction. The loss of stored inputs and accessories were also included under damages. The inputs are valued at farm gate price or market rates.

Losses

The loss was estimated based the final production of fishes which could have been achieved by the affected units at the time of harvest based on average yields and prices recorded in the previous cropping seasons for different species of fishes.

Preliminary assessment in the flood affected areas revealed that the cages along with fishes were completely washed off in many locations like Gothuruthu, Cheriyappilly, Kottuvally and Chathanad in Ernakulam district and Kottappuram and Engandiyoor in Thrissur district whereas partial damage to cages and other infrastructure along with loss of fishes reported in other flood ravaged districts. Most of the affected farms were at final harvest stage yet the farmers postponed the harvest in anticipation of higher returns during the Onam, *Bakird and Christmas* festivals. The cage farms in the districts of Ernakulam and Thrissur were the worst affected accounting for an aggregate loss of Rs.9.94 crores. Fish loss contributed the maximum loss in the major flood hit districts of Ernakulam (90%) Thrissur (69%) and Kozhikkode (67%) followed by loss or damage to infrastructure such as cage frames/ freezers/nets/ drums or boats. In Ernakulam district majority of the farmers stocked Asian seabass along with Etroplus and Tilapia and the highest loss occurred for Seabasss stocks, followed by *Etroplus* and Tilapia.

Many of the farmers in Ernakulm district installed Chinese dipnets along with cages which helped them to enhance their revenue through capture based aquaculture. The live juveniles of redsnappers and carangids collected from these Chinese dipnets were stocked in the cages for getting additional revenue. Majority of the Chinese dipnets in the area were also either partially or fully damaged thus exacerbating the woes of the fish farmers. The total economic loss due to damage and loss in the cage fish farming sector in Kerala was estimated at 216.51 crores (Table 2)

Table 2. Loss and damage to cage farms in Kerala due to floods, 2018

District	Affected areas	No of affected units	Fish loss(t)	Loss(₹ lakhs)	Damages (₹ lakhs).
Alappuzha	Chengannur, Cherthala	62	14.88	66.96	15.14
Ernakulam	Kadamakkudy (Pizhala, Kothad), Gothuruthu, Ezhikkara, Kottuvally(Cheriyappilly) Chendamangalam, Moothakunnam, Aluva and Poothotta	426	191.32	661.22	90.89
Kollam	Chemmakkad, Perinad, Prakkulam	8	0.144	3.57	0.12
Kozhikode	Chelanure, Olavanna, Kadalundi, Feroke Kozhikode, Thalakulathure, Vadakara Maniyur, Koyilandy, Keezhariyur Payyoli	19	7.15	19.16	9.7
Thrissur	Methala(Anappuzha) Kaippamangalam, Mala, Kottappuram, Manalur and Naduvilkkara	70	88.25	220.07	97.21
	Total	585	301.6	968.11	216.51

Source: Estimates by authors and data from State department of fisheries, Kerala

Climate change is causing several catastrophic disasters throughout the world. Many of the recent disasters due to extreme events in India warrant the need for development of a comprehensive disaster preparedness plan for the country. The concept of loss and damage (L&D) of climate change has emerged as one of the emerging work streams in the international climate change regime

(Surminski & Lopez ,2015). The loss and damage associated with climate change impacts needs to be addressed in a comprehensive, integrated and coherent manner (UNFCC, 2013). Comprehensive adaptation and mitigation strategies to improve climate resilience at state and national levels along with international cooperation and expertise to enhance the knowledge and understanding of risk management approaches for reducing the losses and damages associated with the adverse effects of climate change is very much essential in the future.

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