GOVERNMENT OF KERALA

REPORT OF THE COMMITTEE

ON

RISK TRANSFER MECHANISM

For disaster risk financing

30th JUNE 2021

GOVERNMENT OF KERALA

REPORT OF THE COMMITTEE

ON

RISK TRANSFER MECHANISM

For disaster risk financing

30th JUNE 2021

Foreword

Climate change has become an irrefutable reality and so also the risks associated with it. Further, the United Nations Intergovernmental Panel on Climate Change (see IPCC 2018, 2019) confirms that Asian countries in general, and coastal communities in particular, are more susceptible to sea-level rise and consequent flooding. The State of Kerala is highly susceptible to an increasing frequency of natural disasters, due to climate change, given its location along the seacoast. The steep gradient along the slopes of the Western Ghats adds to its vulnerability. Huge losses were sustained in terms of lives and livelihoods, as well as environmental and ecological damage, during the recent natural disasters that have hit the state. The financial burden of recovery and reconstruction mainly lies upon the State government. This is evident from the cyclone Ockhi (2017) and the two floods of 2018 and 2019, with the cost of damage of the 2018 flood alone working out at Rs 31000 crore (USD 4.4 billion) including the damages, loss, and recovery needs. The natural disasters cause not only an enormous financial liability to the State Government by way of immediate rescue, relief & recovery measures, but also create a huge fiscal deficit for the State.

This necessitates the development of sustainable Disaster Risk Financing mechanisms which would help build an ex-ante disaster relief fund and also encourage effective utilisation of ex-post relief measures. This in turn requires an evaluation of the various risk transfer mechanisms including risk pool, insurance and reinsurance solutions and the drawing up of appropriate risk mitigation measures towards optimum risk financing solutions. This would reduce the State's financial liability significantly and also build up the requisite sustainable resources for a boosting of the state infrastructure with adequate risk protection of people's lives, livelihoods and property.

In light of the increasing number of disasters the world has faced in recent years, climate change and global warming may lead to more disasters. Against this background, the Government of Kerala decided to study the possibility of the risk transfer mechanism for disaster financing in the State, in order to be prepared against such financial shocks.

The government have constituted a committee as per order G.O. (Rt) No.256/2021/DMD dated 20/02/2021 (Annexure I) with the following members:

1. Dr. K. Ravi Raman, Member, Kerala State Planning Board: Chairperson
2. Dr. A. Kowsigan IAS, Commissioner Disaster Management, KSDMA
3. Shri. Gokul G. R. IAS, Officer on Special Duty (in-charge of Secretary, Resources), Government of Kerala

4. Shri. G. Srinivasan, Director, National Insurance Academy, Pune
5. Professor Ajit Dayanandan, College of Business & Public Policy, University of Alaska, USA
6. Dr. Steward Doss, Associate Professor, National Insurance Academy, Pune
7. Dr. L. Anitha Kumari, Associate Professor, Gulati Institute of Finance and Taxation, Thiruvananthapuram

Terms of Reference

1. To assess the disaster risk exposures and existing risk financing mechanisms in the State.
2. Examine pros and cons and describe disaster risk financing strategies including insurance/reinsurance solutions and alternative mechanisms.
3. Develop a sustainable disaster risk financing structure after the evaluation of various sources of risk financing options and fund-raising methods for disaster risk protection in the State.
4. Suggest the necessary supervisory and regulatory guidelines for the effective implementation of disaster risk financing strategy.
5. Suggest measures to develop a comprehensive disaster risk financing framework with necessary administrative and technological structures for effective delivery in the short and long terms.

In an assessment of the state's disaster risk exposures and identifying the drawbacks and limitations of disaster risk financing mechanisms, the Risk Transfer Mechanism Committee reviewed the state's disaster risk financing mechanisms. The review suggests that Kerala may be able to implement a sustainable disaster risk financing structure and new risk transfer mechanisms, including climate risk insurance programmes. Furthermore, the Committee recommended the measures to be followed in order to develop a regulatory body for implementing the risk transfer mechanisms and its financial structure. Also, the Committee offered suggestions for improving the administrative and technological structures for the effective implementation of risk transfer mechanisms.

In this report, the Risk Transfer Mechanism Committee proposes a framework to mitigate the problem of natural disasters and their impact on the economy. In addition to reducing the financial burden of the state, climate risk insurance supports society at large in preparing to face future disasters and overcoming financial loss due to catastrophes. As a result, existing government authorities in the State will work more efficiently, and the state will become more prepared and better enabled to cope with any eventuality. In its entirety, the Committee opens up a paradigm shift in the approach to disaster financing, recovery and

reconstruction, as well as developing pre-disaster preparedness and capacity building. In addition, it offers insights for policies and programs for sustainable development to combat the effects of climate change.

The report has been prepared based on both public and expert consultations. However, there are many areas yet to be covered, studied and analysed in detail. It may be in the long-term interests of the state to form a larger committee to study the risk financing system in detail and examine the implications of risk transfer mechanisms, including insurance. The present report was prepared by the Committee members. The report is also the outcome of the efforts of many people.

The Committee is thankful to Dr A. Jayathilak IAS, Additional Chief Secretary, Revenue and Disaster Management, Kerala who initiated and supported the functioning of the Committee.

The Committee benefited from discussions with Dr. Asim Kumar Pattnaik, Dr. K. P. Sudheer, Dr. P. Cyriac Mathews, Dr. Muralee Thummarukudy, Dr. Thankom Arun, Shri. V. Namasivayam, Dr. Sekhar L. Kuriakose, Shri. Joe John George, Shri. Johnny Ruangmei, Smt. Noyingbeni Kikon, Shri. Joy N. R., Shri. Latheef C., Shri. Alias K. M., Shri. Sahadevan P., Shri. P. Rajeev Puthalath, Shri. Akshay Sundar, Shri. Samuel John, Ms. Ani Varghese, and Shri. S. R. Sanal Kumar. The Committee has also benefited from the data and information provided by the Disaster Management Department, Civil Supplies Department, and the Fisheries Department. The Committee is thankful to the Nagaland State Disaster Management Authority for providing information regarding the Nagaland Disaster Risk Insurance Scheme. The Committee also benefited from the hazard vulnerability map provided by the Risk lab of KSEOC. The Committee acknowledges the help and the able research assistance provided by Ms. Chandini P. C. Senan, Hazard Analyst (Economics), Kerala State Disaster Management Authority.

I am grateful to all of them for their committed involvement. I hope this Report serves as a policy document for the government to initiate and launch risk transfer policy measures in the State.

Ravi Raman

30 June 2021

Sl. No.	List of Figures	Page No.
1.1	Multi-hazard susceptibility of Kerala	2
1.2.	Lightning frequency at district level; Murali Das (2007) Cited in SEOC, KSDMA (2012)	5
2.1	Existing parametric insurance products	20
2.2	Parametric insurance of airport in Taiwan	20
2.3	Parametric insurance for disaster risks – product structure	22
2.4	Risk pool with finite reinsurance coverage quota share/XOL option.	24
2.5	Hybrid risk pool model	26
5.1	A flood forecasting tool that utilizes Google maps	57
5.2	Early warning system for cyclones, using a simple mobile communication network.	58
5.3	Areas vulnerable for landslide covered by a distributed early warning system equipment	58
5.4	UNITAR - UNOSAT Geo picture	59
5.5	Drones/Unmanned aerial vehicles	60
5.6	Drone carrying medical box	60
5.7	Example of use of social media	61
5.8	Artificial Intelligence in search and rescue operations	63

List of Annexures

Acronyms

AAY	Antyodaya Anna Yojana
APL	Above Poverty Line
ARC	African Risk Capacity
ART	Alternative Risk Transfer
BPL	Below Poverty Line
CIMH	Caribbean Institute for Meteorology and Hydrology
CMDRF	Chief Minister's Distress Relief Fund
CSR	Corporate Social Responsibility
DDMA	District Disaster Management Authority
DRFIF	Disaster Risk Financing and Insurance Framework
DRPA	Disaster Risk Pool Account
DRR	Disaster Risk Reduction
EWS	Early Warning System
FAIR	Federation of Afro-Asia Insurers & Reinsurers
FEWS NET	Famine Early Warning Systems Network
GIS	Geographic Information System
GPS	Global Positioning System
IoT	Internet of Things
IRDAI	Insurance Regulatory and Development Authority of India
KSDMA	Kerala State Disaster Management Authority
LSGD	Local Self Government Department
LSGs	Local Self Governments
MHA	Ministry of Home Affairs
NAT CAT	Natural Catastrophe
NDMF	National Disaster Mitigation Fund
NDRF	National Disaster Response Fund
NFSA	National Food Security Act
NGO	Non- Government Organisation
PA	Personal Accident
PM CARES	Prime Minister's Citizen Assistance and Relief in Emergency Situations
PSU	Public Sector Undertaking
RBI	Reserve Bank of India
RPA	Robotic Process Automation
RTM	Risk Transfer Mechanism
SDMF	State Disaster Mitigation Fund
SDRF	State Disaster Response Fund
SDRMF	State Disaster Risk Management Funds
SDRFP	State Disaster Risk Fund Pool
SEBI	Securities and Exchange Board of India
SHG	Self Help Group
SI	Sum Insured
MSME	Micro, Small and Medium Enterprises

UAV	Unmanned Aerial Vehicles
UNDP	United Nations Development Programme
UNITAR	United Nations Institute for Training and Research
UNOSAT	United Nations Operational Satellite Applications Programme
USAID	United States Agency for International Development
Wi-Fi	Wireless Fidelity
XVFC	Fifteenth Finance Commission

Executive Summary and Recommendations

The frequent occurrence of disasters in Kerala has repeatedly dented the economy. This is impacting the growth rate, developmental policies, infrastructural improvements, and the daily life of millions of people. The recurring disasters are the social and economic feature of the life of the people. Some of the common natural hazards that directly or indirectly affect people, infrastructure and environment are floods, cyclones, droughts, landslides, lightning, forest fires, strong winds and coastal erosion. Others, such as the Nipah in 2017 and the ongoing COVID19 pandemic, are also increasing the state's vulnerability. This means that the liability of the state has increased due to the mental and financial stress these disasters cause to the common people.

Hence, it is important for the government to re-examine the existing risk financing options and develop appropriate risk financing and risk transfer mechanisms for effective risk mitigation of the disaster events. Moreover, existing traditional risk mitigation measures may not be effective in addressing the heightened levels of risk from catastrophic events and new types of risk mitigation measures and risk transfer mechanisms are required to ameliorate the financial burden on both the state and the people. This necessitates the development of a sustainable Disaster Risk Financing mechanism which would help build an ex-ante disaster relief fund and also encourage effective utilisation of ex-post relief measures.

Taking into consideration the current technology and other infrastructure available within the State, it would be opportune to introduce Climate Risk Insurance as a risk transfer mechanism. Both direct and indirect insurance are considered in the case of insurance for households. The total households are categorised into three modes based on climate risk insurance:

i. Trust/ Assurance Mode

The Government can adopt universal coverage for the entire section of yellow and pink ration cardholders i.e., a total of 38.32 lakh households: an indirect insurance through Group Insurance scheme. The approximate cost of this insurance cover for Rs.1,00,000 Sum Insured (SI) for protecting the household property (value not exceeding Rs.1,00,000) against natural catastrophic perils including fire, explosion, terrorism, and personal accidents would

be approximately Rs.11.88 crore at the annual premium rate of Rs.31[1]. This could be scaled up to any extent as per the policy decisions of the government.

ii. Hybrid Mode

There are nearly 24.73 lakh non-priority subsidy households i.e., blue ration cardholders in which 2.47 households are assumed to be covered by some kind of insurance. The rest of the 22.26 lakh households may be advised to take compulsory insurance coverage to protect their lives, house property against personal accident and natural catastrophic risks. The government can implement the two options:

a) A premium subsidy of 50% to this segment. The households would pay a nominal premium at the rate of Rs.15 (50% subsidy of Rs31 for Rs 1,00,000), and the State Government would pay the balance 50% of the premium.

b) On a priority basis, the unorganised segment of people living in coastal, low lying and hilly regions of the State could be identified and covered by the Government. To those households taken upon a priority basis a full indirect insurance at Rs.31 for Rs1,00,000 SI should be paid by the government as their economic situation is precarious due to the employment in unorganised sectors and hence more vulnerable to hazards and disasters. The rest of the households which are not included in the above section may have to pay the 50% of the premium amount of Rs15 as direct insurance and the remaining premium may be paid by the government as indirect insurance.

iii. Full-Cost Mode

The non-priority category, i.e., white ration cardholders, 26.07 lakh households, out of which nearly 10% of them are expected to have been covered under some kind of insurance either individually or through their employing organisations, and the remaining 23.9 lakh households could be encouraged to take direct insurance against climate risk. The total cost of the premium amount should be paid by the households. Hence, the State Government need not incur any insurance liability towards this non-priority category.

Even insurance for the critical infrastructure and government/public sector organisation's building and other assets is essential so as to reduce the financial liability burden of the state. The insurance premium rate for the industrial properties and infrastructure is 0.35 per

[1]The indicated rate of Rs. 31 for Rs.1,00,000 Sum Insured is the minimum annual premium rate applicable for the households. The actual rate of premium may depend upon the type of building, value of the property and the risk exposures of the regions. The above premium calculations are, by and large, illustrative models.

Rs.1000 for the natural catastrophic risks. If we consider the expected value of property and critical infrastructure as around Rs. 50,000 crore- considering the current development of urbanisation and infrastructure development in the State- the cost of insurance premium for protecting the critical infrastructure for the total value of Rs. 50,000 crores would be around Rs.18 crore (Rs.50,000 crore * 0.35 per Rs.1000). The secondary and tertiary sectors can also be included in the scheme of climate risk insurance such as shops, restaurants, self-employed ventures, hotels, etc.

The disaster financing structure for financing the above mechanism can be undertaken by developing a State Disaster Risk Fund Pool (SDRFP). This SDRFP can not only be utilized for financing the above-mentioned insurance but also to finance any matter related to climate change, sustainable development, disasters, natural hazards and anything and everything to safeguard the environment and the people for a better future.

SDRFP's fund may be deposited in an account named Disaster Risk Pool Account (DRPA), and managed and supervised by the KSDMA, a statutory body under the Disaster Management Act, 2005 handling disaster management chaired by the Hon'ble Chief Minister. A separate implementing cell could be created in KSDMA to regulate and supervise these matters, by building the capacity of the Authority (technological, structural, and human resources). This will increase the efficiency and capability of the KSDMA and will reduce the cost to the government as it would not have to create a new agency from scratch. Instead, the insurance scheme may itself be implemented by the Kerala State Insurance Department (KSID). The DDMAs, Revenue department, and LSG institutions are to be simultaneously strengthened, resulting in a decentralized administrative facility where the KSDMA supervises and regulates effective implementation. This will help in the easy dissemination of information and implementation of rapid action thereby reducing the effect of the damages and losses due to natural catastrophes. A robust and authentic database of people and property at risk of various kinds and weather events will be a prerequisite for operating risk transfer mechanisms.

Improving climate literacy and promoting decentralized action for adaptation and mitigation are critical for building climate change resilience. Every local government should have a climate change adaptation plan and private individuals should be educated on the climate footprint of their personal actions. It has been suggested that various risk mitigation initiatives at different levels - Government, policy makers, insurers, reinsurers, society, corporate, etc., are required to achieve desired level of stabilization of the greenhouse gas concentrations in

the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Green technologies can be used as risk mitigation measures to reduce greenhouse emissions and allow ecosystems to adapt naturally to climate change. Disaster risk-sensitive planning and development will save lives and promote sustainable growth in the State. The Committee deemed Natural Disaster Risk Pool (as outlined in chapter 2) to be a sustainable Disaster Risk Financing and Insurance Framework (DRFIF) for the state. Kerala, with the highest forest cover (around 52.3 per cent) among the larger states in India and its increased focus through local self-governments on climate change adaptation, can help the State emerge as a world leader in community-based climate resilience actions which can help in mitigating the risk from natural catastrophes in the State.

Recommendations

a) A new *Risk Transfer Mechanism* for financing disasters may be implemented.
b) The *Climate Risk Insurance model* may be adopted as the risk transfer mechanism.
c) When the entire section of yellow and pink ration cardholders i.e., a total of 38.32 lakh households are to be covered, the total cost incurred by the government for paying the *indirect insurance premium* would be Rs.11.88 crore (at the annual premium rate of Rs.31 for Rs.1,00,000 Sum Insured) for protecting the property value not exceeding Rs.1,00,000, against natural catastrophic perils including fire, explosion, terrorism, and personal accidents. There can be a cap of Rs. 10 lakhs on the sum insured for the time being. *The premium amount may vary depending upon the rating factors like value of the property, type of structure, risk exposure of the regions*, etc.
d) The total households may be classified into three categories for the purpose of insurance: *Trust/Assurance Mode; Hybrid Mode; and Full -Cost Mode:*
    (i) In Trust/ Assurance mode, the government pay the full premium rate of Rs.31 for Rs. 1,00,000 sum insured as an *indirect universal coverage* as a Group Insurance Scheme.
    (ii) In Hybrid mode, the government can adopt either of the *two options*; a) Households pay 50% of the premium (Rs. 15) as subsidy through direct insurance and rest will be paid by government as indirect insurance; or b) Identify the households who are employed in the unorganised sectors who are residing in the most environmentally vulnerable areas, the government can pay full premium rate Rs.31 for Rs 1,00,000 sum insured and rest of the households can pay 50% of the premium (Rs.15) as subsidy through direct insurance and rest will be paid by government as indirect insurance. *Vulnerability-linked relocation of households at risk should be pursued alongside for better, sustainable and more lasting protection.*

(iii) In the Full Cost mode, the households can pay the full premium rate of Rs. 31 for Rs. 1,00,000 sum insured.

e) The government may develop the *State Disaster Risk Fund Pool* (SDRFP) as a new disaster risk financial source and structure; a key component of the Disaster Risk Financing and Insurance Framework (DRFIF).

f) Climate risk insurance can be implemented using the funds from SDRFP.

g) The funds collected for SDRFP can be deposited in *Disaster Risk Pool Account* (DRPA).

h) An estimated *Rs.566 crore* would be the initial resource base for the proposed DRPA, which could be obtained from taxation and other methods.

i) The *nodal authority* to supervise and regulate matters related to SDRFP, DRPA and the risk transfer mechanism, i.e., Climate Risk Insurance may be *the KSDMA*. An *Implementing Cell* could be formed with operational flexibilities. It is also possible to consider the Kerala State Insurance Department (KSID) as a nodal agency for climate risk insurance scheme as it would be more administratively efficient and economical. KSID can explore the possibility of a self-insurance model for mitigating losses resulting from small and medium disasters (around Rs. 4000 crores[2]). The Department should work in collaboration with the KSDMA, DDMAs and LSGs.

j) KSDMA and KSID may be strengthened through *capacity building* both in terms of human resources and technology. In the later stages, the KSDMA/KSID could find a separate agency for implementing the related schemes including the insurance scheme, if required.

k) The state may improve climate literacy and promote decentralized actions for building climate change resilience. 'Disaster risk sensitive' planning and development should be mainstreamed for lasting protection.

l) The state may negotiate with the Centre and the Finance Commission for more funds as the state is more *environmentally fragile* when compared to many other states.

m) The Government can make it mandatory for the commercial organizations and financial institutions in the country to spend a certain *percentage of their revenue towards the climate change/DRR awareness creation, education, and special campaigns* annually. Adequate provisions for such climate change risk reduction activities to be made out of their Corporate Social Responsibility (CSR) Funds.

n) Civil society organisations and civic bodies can be encouraged to participate in organizing such climate change awareness campaigns; their activities should be promoted in building up collective social insurance.

[2] Average loss assessment based on SDRF calamity relief or total compensation is Rs.3900 crores.

o) Parametric Insurance solution can be structured for mitigating the Disaster Risks in the State of Kerala, covering all the major districts and critical infrastructure, in line with the design implemented by the state of Nagaland by Tata AIG Insurance Company & Swiss Re.

p) The state can adopt the hybrid risk pool model wherein the losses up to Rs.4000 crores can be directly financed by the risk pool account, and the losses beyond Rs.4000 crore up to Rs.30,000 crore, can be protected with Reinsurance support which can help in mitigating moderate and large catastrophic risks in the state.

q) The state can also examine the option of CAT-Bonds, *in lieu* of reinsurance, as an alternative risk financing mechanism for mitigating the state specific large natural catastrophic risks.

r) An extensive study of the catastrophe risk financing system, including insurance in the state, should be undertaken by a larger committee.

Chapter 1
Disaster Risk Exposures and Risk Financing Mechanisms

ToR: To Assess the Disaster Risk Exposures and Existing Risk Financing Mechanisms in the State.

Kerala is a narrow strip of land in the southwestern corner of the Indian Peninsula, lying between the Western Ghats (WG) in the east and the Arabian Sea in the west. Its geographical area is 38,863 square kilometres, including a coastal stretch of approximately 590 km, ranging from 30 to 120 kilometres wide. Kerala has three broad physiographic regions: the highlands (elevation > 75 m above mean sea level and covering the steep and rugged sections of the WG), the lowlands (< 7.5 m above mean sea level, and comprising the coastal plains), and the midlands in between, consisting of the undulating hills and valleys (KSCSTE, 2019, 2007).

The state has one of the densest population profiles in the country with around 859 people per km^2 and is nearly three times as densely populated compared to the rest of India. It has a tropical climate profile with the South-west Monsoon dominating over the rest. The state experiences rainfall during the advancing monsoon, retreating monsoon and sporadic summer thundershowers. The state's river system is dominated by west flowing rivers (41) and east-flowing (3), with most of the rivers originating from the Western Ghats.

Disaster Scenario in Kerala State

The state's location, climatic conditions, high population density, and steep gradation width-wise make it prone to severe natural disasters. It is further inclined to other natural hazards such as coastal erosion, flood, drought, lightning, landslide, earthquakes (Seismic zone III), soil piping, high wind speed and cyclones. The State's Disaster Management Plan has identified 39 hazards as natural and anthropogenically triggered, as indicated in Annexure1. Almost all districts of Kerala are multi hazard-prone, and this condition is further worsened by population pressure and unsustainable land-use practices, which turn hazards into disasters. The multi-hazard susceptibility of the Taluks of Kerala is depicted in Figure 1.1.

The state specific disasters in the case of Kerala are coastal erosion, lightning, strong wind less than cyclone storms, soil piping, heat wave, sunstroke, and sunburn. In the case of the COVID19 pandemic, the Ministry of Home Affairs declared it as a notified disaster. The effect of all these disasters leading to huge economic loss and heavy recovery needs, falls on

the state government as well as on the affected people. Some of the major disasters affecting Kerala are briefly explained below.

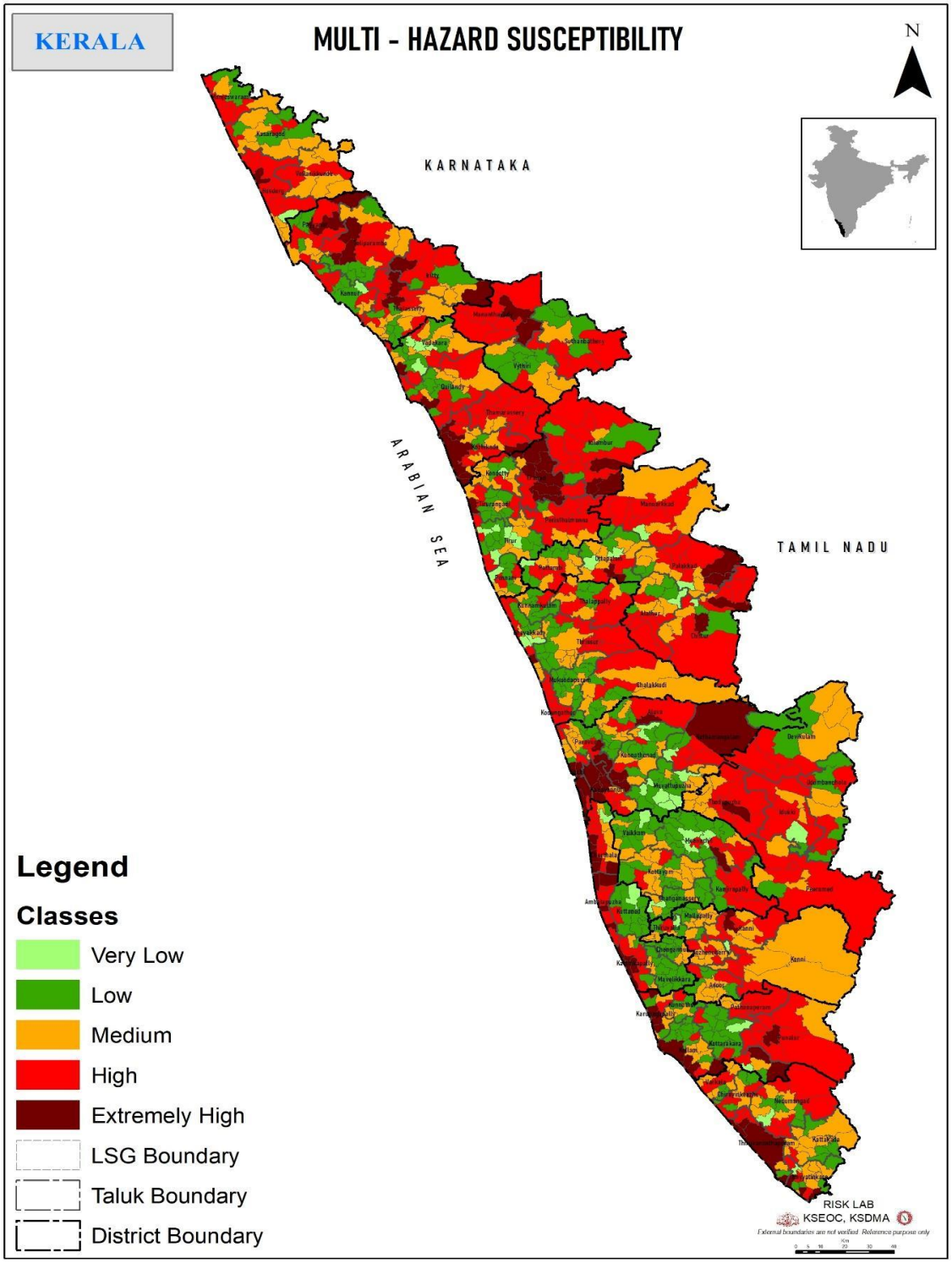


Figure 1.1. Multi-hazard susceptibility of Kerala

1. Flood risk

A study conducted by the National Centre for Earth Science Studies (NCESS) shows that 5642.68 sq.km, which is 14.52% of the State's total area, is prone to floods (KSCSTE, 2019). There were several instances of localized flooding during the monsoon season, and they were centralized in the lowlands. Although Kerala State does not experience floods as severe as in the Indo-Gangetic Plains, floods in the State are becoming more frequent and intense. Monsoon rains are often extremely heavy and cause severe flooding. This was on full display during the August 2018 floods, which affected 12 districts and directly affected 54 lakh people—increasing flood plain occupancy and reclamation of water bodies and wetlands, resulting in increased flood damage.

Approximately 50% of Alappuzha district is identified as flood-prone, especially the Kuttanad region. The flood-prone areas include the Kole lands of Thrissur district, the coastal tracts of Ernakulam and Malappuram districts, and the western part of Kottayam district flanking the Vembanad lake. While the Wayanad district is located on an elevated plateau, flood prone areas can be found in the broad flat valleys and floodplains adjacent to the Mananthavady river. Due to its rugged topography and lack of flat valley bottoms, Idukki district is the least flood-prone area in Kerala.

2. Landslide risk

The western flank of the ghats covering the eastern part of the state is identified as one of India's major landslide-prone areas. The landslides in the state include debris flows, debris slides, earth slide, rockslide, rock fall, etc. In a few cases, rotational types of slides with debris flow are the most prevalent. This phenomenon is marked by the rapid and sudden downslope movement of the oversaturated overburden consisting of soil and boulders, influenced by geo-environmental factors like slope, relative relief, overburden characteristics, land use/ land cover, landforms, as well as stream and valley setting.

The highlands of Kerala, particularly, Wayanad, Idukki, Pathanamthitta, Kozhikode, and Malappuram, are risky areas for landslides. Several people have lost their lives as a result of debris flows over the past three years. Among Kerala's 77 taluks, ten taluks are highly vulnerable, 25 taluks are moderately vulnerable, and 14 taluks are least vulnerable to landslides.

3. Coastal erosion risk

With a length of 590 km and covering about 15% of the state's total area, the coastal zone of Kerala is an important physiographic unit. Hazards in the coastal regions in 9 districts of the state are erosion, storm surges, and sea-level rise. The State has 223 coastal villages which have a high probability of being affected by cyclones. Coastal erosion is rampant throughout the state, with 63% of the coast eroding, including artificial coasts. The natural causes of coastal erosion are waves, winds, tides, near shore currents, storm surges, and sea-level rise. Human activities such as the construction of harbours, jetties and groynes, river training works, mining, and dredging can also lead to erosion of certain regions. Some of the coastal stretches in Kerala have shown long-term erosion with a net loss of land.

It is reported that about 350 km of the coast is under threat of erosion. The rocky coasts with pocket beaches have a minimum level of erosion. In areas with laterite cliffs, undercutting the softer clay layers leads to slumping with a net landward migration of the shoreline. Some segments show long-term erosion in the sandy areas, while others have either accretion or stable conditions. Studies have also shown that in regions undergoing erosion, a reversal can take place after a long period. Extensive sea wall construction along with gabion-boxes and groins has failed to arrest erosion in many cases. The tsunami of 2004, which was experienced in most of the State's coastal regions, has added a new dimension to the disaster scenario of the State.

4. Lightning risk

Kerala's geography has a high propensity for lightning due to weather patterns and the placement of the Western Ghats, causing convective currents leading to lightning clouds. Higher population and vegetation density result in more casualties impacting human and animal life. Accidents caused by ground conduction from trees are a special feature of Kerala. Most of the lightning incidents and consequent loss of life and property damage occur during April, May, October, and November. Figure 1.2 given below highlights the various districts/locations vulnerable to lightning hazards in Kerala.

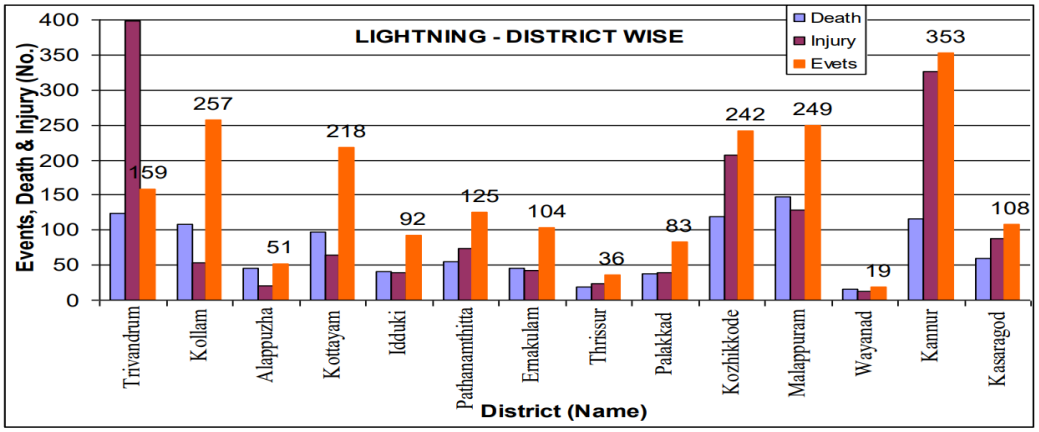


Figure 1.2. Lightning frequency at district level; Murali Das (2007) Cited in SEOC, KSDMA (2014)

Every year, there are, on an average, 71 deaths and 112 injuries caused by lightning. In Kerala, there were 110 lightning-related deaths between January 2010 and May 2014. Most of the decedents and injured due to lightning were breadwinners from relatively poor families and were often women (KSDMA, 2014). Most of the districts in the state are vulnerable to lightning risk. However, there are five districts, viz. Kollam, Kottayam, Kozhikode, Malappuram, and Kannur that have a very high vulnerability, while Thiruvananthapuram, Ernakulam, Pathanamthitta, Idukki, and Kasaragod have moderate hazard exposures.

Table 1.1. Disaster loss estimated from 2017 to 2019 by KSDMA, Government of Kerala

Sl. No	Items	Ockhi 2017 (Rs in crores)	Flood 2018 (Rs in crores)	Flood 2019 (Rs in crores)
1	Gratuitous Relief	70.28	76.73	374.22
2	Search & Rescue Operations	60	276.66	2.7
3	Relief Measures	15.5	314.35	245.14
4	Clearance of Affected Areas	1.1	77.01	12.72
5	Agriculture	10.75	281.45	66.36
6	Animal Husbandry	-	47.47	44.71
7	Fisheries	9.79	1.73	0.29
8	Handicrafts / Handloom	-	1.11	-
9	Housing	173.7	2,757.35	748.58
10	Power	46.11	113.37	102.27
11	Roads & Bridges	2.05	654.24	203.49
12	Irrigation and Water	32.6	587.92	127.26
13	Community Owned Assets	6.5	427.4	168.33
	Total	**428.38**	**5,616.78**	**2,096.07**

Source: Disaster Management Department, Government of Kerala

As shown in Table 1.1, three out of the past five years have seen significant disasters; the state demanded a sum total of around Rs. 8144 crores from the Central government. We do not yet have a complete estimate of the state's actual recovery needs due to past disasters. Based on the Post Disaster Need Assessment (2018), which is shown in Table 1.2, the actual flood losses, damage, and recovery needs for the flood of 2018 have been estimated at around Rs. 31,000 crores.

Table 1.2. Sector-wise summary of disaster effects (Damage and loss) and recovery needs for 2018 Kerala Floods & Landslides

Sector	Damage	Loss	Total Effect (Damage + Loss)	Total Recovery Needed
Social Sectors				
Housing, land, and settlements	5,027.00	1,383.00	6,410.00	5,443.00
Health and nutrition	499	28	527	600
Education and child protection	175	4	179	214
Cultural heritage	38	37	75	80
	5,739.00	**1,452.00**	**7,191.00**	**6,337.00**
Productive sectors				
Agriculture, fisheries, and livestock	**2,975.00**	**4,180.00**	**7,155.00**	**4,498.00**
Infrastructure sectors				
Water, Sanitation and Hygiene	890	471	1,361.00	1,331.00
Transportation				10,046.00
Power				353
Irrigation				1,483.00
Other infrastructure				2,446.00
	890	**471**	**1,361.00**	**15,659.00**
Cross–cutting sectors				
Environment	26	0.04	26.04	148
Employment and livelihoods	881	9,477.00	10,358.00	3,896.00
Disaster risk reduction	17	583	600	110
Gender and social inclusion	0.9	-	0.9	35
Local governance	28	-	28	32
	952.9	**10,060.04**	**11,012.94**	**4,221.00**
Total	**10,556.90**	**16,163.04**	**26,719.94**	**30,715.00**

Source: Kerala Post Disaster Needs Assessment Floods and Landslides - August 2018

Regardless, the total economic loss estimated according to the NDRF norms and the actual estimation by PDNA for flood 2018 are vastly different. Further, the actual recovery needs and economic losses were not calculated by the State after every disaster. As per the norms and items of SDRF/NDRF assistance, the loss and damage estimated are comparatively very less than the actual loss.

The assistance provided by SDRF/NDRF is far too small compared to the economic losses incurred by individuals and society. For example, a fully damaged house due to any disaster (mentioned in Annexure 4) can get Rs. 101900/- if it is in a hilly area or Rs. 92100/- in a plain area is significantly less. To quote PDNA (2018):

"The majority of Kerala's population has income higher than the national average. The cost of household items lost could be tentatively put at INR 10–12 lakh per household. Houses in Kerala are normally large and so the replacement cost of the average house would be more than INR 40–50 lakh. This cannot be compensated by the government exchequer and the initial support given by the state is very meagre, in comparison to the loss. Such natural calamities may not be a one-time phenomenon and could occur repeatedly, increasing vulnerability further, multiplying manifold the burden on the state exchequer. Looking at Kerala's risk profile, it would be appropriate for the government to come up with new financial tools for building financial resilience in the state and its people. Risk transfer, insurance, insurance pooling, micro insurance could be possible alternatives" (Page 432 and 433).

To quote Rebuild Kerala Development Programme Plan Report (2019):

"Currently, disaster risk financing is characterized mostly by ex-post mechanisms (e.g., budget reallocations) rather than ex ante (e.g., insurance of public assets, market-based risk transfer, etc.). The State draws finances for DRM activities primarily from its own budget, resources provided by the GoI, external financing institutions and voluntary contributions. Kerala needs to explore sustainable financing options for DRM and DRR, for example, catastrophe insurance, insurance linked-safety net programs, and other innovative insurance products to reduce the fiscal burden of disasters on State resources. While most better performing states in terms of infrastructure have Capex to GSDP ratio more than five, Kerala managed only 1.79. In critical infrastructure sectors, there is a need to explore innovative financing structures and alternate revenue models for raising funds to support resilience" (Page 29).

The central concept of Insurance is 'collective risk bearing'. When it comes to losses sustained by households affected by disasters, in a welfare state, the benevolent government in itself appears to play the role of an informal insurer of first resort, in a sense (working on sort of a nominal cover charging zero insurance premium), providing immediate relief and making good a part of the losses sustained by people in distress in the aftermath of a disaster

by granting nominal financial assistance (bound by an accepted minimum relief code or disaster relief norms), routed through the government machinery that identifies such people in distress. Thus, the Government *of, by and for* the people is itself a 'collective' that bears 'risk', diverting its own resources (Centre /State). While such assistance is much appreciated when disbursed on time, the families still have to muster plenty of financial resources (savings or borrowings) to get their lives back to normalcy.

The poor, with little or no financial cushion of their own are generally disproportionately affected by disasters and it may take longer to set their finances right at the level of the household. Nominal assistance provided by the government may not cover the value of the physical assets lost or damaged. With a fairly and relatively better standard of living achieved by the average Kerala household, the value of household assets lost or rendered useless (e.g., in a flood) is quite sizeable and a government on its own may find it difficult to make good on the entire losses sustained by households by diverting its scarce resources. The existing risk financing mechanism in the state is not enough to compensate for half, or a quarter of the loss and damage faced by the individual and society affected by a disaster. So, the need for a new and advanced risk transfer mechanism for financing loss and damage should be implemented by the Government of Kerala.

It is acknowledged the world over, that the loss of lives to natural calamities has come down drastically with better early warning systems and improved relief and rescue measures guided by technology. However, the economic losses decade on decade have been increasing, on the contrary. The culture of 'disaster risk-sensitive development' or 'development embracing the principles of disaster risk reduction' is yet to be effectively mainstreamed for sustenance. Sustainable development in harmony with nature is still not effective in practice. Coastal areas account for 8 % of the total land area, but they are home to 30 % of the world's population. The signs of climate change are most obvious in coastal areas, apparently increasing vulnerability. Thus, with the passage of time it is quite likely that the size of the population at risk will progressively increase. There appears to be an increasing frequency of extreme weather events that are said to be associated with climate change. The present financial cover provided by the government may be characterised as nominal/subsistence level. Generally, people are underinsured. Public assets are also not covered. In such a scenario, carefully designed and calculated risk transfer mechanisms might help households to rebuild themselves faster and help governments to lessen the diversion of their own scarce resources without compromising the welfare of its people.

Existing risk financing mechanisms in the State of Kerala

Risk financing is not an alien concept to the State of Kerala. As calamities and accidents are faced by the state and its people, risk financing mechanisms are brought into play in one way or the other. The loss sustained by the government and the people in the face of natural calamities is huge owing to a state of underinsurance of assets. Presently, there are two major risk financing mechanisms in the state, which the disaster management department operates. They are the State Disaster Response Fund and the State Disaster Mitigation Fund.

State Disaster Response Fund (SDRF)

SDRF is the primary fund available to the state governments for meeting any threatening disaster situation or disaster. The Government of Kerala established this fund vide G.O (P) No. 498/2010/DMD dated 3-12-2010 with the powers conferred by clause (a) of sub-section (1) of section 48 of the Disaster Management Act 2005. The 15th Finance Commission recommends the allocation, arrangement, and amount of funds for each year in its report. As per its recommendation, an annual Central contribution is released in two instalments for a financial year, and the financing pattern is a sharing arrangement between the Centre and the State. The fund is non- lapsable, and any saving from a particular year is carried forward to the following year. The allotment in the State is as determined by the State Executive Committee of KSDMA following the norms of the Government of India.

The Finance Commission recommends the year-wise allotment of SDRF for each state and the proportion of its allocation between the union and state governments. The Central share - State share ratio is 75:25 as recommended by the 14th Finance Commission (2015- 2020). Table 1.3 depicts the SDRF fund allotted to the state of Kerala by the 14th Finance commission for the period from 2015 to 2020.

Table 1.3. SDRF opening balance and allotment by the 14th Finance Commission to Kerala

Year	Central Share (75%) (₹ in crores)	State Share (25%) (₹ in crores)	Total (₹ in crores)	Opening Balance as on 1st April (in crores)
2015-16	138.75	46.25	185	
2016-17	145.5	48.5	194	160.66
2017-18	153	51	204	115.86
2018-19	160.5	53.5	214	287.08
2019-20	168.75	56..25	224	2107.46
2020-21	-	-	-	542.01
Total	766.5	255.5	1022	

Source: Disaster Management Department, Government of Kerala

From this up to 10% of the funds may be utilized for state-specific disasters. The expenditure on the procurement of essential search, rescue, and evacuation equipment, including communication equipment, etc., for disaster response is to be incurred by SDRF only, as assessed by the State Executive Committee (SEC). Expenditure on such an account should not exceed 10% of the annual allocation of the SDRF. The expenditure for capacity building should not exceed 5% of the annual allocation of SDRF.

The Disaster Management Department allots assistance for disaster according to the requirements of the districts and government departments. This is allocated under 23 heads of account, as mentioned in Annexure 5. The major expense incurred by the state is on the head of accounts for 'repair to houses due to flood', 'repair & restoration of damaged roads and bridges due to flood' and 'food & clothing due to flood'. Funds for COVID19 containment also are now drawn from SDRF subject to the norms set by Government of India. Due to this, in the last financial year, the expenditure on this account was the highest. Owing to floods in 2018 and 2019, the expense from the heads of account on flood was high. The major expense of the government went towards grants for house damages. Funds from the CMDRF were dovetailed with assistance under SDRF to enhance the quantum of assistance.

As per the 15th Finance Commission (XVFC), the total allocation for the SDRMF to the states for the duration of the award period is Rs. 1,60,153 crores. The SDRF would receive 80% and SDMF 20% of the total SDRMF. In the SDRF allocation of 80%, there would be three sub-allocations: Response and Relief (40%), Recovery and Reconstruction (30%), and Preparedness and Capacity-building (10%). While the funding windows of SDRF and SDMF are not interchangeable, there would be flexibility for re-allocation within the three sub-windows of SDRF. The total SDRF allotted to Kerala for the financial years from 2021-22 to 2025-26 is Rs. 1852.8 crore. The financial year-wise allocation of the fund is presented in Table 1.4.

Table 1.4. Annual allocation of fund under SDRF for the period 2021-26.

Year	Central share (75%) (₹ in crores)	State share (25%) (₹ in crores)	Total (₹ in crores)
2021-22	251.2	84	335.2
2022-23	264	88	352
2023-24	277.6	92	369.6
2024-25	291.2	96.8	388
2025-26	306.4	101.6	408
Total	**1390.4**	**462.4**	**1852.8**

Source: Computed from XVFC Report (2021), Volume II

State Disaster Mitigation Fund (SDMF)

The Disaster Management Act, 2005 provides for the establishment of a financial mechanism for mitigation purposes at the national and state level. The Act states that the State Government shall, immediately after notification of constituting the State Disaster Management Authority, establish for the purposes of this Act a fund to be called the State Disaster Mitigation Fund. Section 2 (i) of the Disaster Management Act defines 'mitigation' as measures to reduce the risk, impact or effects of a disaster or a potential disaster situation. Hence, mitigation includes large-scale interventions such as the construction of coastal walls, flood embankments, etc. But these are very resource-intensive measures that should be pursued through regular development schemes and not from the mitigation fund. The State of Kerala has made a budgetary provision such as "State Disaster Mitigation fund' as per G.O (P) No. 660/2011/DMD for disaster mitigation and prevention. There are several mitigation programmes in the state, including the Mullaperiyar Crisis Management Plan, and Operation Anantha.

The amount allocated for the SDMF for the period 2021-26 is ₹463.2 crores, i.e., 20% of ₹2316 crore, the latter being the State Disaster Risk Management Fund available for Kerala. The year-wise allocation of the fund for the years 2021-26 as per the XVFC is presented in Table 1.5.

Table 1.5. Annual allocation of fund under SDMF for the period 2021-26.

Year	Central share (75%) (₹ in crores)	State share (25%) (₹ in crores)	Total (₹ in crores)
2021-22	62.85	20.95	83.8
2022-23	66	22	88
2023-24	69.3	23.1	92.4
2024-25	72.75	24.25	97
2025-26	76.5	25.5	102
Total	**347.4**	**115.8**	**463.2**

Source: Computed from XVFC Report (2021), Volume II

Chief Minister's Distress Relief Fund (CMDRF) in Kerala

CMDRF provides financial assistance to people affected by major natural calamities like floods, drought, wildfire etc. Educational, cultural, and charitable institutions of a public nature, which are affected by such calamities and whose financial position does not enable them to repair the damage caused to their property are also eligible for financial assistance from the fund. It is an emergency assistance granting relief to deserving families and individuals in case of loss of life, medical treatment for major diseases, etc.

Relief is provided for all purposes which the state government finds relevant as per norms. Financial assistance from this fund would be restricted to cases not covered by other special relief programs of the government. The assistance does not cater to routine/ordinary cases of poverty but caters only to exceptional cases of real hardship due to sudden loss of income/death/other distress. Transfers to the end beneficiary are done through the direct bank transfer system. CMDRF funds are open to audit by the Comptroller and Accountant General and the budgeting and expenditures are subject to scrutiny by the State Legislature. The donations made to the fund are eligible for 100% exemption from Income tax under section 80 G of the Income Tax Act, 1961.

Following the floods, thousands of individuals and organizations contributed to the CMDRF. The CMDRF allotment and expenditure during the period from 2015-16 to 2019-20 in Kerala is presented in Table 1.6. The mobilization was Rs. 7043.61 crore in 2018-19 after the devastating floods of 2018. Regarding the allotments (Expenditure), Rs. 4978.44 crore was spent from the total receipt resulting in a balance of Rs. 2065.16 crore (Table 1.6).

Table 1.6. CMDRF allotment and expenditure in Kerala (in lakh)

Year	Allotment Amount	Expenditure Amount	Surrender Amount	Expenditure as a percentage of Allotment
2015-16	15953.87	13569.94	2383.93	85.06
2016-17	22009.15	15239.23	6769.92	69.24
2017-18	24467.58	20040.8	46026.78	81.24
2018-19	704360.64	497844.86	206515.79	70.68
2019-20	146559.18	136620.94	8095.8	93.22

Source: https://donation.cmdrf.kerala.gov.in/

The Government allocates the CMDRF fund of COVID19 of various purposes of urgent nature such as the distribution of food grain kits to family card holders, for financial assistance to BPL and AAY families, etc. A major portion of the fund has been expended on rebuilding damaged houses/buying land and building houses. The creation of CMDRF resulted in boosting the mobilization and allocation of funds for various activities. This has helped the Government to respond quickly to distress situations without waiting for external assistance or budgetary funds.

Budget allocation for disaster management in Kerala

The Government of Kerala allocates funds for relief assistance through the budgetary process. The budgetary allocation for disaster relief assistance comes under the head of account of 'Other miscellaneous relief expenditure - State Budget' sanctioned to different districts and government departments by the Disaster management department. Table 1.7 indicates the year-wise budget allocation of funds for relief expenditure by the State government.

Table 1.7. Kerala State Budget Allocation for Relief Expenditure

Financial year	Head of Account
	2245-80-800-80-Other miscellaneous relief expenditure - State budget (in crore)
2018-19	4.17
2019-20	0.86
2020-21	0.3
Total	**5.3**

Source: Disaster management department, Government of Kerala

Flexi-funds within Centrally sponsored scheme

The States may, if they so desire, set aside 25% of any Centrally sponsored scheme (including the central and state share for any given scheme in a financial year), except those which emanate from legislation or scheme where the whole or a substantial proportion of the budgetary allocation is flexible. The NITI Aayog has issued instructions for Rationalization of CSS, vide OM No. O-11013/02/2015-CSS & CMC dated 17th August 2016. One of the objectives of this flexi-fund is to undertake mitigation/restoration activities in case of natural calamities, or to satisfy local requirements in areas affected by internal security disturbances.

Other disaster risk financing mechanisms

Currently, there are several disaster risk financing mechanisms with other government entities besides the Disaster management department and KSDMA. Some of them are as follows:

1. Group accidental insurance scheme for fishermen community

This was implemented for fishermen and allied fishermen communities within the age group of 18-60. These fishermen are registered under the Kerala Fishermen Welfare Fund Board and enrolled in the Fisheries Information Management System (FIMS), a database of the Fisheries department. This is a one-year term insurance cover stretching from December 17 to December 16 of next year, renewable from year to year. This insuring process will re-

occur every financial year in which new fishermen and allied fishermen are enrolled and some are cancelled. Death and permanent disability are insured for Rs.10 lakhs, partial disability for Rs. 5 lakhs, and hospitalization for Rs. 25,000.

The premium amount for fishermen is Rs. 342/- and for allied workers of the fishermen community is Rs. 111/-. The premium amounts are paid from the Fisheries department's plan funds. For the financial year 2020-21, 2.4 lakh fishermen and 85,319 allied fishermen were enrolled in this scheme.

2. Kerala state crop insurance scheme

State crop insurance scheme has been operated in the State by the Agricultural department since 1995 covering 25 major crops grown. This scheme was restructured in 2016-17 by bringing considerable enhancement to the crop loss compensation and the scheme now covers 27 major crops. The participants who contribute to the fund for the operation of this scheme are farmers through payment of registration fee and premiums and the State Government through its contribution. Not only the major crops but also vegetables, fruits and perennial crops are also covered under the scheme. During the financial year 2020-21, an amount of Rs. 2000 lakh was earmarked for the scheme.

3. Contingency programme to meet natural calamities and pests &disease endemic

The scheme is intended to create a buffer stock of seeds for paddy and other annual crops for distribution to affected farmers in the event of natural calamities and resultant crop damage. Assistance for strengthening of bunds to prevent breaches during floods and for removal of debris will be a much-needed financial support to the affected farmers, and an amount of Rs.750.00 lakh was provided for the scheme during 2020-21.

4. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)

The Scheme was launched in 2015 by the Union Government offering insurance cover to bank account holders in the age group of 18 to 50 years. The eligibility age for the insurance was extended up to 70 years in the later years. This is a term insurance cover stretching from June 1 to May 31, renewable from year to year. It offers life insurance cover for death due to any cause, and the nominees/ heir will receive the claim amount. The risk coverage under the scheme is Rs. 2 lakhs for accidental death including full disability and Rs. 1 lakh for partial disability. The premium of Rs. 324 per annum is to be deducted from the account holder's bank account through 'auto-debit' facility in one instalment. Even if a person dies due to COVID19, the maximum sum insured of Rs. 2 lakh is payable to the beneficiaries of

this policy. The insurance regulator (IRDAI) has designed exclusive COVID19 protection covers called Corona Kavach and Corona Rakshak health insurance policies. Corona Kavach is an indemnity-based family floater cover with a maximum hospitalization coverage of 5 lakhs and Corona Rakshak is a benefit policy where one-time payment of Rs. 2.5 lakh is made to the policyholder on being diagnosed with COVID19. These policies are offered by all insurance companies through multiple channels, including bancassurance.

5. Pradhan Mantri Garib Kalyan Package: Insurance scheme for health workers fighting COVID19

This program was launched by the Union government as part of the Pradhan Mantri Garib Kalyan Package. This is a comprehensive personal accident cover of Rs. 50 lakh for 90 days for a total of around 22.12 lakh public healthcare providers including community health workers, who might have to be in direct contact and care of COVID19 patients and who may be at risk of being impacted by this. This is funded under the NDRF budget operated by the Health Ministry. The insurance company undertakes actual payment of coverage under certification of the authorised Central/State government officials.

These are the major existing risk financing mechanisms for confronting calamities and other natural catastrophes in the State. Some of the other existing risk financing mechanisms in the state are as follows and these are not solely applied in disaster situations alone. The insurance scheme undertaken by the Government of Kerala are Comprehensive Health Insurance Schemes- Rashtriya Swasthya BimaYojana and Senior Citizens Health insurance scheme by Health Department; Vidarbha Package, Gosuraksha – cattle insurance scheme and duck insurance by the Animal Husbandry Department; Group insurance scheme and Kerala state life insurance scheme by the Kerala State Insurance Department for government employees; **General Insurance Branch** including Fire insurance branch, Marine insurance branch, Miscellaneous insurance branch, Act liability insurance, Motor accident claims tribunal cases by the Kerala State Insurance Department; and Insurance of commercial vehicles by the Motor vehicles department. The State government undertakes many other programmes and schemes for the welfare of the people and society which also have elements of risk financing. Some of the welfare fund boards like Kerala Motor Transport Workers' Welfare Fund Board, Kerala Abkari Workers' Welfare Fund Board, Kerala Agricultural Workers' Welfare Fund Board, Kerala State Anganwadi Workers' and Helpers' Welfare Fund, Kerala Auto rickshaw Workers' Welfare Fund Board, Kerala Co-operative Development and Welfare Fund Board, etc., are under the State government. In

the State, there is an extensive social safety net. For the Government of Kerala and its people, risk financing is not a new concept.

Conclusion and recommendations

The Government of Kerala has implemented many schemes, policies, and programs to protect the people from natural catastrophic events, which can be seen as risk transfer mechanisms. Similarly, there are many risk financing mechanisms such as SDRF, SDMF, CMDRF, budgetary allocations, State crop insurance, Group accident insurance for Fishermen, etc., also already available in the State. However, these existing risk financing or risk transfer mechanisms are not quite adequate for meeting the losses and damages caused by natural catastrophic events in recent times, creating a heavy financial burden on the State and the people. In particular, the costs of rebuilding the damaged property and houses and critical infrastructure like roads, bridges, airports, etc., after the disasters, are the major financial liabilities for the State government. Secondly, the insurance protection gap (difference between the economic loss and insured loss) is also very high (more than 90%) in the State, which leads to greater financial requirement for the State to provide relief and rebuild property and infrastructure. Thus, it is essential for the State to consider the suggested risk financing and risk transfer mechanisms for effective disaster risk management. **In this context, the Committee suggests implementing a new risk transfer mechanism which is suitable for the State of Kerala (see Chapters 2 & 3).**

Chapter 2

Disaster Risk Financing: Strategies and Alternative Mechanisms

ToR- Examine pros and cons and describe disaster risk financing strategies including insurance/reinsurance solutions and alternative mechanisms.

As noted earlier, the State of Kerala is highly susceptible to the increasing frequency of natural disasters. Disasters have caused massive damage to critical infrastructure, property, crops, animals, and people's lives, and contributed to environmental and ecological imbalance. The resultant financial liability falls on the State government by way of immediate rescue & relief measures and rebuilding the property and critical infrastructure. This necessitates the need to develop a sustainable disaster risk financing mechanism that would help build an ex-ante disaster relief fund reducing the financial burden on the State. One of the aims of the Sendai Framework for Disaster Risk Reduction, where India is a signatory, is also to achieve a substantial reduction in disaster losses from extreme events by adopting a comprehensive risk transfer mechanism. This requires evaluating the various risk transfer mechanism including risk pool, insurance, reinsurance, and alternative risk transfer mechanism like ART & Parametric risk solution, etc., and suggesting the appropriate risk mitigation measure which can help with the optimum risk financing solution which would reduce the State's financial liability significantly and provide sustainable resources necessary for rebuilding the state infrastructure with adequate risk protection of people's lives and property.

The various risk transfer mechanisms available for effective risk reduction or mitigation are explained below by evaluating them in terms of the pros and cons of each risk transfer measure to identify the most effective and efficient disaster risk reduction measure for the state of Kerala. The following are the risk transfer mechanisms that can be implemented in the state of Kerala:

1. Climate Risk Insurance
2. Parametric Insurance with Reinsurance support
3. Natural Disaster Risk Pool
4. Hybrid Model Risk Pool

1. Climate Risk Insurance

Climate Risk Insurance is a vital instrument within a comprehensive climate risk management system spanning a continuum of prevention, risk reduction, risk retention, and risk transfer to such insurance schemes. Climate risk insurance can play numerous roles – at individual, community, regional, country, and global levels in providing security against the loss of assets, livelihoods, and even lives in the post-disaster period (GIZ, 2015). Thus, climate risk insurance can ensure reliable and dignified post-disaster relief, help to rebuild assets/houses/critical infrastructure, set incentives for prevention; provide certainty for weather affected public and private investments, and ease disaster-related poverty and spur economic development.

Insurance can be classified into two categories: Direct Insurance and Indirect Insurance. **Direct Insurance** is the type of property, personal accident, health, and life insurance in which the insured/beneficiary benefits directly from transferring the risk to insurers When the insured event or perils are triggered, the insured beneficiary receives the insurance pay-out directly from the insurers. **Indirect Insurance** is the type incurred by the government or organisation, where the intended beneficiary benefits indirectly from the payments intermediated by an insured institution.

Pros/Merits

a) Climate risk insurance is ideal for covering all kinds of disaster risks such as floods, storms, cyclones, earthquakes, landslides, inundation, etc., and also for covering fire, lightning, explosions, aircraft impact damage, terrorism, etc.
b) Insurance is a risk transfer mechanism that helps to reduce the negative impacts of disasters by spreading the risk of loss among people and across time.
c) It helps promote the adoption of insurance-related solutions to facilitate the assessment of loss and damage to affected property and infrastructure as it is a prerequisite for identifying needs and policy priorities.
d) It encourages people to adopt effective risk management practices individually, which can help reduce premiums. In addition, a well-designed climate risk insurance can incentivize households, organisations, and governments to implement effective loss reduction measures, which helps build a climate resilience society for the State.

e) It helps reduce the financial repercussions of volatility and uncertainty in decision-making in critical infrastructure development activities and investments. It also helps to foster an environment more conducive to climate-resilient investment in key sectors.
f) Insurance helps provide timely and reliable finance to cover loss and damage compared to other ad hoc post-disaster financing options such as aid, loans, and family assistance.
g) It helps households to get back to their business or work quickly, enabling them to be financially independent.
h) It helps the government avoid fiscal deficits and costly post-disaster loans and expedite their post-disaster relief activities and rebuild the critical infrastructure quickly.

Cons/Demerits

a) There are exclusions and deductibles.
b) The claims settlement process is not so easy as the customers must report the loss to the insurance company. Then, the company will analyse the damages and losses, and after approval, the claim can be received.

2. Parametric insurance with reinsurance support

The Parametric Insurance is an Index-based insurance wherein the coverage is given on the occurrence of a natural catastrophe (flood, cyclone, and drought, etc.) resulting in the breach of the selected parameters on a fixed severity scale or trigger points. Parameters can be the weather perils (rainfalls/precipitation, temperature, wind speed, etc.) applied to fixed locations during a pre-defined period (May to October, October to January). The loss shall only be admissible if the Nat-Cat event has breached the set parameters covered for a given location. Parametric Insurance provides an immediate pay-out with a recourse action (% of Sum Insured) on post-loss assessment to the insured population in the affected location.

As per Swiss Re Corporate Solutions (2019)*"Parametric Insurance or index-based insurance solutions are a type of Insurance that covers the probability of predefined event happening instead of indemnifying the actual loss incurred."*

Many countries, places, and sectors have already implemented this insurance scheme. Some of them are indicated in the below Figures 2.1 and 2.2.

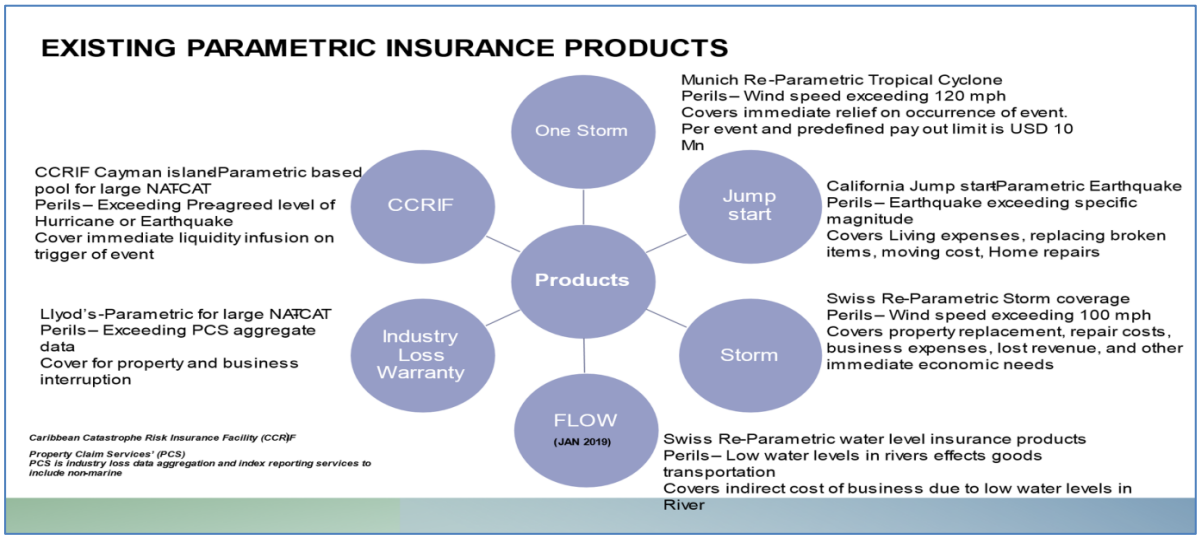
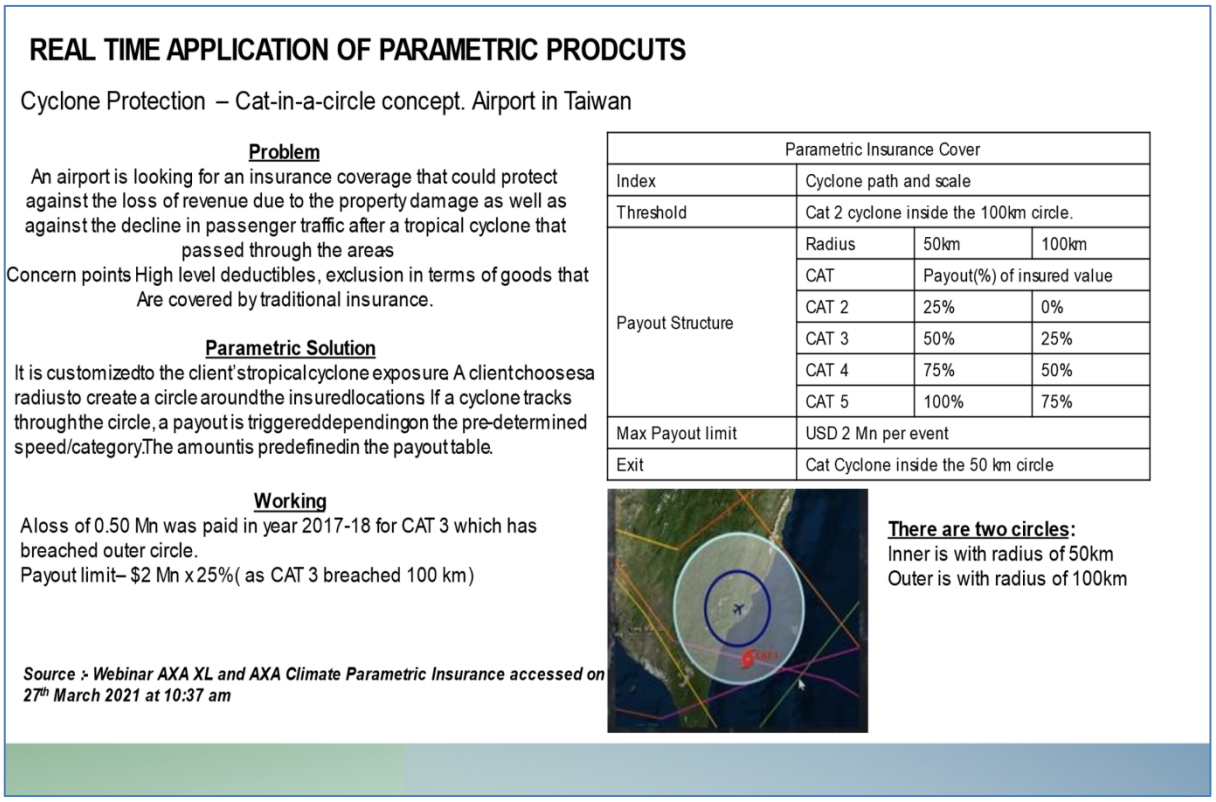


Figure 2.1. Existing parametric insurance products

Airport in Taiwan was covered by a parametric insurance for a maximum loss of $2 million.



Parametric Insurance Cover			
Index	Cyclone path and scale		
Threshold	Cat 2 cyclone inside the 100km circle.		
Payout Structure	Radius	50km	100km
	CAT	Payout(%) of insured value	
	CAT 2	25%	0%
	CAT 3	50%	25%
	CAT 4	75%	50%
	CAT 5	100%	75%
Max Payout limit	USD 2 Mn per event		
Exit	Cat Cyclone inside the 50 km circle		

Figure 2.2. Parametric insurance of Airport in Taiwan

Source: AXA XL Climate Parametric Insurance (2021)

Pros/Merits

a) Simple index-based insurance which provides an instant pay out to the insured which can be immediate relief in times of crisis.
b) No exclusions and deductibles
c) Customized parametric products for each risk exposure at a given location can be designed for the major perils like floods, cyclones, and landslides, etc.
d) The pay-out can be automated on the occurrence of pre-defined events triggering the strike points at the selected location.
e) Availability of different types of parametric insurance covering various natural catastrophic events.
f) Easy claims settlement process where claims can directly be credited to the insured accounts, without the customers reporting the loss to the insurance company.
g) The premium could comparatively be cheaper.
h) The coverage can be customized for a particular region or a specific location.

Cons/Demerits

a) The coverage is usually customized for a particular region or a specific location.
b) The coverage is usually customized for specific and prominent NAT CAT perils in the regions i.e., flood, cyclone, lightning, landslide, and forest fire, etc.
c) It can be implemented in those regions with advanced and block chain technology and Artificial Intelligence.
d) A critical assessment of the risk exposures in terms of geographical as well as social or demographic vulnerability in the state is require for successful implementation.

Nagaland's Parametric Insurance Solution

Parametric Insurance solution design is implemented by the state of Nagaland by Tata AIG Insurance Company and Swiss Re. The parametric insurance cover design for the state of Nagaland by Tata AIG Insurance company & Swiss Re is explained below in Figure 2.3.

The Parametric Insurance is designed to cover disaster risks in the selected locations of Nagaland State. This cover provides immediate relief to the insured people in the selected localities of Dimapur, Kohima, Wokha, Zuheboto, Mokokchung, and Nagaland, on the occurrence of selected disaster risks from 1st June 2020 to 31st March 2021. The parameters triggering the defined precipitation/rainfall trigger index exceed 385 mm cumulatively in consecutive 7 days in any month of the policy period.

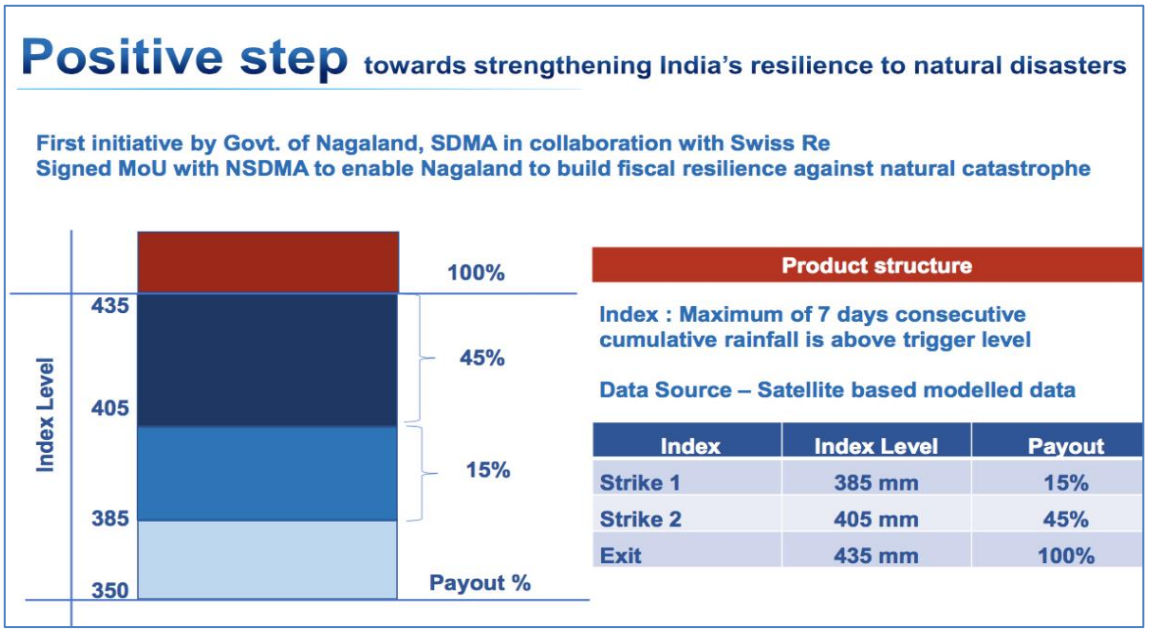


Figure 2.3. Parametric insurance for disaster risks – Product structure

Source: Tata AIG& Swiss Re 2020, Parametric Insurance for Nagaland Government

The product has two strikes 1 & 2. Strike 1: where the cumulative index exceeds 385 mm of rainfall but less than 405 mm, then 15% of the sum insured will be paid as the pay-out. And Strike 2, if the cumulative index exceeds 405 mm but less than 435 mm, then 45% of the sum insured is paid to the insured. The Exit strike rate is 435 mm, where if the cumulative rainfall exceeds 435 mm, then 100% of the sum insured is paid as compensation to the insured.

Based on historical weather data, similar parametric insurance cover for specific catastrophic risks like floods and cyclones, can be designed. The cost of premium for such parametric insurance cover can be determined based on the historical loss experience of the selected disaster risk (Flood/Cyclone) in terms of its frequency of occurrence and the expected loss triggered by the calamity in a particular region. Reinsurers like GIC Re, Swiss Re, and Munich Re can be approached for developing such parametric insurance solutions.

3. Disaster risk pool

A disaster risk pool allows countries or states to respond quickly to disasters and reduce their impact on people and their livelihoods through securing access to financial resources before a disaster strike. Through this pool, countries or states can pool risks in a diversified portfolio, retain some of the risks through joint reserves and capital, and transfer excess risk to the reinsurance and capital markets.

Once the pool has an adequate fund, it can be used to pay for the disaster risk losses and damage in the state. It will help expedite the relief measures within the state and help reduce the disaster risk. The pool can even be utilised to finance insurance premiums to ensure adequate risk protection of property damage, life, health, and critical infrastructure of the state.

Some of the countries and places which have implemented natural disaster risk pool are as follows:

- Federation of Afro-Asia Insurers & Reinsurers (FAIR) Nat CAT pool of African and Asian
- Natural Catastrophe risk pool 'ARC – African Risk Capacity'.
- France- national NATCAT Pool which covers all catastrophe risks except storms.
- The USA has a national flood insurance pool covering only flood risk and the risk pool is regulated by individual states.
- Turkey and Taiwan have a government supported Risk Pool covering only earthquake risks in the country.

France has a national NATCAT Pool which covers all catastrophe risks except storms. This pool is supported by the Government with compulsory insurance coverage for the general public and business houses. The U.S.A has a national flood insurance pool covering only flood risk and the risk pool is regulated by individual states while Turkey and Taiwan have a government supported Risk Pool covering only earthquake risks in the country.

Pros/Merits

a) The risk pool shares both the premium and claims in a certain proportion of coverage for risks or liability.
b) A pool is a higher-level risk financing mechanism.
c) Can be used to finance the multiple disaster risks (floods, cyclones, earthquakes, etc.).
d) Risk pools not only help in mitigating financial losses but also provide economic stability and reduce government burden.
e) It provides immediate financial relief to the poor and financially weaker sections of the country who otherwise have no means of any insurance coverage.
f) It provides an effective platform to increase knowledge and capacity around disaster risk.

Cons/Demerits

a) Usually operates at country level or a larger geographical territory. But it can be structured for a particular state also.

b) The risk pool is highly dependent upon the reinsurance capacity available. Without the reinsurance arrangement, it would not be sustainable for the pool to function for a long period.

Considering the vulnerability of the state to different types of catastrophic risks, the following model of risk pool is suggested. As depicted in Figure 2.4, the cedent to the risk pool can be the State Government along with corporate or business groups, NGOs who contribute to the risk pool. The Disaster Risk Pool can buy Excess of Loss Reinsurance protection from GIC Re or other international reinsurers who operate in the Indian market. The Risk Pool or Fund proposed for the state government can reinsure for multi-peril and multi-year contracts under the Finite Reinsurance Program with the XL treaty, where the catastrophic losses are huge. This Finite reinsurance program can protect the pool for a period of 5 years. Finite reinsurance is a multi-year reinsurance program, and it can be an ideal program to protect losses from large catastrophic risks ranging from Rs.4000 crores to Rs.20,000 or 30,000 crores. The finite reinsurance programme can be directly taken from a national reinsurer like GIC Re or an international reinsurance company (Swiss Re, Munich Re, Lloyds, etc.).

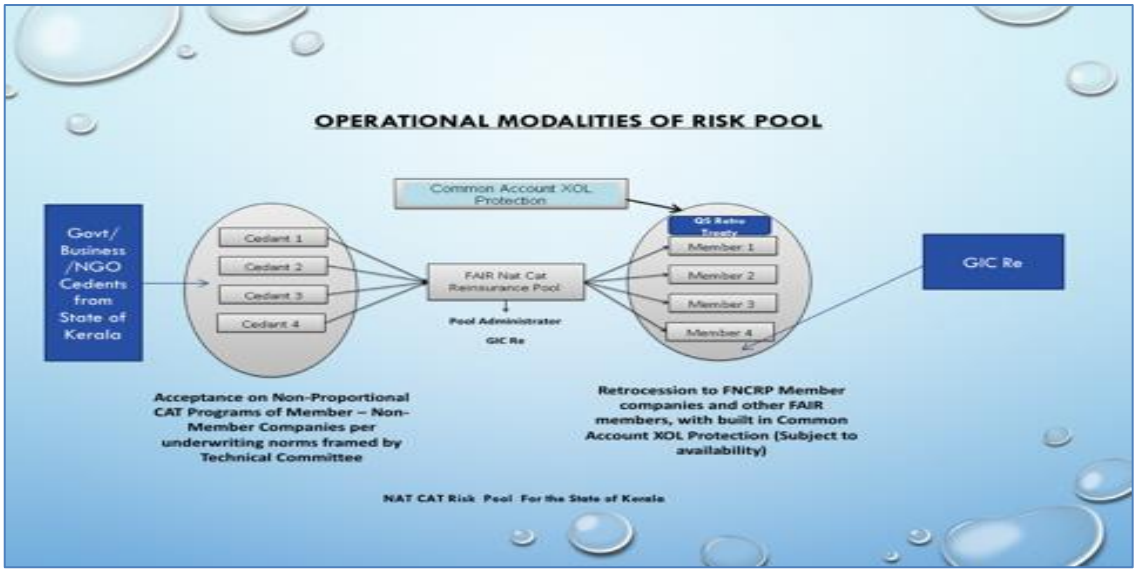


Figure 2.4. Risk pool with finite reinsurance coverage quota share/XOL option.

Advantages of Reinsurance:

1. It offers protection from large catastrophic risks like large cyclones, floods, earthquakes, etc.
2. The cost of reinsurance (premium) would be comparatively cheaper as they have large insurance capacity and global risk carriers can easily diversify the risks globally.
3. Reinsurers can also provide technical knowledge of risk mitigation and hazard management, etc., which can be highly useful to the state government or NDMA in timely mitigation of natural catastrophic risks.
4. Finite reinsurance is a multi-peril and multi-year contract which can be taken for 5 years, which would simplify the administrative process and also the cost of reinsurance would comparatively be cheaper.
5. Reinsurers usually offer high-risk capacity; their financial conditions or solvency need to be looked into while selecting them.

4. Hybrid Risk Pool model

The Hybrid Risk Pool is a larger version of the risk pool mentioned above. In this model, every risk financing mechanism that already exists and that is mentioned above is included. All the financing that is received by the state for disaster financing in the form of support, donations, allocated through the budgetary process, funds sanctioned by the central government, etc.is brought under this hybrid pool. As the impact of the disaster varies the financial coverage by the risk financing technique changes.

Pros/Merits

a) The Hybrid Risk Pool as described above is very flexible and provides multiple risk transfer options for the State to utilise.
b) The amount of risks that can be mitigated by each type of risk transfer methods (direct insurance/Reinsurance/Parametric/CAT bonds, etc.) is indicated in the diagram. Depending upon the amount of risk exposures, suitable type of risk transfer can be selected by the State Government.
c) The hybrid risk pool offers higher risk capacity for managing disaster risks for the state. As a result, the financial responsibility of the State would come down drastically, as the pool is structured to take care of the losses up to Rs.50,000 crore in any calamity year.

Cons/Demerits:

a) Currently, there are no Cat bonds available in the Indian market. However, the national reinsurance company GIC Re can be approached for this purpose and GIC Re with the

support of SEBI and IRDAI, can issue Cat bond to cover the large natural calamity risk for the state of Kerala.

b) The risk amount indicated in the model below are illustrative figures, but they are based on the loss experience from the 2018 Kerala Flood. Hence, the actual cost of insurance premium is not possible to work out which requires a separate study or analysis to estimate the appropriate loss exposures and cat models to work out the premium rates for Cat Bonds and Parametric Insurance.

The hybrid model can be adopted considering all the above risk transfer mechanisms mentioned above. As given in Figure 2.5, the structure of the risk pool can be made as discussed below: The first option wherein the risk pool can directly finance the losses up to Rs.4000 crores either directly compensate the losses by way of relief measures or can protect them by the state government through additional funding. The risk pool can protect against medium and large losses beyond Rs. 4,000 crores up to Rs. 30,000 crores with reinsurance support. Alternatively, the pool can also mitigate such risks through a Parametric Insurance solution. And any losses above Rs.30,000 crores up to Rs.50,000 crore, the state can explore the option of NATCAT-Bonds to mitigate large state specific natural catastrophic risks. If the losses exceed Rs.50,000 crore, then the State can seek the help of the Central Government and international financial institutions like IFC, WB & ADB, etc.

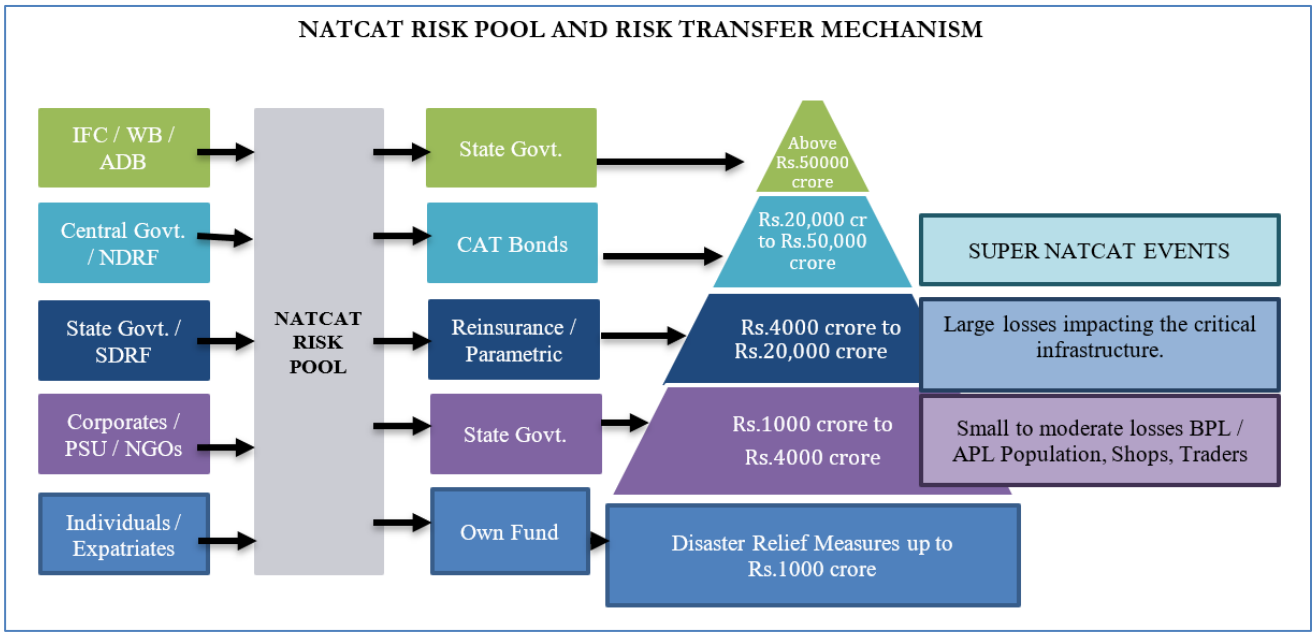


Figure 2.5. Hybrid Risk Pool model

The first column of the model depicts the various risk financing options pooled under the NATCAT/Disaster Risk Pool. The third column describes the various risk transfer options

available. The fourth column indicates the expected losses that can be mitigated through various risk transfer mechanisms. The figures indicated in the model are expected loss figures expressed in different ranges (they are just illustrative figures to understand the magnitude of the loss exposures).

New Risk Transfer Mechanisms for Kerala

As part of developing a sustainable Disaster Risk Financing and Insurance Framework (DRFIF) that can be introduced in the state, the Committee explored the basic characteristics of households in the state. In Kerala, the utilisation of the benefits of risk financing through insurance is extremely low by the people and even by the government. The current insurance penetration in India is 3.76%, and in the state of Kerala it is 1.07%, both are quite low. During the 2018 Kerala floods, the insured claims were less than 10% of the total property or financial loss incurred. While the estimated losses, damages and recovery needs estimated for the state to be around Rs. 31,000 crores, the insured losses were less than Rs. 300 crores. Even people who have taken life insurance and crop insurance were less than 10%, indicating a wide protection gap mainly through insurance in case of natural calamity or disaster is more than 90%.

Natural Catastrophic Insurance (NAT CAT insurance)/Climate Risk Insurance implementation of disaster financing can be undertaken by covering the household's property and contents against all the natural catastrophic perils, i.e., storm, flood & inundation, earthquake, tsunami, landslide, lightning, and forest fire, as well as personal accident including death due to disaster, and other accidental death. For this, the government can classify households in the state based on income, food security, cost of living, and so on. As per the National Food Security Act (2013) and the State level welfare measures, the government has already done such a classification through the different supply of ration cards to the households (yellow, pink, blue and white card holders) (see Table 2.1). The most economically backward families carry the Antyodaya (yellow card). The pink card holders are below the poverty line (BPL or priority category). The blue and white card holders are in the non-priority category (APL): blue cards are eligible for subsidised rations as well, whereas those with white cards are not normally eligible for any kind of subsidy. Furthermore, white card holders also benefit from PDS subsidies[3]. **Using the above classification of households, the committee divides the households into three categories to implement the risk transfer insurance mechanism:**

[3]However, currently the white cardholders in Kerala benefit from the PDS subsidies.

1) **Trust/Assurance Mode**
2) **Hybrid Mode**
3) **Full-Cost Mode**

Indirect and universal insurance can be provided to the yellow and pink cardholders, as they are the most vulnerable and economically weaker sections of society; these households are already covered under NFSA subsidies. These cardholders' premiums can be financed entirely by the government. This is the first category named as the **Trust/Assurance mode.**

The second category is called the **Hybrid mod**e, consisting of households with blue ration card i.e., non-priority households with subsidies, where two options can be applied: (i) direct insurance with premium subsidy occurred under indirect insurance and (ii) indirect insurance to unorganised and vulnerable sections of the households occurring only 60% of the households with blue ration cards included. The premium will be either partly paid by the households and partly by the government or fully paid by the government. The third category, called **Full Cost mode**, includes households with White ration cards, which will be insured through direct insurance. The households will pay the premium for the insurance.

Table 2.1. Category of households and proposed RTM

Category of population	2017	2020	Risk Transfer Mechanism (RTM)	Category Based on RTM
AAY (Yellow Card) /Priority (Pink Card)	35.08 lakh households (43.7%)	38.32 lakh households (43%)	Indirect Insurance by State / Central Govt.	**Trust/ Assurance Mode**
Non-priority /APL with subsidies (Blue Card)	29.35 lakh households (36.58%)	24.73 lakh households (27.75%)	Direct Insurance with premium subsidy	**Hybrid Mode**
Non-priority with Non-Subsidy (White Card)	15.81 lakh households (19.69%)	26.07 lakh households (29.25%)	Direct Insurance	**Full Cost Mode**
Total Population	80.24 lakh households	89.12 lakh households		

Source: Department of Food, Civil Supplies and Consumer Affairs, Government of Kerala

The type of insurance, the cost incurred and the estimated rate that will be paid as premium is given in Table 2.2.

Table 2.2. Household category and proposed insurance

Category based on RTM	Population as of 2020	No of insured	Type of insurance	Proposed insurance with cost
Trust/ Assurance Mode	38.32 lakh households	None assumed to be insured	Personal Accident + Property Insurance + NAT CAT perils	Indirect Insurance at Rs.31[4] for Rs.100000 SI; a total of Rs.11.88 crore to be paid by Government
Hybrid Mode	24.73 lakh households	2.47 lakh households	Personal Accident + Property Insurance + NATCAT cover Rs.31 per 1,00,000	Option 1: Direct insurance paid by Households at Rs.15 for Rs.100000 SI (50% premium subsidy) + Indirect insurance paid by State Government at Rs.16 for Rs.100000 SI; Government contribution would be Rs 3.56 crore. Option 2: a) Full Indirect Insurance paid by State Government at Rs 31 for Rs 100000 SI to those who are in unorganised sector and highly vulnerable to hazards. b) Those who are not included above will have direct insurance paid by Households at Rs.15 for Rs.100000 SI (50% premium subsidy) + Indirect insurance paid by State Government at Rs.16 for Rs.100000 SI.
Full Cost Mode	26.07 lakh households	2.08 lakh household is insured	Personal Accident + Property Insurance +NATCAT Rs.31 per 1,00,000	Direct insurance paid by Households (No liability for State Government)
Total population	89.12 lakh households			

- SI denotes Sum Insured.

[4] The rate of 0.31 is worked out taking into account catastrophic risk perils at the rate of 0.10+ 0.13 PA and 0.08 terrorism risk per Rs.1000 Sum Insured.

Trust/Assurance Mode

The consideration of the priority group (Pink card) and the AAY category (Yellow card) of people or the economically weaker section of the population, which is nearly 1.53 crore people (43% of the population) in the State because they are highly vulnerable to natural calamities or disasters. These segments of people can be covered by Natural Catastrophic Insurance covering their house property and contents against all-natural catastrophic perils i.e., storms, floods & inundation, earthquakes, tsunamis, landslides, lightning, and forest fires, etc. This cover also protects them against personal accidents. In addition, the government can cover the entire section of this AAY/BPL/Priority segment through the Group Insurance scheme. Therefore, the state government can consider two options that can be applied for this segment of the population.

- Option 1- The total cost of this insurance cover to the government would be approximately Rs.11.88[5] crore (38.32 lakh households at the premium rate of 0.31[6] per Rs.1000 Sum Insured). Here, the households are insured for both natural catastrophic risks (NAT CAT perils) and Personal Accidents.
- Option 2 - The government wants to cover this category of the population only against the natural catastrophic risks. The total cost of insurance would be Rs. 3.83 Crore (38.32 lakh households at the premium rate of 0.10 per Rs.1000).

Hybrid Mode

Most of the people in hybrid mode are unskilled labourers/semi-skilled workers employed in the unorganised sector. There are nearly 24.73 lakh households in the state. These segments of people are highly exposed to additional risks in the form of income volatility, hazardous workplace conditions, and lack of old-age benefits. This section of the population could be advised to take compulsory insurance cover to protect their lives, houses and property against personal accident, and natural catastrophic risks. People live in coastal regions, low lying, and hilly regions can be covered by compulsory Natural catastrophic risk insurance for personal accidents. The total premium cost would be Rs.31 (0.31 per Rs.1000 for Catastrophic risk perils, PA, and terrorism) per Rs.1,00,000 Sum Insured. The government can implement the two options.

[5] The indicated rate of Rs.31 per annum for Rs.100000 Sum Insured is the minimum rate applicable for households. The actual rate of premium may depend upon the type of building, the value of the property and the risk exposures of the region. The above premium calculations are only for the purpose of understanding.

[6] See Footnote 4.

- Option 1- The households can be encouraged to pay a nominal premium at the rate of Rs.15 (50% subsidy), and the State government can pay the balance of 50% of the premium. The total cost of such insurance for **the State government would be approximately Rs. 3.56 crore at the premium rate of Rs.16 * 22.26 lakh householders** (assuming that 10% of this group is already covered by some kind of insurance either individually or group at their workplace, particularly those who are employed in organised or government sectors).
- Option 2 - On a priority basis, at least the unorganised segment of people living in coastal, low lying, and hilly regions of the state can be recognised and covered by the Government. To those households taken on a priority basis a full indirect insurance at Rs. 31 for Rs. 100000 SI should be paid by the government. As their economic situation is bad due to the employment in unorganised sectors, they are already more vulnerable to many hazards and disasters. The rest of the households which are not included in the above section will have to pay 50% of the premium amount of Rs 15. as direct insurance and the remaining premium will be paid by the government as indirect insurance.

Full- Cost Mode

The non-priority with non-subsidy income category, 26.07 lakh households, out of which nearly 10% of them are expected to have been covered under some kind of insurance either individually or through the organisation where they are employed, the rest 23.9 lakh households can be encouraged to take climate risk insurance. Of this segment, at least 20% of them can be motivated to take direct insurance protection covering their property and contents against natural catastrophic perils. This would cost them Rs.31 for a sum insured of Rs.1,00,000. Hence, the State Government need not incur any insurance liability towards this non-priority category.

The insurance coverage amount will be decided by the government as well as the total amount paid as premium for a household in the case of yellow, pink and blue cardholders. Currently, the maximum amount of sum insured can be set at Rs. 10 lakhs; considering the cost of an affordable disaster resilient house with reasonable comfort. As in the case of option 2, the exact number of households covered under **full indirect insurance is not known to the committee. So, the government can take measures to identify the households in each of the categories and accordingly quantify the cost.**

All categories are given the extra option of increasing their insurance coverage by paying the extra premium by themselves. If the households are of the opinion that the coverage amount is less, they can pay the extra amount as premium to the insurance agency. Only a single

house and property of an individual can be covered under this insurance scheme by the government. Those individuals with more than one house or property have the option of insuring their property or house by paying direct insurance to the insurance agency, even if the household comes under yellow/pink/blue cards. Insurers use assessment tools to quantify the risks posed to different types of property based on variables such as the age, structure, and type of the building, the vulnerability of the region, and so on.

Critical Infrastructure and Government/Public sector organisation's building and other assets:

The critical infrastructure for the state will mainly include airports, road, bridges, rail transport services, power & water sectors, All Government & Municipality buildings, schools, hospitals, community centres, and health centres, etc. The total value of infrastructure damages in the 2018 Kerala Floods as estimated by the World Bank & Asian Development Bank was around Rs.15,659 crore, while the estimated loss as per the High-Level Committee constituted by the Ministry of Home Affairs was Rs.4,796 crores. This indicates the insufficiency of the SDRF to finance the losses and damages caused by the 2018 Kerala Floods. Hence, there is a need to examine the adequacy of insurance coverage by protecting all the critical infrastructure.

Cost of Climate Risk Insurance for protecting critical infrastructure:

The insurance premium rate for industrial properties and infrastructure is 0.35 per Rs.1000 for Natural Catastrophic risks. If we consider the expected value of property and critical infrastructure is around Rs.50,000 crore considering the current development of urbanisation and infrastructure development in the State. The cost of insurance premium for protecting the critical infrastructure would be around Rs.18 crore (Rs.50,000 crore * .35 per Rs.1000[7]).

Other sectors:

The climate risk insurance scheme can also be implemented in the secondary and tertiary sectors of the state such as micro, small and medium enterprises (MSME), self-employed business ventures, shops, restaurants and so on. The government could make provisions to

[7]The premium rate of 0.35 is the rate applicable to industry and infrastructure currently under catastrophic risk perils including flood, storm, inundation, and earthquake for zone 3 risk category. The estimation of the cost of the premium amount for covering the critical infrastructure is done only for the purpose of understanding. The actual premium rate may vary depending upon the type of property or industry, infrastructure, non-industrial risks, etc.

include all these sectors under this climate risk insurance to make it more effective and all-inclusive which would draw the larger economy and society into the network of liberal insurance programmes.

Conclusion and Recommendation

The committee feels that the state could adopt the Climate Risk Insurance model as the risk transfer mechanism. The state can use the disaster risk pool to finance insurance premiums for yellow, pink, and blue cardholders (option 1 of hybrid mode) which will **cost the government Rs. 15.44 crore for Rs. 100000 Sum Insured.** The amount of sum insured will be decided by the government and related agencies; accordingly, the premium amount will differ. For example, if the sum insured is Rs. 10 lakh then the premium rate may vary depending upon the value of the property, type of construction and risk exposure of the region, etc. Thus, insurance will reduce the direct burden on the government and facilitate the easy flow of the financing system. If required, reinsurance protection for the large risks can be opted by the State to mitigate the severe disaster occurring in the state.

According to the committee, a universal assurance model should be implemented with free coverage for yellow and pink cardholders and subsidised coverage for blue card households. **Full-cost mode applies to white cardholders.** It has been suggested that various risk mitigation initiatives at different levels - government, policy makers, insurers, reinsurers, society, corporate, etc., are required to achieve the desired level of stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Green Technology can be used as a risk mitigation measure to counter greenhouse effects, reduce emissions and allow ecosystems to adapt naturally to climate change. Disaster risk-sensitive planning and development will save lives and promote sustainable growth in the state.

Considering the impact of climate change, increasing incidence of natural catastrophic, and effect of pandemic in the state, suggested after considering last five-year average expenditure of Rs.720 crore may be allocated every year to the SDRF account which is way too less than the actual financial loss and damage incurred by the people and society. Till now, the only way to finance such natural catastrophic events is through SDRF, NDRF, and CMDRF. Even the financial assistance given by the government are only a tiny part of the loss and damage incurred by the individual. These financial assistances are neither sufficient to cover the government's liability nor the financial losses and damages of the people. Thus, the

requirement for an alternative disaster risk financing mechanism may be an immediate priority of the state government. However, vulnerability-linked relocation of households at risk should be pursued alongside for better, sustainable and more lasting protection. So also, 'disaster risk-sensitive' planning and development should be mainstreamed for lasting protection.

Chapter 3

Risk Financing Structure and Fund Raising

ToR: Develop a sustainable disaster risk financing structure after the evaluation of various sources of risk financing options and fund-raising methods for disaster risk protection in the state.

A state like Kerala which is a multi-hazard zone has experienced many disasters from floods to droughts, coastal erosion to soil piping, cyclones to heat waves and many more. For such a state, a sustained disaster risk financing structure is essential as well as inevitable. The impact of some disasters leads to huge losses and damage to the ecology, economy, and lives of living beings. So, Kerala being a state of the federal system and a democratic country like India requires a financial structure to finance such losses and damages incurred by disaster.

Kerala already has some of the sustainable disaster risk financing structures as mentioned in Chapter 1, which are SDRF, SDMF and CMDRF. Centrally, NDRF, NDMF and PM CARES are some of the funds used to finance disaster management in the country. The source of funding such as SDRF, NDRF, NDMF and SDMF gives power to both central and state governments to recommend provision of funds for disaster relief as per the Disaster Management Act. As the occurrence of disasters in the country, especially in the state of Kerala, is increasing every year, it is difficult to finance the losses and damage only through this financing structure. The assistance given to the beneficiaries is way too small compared to the losses incurred by them. Only a small amount of compensation is paid by the state government using these financial structures, and only for those items and norms suggested by the SDRF/NDRF. The exact value of the losses and damage is not estimated by the government for providing compensation or assistance to the beneficiaries. But they are estimated according to the norms and items assistance of SDRF/NDRF as revised every five years by the Ministry of Home Affairs as per the recommendation of the Finance Commission. Not even half of the loss and damage suffered by the victims of the disaster were compensated. In states like Kerala where 43% are below the poverty line and 60% are employed in the unorganised sector, the effect and impact of a natural disaster is devastating, even after it occurs. During such a situation it is essential to console and give hope to the people to survive. Thus, it is important to find a new risk transfer mechanism which will compensate sufficiently to help rejuvenate both the economy and its people, bring economic stability, and reduce the burden of the government.

Even the XVFC also suggested the insufficiency of resources provided by the SDRF and NDRF in many situations and mentioned other ways to mobilise funds. To quote:

The resources provided by the SDRF and NDRF would be insufficient in many situations, and both the Union and State Governments would be constrained to mobilise disaster funding through other sources like reconstruction bonds, contingent credit/standby facility with international financial institutions, crowdfunding platforms and corporate social responsibility. Developing these financial mechanisms and instruments ahead of a contingent situation would help governments identify and select more cost-effective options. We recommend that the Union and State Governments look at these mechanisms and instruments carefully and consider accessing them when they are faced with disasters. (XVFC, Page 253, Para 8.119)

The risk transfer mechanism that can be adopted by the government which provide more compensation than the present assistance does, is recommended by the committee in the previous chapter as Climate Risk Insurance. This mechanism cannot be financed by the above-mentioned financial structure as per the Disaster Management Act. A new and sustainable disaster risk financing is relevant. In this context, the Committee recognised the Natural Disaster Risk Pool (as mentioned in Chapter 2) as the sustainable Disaster Risk Financing and Insurance Framework (DRFIF) that can be introduced in the state. The Committee named this risk pool as the **State Disaster Risk Fund Pool (SDRFP)** because this will be the first risk pool that will be implemented by the state government in Kerala. The sources of funds in the pool (see Chapter 3) and the financing undertaken from it will be the decision of the state.

SDRFP as the financing structure in Kerala

The Committee suggests the development of a State Disaster Risk Fund Pool (SDRFP) as the sustainable disaster risk financing structure for Kerala State. The SDRFP will act as an independent risk pool which is accountable and utilized by the state government. This will be utilized for disaster management, overcoming climate change and sustainable development that is occurring in the state. It helps to overcome the present available procedures and difficulties in` availing funds for implementing the new risk transfer mechanisms from SDRF/NDRF as per the Disaster Management Act. The utilization of the SDRF/NDRF can be only taken as norms and items of assistance suggested by the Ministry of Home Affairs (MHA). Even so, this fund can only be used to those disasters which are identified as national disasters, state specific disasters, and notified disasters by the MHA. Thus, creating such a financing structure like a state disaster risk fund pool will help the state to take urgent independent decisions during disasters, and even

implement mitigation, preparedness and capacity building programmes that cannot be undertaken by the state using SDRF and SDMF.

As the present risk financing mechanisms are not sufficient to meet the requirements and cover the damages and losses incurred by individuals, society and even the government. By establishing a Disaster Risk Pool, a full-fledged social fund which has the flexibility to receive donations from government departments, Panchayat Raj Institutions, NGOs, corporate entities, individuals etc. This is to be developed as an Exclusive Self-Sufficient Disaster Risk Pool. The Risk Pool can be constituted as an Ex-ante Disaster Risk Pool. In addition, the unutilised fund, which was allocated for disaster relief, can ideally be parked under the ' Catastrophic Risk Pool'. The government should endeavour to clearly delineate the functions and activities under SDRFP and CMDRF. This will help with public communication and accountability.

Even the 15th Finance Commission suggested the implementation of alternative financing methods by both the Central government and state governments. The fund from this pool can also be used for financing the risk transfer mechanism recommended by the Committee i.e., the Insurance Disaster Scheme. The government implements this scheme then the financing part for indirect insurance for pink, yellow and blue cards is done through this pool. This will reduce the burden of financing directly by the State government. The SDRFP will become sustainable in the long run and allow flexible utilization of funds by the government. This also reduces the burden of the state in executing climate change risks.

Utilization of State Disaster Risk Fund Pool (SDRFP)

1) Financing any kind of risk transfer mechanism implemented by the state government.
2) Insurance programs, particularly the indirect insurance programme mentioned in Chapter 2.
3) Implementation of mitigation programmes like school safety projects, empowering communities to build resilience from the impact of future hazards etc.
4) Capacity building programmes with a long gestation period involve strengthening of physical, social, economic, and behavioural changes of the people.
5) For the assessment of geographical risk exposures, it is necessary to classify the regions based on the severity of vulnerability in the state.
6) Programmes for protecting the environment from pollution and other degradation through afforestation and other means.
7) Undertaking disaster risk-sensitive planning, advocacy work and camping programmes.

8) Sustainable development measures for effective disaster risk mitigation.
9) Conservation of forest, water, and living organisms in the state.
10) Subsidy measures to meet the demand for eco-friendly products.
11) Measure to restore the coastal plain from erosion.
12) Expenses and assistance for epidemic and pandemic relief measures in the state.
13) Implementation of advanced technologies including Artificial Intelligence and block chain technology for risk identification, pre & post disaster communications, and risk mitigation measures.
14) All other risk mitigation measures that cannot be implemented or executed using SDRF/NDRF.

Disaster Risk Pool Account (DRPA)

The funds collected for SDRFP will be deposited under the Disaster Risk Pool Account which will be an independent account. Apart from utilizing the resources for the above-mentioned utilization the fund deposited can be also used for investment, re-investment, and other purposes so that the interest and dividend can be attained, making it a self-financing account in the future. The Disaster Risk Pool Account should consist of an initial amount in it as a deposit which should be over and above the cost incurred by the state after implementing climate risk insurance. So that other mentioned utilisation of funds from this pool can be undertaken.

Sources of Funds as Identified by the Committee

1. Budgetary Allocation

As a pilot disaster risk financing structure implemented in the state, an initial amount of Rs. 200 crores should be allocated from budgetary allocation as part of the promotional activity. As the occurrence of disasters in the state is increasing each year, the financial burden of the state is also increasing. Financing this DRPA will reduce the contingent liabilities that the state government could otherwise have to bear. This also removes uncertainty about risk ownership which will be borne by the risk transfer mechanism implemented by using the finance from the DRPA. As many new projects and programmes can be implemented using the fund from DRPA for mitigation, preparedness, resilience and many other purposes mentioned earlier, an amount Rs. 50 crores on an annual basis from the same head of budgetary allocation can be allotted after the first year of implementation of DRPA. **In this context the committee suggests a one-time initial allocation of Rs. 200 crores from the budgetary allocation for promotional activities and after the first year of implementation, a year-wise allocation of Rs. 50 crores from the same head.**

2. LSG Allotment

According to the 6th State Finance Commission, the budget allocation of the state to the local self-government is based upon the devolution formulae. In this the general sector consists of five indicators of which ecological vulnerability with 10% weightage is one of those indicators. The ecological vulnerability is incorporated due to the increasing necessity in view of the floods of 2018 and 2019 and the de facto roles played by local governments. It is calculated by giving equal weightage to the following indicators.

(1) Flood plain area

(2) Length of coast

(3) Disaster prone area.

The development fund for the general sector through budget 2021-22 is Rs. 3363.75 crores of which Rs. 336.375 crores are distributed to local governments based on ecological vulnerability. This fund is first divided among rural local governments, municipalities, and corporations. Each local government is sanctioned with a budgetary fund based on the weightage of the indicators. This amount is distributed for the betterment of the LSG from ecological vulnerability. A part of it can be allocated to the DRP account. The committee suggests 2% of the total amount of Rs. 336.38 crore be allocated to the DRP account. Thus, a total amount of Rs. 6.73 crore should be allocated to this account in 2021-22. There are two options for the allocation of the fund:

a) Fund directly allocated by the State government to the DRP account.
b) The fund is allocated by each local self-government according to their share of funds for ecological vulnerability so that a total amount of around Rs.7 crore is deposited.

The second option gives the LSG a direct influence and an ownership right to the fund. The reason for contributing to the risk pool is that the share of funds is calculated only considering the three indicators of flood plain area, length of coast and disaster-prone area. As the occurrence of disasters in the state has increased and the effect and impact of them have also changed, the share of distribution is not efficiently distributed. Some of the areas with high ecological vulnerability were allotted only a small part of the fund which might be insufficient for the improvement of ecology and undertaking mitigation measures by LSG. As the risk pool fund can be utilised for mitigation, capacity building and ecological improvement. This gives the LSG better financial support and easy access to funds to undertake any project or programme for ecological improvement. **In this context, the committee proposes that an annual allocation of 2% of the LSG allotment for ecological vulnerability should go to DRPA.**

3. A Disaster response allotment on land revenue and stamp duty and registration

A portion of the government levy on land can be explicitly earmarked for the fund. We recommend setting aside 1% of total revenue from land revenue, stamp duty, and registration for the fund.

The existing land tax rates are very low. The existing land tax in the Municipal areas is only Rs. 2.02 per Cent or Rs. 5 per Are. In the corporation area the existing land tax rate is only Rs. 10 per Are (or Rs. 4.04 per Cent). Hence a person having 4 Cents of land (1.62 Are) has to pay only Rs. 16.12 as land revenue in a year. The government may consider increasing land tax rates. The flow to the fund will also proportionally increase as land tax rates increase.

The stamp duty rate at present, as per the last revision in 2014-15, is 8% irrespective of the location. In addition, there is a 2% registration fee. The rates of stamp duty and registration are some of the highest in the country. Even though fair value is lower than market value, Kerala's tax collection from stamp duty and registration has been stagnant due to demonetisation, devastating floods, and now the COVID19 pandemic. Hence, there is no room for any immediate increase in the rates. But the government can allocate 1% of the total collection of stamp duty and registration fees to the fund.

For the present financial year 2021-22, **the committee suggests 1% of the present revenue from land tax and stamp duty and registration be allocated to the DRPA**. Table 3.1 indicates the revenue from the land revenue and stamp duty and registration. An estimated amount of Rs. 4.40 crores from land revenue and Rs. 43.06 crore from stamp duty and registration can be allocated for the DRPA. Thus**, a total of around Rs. 47 crore can be allocated to the DRPA in the financial year 2021-22.**

Table 3.1. Tax revenue from land revenue and stamp duty and registration

Financial year	Land revenue (in crore)	Stamp duty and registration (in crore)
2018-19	202.78	3693.17
2019-20	332.42	3615.01
2020-21 (Revised estimate)	440	3061.98
2021-22 (Budget estimate)	440	4306.24

4. Green Tax/Carbon Tax on Motor Vehicles

The department of motor vehicle has already implemented a green tax/carbon tax to reduce carbon emission thereby increasing the consumption of green vehicles or environmentally friendly vehicles. In the past years of 2018, 2019 and 2020, an amount of Rs. 470 lakhs, Rs. 639 lakhs and Rs. 354 lakhs were the revenue from green tax on vehicles in the state. Considering the average revenue from green tax for these years, there is a potential of Rs. 488 lakhs for 2021. In 2021, till June 15th, a revenue of Rs. 148 lakhs were collected under this tax. And a potential of Rs. 340 lakhs can be collected in the rest of the months. **The committee suggests that the whole amount of Rs 4.88 crore collected from this green tax be allocated to the risk pool account**.

Presently the green tax is collected from the vehicle after the completion of the date of its registration. Motor vehicles are classified into different classes and the green tax levied also differs accordingly. This is presented in Table 3.2.

Table 3.2. Rate of Green Tax levied on Vehicles in Kerala.

Sl. No.	Class and Age of Vehicle	Rate of Green Tax (in Rs.)	Incidence of Levy
1	Non-Transport Vehicles having four or more wheels and completed 15 years from the date of its registration	400 for every five years	At the time of renewal of registration
2	Light Transport Vehicles having four or more wheels and have completed 10 years from the date of its registration	200 for every year	At the time of renewal of fitness certificate
3	Medium Transport Vehicles which have completed 10 years from the date of its registration	300 for every year	At the time of renewal of fitness certificate
4	Heavy Transport Vehicles which have completed 10 years from the date of its registration	400 for every year	At the time of renewal of fitness certificate

As no green tax or carbon tax is levied during the date of vehicle registration which is important and essential so that the tendency of the consumer might change their demand for eco-friendly or green vehicles. **In this context, the committee proposes to levy a green tax or carbon tax on vehicles which are not eco-friendly at the time of their registration.** Table 3.3 indicates the rate of green tax imposed on non-eco-friendly vehicles at the time of their registration and the potential revenue collected from different classes of vehicles. The average consumption of vehicles in the different classes is considered from

financial year 2017-18 onwards to arrive at the potential revenue. As half of the registration of vehicles in the state is undertaken for two wheelers, a separate classification is done. From this a revenue of Rs. 35.02 crore can be collected by the government. In this context, the committee proposes to deposit this amount in the DRPA. Thus, **a total green tax amount of around Rs 40 crore (Rs 4.88 crore + Rs 35.02 crore) from vehicles can be incorporated in the DRPA.**

Table 3.3. Proposed implementation of green tax during registration of non-green vehicles.

Sl. No.	Class	Rate of Green Tax at the date of Registration (in Rupees)	Potential Revenue (Rs in crores)
1	Heavy Vehicle	1000	0.45
2	Light Vehicle	750	17.83
3	Medium Vehicle	500	0.19
4	Three-Wheeler	300	0.78
5	Two-Wheeler	250	15.76
	Total		**35.02**

5. Disaster response on property tax

The state government is collecting only 0.04 percent of Gross State Domestic Product (GSDP) as property tax during 2018-19 in urban local governments, as per a report submitted by GIFT on the budget proposal for 2021-22. As per the estimate of the World Bank study for XVFC, the property tax collection in India is around 0 .2 percent of GDP in 2016. Several factors lead to low property tax revenue in India: undervaluation, incomplete registers, policy inadequacy and ineffective administration. Another big challenge for property tax administration is the lack of accurate property tax records by urban local bodies (Main Report XVFC, Page 184 and 185).

As per the recommendation of XVFC, the property tax collection of urban LGs in Kerala would have been raised to Rs. 1563.31 crores. The difference between the actual and estimated collections is Rs.1255 crores. As Kerala is a state with high land value and there is the existence of around 90 percent of pucca houses, there would be immense potential to raise the collection of property tax. If the LGs collected property tax to the tune of 3 per cent of GSDP (as in the case of developed countries), then the collection would have become Rs. 23445 crores. This would improve the fiscal space of the state as it could reduce the plan transfers to LGs. The LGs can meet some of the developmental expenditure from their own resources. As a result, the committee suggests increasing the property tax gradually to around 3 percent GSDP.

As per the present tax system the property tax received by the LGs is very small. The table 3.4 shows the year-wise revenue from property tax.

Table 3.4. Tax on property (in crore)

Year	Property tax (Rs. in crore)
2015-16	537.88
2016-17	728.83
2017-18	906.88
2018-19	879.19
2019-20	840.12

The estimated revenue from property tax in 2021-22 would be around Rs. 1000 crores, by considering the growth of collection of previous years**. The committee proposes the allocation of 1% of presently collected revenue to the DRPA i.e., Rs. 10 crores.** House damage is one of the major damages that occurred due to the disaster in Kerala. The compensation given for this damage is less compared to the damage and loss than fell on the individual due to these catastrophes. Even the funds allotted as assistance from SDRF/NDRF for house damage is trivial. The liability of the state government in flood 2018 due to its severity and damage to a large number of houses forced it to compensate an amount more than the assistance mentioned in the SDRF/NDRF norms i.e., more than Rs. 4.9 lakhs per house. This extra amount paid for as compensation was taken from CMDRF. The compensation is only given for house damage. The assistance for the loss of assets other than house is not compensated. The Natural Disaster Risk Pool can be utilised for compensating the fully damaged houses by providing basic necessary commodities and assets required by a household in Kerala.

In this context the committee recommends an additional tax on properties be levied by the LSGs from which 0.5% can be allocated to the DRPA in the coming financial years.

6. Special Cess on Gold jewellery

At present, flood cess on gold of 1% of its distribution value is levied by the state. This cess was implemented by the Kerala government for two years from August 2019 onwards till July 2021. Table 3.5 shows the revenue from this cess till 2020-21.

Table 3.5. Kerala Flood Cess from Gold.

Year	Amount (in crore)
2019-20 (From August onwards)	43.01
2020-21	70.52

Being a consumerist state like Kerala, where the consumption of gold is much higher compared to all other states in India. According to the 2011-12 NSSO report on Household Consumption of Various Goods and Services in India, the monthly per-capita quantity of gold consumption of households per 1000 is 139 in rural in the sample of 412 and 119 in urban in sample 235. This indicates a huge amount of consumption. The tax revenue received by the government is comparatively less, as shown in Table 3.5, compared to the consumption increase that might have occurred in the state. For instance, tax compliance can be increased compared to the monthly per- capita expenditure on gold ornaments of Rs. 208.55 in rural areas and Rs. 189.95 in urban areas, according to the NSSO report of 2011-12. This indicates that the annual expenditure on gold of the total population is Rs. 8320.68 crore as per the census of 2011. If 0.5% of the special cess is levied, then a potential of around Rs. 42 crore of revenue can be collected. This accounts for little of the revenue that can be achieved from the above cess on gold.

The committee suggests the implementation of a special cess on gold jewellery, which however is to be negotiated with the GST Council. By implementing this special cess on gold with increasing cess compliance, around Rs. 42 crore could be mobilised. **The committee proposes to allocate this amount to the DRPA.**

7. Tax on Vacant Houses/Flats

A new tax could be introduced on vacant houses in the state. As per the census 2011, about 11,89,144 houses (10.6%) remain vacant in the state. The same suggestion was also mentioned in the Kerala Post Disaster Needs Assessment (PDNA, 2018). To quote:

"A new tax on vacant houses could be levied by local self- governments. There are about 1.2 million vacant houses and flats in Kerala. An additional tax of INR 2 per square feet per year would yield tax revenue of INR 220 crore (INR 2 x 1000 square feet x 1.1million). Several European countries have such taxes. In addition to raising the tax revenue, this step would bring 1.2 million houses into the rental market, reducing the rentals and making Kerala an attractive destination for the IT sector, compared to Bangalore or Chennai." (Page 60, PDNA)

The committee suggests channelling the new tax on vacant houses of Rs. 220 crore (approximately) to the DRPA. In addition to the above-mentioned advantages, this also discourages the over-extraction of natural resources for the building of palatial houses and flats.

Table 3.6. Resource mobilisation for the proposed Disaster Risk Pool Account		
Source of fund	**Initial Amount (Rs in crore) in 2021-22**	**Modes of Mobilization And Allocation 2021-22**
Budgetary Allocation on Promotion Activity	200	As a one-time allocation during implementation
Special Cess on Gold	42	0.5% special cess on gold jewellery based on distribution price
Land revenue and stamp duty and registration	47	1% of the current estimated tax revenue
Property tax	10	1% of the current estimated tax revenue
Green tax on vehicle	40	Total tax revenue that will be collected after implementing initial green tax.
LSG budget allocation	7	2% of the allocation of Rs 336 crore for ecological vulnerability.
Tax on vacant houses	220	Potential tax revenue
Total	**566**	

Other Sources of Funding

- **Demand a portion of the cess collection from the Central government.** In 2011-12, the total percentage of cess and surcharge as a percentage of gross tax revenues was 10.4 per cent. This increased to 19.9 per cent in 2020-21. A portion of this amount can be disbursed to states for meeting disaster relief. This could be done by the state government requesting the Centre.
- **Borrowing from international financial institutions**: Like the World Bank and Asian Development Bank to support recovery and reconstruction with the permission of the central government within the enhanced borrowing limit of FRBM restrictions.
- **Corporate Social Responsibility (CSR) funds**: It would also be possible to channel a portion of CSR funds for disaster risk financing. The State can negotiate with the Centre to make the necessary amendments in the Indian Companies Act, 2013.
- **Financing by the apex banks** and institutions.
- **CAT Bonds** as an alternative financing mechanism for mitigation of large catastrophic risks in the State, a possibility that has yet to be analysed.

Conclusion and Recommendations

There are already a number of financing mechanisms for disaster risk in the state. But a new risk transfer mechanism that is not currently available in the state cannot be funded using current financial structures. **In this context, the committee proposes the development of a State Disaster Risk Fund Pool as a new disaster risk financial structure in the State of Kerala.** The SDRFP is a financial structure from which funds can be utilised for climate change programmes and policies as the State government may wish. Currently available fund structure, SDRF is more of a relief measure and our suggestion is to create a state-level disaster risk pool with multiple layers of protection as a risk transfer mechanism. **The committee suggests that the implementation of the climate disaster insurance be undertaken using funds from SDRFP. The funds collected for SDRFP can be deposited in the Disaster Risk Pool Account (DRPA) which will be a newly created account solely for the above purpose. The committee is of the view that a minimum of around Rs. 566 crore can be mobilised and allocated for DRPA using the above-mentioned means. Other sources of funds can also be mobilised by the government as per its discretion.** However, the Committee feels a larger committee should be formed by the state to study the risk financing system, as well as to examine the implications in detail of risk transfer mechanisms including insurance.

Chapter 4
Supervisory and Regulatory Guidelines

ToR: Suggest the Necessary Supervisory and Regulatory Guidelines for the Effective Implementation of Disaster Risk Financing Strategy

Increasing frequency of high severity Natural catastrophic events, particularly floods, cyclones, droughts, landslides, lightning, forest fires, etc., due to climate change, rising sea levels, threaten sustainable development and resilience, and impair the socio-economic development of the region. The burden of climate change impact is not evenly distributed across the regions. States like Kerala have been highly exposed to catastrophic risks due to differing exposures, vulnerabilities and coping capabilities of the government and the community at large. Increasing vulnerability to catastrophic events in the state, climate risk insurance premium rate will also increase, and the availability of insurance coverage will be reduced as insurers will not be interested in covering the vulnerable section of the population as the cost of operation will be higher. Further, it would also affect the affordability of people and result in low insurance penetration and limited coverage. As a result, the financial burden of the government on financial risk reduction & management would increase and the cost of protecting the vulnerable section of the population would also go up which would increase the insurance protection gap in the State.

Hence, it is important for the regulators and government to keep the insurance cost reasonable despite the increased frequency of natural catastrophic events. Moreover, existing traditional risk mitigation measures may not be effective in addressing the increased catastrophic events. New types of risk mitigation measures and risk transfer mechanisms like catastrophic risk pools, parametric insurance, alternative risk transfer (ART) through capital markets, needs to be looked into as possible risk mitigation solutions. In light of these changes, this chapter suggests what changes need to be made in the existing legal and regulatory measures and the new guidelines to be introduced in the State.

Supervisory and Regulatory Body

A supervisory and regulatory body is mandatory for the proper functioning and operation of the funds of the State Disaster Risk Fund Pool (SDRFP). In this context the Committee suggests the existing authorities looking into the matter of disaster related activities may also take care of the SDRFPC. Kerala State Disaster Management Authority is a statutory body under the Disaster Management Act, 2005 handling disaster management. This authority is

chaired by the Hon'ble Chief Minister of the State. It helps in the coordination and implementation of disaster related activities. KSDMA played a critical role during the last few disasters, particularly the floods of 2018 and 2019, the Ockhi cyclone of 2017 and the Tauktae cyclone of 2021.

Thus, KSDMA should regulate and supervise the proper utilization of the finance for matters mentioned in Chapter 3 which cannot be undertaken till now due to administrative and legal constraints faced by the present risk financing structure. The institutional capacity building of KSDMA is required to regulate the above and a separate division is required to be constituted with more resources to solely look into the working matters of SDRFP. The Committee suggests the creation of an Implementing Cell in KSDMA to solely handle the working matters related to SDRFP and DRPA including Climate Risk Insurance**.** This will bring more autonomy, flexibility, and operation efficiency to KSDMA.

It is also possible to consider the Kerala State Insurance Department (KSID) as a nodal agency for the climate risk insurance scheme. The KSID is a Commercial Department doing both General Insurance Business and Life Insurance business. It is empowered to underwrite general insurance on any subject in which the State government has a substantial financial interest. For the implementation of the climate risk insurance scheme, the department should work in collaboration with the KSDMA, DDMAs and LSGs. The committee is also of the opinion that strengthening the institutional capacity and efficiency of KSID for the implementation of the mentioned scheme. Bringing the related policy issues together under one department and making them capable of managing related policies would strengthen state governance. This is also beneficial for the state as the financial circulation of the fund occurs inside the state rather than going out of the system. The KSID can also explore the possibility of a self-insurance model - a kind of self-insurance by the government - for mitigating the losses (around Rs. 4000 crore) arising from small and medium disasters. We do not rule out the possibility of forming a special purpose vehicle. At a later stage, the KSDMA/KSID can find a separate agency to implement the related schemes including the risk insurance scheme, if required.

Guidelines for the Implementation of Disaster Risk Financing Strategy

The following are the guidelines for the effective implementation of disaster risk financing strategy in the state of Kerala.

1. As the insurance penetration of the state is quite low and the insurance awareness of the people is also expected to be lower. The Government and Regulator i.e., KSDMA should

organize a Climate Change and Risk Protection Awareness among all sections of the population including government offices, PSU & Private Organizations, MSME, NGOs & SHGs in the State. Increased awareness would make people realize the importance of disaster risk management and encourage them to go for risk mitigation measures and build community resilience. Accordingly, the importance of building community resilience, school education and public awareness about DRR need to be highlighted in legislative frameworks.

2. Policy initiatives through LSGDs to bring more households under the insurance net, including businesses or industrial units, which are not normally covered through this climate risk insurance.
3. The regulators (RBI, SEBI, IRDAI) can make it mandatory for the insurers, reinsurers and financial institutions, and intermediaries in the country to spend a certain percentage of their revenue on climate change/DRR awareness creation, education and special campaigns annually. Companies can be encouraged to participate in organizing such climate change awareness campaigns and adequate provisions for such climate risk reduction activities, can be made out of their Corporate Social Responsibility (CSR) funds.
4. The PSU and private organizations can also contribute towards the State Disaster Risk Fund Pool which would help finance the premiums of the priority or BPL categories and also the APL with subsidy category population in protecting their lives, property and assets from natural catastrophic risks.
5. Continuously rising NATCAT events would increase the insurance premium and reduce the available insurance coverage in the State/Country. Hence, it is necessary that the regulator should ensure that the premium rate for Climate Risks/NATCAT Risks should be kept under the nominal rate in order to make it affordable for the vulnerable section of the population.
6. Climate Risk Insurance should be made mandatory for the regions which are vulnerable to natural catastrophic risks, and affordable coverage should be available for the priority or BPL category and non-priority subsidiary people who live in the coastal regions or in the low-lying areas which are vulnerable to floods and inundation.
7. The government should encourage community level Disaster Risk Reduction activities. Allocate funding to build a Disaster Risk Pool for Community level DRR activities and enable the involvement of communities, housing societies, other civil/welfare organizations including NGOs, SHGs, Samitis, and the private sector in DRR activities to move towards building community level climate resilience.

8. The government should ensure that development planning takes into account cost-benefit analysis and local variability in hazard profiles, exposure and vulnerability. Ensure full implementation of building codes, land use regulations and other legal incentives.
9. The Insurance regulator IRDAI has recently introduced a Standard Property Insurance covering all kinds of properties – residential, commercial, offices, industrial buildings, critical infrastructures through a comprehensive peril including all-natural catastrophic perils, fire, lightning, explosions, forest fire, and terrorism, etc., at a very nominal rate of premium. Such insurance can be considered for protecting the Priority/BPL/APL subsidiary, or the economically vulnerable population in the state. The Central and State can offer premium subsidies for such insurance coverage for the economically vulnerable population.
10. The Insurance Regulatory Authority (IRDAI) should also permit the state government to directly secure reinsurance support/protection in case the state government forms a Catastrophic Risk Pool. This would enable the State level Risk Pool to obtain direct reinsurance support in the form of Excess of Loss Reinsurance protecting the losses beyond their capacity. This would enhance the risk capacity of the pools to expand to cover a large number of people, properties and critical infrastructure in the State.
11. Governments and Regulators should incentivize the general public for their contribution toward risk reduction and risk management activities. Insurance companies should offer discounts in the premiums for any such activities resulting on disaster risk reduction and management. This would encourage society to build community level climate risk resilience.
12. Government and Regulators should make it mandatory for PSUs and private companies to invest a certain percentage of their investments in stocks/companies associated with projects favouring the green revolution reducing carbon emissions or climate risk reduction and risk management activities.
13. Regulators should encourage companies to introduce Parametric Insurance solutions for climate risk reduction and management, and also ensure that the premium charged under the parametric insurance is reasonable and affordable for people.
14. The state can adopt the hybrid risk pool model wherein the losses up to Rs.4000 crore can be directly financed by the risk pool account, and the losses beyond Rs.4000 crore up to Rs.30,000 crore, can be protected with Reinsurance support which can help in mitigating moderate and large catastrophic risks in the state.
15. The state can also examine the option of CAT-Bonds, in lieu of reinsurance, as an alternative risk financing mechanism for mitigating the state specific large natural catastrophic risks; CAT-Bonds are being used in the developed markets to protect large catastrophic events.

Conclusion and Recommendations

There has been a strong link between increasing Nat Cat events and the climate change globally. Kerala state's topography and agro-climatic conditions make it highly vulnerable to natural catastrophic risks. Combating climate change and disaster risks requires concerted effort, legal and regulatory changes, and planning by all the key stakeholders i.e., government and policy makers, community, organizations, and financial institutions, etc. More importantly, all these policy changes, legal and regulatory guidelines that integrate DRR, climate change adaptation and development planning into one coherent approach, are likely to result in better risk governance. In this context, the Committee suggests a supervisory and regulating body to handle the matters related to SDRFP, and DRPA including insurance scheme by creating a separate implementing cell in KSDMA. The KSID may also be able to implement the Climate Risk Insurance Scheme as suggested in the second chapter, by making use of the framework mentioned in designing and formulating it. In the later stage, the KSDMA/KSID can find a separate agency for implementing the related schemes.

The Committee believes in improving climate literacy and promoting decentralized action for adaptation and mitigation as these are critical for building climate change resilience. The Committee is of the opinion that every local government should have a climate change adaptation plan and private individuals should be educated about the climate footprint of their personal actions. It has been suggested that various risk mitigation initiatives at different levels - government, policy makers, insurers, reinsurers, society, corporate, etc., are required to achieve the desired level of stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Green technologies can be used as risk mitigation measures to reduce greenhouse emissions, prevent further damage and allow ecosystems to adapt naturally to climate change.

Chapter 5

Technological Structure and Effective Delivery

ToR: Suggest measures to a comprehensive disaster risk financing framework with necessary administrative and technological structures for effectively delivery in the short and long terms.

In the state, several disaster risk mechanisms exist, as discussed in Chapters 1, 2 & 3. It is, however, undertaken via ex-post mechanisms (such as budget reallocations) rather than ex-ante mechanisms (such as insurance of public assets, market-based risk transfer). The State finances its disaster risk interventions principally through its own budget, resources provided by the Union government, external financing institutions, and voluntary contributions. To reduce the fiscal burden of disasters on the State, innovative, sustainable financing options for disaster risk management are necessary. *The Committee, therefore, suggests that the State Disaster Risk Fund Pool (SDRFP) be a key component of the Disaster Risk Financing and Insurance Framework (DRFIF).* The SDRFP can be used to fund climate change-related activities and sustainable development programmes, as well as innovative climate risk insurance programs. The initial resource base in this pool is around Rs. 566 crore. As described in sections below, the government requires an administrative design, planning and technological structure for the above-mentioned programmes, SDRFP and DRPA.

Administrative Structure and Planning

The Disaster Management Act, 2005 (Central Act 53 of 2005) mandates the establishment of the State Disaster Management Authority, the State Executive Committee, and District Disaster Management Authorities. Accordingly, the Government of Kerala framed the Kerala State Disaster Management Rules, 2007 vide Kerala Extraordinary Gazette S.R.O No. 201/2007 dated 1st March 2007 (amendments vide S.R.O No. 583/2013 dated 17th July 2013 and S.R.O. No. 263/2016 dated 2nd March 2016) and notified the State Disaster Management Authority, the State Executive Committee, and the District Disaster Management Authorities.

In the previous chapter, the Committee proposed that KSDMA regulate the State Disaster Risk Fund Pool and Disaster Risk Pool Account. To implement the SDRFP and DRPA, a separate implementing cell will be created. This will give the authority more autonomy, flexibility, and operational efficiency. Additionally, it will facilitate rapid decision-making. As

a result, the Committee believes in strengthening the existing institutional system - the KSDMA, the DDMAs, and the Local Sector Groups - rather than creating a new agency or authority.

As part of this, the KSDMA should advance its organizational capacity, which would involve financial, technical, and adaptive capabilities. The advancement of financial capacity and capability would imply strengthening its financial resources and maximising its financial autonomy. The technical capacities should consist of advanced digital and innovative interventions in risk assessments and delivery of risk compensation measures, including the insurance we have suggested, ability to respond to calamities, enrichment of expertise, collective skill development and so on. The KSDMA should also improve its adaptive capacities through collaborative efforts with the NDMA and other stakeholders including non-governmental organisation, and the KSDMA should be in a position to make use of the Disaster Risk Financing and Insurance Framework (DRFIF) with at least three critical features/components as follows:

1. Risk Identification and Assessment: The first critical component as identified by the Committee, within the context of existing literature (See OECD 2015) is the proper risk identification and measurement of damage due to natural and other kinds of hazards. The first step of assessing the damage is presently left to the LSGs and the DDMAs as they have first-hand information and familiarity with the region and the households affected and the consequences thereon. The Committee suggests LSGs and DDMAs should jointly identify and assess the impact of hazards and the costs required for recovery, including compensation for households. They should jointly feed the KSDMA as they have data and first-hand information. This involves strengthening the database of households, communities, and regions regularly updated at the local level. This is particularly so in the short run.
2. Risk Governance and Delivery: Once the LSGs-DDMA combined force identifies the risk and its actual impact, it is important to measure the scale of the actual risks in a particular region or a particular household. Risks thus identified and measured could be combined and aggregated both in terms of the impact and compensation required. This should be done at the level of KSDMA in collaboration with the LSGs-DDMAs. In the second phase, the assessment thus made could be verified by the experts of the KSDMA in association with the LSGs and the KSID. This will have a space for discussion for a consensus regarding the nature of the damage and the amount to be compensated as per the guidelines.

3. Risk Mitigation and Resilient Strategies: In the context of climate change, which is an irrefutable reality, the Committee feels that the KSDMA should give more importance to developing and implementing risk-minimizing strategies and techniques that would be a highly complex process. The Committee would suggest a drastic change in the planning process in the state to address the risk mitigation strategies as it is directly related to the developmental planning of the state.

The Kerala State Insurance Department (KSID) could be the nodal agency of running the climate insurance programme. As mentioned earlier, the KSID is a Commercial Department doing both General Insurance Business and Life Insurance business. As it is empowered to underwrite General Insurance of any subject in which the State Government has substantial financial interest, the suggested insurance scheme can also be brought under the KSID which would obviously require its capacity building. The department should work in collaboration with the KSDMA, DDMAs and LSGs. The DDMAs, Revenue department, and LSG institutions which would in turn help develop a decentralised administrative system for climate risk insurance programmes. The KSDMA can continue to play a crucial role in supervising and regulating the scheme for effective implementation. This will help in the easy dissemination of information and implementation of rapid action thereby reducing the effect of the damage and losses due to natural catastrophes. A robust and authentic database of people and property at risk of various kinds of weather events will be a prerequisite for operating risk transfer mechanisms.

Eventually in the long run, the KSDMA/KSID could seek the help of a third party/insurance company to assess the impact of hazardous risks and determine the steps to be undertaken in the form of insurance, compensation and so on. The possibility of setting up a special purpose vehicle is certainly not excluded. In the long run, it is not sufficient to assess the loss of assets but also to measure the cost of recovery, the amount needed to revive livelihoods, reconstruct and rebuild the damaged regions, with a new vision with the help of state of the art technology which would call for more technical and financial requirements. This is also part of the governance of risks in such a way that the parties involved will be compensated for their loss, mainly in the form of financial relief, but the other forms of relief, such as rehabilitation, should also be given equal weightage.

As the Committee mentioned earlier in Chapter 2, poor households are more often affected by natural hazards. Global studies also reveal the same. Hence planning development should take into account the economic, ecological, and spatial implications of planning, broadly,

"ecospatial planning" in which *eco* means economics and ecological and *spatial,* the relations between place and space and the inherent power relations (see Raman 2020). It is suggested that if the government works out comprehensive ecospatial planning for different time periods for various ecologically sensitive regions such as coastal areas, high ranges, and river basins, the risk mitigation measures would be more effective and help achieve sustainable development goals. It is important to note that designing "ecospatial" regional planning for each of the vulnerable regions – which would also include disaster risk-sensitive/informed strategies and planning - is not just to do with land resources, topography, or even humans alone, but it is also equally pertinent to the long-term sustainability of society-nature relations. It is critical to pursue vulnerability-linked relocation of households at risk in parallel to achieve better, more lasting and sustainable protection. Hence, wider policy measures including "room for river", afforestation, scientific management of dam, depopulation of hazardous and vulnerable regions, spatial relocation, construction of disaster resilient buildings and houses, promotion of solar energy, holistic empowerment of the marginalised social sections and so on would become critical components. The Committee feels that there should be comprehensive *ecospatial planning* for the entire state; this exercise could begin with a focus on vulnerable communities and regions.

Keeping with the existing autonomy of the LSGs, their involvement in disaster management and ecological improvement should be widened. For which their capability and capacity should be increased within the system. Thus, the Committee suggests the capitalization of the capability and capacity of LSGs and DDMAs utilizing SDRFP, SDRF, and the State Plan Fund. Diverse financial mechanisms for risk mitigation should also be selected based on the frequency and impact of the disasters due to climate change. In the risk financing mechanism, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) may be involved in that the funds available for social security can be synergistically used for the activities of mitigating disaster risk without compromising the schemes' objectives.

Role of Technology in Disaster Risk Mitigation:

Rising disaster risk exposure, due to climate change, ecological distress, and urbanisation, poses multiple challenges for disaster risk mitigation. The holistic approach of risk management focuses on mitigation, loss control & loss reduction, efficient execution of rescue operations during the calamity and post-disaster recovery and rebuilding of the damaged properties and critical infrastructure. Each of these operations require authentic

and timely data to predict well in advance as well as accurate assessment of loss or damage. Data driven approaches to Disaster Management entails state of the art data collection, processing and dissemination techniques which are now available freely due to technological innovations. The latest technological applications like Geographic information system (GIS), Remote sensing & satellite images, connected devices, ground sensors, Geo-tagged smart phone applications, Drones, and accurate weather data processing have emerged as valuable tools to public safety and disaster management. Most of the disasters have occurred due to some kind of extreme weather events. Weather models have improved over the years in forecasting ahead of time the events that could occur and sending alerts to the public ahead of time based on the location information and sensors available in the region. Other data collection techniques such as dense networks of earth observation sensors provide hitherto unprecedented opportunities for stakeholders to be better informed. A combination of these approaches provides a decision-making tool for ensuring rescue, recovery, and resilience to help the public become fully protected, connected during extreme weather events or any disasters, and aware of the situation. Better data leads to proactive management, informed mitigation and lower human and economic costs.

Application of Geographic Information System (GIS) in Disaster Risk Management

With the help of Remote sensing and satellite images, the current level of GIS applications has improved to predict certain disasters like cyclones, floods, droughts, landslides, etc., fairly in advance up to 96 hours before the occurrence of the catastrophic events. These techniques can be used for early warning communications and also for comprehensive hazard mapping of the disaster risks enabling the government authorities to take faster decisions and preventive measures. The web mapping systems like Google maps, Bing maps, Open Street Maps, along with the usage of weather and Big Data, can help in disaster risk reduction largely. There are a number of open-source hydrological analytical tools like SOBEK, IDSS, OASIS[8], etc. which use multiple modules to estimate the flow, inundation depth, duration and frequency of the flood is modelled using geo-data inputs covering roughness of the weather, land use, surface and agro-climatic information. These tools can be used for flood forecasting, optimization of drainage systems, control of irrigation systems, river morphology, surface water quality, etc. The OASIS loss modelling suite can be used for disaster hazard mapping as well as loss assessment.

[8]SOBEK is a flood modelling suite from Deltares, IDSS – InfosysData Services suite, OASIS – Catastrophic loss modelling tool.

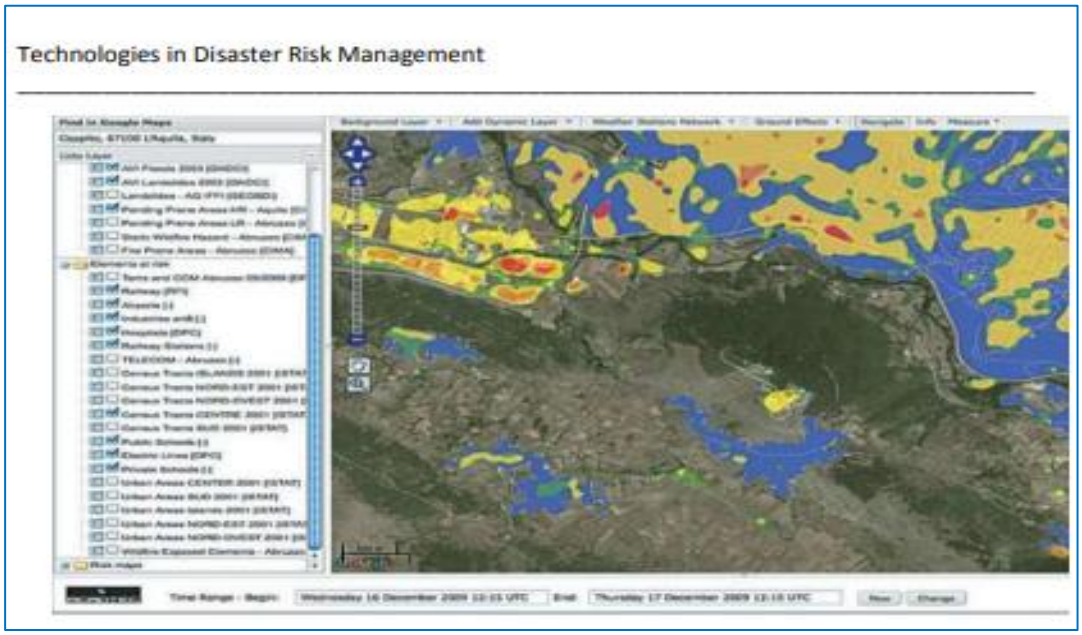


Figure 5.1. A flood forecasting tool that utilizes Google maps

Source:

http://63.175.159.26/erc/lib/pdf/Revised%20Dewetra%20Guide_June%202012.pdf

Under the United Nations Development Programme (UNDP), the Caribbean Institute for Meteorology and Hydrology (CIMH), developed DEWETRA platform (van Westen et al., 2020), a real-time data and information integration system for hydrometeorological risk forecasting, environmental monitoring and disaster risk mitigation. This platform uses multi-layer information from satellite, weather sensors, Google maps, Meteorological radars, automatic weather stations, etc., and provides real time weather/flood forecast information. This platform can be used for vulnerability/hazard risk mapping, flood/landslide/wildfire risk assessment & forecast.

Early Warning System (EWS):

These multi-hazard analysis tools can effectively be used for a timely early warning system which is an important risk prevention or mitigation program for the State government. Effective Early Warning System requires a simple and clear communication system targeting the vulnerable people to be shifted to the safe areas in quick time. Necessary disaster risk information which is more accurate and reliable needs to be available before the disaster strikes, which can help in timely risk response and mitigation.

The following heterogeneous network architecture which uses satellite network, Wi-Fi, and mobile communications, connecting the different layers of disaster risk management

authorities, armed forces, community/slum managers and the affected areas on a real time basis. This network provides early warning for cyclones from 24 hours to 96 hours lead time targeting slum dwellers in Korail, Dhaka.

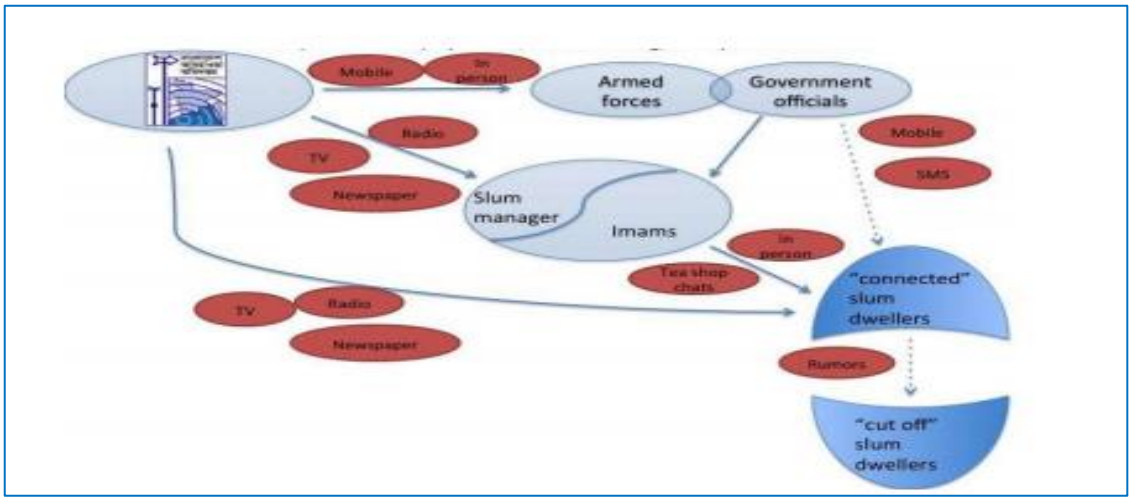


Figure 5.2. Early Warning system for cyclones, using simple mobile communication networks.

The wireless sensor network systems can be used for monitoring the floods, cyclones, landslides, droughts, etc. (Figure 5.2). An integrated wireless communication system using radio, mobile applications, internet, Google maps, and social media (Twitter and Facebook) can effectively be used for the early warning as well as the post-disaster response and recovery activities.

Figure 5.3 shows the use of smart phone-based applications with geo-tagging facilities connected with wireless sensors can be used to identify the vulnerable areas for landslides in the state of Kerala.

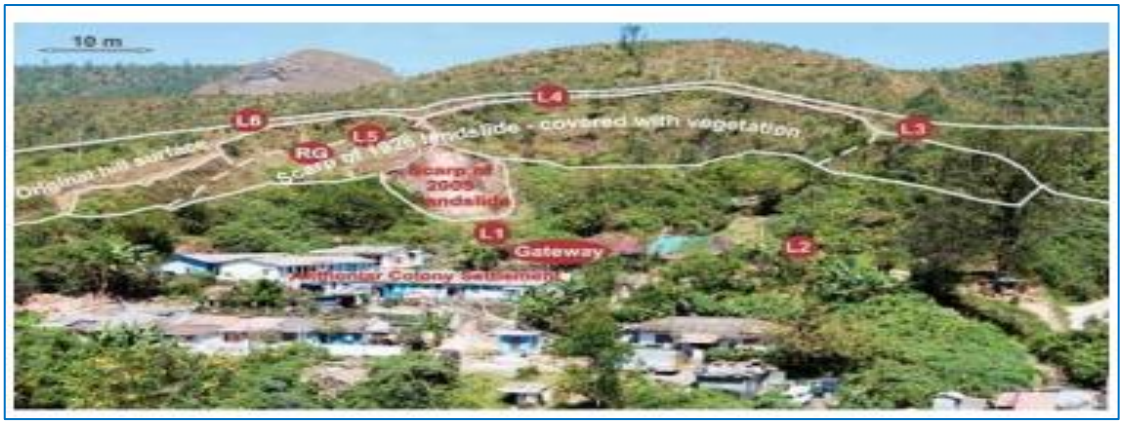


Figure 5.3. Areas vulnerable for landslides covered by a distributed early warning system equipment.

Use of Technology for Disaster Response and Emergency Relief measures:

A Satellite based Emergency Mapping and Response measures can help in post-disaster relief and response activities. Multiple technologies like GIS, Smart phone, Remote sensing, and Drones can also be used for these emergency relief and mitigation responses. Crowdsourcing open software is also one of the effective tools for disaster relief activities. Crowdsourcing open system enables communities in the vulnerable areas to post disaster related information, upload pictures taken from their smartphone, and share social media information freely into the software. It empowers the citizens/community members to contribute to relief efforts and loss assessments by sharing the photos/images of the post-disaster risk situations during a calamity. This system uses GPS to connect with the mobile phones of the users with geo-tagging of the pictures and requires low bandwidth connectivity.

For example, UN-Asign is a free crowdsourcing application which can be used by any Android or iPhone-based smartphone. This application enabled the common people in the vulnerable areas during the floods in Thailand in 2011, to post geo-tagged pictures of the major arteries and highways complemented by satellite imagery to provide comprehensive monitoring and assessment of flood situations (van Westen et al., 2020).

Figure 5.4. UNITAR-UNOSAT Geo picture

The above picture exhibits the flood prone areas (highlighted in red), the highways (highlighted in blue colour) and land areas through which relief measures can easily be fastened up.

Use of Drone for disaster risk relief and loss assessment:

Drones or Unmanned Aerial Vehicles (UAV) can be used for taking high-resolution pictures of the affected areas and can be used in post-disaster relief activities and loss assessment. The drones can also be used for carrying medicine, food, and other light medical equipment during the relief activities. It can also be used for assessment of damaged buildings, infrastructure, water levels, crop damage and also to monitor the crop health during the different phases of its vegetation phases.

Figure 5.5. Drone/Unmanned Aerial Vehicles

The Ministry of Science & Technology of Ethiopia has effectively used drones for carrying cargo weighing 5 kilograms, to deliver medicine and medical equipment from the disaster relief centers to remote areas of the affected places up to 150-kilometre distance (van Westen et al., 2020).

Figure 5.6. Drone carrying medical box

Source: https://addisfortune.net/articles/nations-first-drone-soars-high

Use of Social-media and Mobile Applications for effective post-disaster communication

With the increasing usage of smartphones, mobile applications have now become the popular mode of communication. These applications connected through a web server can serve one of the best modes for reporting the disaster incidences instantly by the people from various parts of the regions during the onset of the calamity. Since these applications are connected through a web server, the nearest local disaster risk management centre can be contacted for the relief measures and the same can be simultaneously monitored by the regional cell and the central rescue team. Using mobile apps, the community members can report the incidents quickly with relevant photos, videos and location details. Similarly, social media like Facebook, and WhatsApp can also be used as an effective medium for disaster-relief response. For example, Facebook has a safety check tool which allows users to mark their safety as well as their family and friends. MyShake[9] is a citizen early warning network which brings different segments of users together to build a global earthquake early warning network. The app monitors earthquake relief measures using the data from the user's phone sensors and automatically connects them to the nearest rescue operation centre.

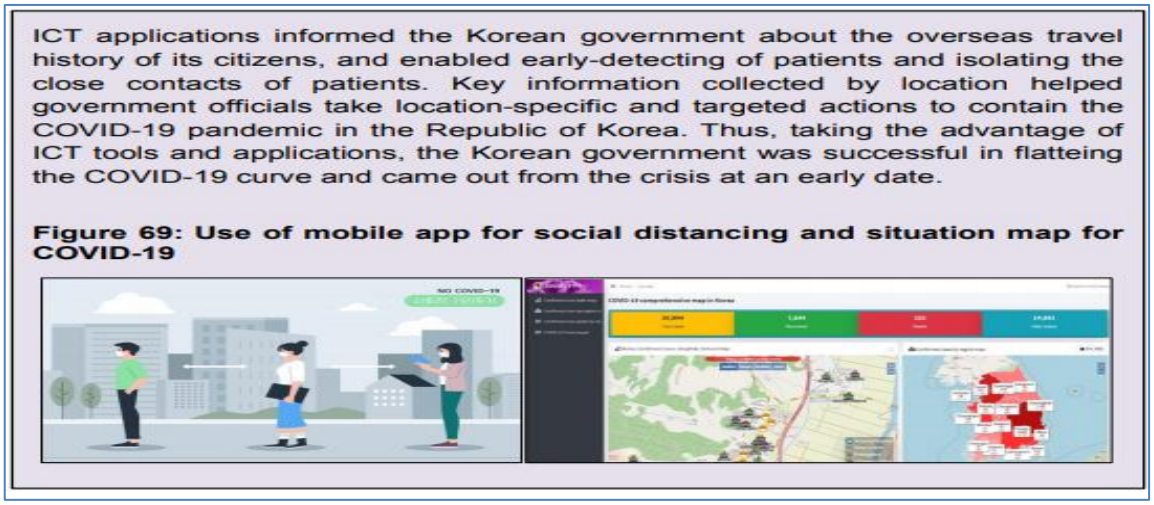


Figure 5.7. Example of use of social media

Source: APCICT, Republic of Korea, 2020

The Government of Republic of Korea[10] has built a nationwide network for disaster and safety communication which connects all the citizens with multiple institutions including

[9]MyShake, "Early warning network available at https://myshake.berkeley.edu/about-us.html.

[10]National Disaster Safety Communications Network Project. http://www.businesskorea.co.kr/news/articleView.html?idxno=9252.

police, fire-fighters, public officials and electricity, gas, and forest services enabling them to communicate and promptly support rescue operations during the disaster/emergency times.

Use of Artificial Intelligence in Search and Rescue Operations

The recent nation-wide proliferation of internet connections, availability of large volumes of data, introduction of new-age technologies; Block-chain Technology, Internet of Things (IoT), Artificial Intelligence, Robotic Process Automation (RPA) connected cars, Smart Homes and Smart Devices, etc., have enabled the development of innovative technological solutions.

Deep Learning techniques

Augmented Reality is a wireless device linked to a cloud database and mobile applications which use high-definition stereoscopic visual displays, voice and gesture activated controls. Hence, it is a virtual device fitted with 3D smart-glass technology that can display the magnified images of the pictures, photos and videos taken from a distant location on a real-time basis. AR can enable the rescue field to staff, community members, medical professionals, and government officers to perform their relief and rescue operations with much more efficiency, safety, and speed.

Virtual 3D tool fitted with drones can be used for conducting search and rescue operations in remote places, particularly in hilly regions and collapsed buildings during a disaster like earthquake. These tools can sneak into unstable structures, confined spaces, and remote areas easily and can provide real time video communications about the condition of the survivors. It can also be used along with deep learning algorithms for damage/loss assessment of the damaged property, buildings, crops, and other infrastructures with reasonable accuracy.

With the help of AR technology, the technician or the field staff can visit or use AR devices fitted with drones to arrive at the loss assessment and survey the incident easily and send instant images, texts, videos, etc., on a real time basis to the insurers or senior surveyors for their interpretation and report preparation. Even it allows the insurer and the surveyors to instruct the drone or any one on the field to do the assessment as per their requirement. Similarly, AR can also help doctors carry out more accurate and quick surgeries with the help of the senior surgeon or experts as it allows the doctors to share the live videos of the surgery, X-ray, CT scan images with the experts. They can instruct and or guide the operating team or give their opinions on a real-time basis.

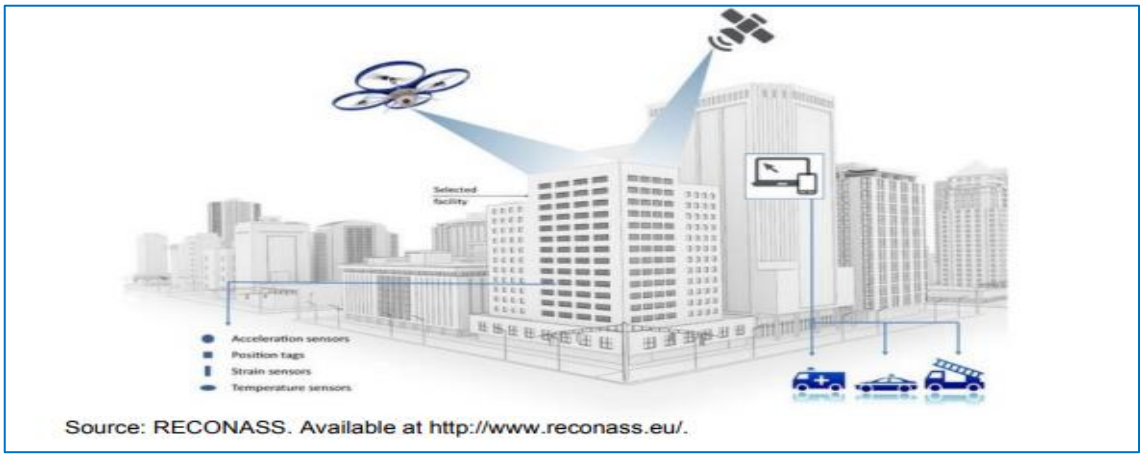


Figure 5.8. Artificial Intelligence in search and rescue operations

Conclusion and recommendations

Advances in the technology and availability of large data have enabled to develop new age digital applications like GIS, Remote sensing, Satellite images, Drones, and use of AI & DL algorithms for effective disaster risk management. These tools can be used for early identification of catastrophic risk events, building integrated early warning systems for pre- and post-event disaster risk communications ensuring safety and risk reduction when disaster strikes. However, there is a strong need to develop repository of historical disaster risk data and hazard/peril wise risk information, which can be analysed periodically to understand the dynamic changes of the disasters and detect these disasters in advance which can help the policy makers to develop suitable risk mitigation strategies for effective disaster risk management. Further, these technologies (Remote sensing, satellite images, deep learning tools) can also be put to use for periodical hazard risk analysis and post disaster loss/damage assessments, risk reduction & monitoring, and also to decide suitable risk financing and transfer mechanisms for the state. Further, the state can make use of crowdsourcing open software or platforms involving the local community members to communicate with the government and disaster risk department officers during the time of calamity, which can help in building community or block level resilience in the State.

Annexure 1

File No.DMA2/918/2020-DMD

GOVERNMENT OF KERALA

Abstract

Disaster Management Department - Disaster Risk Financing-Examining the pros and cons of providing insurance cover for the disaster affected and alternative mechanisms of disaster relief, sources of funding, formulation of the regulatory/legal framework covering administrative and digital aspects - Members co-opted by the Chairman and Committee constituted by the Commissioner Disaster Management - ratified - orders issued.

DISASTER MANAGEMENT(A)DEPARTMENT

G.O.(Rt)No.256/2021/DMD Dated,Thiruvananthapuram, 20/02/2021

Read 1. G.O(Rt)No.218/2021/DMD dated 17-02-2021
2. Proceedings No.OM SDMA/1173/2020/SDMA-KSDMA dated 18-02-2021
3. E-mail message dated 19/02/2021 from Commissioner, Disaster Management.

ORDER

Government as per order read as 1st paper has directed the constitution of Committee under the Chairmanship of Dr. K Raviraman, Member, Kerala State Planning Board, to study risk transfer mechanism in association with disasters. Government has also permitted the Chairman of the committee to co-opt members to the committee. Accordingly as suggested by the Chairman members have been co-opted to the committee.

2) Now the Commissioner, Disaster Management as per letter read as 3rd paper has requested to ratify the constitution of the committee to study 'risk transfer mechanism' in association with disasters.

3) Government has examined the matter in detail and are pleased to ratify the action of the Commissioner, Disaster Management in co-opting the members of the committee constituted as per Government Order read as 1st paper.

(By order of the Governor)
DR. A JAYATHILAK IAS
PRINCIPAL SECRETARY

The Commisioner, Land Revenue, Thiruvananthapuram

Annexure 2

File No.DMA2/918/2020-DMD

GOVERNMENT OF KERALA

Abstract

Disaster Management Department - Committee Constituted to study 'risk transfer mechanism' in association with disasters - Terms of References of the Committee - orders issued

DISASTER MANAGEMENT (A) DEPARTMENT

G.O.(Rt)No.277/2021/DMD Dated,Thiruvananthapuram, 24/02/2021

Read 1 G.O(Rt) No.218/2021/DMD dated 17-02-2021
2 G.O(Rt) No.256/2021/DMD dated 17-02-2021

ORDER

Government as per order read as 1st paper has directed the constitution of Committee under the Chairmanship of Dr. K Raviraman, Member, Kerala State Planning Board to study the pros and cons of providing insurance cover for the disaster affected and alternative mechanisms of disaster relief, sources of funding, formulation of the regulatory/legal framework covering administrative and digital aspects. The Terms of Reference of the Committee Constituted for the above purposes is as follows;

1. To assess the disaster risk exposures and existing risk financing mechanisms in the State.
2. Examine pros and cons and describe disaster risk financing strategies including insurance/reinsurance solutions and alternative mechanisms.
3. Develop a sustainable disaster risk financing structure after the evaluation of various sources of risk financing options and fund raising methods for disaster risk protection in the State.
4. Suggest the necessary supervisory and regulatory guidelines for the effective implementation of disaster risk financing strategy.
5. Suggest measures to develop a comprehensive disaster risk financing framework with necessary administrative and technological structures for effective delivery in the short and long terms.

(By order of the Governor)
DR. A JAYATHILAK IAS
PRINCIPAL SECRETARY

The Commisioner, Land Revenue, Thiruvananthapuram
The Commisioner, Disaster Management, Thiruvananthapuram
The Principal Accountant General (Audit) Kerala, Thiruvananthapuram
The Accountant General (A&E) Kerala, Thiruvananthapuram

Annexure 3

Proceedings of the Commissioner, Disaster Management
Present: Dr A. Kowsigan, IAS

OM SDMA/1173/2020/SDMA-KSDMA Thiruvananthapuram, Dated 20.02.2021

Sub: Disaster Risk Financing – Risk transfer mechanism - Examining: the pros and cons of providing insurance cover for the disaster affected and alternative mechanisms of disaster relief, sources of funding, formulation of the regulatory / legal framework covering administrative and digital aspects – Committee chaired by Dr K Ravi Raman, Member of the State Planning Board, Kerala – Members co-opted by the Chairman and Committee constituted – **Erratum** - Orders issued

Read: 1.G.O. (Rt) No. 218/2021/DMD, dated: 17.02.2021
2. Order No. OM SDMA/1173/2020/SDMA-KSDMA, Thiruvananthapuram, Dated 18.2.2021
3. G.O. (Rt) No. 256/2021/DMD, dated 20.02.2021

Vide order read as paper 2 above, members were co-opted to the committee and the committee was constituted. The Chairman has pointed out that committee member Dr Steward Doss is an Associate Professor and that necessary changes be made in the order to this effect.

In these circumstances, with respect to the order issued vide paper 2, the following **'erratum'** is issued and para 3 of the said order shall be read as follows:

"Accordingly, the following members are co-opted to the committee, as desired by the Chairman.

1. *Dr A. Kowsigan, IAS*
   Commissioner Disaster Management,
   Kerala State Disaster Management Authority
   Thiruvananthapuram

2. *Shri Gokul G R, IAS*
   Officer on Special Duty (in-charge of Secretary, Resources)
   Government of Kerala
   Thiruvananthapuram

3. *Shri G. Srinivasan*
   Director
   National Insurance Academy
   25, Balewadi, Baner Road,
   NIA P.O., Pune 411 045

4. *Professor Ajit Dayanandan*
   College of Business & Public Policy
   University of Alaska,
   3416 Seawolf Drive, USA

5. *Dr Steward Doss*
   Associate Professor, National Insurance Academy
   25, Balewadi, Baner Road
   NIA P.O., Pune 411 045

6. *Dr L Anitha Kumari*
   Associate Professor, Gulati Institute of Finance and Taxation
   Thiruvananthapuram
   Kerala, India"

Commissioner, Disaster Management

To

1. Dr K Ravi Raman, Full Time Member, Kerala State Planning Board, Government of Kerala, Pattom, Thiruvananthapuram
2. All the Members of the Committee
3. Member Secretary, KSDMA

Copy to

1. The Principal Secretary, Revenue and Disaster Management, Government of Kerala
2. PS to Hon'ble Minister for Revenue & Housing

Annexure 4: Identified hazard types in Kerala

Sl. No.	Category	Type
1	Natural Hazards	Flood (Riverine, Urban and Flash Floods)
2		Landslides (includes debris flows, rock fall, rock avalanche, rockslide, landslips and mud slips)
3		Drought
4		Coastal hazards (High waves, Storm surges, *Kallakadal,* Tsunami, Salt Water Intrusion, Coastal erosion*)*
5		Wind (Cyclone, Gustnados, Gusty winds)
6		Lightning
7		Earthquakes
8		Human epidemics
9		Plant disease epidemics and pest attack on crops
10		Avian epidemics
11		Animal epidemics
12		Pest attack of human habitations
13		Forest Fire
14		Meteorite/asteroid impacts
15		Soil Piping
16		Heat wave/sunburn/sunstroke
17		Natural background radiation
1	Anthropogenic Hazards	Stampedes
2		Firecracker accidents
3		Petro-chemical transportation accidents
3		Industrial accidents
4		Dam break
5		Dam spillway operation related floods & accidents
6		Oil spill
7		Road accidents involving civilian transport vehicles
8		Human induced forest fire
9		Human-animal conflicts
10		Fire accidents in buildings and marketplaces
11		Boat capsizing
12		Accidental drowning
13		Building collapse
14		Hooch accident
15		Air accidents
16		Rail accidents
17		Terrorism, riots and Naxalite attacks
18		Nuclear and radiological accidents
19		Space debris impacts
20		Biological accidents
21		Occupational and recreational area related hazards
22		Accidents in Armed Forces premises
23	Disasters outside State's administrative boundaries, affecting Keralites	

Source: Kerala State Disaster Management Plan (2016), Section 2.2

Annexure 5: State Expenditure from SDRF to different Head of Account

Sl. No.	A	B	C	D	E
	Head of Account	Expenditure 2018-19	Expenditure 2019-20	Expenditure 2020-21	Total in Crores
1	2245-01-101-98-Drought-Food & Clothing	0.00	0.00	0.0	0.00
2	2245-01-101-99-Drought-Agri.Crop loss	14.03	0.69	0.7	15.37
3	2245-01-102-99-Drought-Drinking water supply	5.86	2.71	1.8	10.41
4	2245-01-105-99-Drought-Veterinary care	0.00	0.12	0.0	0.12
5	2245-01-800-95-Drought-Sunburn	-	-	0.0	0.04
6	2245-02-101-94-Flood-Other items	211.37	146.60	305.0	662.95
7	2245-02-101-95-Flood-Agri crop loss	61.02	1.63	27.7	90.37
8	2245-02-101-96-Flood-Supply of medicines	0.54	0.05	0.0	0.59
9	2245-02-101-98-Flood-Food & Clothing	276.09	339.66	26.5	642.30
10	2245-02-102-99-Flood-Drinking water supply	2.55	20.09	14.4	37.02
11	2245-02-105-99-Flood-Veterinary care	26.34	3.16	0.0	29.55
12	2245-02-106-99-Flood-Repair & Restoration of damaged Roads and Bridges	130.24	28.31	47.4	205.99
13	2245-02-107-99-Flood-Repair to Govt.Office Building	0.10	0.05	0.0	0.15
14	2245-02-110-99-Flood-Repair of damaged water supply	5.86	18.70	0.0	24.57
15	2245-02-111-99-Flood-Exgratia to bereaved families	19.45	9.19	4.3	32.92
16	2245-02-112-99-Flood-Evacuation of Population	5.94	0.37	0.3	6.65
17	2245-02-113-99-Flood-Repair to houses	490.74	676.04	64.1	1230.89
18	2245-02-114-99-Flood-Assistance to farmers to purchase Agri.inputs	13.43	2.72	2.6	18.70
19	2245-02-115-99-Flood-Assistance to farmers to clear sand/silt salinity from land	51.98	6.07	4.6	62.68
20	2245-02-118-99-Flood-Assistance for repair of fishing boats	1.33	0.78	0.1	2.18

21	2245-02-119-99-Flood-Assistance for artisans for repair/replacements of damaged tools &equipment	0.00	0.00	0.0	0.00
22	2245-02-122-99-Flood-Repair & Restoration of damaged irrigation & Flood control works	0.64	455.47	0.4	456.51
23	2245-02-800-96-Flood-Exgratia to injured persons	0.11	0.03	0.0	0.14
	Total	**1317.64**	**1712.45**	**500.0**	**3530.10**
Source: Disaster Management Department, Government of Kerala					

References

Ashraf A (2021) Lessons learned from COVID-19 response for disaster risk management. Natural Hazards 107: 2027-2032. https://doi.org/10.1007/s11069-021-04658-0

Axa XL (2021), AXA Climate Parametric Insurance, AXA XL, U.K.

Born P, Klein RW (2016) Catastrophe risk and the regulation of property insurance markets. Journal of Insurance Regulation 35(5): 1-35.

Gadgil M (2011) Report of the Western Ghats ecology expert panel. The Ministry of Environment and Forests, Government of India.

GIZ (2015) Climate Risk Insurance: For strengthening climate resilience of poor people in vulnerable countries. GIZ Report, Germany.

Government of India (2020) Finance Commission in Covid times report for 2021-26. Volume I- Main Report.

Government of India (2020) Finance Commission in Covid times report for 2021-26, Volume II- Annexes

Government of Kerala (2017) Memorandum revised based on discussions with Inter Ministerial Central Team- Cyclone Ockhi 30th November 2017-17th January 2018, Thiruvananthapuram, Kerala, India. Available online: https://sdma.kerala.gov.in/wp-content/uploads/2019/08/Memorandum-Ockhi-2017.pdf

Government of Kerala (2018) Additional memorandum Kerala Floods 2018- 1st August to 30th August 2018, Thiruvananthapuram, Kerala, India. Available online: https://sdma.kerala.gov.in/wp-content/uploads/2019/08/Memorandum2-Floods-2018.pdf

Government of Kerala (2018) Memorandum (revised) Monsoon calamity losses 29th May to 31st July 2018, Thiruvananthapuram, Kerala, India. Available online: https://sdma.kerala.gov.in/wp-content/uploads/2019/08/Memorandum1-Floods-2018.pdf

Government of Kerala (2019), Memorandum Kerala Floods – 2019, Thiruvananthapuram, Kerala, India. Available online: https://sdma.kerala.gov.in/wp-content/uploads/2020/03/Memorandum-pages-deleted-Copy-compressed.pdf

Government of Kerala (2019), Rebuild Kerala Development Programme- A resilient recovery policy framework and action plan for shaping Kerala's resilient, risk-informed development and recovery from 2018 Floods. Available online: https://rebuild.kerala.gov.in/reports/RKDP_Master%2021May2019.pdf

Government of Kerala/Kerala State Disaster Management Authority (2012) Lightning and coastal erosion request for inclusion in the list of natural calamities eligible for funding from National Disaster Response Fund, Thiruvananthapuram, Kerala, India. Available online: https://sdma.kerala.gov.in/wp-content/uploads/2019/08/2014-Why-Lightning-and-Coastal-Erosion.pdf

Government of Kerala. (2018). Kerala Post Disaster Needs Assessment: Floods and Landslides-August 2018, Thiruvananthapuram, Kerala, India. Available online: https://www.undp.org/content/dam/undp/library/Climate and Disaster Resilience/PDNA/PDNA_Kerala_India.pdf

Government of Kerala/Kerala State Council for Science, Technology and Environment (KSCSTE) (2007) State of the Environment Report – Kerala 2007: Volume 2, Natural hazards. Thiruvananthapuram, Kerala, India

Government of Kerala/Kerala State Council for Science, Technology & Environment (2019), Committee examine the causes of repeated extreme heavy rainfall events, subsequent floods and landslides and to recommend appropriate policy response, Thiruvananthapuram, Kerala, India. Available online: https://drive.google.com/file/d/1TmczTO2SbAssijbUeqQLXI3IZ_DUOk9s/view.

Intergovernmental Panel on Climate Change (IPCC) (2018) Global Warming of 1.5C, the UN. Available online: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf

Intergovernmental Panel on Climate Change (IPCC) (2019) Climate Change and Land, the UN. Available online: https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/210202-IPCCJ7230-SRCCL-Complete-BOOK-HRES.pdf

Kerala State Disaster Management Authority (2016) Kerala State Disaster Management Plan, 1st edition, Department of Revenue and Disaster Management, Government of Kerala, p. 164.

Murali Das S (2007) Chapter 5: Lightning. In: E.P. Yesodharan, K. Kokkal, P. Harinarayanan (Editors), State of the environment report of Kerala 2007 - Volume II: Natural Hazards. KSCSTE, Government of Kerala, Thiruvananthapuram, Kerala, pp. 164.

OECD (2015) Disaster risk financing A global survey of practices and challenges. Available online: https://www.oecd.org/daf/fin/insurance/OECD-Disaster-Risk-Financing-a-global-survey-of-practices-and-challenges.pdf

Raman KR (2020) Ecospatiality: Transforming Kerala's post-flood riskscapes. Cambridge Journal of Regions, Economy and Society 13: 319–341.

Swiss Re (2019) Parametric Insurance, Swissre Report, Zurich.

Tata AIG (2020) Parametric Insurance for Nagaland Government, Tata AIG and Swiss Re, India.

van Westen CJ, Hazarika MK, Nashrrullah S (2020) ICT for disaster risk management, APCICT, Republic of Korea.

Government of Kerala/ Kerala stets Planning Board (2019), A Special Package For Post-Flood Kuttanad, Thiruvananthapuram, Kerala. Available online: https://spb.kerala.gov.in/sites/default/files/2020-09/Kutanad_Large2.pdf