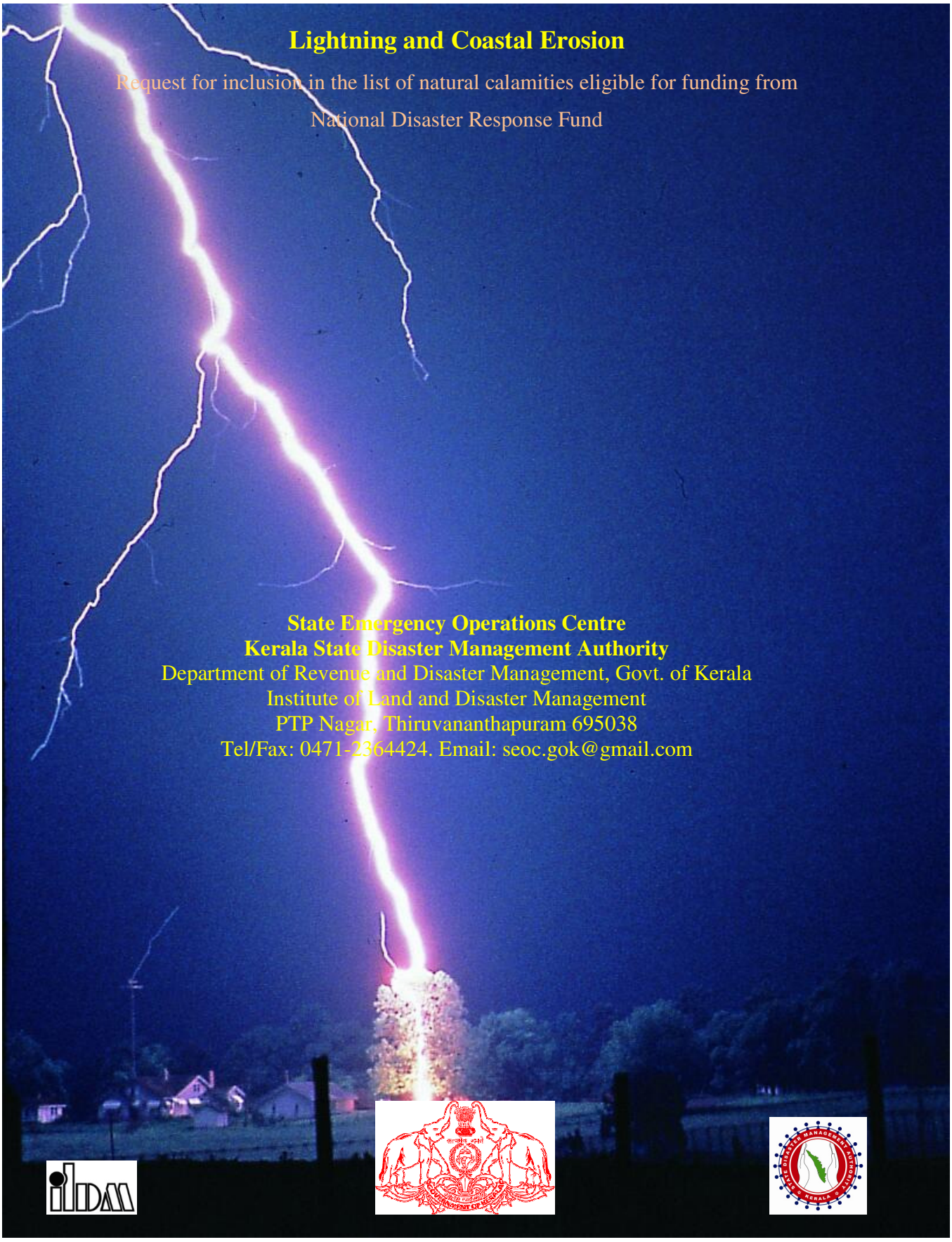

Lightning and Coastal Erosion

Request for inclusion in the list of natural calamities eligible for funding from National Disaster Response Fund

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Kerala State Disaster Management Authority
Department of Revenue and Disaster Management, Govt. of Kerala
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1. Introduction

Lightning and coastal erosion are part of the natural evolutionary system of the earth which turned into 'hazards' when the human system started interacting with it. The human system itself was subjected to significant transformations over its history. These transformations and their links to the natural system have served as templates of the dynamics of naturally triggered hazards and therefore, of disasters (Alcantara-Ayala, 2002).

This 'template of disasters' is particularly apparent in the state of Kerala where, within a short period of last 80 years, there has occurred a rapid socio-economic transformation from an agrarian society to a highly urbanized consumerist society. Parallel to this societal transformation, the population pressure along the coastline forced the then marginalized sections of the community to migrate from the coastal belt to the relatively inhospitable terrain of the Western Ghats (George and Chattopadhyay, 2001). A study conducted on migration suggested that in the past 80 years the coastal plains recorded a population growth of 306% where as the highlands, foot hills and uplands together experienced a growth of 1342% (Nair et al., 1997). This population with a density of ~819 people/km^2 (Census of India, 2001) is more or less widely distributed across all geomorphic units of the state, exposing them to multiple hazards including lighting and coastal erosion. The international scientific community has had recognized lightning and coastal erosion as 'naturally triggered hazards' a couple of decades ago and has had ever since vested significant attention in understanding the scenarios that transforms these 'natural processes' into disastrous events.

There are some 24,000 lightning deaths and 240,000 injuries annually worldwide (NLSI, 2011). The United States of America and the European Union has dedicated lightning research centers, while it has received very little scientific attention in India as a hazardous natural phenomenon. Coastal erosion is well researched across the world as well as in India by research institutions such as the Indian National Centre for Ocean Information Services, Centre for Earth Science Studies, National Remote Sensing Centre etc. from an earth systems process as well as from a hazard perspective.

2. Lightning – natural phenomenon turned disaster

In Kerala, research on lightning has been conducted for over a decade by the National Centre for Earth Science Studies (CESS), Ministry of Earth Sciences, Govt. of India. The NCESS maintains a regularly updated Geographic Information Systems based database of lighting felt reports which is collected from newspaper reports or compensation claims submitted by the affected to the Department of Revenue, Govt. of Kerala. It is known from studies that Cumulonimbus (Cb) clouds produce lightning. Kerala's typical topography favors frequent Cb formation especially during the months of April-May and October-November (Murali Das, 2007; Vishnu et al., 2010).

Figure 1 shows the village wise frequency of fatal/injury causing lightning events/year. The figure indicates that the mid land of Kerala is significantly prone to lightning. The high lands have the least of incidence and the frequency and distribution in the low lands falls between the other two. A simple explanatory statistics derived from this database of 17 years shows that there has been on an average **71 deaths and 112 injuries due to lightning every year**. Between **January 2010 and May 2014**, there have been **110 fatalities** due to lightning in Kerala. It was noted that most of the demised and the injured due to lightning were bread earning members of relatively poor families, and often were women.

Figure 2 shows the distribution of fatal lighting between January 2010 and May 2014 in Kerala. Figure 3 shows the district wise distribution of lightning incidents from which it is evident that lightning fatalities is the highest in Malappuram district, highest number of lightning hit injuries are reported from Thiruvananthapuram district and the highest number of lightning events are reported from Kannur district. It is as well apparent from Figure 2 that **no district of the state is devoid of lightning fatalities or injuries**.

Property damage due to lighting is also very high in the state. Sample data from the BSNL on lightning affected telephone connections for a small period in 2002 shows that the losses were as high as about Rs. 20 million and the total number of subscribers affected were ~18000 (Murali Das, 2007). Lightning hits burning down several coconut palms and rubber trees are quite common in the state, but are never reported or compensated for and hence goes excluded form the database. This implies that the ***cumulative revenue loss due to lightning may run to a tune of several million rupees every year***.

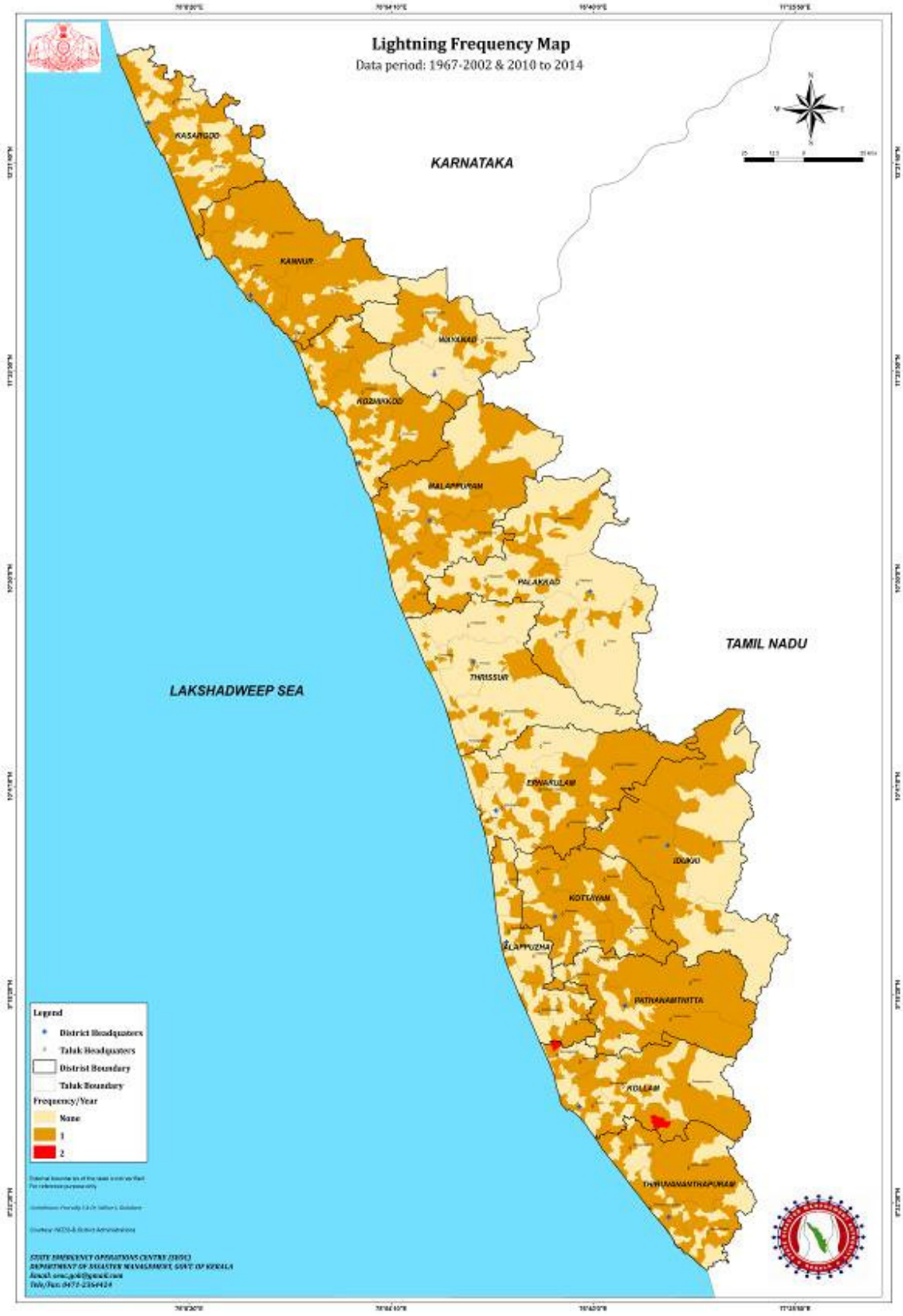

Figure 1: Fatal/injurious/catastrophic lightning frequency map of Kerala

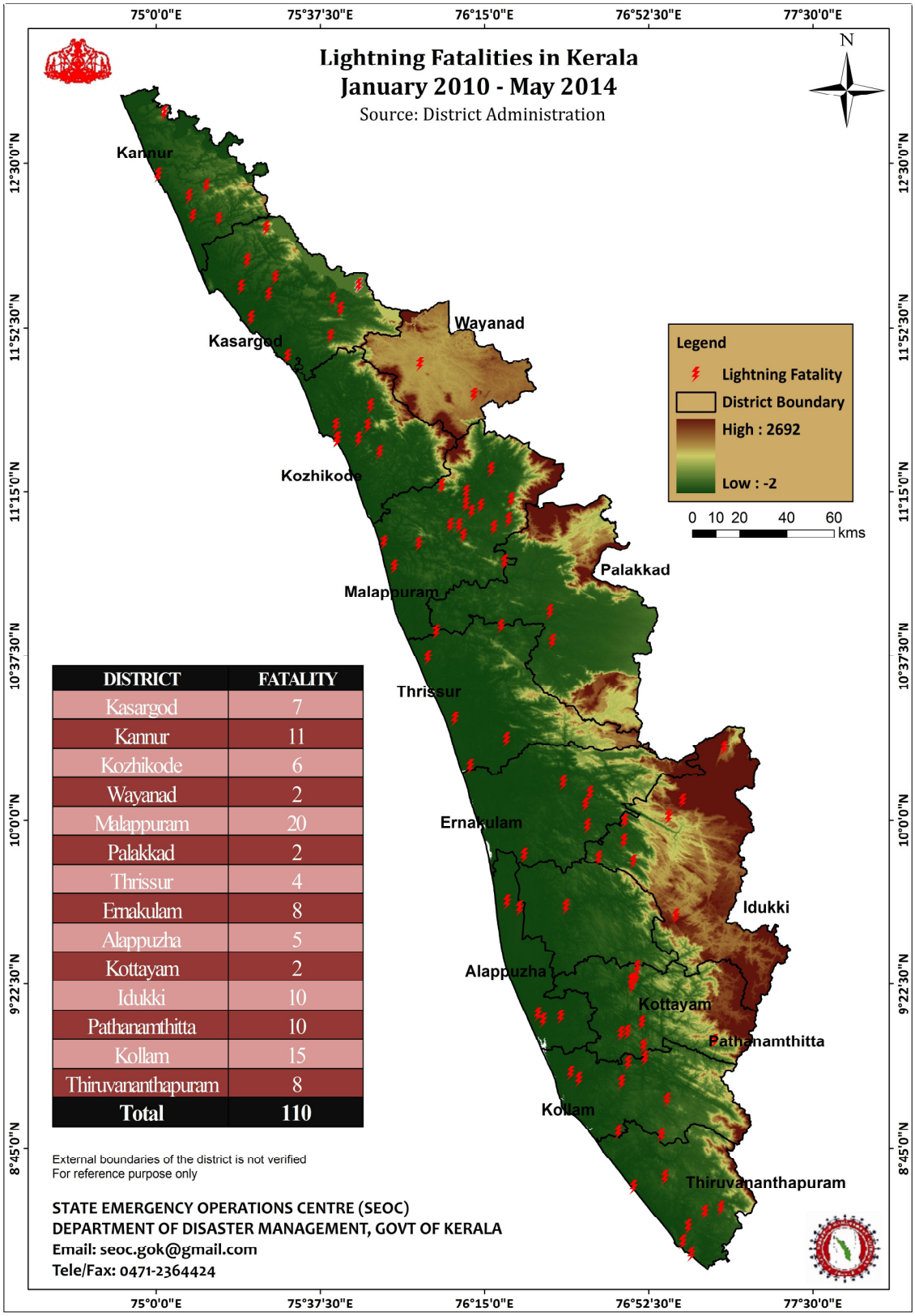

Figure 2: Fatal lightning map of Kerala (2010-2014)

It may be noted that lightning hits on 10 or 20 cash-crop stands often devastate the economic stability of the affected farmer. Unlike elsewhere in the country, majority of the cash crop farmers of Kerala have very small land holdings (~0.7 acre) due to high population density and consequent land fragmentation, and their sole livelihood may be the earnings from these cash crops. Thus, unlike other states, the high population density, high frequency of lightning and high vegetation density supplements each other in causing more frequent lightning fatalities, injuries and property loss in the state.

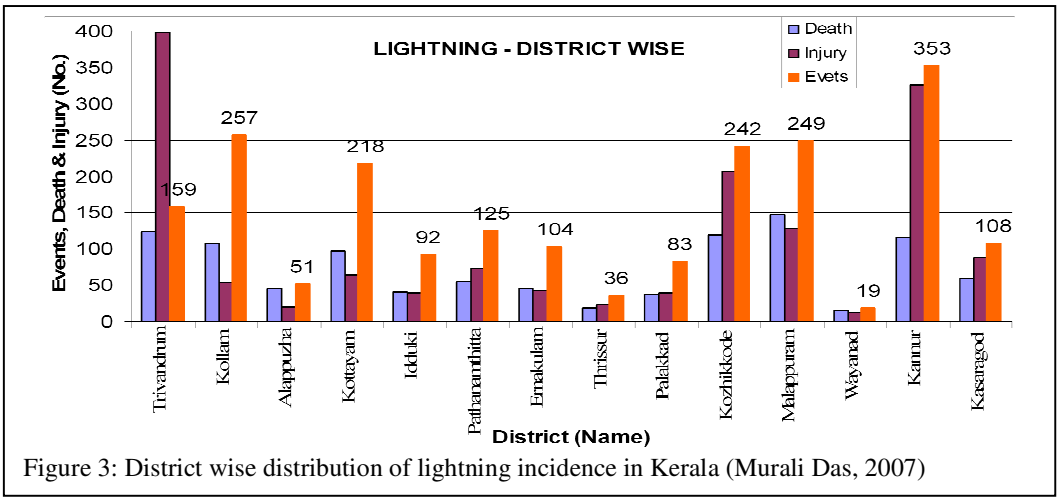

Figure 3: District wise distribution of lightning incidence in Kerala (Murali Das, 2007)

The pressing need to understand lightning from a hazard and disaster risk reduction perspective was recognized by the Kerala State Science Technology and Environment Council (Department of Science and Technology, Govt. of Kerala) and hence they included lightning as one of the six hazards, each being described as a chapter, in the 'Status of Environment Report 2007 – Vol. II, Natural Hazards' (Yesodharan et al., 2007). Further, in October 2010, a consultative workshop on hazard, vulnerability and risk assessment was convened by the UNDP Disaster Risk Reduction Programme under the guidance of Dr. P.K Champathi Ray, Scientist SG, Head - Geosciences Division, Indian Institute of Remote Sensing (IIRS), ISRO which was attended by scientists working in the research and development laboratories of the state on various hazards. This consultative workshop recommended lightning as a priority hazard to be addressed from a disaster risk reduction perspective in the state.

3. Coastal erosion

The 590 km coast of Kerala is one of the most densely populated land areas in the country. This coastline is exposed to high waves, rogue waves, 'Kallakadal' and Tsunami. These natural phenomena in turn results in rampant coastal erosion and consequent beech loss. The very recent 'Fact sheet of shoreline changes – Kerala, National Assessment of Shoreline Change' published by the Ministry of Environment and Forests, Govt. of India (NCSCM et al., 2011) shows that a major stretch of Kerala's coastline (~63%) is eroding rapidly. Figure 4 shows the erosion prone areas of the Kerala coast.

Figure 4: Erosion and accretion prone areas of Kerala (NCSCM et al., 2011)

Of the nine coastal districts, they being Kasargod, Kannur, Kozhikode, Malappuram, Thrissur, Ernakulam, Alappuzha, Kollam and Thiruvananthapuram (from north to south), the coastline of Thiruvananthapuram district is the most prone to erosion. About 23% of Thiruvananthapuram coastline is affected by erosion. About 310 km of the coastal stretch of Kerala has seawalls, riprap revetments, groynes etc. These artificial coasts are essentially eroding coasts and therefore it is appropriate to consider them as eroding coasts (NCSCM et al., 2011). The other districts that are highly prone to erosion, but are partly safeguarded by artificial means are Kollam and Ernakulam. Coastal erosion results in the loss of life and property of the coastal fisher population who are one of the most downtrodden communities of the state. One of the most apparent losses of property is the damages that come about to the dwelling spaces of the fisher population. Every year hundreds of houses are damaged due to the furry of the sea. Almost all fisher families prefer to live along the coast and very few of them tend to have landed property or houses further inland. The Tsunami of 2004 exposed the weakness of Kerala's coastal fisher population in terms of their resilience and coping capacity. Almost 1.3 million people in 187 villages of Kerala were affected by Tsunami with a death toll of 171 persons and a house damage of 17381. The waves also damaged livelihood of the fishermen community. Every year, the coastal district administrations of Kerala are forced to open a number of relief camps costing substantial loss to the exchequer. Tables 1 to 3 given below shows the statistics related to coastal erosion in Kerala from 2002 to 2012.

1 Year wise details of total land area eroded due to coastal erosion (in ha)

District	Year										Total
	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	
Kollam	0.35	0.4	1.54	0.18	0.2	0	0.15	0.1	0.57	0.12	3.61
Alappuzha	0.3	21.22	0.3	0.1	0.15	0.13	0.1	0.01	0	0	22.31
Trissur	23.49	12.31	21.09	44.26	43.93	58.53	36.24	48.03	68.6	13.28	369.76
Malappuram	5.50	5.90	3.90	5.90	5.90	5.50	5.50	5.90	5.90	6.30	56.22
Kozhikode	3	2.8	3.4	3.2	3.1	2.9	2.3	2.7	2.4	2.9	28.7
Kasargodu	1.13	0.95	1.1	1.03	0.88	0.95	1.52	1.33	1.51	2.35	12.75
Total	33.7	43.58	31.33	54.67	54.16	68.01	45.81	58.07	78.98	24.95	**493.3**

2 Year wise details of total number of people affected due to coastal erosion

District	Year										Total
	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	
Trivandrum	29	35	2456	29	524	194	52	579	133	213	4244
Kollam	201	240	2500	545	401	0	402	425	508	608	5830
Alappuzha	205	13517	199	236	1267	150	201	202	252	190	16419

Trissur	1731	14019	1571	1416	2693	1110	2753	1140	647	79	27159
Malappuram	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	15000
Kozhikode	120	130	350	120	130	140	110	130	150	130	1510
Kasargodu	74	852	89	66	48	41	54	88	162	103	1577
Total	4057	30725	12597	4932	7278	3637	5204	4169	3490	2862	**78951**

3 Year wise details of area of agricultural land lost due to coastal erosion (in ha)

District	**Year**										**Total**
	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	
Kollam	0	0	0	0	0	0	0	0	0	237	237
Alappuzha	1.2	170.3	1.2	0	0.2	0.7	0.7	1	0	2.5	177.8
Malappuram	2.56	2.74	3.90	2.50	3.91	3.00	2.64	2.76	3.29	3.02	30.33
Kozhikode	1.6	1.9	1.3	1.6	0.9	1.3	1	1.8	1.2	1.8	14.4
Kasargodu	155	0	125	0	0	45	0	150	48	0	523
Total	160.35	174.9	131.4	4.102	5.01	50	4.34	155.6	52.49	244.3	**982.5**

In light of the facts and figures above, the Government of Kerala has since 2011 repeatedly appealed to Government of India for declaring coastal erosion as a natural calamity eligible for assistance from the National/State Disaster Response Fund.

Of the nine coastal districts, the coastline of Thiruvananthapuram district is the most prone to erosion. About 23% of Thiruvananthapuram coastline is affected by erosion. About 310 km of the coastal stretch of Kerala has seawalls, riprap revetments, groynes etc. These are marked as 'Artificial Coast' in Figure 4. These artificial coasts are essentially eroding coasts and therefore it is appropriate to consider them as eroding coasts (NCSCM et al., 2011). Figure 5 shows district wise erosion/accretion characteristics of Kerala coast. The other districts that are highly prone to erosion, but are partly safeguarded by artificial means are Kollam and Ernakulam (80% of the coastline of the respective districts). The Department of Irrigation has identified coastal erosion prone zones, they being: Poovar-Vizhinjam, Kovalam-Valiathura, Perunnathuruthu to Neendakara, Kayamkulam, Ambalappuzha, Thumboli, Chellanam, Cochin Harbour, Azikkode, Kozhipram, Chavakkad, Ponnani, Kadalundi, Elathur, Tikkodi, Murad, Puthiyappa Angadi, Neelaswaram and Manjeswaram, spread along the nine coastal districts of Kerala.

Coastal erosion results in the loss of life and property of the coastal fisher population who are one of the most downtrodden communities of the state. One of the most apparent losses of property is the damages that come about to the dwelling spaces of the fisher population. Every year hundreds of houses are damaged due to the furry of the sea. Almost all

fisher families prefer to live along the coast and very few of them tend to have landed property or houses further inland. The Tsunami of 2004 exposed the weakness of our coastal fisher population in terms of their resilience and coping capacity. Almost **13 lakh people in 187 villages** of Kerala were **affected by Tsunami** with a death toll of **177 persons and 13735 of house damage**. The waves also damaged livelihood of the fishermen community. Thus every year when a coastal dwelling space is affected the family has to be **accommodated in relief camps costing substantial loss to the exchequer**.

4. Conclusion

According to UNISDR (2009), *natural hazard* is a ***natural process or phenomenon that may cause loss of life, injury*** or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage and *disaster* is a serious disruption of the functioning of society, causing widespread human, material or environmental losses which ***exceed the ability of the affected people to cope using their own resources***.

Following the above definitions of the UN, ***lightning and coastal erosion are natural hazards*** which occurs randomly which can neither be predicted nor be prevented by the present state of the art techniques of humans. It is evident from the above description based on the reliable database collected and analyzed by CESS and NCSCM, that lightning and coastal erosion cause numerous fatalities (second to no other natural hazard) and significant damage to life and property in Kerala. It is often the poor and the marginalized of the state that are affected by the disastrous consequences of lightning hits or coastal erosion and often it is the sole bread earning member or the leading woman of the house who is killed or fatally injured by the events. Property loss is also substantial as illustrated by a sample data from the BSNL and the case of 2004 December and the cumulative revenue and economic loss may be of several million rupees. Thus, ***lightning*** and ***coastal erosion*** are ***disasters*** which exceed the ability of the affected people to cope using their own resources. Hence lightning and coastal erosion qualify to be defined as natural calamities.

Given the aforesaid scientific and verifiable facts, the Government of Kerala herewith requests Government of India to ***declare 'lightning and coastal erosion' as Natural Calamities and permit to allot compensation for loss of life, injuries and property damages*** *as a consequence of these phenomena.*

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