National Disaster Management Authority

PDNA – Kerala (A case study)

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I LOST MY HOUSE WITH FLOOD.
I LOST MY COW TOO
I LOST MY SCHOOL BOOKS.
OK.. DON'T WORRY. I ALSO LOST MY NATIONAL DISASTER MANAGEMENT PLAN.
KYAWTHUYEIN©2015

WORKING OUT THE MONSOON MAGIC

The Indian monsoon is one of the most complex weather systems in the world and it is hard to predict. The monsoon system originates around Australia and goes all the way up to Tibet. Here's how the remarkable system works:

1 | The entire monsoon activity in the world happens between 30° S & N. Some time in January, a high pressure area called Mascarenas High builds up off the western coast of Australia

2 | It then moves west, travelling roughly 2,500 km to the coast of Somalia where the coast is high. This deflects winds back across Indian Ocean and Arabian Sea. This is called Somalia Jet

3 | The east-west branch of Somalia jet gathers moisture as it goes along. It flows across the Indian landmass and brings rain to North-East India

4 | Once low pressure is formed at the Bay of Bengal head, the monsoon moves westwards across UP and is powered to Delhi and onwards to Jammu

5 | The Tibetan High creates an easterly tropical jet, moving it back to over the Bay of Bengal to dissipate at its origin

NORMAL ARRIVAL DATES

UP | June 15

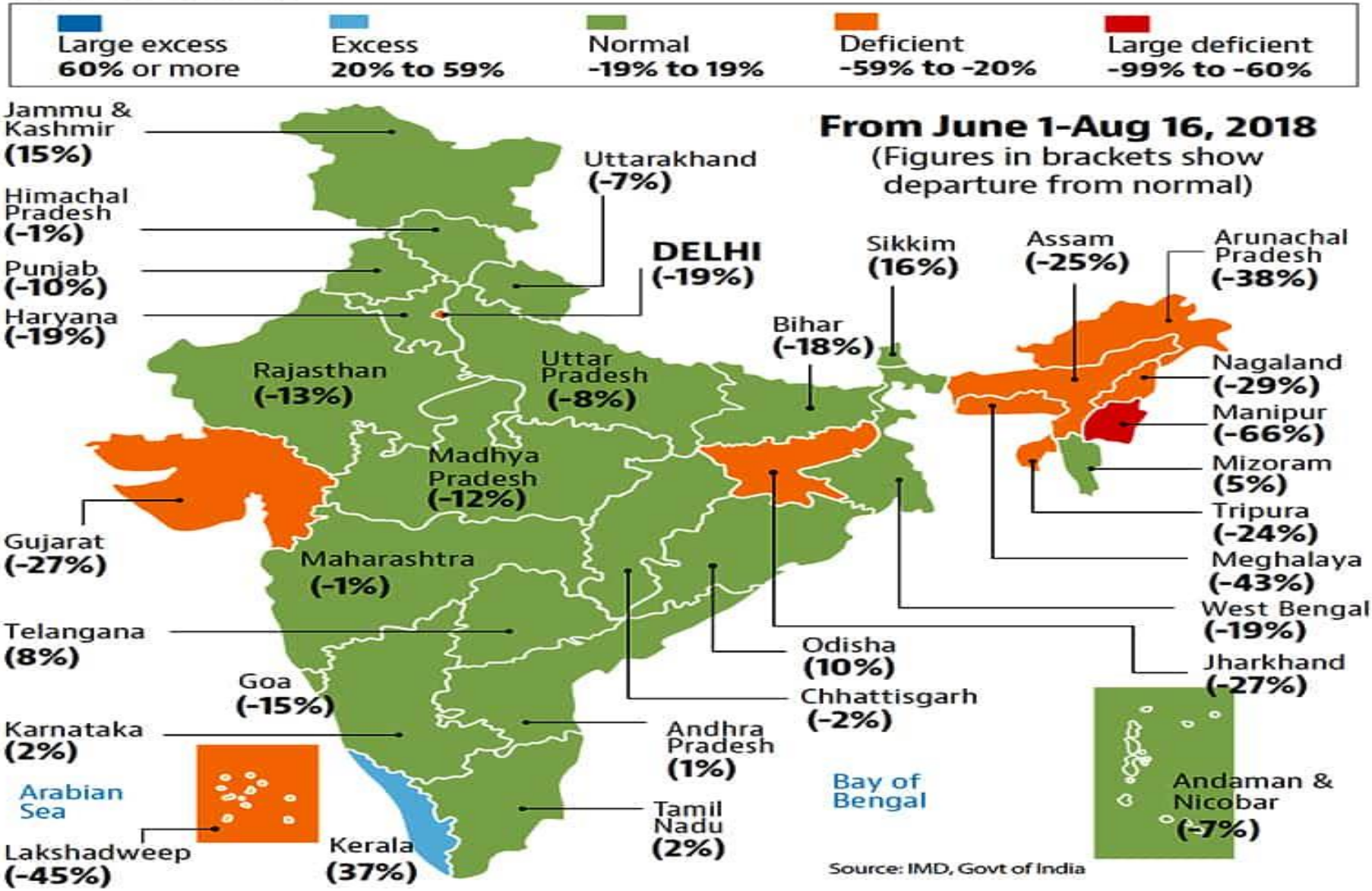
Lucknow | June 18

Covers entire UP | June 25

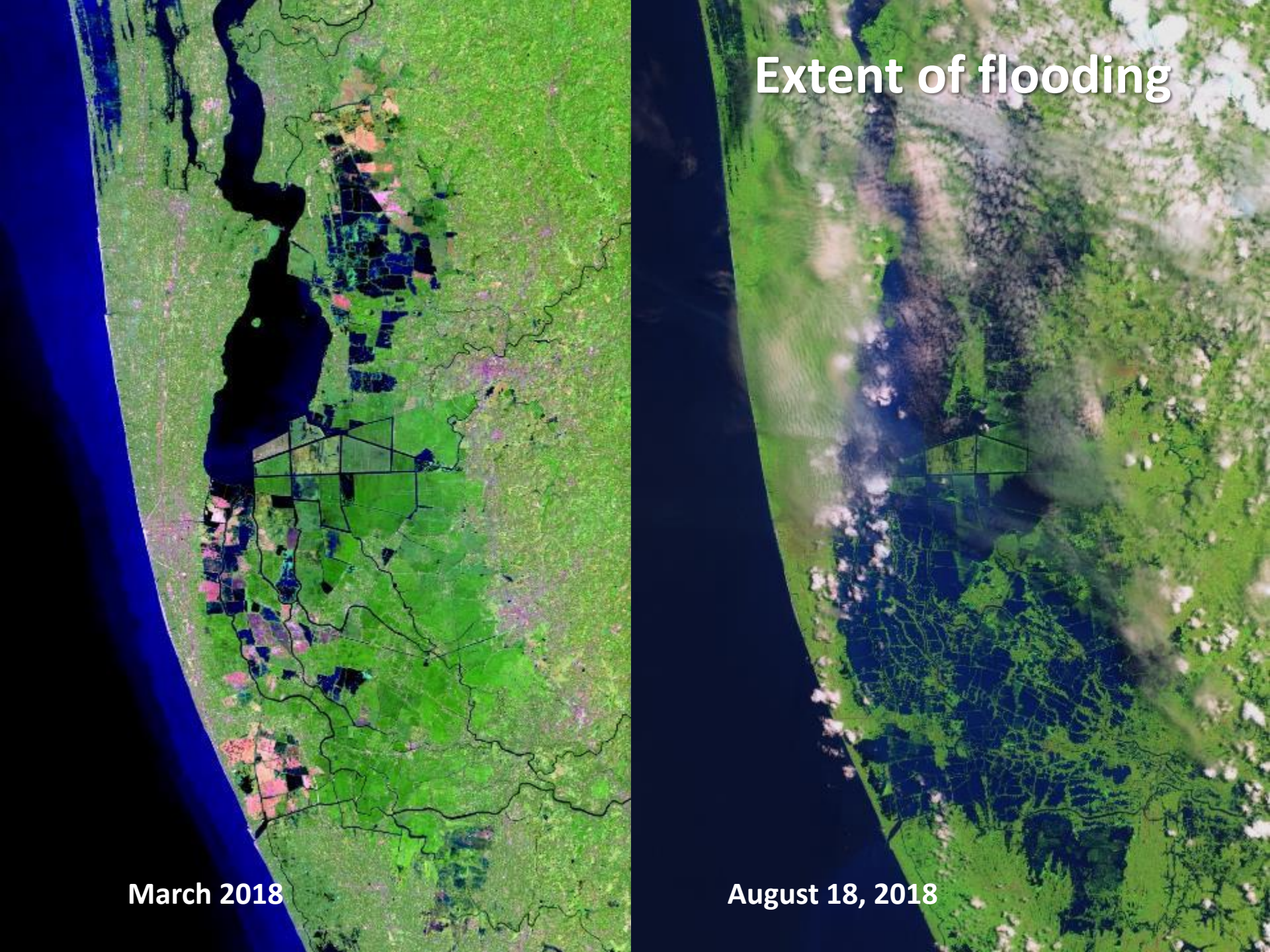
Year	UP	Lucknow
2009	June 29	June 29
2010	July 4	July 5
2011	June 17	June 19
2012	June 21	July 5
2013	June 15	June 16
2014	June 19	July 1
2015	June 23	June 25
2016	June 19	June 21
2017	June 27	July 1
2018	**June 27**	**June 27**

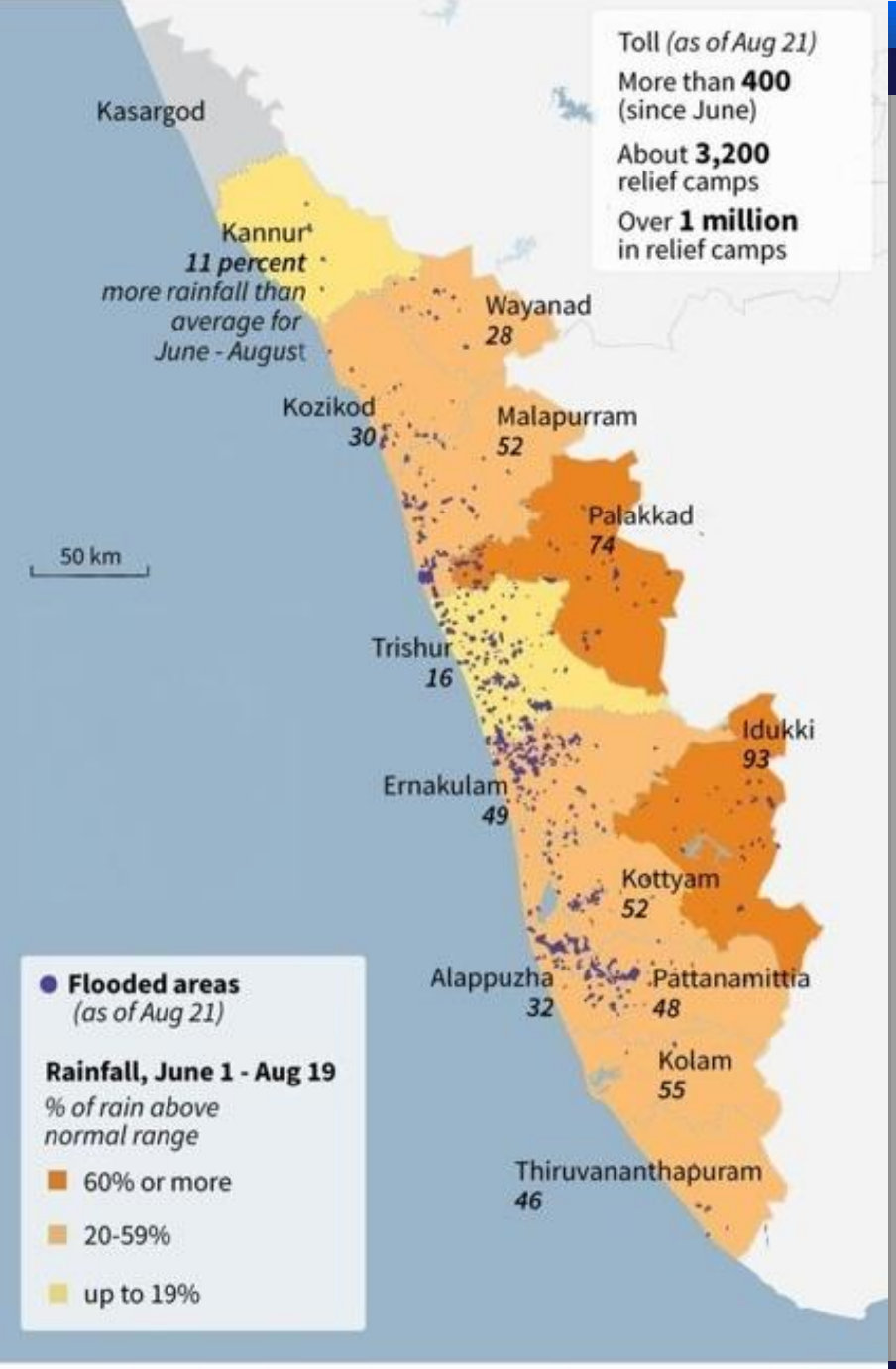
Monsoon trend in India

STATUS CHECK



-8% of long-period average (LPA) is the rain deficit as of Aug 16. The rainfall has been below the mark, with the deficit at the end of June being 5%. Over a third of the country, by area, had received below normal rain as of Thursday


Extent of flooding
March 2018
August 18, 2018



- Extremely high rainfall led to severe flooding and landslides
- Up to 5.4 million people, 1/6th of State population, affected
- Large-scale rescue and relief operations saved many lives
- Up to 1.4 million people lived in 5600+ relief camps
- Evacuation of over 260,000 persons to safer locations

Exceptional rescue and relief operations by the government as well as the communities

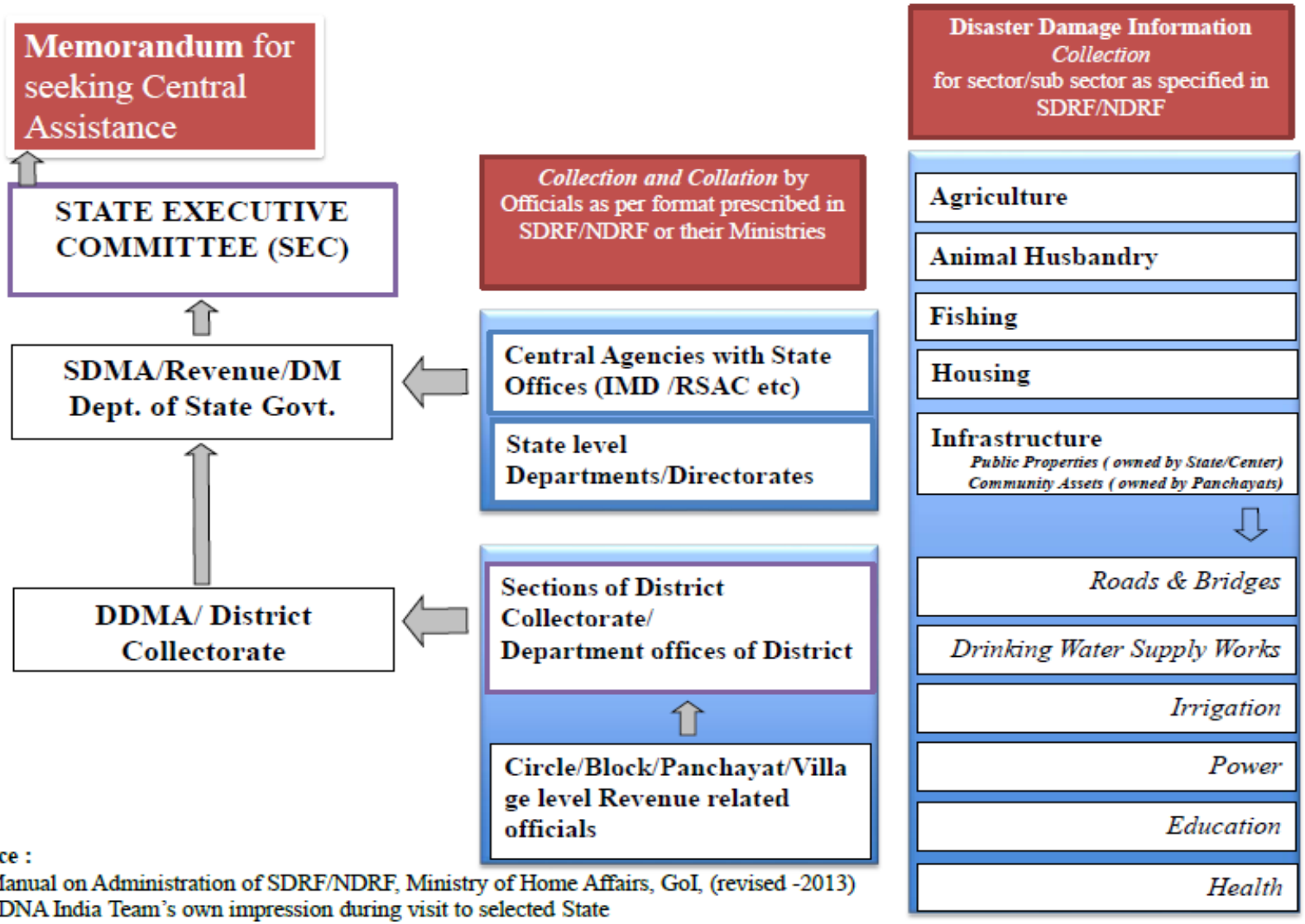
- Efficient establishment and operations of 5,645 relief camps
- Quick restoration of connectivity: electricity, roads and telecom
- Mobile App-based damage enumeration
- Local fisherman communities helped with rescue operations

District	No of Thaluk affected	No of GP affected	No of Villages affected	No of Families affected	No of Camps	No of people in Camps	No of Houses fully damaged	No of Houses partially damaged	No of Death	Agriculture loss (Ha)	Overall population affected
Palakkad	3	5	11	750	22	2734	89	200	1	1135	3000
Idukki	3	22	85	5600	18	1260	110	929	18	3990	24450
Wayanad	3	23	48	6230	131	3306	84	1893	6	5860	26644
Calicut	7	10	27	1721	8	682	16	94	2	2145	8233
Kannur	9	19	40	1141	26	901	48	346	6	3415	6484
Malappuram	4	11	28	2843	14	2175	112	224	12	3189	5532
Emakulam	6	32	65	2744	78	10510	0	0	3	1900	12976
Total	**35**	**122**	**304**	**21029**	**297**	**21568**	**459**	**3686**	**48**	**21634**	**87319**

PDNA

- Based on the data compiled by the State govt for all affected districts and field visits of 10 districts
- Discussions with the district admin. and line departments to understand damage extent, data collected, and gaps
- Consolidation of available information and cost estimation using multi-sector expertise

Existing Practice of Collecting, Collating and Reporting of Disaster Damage Data



Source :

1. Manual on Administration of SDRF/NDRF, Ministry of Home Affairs, GoI, (revised -2013)
2. PDNA India Team's own impression during visit to selected State

Overview of Recovery Needs

Sector
Housing
Public Buildings
Urban Infrastructure
Rural Infrastructure
Irrigation and Water Resources
Power
Transport
Health
Livelihoods
Natural Environment & Biodiversity
Cultural Heritage

Recovery Needs – By Sub-Sectors

Sector
Housing
Public Buildings
Urban Infrastructure
a. Infrastructure
b. Water Supply & Sanitation (Urban)
Rural Infrastructure
a. Infrastructure
b. Water Supply & Sanitation (Rural)
Irrigation and Water Resources
Power
Transport
a. Roads (state)
b. Roads (NH)
Health
Livelihoods
a. Agriculture
b. Livestock
c. Fisheries
d. Industries/MSME
e. Handloom and Coir
f. Tourism
Natural Environment & Biodiversity
Cultural Heritage

Housing

District	Fully Damaged	Partially Damaged	Cost (INR million)
Kollam			
Pathanamthitta			
Alappuzha			
Kottayam			
Idukki			
Ernakulam			
Thrissur			
Palakkad			
Malappuram			
Kozhikode			
Wayanad			
Kannur			
Thiruvananthapuram			
Kasaragod			
Total			

Cost estimates include cost of repair, reconstruction, basic services provision, land acquisition, rental and shifting allowance:

- INR 400,000: Avg. unit cost for fully destroyed *kutcha* houses and 40% of the fully damaged *pucca* houses
- INR 600,000: Avg. unit cost for balance 60% fully damaged *pucca* houses
- 20%: Avg. cost of repairing partially damaged *kutcha* and *pucca* houses of total reconstruction costs.
- 30% and 20%: No. of fully damaged kutcha and pucca houses that may need relocation, respectively
- 30%: The cost of providing basic services of the reconstruction cost of houses that require relocation
- 50%-50%: Share of relocation to individual plots and group housing
- 0.02 acre/2 cent: Land requirement for the individual plots +30% for group housing for basic services and community infra
- INR 25 million /acre: The cost of land
- INR 2,000/month for 12 mo. rental assistance + INR 15,000 onetime shifting allowance

Estimates based on GoK's LIFE (Livelihood Inclusion and Financial Empowerment)

Housing

Recovery Needs (Short-Medium Term)

- Post-disaster housing reconstruction policy
- Innovative financing techniques like TDR, land-pooling
- Household damage assessment and eligibility survey
- Bio-fences in rural areas and permeable fences in urban areas
- Recycle construction debris – used for construction products needed in reconstruction
- Choice of technologies and material to revive local economy
- Kuttanad specific reconstruction approach

Resilience needs (medium-long term):

- Set up Authorities to protect Kuttanad Backwaters, Kole Lands, Highlands and other such ecologically fragile and disaster vulnerable regions with a mandate including building bye laws, land use planning, tourism and other infrastructure.
- Revise Panchayat Building Rules and develop Panchayat-level land use plans
- Set up a Construction and Demolition Waste recycling plants per GoI Rules

Public Buildings

Type of Building	Total Number of Buildings	Cost (INR million)
Education	774	
Livelihood/Markets	50	
Others	795	
Total	**1,619**	

Recovery strategy

- Determine exposure to hazards ⇒ **conduct safety audits**
- **Replacement programme** for buildings that has topped the service life
- Adopt higher **standards for infrastructure design** to make it resilient to extreme events
- Determine select public buildings as emergency facility and undertake **structural and non-structural mitigation measures**
- Protect and **build redundancy measures** in public buildings/critical facilities, and ensure the buildings are accessible and operable during and following most hazard events.

Public Buildings

District	Number of Buildings	Cost (INR million)
Kollam	16	
Pathanamthitta	224	
Alappuzha	262	
Kottayam	52	
Idukki	104	
Ernakulam	167	
Thrissur	356	
Palakkad	116	
Malappuram	98	
Kozhikode	90	
Wayanad	126	
Kannur	8	
Thiruvananthapuram	0	
Kasaragod	0	
Total	**1,619**	

Urban Infrastructure

Districts	Urban Infrastructure	Urban Water
	INR Million	INR Million
Thiruvananthapuram		
Kollam		
Pathanamthitta		
Alappuzha		
Kottayam		
Idukki		
Ernakulam		
Thrissur		
Palakkad		
Malappuram		
Kozhikode		
Wayanad		
Kannur		
Kasaragod		
Total		

Urban Infrastructure

Urban Infrastructure

- Incorporation of hazard zonation in town planning standards and processes
- Development of technical guidelines and specifications for infrastructure asset management
- Ensure incorporation of disaster resilient features in all infrastructure investment
- Policies to relocate vulnerable settlements/houses/buildings to safe areas

Urban Water Supply

- Audit of assets from climate change perspective to ensure application of resilient measures in designs on all ongoing and proposed works
- Ensuring source sustainability (perennial rivers/reservoirs and interlinking of strategically important schemes)
- Expansion of pipe water coverage with service connections to reduce non-revenue water
- Technical Assistance to carryout detail planning and design for the planned future investments

Rural Infrastructure

Districts	Rural Infrastructure	Rural Water
	INR Million	INR Million
Thiruvananthapuram		
Kollam		
Pathanamthitta		
Alappuzha		
Kottayam		
Idukki		
Ernakulam		
Thrissur		
Palakkad		
Malappuram		
Kozhikode		
Wayanad		
Kannur		
Kasaragod		
Total		

Rural Infrastructure

Rural Infrastructure

- Capacity building of the engineering cadre of local bodies for application of disaster risk reduction measures in rural infrastructure
- Climate resilient designs adopted for rehabilitation / reconstruction of damaged infrastructure

Rural Water Supply

- Audit of assets from climate change perspective to ensure application of resilient measures in designs on all ongoing and proposed works
- Utilization of unused Water Treatment capacity to support expansion of piped water connection
- Reduce dependency on water from open-wells or tube wells by optimum utilization of spare capacity of KWA, and expansion of piped water supply to rural households
- State should support handed over damaged community water supply schemes with fresh/additional financial assistance to revive supply

Irrigation and Water Resources

District	Flood Protection (INR Millions)	Irrigation (INR Millions)	Water Resources (INR Millions)	Study & Planning (INR Millions)	Short & Mid-Term INR (Millions)
Alappuzha					
Thrissur					
Kozhikode					
Pathanamthitta					
Ernakulam					
Other 9 districts					
Multi-districts					
Grand Total					

Recovery strategy

- Rehabilitate protection structures and diversion bunds on a priority basis to avoid further damages.
- Ensuring regular repairs and maintenance of structures for durability, effectiveness and resilience.

Irrigation and Water Resources

Short and Mid Term recovery

- **Flood Protection**
  - Repair damaged infrastructure like bunds, regulators, weirs, check dams, dykes
  - Invest in real time monitoring systems and for flood modelling for inundation mapping
- **Irrigation**
  - Repair and invest in maintenance of affected infrastructure such as canals, distributaries, structures, canal side roads
- **Water Resources**
  - Repair operating systems, monitoring equipment, and buildings
  - Integrated dam management plans for both Irrigation and KSEB dams
- **Studies and Planning**
  - Technical studies and master planning for long-term projects
  - Develop Build Back Better guidelines and budget for implementation

Long Term Measures

- **Irrigation Projects:**
  - Modernize, repair the schemes and lining of existing canals in the command area
- **Kuttanad Flood control measures:**
  - Renovation and extension of Alappuzha-Chenganassery Canal
  - Modernization of Thottappally Spillway

Power

Activity	Typology for reconstruction/recovery	Reconstruction/Recovery
		INR million
Generation	Civil works, Excitation system, SCADA, Control Panel	
Distribution	Poles, Distribution Transformers, Meters, Weatherproof cables, ELCBs.	
Transmissions	Power Transformers, Conductors, Disc Insulators, Circuit breakers, Lightning Arrestors.	
Total		

*Total includes state level transmission lines, substations, and transformers.

Cultural Heritage

Recovery strategy:

- To identify, record and assess affected tangible and intangible heritage components in the various districts within the state
- To put a value to the cultural assets which have been damaged in the floods and include them in ‘Rebuild Kerala’ planning
- Creating monetary resources to rebuild exclusive cultural heritage
- To list all the cultural heritage components and create a database of heritage in the state of Kerala
- Developing cultural heritage disaster mitigation measures
- Forming a rapid response team for heritage architects, engineers, conservators, historians, archaeologists and all those who are concerned about heritage

Cultural Heritage

District	Movable Heritage		Immovable Heritage		Intangible Cultural Heritage (Traditional Knowledge Systems)			
	Artefacts	Infrastructure	Built Infrastructure	Articulation/ Murals	Raw Materials	Finished Goods	Machine/ Equipments	Built Infrastructure
Alappuzha								
Pathanamthitta								
Ernakulam								
Thrissur								
Palakkad								
Wayanad								
Total								

Social Impact Recovery Strategy

Activity	INR (in Million)
Study of 'Impacts, Issues and Resilience Needs of Women Impacted by Floods in Kerala'	
Study of 'Impacts and Recovery Needs of Children who have become Orphans due to Floods in Kerala'	
Program for supporting vulnerable older persons impacted by floods- health care, housing & food, relocation and preparedness for future natural disasters including imparting coping skills and awareness generation	
Total	

Social Impact of the Floods

- Floods impact are far greater on the vulnerable sections of the society, including tribal population, women, children, older and differently abled persons
- Floods have rendered many homeless and caused huge loss of household assets and livelihoods, straining the already limited resources of the poor and marginal sections
- Apart from other major social problems, floods of this magnitude can result in mass migration, psycho social impacts, high crime and suicides and sexual abuse of women and children
- Quite often in the overall relief program, these differential impacts of floods on vulnerable sections are overlooked
- There is a critical need to properly assess the impacts of floods on vulnerable population and provide them with additional support to cope up with these hard situations

Natural Environment and Biodiversity

Recommended Actions:

Technical Studies

- Wetlands and Mangroves assessment
- Biodiversity assessment

Short-term

- Restoration of forests / wildlife sanctuaries
- Developing an integrated approach for preventing landslides in forest / wildlife areas

Medium-term

- Improved land use plans in the periphery of forest areas / wildlife sanctuaries to reduce human-induced development impacts

Natural Environment and Biodiversity

S. No	Districts	Cost in INR (Millions)
A	District Wise Break-up	
1	Thiruvananthapuram	
2	Kollam	
3	Pathanamthitta	
4	Alappuzha	
5	Kottayam	
6	Idukki	
7	Ernakulam	
8	Thrissur	
9	Palakkad	
10	Malappuram	
11	Kozhikkode	
12	Wayanad	
13	Kannur	
14	Kasaragod	
B	Other restoration	
Vembanad Kol		
Other Ecosensitive areas (all other districts)		
Total		

Tourism

Damages / Recovery need	Cost (INR million)
Reconstruction of public, private and community owned infrastructure incorporating disaster resilient factors	
Total	

Recovery strategy

- Facilitate financial recovery of both employees and owners: Alternate interim livelihoods, credit facilities, tax relief, expedited processing of insurance claims
- Ensure all reconstruction is risk-informed: site-selection and design of all new construction and restoration efforts based on a detailed risk analysis exercise
- Initiate Disaster Risk Management within Tourism Sector: Accreditation criteria, contingency planning by enterprises, enhanced capacities of tourism employees for disaster response
- Brand ‘Resilient Kerala’: Multi-pronged communication strategy to restore confidence of travelers and contribute to Kerala’s recovery and raise awareness about resilience measures

MSME, Handloom & Coir

Damages / Recovery need	Cost (INR million)
Restoration of essential infrastructure, equipment and machinery, damaged input stocks **(Nano / micro / Kudumbashree units)**	
Reconstruction of damaged workplace, repair / replacement of looms, restoration of raw material stocks **(Handloom units)**	
Total	

Recovery strategy

- Reconstruction of damaged work places to safer standards, replacement/repair damaged equipment, promote insurance
- Financial Resilience: Develop innovative financial options tailored to meet business requirements of weavers / nano / micro entrepreneurs and ease credit burden
- Risk assessment of nano / micro / small enterprises needs to be carried out and appropriate infrastructure upgradations taken up;
- End-to-end value chain support including capacity building, backward and forward linkages, packaging, branding and other business development services

Livestock, Fisheries

Damages / Recovery need		Cost (INR million)
Livestock	Restoration of livestock units	
	Reconstruction / restoration of individual assets and public institutions and infrastructure	
Fisheries	Replacement of damaged or lost Boats and Nets	
	Revival of Aquaculture	
Total		

Recovery strategy

- Focus on realizing genetic potential of milch animal: Better animal management techniques to double yield: preventing care, protein bypass supplements; CO3 grass; disease management
- Promote indigenous breeds: 94% crossbred varieties in Kerala. Re-introduce disease-resistant indigenous cattle breeds in specific areas; Invest in branding and promotion of A2 milk
- Improve awareness of livestock insurance for improved resilience
- Strengthen fisheries value chains: Creating/improving necessary facilities in landing centers. Providing drying platforms and cold chain facilities, proper weighing and packaging facilities, transport facilities and marketing linkages to the fishing communities.

Agriculture

Recovery need	Cost (INR million)
Levelling / Desilting / Reclamation of agricultural land	
Reconstruction / repair of essential community / public infrastructure and tools & equipment	
Restoration of damaged crops (cost of inputs for one season / year)	
Total	

Recovery strategy

- Shift to agroecological approach (23 agroecological management units) with climate-smart elements and farm investments tailored to the specific agroecological conditions
- Combine land restoration measures with package of nutrients and soil ameliorants to restore soil fertility
- Integrated investments in Kuttanad and Kole wetlands including environment-friendly bunding, channel deepening, integration with animal husbandry and cage culture
- Multi-institutional studies to map vulnerabilities in hill districts; replantation needs to combine crops with shallow root systems and crops with deep root systems
- Invest in improving awareness and uptake of crop insurance among farmers

Livelihood Sectors – Recovery Needs

District	Agriculture	Livestock	Fisheries	Industries / MSMEs	Handloom / Coir	Tourism
Thiruvananthapuram						
Kollam						
Pathanamthitta						
Kottayam						
Idukki						
Alappuzha						
Ernakulam						
Thrissur						
Palakkad						
Malappuram						
Kozhikode						
Kannur						
Wayanad						
Kasaragod						
Total						

Health

- Replacement of damaged equipment and furniture will also be part of reconstruction.
- New infrastructure should have flood risk reduction measures.
- NCD survey to understand the disruption in treatment of NCDs among flood affected patients including complications such as end organ failure.
- Strengthen the disease surveillance systems such as Integrated Disease Surveillance Program (IDSP)

Health

Activity	Target Asset	Unit	Cost (INR Million)
Reconstruction of Taluk HQ Hospital in Pulikunnu	Reconstruction	1	
Reconstruction of totally damaged health facilities	Reconstruction	30	
Repair of hospitals with major damage	Repair	27	
Repair of hospital with minor damage	Repair	119	
Replacement of damaged equipment and purchase of additional equipment	New equipment procurement	178 facilities affected	
Replacement of damaged furniture	New furniture procurement	178 facilities affected	
Total			

Transport

District Name	Fully Damaged	Severely Damaged	Lightly Damaged
	INR (Million)	INR (Million)	INR (Million)
Thiruvananthapuram			
Kollam			
Alappuzha			
Pathanamthitta			
Kottayam			
Idukki			
Ernakulam			
Thrissur			
Palakkad			
Wayanad			
Malappuram			
Kozhikode			
Kannur			
Kasaragod			
Total			

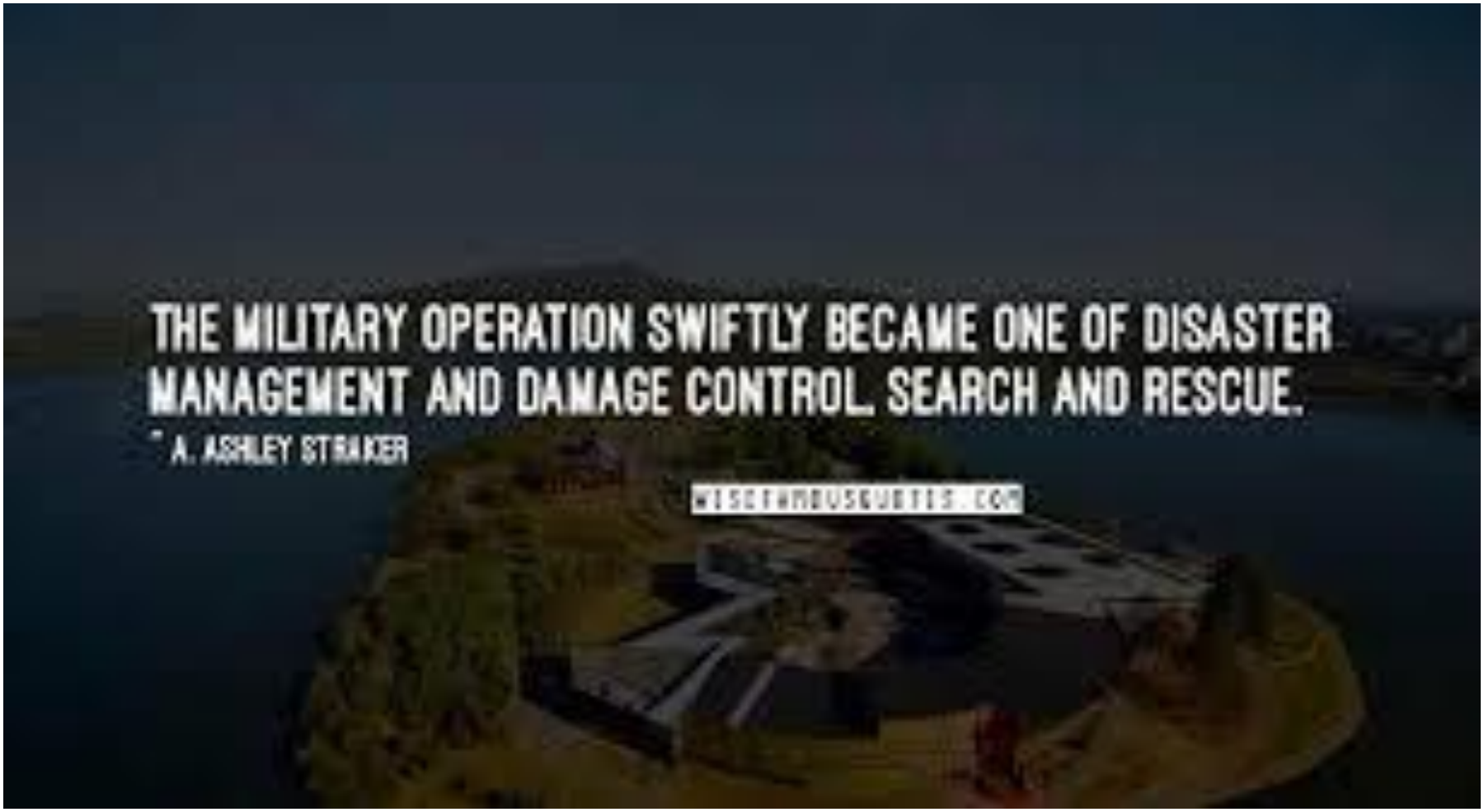
*Total includes internal GP roads and tribal roads.

Debris Management

- Construction & debris waste removal
- Agriculture reuse of organic waste
- Fisheries infrastructure (incl. nets) – using financial incentives
- Households, plastics and electronic wastes – using financial incentives
- Debris & marine litter through incentivizing community

Additional risk mitigation measures

- Reduce vulnerability of current housing stock
- Raising and strengthening embankments
- Establishing and strengthening the institutional capacity to manage natural disasters in the state
- Develop risk financing mechanisms, in particular increasing insurance penetration for plantation farmers, MSMEs and tourism assets.
- Special attention for disadvantaged and marginalized groups at risk
- Exploring, utilizing and popularizing options for risk transfer mechanism for state and individuals


THE MILITARY OPERATION SWIFTLY BECAME ONE OF DISASTER MANAGEMENT AND DAMAGE CONTROL, SEARCH AND RESCUE.
" A. ASHLEY STRAKER

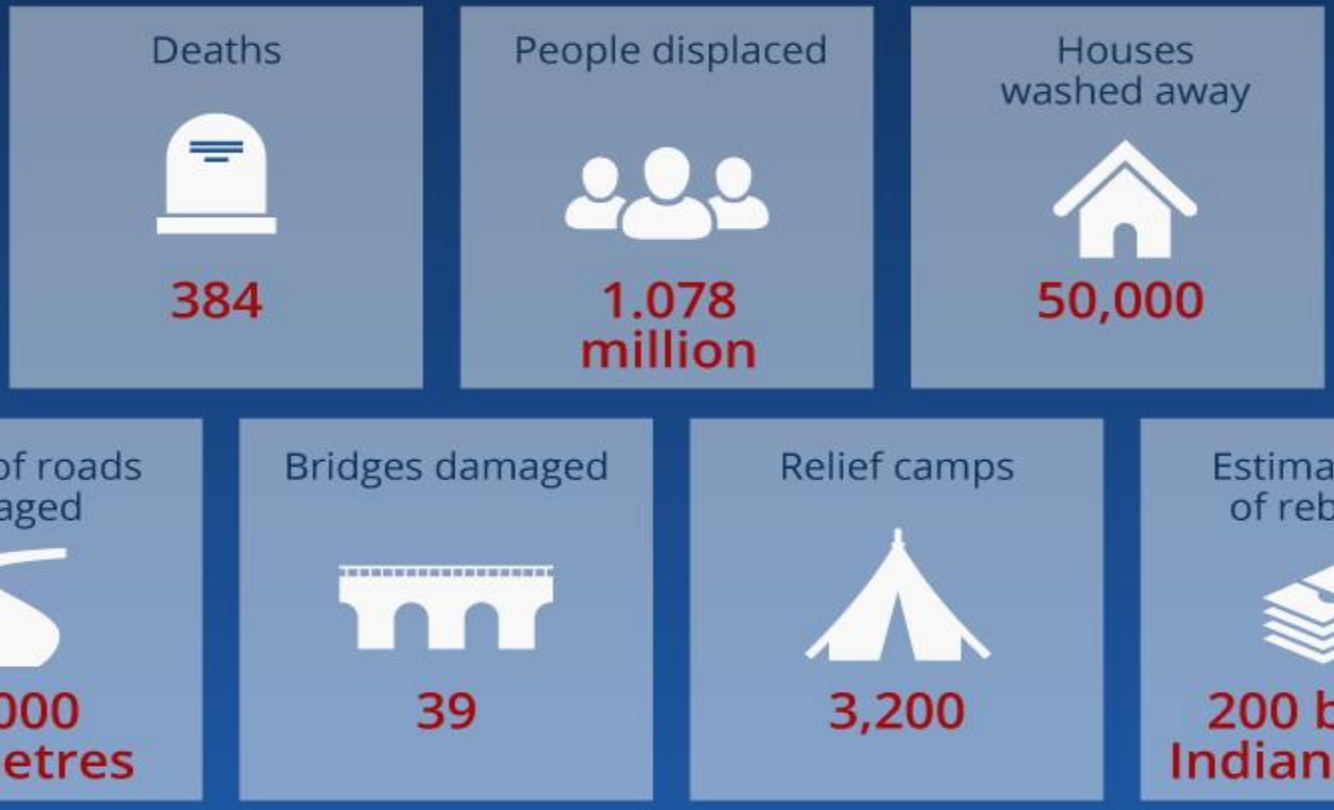
"Keep it short and simple (KISS). Abraham Lincoln's Gettysburg Address took only two minutes and 246 words, most of them of one or two syllables. Before Lincoln, then-famous orator Edward Everett's spoke for two hours and 13,607 words, many of them multi-syllabic. Simplicity is more memorable." - David Kusnet, former speechwriter to Bill Clinton

MAJOR FACTORS

- 67 days of rainfall out of 80 days of monsoons
- 30 % more rainfall
- Rule curve for Dams not followed
- No dedicated NDRF Bn stationed in Kerala

The Kerala floods were the worst in over a century

Key data regarding the severe flooding in the Indian state of Kerala in 2018*



* Estimated data. As of August 21st, 2018.

Sources: Livemint, Firstpost

FIRST TIME.....

- CAP and NDMS
- Priority routing
- Restructuring of Loans
- Initiate a world bank PDNA also

KEEPING TRACK

Data from satellites and buoys is being harnessed to forecast weather over Kerala and is being used to aid in rescue work

SATELLITES

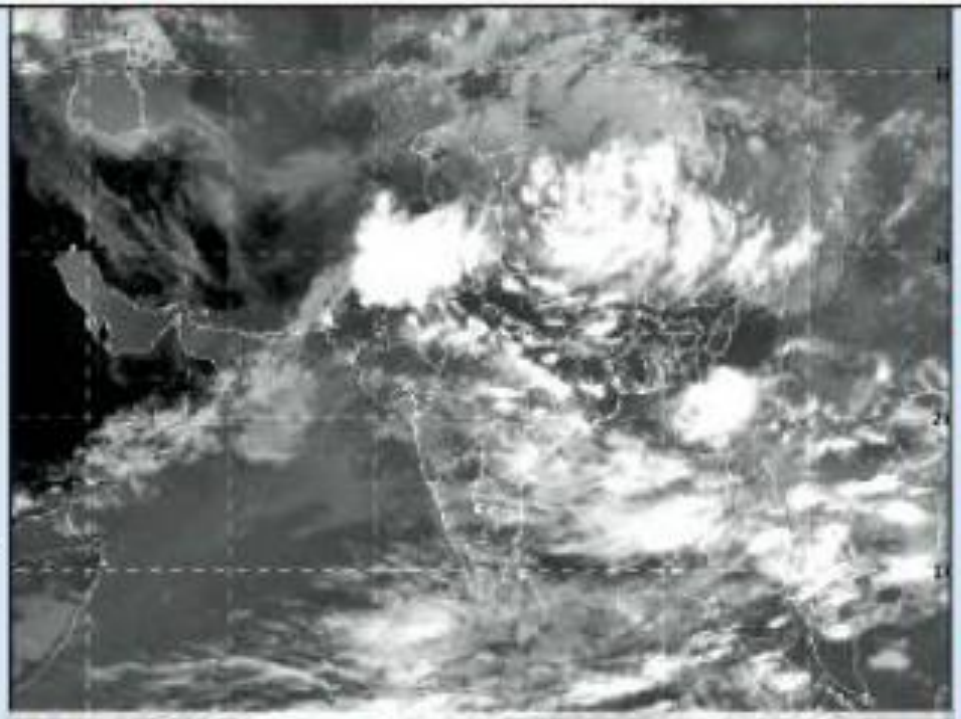
- Real-time satellite images are mapped and assessed at **the National Remote Sensing Centre (NRSC) and information about inundation is shared with state and central governments**
- **Five satellites are monitoring the weather and flood situation in Kerala:**

Oceansat-2

Resourcesat-2

Cartosat-2 and 2A

INSAT-3DR



A satellite image from INSAT-3DR taken at 6.45pm on Saturday

BUOYS

- **Buoys track waves and wind** in the Arabian Sea
- **Six wave rider buoys are maintained** by Indian National Centre for Ocean Information Services (INCOIS) at a depth of 25m
- **Seven data buoys are maintained** by National Institute of Ocean Technology (NIOT) at a depth of around 3,000m
- **INCOIS uses data from buoys to measure wave direction,** wave period and wave height
- **A three-day forecast on high waves and wind alert** is provided

Flood toll and damage

- At least **400 people have died** in the floods triggered by heavy rains
- Of the 14 districts, **11 have recorded excess rains.** Idukki, Palakkad, Alappuzha, Ernakulam and Thrissur are among the worst-affected districts
- As many as **43 people died in Idukki** district alone

Points of concern about dams

- The average lifespan of a dam is **50 years,** after which the likelihood of its failure increases dramatically
- In Kerala, at least **24 dams** are more than **50 years old**
- The **Mullaperiyar Dam** in Idukki district is **123 years old**
- The **safety of the dam** has been a major cause of concern and there have been demands for decommissioning it in the past

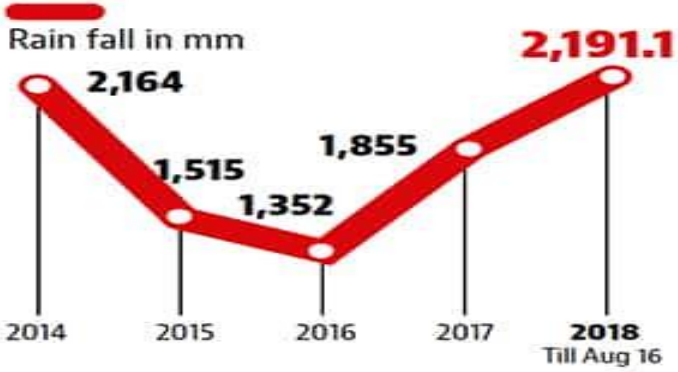
Rains in Kerala and rest of India

Kerala normally receives highest rain among Indian states. But, this year has been unusual

7,158 mm (46.09 %)
of the rainfall in India in entire region
(Kerala, Konkan and Goa, Coastal Karnataka)

15,530 mm In rest of India

Average rainfall in Kerala in past years



1,606 mm rainfall Kerala received till mid-August in 2017

30% excess rainfall in 2018 as compared to normal years --- long term average of 50 years.

70% excess rain in Idukki district, which has Mullaperiyar and Idukki dams.

41% excess in Malapurram and Kottayam districts

21% excess in Ernakulam district

Rains and floods heaviest since 1924

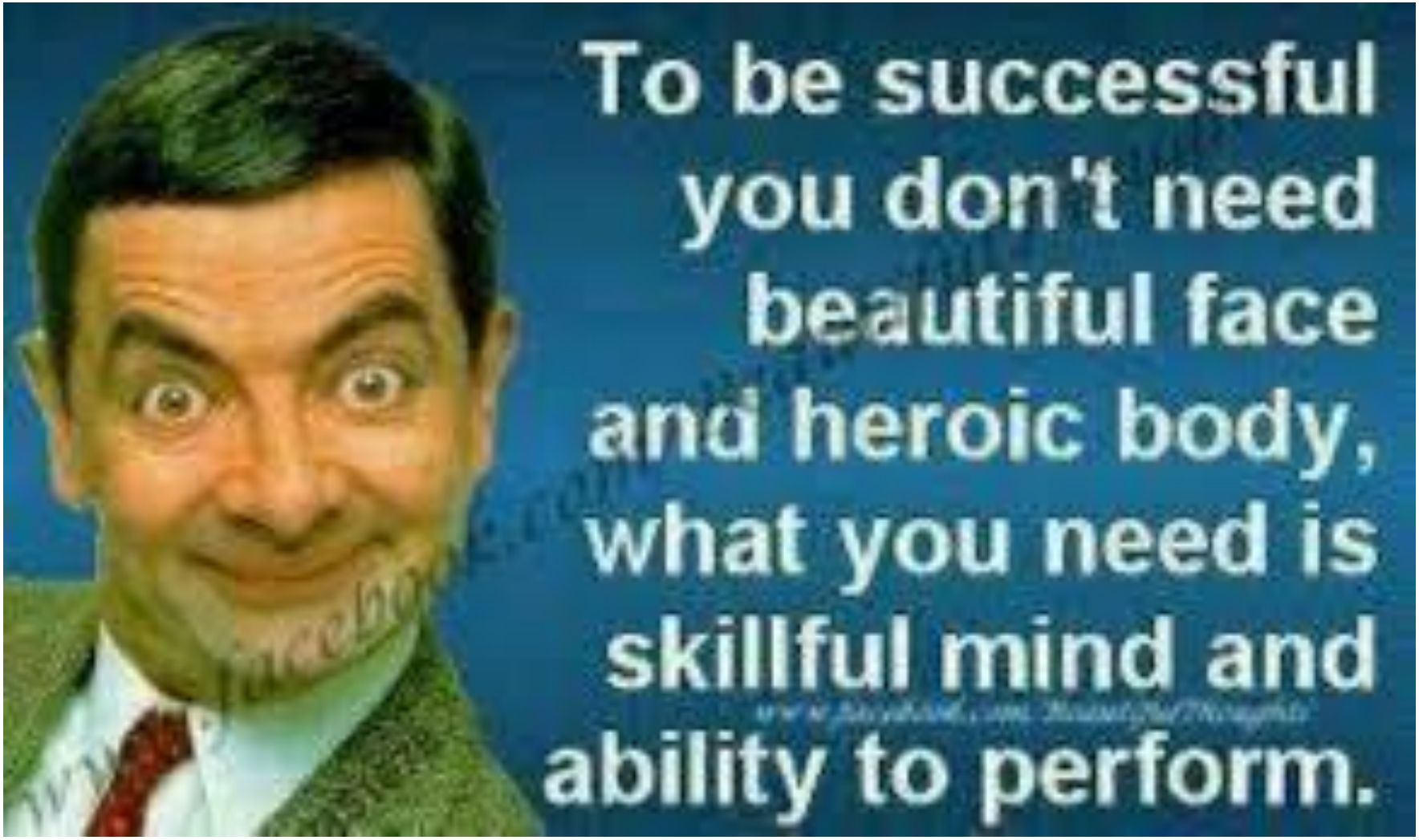
Rescue teams evacuate residents in a boat in Aluva. AFP

IMPACT				
	8,316 crore loss	**1,50,000** people in relief camps	**10,000** km big and small roads affected	**444** Villages declared flood-hit
ACTION	Moratorium on agricultural loans	₹10,000 interim relief for those in relief camps	₹10 lakh for those who lost both land, house	

SOURCE: IMD


WHEN SOMETHING BAD HAPPENS
YOU HAVE THREE CHOICES. YOU
CAN EITHER LET IT DEFINE YOU,
LET IT DESTROY YOU, OR YOU
CAN LET IT STRENGTHEN YOU.


"I'LL BE BACK..."
"REPEATEDLY!"


To be successful
you don't need
beautiful face
and heroic body,
what you need is
skillful mind and
ability to perform.

Thank you