REVITALIZING THE DISASTER RESPONSE MECHANISM IN FACE OF CALAMITY IN INDIA

A Dissertation submitted to the Panjab University, Chandigarh for the award of Master of Philosophy in Social Sciences, in Partial Fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA)

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CERTIFICATE

I have the pleasure to certify that Brigadier Kuldip Pathak, SM, VSM has pursued his research work and prepared the present dissertation titled **Revitalizing the Disaster Response Mechanism in Face of calamity in India** under my guidance and supervision. The dissertation is the result of his own research and to the best of my knowledge, no part of it has earlier comprised any other monograph, dissertation or book. This is being submitted to the Panjab University, Chandigarh, for the purpose of Master of Philosophy in Social Sciences in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration of the Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Brigadier Kuldip Pathak, SM, VSM, is worthy of the award of M.Phil degree of Panjab University, Chandigarh.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ARMVs	Accident Relief Medical Vans
ACAS	Assistant Chief of Air Staff
ACNS	Assistant Chief of Naval Staff
ACIDS	Assistant Chief of Integrated Defence Staff
BIS	Bureau of Indian Standards
CAG	Comptroller and Auditor General
CADRE	Community Action for Disaster Response
CBRN	Chemical, Biological, Radiological and Nuclear
CBOs	Community Based Organisations
CCS	Cabinet Committee on Security
CD	Civil Defence
CDRI	Coalition for Disaster Resilient Infrastructure
CISC	Chief of Integrated Staff of the Chairman Chiefs of Staff Committee
CMG	Crisis Management Group
COP	Conference of Parties
CBRN	Chemical, Biological, Radiological and Nuclear
CCMNC	Cabinet Committee on Management of Natural Calamities
CPMF	Central Para Military Forces
CPWD	Central Public Works Department
CRED	Centre for Research on the Epidemiology of Disasters
CSSR	Collapsed Structure Search and Rescue
CSR	Corporate Social Responsibility
CRF	Calamity Relief Fund
CWC	Central Water Commission
DM	Disaster Management
DCBA	Disaster Countermeasures Basic Act
DCMG	Defence Crisis Management Group
DCNS	Deputy Chief of Naval Staff
DDMA	District Disaster Management Authority
DEOC	District Emergency Operations Centre
DGMO	Director General of Military Operations
DMAT	Disaster Medical Assistance Team
DRDO	Defence Research and Development Organization

DRR	Disaster Risk Reduction
DTC	Decontamination and Treatment Centre
EM-DAT	Emergency Events Database
EOC	Emergency Operations Centre (Control Room)
ETF	Engineers Task force
FEMA	Federal Emergency Management Agency
GDP	Gross Domestic Production
GIS	Geographic Information System
GP	Gram Panchayat
GPS	Global Positioning System
GOI	Government of India
HADR	Humanitarian Assistance and Relief
HPC	High Powered Committee
HOPE	Hospital Preparedness for Emergencies
IAF	Indian Air Force
ICT	Information and Communication Technology
IDNDR	International Decade for Natural Disaster Risk Reduction
IDRN	India Disaster Resource Network
IDS	Integrated Defence Staff
IEC	International SAR Advisory Group External Certification
IIT	Indian Institute of Technology
IMD	Indian Metrological Department
INSARAG	International Search and Rescue Advisory Group
IRT	Incident Response Team
JMAT	Japan Medical Associations Team
KSEB	Kerala State Electricity Board
KWA	Kerala Water Authority
MEA	Ministry of External Affairs
MERT	Medical Emergency Response Team
MFR	Medical First Response
MHA	Ministry of Home Affairs
MSDF	Maritime Self Defence Forces
NCMC	National Crisis Management Committee
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force

NDMP	National Disaster Management Programme
NDRF	National Disaster Response Force
NEC	National Executive Committee
NEOC	National Emergency Operations Centre
NSG	National Security Guard
NCC	National Cadet Corps
NCCF	National Calamity Contingency Fund
NCMC	National Crisis Management Committee
NDEM	National Database for Emergency Management
NDMA	National Disaster Management Authority
NDMF	National Disaster Mitigation Fund
NGOs	Non-Governmental Organisations
NIDM	National Institute of Disaster Management
NITs	National Institutes of Technology
PIB	Press Information Bureau
QRT	Quick Reaction Team
SAR	Search and Rescue
SDMA	State Disaster Management Authority
SDG	Sustainable Development Goal
SDRF	State Disaster Response Force
SEC	State Executive Committee
SEOC	State Emergency Operation Centre
SNC	Southern Naval Command
SOPs	Standard Operating Procedures
SWR	Swift Water Rescue
ULBs	Urban Local Bodies
TA	Territorial Army
UN / DAC	UN Disaster Assessment and Coordination
UN / ISDR	United Nations / International Strategy for Disaster Reduction
UN-OCHA	United Nations Office for the Coordination of Humanitarian Affairs
USAR	Urban Search and Rescue
VSAT	Very Small Aperture Terminal
WCDRR	World Conference on Disaster Risk Reduction
WSSD	World Summit on Sustainable Development
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

India is highly vulnerable to natural disasters on account of its diversity of geo-climatic conditions and socio-economic settings. Floods, droughts, cyclone, earthquakes and landslides have been a recurrent phenomenon. The vulnerability in India is more compared to developed countries. This is resulting in huge loss in terms of human, financial, environmental and livelihood. As witnessed in the historical timelines, the disaster governance in India was primarily based on contingency management approach. Codes and guidelines for preparedness and relief existed even before Independence. Post Orissa Super Cyclone 1999 & Gujarat Earthquake in 2001, it was realized, that there was an urgent need to adopt multi-disciplinary and multi-sectoral approach and incorporation of risk reduction in the development plans and strategies.

The Disaster Management (DM) Act came into force in 2005 and the National Policy on Disaster Management (NPDM) was released in 2009. The National Disaster Management Plan (NDMP) was released in 2016, which focuses on prevention & mitigation as the basic tools for reducing human suffering. The NDMP was prepared as per Sendai Framework on Disaster Risk Reduction signed by India in 2015, further revised in 2019. While the new system has crossed the evolutionary stage, the disaster response mechanism in India has become more professional and swift. However, the handling of disasters during the last decade, still reveal a number of inadequacies in our DM Act / policies and DM agencies at National, State & District level. The level of orientation, focus and preparedness of various States, including their SDMAs and the grassroots level DM machinery varies. In most of the States, community participation and awareness in the public, has been found to be inadequate or lacking. As a result, during disasters the Armed Forces are invariably requisitioned to assist the civil administration. Despite raising of NDRF as a specialist force to respond to disasters, there is has been no reduction in involvement of the Armed Forces in DM operations. Considering these shortcomings, this dissertation attempts to identify & analyze the inadequacies in DM response mechanism of India and recommend measures to strengthen the DM response mechanism, to make it more synergized, responsive and swift.

India's Disaster Vulnerability

India is one of the most disasters prone countries of the world, almost 80% of India's geographical area is considered at risk to one or more type of natural disaster. About 60% of the landmass is prone to earthquakes of various intensities, over 40 million hectares is prone to floods, about 8% of the total area is prone to cyclones and 68% of the area is vulnerable to droughts. Further, a mix of poor socio-economic conditions and disasters has created a vicious cycle of poverty and vulnerability. Around 260 million poor living in the country, majority of them are living in the disaster-prone regions, especially in the arid, semi-arid and floodplains. The changing topography due to environmental degradation has also increased the vulnerability of the country. During the last thirty years' time span, the country has been hit by 431 major disasters resulting into 143039 people getting killed and about 150 crore affected by various disasters in the country. These disasters caused huge loss to property and other infrastructures costing more than US $ 4800 crore.

Indian Disaster Framework & NDMP

The DM Act 2005 has provided the legal and institutional framework for DM in India at three levels, i.e. National, State and District levels. In the federal polity of India, the **primary responsibility of DM vests with the State Governments**. The Central Government lays down policies & guidelines and provides technical, financial and logistic support, while the district administration conducts the disaster relief operations in collaboration with central and state level agencies. Post enactment of DM Act 2005 & National Policy on Disaster Management (NPDM) 2009, there has been a paradigm shift in the way the disasters are being handled in India. From a relief-centric response, India **has now transited into proactive prevention, mitigation and preparedness driven approach,** to minimize loss of lives and property. The act created three new institutions; NDMA, NIDM and NDRF. The NDMA is the apex body at the top, NDRF is the specialist force to deal with disasters and the NIDM was created with a mandate of planning and promoting training & research in the area of DM. NDMP 2016 is the first-ever national plan prepared in the country. It aims to make India disaster resilient and significantly reduce the loss of lives and assets. The plan is based on the four priority themes of the "Sendai Framework," namely; understanding disaster risk, improving disaster risk governance, investing in disaster risk reduction (through structural and non-structural measures) and disaster preparedness, early warning & building back better, in the aftermath of a disaster.

The MHA is overall responsible for DM in the country, with support of specific ministries, which have been designated as nodal agencies to lead the disaster relief initiatives in the country. At the State level, the SDMA and DDMAs, are responsible for dealing with disasters at grass root levels. In 2019, PM Narendra Modi announced a global Coalition for Disaster Resilient Infrastructure (CDRI), at the UN Climate Action Summit 2019 in New York. PM Modi emphasised upon the requirement to establish a global platform for knowledge exchange and capacity development to facilitate the development of disaster resilient infrastructure for sustainable development.

Reasons for Poor / Inadequate Response

Since enactment of DM 2005, India's DM response has substantially improved during various natural & manmade calamities in last decade and our response to disasters has become more cogent & coordinated, greatly facilitating in mitigating loss of lives and material damages. The newly raised National Disaster Response Force (NDRF) has performed well in DM operations; however, its performance during large scale calamities has been found to be inadequate. The level of orientation, focus and preparedness of various States, including their SDMAs and the grassroots level DM machinery varies. In most of the States, the focus and preparedness has been found to be inadequate or lacking, seriously impinging on the disaster response & rescue efforts. As a result, the Armed Forces are invariably requisitioned to assist the civil administration, once the disaster has struck. The NDRF was raised with the aim to create a specialist disaster response force and to reduce the involvement of Armed Forces in DM operations. However, despite the raising of NDRF, there is has been no reduction in involvement of the Armed Forces in DM operations. Lack of efficient DM machinery at State, District and local level, absence of first responder capacity at the community level and lack of adequate competencies & capabilities among disaster managers, are some of the reasons for poor response during disasters. The poor response could also be attributed to lack of integration of the Armed Forces and also due to non-inclusion of agencies / organizations like Red Cross, NGOs, NCC, NSS, Civil Defence and schools/ colleges in DM framework.

Lessons from Japan's Disaster Management System

India has lessons to learn from the Japanese experience in handling disasters. Japan's geography and climate makes it vulnerable to frequent natural disasters such as typhoons,

torrential rains and heavy snow, earthquake, tsunamis and volcanic eruptions. To protect lives of their citizens, their livelihood and property from natural disasters and its management is a national priority. In Japan, the DM system has been developed and strengthened following the bitter experience of large-scale natural disasters and accidents. Japan's DM system focuses on prevention, mitigation, preparedness, emergency response, as well as recovery and rehabilitation. With clear roles and responsibilities of the national and local governments, the relevant stakeholders of the public and private sectors cooperate in implementing various disaster countermeasures. In prefectures and local municipalities, the prefectural and municipal DM Councils are established with the members of representatives of local government organizations, including police and fire management department and local public companies. Implementation of disaster risk management measures is based on the Local DM Plans, drafted by the Councils. The **local participation in DM is the essence of their plan** and the Japanese do not have a concept of a standing disaster response force for emergency response and executes its relief & rescue operations through its self-defense forces and well trained civil volunteers.

Recommendations

In a huge country like India, with multi disaster vulnerability, there is a need to include **DM subject in the concurrent list** and a **separate DM Ministry** at National & State level to deal with all types of calamities as suggested by the High Powered Committee in 2002. The DM Act 2005 was enacted 15 years ago and since then the DM frame work in India has improved significantly. However, there are certain inadequacies / shortcomings in our DM framework / mechanism, which need to be removed, to make our disaster response mechanism more robust and swift. In Japan, Post Tsunami in 2004, the DM acts and polices were reviewed four times, to strengthen DM framework. Similarly, **we also need to periodically review our DM acts & policies to strengthen our DM mechanism**.

To strengthen the overall DM response mechanism at Centre & State levels, there is a requirement of a **multi-level response mechanism (four layered**); the NDRF and the Armed Forces at National level; SDRF at State level; Fire & Emergency Services, Civil Defence, State Police, Home Guards, NSS and NYKS etc at District level and well aware community and volunteers at grass root level. **There is also an urgent need for a matching state response mechanism** at all levels (state/district/block/panchayat). **International assistance** received from various countries / international organizations also needs to be incorporated into our overall DM framework, for its optimum utilizations and prevention of duplication of efforts. To **strengthen**

the DM emergency response mechanism, there is an urgent need to building capacities on Community Action for Disaster Response (CADRE), Hospital Preparedness for Emergencies (HOPE), Medical First Responder (MFR) and Collapsed Structure and Search and Rescue (CSSR). We also need to focus on strengthening the Disaster Management Support (DMS) at State level by creating suitable infrastructure, Incident Response System (IRS), procurement of equipment and capacity building.

We need to focus on **building Community based DM response mechanism**, creating resilience at grassroots level. **Capacity building** of State Police, Home Guards**,** Fire Services, Civil Defence, NCC & NSS volunteers, to **create effective first responder capability**, needs to be undertaken by the States. **Clear mandate and tasks for these services / organizations, including Armed Forces & NGOs** need to given out in our National/State Acts and policies, for efficient and swift conduct of DM response and relief operations. The NDRF & SDRF need to be equipped and trained on specialist emergencies and a separate cadre needs to be created for these specialist forces, for retaining the trained manpower and expertise. It is also **recommended that the MFR and CSSR training capsule be made mandatory for all the Para Military forces, undergoing recruitment training**. This will greatly facilitate in keeping the PMF adequately trained for DM operations.

India needs to lay emphasis on **building infrastructure for advanced hazard tracking** of climatological and geological hazards, state of art modeling techniques and systems for early warning of calamities and dissemination of information / warnings to various stake holders, including local communities. There is requirement of establishing a national public early warning system in the country, on the lines of Japan response model, with last mile connectivity to alert / warn to villagers in remotest areas. State Governments need to **develop Search and Rescue capabilities and reserve caches** in recurrent disaster prone areas and **construct disaster resilient infrastructure** to prevent loss of lives and property during calamites. There is a **need to bring in high end technology** to increase our capacities in the domain of response and for that we need to integrate all our key institutions in the area of research & development.

Conclusion

Natural disasters will continue to bedevil the country. It is the collective efforts of the GoI and the State governments, along with the people's active participation that will facilitate in rendering a synergized and a prompt response to mitigate the risks of disasters. The exploitation

of technological advancements will enable predication of impending calamities and help the DM agencies to timely preposition rescue teams and carryout preventive evacuations of locals from the affected areas, thereby drastically reducing the loss of lives and damage to property. The enactment of the DM act in 2005 gave an unprecedented fillip to institutional capacity accretion and capability building for addressing the entire gamut of DM activities. In nearly a decade since then, some entities created by the act like NDMA and NDRF have emerged almost as envisioned, while others like NIDM, SDMAs, DDMAs, etc are still away from any meaningful value in the DM calculus and framework. The DM Act 2005, which was enacted 15 years ago and other laws / policies need to be reviewed periodically, especially after a major disaster, to incorporate the lessons learnt to further strengthen / improve upon the DM Mechanism.

The growing scale, frequency and ferocity of disasters necessitate optimal employment of all national resources of which in terms of capability in the context of DM, armed forces remain unparalled. If our nation is to evolve, an overall framework that is responsive, capable of swift reaction and sustained operations, the armed forces will need to be integrated into the DM framework. Finally, the State governments need to focus on community resilience, as they are the nearest to the site of the disaster and usually the first responders. The world over, there is renewed focus on community as the pivot of all DM activities.

CHAPTER I

INTRODUCTION

"Even with all our technology and the inventions that make modern life so much easier than it once was, it takes just one big natural disaster to wipe all that away and remind us that, here on Earth, we're still at the mercy of Nature"

Neil deGrasse Tyson
American Astrophysicist
Author

Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources **(UNISDR 2009)**.

Disasters can either be natural or manmade. Natural disasters include floods, droughts, earthquakes, cyclones, hurricanes, tornadoes, landslides, volcanic, eruptions, tsunamis etc. Manmade disasters can include chemical accidents, oil spills, radiological accidents, conflicts/wars, mass population displacement, forest fires, etc. Natural disasters have been a major concern of the global community since more than 203 million people are affected annually year **(John 2003).** The intensity of natural disasters have been on the rise mainly due to reasons attributable to mankind in terms of wanton destruction and utilization of Earth's resources, thus leading to changes in the ecological balance of the earth, as well as on overall global warming.

A vast country with varied climatic conditions and terrain, India remains vulnerable, in varying degrees to various types of natural and manmade disasters. 58.6 % of India's landmass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12%) of its landmass is prone to floods, about 5,700 km, out of the 7,510 km coastline is prone to cyclones / tsunamis and mountainous areas are at risk from earthquakes, landslides and avalanches. Among all disasters afflicting the country, river floods are the most frequent and often the most devastating **(Sharma 2001)**. Nearly 68 % of the cultivable area is vulnerable to droughts **(NDMA 2008)**, Earthquakes are considered amongst the most dangerous and hazardous, their impact being sudden with little or no warning. The Himalayan region, Northeast India, Myanmar, Andaman & Nicobar Islands region is a part of the global seismic belt running from Mediterranean Sea, Turkey, Iran, Afghanistan, Himalayas, Myanmar, extending to Indonesia and

thence to the Pacific region. The occurrence of the earthquakes in this region is attributed to the north and north-easterly movement of the Indian plate, at the rate of five cm per year. **(Srivastava, HN)**.

Disaster risks in India are further compounded by increasing vulnerabilities related to changing demographics, increase in population density, large scale deforestation, rapid change in socio-economic conditions, unplanned urbanization & disregard to construction within high-risk zones, climate change and various pandemics. Evidently, all these contribute to a situation where disasters seriously threaten India's economy, its population and sustainable development. These factors have further increased / aggravated common disasters, such as in the case of the Kashmir, Chennai and Kerala floods. In addition, India is also remains vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other manmade disasters. An industrial disaster like the infamous Bhopal gas tragedy of 1984 was extremely catastrophic.

India is among the top ten disaster prone countries of the world, frequently hit by natural disasters. These included the earthquake in Gujarat in 2001, which resulted in 20,000 deaths, the Tsunami in Indian Ocean in 2004 caused around 11,000 deaths and affected 2.79 million people, the 2013 floods in Uttarakhand resulted in 5,748 deaths and affected 4,200 villages. Before this, India's major disasters included Cyclone Paradip in 1999, which caused more than 10,000 deaths. In all the major disasters, the poor in India faced the maximum brunt, as they were found to be extremely vulnerable, in face of the calamities. According, to the World Risk Index 2014, India is among top ten of the countries at risk from natural hazards and more importantly, for many decades after attaining independence, severely lacked the capacity to deal and mitigate these hazards **(WRR, 2014).**

India has come a long way from its relief oriented approach to disasters based on the British legacy of Famine Code to the National Disaster Management Plan (NDMP), prepared by National Disaster Management Authority (NDMA) in 2016, based on the DM Act of 2005. The authorisation of the DM act of 2005, **prompted in change of outlook in DM, from relief centric reaction to a proactive prevention, mitigation and preparedness centric response** to minimise loss of lives and property during disasters. NDMP focuses on prevention & mitigation as the basic tools for reducing human suffering **(NDMP2016)**. The NDMP was prepared as per Sendai Framework on Disaster Risk Reduction, signed by India in 2015.

The DM Act, 2005, envisaged the creation of the National Disaster Management Authority (NDMA), headed by the Prime Minister, State Disaster Management Authorities (SDMAs) headed by the Chief Ministers and District Disaster Management Authorities

(DDMAs) headed by the District Collector or District Magistrate, to spearhead and adopt a holistic and integrated approach to DM. The DM Act, 2005 clearly spells out role of various agencies or stake holders responsible for DM. Additionally, National Disaster Relief Force (NDRF) has been raised as a specialist force to deal to deal with any disaster or threatening disaster situation, as a direct result of this Act. The role of Armed Forces in national disasters has been assigned as secondary in nature, as per the DM Act 2005 **(MHA2005).**

Since then, India's DM response has improved during various natural & manmade calamities. However, the Uttarakhand floods in 2013, Kerala floods of 2018, Cyclone Amphan in West Bengal/ Orissa in 2020, Baghjan oil well fire in Assam in 2020 and the recent Glacier burst in Uttrakhand in 2021, are some of the examples to highlight inadequacies in our preparedness and tawdry response of our DM agencies. State governments and the local authorities are often found under-prepared in dealing with calamites; as a result the Armed Forces are invariably called out to assist the civil administration, once the disaster has struck. The Armed Forces of any country are probably the best organised and are in a high state of readiness to provide immediate support in a full range of public services such as public works, communications, transport, emergency medical services and rescue activities. In India's context, the Armed Forces are called in reaction mode, after the calamity/ crisis has struck, losing the vital time for emergency response. Such a vital national resource has been left out during the planning and preparation stage of the DM process by DM Act 2005, seriously impinging the response & relief efforts.

Therefore, there is a need to identify the shortcomings/ challenges in our DM mechanism and recommend measures to strengthen our mitigation and response measures to make India disaster resilient. As the scope of the subject is very large**, the study will focus on strengthening the response mechanism, with special emphasis on emergency response mechanism,** to make the DM more efficient and robust.

Statement of the Problem

For a developing country like India, which is plagued by natural and manmade calamities, with alarming regularity, the need to evolve and put into effect strategies, adopting an integrated approach that ensures optimum utilization of all available agencies, to deliver robust and swift response, cannot be overemphasized. Post the implementation of DM Act of 2005, the response mechanism during occurrence of a disaster has improved. However, it was observed during the disasters in last decade, that the response mechanism of National and State level agencies, still

require considerable improvement. NDRF, the main force responsible for disaster response has been found to be underprepared & under-equipped on several instances, especially during large scale calamities. Likewise, in majority of the States, the disaster response and mitigation capabilities are lacking / nonexistent, resulting in delayed & tardy response during rescue & relief efforts, thus leading to large scale casualties and damage to property. As a result, the Armed Forces are invariably requisitioned to assist the civil administration, in a reactive mode and the former have to function without adequate preparations, information of the area, equipment and lack of synergy with other DM agencies. This happens due to absence of clear mandate for Armed Forces in DM Act of 2005, as result they are left out during the planning and preparatory phase. Likewise, there are other shortcomings / gaps in our National / State Acts & policies, including various reasons at State / District level, for eg, lack of orientation, training and inadequate capacities of DM agencies, to name a few, responsible for poor response during rescue & relief. Thus, there is need to identify the gaps / shortcomings in our disaster response mechanism and recommend measures to make the disaster response mechanism, robust and swift.

In addition, there is also a need to incorporate disaster response content into the Nation's DM strategy to break free from the restrictive focus of only alleviation and restoration measures.

Aim & Objectives of the Research

Aim. To study DM mechanism in India, analyse India's disaster response mechanism and recommend measures to strengthen the response mechanism during disasters. The study will primarily focus to strengthen the response mechanism, especially the emergency response to make the DM response mechanism more efficient and robust, to include:-.

(a) Early Warning.

(b) Evacuation & Saving People.

(c) Providing Immediate Assistance.

(d) Immediate Restoration of Infrastructural Services.

Objectives. The objectives of the research work are:-

(a) To study India's institutional DM framework and analyse inadequacies in our disaster response system, especially emergency response, through case studies of recent

disasters. Also carryout out a comparison of our DM response mechanism, with that of the developed countries.

(b) To analyse and recommend changes to legal framework DM and the DM mechanism at National & State Level, especially to improve the response, with special reference to NDRF Battalions and other agencies.

(c) To identify the existing national resources, with special reference to the Armed Forces, which will address DM mechanism inadequacies & improve our response during a calamity.

(d) To recommend measures to strengthen India's response mechanism, especially emergency response.

Hypothesis

The hypothesis of the dissertation is that India's preparedness to deal with disasters with respect to preparation, mitigation, response procedures and rehabilitation has improved with enactment of DM Act of 2005. However, based on the performance of our DM agencies during calamities / emergencies in last decade, substantial efforts are still required at Centre / State level to improve the capacities & competencies of DM agencies, including local communities at grassroot level, to strengthen the DM response mechanism during emergencies. The DM response mechanism needs to be revitalised, synergized and made proactive.

Rationale and Justification

India's DM response, in recent past has improved during various natural & manmade calamities, post the enactment of DM Act, 2005. The Act led to creation of the National Disaster Management Authority (NDMA), headed by the Prime Minister, State Disaster Management Authorities (SDMAs) headed by the Chief Ministers. However, the Uttarakhand floods in 2013, Kerala floods of 2018, Cyclone Amphan in 2020, the Bhagjan Oil well fire in 2020 and the recent Glacier Burst in Uttarakhand in 2021, exposed the shortcomings of DM mechanism and highlighted the inescapable requirement of reviewing our DM response plans to remove the shortcomings observed during these disasters and strengthen our DM response mechanism in an event of a calamity.

Therefore, there is a need for research to identify shortcomings in our capabilities to respond to disasters and recommend measures to strengthen response mechanism of our DM machinery, making it more efficient and robust.

Research Questions

The research questions are as follows:-

(a) What are the shortcomings in our DM framework and disaster emergency response system and how do we compare ourselves with the DM system of the developed countries?

(b) What are the strengths & weaknesses of various stake holders responsible for DM at Centre, State & District Level, with special reference to SDMAs / DDMAs / NDRF /SDRF?

(c) What are the existing national resources, with special reference to the Armed Forces, which can address our inadequacies?

(d) Is there adequate coordination between NDRF and Armed Forces during DM response?

(e) What are the recommended changes / measures to further improve our DM response mechanism to make it more robust, synergised and proactive?

Methodology

A detailed study of the subject with special reference to three case studies has been carried out to analyse the response of DM agencies, including that of NDRF & SDRF and the role played by the Armed Forces during the calamities. A response mechanism of a developed country has also been studied to identify their strengths, which will assist in improving our response. Interaction and visit was planned to be carried out with the NDRF Battalion at Ghaziabad & NDMA, however, the same could not materialize due to non grant of permission, owing to COVID pandemic. However, interactions were carried out serving and retired officers of NDMA to understand the strengths, weaknesses and shortcomings of various DM agencies, including the SDMA & SDRF at State level (especially about the functioning of the agencies in Uttrakhand, Sikkim & Odhisa). In addition, information was gathered from Service officers of the Army Navy and Airforce, especially those who had been involved in rescue and relief operations.

Own experiences in management of disaster relief were also used to bring out relevant lessons. Views of the retired and serving civil servants involved in DM were also solicited to build a wholesome picture. After a thorough study, the analyses were carried out and recommendations made.

Research Design

Since the topic involved a large number of intangible variables; descriptive and qualitative methods of analysis was used. The material available and the factual data was analysed to draw inferences. In addition, evaluating research technique was also be used to assess our DM response mechanism, with specific reference to NDRF and utilization of Armed Forces, to strengthen the coordination & response mechanism. It involved fact-finding followed by interpretation. A questionnaire was formulated to carry out a survey of various stakeholders (Govt – NDRF, Army/ Locals), to obtain a feedback on the shortcomings noticed during recent calamities and areas, where we need to lay efforts to make our response mechanism more efficient, robust and swift.

Literature Review

Adequate literature is available on the subject of DM. There are also several journals, articles and research papers and reports on the subject by NDMA, Ministries and Academic institutes and various think tanks. The DM response plan has been given out by the NDMA and SDMAs of some States, which lay down the action plan by nodal ministries/ departments. In addition, the following important reference points have been identified:-

(a) **Books**.

(i) Ashu Pasricha and Kiyanoush Ghalavand in their book **Disaster Management and Strategies** have given strategies to deal with disasters (Pasricha and Ghalavand, 2014).

(ii) Professor Vinod Kumar Sharma in his book **Disaster Management** has discussed the India's response strategy in detail. The book has useful information regarding natural disasters, such as disaster history report, guidelines of hazards and vulnerability analysis, but the book has limited details about the emergency response force. (Sharma, 2013).

(iii) **Disaster Management** by SL Goel and Ram Kumar was first published in 2001 and primarily covers aspects related to DM, organisational structure, material, financial management & health management and finally covers rehabilitation measures, especially in case of earthquakes. The book is a good source to understand the basics of DM process. However, the book focuses more on earthquakes. It is also pertinent to note that the book was published before National DM Act 2005 was promulgated; hence the implications and effects on Disaster relief are not included (Goel & Ram, 2001).

(iv) Mohan Kanda in the **Special Issue on Disaster Management**, Journal of Governance, Jan 2021, brings out the paradigm shift in DM approach in the World and India, the changing landscape, current thrusts, developing capacities in DM and preventing losses from landslides & floods, but the book has limited details about the emergency response force (Kanda, 2021).

(v) **Safety and Disaster Management** written by Dr S Arulsamy and J Jeyadevi. This book covers various types of disasters, their cause, effects on environment and infrastructure, strategies for DM, planning and risk management process and aspects of mitigation in detail. The book also incorporates National DM Act 2005 and the present DM structure in India at various levels (Arulsamy & Jeyadevi, 2016).

(vi) **Disaster Management: Humanitarian Logistics in Relief Operations by H K Dangi** examines the systematic approach to relief logistics, global best practices and discusses briefly the role of NDRF, Armed Forces & NGOs in relief operations (Dangi, 2014).

(vii) **Disaster & Tsunami Management by A K Singh**, IPS has discussed the role of employment of the Armed Forces in search & rescue management, but does not discuss the measures to strengthen the DM response mechanism, including the response of NDRF (AK Singh, 2016).

(viii) **Disaster Management: Future Challenges and Opportunities by Jagbir Singh** highlights the technological means to manage disasters, with specific reference to remote sensing, GPS and GIS. Armed Forces satellite and space capabilities can be used to supplement the national resources. The book

dose not give out the recommendation to strengthen the response mechanism during disasters (Jagbir Singh, 2007).

(b) **Seminars, Research Papers, and Articles**.

(i) **Seminar on 'Revisiting India's Disaster Response Mechanism 2016'** was carried out by Vivekananda Foundation in Nov 2016 and a paper was brought out subsequently. The seminar brought out the shortcomings in our DM response mechanism and recommendations were given to improve the response mechanism (Vif India, 2016).

(ii) **Handbook on Disaster Management for Nodal Officers** by NIDM 2019. The handbook gives out the details of global agreement in DM in 2005, to include Sendai Framework for disaster risk reduction, Paris Agreement 205 and Sustainable Development Goals (SDG), 2015. The book also gives out institutional frameworks at National & State level for conduct of DM operations, including the financial arrangements, Post Disaster Damage & Need Assessment, Mainstreaming of Disaster Risk Reduction and National Early Warning System. However, fails to brings out the details of emergency response mechanism. (NIDM, 2019).

(iii) **Review of Institutions, Strategy for Standardisation & Mechanism and Capacity Building Strategy** carried out by Seads Technical and submitted to NIDM in September 2014 (SEADS 2014).

(iv) **2019 White Paper on Disaster Management in Japan** by Cabinet Office, Government of Japan. The White Paper brings out the lessons learnt from disasters of 2018 in Japan and gives out measures for disaster prevention and mitigation. It also gives out the implementation of the three year emergency response plan for Disaster Prevention, Disaster Mitigation and building national resilience and gives out ways towards establishment of a disaster conscious society (White Paper Japan 2019).

(v) **Disaster Management in Japan** by Cabinet Office, Government of Japan, Mar 2015, gives out detailed disaster emergency plan for Japan (CO Japan 2015).

(vi) "**A Study on the Disaster Management Framework of Japan"**, written by Chathura Liyanaarachchige of Asian Disaster Reduction Center in Apr 2016, analyses in detail the disaster response plan of Japan.(ADRC 2016).

(vii) Research Report on **Emergency Response Management in Japan** by Emin NAZAROV Nov 20122, Crisis Management Center Ministry of Emergency Situations, Republic of Azerbaijan analyses the emergency disaster response mechanism of Japan. (NAZROV, 2011) .

(viii) **Training Regime for Disaster Management issued by NDMA**. This booklet was issued by the NDMA in 2008, within three years of promulgation of NDMA, 2005. It gives broad training philosophy, primarily for the NIDM and NDRF to conduct training for DM delving upon each of the three phases of disaster in particular (NDMA, 2008).

(ix) **Disaster Management and the Role of Armed Forces** had been taken up as research project by Maj Gen N C Badhani. His research has focussed on the role of Armed Forces and how to improve its effectiveness during disasters. However, it has still not analysed the capabilities of NDRF and its synergised response with the Armed Forces. (Badhani, 2016).

(x) **Armed Forces in Disaster Management by O S Dagur**. This was published as Manekshaw Paper No 4 in 2008 and is an informative document in understanding the limitations in role of Armed Forces, training and equipment issues, faced while carrying out DM.(Daggar 2008).

(xi) **Armed Forces and Disaster Management in India by Ganesh Kumar and Brigadier Ravi Dimiri**. This was published by New Delhi Publishers in 2018. It analyses the role of Indian Armed Forces in DM by looking at deployment of Indian Armed Forces for the same in 2016. It consists of certain facts and suggestions with regards to role of the Indian Armed Forces and very briefly covers the disaster response mechanism in India.(Ganesh & Dimri, 2018).

(x) **Hyogo Framework for Action 2005-2015** by International Strategy for Disaster Reduction International Strategy for Disaster Reduction World Conference on Disaster Reduction from 18-20 Jan 2005. (UNIDSR 2005).

(xi) **Sendai Framework for Disaster Risk Reduction** 2015-2030 at Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, on 18 March 2015 (UNIDSR2015).

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(xii) In IIPA a dissertation was done by Brig Rajesh Sirivastava (44 APPPA) **on National Disaster Response Force: Strength & Weaknesses And it's Synergy with the Armed Forces**. The dissertation brings out the Strengths and weakness of NDRF and gives out recommendations for bringing in synergy with Armed Forces. However, the dissertation falls short of giving recommendations to strengthen response mechanism (Srivastava 2019).

(b) **Acts & Manuals**. Following have been analyzed:-

(i) Disaster Management Act 2005 by MHA (MHA 2005).

(ii) National Policy on Disaster Management 2009 by MHA (MHA2009).

(iii) Disaster Management in India in 2011 by MHA (MHA 2011).

(iv) Task Force Report on Review of DM Act 2005 by MHA in 2013 (MHA 2013).

(vi) National Disaster Management Plan (NDMP) 2016 by NDMA. (NDMP, 2016).

(vii) NPDM,(2009). National Policy on Disaster Management: 2009. New Delhi: Ministry of Home Affairs. (NPDM, 2009).

(viii) Report of High Powered by Committee on Disaster Management by National Centre for Disaster Management, 2001. (NCDM, 2001).

(ix) State Disaster Management Plan 2017, Odisha State Disaster Management Authority (OSDMA), Government of Odisha. (Odhisa, 2017).

(x) Incident Response System by NDMA, MHA in 2020. (NDMA, 2020).

(xi) Disaster Management in India by NDMA , MHA in 2020. (NDMA, 2020).

Research Methods and Data Sources

Study will be based on both primary and secondary sources.

(a) Primary research was based on:-

(i) Obtain firsthand account of efforts of Central & State agencies (NDRF & SDMA), during recent calamities, in Uttarakhand, Kerala, West Bengal , during 2013-20. A questionnaire was formulated to obtain a feedback on the shortcomings noticed during recent calamities and areas where we need to work to make our disaster response more robust.

(ii) Interacted with NDMA, HQ IDS and NDRF HQ to get a feedback of the ground situation. In addition, information was gathered from service officers of the Army Navy and Airforce and some NGOs, those who have been involved in relief & rescue operations.

(iii) Interviews with some members of NDMA and SDMA of Sikkim, Odisha and Uttarakhand.

(b) Secondary research will based on:-

(i) Study of DM system of one developed country.

(ii) Books, research papers, academic papers, reports, newspaper and magazine articles in IIPA and online.

Chapterisation

21. The layout of the dissertation will be as under:-

(a) **Chapter I** : **Introduction** (Research Methodology).

(b) **Chapter II** : **Disaster Risk Profile of India.** This chapter will discuss the **disaster risk profile of India**. It will also briefly explore India's vulnerabilities during hazards.

(c) **Chapter III** : **Global & Indian DM Frameworks**. This chapter will analyse various global DM frameworks and the National DM Act and its effectiveness in dealing with various situations.

(i) Global DM Frameworks to include Hyogo Framework for Action Plan and Sendai Framework.

(ii) Indian DM frameworks to include NDMA Act 2005 & NDMP 2016 and its effectiveness in dealing with various situations.

(iii) Capabilities and tasks of NDRF will be analysed.

(d) **Chapter IV**: **Analyse the Disaster Response in Uttarakhand floods in 2013 and Kerala floods of 2018**. Response during the **Cyclone Amphan in West Bengal/ Orissa** in 2020 will also be examined. Response mechanism during Uttarakhand & Kerala floods will be analysed in detail with special reference to the emergency response. Also the Response efforts of West Bengal & Odisha during the Cyclone Amphan will also analysed. Shortcomings in the present DM mechanism will be identified.

(e) **Chapter V**: **Disaster Response System of Japan**. The disaster response system of Japan (developed country) will be analysed to bring out its strengths & the best practises, which can be effectively incorporated in our DM mechanism to strengthen our response system.

(f) **Chapter VI** : **Capabilities of Armed Forces to supplement NDRF**. Capabilities of the Armed Forces which are available and can be useful to supplement the capabilities of NDRF Battalions will be identified.

(g) **Chapter VII** : **Recommendations to make the DM response mechanism more robust & efficient**, in an event of a disaster to save valuable lives and property.

CHAPTER II : DISASTERS & THE RISK PROFILE OF INDIA

"To build a safer and disaster resilient India by a holistic, pro-active, technology driven and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness and mitigation."

-*Vision of NDMA* **(NDMA, 2009)**

General

India's geo-climatic conditions, as well as its high degree of socio-economic vulnerability, makes it as one of the most disaster prone countries in the world. A disaster is an extreme disruption of the functioning of a society that causes widespread human, material or environmental losses that exceed the ability of the affected society to cope with its own resources. Though India comprises only 2% of world's land mass, it is home to one-sixth of world's population. India has a highly diversified range of natural features. Its unique geo-climatic conditions make the country among the most vulnerable to natural disasters, which occur with alarming frequency and regularity. Surya P Loonker, Give2 Asia Field Advisor in India remarked that "while the society at large has adapted itself to these regular occurrences, the economic and social costs continue to mount year after year" **(Asia Org 2015)**. In last 30 years (1990-20), India has witnessed 431 major disasters resulting into large scale loss of life, affecting millions of households and economy getting adversely affected. Major natural disasters that affected the country during this period are summarised below in a tabular form **(MHA, 2011)**:-

Occurrence	Deaths	Total affected	Total damage ('000 USD)
431	143039	150 crore	$ 4800 Crore

Table 1: Major Natural Disasters That Affected Country(1990-2020)

A pictorial representation of some of the major disasters that occurred in India from 1980 to 2014 is as under **(MHA, 2011)**:-.

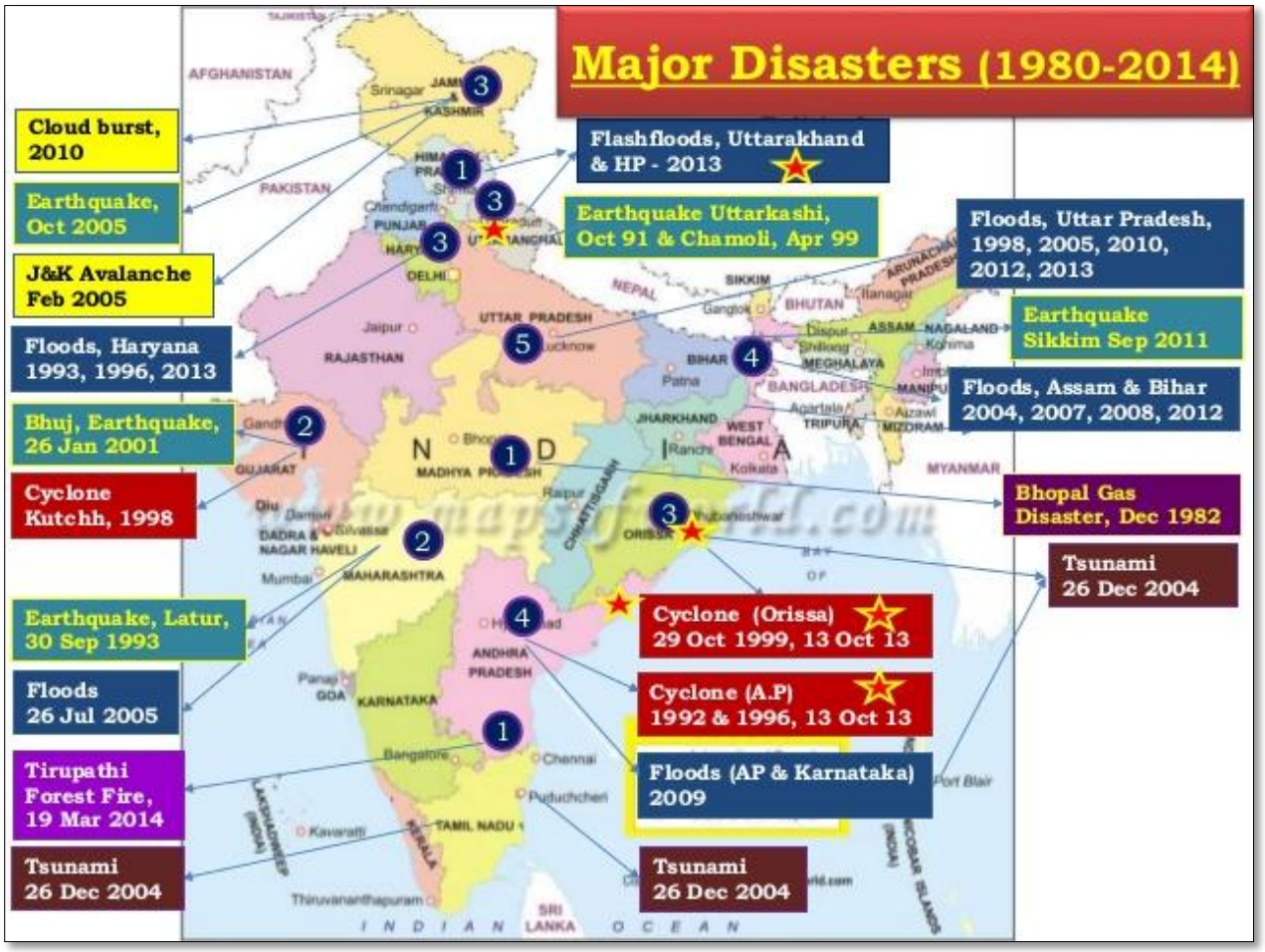


Figure 1: Major Disasters in India Source: MHA

The devastating floods in Kashmir & Uttarakhand in 2014 & the Kerala 2018 and the recent Glacier Burst in Uttarakhand in 2021, brought into sharp focus the strengths and inadequacies of our disaster preparedness and management apparatus of the country. It has once again exposed our lack of disaster mitigation steps and inability to effectively respond to disasters. In the past also, we were found wanting when calamities like the Gujarat earthquake, Bhopal gas tragedy, Latur earthquake and Orissa cyclones in 1999.

In recorded history, danger has been an integral part of human existence and societies have attempted to anticipate the unexpected and devised measures to reduce the losses. In the past, we in India have dealt with emergencies from the 'crisis-reactive mode'; we have waited till the disaster have struck and then tackled the losses, as they occurred. However, post enactment of DM Act 2005, DM system of India has undergone a paradigm shift from humanitarian relief and rehabilitation of the victims to holistic management of disasters, which includes pre-disaster

prevention, mitigation and preparedness, as well as post-disaster response, recovery and reconstruction.

In order to understand the disaster risk profile of India, it would be in order to lay down the bare essentials of disaster in subsequent paragraphs.

What are Disasters?

A serious disruption of the functioning of a community or a society, involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disaster is also described as a "catastrophic situation in which the normal pattern of life or eco-system has been disrupted and extraordinary emergency interventions are required to save and preserve lives and or the environment". The World Health Organization (WHO) defines disaster as 'any occurrence that causes damage, economic destruction, loss of human life and deterioration in health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area'.

Federal Emergency Management Agency (FEMA) of United States, defines disaster as 'an occurrence of a severity & magnitude that normally results in deaths, injuries & property damage & that cannot be managed through the routine procedures & resources of government. It usually develops suddenly & unexpectedly & requires immediate, coordination & effective response by multiple government & private sector organizations to meet human needs & speedy recovery.

The DM Act, 2005 defines disaster as "a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area" **(MHA, 2005)**

The United Nations defines disaster as "the occurrence of sudden or major misfortune which disrupts the basic fabric and normal functioning of the society or community". The revised UNISDR terminology, defines 'disaster' as "A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following; human, material, economic and environmental losses and impacts" **(UNIDSR, 2016).**

In total, it is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Hazard: A dangerous phenomenon, substance, human activity or condition 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 **(UNISDR 2009).**

Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard **(UNISDR 2007)**.

Disaster Risk Management

The systematic process of using administrative directives, organizations and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster (**UNISDR 2009)**.

Types of Disasters

The High Powered Committee (HPC) on Disaster Management in their report in 1999, identified 31 disasters (later Tsunami was included in 2004) and categorized them into the following five types, from the point of view of their management **(NCDM2001).**

(a)	**Water and climate related disasters**	Floods and drainage management Cyclones Tornadoes and hurricanes Hailstorm Cloud burst Heat wave and cold wave Snow avalanches Droughts Sea erosion Thunder and lightening Tsunami
(b)	**Geological related disasters**	Landslides and mudflows Earthquakes

		Dam failures/ Dam bursts Minor fires
(c)	**Chemical, industrial and nuclear related disasters**	Chemical and industrial disasters Nuclear disasters
(d)	**Accident related disasters**	Forest fires Urban fires Mine flooding Oil spills Major building collapse Serial bomb blasts Festival related disasters Electrical disasters and fires Air, road and rail accidents Boat capsizing Village fire
(e)	**Biological related disasters**	Biological disasters and epidemics Pest attacks Cattle epidemics Food poisoning

Table 2: Categorization of Disasters

VULNERABILITY OF INDIA TO DISASTERS

India's Disaster Risk Profile

India has been vulnerable, in varying degrees, to a large number of natural, as well as, human induced disasters, on account of its distinctive geo-climatic and rapidly changing socio-economic conditions. India is highly vulnerable to floods, droughts, cyclones, earthquakes, landslides, avalanches and forest fires. Out of 36 States and UTs in the country, 24 of them are disaster prone. As per the natural hazards map of India, 58.6 % of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods, about 8% of the total area is prone cyclones and 68% of the area is susceptible to droughts **(MHA, 2004)**. From

the multi-hazard map of India, it is observed **(MHA, 2011)**:-

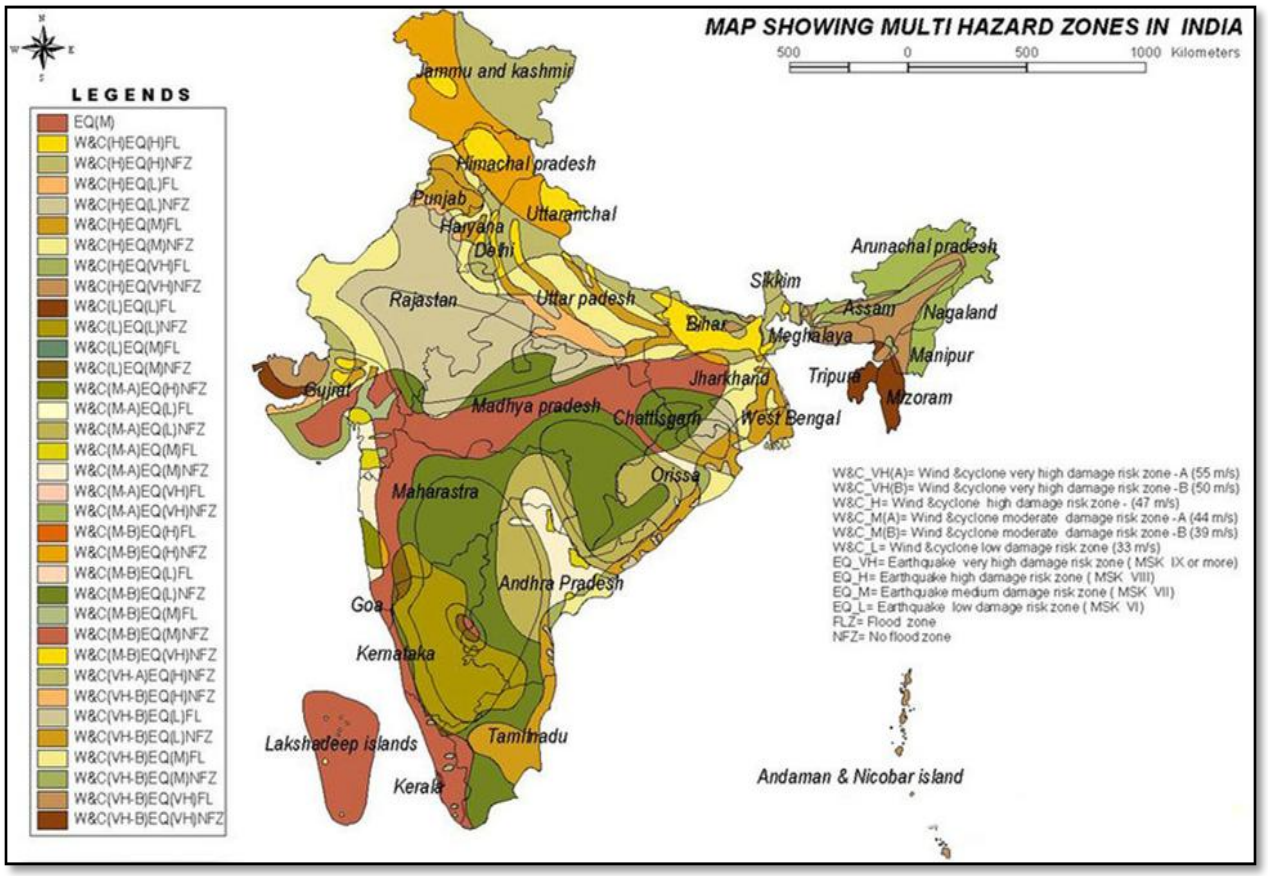


Figure 2 : Multi Hazard Zones - India **Source:** MHA

(a) India is one of the ten worst disaster prone countries of the world. The country is prone to disasters due to number of factors; both natural and human induced, including unique geo-climatic conditions, topographic features, environmental degradation, urbanisation, industrialization, population growth and non scientific development practices. The reason for the high vulnerability of the country to natural disasters is its unique geographical and geological situation. As far as the vulnerability to natural disasters is concerned, the five distinctive regions of the country, i.e. Himalayan region, the alluvial plains, the hilly part of the peninsula and the coastal zone have their own specific tribulations. While on one hand, the Himalayan region is prone to disasters like earthquakes and landslides, the plains are affected by floods almost every year. The desert part of the country is affected by droughts & famine, while the coastal zone is susceptible to cyclones & storms.

(b) The geological location of India is the main reason for its increased vulnerability. **The geo-tectonic features of the Himalayan region and adjacent alluvial plains make the region susceptible to earthquakes, landslides and soil erosion.** Though, Peninsular India is considered to be the most stable, but occasional earthquakes in the region shows that geo-tectonic movements are still taking place.

(c) The tectonic features and characteristics of the Himalayas are also prevalent in the alluvial plains of Indus, Ganga and Brahmputra, as the rocks lying below the alluvial pains are just extension of the Himalayan ranges. Thus this region is also quite prone to seismic activities. In addition, as a result of various **major river systems flowing from Himalayas, huge quantity of sediments are brought by them, resulting into frequent floods**, especially in the plains of Uttar Pradesh & Bihar.

(d) The **western part of the country, including Rajasthan, Gujarat and some parts of Maharashtra are hit very frequently by drought conditions**. If monsoon worsens, the drought conditions spreads in other parts of the country, as well. The disturbance in the pressure conditions over oceans, result into cyclones in coastal regions. The geo-tectonic movements taking place in the ocean floor make the coastal region prone to tsunami disaster.

(e) The extreme weather conditions, huge quantity of ice and snow stored in the glaciers, etc. are other natural factors, which make the country prone to various forms of disasters.

(f) Along with the natural factors, **various human induced activities,** like increasing demographic pressure, deteriorating environmental conditions, including deforestation, unscientific development, faulty agricultural practices, unplanned urbanisation and construction of large dams on rivers, are also responsible for accelerated impact and increase in frequency of disasters in the country.

Effect of Disasters : India

India is highly vulnerable to extreme weather events. Since 1980, both the number and severity of such events have increased. Weather events can be classified as extreme on the basis of various factors, such as the impact, the socio-economic losses, environmental degradation and long term damages. With more than 70 % of India's population relies on agriculture directly or indirectly, the impact of extreme weather conditions on human life and other living beings is

critical. Some of the prominent hazards, which adversely impact our country, are given below:-

Floods.

(a) India is one of the most flood prone countries in the world and about 30 million people are affected annually. 24 out of 36 States and UTs in the country are subject to floods and 40 million hectares of land, roughly one-eighth of the country's geographical area, is prone to floods. The map showing Flood Zones in India is at Fig 3 **(MHA, 2011).**

(b) The average rainfall in India is 1150 mm, with significant variation across the country. The annual rainfall along the Western Coast and Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2500 mm. Almost 85% of the annual average rainfall of 1200 mm is concentrated over a short monsoon season of four months from June to September. The average precipitation in the Indo-Gangetic plain is 1500mm, while in Upper Assam, it is over 2500mm. This factor combined with inflow of water from the northern rivers from Nepal results in the Ganga-Brahmaputra basin carrying 60% of the nation's total river flow and therefore the region is most prone to floods **(Sharma 2001).** On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year. On an average, 6.7 million hectares of land is flooded annually causing extensive damage to crops, houses and public utilities. Floods are a perennial phenomenon in at least 5 states – Assam, Bihar, Orissa, Uttar Pradesh and West Bengal. On account of climate change, floods have also occurred in recent years in areas that are normally not flood prone. In 2006, drought prone parts of Rajasthan experienced floods. The floods in Uttarakhand in 2013, the Kashmir floods in 2014 and the floods in Kerala in 2018 have highlighted that the entire country is vulnerable to floods. Flood destructions have always brought miseries to numerous people, especially in rural areas. Flood results in the outbreak of serious epidemics, specially malaria and cholera. Simultaneously, scarcity of water also arises. Floods have a drastic effect on agricultural, sometimes water remains standing over large areas for long span of time hampering the crop cultivation. Floods occur in almost all rivers basins in India. The main causes of floods are heavy rainfall, inadequate capacity of rivers to carry the high flood discharge, inadequate drainage to carry away the rainwater quickly to streams/ rivers. Landslides blocking streams, typhoons and cyclones also cause floods. Flash floods occur due to high rate of water flow as also due to poor permeability of the soil. Areas with hardpan just below the surface of the soil are more prone to floods, as water fails to seep down to the deeper layers. Vulnerability to floods and natural disasters

is caused by the high population density, widespread poverty, unemployment, illiteracy, enormous pressure on rural land and an economy traditionally dominated by agriculture. Children and women are particularly vulnerable. 85% of the deaths during disasters are of women and children. In future, programme, flood control and management planning along with climate change needs to be integrated into development planning in the country.

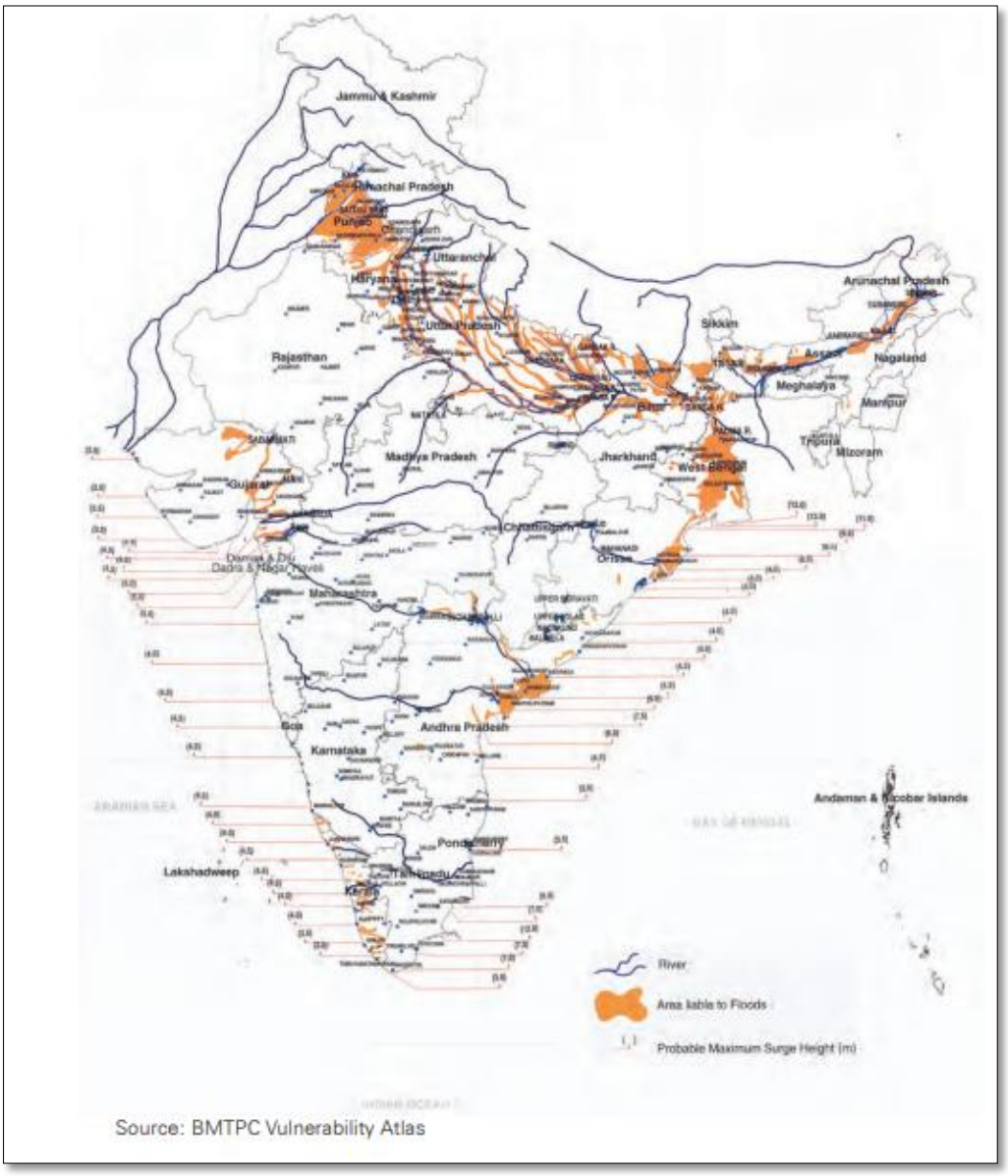


Figure 3 :Flood Zones -India Source MHA

23. **<u>Cyclones & Tsunami</u>**.

(a) India has a long coastline of 5700 Km, which is exposed to tropical cyclones arising in the Bay of Bengal and Arabian Sea. The Indian Ocean is one of the six major cyclone-prone regions in the world and India is exposed to nearly 10 % of the world's

tropical cyclones. About 71% of this area is in ten states (Maharashtra, Karnataka, Kerala, Gujarat, Tamil Nadu, Goa, Puducherry, Andhra Pradesh, Orissa and West Bengal). The islands of Andaman, Nicobar and Lakshadweep are also prone to cyclones and tsunamis **(SAKDN, 2015**). On an average, about five or six tropical cyclones form in the Bay of Bengal and Arabian Sea and hit the coast every year; out of these, two or three are severe. Cyclones, Tsunami & Wind mapping in the country is given in Fig 4.

(b) The **Eastern coastline is more prone to cyclones, as about 80 % total cyclones generated in the region hit there**. Most casualties are caused by coastal inundation by tidal waves and storm surges. The worst devastation takes place during peak surge occurs at the time of the high tide. Most cyclones occur in the Bay of Bengal followed by those in the Arabian Sea and the ratio is approximately 4:1. The effect of a storm surge is most pronounced in wide and shallow bays exposed to cyclones such as in the northern part of Bay of Bengal. The incidence of cyclonic storms, with wind speeds between 65 Km/h and 117 Km/h and severe cyclonic storm with wind speeds between 119 Km/h and 164 Km/h, reaching Tamil Nadu and Andhra Pradesh is high during the north east monsoon season, i.e. October – December, where as the severe storms occur in the Orissa - West Bengal Coast**(SAKDN, 2015**).

(c) A severe super cyclonic storm with winds of up to 250 km/hour crossed the coast in Orissa on 29 October 1999. This may have been the worst cyclone of the country in the Orissa region and was responsible for as many as 10,000 deaths, rendering millions homeless and extensive damage to property and environment.

(d) The yearly distribution of tropical cyclones in the north Indian Ocean indicates large year to year variations in the frequency of cyclonic disturbances and tropical cyclones. However, the trend indicates an increase with time. The annual average of cyclonic disturbances in the North Indian Ocean is about 15.7, with a standard deviation of 3.1. The annual number of cyclonic disturbances range from seven in 1984 to twenty three in 1927. The annual average of tropical cyclones has varied from one in 1949 to ten in 1893, 1926, 1930 and 1976. Refer Fig 4 Map **(MHA 2011)**.

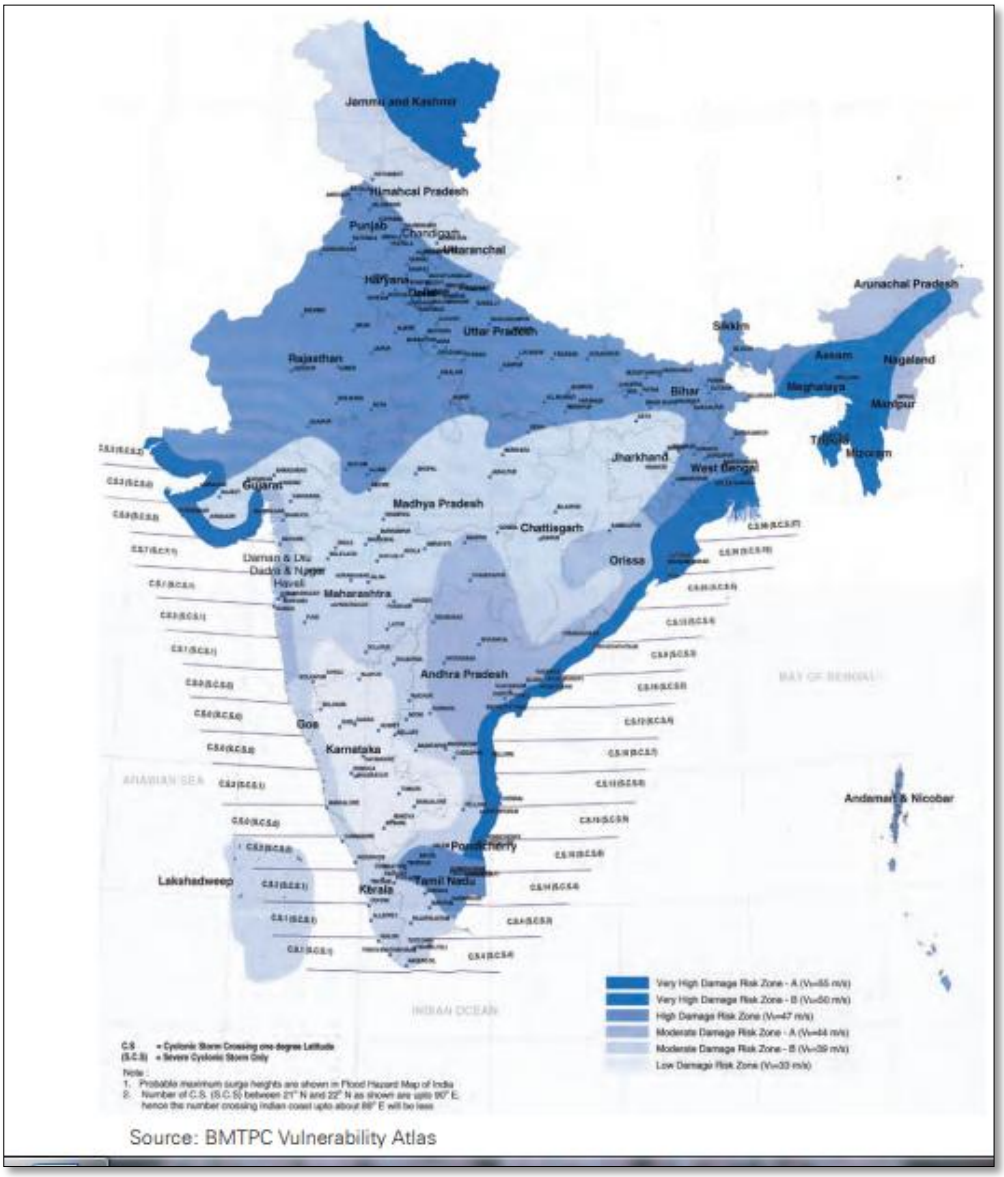


Figure 4 : Cyclones & Tsunami -India Source MHA

<u>Earthquakes</u>.

(a) Earthquake is considered to be one of the most dangerous and destructive natural disasters. The impact of this phenomenon is sudden with little or no warning, making it just impossible to predict it or make advance arrangements & preparations against damages and collapses of buildings and other man-made structures (in the immediate time period, prior to an earthquake).

(b) The entire Himalayan Region is considered to be vulnerable to high intensity earthquakes of a magnitude exceeding 8.0 on the Richter Scale, and in a relatively short span of about 50 years, four such major earthquakes have occurred in the region, Shillong,

1897 (M8.7), Kangra, 1905 (M.8.0), Bihar–Nepal, 1934 (M 8.3), and Assam–Tibet, 1950 (M 8.6). Scientific publications have warned that very severe earthquakes are likely to occur anytime in the Himalayan Region, which could adversely affect the lives of several million people in India. Some significant earthquakes in India are listed in the Table:-

Date	Location	Magnitude
10 June 2008	Tibet	6.4
27 June 2008	Andaman Islands	6.7
28 June 2008	Andaman Islands	6.1
25 August 2008	Tibet	6.4
08 October 2008	Andaman Islands	6.0
10 November 2009	Nicobar Islands	6.1
30 March 2010	Andaman Islands	6.8
12 June 2010	Nicobar Islands	7.8
18 June 2010	Andaman Islands	6.0
10 November 2010	Southeast Indian Ridge	6.3
19 September 2011	Sikkim	6.9
26 January 2001	Gujrat	7.7
Source: IMD & SADR		

Table 3: Some Significant Earthquakes in India

India has been divided into four seismic zones according to the maximum intensity of earthquake expected (Refer Figure 5) **(MHA, 2011).** Bureau of Indian Standards [IS 1893 (Part I):2002], has grouped the country into four seismic zones, viz. Zone II, III, IV and V. Of these, Zone V is seismically the most active region, while Zone II is the least. Broadly, Zone - V comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands. Zone - IV covers remaining parts of Jammu and

Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, Northern Parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan. Zone – III comprises Kerala, Goa, Lakshadweep islands and remaining parts of Uttar Pradesh, Gujarat and West Bengal, Parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Orissa, Andhra Pradesh, Tamilnadu and Karnataka. Zone - II covers remaining parts of country **(PIB, 2017)**.

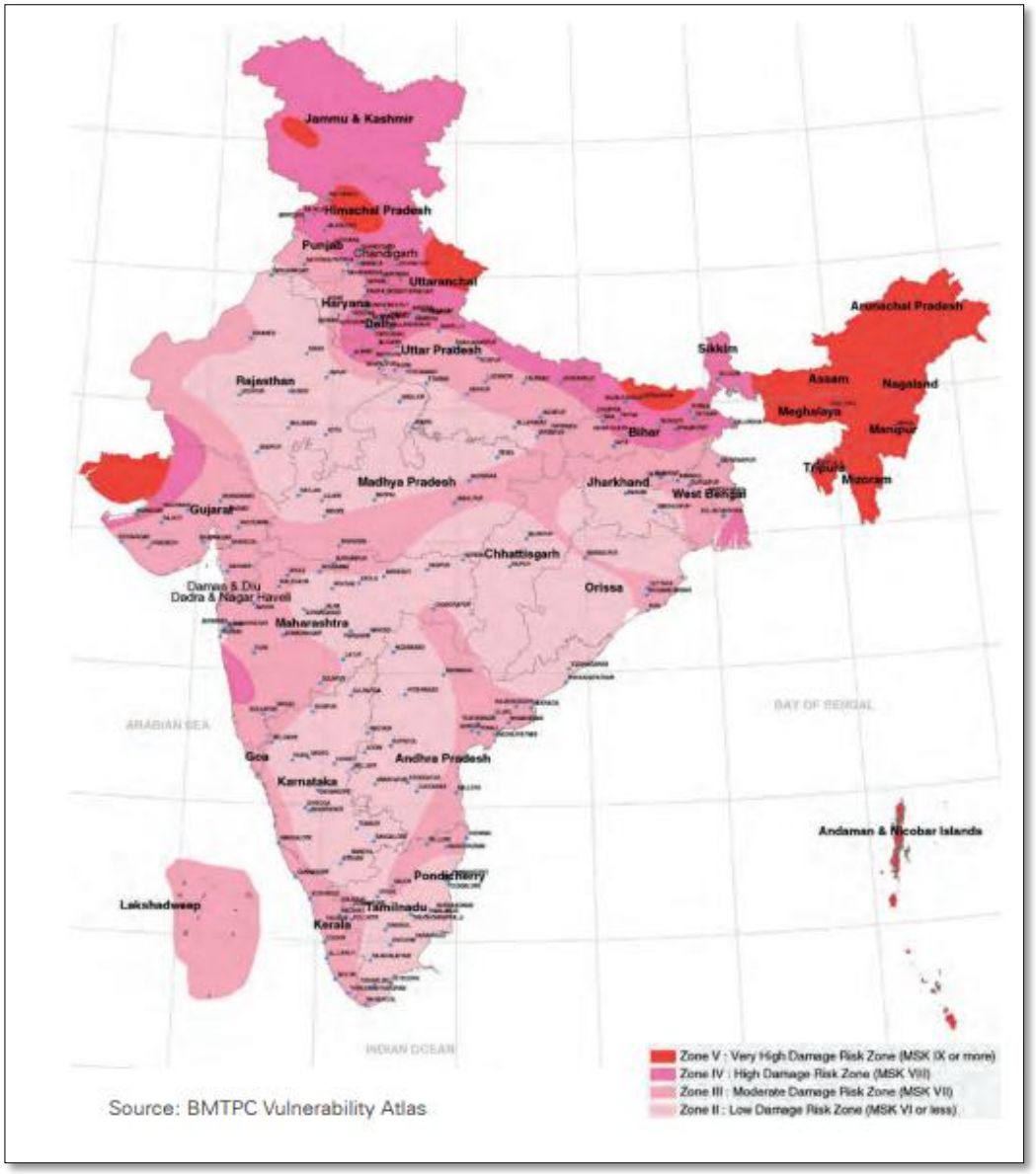


Figure5 : Seismic Zones of India Source MHA

About 58.6% % of total area of the country is vulnerable to seismic activity of varying intensities.**110 districts across India, fall in Zone V (Over 1/7th of the districts in the country).** Most of the vulnerable regions are generally located in Himalayan & sub-Himalayan belt and in Andaman & Nicobar Islands. The Himalayan mountain ranges

are considered to be the world's youngest fold mountain ranges. The Himalayan frontal arc, flanked by the Arakan Yoma fold belt in the east and the Chaman fault in the west, forms one of the most seismically active regions in the world. Four earthquakes exceeding Magnitude 8 on the Richter scale have occurred in the span of the last 53 years. After the Earthquake in Latur in Maharashtra in 1993, which was considered to be least prone to earthquake, no area is considered safe from this disaster in India.

Droughts.

(a) Drought is a situation of less moisture in the soil (which makes the land unproductive) and scarcity of water for drinking, irrigation, industrial uses and other purposes, usually caused by deficient / less than average rainfall over a long period of time. It is one of the perennial features in some states, such as Rajasthan, Orissa, Madhya Pradesh, and Gujarat. In India around 68 % of the agriculture land country is prone to drought in varying degrees. Of the entire area 35 % receives rain fall between 750 mm and 1125 mm, which is considered drought prone, while 33 %, which receives rainfall less than 750 mm is considered to be chronically drought prone.

(b) The primary cause of any drought is deficiency of rainfall and in particular, the timing, distribution and intensity of this deficiency in relation to existing reserves. A prolonged period of dry weather leading to drought is a widely recognized climate anomaly. Drought can be devastating, as water supplies dry up, crops fail to grow, animals die, and malnutrition and ill health become widespread. The environmental effects of drought, including stalinization of soil and groundwater decline, increased pollution of freshwater ecosystems and regional extinction of animal species. Most of the drought prone areas identified by GoI lie in arid, semi-arid and sub-humid areas of the country.

(c) India is primarily an agrarian economy and this sector employs over 50 % of the population. Adding to the vulnerability is the fact that approximately 56% of the total cropped area is rain fed. In India, around 68% of the country is prone to drought in varying degrees. 35% is drought prone while 33% is chronically drought prone **(MJS,2017)**. Droughts adversely impact the livelihood and economies of a large section of population in the rain-fed, arid and semi-arid regions.

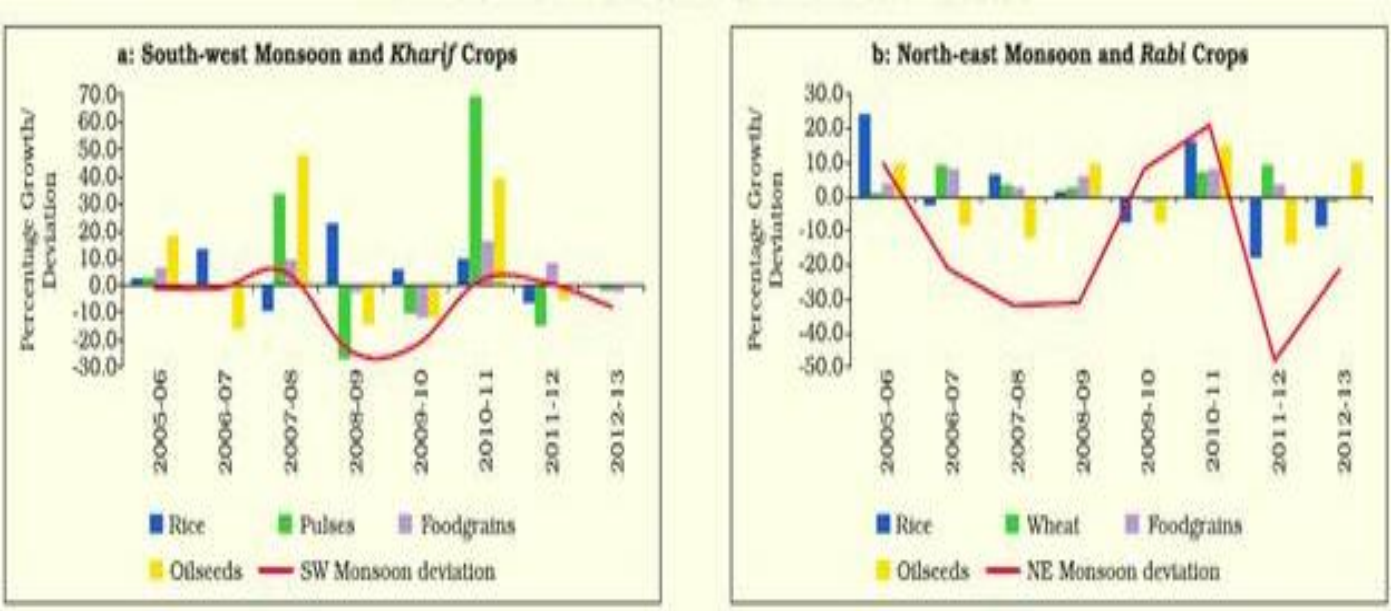


Figure 6 : Rainfall Deficiency & Agriculture Production

<u>Landslides</u>. Hilly regions such as the Himalayas, North-East India, the Nilgiris, and Eastern and Western Ghats are highly prone to landslides. Landslide-prone areas largely correspond to earthquake-prone areas, i.e. North-west and North-East, where the incidence of landslides is the highest. Landslide prone map of India is as under:-

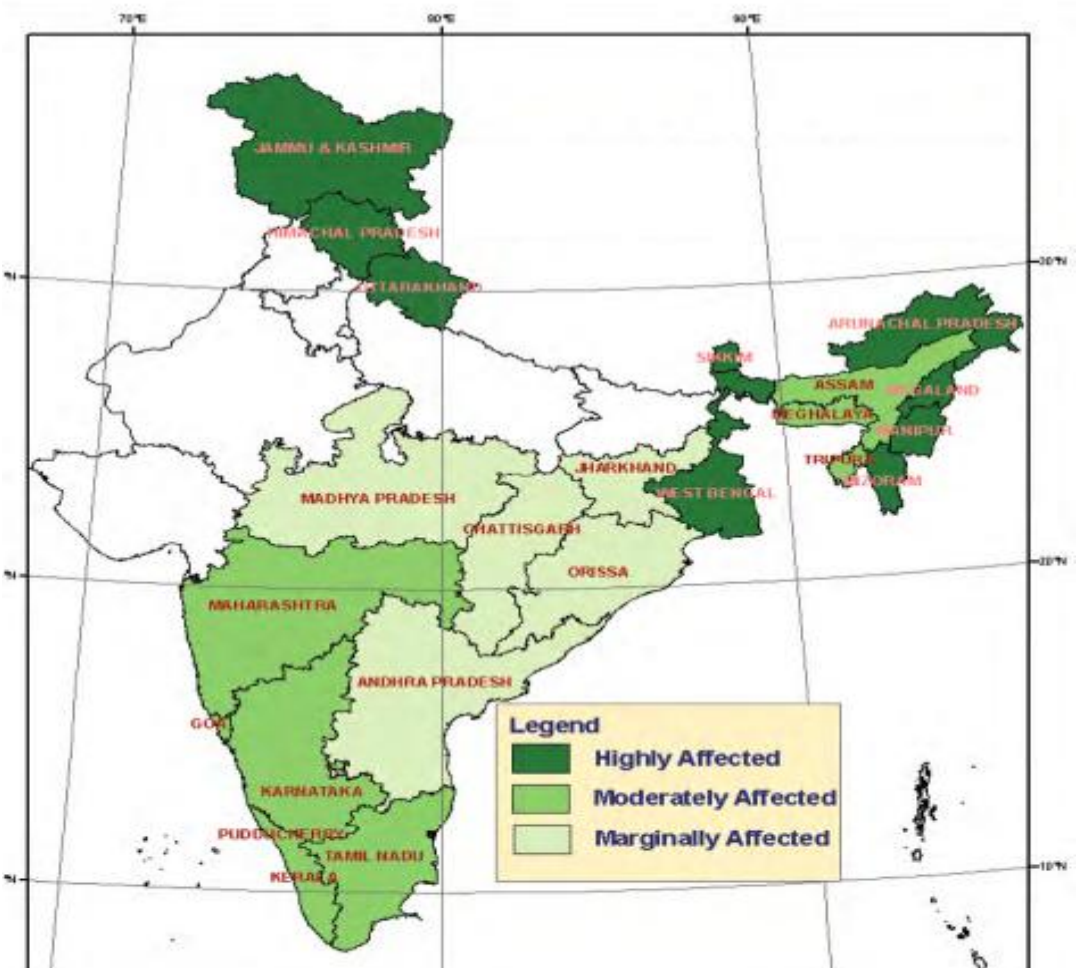


Figure 7 : Land Slide Affected Areas Source MHA

Heat & Cold Waves. Heat and Cold waves are annual phenomenon in North India. Hundreds of people die of heat and cold related diseases every year and most of them are from poor urban & villages in northern parts of the country. Heat and Cold wave related deaths is given in the following two tables:-

Year	No of Deaths	Year	No of Deaths
1990	2	**2001**	70
1991	252	**2002**	806
1992	114	**2003**	1539
1993	42	**2004**	117
1994	434	**2005**	587
1995	412	**2006**	135
1996	20	**2007**	476
1997	20	**2008**	294
1998	1662	**2009**	1071

1999	126	**2010**	1274
2000	57	**2011**	793
Source NCRB 2009, 2010, 2011 Reports			

Table 4: Deaths due to Heat Waves in India

State	Epochs		
	1978-99	2000-09	1901-2009
West Bengal	28	7	54
Bihar	67	12	121
Rajasthan	53	12	207
Uttar Pradesh	47	13	140
Gujrat	6	-	99
Himachal Pradesh	18	4	26
Jammu and Kashmir	15	2	213
Maharashtra	18	1	83
Madhya Pradesh	12	1	117
Orissa	-	3	15
Andhra Pradesh	-	-	2
Assam	-	2	4
Haryana, Delhi Chandigarh	15	15	34
Tamil Nadu	-	-	-
Karnataka	-	-	10
Jharkhand	-	-	1
Source: IMD Weather Events Annual Reports; EM-DAT **Note: Epoch is defined as number of events.**			

Table 5: Number of Cold Waves in India

Man Made Disasters

Industrial and Chemical Disasters. These are caused by chemical, mechanical, civil, electrical or other process failures due to accident, negligence or incompetence, in an industrial plant which may spill over to the areas outside the plant or within causing damage to life, property and environment. New industries are also coming up at a rapid rate. While chemical disasters are occurrence of emission, fire or explosion involving one or more hazardous chemicals in the course of industrial activity (handling), storage or transportation or due to natural events leading to serious effects inside or outside the installation likely to cause loss of life and property including adverse effects on the environment. **The Bhagjan oil well fire in Assam and the gas leak from the LG Polymers plant in Visakhapatnam in 2020 are the two examples of the examples of industrial disasters in 2020**, Industrial emergencies may arise in ways, such as:-

(a) Explosion in a plant.

(b) Accidents in storage facilities of chemicals.

(c) Accidents during the transportation of chemicals, misuse of chemicals.

(d) Improper waste management & Accidents in treatment plants..

(e) Lack of environmental clearances for the industries.

(f) Technological system failures.

(g) Failures of plant safety design.

(h) Arson and sabotage.

(i) Human error.

Year	**No of Incidents**	**No of Deaths**	**Nos of Injured**	**States where the Incidents were Recorded**
2002	06	05	31	Gujarat, Kerala, Maharashtra
2003	06	11	112	Andhra Pradesh, Assam, Kerala, Madhya Pradesh, Punjab
2004	18	47	91	Andhra Pradesh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttrakhand, West Bengal, Delhi
2005	11	15	14	Andhra Pradesh, Assam, Gujarat, Kerala, Tamil Nadu, Uttar Pradesh
2006	16	32	24	Andhra Pradesh, Gujarat, Kerala, Maharashtra, Rajasthan, Uttrakhand, Uttar Pradesh, West Bengal
2007	18	37	14	Assam, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Punjab, Uttrakhand, West Bengal
2008	23	50	148	Andhra Pradesh, Gujarat, Jharkhand, Kerala, Maharashtra, Uttar Pradesh

2009	24	50	128	Andhra Pradesh, Assam, Haryana, Kerala, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Uttrakhand, West Bengal
2010	08	12	01	Andhra Pradesh, Assam, Maharashtra, Punjab, Uttar Pradesh
Total	130	259	563	
Source: Ministry of Environment and Forests				

Table 6: Year wise Chemical Disasters in India during the last Decade

Stampede. Incidents of stampedes can occur in numerous socio-cultural situations. These stampede incidents can be categorized into the following types, where the causes and the impact are described in the incident. Though the list is not exhaustive, it provides a fair idea about various types of events / situations, where stampedes can occur:-

Date	Event	Deaths	Injured
Jan 2005	Hindu pilgrims stampede near a remote temple in Maharashtra, India	265	
Dec 2005	Flood relief supplies were handed out to homeless refugees in southern India	42	
03 Oct 2007	Train station in northern India	14	
27 Mar 2008	Indian temple crush during a pilgrimage	08	10
03 Aug 2008	At the Naina Devi temple in Himachal Pradesh	138	47
30 Sep 2008	At the Chamunda Devi temple in Jodhpur, India	147	
04 Mar 2010	At Ram Janki Temple, in Kunda, India	71	200
14 Jan 2011	At Sabarimala, Kerala	104	50
Source: NIDM			

Table 7: Major Stampedes in India 2005-2010

Nuclear Emergencies. Nuclear emergency/ disaster is caused due to an extraordinary release of radioactive material or radiation, either in the operation of nuclear reactors or other nuclear events like explosion of a Radiological Dispersal Device (RDD) or Improvised Nuclear Device (IND) or explosion of a nuclear weapon. It is accompanied with sudden release of harmful radiations or radioactive materials or both together in to the environment.

Date & Month	Place	Events
4 May 1987	Kalpakkam	In an incident during refueling of FBTR, structural deformation happened in some of the fuel assemblies. There was no release of radioactivity. The reactor remained shut down for about two years. Restoration involved development of special tools, inspection and removal of affected fuel assemblies.
13 May 1992	Tarapur, Maharashtra	There was a minor tube leak in one heat exchanger which was subsequently replaced. Radioactivity released was within the regulated limits
31 Mar 1993	Bulandshahr, Uttar Pradesh	A fire occurred in Turbine building which is not a part of reactor system. This resulted in damage of the steam turbine blades. The reactor was brought to safe shutdown state. The unit was restarted after Regulatory approval
22 Oct 2002	Kalpakkam	About 75 kg of sodium from primary sodium purification line at Fast Breeder Test Reactor leaked inside the purification cabin. There was no fire or any release of radioactivity.
April 2010	Mayapuri, Delhi	In a radiological accident, an irradiator was sold to metal scrap dealer. The dealer dismantled the irradiator which caused release of radioactive source.

Table 8: Incidents in Nuclear Facilities in India

Other Manmade Disasters. The other manmade disasters are rail, air road and mine accidents, which cause immense loss of life and property. Global Status Report on Road Safety

(WHO, 2009) has estimated that 1.2 million people die on the roads every year in the world and about 50 million others are injured. Rail accidents also, lead to loss of several lives and cause severe disruption of traffic etc, necessitating large scale help from other government/non-government and private organizations. India needs to be prepared to mitigate / lessen the losses due to these manmade disasters.

Epidemics in India. Infectious diseases are a major public health problem in India. While many infectious diseases like COVID 19, tuberculosis, dengue and malaria are endemic, some of them attain epidemic proportions. An epidemic refers to an increase in number of cases of a disease in a community, clearly in excess of what is normally expected in that population. Epidemics are public health emergencies which disrupt routine health services and are major drain on resources. Epidemics include viral infections disease (COVID 19, mengitis, measles, dengue, polio, typhoid fever etc) and bacterial infectious diseases (cholera, diarrhea etc). The outbreak of Plague in Gujarat in 1994 had resulted in an estimated loss of almost US$ 2 billion. COVID 19 has deeply impacted the world economy including Indian economy. The Indian GDP growth rate for 2020-21 is estimated to show negative growth.

Climate Change

Climate change is expected to increase the frequency and intensity of extreme weather conditions and give rise to new vulnerabilities with differential spatial and socio-economic impact on communities. The unprecedented increase is expected to have severe impact on the hydrological cycle, droughts, water resource, floods, forest and ecosystems, sea level/coastal area losses of coastal wetlands and mangroves, food security and health. The impact would be particularly disastrous for developing countries, including India and will further degrade the resilience of poor and vulnerable communities.

Conclusion

India is vulnerable in varying degrees to a large number of natural as well as man-made hazards. Almost 85% of India's area is vulnerable to one or multiple hazards. Of the 28 states and 8 Union territories, 22 are disaster prone. It is vulnerable to wind storms spawned in the Bay of Bengal and the Arabian Sea, earthquakes caused by active crustal movement in the Himalayan mountains, floods brought by monsoons and droughts in the country's arid and semi-arid areas. Almost 58.6% of the land is vulnerable to earthquakes of moderate to very high intensity (high

seismic zones III-V), 68% cultivable area to drought; of its 7,516-km-long coastline, close to 5,700 km is prone to cyclones and a 12% to floods and river erosion. India has also become much more vulnerable to tsunamis since the 2004 Indian Ocean Tsunami **(SAKDN, 2015**).

In India, a closer analysis of what transforms a natural event into a human and economic disaster reveals that the fundamental problems of development that the country faces are the very same that contribute to its vulnerability to the catastrophic effects of natural hazards. Even as substantial scientific and material progress is made, the loss of lives and property due to disaster has not decreased. In fact, the human toll and economic losses have mounted. With the objective to reduce loss of lives and property, to restrict socio-economic damage through concerted international action, especially in developing countries. The super cyclone in Odisha in October 1999 and the Bhuj earthquake in Gujarat in January 2001 underscored the need to adopt a multi-dimensional and multi-disciplinary approach and incorporate risk reduction strategy in the developmental plans. The State of Uttarakhand was caught underprepared, when the catastrophic floods hit the state in 2013, killing more than 5,500 and affecting more than 100,000 others despite a history of calamities in the region. Besides this, the last decade has seen a series of natural disasters, notably Cyclone Hudhud & Phailin, Leh Cloudburst, Kashmir and Assam floods leading to heavy loss of lives and economy, due to inadequate preparation and poor response. The disasters in India in last three decades account for a loss of 1, 43,039, lives and affecting 150 crore people in the country, in addition to properties worth US $ 4800 crores to various disasters **(MHA, 2011).**

CHAPTER III

GLOBAL AND INDIAN DISASTER MANAGEMENT FRAMEWORK

"Remember: When disaster strikes, the time to prepare has passed"

Steven Cyros

What is Disaster Management?

Disaster Management means a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for :-

(a) Prevention of danger or threat of any disaster.

(b) Mitigation or reduction of risk of any disaster or its severity or consequences.

(c) Preparedness to deal with any disaster.

(d) Prompt response to any threatening disaster situation or disaster.

(e) Evacuation, rescue and relief.

(f) Rehabilitation and reconstruction.

(g) Assessing the severity or magnitude of effects of any disaster.

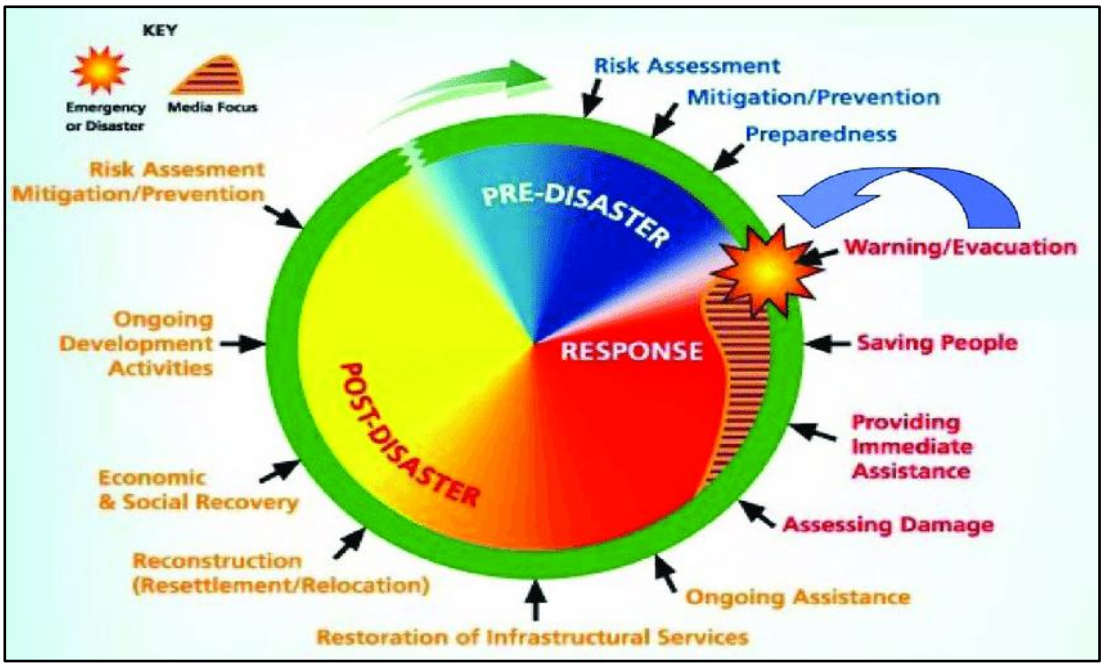


Figure 8: Disaster Management Cycle

Key Phases of Disaster Management.

25. There are three key phases of activity within DM **(NIDM, 2010)**:-

(a) **Pre – Disaster Phase**.

(i) **Prevention and Mitigation**. Reducing the risk of disasters involves activities that reduce and modify the scale and intensity of the threat faced. Mitigation includes all initiatives taken to minimize both the effects of the hazard itself and the vulnerable conditions

(ii) **Preparedness**. This embraces measures that enable governments, communities and individuals to respond rapidly to disaster situations to cope with them effectively. Preparedness measures include preparation of contingency plans and pre-positioning of resources (for example, boats & lifesaving jackets in flood prone areas, conduct of mock drills, etc).

(iii) **Early Warning**. This is the process of monitoring the situation in communities or areas known to be vulnerable to onset of hazards, and passing the knowledge of the pending hazard to people who are likely to be affected.

(b) **During Disaster Phase: Response**.

(i) Response is defined as the actions taken to save lives and prevent further damage in a disaster or emergency situation. Response is putting preparedness plans into action. Response activities may include damage assessment, search & rescue, fire fighting and sheltering victims. Response activities take place during an emergency.

(ii) It refers to the first stage response to any disaster, which includes setting up of control rooms, putting the contingency plan in operation, issue warning, search & rescue, taking action for evacuation, establishment of relief camps, provisioning of relief material & rendering medical aid to the needy, restoration of communication and basic supplies.

(c) **The Post- Disaster Phase**.

(i) **Recovery**. Recovery is used to describe the activities that encompass the three overlapping phases of emergency relief, rehabilitation and reconstruction.

(ii) **Rehabilitation**. Rehabilitation includes the provision of temporary public utilities and housing as interim measures to assist long-term recovery.

(iii) **Reconstruction**. Reconstruction attempts to return communities to improved pre-disaster functioning & includes activities such as replacement of buildings, infrastructure and lifeline facilities. Needless to say it's a long-term process.

Global Disaster Management Framework

Over the last four decades or so, there has been a paradigm shift in the DM approach, all over the world, away from the erstwhile post event emphasis, towards a new focus on mitigation, preparedness and in some cases, even prevention. In other words, the order in which the **2 Ps** (Prevention and Preparedness) and **3 Rs** (Rescue, Relief and Rehabilitation) of the DM continuum are dealt with, has been altered, with **greater importance being attached to the 2 Ps and special attention on the M (Mitigation) (Khanda, 2021).**

Internationally, DM has witnessed a **major shift from the traditional emphasis on disaster response to disaster reduction**. It **seeks to promote a "culture of prevention"**. While natural calamities are inevitable and difficult to predict, all threats arising due to them are impossible to be eliminated. The modern technical measures, traditional practices, promoting public awareness and undertaking mitigating measures can reduce the extent or severity of disasters. Mr Ban Ki Moon, the United Nations Secretary General said that "we must, above all, shift from a culture of reaction to a culture of prevention. Prevention is not only more humane than cure; it is also much cheaper... Above all, let us not forget that disaster prevention is a moral imperative, no less than reducing the risks of war" **(UNISDR. 2015).**

The **World Conference on Disaster Risk Reduction** is a series of United Nations conferences focusing on disaster and climate risk management in the context of sustainable development. The World Conference has been convened three times, with each edition till date having been hosted by Japan, first in Yokohama in 1994, the second in Kobe in 2005 and the third in Sendai in 2015. The conferences bring together government officials and other stakeholders, such as NGOs, civil society organizations and private sector representatives from around the world to discuss how to strengthen the sustainability of development, by managing disaster and climate risks **(ADRAC,2016)**.

1994 First World Conference on Natural Disasters in Yokohama. The First World Conference on Natural Disasters in Yokohama, Japan from 23-27 May 1994, adopted the Yokohama Strategy for a Safer World. It provides guidelines for natural disaster prevention, preparedness and mitigation. It was felt that disaster response yields only temporary results, at very high costs. **Disaster prevention, mitigation and preparedness are better than disaster response in achieving the objectives of vulnerability reduction**. Prevention and mitigation contribute to lasting improvement in safety and are essential to integrated disaster management. Yokohama Strategy emphasized that natural disasters were beyond the control of human beings. However, vulnerability towards disasters usually stems from the human activities & interventions (**ADRAC, 2016)**. The conference stressed upon the international community for close cooperation through sub regional, regional and international alliances to achieve meaningful progress on disaster mitigation, through transfer of technology, sharing of information, mobilisation of resources and joint disaster prevention and mitigation activities. The following principles were inspired by the Yokohama Conference for a Safer World **(UNIDSR, 2005)**:-

(a) Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures.

(b) Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief.

(c) Disaster prevention and preparedness should be considered integral aspects of development policy and planning at national, regional, bilateral, multilateral and international levels.

(d) The development and strengthening of capacities to prevent, reduce and mitigate disasters is a top priority area to be addressed during the decade, so as to provide a strong basis for follow-up activities to the decade.

(e) Early warnings of impending disasters and their effective dissemination using telecommunications, including broadcast services, are key factors to successful disaster prevention and preparedness.

(f) Preventive measures are most effective when they involve participation at all levels, from the local community through the national government to the regional and international level.

(g) Vulnerability can be reduced by the application of proper design and patterns of development focused on target groups, by appropriate education and training of the whole community.

(h) The international community accepts the need to share the necessary technology to prevent, reduce and mitigate disaster; this should be made freely available and in a timely manner as an integral part of technical cooperation.

(i) Environmental protection as a component of sustainable development consistent with poverty alleviation is imperative in the prevention and mitigation of natural disasters.

(j) Each country bears the primary responsibility for protecting its people, infrastructure, and other national assets from the impact of natural disasters. The international community should demonstrate strong political determination required to mobilize adequate and make efficient use of existing resources, including financial, scientific and technological means, in the field of natural disaster reduction, bearing in mind the needs of the developing countries, particularly the least developed countries.

Hyogo Framework for Action (HFA) – 2005-2015.

(a) After the Indian Ocean Tsunami on 26th December 2004, the World Conference for Disaster Reduction was held in Kobe from 18 to 22 January 2005. The conference came out with 10 years Hyogo Framework for Action (2005-2015). Building the resilience of Nations and Communities to Disasters (HFA) was the first plan to describe the work that was required from all different sectors and actors to reduce disaster losses. It reviewed the progress made since Yokohama Strategy and identified major gaps and challenges. The gaps and challenges being **(UNIDSR, 2005)**:-

(i) Governance - organizational, legal and policy frameworks.

(ii) Risk identification, assessment, monitoring and early warning.

(iii) Knowledge management and education.

(iv) Reducing underlying risk factors.

(v) Preparedness for effective response and recovery.

(b) The expected outcome of the conference required full commitment and involvement of all members including governments, regional and international

organizations, civil societies, corporate sector and the scientific community to `substantially reduce disaster losses by 2015, by building the resilience of nations and communities to disasters. This means reducing loss of lives, mitigating material and environmental losses, when hazards strike. The HFA outlines five priorities for action, and offers guiding principles and practical means for achieving disaster resilience. The **five priorities** are **(ADARC, 2016)**:-

(i) **Priority Action 1**. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.

Countries that develop policy, legislative and institutional frameworks for disaster risk reduction and that are able to develop and track progress through specific and measurable indicators have greater capacity to manage risks and to achieve widespread consensus for, engagement in and compliance with disaster risk reduction measures across all sectors of society

(ii) **Priority Action 2**. Identify, assess and monitor disaster risks and enhance early warning.

The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge.

(iii) **Priority Action 3**. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.

Disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities.

(iv) **Priority Action 4**. Reduce the underlying risk factors.

Disaster risks related to changing social, economic, environmental conditions and land use, and the impact of hazards associated with geological events, weather, water, climate variability and climate change, are addressed in sector development planning and programmes as well as in post-disaster situations.

(v) **Priority Action 5**. Strengthen disaster preparedness for effective response at all levels.

At times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management.

India's Initiative for HFA. India has intently initiated the roadmap to implement the activities of the HFA. India has constituted a Working Group under the Chairmanship of Joint Secretary (Disaster Management), Ministry of Home Affairs with representatives from Ministries of Rural Development, Panchayati Raj, Urban Development, Health and Family Welfare, Environment and Forests, Women and Child Development, Earth Sciences, Science and Technology and also from Planning Commission, NIDM and NDMA. The responsibility of various ministries/ departments **(MHA, 2011)**:-

Ministries/Departments/ Agencies Designated for HFA Initiative by India		
Priority 1	Disaster risk reduction is implemented as a national and a local priority with a strong institutional basis.	Ministry of Panchayati Raj, NIDM for human resources, Planning Commission for financial resources, DM Division of MHA
Priority 2	Identify, assess and monitor disaster risks and enhance early warning.	National Remote Sensing Agency, Central Water Commission, India Meteorological Department, Geological Survey of India, DM Division of MHA
Priority 3	Knowledge, innovation and education to build a culture of safety and resilience at all levels.	NIDM, DM Division of MHA, CBSE, NCERT, other research organisations, NDMA, Ministry of Health and HRD
Priority 4	Reduce the underlying risk factors.	Ministry of Environment and Forest, Rural Development, Science and Technology, Health and Family Welfare, Urban

		Development, Planning Commission, DM Division of MHA, NIDM and NDMA
Priority 5	Strengthen disaster preparedness for effective response at all levels.	DM Division of MHA

Table 9 : Ministries/Departments/ Agencies Designated for HFA

Sendai Framework for Disaster Risk Management

During the Third UN World Conference on Disaster Risk Reduction, The Sendai Framework was adopted by member states on 18 March 2015 in Sendai City of Miyagi prefecture in Japan. The Sendai Framework is a 15 year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders, including local government, the private sector and other stakeholders. It aims the following outcome **(UNISDR, 2015):-**

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

The Sendai Framework is the successor instrument to the (HFA) and is the outcome of stakeholder consultations initiated in March 2012 and inter-governmental negotiations held from July 2014 to March 2015, which were supported by UN General Assembly. The **seven targets and four priorities** for action are **(UNISDR, 2015):-**

(a) **The Seven Global Targets**.

(i) Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality rate in the decade 2020-2030, compared to the period 2005-2015.

(ii) Substantially reduce the number of affected people globally by 2030, aiming to lower average global figure per 100,000 in the decade 2020 -2030 compared to the period 2005-2015.

(iii) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.

(iv) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.

(v) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.

(vi) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030.

(vii) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

(b) **The Four Priorities for Action**. The four priority areas for the action are:-

(i) 'Understanding disaster risk'. The risk assessment, prevention, mitigation, preparedness and response should be based on the knowledge of hazard, vulnerability, environment, capacity and exposure of people and infrastructure to hazards.

(ii) 'Strengthening disaster risk governance to manage disaster risk'. It emphasises on collaboration and commitment at national, regional and international level to manage disaster risks

(iii) 'Investing in disaster risk reduction for resilience'. To enhance the economic, social, cultural, health and environment resilience of individuals, society and nation as whole, public and private investments in disaster risk reduction through structural and non-structural measures are essential.

(iv) 'Enhancing disaster preparedness for effective response and to "Build Back Better" recovery, rehabilitation and reconstruction'. There is a need to strengthen disaster preparedness for response. All actions must pre-empt the

emergency. Therefore, measures must be taken to ensure all capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better. It should be an opportunity towards development by integrating disaster risk reduction measures.

United Nations Disaster Assessment and Coordination (UNDAC). UNDAC is an international emergency response system to deal with sudden onset of disasters / emergencies. It is manned by DM professionals trained to deal with disasters and are entrusted to carryout quick assessments of priority needs and onsite coordination of international assistance. These professionals are nominated and funded by OCHA, UNDP, member governments, World Food Programme (WFP), United Nations Children's Emergency Fund (UNICEF) and World Health Organization (WHO). The organisation assists United Nations and government of the disaster affected government in coordinating the international assistance during onset of a sudden disaster situation. It also assists in the coordination of international relief at the national level and/or at the site of the emergency.

United Nations Office for the Coordination of Humanitarian Affairs (OCHA). OCHA was established in 1991 by the UN General Assembly resolution 46/182. The aim is to strengthen the response of United Nations to complex emergencies and natural disasters. OCHA is responsible to bring together humanitarian actors to ensure a coherent response to emergencies. The relief or protection is provided by OCHA, when it is most needed. The OCHA mandate is to "*coordinate effective and principled humanitarian action in partnership with national and international actors*".

SAARC Disaster Management Centre (SDMC). SAARC SDMC was established in October 2006 and it functions from premises of National Institute of DM, New Delhi. The Centre has the mandate to serve eight Member Countries of South Asia Association of Regional Cooperation (SAARC); Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. It provides member countries policy advice and facilitating capacity building services, including training, system development and exchange of information for effective disaster risk reduction and for planning and coordinating a rapid regional response mechanism to disasters in South Asia. The Centre is under transition and presently non-functional since 01 January 2016.

Coalition for Disaster Resilient Infrastructure (CDRI. Making infrastructure disaster and climate resilient is a global challenge concerning both developed and developing countries.

Having experienced large scale infrastructure damages in Gujarat, as Chief Minister during Bhuj Earthquake, PM Narendra Modi, recently announced a global Coalition for Disaster Resilient Infrastructure (CDRI), at the UN Climate Action Summit 2019 held in New York City, USA, for creating disaster resistant infrastructure for sustainable development.

(a) CDRI will act as a convening body that will pool best practices and resources from around the world for reshaping construction, transportation, energy, telecommunication and water, so that buildings in these core infrastructure sectors factors in natural catastrophes. CDRI will serve as a platform where knowledge is generated and exchanged on different aspects of disaster resilience of infrastructure and brings together a multitude of stakeholders (governments, private sector, academic research institutions and international organizations). Aim of CDRI is to assist countries upgrade their capacities, standards, regulations and practices with regards to infrastructure development in accordance with their disaster risk context and their economic needs. At present, **the CDRI, co-led by India and the United Kingdom, has 18 nations and 4 international organizations** as its members. The CDRI is served by a Secretariat based in New Delhi. The CDRI has a multi-year work plan, which will culminate in 2022, coinciding with the mid-term review of the SDGs, SFDRR and the Paris Agreement on Climate Change (**Kanda 2021)**.

(b) The **annual 'ICDRI 2021' was held from 17 to 19 March 2021**. During the Conference, the 27 Member European Union (EU) joined the coalition. PM Modi while giving the inaugural speech, termed the COVID-19 pandemic a 'once-in-a-hundred-year' disaster that taught the world that in an interdependent and interconnected world, country-rich or poor, in the east or west, north or south; is immune to the effect of global disasters. PM also elaborated on **key priority areas**:-

(i) CDRI must embody the central promise of the Sustainable Development Goals, that is, "leave no one behind".

(ii) Stock of the performance of some of the key infrastructure sectors must be undertaken, particularly health infrastructure and the digital infrastructure, that played a central role during the COVID -19 pandemic.

(iii) In quest for resilience, no technological system should be considered too basic or too advanced. The CDRI must maximize the demonstration effect of the application of technology.

(iv) The notion of "resilient infrastructure" must become a mass movement, galvanizing the energies of not just the experts, and formal institutions.

INDIAN DISASTER MANAGEMENT FRAMEWORK

General

The DM Act 2005 has provided the legal and institutional framework for disaster management in India at the national, state and district levels. **In the federal polity of India the primary responsibility of DM vests with the State Governments**. The Central Government lays down policies and guidelines and provides technical, financial and logistic support, while the district administration carries out most of the operations in collaboration with central and state level agencies. Earlier, DM was being handled by "Natural Disaster Management Division" of Ministry of Agriculture and a review of the DM in India was carried out by the Government of **(MHA 2004).** India, post Bhuj earthquake, DM (excluding drought and epidemics) was transferred to the Ministry of Home Affairs (MHA). The actual transfer of work took place in June 2002.

Paradigm Shift. During the last 15 years the country has witnessed six major earthquakes and four severe cyclones. Floods and droughts occur almost every year. These disasters have underscored the need of a multi-dimensional, multi-disciplinary and multi-sectoral approach involving diverse scientific, engineering, social and financial processes. The government has therefore brought about a change in orientation from a relief centric approach to a holistic approach, covering the entire cycle of DM encompassing prevention, mitigation, preparedness, response, relief and rehabilitation.

DM Act 2005 : Institutional and Policy Framework

The DM Act, 2005 came into the statute book on 26 Dec 2005, through a Gazette notification, exactly on the first anniversary of the devastating tsunami of 2004, which killed

nearly 13,000 people in India alone and affected 18 million people. The act provides a legal and institutional framework for "the effective management of disasters and for matters connected therewith or incidental thereto."**(MHA**, **2005)**. The Cabinet Committee of Security (CCS) oversees all aspects relating to the management of natural calamities including assessment of the situation and identification of measures and programmes considered essential to reduce its impact, monitor and suggest long term measures for prevention of such calamities, formulate and recommend programmes for public awareness, for building up society's resilience to them.

The DM Act, 2005 has created new institutions at the National, State, District and local levels. The National Disaster Management Authority (NDMA) and State Disaster Management Authorities (SDMAs) have been created to spearhead and implement a holistic and integrated approach to DM in India. The DM structure has gradually evolved and a formal policy was articulated in terms of a 'National Disaster Management Policy 2009' which delineated responsibility and tasking of various stakeholders.

National Vision. The National Vision as defined in the National Policy is 'to build a safe and disaster resilient India by developing a holistic, pro-active, multi-disaster and technology-driven strategy through a culture of prevention, mitigation, preparedness and efficient response.' **(MHA, 2009)**.

Salient Features of DM Act 2005. The Act provides for establishing several institutions at the state and district levels with adequate financial and administrative powers. The NDMA is the apex body at the top, National Disaster Response Force (NDRF) is the specialist force to deal with disasters and the National Institute of Disaster Management (NIDM) was created with a comprehensive mandate of planning and promoting training and research in the area of DM, development of a national level information base, initiating prevention mechanisms and mitigation techniques. The act also provides guidelines for creation of National Mitigation Fund, and establishment of funds by State Government and allocation of funds by ministries and departments for emergency procurement **(NPDM, 2009).**

The National DM Structure. The DM Act ushered in a paradigm shift from the erstwhile relief centric response to a proactive preparedness approach, wherein various structures have been created with specific roles and responsibilities. The National DM Framework is as given below **(MHA, 2005)**:-

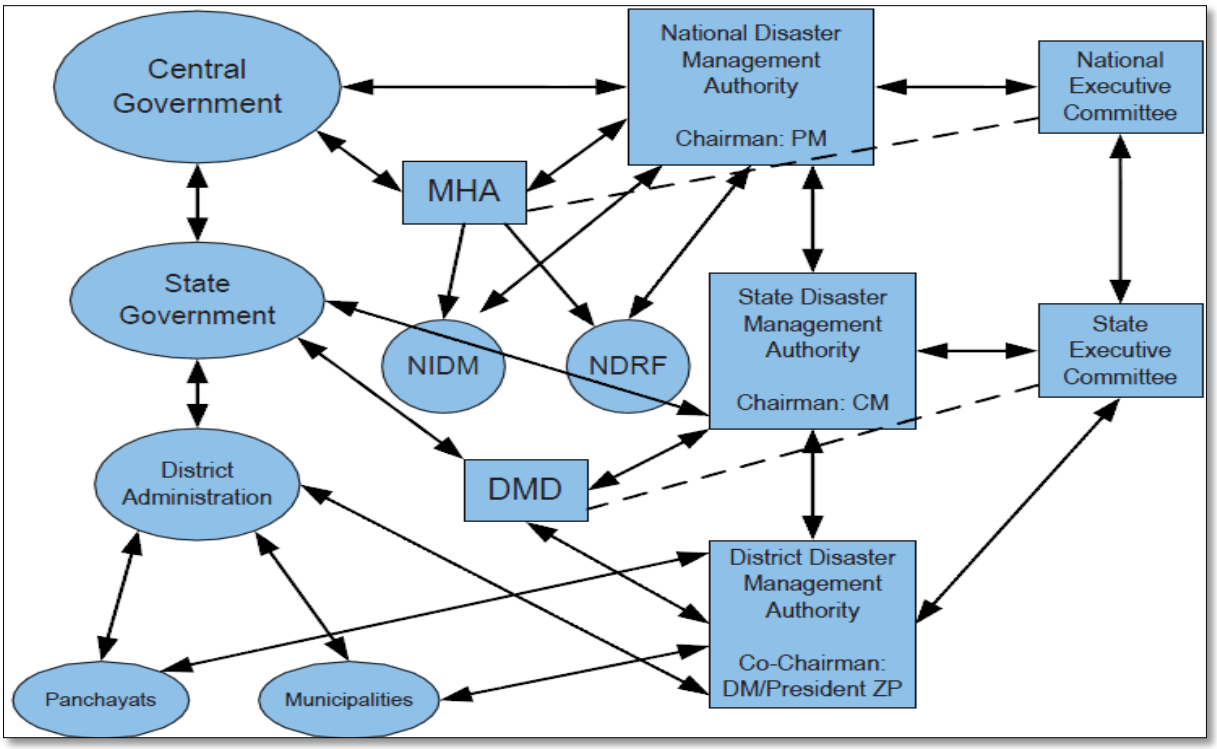


Figure 9: National DM Frame Work

(a) **National Disaster Management Authority (NDMA)**. The NDMA is the apex body with PM as the Chairperson. The NDMA is responsible for drawing up and monitoring the implementation of DM plans and policies, ensuring measures for prevention and mitigation of disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation. NDMA has the power to approve the national plans and the plans of the respective ministries and departments of GoI. The general superintendence, direction and control of NDRF, is also vested in the NDMA.

(b) **National Executive Committee (NEC)**. The NEC is mandated to assist the NDMA in discharge of its functions and to further ensure compliance of the directions issued by the Central Government. The NEC consists of the Union Home Secretary as the Chairperson and the Secretaries to the GOI's of various Ministries/Departments. Special invitees include Secretaries in the Ministry of External Affairs, Earth Sciences, Human Resource Development, Mines, Shipping, Road Transport & Highways and Secretary, NDMA. The **NEC is responsible to prepare the national plan and coordinate / monitor the implementation of the national policy and the guidelines issued by NDMA.** While disaster specific guidelines are to be formulated by NDMA, NEC is to give

directions to the concerned Ministries/Departments of the GoI, the State Governments, regarding measures to be taken by them in response to any disaster situation. The National DM Structure is as under **(MHA, 2011)**:-

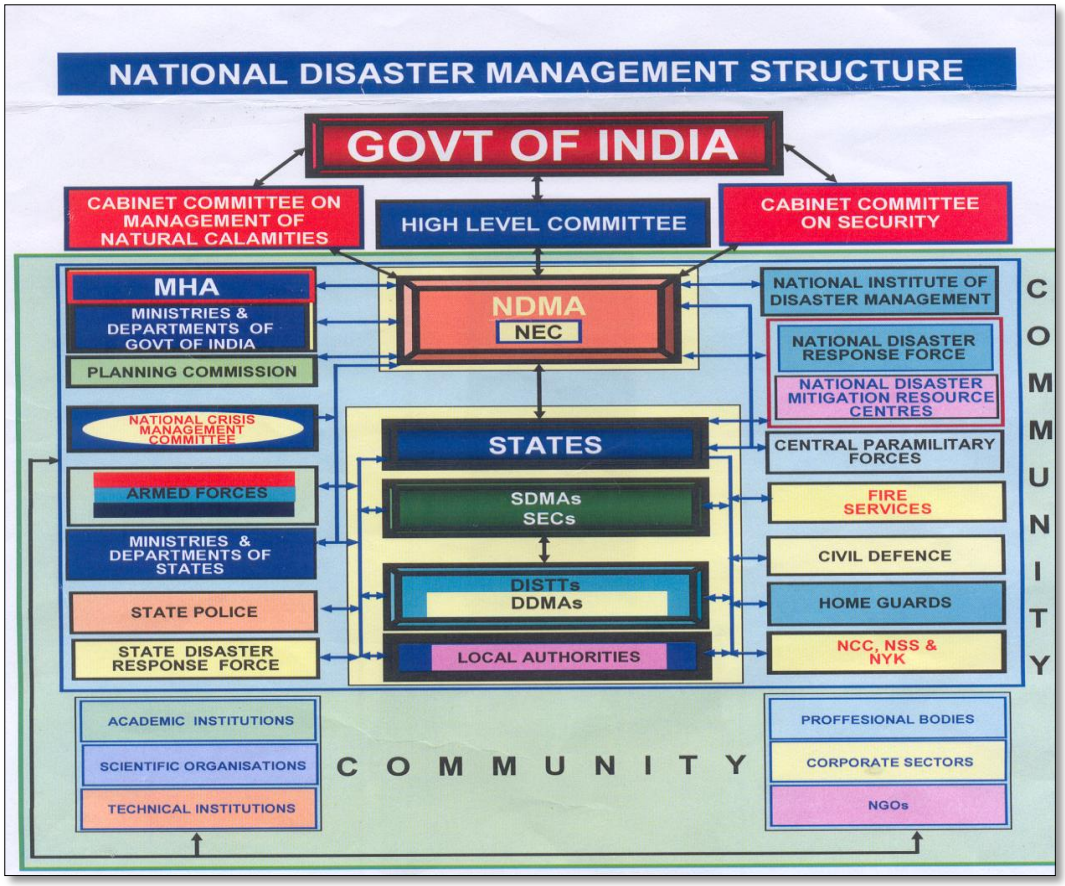


Figure 10: National DM Structure

(c) **<u>Central Level</u>. The *Ministry of Home Affairs (MHA)* in the Central Government has the overall responsibility for DM in the country.** For certain specific types of disasters, various ministries have been designated as nodal agencies to lead the disaster relief initiatives in the country.

<u>Disasters</u>	**<u>Nodal Ministry</u>**
Earthquake and Tsunami	MHA/Ministry of Earth Sciences/IMD
Floods	MHA/Ministry of Water Resources/CWC
Cyclones	MHA/Ministry of Earth Sciences/IMD
Drought	Ministry of Agriculture
Biological Disasters	Ministry of Health and Family Welfare
Chemical Disasters	Ministry of Environment & Forests
Nuclear Disasters	Ministry of Atomic Energy

Air Accidents	Ministry of Civil Aviation
Railway Accidents	Ministry of Railways
Urban Floods	Ministry of Urban Development

Table10:Ministries/Departments/ Agencies Designated for Disaster Management

(d) **State Level**. At the State level, the **State Disaster Management Authority (SDMA)**, headed by the Chief Minister, lays down policies and plans for disaster management in the State. It performs the same duties as the NDMA the state level. The State Disaster Management Department (SDMD) (mostly positioned in the Revenue and Relief Department), is the nodal authority. **State Executive Committee (SEC),** headed by Chief Secretary, is to coordinate and monitor implementation of National Policy, National Plan and State Plan. It is the primary responsibility of the State Governments/SDMAs to monitor and assess any developing situation and keep the NDMA and NEC apprised of the same. They are also to be responsible to constantly evaluate their own capabilities to handle any emerging situation and project the anticipated requirements from the central resources in advance. This also includes training and equipping of State response forces, community preparedness, training and creation of response caches at the District level.

(e) **District Level**. At the district level, the District Disaster Management Authority (DDMA) is headed by the District Magistrate, with the elected representative of the local authority, as the Co-Chairperson. DDMA is responsible for planning, coordinating and implementing body for DM at district level. It is responsible for preparing the district disaster management plan and monitor the implementation of the National and State policies and the National, State and the District plans.

Local Authorities. Other than the National, State, District and local levels, there are various institutional stake holders, who are involved in DM at various levels in the country. These include the Municipalities, Town Planning Authorities, State Police, Para Military Forces, Civil Defence, Home Guards, Fire Services, Ex-Servicemen, NGOs , public and private sector enterprises, all of whom have important roles to play. **(MHA, 2011)**. These are essential stake holders during disaster response, including relief, rehabilitation and reconstruction in the affected areas.

National Institute of Disaster Management (NIDM). In accordance with the act, NIDM was founded from the already functioning National Centre for DM since Oct 2003. The

NIDM is to function within the broad policies and guidelines laid down by NDMA. NIDM is required to design develop and implement training programmes, undertake research, implement HRD plan and assist other training institutes, state governments and organizations. It will develop educational material for dissemination, promote awareness, document and develop national level information base, relating to DM policies, prevention mechanisms and mitigation measures.

Platform for Disaster Risk Reduction (NPDRR). The GoI has constituted a multi-stakeholder National Platform for Disaster Risk Reduction (**NPDRR) in 2013, to prepare a roadmap for all kinds of DM and sustainable development and make India disaster resilient by 2030**. It is a platform to bring together the whole range of India's disaster risk community from government, parliamentarians, mayors, media, international organizations, NGOs, local community representatives, scientific and academic institutions, corporate businesses, etc. The NPDRR is chaired by the Prime Minister. The main functions of NPDRR are:-

(a) It aims to finalise a strategy in coordination with state governments for disaster risk mitigation.

(b) To learn from previous mistakes and prepare a layout in advance for its annual DM plans to make India disaster resilient by the year 2030.

(c) It promotes participatory decision making in DM.

(d) To promote active participation of non-governmental organisations, individuals & communities in framing of DM policy

(e) To work in accordance with the four priority themes of the Sendai framework. These include understanding disaster risk reduction, improving disaster risk governance, investing in disaster risk reduction, disaster preparedness and to fully achieve the targets by 2030. The first meeting of NPDRR was organized on 13-14 May 2013 in New Delhi on the theme "Mainstreaming DRR in Development: From Risk to Resilience". It was organised with an objective to encourage implementation of Hyogo Framework of Action and to create a pool of resources of scientists, practitioners in Disaster Risk Reduction.

The 2nd meeting of NPDRR was held on 15-16 May 2017 at Vigyan Bhawan, New Delhi, on the theme "Disaster Risk Reduction for Sustainable Development: Making India Resilient by 2030". The meeting deliberated on emergent issues, with special focus on Prime Minister's

Agenda 10 on Disaster Risk Management and its relevance in integrated implementation of Sendai Framework for Disaster Risk Reduction (SFDRR), Paris Climate Agreement and Sustainable Development Goals (SDGs). The **Prime Minister's 10 point agenda** emerged as recommendations of 2ND NPDRR, 2017.

(a) All development sectors must imbibe the principles of disaster risk management.

(b) Risk coverage must include all, starting from poor households to SMEs to multi-national corporations to nation states.

(c) Women's leadership and greater involvement should be central to disaster risk management.

(d) Invest in risk mapping globally to improve global understanding of Nature and disaster risks.

(e) Leverage technology to enhance the efficiency of disaster risk management efforts.

(f) Develop a network of universities to work on disaster-related issues.

(g) Utilise the opportunities provided by social media and mobile technologies for disaster risk reduction.

(h) Build on local capacity and initiative to enhance disaster risk reduction.

(i) Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster.

(j) Bring about greater cohesion in international response to disasters.

National Emergency Operation Centre (NEOC). The NEOC in the Ministry of Home Affairs functions 24×7 to monitor the disaster or disaster-like situation. Based on the feedback received from national forecasting agencies, viz. the Indian Meteorological Department, Central Water Commission, Snow and Avalanche Study Establishment, advisories to the concerned states/UTs are issued from time to time for keeping watch on the developing situation and take necessary measures such as evacuation of the vulnerable persons, operation of relief camps, pre-positioning of essential commodities, etc. During the calamities of severe nature, special situation reports are also prepared and issued to all concerned. NEOC also issue SMS alerts to the concerned officers at the central and state government level.

National Disaster Response Force (NDRF) : Role & Organisation

Two national calamities in quick succession in the form of Orissa Super Cyclone (1999) and Gujarat Earthquake (2001) brought about the realisation of the need of having **a specialist response mechanism** at National Level, to effectively respond to disasters. NDRF was established under the statutory provision for the constitution of the Force, vide **section 44 (i)** of the Act. NDRF a specialist force is gradually emerging as the most visible and vibrant multi-disciplinary, multi-skilled, high-tech force of the NDMA, capable of dealing with all types of natural and man-made disasters. NDRF was established in 2006 for DM and specialised response to natural and man-made disasters. It began with strength of eight battalions of Central Armed Police Forces, two each from BSF, CRPF, CISF and ITBP. Two more battalions have been additionally sanctioned and will accrue from SSB. Presently, there are 12 NDRF bns. The control of NDRF is vested with NDMA. The command and supervision of the NDRF is vested with the Director General appointed by the Government of India. The NDRF is equipped and trained to respond to situations arising out of natural disasters and CBRN emergencies.

Vision of NDRF. To emerge as the most visible and vibrant multi-disciplinary, multi-skilled, high-tech force capable to deal with all types of natural, as well as man-made disasters and to mitigate the effects of disasters. At present, NDRF consists of 12 battalions, three each from the BSF and CRPF and two each from CISF, ITBP and SSB. Each battalion have 18 self-contained specialist, search and rescue teams of 45 personnel each, including engineers, technicians, electricians, dog squads and medical/paramedics. The total strength of each battalion is 1,149. All the 12 battalions have been equipped and trained to respond natural, as well as man-made disasters. Battalions are also trained and equipped for response during chemical, biological, radiological nuclear (CBRN) emergencies. **(NDRF, 2019)**. These NDRF battalions are located at 12 different locations in the country based on the vulnerability profile of country and to cut down the response time for their deployment at disaster site, as shown below (Fig11):-

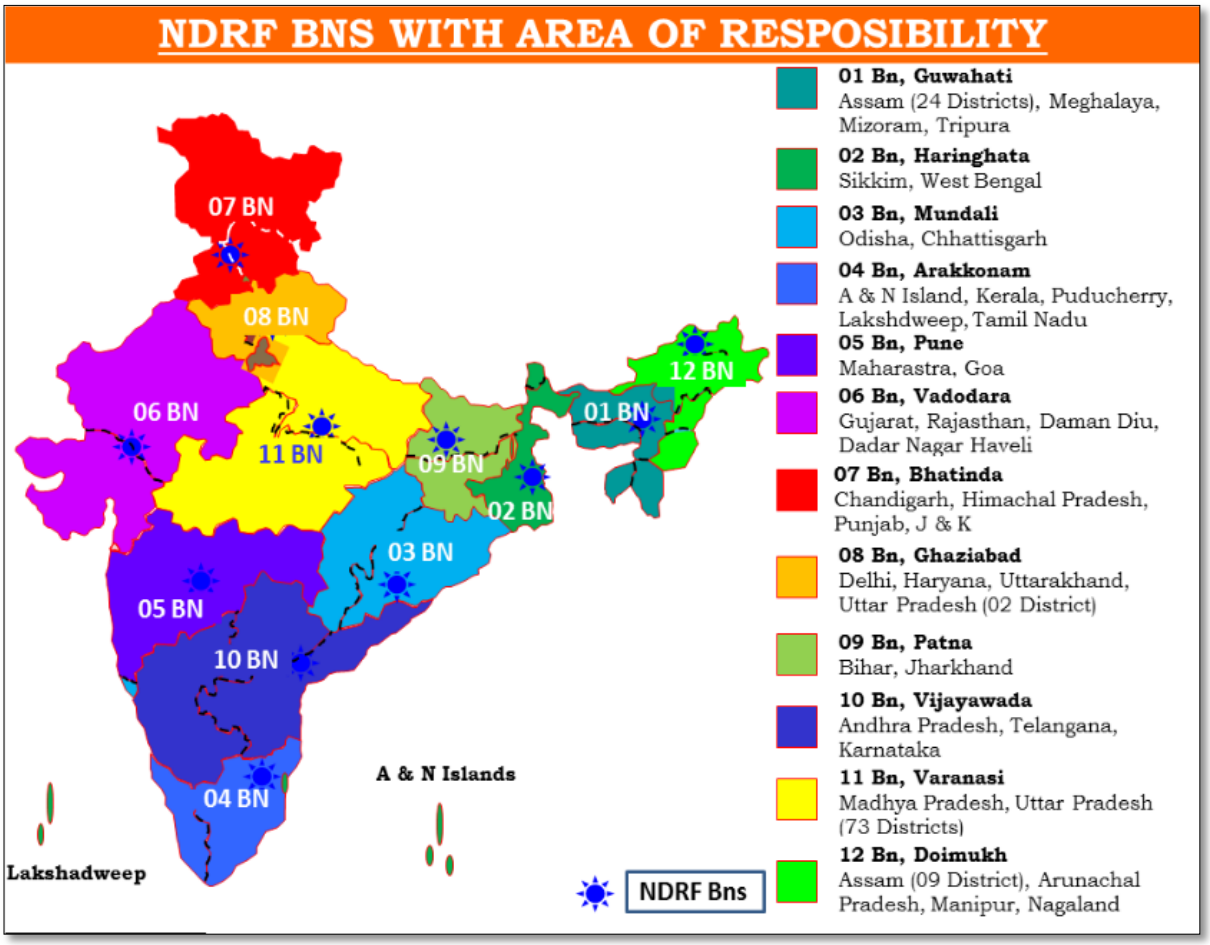


Figure 11 : NDRF Bns locations and their respective area of responsibility

Role of NDRF

NDRF is a 'Specialist Force' which has been designed to respond to disasters/ threatening disaster. Its functional role during disasters is to execute a specialized response. In case of an impending disaster is to carry out a proactive deployment of teams to assist in DM. During the non-disaster period, it has multiple roles, to include:-

(a) Skills upgradation of its own forces or in other words train itself for various contingencies.

(b) Training other stake holders to include SDRF, Civil Defence personnel, Home Guards and other similar resources available at the State level.

(c) Creating resilient community by engaging the community in capacity building and public awareness programme.

(d) Familiarization exercises and mock drills at likely disaster sites and also at schools and colleges.

The composition of each NDRF battalion is laid down and each battalion has a strength of 1149 personnel, which are organized themselves into 18 self-contained specialist teams of 45 members each. Each of these teams comprises of specialist manpower viz. Medical Officers, Engineers, Paramedics, Technician, Electrician and dog squads. All Battalions are trained and equipped for all natural disasters and for CBRN emergencies.

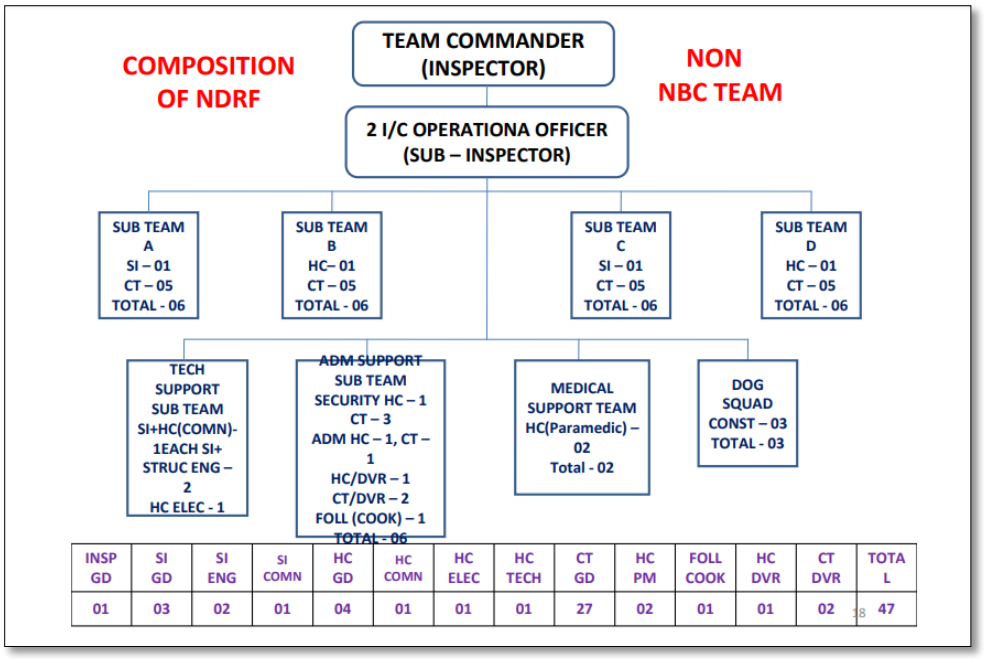


Figure 12 : Composition of NDRF Team Non NBC

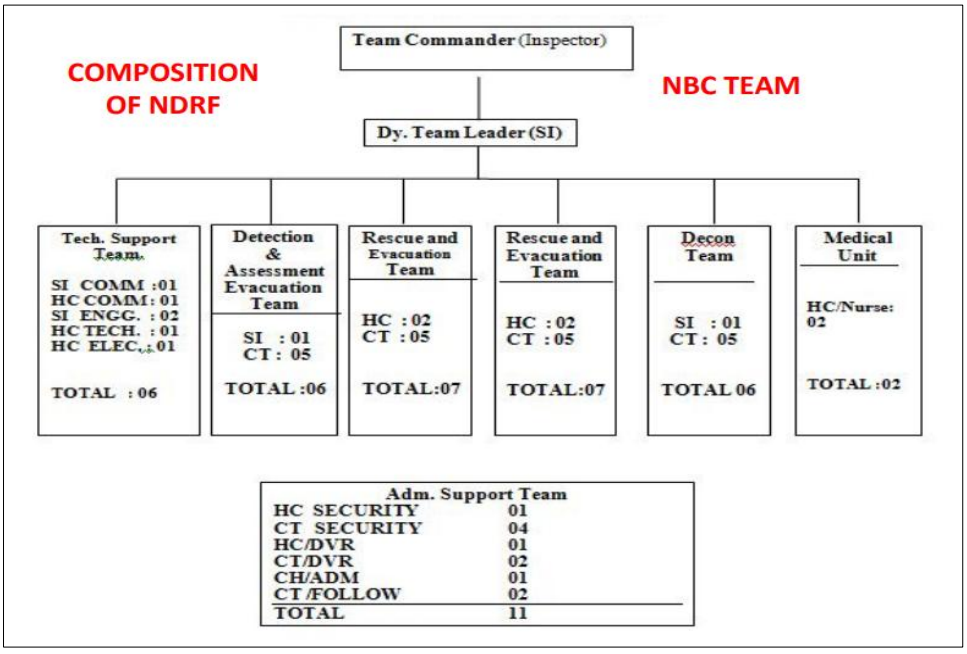


Figure 13 : Composition of NDRF Team NBC

New Raising : NDRF

Sometime in mid-August 2018 the Union Cabinet gave approval to increasing the size of the NDRF and it will soon raise four more battalions, adding to existing 12. The four new battalions would be stationed in Jammu & Kashmir, Himachal Pradesh, Uttarakhand and NCR Delhi. These battalions will be modernised to meet international standards and NDRF also has proposed to have exclusive women contingents within battalions to take care of women during times of distress. The objective of raising four additional battalions is to reduce response time keeping in view vast geographic area of the country. These four battalions will initially be raised as two battalions in Indo-Tibetan Border Police (ITBP) and one battalion each in Assam Rifles (ARs) and Border Security Force (BSF). Later, these four battalions will be converted into NDRF battalions.

Indian Response Mechanism: In Face of Disasters

As per the National Disaster Management Plan **(NDMP 16)**, response measures are those taken immediately after receiving early warning, anticipating an impending disaster or post-disaster in cases, where an event occurs without warning. The **primary goal of response to a disaster is saving lives, protecting property, environment, and meeting basic needs of human and other living beings**, after the disaster. In the section on response, roles, function and

responsibilities of ministries and agencies that have a key role to play are described. Since contexts, knowledge base and technologies change, DM plans must be updated periodically to reflect any changes in the key roles envisaged to particular ministries or agencies.

At the national level, the central government has assigned nodal responsibilities to specific ministries for coordinating disaster specific responses. The NDMA will be coordinating with relevant nodal ministry. The disaster-specific nodal ministry will ensure liaison with the state government where the disaster has occurred and coordination among various relevant ministries and departments to provide quick and efficient response. The State Government through SDMA will activate the **Incident Response Teams (IRT)** at State, District, or the block level as required. The IRTs will coordinate with the **State & District EOC**. The SDMA (or its equivalent, CoR, or Dept. of Revenue) will provide technical support to the response. Different central ministries and departments will provide emergency support to the response effort as per request from the State Government. The **SDMA / Department of Revenue or Commissioner of**

Relief (as applicable), is the nodal agency for coordination of disaster response. The various agencies whose responsibilities are defined in detailed DM plans for the state and district will be responsible specific response measures. The **DDMA is the nodal agency for coordination of response at District level, supported by other district level agencies**.

Plan Activation

NDMP remains in operation during all phases of disaster cycle i.e. mitigation, preparedness, response and recovery. However, NEC may activate disaster response system (partially or fully with all support functions activated based on the situation) on the receipt of disaster warning or upon the occurrence of a disaster. The occurrence of disaster may be reported by the relevant monitoring authorities (both National and State) to the NEC by the fastest means. The NEC will activate emergency support functions including the NEOC, scale of which will commensurate with the demand of situation (size, urgency, and intensity of incident). The activation sequence for national response in the event of a disaster, is as given below **(NDMP, 2016)**:-

(a) The relevant State Government would assume direct responsibility in the event of a disaster.

(b) The MHA would assume direct responsibility in case of Union Territories.

(c) The response from Central agencies would come into operation when the relevant State Government makes a specific request for Central assistance, financial, logistical, or resources – including transport, search, rescue and relief operations by air, inter-State movement of relief materials, among others.

(d) The direct involvement of Central Agencies will apply to those cases where the GoI has primary jurisdiction; organisation of international assistance, response on high seas, and impact assessment of disasters with the assistance of international agencies, and financial assistance from the National Disaster Response Fund.

Institutional Arrangements for the Response System

The institutional arrangements for the response system consist of the following elements:-

(a) Nodal Central Ministries with disaster-specific responsibilities for national-level coordination of the response and mobilization of all the necessary resources.

(b) Central agencies with disaster-specific responsibilities for early warning systems and alerts.

(c) National Disaster Response Force (NDRF).

(d) State Disaster Response Force (SDRF).

There will be National Emergency Operations Centre (NEOC), known as NEOC-1 under the MHA and NEOC-2 under the NDMA. It will be connected to the following control rooms:-

(a) All agencies designated to provide early warning information about hazard events State Emergency Operations Centre (SEOC).

(b) District Emergency Operations Centre (DEOC).

(c) NDRF.

(d) Integrated Defence Staff (IDS).

(e) MEA.

(f) CAPFs.

CHAPTER IV : CASE STUDIES: DISASTER RESPONSE DURING UTTARAKHAND FLOODS IN 2013, KERALA FLOODS IN 2018 & CYCLONE AMPHAN 2020

The source of man's unhappiness is his ignorance of Nature

Paul Henry Thiry d'Holbach

UTTARAKHAND FLOODS IN 2013

In Jun 2013, an unprecedented hydro - metrological disaster hit parts of Uttarakhand, largely the Mandakini valley of Higher Himalaya in Rudraprayag district, in which around 5700 persons are believed to be missing / killed. The disaster took place in two phases; Earlier, in the evening hours of 16 Jun, a breach of the landslide dammed lake formed close to Kedarnath on Mandakini river ravaged Rambara and Gaurikund. Subsequently in the morning hours of 17 Jun, breach of the glacial lake, Chorabari Tal, devastated the temple township of Kedarnath.

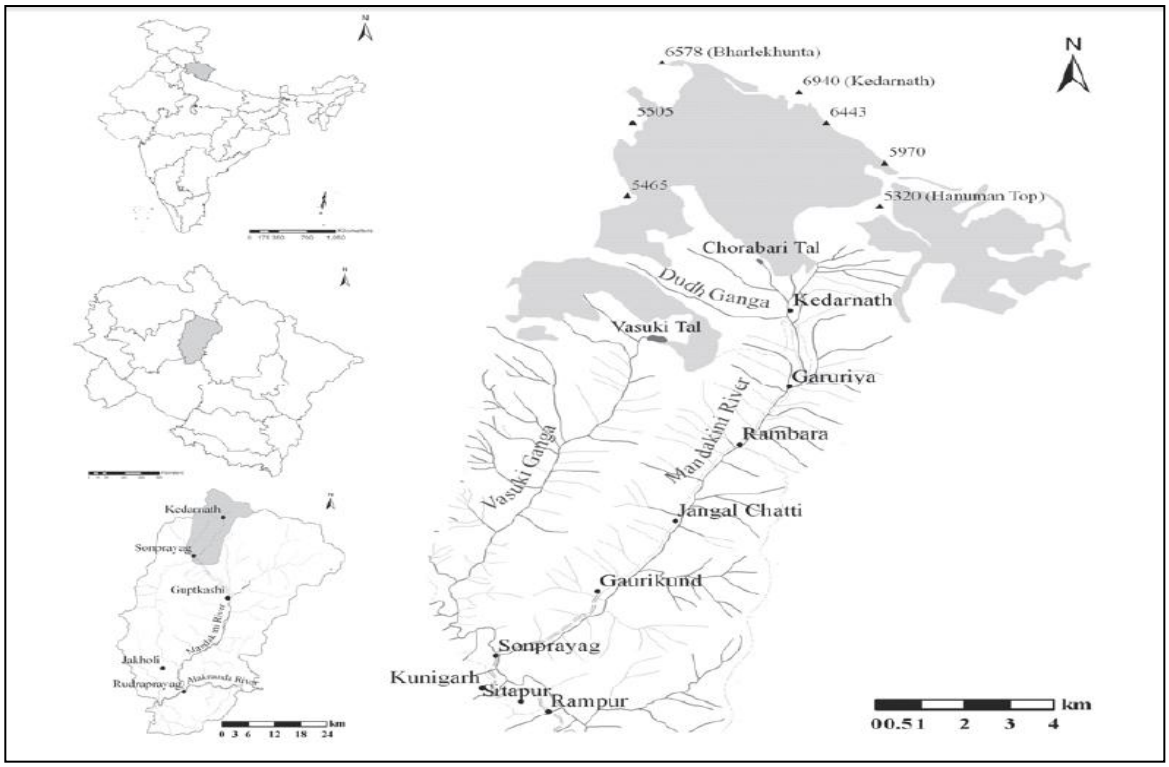


Figure 14 : Location map of the area devastated by floods in Jun, 2013

(Asian Journal of Environment and Disaster Management,Vol.5, No. 2 (2013) 43–51)

Events Leading to Disaster

The sequence of events that resulted in the disaster need to be reconstructed and analysed so to draw pertinent lessons in disaster prediction and response. As narrated by the survivors of the disaster, the following events unfolded from 14 Jun onwards :-

(a) Incessant rains in the area continued between 14 to 17 Jun, 2013. Rainfall on 16 and 17 Jun, 2013 was particularly heavy and tragedy struck Kedarnath on the night of 16 Jun and in the morning hours of 17 Jun, 2013.

Date	**Rainfall (mm) at Rudraprayag**	**Rainfall (mm) at Gaurikund**	**Levels of Mandakini at Rudraprayag at 0800 h (in meters asl with 626.00 meters being the danger level)**
15 Jun	41.4	250.0	618.12
16 Jun	105.2	+ 250.0	625.00
17 Jun	100.2	180.0	633.50
18 Jun	62.1	0	626.65
19 Jun	7.0	0	623.00
20 Jun	0	0	622.48

Table 11 :Details of Rainfall and Water level Data of Mandakini at Rudraprayag

(Indian Disaster Reports 2013 by NIDM **)**

The abandoned eastern channel of Mandakini at Kedarnath became active in the evening hours of 16 Jun, 2013 and it washed off the pedestrian bridges over Mandakini connecting Kedarnath to Rambara and turning Kedarnath into an Island. The flood waters also washed off Sanatan Dharm Sabha guest house, Shankaracharya Samadhi and a few other structures in the vicinity of the temple together with a few persons.

After the heavy rains on the evening of 16 Jun, many persons in Kedarnath assembled in the temple premises and engaged in prayers, large number of persons however returned to their respective places around 0200 hrs on 17 Jun, 2013.

Rambara and Gaurikund were devastated on the night of 16 Jun, 2013. In Kedarnath, major devastation took place in the morning hours of 17 Jun, 2013. Breach of Chorabari Tal took place around 0700 hrs on 17 Jun and floodwaters of Mandakini ravaged Rambara, Gaurikund and Sonprayag again in the morning hours of 17 Jun, 2013.

The gushing waters carried with it, huge glacial boulders that choked the western channel of Mandakini. The flow water and debris got diverted towards Kedarnath township, which was completely ravaged. There was no warning and most people were taken by surprise and had no time to respond. Besides Kedarnath, this event also caused devastation in Rambara, Gaurikund, Sonprayag and other adjoining places along the valley.

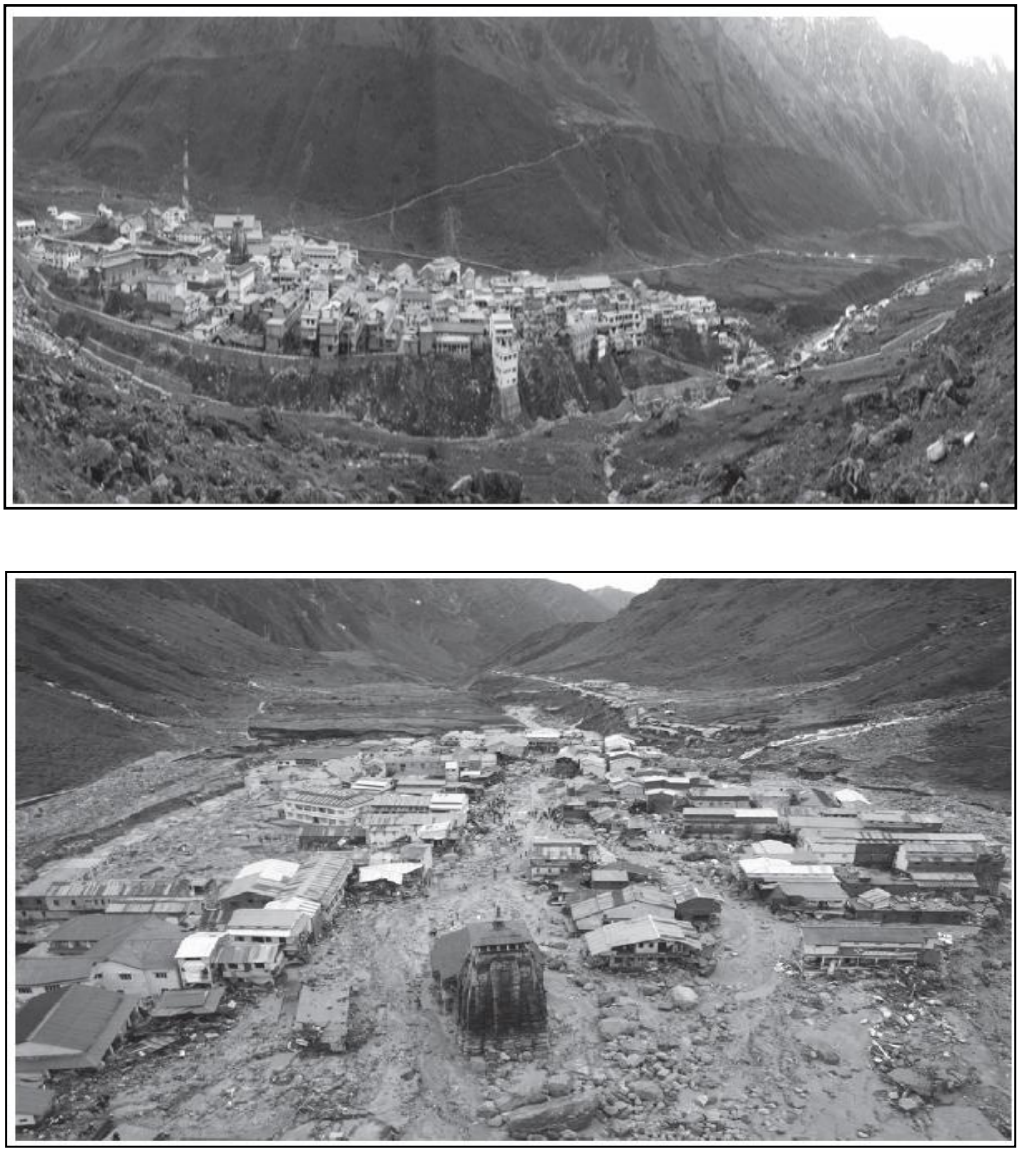


Figure 15 : Kedarnath Town – 'Before' and 'After' the floods

(Asian Journal of Environment and Disaster Management Vol. 5, No. 2 (2013) 43–51)

Aftermath of the Deluge

The scale and magnitude of the disaster was such that more than 5000 persons went missing and/or presumed to be dead. The disaster was of an 'unprecedented magnitude'. The

national highways and other important roads were closed to regular traffic. More than one lakh pilgrims, tourists and about 50 thousand locals trapped due to adverse terrain and extremely hostile weather conditions. The sequence of events in the Mandakini valley took everyone by surprise and no worthwhile warning could be passed on to neighbouring areas. Attempts were however, made to communicate the news of flooding over high frequency police radio set, but the seriousness of the incidence could not be assessed from these attempts. All communications with Kedarnath valley were snapped on the late evening of 16 Jun 2013. Adverse weather and terrain conditions did not provide opportunity of resorting to alternative probes. The outside world, as also the local administration, therefore remained unaware of the events in Mandakini valley, till the afternoon of 17 June 2013.

Aerial rescue operations could only be initiated on the morning of 18 June 2013. Ground search and rescue operations were hampered by washing off of the pedestrian track at many places between Gaurikund and Rambara and the serious rescue efforts could actually start only on 19 June 2013. Terrain conditions made it difficult even to airdrop food and water at many locations, wherein people were stranded in large numbers. The heavy rains, flash floods, massive landslides and road blocks left over 1,25,000 people stranded at various locations. Most of the rivers and feeder streams in the region like Alaknanda, Bhagirathi Dhauliganga, Mandakini, Pindar, Gori, Dhauli, and Kali flooded over their boundaries and inundated the surrounding areas. National Highway 58 (Rishikesh-Badarinath), an important artery connecting the region, was washed away near Joshimath and at many other places. For more than three days, stranded pilgrims and tourists were either without rations or survived on little food in Kedarnath, Gangotri, and Badarinath axis. Rescuers at Haridwar on the river Ganga recovered bodies of victims washed down by the flooded rivers and some bodies were later found in distant places like Bijnor, Allahabad and Bulandshahr in Uttar Pradesh.

Assessed Damage due to the Calamity.

According to figures provided by the Uttarakhand government, more than 5,700 people were ‘presumed dead’. This total included 934 local residents. In a massive evacuation-cum-rescue operation, Indo-Tibetan Border Police (ITBP), Air Force, Army, NDRF, and state administration evacuated more than a lakh people from the flood-ravaged area.

Details / Affected Parameters	Damage / Loss	Remarks
Villages affected	**1800**	

Death	**5700**	Official figures
Families Rendered Homeless	**2500**	
Stranded Population	**1,25,000**	
Main Pilgrimage Centres Affected	05	
Roads Damaged	17000 km	
Bridges Destroyed	150	
Loss to Roads / Bridges (Financial)	Rs 2000 Crores	

Table 12: Post Disaster Assessment- Uttarakhand Floods (CAG, 2013)

Disaster Relief Efforts : Analysis

Response of State Government / SDMA. The State Administration was caught completely unaware and unprepared. The immediate response was extremely tardy and unplanned. Incidentally, the unsatisfactory status of the state's preparedness to face any disaster situation was highlighted by the CAG in their report 'Performance Audit of Disaster Preparedness in India' / Report No released in Mar 2013, just ***three months prior*** to the disaster **(CAG, 2013).** The report highlighted major inadequacies in the state machinery in its capacity to tackle any likely disasters. When the floods hit Uttarakhand in Jun 2013, the report seemed prophetic, as the issues highlighted therein, were the very reasons of the poor performance of the state disaster response machinery in addressing the calamity. The CAG audit report highlighted the following shortcomings in the preparedness levels of the state **(CAG, 2013)**:-

(a) SDMA, although constituted in Oct 2007, had not formulated any rules, regulations, policies and guidelines. State Executive Committee (SEC) was formed in Jan 2008, but had never met since its creation. **The State DM structures were virtually non-existent.**

(b) The State DM Plan was still under preparation and no actionable programs were prepared for various disasters.

(c) There were irregularities in the management of State Disaster Response Fund. These included non investment of funds, which resulted in potential loss of interest of Rs 9.96 Crores during 2007–12. State Government did not submit utilisation certificates and Annual Report of Natural Calamity and therefore no funds were released from the central share to the state for year 2011–12.

(d) **No plan was prepared in the State for early warning**. The communication system was inadequate and would result in delayed information to vulnerable population.

(e) The State Government had not sanctioned any post for the SDMA which affected the establishment of the Management Information System. In the DEOC (District Emergency Operation Centre) at district level, there was an acute shortage of manpower. In 13 districts, only 66 posts were filled against sanctioned manpower of 117.

(f) It was also noticed that no master trainers were trained to impart training to the staff at the district, block and village level engaged in the prevention and mitigation of disaster management. Medical personnel were also not trained in hospital preparedness for emergencies or mass casualty incident management.

(g) The Uttarakhand government seemed overwhelmed by a disaster of such magnitude, the reason - as is evident from the audit report by CAG of the Uttarakhand Disaster Management Authority.. While the State machinery was unprepared and therefore could not timely & properly respond, coordinate and control the relief efforts. **The State Government failed to assess the gravity of the calamity and was completely paralysed. As result there was a inordinate delay in requisitioning the Armed Forces**. Five days after the tragedy had struck, the State administration admitted that there had been a lack of coordination between government agencies engaged in rescue operations.

Response from NDRF. The NDRF deployed 14 teams (a total of 449 persons), from two NDRF Battalions, in six locations. Five teams in Rudraprayag District, three teams in Haridwar, one team in Guptkashi, one team in Lakshar, one team in Gaurikund, one team in Dehradun and one team at Jolly Grant Airport. The NDRF mission was to assist the 'State government in search and rescue operations' and rescued 9,321 persons and recovered 142 bodies. The NDRF also suffered causalities in a helicopter crash that took place and lost 9 officials. **While the NDRF contributed immensely in the rescue operations, arrival of its teams at the incident site was possible only on 18 Jun**.

Response from ITBP. About 1600 ITBP personnel (300 from 1st Battalion Joshimath, 300 from 8th Bn Gaucher, 300 from 12th Bn Matli, 100 from M&SI (Auli) and around 600 personnel from 7th Merthi and 14th Bn (Pithoragarh) were involved in rescue and relief operations in Uttarakhand. The Indo-Tibetan Border Police rescued 21 foreign nationals from

remote areas of Uttarakhand besides rescuing and evacuating 33,009 Indian nationals from various disaster sites. **All locations of ITBP in disaster affected areas like Joshimath, Gaucher, Uttarkashi, Matli Lambaghat and Nyu Sobla, opened temporary relief camps and provided shelter, food and medical assistance for the stranded population.** ITBP personnel also assisted Border Road Organisation (BRO) in restoration of damaged roads and construction of bridges.

Response from Armed Forces

(a) The Armed Forces were the first to get involved in the disaster relief efforts, **primarily due to availability of some army units and troops in the affected areas**. The subsequent relief operations were a joint effort with the army, air force, ITBP and NDRF combining their resources to bring relief to thousands of stranded persons. Indian Navy also sent a small team of marine commandos (MARCOS), specially trained in diving, to Rudraprayag and Rishikesh. The response of the relief teams of the armed forces came in for much appreciation as they were able to deliver, despite working under severe constraints of weather and terrain.

(b) In the massive response operation named '***Surya Hope***', the IAF rescued 23,775 persons, the Army 38,750, ITBP 33,000 and NDRF 9,000 from the affected areas. IAF dropped about 730 MT of essential commodities at different places. Civil aviation helicopters airlifted 13,000 pilgrims/local people to safer places. Other state government agencies such as police department, district authorities, NGOs and volunteers also helped in the rescue and relief operations. The major part of the evacuation was accomplished in less than a fortnight making it one of the largest, swiftest and safest rescue/evacuation operations. **(NIDM, 2013)**. Internally, the relief operations of the armed forces were also not flawless and had numerous lessons for the future.

Lessons for the State Administration and Disaster Relief Machinery

The Uttarakhand devastation highlighted the unpreparedness and inadequate response of the civil administration and the disaster management structures, both at the national and state level. The performance of the NDMA and state administration has been widely criticised for their tardy response and ill-preparedness. The Government of Uttarakhand and the SDMA have been blamed for not taking heed of the meteorological department's warning and failing to issue timely evacuation advisory. There have also been allegations that the Uttarakhand government was slow and inept in coordination of the entire relief effort. Three crucial days were lost because of the

delayed action. The **lessons for the state administration and the higher elements in the response matrix,** as deduced from various studies and feedback, **are compiled below, in succeeding paragraphs.**

Precautionary steps by State administration were not adequate in foreseeing eventualities of this magnitude. India has an elaborate multi-tier and multi-agency natural disaster and flood early warning system, both at the Central and the state levels. There are federal nodal agencies responsible for providing early warnings. None of these agencies except the Indian Meteorological Department is known to have provided early warning of the calamity that struck Uttarakhand in Jun 2013.

On Jun 13, 2013, Meteorological Department (IMD), Dehradun, forecasted 'heavy to very heavy rainfall in the upper regions of Uttarakhand in the next 48 to 72 hours'. The Central Government, Uttarakhand Government and NDMA ignored the warning. **No warning or advisory was issued by the State Government to the residents of the affected areas or the more vulnerable pilgrims. (NIDM, 2013)**. Even after meteorological departmental warning, no specific steps were taken to stop/evacuate the pilgrims from vulnerable centres.

No regular briefing or update had been given to police personnel as to methods of handling such disasters. The regulatory system to control day – wise inflow of pilgrims to Kedarnath, Badrinath, Hemkund Sahib, Gangotri and Yamunotri were either weak or inadequate.

When the disaster struck, the local administration and population was severely affected. Normally these elements are at the forefront of providing relief and support in case of any disaster but in this case, these elements were equally affected. There was no effective presence of civil administration in these areas to guide and control the relief columns being inducted. The civil functionaries in most of the districts had either left or were in the process of moving to safer areas.[1] There was complete **absence of first responder capacity and awareness at the community level, which resulted in large number of casualties.**

The **national level coordination post the disaster, was satisfactory**. Regular Crisis Management meetings were held at Delhi and Dehradun for macro level coordination, but **micro level state machinery was finding it very difficult to implement the decisions and directions**.

[1] As conveyed, during interaction, by Lt Gen NS Bawa, AVSM**, GOC Uttar Bharat Area, Controlling Headquarters of army relief operations in Uttarakhand.

Even though help lines were established at State Headquarters and Central Armed Force Campuses, **individual specific information** was very limited. The relatives and families of the victims from all over the country were anxious to get information, but hardly any details of specific nature were available.

The **law and order issues** such as controlling stranded population, regulating air evacuation, traffic control, keeping an eye on anti-social elements are extremely important aspects in disaster response of mass scale and these were ignored. The VIP culture and expectation of out of turn priority by influential people over injured, children, women and aged for evacuation caused difficulties to rescuers.

The district administration was **found lacking in organising coordination meetings during preparatory stage** with ITBP, local units of Army/GREF. The periodic coordination meetings could have ensured that functional problems are sorted at the grassroots level.

The communication network normally gets disrupted in a disaster. Hence, **a proper plan for alternative satellite based communication is desirable.** During the response operation, country had to import such sets from Hong Kong since those were not readily available within the country. **(Austine, 2014)**.

Summary : Lessons Learnt

The Uttarakhand floods in 2013 brought to the fore, the inherent problems and under preparedness of the national and state disaster response machinery to deal with disasters of such magnitude. The Uttarakhand disaster clearly highlighted the inadequate and uncoordinated response of the civil administration and the disaster management structures, both at the national and state level. There was complete **absence of first responder capacity and awareness at the community level, which resulted in large number of casualties.** Despite a well defined institutional mechanism at National, State & District level in the form of NDMA and SDMA, the responses were inadequate due to :-

Complete **paralysis of command and control system of State Administration**, led to failure to assess the gravity of the calamity. As a result, there was absence of timely and integrated response and evacuation of locals to safer places. The local administration, responsible for evacuation and provide relief to local population were themselves

rushing to safer places. There was **no system to forewarn / alert the local people of the likely heavy rains**. As the **communication systems of civil administration failed** due to the adverse conditions, the **SDMA and NDRF had to depend on Army's satellite phones** for coordinating the relief work.

Lack of coordination leading to uncertainty and confusion. Delay in mobilization of men, material, relief stores and machines. Poor/lack of resource/ inventory management leading to non /sub optimal usage.

There was no clarity of roles and responsibilities, especially in the initial stages of the relief efforts and therefore **duplication and overlapping of efforts** resulting in considerable time delay in the response itself.

Designated authorities were not backed by professional response teams. There was a clear lack of adequate competencies and capability among disaster managers. Authority and responsibility based on position / designation (not backed by professional training).

Inadvertent fallout of the inability of the state machinery to deliver during the crises was the immense responsibility that befell on the armed forces to deliver despite the daunting constraints. **There was lack of synergy and interoperability issues between NDRF & Armed Forces, due to lack of prior training and coordination**. While the contributions and performance of the armed forces have been widely lauded, Uttarakhand floods highlighted that NDRF is a good asset for localized disaster response (small scale)**, but is insufficient for a major disaster, for which the response will have to be based on the Armed Forces,** as in any other country**.** *It is imperative that the DM Act needs to incorporate the Armed Forces into the DM Mechanism. This will not only empower the armed forces for future such employments but also trigger reforms to strengthen the core of our national disaster response mechanism.*

KERALA FLOODS IN AUG 2018

General

Kerala is a land of rains and rivers. The State has mainly two rainy seasons viz. the Southwest monsoon that arrives towards the end of May or early June, which is known as ***edavapathi*** and Northeast season which hits the State during mid-October which is known as

thulam. Very heavy monsoon rains are a part of the State every year, however, the Southwest season of 2018 had a different impact as the monsoon resulted in a disastrous flood. Between June 1 and August 18, 2018, Kerala experienced the worst ever floods in its history since 1924. During this period, the state received cumulative rainfall that was 42% in excess of the normal average. The heaviest spell of rain was during 1-20 August, when the state received 771mm of rain. The torrential rains triggered several landslides and forced the release of excess water from 37 dams across the state, aggravating the flood impact. Nearly 341 landslides were reported from 10 districts. Idukki, the worst hit district, was ravaged by 143 landslides. The heavy downpour in the catchment areas of all the 41 west flowing rivers made the rivers swelled up and overflowing flood waters shifted the course of the rivers, submerged the settlements, bridges washed away and ransacked roads.

During the peak time of the emergency situation, two district Pathanamthitta and Thrissur were about 80% submerged. More than one million people got affected. 35 out of the 44 dams within the state were opened for the first time in history. In a span of 30 days, 384 human lives were lost, thousands of houses damaged, over a million and half people were moved to relief camps, large stretches of major roads got washed away and many bridges got damaged. Cochin International Airport which is one of the busiest International airports of the country got flooded and suspended its operations from 15 to 29 Aug 2018.

How the Situation Unfolded

The summer monsoon rainfall in Kerala from May to Aug 2018 was 2,290 mm, which was 53% above normal. The average rainfall during the summer monsoon period (Jun-Sept) is about 1,619 mm. This made 2018 Kerala's third wettest year in the last 118 years (1901-2018); 1924 and 1961 were the wettest years with about 3,600 mm of annual rainfall. Till 21 Aug, Kerala witnessed few extreme rainfall events covering almost the entire State. Kerala received 1634.5 mm rainfall during the period 01May to 07 Aug, which is more than the average rainfall (1619.37 mm) during the summer monsoon period (Jun-Sept). As a result, six of the seven major reservoirs in the State had over 90% storage before 08 Aug, well before Kerala received the unprecedented extreme rainfall events **(Srivastava, 2019).**

On 08 Aug 2018, Kerala received rainfall of 310mm over 24 hours. The shutters of Neyyar dam rose to 5 inches from 4 inches. Chalakuddy river started overflowing. Central government team visited flood-hit regions of Kuttanad, Upper Kuttanad. Meanwhile over 20 landslides were reported in Kannur district and hundreds of families were isolated.

On 09 Aug 2018, 24 dams across the state opened. On the same day Idukki dam's first gate were opened which had never been opened in the last 26 years. Shutters of Idamalayar dam were also opened for the first time in 5 years. Landslides were reported in Malappuram, Idukki, Wayanad, Kannur, Kozhikode and Palakkad districts. Red Alert was issued in Wayanad. The nation's disaster response system was activated and 15 NDRF men with a chopper reached Wayanad. A further 5 choppers (3 from Air force, 1 from Coast Guard, and 1 from Navy) were also pressed into action. Parts of Nilambur were evacuated, and situation worsened in Kuttanad.

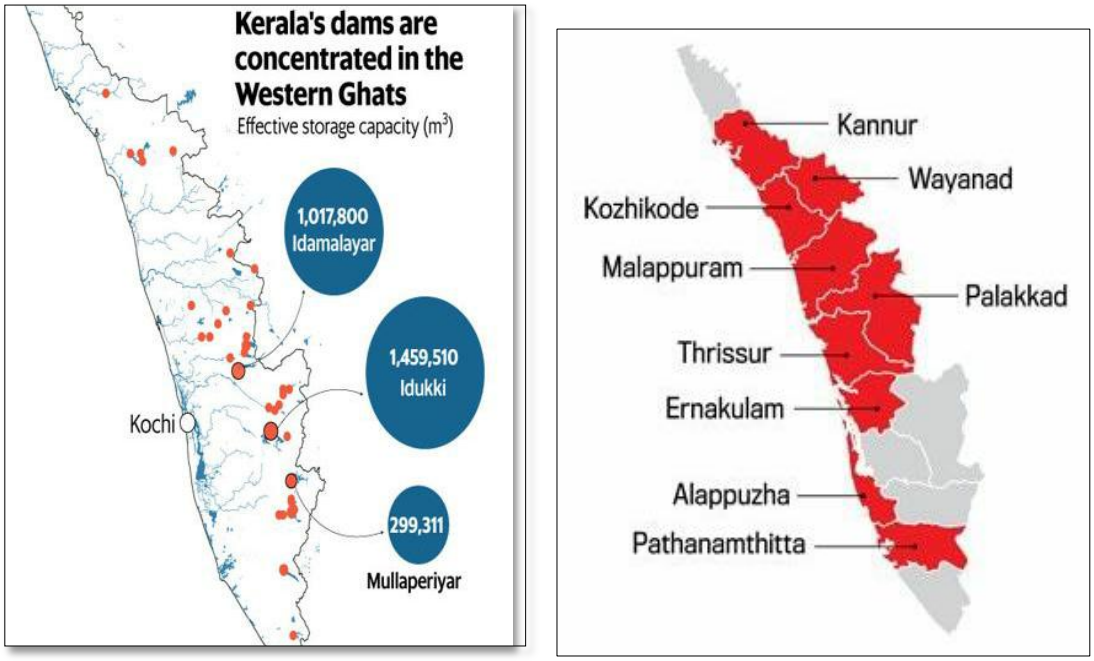


Figure 16 : Map Showing Locations of Dams and Areas Affected

By the next day, half of Kerala was declared flood-hit. State emergency response mechanism was already in action and almost 10,000 people were evacuated. Due to incessant rainfall all the five gates of Idukki-Cheruthoni dam had to be opened. Kochupampa dam was also opened. Armed Forces were requisitioned by the civil administration and 80 Army personnel from Madras Regiment were deployed for rescue and relief missions for tourists in Pallivasal, Idukki. Navy and NDRF teams reached Ernakulam. Basic services were disrupted and there was a drinking water crisis in Kochi, as the supply from Aluva was down by 20%. Air services were also affected and Thiruvananthapuram airport was geared up, as Cochin International airport was shut down.

On 11 Aug, Idukki dam level reached 2400.18 feet and Banasura Sagar dam had to be opened. Upper Kuttanad experienced heavy downpour and IMD issued Red Alerts across 8 districts. Chief Minister Pinarayi Vijayan undertook aerial survey of affected regions and appealed to all to donate generously to Chief Minister's Distress Relief Fund since preliminary

assessments indicated that total loss due to flooding would be worth more than Rs 8,000 crores. The next day Union Home Minister, Rajnath Singh, took an aerial survey of Ernakulam and Idukki districts of Kerala and asserted that the situation was “very serious” and announced immediate release of Rs 100 crore. Meanwhile, a powerful low-pressure formation developed over Odisha coast, and rain was forecasted for 2 more days. By this time 302 relief camps had been set up and the Red Alert in flood affected districts continued.

By 14th Aug, all gates of Idukki dam had been opened and Walayar and Mattuppetti dams were also opened. Water level stood at 2,397 feet at Idukki-Cheruthoni dam and reached 138 feet at Mullapperiyar dam. Munnar town was isolated and till now 52 units of the defense forces had been deployed. On 15th Aug, there were additional rains and following these heavy rains, gates of 35 dams in the state were opened. It was the first time in history where all five gates of Idukki dam had been opened. Government issued an alert before opening gates of Mullaperiyar dam when water levels reached 140-foot mark. Kochi Airport was shut down for the next few days, thereby hampering the air relief works. Southern Railways and Kochi Metro also suspended operations due to floods.

The state on 16 Aug was that Idukki had to endure 84% extra rain. State disputes came on the forefront and Tamil Nadu government declined Kerala's request to reduce water level at Mullapperiyar dam to 139 feet. Water levels at Idukki and Mullapperiyar dams reached 2402.2 feet and 141.95 feet respectively. Neyyar dam had to be opened for the first time in decades. **Due to uncontrolled flow of water, 87 landslides were reported across the state, leaving hundreds isolated**. Situation worsened further in Idukki, Upper Kuttanad was flooded and Wayanad Churam was blocked.

The disaster response system of the entire nation was working overtime and 40 more units of NDRF were appointed. On 16 Aug, NDRF evacuated 926 people to safer places at Pathanamthitta, Kozhikode, Ernakulam, Thrissur and Alappuzha. Navy's Marine Commandos were also deployed and two ships of the Coast Guard moved to Cochin. Cauvery River surpassed the danger mark. Army constructed a 35 feet long bridge to rescue around 100 people from Valiyakadu village in Malampuzha. Approx 1000 fishing boats from Thiruvananthapuram and adjoining areas had joined rescue ops and the total number of DM teams reached to 220.

By 17 Aug, 82,442 individuals had been rescued and around 142,000 people were in 416 relief camps in Ernakulam district. 80,757 people were placed in 500 relief camps in Alappuzha district. On 18 Aug, 58,506 people rescued; however, 388 individuals were also reported missing.

On 19th August there was a respite in the rainfall and the red alerts were withdrawn from all districts. However, IMD predicted strong winds by the coasts and rough seas over the south, central and northwest Arabian Sea. Fishermen were advised not to go out to sea in these areas. Water receded in Ranni, Konni, Kozhancherry and parts of Pathanamthitta district. Road and rail transportation services resumed and the CM directed that focus of effort should now shift from rescue to rehabilitation.

Damage Assessment. 12 of 14 districts were worst affected by Kerala floods with 384 lives were lost and 15 were reported missing. Damage assessments were having varying estimates however, according to Kerala's preliminary reports estimate of 50,000 Crores rupees worth was lost. More than three lakh farmers affected and some incidences of suicide were reported. 221 bridges were damaged and more than 10,000 Kms of roads were damaged. More than 20,774 houses were also damaged heavily. Another estimate of losses as shown in media reports is shown in the following figure **(Keelery, 2018)**:-

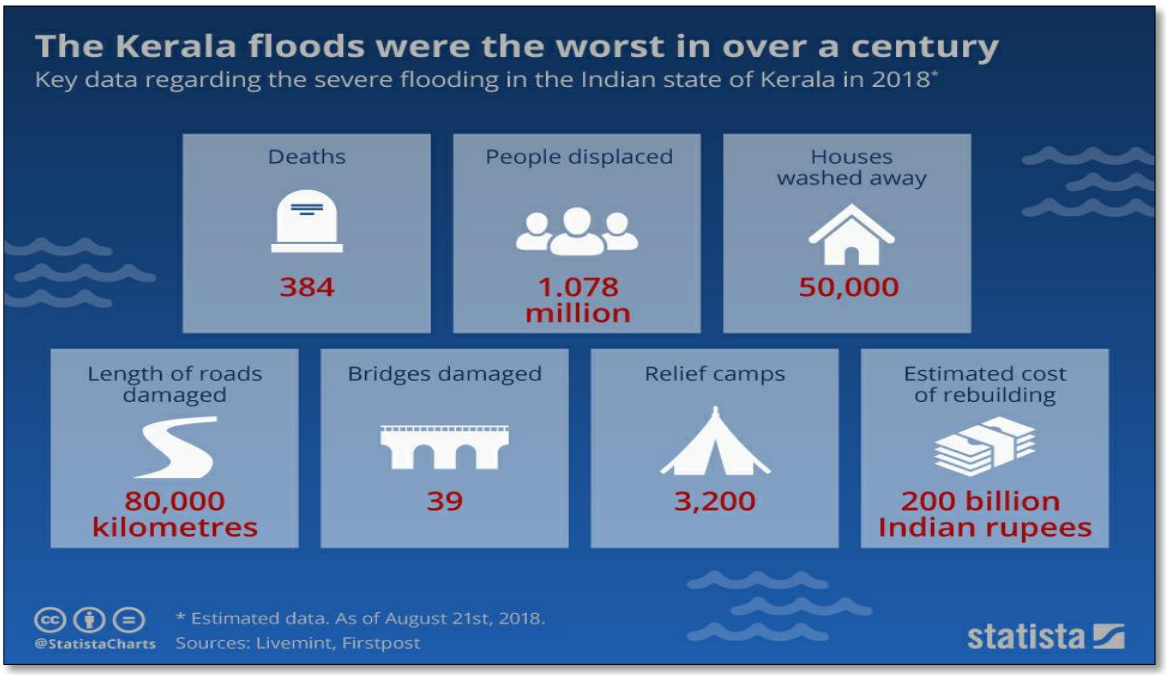


Figure 17: Losses in Kerala Floods

Causes of the Disaster

Heavy Rainfall. An IIT study team stated that a combination of four factors led to extreme flooding across Kerala this year. The factors are above normal seasonal (May-Aug) rainfall, extreme rainfall events occurring almost across the State during the season, over 90% reservoir storage even before the onset of extreme rainfall events, and the unprecedented extreme

rainfall in the catchment areas of major reservoirs in the State led to the disaster. **(Mishra, 2018)**

The summer monsoon rainfall in Kerala from May to Aug 2018 was 2,290 mm, which was 53% above normal. The average rainfall during the summer monsoon period (Jun-Sept) is about 1,619 mm. This makes 2018 Kerala's third wettest year in the last 118 years (1901-2018); 1924 and 1961 were the wettest years, with about 3,600 mm of annual rainfall. As a result, six of the seven major reservoirs in the State had over 90% storage before 08 Aug, well before Kerala received the unprecedented extreme rainfall events. Thereafter, 21 Aug, the State witnessed few extreme rainfall events covering almost the entire State. Consequently, the catchment areas of major reservoirs in the State received extreme rainfall never before witnessed in the State which resulted into this disaster. The role of other factors such as changes in infrastructure which have grown at the expense of vegetation and drainage added to the damages incurred.

Central Water Commission Hydrological Studies Organisation Hydrology (S) Directorate in its Study report **(CWC, 2018)** concluded that August 2018 flood in Kerala was due to severe storm occurrences, during 8-9 Aug 2018 and 15-17 Aug 2018. The storm of 15- 17 Aug 2018 resulted in heavy flooding in Periyar, Pamba, Chalakudi and Bharatpuzha sub-basins of Kerala. The rainfall during 15-17 Aug 2018 was almost comparable to the historical 16-18 Jul 1924, rainfall of Kerala, particularly in Periyar, Pamba, Chalakudi and Bharatpuzha sub-basins

Role of Dams. According to some reports mismanagement of dams was the primary reason for the Kerala floods. One of the major functions of dams is flood protection by attenuating the flow of water and its impact downstream. One of the main rules followed in dam management is to maintain a flood cushion (buffer) in case of unexpectedly high rainfall. Kerala has 39 major dams, whose maintenance is shared between the Kerala State Electricity Board (KSEB) and the Water Resources Department. The Periyar is the longest river in Kerala and has the highest discharge potential. Some of the main dams across this river that are maintained by the KSEB are Idukki, Lower Periyar, and Madupetty. The water from Lower Periyar, Madupetty and Mullaperiyar drains into the Idukki reservoir consisting of the Idukki dam and the Cheruthoni dam. The water from the Idukki reservoir and Idamalayar drains directly into the Bhoothathankettu dam, which is the lowermost in the Periyar system, just 15 km from Kothamangalam town.

According to India Meteorological Department's study, the rainfall in August was only the sixth highest in the past 143 years (1875-2017) in Kerala. All dams in Kerala reached their full reservoir level by July-end, and were thus incapable of containing the water flow from torrential rainfall in August. This forced the State government to open the gates of 34 major

dams, thereby submerging all the major towns downstream. According to the data released by the State Disaster Management Authority, 85,300 litres of water was released every second from Kakki - Anathode dam, and 47,000 litres from Pampa dam at 4 p.m. on August 14. The shutters of both dams were raised at night. By 10 p.m., 4.68 lakh litres of water started gushing out of both dams. Data posted by the KSEB reveals that the water released into the Periyar river basin from the Idukki and Idamalayar dams surged from 46.26 mcm/day on August 14 to 200 mcm/day the next day. This caused the towns downstream to be totally submerged. **An analysis of spill from these dams reaffirms the gross mismanagement in the operation of dams**. The State government and the KSEB opened 34 of the 39 major dams simultaneously; controlled release from these dams would have reduced the gravity of the calamity

However according to Central Water Commission Hydrological Studies Organisation Hydrology (S) Directorate Study report **(CWC, 2018)**, the release from reservoirs had only minor role in flood augmentation as released volume from the reservoirs were almost similar to inflow volumes. In fact Idukki reservoir absorbed a flood volume of about 60 MCM during 15-17 Aug 2018. Even, with the 75% filled reservoir conditions, the current flood could have not been mitigated, as one day rainfall in majority of the area was more than 200 mm and severe rainfall continued for 3 to 4 days.

Indiscriminate Urbanization. Admittedly, the change in topography due to human interventions and climate change has contributed to the sporadic and excess rainfall. The proliferation in illegal stone-quarrying activity has been a major reason for widespread landslides. The decision of the incumbent government to **reduce the boundary of a quarry from residential buildings to 50 metres, has facilitated the mushrooming of the stone quarrying mafia**.

Lack of Inter Government Coordination. The State government also failed miserably in coordinating with the Tamil Nadu government on the release of water from Upper Sholayar despite the State heading the joint water regulatory board. The Government of Kerala argued in the Supreme Court that the sudden release of water from the Mullaperiyar Dam by the Tamil Nadu government was one of the reasons for the devastating flood in Kerala. The Tamil Nadu government rejected the argument, saying that Kerala suffered the deluge due to the discharge of excess water from 80 reservoirs across Kerala, spurred by heavy rains from within the state; It also argued that the flood surplus from the Idukki dam is mainly due to the flows generated from its own independent catchment due to unprecedented heavy rainfall, while the discharge from Mullaperiyar dam was significantly less.

Though it is difficult to attribute any single event to climate change, it's possible role in causing the heavy rainfall event over Kerala cannot be ruled out.

Emergency Response : Analysis

To assist the state of Kerala, the Centre launched massive rescue and relief operations. In one of the largest rescue operations, **40** helicopters, **31** aircraft, **182** teams for rescue, **18** Medical Teams of Defence forces, **58** teams of NDRF, **7** companies of CAPFs were pressed into service along with over **500** boats and necessary rescue equipments. They successfully saved over **60,000** human lives by rescuing them from marooned areas and shifting them to relief camps. Defence aircrafts and helicopters have made 1,084 sorties of duration **1,168** flying hours and airlifted **1,286** tonne of load and carried **3,332** rescuers. In addition, a number of Navy and Coast Guard ships were pressed into service to carry relief material to Kerala **(PIB, 2018).**

NDRF did a commendable job and till the last day of calamity, that is 21 Aug 18, 41 teams of NDRF were still deployed in Kerala to assist the state administration in rescue, relief and rehabilitation work. A Press release issued by NDRF stated that "during the rescue and relief operations, NDRF teams demonstrated their prowess and professionalism and left no stone unturned to provide immediate relief to the victims. In on-going operation, National Disaster Response Force (NDRF) has rescued 535 lives and evacuated 24,616 marooned people to safer places as well as teams have rescued 119 livestock and provided pre hospital treatment to the 4908 people, so far". **(NDRF, 2018)**

The Armed Forces were equally committed in managing the disaster and the Army was deeply involved in the Rescue & Relief operations, since the request for provision of Army assistance was received on 09 Aug 2018. Accordingly, Indian Army carried out execution of Disaster Relief tasks on a war footing which was greatly appreciated by civilian populace and the State administration. As on 17 Aug 18, a total of 10 flood relief columns, each having an approximate strength of 65 personnel carried out rescue operations in ten districts of Kerala. In addition to these 10 flood relief columns, 10 Engineer Task Forces (ETF), each having an approximate strength of 40 personnel from Jodhpur, Bhopal, Pune, Bangalore and Secunderabad were pressed into action. Army also utilised 53 military boats to evacuate civilians from flood affected areas. In spite of continuous and heavy rains, Indian Army columns worked round the clock to restore connectivity to remote villages by constructing temporary foot bridges, bunds and preparing alternate routes. 13 temporary bridges were constructed to reconnect 38 remote areas and total of 3627 personnel had been rescued till 17 Aug 2018, which included 22 foreign

nationals. Relief materials were also sent to 19 villages with medical aid being provided to approximately 500 civilians. **(PIB, 2018)**

Indian Air Force, too responded immediately to the crisis in extending all possible assistance to the residents of Kerala through Humanitarian Assistance Disaster Relief (HADR) missions. Concerted efforts were made by IAF in rescuing stranded people from the flooded areas. Ladies, children, elderly people and residents were winched from the rooftops of submerged houses to safety by IAF helicopters. To summarise, the effort of Indian Air Force, it carried out 517 sorties of Fixed Wing aircraft, airlifting 3787 persons and 1350 Ton of load and 634 sorties of Helicopters, winching 584 persons and airlifting 247 Ton of load **(PIB, 2019)**. IAF helicopters had also dropped food and water packets to the stranded people in the affected areas. Transport aircraft from all corners of the country have been flying day and night to ensure relief material is available in the relief camps and till 21 Aug 2018, 974 Tons of relief material has been airlifted to Kerala state. No 1 Rapid Action Medical Team (RAMT) of the Indian Air Force had been airlifted from Command Hospital Air Force Bengaluru to Thiruvananthapuram to assist in the medical relief efforts to the residents of Kerala. Additionally, 119 civil Doctors with 63 Tons of medicine and equipment had been airlifted to Kochi and Thiruvananthapuram for further positioning at various medical camps **(PIB, 2018).**

The Southern Naval Command commenced its Operation Madad and by 24 Aug 18 had successful completed the rescue and relief operations. This was the largest ever HADR operation undertaken by the SNC that lasted close to sixteen days, with a total of 16,843 persons having been rescued, of which 15670 were by boat, while 1173 had to be airlifted. The efforts reached a peak with 92 rescue teams with Gemini boats deployed in a day. The aircraft were also able to undertake air sorties from daybreak to dusk without stopping. Rescue camps were organised at two places, Naval Armament Depot, Aluva and the T2 Hangar, Naval Base for the displaced persons. Medical camps were set up at Wayanad and Aluva where access by road was not possible. A community kitchen, which was feeding up to 10,000 people all three meals and tea twice was set up. Emergency repairs of critical public facilities and infrastructure was undertaken at Amritha Hospital, Pazhassi dam and KWA water pumps to restore water supply, and some of the KSEB transformers to restore power supply **(PIB, 2018)**.

Removing Vulnerability to Disasters

Improving Flood Forecasting. As is evident from the above analysis that apart from the heavy rainfall, one of the main reason for the **extensive losses in this disaster was the poor**

management of dam waters. In case, we are able to **improve our flood forecasting**, we would be able to control the flow of waters from the dam. There have been improvements in the methods of flood forecasting in the world, however **India lacks the required monitoring network, which allow real time flood prediction**. New techniques have been developed in which with the help of satellites floods can be forecasted based on the quantum of water flow in the river. Radar altimetry, for example, can accurately estimate water levels and can predict the flow downstream. This technique though requires low revisit time of satellite; otherwise it may lead to delay in flood prediction. To overcome this problem, the scientists have used the artificial neural networks to merge data from multiple satellite sources and optical sensors. This technique has resulted in a reliable tool for estimating river discharge. India needs to work towards this technology since many more states are vulnerable to flood prone disasters. **(Srivastava, 2019)**

Environmental Degradation. Environmental reasons also played a major role in the massive economic losses suffered by the state. Over a period of time the floodplains of the river were indiscriminately encroached and also the water bodies had slowly vanished. The natural water drainage system of the terrain had been destroyed and numerous water obstacles were created which hindered the flow of rivers. The same was experienced during Kashmir Floods and the recent Hyderabad Floods. Even if accurate flood forecasting was possible, it would have been of no use since the terrain profile had already been altered. In this kind of problem the Government needs to step in and delineate the floodplains where all economic activity is restricted even if there is the slightest probability of floods.

The State Government's Ministry of Environmental Affairs needs to play a proactive role in screening the various development projects for the risk they pose to the land and water ecosystem. Innovative means would be required to **regulate high risk projects and should take into account climatic changes taking place due to global warming.** Even the agricultural activities need to be regulated in the vulnerable stretches, since indiscriminate farming in the flood plains pose a hazard to the humanity as a whole.

After **removing all encroachments in flood plains, there should be an effective action plan to restore the river basin ecosystem.** The plan should have strict control over illegal activities like sand mining and other activities which affect the flow of river water.

Optimal planning of the dam locations which assist in regulating the flow of river water is a must. A centrally located dam which stores the water for socio-economic use and also assists in mitigation of disasters. The location of dam should not only be based on maximum economic potential, but also regulating the flow of river water.

Holistic approach to management of water needs to be adopted which takes into account the urban water system as well. Embankments to divert the flow of water helps in developing settlements but at the same time develop into vulnerability during flooding. **Sponge city is a concept should be put into effect**. A Sponge City is a city that has the capacity to mainstream urban water management into the urban planning policies and designs. It should have the appropriate planning and legal frameworks and tools in place to implement, maintain and adapt the infrastructure systems to collect, store and treat (excess) rainwater.

Summary

The floods in Kerala in August 2018 were unprecedented and despite national level efforts towards mitigation of disasters, the state suffered heavy losses in terms of human lives and resources. The response to the disaster was encouraging and has certainly improved, as compared to the past. However, it was observed that the **coordinated & proactive response was found lacking and the SDMA was found inapt to deal with a disaster of such magnitude.** As a result all the agencies were operating on a standalone mode, leading to duplication of relief efforts. **This happened, due to lack of coordination and direction at the apex level** in the Government & SDMA. In addition, there was no joint training, coordination and rehearsals conducted between the civil administration, SDMA, NDRF, flood relief agency and the Armed Forces.

One of the major inadequacies which was noticed was the **lack of adoption of latest technological means** in preventing and fighting this disaster. Despite the meteorological department predicting incessant rains, means were not available to predict the severity of the outcome and warn all concerned. **The dams played a crucial role** and it appeared that there **was no contingency** planning available to this kind of water deluge. So the steps towards disaster response & mitigation by the Kerala Government failed.

The response by the Centre was also graduated and reactive as everyday based on the situation on ground more forces were deployed. Once the men were there on ground they did not have the right equipment to provide assistance. The Armed Forces did the best they could and mobilised all possible resources, but there resources are not designed for relief and rescue work. NDRF is designed for this and did an exemplary job, but they also found a need for better equipment to deal with search and rescue operations. The shortfall in numbers of NDRF was made up by the Armed Forces and the civil society, but each of these rescue members were not suitable equipped to provide optimal rescue effort. **Overall our response was much below par,**

when compared to response of a developed nation during its disaster.

The rampant environmental degradation and **haphazard urbanization, was one of the prime reasons for the floods**, as the river flood basins have been encroached, leading to flooding. Urbanization plans need to be risk sensitive. **Stringent land use regulations can greatly assist in mitigating disaster damages**, by ensuring that new development occurs in places that are safe or can be easily protected. **Proper flood zoning of areas need to be done to prevent any urbanization in those flood prone areas**. We also need to avoid unchecked urban development that leaves very less green spaces and block the natural drainage, leading to increase in flood, causing loss of life and property. Kashmir floods in 2013, Uttrakhand flood in 2014 and Kerela foods in 2018 and recent Hyderabad floods in 2020, **occurred because of unplanned urban development and massive deforestation.** Implementing risk-based land-use plans remains challenging; however, we need to have strong institutions that can ensure that land-use plans are actually enforced. Worldwide, risk-sensitive land usage plans face strong political and economy obstacles and are often willfully ignored, causing immense damages during calamities.

CYCLONE AMPHAN; 2020 : ODHISA & WEST BENGAL

In 1970, when Cyclone Bhola devastated Bangladesh, half a million people died. In 1999, the Odisha super cyclone resulted in close to 10,000 fatalities. However, since than both countries have invested heavily into **creating weather forecasting and early warning systems in Bay of Bengal**. As a result, the statistics of loss of lives has drastically come done (less than hundred people lost their lives in Cyclone Fani and Cyclone Bulbul cost less than 50 lives). Orissa remains most vulnerable to cyclone disasters and has instituted effective DM mechanism, to save loss of lives and damage to property.

The cyclone Amphan struck the southern West Bengal coast on 20 May, leading to devastation in areas of Sundarban and E Midnapore district in West Bengal and the coastal blocks of Odisha. The cyclone was a category-3 hurricane; the most powerful storm in the Bay of Bengal in over a decade, making landfall with sustained wind speeds of 170 kilometres per hour (kmph), with gusts of upto 190 kmph and storm water surges of upto 16 feet. Gale winds blew away shanties, flattened kutcha houses and uprooted trees and electric poles, killing at least 86 people in West Bengal. The cyclone is believed to have affected 60 million in West Bengal and 4.5 million people in Odisha.

The overall damages are estimated to be $13.5 billion. The material damages and loss of lives suffered by Odhisa, as compared to West Bengal, were much lesser. The preparation and response of both the States to Cyclone Amphan has been analysed. Also, some of the best practises of SDMA Odhisa have been brought out and the changes being brought out by SDMA West Bengal, are given in succeeding paragraphs.

Evaluation of Response of West Bengal and Orissa: Cyclone Amphan

Early warning on Cyclone Amphan by India Meteorological Department (IMD), triggered large-scale evacuations in coastal districts of Bay of Bengal States of Odisha and West Bengal, as well as in Bangladesh. The response in West Bengal, which bore the brunt of the cyclone, failed to timely respond and evacuate people from its coastal areas, prompting a demand for revamping the state's disaster governance. Odhisa, on the other hand, having learnt its lessons during 1999 super cyclone, had successfully managed to mitigate its losses during cyclone Phailin in 2013 and cyclone Fani in May 2019, once again proved the effectiveness of its disaster governance, during Cyclone Amphan.

During the Cyclone Amphan, both States; West Bengal and Orissa had received the adequate early warning of the impending cyclone from IMD, at same time. The response of SDMA of Orissa was far more robust (as compared to West Bengal), as SDMA Odhisa without wasting any time, began preparations for the impending cyclone, which included **timely alerting the locals, evacuation of locals from costal & low-lying areas** and kutcha houses to cyclone shelters, safeguarding Rabi crops in mandis, **timely prepositioning of ODRAF and NDRF teams**, as also medical and other essential supplies in areas, where the cyclone footfall had been predicted. The **community response teams were quickly activated** and they **assisted the civil administration** to prepare for the impending cyclone **(OSDMA,2017)**. Whereas, the response mechanism of West Bengal SDMA was found wanting and the community participation & involvement was inadequate / lacking, resulting 84 casualties.

The **State of West Bengal was found underprepared, with no prepared and rehearsed evacuation plan**. The West Bengal State has invested very little in construction of community shelters for locals and their livestock in coastal areas, as also in local community training and awareness to combat disasters. However, on interactions with the NDMA officials, it emerged that the State is in the process for preparing resolute pre-emptive mitigation and response mechanism, post Cyclone Amphan. Efforts are being made to improve response at

grassroot levels and encourage community participation, on lines of Sikkim and Odhisa. Some highlights are discussed below.

Role of NDRF. During Cyclone Amphan, 20 NDRF teams were deployed in the coastal areas of Odisha in Balasore, Jagatsinghpur, Jajpur, Kendrapara, Puri & Bhadrak and 19 NDRF teams were deployed at coastal areas of West Bengal like Kolkata, Nandigram, Kontai-1 Block & Digha, (East Medinapore), Arambagh (Hooghly), Uluberia & Domzur (Howrah), Sandeshkhali, Hasnabad & Hingalganj (24 Pargana, North), Pathar Pratima, Naamkhana, Gosaba, Kakdweep & Sagar Island (24 Pargana, South) and Rajarhat. A relief of ₹1,000 crore and ₹500 crore was released from the National Disaster Response Fund (NDRF) to West Bengal and Odisha, respectively, due to the destruction caused by Cyclone Amphan.

Post Survey / interaction with locals of coastal region and interaction with officials of NDMA & SDMA in West Bengal & Odisha, the performance evaluation in terms of response and preparations, are given below.

Evaluating Odisha SDMA Performance : Best Practises

Efficient SDMA. State of Odisha frequently suffers from cyclones, floods and occasional tsunamis and has often been referred to as the 'disaster capital' of the country. The Odisha State Disaster Management Authority (OSDMA) was established in 1999, much before DM Act 2005 was enacted. OSDMA was the first DM authority centre established in India, or perhaps the world, given its scale of operations. Odisha, along with Assam, Gujarat, and Bihar are the only states with active State Disaster Management Authorities (SDMAs) **(OSDMA, 2017).** In most states, SDMAs are still being run out of the State Revenue Department Office, which is a temporary arrangement.

Investing in Community Preparedness. In 1999, Odisha had witnessed a Super Cyclone which led to the loss of 10,000 lives. The unfortunate experience propelled the State to construct 879 multipurpose cyclone and flood shelters along its **480 km long coastline, equipped with community kitchens and life-saving equipment**. The shelters offer all services that are required during emergencies and have allotted announcement vehicles. Some buildings have also been designated as cyclone shelters, so that evacuees do not get scattered at different locations, but can stay within their communities.

Timely Evacuation of People. During Cyclone Amphan, **nearly 200,000 people were evacuated in the state.** Cyclone preparations began as soon as the alerts were issued by the IMD and restoration efforts were undertaken on a war footing, so that by the time the cyclone steered away from Odisha, towards West Bengal, more than 85% of the power restoration work was already done. Heading the central team to carryout post damage assessment during Cyclone Amphan, Joint Secretary of Union Home Ministry, Shri Prakash, stated that "***community involvement" in the process of disaster management had been one of the "achievements of the Odisha Government."***

State Emergency Operation Centre and Early Warning Communication System

State Emergency Operation Centre. The State Emergency Operations Centre (SEOC) and District Emergency Operation Center (DEOC) play an important role in effectively and efficiently coordinating multiagency, intergovernmental responses to disaster events. The SEOC functions in the Office of Special Relief Commissioner, all round the year. Similarly, DEOC of six coastal districts of State of Odisha normally function in the offices of Collectors round the clock and DEOCs of rest 24 districts functions from the 1st of May to 30th of November, during which, there is likelihood of occurrence of major natural calamities, like floods and cyclones.

Warning Dissemination Protocols. The warnings received at the state level are communicated to the District Collectors, through telephone / fax / Wireless / e-mail. They in turn communicate the same to the GPs and Villages through Tehsildars and Block Development Officers by means of telephones, VHF and by person. A **four stage warning system** for tropical cyclones is followed by IMD since, year 1999:-

(a) Firstly, a special bulletin known as "**Pre-Cyclone Watch"** is issued containing early information about the development of a cyclonic disturbance in the North Indian Ocean, it's likely development into a tropical cyclone and the coastal belt likely to experience adverse weather.

(b) Secondly, **"Cyclone Alert"** is issued at least 48 hours in advance of the expected commencement of adverse weather over the coastal areas.

(c) Thirdly, **"Cyclone Warning"** is issued at least 24 hours in advance. These warnings continue to be issued at 3 hours interval giving the latest position of the cyclone,

its intensity (maximum sustained surface wind speed) and likely time and point of landfall together with storm surge height and type of damage expected.

(d) Fourthly, **"Post Landfall Scenario"** is issued to cover the devastating impacts of the cyclones of inland areas. This commences about 12 hours before landfall and continues till such time, as the cyclone-force winds are expected to prevail in the interior areas. At this stage, the district Collectors of all interior districts, besides the coastal areas likely to be affected are included in the bulletin.

(e) After the weakening of the cyclone into a depression stage, a final message on de-warning is issued.

Existing Infrastructure for Warning Dissemination. These EOCs have been provided with fax / telephone and wireless connectivity. Warning messages are received at the respective district EOCs and are immediately communicated to field level, through telephones, civil and police VHF networks. Satellites phones have been provided to Collectors of the cyclone prone districts. Optical fibre cable lines have been laid down in the coastal areas, for uninterrupted communication.

Early Warning Dissemination System (EDWS). EWDS for last mile connectivity is one of the Components (Component-A) of the National Cyclone Risk Mitigation Project (NCRMP) under World Bank assistance. It has been implemented in 1205 villages of 22 blocks under 6 coastal districts (Balasore, Bhadrak, Jagatsinghpur, Kendrapara, Puri & Ganjam), within 5 km form coastlines of Odisha. The project aims at establishing a **fool-proof communication system to address the existing gap of disseminating disaster warning up to the community level**, especially for cyclone and tsunami. EWDS comprises of technologies like Satellite Based Mobile Data Voice Terminals (SBMDVT) to be established in State Emergency Operation Centre (SEOC) and six District Emergency Operation Center (DEOC), Digital Mobile Radio (DMR), Mass Messaging System, Alert Siren System at 122 locations and Universal Communication Interface (UCI) for interoperability among different communication technologies. People in the coastal areas are alerted through these 122 alert siren towers. The EWDS mechanism warns people in time of impending cyclone and alerts them to move safe places. It has robust alarm and communication arrangement. **SDMA can activate sirens across 122 towers operational across the state's 480 km coastline**, alerting the population at the press of a single button.

Community Based Disaster Preparedness & Capacity Building. Odisha has recurrently been in the news in recent years for the exemplary way in which it has managed to

deal with disasters. Community based disaster risk reduction is at the very heart of Odisha's approach towards DM. One of the central themes of the State DM plan states that **"community based disaster preparedness and capacity building of local population is the key to effective disaster management."** This is because during any disaster, **communities are always the worst affected and the first to respond**. Community participation in the process of DM ensures local ownership, addresses local needs and promotes a culture of mutual help to prevent and minimize damage. **Community preparedness,** however, is not limited to their participation in disaster management activities alone, it also involves the effective and active cooperation of the community members with the local and national disaster management authorities. Emphasis is being laid **to increase the capacities of the communities in the State to deal with the disasters, to be proficient first responders and also assist the government machinery** during calamites. Lesson from past disasters are kept in mind while designing prevention and response strategies.

Odisha Disaster Rapid Action Force (ODRAF). Odisha has 20 units of Odisha Disaster Rapid Action Force (ODRAF), comprised of highly trained personnel with multi-disaster tackling capabilities. They are trained in tackling floods, building collapses, cyclones, biological and nuclear disasters." The personnel of ODRAF **provide comprehensive training to local villagers, panchayats, schools & college students** in saving human lives and reaching out to the helpless population affected by disasters **(OSDMA, 2017)**.

Proactive Deployment of Civil Administration, NDRF & ODRAF. The proactive deployment of the NDRF, ODRAF and other civil administration in the anticipated areas of cyclone was extremely helpful in timely responding and mitigating losses during the cyclone.

Enmeshing the NGOs in State DM Plans. The Odhisa State Government has effectively & efficiently enmeshed various NGOs in their State DM plan. These NGOs have proved to be vital stakeholders in the relief, response, rehabilitation, reconstruction and mitigation process. NGOs have also been instrumental in **facilitating communication and coordination between the administration and the affected communities**, which has effectively helped the State Government to deal with calamites.

Tsunami Preparations. Based on an early tsunami experience of 2004, when sea water intruded up to 1.5 kms into the land, the government also identified 328 villages as tsunami-prone and undertook measures to enhance their disaster preparedness. The two villages which have

been declared 'Tsunami Ready', under the Indian Ocean Tsunami Ready Programme of IOC-UNESCO, a community performance based programme, are amongst these identified villages. The preparedness the village communities exhibited when the UNESCO team visited in December 2019 met the **parameters of this programme which ranged from having community tsunami risk reduction plans, designating tsunami hazard zones, a reliable means to receive official tsunami alerts round the clock, having easily understandable evacuation maps, an annually conducted tsunami community exercise.** Plans are afoot to have one such model village in each of the state's six coastal districts.

MGNREGS to reduce the vulnerability of Villages & Communities. The State Government has efficiently utilized MGNREGS scheme to reduce the vulnerability of villages and communities against natural hazards such as floods, droughts, landslide etc. The State Government has undertaken some initiatives to remove vulnerabilities, as also ensure livelihood security in the event of Disasters:-

(a) Expand and strengthen drought proofing activities.

(b) Strengthening of flood protection structures within the villages/ Panchayat.

(c) Undertaken works related to removal of river siltation.

(d) Undertake plantation works for preventing river erosion/incursion as well as landslide mitigation;

(e) Create structures to regulate flow of rainwater.

(f) Construction of various community assets/structures under the Scheme.

Lessons Learnt: Cyclone Amphan

Creation of Effective SDMA & DDMAs : States

(a) During the recent Cyclone Amphan in 2020, which made a landfall West Bengal and Orissa; the damage and loss to life was negligible in Orissa, whereas the destruction and loss to lives was more in Bengal. The primary reason being that Orissa has an effective SDMA & DDMAs and efficient State Government machinery, which had **proactively deployed relief agencies and carried out timely evacuations, resulted in minimal losses / damages**, whereas such an effective disaster mechanism was found wanting in West Bengal.

(b) The State Govts must make their SDMA and DDMAs functional & effective, also the States must construct disaster risk mitigation infrastructure, set up evacuation protocols, identify safe buildings, like schools for housing communities and work with communities, NGOs and local organizations to set up volunteer teams to move people to safe houses, before cyclones / floods. The **community participation and rehearsals / mock drills are essential to mitigate losses**. It has been proved that **warnings issued 48 hours before a cyclone / flood, enables the overall damage to be reduced by more than 50 %**.

Advance Warning System & Evacuation Plans: Tsunami / Cyclones. Weather forecasts enable advance intimation/ warning and preparation for extreme events. It helps to **preposition the relief agencies in advance and carryout timely evacuation of people** from the areas likely to be impacted by a calamity, to safe houses and also to preposition of adequate stocks of relief material & medicines. The value of preparedness was demonstrated when Cyclone Phailin, with wind speeds upto 200 kilometers an hour, made a landfall in the State of Odisha in Oct 2013. A cyclone of similar intensity had hit the same coastline in 1999, causing massive devastation and resulted in death of more than 10,000 people in the coastal Odisha. This time, however, the story unfolded differently, the death toll was 38 persons, less than 0.4 percent of the death toll from the 1999 cyclone. Similarly, the impact of Cyclone Amphan was minimal, as IMD had predicted well in advance the exact land fall of these cyclones. Our Country must continue to lay emphasis on creating infrastructure to predict accurate and timely forecast of the cyclones, tsunami and heavy rainstorms to prevent devastation.

Education Awareness & Capacity Building : Local Population. Conduct of disaster awareness education and regular training programs at local community levels in disaster prone areas is extremely essential. The community awareness, preparedness to deal with the disasters, training on first aid, awareness on where to go, incase of a calamity and how to keep yourself alive in an emergency, until help can reach you, is extremely important. **Local people are the first responders during a disaster and their training and awareness is extremely important to mitigate the damages and help in saving lives**.

Protecting the Ecosystems: Minimizing Risks. A healthy ecosystem has a very important role to play in reducing the risks of disasters through multiple ways. A healthy ecosystem comprising of wetlands, forests and mangroves in coastal areas can not only reduce vulnerability to hazards by supporting livelihoods, but also act as physical barriers that reduce the

impact of hazard events. Trees on steep slopes protect rural villages / towns from landslides during heavy rains and mangroves protect coastal livelihoods during storm surges. Forest cover helps to reduce the occurrence of droughts and protect the ecosystems, thereby reducing the exposure to natural disasters. People on the coastline have rampantly removed the mangroves in the coastal areas for economic reasons, including tourism and settlements. As a result, in absence of mangroves & forest cover, the damage caused by the cyclones is extremely high. Therefore, there is an **urgent need to rehabilitate the mangroves on the coastline and also rehabilitate the people settled on the coastline,** to safer areas to prevent loss of lives during the cyclones. Also, there is an urgent need to carryout out massive afforestation drive in the drought & landslide prone areas, to prevent droughts and landslides / floods.

Recommendations by NDRF Chief. Based on their experience of rescue operations during Cyclone Amphan, Chief of NDRF, Shri SN Pradhan, stressed upon the **need to upgrade rural infrastructure** for quick evacuation and relief operations. He underlined that with climate change happening, extreme weather events will become more frequent and the state governments could minimise damage and save lives by **building disaster resilient infrastructure**, especially in the coastal zones. He urged that government housing schemes like the Pradhan Mantri Awas Yojana should incorporate designs that are made keeping natural disasters like cyclones in mind. He further stressed on the **need to have underground electrification, especially in rural and coastal areas**, so that power supply could be restored quickly in the event of a disruption due to weather-related events. **(Pradhan, 2020).**

CHAPTER V: DISASTER RESPONSE SYSTEM OF DEVELOPED COUNTRY: JAPAN

General

Japan consists of total of 6,852 islands, extending along the Pacific coast of East Asia. Japan lies between latitudes 24° and 46°N and longitudes 122° and 146°E. The main islands, from north to south, are Hokkaido, Honshu, Shikoku and Kyushu. The Ryukyu Islands, which includes Okinawa, are a chain to the South of Kyushu. Together they are often known as the Japanese Archipelago.

Japan is located in a volcanic zone on the Pacific Ring of Fire. It is primarily the result of large oceanic movements occurring over millions of years from the mid-Silurian to the Pleistocene, as a result of the subduction of the Philippine Sea Plate, beneath the continental Amurian Plate and Okinawa Plate to the South and subduction of the Pacific Plate, under the Okhotsk Plate to the North. Japan was originally attached to the eastern coast of the Eurasian continent. The subducting plates pulled Japan eastward, opening the Sea of Japan around 15 million years ago. **(ADRAC 2016)**.

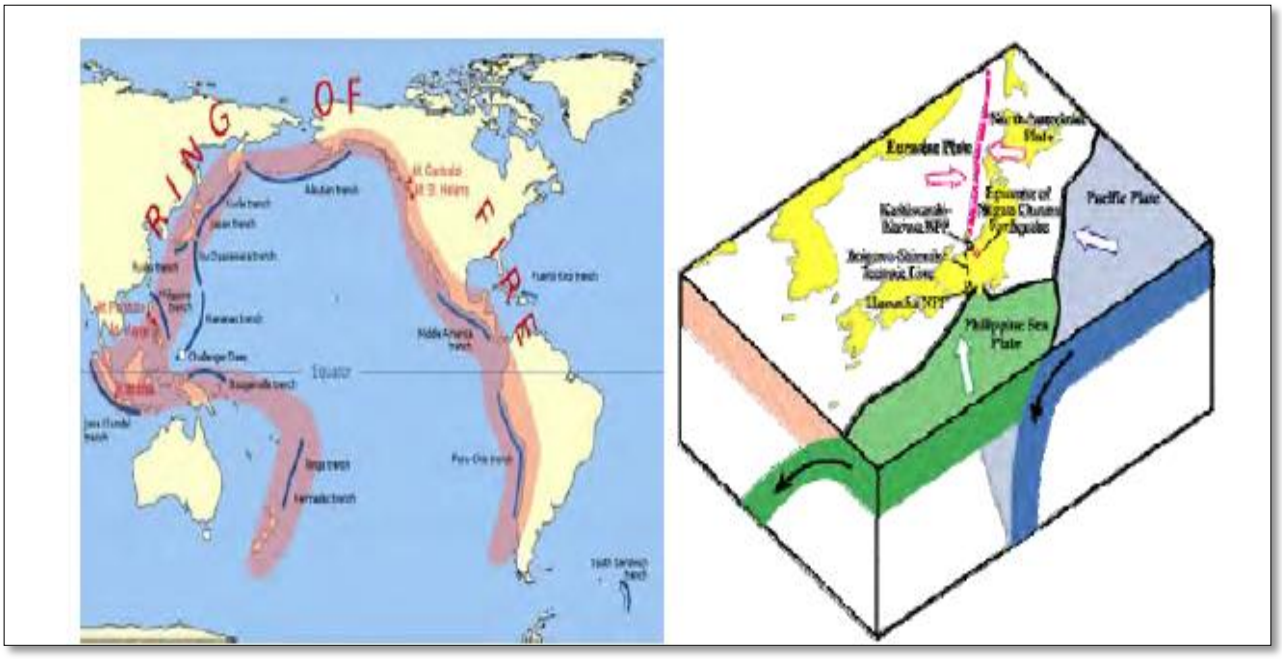


Figure 18 : Japan's Geographical Vulnerability to Disasters

Disaster Profile : Japan

Japan has 108 active volcanoes. Destructive earthquakes, often resulting in tsunami, occur several times each century. Due to its location in the Pacific Ring of Fire, Japan is substantially prone to earthquakes and tsunami, having the highest natural disaster risk in the developed world.

Every year there is a large number of loss of people's lives and properties in Japan due to natural disasters. The 1923 Tokyo earthquake killed over 140,000 people. Until the second half of 1950s, large scale typhoons with earthquakes caused extensive damage and thousands of casualties. Thereafter, with the progress of society's capabilities to respond to disasters and mitigate vulnerabilities to disasters by developing disaster management systems, promoting national land conservation, improving weather forecasting technologies, and upgrading disaster information communications systems, disaster damage has shown a declining tendency. In spite of such efforts, in 1995, more than 6,400 people died of the Great Hanshin-Awaji Earthquake. Also, in 2011, more than 18,000 people died or went missing due to the Great East Japan Earthquake. The massive earthquake was followed by tsunami and release of radiation from the Fukushima Dai-ichi nuclear power station, constitute as one of the greatest disasters to strike Japan in recent times **(Panda, 2012)**. There is also a high probability of the occurrence of large-scale earthquakes in the near future including impending possibilities of Nankai Trough Earthquake and Tokyo Inland Earthquake. As such, natural disasters remain an intimidating threat to the safety and security of the country.

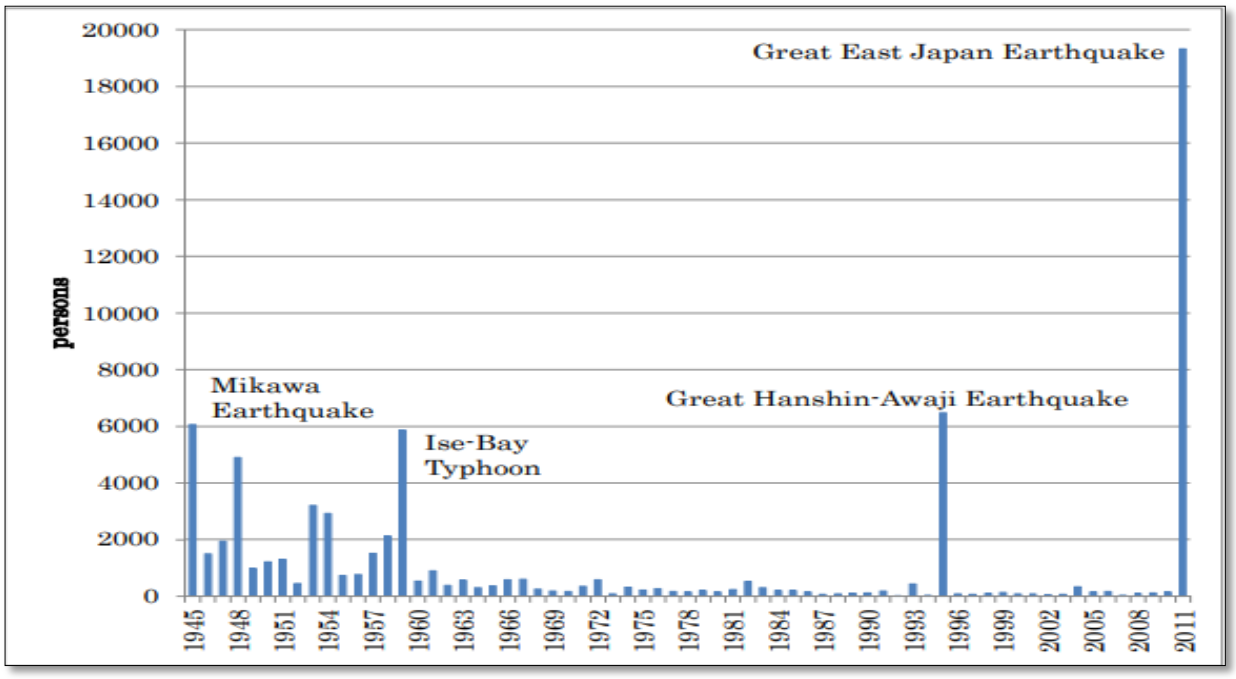


Figure 19 : Casualties in Disasters in Japan (ADRAC 2016).

DISASTER MANAGEMENT SYSTEM : JAPAN

Overview. DM system of Japan has undergone tremendous advancement throughout the past 5-6 decades. DM in Japan is vested on three layered system – national, prefectural and municipal layers. It is the direct responsibility of municipalities to carry out emergency response operations, such as firefighting, rescue, ambulance service. DM Councils established at each level and each council is responsible for the implementation of all DM related issues under its authority. The comprehensive coordination and communication system has been put in place to foster holistic and effective management at each level

National Policy Strategy and Legislation in Disaster Risk

Various DM related laws adopted since late 40s has laid down the legal framework for the disaster management system of Japan. These laws cover all phases of disaster management – preparedness, prevention/mitigation, response and recovery/rehabilitation phases. There are 7 Basic Acts; 18 with regard to Disaster Prevention and Preparedness; 23 Disaster Recovery and Reconstruction and Financial Measures. **(ADRAC 2016)**

The cornerstone of legislation on disaster risk reduction is the **Disaster Countermeasures Basic Act, enacted in 1961**, which set out the basis for measures to reduce disaster risk in Japan. There are also organizations involved in disaster risk reduction, legislation on disaster risk reduction and emergency response to disasters, post-disaster recovery and reconstruction, and all-round legislative provision regarding specific disaster risk reduction activities. Disaster countermeasures and risk reduction are comprehensively covered.

Under the Disaster Countermeasures Basic Act, the Basic Plan for DM has been introduced, setting out comprehensive and long-term plans for disaster risk reduction in Japan. Based on this Plan, a comprehensive disaster-management planning system has been established.

The lessons learned from the Great Hanshin-Awaji Earthquake (Kobe Earthquake) of 1995, prompted enhancements to Japan’s disaster risk reduction legislation and government policy. In recent years, emphasis has been accorded to countermeasures for large-scale earthquake disasters. Legislation has been passed regarding countermeasures for large-scale ocean-trench type earthquakes, such as the anticipated Tokai, Tonankai and Nankai Earthquakes.

Earthquake countermeasures for large cities where damage is likely to be wide-ranging have been established, and improvements have been made to the overall framework with regard to legislation on disaster risk reduction and disaster countermeasures **(Japan, C O).**

Multi Sectoral Coordination & Collaboration in Disaster Risk Reduction

Under the Disaster Countermeasures Basic Act, the Central Disaster Management Council was formed, to ensure the comprehensiveness of disaster risk management and discuss matters of importance with regard to disaster management.

Within the Cabinet Office, which is the secretariat for this Council, the Minister of State for Disaster Management has been assigned as the Minister State for Special Missions for this issue. This Minister is assisted by the department of the Cabinet Office Director-General for DM. His mandate being to handle planning and central coordination with regard to matters relating to basic policy on disaster risk reduction, and matters concerning disaster countermeasures in the event of a large-scale disaster. The Minister is also responsible for the integrated handling of information-gathering and other emergency measures, working closely with the Cabinet Secretariat, in the event of a disaster **(Japan**,**2015)**.

DM Structure at National Level

The Cabinet Office closely works together with relevant ministries & agencies to prevent, respond and recover from disasters and works to ensure that the nation prepares strongly for such events.

Under the **Disaster Countermeasures Basic Act of 1961**, the Central Disaster Management Council (CDMC) was formed with the main objective of "ensuring comprehensiveness of disaster management and to discuss matters of importance with regard to disaster management".

The CDMC was positioned within the Cabinet Office, as one of Cabinet's major policy councils. The CDMC is chaired by the Prime Minister and comprises of Minister of State for DM, all ministries, heads of major public institutions and experts. Since the reorganization of ministries and agencies in particular, leaders of local public bodies and experts with practical experience have been incorporated as new participants. The council promotes comprehensive disaster countermeasures, including deliberating important issues on disaster reduction according

to requests from the Prime Minister or Minister of State for Disaster Management. The organization structure of the CDMC is shown in figure 20. **(ADRAC 2016)**

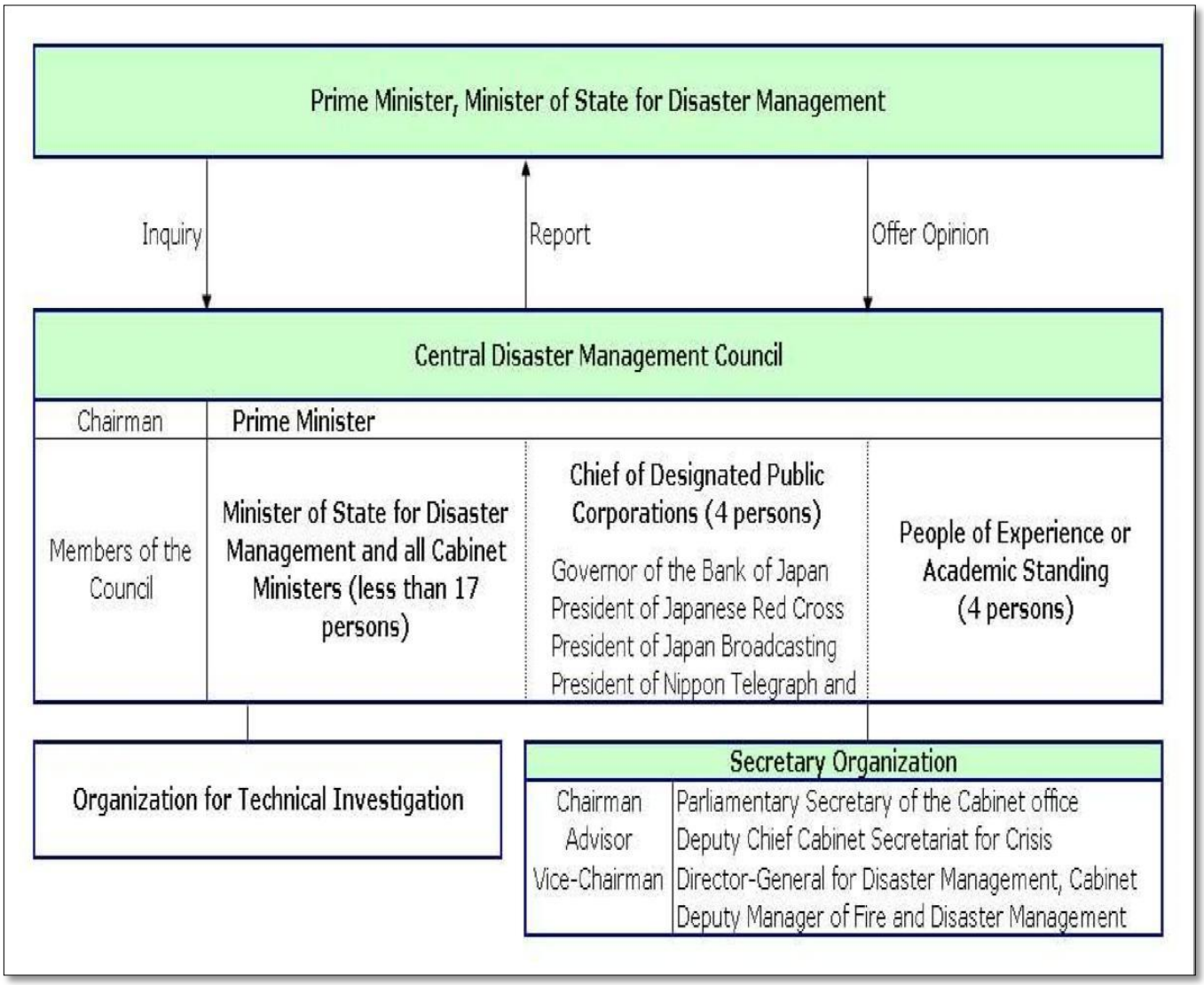


Figure 20: Composition of CDMC

Duties of CDMC

(a) Prepare and promote implementation of the Basic Disaster Management Plan and draft the Earthquake Disaster Management Plan.

(b) Prepare and promote implementation of the urgent measures plan for major disasters.

(c) Deliberate important matters pertinent to DM, according to requests from the Prime Minster and/or Minister of State for DM (general coordination of basic DM policies and DM measures, declare emergency situations caused by disasters etc.)

(d) Offer opinions regarding important matters pertinent to DM to the Prime Minister and Minister of State for DM.

Disaster Countermeasures Basic Act (DCBA). The enactment of the DCBA in 1961 is considered to be the turning point in the history of modern DM system of Japan. Two years after the Ise-wan Typhoon, which caused tremendous devastation and over 5000 lives were lost, DCBA defined protection of national land, as well as citizens' lives, livelihoods and property from natural disasters as a national priority **(Nazarov, 2011)**. The basic scheme of DBCA is as shown in Figure 21 **(ADRAC 2016)**:-

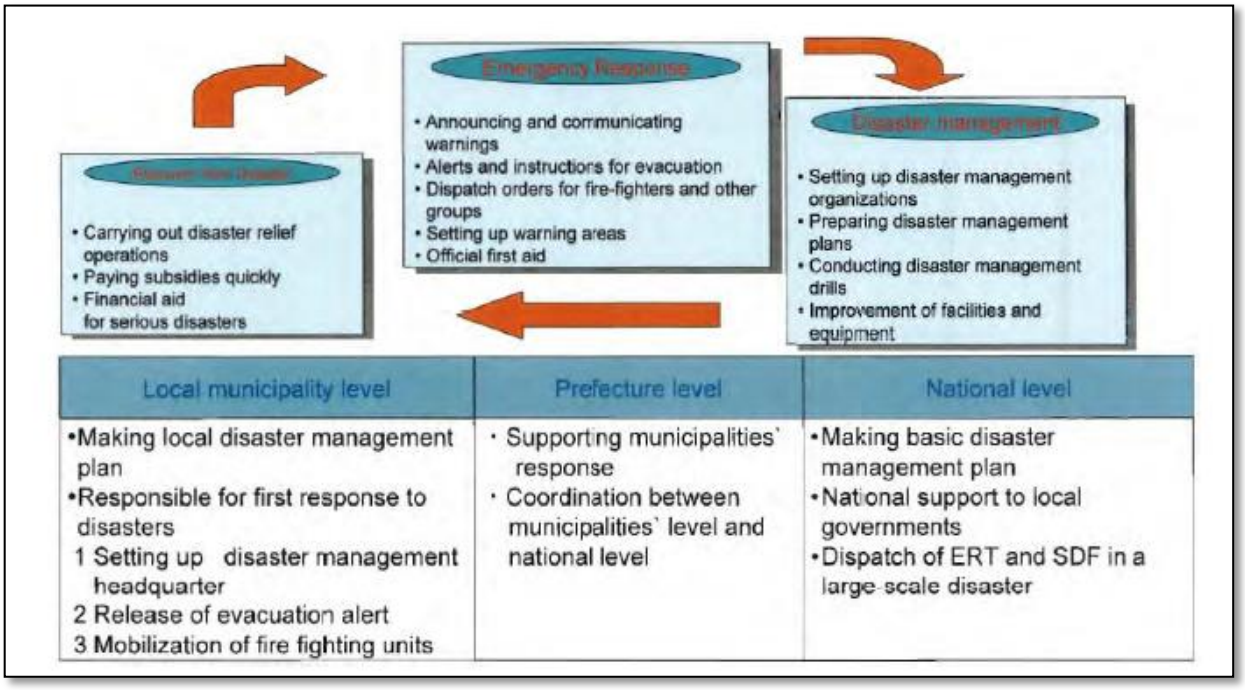


Figure 21: Basic Scheme of DCBA

One of Japan's most recent initiatives in the field of disaster risk reduction and management is the publication of the White Paper on DM in 2015. This annual report provides comprehensive information including disaster losses and relevant data and statistics; updates on the progress of recovery and reconstructions from specific disasters; policies and measures for DM by disaster type and insights into good practices on disaster risk reduction/ prevention at local/community level, and much more. **(Japan, 2015)**

Structure of DM Plan : Japan

The structure of DM in Japan is as depicted in the Figure 22 **(ADRAC 2016)**:-

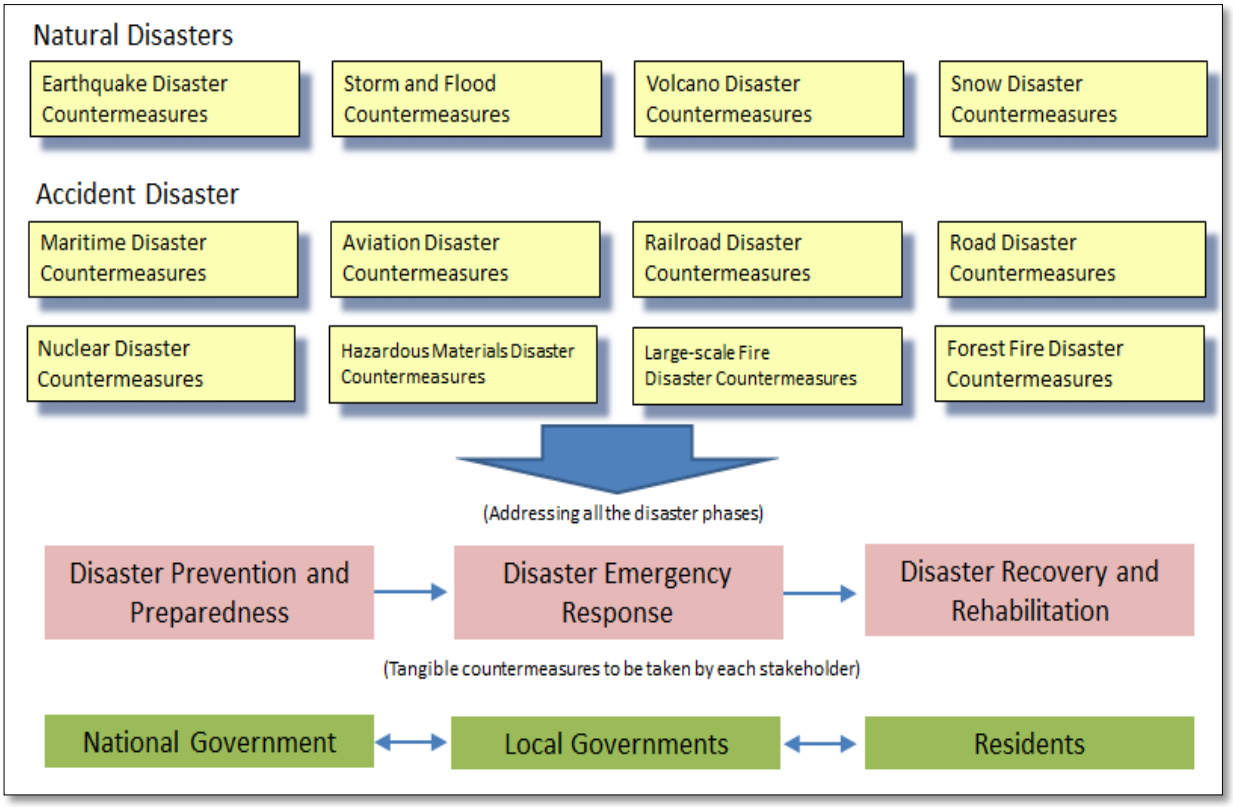


Figure 22: Structure of DM Plan of Japan

The **Ministry of DM is the lead ministry on behalf of the Cabinet Office** and has eight separate offices to deal with disasters:--

(a) DM.

(b) Disaster Response Operations.

(c) Communities/Drills.

(d) Surveys/Policy Planning.

(e) Disaster Victims Administration.

(f) Disaster Preparedness, Public Relations and International Cooperation.

(g) DM Planning.

(h) Project Promotion.

The **priority of the State authorities is on disaster risk management**. **Aim is to reduce damage** caused by disasters, especially due to sudden onset of earthquakes and tsunamis. This has been specifically implemented by taking measures for all likely kind of disasters. The decrease in the number of casualties by earthquakes is ensured by retrofit / rebuilding of old existing houses / buildings, affixing furniture and adhesive protective films on old windows and encourage companies to make Business Continuity Plans. The **decrease in the number of casualties by tsunamis is ensured by distributing tsunami hazard maps, disseminating tsunami warnings effectively, pre-positioning the medical response teams and ensuring that people are evacuated to safe places, prior to impending disaster**. Similarly, decrease in the number of casualties by typhoons and floods is affected by providing early evacuation alerts for the elderly & disabled and distributing flood hazard maps to all affected people.

The Government of Japan advocated the importance of "mainstreaming disaster risk reduction (DRR)" at the Third UN World Conference on Disaster Risk Reduction (WCDRR). '**DRR mainstreaming' implies making prior efforts in initiatives to mitigate damage from disasters.** In other words, to ensure that DRR efforts are reflected in all policies on a widespread basis. DRR cannot be achieved unless advanced preparations are made and the policies are implemented sincerely. **Japan has emphasized on building a DM system with relevant ministries, public agencies, local governments, community participation and raising volunteers (Japan, 2015).**

<u>Disaster Response Mechanism : Japan</u>

In the event of an extreme disaster, that cannot be handled at the local level, a **Major DM Headquarters** is established which is led by the Minister of State for DM (or in the event of an extraordinary and violent natural disaster, a **Extreme DM Headquarters** is established, which is led by the Prime Minister). Based on legal provisions laid down for management of disasters, several ministries coordinate with the principle ministries and agencies to respond to the emergency situation**. Japan does not have a standing response organization, like NDRF or FEMA of USA** (which has a standing strength of more than 10,000 personnel). Following the occurrence of a disaster, depending on the scale of the disaster, National Onsite DM Headquarters and on-site contact offices are set up. The Cabinet Office closely collaborates with relevant ministries & agencies to prevent, respond to & recover from disasters and works to ensure that the country prepares strongly for such emergencies. **(Japan, CO)**

In the event of a calamity, national government institutions, local governments, public agencies and other institutions involved in DM work as one, in cooperation with residents, to respond to that disaster. DM Headquarters endeavour to formulate a whole picture of the damage and action are taken immediately, without waiting for requests for assistance from the affected areas. Large support units such as the local police, fire services and Self-Defense Forces are immediately dispatched to the administrative divisions, where the disaster impact is expected.

Outline of DM System. Japan is **governed by a three-tiered administration: the National Government, Prefectures and Municipalities**. Comprehensive disaster prevention plans are developed in accordance with the roles to be performed at each stage. The details are given in Figure 23, below **(ADRAC 2016)**:-

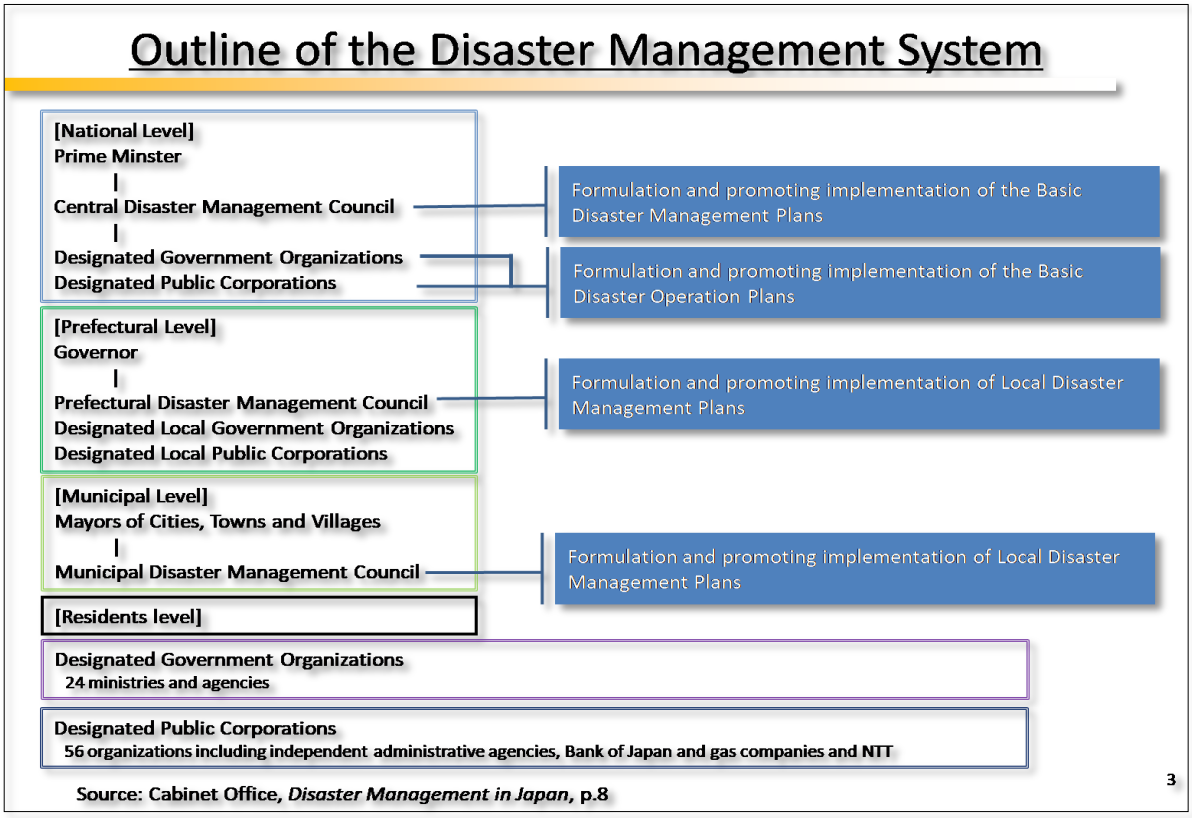
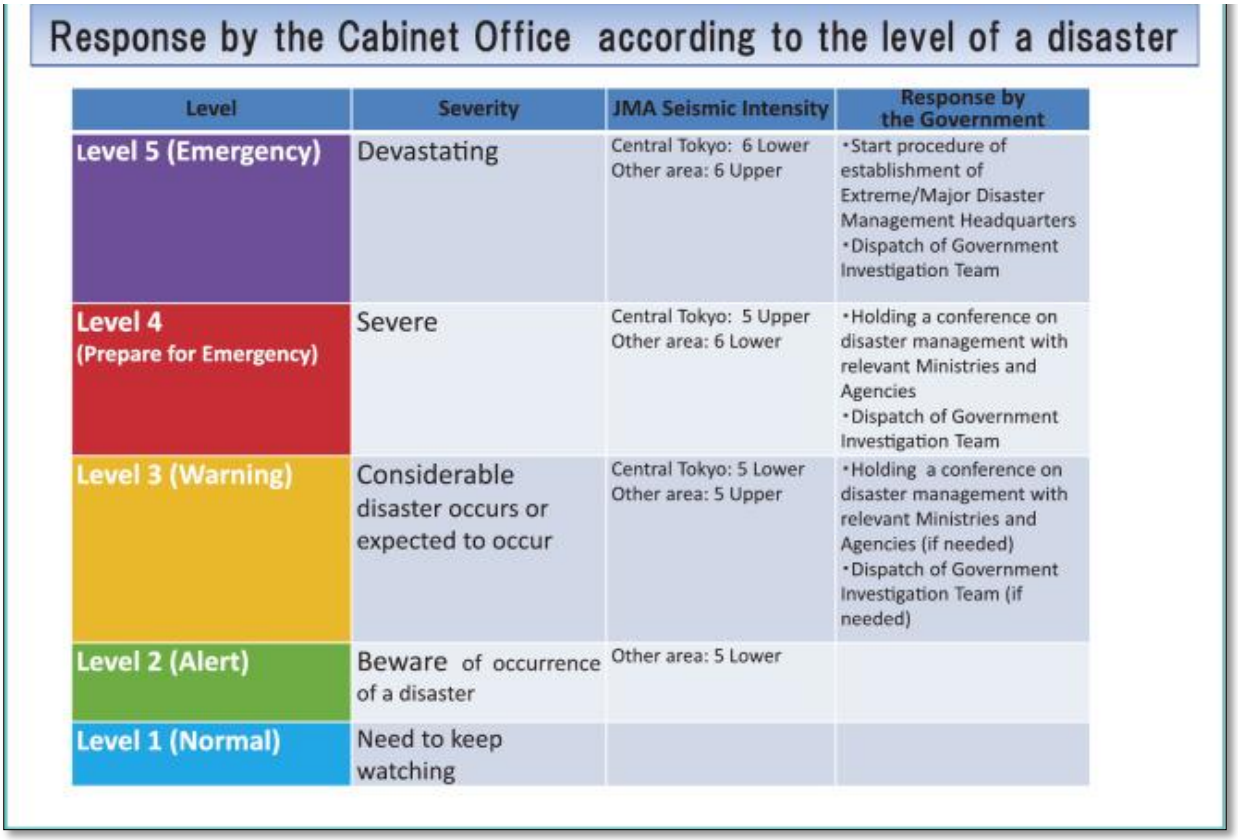


Figure23: Organization of Disaster Management System: Japan

Response by Cabinet Office. In the event of a disaster, or where there is a risk of a disaster, the Cabinet Office, with the cooperation of relevant ministries and agencies, takes the lead in countermeasures, corresponding to each level of disaster with level 1 at normal times up

to level 5, when a devastating disaster occurs. Response by the Cabinet Office, according to the level of disaster is given at Figure 24. **(Toshinori,2016)**



Response by the Cabinet Office according to the level of a disaster

Level	Severity	JMA Seismic Intensity	Response by the Government
Level 5 (Emergency)	Devastating	Central Tokyo: 6 Lower Other area: 6 Upper	・Start procedure of establishment of Extreme/Major Disaster Management Headquarters ・Dispatch of Government Investigation Team
Level 4 (Prepare for Emergency)	Severe	Central Tokyo: 5 Upper Other area: 6 Lower	・Holding a conference on disaster management with relevant Ministries and Agencies ・Dispatch of Government Investigation Team
Level 3 (Warning)	Considerable disaster occurs or expected to occur	Central Tokyo: 5 Lower Other area: 5 Upper	・Holding a conference on disaster management with relevant Ministries and Agencies (if needed) ・Dispatch of Government Investigation Team (if needed)
Level 2 (Alert)	Beware of occurrence of a disaster	Other area: 5 Lower	
Level 1 (Normal)	Need to keep watching		

Figure 24: Response by the Cabinet Office: Level of Disaster

Response Large Scale Disasters

During a large scale disaster, an Emergency Response Team made up of Director-General and members of related ministries & agencies is summoned to the Prime Minister's Office to begin talks within 30 minutes of the occurrence of the disaster. Then an extraordinary cabinet meeting is held and the Extreme DM Headquarters is established. The Headquarters, headed by the Prime Minister as the Chief, takes control of the operations and provides overall coordination regarding disaster emergency measures. Accurate and prompt actions are expected to be taken in response to the instructions from the Chief. **(Toshinori,2016)**

Prompt and accurate emergency response is demanded in the event of a disaster, and to ensure its reliability, the government may establish the **'Onsite Headquarters' for DM.** For example, during the Hiroshima landslides in August 2014, the Onsite DM Headquarters was set up and headed by a State Minister of Cabinet Office. Likewise, Prefectural DM Headquarters and

Municipal DM Headquarters are set up in affected areas and these administrative units coordinate operations.

Figure 25 shows, an outline of counter measures considered by the Central DM Council in response to large-scale earthquakes. It specifically suggests that the possibility of a Nankai Trough Earthquake (with a magnitude of 8 or 9) and a Tokyo Inland Earthquake, within the next 30 years. The Council is presently reviewing the estimation of damage based on the Great East Japan Earthquake, while promoting countermeasures. (**Toshinori,2016).**

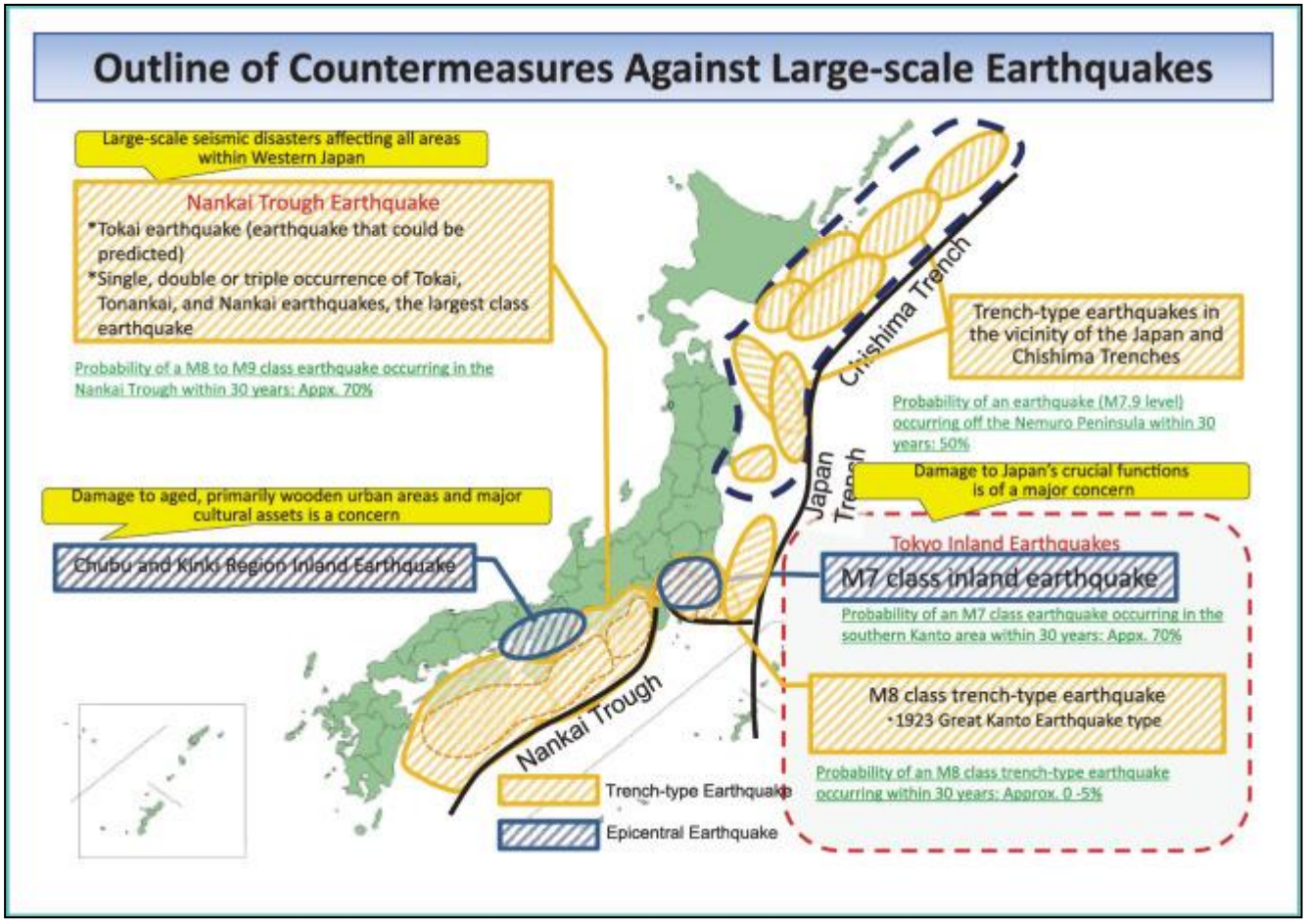


Figure 25: Countermeasure against Scale Earthquakes

In March 2015, based on the estimation of damages, a specific Emergency Management Plan for a Nankai Trough Earthquake has been formulated. Refer 26. **(Toshinori,2016).** This plan is made up of five categories, in response to large-scale disasters, which includes emergency transportation routes, rescue, first aid, fire fighting, medical, supplies and fuel.

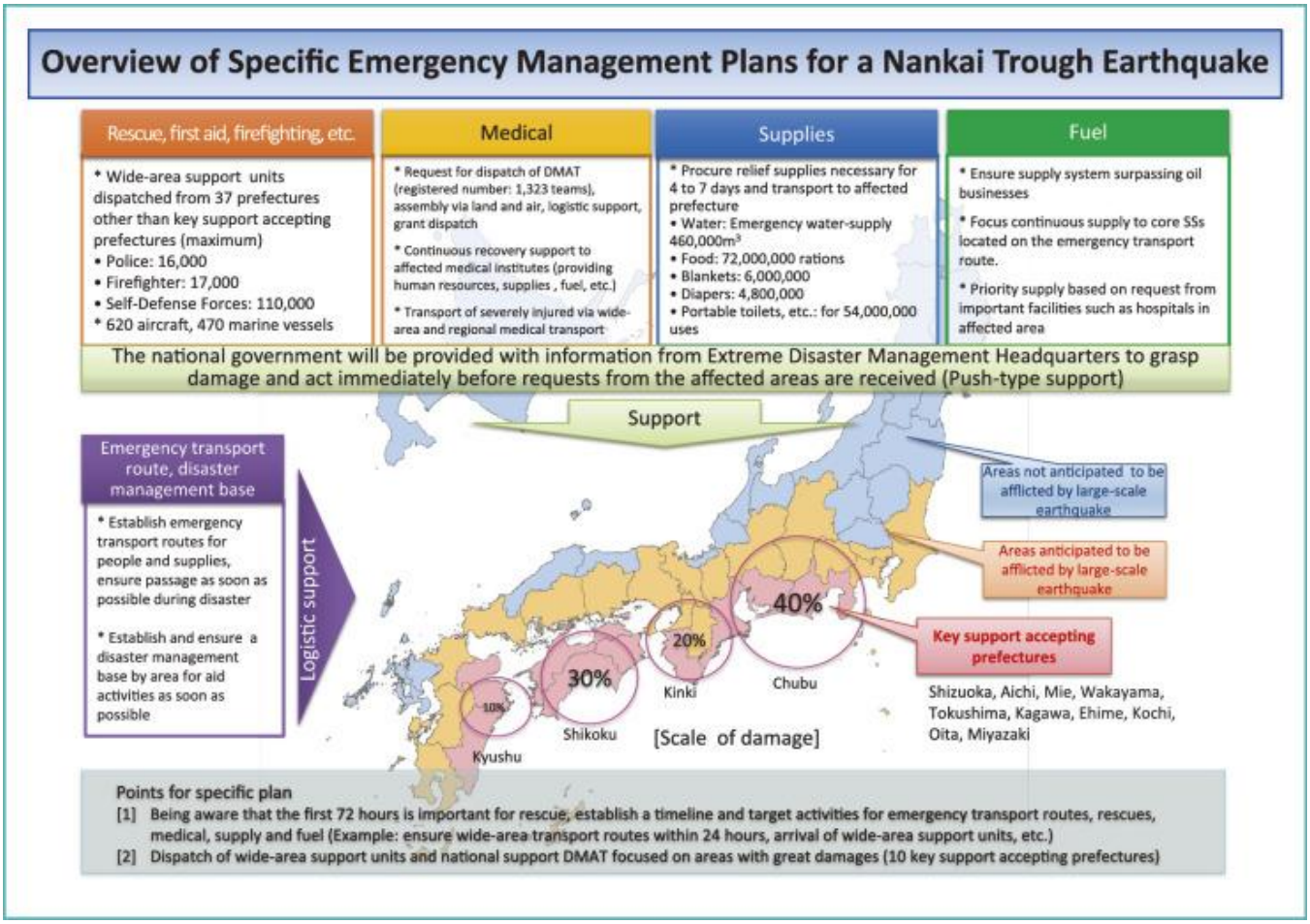


Figure 26: Specific Emergency Management Plan for a Nankai Trough Earthquake

By incorporating lessons learned in the Great East Japan Earthquake, the Extreme DM Headquarters can acquire a wholesome picture of the damage and action can be taken immediately, without waiting for requests for assistance from the affected areas. Wide area support units, such as the police, fire fighters and Self Defence Forces are pre-positioned, where substantial devastation is expected.

Medical Care & Support

For life saving, a timeline an initial 72-hour maximum period for rescue is taken as a parameter. Regarding medical care, JMATs (Japan Medical Association Teams) and DMATs (Disaster Medical Assistance Teams) are dispatched into the disaster hit areas, during the initial 72 hours and provide assistance to the disaster base hospitals in the affected areas. In addition, the plan is to quickly build a backup system for treatment by transporting critical patients out of the disaster areas from air transport centres.

The Ministry of Health, Labour and Welfare (MHLW) has been advancing its policy of DM in three verticals, focusing on providing effective and efficient medical care during disasters. These are:

(a) Setting up disaster base hospitals,

(b) Operating and training DMATs (Disaster Medical Assistance Teams).

(c) Establishing an EMIS (Emergency Medical Information System).

As a rule, **one or more disaster base hospitals are set up in every secondary medical zone**. Currently, **there are 695 designated hospitals across Japan** that can act as bases to take in large numbers of injured victims, in addition to providing medical care. **(Toshinori,2016)**

During the Great East Japan Earthquake of March 2011, 383 teams were dispatched to the affected areas. 88 teams were active at the time of the Hiroshima landslides in August 2014 and during heavy rain disasters of September 2015. To provide appropriate medical care in the event of a disaster, "all Japan" response system, that includes collaboration with various sectors all over Japan is ensured.

Disaster Response Forces : Japan

For the emergency response to a disaster, Japan does not have a standing force and relies on its Self Defence Forces, which are akin to our Armed Forces and Fire Corps Volunteers. The Volunteer Fire Corps is made up of volunteer fire-fighters, who protect the region's safety and sense of security and they play a key role in improving regional fire/disaster preparedness. Volunteer Fire corps members engage in fire-fighting, lifesaving and first-aid activities during a disaster and during non-crisis times, they work on the promotion of disaster preparedness awareness to local residents. Anyone over 18 years of age can become a member, students and women are encouraged to be a part of this force. The strength of these volunteers varies (Japan, White Paper on Disaster Management in Japan, 2015), as follows **(Toshinori,2016)**:-

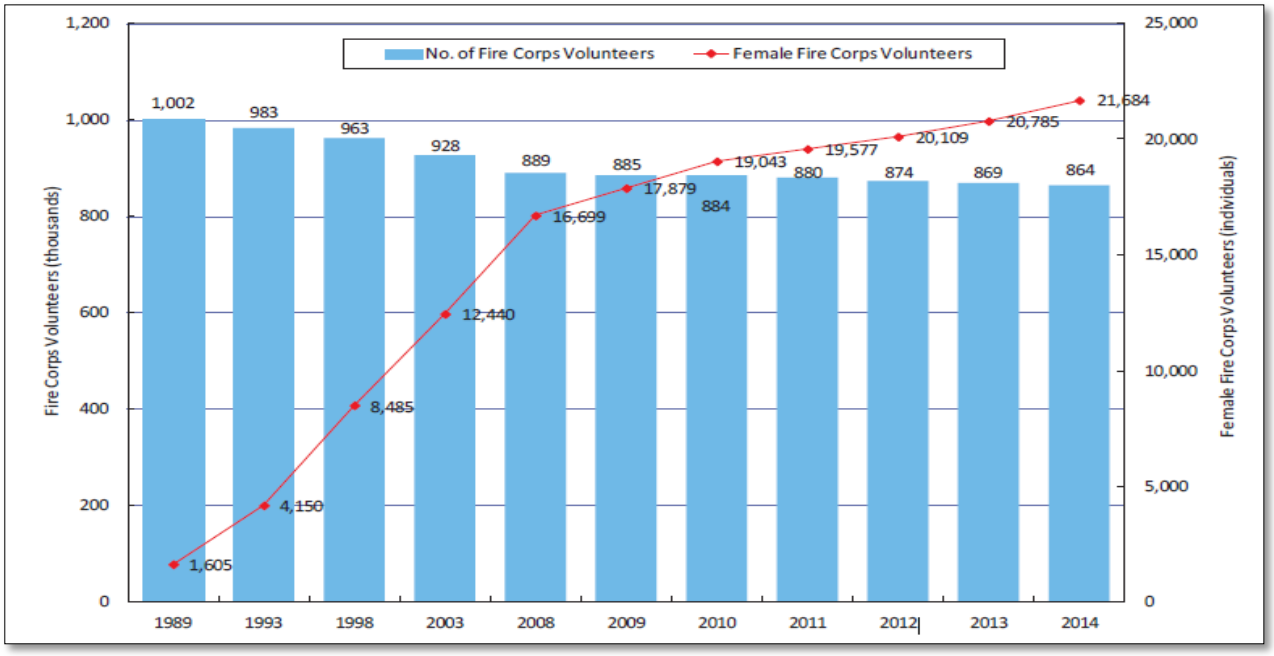


Figure 27 : Trends in Volunteer subscription for DM

The Japanese Self Defence Forces (SDF) response is reserved primarily for larger scale disaster operations. The mainstream view is that the military plays a limited and supplementary role. This concept of a "last resort" is consistent with SDF's approach toward its disaster relief missions. **The employment of SDF during a disaster is based on three principles; magnitude & urgency, contribution to common good and no comparable civilian alternatives.**

Fire and Disaster Management Agency in Japan (FDMA). Fire services in Japan began as municipalities with functions closely linked to local communities and has played a vital role in ensuring the safety and security of the public of Japan. FDMA is active in areas ranging from emergency rescue to the handling of hazardous materials, as well as fire prevention and fire fighting. FDMA fulfils its responsibilities based on disaster prevention system that operates around regional fire defence headquarters and volunteer fire corps, along with the cooperation of residents in local communities.

Disaster Resilient Infrastructure. Given the regularity of earthquakes in Japan, infrastructure is constructed to withstand earthquakes. Houses in Japan are built to comply with rigorous earthquake-proof standards that have been set by law. These laws also apply to other structures like schools and office buildings. It's said that around 87% of the buildings in Tokyo are able to withstand large earthquakes. Many structures are built to become a little more flexible, if hit by a tremor and some structures are built on Teflon, which allows buildings to move with the shock, while still others feature inflated, rubber, or fluid-filled bases, which can absorb shock. During the 2011 floods, when the airports and roads were closed, the Blue Line was able to

continue to operate even in flooded areas without intrusion.

LESSONS LEARNT: JAPAN DISATER RESPONSE MECHANISM

Being one of the most disaster prone countries in the world, Japan has developed sophisticated and all-embracing DM system. **Based on 3-layered national government system and administrative delimitation** of the country, formation and evolution of the DM system in Japan has been heavily influenced by unfavorable geographical position, as well as, meteorological, and topographical conditions and various large scale disasters have been driving force of new changes and enhancements to it.

National and local governments in Japan have distinct and complementary roles in DRM planning. At National level, Government is in charge of defining the overall DRM strategy, coordination and legislation, allocation of funds, and deployment of the government budget. At local level, the local governments & other agencies are focusing on coordination of administrative and operational functions; undertake preventive measures, such as education, safety drills and issuing & transmitting of information / warnings, organizing evacuation and rescue activities and carryout supply distribution in emergency situations, as also carryout overall coordination of reconstruction and restoring livelihoods during the recovery phase. **Creation of disaster resilient infrastructure in Japan has gone long way in mitigating casualties and material losses in the country.**

The Central Government provides substantial funding for emergency response and reconstruction. After Great Hanshin-Awaji Earthquake in 1995, countermeasures have been emphasized even more and a full revision of the Disaster Countermeasure Basic Act was initiated in December 2011. The main drivers of the latest revision are, the need to account for low-probability, high impact multi location hazards and to strengthen the local government's role in providing training and planning emergency measures and evacuations. **Japanese Self Defence Forces are an essential stake holder in DM in the country.**

Disaster Response Mechanism : Japan

Rather than being managed by one central body, DM system of Japan is decentralized and growing trend of decentralization is being observed recent years. As one

of the most prominent characteristic features of the system, decentralization enables more government agencies to be involved in DM. The **three layered hierarchy of the system, fosters comprehensive supervision and management of overall system**. It also allows tackling the each disaster and accident on relevant level and with relevant resources, depending on its scale and implications. **Activities at National, Prefectural and Municipal are taken in concerted and coordinated manner and supervised by the higher level**. Such a hierarchical system and distribution of responsibilities ease the burden of each involved agency, enabling each of them to manage specific issues with more engagement and efficacy.

Integration of DM measures by specific bodies allows handling specific DM issues more professionally. **Municipalities are responsible for ensuring and carrying out quick response operations on the land area, the Coast Guard are responsible for territorial waters of Japan.** Specialized bodies, such as trained emergency medical assistance teams (DMAT and JMAT) and specialized teams of several public corporations are designated for DM under the DCBA. In turn, additional assistance forces are managed by national level government organizations such as Fire and Disaster Management Agency (FDMA), Ministry of Land Infrastructure, Transport & Tourism (MLIT) and Ministry of Health, Labour and Welfare (MHLW), undertake disaster response actions, once the scale of the disaster is out of response capabilities of a municipal government. At the same time, MLIT, FDMA, MHLW are central bodies for national level supervision and coordination of emergency response activities, as well as response assistance during large-scale disasters.

JMA is the key body in prediction of major natural hazards, such as earthquakes, tsunamis, typhoons and volcano eruptions, while MLIT is for flood and sediment disasters and cooperation with them is essential for municipalities and other disaster response organizations. **It must be noted that application of latest technologies for disaster warning and communication by JMA has greatly improved disaster response system in Japan.** In addition, state lifeline agencies, railway companies, NHK has established quick information sharing with JMA and other relevant bodies, as well as response mechanism within respective fields of activity. Although playing important role during large-scale disaster National Police and Self-Defense Forces are additional response forces, who join the response activities only upon request.

The large natural disasters in recent decades, such as Isewan Typhoon, Great Hanshin-Awaji Earthquake influenced the new disaster response forces - DMAT and disaster response

mechanisms – Phoenix System and Emergency Medical Information System in Hyogo Prefecture have been introduced and integrated.

Establishment of '**ad hoc headquarters' during large-scale disasters** at all levels peculiar indicator of the disaster response in Japan. Such headquarters serves for quick mobilization of forces, better coordination of response activities and disaster information sharing. Because Japan is subject to recurring large-scale natural disaster additional measures other than permanently functioning bodies are necessary to reduce impact of disasters.

Large number of **voluntary response organizations** and people involved in voluntary disaster response showcase, high level of disaster awareness and social responsibility for disaster reduction in the country. Voluntary teams have demonstrated remarkable efforts in providing psychological support to the affected people and to provide basic & essential utilities.

Regular Review of DM Plans. Japan has taken steps to increase its own disaster preparedness since the devastating 2011 earthquake and tsunami. **Japan has revised its basic disaster prevention law three times over the past six years** to improve it DM response. Similarly, DM plans in India at the national, state and district levels need to be revised periodically, based on lessons learned from other disasters in and outside the region. The Armed Forces of India and also various NGOs / agencies need to be incorporated in DM mechanism in India (DM Act of 2005), for better and timely response, preparation and coordination.

Disaster Risk Reduction Education in Japan.

Risk awareness at schools / colleges is part of Japan's strategy to promote Nationwide Commitment to DRR. The main objective is to enhance capacities of college and schoolchildren of all ages to actively contribute to DRR initiatives in their local communities. It is to ensure that all new generations of Japanese children develop their capacities to respond appropriately when disaster hit, to enable them to save their lives and contribute to saving those of others. Drawing from past disaster experiences, risk awareness is enhanced through the development of practical skills and routine disaster education in schools, in order to take actions when a disaster strikes. Local approaches are encouraged to take into consideration the local specificities of disaster risks.

Community Participation in Disaster Management

When disasters strike, communities become the immediate victims, but they are also the

first responders. In the recent years in Japan, **"Community based DM" has been the prime focus of DM mechanism.** Community based disaster prevention led by citizens, plays the central role in reducing disasters. Japan lays emphasis on empowering its citizen to actively participate during natural disasters to respond and assist the disaster relief forces to mitigate losses. Regular emergency drills and rehearsal are carried out to prepare its citizens for natural disaster situations. Active community participation is encouraged to improve 'earthquake proof' equipment in houses, including fire fighting equipment, stocking medical emergency goods and food items that can be easily used in case of disaster. Active community participation has gone a long way in mitigation loss of valuable lives to a great extent.

CHAPTER VI: CRITICAL ANALYSIS OF CAPABILITIES OF NDRF & IDENTIFICATION OF CAPABILITIES OF ARMED FORCES TO STRENGTHEN DISASTER RESPONSE MECHANISM

Introduction

Two major calamities in quick succession in the form of Orissa Super Cyclone in 1999 and Gujarat Earthquake in 2001, brought about the realization of the need of having a specialist response mechanism at National Level, to effectively respond to disasters. NDRF was established under the statutory provisions, vide section 44 (i) of the DM Act of 2005. NDRF, a specialist force has emerged as the most visible and vibrant multi-disciplinary, multi-skilled, high-tech force of the NDMA, capable of dealing with all types of natural and man-made disasters.

All the twelve battalions of NDRF are equipped and trained to deal for all natural disasters, including four battalions in combating nuclear, biological & chemical disasters. Similarly, the States need to set up State Disaster Response Force (SDRF) teams, on similar lines of NDRF teams, set up by the Central Government. While the new disaster system and the NDRF have crossed the evolutionary stage, NDRF has evolved itself and proved to be effective in dealing with disasters, as seen in the Kerala floods of 2018 and Cyclone Amphan in 2020 and other emergencies. NDRF, in a short span of raising, has acquired a niche for itself as a professional force and has been involved in full spectrum operations, ranging from building collapses in urban areas, floods, earthquakes, train and boat accidents, etc. It has also acquitted itself admirably in its first engagement on a foreign soil (Japan). However, the question remains, whether NDRF has been able to fulfill the mandate as envisioned by the DM act, 2005. (The response & contribution of the various agencies involved in recent calamities, including NDRF and Army has been analysed in detail in Chapter IV). A critical appraisal of NDRF performance during recent calamities and the capabilities of the Army, which can be utilized to make the DM mechanism more responsive and efficient, are discussed in succeeding paras.

Critical Appraisal of NDRF Performance

NDRF today has strength of 12 battalions comprising 144 specialised teams trained for various types of natural and man-made disasters. Four battalions have been specially set up for handling radiological, nuclear, biological, and chemical disasters. The GoI has given approval for

raising four additional NDRF battalions. The contributions and limitations observed during the recent disasters are as under:-

(a) **Sikkim Disaster- 2011**. **Ten Teams** consisting 403 NDRF rescuers from 08 Bn Greater Noida and 02 Bn Kolkata were airlifted to Sikkim after the earthquake in September 2011. It was observed that NDRF had fallen short in terms of personnel and logistic backup. **The NDRF resources were too little and were found ill-equipped to deal with such huge calamity**. It was the Armed Forces, primarily the army, that carried the major response and relief operations.

(b) **Uttarakhand Disaster- 2013**. One of the largest evacuation operations in India's history was witnessed during the floods in Uttarakhand. About 75,000 pilgrims were stranded over an affected area of 40,000 sq Kms. The NDRF deployed **14 teams** (a total of 850 persons), from two NDRF Battalions. In comparison, the Army had deployed 40,000 personnel over 40,000 sq kms of affected areas to provide rescue, relief and evacuation. The IAF too deployed its heavy and medium lift helicopters, besides transport and special ops planes like the C-130s The **Army and ITBP units located in disaster affected areas were the first responders during the calamity**. While the NDRF contributed immensely in the rescue operations, their teams arrived two days after the calamity had struck and their overall response was found to be tardy. In the widely documented Uttarakhand disaster, **850 personnel of NDRF rescued 9657 personnel, out of an approx 75000 pilgrims / locals**. The Armed Forces were requisitioned due to response paralysis of the State / local administration and delayed response of NDRF. **14 teams were found to be grossly inadequate to deal with a calamity of such a magnitude**.

(c) **Kerala Floods 2018**. During the Kerala floods, NDRF deployed **55 teams,** with 38 boats and played a crucial role in providing relief to many affected people. NDRF rescued 535 lives and evacuated 24,616 marooned people to safer places as well as teams have rescued 119 livestock and provided pre hospital treatment to the 4908 people (**NDRF, 2018**). Besides this, the NDRF had set up a number of medical camps in various districts and provided medical assistance to over 6800 sick and needy persons. However, **the major evacuations and relief work was carried out by the Armed Forces**. The vast magnitude of disaster dwarfed the contribution of NDRF and brought out their inadequacies to the fore. In an article in the Pioneer on 11 Dec

2018, Ramesh Davesar stated "At present, the NDRF has strength of 12 battalions drawn from various Central Police Organisations; each battalion designed to provide 18 rescue teams of 45 people each. In all, 216 teams are available. Prima facie, keeping in mind the vastness, doubt arises on its pan-Indian capability to fight disasters. Sadly, the present organisation, bereft of captive resources such as air effort, specialised equipment and lack of wherewithal to administrative support, among others makes for a truncated outfit.'

Cyclone Amphan 2020. During Cyclone Amphan, **39 NDRF teams** were deployed (pre-emptively), in the coastal areas of Odisha & West Bengal. The NDRF played a very important role in mitigating the loss of lives by assisting both State administrations in carrying out mass pre-emptive evacuations of more than 2.37 lakh people to safer places. NDRF teams worked relentlessly to bring in normalcy, by removing uprooted trees on the roads, restoration of electricity, communications, water supply and organising medical relief in cyclone affected areas. The performance of NDRF during this calamity was appreciated.

Inherent Strengths of NDRF. The inherent strengths and core competencies identified are **(NDRF,2014)**:-

(a) NDRF is well trained for variety of relief / rescue operations, ranging from boat capsizing, train accidents, major and minor floods, earthquakes, precautionary deployment, etc.

(b) **Pre-Disaster Specialist Force. NDRF has been very effective in evacuation of population to safe areas in the pre-disaster phase**. Technological advancements in early warning, networking of coastal weather stations, etc have proved to be game changer for coordinated pre-disaster phase activities. Some of the enabling factors for success of NDRF are listed below:-

(i) As NDRF personnel are drawn from existing CPFs, there is a familiarity with operating systems at the district and the local levels. State Police Forces find co-opting NDRF personnel in pre and during disaster phases easy and seamless.

(ii) Most of the state resources for DM like Civil Defence, Home-guards, Fire servicemen are being trained by NDRF and hence during disaster deployment,

there is seamless integration of operating forces, bringing synergy and efficacy to entire spectrum of DM activities.

(iii) From the quantum of rescue effort in terms of teams from various battalions deployed and the lives saved and relief provided, the following can be concluded:-

(aa) **Pre-Disaster Deployment.** When NDRF has been swiftly deployed in the area expected to be affected by the disaster, it has been most-effective.

(ab) **Poor Capacity of State Governments / Institutions.** Even in emergencies of minor nature such as ferry/ boat capsizing, the local administration in the states, have been found to be woefully lacking in capacity, in terms of equipment and trained manpower to contain losses. NDRF has been called in more in the role of mopping up as in fishing out of dead bodies rather than any relief or rescue work.

(ac) **CBRN Capacity.** NDRF has been deployed on regular basis in a precautionary and preventive role for CBRN emergencies. Ever since, India became a declared nuclear power and the nuclear deal with USA, a critical area of concern has been safety in terms of CBRN capabilities. In the short time that NDRF has existed, its capacity accretion in terms of trained manpower (two battalions) and specialist equipment and demonstrated capability has been very impressive. Today, it has emerged as the premier agency for CBRN defense. It is regularly employed during Parliament sessions and major heads of states/government meetings. The performance of the force in its first ever overseas assignment at Japan has won it many laurels.

(ad) **Training & Capacity building SDRF, Police, Home Guards Civil Defence, Police, etc.** NDRF has played a pivotal role in training the accredited forces of the states like Home Guards, SDRF, Civil Defence volunteers in the specialist disaster response roles.

(ae) **Dispersed Deployment**. The present system of dispersed location to cover various parts of the country has served the NDRF well. It has helped the force in responding swiftly, carry out training and awareness programmes for state forces in their respective areas of responsibilities. It has also helped to develop special role & specific skills for its personnel by decentralized command and control which has further assisted the force in establishing linkages with the state government machinery for disaster preparedness.

(c) The strength of NDRF is always going to be inadequate, but its capacity and capability in terms of training, equipment, specialised skills will enable the force to carve a niche for itself in the national DM calculus.

Limitations : NDRF. The NDRF though has performed admirably, some limitations need consideration **(NDRF, 2014)**:-

(a) Even though NDRF is the largest stand alone disaster response force in the world, it **does not possess a permanent or regular cadre**. NDRF personnel come from different Central Police Forces with differing operation ethos and systems. Though in nearly a decade of its existence, NDRF has been able to operate in a cohesive and effective manner. However, the issues of **career advancement in NDRF and or parent forces are likely to be issues that need to addressed.**

(b) The 'pooled in' personnel, return to their parent formations after a specific tenure in NDRF. Their skill, experience and expertise developed while working with the NDRF is thus lost and may not be available for disaster response after they leave.

(c) The DM act has placed the duties of Civil Defence, Home Guards and Fire Services under DG, NDRF. This is aimed at having an integrated approach to response and rescue services and capabilities to manage disasters. However, **many governmental and inter-ministerial arrangements that existed prior to the enactment of DM act still exist and or operational. For example, DG Civil defence still exists separately under MHA and there is hardly any cross-integration with NDRF.**

A seminar on "Revisiting India's Disaster Response Mechanism: Challenges and Way Forward" on 06 May 2016 was held at Vivekananda International Foundation. Some suggestions to improve the DM response mechanism emerged during the conference, are as follows **(Vif**

India, 2016):-

(a) Gen NC Vij, founder chairman of NDMA opined that NDRF has earned a niche for itself for its professionalism in handling different types of disasters during last 15 years of raising. He further said that it was increasingly felt that having **one professional response mechanism at national level alone is not enoug**h and advocated for **a multi- level response mechanism**; the NDRF and the Armed forces at national level; State Disaster Response Forces (SDRF) at state level; Fire & Emergency Services, Civil Defence, Police, Home Guards, NSS and NYKS etc at district level and a well aware community, at grass root level. Referring to the operational capability of NDRF, Gen Vij highlighted the need of appropriate training infrastructure, well trained personnel and state of art technical equipment. He laid emphasis on **matching the capacities of SDRF with NDRF** at all levels with requisite trained personnel and equipment.

(b) Shri Kiren Rijiju, MoS, Ministry of Home Affairs mentioned that there is a need to bring about **high end technology to increase our capacity in the domain of response** and laid emphasis on integration of all our key institutions, such as Indian Institute of Technology, Indian Institute of Management and Indian Space Research Organization in the area of research & development.

(c) The general opinion was that though **NDRF is performing very well, but there are some shortcomings, like non-availability of critical equipment**, especially in the area of management of fire fighting and we need to build our capacities, urgently. An example of fire incident in Uttarakhand was cited, which caused massive loss and NDRF and Home Guards had to struggle to diffuse the fire, not because of lack of their commitment, but because of lack of critical equipment required to diffuse the fire.

(e) Shri OP Singh, DG NDRF (retired), mentioned that NDRF was facing organizational deficiencies such as lack of technical equipment, trained personnel and strategies and hence there was a need to revisit the requirements, to achieve operational requirements. He suggested for the importance to keep pace with emerging risks and make sure that appropriate institutions equipped with technology and expertise can be used as a catalyst. He laid emphasis upon the need of setting up of a modern Emergency Operations Centre, near the disaster site for onsite coordination and resource categorization, for quick response during a calamity.

(f) As per Shri OP Singh, some of the shortcomings of NDRF, were the existing

personnel policies unsuitable for its role, rotation of police personnel (5 year rule); lack of modern training facilities meeting the international technical and equipment standards for urban search and rescue; lack of specialist leadership and continuity; lack of exposure to international training and functioning with the Armed Forces. **(Vif India, 2016)**

(h) There was a need felt for INSARAG certification for NDRF and a systematic study of manpower and equipment requirement of NDRF and SDRF in the country.

(i) It was suggested that there was a requirement of **implementation of 'brick system' for equipment in NDRF**, on the lines of Army. The importance of coordination between Army and NDRF during normal period was found lacking and was a requirement for institutionalizing training between the two.

(j) There is a need to **strengthen our response capacities to handle CBRN emergencies**. NDRF needs to be better equipped with technical equipment and personnel training and emphasis should be laid on deploying young men in the specialised response force.

(k) For a specialist force like NDRF, which has the unique distinction of being the single largest dedicated disaster response force in the world, a dedicated training institution of international standard is a must. MHA had given, in principle, approval of setting up a national level training institution (National Disaster Response Academy), which needs to be opened at earliest.

(l) NDRF has earned a niche for its professionalism, but is still not qualified for any international deployment under the umbrella of the UN OCHA. To qualify for any such deployment, a specially selected team (80/ 90 personnel] need to go through the rigorous process of IEC (International Search & Rescue Advisory group External Classification), which is a long drawn process. In principle decision of Govt to have an IEC certified team of NDRF is needed.

(m) The inventories of tools, equipment and accessories, as also transport of NDRF for launching specialised effective response need up-gradations from time to time. Government needs to look into this aspect on priority.

ROLE OF ARMED FORCES : DISASTER RESPONSE MECHANISM

Armed forces have been traditionally the **'first resort' of the administration and the last to exit the disaster scene**. In nearly, every crisis faced by the state and Union governments, armed forces have been called for, whether it is rioting, plaque, rescue and relief during and after disaster. On account of their vast potential to meet any adverse challenge, speed of operational response and the resources and capabilities at their disposal, the armed forces have historically played a major role in emergency support functions. These include communication, search and rescue operations, health and medical facilities, and transportation, especially in the immediate aftermath of a disaster. The air and heli-lift and movement of assistance to neighbouring countries primarily fall within the expertise and domain of the armed forces.

The deployment of Armed Forces is governed by the Govt of India's instruction on 'Aid to Civil Authorities' and their intervention is sought by the authorized government authorities, **when the situation is beyond the control of the civilian resources**. Over the years, the Armed Forces have been repeatedly requisitioned for rendering aid to civil authorities and they have been acknowledged as the 'first resort', an asset which has never let down the country in times of crises.

The Armed Forces have played and shall continue to play important role during post disaster scenarios. During the Gujrat Earthquake, Indian Army was to first to respond. Within 45 minutes of the disaster, 14 columns were sent out for Bhuj Military Station and 16 columns from Gandhidham. On the first day, Army recovered 310 survivors and 116 dead from Bhuj and 256 survivors and 58 dead from Gandhinagar. Military Hospital Bhuj was the only hospital in Bhuj and adjoining areas, with the civil general hospital having collapsed, treated about 50,000 civilians that included 1500 operations. Similarly, the armed forces were the first to get involved in the disaster relief efforts during the Uttrakhand floods in 2013, primarily due to availability of some army units and troops in the affected areas. In the massive response operation launched by Armed Forces, named 'Surya Hope', unprecedented in the nation's history, the IAF rescued 23,775 persons, the Army 38,750, ITBP 33,000 and NDRF 9,000 from the affected areas. IAF dropped about 730 MT of essential commodities at different places. The major part of the evacuation was accomplished in less than a fortnight making it one of the largest, swiftest and safest rescue/evacuation operations **(Vif India, 2016). Likewise, in several other national level calamities, such as Kashmir floods, Chennai Floods and Kerala floods, the Armed Forces**

were the first to respond and essentially becoming the backbone of the rescue and relief operations.

This justifies the contention of Lt Gen NC Vij, PVSM, UYSM, AVSM (Retd) that, despite the creation of NDRF, the Armed Forces form the core of government response capacity and has become the crucial immediate responders in all serious disaster situations.

DM Act of 2005 and Armed Forces

Paradoxically, the DM Act of 2005, which is supposed to be an important instrument to articulate the role and functions of various organs of the government and a tool to bring in a sense of accountability and responsibility, merely includes the mention of 'deployment of naval, military and air forces, other armed forces of the Union or any other civilian personnel, as may be required for the purposes of this Act', under the heading 'Measures by the Government for DM. There is **no amplification or mention of the role of the armed forces with a view to offer legal support and back-up**. **The Act is surprisingly silent on the aspect of assigning a well defined role and responsibilities to the armed forces.**

Conceptually, as per the Act, the Armed Forces are to be called upon to assist the civil administration only when the situation is beyond their coping capability. The act, however, recognizes the vast potential in terms of expertise in communication, search and rescue operations, health / medical facilities and transportation, especially in the immediate aftermath of a disaster. At the National level, the Chief of the Integrated Defence Staff to the Chairman Chiefs of Staff Committee has been included in the NEC. Similarly, at the State and District levels, the local representatives of the Armed Forces may be included in their executive committees to ensure closer coordination and cohesion.

Implications for Armed Forces

The DM Policy does bring about a paradigm shift from the erstwhile relief centric response to a proactive preparedness approach. However, **the role of armed forces, as articulated in the policy, is rather ambivalent and leaves a lot for interpretation**. While it recognises that the Armed Forces may invariably be called upon to help the civilian administration, it **falls short of defining a formal and a clear cut mandate for the Armed Forces in the policy document**. The Act, specifically viewed from the perspective of the armed

forces, has several far reaching ramifications for the Armed Forces and these were to later manifest during the response of the Armed Forces in the Kashmir, Uttarakhand & Kerala Floods. Some of the key aspects of this gap or lacunae in the DM framework as it exists today are examined below:-

(a) **Absence of Clear Mandate for Armed Forces in DM : Affects Preparation & Training**. Employment of Armed Forces is contingent on being requisitioned for assistance by the civil administration. The normal course of disaster response, defined in the national policy, does not describe the role of Armed Forces. This has a bearing on the preparedness levels of the forces, as also Armed Forces have to operate without prior knowledge of the terrain, equipment and synergy with other DM agencies.

(b) **MoD : Not a Nodal Agency for DM.** The MoD, which exercises control over the Armed Forces, is not assigned any primary or secondary responsibility in any of the recognized major disasters. This effectively has contributed to very few institutional linkages between the Armed Forces and the State and District Administrations.

(c) **Lack of Armed Forces Representation in DM Mechanism**. The Armed Forces have token representation in the decision making echelons of the new structures. Though, NEC has service chiefs as members, however, **at the functional levels, i.e in the NDMA, SDMA and DDMA, the forces have no representation in the planning process**. The task forces are directly required to contribute during disasters, when called upon to do so. This does not augur well for the organisation as the constraints and sensitivities of the forces are not easily understood by all. **The rich expertise of the Armed Forces is also left un-utilised**. Presently, there are no laid down qualifications for members including the Vice Chairman of the NDMA. The need for inclusion of members of Armed Forces, with proven record of handling disasters, in the NDMA has been highlighted by many eminent experts but the same is yet to manifest in terms of any concrete measures to restructure the existing organizations.

(d) **Lack of Equipment for DM**. The DM Policy **does not cater for any equipment / stores for Armed Forces**. In case called for assistance, the elements of Armed Force are expected to contribute to the relief efforts with their authorised war like equipment, often unsuitable for such usage. There is no induction of new

equipment or stores to empower Armed Forces in contributing better to the relief efforts in times of disasters.

(e) **Lack of Civil-Military Liaison.** During non-disaster period, there is hardly any meaningful liaison between the civil government machinery and the military. At the state level, the liaison apparatus is rudimentary and restricted to land- encroachment, exchange or top dignitary issues.

Lack of Synergy & Joint Training with Civil Administration/ Other Agencies. In the absence of clear mandate for Armed Forces in DM mechanism, the relief teams of armed forces, when employed, are to build up and function under the Incident Command System (ICS) established by the civilian administration. However, the same is seldom rehearsed and practiced in peace time; this has major ramifications during actual disaster relief efforts where close and intimate coordination is expected within stringent constraints of time and space.

Lack of DM Database Access. The Armed Forces handle disasters without any database of the resources, skills, and services essential for effective response at short notice. The DM act and the progress thereafter has led to focus on early warning, IDRN - India Disaster Resource Network, integration of state and district level information, etc. NDRF and other stakeholders have seamless access to the databases; however Armed Forces being outside the existing framework, lack access and often operate in isolation or last minute information during crisis situations.

Strengths of Armed Forces : Relief Operations

In the absence of a well defined mandate in DM Act of 2005, the task forces from the Armed Forces, initially function under complete organizational and information voids. Despite the constraints, these teams are able to deliver due to **unity of command, professionalism, teamwork and a profound sense of willing to sacrifice,** that are the essence of any military operation. Certain strengths of Armed Forces that emerge and have got highlighted in the disaster relief operations of the Armed Forces are enunciated below. These must be nurtured and optimally exploited to fine tune the existing structures of disaster response mechanism in the country.

(a) **Speed of Response to Disaster**. It is the first response to a disaster that will set the tone for the way events later unfold. The Armed Forces in the past have responded

commendably in all rescue and relief efforts, by being the first agency to respond swiftly in a planned manner. In Uttrakhand relief operations in 2013, the command and control elements responsible for rendering aid to civil authorities ,i.e. HQ, Uttar Bharat Area under Lt General Navtej Singh Bawa, the General Officer Commanding (GOC) moved to Dehradun on 17 / 18 Jun. This was done even before the formal requisition for assistance of army, was received from the State Government, which was finally initiated on 20 Jun. The Air Force, similarly, was functionally prepared on 18 Jun, wherein IAF station Sarsawa and Jolly Grant helipad at Dehradun. These were nominated as hubs for conducting relief operations in the state. The speed of response of the Armed Forces during the relief efforts, in many ways, reinforced the perception that the Armed Forces are perhaps the only institution in the country that can respond to such a challenge with speed.

(b) **Inherent Organisational Capability**. In a disaster of the magnitude that was witnessed in Uttarakhand & Kashmir floods or Gujrat Earthquake, the biggest problem was that the local civil administration, supposedly the corner stone and coordinating hub forall subsequent relief efforts ,was itself paralysed and therefore unable to function. In Uttrakhand and Kashmir, most of the civil government officials the SDMA & SDRF, were ill prepared to handle a disaster of such a magnitude. It was also seen that, when the Army and ITBP personnel were moving forward to the incident areas, the State Government officials were moving back to safer places. This does not augur well for our disaster response model, which largely depends on the local administrative bodies to provide the basic framework on which the responders like NDRF and Armed Forces are required to build up. Army units and formations, within days, were able to control and coordinate the relief efforts even in areas, where they had to start from scratch. This capability is most crucial while combating disasters of the magnitude that was witnessed in Sikkim, Uttarakhand, Kashmir and Kerala, where the local administration proved ineffective.

Multi Tasking and Versatility. The ability to multitask without affecting the main missions shows the inherent flexibility and versatility of the Armed Forces. Armed forces assisted in finding missing people, medical camps were set up by Army doctors to provide medical aid in distant areas, the units doubled up as sheltering bases for stranded pilgrims, light helicopters and air force planes assisted in dropping supplies and the army seamlessly went about the main task of rescuing stranded pilgrims in a viable period.

Integral assets like Air Force and Special Forces provided a potent flexibility and versatility, which proved to be extremely beneficial.

Resources and Capabilities: Armed Forces

Before looking into the capability and resources at the disposal of the Armed Forces, it is important to know what all assistance they can provide to the civil administration, at the time of crisis. These are as under:-

(a) **Infrastructure for Command and Control**. Infrastructure for setting up of command and control organization for providing relief is an important task for the Armed Forces. This would involve provisioning of communication equipment, both telephone, radio and specialist manpower to handle it.

(b) **Medical Aid**. Provision of medical care with the help of medical teams, including treatment at the nearest military hospitals. This is another major task performed by the Armed Forces.

(c) **Transportation of Relief Material**. Provision of logistic backup to include aircrafts, ships and vehicles for transportation of relief material to the affected areas is also one of the functions which they may be required to undertake.

(d) **Establishment of Relief Camps**. Setting up and running of relief camps can be effectively carried out by the Armed Forces.

(e) **Construction, Repair of Roads and Bridges**. The army engineers can undertake construction and repair of roads and bridges to enable relief teams/ material to reach affected areas. This also includes provisioning of technical and plant equipment such as cranes, bulldozers and boats etc.

(f) **Maintenance of Essential Services**. Repair, maintenance and running of essential services like transport, railways etc may have to be undertaken in the initial stages of disaster.

(g) **Evacuation of People to Safer Areas**. Assist in evacuation of people to safe places before and after disaster is one of the most important tasks that the Forces may be assigned to do.

(h) **Stage Management of International Relief.** The Armed Forces with their airlift

and sealift capability can undertake stage management of handling of international relief.

(j) **Security**. The Armed Forces may also be called to coordinate provisioning of escort for men, material and security of various sensitive installations.

Principles of Employment : Armed forces. The operations of the armed forces whenever called upon to assist the civil authority in rendering relief are governed by certain guiding principles **(IDS, 2009).** These are enumerated below:-

(a) **Judicious Use of Armed Forces**. The assistance by Armed Forces should be requisitioned only when it becomes absolutely necessary and when the situation cannot be handled by civil administration from within its resources.

(b) **Immediate Response**. When natural and other calamities occur, the speed for rendering aid is of paramount importance. It is clear that under such circumstances prior sanction for assistance may not always be possible. In such cases, when approached for assistance, the Army should provide the same without delay. No separate government sanction for aid rendered in connection with assistance during natural disaster and other calamities is necessary.

(c) **Command of Troops**. The Army units while operating under these circumstances continue to be under command of their own commanders and aid rendered is based on task basis.

(d) **No Menial Tasks**. While assigning task to the troops it must be remembered that troops are not utilised for menial tasks. Troops should not be utilised for disposal of dead bodies.

(e) **Requisition of Aid on Task Basis.** The requisition of Armed Forces should not be in terms of number of columns, engineer and medical teams; instead the civil administration should spell out task and leave it to army authorities to decide the force level, equipment and methodology to tackle the situation.

(f) **Regular Liaison and Co-ordination**. In order to ensure that optimum benefit is derived out of Armed Forces employment, regular liaison and co-ordination needs to be done at all levels and contingency plans made and disseminated to the lowest level of civil administration and the army.

(g) **Advance Planning and Training**. The Army formation located in areas prone to

disaster must have detailed plans worked out to cater for all possible contingencies. The troops should be well briefed and kept ready to meet any such contingency.

(h) **Integration of all Available Resources**. All available resources, equipment, accommodation and medical resources with civil administration, civil firms, NGOs etc need to be taken into account while evolving a disaster relief plan. All the resources should be integrated to achieve optimum results. Assistance from outside agencies can be super imposed on the available resources.

(i) **Early Derequisitioning**. Soon after the situation in disaster affected area has been brought under control of the civil administration. Armed Forces should be de-requisitioned.

Sequence of Actions and Challenges during Disasters : Armed Forces

Once a disaster/national calamity is declared a meeting of the Defence Crisis Management Group (DCMG) is convened by HQ IDS which is attended by representatives of all three services. The instructions are passed for action by each service & the lead service is nominated. There may be occasions when one service is nominated as lead service in one State & other in another affected state based on the situation. The lead service then issues directions to the concerned Command HQs and who in turn issue orders to nearby static/field formations as per the requirement. The field formation then interacts with state agencies to organise relief **(IDS, 2009).**

At the national level, the Chief of the Integrated Defence Staff and the Chairman, Chiefs of Staff Committee are already part of the National Executive Committee (NEC) of the NDMA. (NDMA, National Disaster Management Plan, 2016) The Defence Crisis Management Group (DCMG) was institutionalized under the chairmanship of CISC in Jul 05. It has nine members to include CISC-Chairman, DG DIA, DCIDS (Ops) HQ IDS, DGMO Army HQs, ACNS (IW Ops) NHQs, ACAS (Ops) Air HQs, ACIDS (Jt Ops) HQ IDS, JS (G) MoD, ADGAFMS, DACIDS (Op Lgs) Secretary and DRDO representative. The DCMG has a watch, analysis, and overall plan formulation and coordination role. Detailed planning, execution and management will be carried out by the respective Services. DCMG prepares detailed strategic estimates for each crisis situation. **(Chand, 2010)** At the Services HQ level the DGMO, ADGMO (A), DIR MO 6 in Army Headquarters; DCNS, ACNS (IW & Ops), DNO in Naval Headquarters and VCAS, ACAS (Ops), D Ops (T&H) in Air Force Headquarters are charged with coordinating the Emergency Response measures for DM.

Disasters in the recent years have shown that in the after-math of major calamities, there is no likelihood of any communications, infrastructure and civil set-up remaining intact. Therefore, in the initial stages, suitable key personnel, both civil and military and infrastructure/communications equipment will have to be moved by the fastest means to the affected areas. Transport aircraft/helicopters would have to be earmarked and kept ready to move such elements, at short notice. Some of the challenges that have been experienced recently during relief operations are: -

(a) Local authorities did not possess any inputs regarding the situation & services first had the task of gaining information of the extent of damage and the relief effort required.

(b) Heavy rains & poor weather conditions made relief operations difficult.

(c) There usually was a shortfall of the capability available for evacuation of affected personnel & the requirement.

(d) Problems were experienced of communication & compatibility of equipment between the different relief agencies.

(e) State Departments were not available for coordination where the army columns had already reached, leading to delay in affecting relief.

(f) There also was appreciable reluctance in providing resources of the state to the services.

Overall Analysis

Of all the institutional entities set up by the DM act 2005, NDRF has been a success story. There has been a paradigm shift in DM; from post disaster relief to preparedness and pre-disaster mitigation. In areas of flood relief and urban search and rescue too, it has acquitted itself well. The NDMA and NDRF have now strengthened the State's ability to prepare and handle disasters. However, the desired capacity accretions in Civil Defence and fire services has not gained traction, as these critical services are only notionally under NDMA/NDRF and are controlled by erstwhile institutional arrangements under the MHA.

Incidents of natural calamities in the current decade, particularly the floods in Kashmir, Chennai, Uttarakhand and the recent flood fury in Kerala, are incidents expose shortcomings / limitations in effectively combating the menace. Calamities of large magnitude have brought out

the strength and inadequacy of the nation's resources to include NDRF and Armed Forces. Inability of the local and State Civil administration to handle incidence of a massive natural or manmade disaster would happen since the governance setup itself is disrupted. It has been seen that the **response of NDRF has been found to be inadequate during calamities of big magnitude,** affecting large geographical expanse and the **scale or frequency of deployment of armed forces has not shown any appreciable reduction.** While, NDRF continues to impress with its continual capacity and capability enhancement across the spectrum of DM activities, **the role of Armed Forces continues to be relevant as before especially in the rescue, relief and recovery phase of DM activities.**

The successful accomplishment of the DM would be achieved by intimate interaction and coordinated response by the NDRF, Armed Forces and other civil constituents. The NDRF which has the main role of giving emergency response to disasters has unfortunately not been able to meet the national requirement and has just been able to display patches of brilliance. Therefore**,** the limitations of NDRF need to be overcome and to overcome their shortcomings and to strengthen the response mechanism and functioning of the DM mechanism, institutionalizing the role of the Armed Forces in disaster response need to be legislated in DM Act of 2005.

The Armed Forces possess immense capacity due to their inherent cohesiveness, combat orientation, training and operating philosophy for DM relief and rescue. The DM act of 2005 and the subsequent PK Mishra commission have been silent on any specific role for the Armed Forces. This has **severely affected the integration of armed forces in the overall DM calculus and the legal framework.** The growing scale, frequency and ferocity of disasters necessitate optimal employment of all national resources of which in terms of capability in the context of DM, Armed Forces remain unparalled. **If our Nation has to evolve an overall framework, that is responsive, capable of swift reaction & sustained operations, the Armed Forces will need to be integrated into the DM framework.**

CHAPTER VII : RECOMMENDATIONS TO STRENGTHEN INDIAN DISASTER RESPONSE, IN FACE OF CALAMITIES

Post enactment of DM Act 2005 & NDMP 2009, there has been a paradigm shift in the way the disasters are being handled in India, From a relief-centric response, India has now transited into proactive prevention, mitigation and preparedness driven approach, to minimize loss of lives and property. The DM Act 2005 provides for establishment of institutional framework at three levels, i.e. National, State and District. The formulation of policy and DM plans are now backed by statutory and financial support. The act created there new institutions, namely, NDMA, NIDM and NDRF at the national level, as three key levels of the mainstreaming DM. While, NDMA is an altogether a new creation, NIDM and NDRF were created out of re-appropriated existing government resources. A significant feature of the Act is provision of a separate chapter on 'Response', mandating constitution of NDRF, as a specialist force to deal with any disaster or threatening disaster situation. The Act remained silent on the aspect of assigning defined role and mandate for the Armed Forces, one of the governmental agencies, frequently called in for dealing with disasters. The NDRF was raised to provide speedy response and reduce the involvement of Armed Forces in DM; however in the last decade, it has been observed that the involvement of Armed Forces has not reduced, in any manner..

Inadequacies of Our Disaster Response System

Since then, India's DM **response has improved during various natural & manmade calamities in last decade and our response to disasters has been more cogent & coordinated and has greatly helped in mitigating loss of lives and** material damages. It has been observed that the NDRF has performed well, but its performance during large scale calamities has been inadequate.. During natural calamities of larger magnitude in last decade; the Uttrakhand floods in 2013, Chennai Floods of 2015 or even Kerala floods of 2018, highlighted the inadequacies and under preparedness of DM agencies at National & State level, while responding to such calamites. The **level of orientation, focus and preparedness of various States, including their SDMAs and the grassroots level DM machinery varies; in most of the States, was found to be inadequate or lacking**. As a result, **the Armed Forces were invariably requisitioned to assist the civil administration**, once the disaster had struck. The Armed Forces were requisitioned in a reactive mode and had to function without adequate preparation, information of

the area, equipment and lack of synergy with other DM agencies, as there was no proper interaction / coordination with them, due to lack of clear mandate to Armed Forces in DM Act of 2005. In nutshell, **despite raising of NDRF, with the aim to raise a specialist force and to reduce the involvement of Armed Forces in DM, there is has been no reduction in involvement of the Armed Forces in DM operations and the later continues to be heavily involved in DM operations.** The glaring inadequacies in response and lack of specialist equipment with NDRF and SDMA, was once again highlighted during the recent Glacier Burst in Uttarakhand in Feb 2021. The DM agencies were unable to enter the tunnels to retrieve / provide essential life saving supplies to the trapped, while efforts were being made to rescue them. The Army and Navy Special Forces divers were requisitioned at the last hour, when the involved DM agencies failed in their rescue efforts to retrieve the trapped and the chances of their survival had become remote. This incident once again highlighted the inadequacies in DM response system.

The overall trend in the Country indicates that the **level of preparedness and response mechanism of the Centre, as well as the States is extremely uneven and requires considerable strengthening.** Inspite of having well defined institutional mechanism at National, State & district level, in form of NDMA,SDMA and DDMA, the **DM response remains inadequate** due to:-

(a) Some of the **Nodal Ministries** responsible for dealing with specific disasters, as per their charter, **lack expertise and orientation** to deal with charter specific disasters.

(b) Lack / absence of **efficient DM machinery** and **orientation** at State, District and local level, to fight disasters. **Absence of first responder capacity at the community level**.

(c) Absence of **appropriate plans for response** at the State & District level. Inadequate or zero investments by some States in creating response and survival infrastructure.

(d) Lack of **adequate competencies** and **capabilities** among disaster managers, especially at State and District level. Lack of coordination & training between various stake holders.

(e) Absence of **community participation** and **lack of awareness** about actions to be carried out at grassroot level, in face of calamities is main reasons for casualties.

(f) **Absence of clear mandate for Armed Forces** in DM Act 2005 precludes

optimum utilization of one of the main agencies employed in DM. and affects in its preparedness and response. Non inclusion of NGOs, private & public industries, civil society and schools in DM plans, results in non optimal utilization of resources and efforts, having an adverse affect on preparedness and response.

(g) Designated authorities not backed by professional response teams.

(h) Delay in mobilization of men, material and relief stores.

(i) Poor/lack of inventory management, leading to sub optimal usage.

Best Practices : Japan DM Response System

Japan being most prone to natural disasters in the world has evolved the best DM model in the world. The DM system of Japan has been studied in detail in this research and have reached to a conclusion that some of the best practices of Japan DM system are extremely relevant in our context and should be incorporated into DM mechanism, to make our system more robust and responsive. Some recommendations to overcome the shortcomings and to further strengthen and the DM response mechanism in India, are given in succeeding paragraphs.

Emergency Response System. Being one of the most disaster prone countries in the world, Japan has developed a sophisticated and all-embracing DM system, with particular emphasis on **enhancing a robust early warning & response mechanism**, with an aim to save lives and prevent loss of property. Some highlights are:-

(a) Japan is governed by a **three-tiered administration**; the national government, prefectures, and municipalities. **It is the direct responsibility of municipalities to carry out emergency response operations**, such as fire fighting, rescue, ambulance service within its territory, whereas prefectural governments are authorized to render assistance. National government and its relevant bodies oversee the whole coordination process during the phase and provide local governments with necessary information about the hazard while local governments provide the national government agency with the damage information and if the scope of the disaster elevates beyond the response capabilities of the municipality puts in action its own disaster response forces. Depending on the scale of the disaster, **adhoc emergency headquarters** at all three levels, as well as **on-site response headquarters are established**.

(b) The national government collects disaster information at the Cabinet Information Collection Centre (CICC), 24 hours a day. At the time of a large-scale disaster, the designated emergency response team comprising of the director-generals of the respective ministries and agencies, assemble immediately at the **Crisis Management Centre in the Cabinet office to analyze the disaster situation and to decide response level, depending on level of disaster**. According to the level of damage, the government may establish a **Major DM Headquarters**（headed by the Minister of State for DM） or an **Extreme DM Headquarters**（ headed by the Prime Minister). Additionally, a government investigation team headed by the Minister of State for DM may be dispatched, or an on-site DM headquarters may be established.

(c) Actions at national, prefectural and municipal are taken in concerted and coordinated manner and supervised at the highest level. Such a hierarchical system and distribution of responsibilities is likely to ease the burden each involved body enabling each of them to manage specific issues with more engagement and efficacy given the high frequency of natural disasters in Japan.

(d) **Community based DM response** in encouraged in Japan to mitigate loss of lives and the **DM education** is laid emphasis for the school and college children, for increasing awareness and ensuring prompt response in event of an crisis,. Emphasis remains on creating volunteers from the communities, to have effective first responder capability.

(e) **Medical Response**. **For life saving, an initial 72-hour period for rescue** is taken as a parameter for planning**.** Accordingly, JMATs (Japan Medical Association Teams) and DMATs (Disaster Medical Assistance Teams) are inducted into the disaster hit areas, pooled in from other parts of the country, during the initial 72 hours for relief and rescue. As a rule, one or more **disaster base hospitals** are set up in every secondary medical zone. These hospitals are designed to withstand various disasters with reinforced earthquake resistance. Currently there are 695 designated hospitals across Japan that can act as bases.

RECOMMENDATIONS TO STRENGTHEN THE DISASTER RESPONSE MECHANISM

Overall Strategy: Strengthening DM Response Mechanism. A holistic and integrated approach needs to be evolved towards DM, with focus on building partnerships and promoting

synergy at various levels for institutionalizing a synergized and a prompt response mechanism. The **primary aim of response during a disaster** is to save lives, protect property, environment and meet basic needs of humans and other living beings, after the disaster. To strengthen our **DM response mechanism,** our country needs to focus upon:-

(a) **Promoting Community based DM**, including last mile integration of the policy, plans and its execution. Focused efforts at grassroot levels.

(b) Formulation of **DM Plans at State & District & Block levels** & their periodic review & rehearsals.

(c) Ensuring efficient mechanism for **identification, assessment and monitoring** of disaster risks.

(d) **Capacity development of all DM agencies** at all levels to **effectively respond to multiple hazards**. Enhance **emergency response capacity** in field of Medical First Response (MFR), Collapsed Structure Search and Rescue (CSSR), Community Action for Disaster Response (CADRE), Hospital Preparedness for Emergencies (HOPE) & Swift Water Rescue (SWR).

(e) Developing state of art **Forecasting & Early Warning Systems and Search & Rescue capabilities**, backed by **fool proof communication systems**.

(f) **Preposition response & relief teams** in the areas, likely to be impacted and **carryout out preventive evacuation** of locals.

(g) Ensuring **efficient response and relief mechanism** at State and District levels, to prevent/ mitigate loss of human lives and their livestock. Maintain **reserve caches** disaster prone districts.

(h) **Undertaking mitigation measures** based on technology, traditional wisdom and environmental sustainability.

(i) Promoting a culture **of awareness, prevention, preparedness and resilience** at all levels, through education, knowledge and innovations. Improve the understanding of disaster risk, hazards, and vulnerabilities among the citizens.

(j) Building **disaster resilient structures** and **habitat** for ensuring safer living.

Need for a Four Tier DM Mechanism : Improving Disaster Response

Dealing with disasters during last one decade has shown that in a huge country like India with multi disaster vulnerabilities, the resources of NDRF and Army at national level need to be supplemented by resources at state & district levels. Thus, the need for a **four tier response mechanism**, to conduct operations; **firstly,** at **local community level**, with participation of local Gram Panchayat (GP), sensitized community, village/ local volunteers and NGOs; **secondly at Sub-Divisional level**, with participation of local police, Fire Services, NGOs and sub-division administration; **thirdly, at District/State administration level**, with participation of SDRF, Paramilitary Forces, Civil Defence, Home Guards available in the districts and **fourthly, at State/National level**, with participation of NDRF and other elements of government organizations and NGOs. The **international assistance received from various countries**, including from international organizations is a vital resource and needs to be incorporated into our overall DM plan, for its optimum utilizations and prevention of duplication of efforts.

In this **multi-level response mechanism**, organisations like NCC, NSS, and NGOs need to be integrated in the disaster response mechanism in the States, for a robust response. Equally significant is the **role of medical professionals** in ensuring prompt medical response and casualty management. Since **community members are the first responders in a disaster situation**, it is essential to create awareness and capacity of the communities, to improve the response mechanism and survivability. For this, the youth need to be trained at the panchayat level on various emergency protective measures that need to be taken during a disaster, including first aid training. **States need to lay emphasis on building community preparedness and first responder capacity at grass root levels**.

Strengthening Legal Framework: Improve DM Response

Inclusion of DM in Concurrent List. The DM lies under the **State list in the 7th Schedule of Constitution**. Though the prime responsibility to deal with disasters rests with the State, however, the Centre also plays an extremely important and active role in planning and execution, in all phases of DM. It is imperative that the complete synergy of efforts between the Centre and States is essential for synergized and swift response during a disaster. It requires national effort to mitigate the loss of lives, damage to property and rehabilitation. Keeping in view the importance of field of DM, the issue of **inclusion of this subject in the concurrent list** is extremely essential to strengthen the overall DM response mechanism at Centre & State levels.

Setting of DM Ministry: India. The MHA is overall responsible for DM in country. For certain specific types of disasters, various ministries have been designated as nodal agencies to coordinate the disaster relief initiatives in the country (**NDMA 2011**).The orientation, preparations and expertise to respond/deliver, varies in each Ministry and often results in inter ministerial blame games during crisis. During the floods in Kashmir, Chennai Floods or the Kerala Floods or latest Hyderabad Floods, the responsible ministry, i.e Ministry of Urban Development (MoUD) was found wanting in deal with floods in urban areas. Similarly, The Baghjan oil well fire in Dibru Saikhowa National Park in Tinsukia district in May 20 was finally plugged after five months, with help of experts from experts from Canada, US and Singapore and the specialist equipment flown from Canada. The Ministry of Petroleum and Natural Gas (MoPNG), the nodal ministry responsible for such disaster was found inapt in dealing with such a disaster. The recent Glacier Burst incident handling in Uttarakhand in Feb 2021, is one of the many examples to support the argument. On the other hand, Japan has a single ministry for dealing with all types of disaster, with support of affiliated ministries. In Indian context, we also need a **separate ministry to deal with DM**, which is ably supported by affiliated ministries, at the national and state level, for delivering an effective, coordinated and swift response, during a disaster.

Categorization of Disasters. Disaster/ crisis management should continue to be the primary responsibility of the State Governments and the Union Government should play a supportive role. The Act needs to provide categorization of disasters, local, district, state or national level. This categorization along with intensity of each type of disaster will help in determining the level of authority responsible for dealing with the disaster, as well as the scale of response by the NDMA.

Role of Community : Essential Stake Holder in DM. The community plays a key role and are the first responders during a disasters; this has been experienced worldwide and within. However, The DM Act, 2005 does not define "community" and their role, in face of natural disasters. During various interactions with experts and DM agencies, it is felt that the role of community needs to be clearly defined, being an essential stake holder, facing the brunt. In absence of a clear mandate and role for the communities, DM mechanism cannot be dealt comprehensively. Besides, one of the functions assigned to the district administration in the Act is to "facilitate community training and awareness programmes". **The mandate towards communities needs to be clearly brought in the DM Act, for effective, swift and resolute response, in face of a disaster.**

Inclusion of Clear Mandate for Armed Forces. As of now, the Armed Forces operate outside the existing framework of DM, as defined by the DM act of 2005. The DM Act 2005 does not give a clear role for the Armed Forces in DM mechanism. As a result, the Armed Forces are not involved in preparation and coordination with other DM agencies during pre-disaster phase, which is essential for delivering a coordinated, effective & swift response. Inaddition, owing to lack of mandate, the Armed Forces are not able to procure specialist equipment, which is essential for emergency rescue & relief. However, the Armed Forces in reality are invariably requisitioned, after a calamity has struck and the situation is beyond the control of the DM agencies. In the last decade, it has been observed the NDRF & SDRF were very often found to be inadequate and ill-equipped to deal with large scale disasters and the Armed Forces were requisitioned, post the calamities had struck. Due to lack of clear mandate, the Armed Forces function without adequate preparation, information of the area and specialist equipment, once requisitioned. In a developing country like ours, which is prone to frequent large scale natural disasters, the involvement of Armed Forces to fight the disasters cannot be obviated. It is therefore imperative that a clear mandate is given out for the Armed Forces, so that their role and task is formalised in DM mechanism. This serious systemic anomaly and needs to be addressed on priority and will facilitate the Armed Forces to prepare, coordinate and rehearse with other DM agencies at all levels, to deliver a robust and swift response. Inaddition, **MoD also needs to be made a Nodal Agency for DM for synergy & better inter ministerial cooperation, during a disaster response .**

Inclusion of SDRF & Role of State Police: DM Act 2005. States may be encouraged to accord priority to set up their own dedicated 'State Disaster Response Force', as suggested in the 'National Policy on Disaster Management' (2009). Union Government needs to include a provision for constitution of' SDRF in Chapter VIII of DM Act 2005. Though the act, **it needs to be made mandatory for every State to have its own SDRF**. It is also recommended that a **clear mandate and role of State Police** be given out in DM Act, so that the State Governments build the capacities of their State Police to deal with crisis / calamities, efficiently & effectively.

Duties & Responsibilities: Voluntary Organizations. The DM Act 2005 does not give out the duties and responsibilities, including their rights in respect of other stakeholders, such as NGOs, Self Help Groups (SHGs) and volunteers. There should be an appropriate provision in the Act, listing out the duties and responsibilities of these voluntary organizations, as also their rights, such as obligation of government to organize training programmes for them, generate awareness and their recognition through issuance of identity cards for voluntary rescue workers etc.

Regular Review: DM Acts / Mechanism. Since the devastating earthquake and tsunami in 2011, **Japan has revised its basic disaster prevention law, three times over the past seven years to improve it DM response**. Similarly, DM plans in India at the national, state and district levels need to be revised periodically, based on lessons learned from other disasters in and outside the region. This will ensure cogent and robust response for our DM agencies at Centre & State level. The DM plans be reviewed and updated as indicated below:-

(a) Major review and revision after each major incident.

(b) After significant change in operational resources (e.g, policy, personnel, organizational structures, management processes, facilities, equipment).

(c) Subsequent to any notification or formal update of planning guidance or standards.

(d) After every case of plan activation in anticipation of an emergency.

(e) After the completion of major exercises.

(f) Change in the district's demographics or hazard or threat profile.

Role of NDMA vis-à-vis MHA. There is a requirement of clarity in roles of NDMA vis-à-vis MHA. The role of **NDMA has been primarily envisaged in pre-disaster aspects like mitigation, preparedness,** etc, while **MHA is primarily perceived as responsible for response & relief**. The command and control of NDRF, whose main function is in the response phase, vests in NDMA. Based on tasks assigned to NDMA, which include laying down and approving policies, guidelines, formulation of national plan, coordinating enforcement and implementation of policies and plans, international cooperation and laying down broad policies and guidelines for NIDM, it may be **more appropriate to call it *National Disaster Mitigation Authority,*** with '**response' being the responsibility of MHA**. *The functions of NDMA and MHA need to be clearly defined in the Act itself, so as to remove any possibility of confusion.*

Composition of NDMA. Besides Chairperson and Vice Chairperson, NDMA has eight members. It is recommended that at least four of these eight members should be DM professionals with proven track record.

Strengthening of NDRF. Under DM Act of 2005, NDRF was raised in 2009, as a specialist force to respond to natural and manmade disasters. By virtue of its design and

capability, the response time during disasters has been reduced substantially, with the concept of **'Proactive availability' to States' and 'Pre-positioning'**, in threatening disaster scenarios. During the last decade, the force has proved itself to deliver professional and coordinated response to wide array of natural and manmade disasters. However, their response to large scale disasters has still been found wanting, due to lack of strength and availability of specialist equipment for rescue and relief operations. Some of the other shortcomings noticed are; the limited logistic capabilities, lack of permanent cadre, existing personnel unsuitable for its role, rotation of police personnel (5 year rule), lack of modern training facilities & infrastructure, lack of specialist leadership and continuity and lack of exposure to international training and functioning with the Armed Forces. For making the NDRF more responsive & effective, following are recommended:-

(a) The ambiguity with respect to command and control of NDRF, between MHA & NDRF needs to be clarified, for their optimal preparedness & utilisation.

(b) Provision of state-of-the-art equipment, required for rescue and relief operations.

(c) NDRF must have a permanent cadre to retain the skilled/ trained manpower for specialised operations. Need for retention of young motivated men in the response force.

(d) Provision of logistic capabilities for making NDRF self contained during operations.

(e) Need to strengthen our response capacities to handle CBRN emergencies.

(f) Regular specialist training of NDRF personnel, including sharing best practices with other international agencies, involved in DM.

(g) Regular interaction and training with the Armed Forces, to build mutual understanding and synergy.

STRENGTHENING : FORECASTING & EARLY WARNING SYSTEMS

Forecasting and Early Warning Systems: Improving Response.

While IMD and CWC have improved the existing systems to forecasting and providing early warning of cyclones, floods and tsunamis to a large extent, the dissemination of warnings /

alerts on real time basis have not really trickled down to community level in remote villages/ areas. Odisha is the first state in the country that has implemented an **Early Warning Dissemination System (EWDS).** It covers 1205 villages in six coastal districts of the state, which are prone to cyclones, floods and tsunamis, based reliable communication system. This system integrates technologies such as digital mobile radio; location based alert systems, remotely operated siren systems. The EWDS system helps in disseminating warnings / alerts, simultaneously from the state, district and block levels in different forms like messages, voice, siren, etc. All cyclone bulletins and warnings messages are shared real time with SDMA, EOCs, DM agencies and locals in remotest villages. Inaddition, OSDMA in collaboration with Regional Integrated Multi-Hazard Early Warning System (RIMES) has also developed a web and smartphone based platform, known as "SATARK" (System for Assessing, Tracking and Alerting Disaster Risk Information based on Dynamic Risk Knowledge). The application provides real time watch, alert and warning information for different hazards. These initiatives have substantially reduced the loss of lives and property during cyclones.

Similarly, it is extremely necessary to **establish state of art and reliable forecasting and early warning systems** for all types of disasters in all coastal states. The nodal agencies responsible for monitoring and carrying out surveillance, for specific natural disasters, need to identify technological gaps and formulate projects for their upgradation, in a time bound manner. All States need to provide India Meteorological Department (IMD), the required infrastructure for upgradation / establishment of meteorological observation systems. Partnership with the World Meteorological Organisation (WMO), Pacific Tsunami Warning System and other regional and global institutions is important for receiving / sharing real-time information on cyclones & Tsunami. Emphasis needs to be laid to improve the existing systems for dissemination of warnings from State down to community level.

Use of Technology : Improve Disaster Response. With technological advancements such as Artificial Intelligence (AI) and Machine Learning (ML), it is easier for the scientist to process and interpret a large quantity of weather related data and accurately carryout weather predictions and its impact on population. Recently experts at Cornell University developed a programme based on AI, which is able to better forecast "slow-slip earthquakes." Similarly, latest technologies are being used to forecast heavy rains or storms that can create flood situations. Likewise, predicting heat waves is becoming increasingly important around the world, as their frequency is growing and they not only cause the loss of human lives, but also cause health issues, increase economic spending, affect agricultural production and energy demands.

Forecasting models use complex algorithms that can assess the onset, duration and demise of upcoming heat waves. One such model was developed in India, at the Indian Institute of Tropical Meteorology. AI can help technologists better interpret data and create forecasting models that can automatically alert authorities in advance. It is recommended that our country needs to utilize latest technologies and invest in research & development, to create capability to predict and forewarn about the natural calamities, such as earthquakes, cyclones, tsunamis, droughts, heavy rains and floods. Early warning / prediction about such calamites will help us to prepare better and improve our response system to deal with them.

Risk Assessment and Vulnerability Mapping. Hazard zonation, mapping and vulnerability analysis in a multi-hazard framework is recommended to be carried out of the entire country, using Geographic Information System (GIS) based databases, such as the National Database for Emergency Management (NDEM) and National Spatial Data Infrastructure (NSDI). National DM agencies. DM authorities at the State and District levels need to carry out risk and vulnerability assessment of all disaster prone areas, so that effective and robust DM plans.

Strengthening of the Emergency Operations Centers (EOCs), Incident Response Teams (IRTs) & Medical Emergency Response Teams (MERTs). The establishment of Emergency Operations Centres (EOCs) at the Centre, State, District level & Metros, equipping them with the modern technologies & communication facilities needs to be accorded priority. For the last mile connectivity and control of the operations at the disaster hit areas, availability of portable platforms need to be incorporated. The integration of satellite communication, underground optical cable communication into DM communication system, will ensure seamless passage of information. Likewise, State Governments need to keep fully trained, operationally ready IRTs and MERTs at State & District level, for quick response.

Integrated Control Room for Emergency Response (ICR –ER). ICR-ER has been recently commissioned at MHA with the assistance of ISRO, to immediately respond to the people in distress during natural calamities. The MHA has set up ICER-ER to address the requirement of getting disaster information on near real-time basis, carryout strategic level monitoring, situation awareness and for command and control to provide and emergency response in the diverse internal security situations and disaster related emergencies. ICR-ER will facilitate in increasing the operational effectiveness and will be helpful in rendering timely response / assistance during various emergency situations. It is recommended that the States also need to establish such mechanism and could be integrated with the SEOCs & DEOCs, in the

States and Districts for improve situational awareness, better planning and delivering a synergized and swift response (**NDMA, 2020**).

STRENGTHENING OF DM MECHANISM STATE, DISTRICT & LOCAL LEVEL : IMMEDIATE RESPONSE

As observed by the PK Mishra task force **(NDRF 2014)**, there has been little or no progress strengthening the DM mechanism, including efforts to capacity building at State, District and local levels. Although, 31 DM Centers have been established in states and additional 11 Centers are in the process of being set up and despite the fact that most of the DM Centers have been functional for more than one and half decades, the performance of these DM Centers, except few, has left much to be desired. **(Seads, 2014).**

In most of the States, disaster response / contingency plans at the State, District / local level, hardly exist. At the grass root levels in most of the States, there is complete lack of awareness & sensitiveness on the subject and there is hardly any functional government DM machinery existing, leading to disastrous consequences in face of calamities. Some States like Gujarat and Orissa established SDMAs, prior to the DM act 2005 and have developed excellent resilient capacities. However, majority of the states have poor capacity for handling disasters. From a child falling in to a drain, to building collapses, to cap oil well fires, to accidents in industries and to deal with cyclone and floods, sates invariably rely on central assistance, both in form of NDRF and mitigation & rehabilitation funds. Some recommendations to **strengthen the DM response mechanism in States**:-

Creation of Functional SDMA & Formulation DM Plans : States. The prime responsibility of dealing with disasters lies with the States and they need to develop their own response potential progressively and complete the process at the earliest. However, most of the states have non functional / adhoc SDMAs, with its members in ex officio capacity, barring few states like Bihar, Odisha, Sikkim and Gujarat, which have fully functional SDMAs; the SDMA of these states having a exclusive secretariat, with full time members **(Seads, 2014)**.

All the State Governments need to give impetus on creating **functional & efficient SDMAs** in their respective states and lay down their own policy frameworks, based on their vulnerabilities, consistent with the National Policy. **SDMAs need to have a exclusive secretariat**, under Section 16 of the Act. The State Governments need to focus on formulating

their disaster / crisis management plans at the State, District & Block level. Inaddition, the SDMA and other agencies involved in DM in the state need to **regularly meet to review and update their DM plans and carryout regular rehearsals & mock drills**. The States need to put in all efforts to fully **operationalise their DM Centers** and integrate them with EOCs at district and block level. State Governments, also need to focus on training and equipping of state response forces, community preparedness & **creation of 'response caches' at the district / block level** (fresh water, rations, medical survival kits**)**. States must lay efforts to **create adequate Search & Rescue capabilities**, to mitigate loss of lives. Emphasis needs to be laid on strengthening the **DM machinery at the grassroots,** with the participation of local population, for swift response. The NDMA and SDMAs need to network with the corporate entities to strengthen and formalise their role in the DM process for ensuring safety of the communities.

Need for Dedicated SDRF: States. The States need to have their own dedicated SDRF, as the central forces may take time to reach the disaster site, whereas, the SDRF & local Police have the advantage of **arriving first at the location and play an extremely essential role in preventive evacuation of locals**. These forces have advantage of being well conversant with the terrain, language, local sensitivities and resources, besides having a well developed communication system. The SDRF units need to be stationed in all vulnerable districts for speedy response. The task of SDRF during disasters would be to carry out preventive evacuation, reduce casualties, clearance of channels of communication, quick deployment of personnel & equipment and support institutional arrangements. During other times, the SDRF units need to be utilized for capacity building of communities, awareness generation, besides conducting rehearsals/ mock exercises for natural and manmade disasters, along with other DM agencies. The SDRF would only be operationally effective, if it is a dedicated force for disaster related duties only and is trained & equipped on the lines of NDRF. The SDRF personnel need to have a fixed tenure of at least 5-7 years for permanency. As of now, 22 states have issued Gazette notification to constitute SDRF, but so far only 12 states have SDRFs in place **(Vif India, 2016)**. States like Bihar, Odisha, Gujarat, Assam and Mizoram have raised efficient and reliable SDRF and others need to follow suit. **Providing NDRF trained officers on deputation to SDRF** would facilitate training, equipping & operationalisation of SDRF in the States. **MHA may consider taking a policy decision on such a deputation policy.**

Capacity Building : State Police

Local police being closest to place of impact and have advantage over other DM agencies, in terms of their proximity to an incident, organizational capability, terrain & demographic information and authority to command people & resources. Local police with a well developed communication system could respond within no time, whereas specialized outstation forces have costs in terms of time lag, which may be critical many a times. Thus, the local police also plays a vital role of facilitator/ bridge between the community and the outside responders. It has been experienced that even though local police gets actively involved in disasters, their performance has been found to be wanting during crisis, due several reasons, including absence of clear mandate of their role in DM and lack of training & equipment. Therefore, it is essential that local police at field level, who are first to respond, are fully involved in the preparation of the local crisis/disaster plans and are trained to handle all types of crisis anticipated in their area.

The National /State DM Act, State Police Acts and policies do not provide a clear role and responsibilities of police, which is absolutely essential for effective response. Off late, some States Governments have enacted new Police Acts that have included DM function as one of the core function. Kerala Police Act 2010 was the first to specifically mention responsibilities of police in a disaster. It is recommended that the local police are legally empowered to command people and their resources to support them, as District Magistrate has been empowered under National DM Act, it will result in better response. National / State DM acts need give *out a clear role of local police in DM, as also empower them to command local resources including manpower*. The State Governments need to undertake earnest efforts to build the capacities of the State Police, to effectively & efficiently respond during a situation of crisis.

Medical Emergency Response

Medical preparedness is a crucial component for any DM Plan. There is a need to provide effective and efficient medical care in first 72 hours of a calamity, to safe valuable lives, thereafter the chances of saving become grimmer, as the time elapses. On lines of the Japan model of providing cover, there is a need of setting up **disaster base hospitals** (earthquake / flood resistant) in all disaster prone areas, create pool of **Medical Emergency Response Teams (MERTs**) in all states and also establishing an EMIS (Emergency Medical Information System). The MERTs from the entire country can be inducted into the disaster hit areas, as per requirement. Some teams could be deployed, preemptively, in face of likely calamity. Regular mock drills / rehearsals need to be carried out in normal time for optimum results.

Mobile hospitals and heli-ambulances for evacuation of patients is a crucial component of DM efforts. The Accident Relief Medical Vans (ARMVs) of the Ministry of Railways stabled at stations every 100 km, can be utilized for emergency medical response by the State and District authorities during calamities. The **mobile Army Hospitals** can also be requisitioned for beefing up medical resources. Proper and speedy disposal of the dead bodies and animal carcasses deserves attention, to prevent any pandemic.

Raising of IRTs & SEOCs / DEOCs: States. It is essential that the first responders and relief reach the affected areas in the shortest possible time. Often, there are inordinate delays due to location inaccessibility, nature & severity of disaster and due to inadequate preparedness. In many situations, even a delay of six to twelve hours will prove to be too late or unacceptable. The State Governments need to create fully operational EOCs at State, District, or block level and ensure fool proof communication, to alert and disseminate warnings to locals. Likewise, the States need to raise IRTs at State, District and Block level, for rapid deployment and quick response, in face of calamities.

DDMAs : District Level. Despite the fact that DDMAs have been assigned a key role at district level, combining the roles assigned to SDMAs and SECs at State level. The **DDMAs, though constituted in most of the districts, are virtually defunct. (Seads, 2014)** District Magistrate / Deputy Commissioner is the head of DDMA in a district. He is the focal point for preparation of the district level plans and for directing, supervising and monitoring relief measures for the natural disasters. However, the District Magistrates are too busy with their regular work assigned to them and barring disaster situations, they have no time to perform the functions assigned to DDMAs. Inaddition, **DDMAs are not provided with any secretarial assistance** and in the absence of a dedicated secretariat for DDMAs, it is difficult to ensure that the statutory responsibilities are carried out, as mandated. Further, most of the district level officers, including District Magistrates and Chief Development Officers have no training or experience to deal with disaster situations. To make the DDMAs effective, following are recommended:-

(a) DDMAs must have a **compact secretariat,** which should function throughout the year to ensure that the mandated functions assigned to DDMAs are performed diligently.

(b) District Forest Officer or any suitable officer may be nominated at the district level to coordinate and oversee regular meetings and rehearsals on behalf of District Magistrate, at district level.

(c) The number of **members of DDMAs may be increased** by amending the Act, to enroll 2-3 DM specialists as members for specialist advice/guidance for formulation of DM plans and its execution.

(d) DDMA must **create infrastructure / capability** for quick and robust response:-

(i) The **district emergency response plan** should be prepared in consultation with all concerned. The plan should be known and accepted by all the agencies. **This should be apart of the District DM management Plan**. Both plans at District & Block level need to be prepared, rehearsed and updated regularly.

(ii) Functional **EOCs** at District & Block level with **foolproof communication** for seamless connectivity.

(iii) Capability to establish **mobile EOCs & Adhoc HQs** at the impact location, for taking control of rescue & relief activities, command & control, situational awareness and to reduce time to provide emergency response.

(iv) **Forecasting** and **Early Warning Systems** and multiple **Alarm System t**o alert the local in the remotest villages. (On lines of Odhisa Model).

(v) Adequate **Search & Rescue capabilities** need to be created at District level to mitigate loss of lives.

(vi) **IRTs** and **MRTs** for quick response at the impact site.

(vii) **Cyclone / Flood Shelters** in the coastal / flood prone areas for locals, including for livestock.

(viii) Provision of **'response caches' at the district / block level** in disaster prone districts. Response caches to include fresh water, rations, medical survival kits and some survival equipment.

(e) The **prepositioning of the NDRF/ SDRF at anticipated place of impact** will assist the states in quicker response to any crisis. This guiding principle needs to be incorporated in all DM plans,

(f) To make the DM plans work at grassroot level, the role of community and their ability to support the state machinery at the impact site during natural disasters is extremely essential. DDMAs need to focus on **encouraging community participation and raise volunteer force at grassroot level for functioning as first responders.** The **NGOs and other private industries / agencies need to be enmeshed in DM plans** for economy of effort & response.

(g) **Standard operating procedures** need to be developed for each disaster at the district and community level, keeping in mind the disaster vulnerability of the area. DM plans at all levels should have handbooks, checklists, manuals with precise instructions for DM personnel, search and rescue teams, IRTs, MRTs and EOCs.

(h) **Unity of command** should be the underlying principle for effective rescue operations and optimization of resources. In a district, all agencies of Union and State Government need to work under the leadership of the District Collector for optimization of efforts. Such unity of command principle should pervade at all field levels.

(i) Provision of a **Mitigation Fund at district level** to enable the District Collectors to take up limited intervention programmes in normal times.

(j) **DM training / refresher** courses to be conducted for selected officers of DDMA and other agencies, including District Magistrates and Chief Development Officers.

(k) A statutory provision needs to be included in the DM Act to **provide for a post of Block Disaster Management Officer in each block** and these officers should be available for DM work throughout the year.

DM by at Village / Panchayat Level . As per the definition of the 'local authority' in the DM Act, 2005, it includes "panchayati raj institutions, municipalities, a district board, cantonment board, town planning authority or Zila Parishad for rendering essential services or,

with the control and management of civic services, within a specified local area" **(Seads, 2014).** As per the act, the 'local authority' needs to ensure that its officers & employees are trained for DM and resources relating to DM are so maintained as to be readily available in the event of a disaster. Inaddition, 'local authority' is legislated to ensure that all under construction projects within its jurisdiction conform to the specifications laid down for prevention & mitigation of disaster and in entrusted to carry out relief, rehabilitation & reconstruction activities in the affected area, in accordance with the State and District Plans. However, despite these statutory provisions, the involvement of GPs and other local government institutions is lacking or nonexistent. These local institutions can play a very effective role in generating DM awareness, undertake advocacy with district officials for mitigation measures in their respective villages and assist in distribution of relief. It is therefore necessary to involve GPs in all facets of DM. This institutional mechanism, though available at village level with statutorily mandated responsibilities is by and large being ignored by the States. This requires urgent attention.

Prepositioning of Rescue Teams & Timely Evacuation of People. The prepositioning of rescue teams & timely evacuation of more than 200,000 people from the affected coastal areas of State of Odhisa & West Bengal during Cyclone Amphan, resulted drastically reducing the casualties. Cyclone preparations & evacuations of local began as soon as the alerts were issued by the IMD and restoration efforts were undertaken on a war footing. **Proactively pre-positioning of rescue teams & timely evacuation of locals from the likely areas of impact will improve the DM response mechanism** and drastically reduce the casualties and damage to property. It is recommended that these two aspects need to be made guiding principles to formulate effective and responsive DM plans.

Enhancing Emergency Response : Disasters. To enhance emergency response capacity, training in Medical First Response (MFR), Collapsed Structure Search and Rescue (CSSR), Community Action for Disaster Response (CADRE), Hospital Preparedness for Emergencies (HOPE) & Swift Water Rescue (SWR) and Training for Instructors (TFI) needs to be undertaken. States need to coordinate with NIDM/NCDC to train and maintain skills of their response forces and simultaneously build institutional capacity in terms of SOPs, equipment, evacuation procedures, etc. The IRTs, SDRF, local police, Home guard and Civil Defence personnel and can be trained by NDRF and they can supplement the efforts to train state agencies and local volunteers at grassroot levels to build capacities. During the non-disaster periods, *NDRF/ SDRF personnel need to carry out mass awareness and mock drills to fine tune SOPs with state agencies and volunteers, including locals.*

Creating Disaster Resilient Infrastructure. The State of Odhisa has constructed 879 multipurpose cyclone and flood shelters, along its 480 km long coastline, equipped with alarm systems, community kitchens and life-saving equipment. These shelters offer all services that are required during emergencies. Similar provisions exist for the livestock of the villagers. This has drastically reduced the number of casualties during cyclones/ floods. It is recommended that other States also need to **upgrade their rural infrastructure** and focus on **building disaster resilient infrastructure**, for quick evacuation & relief operations. The government housing schemes like the **Pradhan Mantri Awas Yojana** should incorporate designs that are made keeping natural disasters prevalent to that particular region in mind. It was a lesson learnt from Cyclone Amphan that we need to have **underground communication cables and electrification, especially in rural and coastal areas.** The *underground communication cables will ensure uninterrupted communication and underground electrification will facilitate in quick restoration of power supply, in the event of a disruption due to weather-related events.*

Setting up of Temporary Relief Camps. DDMAs, especially in recurring disaster prone areas, need to identify locations for setting up temporary camps for housing the displaced / homeless. Agencies to supply the necessary stores and equipment need to be identified in the pre-disaster phase. The use of premises of educational institutions for setting up relief camps need to be discouraged. The temporary relief camps need to have adequate provision of drinking water and bathing, sanitation, rations and essential health-care facilities. Response teams and volunteers would need to set up community kitchens for providing food, provide medical support including psychological counseling in relief camps and education to children through the restoration of schools and anganwadis.

Coordinating Relief. Effective coordination is essential at the district and sub-district levels for rescue / relief operations and to ensure proper receipt and provision of relief. Following are recommended:-

(a) During rescue and relief operations, unity of command should be ensured with the District Magistrate in total command.

(b) Provision of safe drinking water, food, medical aid and sanitized living conditions should be given priority.

(c) Trauma care and counselling should be made an integral part of the relief operations.

(d) All procurement and distribution of relief materials should be done in a transparent and fair manner. Monitoring and vigilance committees should be set up involving the stakeholders. These committees could also look into grievances.

(e) There is urgent need to evolve objective methods of assessing the damage so that there are no allegations of bias, distortions, exaggeration or arbitrary scaling down. Satellite imagery could be used as a tool to validate the reported damages. *NDMA should be requested to draw up the necessary detailed guidelines for assessment, to be followed by all authorities.*

MGNREGS to Mitigate Vulnerabilities : Villages & Communities. The *State Governments need to efficiently utilize MGNREGS scheme to reduce their vulnerabilities of their villages* against natural hazards such as floods, droughts, landslide etc. Odhisa Government is very effectively utilizing the scheme to mitigate vulnerabilities of its villages, as also creating livelihood. Some of the initiatives that can be undertaken to remove vulnerabilities, as also ensure livelihood security, are:-

(a) Expand and strengthen drought proofing activities.

(b) Strengthening of flood protection structures within the villages/Panchayat.

(c) Undertaken works related to removal of river siltation.

(d) Undertake plantation works for preventing river erosion/incursion as well as landslide mitigation;

(e) Create structures to regulate flow of rainwater.

(f) Construction of various community assets/structures under the Scheme.

Crisis Management Set Up for Metropolitan / Large Cities. Disasters in urban areas are distinct in many ways and their impact of damage is very high, warranting effective DM response. Of late, there has been an alarming increase in disasters in urban areas. There is a need to have effective & prompt disaster response plan in place in all metropolitan / larger cities in the country. *An appropriate amendment may be made in the DM Act, 2005, to give the legal mandate for DM to Municipal Corporations* in megacities having jurisdiction over more than one district. The Mayor, assisted by the Commissioner of the Municipal Corporation and the Police

Commissioner should be directly responsible for crisis management. Action plans for preventing unplanned urbanization and ensuring safer human habitat, against all forms of disasters need to be undertaken on priority. State Governments/UTs concerned need to accord priority for improving urban drainage systems, with focus on non-obstruction of natural drainage system, to prevent urban flooding. Urban mapping of infrastructure needs to undertaken for development of Decision Support System (DSS), for management of urban risks. Creating public awareness is extremely essential. Also, *search and rescue efforts in the urban areas also require specialized training and the DM agencies, including NDRF, SDRF and Fire & Emergency Services need to be equipped with latest equipment to deal with emergencies in urban areas.*

Capacity Building : Communities

Community by the virtue of being located in the place of disaster, are the first to respond. It is extremely essential that their capabilities are enhanced to make the DM response for robust and swift, during a calamity. The NDRF, SDRF, local police and Civil Defence need to be more active in building community awareness & their capacity. There is a need to focus on conducting school & colleges safety programmes to increase DM awareness and raise volunteers at the grassroot level. The vulnerability factor of a place needs to be kept in consideration, while working on the preparedness level. The following are recommended to increase the capacities of the communities:-

(a) **Civil Defence**. Being a community based organization, Civil Defence plays an extremely vital role in quick response during an emergency, as they are closest to the place of impact and can respond fastest, provided they are well trained. The Civil Defence volunteers have a good understanding of local hazards, risks involved, damage potential and the consequences. They are also in a better position to respond with local resources and equipment and determine requirement for additional resources, including technical response and preparing the ground for directing rescue and relief aid in affected areas. The Civil Defence Act needs be amended, so as to cover all types of disasters. The States need to constitute Civil Defence in all districts and train them. Also, States need to initiate steps for **integration of Civil Defence in state disaster response mechanism and its utilisation in community capacity building.**

(b) **NSS & NCC**. The inclusion of youth in disaster response mechanism is crucial in building a global culture of safety and resilience. It is also a long term investment to protect and expand on hard earned developmental gains. The NSS & NCC students can

be trained by NDRF / SDRF and in turn, these youth train the community at grassroot level during normal times and during disasters *can function as first responders to coordinate and organize relief.*

(c) **Home Guards and Fire Services**. Fire services and the Home Guards at the field level, like local police are the first responders and should be adequately trained in handling crises/disasters. Such training should be specific to the types of crises envisaged in an area. More importantly, they should be fully involved in the preparation of the local crisis/ DM plans and also be fully conversant with them. A section of Home Guards should also be given para-medical training. **Fire Services need to be renamed as Fire and Rescue Services**, with an enhanced role to respond to various types of crises. At the national level, there is acute shortage of expertise and equipment to deal with major fire incidents. Priority attention needs to be accorded to training of personnel and procurement of modern equipment. Considering huge inadequacies in the field of personnel, equipment and training at all levels in the Fire services, a time bound action plan for upgradation of Fire Services needs urgent attention. *Fire and Rescue Services should be brought under the operational control of the SDMA / DDMA, under the gambit of DM Law. The NDMA may be requested for inclusion of these services in the DM Act.*

Community Awareness and Development. During most of the disasters like earthquakes, cyclones, tsunamis, etc the main reason for the high loss to life is due to ignorance of the affected populace about the actions which they are required to do. There are number of incidents, especially during earthquakes, wherein people due to panic moved inside the buildings and got buried in the debris. Therefore, concerted effort in this direction is a mandatory requirement. The community needs to be well informed about the physical features of their location / settlement and the hazard events they are likely to experience. Such a social consciousness about disasters leads to building an organization / network within the community for risk reduction.

State Government must **focus on community resilience**, as they are the **nearest to the site of the disaster and are the first responders.** The world over, *there is renewed focus on community as the pivot of all DM activities. NDRF, SDRF and Civil Defence need to be more active in building community awareness.*

Role of Local Self-Governments, Public & Private Entities & NGOs. State Governments need to incorporate provisions in the State DM law to provide a well defined role to the Municipal bodies, Panchayat raj institutions and NGOs. Agreements need to be signed at the local level with private, public and NGOS, to coordinate and specify responsibilities for emergency response measures, rescue operations and evacuation plans. Assistance / services can be delivered as soon as a disaster strikes, even without a formal request or authorization from the local government. This will relieve the load on NDRF and ensure that the local government machinery is able to respond swiftly and efficiently. This model has successfully been implemented in State of Odhisa.

Documentation of Best Practices and Research. In the immediate aftermath of any disaster, field studies are recommended to be carried out, with the help of experts to identify gaps in the existing prevention and mitigation measures and also evaluate the status of preparedness and response. Similarly, the lessons of past disasters also need to be compiled and documented. The recovery and reconstruction process are also recommended to be analysed for further refining the DM processes and training needs. *NIDM needs to develop a reference book for the development of case studies and documentation of best practices in a professional manner*. This knowledge needs to be disseminated to States / Districts and also shared with international organisations.

Strengthening of NIDM. NIDM needs to continue to function as an autonomous body and function as an apex professional institution in DM. In addition to research and studies, the institution needs to engage itself in documenting and disseminating global and national best practices and in developing planning, training and evaluation methodologies. For this, NIDM needs to be strengthened adequately. It is at present focused on organizing training programmes only and its other functions as laid down in the Act are getting relegated. NIDM is not merely a training institute, it has to perform several other functions also such as research and education, documentation, development of national level information base, extending professional and policy support to Central and State Governments and State Training Institutes etc. The institute should only concentrate on training of policy makers and Master Resource Persons/ Trainers and not focus on organising a large number of training programmes. It should extend support to State level training institutes/centers by developing trainers and training modules. NIDM needs to extend support to State level training institutes to develop State Training and Capacity Development Policy, Training Infrastructure, training modules for all stakeholders,

Documentation of past disasters and development of case studies and process for selection of participants.

National Disaster Response Academy. A dedicated training institution of international standard is essential for regular training of a specialist disaster response force, like NDRF. MHA had given, in principle, approval of setting up a national level training institution long back, meant for training of trainers of NDRF, SDRF and also trainees of SAARC countries. 150 acres of land was acquired at Nagpur, three years back and a proposal for construction was sent to MHA by the NDRF to set up this Academy. The approval for construction (100 crores) is still pending at MHA. This training academy needs to be built at the earliest. This Academy would not only help in enhancing the professionalism of NDRF and SDRF, but would also put India in a leadership position to impart training to responders of Asian countries, in the field of disaster response.

Quick Decision for International Deployment of NDRF in Emergencies. At present there is no mechanism for expeditious decision of international deployment of NDRF within 10/ 12 hours of getting the requisition from affected country. During the triple disaster in Japan in March 2011, the **NDRF team was dispatched 15 days after the disaster due to delayed decision by the Govt**. In this regard, a SOP, prepared by NDMA, was forwarded to Ministry of Home Affairs (MHA) in 2014. It needs approval of the Govt of India at the earliest.

Increasing Trend of Disasters in Urban Areas : Mitigating Measures

Critical Infrastructure. It is extremely essential that critical infrastructure like dams, nuclear and other sensitive installations, power stations, roads, bridges, flyovers, water storage towers, irrigation canals, ports and other civic utilities are built as per the laid down standards of that geographical area and constantly monitored for safety standards in consonance with worldwide safety benchmarks and strengthened, where shortcomings observed. The houses, buildings and other infrastructures in towns & villages need to be constructed, especially in high risk disaster prone areas, as per the standards laid down. Violations of the norms lead to large scale destruction and loss of lives. Since, India is a developing country and will be heavily investing in infrastructure sector, it is extremely essential that our country **actively leads the CDRI and focuses on creating disaster resilient infrastructure for sustainable development and economic growth.**

Environmentally Sustainable Development. Environmental considerations and developmental efforts need to go hand in hand for ensuring sustainability. Restoration of

ecological balance in the Himalayan regions and raising coastal belt plantations need to be incorporated wherever necessary in DM plans. Eco Systems of forests, islands, coastal areas, rivers, industrial environment and agricultural urban environment need to be taken cognizance of, for ensuring ecological balances and sustainable development. Zonal regulation must ensure the preservation of natural habitats. Therefore, *there is an urgent need to rehabilitate the mangroves on the coastline and carryout out massive afforestation drive in the drought & landslide prone areas, to prevent droughts and landslides / floods.*

Climate Change Adaptation. Climate change is impacting on our glacial reserves, water balance, agriculture, forestry, coastal ecology and bio diversity. There are definite indications that climate change would increase the frequency and intensity of natural disasters like cyclone, flood and drought in the coming years. In order to meet these challenges in a sustained and effective manner, *synergies in our approach and strategies for climate change adaptation and disaster risk reduction needs to be encouraged.*

CONCLUSION

"My experience in Gujarat shows that how so ever big a problem might be, it is not insurmountable if we have the will to act"

- Mr Narendra Modi, Prime Minister

Significant efforts to professionalize DM system have been undertaken by GoI and some of the States, post Gujarat Earthquake and Indian Ocean Tsunami 2004. Enactment of DM Act 2005, was a defining step, laying down a three tier institutional mechanism and providing for integrated approach to DM at National State & District level. Since then, substantial work has been carried out by GoI to cover the entire cycle of DM, including response and preparedness of response. Dedicated institutions for disaster response, early warning systems and emergency operation centers have been set up. All these concerted efforts have contributed to significant reduction in loss of lives and property in disasters in the recent years.

Emergency response to natural and manmade disaster has always remained a challenging task for the National and State Governments. While, India has a well defined institutional mechanism at National, State & District level in form of NDMA and SDMA & DDMA, but still our response during last decade has still been inadequate. It is due to various reasons, as highlighted in the Study, including lack of seriousness & awareness in most of the States to deal with natural & made disasters. It emerged during research that there is lack of adequate competencies and capabilities among various agencies involved in DM at State & District level, in most of the States. Inaddition, complete **absence of first responder capacity at the community level, lack of volunteers and neglect of essential stake holders at grass root level**, like Civil Defence and Fire Services have been the major reasons for poor emergency response. The poor response could also be attributed to lack of integration of the Armed Forces in preparedness & response and also due to non inclusion of Red Cross, NGOs, civil society, and schools in disaster preparedness and response.

In a huge country like India, with multi disaster vulnerability, there is **requirement of a multi level response mechanism** (four layered); the NDRF and the Armed forces at National level; SDRF at State level; Fire & Emergency Services, Civil Defence, State Police, Home Guards, NSS and NYKS etc at **District level and well aware community and volunteers at grass root level,. There is an urgent need for a matching state response mechanism at all levels (state/district/block/panchayat).**

India needs to invibe the best practices from the Japan's 'Emergency Disaster Response Model'. There is need to **establish DM Ministry at National & State Level** to deal with all types of calamities and a need to build a **Community based DM response mechanism, creating resilience at grassroots level**. **Capacity building** of State Police, Home Guards**,** Fire Services, Civil Defence, NCC & NSS volunteers, to **create effective first responder capability**, needs to be undertaken by the States. .

Our Country needs to lay emphasis on **building infrastructure for Advanced hazard tracking** of climatological and geological hazards, state of art modeling techniques and systems for **early warning of calamities** and **dissemination of information / warnings** to various stake holders, including local communities. There is requirement of establishing a **national public early warning system in the country**, on the lines of Japan response model, with last mile connectivity to alert / warn to villagers in remotest areas. State Governments need develop **Search and Rescue capabilities, reserve caches** in recurrent disaster prone areas and construct **disaster resilient infrastructure** to prevent loss of lives and property during calamites. There is a need to bring in **high end technology to increase our capacity in the domain of response** and for that we need to integrate all our key institutions such as Indian Institute of Technology, Indian Institute of Management and Indian Space Research Organization in the area of research & development.

Natural disasters will continue to bedevil the country. It is the collective efforts of the GoI and the State governments, along with the people's active participation, that will facilitate in delivering a synergised and a prompt response to mitigate the risks of disasters. The exploitation of technological advancements will enable predication of impending calamities and help the DM agencies to timely preposition rescue teams and carryout preventive evacuations of locals from the affected areas, thereby drastically reduce the loss of lives and damage to property. The growing scale, frequency and ferocity of disasters necessitate optimal employment of all national resources of which in terms of capability in the context of DM, Armed Forces remain unparalled. **If our nation is to evolve an overall framework that is responsive, capable of swift reaction and sustained operations, the Armed Forces will need to be integrated into the DM framework**.

REFERENCES

ADRAC,(2016). A Study on the Disaster Management Framework of Japan, by Chathura Liyanaarachchige of Asian Disaster Reduction Center: ADRAC.

AK Singh, I. (2016). *Disaster and Tsunami Management.* ISBN.

Asia Org, (2015). Disaster Preparedness and Resiliency: India 27 Aug 15 http:// www.give2asia.org/disaster-preparedness-and-resilience-india : Asia Org.

Austine Eapen,(2014). '*Uttarakhand Disaster—A Wake Up Call: A Case Study On Uttarakhand Disaster Response – 2013*'. Indian Journal Of Public Administration 302 / *Vol. Lx, No. 2, April-June 2014.*

Badhani N,(2016). Disaster Management and the Role of Armed Forces. *Research Paper*. Lucknow University: Badhani

CAG. (2013). *Report No. 5 of 2013 - Performance Audit of Civil Disaster Preparedness in India of Union Government, Ministry of Home Affairs.* New Delhi: CAG.

CAG. (2017). *Disaster_Management of Report No 4 of 2017 Performance Audit of Flood Management and Response.* New Delhi: CAG.

Chand, D. (2010). Armed Forces Response Plan to Disaster. *Centre for Land Warfare Studies*, 117: Chand

CDKN, (2016). Strengthening disaster risk management in India: A review of five state disaster management plans by Aditya Bahadur, Emma Lovell and Florence Pichon Climate & Development Knowledge Network (CDKN), Jul 2016: CDKN

CLAWS. (2014). *Disaster Management: Integrated Response Strategies.* New Delhi: CLAWS.

Commission, P. (2006). *Report on Working Group on Disaster Management for the Eleventh Five Year Plan (2007-12).* New Delhi: GoI.

CWC. (2007). *Water Data Complete 2005 and Central Water Commission.* New Delhi: Central Water Commission.

CWC. (2018). *STUDY REPORT Kerala Floods 2018.* New Delhi: Central Water Commission Hydrology Directorate.

Dagur, C. O. (2008). *Armed Forces in Disaster Management.* New Delhi: Centre for Land Warfare Studies.

Dangi, H. (2014). *Disaster Management: Humanitarian Logistics in Relief Operations.* Index International.

Davesar, R. (2018, December 11). *The Pioneer*. Retrieved February 04, 2019, from The daily pioneer:https://www.dailypioneer.com/2018/columnists/disaster-management-a-distant-dream.html

Disasters, C. f. (2018). 2018: Extreme Weather Events Affected 60 Million People. Geneva: UNISDR: Disasters

Fagel, M. J. (2015). *Principles of Emergency Management and Emergency Operation Centre.* Florida: CRC Press : Fagel

FEMA. (2019, January 30). *FEMA About the Agency.* Retrieved February 22, 2019, from www.fema.gov: https://www.fema.gov/about-agency: FEMA

Government of Bihar, Disaster Management Department. The State Disaster Management Plan. Bihar: Government of Bihar, Disaster Management Department.: Government of Bihar

Gandhi, P. J. (2007). *Disaster Mitigation and Management.* New Delhi: Deep and Deep Publications : Gandhi

Gautam, S. H. (2012). *Reassessing India's Disaster Management Preparedness and Role of Armed Forces.* New Delhi: Gautam.

Ghalavand, A. P. ((2014)). *Disaster Management and Strategies.* ISBN : Ghalavand.

GoI. (2001). *Manual of Disaster Management in India.* New Delhi: NDM Division Ministry of Agriculture. GoI

IDS, H. (2009). *Armed Forces Response Plan.* New Delhi: Headquarters Integrated Defense Staff : IDS

INSARAG. (2017, July 01). National Accreditation Process. Retrieved February 22, 2021, from www.insarag.org:https://www.insarag.org/capacity-building/national-guidelines: INSARAG

Japan, C. O. (2015). *White Paper on Disaster Management in Japan.* Tokyo: Cabinet Office, Japan Government.

Jagbir Singh (2007). Disaster Management: Future Challenges and Opportunities , Chapter 16.

Japan, C. O Disaster Management in Japan. *Disaster Management.* Tokyo: Cabinet Office.

John Walter, (2003). World Disasters Report 2003 (Focus on Ethics and Aid) June 1, 2003: John2003.

Juha I Uitto, R. S. (2016). *Sustainable Development and Disaster Risk Reduction.* Kyoto: Springer: Juha2016

Kapur, A. (2010). *Vulnerable India A Geographical Study of Disasters.* New Delhi: Sage Publications : Kapur.

Keelery, S. (2018, August 28). *The Statistics Portal*. Retrieved February 05, 2019, from www.statista.com: https://www.statista.com/chart/15242/key-data-regarding-the-severe-flooding-in-the-indian-state-of-kerala/: Keelery

MHA. (2005). *National Disaster Management Act 2005.* New Delhi: MHA.

MHA. (2011). *Disaster Management in India.* new Delhi: MHA

MHA. (2013). *Task Force Report on Review of DM Act 2005.* New Delhi: MHA

MHA. (2017). *Disaster Management Division MHA.* Retrieved February 04, 2021, from Disaster Management Division MHA: http://www.ndmindia.nic.in/constitution

MHA, (2018). "Disaster Management in India, A Status Report",published by MHA, 2008, p 71 accessed at www.mha.gov.in on 15 September 2020. (MHA2018)

Mishra, P. V. (2018, September 24). Kerala Floods Causes. *The Hindu*, p. 16: Mishra PV

Mishra, V. K. (1999). Role of Armed Forces in Natural Disaster Management. *Research Paper*. IIPA; Mishra VK

MJS.(2017), A brief on Drought 16 Aug 2017 by Ministry of Jal Shakti : MJS

Nazarov, E. (2011). Emergency Response Management in Japan. Asian Disaster Reduction Center, 47 : Nazarov.

NCDM, (2001). [1]Report of High Powered by Committee on Disaster Management by National Centre for Disaster Management, 2001: NCDM

NPDM. (2009). *National Policy on Disaster Management : 2009.* New Delhi: Ministry of Home Affairs : NPDM.

NDMP, (2019), National Disaster Management Plan, National Disaster Management Authority, MHA: NDMP.

NDMP. (2016). *National Disaster Management Plan.* New Delhi, MHA: NDMP

NDMA. (2008), *Vulnerability Profile of India*, published by NDMA in 2008: (NDMA)

NDMA, (2010). National Disaster Management Guidelines for Incident Response System , A publication of the National Disaster Management Authority, Government of India.: NDMA

NDMA. (2018). Kerala Floods. *Aapda Samvad September issue*, 10, MHA.: NDMA

NDMA. (2018). *NDMP-2018-Revised-Draft.* New Delhi: NDMA, MHA. NDMA

NDMA,(2020).Disaster Management in India, MHA, https://www.ndmindia.nic.in/images/pdf/disaster_management_in_india.. Pdf, Accessed on 01 December 2020.

NDMA, (2020), Incident Response System, NDMA, MHA: NDMA https://ndma.gov.in/sites/default/files/PDF/Guidelines/incidentresponsesystemjuly.pdf

NDRF, (2014). National Disaster Response Force: An Analysis, by A Shajahan. Project Study, Teri University, New Delhi: NDRF

NDRF, (2018). *National Disaster Response Force 05 Nov 2018*. Retrieved 20 Dec, 2020, from ndrf.gov.in: http://www.ndrf.gov.in/operations/kerala-floods-2018: NDRF

NDRF, (2018). *NDRF, 21 Aug 2018,* Retrieved November 25, 2020, from ndrf.gov.in: http://ndrf.gov.in/pressrelease/ndrf-saved-535-lives-and-evacuated-more-24600-marooned-people-flood-hit-kerala: NDRF.

NDRF. (2019). *ndrf.gov.in*. 02 February 2019. Retrieved 02 January 2021, from National disaster Response Force: http://www.ndrf.gov.in/about-us

NIDM, (2010). *Understanding Disasters,* NIDM Publication; p 4-6 accessed at www.nidm.gov.in on 30 September 2020: NIDM.

NIDM, (2013). Proceedings of the ' *National Workshop on Uttarakhand Disaster 2013: Lessons Learnt*'. Organized by NIDM on 19 Aug 2013. NIDM.

OSDMA,(2017). Odisha State Disaster Management Authority (OSDMA), Government of Odisha, 2017: OSDMA

Panda, R. (2012). Japan's Disaster Response Management ; Lessons for the World. *Jornal of Defence Studies*, 18.

PIB. (2017). *Seismic Zones.* New Delhi: Ministry of Earth Science.: PIB

PIB. (2018, August 23). *Press Bureau of India.* Retrieved November 24, 2018, from pib.nic.in: http://pib.nic.in/newsite/PrintRelease.aspx?relid=182031: PIB.

PIB. (2018, August 18). *Press Information Bureau.* Retrieved November 26, 2019, from http://pib.nic.in/: http://pib.nic.in/newsite/PrintRelease.aspx?relid=181944: PIB.

PIB. (2018, August 21). *Press Information Bureau.* Retrieved November 27, 2018, from http://pib.nic.in: http://pib.nic.in/newsite/PrintRelease.aspx?relid=182002: PIB.

PIB. (2018, August 24). *Press Information Bureau.* Retrieved November 27, 2018, from http://pib.nic.in: http://pib.nic.in/PressReleaseIframePage.aspx?PRID=1543908: PIB.

PIB. (2019, February 04). *Press Bureau of India.* Retrieved February 05, 2019, from http://www.pib.nic.i: http://www.pib.nic.in/Pressreleaseshare.aspx?PRID=1562584: PIB.

Pradhan, (2020). What Super Cyclone Amphan has taught us – NDRF chief explains, Times Now Digital, 26 May 2020: Pradhan.

Raj, A. (2008). Armed Forces in Disaster Response: Role Reappraisal. *CLAWS Journal*, 182: Raj A.

Reliefweb. (2011, April 13). *Japan Earthquake and Tsunami Update Wednesday, Assistance, Center for Excellence in Disaster Management and Humanitarian.* Retrieved February 13, 2019, from reliefweb: https://reliefweb.int/report/japan/japan-earthquake-and-tsunami-update-wednesday-april-13-2011: Reliefweb

Sahani, P. (2003). *Disaster Risk Reduction in South Asia.* New Delhi: Prentice Hall of India; Sahani P (2003).

Saleem, S. (2018, October 02). *graphoverflow.com*. Retrieved February 05, 2019, from graphoverflow.com: https://graphoverflow.com/graphs/kerala-flood-2018.html: Saleem, S

Saya, S. (2017, May 17). *Japan's International Cooperation on DRR: Mainstreaming DRR in International SocietiesOpen image in new window.* Retrieved February 13, 2018, from pringer Link: https://link.springer.com/chapter/10.1007/978-3-319-59469-9_14: Saya S

Security, D. o. (2019, January 30). *Careers at FEMA.* Retrieved February 22, 2019, from careers.fema.gov: https://careers.fema.gov/fema-corps: Security

Seads, (2014). Review of Institutions, Strategy for Standardisation & Mechanism for setting up of DRR Institute alongwith its Capacity Building Strategy, by Seeds Technical, 22 September2014: Seads.

Sharma, V. K. (2013). *Disaster Management.* New Delhi: Medtech.: Sharma, VK

Singh, D. (2016). Disaster Management in India and the Role of Armed Forces. *Research Paper*. Merrut University: Singh D

Singh, J. (2007). *Disaster Management: Future Challenges and Opportunities.* ISBN: Singh J

Sinha, P. C. (2006). *Disaster Vulnerabilities and Risks.* New Delhi: SBS Publishers and Distributers: Sinha PC

SAKDN,(2015). India Disaster Knowledge Network/Hazard Profile, 30 Jul 15 http://www.saarc-sadkn.org/countries/india/hazard_profile.aspx: (SAKDN 2015).

Srivastava,R (2019). IIPA Dissertation on Strength & Weaknesses and It's Synergy With The Armed Forces . IIPA: (Srivastva.R).

Srivastava HN, GD Gupta, (2006) Management of Natural Disasters in Developing Countries Delhi, 2006 (Srivastva 2006) :(Srivastava HN)

Times, E. (2018, July 14). *The Economic Times.* Retrieved February 21, 2019, from economictimes.indiatimes.com:https://economictimes.indiatimes.com/news/defence/government-assures-support-for-making-sdrfs-self-sufficient/articleshow/59040566.cms. Times. E 2018.

Toshinori, OGATA. (2016). Disaster Management in Japan by in Japan Medical Association (JMA) Journal, 2016: Toshinori

UNIDSR. (2016). *Disaster Management.* Geneva: UNIDSR.

UNIDSR,(2005).HyogoFrameworkforAction,http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf. 11 December 2015: UNIDSR

UNISDR.(2015). http://www.unisdr.org/we/coordinate/sendai-framework, dated 15 Dec 2015: UNISDR.

Uttarakhand SDMA, (2014). SDMP, Uttarakhand: Uttarakhand SDMA, Government of Uttarakhand; Uttarakhand SDMA.

Vif India, (2016). Revisiting India's Disaster Response Mechanism. *Vivekanand Foundation*, 50. Vinod K Sharma (2019). Disaster Management Book (Vif India2016).

Vinod K Sharma, MC Gupta, LC Gupta, BK Kamini,(2001), Manual on Disaster Management in India. NCDM, IIPA, New Delhi (Sharma & Gupta 2001).

WRR, (2014).World Risk Report published on 21 Oct 2014, by UNU-EHS and the Alliance Development Works/ Bündnis Entwicklung Hilft (BEH):(WRR, 2014).

Visits & Interactions

Visit to Sikkim State Disaster Management Autjority (SSDMA): 18 March 21. A detailed interaction was carried out with officials of SSDMA and the Chief Secretary, Sikkim 18 March 2021. during the Forward Area Tour (FAT) visit of APPPA 46 Course.

Interactions carried out with:-

(a) Lt Gen NS Bawa, Retd, GOC Uttrakhand, during Uttrakhand floods 2013. Was in-charge of Army Operations (Operation Surya Hope) .

(b) Shri VK Duggal, Member NDMA and chief coordinator of relief efforts during Uttrakand floods 2013.

(c) Gen NC Vij (Retd), former Vice Chairman, NDMA.

(d) Shri OP Singh, IPS (Retd), former DG NDRF.