

ROLE OF INDIAN ARMED FORCES IN
DISASTER MANAGEMENT :
CHALLENGES AND WAY FORWARD

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 **Air Commodore Kailas Gurao, VM** has pursued his research work and prepared the dissertation titled '**Role of Indian Armed Forces in Disaster Management – Challenges and Way Forward**' under my guidance and supervision. The same is result of research done by him and to best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. 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 (APPPA) of Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of **Air Commodore Kailas Gurao, VM** is worthy of consideration for the award of M. Phil degree of Panjab University, Chandigarh.

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LIST OF ABBREVIATIONS

ACIDS	Assistant Chief of Integrated Staff
ADGMO	Additional Director General Military Operations
ADPC	Asia Disaster Preparedness Centre
AESA	Active electronically scanned array
AFSPA	Armed Forces Special Protection Act
AOC-in-C	Air Officer Commanding in Chief
CBRN	Chemical, biological, radiological and nuclear
CISC	Chief of the Integrated Defence Staff and the Chairman, Chiefs of Staff Committee
CMG	Crisis Management Group
COSC	Chief of Staff Committee
CSSR	Collapsed Structure Search & Rescue
DDMA	District Disaster Management Authority
DGMO	Director General Military Operations
DM	Disaster Management
DNO	Director Naval Operations
DRR	Disaster Risk Reduction
EOC	Emergency Operational Centre
ESF	Emergency Support Functions
ETF	Engineer Task Force

HADR	Human assistance to Disaster Relief
HAM	Ham Radio
HPC	High Powered Committee
IDNDR	International Decade for Natural Disaster Reduction
IDS	Integrated Defence Staff
INCP	Interim National Command Post
INDU	Indian National Defence University
INSARAG	International Search and Rescue Group
MCE	Mass casualty events
MEA	Ministry of External Affairs
MHA	Ministry of Home Affairs
NBC	Nuclear Biological Chemical
NBCW	Nuclear, biological and chemical warfare
NCCM	National Centre for Calamity Management
NCDM	National Centre for Disaster Management
NCCM	National Crisis Management Committee
NDMA	National Disaster Management Authority
NDMP	National Disaster Management Plan
NDRF	National Disaster Response Force
NEC	National Executive Committee
NGO	Non-governmental organization

NIDM	National Institute of Disaster Management
NSET	National Society for Earthquake Technology
NSG	National Security Guard
PEER	Program for Enhancement of Emergency Response
PRI	Panchayati Raj Institution
QRMT	Quick Reaction Medical Team
SAR	Search and Rescue
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEC	State Executive Committee

CHAPTER I

INTRODUCTION

“The source of man’s unhappiness is his ignorance of nature.”

Paul Henry Thiry d’Holback

1. During British period and even after Independence Disaster management was considered as the administration of a country's disaster response. But focus changed during International Decade for Natural Disaster Reduction (IDNDR) from 1990 to 1999 and area of Disaster Management was widened to pre-disaster (Preparedness and Mitigation) and post-disaster (Relief, Rehabilitation and Reconstruction). Because of India’s unique geo-climatic circumstances, country has historically been vulnerable to natural calamities. It has had some of the most severe droughts, famines, cyclones, earthquakes, chemical disasters, train accidents, and traffic accidents in the world. Approximately 60% of the landmass is vulnerable to earthquakes of varying magnitudes; over 40 million hectares are vulnerable to floods; approximately 8% of the overall area is vulnerable to cyclones; and 69 percent of the territory is vulnerable to drought. These vulnerabilities are depicted in Fig 1 as below.

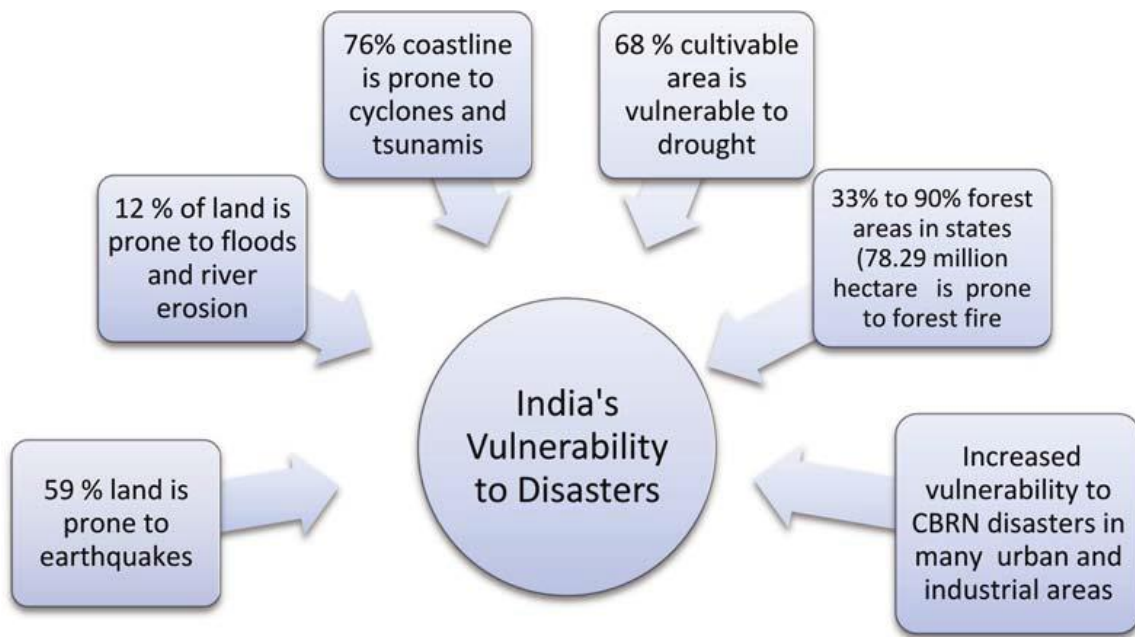


Fig 1 India's Vulnerability to Disasters
(Source :An-Inclusive-Appraisal-of-Community-Awareness paper)

2. In December 2004 Indian Ocean Tsunami ushered in a paradigm shift in India's approach to disaster management. The Disaster Management Act of 2005 established the National Disaster Management Authority (NDMA) to formulate policies and guidelines on disaster management, risk reduction, and disaster prevention, in addition to approving and coordinating the implementation of disaster preparedness and management programmes. The Government passed the National Disaster Management Policy in November 2009. This comprehensive policy document establishes policies for all aspects of disaster management in the country. As a result of these advancements, a variety of structures and procedures have been implemented at various levels. The Ministry of Home Affairs (MHA) is the main ministry in charge of disaster management coordination in the country. The ministry collaborates closely with the Ministry of Earth Sciences and the Indian Meteorological Department.

3. In the past, our response has always been reactive which focused on post disaster relief and rehabilitation and very little attention was paid to prevention, mitigation and preparedness and actions are needed to be undertaken by various agencies involved in provisioning and execution of aid. The armed forces of our nation are an important tool of response available with the government with the IAF being the fastest responder. Aside from its core responsibility of protecting our country's airspace, the Indian Air Force also provides immediate assistance to civil authorities when called upon during any natural or man-made calamity. The capabilities of an aerial platform make it ideal to reduce the effects of the disaster with much faster and farther impact over the affected people and areas.

4. Because of the large geographical size of the country, the government machinery often faces issues of accessibility and timely relief during disaster relief operations. The Indian Air Force aircraft and its personnel have proved their worth when employed for managing disasters in the past and have thus become a most desirable asset to any state government machinery at all the levels. The civil administration looks upon air effort in all their planning processes against any contingency and always falls back to the IAF in any emergency. The additional unique feature which also makes the armed forces called up for this task almost every time are dedication, rigorous training and the will to fight against all odds and keep the things going.

5. It was generally felt that there is greater awareness and urgency in all quarters now to effectively respond to any disaster in the country. However, the flash floods and landslides in Uttarakhand in June 2013 decisively proved the inadequacy of country's preparation to mitigate the disaster which resulted in colossal loss of life and material. The Uttarakhand experience also raises issues about the efficacy of our systems which were expected to be in

place by then. Therefore, there is a serious need to carry out a holistic review of our capability and capacities to undertake prompt and synergized disaster management.

6. There is a need to ensure integration of various Government agencies to ensure timely and efficient rendering of aid. One needs to identify actions to be initiated by various organizations especially Indian Air Force (IAF) and aid items required to be provisioned for various types of Disasters, well before their occurrence and recommending measures to deal with disasters with urgency and efficiency keeping Covid pandemic in mind. The Disaster Relief operations undertaken by the Indian Air Force, directly contribute towards nation building, aerial diplomacy and force projection.

National Security and Disaster Management

7. India, a developing nation, has its security concerns in the fast developing industrial infrastructure, its major irrigation and power projects, and surface communications that span a variety of terrain, including high altitude snow-bound areas which are highly susceptible to natural calamities. Any nation will harbour such concerns, if its land mass is vulnerable to natural disasters that can devastate its economic pillars with just one natural calamity. Natural disasters which undermine any of these entities, indirectly undermine national security. Disasters - whether natural or manmade - gravely affect day-to-day life; the rehabilitation process in their aftermath drains national resources and inflicts permanent scars on the physical and emotional fiber of a society. And therefore, not only does a nation need to have an alert ear to the ground to enable their timely prediction, but evolve a disaster management system which will preclude mass scale damage to our development activities and national reserves. Needless to mention here, the answer lies in developing accurate forecasting

techniques, good communications, an efficient control organisation and wide dispersal of national reserves with good mobility.

8. A scenario in which, due to an earth-quake or flash floods, the Bhakra Dam on the Sutlej River gives way, would result in destruction of everything in its wake, and would also render a major electric power grid chargeless for an unduly prolonged period. A disaster of such magnitude and resultant effects can be considered to threaten national security. Similarly, a ‘Chernobyl’ type incident at one of our reactors would also pose a threat to our national security. India wants to promote international co-operation in Disaster Management and providing necessary assistance to Nepal (Earthquake, 2015), Bangladesh (Early Warming in Cyclone) and Sri Lanka. But some neighboring countries like Pakistan and China can cause more damage during natural calamities and are security threats. The National Disaster Management Structure is clearly laid out in National Disaster Management Plan as depicted in fig 2 below.

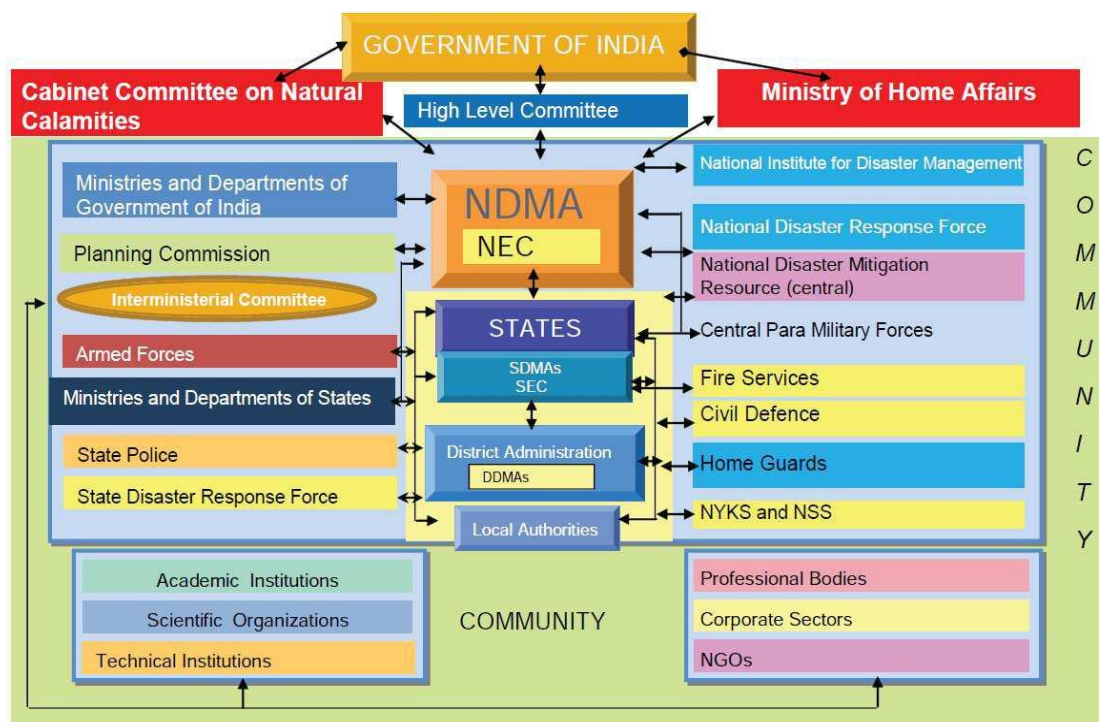


Fig. 2 National Disaster Management Structure
(Source : National Disaster Management Plan Part I)

9. **State Executive Committee.** The Chief Secretary of the State heads the state level committee which is in overall charge of the relief operations in the State and the rehabilitation measures in the wake of natural disasters in their States. The committee functions under the overall direction and control of the State Disaster Management Authority. The Chief Secretary is assisted by four secretaries of the Government of state. State Governments usually have relief manuals and the districts have their contingency plan that is updated from time to time.

10. **Employment of Armed Forces for Disaster Relief during Disasters** The link between natural disasters and security comes to fore in an indirect manner through the employment of the Armed Forces for disaster relief. The Armed Forces, as an arm of the Central Govt, have a major role to play in disaster management. Their primary role is to preserve national interests by safeguarding the territorial integrity of the nation against external threats, as well as the nation's strategic interests in the region. Their secondary role is to assist the civil authorities in handling internal threats, maintenance of essential services, as also to assist the Central or State Governments during natural or other calamities.

11. In organisational and infrastructural terms, the Armed Forces provide a speedy and efficient response in dealing with a disaster situation, which is beyond the resources of the civil administration. However, troops and equipment cannot be pulled out from their places of deployment at random in response to a requisition for such aid, lest our national security interests are jeopardized by their sheer absence from the specific areas of their primary responsibility. Precisely, to avoid such situations, contingency plans must be drawn up at appropriate levels, duly incorporating the local Armed Forces authorities in the planning process.

12. **Approach to Handling Disasters** Disasters occur all over the world with surprising diversity of locations and mediums through which they perpetrate. Yet, we face them with a reactive mind-set rather than preventive. While we do respond to the extraordinary demands in the aftermath of any disaster, we forget the need for continued vigil, preparedness and conscious effort to reduce the occurrence and impact of disasters in the first place. A preventive approach is a complementary pre-requisite to the aspect of post-disaster management. Risk of disaster can be minimised if our geologists, meteorologists, seismologists and hydrologists could identify the areas prone to such disasters and advise the civil authorities against creating population centres or industrial assets at such locations. High reliability prediction centres need to be set up to prevent disasters taking the population and the administration by surprise.

13. Mitigation refers to activities which actually eliminate or reduce the chances of occurrence of a disaster itself, or the effects of a disaster. Preparedness is planning how to respond in case an emergency or disaster actually strikes, and working to increase the resources available to respond effectively. Response activities occur during and immediately after a disaster. They are designed to provide emergency assistance to victims of the event and reduce the likelihood of secondary damage. Recovery is the final phase of Emergency Management cycle. It continues till all systems return to normal.

14 **Existing Disaster Response Mechanism in India** Post 2005, a paradigm shift has taken place in our approach towards Disaster management. Enactment of Disaster Management Act and establishment of institutional mechanisms at the Centre, State and District Level have given an organized framework to the whole Disaster Management set-up. Situation on ground has however not changed much. Our response still remains reactive,

slow, disorganized and doesn't even meet the minimum critical requirements for rescue and relief when a disaster strikes. We need to build better capacities and empower various organs at all levels to provide a respectable response to disasters.

15. **Statement of Problem** It is an indisputable fact that India is highly prone to natural disasters and the trend is ever increasing. The development and natural disturbance by humans have also worked as a catalyst in the process. The loss of human lives and property caused by Disasters are assuming staggering proportions. However, a shift in approach to 'be prepared' and 'mitigate the effects' has taken place. Disaster management in remote and inaccessible locations The Armed Forces are deployed in the proximity or because of their inherent ability to reach such locations in a timely manner, necessitating their active engagement. Armed forces in today's times are an inseparable part of any disaster relief activity thus when called upon in the easily accessible areas, it results in eroding faith of citizens on the civilian government to deliver in times of crisis. It is also evident that the civil administration finds it very difficult to manage the large scale activities involved in relief operations. As a result, both the government and the public have started reposing tremendous faith in the Armed Forces.

16. There is a need to investigate the over-involvement of the Armed Forces in HADR activities and its influence on operational preparation, given that the Armed Forces' equipment and training are designed for war fighting. Furthermore, there is a need to analyse the reaction with a combined and integrated training network, which is essential for successfully utilising the capabilities of both military and civil agencies.

17. **Objectives** The military has adapted to the function of catastrophe management, which is here to stay. With the frequency and severity of relief operations increasing, there is a clear need for a solid framework for effective and efficient response, and the key to any successful operation is well-planned and structured training. As a result, it is critical that we as a force train adequately, particularly with our civilian counterparts, in order to make the training more relevant for use when the need crops up. With this as background the objectives of the research work are:-

- a) To study the existing disaster response mechanism after Disaster Management act and find gaps in coordination while undertaking operations by Armed Forces.
- b) To analyse impact on Operational preparedness of Armed Forces as a result of over exploitation of its assets and equipment.
- c) To recommend amendments that may be incorporated in the already existing institutionalised mechanism and standard operating procedure.

18. **Research Design** The utilization of potent machinery like Armed Forces in disaster management can be extremely effective and responsive considering its outreach in all parts of the country provided that gaps in joint civil military coordination are overcome along with the necessary changes in the already existing institutionalized mechanisms. Therefore, in order to find solutions, as the topic involves a large number of intangible variables which will be obtained by analyzing data to draw inferences both Exploratory and Descriptive methods of analysis will be used.

19. **Justification** The role of Armed Forces in disaster management is very important thus making Disaster management synonymous with Armed Forces. The Disaster

Management Act 2005 is a vital instrument which explains the role and functions of various agencies. Within the confines of the issue, the case that must be made is that organising, training, and equipping Armed Forces without clear role descriptions may not be a good idea. As a result, it is vital to first establish, explicitly, the role that the Armed Forces are anticipated to play in disaster management. Role clarification would substantially contribute to greater preparedness and, as a result, aid in responding effectively and efficiently. However, of late, the Armed Forces are seemed to be over-involved in aid to civil authority. There appears to be rising disquiet among some members of the defence community over the use of the Armed Forces under the Aid to Civil Authority clause, necessitating more investigation.

20. **Research Question** The research questions are as follows:-

- a) What are the challenges faced by Armed Forces in present day Disaster Relief Operations?
- b) What has been the effect on operational readiness of Armed Forces by increase in participation in Disaster Relief ?
- c) What suggestions could be incorporated in the existing institutional mechanism so as to better prepare Armed Forces in handling HADR (Humanitarian Assistance and Disaster Relief) Operations?

21. **Scope** The scope of this paper will be limited to mitigation of disasters due to earthquake, floods and tsunami disasters in India which have historically affected large tracts of territorial space and population thus impacting the livelihoods of communities and pace of development in India. Further focus will be on joint training aspects of military and civil agencies in natural disaster management and its implications on India as a nation with special

emphasis on the role of the Armed Forces with the desired aim of minimum time and maximum results. The impact on operational preparedness has been brought out in terms of aspects which are generic in nature. Effects of participation in disaster management among the three Services is more tangible in Air Force because use of platforms. The statistics of operations have been restricted to Air Force and the effects on the operational readiness in terms of training, availability of platforms, fatigue and morale are more specific to Air Force. The details of flying carried out towards HADR of only sample years have been reflected to demonstrate the complexity and gravity of the issue. Towards that end, preparation levels will be studied and existing gaps will be identified.

22. **Research Methodology** Statistics, data and information collated and compiled from archived files, books, journals from various libraries open source data banks of the Armed Forces. This is a confirmatory research based on the questionnaires being prepared and send to the personnel experienced in HADR (Humanitarian Assistance and Disaster Relief). The Google questionnaire was administered to 70 personnel. A total of 70 questionnaires were sent and 61 responded. interactions and interviews with various government officials, domain experts in field and agencies having experience in handling and monitoring disaster situations.

23 **Chapterisation Scheme** The dissertation is laid out in six chapters as follows:-

(a) **Chapter I - Introduction.** The introductory chapter covers brief background of the topic along with the role played by the Armed Forces nationally. It will also provide the preamble to research, put forth the statement of problem, the objectives of the study , the rationale of the study and Chapterization Scheme.

(b) **Chapter II - Literature Review** In this chapter relevant literature related to role of Armed Forces in Disaster Management will be analyzed. The points of agreements and disagreements would be highlighted to identify the gaps in the literature and their place in the research.

(c) **Chapter III- Role of Armed Forces in Disaster Management**
The role of the Armed Forces in disaster management is critically examined in this chapter. The lessons learnt, various challenges faced and vital experiences would also be highlighted.

(d) **Chapter IV- Case Studies of Major Disasters that struck India** Analyse the Disaster response by the Armed Forces during various natural calamities viz Bhuj Earthquake 2001, Indian Ocean Earthquake and Tsunami 2004, Floods of Uttarakhand in 2013 & Personal experience in HADR Ops during Orissa Super Cyclone 1999.

(e) **Chapter V- Impact on Operational Preparedness** In this chapter will be critically examine the impact of increasing trend of involvement of Armed Forces in HADR and also discuss the way ahead for Armed Forces.

(f) **Chapter VI - Recommendations and Conclusion** The chapter summarizes and suggests a few recommendations and reflections emerging from the study which in an event of disaster may save valuable lives and property.

CHAPTER II

REVIEW OF LITERATURE

1. Disasters strike with virtual regularity, almost every year resulting in heavy casualties as compared to wars/ conflicts. Considering that each time Armed Forces have to play a role of first responders though not mandated as per Disaster Management (DM) Act, (2005), its impact on the Armed Forces operational readiness would need to be evaluated. The pressure to perform with distinction always and at a short notice has its own challenges for Armed Forces. A lot of books, articles and research pieces throw light at this facet. These literatures have been divided in four sections. First section of literature review is about Pre-disaster part which covers Preparedness and the Mitigation , second section covers Post-disaster part covering Relief, Rehabilitation and Reconstruction and the third section is about the role of Armed forces in Disaster Management. The last part covers various Acts and Manuals common to all parts. These various sections are elaborated as below.

2. **Pre-disaster (Preparedness and Mitigation)**

(a) A book on —Strategic Disaster Risk Management documents the issue of critical analyses of the role of civil authorities and Armed Forces in Disaster Risk Management. However, it lacked focus on impact on Operational Preparedness for the Armed Force (Garge, R. 2015)

(b) Book on Disaster Management written by Mohit Bhattacharya deals with

many aspects and aims of disaster management and sheds light on numerous corrective steps required to avert natural disasters such as flood, earthquake, and drought. The devastating flood of 1978 took heavy toll in West Bengal changed the way in which the public administration response and mechanism to effectively deal in crisis situation.(Bhattacharya, M. 2001)

(c) In the article History of Disasters and a Framework for Risk Reduction Rikza Imtiyaz talks about the paradigm shift to disaster risk reduction and climate smart adaptation approaches. This paper gives an insight of evolution and development of various global framework both on national and international level. (Imtiyaz, R. 2021)

(d) Training Regime for Disaster Management issued by NDMA (National Disaster Management Authority). 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(National Institute of Disaster Management) and NDRF (National Disaster Response Force) to conduct training for DM delving upon each of the three phases of disaster in particular (NDMA, 2008).

(e) The Changing Landscape of Disaster Management article by Mohan Kanda documents disasters as a major challenge and recognizes a coordinated and technology driven approach towards DM. This also emphasizes that the paradigm shift that India has ushered through DM Act 2005, placing greater emphasis on proactive efforts instead of reactive efforts ie Mitigation and Preparedness. (Kanda, M. 2021)

(f) 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)

(g) Book on Disaster Vulnerabilities and Risks by Prabhas Sinha gives elaborate on understanding of the various disasters, hazards and crises and their control, mitigation and prevention with reference to possible management solutions. (Sinha, P. 2006)

(h) Sendai Framework for Disaster Risk Reduction 2015-2030 at Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, on 18 March 2015 (UNIDSR, 2015)

(i) Developing National Capacity towards Disaster Management article by V Thiruppugazh emphasizes on the capacity development of both institutional and recipient communities. This article also examines issues and challenges in capacity building for sustainable Disaster Risk Reduction. (Thiruppugazh, V. 2021)

(j) Ashu Pasricha and Kiyanoush Ghalavand in their book Disaster Management and Startegies have given strategies to deal with disasters. (Pasricha, A. and Ghalvand, K.2014)

(k) Current Thrust in Disaster Management in India is discussed in the paper by GV Venugopala Sarma in which the capacity building of all concerned , involvement of civil society and participation of the communities would be the most important ingredients to ensure that the vision of disaster resilient India is realized at the earliest. (Sarma, G. 2021)

(l) Review of Institutions, Strategy for Standardization and Mechanism and Capacity Building Strategy carried out by Seeds Technical(SEADS, 2014)

(m) In the paper titled Creating the National Disaster Response Force KM Singh elaborates on the professional commitment with which the NDRF has dealt with natural disasters within the country and abroad in its last 15 years of formation. The commendable work done by NDRF in the aftermath of Fukushima nuclear leakage in Japan in the year 2011 was a shining example of first trans border operations in disaster response. (Singh, K. 2021)

(n) Training Regime for Disaster Management issued by NDMA in 2008, which gives broadly training philosophy, primarily for NIDM and NDRF to conduct training for Disaster Management delving upon each of the three phases of disaster in particular. (NDMA 2008)

(o) Challenges in Disaster Management in Hill Areas, A Case study of Sikkim by Vinod Sharma and Shymali Singh studied the disaster related to climate change leading to DRR (Disaster Risk Reduction) methods. The Climate School Initiative (CSI) was working efficiently and was an important tool for resilience awareness for

disasters in Sikkim. In addition this paper studied the importance of information disseminations and technology based interventions to increase resilience.(Sharma, VK. and Singh, S. 2021)

3. **Post-disaster (Relief, Rehabilitation and Reconstruction)**

(a) National Institute of Rural Development (NIRD) report on the catastrophic cyclone that hit Orissa in October 1999 provides a comprehensive assessment of the disaster management procedure in India. It covers the administrative infrastructure till District level and initiatives of various players like Govt agencies, the UN bodies, various NGOs and the important role played by Armed Forces . (NIRD-2001)

(b) Prof Vinod Sharma in his book The Disaster Management has discussed the case studies provided by notable personalities on many sorts of disasters such as droughts, earthquakes, and cyclones.This edited book also gives information regarding Natural Disasters in terms of Concepts and guidelines of hazards and vulnerability. This helps in analysis for Administrative actions in crisis situation. (Sharma, VK.1994 and 2013)

(c) Coalition for Disaster Resilient Infrastructure an article by Kamal Kishore emphasis on the need of making infrastructure disaster and climate resilient. This is a global challenge concerning both developed and developing countries. This will definitely require coalition of various countries and partners. (Kishore, K. 2021)

(d) Safety and Disaster Management written by Dr S Arulsamy and J Jeyadevi. This book mainly covers all types of disasters, their effects on environment and infrastructure, strategies for DM and aspects of mitigation in detail. This book brings out National DM Act 2005 and its structure at various levels. (Arulsamy, S. 2016)

(e) In the article The Road Ahead for Disaster Management KR Sastry, Mohan Kanda and CVR Murthy emphasize on agenda which needs to be addressed to make progress by 2030. They stressed upon building technical human resources, embarking on Long term agendas, implementation of DM measures fully and documenting all new disasters to make a decent beginning. (Kanda et al., 2021)

(f) 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).

(g) 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, M. 2021).

(h) 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, H.2014).

(i) Prevention Losses from Landslides paper by R K Bhandari delves into direct and indirect ways by which the losses on account of landslides could be prevented, contained and controlled. Especially it talks about implementaing the wealth of experiences , policies and unpublished literature to show the way forward towards landslide risk resilience. (Bhandari, R. 2021)

(j) 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).

(k) The article Mitigating Losses during Floods by V Bhanumurthy talks about possibility of minimizing the flood damages and improving flood resilience by developing strategies for early warning , emergency response and mitigation. This paper further discusses the potential of geo spatial technologies for flood hazards and urban flood mitigation. (Bhanumurthy, V, 2021)

4. **Armed Forces role in Disaster Management :**

(a) Sanjeev Singh quote in his research article titled Armed Forces in Disaster Management: challenges in Indian perspective talks about the role of Armed Forces and the various challenges faced. Furthermore, it states that the Armed Forces, which are a nation's frontline defence, are expected to carry out any commands that are handed to them. And the Forces play an important part in disaster management in our country. Their commitment and training are proven to be an invaluable addition to catastrophe planners. However, there are still some areas that need to be improved, such as coordination with other authorities, for better disaster management (Singh, S. 2015)

(b) Role of Indian Air Force in terms of increasing HADR mandate is discussed by Vikas Kalyani in his research paper. Wherein he discusses the role of Air Force with its increasing mandate in. (Kalyani,V. 2020)

(c) 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 does not give out the recommendation to strengthen the response mechanism during disasters (Singh, J.2007).

(d) 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 (Singh, A. 2016).

(e) Disaster Management and the Role of Armed Forces is discussed in the research paper by Maj Gen Bhadani wherein he focusses on role of the Armed Forces and the ways to improve its effectiveness during the disasters. However it is silent on synergy between NDRF and Armed Forces. (Bhadani, N. 2015)

(f) Government report tabled in Lok Sabha on 12 Aug 2016 brings out the quantum of effort put in by the Armed Forces during the disaster relief. Though the relief was prompt and effective, the issues of coordination and responsibilities while conducting joint civil military operations have not been projected. Challenges and ways to overcome these coordination issues are paramount for handling such situations in future. (2016)

(g) In NDRF as Systemic Responder article by SN Pradhan gives the ground level perspective of NDRF and its evolving role as systemic first responder is critical to shaping roadmap of a wholesome and robust disaster response ecosystem in India involving all stakeholders.(Pradhan, S. 2021)

(h) While reporting for India Today, Jeemon Jacob in his article brought out that central forces play a pivotal role in the rescue and relief operations in flood-hit Kerala in Aug 2018. Further, the Chief Minister while applauding efforts of Armed Forces also reiterated that the calamity would have been greater if the forces didn't work hand in hand with the state government. Hence this case brings out that

effective coordination between civil and military can bring relief to the needy at the earliest which in turn can reduce the number of casualties in a disaster. The mechanism adopted by the Government of Kerala can provide some lessons and measures which can reduce the gap in civil military coordination.(Jacob,J. 2018)

(i) Armed Forces in Disaster Management by OS 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,O. 2008).

(j) 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. (Kumar,G. & Dimri,R. 2018).

(k) Armed Forces in Disaster Response: Role Reappraisal. This was published in CLAWS journal 2008. This paper analyses the military's role in assisting civil authorities in crisis management. It further elaborates that the key challenge is to maximise the military's ability to respond to disasters by integrating them into the state infrastructure and coordinating all activities. And as the military forces are an important stakeholder, they should be formally recognised as part of the crisis management planning process in the states. (Raj, A. 2015)

5. **Acts and Manuals**

- (a) Disaster Management Act 2005 by MHA(Ministry Of Home Affairs) (MHA 2005).
- (b) Task Force Report on Review of DM Act 2005 by MHA in 2013 (MHA 2013).
- (c) National Disaster Management Plan (NDMP) 2016 by NDMA. (NDMP, 2016)
- (d) Disaster Management in India by NDMA , MHA in 2020. (NDMA, 2020).
- (e) Disaster Management in India in 2011 by MHA (MHA 2011).
- (f) State Disaster Management Plan 2017, Odisha State Disaster Management Authority (OSDMA), Government of Odisha. (Odisha, 2017).
- (g) Incident Response System by NDMA, MHA 2020.(NDMA,2020)
- (h) National policy on Disaster Management 2009 by MHA. (MHA,2009)
- (i) National Policy on DM:2009 MHA. (NDMP,2009)

CHAPTER-III

ROLE OF ARMED FORCES IN DISASTER MANAGEMENT

“Our Armed Forces have time and again demonstrated that they care for and stand by the country’s partners in times of need without distinguishing between natural or man-made disasters”

Raksha Mantri Shri Rajnath Singh

General

World over, all governments have involved their Armed Forces whenever a disaster strikes. They are invariably the first to respond and quickest to reach the affected area. As has been increasingly observed in recent cases across the world, the men in uniform have played a stellar role in mitigating and alleviating the suffering caused by disasters. In India too, traditionally the Armed Forces have been forming the core of the government response and have been intimately involved in providing immediate rescue and relief in all kinds of disasters, be it natural calamity or manmade disaster. It was only post 2005, constitution of specialised NDRF battalions have reduced the pressure on the Armed Forces and the states also have highly trained and specially equipped force available at hand to immediately respond to a disaster situation. NDRF, however, is still a miniscule force and is capable to aptly handle local disaster situations. During major disasters, the Armed Forces with widespread presence, availability of highly trained, dedicated and well equipped human

resources, and their capability to react quickly, would continue to play a vital role in rescue and relief operations. A few types of Disasters which took place in India are as given in Fig 3.

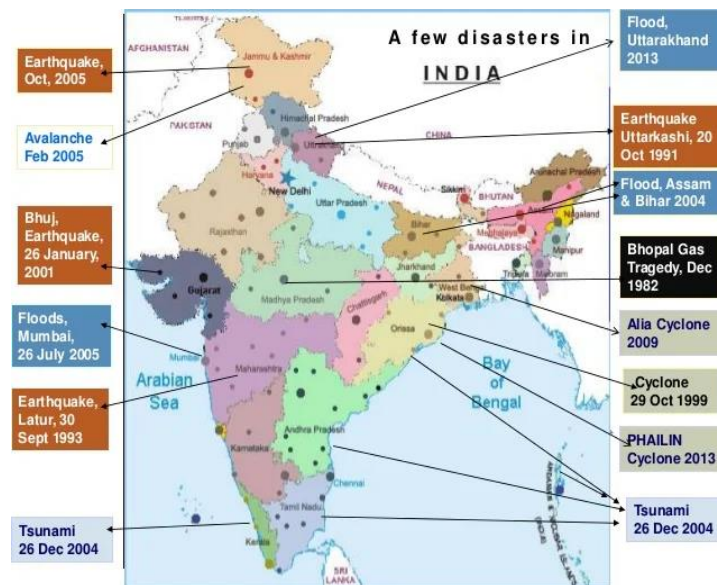


Fig 3 Disasters in India

(Source: *Study of natural disasters in india*, Garg.A)

While the arrival of the Armed Forces instills confidence in the local populace and gives a boost to the administration, their omnipotence and omnipresence should not bring a sense of fulfillment in the psyche of the State Governments. Over the years, the Armed Forces involvement in aid to civil authority has been steadily increasing and the state administration too has steadily increased its dependence on the valuable operational resources of the Armed Forces. Fortunately, the Government, of late, has arrested this trend, and has reviewed its policy on disaster management, which now envisages the development of a more self reliant administrative structure, through a pro-active strategy. Reforms notwithstanding, the Armed Forces continue to be in a high state of preparedness, so as to save that crucial day for the Nation.

The Armed Forces primary responsibility in the country's defence against external and internal dangers is clear and requires no deliberation. The Armed Forces' secondary role in assisting civil authorities is a constitutional requirement, however only as a last resort. Armies have a vital part in the mitigation of numerous types of calamities all around the world. Only when a crisis is beyond the competence of civil government should the Indian Armed Forces be called in to intervene and take on certain tasks. In practise, the Armed Forces are at the heart of the government's reaction capability, and they are frequently the first responders to a big crisis. The Armed Forces have traditionally played a major role in almost all disasters mainly in emergency support functions such as communications, search and rescue operations, health and medical facilities, transportation, power, food and civil supplies, public works and engineering, especially in the immediate aftermath of disasters, due to their ability to organise action in adverse ground circumstances, speed of operational response, and resources and capabilities at their disposal. The Disaster Vulnerability world wide is shown in Fig 4.

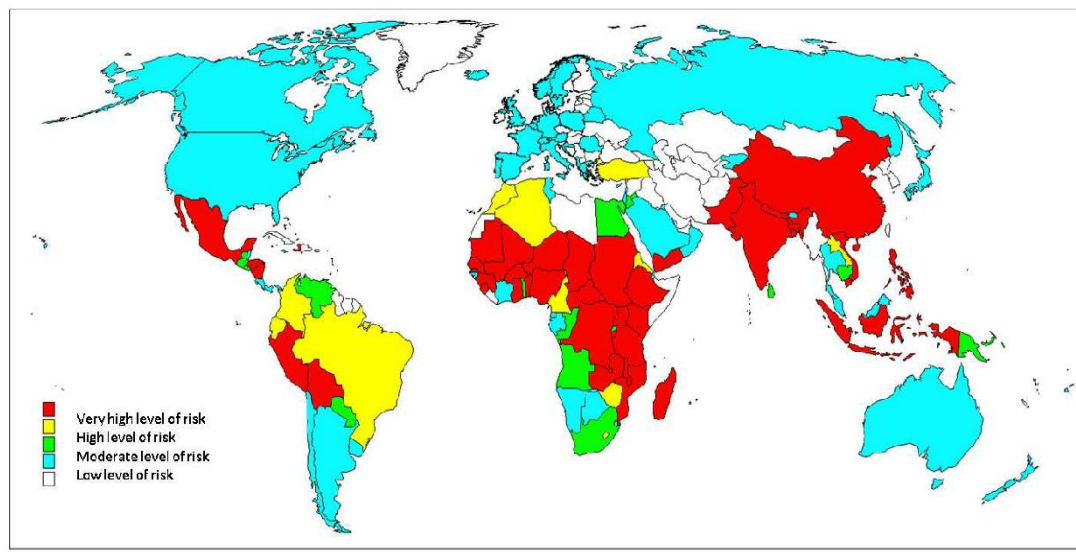


Figure 4 Disaster Vulnerability

(source : <https://journals.openedition.org/cybergeog>)

Although the natural disasters for Armed Forces' is secondary tasks and well defined, it is in the area of aid to civil authorities that the Armed Forces are most frequently used, particularly during man-made or natural disasters. However, in the case of aid to civil authorities, the meaning of the term "disaster" is crucial. By definition, a disaster is a natural or man-made occurrence that produces a sudden disruption of society's normalcy, resulting in such extensive harm to life and property that conventional social and economic institutions are unable to restore normalcy.

As a result, the Armed Forces should only be requisitioned by the civil government if the situation is plainly beyond the local administration's control and capacity (Fig 5). In an ideal situation, a rapid and comprehensive assessment of the necessary reaction to a disaster or impending disaster is required. This will allow for the rapid deployment of critical resources, including Armed Forces troops, in order to reduce damage and losses to a minimum.

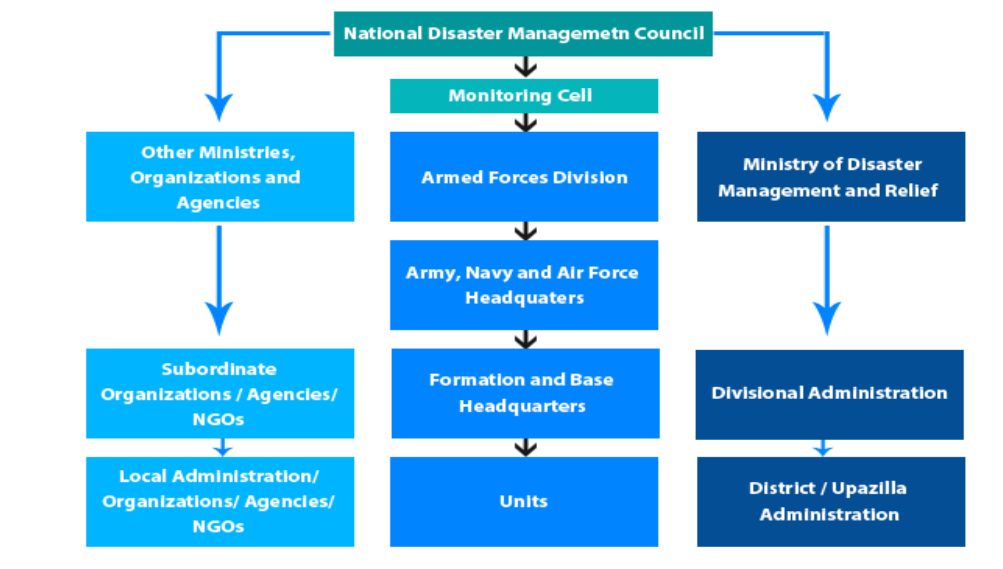


Fig 5 Procedure of Armed Forces Integration during any disaster

(Source: <https://afd.gov.bd/activities/armed-forces-division-in-disaster-management>)

According to the Disaster Management Act, in the event of a deadly disaster or the threat of a deadly disaster, the National Disaster Response Coordination Group will make a recommendation to the government for Armed Forces collaboration. The government may grant orders to the Armed Forces Division to provide required assistance to civil administration in pre-disaster or emergency response activities during a disaster if the National Disaster Response Coordination Group makes a recommendation. The Armed Forces Division advises Service Headquarters on their employment and coordinates three services' efforts. The formation or base headquarters at the division level coordinates with the local government, and the same is true at the district and lower levels. If it becomes necessary to enlist the aid of the Armed Forces to properly deal with a disaster situation on a local level, the District Disaster Response Coordination Group may make a recommendation to the Deputy Commissioner to enlist the Armed Forces' assistance.

Employment of the Armed Forces in Disaster Management

The Indian Armed Forces render timely assistance to civil authorities under “Defence Service Regulations” for the maintenance of law and order, maintenance of essential services, assistance during natural calamities, and any other types of assistance which may be needed by the civil authorities. The Ministry of Defence is the 'Primary Agency' for the Search and Rescue (SAR) function, and a 'Support Agency' for provision of communications, transportation, rehabilitation, engineering, power and medical services. However, over the years, the Armed Forces role has gradually expanded from the SAR function, to also include major responsibilities in the supportive functions and is also

expected to provide sizeable quantities of disaster relief material, for both National and International contingencies.

The disaster management cycle consists of six stages: Prevention, Mitigation, Preparedness, Response (Rescue and Relief), Rehabilitation and Reconstruction. However, the Armed Forces are traditionally called to assist in the response stage of the disaster management cycle for search, rescue and relief. This is also the stage where losses can be minimised and lives saved by rescuers acting swiftly and in a professional manner. Time, at this stage, is always at a premium. Hence, this is the most crucial stage of the Disaster Management Cycle and timely and effective employment of the Armed Forces in search, rescue and relief operations can pay rich dividends in terms of limiting damage and saving lives. However, can the Armed Forces be called only at the rescue and relief stage? What if a major disaster is forecast and heavy losses appear imminent? Can it be assumed that the impending situation is within the means of the local administration or otherwise. There is no clear-cut answer to this question. However, there can be a few scenarios, where deployment of the Armed Forces, just before occurrence of a disaster may result in saving lives and property.

Assistance provided by Armed Forces

The scope of deployment of military resources and capabilities is very broad and ranges from individual specialized pieces of equipment such as portable water purification systems, to small scale specialized capabilities and strategic planning, coordination and logistics capabilities for large and complex situations. In addition Armed Forces are also called upon to provide the following types of assistance :-

- (a) **Provision of Infrastructure** The setting up of Command and Control post for provision of emergency communications and making available technical, medical and other specialist power at the disposal of Central/State agencies.
- (b) **Medical Services.** The primary task of Military doctors during any disaster is management of Emergency Medical care, sanitation and dealing with Trauma & Disability cases. The members of Army Medical Corps immediately start providing all kinds of emergency and general medical services including vaccines and setting up of sanitation facilities , wherever possible to the affected people.
- (c) **Maintenance of Communication lines.** Restoration of field-communication becomes an important task of the Armed Forces in flood affected and cyclone hit areas. Indian Army undertakes this responsibility of restoring communication system and carrying out repair and reconstruction of the roads, bridges damaged by floods, cyclones, tidal waves to help restore effective communication system.
- (d) Setting up and running of relief camps and provide Logistic support for transportation of relief material and manpower especially for the NDRF.
- (e) Handling of International Relief, if requested by the Civil Administration.
- (f) Assist in search & rescue, debris clearance and evacuation of people to safe place before, during and after the Disaster.
- (g) The Armed Forces will participate in imparting training to trainers and DM managers, especially in heli-borne operations & insertions, high-altitude and mountainous rescue, in which the Armed Forces are authority.

In India the Armed Forces are the first responder when disaster occurs. They have equipment, training and a professional response to any situation. The lack of a civil defense

system is also a reason for the dependence on the armed forces in times of calamity. Some specific disasters like oil spills, nuclear accidents require special equipment and training. The armed forces possess capabilities like airlift or the ability to carry large number of men and material to any place across the country. Their expertise in the field of search and rescue is unmatched. The armed forces can also bring in equipment for repairing damaged roads or building makeshift bridges. However operations of the Armed Forces, whenever called upon to assist the civil authorities in rendering relief are governed by certain guiding principles. These are enumerated below:

- (a) Immediate Response. When natural disasters or other calamities strike, getting help as soon as possible is critical. It is obvious that prior approval for help may not always be attainable in such instances. When the Armed Forces are asked for help in certain situations, they should respond quickly. There is no need for a separate government sanction for relief given in response to natural disasters and other tragedies.
- (b) Requisition / De-requisition on Tasks Basis. Civil administration should spell out the task and leave it to the Armed Forces authorities to decide the force levels, equipment and methodology to tackle the situation. Similarly Armed Forces should be de-requisitioned as soon as the situation in disaster affected area has been brought under control of the civil administration.
- (c) Regular Liaison and Co-ordination. In order to ensure that optimum benefit is derived, regular liaison and co-ordination need to be done at all levels and contingency plans made and disseminated to the lowest level of civil administration.

The Army Formations, Naval units and Air Force stations located in areas prone to disasters must have detailed plans worked out to cater for all possible contingencies. The troops should be well briefed and kept ready to handle any contingency.

(d) Command of Troops. The Armed Forces units whilst operating for disaster relief continue to be under the command of their own commanders and aid rendered is based on task basis.

(e) 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

(f) Integration of all Available Resources. While developing disaster relief plans, all available resources, equipment, lodging, and medical resources with civil administration, civil firms, and non-governmental organisations (NGOs) must be considered. To attain the best results, all resources should be integrated. External assistance could be layered on top of the current resources. Similarly, all Armed Forces assets must be coordinated to avoid duplication or overdosing.

Armed Forces commitment towards DM

There appears to be some misunderstanding among a few commanders and staff about whether every requisition for aid to civil authorities must be honoured. The commander on the ground must once again exercise discretion in deciding whether or not to reply or whether clarification from higher headquarters (HQ) is required. In most cases, the

civil administration's request for aid in the event of a disaster is granted. Because there is little or no reaction time, such requisitions for rescue and relief will have to be handled quickly. Requisitions such as the evacuation of a civilian stuck in a hole, the removal of a dead body from the seas, and other requests that do not fit under the category of "disaster rescue and relief" may be denied or carried out only after receiving proper approval from higher headquarters. When asked by civil authorities for assistance, unit / formation commanders may advise the local administration to process their request through the Ministry of Home Affairs (MHA) procedures if there is any ambiguity. Because of the availability of cutting-edge communication systems, it is now possible to obtain clearance from higher HQ without wasting time.

More crucial, however, is to persuade the civil authority to de-requisition the Armed Forces as soon as the rescue and relief activities are completed. The Ministry of Defence (MoD) must approve any deployment that lasts more than 10 days. The commanders in the chain retain professional discretion over the approach of employing the Armed Forces columns. Armed Forces forces tasked with disaster rescue and relief must avoid being employed as a well-organized labour task force for unapproved chores or menial jobs. A good mutual understanding between the civil set-up and local Armed Forces units / formation HQ will go a long way toward ensuring that the Armed Forces' capacities in crisis management are used fairly and effectively.

Challenges for the Armed Forces

In India the Armed Forces have played important role in disaster management as a force of the nation. If any disaster may be natural or manmade breaks out the Government

called them to help and rescue the people. But when they are helping the people, they are also facing many challenges. The challenges facing the Armed Forces are two-fold. Firstly, it is preparedness for disaster response and relief operations, and secondly it is the increasingly uneven frequency of disasters. According to ecological intelligence in the public domain, the latter is well-known while the former needs further study in bringing out the role of Armed Forces in combating disasters.

Major challenges faced by Armed Forces in the preparedness phase is given below:

- (a) Conducting relief operations is a huge challenge in case of disaster with grave magnitudes. Too many agencies and no centralised control over use of assets more than often delays the immediate response.
- (b) Resource constraint is also huge challenge for Armed Forces and in situation of disaster they have to use their limited resources which even cause them mental distress. State of the Art equipment for search and rescue is not available with all Armed Forces units which does challenge them to perform and give desired results. Armed Forces request for provisioning of geographically dispersed tailor-made Disaster Relief Bricks at suitable locations will go a long way towards immediate response by Armed Forces.
- (c) There is a lack of availability of specialist disaster relief equipment at the disposal of military units and formations on peace establishment. These specialist resources could be placed as disaster relief bricks capable of handling a particular type of disaster. Location of these bricks should be as per hazard mapping of areas. Further, there should be separate equipment bricks for training and operations.

(d) Preparedness for disaster response as most of the disaster comes without any intimation especially manmade disasters. Availability of latest Technology for early warning and disaster Prediction is not available at requisite decision- making apparatus within Armed Forces therefore it is always acting in response to the information made available by civil machinery which puts on added pressure on them to respond in the shortest time. Personnel of Armed Forces need to be imparted specialised training and equipment for conduct of HADR operations.

(e) Always being the first respondent in any disaster is the main challenge for the Armed Forces as they have to face the unknown situation. More than often the civil setup is missing in the early hours of disaster being stuck which puts pressure on the immediate responders to not only control the situation but provide immediate assistance.

(f) There is requirement of carrying out regular exercises/mock drills in close coordination with local civil administration and other civil disaster relief forces / agencies to ensure equipment serviceability and operational preparedness. As coordination of effort in such scenarios will determine efficacy of disaster relief, it is critical to have regular seminars, discussions and training sessions involving all agencies.

(g) Interoperability with Regional and International Relief Agencies Response to major disasters does involve regional and international civilian and military HADR organisations. Equipment and procedures interoperability both of our military and civil agencies does pose a challenge to ensure seamless interoperability.

Role Clarity and Empowerment of Armed Forces

Notwithstanding these initiatives, it is highly unlikely that the Armed Forces will ever become redundant of their participation in rescue and relief operations during major disasters. Armed Forces with their inherent culture, dedicated troops, prompt response and resources are well placed to play a major role alongside all other state and Centre level agencies to perform vital role in SAR and relief operations in support of National endeavour to mitigate losses to human lives and property. However, disaster relief being their secondary role, the Armed Forces are not fully empowered in terms of equipment and specialist training to fully utilize their potential.

Joint Civil Military Coordination Issues

Armed Forces in India have been very frequently called upon by Civil Administration to provide assistance in rescue and relief work during natural calamities. However, it has been noticed, time and again, that the performance of the Armed Forces could have been much better had there been closer and more intimate coordination between the civil administration and the Armed Forces. For Armed Forces to effectively conduct relief and rescue operations during a disaster, needs decisive modus operandi and operational coordination with the civil administration. Very intimate and effective coordination between civil administration and the Armed Forces is essential for optimum utilisation of the large resources of the Armed Forces during disasters. Aid to civil authority in cases of disasters has to be viewed as a special emergency and tackled with full enthusiasm and the synergistic efforts of both the civil administration and the Armed Forces. It is essential that both, the civil administration and the Armed Forces be aware of each other's capabilities and limitations and work with the highest degree of coordination

Major Initiatives (NDRF).

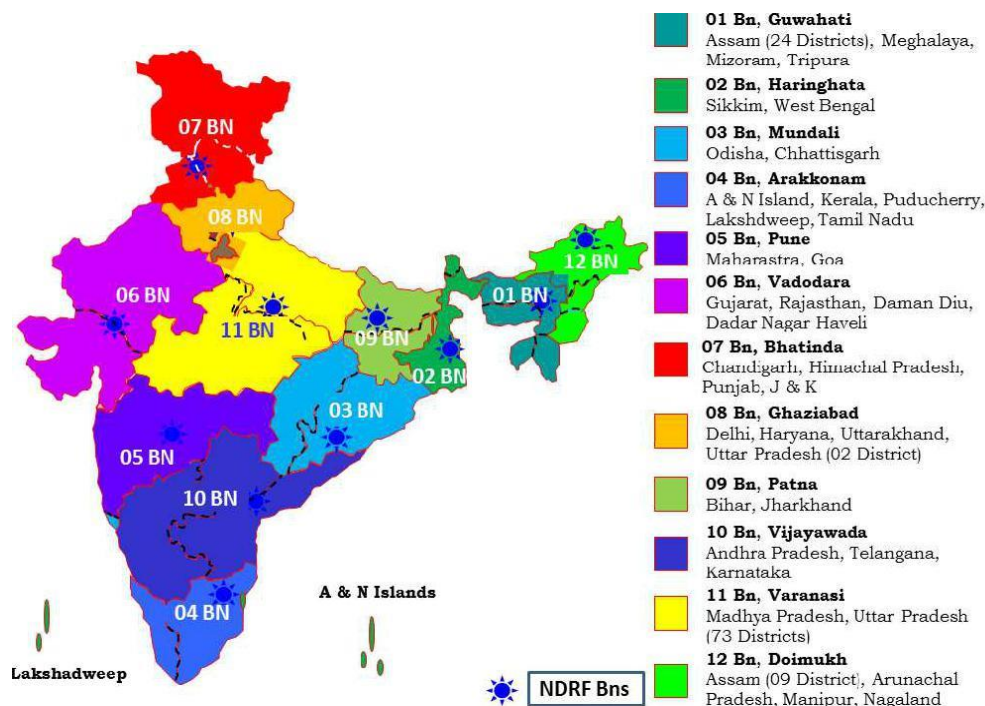


Fig 6 Locations Of NDRF Battalions

(Source <https://www.indiatvnews.com/news>)

Many in the Armed Forces feel that the Armed Forces being the last bastion should not be the first responders unless the scale and magnitude of disaster so demands. The tendency of the district and state administration to straight away requisition Military needs to be checked. However, in the past, absence of specialist rescue and relief force at the disposal of Centre/ State Governments, left the state administration with no choice but to call for local military unit/establishment. This situation has changed since 2005 with the Centre initiating a large number of initiatives in terms of setting up an effective mechanism at Centre, state and district levels and raising of specialist force like NDRF. These are as follows:-

- (a) Eight battalions of central police forces have already been earmarked under the director general NDRF, for development of fully trained and equipped special

response teams. Two each of these eight battalions are being raised by the BSF, CRPF, Indo-Tibetan Border Police ITBP and CISF. The BSF has already raised these two battalions at Guwahati, for the Northeast, and at Calcutta, for the plains and coastal areas (Fig 6). Further, the BSF has also initiated training in disaster management at the Training Academy at Tekanpur. The ITBP too has raised one battalion at Panchkula, while an additional battalion is to be raised at Greater Noida.

(b) The central government is now in the process of training and equipping eight battalions of central paramilitary forces (CPMFs) as specialist response teams. Each team consists of 45 personnel, including doctors, paramedics, structural engineers, etc and, thus, there will be 144 specialist search and rescue teams in the earmarked eight battalions. The process of training and equipping of the 144 specialist search and rescue teams, etc has begun. These teams are being trained in collapsed structure search and rescue, medical first response, rescue and evacuation in flood and cyclone, underwater rescue, etc. In effect, they will have the capability to operate in all types of terrain, in all contingencies/disasters. These specialist response teams are being provided modern equipment and also dog squads for search and rescue. They will be provided with special uniforms made of fire retardant materials, with enhanced visibility in low light and having equipment carrying capacity.

(c) Apart from specialist search and rescue units, it has been decided that all personnel of central police organisations should also be imparted training in search and rescue so that they can be requisitioned to the site of incident without loss of time. Pending arrival of the specialist teams, the battalions located near the site of incident would be deployed immediately. The Ministry of Home Affairs will provide

assistance for the training of the state trainers. Many states/UTs (union territories) have initiated action for setting up of specialised search and rescue (SAR) units. They have also identified trainers who will be imparted training at CPMF training institutions. Some states e.g. Maharashtra, Orissa, Gujarat and Delhi, have trained search and rescue teams.

(d) It has also been provided that 10 per cent of the annual inflows into the Calamity Relief Fund (CRF) can be used for the procurement of search and rescue equipment and communication equipment. States have been advised to include training in search and rescue in the training of state armed police. Fire services are being organised and equipped as multi-hazard response units. These would be named the Fire and Rescue Services. The police is also being trained and equipped to perform a more comprehensive role.

CHAPTER IV

CASE STUDIES :

INDIAN OCEAN EARTHQUAKE AND TSUNAMI 2004,

BHUJ EARTHQUAKE 2001, UTTARAKHAND FLOODS 2013 &

PERSONAL EXPERIENCE IN HADR OPS DURING

ORISSA SUPER CYCLONE 1999

“ We cannot stop natural disasters but we can arm ourselves with knowledge: so many lives wouldn’t have to be lost if there was enough disaster preparedness”

Petra Nemkova

INDIAN OCEAN EARTHQUAKE AND TSUNAMI 2004

(First Multi – Country disaster of this Century)

Tsunamis were not regarded a high-risk hazard before 2004, at least not outside of the Pacific Ocean. In India, Tsunami science is a relatively new branch of study, with minimal application of information in practise due to its least frequency. 'A few years before the actual occurrence of the Tsunami in 2004, scientists published work on a possible ocean-wide tsunami in the Indian Ocean.' The situation was ideal for devastating effects for the Indian Ocean Tsunami in 2004 due to fast population increase in coastal settlements in the

region. The Sumatra-Andaman earthquake, commonly known as the "Boxing Day Tsunami" by the scientific community, struck the Indian Ocean at 00:58:53 UTC on December 26, 2004, with an epicentre off the west coast of northern Sumatra, Indonesia. It was a subsea adventure. It was an undersea mega thrust earthquake that registered a magnitude of 9.1-9.3 Mw, reaching a Mercalli intensity upto IX in certain areas. The earthquake was caused by a rupture along the fault between the Burma Plate and the Indian Plate, thus causing the great Tsunami in the Indian Ocean.

Tsunami Epicentre 2004

The primary earthquake struck around 160 kilometres off the western coast of northern Sumatra, in the Indian Ocean, about north of Simeulue Island and mainland Sumatra, at a depth of about 30 kilometres below mean sea level (Fig 7). Over a distance of 1,300 kilometres, the northern section of the Sunda mega thrust burst. Long, narrow sections of the sea floor swelled up in seconds due to splay faults, also known as secondary "pop up faults." This swiftly rose to its height, accelerating the pace of the waves and devastating the neighbouring Indonesian village of Lhoknga. The ocean seismic activity generated a succession of enormous Tsunami waves with a height of up to 30 metres. Persons living around the Indian Ocean's beaches were disproportionately affected, with an estimated 227,898 people killed in 14 nations. The city of Banda Aceh on the Indonesian coast was said to have the highest number of victims. It also employed substantial disruptions in living circumstances, trade, and commerce, especially in Indonesia, Sri Lanka, India, and Thailand's economies.

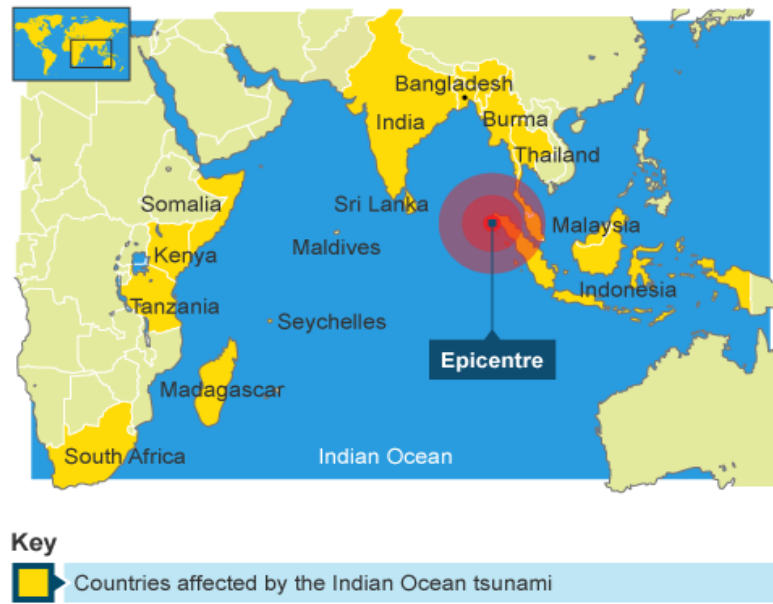


Fig 7 Epicentre of Tsunami
(Source : <https://en.wikipedia.org>)

The earthquake was the third largest ever recorded and had the longest duration of faulting ever observed, between eight and ten minutes. It caused the planet to vibrate as much as 10 millimeters and it remotely triggered earthquakes as far away as Alaska. In the last one hundred years, the only earthquakes recorded with a greater magnitude were the 1960 Great Chilean earthquake with a Magnitude of 9.5 and the 1964 Good Friday earthquake in Prince William Sound with a Magnitude of 9.2 Mw. The only other recorded earthquakes of similar magnitude of 9.0 or greater were off Kamchatka, Russia, on 04 November 1952 with 9.0 MW and Tohoku, Japan with 9.1 Mw in March 2011. Each of these mega thrust earthquakes also spawned Tsunamis in the Pacific Ocean. However, as compared to the 2004 Indian Ocean earthquake, the death toll from these earthquakes was significantly less, mainly because of the lesser population density along the coasts, superior earthquake resistance infrastructure and superior warning systems in the More Economically Developed Countries such as Japan, USA etc.

Energy Released This earthquake in the Indian Ocean released vast energy the majority of which was underground, and which was over 360,000 times more than its ME, equivalent to about 370 years of energy usage in the United States. The sudden rise of the seabed by nearly 40 meters during the earthquake displaced enormous volumes of water, resulting in a Tsunami that majorly struck the coasts of the Indian Ocean. A Tsunami that causes damage far away from its source is sometimes called a TeleTsunami and is much more likely to be produced by vertical motion of the seabed than by horizontal motion". This has been clearly brought out by Nancy Williams in the book Fury of Natural Disasters.

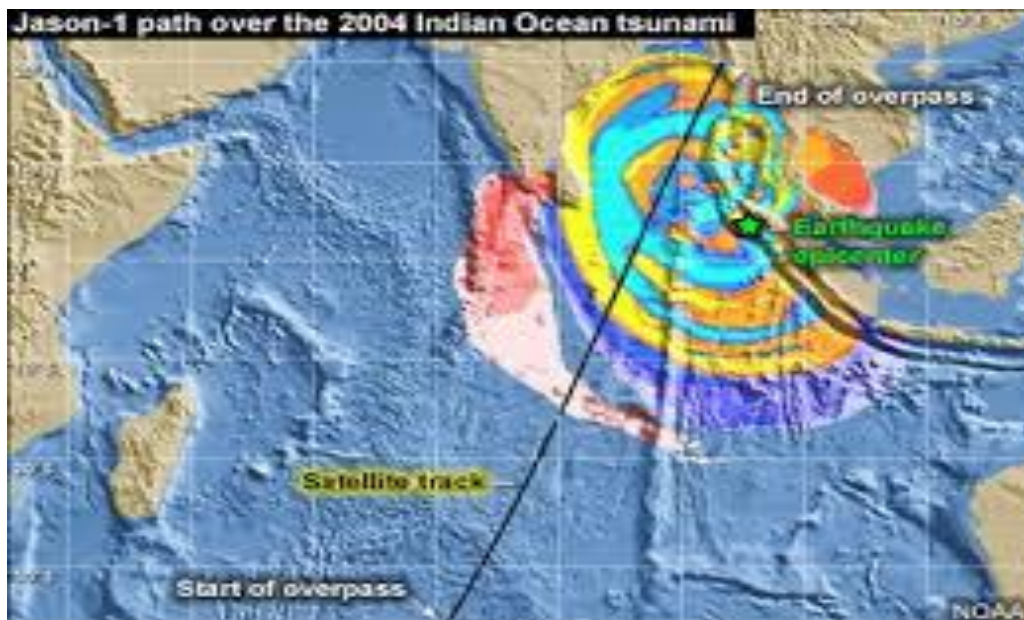


Fig 8 Region effected by 2004 Indian Ocean Earthquake
(Source : <https://earthobservatory.nasa.gov/images>)

The Tsunami, like all others, behaves differently in deep water than in shallow water. Tsunami waves form only a low, broad hump, barely noticeable and harmless in deep ocean bed, but gains momentum and high speed in shallow waters near coastlines, sweeping virtually everything enroute. A Tsunami slows down to only tens of kilometers per hour but, in doing so forms large destructive tidal waves along its path. As the 1.600 km fault line

affected by the earthquake was in a North-South orientation, the greatest strength of the Tsunami waves was in an East-West direction. Thus, Bangladesh which lies at the northern end of the Bay of Bengal had fewer casualties despite being a low lying country reasonably close to the epicenter. It also aided by the fact that the earthquake progressed more slowly in the northern rupture zone, thereby greatly reducing the energy of the water displacements in that region (Fig 8).

Distance alone was no assurance of safety, as Somalia, which was about 4500 km west of the epicenter hit harder than Bangladesh despite being much farther away. Because of the distances involved, the 2004 Tsunami took anywhere from fifteen minutes to seven hours to reach the coastlines of various countries. The northern regions of the Indonesian island of Sumatra were the first one to be hit quickly, while Sri Lanka and the east coast of India were hit roughly 90 minutes to two hours later. Thailand, despite being closer to the epicenter, was struck about two hours later as the Tsunami traversed more slowly in the shallow waters.

Early Signs and Warnings

Despite a delay of up to several hours between the earthquake and the impact of the Tsunami, nearly all of the victims were taken by surprise, as there were no Tsunami warning systems in the Indian Ocean either to detect Tsunamis or warn the population around the ocean. Tsunami detection is not simple because while a Tsunami is in water, it has little height and to detect the occurrences a network of sensors are required. Installing effective communications infrastructure for early warnings of Tsunamis is an even bigger challenge, particularly in a relatively impoverished part of this part of the world. Fig 9 shows impact of Tsunami in a number of countries.

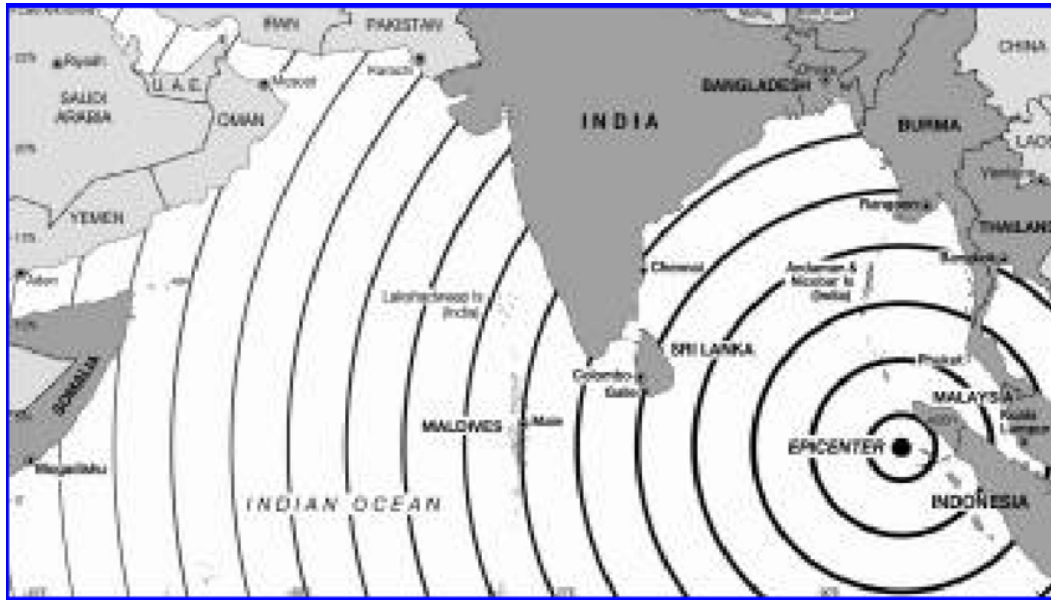


Fig 9 Effect of Tsunami

(Source: <https://www.researchgate.net/figure/Indian-Ocean-earthquak>)

The first warning sign of a possible Tsunami is the earthquake itself. However, Tsunamis can strike thousands of kilometers away where the earthquake either could be felt weakly or totally absent. Usually, in the minutes preceding a Tsunami, the sea often recedes temporarily from the coast, something which was observed on the eastern side of the ruptured zones of the earthquake such as around the coastlines of Aceh province in Indonesia, Phuket Island and Khao Lak area in Thailand, Penang island of Malaysia and some parts of Indian Ocean and the Andaman and Nicobar Islands in India. This unusual sight apparently drawn people, especially children around some areas in the Indian Ocean, to visit the coast to investigate and collect stranded fish from as much as 2.5 km off exposed beach, with fatal results when Tsunami suddenly struck.

The Tsunami arrived along the southeast coast of the Indian mainland in the states of Tamil Nadu and Andhra Pradesh shortly after 9:00 AM. Two hours later, it arrived in the state of Kerala along the southwest coast. Tamil Nadu, Kerala and the union territory of Pondicherry were badly damaged, while Andhra Pradesh escaped with moderate damages.

Three densely populated districts of Kerala state namely Ernakulum, Alappuzha, and Kollam experienced Tsunami related damages, possibly due to diffraction of waves around Sri Lanka Island. The southernmost district of Thiruvananthapuram, however, escaped destruction, possibly due to the wide turn of the diffracted waves at the peninsular tip. Major damages occurred in two tapered strips of land which was one On the west by the Arabian Sea and on the east by the Kerala backwaters. The waves receded before the first Tsunami with the highest fatality reported from the densely Alappuzha panchayat . The worst affected area in Tamilnadu was Nagapattinam district, with 6,051 fatalities reported by a 5 m Tsunami followed by Cuddalore district, where many villages got destroyed. The 13km Marina Beach in Chennai was battered by the Tsunami which swept across the beach. In Puducherry, a 10 m black muddy Tsunami ravaged the city of Karaikal, where 492 lives were lost. The city of Puducherry which was protected by seawalls was relatively intact. Fig 10 shows the effect of Tsunami before and after on Banda Aceh city Sumatra Indonesia.



Fig 10 Before and after Effect of Tsunami - Banda Aceh city Indonesia
(Source: The Asian Tsunami disaster, December 2004. Geology Today)

Tsunami 2004 Damage Tsunami waves destroyed many villages in Andhra Pradesh. In Krishna district the Tsunami created havoc in Manginapudi and Machalipatanam towns. The most affected was Singraikonda town in Prakasham District recording 35 deaths. Given the

enormous destructive power of Tsunami, the fishing industry suffered the maximum. Moreover, the cost of damage in the transport sector was reported in crores. The effects of Tsunami varied greatly across different coastal areas which were directly proportional to the waves experienced, the inundation of distance, height of waves, the population density of the affected area and topographical features. Most of the people killed were members of the fishing community.

As per local eyewitnesses, there were three Tsunami waves in South Andaman. Of the three the third wave was the most devastating. Flooding occurred along the coastlines of the islands and low lying areas inland, connected to open sea through creeks. At Port Blair the water receded before the first wave, and the third wave was the tallest and caused the most damage. However, at Hut Bay, Car Nicobar and Campbell Bay locations south of Port Blair, the water level rose by about 1 to 2 mtr from the normal sea level before the first wave crashed ashore. The significant shielding of Port Blair and Campbell Bay were because of the mountainous and bay areas all around.

In the Little Andaman, Tsunami waves impinged on the eastern shore of this island 25 to 30 minutes after the earthquake in a four-wave cycle of which the fourth one was most destructive with a wave height of about 10 m. The Tsunami waves destroyed settlements at Hut Bay within a range of 1 km from the seashore. Run up level up to 3.3 m have been measured. In the island of Car Nicobar, waves nearly 3 stories high devastated the entire Indian Air Force base, located just south of Malacca strait on Carnic Island.

In Campbell Bay of Great Nicobar Island, the Tsunami waves hit the area three times with an inundation surge of 250 - 550 m. The first wave came within 5 minutes of the earthquake. The second and third waves followed 10-minute intervals after the first one. The

second wave was the strongest. Lethal Tsunami waves inflicted havoc in this heavily populated Jogindar Nagar area, situated 13 km south of Campbell Bay. According to local sources, Tsunami waves struck the area three times. The maximum affected island in the Andaman & Nicobar chain of islands was Katchall Island with 303 people confirmed dead and 4,354 missing out of a total population of 5,31,288.

Effect of Tsunami on India



Fig 11 Mass Destruction by Tsunami 2004

(Source : Images by WorldAtlas.com)

India was the third country that was severely affected, after Indonesia and Sri Lanka. The official death toll in India was reported to be 10,749 and another 6,000 people were reported missing or feared to be dead. Approximately 154,000 homes were destroyed and 600,000 people were displaced and rendered homeless. The overall financial loss to India was estimated at about \$ 2 Billion US dollars. The fishermen communities that lived along

coastline suffered most damage and destruction. Nearly 80 percent of the dead on the mainland were from the fishing communities. They lost their homes, boats and their source of livelihood (Fig 11).

Affected Regions by Tsunami. This disaster affected a total of fourteen regions in India both affecting the Andaman archipelago as well as the coastal regions of mainland India. This ocean earthquake coupled with Tsunami goes down in history as the deadliest of all time. It took the lives of over 230,000 victims and wounded more than double this number across the globe. The Great Nicobar and Car Nicobar islands were the worst hit among all the islands of Andaman's they were exposed to the quake because its flat terrain. Aftershocks continued to haunt the islands days, and one-fifth of the population of the Nicobar Islands was reported dead, injured or missing. Two-thirds of Chowra Island's population comprising of 1500 perished. While this entire Island was marooned, the Trinket Island was divided in two . Communications were cut off to the Nancowry group of Islands some of which were inundated under water for weeks.

In Car Nicobar, 111 Indian Air Force personnel and their family members were washed away when the Tsunami severely damaged their air base. Many religious structures and sports facilities were washed away. Entire Car Nicobar Island tilted by couple of degrees to north while the sea has ingressed at least 100 meters towards the shore line. Barren Island India's only active volcano erupted on 30th Dec 2003 due to increased seismic activity. The southern most part of India Indira Point in Great Nicobar Island which had tidal waves rising 4.25 meters left some ships of coastguard and local fishing boats along with its only lighthouse damaged.

The tsunami waves struck the mainland with a height ranging from 3m to 10 meters and penetrated 300 m to 3 km inland, affecting approximately 2.260 km of coastline with varying intensity. As per the joint report prepared by Asian Development Bank, United Nations and World Bank New Delhi, India, the largest number of villages impacted were in Tamil Nadu (376), followed by Andhra Pradesh (301), Kerala (187) and Pondicherry (33). Tsunami shattered communities with its high toll of human lives, injuries, livestock, homes, family networks and livelihoods. There were long term repercussions for families torn by death or disabilities of members, leaving many widows, children, orphans, and children separated from their families, the elderly and the disabled traumatized. Majority of those affected on the coast were fisher folk who suffered the most damage in terms of housing and livelihoods with losses to their dwelling units, household assets, and their only lively means boats and nets".

Repercussions on Economy. The extent of damage to the economy resulting from the Tsunami depends on the scale examined. While local economies were devastated, the overall impact to the Indias economy was minor because of the huge GDP. The two main activities affected by the Tsunami were fishing and tourism. The impact on coastal fishing communities and the people living there, some of the poorest in the region had been devastating with huge losses to income earners as well as to boats and equipment. In addition to this, many ports, roads and railway, electrical lines, and communication lines too were damaged beyond repair. In Andaman power lines especially in Port Blair many Indian Naval and Coastguard ships along with intra island passenger liners were damaged.

Repercussions on Environment. In addition to the heavy casualties of human lives and livestock, the Tsunami of 2004 has caused an enormous impact on the environment that will continue to affect the region for many generations to come by. Extensive damage were also

inflicted on ecosystems such as Coral Reefs, Mangroves, Forests, Coastal Wetlands, Vegetation, Rock Formations, Animal and Plant Biodiversity and Groundwater/fresh water wells (Fig 12).



Fig 12 Massive Damage by Tsunami 2004
(Source: <https://cimsec.org/legacy>)

According to specialists, the main effect is being caused by contamination to the freshwater supplies, soil salination by the ingress of saltwater infiltration and deposit of a salt layers over arable land. It has been reported that in the Andaman alone, 16 to 17 major coral reefs that were asphyxiated by sea waves could be rendered uninhabitable for decades. Soil became sterile due salt deposits which would render difficultly and costly to restore for agriculture purposes. It also caused death to plants, many micro-living organs and a important soil micro-organisms. Thousands of rice, mango, and banana plantations in coastal areas of Andhra and Tamil Nadu were destroyed almost entirely and had a taken years to recuperate. There had been some terrestrial and aquatic pollution too both in terms of physical debris as well as sewage and chemical effluents. Pollution was more problematic on land and in closed systems such as lagoons, ponds and streams adjoin the coastal areas.

Other Effects

Many health professionals and aid workers have documented widespread psychological and emotional damage as a result of the tsunami. Medical crises could not be met due to the collapse of the medical infrastructure in most of the impacted areas. Because of the distance from the main land, the rehabilitation effort has taken years to take effect, particularly in Andaman, despite passage of time, procedure is still ongoing.

Armed Forces Operation

Massive search and rescue operation were launched with the help of the Armed Forces. These were supported by the Central Para-military Forces and the two Medical First Responders (MFR) specially trained teams of the Ministry of Home Affairs. In all, 20,907 personnel; 8,300 from Army, 5,500 from Navy; 3000 from Air Force; 2000 from Coast Guard and 2107 from CPMF and 40 Ships, 34 Aircrafts and 42 Helicopters were deployed for search and rescue. Such coordinated operations on such a large scale had never been undertaken in the history of the country. The immediate concerns were search and rescue of marooned and stranded persons; evacuating people to safer places; providing temporary shelter and relief camps. The retrieval and disposal of dead bodies posed a major challenge.

Retrieval and disposal of dead bodies was an immediate requirement. Personnel from Central Para-military Forces and employees from the Municipal Corporation of Mumbai were detailed to the worst affected areas in Tamil Nadu and to the Islands to assist in the retrieval and disposal of dead bodies. The quick disposal helped in early sanitization and prevention of any subsequent epidemics.

BHUJ EARTHQUAKE : 26 JANUARY 2001

On the 26th of January, 2001, the Western Indian state of Gujarat was rocked by a powerful earthquake with a Richter-Scale magnitude of 7.7Mw (Fig-13). It resulted in significant loss of lives and property. This earthquake was so powerful in its magnitude that it killed thousands of people, left many more gravely injured, bruised, and disabled, and pummeling them physically, psychologically, and financially. The epicentre of the quake was around 20 kilometres northeast of Bhuj Town in the Kutch region of Western Gujarat, at 23.6 North Latitude and 69.8 East Longitude. Even though the quake occurred at a depth of only 23 kilometres below the surface, it caused severe vibrations and tremors that were felt across 10% of India, as well as Pakistan and Nepal. The aftershocks continued to batter the Kutch area for weeks causing extreme anxiety to a large population of this area.

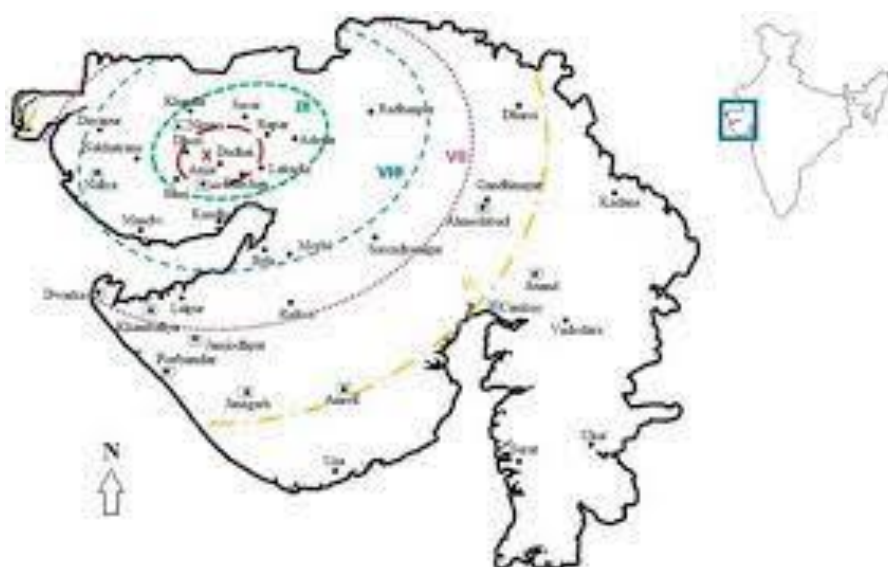


Fig 13 Epicentre of Bhuj Earthquake - 2001
(Source : <https://www.mdpi.com>)

Historically, Seismic activity was prevalent in the affected area of the Kutch. This

region falls in Seismic Zone V, the only such zone outside the Himalayan Seismic Belt. Earthquake seismic vulnerability map is shown in Fig 14.

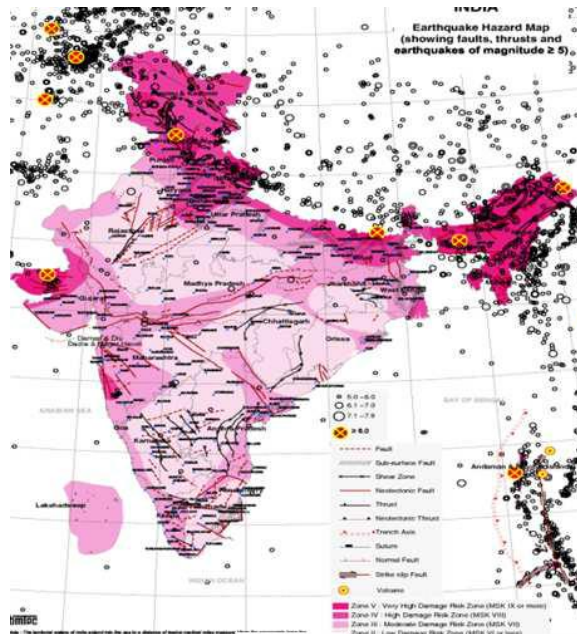


Fig 14 Earthquake Hazard Map Of India

(Source : <https://www.ibtimes.co.in>)

This magnitude of earthquake has not been seen in the last 50 years. The earthquake affected 21 of Gujarat's 25 districts, 18 towns, 182 talukas, and 7904 villages. Many of the impacted locations were as much as 300 kilometres away from the epicentre. Bhuj, Anjar, Bachau, and Rapar, four important urban centres in the Kutch District, were severely damaged. Over 450 villages in rural Gujrath were also severely impacted, with the majority of them completely destroyed. In addition, widespread damage occurred in the districts of Rajkot, Jamnagar, Patan, and Ahmedabad. Major structures, infrastructure, and industrial facilities have been damaged in many urban regions, including Morbi (Ceramic industry), Rajkot, and Jamnagar. Ahmedabad, the state capital, was also hit hard. Anything between 13,805 and 20,023 casualties' was reported with another 167,000 injured and destroyed nearly 400,000 homes.

The death toll in the Kutch region was 12,300. Bhuj, the major town of Kutch was located 20 Kilometers from the epicenter was completely devastated. Substantial damage also occurred to the towns of Bhachau and Anjar with hundreds of peripheral villages razed in many talukas of Anjar, Bhuj and Bhachau, Lakhs of structures were damaged or destroyed including many historical heritage buildings of tourist attractions. The quake destroyed around 40% of homes, eight schools, two hospitals and 4 km of roads in Bhuj.

Ahmedabad with a population of nearly 7 million saw about 50 multi-storied buildings getting collapsed and several hundred people getting killed. The earthquake destroyed 60% of food and water supplies in Kutch. Around 258,000 houses and 90% of the district's houses were either destroyed or damaged rendering irreparable. The biggest setback was the total destruction of the Bhuj Civil hospital and the Air Force Station. The Indian Military Medical teams were air lifted immediately and provided emergency support and first aid care, which was later augmented by the International Federation of Red Cross, Red Crescent Society and an Israeli field hospital staff. A temporary Red Cross hospital and Israeli field hospital remained in Bhuj for some time to provide medical care while a replacement hospital was built subsequently.

The earthquake in Gujarat in 2001 gave various opportunities for learning, which ultimately contributed in the formation of forward-thinking disaster management policies across the country, particularly in respect to earthquakes. India's seismic disaster mitigation initiatives were sparked by the Gujarat earthquake. Earthquakes pose the same problems all over the planet. The challenges that arise during the recovery and reconstruction stages are crucial for effective risk management among a wide range of stakeholders, as well as training and confidence building among experts using proper developmental planning approaches. In

the domains of geotechnical and structural failures, this earthquake has given a number of examples and takeaways. Traditional building design and construction procedures in the country have been criticised for the first time.

11. **Infrastructural Damages.** 20 railway stations across Kutch region were damaged with Gandhidham Stn suffering the worst. Railway tracks too were damaged at many places. Many of them were bent or fish plates were uprooted. However, no major damages were observed to the Railway bridges. Most of the of roadway and highway bridges and their parapets in this region were considerably damaged. The damage to the structures the major ports viz., Kandla, Navlakhi and Adani were negligible. By and large, docking berths, pylons and overhead gantries escaped the wrath of the earthquake. However many residential buildings were damaged even in state capital, Ahmedabad (Fig -15)



Fig 15 Damage in Earthquake

(Source : <https://www.freepressjournal.in/india/2001-gujarat-earthquake-how-the-state-bounced-back>)

Prompt Response by State Disaster Management The response to a system or organization depends significantly on how the people concerned respond to a situation. Bhuj earthquake was an excellent example of this. As soon as the news broke out, the entire state Disaster Management machinery was activated. The State Emergency Control Room at Gandhinagar was activated by 0930hrs. The Collectors of Sabarkantha, Patan, Rajkot, Jamnager districts gave the first hand information on the death toll and other damage in their respective areas.

In addition to the complete breakdown of the landline telephone system cellular networks also collapsed. Communication, even between Gandhinagar and Ahmedabad, became impossible. The satellite telephone of the Air Force Communication lines were used to try and contact Bhuj. Preliminary communication between the state control room and Bhuj indicated that the situation was alarming in Kutch. By 11.30 a.m., it was confirmed that the Bhuj area had been completely devastated by the earthquake. Information also trickled in from sources other than the official channels like the Army and Air Force communication networks. The South Western Air Command and Army Division at Gandhinagar and Ahmedabad immediately were alerted and their search and rescue machinery were activated at once. Helicopters from Jamnagar and transport aircraft from Ahmedabad and Vadodara were immediately dispatched with medical teams and relief material.

The Military Hospital along with the Air Force Medical center were the only functioning medical facilities in the vicinity, which was soon overwhelmed by deluge of dead, dying and injured persons. By 11am, a few enterprising private started treating the injured and initiated medical relief activities at an open ground which later became famous as Hospital Ground. In spite of having only a temporary hut the doctors present there continued their best efforts with whatever little equipment and medical supplies that were

available. Military doctors too started treating the injured from makeshift tents from the airfield itself as hordes of injured started arriving by the Indian Air Force and Army Helicopters to Bhuj. The district administration also concentrated its efforts to provide medical supplies. Emergency medical stores were released and supplies were diverted to these makeshift Medicare centers by the district authorities. Search and rescue operations need a large number of equipment such as bulldozers , cranes and concrete cutters. All out efforts were made by everyone, be it Armed Forces, NGOs, Dist officials, businessmen or farmers to mobilize such equipment from any sources that were available.

The National Crisis Management Committee convened the meeting and deliberated on the situation at 1500 hrs in Delhi. In the meantime, the Cabinet Secretary had already interacted with several state secretaries, asking them to mobilize maximum possible resources. The cabinet secretary along with 30 doctors from the All India Institute of Medical Sciences and Safdarjung Hospital reached Bhuj around 0830 pm to provide relief and emergency Medicare. Even after two days , communication continues to be a grey area. Damage to the Surajbari bridge disrupted road movement. However, the Bhuj Air Force Station runway inspite of some damage, remained functional. This facilitated the movement of supplies various parts of the country and abroad.

12. **Role of the Armed Forces.** Army personnel stationed at Bhuj and Gandhidham quickly geared up to provide assistance to the civilian population. Within 45 minutes of the disaster, the two army units sent out 14 and six columns respectively for relief operations. On the first day itself, the army rescued 110 people and recovered dead bodies at Bhuj. Likewise, they rescued 108 people and recovered 58 dead s from Gandhidham. The military hospital, being the only well-equipped hospital and adjoining areas, treated thousands of

civilians. The GOC-in-C, Southern Command flew in from Pune along with four surgical units. Having assessed the situation, additional medical personnel, equipment and infantry units were moved to Kutch for providing to relief. The army restored arterial road communications of major towns and villages. There was extensive damage throughout the state which is as shown in Fig-16.



Fig 16 Some damaged Buildings in Earthquake

(Source : <https://www.researchgate.net/figure/Structural-failures-during-Bhuj-earthquake-2001>)

The AOC-in- SWAC. quickly ordered airlift of rehabilitation material, medicines , surgical equipments besides water and food for the affected people from every Air Force Station under his jurisdiction. Specialists from various units were augmented. Security of relief material poured in various parts of the world was ensured. The Armed Forces also organized large-scale rescue efforts including eight engineering regiments, 36 columns, 48 IAF aircrafts/helicopters. More than 5,000 trucks, bulldozers, cranes and gas cutters etc.,

were organized for the rescue efforts. The Air Force pressed into service six IL-76, 18 AN-32, four Avros, four Dornier airplanes and 16 helicopters. They flew nearly 1000 sorties, carrying relief materials, tents, equipment, food items, rescue teams and mured persons. The army deployed a large number of troops in the Bhuj and Ahmedabad.

In addition, three columns of the 68 Engineers Regiment were deployed for technical inspection of buildings that were rendered unsafe. A large number of vehicles and equipment were also deployed. They rescued 478 persons, evacuated 484 seriously injured persons and recovered 2,260 dead bodies. The Indian Navy dispatched a team of 30 men with INMARSAT satellite phones. The INS Ganga carried relief materials to Kandla and two naval ships were converted into hospital 98 where surgeries were performed. A Dornier operated between Mumbai and Kandla carrying fresh water. The Union Home Ministry released a number of companies of the Central Paramilitary Forces to for rescue and relief work. Initially 47 of these, such as the RAF, CRPF and BSF, provided rescue and relief services.

Relief by Ministries and States A number of ministries such as Chemicals and Petrochemicals. External Affairs, Finance, Food and Public distribution , Health, Petroleum, Railways, Shipping, Power, Social Justice and Rural Housing. Telecommunication, Urban Development and Women participated in providing immediate relief . The ministry of Railways deployed special trains with relief materials from s Kolkata and New Delhi to Ahmedabad and Bhuj. Ministry of Power erator sets for utilization by the GEB in the Kutch district. The National Thermal Power Corporation assisted in re-commissioning of 10 sub-stations of the GEB.

Many State Governments spontaneously offered relief assistance both in cash and kind. Food, blankets, medicines, medical personnel, water tankers, water bottles, daily essentials, equipment etc., were sent by various state governments and union territories. Many of them also contributed the Gujarat Chief Minister's Relief Fund. Some of these states sent not only equipment and material but also senior officials and supporting staff to undertake relief work. Some of them participated in the reconstruction and rehabilitation work also.

Role of International Community As a policy, the Gol did not appeal for any international humanitarian assistance. However, looking at the magnitude of the disaster, departing from the earlier practices, assistance offered was accepted from the International communities. The United Nations Disaster Assessment and Coordination (UNDAC) team visited the earthquake-affected areas on January 2001. USAID was again a great help to the people of Kutch helping them with their generous grants both in kind as well as cash in the rehabilitation process. The various details are as mentioned below:

- (a) Search and rescue teams from abroad began their operation at 2300 hours on 27 January, when the Swiss search and rescue team arrived by air, closely followed by teams from the UK, Russia and Turkey. The Swiss rescue team consisted of 52 members and 12 sniffer dogs. As soon as they arrived in Ahmedabad they immediately proceeded to the site of the nearest multi-storied building in Ahmedabad and started their rescue efforts. They rescued eight people during their operation.



Fig 17 Aftermath of Earthquake

(Source: <https://www.shutterstock.com/editorial/image-editorial/indian-earthquake-bhachau-gujarat>)

(b) For structural damage (Fig-17) search and rescue was a big challenge. There were two teams from the UK and their search and rescue team comprised of 69 people with equipment. They rescued six survivors and recovered two dead bodies. The British International SAR and dog team had eight members, one dog and sundry equipment.

(c) A total of 26 international teams arrived in Gujarat by 02 February. The first teams started arriving by 27th Jan and by 15 February almost all had left. As there was no possibility of rescuing more survivors by then, the remaining teams were deployed on more general tasks, some helping with the recovery of bodies, others with debris clearance, relief and medical support and few provided assistance to the local teams. The Indian Air Force in consultation with MoD was magnanimous in giving the Air Ops clearances to the international military and civil aircrafts without any delay.

Some Important Lessons

On 3 February 2001, the then-Prime Minister, Atal Bihari Vajpayee, convened an all-party conference at the centre, which was led by him. It was at this meeting that the National Committee on Disaster Management was formed. By a notification dated February 13, 2001, the Indian government established a National Committee of 35 members, with the then-Prime Minister as Chairman and Sharad Pawar, then a Member of Parliament, as Vice-Chairman. The National Committee's member-secretary was the Cabinet Secretary. For the first time, a national level authority to oversee disaster management was established.

During the relief and rehabilitation activities in Bhuj, several lessons were learned. Gujarat has previously dealt with calamities, particularly cyclones. Over time, data analysis, documentation, and systems have grown, allowing for speedy response and effective recovery. However, following the earthquake in Bhuj, it became clear that there was an immediate need to strengthen and expand current systems, as well as refine procedures. Some of the lessons learnt are as given below:-

- (a) Installation & monitoring of Modern Seismic instruments needs to be reviewed at earthquakes prone areas. A similar approach is needed to improve the flood and cyclone forecasts, dissemination and early warning systems.

- (b) Though there were DM plans at all levels but most of them pertained to the flood and cyclones. A realistic and holistic approach encompassing all possible disasters, keeping in mind the vulnerabilities and topography/terrain of the area must be prepared, reviewed and disseminate to the last person in the hierarchy.

- (c) Each district located in areas prone to disasters should maintain an on-line

inventory of resources available with the government, public sector and private sector. This will enable easy and quick mobilization of resources. A statewide on-line resource inventory would enable the mobilization of resources from neighboring districts in the event of a disaster.

(d) The role of police, paramilitary and Armed Forces may be defined and clearly outlined in the disaster management plans particularly with response plans.

(e) Training is extremely important. It is necessary to arrange training in a systematic way so that most of the stakeholders are exposed to the latest ideas and technologies in disaster management. Different government departments, public sector organizations and NGOs should ensure effective participation of their personnel in training programmes. Specialized training facilities for emergency medical management and search and rescue capability should be developed.

(f) Utilizing the services of retired personnel of Armed Forces and even retired police personnel in disaster management efforts may be considered. For this purpose, there should be a systematic approach of having a database, providing orientation from time to time and deploying them quickly at the time of disaster.

(g) Youth organizations such as the National Service Scheme, National Cadet Corps, Youth wings of political parties, student unions, trade unions and the Nehru Yuvak Kendra can play useful roles at the time of a disaster. They have valuable human resources, skills and well defined hierarchy.

(h) Media management is extremely important. Developed countries have custematic arrangements for this purpose. This aspect should be considered while designing an operations Centre and preparing disaster management plans.

(j) Even prior to the Bhuj earthquake, Gol considered the transfer of the subject of

disaster management from the Ministry of Agriculture to the Ministry of Home Affairs. The Bhuj earthquake possibly provided a new sense of urgency. The subject of disaster management when transferred to the Ministry of Home Affairs was at that time headed by the Deputy Prime Minister of India. The Ministry of Home Affairs thereafter undertaken a number of initiatives relating to prevention and mitigation in addition to upgrading of the emergency response system both at Central and States.

(k) A DM programme was introduced by the Government of India in collaboration with the UNDP. Initially, it was envisaged to cover 17 states in India. In each State, vulnerable talukas and villages have been identified. The objective is to put a comprehensive multi-disaster-based programme of community preparedness and capacity building in place. It also aimed to prepare disaster management plans at the grass root level viz., district, sub-district and village/taluk levels.

One of the important lessons learnt was that it is unrealistic to expect accurate figures of losses and damages immediately after a disaster that was so severe and widespread. It may be more rational to follow a systematic approach and a realistic time-frame. In the case of Bhuj earthquake, initial figures were way exaggerated both human losses as well as infrastructural damages. Estimates of the magnitude of the earthquake too varied because of absence of appropriate technological tools at that time. Initially, it was estimated by the IMD to be 6.9 on the Richter scale, the Geological Survey of India estimated it to be 7.6 and US Geological Survey estimated it at 7.7 on the Richter scale. However last estimate finally was agreed upon as the most accurate one.

The stringent enforcement and compliance of seismic laws, building standards, and good construction techniques, particularly in earthquake-prone locations, is a critical concern. Much work continues to be done in this area, as comprehensive rules must be developed based on local characteristics and sound scientific expertise. Similarly, most of the impacted areas lacked systemic relief, rescue, and medical assistance. The mechanism for distributing relief and rehabilitation materials garnered a lot of flak from various sides as well.

The lessons learned from the Gujarat tragedy have raised several issues and led to the adoption of numerous statutory acts, rules, and guidelines in the field of disaster management, not only for Gujarat but for the entire country. The establishment of the National Disaster Management Authority, the DM Act, and the NDRF are only a few examples that deserve honour and recognition. Furthermore, the media's responsibility is to expose the truth and present the situation as it is. They accentuated the flaws and deficits while ignoring, with the exception of a few exceptional cases, the wonderful work done by many people in a variety of settings. They also attempted to sensationalise various aspects of the situation. Without any extensive study, agencies, particularly the media, speculated on mortality and loss statistics. This alone is sufficient to demoralise and creates panic amongst the people. Therefore, DM act 2005 should highlight the requirement of a specialist to brief the media on the day to day development on a situation.

UTTARAKHAND FLOODS IN 2013

In the early hours of June 17, 2013 a flash flood came down upon the overflowing banks of the Chorabari lake in Uttarakhand. Carrying huge amounts of silt and rocks, it destroyed lives, houses and everything else that came its way. Between June 13 and 17, the state of Uttarakhand had received an unusual amount of rainfall. This led to the melting of the Chorabari glacier and the eruption of the Mandakini river. The floods affected large parts of Uttarakhand, Himachal Pradesh and Western Nepal. The heavy rainfall caused massive flash floods and landslides resulting in the death of residents and tourists as well as extensive damage to property. Reportedly the worst hit was the Kedarnath valley popular for the 8th century temple dedicated to Lord Shiva (Fig-18).



Fig 18 Lord Shiva Temple , Kedarnath

(Source : <https://indianexpress.com/article/research/here-is-what-happened-in-kedarnath>)

Following the torrential rains on the evening of June 16, many people in Kedarnath gathered in the temple grounds to pray; nevertheless, a considerable number of people returned to their respective places around 0200 hrs on June 17, 2013. In the morning hours of June 17, 2013, massive damage struck Kedarnath. Huge glacier stones clogged the western Mandakini as the torrent rivers took them. The rubble and water flowed towards Kedarnath township, which was completely destroyed (Fig-19). There was no notice, and most individuals were caught off guard and had little time to prepare. There was no warning and most people were taken by surprise and had no time to respond. Despite the fact that heavy rainfall and cloudbursts are natural causes for the floods and landslides, environmentalists believe that the disaster of 2013 was a manmade one. Unplanned and haphazard construction, mismanaged tourism and related activities including intensive mining in this fragile ecosystem are some of the reasons that made to name this natural disaster partly as man-made that increased the intensity and magnitude of damages.



Fig 19 Worst Affected Areas: Uttarakhand Disaster

(Source: Disaster Nature Fury A preliminary report Uttarakhand disaster)

Effect of Unprecedented Magnitude

More than 5000 people went missing and/or were assumed dead as a result of the disaster's scope and extent (Fig-20). The calamity was unprecedented in its scope. Regular traffic was prohibited on national highways and other major thoroughfares. Due to the harsh terrain and terrible temperatures, more than a lakh pilgrims, tourists, and over 50 thousand locals have been stuck. Between June 13 and 17, the state of Uttarakhand had received unusual heavy amount of rainfall leading to melting of Chorabari Glacier. The sequences in Mandakini valley caught everyone off guard, and there was no useful warning that could be passed on to nearby locations. On the evening of June 16th, all communications with the Kedarnath valley were cut off.



Fig 20 Villages Submerged In Floods
(Source : <https://www.bloomberg.com/news/articles>)

Only on the morning of June 18, 2013, could aerial rescue operations begin. The washing away of the pedestrian trail in numerous places between Gaurikund and Rambara delayed ground search and rescue activities, and major rescue efforts could only begin on June 10, 2013. Even airdropping food and water to many locations where people were stranded in significant numbers was challenging due to terrain conditions. Over 1,25,000 individuals were stranded in various regions due to torrential rainfall, flash floods, major landslides, and roadblocks. Fig 21 showing extensive damage to stable and natural highways.



Fig 21 Nature Fury : Uttarakhand Disaster

(Source : <https://thelogicalindian.com/news>)

Casualty and Damage Assessment

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. The response from these various organizations were praiseworthy and given below (Fig-22).



Fig : 22 Damage Assessment

(Source : <https://www.downtoearth.org.in/coverage/natural-disasters>)

Efforts by NDRF.

In six sites, the NDRF deployed a total of 449 people from two NDRF Battalions. Rudraprayag District has five teams, Haridwar has three, Guptkashi has one, Lakshar has one, Gaurikund has one, Dehradun has one, and Jolly Grant Airport has one. The NDRF's aim was to support the State government with search and rescue operations, and

they were able to save 9,321 people and retrieve 142 bodies. In addition, the NDRF sustained casualties in a helicopter crash, which resulted in the deaths of nine officials. While the NDRF made a significant contribution to the rescue efforts, its crews were only able to arrive at the event location on June 18th.

Efforts by ITBP. In Uttarakhand, almost 1900 ITBP were participating in rescue and relief efforts. In addition to rescuing and evacuating 33,009 Indian nationals from various catastrophe sites, the Indo-Tibetan Border Police rescued 21 foreign nationals from remote areas of Uttarakhand. All ITBP locations in disaster-affected areas, such as Joshimath, Uttarkashi, Matli Lambaghat, and Nyu Sobla erected temporary relief camps for the stranded populace, providing shelter, food, and medical help. ITBP forces also aided the Border Road Organisation (BRO) in the repair and construction of damaged roads and bridges.

First Response from Armed Forces The Armed Forces were among the first to assist in disaster relief operations, owing to the presence of army units and troops in the impacted areas. The Army, Air Force, ITBP, and NDRF combined their resources to provide help to thousands of stranded people in the following relief missions. The Indian Navy also dispatched a small group of marine commandos (MARCOS) to Rudraprayag and Rishikesh, who were specially trained in diving. The military's relief personnel were praised for their ability to deliver while working under extreme weather and terrain conditions.



Fig 23 Air Relief provided by Indian Air Force Helicopters

(Source : <https://www.indiatoday.in/india/north/story>)

The relief work carried out by a combined team of Armed Forces ITBP, Border Security Force, National Disaster Response Force (NDRF), Public Works Department as well as by local administration. The IAF rescued 23,775 people, the Army 38,750, the ITBP 33,000, and the NDRF 9,000 during the huge response operation dubbed "Surya Hope." IAF dropped about 730 MT of essential commodities at different places (Fig- 23). 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.

Lessons for Disaster Relief Machinery

The devastation in Uttarakhand was revealed by media as the civil administration's and disaster management authorities lack of preparedness and response, both at the national and

state levels (Fig-24). The NDMA's and state administration's performance has been highly criticised for their slow response and lack of readiness. The Uttarakhand government and the SDMA have been criticised for failing to heed the meteorological department's warning and issuing an evacuation advisory too late.

The Uttarakhand government has also been accused of being tardy and ineffective in coordinating the overall relief effort. Because of the delay, three important days were wasted. Lessons for state administration and higher aspects of the response matrix, as derived from numerous studies and feedback, are compiled in the following sections.



Fig 24 Kedarnath Town .

(Source : <https://www.slideshare.net/sunilbhatt638/kedarnath-temple-before-and-after>)

The local administration and population were badly impacted when the calamity struck. In these locations, there was no effective presence of civil government to direct and regulate the induction of relief columns. Most civil servants had either fled or were on their

way to safer regions in most of the districts. There was complete paralysis of command and control system of State Administration, which led to failure to assess the gravity of the calamity.

There was lack of coordination and uncertainty and confusion. The district administration was deemed to be deficient in organising coordination meetings with the ITBP and local Army/GREF units during the planning stage. Periodic coordination meetings might have guaranteed that functional issues were addressed at the local level. Following the disaster, the national level cooperation was satisfactory. For macro-level coordination, regular Crisis Management meetings were held in Delhi and Dehradun.

The great duty that fell on the armed forces to fulfil despite the daunting limits was an unintended consequence of the state machinery's inability to deliver during emergencies. Due to a lack of prior training and coordination, there was a lack of synergy and interoperability concerns between the NDRF and the Armed Forces. While the armed forces' contributions and performance have been widely praised, the Uttarakhand floods demonstrated that the NDRF is a good asset for localised disaster response (small scale), but it is insufficient for a major disaster, for which the Armed Forces, as in any other country, will be called upon to respond. The Armed Forces must be included in the DM Mechanism, as required by the DM Act. 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.

AERIAL RECCE SORTIE - FLYING RAKSHA MANTRI



SUPER CYCLONE PARADIP ORISSA 1999

1. *The Super Cyclone that swept the Orissa coast on 29th and 30th October 1999 was perhaps one of the most ravaging natural disasters that mankind has experienced in modern times. The death and destruction that it left in its trail was not only an appalling shock to the whole world, but was*

also a traumatic experience, that will continue to haunt the people of Orissa for generations to come. The super cyclone ravaged the Orissa coast on 29th and 30th, and devastated 12 districts viz., Jagatsinghpur, Kendrapara, Cuttack, Puri, Khurda, Nayagarh, Jajpur, Bhadrak, Balasore, Mayurbhanj, Keonjhar and Dhenkanal.

2. *The Super Cyclone, unprecedented in its sweep and ferocity, killed 9,885 people. Besides causing destruction on a gigantic scale, the Super Cyclone traumatized millions of people who survived its wrath. Over 15 million people were affected by this Super Cyclone. Houses were destroyed, infrastructure ravaged, environment denuded, livelihoods livemperilled and economy shattered.*

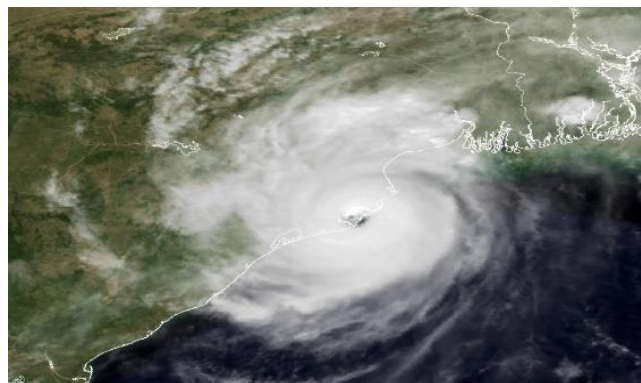


Fig 25 Super Cyclone Orissa 1999

3. **Objective.** *The objective is to share the personal experience involving the rescue of then RM late Mr George Fernandes and his entire entourage including then Joint Secretary Disaster Management Mr Anil Kumar Sinha during the Super Cyclone affecting Paradip port in 1999. To also draw lessons for any emergency arising as this and showing presence of mind and timely action taken.*

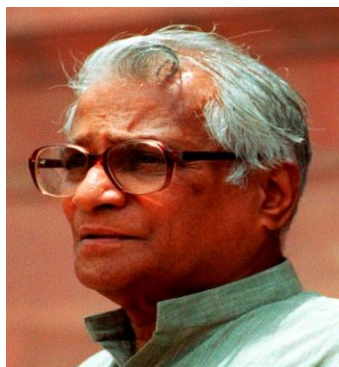


Fig 26
The Then Defence Minister
Mr George Fernandes



Fig 27
Mr Anil Kumar Sinha IAS (Retd.)
Then Joint Secretary, Disaster Management
Govt of India

3. **Scope.** *The scope of the paper is as under :-*

- (a) *Give the background of career in the Air Force.*
- (b) *Development of Super Cyclone in the Bay of Bengal.*
- (c) *HADR mission Operations.*
- (d) *Strategy and Plan for undertaking the mission.*
- (e) *Undertaking VIP commitment.*
- (f) *Planning and Rescue of Raksha Mantri and his entire entourage.*

4. **Task** *I was on the posted strength of a 118 Helicopter Unit since 22 Feb 99. On 01 Nov 99 I was detailed to be leader of two helicopters detachment to Bhubaneswar for HADR mission. As planned we got airborne Guwahati on 29 October and reached Air Force Base Kalaikunda on 30 October.*

5. **VIP Task** *On 01 Nov 1999 I was tasked to fly then Raksha Mantri late Mr George Fernandes , Mr Naveen Patnaik and his entire entourage for a reconnaissance sortie over the cyclone ravaged areas in Paradip followed by a landing at Bhubaneshwar. Reaching Paradip after the unitial recce I apprised the RM about the non availability of suitable landig site due to water logging at most of the places.*

6. *I also briefed him the risk of landing at an unsecured and unprepared helipad especially as we were not carrying any relief material on board ie packed food and water. However, as desired by the RM, a recce was carried out to search for suitable landing ground and landing was executed on an unprepared school site.*

7. **Post Helipad Landing Brief**

The VIPs deplaned and went to a near by place to address the people. However the crowd present there was more keen and looking forward to some relief material mainly food and water. After realising that there was no relief material the crowd started getting disturbed and restive,thus forcing Mr. Navin Patnaik, Minister of Mines and Minerals, who had earlier deplaned, to rush to near by building to seek shelter from the angry mob.



Fig 28 Task One - Retrieval Of VIPs At Landing Site

8. *Part of the crowd by then, turned violent and some of them threatened to burn the helicopter and assault the passengers. Seeing these precarious ground situation building up I decided to go inside the school building and personally look for the VIPs. After managing to get inside the school through knee deep mud slush I realised there was no way I could trace out the VIPs, mainly because of the language barrier and secondly due to shortage of time.*

9. *So I came back and decided to start the helicopter and await arrival of the RM and Mr Naveen Patnaik. This would have helped in two ways. One was that the noise of starting of the Helicopter would have alerted the VIPs and they would make efforts to reach the helicopter. Secondly the starting of the helicopter would have also kept the crowds at bay.*

10. *The Flight Gunner, along with the available policemen was detailed to guard the tail rotor during the start up. Once the helicopter started I noticed some people making human chain and escorting someone towards the helicopter. On seeing Mr. Navin Patnaik being pushed around by the mob, I along with his crew pulled him safely inside the helicopter. By then the crowd started pelting stones and some even tried to board the helicopters. Mr Patnaik informed that he is not at all aware of whereabouts of RM. So here I had another big problem at hand.*

11. **Task Two - Retrieval Of Flight Gunner** *However at this stage, I immediately took-off to ensure safety of the passengers on board and the helicopter. Thereafter I kept orbiting 10 miles from the landing spot and gave ample time for the crowd to dispersed from the helipad. Once the crowd dispersed I planned to picked up the gunner from a low hover so as to reduce time close to ground. Accordingly I briefed the Army personnel onboard. And as planned I was successful in picking up the Flt Gunner from the low hover.*

12. **Task Three - Search For RM** *Once Flt Gnr on board I now started for my next task ie to look for RM. As I had absolutely no idea as to where was the RM I had to rely on my previous knowledge and pick up some clues and try and stitch them together. Doing the same and simultaneously flying was big task. It was like looking for needle in the hay.*

13. *Following the only road we were able to spot a place which was guarded by men in uniform. Immediately we landed there and inquired about the RM. Though the VIP was not there but we definitely got one clue about the VIP. Some guard there saw the Coast Guard commanders vehicle passing by with one civilian passenger. Taking clue from this we decided to proceed to port jetty and try and locate the RM. Once we reach the Paradip jetty we started our recce. After about couple of orbits I managed to locate and spot the Raksha Mantri at the Paradip Port jetty.*



Fig 29 Damage by Super Cyclone 1999

14. **Task Four - Retrieval of RM** *I immediately manoeuvred the helicopter into the confined space, executed a safe landing and picked up the RM. Thereafter we got airborne and set course to Bhubaneshwar finally with everyone on board.*

15. *On the way back the PS to RM profusely thanked me. He also gave in writing the RMs insistence to land in Paradip in spite of me advised against it. We landed safely at Bhubaneshwar with all onboard passengers safe and sound.*

16. **Post Landing Experience.** *After the sortie the RM Mr George Fernandes profusely thanked me for bringing back all the passengers safe and sound. He appreciated my presence my mind during the entire sortie. As per PRO MoD the same was conveyed by the RM himself in the post media briefing.*

17. *Accordingly I briefed my Commanding officer about the entire incident involving the RM. However as he was too busy carrying out liaison of flying operations for the next day he did not insist on detailed briefing.*

18. **De- Briefing** *However the next morning we got message from Air HQ that this mission of safely retrieving the RM and his entourage was well appreciated.*



Fig 30 HADR (Humanitarian Assistance and Disaster Relief) in progress.

19. **Lessons Learnt.** After brain storming post this incident some of the lessons learnt were derived and are as follows :-

(a) **Team Work – Collective & Co-ordinated.** The success of our effort was due to collective and collaborative decision making.

(b) **Foreplan – Visualize the Contingencies.** The events and contingencies were unexpected and could not be predicted, thus presence of mind and foreplan was very effective.

(c) **Presence of Mind.** The presence of mind in these trying circumstances can not only help oneself but also help us to take corrective actions and well in time.

(d) **Handling of hostile situation.** The fear of the unknown and lack of knowledge about the behavior of hostile crowd made us to be cautious in our approach. Handling with patience and talking out with the civilians were the key factors which got the situation under control.

20 The systematic and meticulous and timely actions of saving then RM Mr George Fernandes and his entourage from mob frenzy in a difficult and volatile situation was well appreciated by one and all. Further these actions saved the Raksha Mantri and his entourage from possible physical harm. The SOPs and protocols are integral part of any mission, but need to be flexible, so to adapt to the ever-changing fast scenario. Lastly the presence of mind shown by all concerned in the operations at the time of the crisis saved the day.

This mission of safely retrieving the helicopter as well as rescuing the VIPs from mob frenzy in a difficult and volatile situation was highly appreciated as the actions saved the Raksha Mantri and his entourage from possible physical harm.

For act of professionalism and extraordinary courage in a challenging situation, the Hon'ble President was pleased to award 'Vayu Sena Medal' (Gallantry) to the author.

CHAPTER V

IMPACT ON OPERATIONAL PREPAREDNESS

“Disasters cannot be totally prevented but their impact can be reduced . In this direction Gujarat has not left any stone unturned.”

PM Narendra Modi

Conceptually, the Armed Forces are called upon to assist the civil administration only when the situation is beyond their coping capability. In practice, however, the Armed Forces form an important part of the Government’s response capacity and are immediate responders in all serious disaster situations. Armed Forces are state-created entities tasked with defending the country against foreign threats and internal disputes, as well as projecting and preserving national interests beyond the state's borders. To fulfil its duty, Armed Forces must have professional skills, equipment, training, and management capacity. Aside from that, a constitutional and legal framework outlining their interaction with the political hierarchy is required.

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. Airlift, heli-lift and

movement of assistance to neighbouring countries primarily fall within the expertise and domain of the Armed Forces.

Armed Forces Efforts The magnitude of disaster relief operations undertaken by Armed Forces is very large and there are large numbers of operations where single service has taken part. Air force being the provider of platforms is invariably involved in all operations requiring movement of relief material, personnel and equipment. IAF operates a large variety of platforms ranging from air dominance fighters, Remotely Piloted Aircraft (RPAs) to transport aircraft and helicopters. These assets have different capabilities and can be used for different tasks.

IAF Assets in Disaster Relief



Fig 31 IAF Tableau , Republic Day Parade Jan 2016

(Source : Courtesy Door Darshan TV)

To showcase the increasing contribution of IAF during Disaster Relief in the last 10-15 years, the IAF tableau (Fig 31) was also based on the same theme during Republic Day parade of the year 2016. This event marked the acknowledgement of the

humanitarian role which IAF delivered in the year 2015 wherein, IAF rescued more than 14,000 people and airlifted 2,000 Indians from Yemen in the C-17 Globemaster aircraft. About one lakh people were rescued by the joint efforts of the armed forces and the NDRF. This was followed by operations in Nepal during April 2015 earthquake, where the IAF rescued more than 10,000 people from disaster-hit regions. IAF in coordination with the Indian Army, rescued more than 1,000 people during the Gujarat floods in Jul 2015. In Nov 2015, the IAF was deployed to conduct relief operations in Chennai floods. In over 200 sorties, the IAF airlifted around 1200 people using helicopters. In recent Disaster relief operations, IAF was again the first responder during Kerala floods in 2018. These floods claimed about 480 lives with approx. 10,28,000 people were sheltered in 3750 relief camps. One of the Press release during Kerala floods is as follows:-

“Many parts of Kerala continue to be affected by landslides and floods. Indian Air Force 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. Till date, IAF has rescued 663 people. IAF helicopters have also dropped of 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”.

This indicates that the countrymen acknowledge the contribution of IAF during country's tough times. IAF through its dedication and determination have been performing the task of HADR and proving its mettle in service of the nation. By the virtue of high professionalism, the service remains the backbone for disaster relief operations. The IAF is so structured that it is capable of a rapid response and dispatch self-contained mobile and composite task forces to any part of the country, or even overseas.

Responsiveness, reach and flexibility make air power the first choice of the national leadership in disaster relief and humanitarian assistance operations. As India has acquired new air power assets, including the C-17 Globemaster, C-130 Super Hercules. The essence of utilization of transport aircraft is to utilize the maximum available cargo compartment space and reduce the turnaround time. Availability of information regarding runway length requirement, refuelling requirement, cargo compartment dimensions of various transport aircraft with max all up weight, loading ramp dimensions, parking space dimensions, starting aggregates requirement, etc would definitely speed up the operations and utilization of transport aircraft assets of the IAF during HADR operations.

Helicopters are amongst the most versatile assets in the IAF inventory capable of undertaking a variety of roles. The capabilities and roles undertaken by different helicopters must be conveyed to civil authorities. In addition, requirement of helipad size would assist them in identifying helipad operating areas with GPS coordinates in advance which would greatly help IAF helicopter crew in saving time and effort to locate such areas during relief operations. Similarly, all up weight limitations,

requirement of fuel and starting aggregates, parking space, etc would immensely improve turnaround times leading to effective utilization of these assets during Response phase of HADR operations.

Ramifications on Defence Preparedness India is presently involved in giving a boost to the offensive and defensive military power and acquiring modern technological assets to replace the ageing equipment and aerial assets. A lot of expenditure is being incurred on Armed Forces wherein state of the art equipment is being procured to be at par with the regional powers. This will also enable in maintaining balance in the immediate neighborhood. But, considering the growing needs of this country, there is still a long way to go as far as countering both the adversaries is concerned. There is a big ongoing debate on reduction in military manpower primarily to cut the expenditure so that modernization can continue on an upward trend at a faster pace. Additionally, with current fiscal deficit widening as compared to last year, the future procurements are not going to be easy ones.

In order to counter the growing military power of the neighbouring countries, India has stepped up its military spending by nearly 54 % in a 10-year span aiming to be at par with other nations' defence power (Fig-32). India recorded the third highest change in its military spending among major powers between 2007 and 2016, according to the data compiled by Statistics based on Stockholm International Peace Research Institute's (SIPRI) annual report on defence spending during the same period.

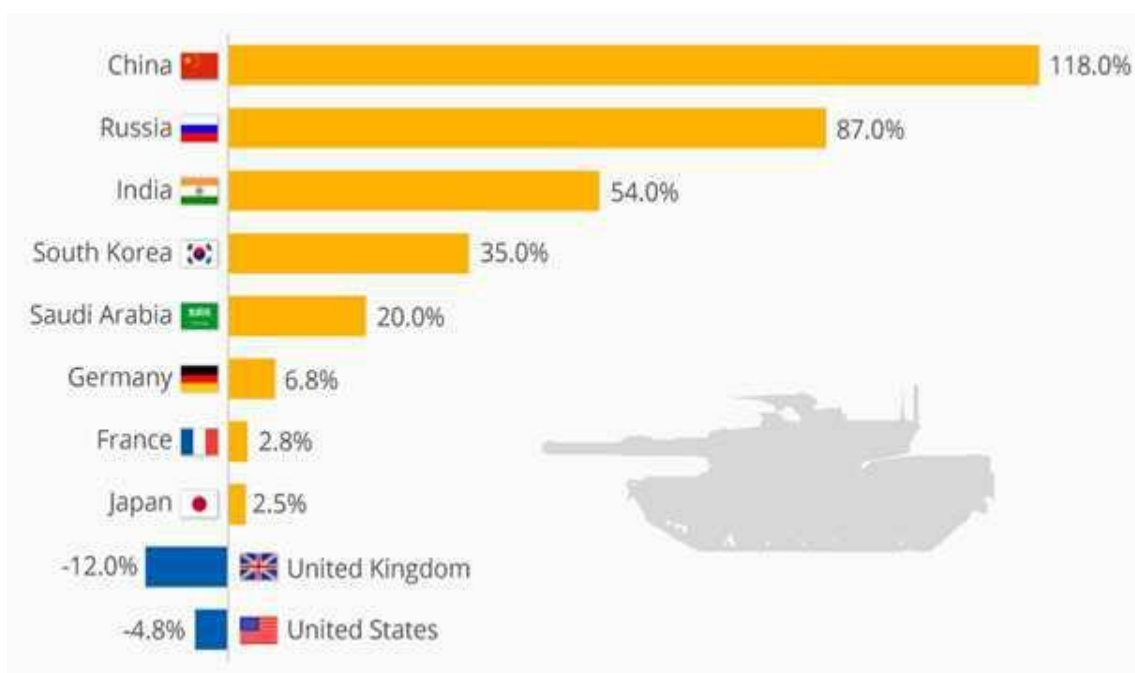


Fig 32 Military Spending Change since 2007

(Source: <https://www.statista.com>)

It is envisaged that the country like India where the resources are just sufficient to meet the operational needs, the civil stakeholders may not be able to afford separate and self sufficient resources for HADR under their dedicated control. This is especially in relation to aerial transportation assets and associated equipment. Therefore, the task of HADR in transportation and establishing vital support facilities would continue to be allocated with the armed forces. Considering the intensity of disasters, where time is of utmost criticality, air power is the only means of delivering the requisite assistance in the shortest possible time. Therefore, when India is making the mark on global forum, it is in the Armed Forces interest to display and prove its might and power during these occasions. This not only instills faith of country's population in Armed Forces but also displays credible military power to the world.

It must be understood that the Armed Forces' preparation will be largely determined by two factors: their personnel's fitness and training, and the equipment they

possess. Furthermore, while equipment acquired for warfighting is purchased for a specific purpose, its use for other duties and protracted deployment of this equipment and its logistics in disaster assistance may wear out equipment intended for the primary task of fighting wars. Maintenance is required because military equipment has a limited lifespan, and replacement takes time. The Armed Forces' long-term involvement in disaster management also limits their ability to conduct wars. Some of the factors which get affected are given in succeeding paragraphs.

Training During disaster relief, the Air Force contributes a significant amount of air lift. This includes not just the aeroplane but also additional search and rescue equipment. Furthermore, these assets are brought in from all around the country. The location of these aircraft, which are otherwise available for training and other operational activities, consumes a significant amount of flight time. A specified number of flying hours are planned for combat training of pilots in any flying squadron of helicopters and transport aircraft, depending on serviceability and other maintenance-related difficulties. During disaster relief, when platforms are used to offer aid, these flying hours are not available for the pilots' regular combat training.

Lack of specialised Training: Some catastrophic situations necessitate specialised training in order to deal with them. Armed Forces do not have the specialised equipment or training to deal with such situations, but through sheer experience, they contribute with passion, which can result in needless injuries. When the bridge in Calcutta fell, for example, Army columns were dispatched right away, but they had to wait for specialised equipment to clear the rubble. In addition, because the Armed Forces are viewed as the government's last choice, such incidents have an

impact on personnel's confidence. Preference should be given to the NDRF because they are specially trained and equipped for the job.

Combat Training. The frequency of disasters, and more importantly, the deployment of Armed Forces in these disasters, has an impact on the military exercises calendar. More recently, during the 2015 Combined Commanders Conference, the Hon'ble Prime Minister directed that the Armed Forces conduct disaster relief training with all stakeholders at regular intervals. This not only takes up a lot of time, but it also takes up resources that could have been used for combat training and exercises.

Consumption of Operational Equipment: Armed Forces operational equipment is frequently consumed during disaster assistance, and replenishment takes a long time due to long lead times, prohibitive costs, and acquisition processes. For example, Army engineering assets such as bridges, dozers, and JCBs are frequently deployed in flood relief and disaster relief operations. These bridges are intended to be employed against our western foe to cross into enemy territory in the western and Rajasthan sectors, and their life is limited to a specific number of passes with a specified load. In these sectors, the network of manmade and natural canals requires such bridges, which are sometimes purchased from foreign suppliers. If these units are de-inducted after relief operations, they will typically have flaws or equipment with a shorter service expectancy. It takes a long time to replenish the same. Meanwhile, this equipment is occasionally made available from Theatre reserves, further reducing our operating capability. The deployment of Army pontoon bridges in the Yamuna flood plains during Shri Shri Ravi Shankar's concert is yet another example of severe misapplication of war fighting equipment in the name of assisting civil authorities.

Though massive earth moving equipment has a dual purpose and can be used to help major relief efforts, it is important to realise that such equipment has a limited engine life. Therefore, its over utilisation will result in reduced life and lower reliability for operational task and will impact its spare management.

Disaster Relief Bricks: Armed Forces advocated procuring geographically dispersed, tailor-made disaster relief bricks that could be utilised during disaster situations to avoid the need of actual war fighting weapons. These include some specialised equipment that, when located in a central area, will not only shorten response time but also conserve war-related equipment and improve response quality. The advantage of being centrally positioned is that this equipment can be used by numerous formations/units, and store recoupling is easy within existing procedures. However, the government's unwillingness to spend on these bricks has led to the exploitation of Armed Forces' warfighting weaponry.

Utilisation of Resources of Armed Force: On December 30, 2018, the Armed Forces assisted stranded visitors in Sikkim. Due to heavy snowfall, the Indian Army rescued over 2,500 tourists caught near the India-China border in Sikkim's Nathu La Pass. According to a Defence Ministry spokesman, the Army gave food, shelter, and warm clothing to the visitors who were stuck between the 17 Mile region and Nathu La in Sikkim. The Indian Army has also provided two sets of full-form BRO JCBs and Dozers for snow removal and road connectivity restoration. There were also plans in place to transport the visitors to the state capital. Following such an operation, it was reported in one of the newspapers that "many of us might not be alive today if it hadn't

been for the Army." A traveller stated, "The troops gave up their quarters and shared lunch with us." Catering for such a large group of people with energy and resources is undoubtedly the job of the Armed Forces, especially in difficult places, but it consumes resources that are rarely reimbursed because they are considered national resources.

Fatigue and Morale

Armed Forces are constantly seeking to improve their warfighting skills, which leads to personnel going above and beyond the call of duty. Personnel from the Armed Forces are thus assigned to peace stations for relaxation, recoupment, and training in preparation for operational missions. With the added pressure of disaster assistance and regular training camps, their curriculum has grown even more, leaving them with no time for themselves. Soldiers will never admit to being exhausted as a result of their training, but it does put physical and mental strain on today's Armed Forces troops. Personnel in the Armed Forces are not as well trained in disaster response as those in the NDRF. Furthermore, the lack of specialised equipment and the pressure to perform flawlessly at all times takes a toll on an individual's mental health. Armed Forces deployment during the initial stages of a disaster is well understood; however, when Armed Forces are also required to assist in the rehabilitation process, which is normally the responsibility of the district administration, Armed Forces are forced to perform menial tasks, which lowers morale. Motivation to fight the enemy differs significantly from motivation to undertake post-disaster labour, which has a profound impact on the psyche of an individual who must adopt an aggressive attitude rather than the compassion he displays during disaster assistance.

Legal backing for Armed Forces While undertaking such tasks, the Armed Forces are not legally backed up by the Armed Forces Special Protection Act (AFSPA). When the Armed Forces are called upon in instances where the situation is deteriorating When it comes to law and order, the commander on the ground and his staff are frequently perplexed. Army and police procedures are incompatible, resulting in out-of-control situations. There are legal proceedings brought against these personnel from time to time, which they must fight on their own. This has an impact on worker morale and how they will respond in future emergencies. Recent incidents such as the Jat agitation and the imprisonment of Baba Rahim hint to systemic flaws. A bench headed by Chief Justice of India, TS Thakur said that Army was capable enough to deal with any situation and as and when the situation arises things will be taken care of.

When working in disaster relief, the Armed Forces may become embroiled in Centre-State issues, especially if the two parties are on opposite sides of the political spectrum. For example, the Armed Forces did an outstanding job during the Kerala Floods, but their personnel are currently addressing a slew of RTI questions on their role and level of effort. This not only adds to the workload, but it also wastes a significant amount of time in useless correspondence at various levels. While a certain level of hostility is essential among Armed Forces personnel to prepare for and fight wars, the frequent usage of the Armed Forces in operations that could have been handled by other agencies dilutes the focus and spirit to fight the enemy. Over interaction with civilian population does at times land up its personnel embroiled in Law and order situations.

Need for a Larger Role for the Armed Forces: The role of the Armed Forces is presently restricted to augmentation of rescue and relief operations as part of the immediate response after the disaster has occurred. The military has had no role in prevention and mitigation of disasters (pre-disaster) and long-term rehabilitation measures (post-disaster) in the past. Now, in the changed scenario, where prevention of disasters and mitigation of adverse effects of disasters including vulnerability and risk assessment, risk reduction and capacity building.

Seeking a larger and proactive role in any of the other spheres like prevention, mitigation and long-term rehabilitation of disaster management may not be rationally justifiable as these basically fall in the realm of the civil administration as a function of governance. The Armed Forces should continue to perform their traditional role of rescue and relief in support of the civil administration. In this era of super specialization and expertise, organisations need to focus on the core competencies and shed the obsession with learning skills that are otherwise readily available with other establishments as their core competencies. The Armed Forces must put an end to the temptation to become a jack of all trades when the new organisations in the form of the National Disaster Response Force (NDRF) at the national level and composite task forces with armed police, fire services, engineers and medical teams being raised at state level. These organisations should be provided specialist training, as already being done.

The Armed Forces can, however, contribute towards immediate response during peak crisis period as an intrinsic part of immediate response to arrest and prevent escalation in loss of human lives and damage to property by being better

trained and prepared for effective and efficient post-disaster rescue and relief operations. Joint training among all stake holders like paramilitary forces, civil defence teams, home guards and the teams from the corporate organisations and NDRF could also be undertaken at regular intervals for capability development. The Indian Armed Forces do not need legislation to offer aid, that too humanitarian in nature, during disasters. But, of course, the planning at the national level must include the scope and limitation of the assistance. Though at national level now, CISC HQ IDS has been made a member of NEC but there is no one at State / District level. Armed Forces have proposed the respective Command HQs at State level and Local Military Commander at District level as functionaries to be incorporated for better planning and coordination.

The Armed Forces have so far been using their own equipment that is meant for combat operations. The commitment of such operational equipment entails serious pitfalls as it will adversely affect their operational preparedness in the long run. The Services have expressed this concern many times and have suggested that a separate cache of equipment in form of disaster relief bricks be maintained for use during rescue and relief operations. Also, the equipment in these disaster bricks needed for disaster response has to be kept in adequate quantities and should be readily accessible, in working condition, at very short notice. It should ideally be in the charge of the organisation that is going to utilise it and the same organisation should also be made accountable for the availability of the equipment and its serviceability.

Armed Forces should be content with and not look beyond the confines of the secondary role, so as not to divert their focus from the primary role of combat and war-fighting. What is more critical are the in-house deliberations on implications of the

role, in terms of a well-defined and explicit tasking along with manpower, skills and other resources required for each task. Availability of Armed Forces deployed in remote areas and their ability to reach inaccessible areas with relative ease, much earlier than even the NDMA forces, more often than not makes them the inevitable choice as the first responders to emergency situations. Provision of assistance by the military, within and outside the country, during major disasters and catastrophes, using the resources and capabilities that it is endowed with by virtue of training, preparedness and ethos to respond to such eventualities, should however continue as hitherto. Such assistance to other countries moreover falls in the realm of humanitarian assistance and contributes towards enhancing foreign relations through goodwill and cooperation.

Way Forward

Our existing plans predominantly address floods, cyclones and earthquakes. We need to identify all potential natural and manmade disasters and draw out well thought out, practically viable and flexible contingency plans for an appropriate and quick response at all levels and phases of the disasters. There should exist synergy and understanding of each other's capabilities and work culture. Crucial equipment like railway tracks, medical vans and ambulances, temporary mobile bridges, earth moving cranes and so on should be identified by state department and be placed at the ready disposal of Armed Forces till additional efforts are mobilized. The initial stages of any disaster are very precarious. Therefore, the communication link between Armed Forces and Civil Authorities must function dynamically on a 'two-way' and 'pro-active' basis to facilitate coordinated response.

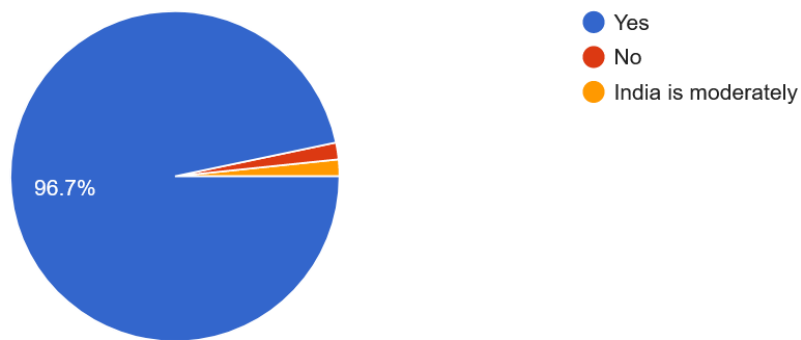
Further a training calendar of Disaster Management institutes and agencies at the international, national and sub-national levels needs to be compiled and publicised so that the stakeholders could avail of the opportunities to build capacities. The NDMA and NIDM have to play a key role in awareness generation and engage with print, electronic and folk media to carry forward programmes for public awareness. There is also a great need to develop the capacity and sensitise the media to comprehend disaster awareness and reporting, so that it plays a positive role in creating awareness and in handling disaster information and news during emergencies.

ANALYSIS OF GOOGLE QUESTIONNAIRE

The aim of this Google Questionnaire was to seek views of the personnel who have participated in actual operations and planning these operations. Questionnaire was sent to 70 serving defence personnel out of which 61 Personnel responded. Their detailed analysis is given below:

1. Do you know that India is highly prone to disasters?

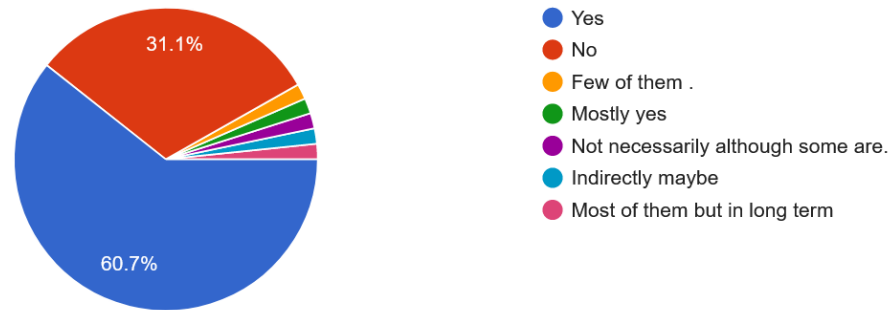
61 responses



More than 97% of respondents have agreed that they are aware that India is highly prone to disasters. This helps them to answer the subsequent questions keeping their personnel experience in mind and therefore the correct assessment.

2. Do you think that the disasters are majorly caused by human activities?

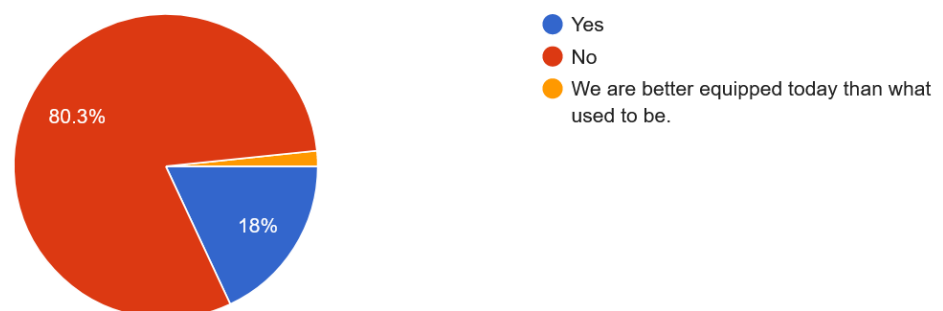
61 responses



More than 61% of respondents have agreed that disasters are majorly caused by human activities. Hence their views on the topography and the disaster prone areas and the challenges faced by Armed Forces should help in overcoming these issues in future operations.

3. Do you think that India as a country has sufficient infrastructure to mitigate the effects of disaster?

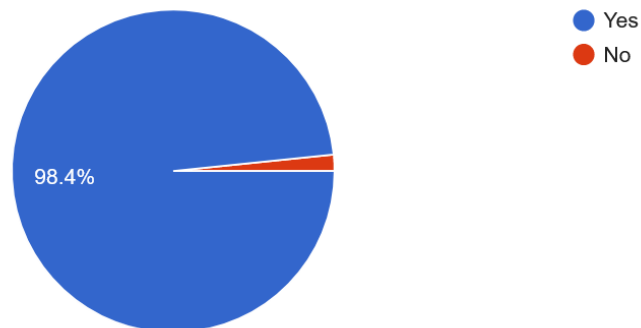
61 responses



81% of respondents feel that there is a lack of infrastructure development to mitigate the disasters and the country is more reactive rather than active in handling disasters.

4. Do you know that there is Disaster Relief Force is formed for the purpose with name NDRF?

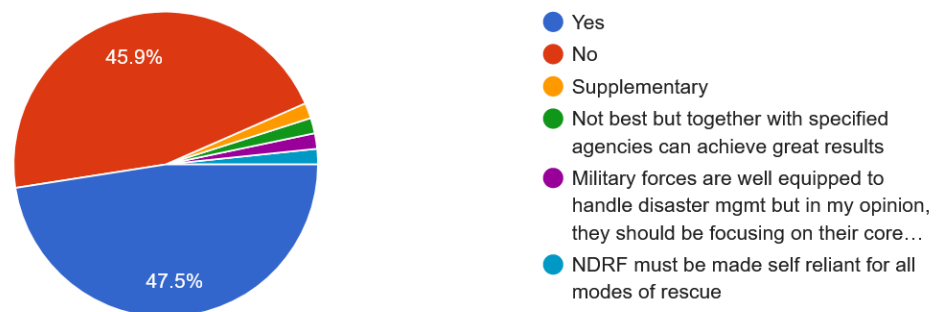
61 responses



More than 99% respondents have the knowledge of NDRF being formed as the Disaster Relief Force. This interaction with the NDRF will definitely help in overcoming coordinating issues in future operations.

5. Do you think that military agencies are best suited for Disaster Management role?

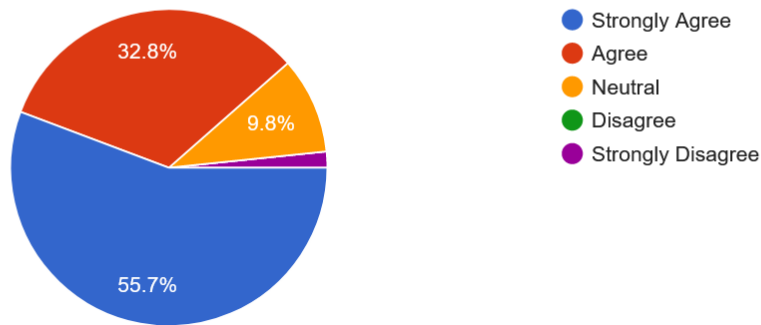
61 responses



More than 49% of respondents feel that Armed Forces are best suited for handling Disaster Management. However around 10 % respondents feel that though the military is well equipped to handle disaster mgmt but they should focus on their primary role of war fighting.

1. IAF would continue to be employed in HADR missions in spite of being the second responder.

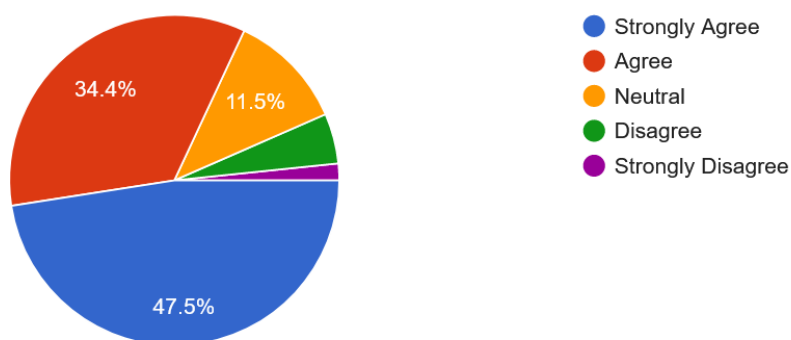
61 responses



More than 88% of respondents feel that there is a strong trend of utilization of IAF which validates the point that Armed Forces in fact are more than often acting as first responders.

2. IAF should actively take part in HADR missions.

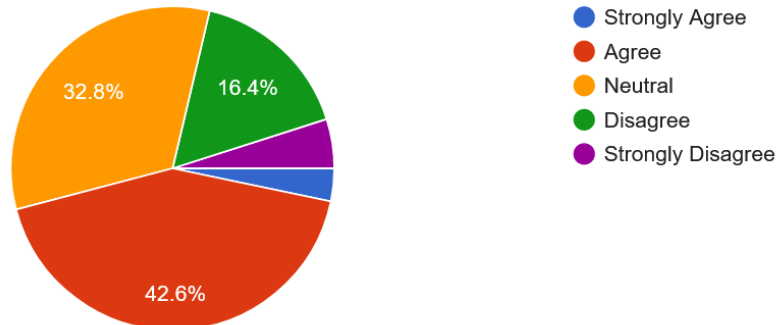
61 responses



An overwhelming 91% of respondents agree that Armed Forces should continue to actively take part in HADR mission.

3. There is good coordination with civil agencies for assisting them during HADR.

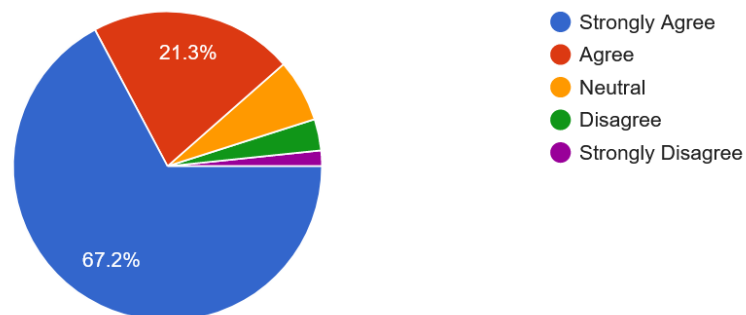
61 responses



43% respondents agree that Armed Forces try to maintain good liaison and coordination with their civil counter parts. However some respondents feel that there is need for the other side to reciprocate too.

4. There is a further requirement of joint coordination (civil and military) at all levels including field forces for effective results during HADR.

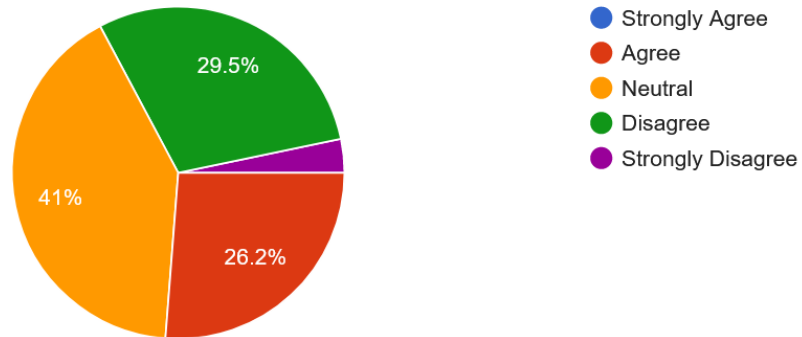
61 responses



Coordination between civil administration and Armed Forces is a concern when it comes to actual conduct of ground relief operations and the same has been echoed by 88% of respondents.

5. Every stakeholder is aware about the role and responsibility in HADR framework.

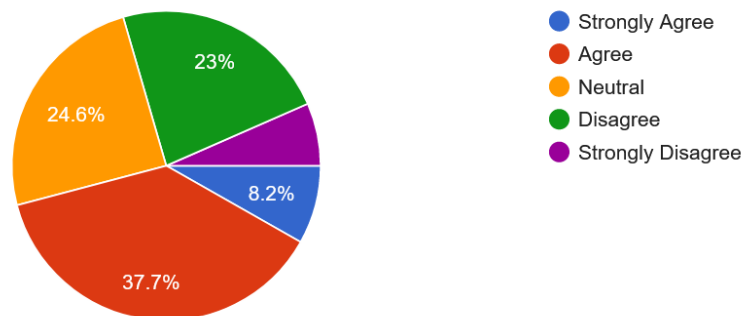
61 responses



More than 33% respondents agree that there is requirement of all stakeholders to get more involved and should be aware of role and responsibility in the HADR framework.

6. The AF units have the knowledge of Disaster prone zones in the vicinity and catered for in the SOPs.

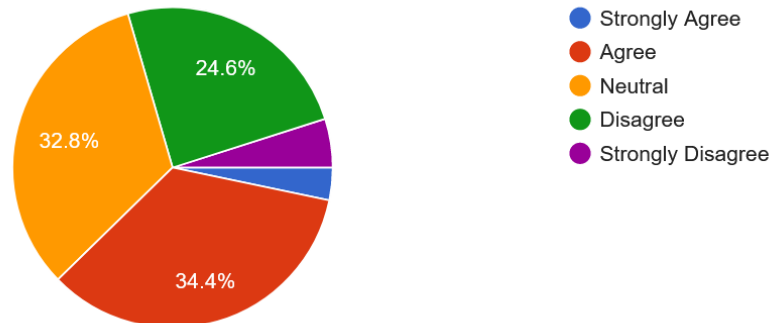
61 responses



More than 38% respondents feel that Armed Forces do have the knowledge of the Disaster prone areas and same is catered in their respective SOPs.

7. HADR resources are placed close to launch bases for minimal time loss.

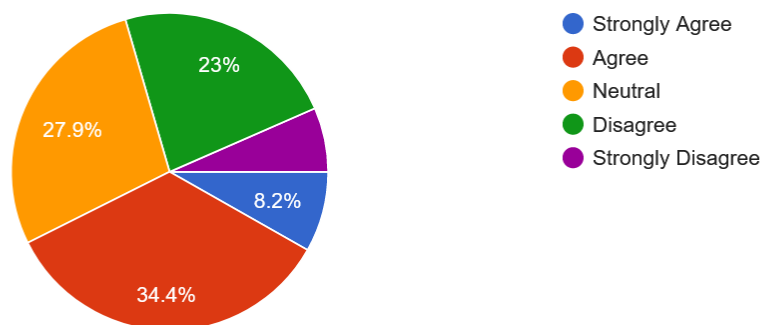
61 responses



More than 44% respondents feel that the HADR resources are placed close to the launching base thus helping to minimize the time loss.

8. Quick response SOPs are in place for immediate launch of relief material.

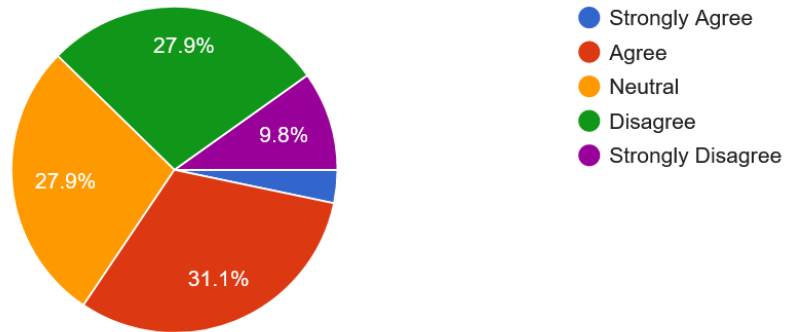
61 responses



Almost 43% personnel feel that SOPs are in place and this is definitely helping to launch the air effort to provide relief material well on time.

9. Regular coordination between IAF and HADR teams like NDRF is carried out for better cohesion.

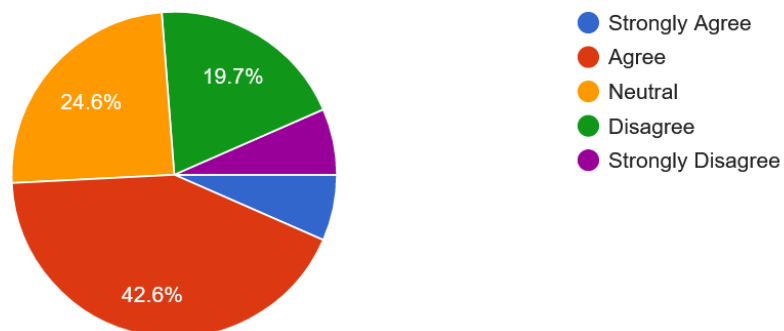
61 responses



Half of respondents are of the opinion that joint mock exercises are not routinely carried out which results in coordination issues. There is requirement of more person to person coordination to iron out the issues.

10. Armed Forces is carrying out HADR specific training on regular basis internally.

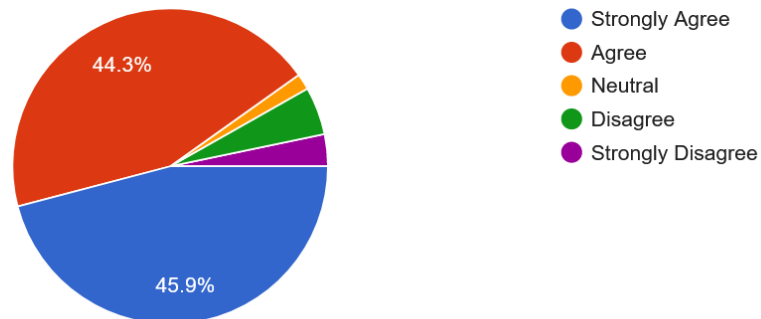
61 responses



More than 53% respondents feel that Armed Forces off late has been carrying out HADR specific training on regular basis internally. This is definitely making the Armed Forces more operationally ready to handle the situations.

11. There is a need to carry out Joint Training with civil HADR teams to validate the plans.

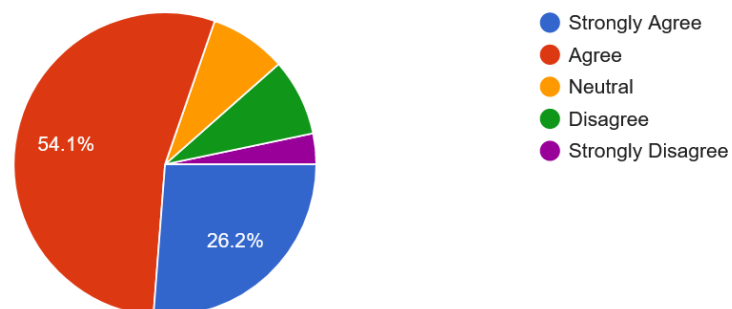
61 responses



However almost 90% respondents are of the opinion that joint mock exercises are rarely carried out with civil HADR teams which results in coordination issues and more than often a blame game regarding promptness and coverage of disaster relief.

12. Some nearby units may be affiliated to a particular NDRF unit to carry out regular training.

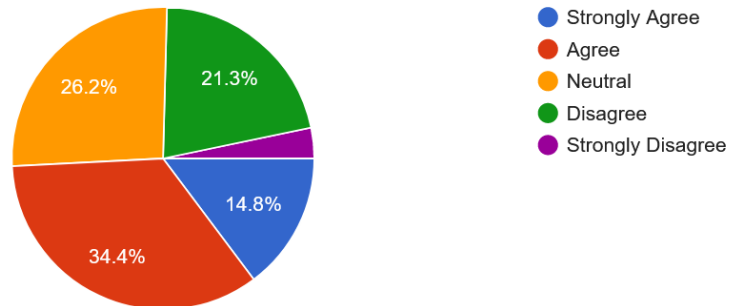
61 responses



81% respondents feel that there is a requirement of affiliating some Armed Forces units to a particular NDRF units to carry out regular training and iron out coordinating issues if any.

13. The permanent basing of IAF assets alongside NDRF battalions which are in high disaster prone areas may resolve the issue of liaison and coordination.

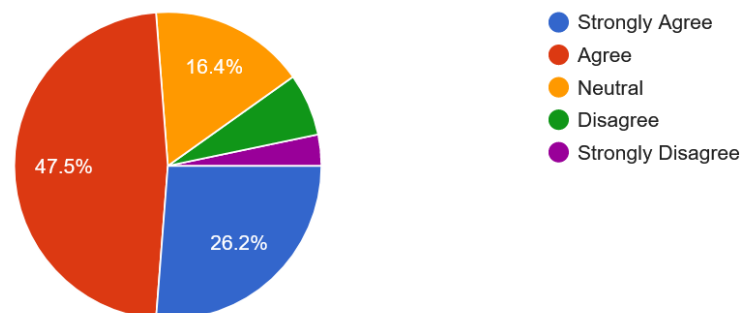
61 responses



Almost 49% respondents feel that having the Armed Forces assets along side the NDRF Battalions will definitely solve the issue of coordination and liaison. These will bring camaraderie between the two forces which will definitely show positive results on ground when called for.

14. A permanent establishment like Disaster Management Cell alongside NDRF Bn may resolve the issue of liaison and coordination and can also act as an advisory body to civil counterparts.

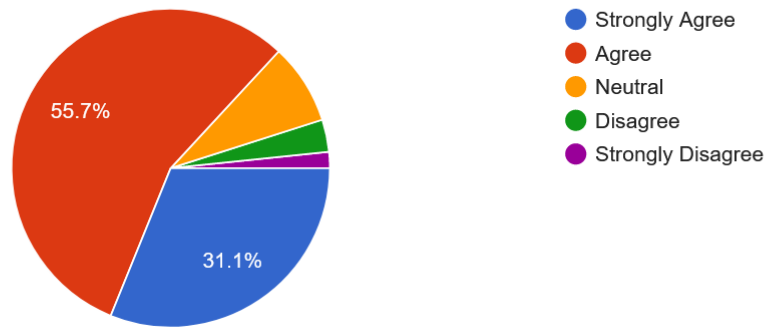
61 responses



Further to the question above almost 75% respondents feel that having permanent Disaster Management Cells along side NDRF Battalions will bring camaraderie between the two and they will also act in advisory role to the civil administration during crisis.

15. The Annual Command Activity Plan/ Training schedule should include joint HADR training taking all the stakeholders participants on board.

61 responses



Almost 87% of respondents feel that The Armed Forces and NDRF along with all stakeholders should do more combined training. Certain exercises should be planned keeping the climatic conditions, availability of equipment and personnel specific to a disaster in mind.

CHAPTER VI

RECOMMENDATIONS AND CONCLUSION

*“ While natural disasters capture headlines and national attention
short term, the work of recovery and re-building is long term”*

Sylvia Mathews Burwell

RECOMMENDATIONS

Disasters have victimized large number of people and caused significant social and economic losses which urgently demand special attention. Over past one decade, the Government of India has been working towards addressing the weaknesses of National Disaster Management System. The notification of Indian Disaster Management Act 2005 was one such step in this direction. However, there are still some grey areas which need to be addressed to hone the National Disaster Management System into well lubricated and ticking machinery.

National/ State Plans At the National level, disaster management has to be integrated with the development process through a well-laid down mechanism that needs to be sustained over a long period of time to achieve visible and desired results. Vulnerability assessment, risk reduction measures, preparedness, objective evaluation and a well-planned post-disaster response to include search and rescue, relief, recovery and rehabilitation are

mandatory for a holistic approach for management of disasters.

Building Capacity of the communities, State and district disaster management authorities shall contribute to strengthening of Government institutions and would also minimise the intervention of Armed Forces in disaster recovery. Also, a willing, professional and collaborative approach integrating individuals, communities, organizations at local, district and state levels is the only way that can lead us to relatively disaster free environs and in case disaster strikes, to suffer the least losses and casualties.

Integrated Planning Long-term and comprehensive institutional frameworks are required to address disaster challenges with a long-term perspective, taking into account these interconnected links. Disaster risk reduction and preparedness should be integrated with developmental projects, and integrated planning between disaster management, development planning, and environmental management institutions should be institutionalised. Although certain states in the Union have taken steps in this direction, there is still a need for national implementation that is integrated and coordinated.

Integrated Approach. There is a need for a coordinating agency to harmonize and synthesize the efforts of multiple stake holders to achieve optimal results in disaster management. There is sometimes unhealthy competition amongst them to catch the limelight and it often results in chaos and sub optimal output.

Early Warning Systems Early warning systems vary for the different types of disasters. Hazard- specific efficient ‘early warning systems’ is the need of the hour and it has to be put in place permanently, so that useful information flows throughout the year and is easily understood by the local community. There is scope for improvement in flood, cyclone and storm surge warnings. Such projects need further encouragement and newer projects should be accorded high priority. Even with the best of early warning systems, the impact

may still be catastrophic if early warning signals are not properly interpreted and communities are not educated and trained to respond to the early warning signals in real time. Therefore, the technology to early warning, on the one hand and, community response to early warning to the other are urgently required. This needs to be coupled with the National Emergency Communication Plan to ensure real time dissemination of early warnings and information to the 'at risk' community and the local authorities.

Role of Satellite Remote Sensing The Earth observation satellites provide synoptic and temporal coverage of large areas in near real time. The repetitive images enable the continuous monitoring of Earth surface features and phenomena. It facilitates the detection and early warning of disasters, especially those of meteorological origin. Besides, the different spatial resolutions of the satellite images enable us to choose images according to the area coverage of disaster prone areas. The forest fires can be detected early and their spread can be monitored. The images enable the mapping of flood affected areas and also track the direction of movement of tropical cyclones. The satellite images also assist in mapping the drought and flood stricken areas and forest fire affected areas. The magnitude of the drought and flood can be assessed using the temporal images of the affected area.

Satellite Communication The development of telecommunication technology using satellites allows transmission of disaster warning even to remote and inaccessible areas. Further, the availability of mobiles enhances the capability to locate isolated people by disaster.

NDMA as a Nodal Agency**NDMA VISION**

"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."

India has an organisation called National Disaster Management Authority for managing disasters. They have response teams in every state as well as in the Centre. The response teams at the centre are called National Disaster Relief Force (NDRF). At the state level it is called State Disaster Relief Force (SDRF). The response teams are trained by armed forces. A robust NDMA is a critical component of the institutional structure, serving as the nodal agency that provides the framework for coordinated action. Although significant progress has been made, there is still more to be done in terms of demonstrating leadership and professional competence, as well as earning the trust and support of stakeholders at all levels. All entities and establishments working to manage disasters should be linked to the NDMA in some form as part of institutionalisation.

Limited Trained Manpower and Assets. Though trained manpower in the form of NDRF with the requisite equipment is available, it lacks the aerial assets which are vital for quick transit and reaching the affected place in the shortest possible time. Therefore, aerial assets of Armed Forces are augmented for the purpose. Now, two totally different agencies working for a common cause can be called a trained force only if they work in cohesion on regular basis at the field level.

Vulnerability Analysis and Risk Assessment Hazard mapping and vulnerability assessment should be reviewed periodically as awareness of risk is necessary

to engage in disaster risk reduction. Development of a Disaster Risk Index is also mandatory while risk assessment is an essential component of strategic planning.

Mock up Drills At least once a year, district collectors should be required to conduct mock exercises and rehearsals of all plans. Mock drills and rehearsals are, in fact, a means of generating and developing the essence of teamwork, as well as providing an objective assessment of the group's or team's preparedness and readiness. At regular intervals, the civil government shall have required liaison and coordination meetings with representatives from the Armed Forces.

Employment of Ex-Servicemen. A large number of Armed Forces personnel separate from services every year. They constitute a large pool of trained manpower, which can effectively be utilized in disaster management machinery by Central and State Governments.

Utilisation of Media. Media should be utilized as a force multiplier for disaster management. It can play a dual role of broadcasting disaster management related information during normalcy which would automatically enhance awareness and then processing accurate information during all the phases of disaster relief operations. Unbiased media through critical analysis can bring forth the accountability of all the stakeholders and hence enhancing efficiency.

Role of Armed Forces The Armed Forces operate outside of the current DM system and are not given a clear role in the DM process under the DM Act of 2005. As a result, during the pre-disaster period, the Armed Forces are not involved in preparation and coordination with other DM agencies, which is critical for delivering a coordinated, effective, and rapid response. Furthermore, the Armed Forces are unable to purchase specialist equipment, which is critical for emergency rescue and relief, due to a lack of mandate. In

actuality, the Armed Forces are inevitably requisitioned after a disaster strikes and the situation is beyond the DM authorities' control. 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, where large-scale natural catastrophes occur frequently, the use of Armed Forces to combat the calamities is unavoidable. It is consequently critical that the Armed Forces be given a clear mandate, so that their function and mission can be formalized in the DM process. This must be addressed as soon as possible in order for the Armed Forces to prepare, coordinate, and practice with other DM agencies at all levels in order to offer a robust and timely response.

The primary role of the Armed Forces is to defend the sovereignty and integrity of our country. Its organisation, training structure and equipment are tailored to meet the said role. With minor changes in the basic structure, it may be possible to handle an additional task such as disaster management. Disaster Management being a highly specialised subject, needs formal training which is presently not catered in Armed Forces. The Armed Forces, should take measures to improve its state of training and equipment holding in disaster prone areas. Members of the civil administration should be made conversant with the principles for employment of Armed Forces. Also, the civil administration should ensure that the co-located Armed Forces units are apprised of a developing disaster situation and all disaster related information is shared with them.

The liaison between civil disaster management agencies and Armed Forces can be carried out as per the area of responsibility. All NDRF Bns falling within the geographical area of command may be factored into the 'Cohesion Day' plan in coordination with the Air Force units. This would enable the NDRF in understanding each other's strengths and limitations in meeting the task of disaster relief. Joint training and mock exercises between the

civil disaster management apparatus and local troops should be carried out from time to time to review operational preparedness and identify gaps in the joint response to a disaster.

National, State and District Level Response Plans The recent Japanese earthquake, tsunami, followed by fire and the nuclear energy crisis is a pointer to the fact that despite best preparedness and mitigation and capacity building plans being in place, response and crisis management plans continue to be relevant. To put things in place an effective response plans at the National, States, Districts and the Sub-districts level should therefore, be encouraged to strengthen review and update the existing capacity for response and crisis management.

Advantage of State Police Local police have an edge over other DM agencies in terms of proximity to an incident, organisational capability, topography and demographics, and authority to command people and resources because they are closest to the point of effect. Local police with a well-developed communication infrastructure might respond in seconds, however specialised outstation forces have fallen behind in terms of response time, which can be essential at times. As a result, the local police play an important role as a facilitator and a link between the community and outside responders.

Even when local police are actively involved in catastrophes, their performance has been shown to be lacking during crises for a variety of reasons, including a lack of clear mandate for their participation in disaster management and a lack of training and equipment. As a result, it's critical that locals on the ground, who are often the first to respond, are actively involved in the development of local crisis and disaster plans and are prepared to handle any form of crisis that may arise in their region. State governments must make serious efforts to improve the capabilities of the state police so that they can respond effectively and efficiently in a crisis.

Medical Preparedness Medical preparation is an important part of any DM strategy. It is critical to give good and efficient medical care within the first 72 hours following a disaster in order to preserve valued lives; after that, the prospects of saving lives get slimmer as time passes. In all disaster-prone areas, disaster base hospitals that are also earthquake resistant must be built, as well as a pool of Medical Emergency Response Teams in all states and an Emergency Medical Information System. A critical component of DM efforts is the use of mobile hospitals and heli-ambulances for patient evacuation. The Army Hospitals on Wheels can potentially be requisitioned to supplement medical supplies. To avoid a pandemic, proper and prompt disposal of deceased humans and animals is essential.

Corporate Social Responsibility(CSR) Business entities are expected to shoulder responsibilities for the impact of their activities on the consumers, employees and community as a whole. Efforts are therefore needed to engage corporate bodies in undertaking disaster risk reduction activities as a part of their corporate social responsibilities. NDMA and NIDM have to actively engage with the corporate sector in mainstreaming DRR within their CSR framework.

Policy Formulation and Planning The overarching strategy must ensure that the institutional framework allows for an integrated approach to disaster management and that disaster mitigation may be incorporated into development planning. Furthermore, procedures must ensure that excessive use of the military is avoided, and that it is only utilised as a last resort. And to make catastrophe risk reduction a top priority at both the national and local levels. With political commitment turned into deeds, the central government should take a more participatory role than just a supportive function. To deter malpractice, strict action will be taken against defaulters, violators of established rules, regulations, bye laws, and other norms relating to people's safety, property damage, and misappropriation of funds.

CONCLUSION

Until recently, before UN IDNDR (1990-2000) Disaster Management in India was considered as a post-disaster function, consisting of actions such as rescue, relief, and rehabilitation following the occurrence of a disaster. Such a strategy was short-sighted, extravagant, and prone to vested interests interfering. However, following the passage of the NDMA, India's approach to disaster management has shifted to a more realistic one. The new strategy is multi-sectoral, multi-disciplinary, comprehensive, and proactive, with disaster management being incorporated into the development planning process. Furthermore, catastrophe management is a significant challenge that cannot be solved by a single agency, technology, or institution, and necessitates the convergence of technologies and institutions in order to meet multiple dimensions, timeframes, and accuracy.

At the National level, disaster management has to be integrated with the development process through a well-laid down mechanism that needs to be sustained over a long period of time to achieve visible and desired results. Vulnerability assessment, micro-zonation, disaster risk indices, risk reduction measures, preparedness, objective evaluation and assessment and a well-planned post-disaster response to include search and rescue, relief, recovery and rehabilitation are mandatory for a holistic approach for management of disasters. Also, a willing, collective, participatory, professional and collaborative approach integrating individuals, communities, organizations at local, district, state, national, regional and international levels is the only way that can lead us to relatively disaster free environs and in case disaster strikes, to suffer the least losses and casualties. In view of the above, it may not be entirely incorrect to assume that the Armed Forces, even in the absence of explicit formal

and legal support would continue to be an important stakeholder in the National endeavor to manage and fight disasters.

Developing countries like India and other neighbouring countries in South Asia are highly vulnerable to climate change and with the ongoing rapid developmental activities, we may witness worse disasters in the times to come. Hence, it will not be inappropriate to assume that in spite of the raising of the National Disaster Response Force (NDRF) and State Disaster Response Forces (SDRF), the armed forces will continue to get embroiled in rescue and relief operations due to the triggering of disasters of unprecedented magnitude as a result of climate change and haphazard development. Eight NDRF units are presently deployed in nine locations across the country. Hence, in a number of cases, the armed forces may have to respond to a disaster even before the NDRF units, on account of their being located closer to the site of disaster than the NDRF units. Crisis management and managing disasters in remote and inaccessible areas where the armed forces are either deployed in the vicinity or due to their intrinsic capacity to reach such areas in an early time-frame would necessitate an active role of the armed forces, a case in point being the Kashmir earthquake.

In order to take on the capacity building of trained manpower, training program needs to be organized for officers and personnel. India being vulnerable to disasters has come a long way with formation of dedicated force like NDRF for the purpose of disaster management with various competent authorities governing them. However, there is a requirement of integrating Armed Forces with NDRF at the field level. With new acquisitions like heavy lift aircraft and helicopters, the capability of Armed Forces has increased manifold. However, as regards capacity building in terms of specialized equipments and kitting of air warriors for special operations during disaster management, the central government should

consider the same so that this most potent force can be gainfully employed in effective disaster management both in India as well as abroad if ever called upon to do so.

It is important to recognise that the Armed Forces play a secondary role in supporting the civilian administration; and that it plays no other role in disaster prevention, long-term mitigation and rehabilitation, or the developmental process associated with disaster management in a broader and more inclusive sense. However, more engagement with the relevant civil agencies at the planning stage would aid in lowering reaction times at all levels, resulting in better and more coordinated disaster mitigation activities. Disaster management is an integral component of the development process, and it is a governance function that spans numerous fields and disciplines, as well as a diverse variety of stakeholders. The Armed Forces are one of the many, but crucial, tools utilised by the government to manage a crisis. The ability to respond successfully in bad conditions should not be overlooked, and training and equipping should therefore become a key outcome area and a large component of the training objectives of units and formations, as and when they are allocated for the duty.

The next important aspect is the public faith in troops and resultant pressure on the administration to call the armed forces to provide succor to affected disaster victims. The reason why the armed forces are called upon to aid civil administration in the very first instance is the public outcry, growing tendency of over-insuring, and not having faith in own civil set-up to deal with emergencies, has sometimes led to unjustified deployment of the armed forces, which is detrimental to the latter's primary role. No government or political establishment is willing to take a chance; hence, deployment of the armed forces in such scenarios becomes a play-safe option. On account of relentless and dedicated efforts, the Armed Forces is no less than the messiah for the victims of various disasters like earthquake, landslides, floods etc. The efforts were lauded not only by the effected population but also the

media, which invariably is critical of any and every shortcoming. Therefore, there is a need for a mechanism to carry out an audit, post-disaster, to examine whether deployment of the armed forces in aid to civil authority was done as a last resort or otherwise. This will help put a check on unwarranted deployment of troops when other governmental entities could undertake relief operations.

With the mounting threat of climate change and terrorist attacks, the military can no longer ignore the increasing likelihood of disasters and mass casualties. While conflicts happen every two or three decades or so, disasters happen virtually every year, particularly in India. These calamities result in a large number of casualties and losses, far more than in traditional wars. The military's role in assisting civil authorities in crisis management circumstances is highly defined and clear. While disaster preparedness complements war readiness, deployment in disaster management also provides the military services with significant opportunity to win the hearts and minds of the public, particularly in areas afflicted by terrorism and communal strife. As a result, the armed forces must improve operational capabilities, beef up their disaster response capabilities, and continue to perform admirably when called upon to assist the civil government. The key challenge is to maximise the military's ability to respond to disasters by integrating them into the state infrastructure and coordinating all activities. Because the military forces are such an important stakeholder, they should be formally recognised as part of the crisis management planning process in the states, rather than just performing a functional role. When deploying troops for disaster relief, the civil government should keep the concept of last resort in mind and derequisition them as quickly as practicable.

BIBLIOGRAPHY

- Arulsamy, Jeyadevi, S. J. (2013). *Safety and Disaster Management*. Neelkamal.
- Arya, A. (2007). *Earthquake Disaster Reduction: Masonry Buildings, Design & Construction*. KW Publications.
- Austin, G. (1966). *The Indian Constitution*. Google Books.
- Bhandari, R. (2021). Preventing Losses from Landslides. *The Journal of Governance*. (Pg 131-154)
- Bhanumurthy, V. (2021). Flood Disaster Management. *Remote Sensing Applications NRSC*.
- Bhatia, G. (2019). An Inclusive Appraisal of Community Awareness and Preparedness In Chandigarh to Combat a Biological Disaster. *Semantic Scholar*.
- Bhattacharya, M. (2001). *Disaster Management*. Jawahar Publication.
- Chand, D. (2010). Armed Forces Response Plan to Disaster. *CLAWS*.
- CLAWS. (2014). Disaster Management: Integrated Response Strategies. *CLAWS*.
- Cuny, F. (1983). *Disasters and Development*. New York Oxford University Press.
- Dagur, O. (2008). Armed Forces in Disaster Management. *Manekshaw Paper*.
- Dangi, H. (2014). *Disaster Management : Humanitarian Logistics in Relief Operations*. Index International Publication.
- Davesar, R. (2018). Disaster Management a Distant Dream. *The Pioneer*.
- Gandhi, P. (2007). *Disaster Mitigation and Management*. Deep and Deep.
- Garg, A. (2015). *Study of natural disasters in india* [Slides]. Slideshare.
<https://www.slideshare.net/AnchitGarg1/study-of-natural-disasters-in-india>
- Garge, R. (2015). *Strategic Disaster Risk Management in Asia*. Springer Publishing.
- Gautam, P. (2012). Reassessing India's Disaster Management Preparedness and Role of Armed Forces. *Journal of Defence Studies*.

Goel, S. (2007). *Disaster Administration and Management*. Deep and Deep Publications.

IDS. (2009). Armed Forces Response Plan. *IDS*.

Imtiyaz, R. (2021). History of Disasters and a Framework for Risk Reduction. *The Journal of Governance*. (Pg 33-49)

Jacob, J. (2018, Aug 16). <https://www.indiatoday.in/india/story/kerala-govt-thanks-central-forces-for-rescue-operations-during-flood-crises-1323568-2018-08-26>

Jamal, A. (2013). *Floods :Can Land Use Planning Help* [Slides]. Slide Show. <https://egyankosh.ac.in/bitstream>

Kalyani, V. (2020). Indian Air Force: A Saviour during Distress. *Salute to the Indian Soldier*.

Kanda, M. (2021a). The changing landscape of Disaster Management. *The Journal of Governance*. (Pg 7-30)

Kapoor, A. (2010). *Vulnerable India A Geographical Study of Disasters*. Sage Publications.

Kishore, K. (2021). Coalition for Disaster Resilient Infrastructure. *The Journal of Governance*. (Pg 63-70)

Kumar, Dimri, G. R. (2018). Armed Forces and Disaster Management in India. *Economic Affairs*.

Lobley, K. (2007). *In Case of Emergency.Design*. masters press.

Manjusree, P. (2021). Mitigating Losses during Floods. *The Journal of Governance*. (Pg 155-178)

Marwah, N. (2016). National Perspective on Disaster Management. *USI, Journal*.

MHA. (2005). *National Disaster Management Act 2005*. GOI.

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*

Mishra, V. (1999). Role of Armed Forces in Natural Disaster Management. Research Paper.

Mohan, C. (2014). *Indian Military Diplomacy: Humanitarian Assistance and Disaster Relief. ISAS Working Paper.*

Murthy, B. (2008). *Disaster Management.* Deep & Deep Publications.

NDMP. (2016). *National Disaster Management Plan. New Delhi, MHA: NDMP*

NDMA. (2008), *Vulnerability Profile of India, published by NDMA in 2008: (NDMA)*

NIDM. (2010). *Understanding Disasters, NIDM Publication: p 4-6* accessed at www.nidm.gov.in on 19 October 2021: NIDM.

NIDM. (2019). *Handbook on Disaster Management for Nodal Officers, NIDM Publication: at www.nidm.gov.in NIDM (2019).*

NIRD. (2001) *Disaster Management- Odisha Cyclones , Floods, Tidal Waves (2001)*

Pasricha, Ghalavand, A. K. (2014). *Disaster Management and Strategies.* Regal Publications.

PIB. (2017). *Seismic Zones. New Delhi: Ministry of Earth Science.: 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. (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. (2019, February 04). Press Bureau of India. Retrieved February 05, 2019, from http://www.pib.nic.in : <http://www.pib.nic.in/Pressreleaseshare.aspx?PRID=1562584>

Pradhan, (2020). *What Super Cyclone Amphan has taught us -- NDRF chief explains, Times Now Digital, 26 May 2020: Pradhan.*

Pradhan, S. (2021). *NDRF as Systemic First Responder. The Journal of Governance. (Pg 419-440)*

Public Procurement Framework in India. (2021). IDSA.In. <https://idsa.in/idsacomments/public-procurement-framework-in-india-amitcowsish>

Raj, A. (2008). *Armed Forces in Disaster Response: Role Reappraisal. CLAWS.*

Rajesh, Jana, A. N. (2009). *Disaster Management and Sustainable Development-Emerging Issues and Concern*. Pentagon Press.

Sachindra, N. (2000). *Anthropology of Disaster Management*. Gyan Publication.

Sarma, G. (2021). Current Thrusts in Disaster Management in India. *The Journal of Governance*. (Pg 50-62)

Sastry, Kanda, Murthy, K. M. C. (2021). The Road Ahead for Disaster Management in India. *The Journal of Governance*. (Pg 459-470)

Sharma, VK. (1994 and 2013). *The Disaster Management*. Medtech Publication

Sharma, Singh, V. S. (2021). Challenges in Disaster Management in Hill Areas : A case study of Sikkim. *The Journal of Governance*. (Pg 248-260)

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

Singh, D. (2018). Disaster Management in India and the Role of Armed Forces. *Economic Affairs*.

Singh, J. (2007). *Disaster Management: Future Challenges and Opportunities*. Dreamtech Press

Singh, K. (2021). Creating the National Disaster Response Force. *The Journal of Governance*. (Pg 411-418)

Singh, S. (2015). Armed Forces in Disaster Management: challenges in Indian perspective. *Scholarly Research Journal*.

Singh, T. (2007). *Disaster Management-Approaches and Strategies*. Akanksha Publishers.

Sinha, P. (2006). *Disaster Vulnerabilities and Risks*. SBS Publishers and Distributers.

Sinha, P. (1998). *Encyclopedia of Disaster Management*. Anmol Publication.

Thiruppugazh, V. (2021). Developing Capacity towards Disaster Management. *The Journal of Governance*. (Pg 71-86)

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.

Waltham, T. (2005). The Asian Tsunami disaster, December 2004. *Geology Today*.

Williams, N. (2010). *Fury of Natural Disasters*. Nimby Books.

Yadav, R. (2011). *Disaster Management in India: Acts: Policies: Guidelines*, Paradise Publishers.

Interactions carried out with :

- (a) Air Vice Marshal S Srinivasan AVSM, VSM , is posted at Air Force Headquarters and is looking after Transport and Helicopter Operations .
- (b) Interaction with Mr Anil Kumar Sinha IAS (Retd.) then Joint Secretary Disaster Management GOI during his address on 1999 Orissa Super Cyclone in IIPA.
- (c) Interaction with NDMA members on 14 March 2022.