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INDIA'S EMERGENCE AS DISASTER RESILIENT NATION: KEY INSIGHTS AND DEVELOPMENTS POST 2014



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Abstract

Disasters are an unavoidable aspect of daily life, posing significant challenges for nations worldwide, particularly in the context of preparedness and rehabilitation. The Indian subcontinent is notably disaster-prone, with over 85% of its geographical area susceptible to multiple hazards. This paper examines India's evolving approach to disaster management, particularly since 2014, highlighting significant advancements in resilience strategies. It argues that recent efforts have shifted focus toward preparedness and proactive measures. Based on a discussion of four case studies: Cyclone Biporjoy, Sikkim flash floods, Uttarkashi Tunnel rescue operation, and Cyclone Amphan, this study intends to offer an in-depth analysis of disasters encompassing early warning, response, and post-disaster efforts in the broader domain of India's comprehensive disaster management framework.

Keywords: Disaster, Disaster Management, Preparedness and Rehabilitation

Introduction

Disaster as an unavoidable phenomenon of our day-to-day existence. However, in the face of uncertainty handling disasters and rehabilitation post-disaster are two key concerns for nations across the world. When a disaster hits a nation, it shakes the country's economic growth. Without proper management plan, many countries found them at the wrath of such disasters. In fact, as the global climate continues to change, many developing nations are prone to more such challenges. It is reported that by 2030, there could be 325 million people trapped in poverty and vulnerable to weather-related events in sub-Saharan Africa and South Asia (**Building Resilience World Bank Report 2013**).

In the Indian context, the Indian subcontinent is distinguished among others as one of the most disaster-prone areas, as more than 85% of India's geographical area is prone to multiple hazards. Out of the total Indian states and union territories, almost three-fourths are disaster-prone (**Shah 2011**). In such a scenario, the Indian approach to disaster management also faced major challenges. However, post-2014, India has made significant progress in enhancing its disaster resilience, reflecting a proactive shift in policy and practice. Based on this context, this paper explores the key insights and developments that have shaped India's approach to disaster resilience in the last one decade. Moreover, based on four case studies, this paper argues that India's approach to disaster since 2014 has been more focused on preparedness. The paper is divided into five key sections to have a systematic understanding. The first section explores the conceptual categories associated with disaster management. The following section provides a historical overview of India's approach to disaster management from independence to 2014. The third part deals with key methodologies used in the paper. The fourth part of the paper discusses the key initiatives taken by the Indian government since 2014, including measures such as early weather forecast techniques

and mitigating disasters. The last section of the paper discusses four key disasters: Cyclone Biporjoy, the Sikkim flash flood, the Uttarkashi Tunnel rescue operation and Cyclone Amphan. Here, the major idea is to grasp disaster from three-phase analysis- early warning, during, and post-disaster efforts.

Disaster Management: Conceptual Exploration

The word disaster is not a new phenomenon in human history. As a term, its meaning and scope have evolved over the years. The UNISDR (2011) defined disaster as "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources". Whereas, the government of India defined it as "an event or series of events, which gives rise to casualties and damage or loss of properties, infrastructure, environment, essential services and means of livelihood on such a scale which is beyond the normal capacity of the affected community to cope with". The Disaster Management Act, of 2005, defines disaster as "a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area" (Gol 2005, .4). Further, refining the concept, the Govt of India in 2011 defined it as "Disaster is also sometimes described as a catastrophic situation in which the normal pattern of life or eco-system has been disrupted and extra-ordinary emergency interventions are required to save and preserve lives and or the environment" (Gol 2011, p 4). From the multiple understandings of the word disaster, a few core issues emerged, such as the magnitude of the disaster, the loss or havoc it has created and lastly, restoring normalcy with diligent efforts.

In common parlance, disasters are of two types, namely natural and manmade. A classification of disaster is listed below in the figure 1.

Figure 1: Typologies of Disasters

Major natural disasters	Minor natural disasters
<ul style="list-style-type: none"> ▪ Flood ▪ Cyclone ▪ Drought ▪ Earthquake 	<ul style="list-style-type: none"> ▪ Cold wave ▪ Thunderstorms ▪ Heat waves ▪ Mud slides ▪ Storm
Major manmade disaster	Minor manmade disaster
<ul style="list-style-type: none"> ▪ Setting of fires ▪ Epidemic ▪ Deforestation ▪ Pollution due to prawn cultivation ▪ Chemical pollution. ▪ Wars 	<ul style="list-style-type: none"> ▪ Road / train accidents, riots ▪ Food poisoning ▪ Industrial disaster/ crisis ▪ Environmental pollution

Source: A. J. Shah (2011)

In the Indian context, the High Power Committee on Disaster Management identified 31 types of disasters. Tsunami was added in 2005 to this list. These 31 types are further classified into five major categories as listed below-.

Figure 2: Types of Disasters

<ul style="list-style-type: none"> • Water and Climate Related: Floods and drainage management; Cyclones or Tsunami; Tornadoes and hurricanes; Hailstorm; Cloud burst; Heat wave and cold wave; Snow avalanches; Droughts; Sea erosion; Thunder and lightning;
<ul style="list-style-type: none"> • Land Related: Landslides and mudflows b) Earthquakes c) Dam failures/ Dam bursts d) Minor fires
<ul style="list-style-type: none"> • Accident Related: Forest fires b) Urban fires c) Mine flooding d) Oil spills e) Major building collapse f) Serial bomb blasts g) Festival related disasters h) Electrical disasters and fires i) Air, road and rail accidents j) Boat capsizing k) Village fire
<ul style="list-style-type: none"> • Industrial: Nuclear Leak; Industrial Chemical leak; Operational Negligence.
<ul style="list-style-type: none"> • Biological: Biological disasters and epidemics; Pest attacks; Cattle epidemics; Food poisoning.

Source: GoI (2011)

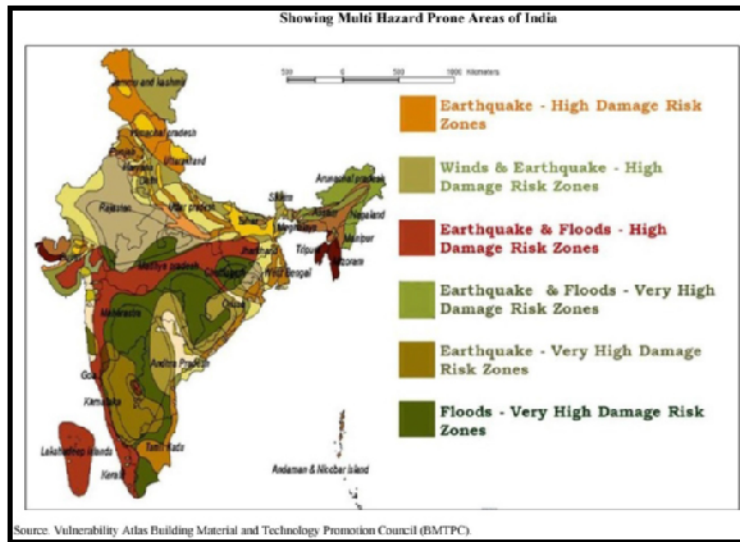
Along with the inescapable disaster phenomenon, the concept of disaster management has become a topmost priority for governments across nations. According to the UNDDR, disaster management is about "the organisation, planning, and application of measures preparing for, responding to, and recovering from disasters." In their view, disaster management might not be able to eliminate disasters completely, but rather, it should focus on the preparedness aspect to decrease the impact of disasters.

In the Indian context, the Disaster Management Act of 2005 defines "disaster management" as a continuous and integrated process of planning, organising, coordinating, and implementing measures necessary to expedite the process of preventing danger from any disaster, mitigating risk, capacity building, preparedness, prompt response, assessing the magnitude of disaster, evacuation and rescue, rehabilitation, and reconstruction. Here, it is evident that disaster management is a process with multiple components ranging from disaster preparedness to recovery management. Disaster management involves administrative decisions and coordination among all levels of government. It also requires community and civil society participation for effective post-disaster resistance. Therefore, disaster management

Disaster Management Landscape of India: Historical Overview

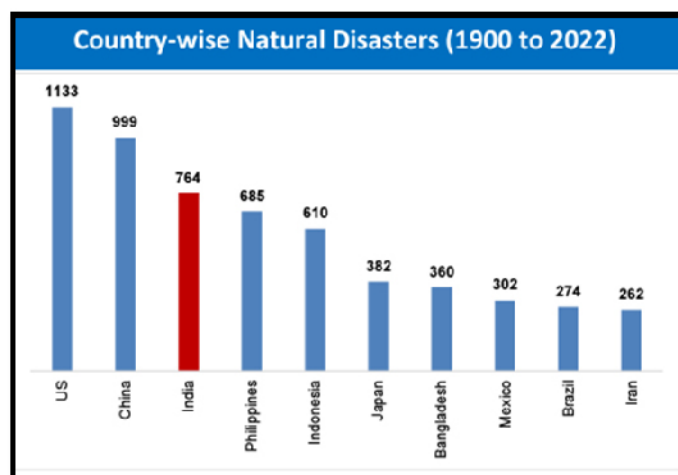
It is known that the Indian subcontinent falls under severe disaster-prone regions and it has to confront various types of disasters. In the hundred years from 1900 to 2000 402 events could be termed as disasters and 354 in the two decades thereafter (2001–21). Each one of these has historically been subjected to such calamities. Based on the probability of occurrence of such events taken together with scientific data about the climatic factors and other geological formations disaster-proneness is arrived at. BMTPC and the Ministry of Home Affairs, Government of India have recorded the vulnerability maps **(Deshpande 2022)** as shown below.

Figure3: Muti Hazard prone Areas of India



Since 1990s, India has experienced the third-highest number of natural disasters globally, following the United States and China. These disasters, which include landslides, storms, earthquakes, floods, and droughts, have totaled 764 recorded events since 1900. From 1900 to 2000, India encountered 402 disasters, while between 2001 and 2022, there were 361 events, highlighting a concerning increase in the frequency of extreme events, each resulting in significant economic strain. Among these disasters, floods are the most prevalent, accounting for nearly 41% of all incidents, followed by storms (**SBI Ecowrap 2023**).

Figure 4: Country -wise Natural Disasters Ranking



Source: EM-DAT; SBI Research

In the face of such natural disasters, the next concern is the amount of loss people bear in terms of both human lives and financial loss. Since 1900, India has suffered an economic loss of \$150 billion (where the loss is reported), with the largest loss from floods (\$92.1 billion) followed by storms (\$44.7 billion). The situation becomes aggravated due to India's low protection gap rate (**SBI Ecowrap 2023**).

While considering the amount of havoc caused by disasters in India, the preparedness aspect showed multiple loopholes since independence. Before the 1990s, India relied on a reactive "firefighting" tactic during catastrophes and lacked a systematic approach to disaster management. A disaster management cell was created under the Ministry of Agriculture after the UN General Assembly declared the "International Decade for Natural Disaster Reduction" (IDNDR) and in response to a number of significant calamities, including the Latur Earthquake (1993), Malpa Landslide (1994), Orissa Super Cyclone (1999), and Bhuj Earthquake (2001). A High-Powered Committee led by Mr. J.C. Pant was established by the Indian government in 2001, and it produced a thorough report with suggestions. This led to the 2002 transfer of the Disaster Management Division to the Ministry of Home Affairs. This led to the passage of the Disaster Management Act in 2005, which established a detailed framework for institutional disaster management in the country (**Deshpande 2022**). In 2011, a policy document related to disaster management was brought which was reviewed in 2013 suggesting a framework for the plan. Finally, a Disaster Management Plan was brought out in 2016.

After enforcing the Disaster Management Act 2005, NDMA became the key body to implement a holistic disaster management plan nationwide. However, the CAG Report to the Parliament in 2013 reported that NDMF has not been constructed even after six years of passing the DM act (p.51). Moreover, NDMA had initiated projects for flood mitigation and landslide mitigation at the national level in 2008.

However, those projects have either been abandoned midway or are being redesigned because of poor planning. The projects to prepare national vulnerability atlases of landslides, floods and earthquakes are also incomplete. In fact, experts opined that if this had been prepared on time, then a certain amount of damage caused by the Uttarakhand flood of 2012 could have been diverted. In the case of Uttarakhand flood 2012, the post disaster management also reported multiple issues. More than 70,000 people were reported missing and without any prior warning and mitigation measures, the situation became worst. In similar lines, not adhering to DM Act 2005 by many states was a major issue as till May 2012, only 14 states shared draft for State Disaster Management Plan and Uttarakhand is among the defaulters (CAG Report 2013, p.21). In fact, after five months of the flash flood and landslide in Uttarakhand the Vice Chairman of NDMA reported that the Uttarakhand government yet not submitted the state level disaster management plan. Therefore, lack of coordination among state and center regarding disaster management guidelines impacted the disaster mitigation efforts.

At the national level, poor sectoral coordination and lack of early warning system coupled with slow response and lack of community participation are core factors contributing to poor response following disasters in the past (**Kaur 2006, p.554**). The prolonged neglect of disaster management in the decades following independence resulted in significant vulnerabilities, amplifying the impact of disasters nationwide.

Methodology

This study provides an analytical and empirical examination of the Indian Government's approach towards mitigating the impact of disasters. It utilises both primary and secondary sources to offer a comprehensive overview. Primary sources include reports from major policy groups and think tanks, newspaper reporting, and data from government sources related to disaster management efforts.

Secondary sources comprise opinion pieces and academic journal articles. The key method used in the study is case study method. In this study, four major natural disasters have been selected based on two key criteria. Firstly, these events occurred after 2014, and secondly, they had a profound impact, resulting in significant loss of life and property along with a key emphasis on the unique methods adopted in disaster management. By analysing these diverse sources, the paper aims to provide a comprehensive overview of the shift in the Indian government's approach to disaster management. The study will focus on presenting consistent results and outcomes across primary and secondary data sources to reduce error.

Disaster Management Post-2014: Shift from Response-centric Approach to Preparedness Approach

Disaster management relies on a comprehensive and well-executed policy framework. Since 2014, the government has continuously worked towards structuring disaster management scenarios in India. To bring coordination in disaster management, the National Disaster Management Authority (NDMA) formulated the National Disaster Management Plan (NDMP) in 2016, with revisions made in 2019 to expedite financial assistance to states after natural disasters. Additionally, NDMA launched the Aapda Mitra scheme to train 6,000 community volunteers in flood-prone districts, with over 5,500 volunteers trained so far. Furthermore, the Government of India initiated the National Cyclone Risk Mitigation Project (NCRMP) to address cyclone risks in coastal states and union territories. In June 2023, a new Rs. 2,500 crore project was introduced to mitigate urban flooding risks in seven major cities: Mumbai, Chennai, Kolkata, Bengaluru, Hyderabad, Ahmedabad, and Pune.

The current government has implemented several safeguards to guarantee that people are ready for natural disasters. The NDMA has issued 26 guidelines on various calamities, strengthened State and District Disaster Management systems, built multipurpose cyclone

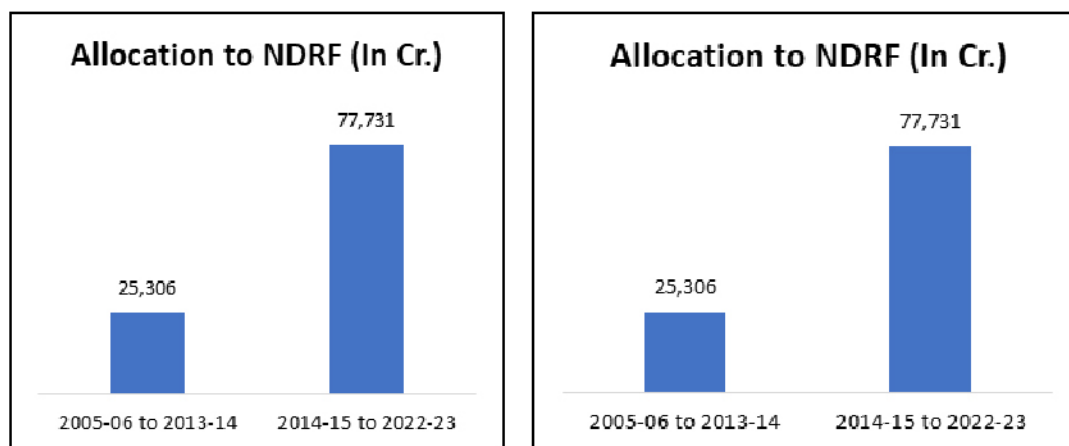
shelters, trained coastal people, and more. Furthermore, the "Scheme for Expansion and Modernisation of Fire Services in the States" was unveiled in June 2023 with a budget of Rs. 5,000 crore. Additionally, the Ministry of Home Affairs has launched an Rs. 8,000 crore disaster management scheme to enhance firefighting services across states, mitigate flood risks in seven major cities, and address landslide threats in 17 states.

A significant portion of disaster management response is comprised of weather forecasting. While IMD has extended its rainfall and flood estimate from three to five days, giving rescue attempts more time, ISRO has discovered 271 wetlands in the Northeast to help with flood management. Meghdoot and Mausam, two smartphone apps for farmers, are among the initiatives under the "Atmosphere & Climate Research-Modelling Observing Systems & Services (ACROSS)" programme that are improving weather monitoring and forecasting capacities. More than one lakh new records have been added to the India Disaster Resource Network, and Rs. 354 crore has been set aside for the Common Alerting Protocol's SMS implementation. Initiatives such as the Disaster Management Information System Portal and the 112 Emergency Response Support System serve as valuable, multifaceted measures. As a result, a remarkable shift was noticed in preparing people against natural calamities.

The financial dimension is crucial in disaster management, and reflecting on past decades, the current government has taken significant steps to implement policy recommendations that establish structured financial arrangements for a Disaster Risk Management Fund, thereby enhancing preparedness and resilience against future calamities. From 2021–2022 to 2025–2026, the Fifteenth Finance Commission suggested establishing the State Disaster Risk Management Fund (SDRMF) and National Disaster Risk Management Fund (NDRMF). On 5 February 2021, the Union Government established the NDMF. So far, 25 states have mentioned establishing an

SDMF. Regarding fund allocation, a significant increase is witnessed in a decadal pattern. Since 2014, a total of 1.04 lakh crore have been allocated to SDRF and over 77,000 crore to NDRF.

Figures 5 and 6: Increase in Allocation of Funds to Disaster Fund



Source: Ministry of Home Affairs

From the above figure, it is evident that almost three times increase in the distribution of disaster funds between the period of 2005-06 to 2013-14 and 2014-15 to 2022-23.

From the above discussion, it is evident that the government, since 2014 has adopted a holistic approach of awareness, vigilance, relief and rehabilitation in responding to disasters. To make India a disaster-resilient nation, the government has adopted a zero-casualty approach to responding to calamities.

Key Findings and Discussion

The government initiatives implemented post-2014 to mitigate disasters have been highlighted in the previous section. This section will analyse the impact of these reforms, focusing on enhancements in coordination, funding, early warning systems, and rehabilitation efforts for specific natural calamities that India has experienced since 2014. A comprehensive examination of various disasters will be presented, drawing on reports from government bodies and media coverage. A

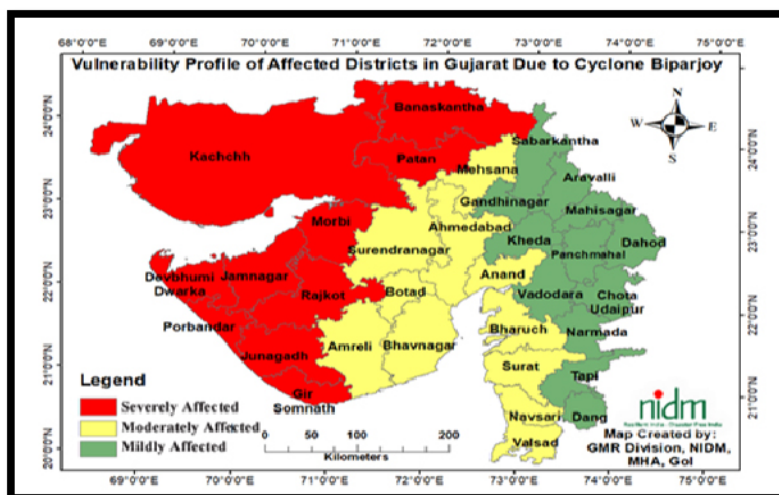
detailed analysis is given below-

1. Cyclone Biporjoy

In June 2023, Cyclone Biparjoy impacted Gujarat's coastal areas, originating from a low-pressure system in the Arabian Sea. The major steps of how state and central government along with community support approached the natural calamity. They are as follows-

Early Warning- The India Meteorological Department (IMD) first reported this system on 5 June, 2023, and issued alerts to west coast states starting 6 June. The cyclone intensified and posed significant threats to the densely populated and infrastructure-rich state. In terms of disseminating earlier warnings, IMD sent warning on 5 June 2023, before further intensifying into a cyclone. IMD alerted the west coast states about the cyclone from 6 June 2023 onwards. The figure below shows the impacted areas of Gujrat due to cyclone Biporjoy.

Figure 7: Vulnerable Districts of Gujarat during Cyclone Biparjoy



Source: Commissioner of Relief, Govt. of Gujarat

Preparedness Aspect- Upon receiving alerts from the IMD, the Union Home Secretary convened a high-level meeting of the National Executive Committee on 11 June, 2023, to assess readiness for Cyclone Biparjoy. On 12 June, Prime minister Narendra Modi chaired a

high-level meeting to review Cyclone 'Biparjoy' preparedness. The Cabinet Secretary held a National Crisis Management Committee meeting to review the preparedness of the Government of Gujarat and relevant central agencies. On 14 June 2023, the National Disaster Management Authority outlined preparedness and response measures for Cyclone Biparjoy, advising stakeholders to establish a Unified Command under the Incident Response System and to utilise the Common Alerting Protocol (CAP) and the Sachet app.

Coordination Aspect- NDRF teams were strategically positioned at vulnerable sites, while the State Emergency Operation Centre (SEOC) was activated under the Additional Chief Secretary for Revenue and Disaster Management in Gujarat. The SEOC coordinated district-level preemptive efforts for resource deployment. The Gujarat State Disaster Management Authority (GSDMA) issued early warning and action messages via various media platforms. Additionally, the State Disaster Response Force (SDRF), police, fire services, Aapda Mitras, and health professionals were prepared for effective disaster response. The administration also deployed HAM radios, satellite phones, and wireless systems to maintain communication.

The NDRF has strategically stationed 12 teams equipped with boats, tree-cutting tools, telecom equipment, and more. Additionally, they have maintained 15 teams on standby for any potential needs.

Figure 8 : Boats parked in highly vulnerable districts

Districts	No. of Boats Parked at Coast
Junagadh	3,377
Kachchh	2,001
Jamnagar	832
Porbandar	4,202
Devbhumi Dwarka	4,385
Gir Somnath	6,675
Morbi	123
Total	21,595

Source: Commissioner of Relief, Govt. of Gujarat

The Outcome- Due to coordinated efforts of both central and state governments, 143,053 people, including salt pan workers, were evacuated and sheltered in community buildings, schools, and Multipurpose Cyclone Shelters (MPCS). Schools were closed in advance to ensure the safety of students and staff. Among the evacuees, 1,152 pregnant women received care, resulting in 828 safe deliveries facilitated by health departments at various healthcare centers. The agriculture, horticulture, and animal husbandry departments also supported farmers, safely evacuating livestock to community cattle sheds (**Report on Cyclone Biparjoy, 2024**).

These proactive measures contributed to achieving the goal of zero casualties, with resilient communities serving as first responders alongside administration and response agencies.

2. Sikkim Flash Flood

A catastrophic flood was triggered in Sikkim on October 3-4, 2023, as a result of a Glacial Lake Outburst in South Lhonak Lake in North Sikkim. This event has led to significant destruction of infrastructure, and property, and tragic loss of human lives.

According to a report from the Ministry of Home Affairs, a satellite-based study conducted by the NRSC of ISRO revealed that South Lhonak Lake had overflowed, draining an area of 105 hectares and causing flash floods downstream. Upon receiving the news, alerts were promptly issued to downstream communities, and Relief and Rescue Operations were launched by the NDRF, SDRF, ITBP, Army, and Sikkim's civil administration. In terms of lives affected, a total of 87,000 people were affected as of 9 October 2023. The four districts, Namchi, Gangtok, Mangan, and Pakyong, are most affected by floods.

In managing the aftermath of the crisis, the state and central government have taken well-coordinated measures. The very next of the flash food i.e. on 5 October 2023, a High-level meeting chaired by Chief Secretary Sikkim was held to review the situation. Rescue teams

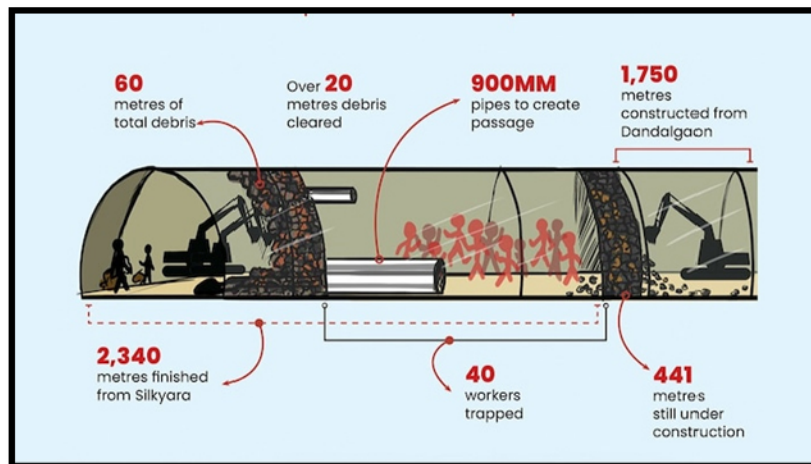
of SDRF, SSAPF, Home Guard, Civil Defense, Civil volunteers, and Police have been deployed for rescue and relief operation in the flood affected areas. The central government also took multiple measures such as continuous review of the situation along with scientific survey team was formed to conduct further study along with constant efforts to restore connectivity in the flood-affected areas of Sikkim. In addition, the Central government has granted early approval to release its allocated portion from the State Disaster Response Fund (SDRF) to Sikkim, totalling Rs 44.80 crore for the fiscal year 2023-24.

To assess the post-impact of the flood, a 20-member Central team from the National Disaster Management Authority (NDMA), Ministry of Home Affairs (MHA), led by the Joint Secretary (Policy and Plan), NDMA, undertook a critical three-day Post-Disaster Needs Assessment (PDNA) in Sikkim. The assessment aimed to evaluate the losses and damages incurred due to the floods in Sikkim on October 3rd and 4th, 2023 (Aapda Samvaad, December 2023).

In terms of funds, the 2024-25 budget has also allocated assistance for flood management-related projects in Sikkim. Due to the coordinated efforts of central and state governments, Sikkim has bounced back, welcoming a record-breaking 290,000 tourists by 31 March, 2024. This surge reflects the successful rebuilding of the hospitality industry, which was severely impacted by the devastating flash floods in October 2023.

3. Uttarkashi Tunnel Rescue operation

On 12 November 2023, a collapse occurred in the under-construction tunnel from Silkyara to Barkot due to debris falling in a 60-meter stretch on the Silkyara side. Immediate mobilisation of resources by the State and Central Governments ensued to rescue the 41 trapped labourers. In this rescue operation, five agencies, namely Oil and Natural Gas Corporation (ONGC), Satluj Jal Vidyut Nigam Limited (SJVNL), Rail Vikas Nigam Limited (RVNL), National Highways and



Source: India Today

Regarding prompt action, the rescue operations were done systematically and scientifically, and leading experts from around the world were brought in to study and explore various options. Prime Minister Modi also held meetings to be briefed on the status of the rescue operations. District-level rescue operations were started as soon as the incident was reported around 5.30 pm on 12 November 2023.

The NHIDCL has initiated several efforts for rescue operations, including the regular supply of fresh food and communication links established by the SDRF and NDRF. Horizontal boring commenced on 22 November 2023 but faced interruptions due to a metallic obstruction, leading to gas cutting and the successful insertion of pipes. Vertical drilling operations by SJVNL began on 26 November, achieving 30.80 meters. THDCL is constructing a rescue tunnel from the Barkot side, having completed six blasts, while RVNL has initiated horizontal drilling with necessary equipment arriving from Nashik and Delhi. Access roads for drilling have been completed by BRO, facilitating operations for both RVNL and ONGC, which is preparing for air drilling.

A joint team from THDCL, the Army, Coal India, and NHIDCL is fabricating a drift tunnel using a semi-mechanised method. At the

same time, BRO continues to develop approach roads to support these efforts. Finally, the rescue operation ended on 28 November 2023 with the successful rescue of all 41 stranded workers. This rescue operation shows the well-coordinated efforts among different government agencies to manage disasters.

The successful rescue operation also garnered wider attention from global experts and officials, highlighting India's shifting approach to disaster management. For instance, international tunnelling expert Arnold Dix, who was also part of the operation, commended the rescue teams for their efforts, noting that the successful outcome would not have been achievable without the collaboration of national agencies. Similarly, Anthony Albanese, Prime Minister of Australia, also praised the rescue operation and the consistent efforts of the Indian government.

4. Cyclone Amphan

Cyclone Amphan hit eastern India, mainly West Bengal and Odisha in May 2020. It caused havoc in West Bengal and impacted Odisha. This natural calamity became more challenging as it was pandemic time. Managing the competing demands of a lockdown with an evacuation was challenging. However, overall human losses were limited to a significant extent. Many issues emerged ranging from protecting the responders to applying disaster risk management amid covid cases. The key steps followed in terms of handling the disaster is as follows-

Early Warning- The IMD maintained continuous surveillance over the North Indian Ocean, monitoring the system since 23 April, 2020, three weeks before the Low-Pressure Area formed on 13 May. Significant advancements were made through remote sensing and satellite image interpretation to analyse and forecast the intensity of Cyclone Amphan. Monitoring utilised data from INSAT 3D, SCATSAT, ASCAT, and observations from ships and buoys. Doppler Weather Radars in Visakhapatnam, Gopalpur, Paradip, and Kolkata tracked the cyclone

from 18 May to 20, while various numerical weather prediction models from the Ministry of Earth Science and IMD were employed to predict its development, movement, and landfall **(Gupta et. al 2021)**.

A five-stage warning system was implemented for Cyclone Amphan based on its observed trajectory over the Bay of Bengal. In West Bengal and North Odisha, the first bulletin was released at 08:45 hrs IST on 16 May, 104 hours before landfall, marking the start of the Pre-Cyclone Watch. This was followed by an upgraded Cyclone Watch at 20:30 hrs IST on the same day, 92 hours prior. A Cyclone Alert (Yellow Message) was issued at 08:40 hrs IST on 17 May, 80 hours before landfall, followed by a Cyclone Warning (Orange Message) at 08:45 hrs IST on 18 May, 56 hours prior. Finally, a Post-Landfall Outlook (Red Message) for interior districts of Gangetic West Bengal, Assam, and Meghalaya was issued at 23:30 hrs IST on 19 May, just 17 hours before landfall

(MoES, 2020).

In the context of pre-disaster preparedness, involved evacuating approximately 3 lakh people from coastal areas to safer locations. Alert messages were dispatched to Municipal Corporations, Panchayat, and Block development offices. The Marine Weather Services in New Delhi issued Global Maritime Distress Safety System (GMDSS) bulletins for deep-sea sailors and fishermen, while Indian Coast Guard officials were prepositioned along the Bay of Bengal coast and advisories were issued to limit their movement. Updates on the cyclonic storm were posted on IMD and disaster management agency platforms, and the chiefs of IMD and NDRF held a joint press conference to inform the media about the storm's details **(Gupta et. al 2021)**.

During disaster, regular monitoring of situation was done in a well-coordinated manner between the state government of West Bengal and Central government. For instance, power supply was suspended in high-alert areas to prevent any accidents. The West Bengal government's electricity department closely monitored the

situation, keeping an eye on instances of fallen electric poles and damaged wires on waterlogged roads. Similarly, a High-level Committee was formed under the Union Home Minister to supervise the situation and approved financial assistance of Rs. 2,707.77 crore for West Bengal and Rs.128.23 crore for Odisha.

Following the landfall of Cyclone Amphan, the Sunderbans region and coastal districts of South Bengal suffered the most severe impacts. Relief operations commenced once the cyclone passed, with state and central teams deployed to assist. NDRF teams successfully evacuated 7,650 livestock to safety, removed 7,392 uprooted trees, and cleared 3,152.5 kilometers of road. Additionally, five columns of the Indian Army and 20 teams from the Indian Coast Guard were assigned to relief and restoration efforts. Various social groups and NGOs actively contributed by providing essential supplies such as food, drinking water, clothing, and medicine to response centers in the affected areas of Kolkata and South 24 Parganas **(Gupta et. al 2021)**.

In post-disaster handling, PM Narendra Modi visited West Bengal to review the situation arising out of Cyclone Amphan on 22 May 2020. After an arial survey of the affected areas, Rs. 1,000 crore financial assistance granted to West Bengal for immediate relief activities in the State Similarly, Rs. 500 crore to the Government of Odisha 'on account basis' from National Disaster Response Fund (NDRF) on 23 May 2020.

Here, it is evident that damage caused by Cyclone Amphan in the state of West Bengal was handled proactively with the help of a comprehensive crisis management method comprising early disaster warning, timely forecasting, prediction of almost accurate landfall, spreading awareness in the designated sectors, and undertaking every possible mitigation measures.

Conclusion

In the field of disaster management planning, India has witnessed a

paradigmatic shift, including components of preparedness, resilience, capacity building, community involvement, and disaster risk reduction. This has ensured that everyone has a more stable and secure life, even in the face of natural disasters, especially in the case of Biporjoy cyclone. From early warnings of impending disasters' impact to quick rescue operations and quick payment of financial aid for recovery, the multi-dimensional approach of the government in the last one decade has brought a shift in the country's approach towards handling disasters.

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