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NATURAL DISASTERS IN INDIA: VULNERABILITY, SUSTAINABLE PREPAREDNESS AND POLICY FRAMEWORK

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ABSTRACT

Natural disasters are on the rise today. During the past couple of decades the world has witnessed unprecedented loss and havoc caused by disasters. Indian subcontinent is particularly vulnerable to cycles, droughts, earthquakes, floods and so forth. The loss of human lives, livestock, property, and infrastructure not only causes setback for national development but also renders communities vulnerable and susceptible to further deterioration. The paper starts with a brief assessment of how India has been affected by natural disasters. It seeks to delineate how the country has responded to combat the challenges and the efforts to integrate disaster risk reduction (DRR) into policy framework.

INTRODUCTION

Disaster is defined as 'Catastrophic situation in which the normal pattern of life or ecosystem has been disrupted and extra-ordinary emergency interventions are required to save and preserve lives and or the environment' (Ministry of Home Affairs, 2011). The Disaster Management Act 2005 has included man-made disasters and 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 result in substantial loss of life or human sufferings 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 an affected area'. Natural disasters can be divided into astro-physical (for example meteorite), geo-physical (for example, earthquakes and volcanoes), and hydro-meteorological (for example, cyclone, typhoon, hurricanes, floods and drought) events. Biological disasters are also disasters, but unlike astro-physical, geo-physical and hydro-meteorological events, these are more effectively controllable and treatable due to advances in molecular epidemiology and

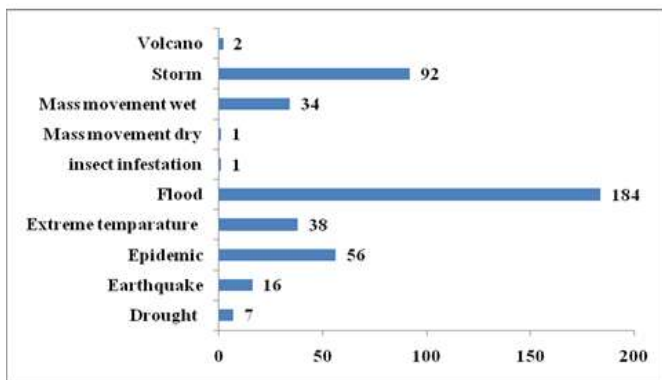
medicine. The Bhopal gas (methyl isothiocyanate) disaster (2-3 December 1984) still lingers fresh in our memories as worst ever man-made disasters that occurred in India. While man-made disasters may be controlled to a large extent by developing designs and efficient monitoring strategies, natural disasters such as astro-physical, geological and hydro-meteorological ones are not under human control. Therefore, preparedness, early warning and mitigation become very relevant here.

Indian Scenario

The Indian subcontinent is highly vulnerable to cyclones, droughts, earthquakes and floods. Avalanches, forest fire and landslides occur frequently in the Himalayan region of northern India. During the last three decades (1980-2010) India has witnessed a total of 431 cases of natural disasters of different magnitude (Figure 1). Among the total number of states/ Union Territories in the country, 25 are disaster prone. On an average, about 50 million people in the country are affected by one or the other disaster every year, besides loss of property worth several million (Table 1). During the two decades of 1970s and the 80s, droughts and famines were the biggest killers in India. But the situation stands altered today. It is probably a combination of factors like better resource management and food security measures that has greatly reduced the deaths caused by droughts and famines.

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(Source: Kumar, 2012)

Figure 1. Natural disaster occurrences reported during 1980-2010 in India

Natural disasters directly impact economies, agriculture, food security, water, sanitation, the environment and health each year. Therefore it is one of the single largest concerns for most of the developing nations. Different natural disasters pose varying levels of physical damage to infrastructure and agriculture with implications for their indirect and secondary impacts. Drought causes heavy crop and livestock losses over wide areas of land but typically leave infrastructure and productive capacity largely unaffected. Floods and cyclones cause extensive damage to both infrastructure and agriculture, depending on their timing relative to the agricultural cycle. While earthquakes have little impact on standing crops excluding localised losses but can cause wide spread devastation of infrastructure and other productive capacity over relatively large areas.

Table 1. People-affected, lives lost and economic damage due to disasters in India during 1980-2010

Year	Types of disasters	People affected	Lives lost	Economic damage (USD x 1000)
1980	Flood	30,000,023		
1982	Drought	100,000,000		
	Flood	33,500,000		
1984	Epidemic		3290	
1987	Drought	300,000,000		
1988	Epidemic		3000	
1990	Storm			2,200,000
	Earthquake		9,748	
1994	Flood		2001	
1995	Flood	32,704,000		
1996	Storm			1,500,300
1998	Storm		2871	
	Extreme temperature		2541	
	Flood		1811	
1999	Storm		9,843	2,500,000
2000	Drought	50,000,000		
2001	Earthquake		20,005	2,263,000
2002	Drought	300,000,000		
	Flood	42,000,000		
2004	Flood	33,000,000		2,500,000
	Earthquake		16,389	
2005	Flood			3,330,000
	Flood			2,300,000
2006	Flood			3,390,000
2009	Flood			2,150,000

(Source: Sharma and Ashutosh, 2012)

Table 2. Year-wise damage caused due to floods, cyclonic storms, landlines and other disasters during the last ten years in India

Year	Lives lost (in No.)	Cattles lost (in No.)	Houses damaged (in No.)	Cropped areas affected (in lakh hectares)
2001-02	834	21,269	3,46,878	18.72
2002-03	898	3,729	4,62,700	21.00
2003-04	1,992	25,393	6,82,209	31.98
2004-05	1,995	12,389	16,03,300	32.53
2005-06	2,698	1,10,997	21,20,012	35.52
2006-07	2,402	4,55,619	19,34,680	70.87
2007-08	3,764	1,19,218	35,27,041	85.13
2008-09	3,405	53,833	16,46,905	35.56
2009-10	1,677	1,28,452	13,59,726	47.13
2010-11	2,310	48,778	13,38,619	46.25

(Source: Sharma and Ashutosh, 2012)

Floods, high winds and earthquakes dominate (98%) the reported injuries, with ever increasing numbers in the last ten years. The period from 2001 to 2011 has been associated with a large number of earthquakes in Asia that have a relatively high injury to death ratio. Floods, droughts, cyclones, earthquakes, landslides and avalanches are some of the major natural disasters that repeatedly and increasingly affect India (Table 2).

The precise cost of the disaster in terms of loss of lives, property, loss of development opportunities and so forth cannot be clearly assessed or counted. The costs of disasters are clearly inequitable, falling heavily only on the few. Disasters result not only in loss of shelter but also create hardships, lack of food availability, temporary loss of livelihood and disrupt socio-economic activities. Some of the losses may be redeemable and compensated for through

Table 3. State-wise losses during 2005-06 to 2009-10

Sl No	Human lives		Cattle		Houses		Crop Area	
	Top 10 states	No.	Top 10 states	No.	Top 10 states	No.	Top 10 states	No.
1	Himachal	379	Assam	11659	Gujrat	221664	Orissa	12.36
2	Uttarakhand	488	Himachal	13551	Rajasthan	269252	Gujrat	12.85
3	Maharashtra	749	Gujrat	19365	Orissa	475618	Rajasthan	17.36
4	Kerala	763	Bihar	20474	Assam	493228	Bihar	21.37
5	AP	770	Karnataka	23020	UP	517198	Maharashtra	21.52
6	WB	921	Arunachal	28409	Maharashtra	723325	UP	22.87
7	Karnataka	990	Maharashtra	46586	AP	857027	TN	23.34
8	Gujrat	1199	WB	47526	Bihar	1089676	AP	29.21
9	Bihar	1684	Rajasthan	50894	Karnataka	1134080	WB	31.38
10	UP	2763	AP	481960	WB	2096665	Karnataka	32.46
	Others	2340	Others	42668	Others	921314	Others	34.43
	Total	13046		786112		8799047		259.15

(Source: Padmanabhan, 2012)

disaster relief and insurance. However, apart from economic dimension, such disturbances have their psychological and social dimensions as well, which need to be studied and documented besides developing appropriate mitigation strategies (Sharma and Ashutosh, 2012)

India's Vulnerability

India is a nation with varied climatologically and hypsographic conditions. Approximately 68 per cent of the land is drought prone, 60 per cent is prone to earthquake, 12 per cent to floods, 8 per cent to cyclones. Almost 85 per cent of the land area in India is vulnerable to natural hazards while 22 States have been marked as hazards prone states. A HIGH Power Committee (HPC) constituted in 1999 identified thirty one disasters in the country. These disasters have been categorised into following five sub-groups depending on generic (origin) considerations and various departments/ministries dealing with various aspects (Sharma and Ashutosh, 2012):

Water and Climate Related Disasters

Floods and Drainage Management, Cyclones, Tornadoes and Hurricanes, Hailstorm, Cloud Burst, Heat Wave and Cold Wave, Snow Avalanches, Droughts, Sea Erosion and Thunder and Lightning.

Geologically related disasters

Landslides and Mudflows, Earthquakes, Dam Failures/ Dam Bursts and Mine Fires.

Chemical, Industrial and Nuclear related disasters

Chemical and industrial and nuclear disasters have been included.

Accident related disasters

Forest Fires, Urban Fires, Mines Flooding Oil Spill, Major Building Collapse, Serial Bomb Blasts, Festival related disasters, Electrical disasters and Fires, Air, Road and Rail Accidents, Boat Capsizing and Village Fire have been included in this sub-group by HPC.

Biologically Related Disasters

Epidemics, Pest Attacks, Cattle epidemics and Food poisoning. The document that reflects the detailed hazard profile of the states in India is the Vulnerability Atlas prepared by the Building Materials and Technology Promotion Centre (BMTPC). The Atlas produced by BMTPC in 1997 was revised in 2006 with latest information available on various hazards. Given the complications in comparing states, the Working Group on Disaster Management for the 12th Five Year Plan has compared the data on various losses incurred due to disasters and rated the states (Table 3). "The states of Gujarat, Maharashtra, Andhra Pradesh, West Bengal, Karnataka and Bihar come under the top 10 states in case of human lives lost, cattle lost, houses damaged and crop area damaged. Andhra Pradesh, Rajasthan and West Bengal record the highest cattle loss due to disasters. Uttar Pradesh, Bihar, Karnataka and West Bengal account for maximum human lives lost, damage to houses and crop area as compared to other states. While the reasons for the vulnerability can be established only on the basis of further analysis these states fall in the high vulnerability category and need special attention" (12th Plan Working Group on DM) (Padmanabhan, 2012).

India's Response

Government of India (GOI) started to integrate disaster risk reduction (DRR) into planning and activities more than two decades ago. In August 1999 a High Powered Committee (HPC) on Disaster Management was constituted under the Chairmanship of Shri J.C. Pant, former Secretary of Agriculture to the Government of India along with experts and officials, to suggest measures to bring about institutional reforms in the field of disaster management. The Committee was also mandated to prepare comprehensive plans for National, State and District levels. Barely two months had elapsed since the constitution of the High Powered Committee, that a Super Cyclone struck Orissa Coast on 29th October 1999. This cyclone was unprecedented in its sweep and ferocity, killing nearly 10,000 people and affecting over 15 million people across 12 districts of Orissa. One year and four months later, the country experienced an earthquake with magnitude of 6.9 on the Richter Scale in Bhuj area of Gujarat State. In this disaster, nearly 20,000 people died, over 1,55,000 were injured and 6 lakh people were rendered homeless. The

turning point in the thinking on disaster management was the Indian Ocean Tsunami of 26th December 2004. This disaster struck the country in more than seven states which highlighted the gaps in early warning, coordination and the management of disasters. A paradigm shift in India's approach was necessary during the aftermath of 2004 Tsunami and a subsequent article, 'Beyond Tsunami: An Agenda for Action (Swaminathan, 2005) confirmed this. The article emphasised that medium and long-term rehabilitation demands three initiatives all along the coast: (i) strengthening the ecological foundations of sustainable human security, (ii) rehabilitating livelihoods and fostering sustainable livelihood security and (iii) putting in place knowledge centres in the vulnerable coastal villages. In other words, this model called for increasing elements of sustainable development in the coastal villages with disaster preparedness, including early warning system. In an All Party Meeting held on 9th January 2005, the need for national level legislation for management of natural and man-made disasters was highlighted.

Consequent to this meeting, Government of India decided to enact a law on disaster management to provide for a requisite institutional mechanism for drawing up and monitoring the implementation of the disaster management plans, ensuring measures by various wings of the Government for prevention and mitigation of disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation. Accordingly a Bill was introduced in the Rajya Sabha on 11th May 2005. Eventually with the enactment of Disaster Management Act 2005 the National Disaster Management Authority (NDMA) was established under the Chairmanship of the Prime Minister. The Act also provides for establishment of State Disaster Management Authorities (SDMAs) chaired by the respective Chief Ministers and District Disaster Management Authorities (DDMAs) chaired by respective District Collectors. Therefore, the disaster management architecture for the country has now been provided with legal backing and with clear delineation of rules and responsibilities. The Act also provides for budget allocation for disaster risk reduction and for response.

With this architecture in place it is now up to the Central and the State Governments to utilise these provisions effectively to reduce the impact of disasters on the people and the country. It is noteworthy to mention that during the past few years of its existence, NDMA has developed a number of disaster management guidelines for managing funds, cyclones, earthquakes, droughts and biological disasters. The very positive aspect is the emphasis on pre-disaster preparedness in a country where it hardly existed. It also addresses technological, social and management dimensions. The ideal model would be the integration of the elements of disaster preparedness with those of sustainable rural development, and the blending of the modern early warning technologies with traditional knowledge of disaster management by indigenous rural communities. All these need to be designed and executed in a 'bottom up' and participatory rather than in a 'top down' manner (Kesavan and Swaminathan, 2006).

Sustainable Preparedness

The Tenth Five Year Plan document has a detailed note on disaster management. The dams and barrages constructed over

the last many decades have protected 15 million ha out of a total of 40 million ha prone to floods annually. Recently the Government of India has constituted a Central Task Force headed by the Chairman, the Central Water Commission to suggest short and long term measures regarding flood control. The Ministry of Home Affairs has initiated National Disaster Risk Management Programme in all the flood prone states such as Bihar, Orissa, Assam, West Bengal and Uttar Pradesh. The major shortcoming in earthquake risk mitigation is that there is no appropriate technology to detect early tremors and provide warning. Use of poor construction materials enhances the risk of collapse even during some of the minor tremors. With advancement of knowledge many in the rural areas have resorted to using brick and cement in place of mud and thatch but without proper and secure designs and civil engineering inputs. A National Core Group for Earthquake Risk Mitigation consisting of experts in earthquake engineering and administrators exists today in order to provide advice and guidance to states on various aspects of earthquake mitigation.

In addition, there is also a National Programme for Capacity Building of Engineers and Architects in Earthquake Risk Mitigation. The Ministry of Rural Development has plans to introduce earthquake/cycle/flood-resistant designs and features in rural housing, anwanwadi centres and so on, constructed under the Indira Awas Yojana (IAY). A National Cyclone Mitigation Project with a mission to construct cyclone centres, coastal shelter belts and others, along with training, awareness and capacity building programme will soon be in place. The Government of India has paid special attention to the north-eastern states and Andaman and Nicobar Islands. The adoption of the "Shillong Declaration" facilitated by the North Eastern Council (NEC), aims to integrate disaster management with developmental planning. The National Disaster Management Guidelines (Management of Cyclone), April 2008, of NDMA have also emphasised a paradigm shift in disaster management.

Disaster Risk Reduction

It is well recognised that the poor and vulnerable sections of the society are impacted disproportionately by disasters. Quite often they lose their homes, assets and livelihoods. While there is genuine concern about the adverse impact of disasters on GDP there is even more concern that our efforts to achieve 'inclusive growth' may not be successful unless Disaster Risk Reduction (DRR) is addressed. To achieve this, the following steps are necessary:

- (a) Mainstreaming DRR into development
- (b) Strengthening early warning systems by leveraging science and technology.
- (c) Increasing awareness and preparedness.
- (d) Strengthening rescue and relief mechanisms.
- (e) Better rehabilitation and reconstruction.

The Government of India administers a number of ambitious programmes in key sectors like agriculture, rural development, urban development, drinking water, rural roads, health, education and food security. These programmes have substantial outlays and are aimed at improving the quality of the lives of our people. While these have contributed in some

way to disaster risk reduction, specific components and interventions for DRR have largely been missing in many of these flagship programmes. The attempt now should be to introduce DRR as a specific component of these schemes (Kumar, 2012). The Rashtriya Krishi Vikas Yojana (RKVY), the flagship programme of the Ministry of Agriculture, provides adequate flexibility to integrate DRR components to take care of extreme weather events. Creating reserves of seeds, pest surveillance systems, providing water storage devices (in combination with MGNREGS) and so forth could be taken up as DRR components. The Pradhan Mantri Gram Sadak Yojana (PMGSY), under the Ministry of Rural Development, provides rural connectivity to habitations. These could also provide lifeline connectivity in the case of disasters to hospitals, food distribution centres, schools and others. Villages with no connectivity at all due to seasonal or perennial rivers can be provided access to economic activity, education and health by constructing small foot bridges by suitably modifying the scheme.

The Indira Awas Yojana (IAY) provides housing for the poor. It is a practice of the Ministry to earmark a small percentage of funds for quick construction of houses to those affected by natural disasters. A change in design norms to accommodate the need for strengthening the house of the vulnerable region needs to be introduced in the coming days. So is the case with Rajiv Awas Yojana (RAY). The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) provides for strengthening infrastructure in selected large cities in the country. Given the fact that urban population in India is growing at a rapid pace and natural hazards in densely populated regions can increase vulnerability and economic losses, and attention to disaster reduction needs to be given in the planning and implementation of the urban development projects. The Rajiv Gandhi National Drinking Water Mission (RGNDWM) provides safe and potable water to all the villages. The Department has earmarked a certain percentage in their outlay for sinking emergency tube-wells in the event of a disaster.

It would be worthwhile to construct these tube-wells on higher platforms in low lying and flood prone areas so that in the monsoon season and in the event of floods, these do not go under water and become unusable. Similarly the health sector has a flagship programme called National Rural Health Mission. While the overall experience in handling epidemics and pandemics has been good, areas like hospital safety, surveillance mechanism for infectious diseases, trauma care, management of mass casualties and so forth, need more attention. Setting up of suitable early warning systems is probably the best intervention which can be made in the years ahead. It should be possible to warn communities in any part of the country about extreme weather conditions substantially well in advance to enable them to save the lives and property. The three departments viz., Science and Technology, Earth Sciences and Space and the organisations under them viz., IMD, INCOIS, NRSC, and SOI need to step up their investments in equipments and human capabilities to provide advance and effective information on disasters. These have to be supported by other scientific departments and organisations like ICAR, ICMR, CWC, GSI and others (Kumar, 2012).

Institutional and Policy Framework

Sharma and Ashutosh (2012) laid out in clear terms the policy framework of the Government of India. The institutional and policy mechanisms for carrying out response, relief and rehabilitation have been well-established since Independence. These mechanisms have proved to be robust and effective insofar as response, relief and rehabilitation are concerned.

a) At the national level, the Ministry of Home Affairs is the nodal Ministry for all matters concerning disaster management. The Central Relief Commissioner (CRC) in the Ministry of Home Affairs is the nodal officer to coordinate relief operations for natural disasters. The CRC receives information relating to forecasting/warning of a natural calamity from India Meteorological Department (IMD) or from Central Water Commission of Ministry of Water Resources on a continuing basis. Each Ministry/Department/Organization nominates their nodal officer to the Crisis Management Group chaired by Central Relief Commissioner. The nodal officer is responsible for preparing sectoral Action Plan/Emergency Support Function Plan for managing disasters.

b) National Crisis Management Committee (NCMC): Cabinet Secretary, who is the highest executive officer, heads the NCMC. Secretaries of all the concerned Ministries /Departments as well as organizations are the members of the Committee. The NCMC gives direction to the Crisis Management Group as deemed necessary.

c) Crisis Management Group: The Central Relief Commissioner in the Ministry of Home Affairs is the Chairman of the CMG, consisting of senior officers (called nodal officers) from various concerned Ministries. The CMG's functions are to review every year contingency plans formulated by various Ministries/ Departments/ Organizations in their respective sectors, measures required for dealing with natural disasters coordinate the activities of the Central Ministries and the State Governments in relation to disaster preparedness and relief and to obtain information from the nodal officers on measures relating to above.

d) Control Room (Emergency Operation Room): An Emergency Operations Center (Control Room) exists in the nodal Ministry of Home Affairs, which functions round the clock, to assist the Central Relief Commissioner in the discharge of his duties. The activities of the Control Room include collection and transmission of information concerning natural calamity and relief, keeping close contact with governments of the affected States, interaction with other Central Ministries/Departments/Organizations in connection with relief, maintaining records containing all relevant information relating to action points and contact points in Central Ministries and so forth, keeping up-to-date details of all concerned officers at the Central and State levels.

e) Contingency Action Plan: A National Contingency Action Plan (CAP) for dealing with contingencies arising in the wake of natural disasters has been formulated by the Government of India and it had been periodically updated. It facilitates the launching of relief operations without delay. The CAP

identifies the initiatives required to be taken by various Central Ministries/Departments in the wake of natural calamities, sets down the procedure and determines the focal points in the administrative machinery.

f) State Relief Manuals: Each State Government has relief manuals/codes which identify that role of each officer in the State for managing the natural disasters. These are reviewed and updated periodically based on the experience of managing the disasters and the need of the State.

g) Funding mechanisms: The policy and the funding mechanism for provision of relief assistance to those affected by natural calamities are clearly laid down. These are reviewed by the Finance Commission appointed by the Government of India every five years. The Finance Commission makes recommendation regarding the division of tax and non-tax revenues between the Central and the State Governments and also regarding policy for provision of relief assistance and their share of expenditure thereon. A Calamity Relief Fund (CRF) has been set up in the State as per the recommendations of the Eleventh Finance Commission (Centre contribute 75% where as State 25%). State can get assistance through National Calamity Contingency Fund (NCCF). Also through Prime Minister Fund.

h) At the State level, response, relief and rehabilitation are handled by Departments of Relief and Rehabilitation. The State Crisis Management Committee is set up under the Chairmanship of Chief Secretary in the State. All the concerned Departments and organizations of the State and Central Government Departments located in the State are represented in this Committee. This Committee reviews the action taken for response and relief and gives guidelines/directions as necessary. A control room is established under the Relief Commissioner. The control room is in constant touch with the climate monitoring/forecasting agencies and monitors the action being taken by various agencies in

performing their responsibilities. The district level is the key level for disaster management and relief activities. The Collector/Dy. Commissioner is the chief administrator in the district. He is the focal point in the preparation of district plans and in directing, supervising and monitoring calamities for relief. A District Level Coordination and Relief Committee is constituted and is headed by the Collector as Chairman with participation of all other related government and non governmental agencies and departments in addition to the elected representatives. With all these laudable efforts, the question remains whether any endeavour without any firm network that connects development, disasters, and political will should effectively reduce death and devastation should another Uttarakhand episode (2013) occurs. Apart from focus on sustainable management of natural resources and knowledge empowerment of the local communities, there should be a conscious paradigm shift from 'top-down' to 'bottom-up' mode of planning and implementation.

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