PRIME MINISTER'S AGENDA 10:

India's Disaster Risk Management Roadmap to Climate Resilient and Sustainable Development

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Abstract

India's Prime Minister opened his long experience including of dealing with major disasters by outlining an Agenda 10 on Disaster Risk Management, during the 7th Asian Ministerial Conference (first after Sendai Framework) in November 2016. Disaster risk, much talked but less understood, particularly how hazards proceed into disaster, is still a valid question to explore, as evident from Priority 1 of Sendai Framework of Disaster Risk Reduction, i.e., 'Understanding Disaster Risk'. The paradigm shift, now second one – to disaster risk management, encompassing climate resilience factors and sustainable development focused, therefore, calls for an honest introspection of the journey and efforts at country level and to delineate a prudent roadmap for attaining the goals of three major agreements to which India is signatory to, viz. SFDRR, Paris Climate Agreement and SDGs. Asian Ministerial Conference Inaugural speech of the Prime Minister delineated the framework for simple and practical roadmap for achieving sustainable development through DRM. The linkages of DRM Agenda 10 of the Indian Prime Minister have been analyzed in this paper to delineate some of the key principles and actions for implementation, and to envisage the concerns of three international policies at the same time, in the light of lessons drawn from three studies on climate resilient disaster management and developmental planning undertaken in Odisha, Uttarakhand and Uttar Pradesh.

1. Introduction: Demystifying disaster dimensions

Interesting and surprising at the same time, Sendai Framework for Disaster Risk Reduction (2015-30) prioritized "Understanding Disaster Risk" at rank one. This simply is the recognition of the fact that despite of thirty years of rigorous policy-science-social practice and research we have still miles to go in demystifying 'what actually makes a disaster'. The United Nation Report titled "Living with risk" claims that though there has been decline in the loss of human lives from disaster the occurrence of disaster is on rise (UNISDR, 2004). Disasters are events of environmental extremes as inevitable entities of this living world. Disaster management highlights the interdependence of the economy, environment and inclusive development. A 'disaster', defined widely and variedly, is a serious disruption to a community's survival, resources and livelihood systems that result from vulnerability to hazard impacts and results in the loss of life, property and environment on a scale which overwhelms their capacity to cope unaided.

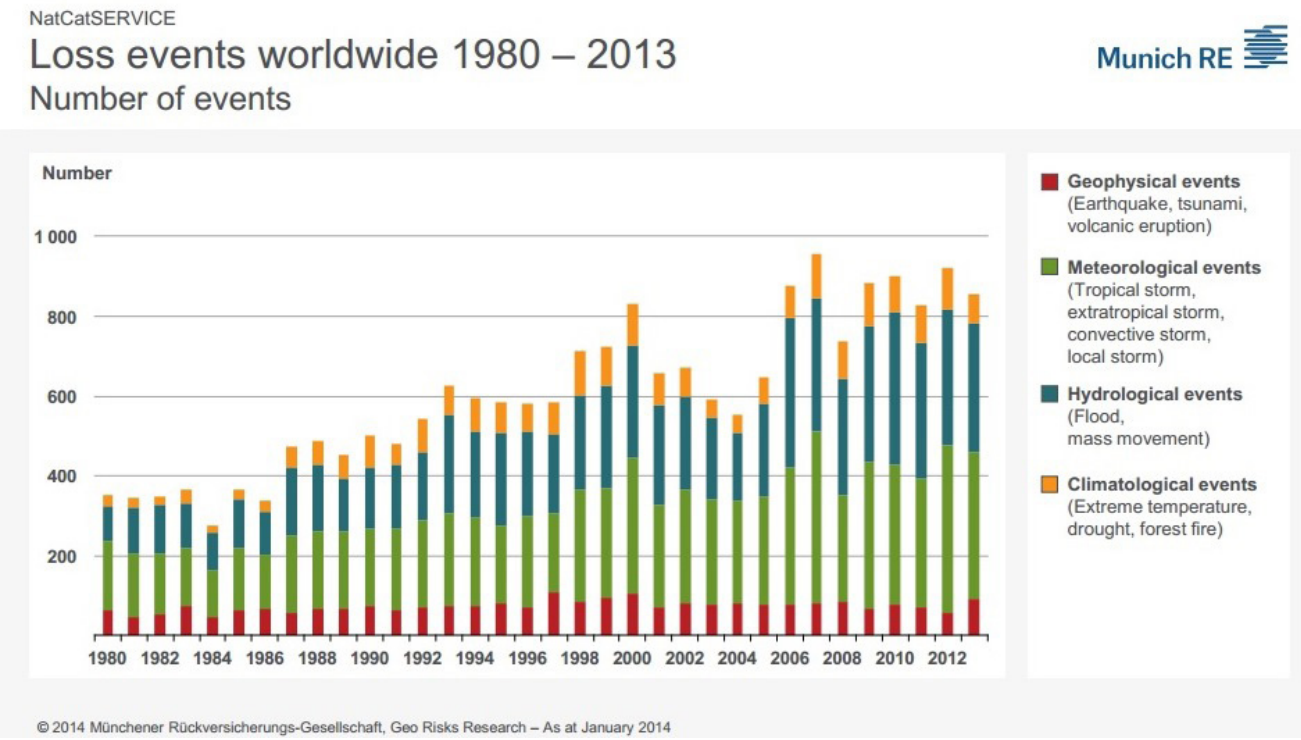


Figure 1. World-wide natural disaster trends showing marked increase in climate related disasters. Annual rate of events has more than doubled since 1980.

Globally, there has been an increasing trend in disaster occurrences (figure 1). It also reveals substantial increased in hydro-climate disasters relatively higher as compared to their geo-physical disasters. Since a disaster is known by a situation of substantial impact, i.e., damage and losses, of vulnerable land system, assets, resources including ecosystems, besides lives and their well-being. Thus, it is the 'vulnerability' of susceptible entities or systems that determine the likelihood of disaster in given 'hazard-risk' scenario. Hence, the 'addressing underlying causes of vulnerability' as highlighted in the Hyogo Framework of Action (HFA) priority, still remains valid in the context of priority 1 of Sendai Framework of Disaster Risk Reduction (SFDRR). Vulnerabilities of the people, land-inhabitations, resources and infrastructure are governed and modified by the state of natural resources management, bio-productivity, technological know-how, people's practices and behaviour (Gupta et al., 2013). Emerging implications of climate change impacts, urban, industrial, infrastructure dimensions of disaster risk are further aggravated by environmental degradation, social-economic inequality and lack of responsible governance.

India faced major disasters of worst kind. To name a few are– Bhopal Gas Tragedy, Orissa super cyclone, Chamoli earthquake, 1995 Uttaranchal forest fire, Bhuj earthquake, Indian Ocean Tsunami, Bihar Kosi flood, 2002 all India drought, Mumbai flood, etc. which caused devastative impacts. Recently, the incidences of Uttarakhand flood, J&K flood, Chennai flood, drought 2009, El-Nino drought 2015, Malin gaon disaster, Cyclones Phailin and cyclone Hudhud, Forest fire 2015, Heat wave 2015 and 2016, etc. have brought in several new dimensions to their occurrence and impacts the society felt. Loss of economy, infrastructure and ecosystems due to the recent disasters have been so huge and posed so long lasting consequences, that the resources and livelihoods of the people are badly jeopardized. This simply reiterates the significance of vulnerability factors in understanding 'disaster dynamics'. Equally important is to mention industrial accidents, mishaps and other technological incidences, like several incidences of bat capsizing, stampede, Mangalore aero plane accident, Mayapuri radiation accident, Korba gas poisoning, Bhilai SAIL disaster, Vishakhapatnam Steel Authority of India (SAIL) explosion, Mumbai gas leak, Jaipur oil fire, Temple crackers disasters, Kolkata hospital fire, Mumbai Mantralaya fire, National Museum of Natural History (NHNH) fire in Delhi, Kanpur train accident, etc. which seek for equal emphasis on human induced and technological disaster risks.

Thus, 'disaster' brings in focus the interdisciplinary nature of subject bringing social along with environmental, technological and health sciences under one umbrella to solve the miseries of nature and human development. A typical listing of disaster typology is given in Box 1. Floods, drought, cyclone and extreme events like heavy rainfall / cloudburst, dry spells, heat-wave, cold-wave, frost, snowfall, wind storms, etc. form example of hydro-meteorological hazards. Earthquake and volcano are typical geophysical hazards. Tsunami is a hydro-meteorological event which can be triggered by an earthquake, but milder ones also by a meteorite or lunar events. Landslides, avalanche, coastal erosion or river erosion, on the other hand, are fundamentally geological but are hydro-meteorologically influenced. Forest fire, pest attack, disease outbreak / epidemic, species invasion / weed infestation, are interface hazards combining hydro-meteorological and biophysical systems. Ecological-geo-environmental settings in combination with social-economic aspirations, developmental patterns, governance and community actions, govern the likelihood of a natural or human-induced hazard process or condition triggering a disaster scenario.

Box 1: Broad categorization of disasters from management approach

1) **Environmental disasters**
   Hydro-meteorological, Vegetation fire, Geophysical, Geo-chemical, Biological, Epidemics .... , etc.
2) **Technological disasters**
   Industrial (chemical, Electrical, Mechanical, Nuclear/radiological, Aviation, Dam break, Mining, Structural collapse .... , etc.
3) **Civil disasters and conflicts**
   Civil unrest, Strike, Win; Sabotage, Mass poisoning, Bomb blast, Stampede, Transport accidents .... etc.

** An environmental disasters may be of natural origin or human-induced / man-made and can also trigger a technological disasters or civil conflicts. On other hand, a technological mishap or civil disaster may trigger environmental calamity.*

(Gupta and Nair, 2012)

Besides the so called 'natural' disasters which are of environmental origin, there are other human-induced and man-made disasters originating from technological or human failure, negligence, omission, intentional or otherwise acts. Mining accidents, building / structural collapse, industrial (chemical), electrical, mechanical, nuclear/radiological, aviation, transport, rail, road accidents, dam break, mining, etc. are examples of technological disasters, often referred to as human-induced disasters as have operability contexts often high. Another category of purely man-made disasters may include, like, civil unrest, strike, war, sabotage, mass poisoning, bomb blast, stampede, etc. However, there is sizeable overlap between and among different categories and type of disasters.

2. Contextual Settings for India's Disaster Risk Management Roadmap

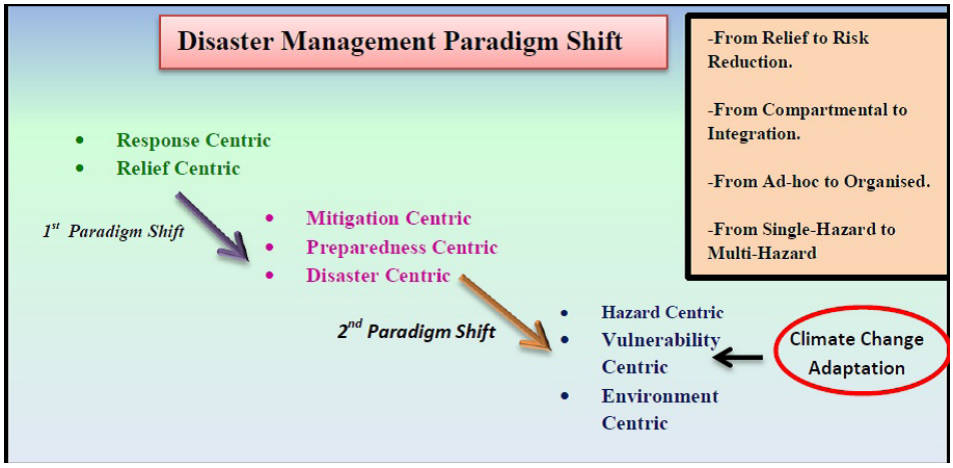
Disaster management is witnessing its turning point in the backdrop of Sendai Framework for Disaster Risk Reduction (2015-2030). This calls for a fresh understanding on emerging challenges, opportunities, and approaches for planning and implementation of disaster management strategies at national, sub-national and local levels. Strengths and weaknesses in developed and developing countries are important concerns. Concrete measures for prevention and mitigation to reduce disaster risk to the populations has been a key aspect of recent researches. Disasters do not differentiate between developing and developed nations and affect significant number of people each year (Nirupama, 2009). However, the type and extent of consequences may vary widely.

There has been a paradigm shift in disaster management from 'response and relief' to 'prevention and mitigation' centric approach, which calls for a holistic framework of disaster resilience at different levels. Planning and implementing of disaster risk reduction requires mainstreaming pathways and appropriate tools. The transition from Hyogo Framework of Action (HFA) to Sendai Framework for DRR (SFDRR 2015-2013) has brought in the core focus on achieving specific goals, integration of climate change adaptation, environment-disaster linkages, and mainstreaming across sectors of development. While experiences of the HFA period have to be tested further with appropriate improvements, policy planning interventions have to be intensified at national, sub-national and local levels for enabling an environment of resilience building (Gupta et al., 2016).

India's disaster management legal framework, spread across the dimensions pertaining disasters, environment, natural resources, health, safety, law & order, etc. at central and state level have evolved manifold over past half the century, and in parallel offer a policy environment for the ongoing 2nd paradigm shift in disaster management, i.e. to 'risk management' – addressing hazards and reducing vulnerability, in the background environmental contexts (figure 2). India's modern policy regime in disaster management flows from the High Powered Committee Report (2001), Administrative Reforms Commission Reports on disaster management (2005), and disaster management policy 2009, to be read contextualized with other sectoral policies viz. environment, agriculture, water, forests, urban sanitation, land-use, voluntary sector, housing, etc. Further, the recommendations of Chief Auditor General (CAG) on disaster management performance (2013) on the review/audit activities of authorities (Ministries, NDMA, SDMA, Departments), NIDM and NDRF, based on ground realities and expectations, are important recommendations for a system overhaul in disaster management. Report of the Task Force (Dr P K Mishra Committee) on review of 2005 Disaster Management Act (report published 2013) brings in contextual recommendations for improving disaster management governance and institutional functioning in the country.

The time has come for the policies, plans and initiatives related to disaster risk reduction to start falling into place and finding coherence in India, as the country addresses the important task of implementing robust disaster risk reduction measures to protect its vulnerable citizens and its ambitious economic growth (Bahadur et al., 2016). India's participation in international policy forum, particularly the Asian Ministerial Conference on Disaster Risk Reduction, 2014 (Bangkok) and Delhi 2016 (in pre and post Sendai backgrounds, respectively), and therefore the Bangkok Declaration and the Agenda 10 on DRM, announced by the Indian Prime Minister in the inaugural address, mark for core reference in delineating a national roadmap, keeping in background the National Disaster Management Plan (2016)

Figure 2. Paradigm shifts in disaster management (Gupta and Nair, 2009)



and National DRM Human Resource Plan as envisaged by DM Act. Internationally, most countries are drawing their national DRM strategies and plans harnessing and addressing possible synergies of SFDRR, Paris Climate Agreement and SDGs for implanting local planning and ground actions.

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National Disaster Management Plan of 2016 is one of the recent and excellent planning frameworks of India in the field of disaster management. The aim of the Disaster Management Plan, 2016 is to make India a resilient country by imbibing the basic principles of disaster risk management. The plan emphasizes to maximize the ability of the country to cope with disasters at all levels by integrating DRR into developmental plans and thus increasing the preparedness to respond to all kind of disasters (NDMP, 2016). The plan has been aligned with the Sendai Framework for Disaster Risk Reduction 2015-2030, Sustainable Development Goals and Paris Agreement on Climate Change and places enormous emphasis on improving the governance of disaster risk reduction and climate change adaptation. Capacity development has been incorporated as an important theme across all the thematic areas of action and includes training programs, curriculum development, awareness, mock drills and large scale disaster response exercises. The plan lays emphasis on the overall development through three key aspects namely; prevention or mitigation for disaster risk reduction, effective preparedness - response and recovery - build back better (Gupta, et al. 2016).

3. Prime Minister's Agenda-10 on Disaster Risk Management

India hosted its 2nd Asian Ministerial Conference on DRR (AMCDRR), and first after the international policy environment of SFDRR - Paris Climate Agreement – SDGs, in November 2016 at New Delhi, with participation of more than 4500 experts, practitioners and official delegates including Ministers across the Asia Pacific. Inaugurating the 7th AMCDRR (first after Sendai framework) Shri Narendra Modi, Prime Minister of India, highlighted a 10 Agenda Roadmap on DRM, that concisely encompass issues, tools and approaches to address almost all the critical challenges in achieving sustainable development objectives, focusing on local 'disaster management system', academic capacity strengthening and harnessing technological advances. Interestingly, the PM's Agenda-10 enables synergies of SFDRR, Paris Climate Agreement and SDGs. India's roadmap on DRM, therefore, under the Agenda-10 may envisage following salient features:

(I) ALL DEVELOPMENT SECTORS MUST IMBIBE THE PRINCIPLES OF DISASTER RISK MANAGEMENT

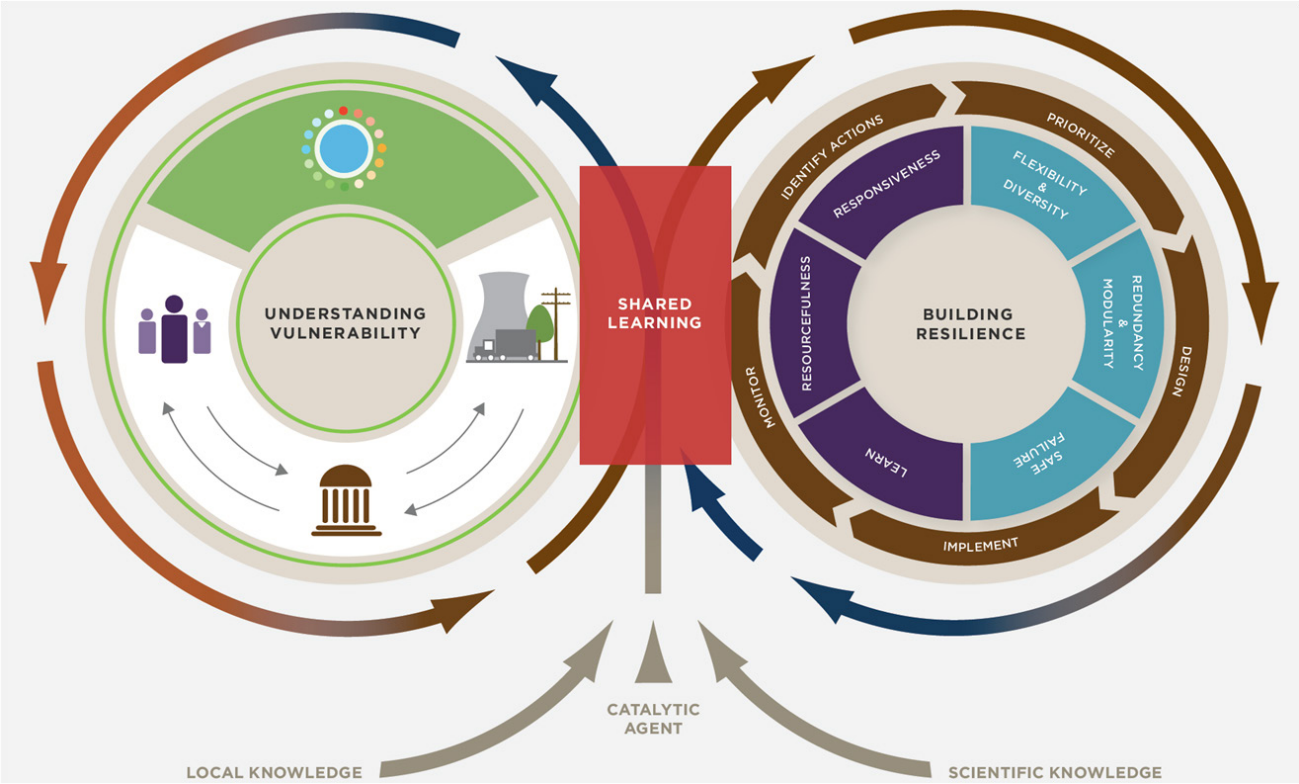
Increasing propensity of disasters and dearth of developmental policy frameworks to minimize the impact of disasters is one of the major concerns for our country. World Bank (2003) estimated that direct natural disaster losses amount to 2% of India's GDP (gross domestic product). Mainstreaming Disaster Risk Reduction concerns in development planning can guide the prioritized and optimized allocation of resources towards the protection of life and assets, restoration of productive systems and livelihoods, regaining market access, rebuilding social and human capital and physical and psychological health. Development plans, therefore, take on a critical role in disaster risk management. According to one of the study of United Nations Development Program, every dollar invested in DRR could save seven dollars in disaster aftermath (JICA, 2015). The process of mainstreaming DRR into development planning needs to utilize appropriate tools and methodologies along with political commitment, public understanding, scientific knowledge and expertise. National and state level development schemes play a crucial role for the socio-economic development of the community. These schemes target huge population every year with large amount of funds for their implementation. Thus, there is tremendous potential for reducing vulnerability & risks through integration of DRR in national and state schemes through structured framework and operational measures. Key sectors of development for the purpose of strategic DRM delineation, especially at sub-national and district level, can be grouped widely as following (Gupta et al., 2014):

(a) Infrastructure and trade Sector Cluster

(b) Environment and natural resources Sector Cluster

(c) Social welfare and Voluntary Sector Cluster

Figure 3. Climate Resilience Framework (Source: ISET, 2014).



Guidance notes and tools have been delineated by the NIDM under a UNDP-NDMA supported programme for key sectors, viz. housing, environment, health, urban, rural development. The principle to inculcate the 'culture of safety and prevention (CUSP)' would be fundamental to imbibe DRM in sector's planning and actions, with following:

1. CUSP principles would ensure:
   - (a) Assets, property, resources concerning the 'sector' are disaster safe / resilient,
   - (B) Activities, services and execution networks of the sector are not jeopardized by a disaster,
   - (c) Activities in the sector do not aggravate a disaster hazard or a contributor to vulnerability
     - (i) Structural: Construction/erection/manufacturing, ecological/landscape or drainage alteration or other physical interventions and
     - (ii) Non-structural interventions: Land-use, restrictions, information, controls, subsidies, levees or incentives, exploitation/consumption, etc.
       - (B) Activities and resources of the sector help DRM and Emergency Response by it and other sectors.
2. Need to apply above CUSP principles in the developmental plans of all related Departments, agencies, boards, institutes, establishments and projects or schemes therein.
3. Need to evolve or customize and apply approaches of sectoral hazard risk vulnerability & capacity analysis (HRV-CA) and prepare-implement DRM plans as part of developmental/working plans for its all departments/agencies or projects.
4. Integrate DRM related assessments into EIA / Policy Analysis (SEA) and Planning and Appraisal Decision for all major projects and Centrally/State funded schemes (currently only a checklist approach is mandated for financial clearance).

(II) WORK TOWARDS RISK COVERAGE FOR ALL

Due to the increase in the intensity and frequency of natural disasters worldwide, emphasis is being placed on designing disaster risk reduction strategies and risk transfer tools. Insurance schemes are increasingly playing visible role as a means of providing economic security against natural disasters. Risk Transfer is a tool that enables a concerned party to share/transfer a portion of the disaster risk to another party, for a certain fee. This party can be the government itself or the microfinance institutions. The absence of disaster insurance means that the government has to bear a huge cost for compensation and rehabilitation work in post-disaster situations. Country risk assessment should ensure that economy has financial resources to rebuild and recover which is critical to growth and effective risk mitigation. Based on nation's practices and existing international disaster risk mitigation frameworks, risk assessment and mapping is a key step for promoting risk financing strategies through a series of steps (OECD, 2012).

The Insurance Regulatory and Development Authority (IRDA), India has framed micro insurance regulations that allow distribution of micro insurance products in the state. The regulations cover insurance for personal accidents, health care for individual and family and assets like houses, livestock, tools and others. In states, various Ministries/ Department have their insurance schemes related to health, crops, livestock, and other which can be utilize in case of disaster. There is need to further promote more locally customized and farmer/trader friendly weather based crop/ agri-business insurance packages. Besides, insurance policies on behalf of likely in-risk population by municipal agencies, institutions/establishments or other premises can be thought of on lines of the Public Liability Insurance Act 1991 (i.e., for hazardous industries).

For safety and resilience of the infrastructure, audit linked insurance packages may promoted. 'Risk coverage for all' need to aim at all the people (in all appropriate age group, sex, communities, occupations, etc), assets and property – public and private (house, businesses, equipment) insurance. Currently, the financial resources for disaster management are given in table 1. Necessary policies / packages may be worked out so that the civil life insurance coverage may include disaster related damage / death and losses.

Table 1. Financial sources available/to be tapped for different components of disaster management

Name	Purpose	Financial arrangements	Activities	Nodal agency
NDRF (NCCF)	Relief Assistance	100% Central Government	Cash and kind relief	Revenue Department
SDRF (CRF)	Relief Assistance	75% Centre, 25% State	Cash and kind relief	Revenue Department
Planning Commission (14th Finance commission)	Capacity Building	100% Centre	Training Awareness Generation IEC material Mock drills	Revenue Department
State Fund	Capacity Building	100% State	Training Awareness Generation IEC material Mock drills	SDMA
Line Department funds Line department	Preparedness and mitigation	budgetary allocation	Activities falling in purview of departments for DRR, Preparedness and mitigation	Line Departments
District Planning Fund	Any public works	MP and MLA aid and grants	Preparedness, Mitigation capacity building, recovery	Local Bodies, Line departments
External Institutional Funding	Projects on DRR, Recovery, Mitigation and Preparedness	Total external or bilateral or multilateral arrangements	Infrastructure upgradation Technological interventions and technical studies DRR projects	Revenue Department

Name	Purpose	Financial arrangements	Activities	Nodal agency
Donor	Any	Total donation in cash and kind	Any	DDMA/SDMA
CSR	Corporate	2 % of profit	Any	Charity Commissioner and Corporate
Appeal	Immediate relief	Fully or partially external funds	Immediate relief, reconstruction	DDMA/SDMA

(III) ENCOURAGE GREATER PARTICIPATION AND LEADERSHIP OF WOMEN IN DISASTER RISK MANAGEMENT

During any disaster, women are mostly considered as victims and vulnerable along with children and elderly people. The increased vulnerability of women is primarily due to biological reasons but social and cultural factors are also associated which are often rooted through the community (Gokhale, 2008). During the major natural disasters of last two decade it has been seen that in India women do not have technical knowledge in general and particularly about the disaster occurrences. The participation of women in the planning, designing, implementing and monitoring emergency programs and rehabilitation projects is still on a low key profile (Gokhale, 2008). Women have historically played a significant role in all stages of disasters and risk reduction (AMCDRR, 2016). Mullings & Noel (1988) recognizes the importance of women role in every aspect of disaster management - preparatory, response and recovery phases. The Sendai Framework for Disaster Risk Reduction (SFDRR) recognizes that gender, disability, age and cultural perspectives are needed in all policies and practices; and that "women and their participation are critical to effectively managing disaster risk and designing, resourcing and implementing gender-sensitive disaster risk reduction policies, plans and programmes; and adequate capacity building measures need to be taken to empower women for preparedness as well as build their capacity for alternate livelihood means in post-disaster situations."

There are various examples from across the globe as well as India were women have demonstrated leadership quality during different phases of disaster management (table 2).

Table 2: Six measures to promote women as measure of change in DRR with local and national capacities

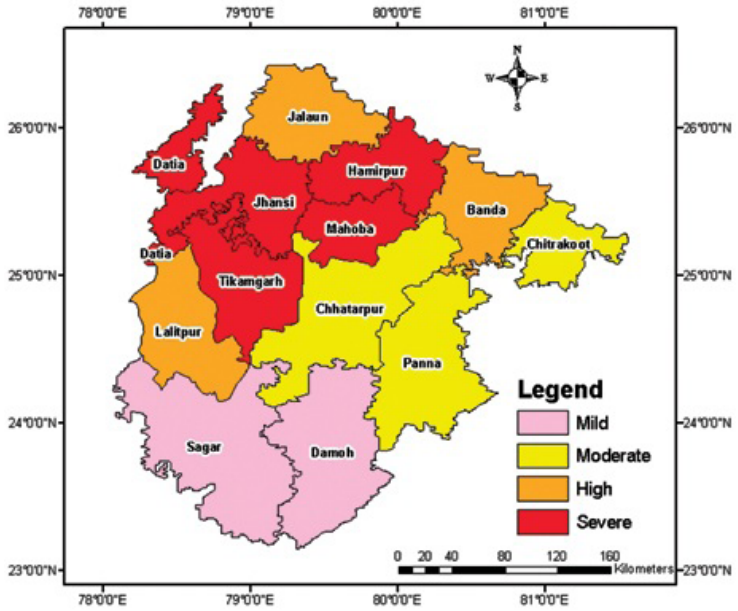
S.No	Measures	Description
1	Participatory decision making	Establishing mechanisms to facilitate the voice and influence of gender equality advocates, civil society and other national machineries, in shaping public policy, making financial decision, monitoring investments and DRM institutions
2	Collaboration and partnership	Promoting and creating partnership opportunities for collaboration between women and grassroots organizations, national and local disaster management institutions in the development, management, implementation and monitoring of DRR initiatives
3	Strengthening women's organization and networks	Recognizing women networks for improved capacity and participation in DRR policy and program levels with particular focus on building resilience
4	Supporting community resilience	Knowledge and expertise should be fully recognized and incorporated into risk reduction plans at local and national levels
5	Engaging men and boys	Men and boys are essential partners in promoting the valuable contributions and leadership of women
6	Ensuring women legal entitlement	Providing assistance and services in relation to disaster risk management such as basic health services, compensation, insurance, social security, credit and employment

Source: UN WCDRR, 2015

(IV) INVEST IN RISK MAPPING GLOBALLY

Disasters are the coincidences between hazardous events, elements at risk, and conditions of vulnerability. Vulnerability reduction integrates social and environmental systems to reduce the intensity and frequency of such risks (Chakraborty and Joshi, 2016). By categorizing regions according to their level of vulnerability, it is possible to design and redesign/modify the developmental plans and activities over land. Such a study to map the sub-national areas districts (and preferably Taluka/Tehsil and panchayat level) in India, vulnerable to natural and climate-induced disasters, is inevitable for implementing the DRM agenda. Such risk mapping would be important for all the areas in region in trans-boundary / international perspective in mountain (Hindu Kush Himalaya) or coastal/oceanic regions.

Figure 4. Composite Drought Hazard Map for Bundelkhand districts (Gupta et al., 2014)



Flood vulnerability maps at sub-district and even at village level has been prepared in some states like Assam. Earthquake zonation as on now is very broad based and need to be downscaled through seismiz micro-zonation for all areas inhabiting human communities and infrastructure. Drought vulnerability mapping has been done on research basis for 13 districts of Bundelkhand (Gupta et al, 2014) whereas for Rajasthan by Indian Council of Agricultural Research (ICAR) and Karnataka by its State Drought Monitoring Centre. Coastal vulnerability mapping has been carried out for climate change impacts. However, these efforts are isolated, segregated and fragmented, and need to be organized and coordinated properly with precision and time frame.

Figure 5. Framework for Risk Mapping and Application

Detailed hazard and vulnerability maps for key disaster risks like earthquake, flood, drought, cyclone, windstorm, need to be developed at Taluka/Tehsil and further at panchayat level, and for industrial-chemical, fire, landslide, avalanche, urban flooding, man-animal conflict hazards for particular region of impact need to be developed. Disaster maps developed based on vulnerability of built environment, by the BMTPC, have long been in reference. Vulnerability maps preparation for particular hazards may be undertaken by the respective Ministries/agencies responsible for dealing with particular type of disasters/hazards.

Sustainable Development Goals and Sendai Framework also highlights the importance of risk mapping for holistic disaster management risk management at all levels. Mapping risk and costing disaster is a powerful tool towards leveraging government fund for investing in DRR (figure 5). Risk and hazard mapping gives a better understanding of hazardous locations and helps in advance planning for managing the disastrous consequences of the hazard (OECD, 2012).

(V) LEVERAGE TECHNOLOGY TO ENHANCE THE EFFICIENCY OF DISASTER RISK MANAGEMENT EFFORTS

Sendai Framework for Disaster Risk Reduction (SFDRR) has been developed with the principle to "Promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, land degradation assessments and informal and non-permanent housing, and the use of guidelines and follow-up tools informed by anticipated demographic and environmental changes", which clearly spelt the need of multiple science-technology disciplines to be on board in the framework of disaster risk management.

In a disaster prone country like India it is important to ensure that people have rapid access to information that encourages preventive measures and enables quick response to protect lives and livelihoods. Completely avoiding the natural disasters is not possible but minimizing the sufferings by creating proper awareness through early warning systems can enhance the efficiency of disaster risk management. The use of technology may emerge as a key to planning sustainable and disaster resilience infrastructure and systems. Technology plays a crucial role with satellite based Geographic Information System and computer simulations providing for disaster mapping, vulnerability assessment and disaster response as well as preparedness. Effective actions when combined with right forecasting and prompt warnings can definitely avert large scale damages and destructions occurring through natural disasters particularly hydro-meteorological disasters. Cyclone Phailin in Odisha is one of the successful examples of timely forecasting by Government of India that saved millions of lives (Gupta et al., 2016). Internet based tools are also gaining popularity in disaster risk management efforts. The India Disaster Response Network (IDRN) is a nation-wide electronic inventory of specialist and essentials resources for disaster response. The primary focus is to enable the decision makers to get details of readily available and updated information about equipment and human resources required to combat any emergency situation (Kutty, 2015).

Changing trend and more awareness towards DRR have opened up a large number of scientific and technological resources and skills to reduce disaster risks (Vyas and Desai, 2007). However, as on now the focus on harnessing technology has been limited to space technology alone with role of modeling/simulation, geo-technology, eco-technology – eco-engineering, medical technology, plastic engineering, food and agro-technologies, environment, water and health sciences, etc. harnessed very meagerly. National Action Plan on Climate Change under its 8 mission taps on technological advances and application and the framework of multiple science-technologies may be roped in for DRM. Science & Technology (S&T) application in DRM need to be promoted at all levels on the principles set by SFDRR as above, and for all the stages of disaster management – HRVA, EIA/SEA, DM planning, mitigation – ecological, environmental, structural, social and capacity interventions, response & relief – S&R, shelter, medical, environmental health (water, sanitation, waste, disease control), rehabilitation, reconstruction, etc. which will need to call S&T expertise from several customary and advanced/specialized disciplines. Equally important is not to forget and miss the potential of traditional knowledge and local or indigenous innovations, which may offer many cost effective solutions in risk mitigation.

(VI) DEVELOP A NETWORK OF UNIVERSITIES TO WORK ON DISASTER ISSUES

Time and again, in the past three decades, role of academia in general and in particular of the Universities in disaster research and professional advancement, has been reiterated. However, disaster management being a discipline not purely of conceptual or doctrine research but of action and practice research, would need to be accustomed in University education and research. A Himalayan University Consortium has been established in the region on the initiative of ICIMOD. There are other University forums at various levels to work and report on disaster management. However, in India, it is would be a need as well as an opportunity to address following issues and challenges in DRM capacity development:

(a) Despite of huge mandate and need for capacity building and professionals in DRM fields, there is only one NIDM in the country (contrary to every state given with one Central University, IIT, IIM, AIIMS), that too with limited faculty resources, and with functional issues of autonomy and academic culture.

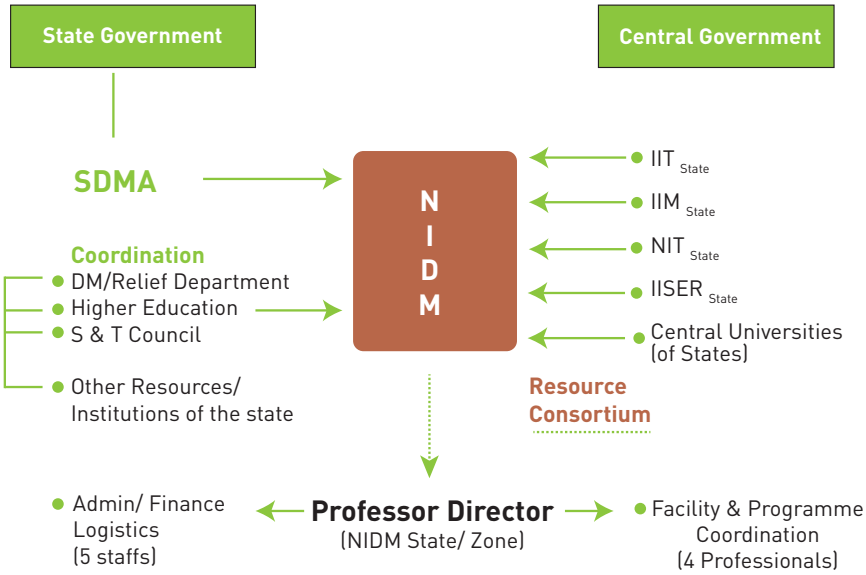
(b) State DRM Centres were established under the Central Sector Scheme of Government of India, discontinued from 2012, and most state governments didn't own these centres after the scheme. Resultantly, most states lack of a DRM Centre or Faculty.

(c) Most Central Universities, in their School of Environmental Studies (an interdisciplinary faculty) proposed a Centre for Disaster Management, but rarely made it functional, due to lack of expert faculty in the area.

(d) Research Programmes in Universities are not synchronized with the principle mainstream of DRM, and the programmes are designed on lines of other conventions disciplines, and their outcomes are seldom utilized in DRM improvement in planning and practice.

Thus, looking to afore mentioned aspects, a network of Universities and IIMs, IITs, NITs, IISERs, and AIIMS, etc. may be formulated at zonal/state level, under the aegis of the Central Government, by establishing NIDM at State Capitals, as a coordination establishment managing a consortium of resources and experts (figure 6). In the initial phase NIDM may be established in 6 locations to cater the states in their zone of geographical influence, i.e. Central India, Eastern, Western, Southern, Northern, Centre at North Eastern. Later these zonal NIDMs may be given the responsibility to establish NIDMs in nearby states. In order to plan for minimal expenditures, following consortium structure is recommended (figure 6). State's Principal Secretary – Disaster Management, besides the representative Professors of IIT, IIM, IISER, NIT and Central University may be member of respective NIDM's Governing Body.

Figure 6. Structure and resource plan of NIDM in Consortium of Central University/Institutes and State Government



(VII) UTILIZE THE OPPORTUNITIES PROVIDED BY SOCIAL MEDIA AND MOBILE TECHNOLOGIES

With the disasters becoming a frequent phenomenon, the world is witnessing the increasing and pertinent role of social media during times of disasters and crisis. It has become a vital tool in helping government agencies and other rescue organizations by disseminating information to wider audience. Each disaster finds its space on social media for information exchange and plays an important role in DRR by informing and raising the public awareness to the forecasting of disasters. The role of social media gained momentum and became an integral part of disaster management cycle during the world response to the 2010 Haiti earthquake (Role of Social Media in Disaster Management, n.a.). During the Nepal tragedy in 2015 the media played an integral part in disaster response in filling the void where cell services were lost (Harihar, 2015). It has also played a pivotal role during Jammu & Kashmir floods. A benefit of social media has been shown schematically in the figure below:

New channel of communication	Multi-way communication	Timely delivery of service
Government/nodal agency can open their own facebook account or twitter account A dedicated personnel expert in information technolgy can be hired to manage those accounts	Victims and their relatives, responders, government personnel, relief officers and many more can be approached at the same time	In case of forecasting and early warning it delivers very quick services to the end user

There is also need to monitor and regulate social media activities, which can be used for spreading wrong information and malpractices. It acts as platform for fund raising; hence, can be used for money laundering. There are instances of online cash stealing which was actually raised for humanitarian assistance. Sometimes social media can also create hoax which can cause unnecessary distress among various stakeholders. Scams and controversy emerges very fast, publicity, allegations, public statements and promises are also shared on social media. Effective steps must be taken by Government and other agencies to tackle the use of social media at the time of disaster.

Table 3: Analysis of role of social media and mobile technologies in different phases of disasters

Pre- disaster	During and after disaster
Disseminating early warning and forecast through social media like in twitter (hash-tags), Facebook (trending news)	Help in rescue operations by locating a spot. For e.g. Whatsapp was used by stranded people to locate a spot during Uttarakhand Disaster in 2013.
Spreading preventive measures like how to vacate the area at the time of disaster and what steps to follow.e.g.as seen during cyclone Phailin in Odisha	Useful in rehabilitation process, for example, social media played a very important role during Chennai Floods in 2015 in disseminating information like boat vehicle availability and also helped in finding shelter for animals.
Using Google map and Facebook to map disaster prone zone so that affected population can be relocated to different and safe place	Makes relief operations more effective and timely. Also helps in raising relief material and money by easy collaboration with responders
Helps in crowd management in public place and help to prevent stampede incidents like in Madhya Pradesh and Andhra Pradesh	Tweeting to Ministries helps in immediate relocation as in the case of recent Yemen crisis
	Data collection and updating alerts and notification becomes easy

(VIII) BUILT LOCAL CAPACITIES AND INITIATIVES

Disasters disrupts the functioning of community or society, causing human, material, economic and environmental losses and there after affecting human development as a whole (UNISDR, 2008). The paradigm shift in approach towards management of disasters in the changing climate scenario accentuates the needs for risk reduction at the community level globally as well as locally. The need to develop the capacity and skills of the community is the need

of the hour so that they can deal with disasters as a way of life instead of a curse. The 12th Five Year Plan (2012-17) of India laid emphasis on capacity building and community awareness. By combining local knowledge with scientific data builds people understanding about climate risks and adaptation strategies. The result provides a solid foundation for identification of practical strategies to facilitate community based adaptation to climate change and disaster risks.

Community Based Disaster Risk Management (CBDRM) is a process in which at risk communities are actively engaged in the identification, analysis, treatment, monitoring and evaluation of in order to reduce disaster risks and vulnerabilities and enhance their capacities (ADPC, 2003). The approach which is promoted under CBDRM is to build people's capacity of coping with disaster risks and reducing their vulnerability thereby developing safer and more resilient communities (Salajegheh et al., 2013). Hyogo Framework for Action (2005) and Sendai Framework for Disaster Risk Reduction (2015) have promoted people centered approach for early warning keeping in mind the demography, gender, cultural and livelihood characteristics of the community at risks (UNISDR, 2005). Early warning is one of the important tools that contribute to the disaster prevention as well as hazard mitigation, thus contributing to disaster risk reduction at local level. An Early Warning System represents the set of capacities needed to generate and disseminate timely and meaningful warning information that enables at-risk individuals, communities, organizations as well as nation to prepare and act appropriately and in sufficient time to reduce harm or loss caused due to disaster (UNISDR, 2009; IFRC, 2012). Local capacities in DRM would need to be steered largely by the DDMAs utilizing the following suggestive framework, guided by national and state plans or advisories:

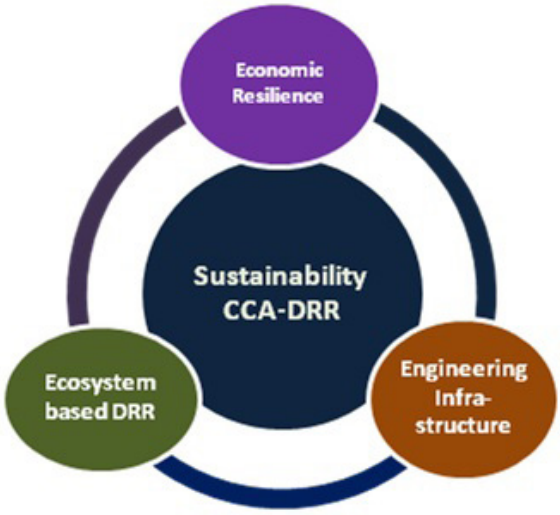
(a) Developing district wide institutional network involving University/college, research institute, NGOs, independent experts, KVK, Industrial Associations, Housing Societies /Resident Welfare Association Federation, media, etc. in the district as DRM Knowledge Forum,

(b) Developing understanding on disaster risk and sensitive land use and revisit development plans by administration at Taluka/Tehsil/Block, Panchayat and Urbal local bodies, and develop their DM plans, with clearly spelt mitigation measures plan, indicating time and resources, and

(c) Maintain roster of volunteers, ex-defense personnel, NSS, NCC, NYK and other resources, besides Military establishments, police, fire and para-military/home guards, etc for emergency response capacity, with necessary coordination/training.

(d) Special emphasis is required on integrating climate change adaptation and capacity building measures with DRM, particularly focusing on safe and resilient infrastructure, public assembly buildings, people's livelihood resources (agriculture, ecosystems and forests/plantation based occupations) and business establishments (figure 5).

Figure 7. Three key contributors of sustainability through DRM



(IX) ENSURE THE OPPORTUNITY TO LEARN FROM A DISASTER IS NOT WASTED

Today more people than ever are vulnerable to natural disasters. Population growth and rapid growth of urban populations in developing countries over the last few decades has resulted in increased numbers of people who require help each year as a result of natural hazards such as storms, floods, and earthquakes. More than a billion people now live within 62 miles of an ocean, with over 10 million people being affected by flooding each year. Global climate change now threatens to increase the number significantly in the 21st Century. Major disasters occur time and again, necessitating emergency measures. Comprising success stories as well as failures, these relief and reconstruction measures hold valuable lessons for the future. However, much of the experiences, insights and lessons are lost as time passes because they are not documented in a way that can be retrieved and utilized when needed (Mishra, 2004).

There have been several disasters in last decades and every disaster brings surprises and important lessons. Experiences show that in many cases the system appears unprepared and starts from the beginning. The same problems arise and the same mistakes are committed when a major disaster occurs, though there are a few exceptions. Each disaster is different that needs to be understood properly. There have been several disasters Disaster disrupts progress as well as destroys the developmental efforts often pushing nations, in quest for progress back by several decades.

Globally, disaster risk reduction might have seen paradigm shift from "relief and response" to "preparedness and mitigation" approach, but in developing country like India the concept still holds the back space or to the most in policy documents and lacks apathy from the policy maker and practitioner in its real implementation on ground. Preservation and use of natural barrier against disasters are relatively low on public agenda, while relief and rehabilitation constitute the primary form of disaster risk management. This type of development is certainly not sustainable. One of the reasons for this phenomenon is that experiences and lessons of disasters in India are not well documented. There may be comprehensive media accounts, official reports and even research papers. But systematic documentation which can guide and facilitate disaster response and recovery is rare. Taking the example of Uttarakhand disaster 2013 documentation, and other previous disasters, help and guidance can be easily derived for proactive approach to take measures which will actually reduce disaster risks, ensuring safety of society and precious resources.

(X) BRING ABOUT GREATER COHESION IN INTERNATIONAL DISASTER RESPONSE

Most regions of the world are prone to multiple disasters, and the complexity of risk is growing and challenge of managing emergencies intensifying gradually with changing landscape, demography, land-use and un-attenuated ecological degradation. In case of a disaster event either in the neighborhood of the country or in case of trans-boundary nature disaster, the response from different sides need to coordinate, collaborate and integrate appropriately. Nepal earthquake 2015 sets another example where the affected country's capacity of emergency response was far exceeded by the size and nature of devastation that the earthquake brought to it. These are the times when all, particularly in the neighborhood and those who are resourceful have to lead the support as appropriate. However, such international response do not come in isolation, but either simultaneous or followed by other agencies like UN or iNGOs, or other countries close by or distant. Therefore, the international response may have an organized structure to function under a designated command system during such disaster events. India has opened its space technology resources to the nations in the region, and extends its support in capacity building and emergency response exercises in South Asia region. However, despite of a SAARC Charter, the unified international response strategy in the region has not been operationalized, where the countries like India may come forward to establish such coordination mechanism with other nations. It is important that the resources are properly assessed and inventories updated so the capacity at particular time is known with full confidence.

The aftermath of disasters (natural disasters in particular) is preceded by the need for large, multifaceted response, recovery, reconstructions as well as rehabilitation programs. Lack of adequate knowledge, capacity, plan and management skills often jeopardizes the very objective of such programs. Ineffective policies as well as unprepared institutions and agencies are roadblock to recovery process resulting in prolonged suffering in terms of livelihoods and shelter as well as delay in restoration of basic services (e.g. water, sanitation, electricity etc). Hence resilient and sustainable recovery after disasters is an important opportunity to promote resilience against future disasters.

4. Prime Minister's Agenda 10 on DRM and Linkages to SFDRR, Paris Agreement and SDGs

The importance of DRR to achieve sustainable development was identified in Millennium Development Summit in September 2010. The High-level Plenary Meeting on accelerating progress towards the achievement of all Millennium Development Goals (MDGs) by 2015 identified that disaster risks are increasing globally due to increasing vulnerability to natural hazards. A risk-sensitive approach would be required for sustainability & accelerated achievement of MDGs.

The year 2015 was a landmark year for the United Nations and Global Development Agenda. The convergence of interests and global concerns for sustainable development, disaster risk reduction and climate change led to the formation of a new roadmap for a sustainable and safe world together: The Sendai framework for disaster risk reduction, The 2030 agenda for sustainable development and The Paris Climate Agreement. These agreements of global significance provide opportunities to build coherence across different but overlapping policy areas.

The Sendai Framework for DRR (SFDRR) was adopted at the Third UN World Conference in Sendai, Japan, on March 18, 2015. SFDRR improves on HFA by identifying the gaps, good lessons learned and future challenges. Key features of SFDRR are:

- Shifting focus from disaster management to disaster risk management by focusing on the underlying drivers of risk.
- For the first time one global goal and outcome is defined.
- Seven global targets are defined to support the assessment of global progress in achieving the outcome and goal of the present Framework.
- The Framework emphasizes the need of strengthening the disaster risk governance by placing governments at the centre of disaster risk reduction.
- A wider scope of DRR focussing on both natural & man-made hazards and related environmental, technological and biological hazards and risks.
- A set of guiding principles are provided for the implementation of Framework.
- Learning from the experience gained by the implementation of HFA and to achieve the expected outcome & goal, the Framework prioritizes the actions into four priority areas.
- Along with social vulnerability, great emphasis is given to environmental aspects by strongly recognizing that implementation of integrated environmental and natural resource management techniques are needed for disaster reduction.
- DRR is identified as a policy concern which cuts across many sectors, including health and education.

Scope of Sendai Framework

Small scale, biological and man-made hazards are added to scope- "The framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by natural or man-made hazards as well as related environmental, technological and biological hazards and risks."

Scope of action in recovery, rehabilitation and reconstruction is increased- "Enhancing disaster preparedness for effective response and to "Build Back Better in recovery, rehabilitation and reconstruction"

Goal

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

Global Outcome

Outcome

"Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience."

13 Guiding Principles & 7 Global Targets

1	2	3	4	5	6	7
Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020–2030 compared to the period 2005–2015	Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015	Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030	Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020	Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030	Substantially increase the availability of and access to multi-hazard earlywarning systems and disaster risk information and assessments to people by 2030

The Four Priorities for Action

1	2	3	4
Understanding disaster risk	Strengthening disaster risk governance to manage disaster risk	Investing in disaster risk reduction for resilience	Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

Table 4: A transcript of the Agenda 10 and its alignment with the Sendai Framework for Disaster Risk Reduction 2015-2030.

Agenda 10	Alignment with various provisions of SFDRR (The following transcripts from SFDRR show direct/indirect linkages with Agenda 10).
All development sectors must imbibe the principles of disaster risk management. -Building Standards -Community Resilience -Risk Consideration in Public Expenditure.	**Preamble**- "Integrate DRR and building of resilience into plans, policies, programmes and budgets at all levels". **Target (d)** - "Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their Resilience by 2030". **Priority 2(d)-**National & local level "To encourage the establishment of necessary mechanisms and incentives to ensure high levels of compliance with the existing safety-enhancing provisions of sectoral laws and regulations, including those addressing land use and urban planning, building codes, environmental and resource management and health and safety standards, and update them, where needed, to ensure an adequate focus on disaster risk management". **Priority 3 -** "Investing in disaster risk reduction for resilience**".**
Risk Coverage for all -Poor, MSMEs, MNCs -Final inclusion & risk insurance for poor	**Preamble**- "DRR practices must be multi-hazard and multi-sectoral, inclusive and accessible in order to be efficient and effective". **Priority 3 (a)** – National & Local level- "To allocate the necessary resources, including finance and logistics, as appropriate, at all levels of administration for the development and the implementation of disaster risk reduction strategies, policies, plans, laws and regulations in all relevant sectors". **Priority 3 (b)** – National & Local level-" To promote mechanisms for disaster risk transfer and insurance, risk-sharing and retention and financial protection, as appropriate, for both public and private investment in order to reduce the financial impact of disasters on Governments and societies, in urban and rural areas".
Involvement & leadership of women in Disaster Risk Management **-**Training -Women Self Help Groups -Women Volunteers	**Preamble**- Governments should engage women stakeholders in design and implementation of policies, plans and standards related to DRR. **Guiding Principle (d)** - "Disaster risk reduction requires an all-of-society engagement and partnership. It also requires empowerment and inclusive, accessible and non discriminatory participation, paying special attention to people disproportionately affected by disasters, especially the poorest. A gender, age, disability and cultural perspective should be integrated in all policies and practices, and women and youth leadership should be promoted. In this context, special attention should be paid to the improvement of organized voluntary work of citizens. **Guiding Principle (g)** – "Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge". **Role of stakeholders** – "Women and their participation are critical to effectively managing disaster risk and designing, resourcing and implementing gender-sensitive disaster risk reduction policies, plans and programmes; and adequate capacity building measures need to be taken to empower women for preparedness as well as to build their capacity to secure alternate means of livelihood in post-disaster situations".
Investment in Risk Mapping globally **-**Mapping risk related to hazards	**Priority 1 (c)** National & local actions- "To develop, periodically update and disseminate, as appropriate, location-based disaster risk information, including risk maps, to decision makers, the general public and communities at risk of exposure to disaster in an appropriate format by using, as applicable, geospatial information technology". **Priority 1 (a)** Global & Regional Actions-" To enhance the development and dissemination of science-based methodologies and tools to record and share disaster losses and relevant disaggregated data and statistics, as well as to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems".

Leverage technology to enhance the efficiency of disaster risk management efforts **-**Exchange of expertise & technologies -E-platform	**Preamble**- Address the existing challenges and prepare for future ones by use of technology and research. **Target (g)** - "Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030". **Priority 1 (e)** Global & Regional level actions- "To support the development of local, national, regional and global user-friendly systems and services for the exchange of information on good practices, cost-effective and easy-to-use DRR technologies and lessons learned on policies, plans and measures for disaster risk reduction".
Develop a network of universities to work on disaster issues **-**Multi-disciplinary research on disaster issues	**Guiding Principle (l)-** "An effective and meaningful global partnership and the further strengthening of international cooperation, including the fulfilment of respective commitments of official development assistance by developed countries, are essential for effective disaster risk management". **Priority 1 (l)-** National & Local actions- "To promote the incorporation of disaster risk knowledge, including disaster prevention, mitigation, preparedness, response, recovery and rehabilitation, in formal and non-formal education, as well as in civic education at all levels, as well as in professional education and training". **Priority 1 (d)** Global & Regional level actions- "To promote common efforts in partnership with the scientific and technological community, academia and the private sector to establish, disseminate and share good practices internationally". **Priority 3 (c)** Global & Regional level actions- "To promote cooperation between academic, scientific and research entities and networks and the private sector to develop new products and services to help to reduce disaster risk, in particular those that would assist developing countries and their specific challenges." **Role of stakeholders**- "Academia, scientific and research entities and networks to focus on the disaster risk factors and scenarios, including emerging disaster risks, in the medium and long term; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making".
Utilize the opportunities provided by mobile and social media technologies **-**Identify their potential	**Priority 1(f)** National & Local level actions- "To promote real time access to reliable data, make use of space and in situ information, including geographic information systems (GIS), and use information and communications technology innovations to enhance measurement tools and the collection, analysis and dissemination of data". **Priority 1 (m)-** National & Local level actions- "To promote national strategies to strengthen public education and awareness in disaster risk reduction, including disaster risk information and knowledge, through campaigns, social media and community mobilization, taking into account specific audiences and their needs". **Role of Stakeholders** – "Media to take an active and inclusive role at the local, national, regional and global levels in contributing to the raising of public awareness and understanding and disseminate accurate and non-sensitive disaster risk, hazard and disaster information, including on small-scale disasters, in a simple, transparent, easy-to-understand and accessible manner, in close cooperation with national authorities; adopt specific disaster risk reduction communications policies; support, as appropriate, early warning systems and life-saving protective measures; and stimulate a culture of prevention and strong community involvement in sustained public education campaigns and public consultations at all levels of society, in accordance with national practices".

Build local level capacities and initiatives -Community based efforts -Traditional best practices & indigenous knowledge	**Guiding Principle (f)** - "While the enabling, guiding and coordinating role of national and federal State Governments remains essential, it is necessary to empower local authorities and local communities to reduce disaster risk, including through resources, incentives and decision-making responsibilities, as appropriate". **Guiding Principle (g)**- "Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge". **Priority 1 (i) (m) (o)**- National and Local level actions "To ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context". "To promote national strategies to strengthen public education and awareness in disaster risk reduction, including disaster risk information and knowledge, through campaigns, social media and community mobilization, taking into account specific audiences and their needs". "To enhance collaboration among people at the local level to disseminate disaster risk information through the involvement of community-based organizations and nongovernmental organizations". **Role of stakeholders**- "Indigenous peoples, through their experience and traditional knowledge, provide an important contribution to the development and implementation of plans and mechanisms, including for early warning".
Learn from disasters -Documentary films -Facilities & Technical support for Post disaster recovery and reconstructions	**Preamble** – "It is necessary to continue strengthening good governance in disaster Risk reduction strategies at the national, regional and global levels and improving preparedness and national coordination for disaster response, rehabilitation and reconstruction, and to use post-disaster recovery and reconstruction to "Build Back Better", supported by strengthened modalities of international cooperation". **Guiding Principle (k)**-"In the post-disaster recovery, rehabilitation and reconstruction phase, it is critical to prevent the creation of and to reduce disaster risk by "Building Back Better" and increasing public education and awareness of disaster risk". **Priority 4**- "Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction".
Cohesion in International response to disasters -Work under a common umbrella to show collective strength	**Preamble** – "To complement national action and capacity, there is a need to enhance international cooperation between developed and developing countries and between States and international organizations". **Guiding Principle (a, h and l)** –"Each State has the primary responsibility to prevent and reduce disaster risk, including through international, regional, sub-regional, trans-boundary and bilateral cooperation". "The development, strengthening and implementation of relevant policies, plans, practices and mechanisms need to aim at coherence, as appropriate, across sustainable development and growth, food security, health and safety, climate change and variability, environmental management and disaster risk reduction agendas". "An effective and meaningful global partnership and the further strengthening of International cooperation, including the fulfilment of respective commitments of official development assistance by developed countries, are essential for effective disaster risk management". **Target (f)** - "Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030". **Priority 1 (c & g)-** Global & Regional level actions – Enhanced international cooperation with the support of the United Nations Office for Disaster Risk Reduction Scientific & Technical Advisory Group.

India is a signatory to SFDRR and is attempting to comply with it on voluntary basis. The country is making efforts to achieve the global targets by making advancement in the entire disaster management cycle by following the recommendations in the Sendai Framework and by adopting internationally accepted best practices.

Table 5: Linking Agenda 10 with Asia Regional Plan for Implementation of SFDRR adopted at Seventh Asian Ministerial Conference for Disaster Risk Reduction, 2016 in India

Asia Regional Plan for Implementation of SFDRR & Agenda 10
1) Linking Agenda 10 with Policy Directions of Asian Plan (a) Point 1 and 10 of Agenda 10 will directly cater to the following policy directions:- - Integration of risk reduction in development. - Cohesion in international agreements to establish a more collaborative environment between the DRR community & Development sector. (b) Agenda 10 is highly aligned to the Guiding Principles of SFDRR as shown in the previous table:- - The Asian Plan calls for adoption of these Guiding Principles in national policies and strategic action plans for implementation of SFDRR. (c) Creating an Enabling Environment through implementation of Agenda 10:- - The priority actions in Asian Plan call for creation of an Enabling Environment for implementation & monitoring of SFDRR at local, national & regional level. The Agenda 10 will facilitate the creation of enabling environment by – Risk Mapping, Capacity Building of Inter-governmental Organisations, Cohesion between International Frameworks, Institutional Capacity Building, Exchange of Technical expertise and knowledge at international platforms and promoting an Inclusive Approach (multi-sector, multi-stakeholder DRR platforms, Leadership of Women, Building of local capacities)
2) Linking Agenda 10 with Long Term Roadmap of Asian Plan The Enabling Environment created at local, national and regional level by implementation of Agenda 10 will support the progress against various SFDRR targets and will lead to achievement of milestones set for 2016, 2018, 2020, 2022, and 2030 in the Long term roadmap.
3) Linking Agenda 10 with Two Year Action Plan The two year Action Plan provides various regional and national level actions. The points articulated in Agenda 10 will facilitate (Directly/Indirectly) the actions in To Year Plan. The linkages between the two are: **Regional level actions:-** -Collaborative mechanism of Inter-governmental organisations -Gender sensitive DRR actions -Regional Cooperation for Disaster Resilient Infrastructure -Enhanced stakeholder engagement **National & Local Level Actions:-** -Risk Profiling -Risk Information Systems -Use of Traditional , indigenous knowledge for local risk assessments -Building local capacities of governments and communities to monitor hazards, exposure and vulnerabilities - Women's participation and equal opportunities at all levels of decision making in DRR.

Recently released National Disaster Management Plan of India (NDMP), 2016, incorporates the approach articulated in Sendai Framework to achieve substantial reduction in disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries. The NDMP is aligned with the goal and priorities of SFDRR. The integration of four priorities for action under the Sendai Framework into the NDMP, 2016 is given in the following table:

Table 6. Incorporation of four priorities for action under the Sendai Framework in NDMP

Sendai Framework for DRR (2015-2030) Priority	Chapters with the priorityas its dominant theme	Linkage with the Prime Minister's Agenda 10
1.Understanding disaster risk	Chapters 2 and 3	Agenda 5, 6, 7, 9
2. Strengthening disaster risk governance to manage disaster risk	Chapters 3, 4, 5, 6, 8, and 9	Agenda 1, 7, 8, 10
3. Investing in disaster risk reduction for resilience	Chapters 3, 4, 5, 6, 7, and 8	Agenda 1, 2, 3, 4, 5, 6
4. Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.	Chapters 4, 6, 7, 8, 9, and 10	Agenda 1, 2, 7, 8. 10

(Source: NDMP, 2016)

The three focus areas of SDGs are: i) Poverty eradication, ii) Safeguard the planet from degradation while making sure that economic, social and technological advancement occurs in harmony with nature; and (iii) Encouraging global peace and just and inclusive societies.

The SDG agenda identifies and asserts the immediate needs to reduce climate and disaster risk & emphasizes resilience building of communities and nations to achieve the SDGs. Explicit references for DRR, CCA and resilience can be observed in goals and targets specially related to poverty, hunger, healthy lives, building resilient infrastructure, education, sustainable management of water, climate change, resilient cities and marine & terrestrial ecosystem.

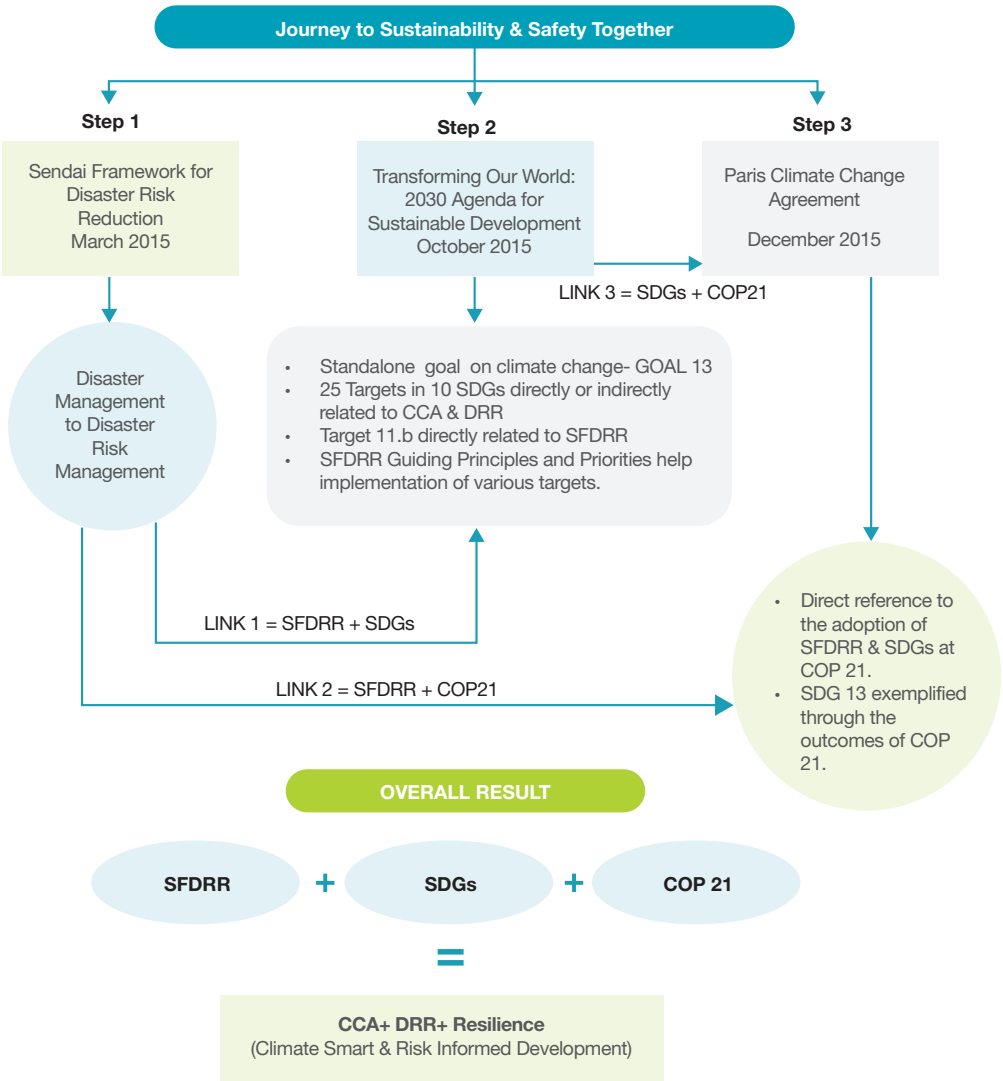
Table 7. DRR-CCA targets in SDGs and Sendai Framework

Sustainable Development Goal	Related DRR or CCA target	How Sendai Framework will help to achieve the goal/target-
Goal 1: End poverty in all its forms everywhere	Target 1.5	*"To achieve this goal and target, Sendai Framework proposes for the promotion and development of social safety nets linked with livelihood enhancement programmes in order to ensure resilience of household and communities to disasters."*
Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Target 2.4	*"To achieve this goal and target in context of Sendai Framework, relevant actions including strengthening productive assets such as livestock, working animals, tools and seeds are required."*
Goal 3: Ensure healthy lives and promote well-being for all at all ages	Target 3.d	*"This target in particular is complemented by the outcome of Sendai Framework which has placed strong emphasis on the resilience of health systems and integration of disaster risk reduction into health care provision at all levels."*
Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Target 4.7 and Target 4.a	*"In order to progress these target actions, implementation needs to consider promoting disaster risk knowledge at all levels including in professional education and training as recommended by the Sendai Framework."*
Goal 6:Ensure availability and sustainable management of Water and Sanitation for all.	Target 6.3, 6.4, 6.5, 6.6, 6.a and 6.b	*"Target 6.6 indirectly provides an opportunity to mainstream ecosystem-based approaches for disaster risk reduction and further highlight their value as a 'win-win' and 'no regrets' solution to the increasing disaster and climate risks underlined in the Sendai Framework."*
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Target 9.1 and Target 9.a	*"In order to progress these targets and goal, the Sendai Framework recommends strengthening disaster resilient public and private investments through structural, non-structural and functional disaster risk prevention and reduction measures in critical facilities, in particular schools and hospitals and other physical infrastructure."*
Goal 11: Make cities andhuman settlements inclusive, safe, resilient and sustainable	Target 11.1,11.3, 11.4, 11.5, 11.b, 11.c	*"Measures to achieve these targets and goal, as outlined in the Sendai Framework, require mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, land degradation assessments and informal and non-permanent housing, and the use of guidelines and follow-up tools informed by anticipated demographic and environmental changes."*
Goal 13. Take urgent action to combat climate change and its impacts	Target 13.1, 13.2, 13.3, 13.a and 13.b	*"In order to achieve these targets and the overall goal, the Sendai Framework recommends to strengthen disaster risk modeling, assessment, mapping, monitoring and multi-hazard early warning systems; promote the conduct of comprehensive surveys on multi-hazard disaster risks and the development of regional disaster risk assessments and maps, including climate change scenarios; and maintain and strengthen in situ and remotely sensed earth and climate observation."*
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Target 14.2	*"The Sendai Framework explicitly seeks to account for the environmental damages caused by disasters – in many cases damages are attributable to the removal of disaster waste and to* *impacts associated with recovery and reconstructions planning that have by-passed existing environmental legislation."*

Sustainable Development Goal	Related DRR or CCA target	How Sendai Framework will help to achieve the goal/target-
Goal 15.Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Target 15.1,15.2, 15.3, 15.4 and 15.9	*"These targets are also in line with the Sendai Framework's focus on building environmental resilience through the inclusion of ecosystems in risk analysis and planning.* *As per marine ecosystems, the Sendai Framework proposes similar priority actions for their terrestrial equivalents - mountains, rivers, coastal flood plain areas, dry lands and wetlands, among others."*

(Source: Compiled from Transforming Our World: the 2030 Agenda for Sustainable Development, 2015& Disaster Risk Reduction & Resilience in the 2030 Agenda for Sustainable Development, 2015)

There is a growing global consensus that disaster risk reduction, climate change adaptation and sustainable development are linked to each other. Many evidences of linkages between the three agendas are observed while studying the Sendai Framework for Disaster Risk Reduction 2015-2030, Sustainable Development Goals 2030 and the Paris Climate Agreement 2015. All of them share a common aim of making the development sustainable. Commitment to the goals and their implementation must become a global priority. To ensure the achievement of SDGs, it is very important to consider current and future challenges caused by disasters and climate change.



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REFERENCES

- ADPC (2005). Training modules for Climate and Flood Forecast Applications in Agriculture. Retrieved from ftp://ftp.fao.org/docrep/fao/008/af967e/af967e00.pdf.
- AMCDRR (2016). Accessed from https://www.amcdrrindia.net/documents/
- Bahadur, A., Lovell, E., Pichon, F. (2016). Strengthening disaster risk management in India: A review of five state disaster management plans. Climate Development Knowledge Network (CDKN) and the Overseas Development Institute (ODI), UK.
- Chakraborty, A. and P K Joshi (2016). Mapping disaster vulnerability in India using analytical hierarchy process. Geomatics, Natural Hazards and Risk, 7(1): 308-325.
- Gokhale, V. (2008).Role of women in disaster management: an analytical study with reference to Indian society. 14th WCEE, October 12-17, Beijing,China. Accessed from http://www.iitk.ac.in/nicee/wcee/article/14_10-0049.PDF
- Gupta, A.K., Nair, S.S. & Singh, S. (2013). Environmental Legislation for Disaster Risk Management, National Institute of Disaster Management & Deutsche Gesellschaft für internationale Zusammenarbeit GmbH (GIZ), 108 p.
- Gupta, A.K., Nair, S.S., Wajih, S.A., Chopde, S., Gupta, G. and Aggrawal, G. (2014). Mainstreaming Climate Change Adaptation and Disaster Risk Reduction into District Level Development Plans. NIDM New Delhi (India), GEAG Gorakhpur (UP, India) and ISET, Colorado (US), P 114.
- Gupta, A.K., Singh, S., Katyal, S., Chopde, S., Wajih, S.A., Kumar, A., (2016). Climate Resilient and Disaster Safe Development - Process Framework, NIDM New Delhi (India), GEAG Gorakhpur (UP, India) and ISET, Colorado (USA), supported by CDKN, UK. September 2016.
- Gupta, Anil K. and Nair, Sreeja S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate change. National Institute of Disaster Management, New Delhi, P 40.
- Harihar, A. (April 27, 2015). Business 2 Community. Social media and its role in disaster management. Accessed from http://www.business2community.com/social-media/social-media-role-disaster-management-01214144#YL1xcejrQZmJBDjv.97.
- JICA (2015). Towards mainstreaming disaster risk reduction: building disaster resilience societies. Accessed from http://gwweb.jica.go.jp/km/FSubject0301.nsf/ff4eb182720efa0f49256bc20018fd25/3958a0a725aba98549257a7900124f29/$FILE/E.pdf.
- Kutty,S.G.(22 May, 2015). The role of technology in disaster preparedness: Lessons from Nepal Earthquake for India. Science, Technology and security forum. Accessed from http://stsfor.org/content/role-technology-disaster-preparedness-lessons-nepal-earthquake-india.
- Mishra, P.K. (2004). The Kutch Earthquake 2001: Recollections, Lessons and Insights. National Institute of Disaster Management, New Delhi. P233.
- Mullings, A. and Noel, G.(1988). Role of women in disaster management. UNDRO News September/October. Accessed from http://cidbimena.desastres.hn/docum/crid/Noviembre2005/pdf/eng/doc7194/doc7194-contenido.pdf.
- National Disaster Management Plan (2016). A publication of the National Disaster Management Authority, Government of India. May 2016, New Delhi.
- OECD (2012).Disaster risk assessment and risk financing: A G20/OECD methodological framework. Accessed from https://www.oecd.org/gov/risk/G20disasterriskmanagement.pdf.

- Role of social media in disaster management.(n.a). Humanitarian Congress Vienna. Accessed from http://www.humanitariancongress.at/role-social-media-disaster-management.
- Salajegheh. S and Pirmoradi. N (2013). Community Based Disaster Risk Management (CBDRM) and Providing a Model for Iran. International Journal of Engineering Research and Development. 7(9).60-69. Accessed at http://www.ijerd.com/paper/vol7issue9/G0709060069.pdf
- Satendra, A. K. Gupta, V. K. Naik, T. K. Saha Roy, A. K. Sharma, and M. Dwivedi (2014). Uttarakhand Disaster 2015. National Institute of Disaster Management, New Delhi, 184 Pages.
- UN WCDRR (2015). Accessed from http://www.preventionweb.net/files/resolutions/N1516716.pdf
- UNISDR (2004). Disaster Risk Reduction in Sustainable Development Outcome Documents, [Pdf], Available at:< http://www.unisdr.org/files/42613_drrinsustainabledevelopmentoutcomed.pdf>, [Accessed 20 June 2016].
- UNISDR (2005). World Conference on Disaster Reduction- Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, Accessed at www.unisdr.org/wcdr.
- UNISDR (2008).Gender Perspectives: Integrating Disaster Risk Reduction into Climate Change Adaptation. Accessed on http://www.un.org/waterforlifedecade/pdf/2008_isdr_gender_perspectives_disaster_risk_reduction_cc_eng.pdf.
- UNISDR (2015). Disaster Risk Reduction & Resilience in the 2030 Agenda for Sustainable Development, 2015- A reflection paper prepared by the UN Office for Disaster Risk Reduction, October 2015. [Pdf], Available at: < www.unisdr.org/files/46052_disasterriskreductioninthe2030agend.pdf>, [Accessed 20 June 2016].
- Vyas, T. and Desai, A. (2007). Information technology for disaster management. Proceedings of National Conference INDIACom 2007. Accessed from http://www.bvicam.ac.in/news/NRSC%202007/pdfs/papers/st_230_03_02_07.pdf.

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